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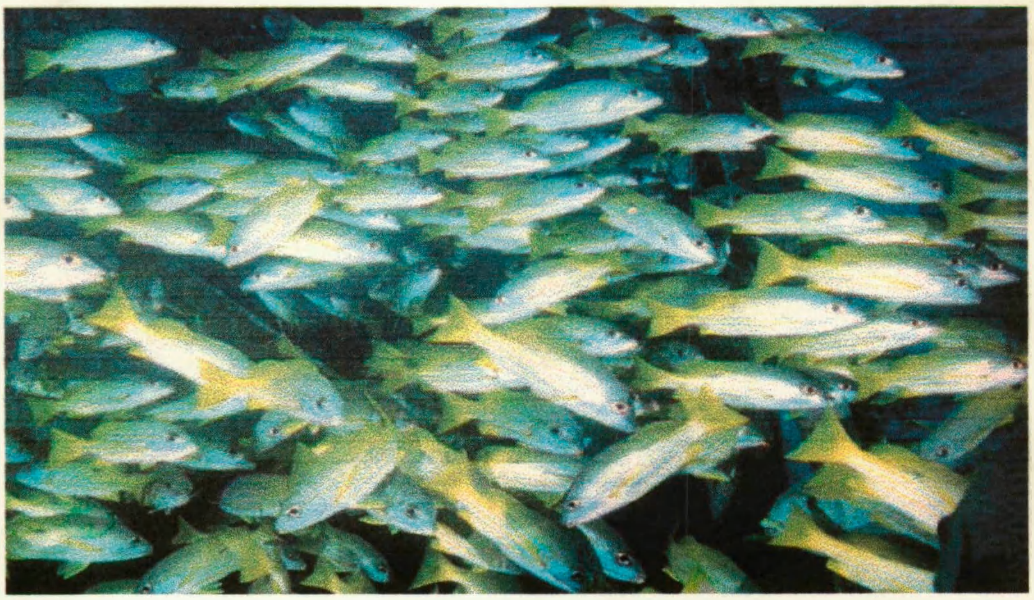
THE ICHTHYOFAUNA OF A TROPICAL MANGROVE BAY (GAZI BAY, KENYA): COMMUNITY STRUCTURE AND TROPHIC ORGANISATION

Enock O. WAKWABI



Thesis submitted in fulfilment for
The award of the degree of Doctor
of Philosophy in sciences (Biology).

Promoter:	Prof. Dr. Magda Vincx
Co-Promoter:	Dr. Jan Mees

University of Gent, Zoology Institute, Marine Biology Section
K.L. Ledeganckstraat 35, B-9000 Gent, Belgium

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"Open, O Lord, the eyes of all people
To behold thy gracious hand in all thy works,
That, rejoicing in thy whole creation,
They may honour thee with their substance,
And be faithful stewards/custodians of thy bounty."

The book of common Prayer, 1979.
MICHAEL A. HUSTON (1994) *Biological Diversity: The coexistence of species on changing landscapes.*

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PREFACE

In a paper presented at the conference on "Conservation of Biodiversity in Africa" held in Nairobi, Kenya on 30th August - 3rd September, 1992; Dr Els E Martens made three very pertinent statements concerning biodiversity in the tropics. That, "tropical ecosystems, as opposed to those in the higher latitudes, are endowed with higher biological diversities; tropical marine ecosystems are comparatively the most diverse with the highest diversity of functions benefiting man; and that, this diversity is even much higher in the Indo-West Pacific oceans". The coastal ecosystems in the Tropics as such are the most vulnerable to anthropogenic impacts. It is common knowledge that the pace at which technology has advanced and the human populations have grown, especially in the coastal areas, outstripped the rate at which the appropriate attitudes towards sustainable environmental and resource utilisation and the development of appropriate structures to minimise exploitative threats on marine biodiversity, have evolved. This lag in aesthetic attitudes and management aptitude was compounded by the lack of relevant information, inappropriate development policies blind to the impacts, the overlapping and competitive jurisdictions on the coastal areas, and the weak structures for integrated coastal zone management.

During the scientific symposium on the Ecology of Mangrove and Related Ecosystems held in Mombasa in September 1990 (under the auspices of the University of Nairobi (UoN), Kenya Marine & Fisheries Research Institute (KMFRI), and the Regional Dispatch Centre (RDC) of the Regional Co-operation in Scientific Information Exchange in the Western Indian Ocean (RECOSCIX-WIO)), it was recognised a/o, the gap in knowledge of the intimate but complex interlinkages within these coastal ecosystems (i.e. mangrove, seagrass and coral reefs ecosystems). This gap was identified to be the major cause for the development woes facing the coastal zones in the Tropics. The need to provide relevant information on the environmental capacities and the natural resources of these ecosystems was apparent. It was also noted that the available information was too fragmented. The symposium then recommended that future priority research areas should focus on: the interlinkages between the mangrove, coral reef and seagrass ecosystems; near-shore small and meso-scale hydrological processes; nutrient fluxes and energy flow; biological processes and use of bioindicators; and integrated coastal zone management.

These priorities have consistently emerged as directing the *"modus operandi"* in this region, especially in relation to the tenets of Agenda 21 of the United Nations Conference on Environment and Development (UNCED), Rio De Janeiro, 1992. A number of programmes with foci on the sea, the marine and coastal environment, the resources, and sustainable development in the coastal area have been proposed within the same priority areas. Following the international symposium and workshop on the status and future of Large Marine Ecosystems (LMEs) of the Indian Ocean (Mombasa, 1993), and the subsequent meetings of the IOC-IUCN-NOAA consultative meeting on LMEs (Paris, January 1997) and the IOCINCWIO-IV/3 (Mombasa, May 1997), three LMEs; i.e. the Somali Current LME, the Aghullas Current LME, and lately, the Mascaren Plateau LME were identified in the region. LME concept and the JGOFS (Joint Global Ocean Flux Studies) activities address the changing oceanic environment and its influence on the environment and resources of the respective coastal areas.

The Land-Ocean Interaction in the Coastal Zone (LOICZ) and the Integrated Coastal Area/Zone Management (ICAM/ICZM) research components are concerned with the anthropogenic impacts from oceanic and land-based activities to the coastal habitats. At the last LOICZ East Africa workshop (Mombasa, March 1997), the indicators of ecosystem health and sustainability in the East African coastal Zone, the Freshwater-Seawater linkages, the impacts of discharges from the Tana-Sabaki basins into the coastal zone, the history and prediction of geomorphic changes in relation to the coastal topography in East Africa, and the relationships between climatic variability and coastal processes, were prioritised research areas.

Together with the UN funded programmes e.g. through IOC/UNESCO, FAO and UNEP, these programmes seem to direct the trend in research in the marine and coastal areas in the region. The recommended work plan for IOCINCWIO (the IOC Regional Committee for the Co-operative Investigations in the North and Central Western Indian Ocean) for the period 1997-2001 (see IOCINCWIO IV/3, Mombasa Kenya, May 1997) is no less emphatic on these foci. In fact the on-going ICAM processes in the region are already addressing most of these research problems.

We cannot claim to have achieved all the goals set at the 1990 symposium on mangrove and related coastal ecosystems. However, the tempo was set and going by what research activities that were undertaken on Gazi bay in the ensuing years, the amount of scientific information that has been generated on the interlinkages between the three ecosystems is enormous (thanks for the support from the Belgian, the Netherlands and the Kenya Governments, and the EEC; and to the researchers from Kenya, Belgium, and The Netherlands). Suffice here to mention that these efforts were spread out to the other coastal states in Eastern Africa (namely: Tanzania and Mozambique).

In this work, we have synthesised the results obtained by the Kenyan-Belgian Research Program (KBP) in Marine Science (1990-1996) on the fish diversity and fish community studies in Gazi bay. We attempted to highlight (despite the low tone) on the interrelationships between the observed species richness and communities with the presence and interlinkages of the coral reef, seagrass, and mangal ecosystems. We also drew information from the results of the EEC's STD II and STD III research programs undertaken concurrently with the KBP projects on the bay. It is our believe that the information and data put together in this thesis are a major contribution towards the realisation of what seemed "whimsical hopes" in science during that (1990) symposium. We have addressed the diversity, community structures and patterns, and the trophic interrelationships of fish in the epibenthos of Gazi bay, to give just a glimpse of the dynamics, interlinkages, and interdependence within and between these coastal ecosystems at that level. This is just but the "tip of the iceberg". We sincerely hope that this work will stir-up and help to nurture further interests in unravelling the "thick of the iceberg!"

Epibenthos include fish (usually juveniles of larger sized fish species and/or mature adults of small sized fish species measuring 20-400mm standard length) and the larger invertebrates (usually, crabs and shrimps) living on or near the seabed. Juvenile fish formed the bulk of our epibenthos collections from Gazi bay. The descriptions we have advanced in this work are therefore based on this nature of material. In some cases, our descriptions seemed to differ from the normal, especially the diets and trophic placement of the fishes under herbivory and omnivory. We note that Shelby D. Gerking (see list of references) also mentioned in his preface the dilemma facing fish ecologists in defining omnivory in fish. We seem to have got stuck in the same *"thick"*, but we observe that, this seemingly weak point could be the source of our future strength in this area of studies. Having worked mostly on the stomach contents of juvenile fishes, our materials were different from what is expected from conventional fishing gears. Information on the food of juvenile fishes is quite limited in literature as most researchers report on larger fishes collected with the conventional fishing gears. The darkest point was the inability to separate what constituted the *"aufwuchs"* in the diets. We suppose that this could be the point at which to light the candle in future excursions of fish stomach contents (especially of those fishes that fall within the affected categories). It is most often recommended to collect data on environmental parameters and on the potential food organisms alongside the fish sampling for stomach analyses. This normally provides information on the importance of the ingested preys in the nutrition requirements of the predator in relation to what was actually available as food to the fish. The lack of such data dug a yawning gap in our presentation on diets. This study was however part of a mega-program in which the environmental aspects (meiobenthos, hyperbenthos, and plankton) were already being addressed.

However, despite these limitations, this could be among the few works of this kind describing a data series of more than 2 years on fish fauna, and describing the communities and the trophic interrelationships of young fish in our region.

Enock O. Wakwabi KMFRI, Mombasa, Kenya.

SUMMARY:

Introduction

The spatial and temporal community structure and the trophic organisation of the fish fauna in Gazi bay (Kenya) is discussed. Gazi bay is presented as part of the entire Eastern African coastal area subjected to the oceanographic and atmospheric processes in the Western Indian Ocean region (WIO).

In order to demonstrate the importance of fish ecology along the Indian Ocean coast, an overview of the fisheries situation in Kenya and the WIO region as a whole has been presented, with focus on the current levels of information and available data. It is rather strange that marine fish landings increase northwards, eastwards, and southwards with Kenya having the lowest! It may be interesting in the future to look at the interrelationships between fish stocks across the borders and the movement of these stocks in relation to the oceanography and the monsoons in the entire region.

Aims and objectives of this study

The aim of this study was to collate and synthesise the available information, and to collect a time series of new, quantitative data on the fish fauna of Gazi bay, and to attempt to identify observable patterns in relation to the biotic and abiotic environment of the bay. The hypothesis tested in this study rested on the premise that the observed diversity of species and patterns of occurrence were a product of the existing spatial structures (the coral reef, seagrass beds, mangrove swamps, and rivers) modified in time and space by the seasonal changes in the magnitudes of the Monsoon winds and the oceanic as well as coastal currents, the semi-diurnal tidal cycles, and the seasonal patterns in rainfall. This study has four main objectives, namely: (1) to compile and synthesise the available data on fish fauna of Gazi bay; (2) to identify and describe the spatial structure and the temporal patterns of the fish communities in the epibenthos of Gazi bay from the newly collected time series data; (3) to describe the diets of the abundant fish species in the epibenthos of Gazi bay (also from the newly collected time series data); and (4) to synthesise the trophic data and describe the trophic organisation of the fish fauna in Gazi bay.

This work is a major contribution to the understanding of the fish ecology and the diversity of the fish fauna in an intimately placed tropical coastal ecosystem. It is an important contribution to the knowledge of many tropical fish species (many of which may be important to the fisheries in the area). Results of this study may therefore find broad application in marine biodiversity, fisheries, and in integrated coastal zone management. Information on the interlinked nature and the interrelationships between the fringing coral reefs, the seagrass beds, and the mangrove ecosystems in Gazi bay was also provided. The information has relevance elsewhere where the three ecosystems co-occur, equally juxtaposed within the tropics.

where?

Results:

Results of this study are reported in five chapters: namely

Chapter 2: The ichthyofauna of a tropical mangrove bay (Gazi bay, Kenya).
Chapter 3: Epibenthic communities in a tropical bay, Gazi bay, Kenya. I: Spatial organisation.
Chapter 4: Epibenthic communities in a tropical bay, Gazi bay, Kenya. II: Temporal patterns.
Chapter 5: The diets of juvenile fishes in a tropical mangrove bay, Gazi bay, Kenya.
Chapter 6: The trophic organisation in fish fauna of a tropical bay, Gazi bay, Kenya.

The Kenyan coast with its physical features, population, and resources is described (chapter 1), giving a brief treatise on the evolution of the existing coastal topography, the changing monsoon climatic and oceanographic conditions in the region, and the coastal and marine habitats. The brief treatments of the fringing coral reef, the lagoon, and the mangrove habitats is meant to orientate the reader to the ecosystems typical of Gazi bay.

The chapter on the ichthyofauna of Gazi bay provides a synthesis of collated information on the fish species composition. The six reported studies deployed different sampling techniques and strategies, and were quite comprehensive in area coverage. In total, 346 species in 72 families of fish have been reported from Gazi bay. Of these, only 11 species and 20 families were common to all the six campaigns. A total of 180 species and 20 families were unique to one or the other campaign. It was characteristic of all the campaigns that very few species dominated the catch, the majority of species representing <0.05% each, of the total number of individuals caught. *Sphaeramia orbicularis* (Cuvier, 1928) (Apogonidae) constituted 96% of the total catch in fykenets and dragnets deployed in the mangrove swamp. *Atherinomorus duodecimalis* (Valenciennes, 1835), *A. lacunosus* (Forster, 1801) (both Atherinidae), *Herklotsichthys quadrimaculatus* (Ruppell, 1837) (Clupeidae), *Gerres acinaces*

Bleeker, 1854 and *G. oyena* (Forsskal, 1775) (both Gerreidae) were the most abundant species caught in beach seines, where only 3 species made upto 70% of the total catch per campaign. The dominant species in beam trawls were: *Leptoscarus vaigiensis* (Quoy & Gaimard, 1824), *Scarus sordidus* Forsskal, 1775 (both Scaridae), *Plotosus lineatus* (Thunberg, 1787) (Plotosidae), *Parascorpaena mossambica* (Peters, 1855), *Sebastapistes strongia* (Cuvier, 1829) (both Scorpaenidae), *Apogon fragilis* Smith, 1961, *A. nigripes* Playfair & Gunther, 1866, *Fowleria aurita* (Valenciennes, 1831) (all Apogonidae), *Siganus sutor* (Valenciennes, 1835) (Siganidae), *Lethrinus harak* (Forsskal, 1775) *L. nebulosus* (Forsskal, 1775) (both Lethrinidae) and *Cheilio inermis* (Forsskal, 1775) (Labridae). The most speciose families were Apogonidae, Gobiidae and Labridae. The composition and size of catches at any one point in the bay changed a lot within and between the sampling campaigns suggesting a constantly changing environment and fish community.

As an addendum to this chapter, the epibenthic fauna of another kenyan mangrove system, Tudor creek, Mombasa is presented to allow comparison with Gazi bay. Both Tudor creek and Gazi bay have dense mangrove forests. Tudor creek receives more freshwater and land derived nutrients, especially during the rainy season from its comparatively many larger rivers. The terrigenous alluvium sediments that dominate in Tudor creek give it a different abiotic environment than the predominantly coraline sands in Gazi bay. The position of Tudor creek around Mombasa as a port and industrial hub also exposes the creek to more anthopogenic influences than Gazi bay. The rainfall pattern was seen to play a major role in the composition, distribution and densities of fish and penaeids in Tudor creek. The penaeids (especially *Penaeus monodon* Fabricius, 1798, *P. indicus* H. Milne Edwards, 1837, and *Metapenaeus monoceros* together with caridean shrimps, gobies (especially *Yongeichthys nebulosus* (Forsskal, 1775)), the striped eel catfish (*Plotosus lineatus* (Thunberg, 1787) (Plotosidae) and the blackspot snapper *Lutjanus fulviflamma* (Forsskal, 1775) (Lutjanidae), were predominant in Tudor creek. The typical seagrass fish species e.g., the scarids and labrids that were predominantly caught in Gazi bay, were notably absent in Tudor creek. It should however be pointed out that the sampling strategy deployed on Tudor creek was different. The study on Tudor creek targeted freshly recruited *Penaeus monodon* postlarvae and juveniles. Samples on Tudor creek were therefore only taken during the low spring tides. The observed differences in the results between the two areas were also subject to this difference in strategy.

The spatial structures determining the community patterns in Gazi bay (chapter 3) were prescribed on the basis of the fringing coral reef, the distribution and intensity of the seagrass beds, the mangrove swamps, and the river mouths. There was a community related to the estuarine river mouths (Kidogoweni and Mkurumuji), a community relating to the predominantly monospecific *Thalassodendron ciliatum* (Forsskal) Den Hartog seagrass beds in the main lagoon, a community relating to the peripheral highly interspersed mixed meadows in the seagrass-mangrove swamps associated areas in the lagoon and in the two creeks, and a community relating to the proximity of the fringing coral reefs. The approximate positioning of the sampling stations *vis-à-vis* these structural factors influenced the actual catch composition, hence the observed community clusters. Density and species richness increased into the lagoon and seawards with the lowest catch (<35 individuals and <10 species per standard 10 minutes tow, respectively) at the estuarine end of the western creek. There were station to station differences in species composition, especially at dominance levels revealing discrete distributions patterns. For example *Apogon nigripes* (Apogonidae) was predominant in the western creek and at the outermost station towards the reefs, but was quite rare in the lagoon. *Scarus sordidus* (Scaridae) was only important in the lagoon, but was hardly represented in the creeks. *Leptoscarus vaigiensis* (Scaridae) was important throughout the bay except around the estuaries. The majority of the species caught in the spatial survey occurred only in 1-2 tows; no single species was represented in all the 32 beam trawl samples. It was further observed that the areas which had highest density, were equally the most speciose areas as compared to the areas with lower density. The instantaneous communities were therefore a product of the prevailing conditions at the time of sample.

The temporal patterns (chapter 4) were overly masked, probably due to our failure to cover the shorter-term tidal and diel cycles in our sampling strategy. There was however a sharp drop, both in densities and numbers of species, at the onset of the long rainy period in May. Increased production during this wet season and the stabilisation of the water salinity through ionic stripping by the seagrass enabled immediate rebuilding of the fish populations. The dry season was characterised by higher densities and more species than the wet season. Fish density was almost always lowest in July and in October-November and highest in April and August. Apart from the seagrass parrotfish *Leptoscarus vaigiensis* that was almost omnipresent, the rest of the dominant species occurred intermittently in the catches at the various stations. This monthly station to station differences in species dominance somehow confirmed the pre-eminence of spatial structures over the temporal patterns in the organisation of fish communities in Gazi bay.

Four feeding guilds, namely omnivores, piscivores, zooplanktivores and benthivores, were identified from the 33 dominant fish species collected in the beam trawl catches (chapter 5). The omnivorous guild was separated from the others on the basis of having taken "*aufwuchs*" species as the main dietary items. *Aufwuchs* constituted over 90% of the ingested biomass in this guild. The gravimetric composition of the diets taken by the piscivorous guild were >60% pisces. Zooplanktivores were separated on the basis of the calanoid copepods (which contributed >40% of the gravimetric composition of the diets), while benthivores were separated on the basis of amphipods (which made up >30% of the total ingested biomass by the guild). The numerical diet composition was quite variable for each guild. Ontogenetic shifts in diets were observed, especially in the omnivorous guild, where the younger fish took more animal prey in their diets than the older fish. The proportion of plant to animal material increased in the diets with the size of the predators. Ontogenetic shifts were also observed among the benthivores, e.g. in *Cheilio inermis* (Labridae) and in *Lethrinus nebulosus* (Lethrinidae), and in some zooplanktivorous species, e.g. in *Apogon fragilis* (Apogonidae). This was not very clear in the Piscivores. The size range of the examined predators may, however, have been a limitation. Despite the wide spectra of prey taken by each species, the individual stomachs were found to contain very few types of prey. This was deduced to imply that the individual relied on the most prevalent prey at the time of feeding. This tendency seemed to depict the seasonal patterns in the prey populations. There was for example, a coincidence in prevalence of juvenile copepods in the stomach contents of zooplanktivorous and benthivorous predators during the wet season (in May-August) when the water productivity and zooplankton densities on the bay are reportedly high.

For the synthesis of the trophic organisation in Gazi bay we revisit the entire list of the recorded fish species in the bay (chapter 2) and draw information from the FISHBASE (1998) database. Apart from the trophic data, we also present information on the types of environment (marine, brackishwater, or freshwater) and habitats (coral reef, lagoons, seagrass beds, mangrove swamp, etc) the species are known to associate with. This information was deliberately included to give credence to the nursery and foraging roles of Gazi bay. The trophic data were greatly summarised. Three trophic levels were used to classify the fish species: herbivore, omnivore, and carnivore. The preferred food (prey) items (e.g. fish, macrofauna, benthos, necton, macroalgae, phytoplankton, zooplankton, filamentous algae, ecto-parasites, life coral heads, insects etc) were also listed for each species. Where there was no data on diets, the trophic information was listed as unknown. Over 70% of the fish species recorded in Gazi bay were marine species and about 20% were either anadromous or catadromous. Both categories were typically coral reef associated fishes. Twenty-nine species were euryhaline and two species were typically freshwater fish. Carnivorous species represented over 63% of the total, about 20% were omnivorous and 4% were herbivorous species. The diets of the rest were unknown. Although there were fewer herbivorous species, the guild was the most populous with the highest density per species. Carnivores and omnivores were more important outside the *Thalassodendron* beds, where herbivores were comparatively prevalent. The pattern of trophic organisation observed in Gazi bay may be closely associated with the behaviour of the fish species in these trophic guilds, especially in the shallow intertidal or tidally fluctuating environments in coastal habitats. The overload of carnivores in the shallower water is a typical foraging behaviour among this guild, meant to give them advantage over the tidally concentrated prey organisms including juvenile fish. Herbivores were more important in the seagrass beds and in macro-algal mats where they derived both food and refugia. The large numbers of very poorly represented carnivorous and omnivorous species may suggest that most of these species were probably visiting foragers in the bay. This information is however not conclusive. Further corroborative studies may be required particularly on the shorter-term tidal and diel patterns to help decipher more on the dynamisms behind the observed patterns.

SAMENVATTING

Inleiding

In deze thesis worden ruimtelijke en temporele patronen in de epibenthische gemeenschappen van een tropische baai (Gazi Bay, Kenia) beschreven. De gemeenschapsstructuur en de trofische organisatie van de visfauna worden onderzocht. Eerst wordt de baai voorgesteld als een deel van de oost-afrikaanse kust dat beïnvloed wordt door de oceanografische en atmosferische processen van de Westelijke Indische Oceaan (WIO) regio. Om het belang van het bestuderen van de ecologie van beenvissen in de regio aan te tonen, wordt een overzicht gegeven van de visserij in de WIO regio. Het is opmerkelijk dat de mariene visproduktie toeneemt naar het noorden, het oosten en het zuiden toe, terwijl ze in Kenya het laagst is. In de toekomst kan het interessant zijn de relaties tussen de visstocks over de landsgrenzen heen te onderzoeken en de bewegingen van deze stocks te relateren aan de regionale oceanografische processen en het door de moesson gestuurde klimaat.

Doelstellingen

Het doel van deze studie is om (1) een overzicht te geven van alle reeds gepubliceerde informatie over de visfauna van Gazi Bay en (2) een nieuwe tijdsreeks van kwantitatieve gegevens te verzamelen en hierin te trachten patronen te identificeren die kunnen gerelateerd worden tot de biotische en abiotische karakteristieken van de baai. De werkhypothese die in deze thesis getest werd, is dat de waargenomen diversiteits- en distributiepatronen een produkt zijn van de bestaande ruimtelijke structuren (het koraalrif, de zeegrasvelden, het mangrovebos en de rivieren), in ruimte en tijd gemodifieerd door seizoenale veranderingen in de intensiteit van de moessonwinden, de neerslag en de oceanische en kuststromen en de semilunaire tidale cycli. De vier belangrijkste objectieven waren: (1) de gegevens over de visfauna van Gazi Bay verzamelen en synthetiseren; (2) ruimtelijke en temporele patronen in de vis- en epibenthische gemeenschappen van de baai identificeren en beschrijven aan de hand van een nieuw verzamelde tijdsreeks van kwantitatieve stalen; (3) het dieet van de abundantste vissoorten in deze stalen beschrijven; en (4) de gegevens over de voedingsecologie synthetiseren en de trofische organisatie van de visfauna in Gazi Bay beschrijven. We hebben gepoogd een significante bijdrage te leveren tot onze kennis over de biologie en ecologie van vaak weinig bestudeerde vissoorten in een tropisch kustecosysteem. We hopen dat de resultaten die in deze studie voorgesteld worden, bruikbaar blijken te zijn voor diverse disciplines zoals het bestuderen van mariene biodiversiteit, het beheer van de (artisanale) visserij en het geïntegreerd kustzonebeheer. Er wordt ook informatie gegeven over de relaties tussen koraalrif-, zeegras- en mangrove-ecosystemen. Dit is relevant voor alle tropische gebieden waar deze systemen samen voorkomen.

Resultaten

In een eerste hoofdstuk wordt de keniaanse kust beschreven. De nadruk ligt hierbij op het ontstaan van de huidige kusttopografie, het veranderende moessonklimaat en de oceanografische condities in de regio en in de kust- en mariene habitaten. De typische ecosystemen in Gazi Bay, nl. het koraalrif, de lagune en de mangrove, worden kort besproken.

De resultaten van de studie worden dan in een vijftal hoofdstukken besproken:

Hoofdstuk 2: De ichthyofauna van een tropische mangrove baai (Gazi Bay, Kenia)

In dit hoofdstuk wordt alle beschikbare informatie over de soortensamenstelling van de visfauna van Gazi Bay gesynthetiseerd. De zes studies die in het gebied werden uitgevoerd, gebruikten verschillende staalnametechnieken en –strategieën. In totaal werden er in de baai reeds 346 vissoorten in 72 families waargenomen. Slechts 11 soorten en 20 families werden in alle studies gerapporteerd; 180 soorten en 20 families werden maar in één van de studies gevonden. Slechts enkele soorten domineerden de vangsten; de meerderheid van de soorten vertegenwoordigden <0.05% van het totaal aantal gevangen individuen. *Sphaeramia orbicularis* (Cuvier, 1928) (Apogonidae) maakte 96% van de totale vangsten uit in fuiken en sleepnetten die in de mangrovebossen gebruikt werden. *Atherinomorus duodecimalis* (Valenciennes, 1835), *A. lacunosus* (Forster, 1801) (Atherinidae), *Herklotsichthys quadrimaculatus* (Ruppell, 1837) (Clupeidae), *Gerres acinaces* Bleeker, 1854 en *G. oyena* (Forsskal, 1775) (Gerreidae) waren de meest abundante soorten in ringzegenstalen. De dominante soorten in boomkorvangsten waren *Leptoscarus vaigiensis* (Quoy & Gaimard, 1824), *Scarus sordidus* Forsskal, 1775 (Scaridae), *Plotosus lineatus* (Thunberg, 1787) (Plotosidae), *Parascorpaena mossambica* (Peters, 1855), *Sebastapistes strongia* (Cuvier, 1829) (Scorpaenidae), *Apogon fragilis* Smith, 1961, *A. nigripes* Playfair & Gunther, 1866, *Fowleria aurita* (Valenciennes, 1831) (Apogonidae), *Siganus sutor* (Siganidae) (Valenciennes, 1835), *Lethrinus harak* (Forsskal, 1775) *L. nebulosus* (Forsskal, 1775) (Lethrinidae) en *Cheilio inermis* (Forsskal, 1775) (Labridae). De soortenrijkste families waren deze van de kardinaalvissen Apogonidae, de grondels Gobiidae en de lipvissen Labridae. In een addendum van dit hoofdstuk wordt het epibenthos van een ander keniaans mangrovesysteem (Tudor Creek, Mombasa) beschreven en vergeleken met dat van Gazi Bay. Zowel Tudor Creek als Gazi Bay zijn gekenmerkt door dense mangrovebossen, maar Tudor Creek ontvangt meer zoet water en terrigeen alluviaal sediment, vooral in het regenseizoen. De neerslagpatronen bleken in belangrijke mate de seizoenaliteit in de soortensamenstelling, de distributie en de densiteiten van de vissen en steurgarnalen te bepalen. Penaeidae (voornamelijk *Penaeus monodon* en *Metapenaeus monoceros*), Caridea, Gobiidae (voornamelijk *Yongeichthys nebulosus*), *Plotosus lineatus* (Plotosidae) en *Lutjanus fulviflamma* (Lutjanidae) waren de dominante soorten in Tudor creek. Typische zeegrasfamilies zoals Scaridae en Labridae – belangrijk in Gazi Bay – waren niet aanwezig in Tudor Creek.

Hoofdstuk 3 : Epibenthische gemeenschappen in een tropische baai (Gazi Bay, Kenia).

I. Ruimtelijke patronen.

De ruimtelijke patronen in gemeenschapsstructuur waren gecorreleerd met de nabijheid van het franjerif, de verspreiding en dichtheid van de zeegrasvelden en de nabijheid van mangrovebossen en rivieren. Volgende gemeenschappen werden geïdentificeerd: (1) de gemeenschap van de mondingen van de estuaria van de rivieren Kidogoweni and Mkurumuji, (2) de gemeenschap van de *Thalassodendron ciliatum* zeegrasvelden (centraal in de baai), (3) de gemeenschap van de perifere gemengde zeegrasvelden in de met mangroves geassocieerde delen van de baai zelf en van de twee hoofdkreken en (4) de gemeenschap in de nabijheid van het koraalrif. Densiteiten en diversiteiten stegen in zeewaartse richting. De armste stations (<35 individuen en <10 soorten per sleep van 10 minuten) waren gelegen in het estuariene deel van de estuariene kreek. De soortensamenstelling varieerde van station tot station, vooral wat betreft de dominantie van soorten. *Apogon nigripes* (Apogonidae) was bijvoorbeeld dominant in de westelijke kreek en in het verste station nabij het rif, maar de soort was vrij zeldzaam in de baai zelf. *Scarus sordidus* (Scaridae) was enkel belangrijk in de baai en was zeldzaam in de kreken. *Leptoscarus vaigiensis* (Scaridae) was in gans de baai belangrijk, behalve in de nabijheid van de estuaria. De meerderheid van de waargenomen soorten werd slechts in 1 of 2 slepen aangetroffen; geen enkele soort kwam in de 32 slepen voor.

Hoofdstuk 4: Epibenthische gemeenschappen in een tropische baai (Gazi Bay, Kenia).

II. Temporele patronen.

Seizoenale patronen waren niet erg duidelijk in onze data. Dit was waarschijnlijk te wijten aan de staalnamestrategie: er kon geen rekening gehouden worden met variabiliteit op kortere termijn, bijvoorbeeld ten gevolge van tidale en diurnale cycli. Toch werd er een scherpe daling van de densiteit en diversiteit waargenomen aan het begin van het lange regenseizoen in mei. Verhoogde productie en de stabilisering van de saliniteit door het ionisch strippen van de zeegrassen in dit regenseizoen liet een wederopbouw van de vispopulaties toe. Het droge seizoen werd gekenmerkt door hogere densiteiten en een groter aantal soorten dan het regenseizoen. Densiteiten waren het laagst in juli en in oktober-november en het hoogst in april en augustus. De met zeegras geassocieerde soort *Leptoscarus vaigiensis* was bijna altijd en overal aanwezig. Alle andere dominante soorten kwamen vrij onregelmatig in verschillende stations voor.

Hoofdstuk 5: Het dieet van juveniele vissen in een tropische mangrove baai (Gazi Bay, Kenia).

Analyses van de maaginhoud van de 33 dominante vissoorten uit de boomkorstalen lieten toe vier guilds te identificeren, namelijk omnivoren, piscivoren, zooplanktivoren en benthivoren. Indicators voor de guild van de omnivoren waren "*aufwuchs*" soorten, die meer dan 90% van de opgenomen biomassa vertegenwoordigden. De gravimetrische samenstelling van het dieet van de piscivoren bestond voor >60% uit vissen. Indicatorsoort voor de zooplanktivoren waren calanoide copepoden (deze maakten gravimetrisch >40% van het dieet uit). De benthivoren werden gegroepeerd op basis van amphipoden (>30% van de opgenomen biomassa). De numerieke samenstelling van het dieet was vrij variabel binnen elke guild. Ontogenetische veranderingen in het dieet werden vooral binnen de guild van de omnivoren waargenomen: de jonge vissen namen hierbij meer dierlijke prooien dan de oudere. Ook in de guilds van de benthivoren, bvb. in *Cheilio inermis* (Labridae) en in *Lethrinus nebulosus* (Lethrinidae) en de zooplanktivoren, bvb. in *Apogon fragilis* (Apogonidae) werden ontogenetische shifts waargenomen, maar niet in de guild van de piscivoren

Hoofdstuk 6: De trofische organizatie van de visfauna van een tropische baai (Gazi Bay, Kenia).

Voor de synthese van de trofische organisatie in Gazi Bay werd vertrokken van de volledige lijst van alle waargenomen vissoorten (hoofdstuk 2) en van de informatie uit de maaganalyses (hoofdstuk 5). Verder werd informatie gehaald uit de FISHBASE (1998) database. Naast de trofische klassificatie, wordt ook informatie gegeven over het type habitat (marien, brak of zoet water - koraalrif, lagune, zeegrasveld, mangrovebos,...) waarmee de soorten geassocieerd zijn. Drie trofische guilds werden gebruikt om de vissoorten te klassificeren: herbivoren, omnivoren en carnivoren. De geprefereerde voedselitems (prooien) (bvb. vis, macrofauna, benthos, necton, macroalgae, phytoplankton, zooplankton, filamenteuze algen, ecto-parasietes, levend koraal, insecten,...) werden voor elke soort opgesomd. Voor sommige soorten werd er geen informatie over het dieet gevonden; deze werden geklassificeerd als "onbekend". Meer dan 70% van de vissoorten van Gazi Bay waren mariene soorten en ongeveer 20% waren anadroom of katadroom. De meeste soorten waren typisch geassocieerd met koraalriffen. Negenentwintig soorten waren euryhalien en twee soorten waren zoetwatervissen. Carnivore soorten vertegenwoordigden meer dan 63% van het totaal, 20% waren omnivoor en 4% waren herbivoor (het dieet van de rest van de soorten blijft onbekend). De guild van de herbivoren was ondanks het laag aantal soorten gekenmerkt door de hoogste densiteiten. Carnivoren en omnivoren waren belangrijker buiten de *Thalassodendron* velden, waar de herbivoren goed vertegenwoordigd waren.

CHAPTER 1

1.0 GENERAL INTRODUCTION

Kenya has a coastline of about 600km long on the western shores of the Indian Ocean. The almost continuous fringing reef some 500m-2km offshore is a distinctive feature of the coastal environment and resources. Other distinctive features include the Lamu Archipelago with its extensive creeks, mangrove forests and coral gardens; Ungwana bay, with its affluent River Tana; the Sabaki River north of Malindi; the Malindi-Watamu coral gardens; the creeks at Kilifi, Mtwapa, in Mombasa (Tudor creek and Port Reitz creeks having the major ports of Tudor and Kilindini); Gazi bay and Funzi bay; and the small islands Chale and Funzi in the south (Fig. 1.1). River Tana is the longest in the country with its catchment in the highlands in central Kenya. The Sabaki combines the Rivers Galana and Athi, which also have origin in the central highlands. Ungwana bay including the north Kenya banks is the largest and widest continental shelf area on the Kenya coast. It is therefore the main trawling ground for fish and prawns.

Over two million people live in the coastal area of Kenya (approximately 8.5% of the national population, 1989 population census), with an overall density of about 22 persons per km^2, against the national growth rate of 4.2% and a local urbanisation rate of 18% (ODIDO, 1998). Mombasa being the main city on the coast has about 20% of the coastal population with a much higher density (1637 persons per km^2) (ODIDO, 1998). Most of the people rely on the coral reef and the Mangrove for their economic and livelihood activities. The coral reef is the major fishing ground for the traditional and artisanal fishers who form about 80% of the total (5000) coastal and marine fishing force. The reef is also the main source of the building stones and lime, while the live coral gardens are the major tourist attractions. Tourism is among the most important industries and sources of foreign currency (together with e.g., Tea and Horticultural products) in the country.

Mangroves are the other important natural resource on the Kenya coast. The most explicit reliance the coastal people have displayed in relation to the mangrove is in building and fuel wood. Almost unrivalled in the building industry along the coast is the mangrove pole (whatever size). Mangroves were also the major source of charcoal and firewood, especially in the lime production. The rather implicit reliance on mangroves is the ecological role the

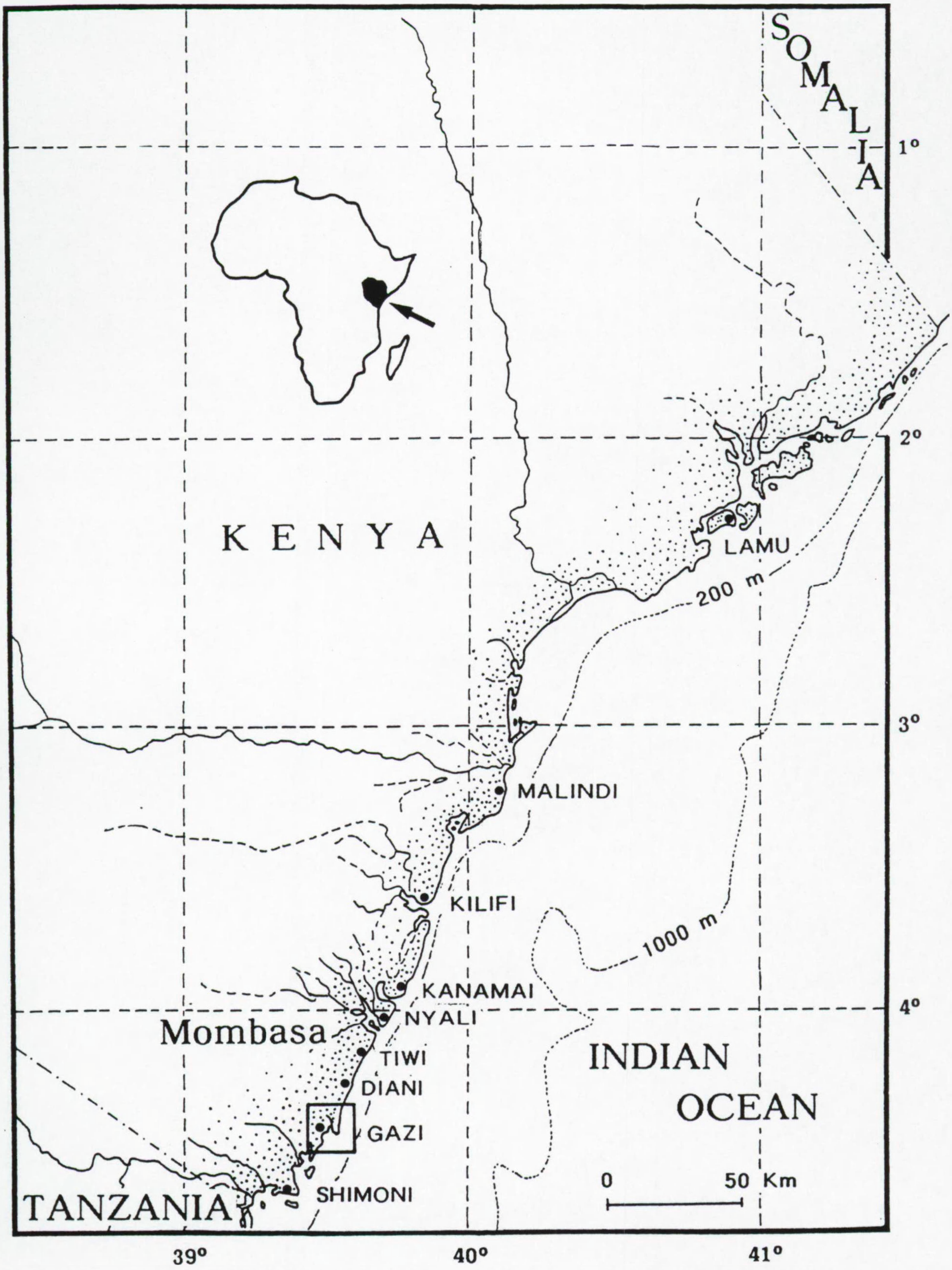

Figure 1.1: Map of the Kenya coast showing the major topographic features.

ecosystem plays in the overall coastal topography, ecology and in the production and sustenance of fish and fishery resources. It is this latent especially the ecological aspects that form the thrust of this thesis. Mangroves were also the natural sources of traditional medicine and tannin and the forests enclosed the traditional shrines for the local people.

This work endeavours to highlight on the interrelationships between the rich biological diversities in the mangrove swamps, the coral reefs, and the adjoining habitats in the interlinking lagoons (the seagrass beds), with a focus on fish in Gazi bay. It has been remarked that, "the dilemma that faces Eastern African nations today is that they are depending more and more on the coastal zone for their livelihood and wellbeing, the natural habitats and ecosystems which sustain these resources are being destroyed or stressed through pollution, various developments and other impacts" (UNEP, 1998) of anthropogenic origin. This statement cannot be over emphasised, coming as it is in the Kenyan part of that big project (EAF/14) to cover the entire Western Indian Ocean region (i.e., Eastern African coastal states and the Island states in the WIO). You only have to step out any where along these shores to behold in awe the strangely cited developments, unabatable coastal erosion, cleared mangrove forests, huge abandoned quarries, diminished landings and landed sizes of fish, diminished quality of mangrove poles, and so on. The major issue however is that, despite the research efforts and requirements for EIAs for development, there has been very little, if any, integrative approach to the coastal zone with its abundant resources. Each resource was treated separately and harnessed independently in disregard to the effects such harnessing had on the overall ecosystem. The recently set-up Integrated Coastal Zone Management (ICZM) team was the first ever step towards integrated approaches to coastal environment and resources. It is anticipated that the results of their work will greatly benefit the development and utilisation of these resources. There is already a lot of groundwork, culminating into regional as well as national initiatives (see e.g., LINDEN, 1995; LINDEN & LUNDIN, 1996; 1997; HUMPHREYS & FRANCIS, 1997; UNEP, 1998) towards integrated coastal zone (area) environmental and resources management.

1.0.1 Geological Background:

The evolution of the present coastal biotopes on the East African coast is related to the past geological processes in the region. It is believed that the present configuration of the East African Coasts evolved during the Pleistocene to Recent times (between 1.6million and 10,000 years ago) (CRAME, 1980; 1981; HAMILTON & BRAKEL, 1984; RUWA, 1993; RICHMOND, 1997; UNEP, 1998). This period was characterised by numerous fluctuations in global temperature marked with alternating glaciers and warming which resulted into numerous fluctuations in sea levels (RICHMOND, 1997; UNEP, 1998). The largest net relative drop (15m) in sea levels in the Western Indian Ocean is believed to have occurred during this time (RICHMOND, 1997). These phenomena were responsible for the formation of the present-day creeks, bays, river mouths, coral reefs, reef platforms and the extent of the continental shelves. Evidence for this can be seen from the fossil coral colonies, giant clams and sometimes fossilised shark teeth, in the fossil coral limestone cliffs standing about 5-12m above the water (RICHMOND, 1997, KAIRU, per. Comm).

1.0.2 The climate and oceanography:

The general climatic conditions in East Africa is Tropical, with the air temperatures always above 20°C and sea water temperatures usually within 23-30°C. It is however subject to two major alternating but distinctive seasons: the Southeast monsoon season (SEM) in May-October and the Northeast monsoon season (NEM) in November-March. The characteristic Trade winds also swing in magnitude with the alternating monsoons (Fig. 1.2). The Southeast Trade winds (*Kusi* in Kiswahili) being dominant during the SEM moves at about 5m/sec, and the Northeast Trade winds (*kaskazi* in Kiswahili) in the NEM move at about 9m/sec (RICHMOND, 1997). These changing wind direction and strength have profound influence on the rainfall pattern and amounts received in the region. The Northeast Trade winds are generally dry winds coming as they do from the hot and dry Sahara and Arabian landmasses in the north. They therefore bring with them the drying effect. The NEM season therefore coincides with the dry period in the region. The Southeast Trade winds arise from the high pressure belt in the cold Southwest drift in the south and passes over the warm South Equatorial Current (see BENOOT *et al.*, 1983 or any standard world maps Atlas). These moisture-laden winds are deflected land wards as they approach the Equator (Coriolis force) and cause the long rains associated with the SEM season (RICHMOND, 1997, UNEP, 1998). Other types of wind but which do not have the same pattern as described for the Trade winds are the erratic cyclones and the daily land-sea breezes. The cyclones when they occur can be very strong (>100km/hr) and sometimes destructive.

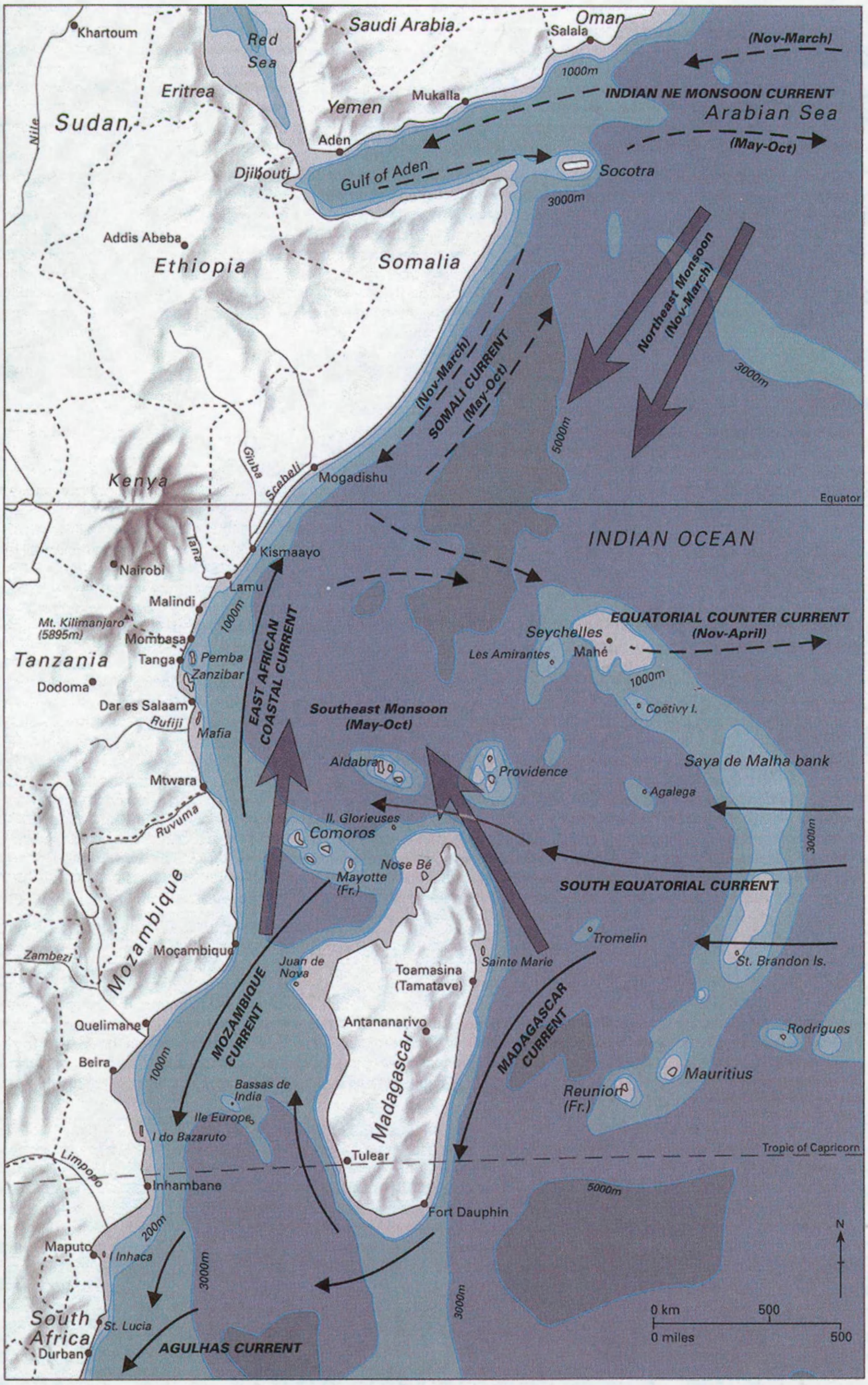

Figure 1.2: Map of the Western Indian Ocean showing the water depths, direction of the monsoon winds, and the major oceanic and coastal currents. After RICHMOND, 1997.

The oceanography in the Western Indian Ocean is characterised by the influence received from the above swinging winds and the oceanic as well as coastal currents. The westerly flowing South Equatorial Current dominates the circulation in the Western Indian Ocean. On passing the northern tip of Madagascar (Fig 1.2), the SEC split into the Mozambique Current southwards and the East African Coastal Current (EACC) northwards. The EACC is the main stream washing the entire East African coast all the year round. During the SEM season, the EACC flows into the northward flowing Somali Current (SC) and continue all the way to the Horn of African and into the Arabian Sea. However, during the NEM, the SC reverses direction southwards and meets the EACC off the Kenyan-Somalia coasts (depends on the strengths of the two currents), causing a local upwelling at the confluence and an eastward flow, the Equatorial Counter Current (ECC) north of the SEC (RICHMOND, 1997; UNEP, 1998, WAKWABI & NGULI, unpublished data). These reversals have profound influence on the productivity in marine and coastal waters in their vicinities.

The region is characterised by semi-diurnal tidal cycles with two neap tides and two spring tides in every 28 days (one lunar cycle). The timing of the low and high waters varies with the position along the coast. The tidal range is about 3.8m in Mombasa (is also variable with position) (RICHMOND, 1997; UNEP, 1998).

The winds, the coastal and oceanic currents, and the tides are the main forcing in the coastal biotopes. Together with the rainfall and river affluence, these are the main driving forces on the productivity and activity in the coastal waters.

1.1 COASTAL AND MARINE HABITATS IN THE EASTERN AFRICA:

The East African coastline is intermittently broken at points to give way to varied sizes of river and stream mouths opening into the Indian Ocean, large creeks, and bays. Important river mouths include the Guiba-Scebeli in Somali, the Tana and Sabaki in Kenya, the Rufiji in Tanzania, and the Ruvuma, Zambezi, and Limpopo in Mozambique (see Figs 1.2 & 1.3). These are major drainage with great catchments in the mainly agricultural hinterlands. They are therefore sources of large amounts of allochthonous production in the adjacent nearshore and inshore coastal waters especially during their respective flood periods. The estuaries of these rivers adjoin in major bays (e.g., Ungwana bay in northern Kenya receives both the Tana and Sabaki rivers, and the Limpopo enters the sea via the Maputo bay). These bays lie adjacent to wider shelf areas with conducive trawlable grounds and fishable stocks.

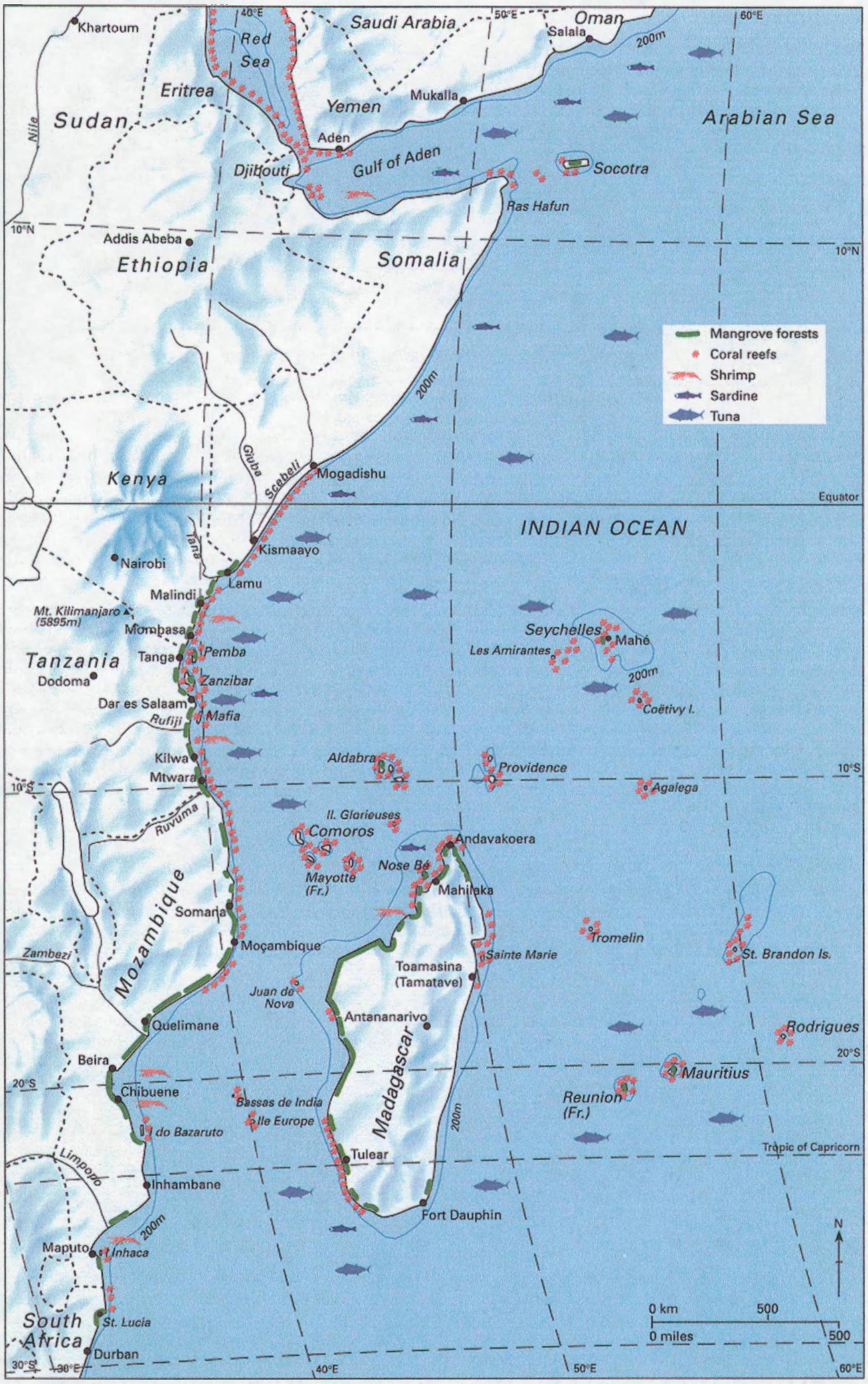

Figure 1.3: Map of the Western Indian Ocean showing the distribution of mangrove forests and the fringing coral reefs along the Eastern African coastline and around the Islands, and the distribution of some major fisheries (sardines, tuna, shrimp). After RICHMOND, 1997.

1.1.1 The fringing coral reefs:

Offshore, and running along the seaward edge of the narrow (<500m at the narrowest to about 50km at the widest) continental shelf is the almost continuous fringing coral reef (Fig. 1.3). The reef lies between 500m and 2km offshore on the Kenyan coast (UNEP, 1998) with points of discontinuity adjacent to the major river mouths due to lowered salinity and high turbidity of the water from the effects of the rivers (UNEP, 1998). Beyond the reef, the shelf drops off (in most cases almost vertically) into the abyssal. Where there is an extended shelf slope, are important fishing grounds especially for the sport fishers, and artisanal and traditional fishers (RICHMOND, 1997; UNEP, 1998).

1.1.2 The lagoons:

Between the shores and the fringing coral reef is usually the reef lagoon of varied width and depth. These lagoons have diversified bottom types: hard, soft, rubble, sandy, muddy etc, and are therefore covered by varied foliage of seagrass and algal mats. The lagoons are also dotted with colonies of life patch coral growths. These features continue into the creeks and bays where conditions allow (i.e., where the water remains clear with marine salinity ≈35ppt and temperatures of 25-30°C most of the year) (RICHMOND, 1997). Where there is strong river (freshwater) influence, the coral reefs and seagrass do not proliferate due to heavy sedimentation and the fluctuating salinity. Life coral colonies for example are only limited at the mouth end of Tudor creek, but not inside the creek (personal observation). The creek receives freshwater and sediments especially during the rainy season, which greatly depresses the salinity (WAKWABI & JACCARINI, 1993).

1.1.3 The mangroves and mangrove swamps:

Along the shores are sandy beaches, dunes and mangrove swamps (in some cases with salt marshes behind the mangrove forests). Mangrove swamps are characteristic of the gentler shores as opposed to the shores ending into rocky cliffs. They grow on sheltered sedimentary shores, especially in bays, creeks, and estuaries and are delimited in the Tropics. The swamps are flooded at high tide and drained at low tide. The various species of mangrove trees are clearly zoned between the upper shore and the mid-eulittoral zone (RUWA, 1993; RICHMOND, 1997). In Kenya, of the 8 species of mangroves, *Avicenia marina* and *Rhizophora mucronata* are the commonest (UNEP, 1998). *Heritiera littoralis* is only in one pure stand at Kipini, in the Tana estuary (RUWA, 1993; UNEP, 1998). The other species are *Ceriops tagal, Bruguiera gymnorrhiza, Sonneratia alba, Xylocarpus granatum,* and *Lumnitzera racemosa. Avicenia marina and Sonneratia alba* are the first colonisers giving way to *Ceriops tagal* and *Rhizophora mucronata* that colonises the softer muddy swamp that is established by the first colonisers (UNEP, 1998). The later is usually established between *Sonneratia* and *Avicenia* on the creek edge and *Ceriops* on the land wards. *Bruguiera* normally grows in the same zone with *Rhizophora* (UNEP, 1998). However, *Sonneratia alba and Rhizophora mucronata* are usually on the seaward side, while *Avicenia marina and Lumintzera racemosa* occupy the higher land wards side (RUWA, 1993; UNEP, 1998). *Bruguiera gymnorrhiza* frequently occurs behind the *Rhizophora mucronata* zone while *Xylocarpus granatum* is usually above the *Avicenia marina* zone (UNEP, 1998). *Ceriops tagal* is found behind the *Rhizophora* zone in the land wards direction (RUWA, 1993).

The largest expanse of mangroves are almost always associated with the large river mouths (RICHMOND, 1997), though some extensive mangrove stands, the creek and fringe mangroves (RUWA, 1993), have developed in areas with no direct river or surface freshwater influence (Fig. 1.3). Such stands are believed to be nourished by underground aquifers through seepage (RUWA & POLK, 1986). The distribution of major mangrove forests along the Kenya coast is presented in Fig. 1.4. It is worthy to note that most of the stands occur in relation to the river mouths along the coast.

Mangroves are salt tolerant terrestrial evergreen angiosperms, which were out competed in their original freshwater environment and have adapted to the saline conditions (COPPEJANS, pers. comm.). Their canopy height and expanse depends on the conditions of growth. Where the conditions are favourable, they develop into a forest with high trees, but where the conditions are less favourable (colder and hyper-saline waters); they grow only into shrubs. They have developed various adaptations to be able to thrive in these very harsh (water stress) conditions: among them being the reduced and concealed stomata in leaves; the pneumatophores and prop (stilt) roots; presence of lenticels and aerynchyma in the pneumatophores, stilt roots and on the stem; the extensive root system; and viviparity as a mode of reproduction (with the exception of *Sonneratia alba*) (COPPEJANS, pers. comm.). Mangroves require generally Tropical temperatures (>20°C), sustained supply of fine-grained alluvium, protected shores (from strong tidal currents and waves), saline waters, and large tidal ranges (FURUKAWA & WOLANSKI, 1996; COPPEJANS, pers. comm.). By the nature of their rooting, mangroves develop and consolidate shorelines, by trapping sediments and protecting the shore from the storm tidal waves and gully and river erosion (FURUKAWA & WOLANSKI, 1996). The swamps constitute very special environment and therefore a habitat for different marine and brackishwater flora and fauna. This habitat where ever it occurs, is known to provide important nursery and foraging grounds for both marine and brackishwater fish and invertebrates (e.g., PARRISH, 1989; BLABER, 1980; 1986; GARCIA & LE RESTE, 1981; COLLETTE, 1983; HUTCHINGS & RECHER, 1983; BIRKELAND, 1985; GROVE *et al.*, 1986; ROBERTSON & DUKE, 1987; MATTHES & KAPETSKY, 1988; PARRISH, 1989; SASEKUMAR *et al.*, 1992; WAKWABI & JACCARINI, 1993; LAEGDSGAARD & JOHNSON, 1995; CHONG *et al*, 1996; WAKWABI, 1996; RÖNNBACK *et al*, 1998). There is a relationship between the mangrove cover and total penaeid landings by country in the WIO region (see Table 1.1).

The northernmost limit of mangrove growth on the East African coast is at the Kenya-Somali border, the southernmost limit is at St. Lucia on the KwaZulu-Natal coast of South Africa (Fig. 1.3) (RICHMOND, 1997). The coral reefs have also about the same extend south, but reach Mogadishu in the north and there are extensive coral reefs from the horn of Africa into the Red sea.

Table 1.1 The total shelf (0-400m deep) area (km^2), area of mangrove swamps (km^2), total trawlable grounds (km^2) (and its percentage of total shelf area), and the total prawn catch (tonnes, 1988 records) from a selected Eastern African Coastal and Western Indian Ocean Island states. Source FAO/IOP, 1979; FAO, 1988; RUWA, 1994.

Country	Shelf	Trawl area (%)	Mangrove area	Prawn catch
Kenya	19,120	10,994 (57%)	530	149
Tanzania	18,508	15,440 (81.6%	960	1,324
Mozambique	86,090	71,592 (83%)	850	5,753
Madagascar	120,000	120,000 (100%)	3,207	10,000

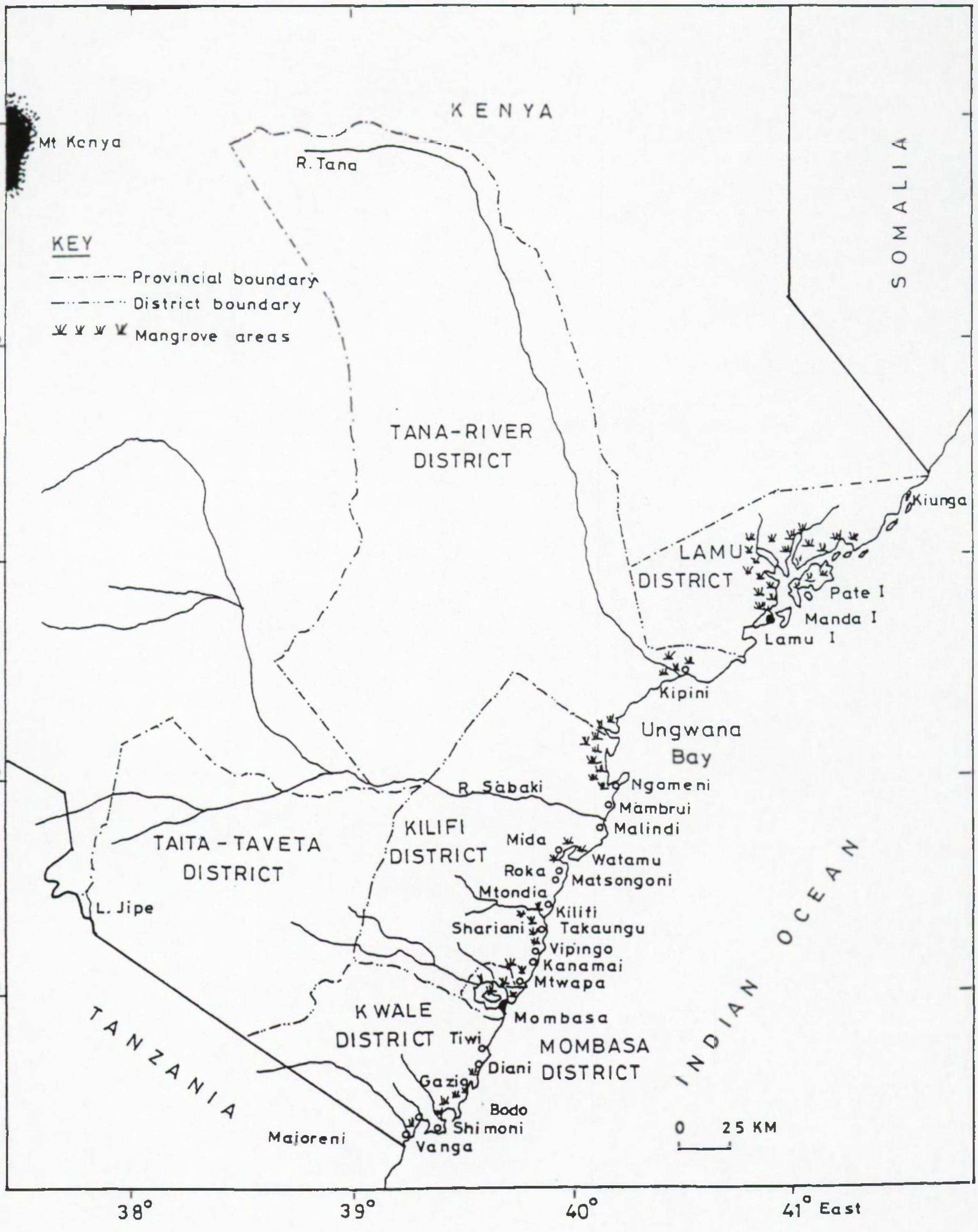

Figure 1.4: Map of the Kenyan coastal zone showing the areas of dense mangrove cover. After RUWA, 1990.

1.2 FISHERIES IN EAST AFRICA: An Overview.

The western Indian Ocean fishing area (area 51) has a total surface area of about 30 million km^2 (FAO, 1997). Marine capture fisheries have grown steadily in the region from a merely 0.5 million tonnes in the 1950s to about 3.8 million tonnes in 1992 (FAO, 1997). There has been a slight drop (to about 3.7 million tonnes, average annual landings) from the 1992 peak due to the recent fluctuations in the small pelagics (clupeids and percomorphs) stocks in the northern part of the region (FAO, 1997). These fluctuations were however buffered by the steady increase in the landings from the demersal species, especially the red fishes during the same period (FAO, 1997).

The fisheries characteristics in this area are a reflection of the diversity of the area. The northern part (starting from the Somali coast into the North Arabian sea including the Persian Gulf, the Gulfs of Aden and Oman and the Red sea) and the Pakistan and Western coast of India is characterised with monsoon driven upwellings. The marine fisheries in this area are relatively more productive in the region (Table 1.2). The Eastern African coastal states (Somali-Kenya-Tanzania-Mozambique) are the least productive in the region, the pattern of which seems to start off the Kenyan coast in all directions (north, west and south).

The East Coast of Africa presents a wide range of oceanographic environments, some of which are at scales unique to this area. The Western Indian Ocean is known to contain some of world's most dynamic LMEs. The Somali Current (during the SEM) for example, is the fastest open ocean current in the world, and the upwelling it generates during its peak flow is reportedly the most intense large-scale seasonal coastal upwelling in the world (FAO, 1997). The fishery production levels in this general area are puzzling, given that the influence of the stated oceanographic conditions reaches the productive North and the Island states. Despite the very low production (Table 1.2), the coastal fisheries in this area are reportedly fully to over-exploited (FAO, 1997). Probably, the intensity of the Somali Current, the East African Coastal Current, and the Equatorial Counter Current combine forces with the shifting monsoons to deprive this area of its coastal and oceanic production exporting to the far North and East. The Indian Ocean continental shelf of Africa is relatively narrow, although this may not be a good reason for the meagre fisheries.

Table 1.2: The average annual (1991-1993) landings (tonnes) of the marine fisheries from a selection of the Western Indian Ocean Coastal and Island states (inclusive of fish, cephalopods and crustacean only). Source: FAO, 1997.

State	Marine Fish landings (Tonnes)
Regional total (1981-1983)	2,105,376
Regional total (1991-1993)	3,708,448
Pakistan	443,400
Iran	231,500
Oman	115,500
Yemen	82,700
Somali	15,100
Kenya	6,100
Tanzania	51,200
Mozambique	26,300
Madagascar	78,600
Mauritius	19,700

The coastal fisheries are harvested by the coastal states while the lucrative oceanic fisheries are exploited by distant-water fleets mainly from Europe and Eastern Asia (FAO, 1997). Due to the economic situations in the East African states, most of the coastal trawler fisheries target the penaeid prawns for their value on the export market. However, coastal fisheries provide the bulk of the vital animal protein since other sources of animal protein are generally expensive and out of reach to most of the local populations.

1.2.1 Marine and Coastal Fisheries in Kenya:

Kenya has a very narrow continental shelf reaching about 50km at the widest but mostly less than 2km wide. The shelf is dotted with rocky and coral outcrops, which make most parts inaccessible to the conventional commercial fisheries (e.g., bottom trawl fisheries). Ungwana bay and the North Kenya Banks, in the north coast of Kenya, being the only trawlable areas (with the widest shelf area and a smooth seabed) experiences a kind of "trawlers bonanza" during the prawning season (the NEM), as penaeid prawns are the target species and the principal catch of this fishery. Elsewhere, along the coast, fishing is done on foot, on small canoes or cataracts, on wind powered dhows, outrigger boats, and (on a lesser extend) on motor powered boats. The distribution of these boats by district (Table 1.3) was noted to represent a much better picture of the fishing activities in the coast than the much preferred fish landing statistics (UNEP, 1998). Note that the south coast had the highest number of boats. This implies that the reefs in this section of the Kenyan coast are probably the most productive. It is also notable that most of the sport fishing is carried out in this general area extending south to the Pemba Channel (Pers. Observ.). In fact some fishers from Pemba come all the way into the southern Kenya's reefs to fish due to better catches, probably as a result of the long time, since 1978, (UNEP, 1998) coral reef conservation under the Marine Protected Areas on this Kenyan side (Pers. Observ.).

The artisanal and traditional fishers operate on a daily basis within the semi-diurnal tidal cycle between the reef and the shore. They deploy small gears e.g., gill nets, seine nets, cast nets, traps, long lines, harpoons, spear guns, etc; and use all sorts of fishing methods e.g., bit-fishing, diving (skin and scuba), surrounding, digging, picking, and/or chasing (depending on the situation and/or condition of tide). Their fishing grounds are on the reef slope, the reef itself, within the lagoon behind the reef, and in the mangroves. This fisheries account for about 90% of the total marine fish landings (about 8000mt in 1992) in Kenya (UNEP, 1998). A number of the fishers are also doing booming business in life coral fish for aquarium. Basing on the UNEP (1998) proposed dependence ratio of 7:1 dependants to a fisherman, then a total of 35,000 people (3.5% of the population) in the coast rely directly on fishing as a means of livelihood. This figure excludes the fishmongers, fish traders and processors of fish and fishery products as well as those involved in gears and boat making and their dependants.

Table 1.3 Distribution of the small/traditional fishing craft along the Kenya coast. Source: UNEP, 1998.

District	Lamu	T. River	Kilifi	Mombasa	Kwale
N_o of Boats	508	-	361	401	558

Three types of fisheries therefore operate in the Kenyan coastal waters: commercial fishery (mostly licensed foreign owned trawler, seiner, and longline fleets), artisanal fishery (basically with the small traditional gears by the local people), and the sport fishery (operated by fishing clubs and major Hotels alongside other tourist activities with small but quite sophisticated and expensive gears). The trawlers operate smaller boat (15 - 30m long with 1 week to 1 month holding capacity) and basically ply the Ungwana bay-North Kenya Banks for prawns and land finfish as by-catch at their bases in Mombasa and Malindi. Purse seiners and long-liners on the other hand are based on the high seas, only entering national waters to refill and/or to trans-ship their Tuna and Tunalike fish, Billfish and sharks (or shark fins) at Mombasa. Mostly French and Spanish (for purse seiners), and Taiwanese, Japanese and Korean fishers (for long-liners) dominate these fleets. The boats which are comparatively larger (>30m long) are fully fitted for on-line fish processing on board, with holds of 150-1200mt. They operate much larger gears, namely: trolling lines (up to 100km long with >3000 hooks each), purse seines (over 300m deep), surface set gillnets (or what used to pass as drift nets), hand lines, and long-lines. Their catch is not always recorded as part of the national catch, but in the trans-shipment records.

In Table 1.4 is presented the fisheries production in Kenya for the period 1990-1995. The total marine landings fluctuated between 2.4% and 5% of the total national fish production. Artisanal fisheries account for about 90% of this marine catch. Lake Victoria alone accounts for over 90% of the of the total annual fish production in Kenya. Most of this fish is consumed in the country. About 8% is exported. Almost 80% of the catch from marine invertebrate fisheries is exported (Pers. Observ). The Nile perch products are the country's principal fish and fishery exports (Fisheries Annual Statistics, 1993).

Maricultural initiatives along the Kenya coast have most often ended at the experimental levels. This is mostly blamed on the lack of the financial and appropriate support infrastructure required to sustain these initiatives. The experimental (FAO-Kenya Government) shrimp farm at Ngomeni (north coast of Malindi) and the (KBP) oyster farm at Gazi, are good examples.

The information status especially on the levels of fishable stocks, on the nursery grounds, and on the ecology of the commercially exploitable fish species is growing but at a very slow pace. In most cases, when available, this information lacks the integrative aspects intricate to the coastal area. Yet, without a good understanding of the interrelationships between (for example) the mangrove swamps, the coral reefs and the interconnecting lagoons, whatever volumes of information and data generated on anyone of these ecosystems will just remain like “stand-a-lone” efforts without integration.

So far, the research undertaken on fishes and other fishery biota, for example in Ungwana bay (BRUSHER, 1981), Mida creek (MWATHA *et al.*, 1998), Tudor and Port Reitz creeks (BRUSHER, 1981; GROVE *et al.*, 1985; LITTLE *et al.* 1988; WAKWABI & JACCARINI, 1993; WAKWABI, 1996), and Gazi bay (WOITCHIK, 1993; RUWA & POLK, 1994; HEMMINGA, 1995; DE TROCH *et al.*, 1996; 1998; KIMANI *et al.*, 1996; MARGUILLIER *et al.*, 1997) and the coral reef research initiatives under the Coral Reefs Conservation Project (McCLANAHAN & MUTHIGA, 1989; McCLANAHAN & SHAFIR, 1990; McCLANAHAN & MUTERE, 1994; McCLANAHAN *et al.*, 1994; UKU, 1995; MUTHIGA, 1996) is acknowledged. Having focussed on the shallow inshore waters, the reports in these studies emphasise the nursery roles the respective areas play to different fishery species. Lately, the role these coastal habitats play in the totality of the biological diversity in our area and particularly (not always) towards the conservation of the threatened sea turtle and the dugong populations is becoming important. Hardly however, had anyone study treated in-depth the diversity, communities, and trophic dynamics (with the stretch of data in time and scope) of the ichthyofauna as was achieved in this (present) study.

Table 1.4 Quantity (tonnes) and value (K£'000) of fish and fishery products landed in Kenya in 1990-1995. (*) Denotes provisional values. Source ODIDO, 1998.

Production	1990	1991	1992	1993	1994	1995*
L. Victoria	185,101	186,366	151,206	174,829	193,652	190,009
Others Inland	6,705	4,732	4,841	4,027	4,309	4,450
Marine fish	9,972	7,464	7,244	4,336	5,004	6,231
Grand Total	201,778	198,562	163,251	183,193	202,965	200,690
Value(000K£)						
Total inland	80,174	83,306	162,277	180,446	185,927	164,416
Marine fish	10,358	7,320	9,872	7,838	12,669	13,012
Grand Total	90,532	90,626	172,149	188,284	198,596	178,012

With our poor state of fisheries, we need to diversify the economic bases of the coastal people for their livelihood. The land in the coastal strip is poor agriculturally (very dry, stony, sandy, saline soils, etc). To diversify the economy will need the ICZM approach for any sustainable production. This requires a core of information and a database from which development strategies can be drawn. Gazi bay among other equivalent systems will therefore provide appropriate examples from which future researchers, policy makers, and developers in the coastal area could draw informed opinions. The bay is placed in the area of the Kenya coast where fishing and fisheries related activities are the mainstay social and economic activities (see Table 1.3). The most important ground fish species in the landings (Table 1.5), e.g., the Rabbit fish (Siganidae), Scavengers (Lethrinidae), Snappers (Lutjanidae), and Parrotfish (Scaridae), are incidentally very important nursery candidates on this bay (as will become more clearer in the ensuing chapters in this thesis).

Table 1.5: Categorised marine fish landings by species (groups), weight and value for 1992 and 1993. Source: Fisheries Department, Fish Landings Statistics, 1993.

SPECIES (GROUP)	1992		1993	
Demersal	Tonnes	,000 KSH	Tonnes	,000 KSH
Rabbit fish (Siganidae)	495	7,929	440	9,805
Scavenger (Lethrinidae)	477	6,760	441	9,413
Snappers (Lutjanidae)	155	2,225	129	3,833
Parrotfish (Scaridae)	177	2,679	167	3,880
Grunters (Haemulidae)	61	884	65	1,256
Goatfish (Mullidae)	37	585	31	738
Rock cods (Serranidae)	78	1,280	85	2,025
Cat fish (Plotosidae)	33	343	36	583
Others (mixed demersals)	695	14,151	897	20,494
TOTAL (Demersal)	2,508	36,838	2,293	52,007
Pelagics				
Jacks & mackerels (Scombridae)	217	4,295	112	3,502
Mullets (Mugilidae)	117	1,885	116	2,867
Barracuda (Sphyraenidae)	53	901	57	1,331
Sardines (Clupeiformes)	358	3,748	166	2,938
King/Queen fish (Carangidae)	111	4,233	68	2,383
Milk fish (Chaniidae)	19	246	26	495
Others (mixed pelagics)	2,720	63,717	831	26,682
TOTAL (Pelagics)	3,595	79,025	602	33,170
Sharks & Rays (Elasmobranchii)	173	2,404	152	3,933
Crustacea				
Prawns (Penaeidae)	388	45,066	208	35,873
Others (crustaceans)	185	17,086	164	20,698
Other invertebrates	395	17,009	141	4,048
GRAND TOTAL	7,244	197,428	4,336	156,757

1.3 GAZI BAY:

Gazi bay, also known as Maftaha bay, is located about 4°22'S, 39°30'E (KITHEKA, 1996; OHOWA et al, 1997) some 60km south of Mombasa Island on the Kenya coast (on the shores of the Western Indian Ocean). It is a shallow (<5m mean depth) bay, semi-enclosed by an almost continuous coral reef on the seaward side and surrounded by a dense and extensive mangrove forests on the land ward side (Fig. 1.5). The bay has a total surface area of approximately 10km^2 with the swamp and 5-7km^2 excluding the swamp area. It has two main creeks, the west creek ending in the River Kidogoweni estuary and the blind-ending east (or Kinondo) creek. The other river entering the bay, but from the reef end, is the River Mkurumuji (Fig. 1.5). These two rivers are quite seasonal, filling with floods during the long rains and almost dried out during the dry season. The water circulation, nutrient regeneration and fluxes, and salinity distribution in Gazi bay were discussed in HEMMINGA *et al.*, 1994; KAZUNGU *et al.*, 1993; KITHEKA, 1993; 1996; SLIM *et al.*, 1996; OHOWA *et al.*, 1997). The dominant forcing on the bay are the on-shore winds, the semi-diurnal tides, and the river affluence which are themselves quite variable on semi-diurnal to seasonal scales (KITHEKA, 1996). These forces are subject to the general shifting in magnitudes of the oceanic and coastal currents and in the Trade winds in the region. The water flow pattern in the bay (Fig. 1.6) traps the affluent freshwaters from the two rivers restricting the influence of River Mkurumuji to the main bay lagoon area and that of River Kidogoweni in the upper reaches of the west creek. This is believed to maintain a healthy fringing coral reef, as the low salinity, turbid river water does not reach them (KITHEKA, 1996).

Seven of the 8 mangrove species along the Kenya coast occur in Gazi (KOKWARO, 1985; SPEYBROECK, 1992; RUWA, 1993; KAIRO, 1995) with very clear zonation between the watermark and dry land (SPEYBROECK, 1992;PPP RUWA, 1993; KAIRO, 1995). *Sonneratia alba* and *Rhizophora mucronata* are restricted to the deeper end (seawards) while *Lumnitzera racemosa* and *Xylocarpus granatum* are restricted on the higher (landwards) ground. *Ceriops tagal* and *Bruguiera gymnorhiza* occur in between this range in mixed stands with *Rhizophora mucronata*, (for both species), and/or with *Avicenia marina* for the later and *Xylocarpus granatum* for the former (RUWA, 1993). *Avicenia marina* has the widest distribution depth and width of shore in the area (RUWA, 1993).

Within the creeks and in the main bay lagoon, the seabed is covered by seagrass beds and macro-algal mats of varied intensities on and interspersed with bare sands, soft mud,

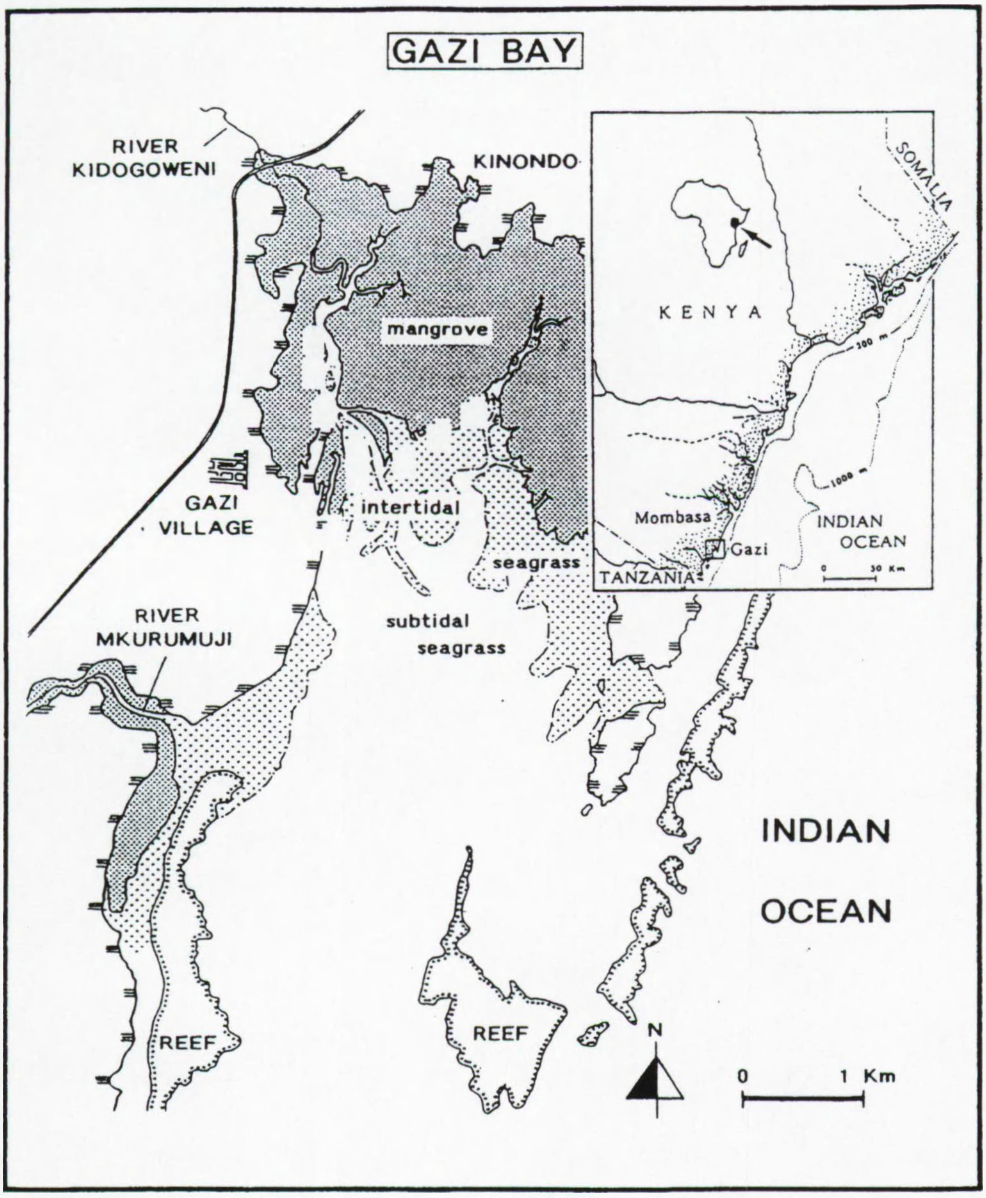

Figure 1.5: Detailed map of Gazi bay, Kenya showing the river mouths, areas of mangrove cover, intertidal and subtidal seagrass beds and the fringing coral reefs. Adapted from DE TROCH *et al.*, 1996.

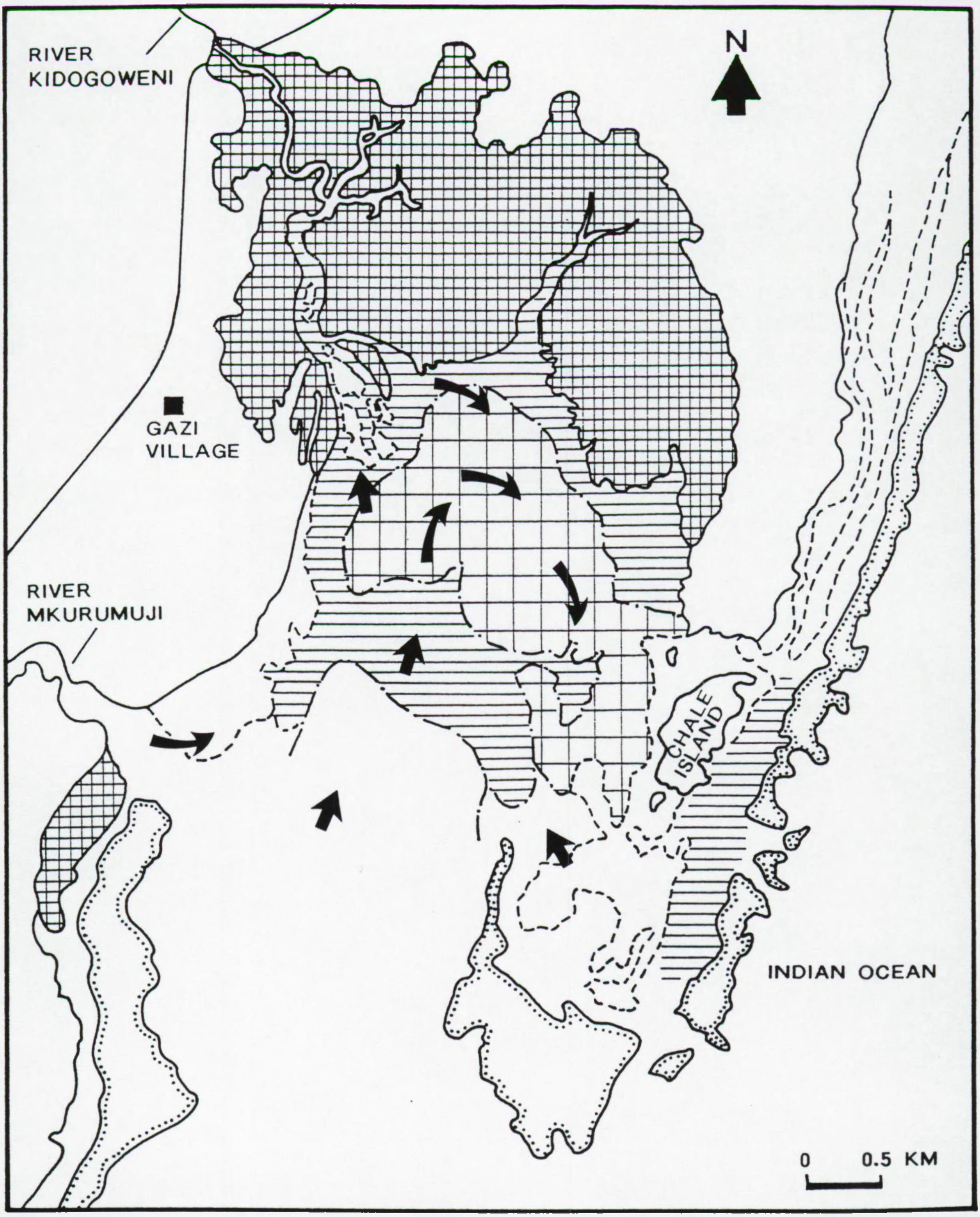

Figure 1.6: Water circulation in Gazi bay. Adapted from KITHEKA, 1996 & OHOWA *et al.*, 1997.

▦ Mangrove

▤ Seagrass beds (cover 30-100%)

⋯ Reefs

⊞ Seagrass beds (cover 10-30%)

╌ Intertidal flat

➡ Direction of water and tidal flow.

rubble, and sometimes hard rocky surfaces. COPPEJANS *et al.* (1992) provides a full picture on the zonation in the lagoon area. *Boodleopsis pusilla* marks the transition area from the mangals into the seagrass beds. *Halophila ovali* and *Halodule wrightii* form the pioneer associations on the upper limits of the beds and on newly accreted and consolidated sand layers on the coral platform in the mid-littoral zone. *Thalassia hemprichii*, in association with *Cymodocea rotundata, C. serrulata, Halimeda opuntia, Gracilaria salicornia* and *G. corticata,* depending on depth and/or morphology of the bedrock (pools or flats) form the climax cover (sometimes interspersed with *Halimeda opuntia, Gracilaria salicornia,* and *G. corticata*) of the intertidal zone. This leads to patches of mono-specific *Enhalus acoroides* cover from the low neap tide water level downwards. Mixed meadows of *Thalassia, Cymodocea serrulata, C. rotundata,* and *Halodule uninervis* in association with the macro-algae: *Halimeda macroloba* and *Avrainvillea obscura* are typical of the deeper zone from the mean low water mark to a further -1m deep with localised pioneer patches of *Syringodium isoetifolium* on the bumps and *Halophila stipulacea* on bare sand. The deeper lagoon area (-1m and below) is covered by a homogeneous, mono-specific *Thalassodendron ciliatum* meadows (with local replacement by *Enhalus acoroides).*

The coral reef and the Chale peninsular are part of the main long-shore fringing reef on the East African coast. Slightly north of Gazi are the extensive Diani reefs and south of Gazi is the Kisite-Mpunguti (Shimoni) Marine National Park with extensive coral gardens. The small Islands of Funzi and Shirazi are also part of this main reef area. This reef is the centre of the tourist and fisheries activities in the south coast of Kenya. The exploitative impacts on the reefs have been reported in e.g., MCCLANAHAN & MUTHIGA, 1988; MCCLANAHAN & MUTERE, 1994; MCCLANAHAN *et al.*, 1994; MCCLANAHAN & OBURA, 1995). For example, prolific growth in the populations of the sea urchins was found to correlate to fisheries activities and coral exploitation, whereby over-exploited and over fished reef areas had higher sea urchin densities compared to the protected reef areas. Over fishing reduced herbivorous fish competitors and carnivorous fish predators that take juvenile sea urchins e.g. the Trigger fishes (Balistidae), while over-exploitation of the reef led to ecosystem imbalance favouring the urchin population to fish populations.

The reef enclosing Gazi bay is important in the maintenance of the seagrass and mangrove ecosystems in the bay both as a shield to strong currents and waves from the open oceanic waters and as a source and sink of nekton (seston) in the bay. This interlinkage was the subject of concerted research efforts on this bay during the last half decade (see e.g., JACCARINI & MARTENS, 1992; WOITCHIK, 1993; HEIP *et al.*, 1995; HEMMINGA, 1995; SLIM *et al.*, 1996).

1.4 RECOMMENDATION:

Fish and currents "*know no boundaries*". Fisheries management should recognise the roles fish play in the ecosystem. It has been commented on the development of the fish meal to exploit the myctophid (*Benthoseme pterotum*) in the Gulf of Oman and Arabian sea, that "***the development of this fishery raises a number of yet to be answered questions, such as the importance of this resource to other components of the ecosystem, especially the large migratory scombrids, and the existence of the stock or population structure of this species in its potential fishery area"*** (FAO, 1997). It is always the practice for the "owner coastal states" to plan for and manage the fish resources in their EEZs. What of the LMEs?

PITCHER & HART (1982) quote the prose (***in*** P. A. Larkin's (1977) epitaph for the concept of Maximum Sustainable Yields).

"***Here lies the concept, MSY,***
It advocated yields too high,
And didn't spell out how to slice the pie,
We bury it with the best wishes,
Especially on the behalf of fishes,
We don't know yet what will take its place,
But we hope it's as good for the human race."

It is true, that most world fisheries have been mismanaged simply from mis-application of scientific information on the fish stocks. The simple case is that of the estimate ***in*** Graham & Edwards, 1962 on the north Atlantic fisheries in the late 1950s also referred to in PITCHER & HART (1982). It was rather unfortunate that the world's potential fish production was being predicted on the basis of an estimate from one area with the assumption that the entire area under the world oceans has a uniform production potential! This must have contributed to the rush and over-establishment on some fisheries areas. In the later years, a number of tools were proposed for effective fisheries exploitation and management. Among them were the TACs (Total allowable Catch) for the shared stocks, and the EEZs to give authority to the "owner states" on the fish resources in their coastal areas. Probably, the LMEs concept should be advanced to cover the management of fisheries resources in their boundaries.

The rational and scientific management of fisheries must depend on the fundamental understanding of the fish biology and ecology. Whatever the tools we opt for to manage the fisheries resources within our areas of jurisdiction, fisheries managers should learn to listen to science before making that vital decision on fish and the fisheries.

Gazi bay is an important nursery and foraging area for the reef associated marine fish, among them, the most important ground fishes (rabbitfish, scavengers, snappers, and parrotfish) exploited by the artisanal as well as the commercial trawler fisheries. The combination of mangroves, seagrass beds, and the coral reefs, create a unique ecosystem in this bay. Unique in the sense that the three habitats are inter-dependent for their existence and health. The exploitation of one or the other of these habitats must always consider the consequences on the sustainability of the total ecosystem. As a nursery area, it should be protected.

Considering that important world fisheries have in the past collapsed (RUSS, 1996; PAULY & CHRISTENSEN, 1996; PITCHER, 1996) in the face of scientifically correct management (c.f. the Canadian cod fishery, the orange roughy and the Illex squid fisheries of the Southeast Australia, and the over-capitalised prawn fishery in northern Australia, to name but a few), I would like to loud the sentiments of RUSS (1996) on the existence of and the value of protecting the "natural spatial refugia" for fish. The conventional methods of assessing the status of a fishery, rely so much on the past and current performance of the fishery, so much that estimates of potential yields, sustainable yields, etc, can sometimes be misleading. This is even worse in the multi-species, and multi-fishery situations in the tropics.

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CHAPTER 2

2.0 THE ICHTHYOFAUNA OF A TROPICAL MANGROVE BAY (GAZI BAY, KENYA).

2.0.1 ABSTRACT

Gazi bay is a shallow coastal system located on the Kenya coast. It is characterised by a variety of habitats: the bay is bordered by extensive mangrove swamps on the landward side and fringed with a coral reef on the seaward side; the mangroves are intersected by large creeks, one of which is a seasonal estuary. Well-developed seagrass and macro-algal beds, as well as unvegetated sandy areas are present at both intertidal and subtidal levels. The ichthyofauna of the system has been studied intensively between 1991 and 1996. Forty-two beam trawl samples were taken over the entire bay and creeks in spatial surveys conducted in 1994 and 1996; seven stations were further sampled monthly from December 1994 to September 1996 (22 months). Additional data were taken from the literature. Different sampling methodologies and strategies have been deployed: fykenets, beach seines and several types of beam trawls were used in different habitats and in different seasons and time of day. In this paper, a summary and comparison of the different studies on the fish fauna of Gazi bay is presented, an up-to-date species list is compiled and emerging diversity patterns are discussed in relation to the sampling strategies.

More than 18000 specimens belonging to 49 families and 215 species were collected during the spatial and seasonal beam trawl surveys (a total of 350 tows). To date, a total of 346 fish species in 72 families have been identified from the bay. Only 11 species and 20 families were common to all studies, while 180 species and 20 families were recorded only in one study. In all the studies, majority of the species each represented less than 0.05% of the total catches. Apogonidae, Gobiidae, and Labridae were the most speciose families. *Leptoscarus vaigiensis, Scarus sordidus, Plotosus lineatus, Parascorpaena mossambica, Sebastapistes strongia, Apogon fragilis, A. nigripes, Fowleria aurita, Siganus sutor, Lethrinus nebulosus, L. harak*, and *Cheilio inermis* were the most abundant species in the beam trawl studies, while the most abundant species in the beach seine studies were *Atherinomorus duodecimalis, A. lacunosus, Herklotsichthys quadrimaculatus, Gerres* *acinaces, and G. oyena.* Only 3 species made up 70% of beach seine catches while this was spread out to more than 15 species for the beam trawls. *Sphaeramia orbicularis* made up 96% of the fykenet and dragnet catches from the shallow channels in the mangrove swamp.

Key words: Ichthyofauna, coastal ecosystems, seagrass beds, and mangroves, Kenya.
Running title: Ichthyofauna of Gazi bay, Kenya.

2.1 INTRODUCTION:

Tropical shallow marine ecosystems (creeks, bays and lagoons) are characterised by interlinked mangrove swamps, seagrass beds, coral reefs and estuaries, all of which are considered to be important nursery and foraging grounds for a variety of marine fish species. The importance of these different coastal habitats in the life histories of marine fishes are well documented for several areas, e.g. DAVIS (1988), BLABER & MILTON (1990), ROBERTSON & DUKE (1990), BLABER *et al.* (1992; 1995), WILLIAMSON *et al.* (1994), and LAEGDSGAARD & JOHNSON (1995), for the Australian mangrove associated ecosystems; SEDBERRY & CARTER (1993), SCHMITTER-SOTTO & GAMBA-PEREZ (1995), and ROOKER *et al.* (1996), for the Caribbean; FOUDA & AL-MUHARRAMI (1995), and HUSSAIN & SAMAD (1995) for the Arabian sea). These biotopes are important nursery grounds for marine and estuarine fish. Elsewhere, outside the tropics, the South African estuaries have also been reported to play the same roles for both marine and estuarine fishes, e.g. BECKLEY (1984), WHITFIELD & KOK (1992), CYRUS & FORBES (1996), HARRIS & CYRUS (1996), and WHITFIELD (1997). As for Kenyan waters, mangrove creeks have been reported to provide nursery areas for different marine species, e.g. LITTLE *et al.*, (1988) for marine fish, and WAKWABI & JACCARINI (1993) for penaeid prawns. DE TROCH *et al.* (1996, 1998); KIMANI *et al.* (1996); and MARGUILLIER *et al.* (1997) mention the importance of the mangrove-seagrass-coral interlinkages in the life histories of fishes in Gazi bay.

Gazi bay (4° 25' S, 39E 30' E) is located some 60km south of Mombasa Island on the Kenya coast (Western Indian Ocean) (KIMANI *et al.*, 1996; MARGUILLIER *et al.*, 1997). The bay is semi-enclosed and shallow (< 5m mean depth) (KITHEKA, 1996), with a fringing coral reef on the seaward side and dense mangrove forests on the landward side. The bay is 1.75-3km wide and 3-4km long with a surface area of about 10km^2 or 5-7km^2 excluding the mangrove swamps (KIMANI *et al.*, 1996; OHOWA *et al.*, 1997). Two main creeks open into the northern part of the bay: the western (Kidogoweni) creek and the eastern (Kinondo) creek. The western creek is also the mouth of the Kidogoweni river, which fills intermittently with seasonal floods during the wet season. The eastern creek has no direct freshwater input. Another seasonal stream, the Mkurumuji, enters the bay directly towards the reef end (southern region of the bay). The coral reef and the Chale peninsula (Fig. 1) are part of the

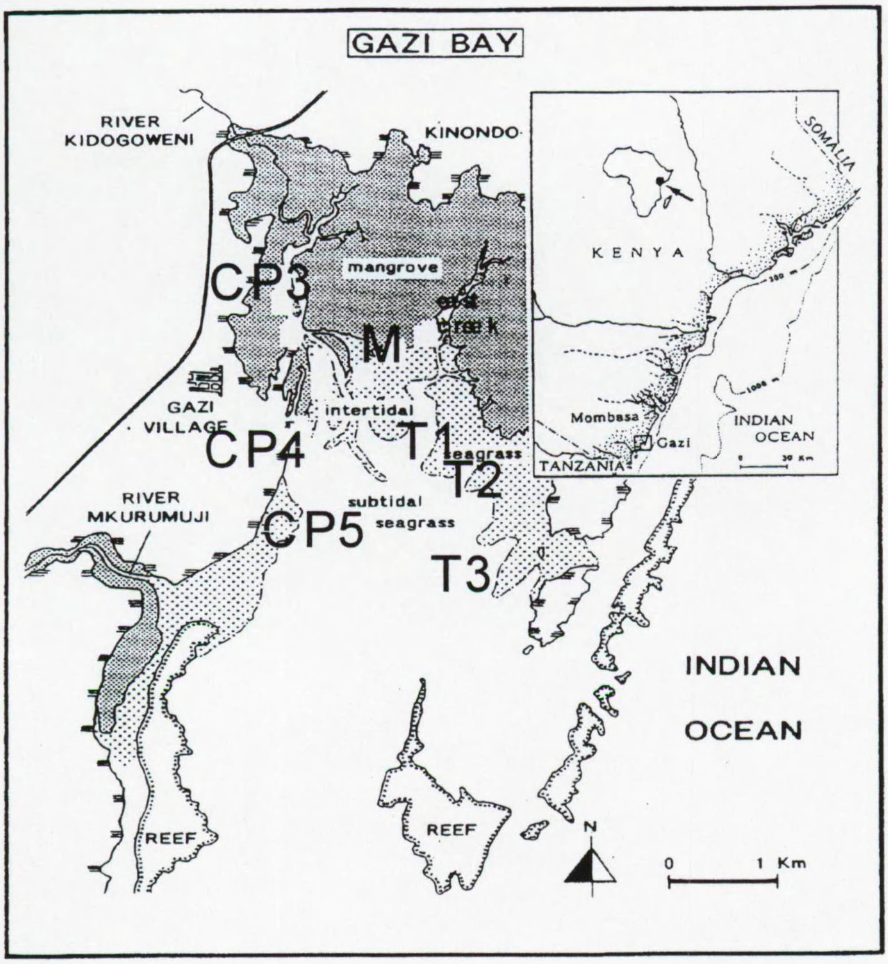

Fig. 2.1: Map of Gazi bay, Kenya (after SLIM, 1993; DE TROCH *et al.*, 1996), with indication of the stations sampled during the 22 month beam trawl survey.

main long shore reef that encloses a narrow continental shelf (0.5-2km). Between the reef and the shore, extensive seagrass beds and macro-algal mats cover about 70% of the bay's area. These are dominated by *Thalassodendron ciliatum* and *Halophila stipulacea* in the sub-tidal waters, *Thalassia hemprichii, Cymodocea rotundata* and *C. serrulata* at the lower intertidal level, and *Halophila ovalis-Halodule wrightii* associations in the higher intertidal to the upper limits of the beds (COPPEJANS *et al.*, 1992; COPPEJANS & GALLIN, 1992; VAN AVESAATH *et al.*, 1993). A number of macro-algal species (notably: *Caulerpa racemosa, Caulerpa scalpelliformis, Caulerpa sertularioides, Halimeda macrolaba* in the western creek; *Acanthophora specifera, Amphiroa fragilissima, Chaetomorpha crassa, Cystoseira myrica, Gracilaria corticata, G. folifera, G. millardeti, G. salicornia, Halimeda opuntia, Hypnea* *cornuta, Janea adherens, Padina boreana,* and *Sargassum spp* in the eastern creek) are also important vegetation cover associated with the seagrass beds. The mangrove stands are characterised by the presence of 7 species of trees; namely: *Avicennia marina, Rhizophora mucronata, Sonneratia alba,* and *Ceriops tagal* (as dominant species), and *Bruguieria gymnorrhiza, Lumnitzera racemosa* and *Xylocarpus granatum* (KIMANI, *et al.*, 1996; KITHEKA, 1996; COPPEJANS *et al.*, 1992).

KITHEKA (1996) and OHOWA *et al.* (1997) respectively describe the hydrography and the seasonal distribution of dissolved inorganic nutrients in the bay. The most important driving forces on the primary productivity and hydrodynamic characteristics of Gazi bay are the prevailing onshore winds (monsoon), the mixed semidiurnal tides (1.4 - 3m tidal range), and seasonal river runoff (KITHEKA, 1996). The main climatic seasons are the Southeast monsoon (March to September) and the Northeast monsoon (October to March). The Southeast monsoon period coincides with the wet season ("long rains", generally from May to August). A second peak in rainfall ("short rains") tends to coincide with the inter-monsoon period in October and November. December to April is the dry season. The dominant tidally driven water circulation pattern, coupled with the effects of onshore winds and the long-shore current generated by wave breaking, promotes the coastal trapping of turbid brackish waters and its inherent nutrient content (KITHEKA, 1996) delimiting the river influence to the bay and creeks. The tidal pressure into the western creek traps the Kidogoweni waters with its particle and nutrient load in the upper reaches of the creek, thus nourishing the extensive mangrove stands in this creek. The waters in Gazi bay are generally poor in nutrients as compared to those reported from comparable biotopes in the region (OHOWA *et al.*, 1997). However, within the bay itself, nutrient levels are higher inside the creeks and closer to the river mouths than in the bay proper. Primary production in the bay follows the rainfall pattern with highs during the wet season and lows during the dry season (OHOWA *et al.*, 1996).

In this paper, we present preliminary results from a two-year intensive study of the demersal fish fauna of Gazi bay: spatial beam trawl surveys covered 42 stations, while monthly samples were taken in 7 stations. Further, we compile a full species list of the fishes recorded from Gazi bay using the data presented in NTIBA *et al.* (1993), VAN DER VELDE *et al.* (1994), BEULS (1995), DE TROCH *et al.* (1996; 1998) and KIMANI *et al.* (1996), and the present study.

2.2 MATERIALS AND METHODS:

2.2.1 Literature data:

Besides data from fish samples collected by the authors (see below), information from the following studies were used to compile the species list for Gazi Bay:

A beach seine (dimensions: 40m long, 2m high and 5mm stretched mesh size) was used to collect fish samples on three consecutive days of low water spring tide during the STD II survey (NTIBA *et al.*, 1993; KIMANI *et al.*, 1996). Both day and night samples were collected between March 1991 and April 1992.

DE TROCH *et al* (1996) also deployed a beach seine (80m long, 1.2m high and 25mm stretched mesh size) during a two day sampling campaign in August 1993. Samples were taken during daytime and around low-water spring tide.

The STD III study (VAN DER VELDE *et al.*, 1994) was conducted from October 1993 to March 1994 with a variety of sampling methods and gears. Fykenets (1.6m long and 20mm stretched mesh size) were used in the mangroves of the eastern creek. Visual counts were carried out in the mangroves and on the inner slope of the reef. A beam trawl (1.5m beam and 20mm stretched mesh size) was deployed over the seagrass beds in the bay proper and in the eastern creek with two zodiacs powered by outboard motors. A beach seine (80m long, 2m high, and 20mm stretched mesh) was used to sample in the western creek and along the southern beach of the bay. Rotenone was used in intertidal pools during low tide to collect fish that hide under stones and bury in the sand. All sampling was restricted to daytime.

Finally, BEULS (1995) used a beam trawl (1.5m beam, 3mm-mesh size) daily for seven days during the low tides in August 1994. Both day and night samples were taken on muddy substrate at the mouth of the western creek.

2.2.2 Field sampling and data analysis:

Thirty-two beam trawl (1.5m beam, 5mm-mesh size) samples were taken over the entire bay and creeks (Fig. 2.2) in a 4-day spatial campaign in October 1994. Another 10 samples were taken with the beam trawl on the 17th and 19th July 1996 in the western creek and in the bay (i.e., 2 tows in the creek, 2 at the mouth, and 3 in the seagrass beds on either side (eastern and western sides) of the bay. Seven stations (marked on Fig. 2.1) were further sampled monthly with a 2mm meshed inner lining in the beam trawl net from December 1994 to September 1996 (22 months). Samples were always taken during daytime and each tow took 10 minutes (actual towing time) with a zodiac equipped with a 25-hp outboard

Ten fykenets (26mm mesh size, 18mm mesh size in the codend, 0.864m² mouth opening, and 1.765m wings) were deployed during low tide in a shallow mangrove channel in the eastern creek for 4 days and 1 night in August 1993. A dragnet (20mm-mesh size) was concurrently deployed in the same channel.

In the field, all fish were sorted out of the debris collected by the nets and immediately preserved in a 10% seawater-formaldehyde solution. In the laboratory, all fish specimens were identified to species level using the keys provided in SMITH & HEEMSTRA (1986), SMITH & SMITH (1963), SMITH (1961), BIANCHI (1985), and FISCHER & BIANCHI (1984) and counted.

2.3 RESULTS

2.3.1 Field sampling:

A total of 14327 fish specimens in 160 species (49 families) were collected during the seasonal beam trawl survey (308 tows). The total catch for the spatial beam trawl survey (42 tows) was 4307 fish specimens in 124 species (32 families), and that for the fykenets and the dragnet was 1348 fish in 22 species (13 families) (Table 2.1). The most abundant and widely distributed species during the seasonal survey were *Saurida undosquamis, Syngnathoides biaculeatus, Parascorpaena mossambica, Apogon cookii, A. fragilis, A. nigripes, Fowleria aurita, Lutjanus fulviflamma, Lethrinus harak, L. nebulosus, Cheilio inermis, Halichoeres iridis, Stethojulis strigiventer, Leptoscarus vaigiensis, Scarus sordidus, Petroscirtes breviceps, P. mitratus, Gnatholepis sp1, Siganus sutor, Paramonacanthus barnardi*, and *Canthigaster valentini*. These species were each represented with more than 100 individuals in the total catch and they were encountered in more than 10% of the samples (Table 2.1). *Plotosus lineatus* was quite abundant (1466 individuals caught), but it was only encountered in 7% of the samples. Fewer than 100 individuals were caught of *Syngnathus acus, Yongeichthys nebulosus*, and *Bothus mancus*, but they were encountered in more than 10% of the samples (Table 2.1).

During the spatial trawl survey *Sebastapistes strongia, Foa brachygramma, Fowleria aurita, Lutjanus fulviflamma, Calostomus spinidens, Leptoscarus vaigiensis, Gnatholepis sp1*, and *Siganus sutor* were the dominant species (>100 individuals caught and present in >50% of the samples) (Table 2.1). *Plotosus lineatus* and *Scarus russelli* were also abundant, but they were restricted to 5% and 26% of the tows, respectively (Table 2.1). *Saurida* *gracilis*, *Syngnathoides biaculeatus*, *Stethojulis strigiventer*, *Petroscirtes mitratus*, and *Bothus pantherinus* were present in more than 40% of the tows but in lower numbers (<100 individuals caught). Only one species, *Sphaeramia obicularis* made up 96% of the combined catch in the fykenets and dragnet (Table 2.1).

The most abundant demersal fish species in Gazi bay (see Annex 5) was *Leptoscarus vaigiensis* (it constituted >14% of the total catch in the seasonal survey). *Plotosus lineatus*, *Scarus sordidus*, *Apogon fragilis*, *Fowleria auritus*, *Apogon nigripes*, *Siganus sutor* were also dominant species (contributed >5% each to the total catch). *Lethrinus nebulosus* (4%), *Parascorpaena mossambica*, *Cheilio inermis* (≧3% each), *Lethrinus harak*, *Stethojulis strigiventer*, *Halichoeres iridis*, *Apogon cookii*, (each made upto 2% of the total catch), and *Lutjanus fulviflamma*, *Paramonacanthus barnardi*, *Petroscirtes breviceps*, *Canthigaster valentini*, *Gnatholepis sp1*, *Petroscirtes mitratus*, *Syngnathoides biaculeatus*, *Cheilodipterus lineatus* and *Saurida undosquamis* (each ≧1% in the total catch) were subdominant. Another forty-eight fish species were present in intermediate numbers (between 10 and 100 individuals caught), but the majority of the species were rare (<10 specimens caught). Most of the abundant species listed above were caught at all seven stations. The only exceptions were *Plotosus lineatus* (never caught at cp3 and m) and *Canthigaster valentini* (not caught at cp5 and m). Other less abundant species with a wide distribution (recorded from all stations) were *Bothus mancus*, *Yongeichthys nebulosus*, *Syngnathus acus*, *Plectoroglyphidodon lacrymatus*, *Canthigaster solandri*, *Chelonodon laticeps*, and *Parupeneus barberinus*.

During the seasonal survey, the highest number of species (85) was collected in April 1995 while only 25 species were collected in January 1996. The average numbers of species in the catch remained relatively high during the dry season (December to April: average of 49.8±6.7 species per month) and tended to be lower during the wet season (May, June and July: average of 43.8±6.7 species per month). The fish fauna of the seagrass stations T1, T2 and T3 (*Thalassodendron* area) was more diverse (20.5±2.3, 19.9±2.1 and 17.7±2.5 species, respectively) than that of the mangrove stations cp3, m, cp4 and cp5 (10.3±1.4, 12.6±1.3, 11.0±1.6 and 10.0±1.8 species, respectively) (Table 2.2). Densities varied considerably between tows, stations and months. Generally, higher densities were recorded from the *Thalassodendron* stations (T1, T2, and T3: 181.9±47.0, 217.5±68.3 and 93.4±18.0 individuals per sample, respectively) than the mangrove stations (cp3, cp4, cp5 & m: 58.5±15.9, 59.2±17.8, 46.7±15.5, and 60.2±12.8 individuals per sample, respectively) (Table 2.2). Densities dropped in May and were slightly lower in the wet season (473.4±155.7

2.2). Densities dropped in May and were slightly lower in the wet season (473.4±155.7 individuals per month) as compared to the dry season (983.6±278.1 individuals per month). The monthly distribution of the average catch per sample (numbers of species and individuals) is presented in Table 2.3, and Fig. 2.3 demonstrates the seasonal patterns in species numbers and densities for both groups of stations. A major peak was observed in April and two minor ones in August and November-December for both groups of stations. There was a general drop in catch during the second year of study (Table 2.3). This drop could not however be explained.

Table 2.2: Total number of species and average numbers of species and individuals (average over 22 months ± standard error of the mean) caught per sampling station during the seasonal beam trawl survey of Gazi bay (for location of the stations, see figure 1).

Station	Total number of species.	Mean number of species.	Mean number of individuals.
Cp3	52	10.27 ± 1.39	58.55 ± 15.93
M	57	12.59 ± 1.31	60.23 ± 12.76
T1	76	20.50 ± 2.33	181.91 ± 47.04
T2	83	19.86 ± 2.10	217.55 ± 68.33
T3	98	17.68 ± 2.50	93.41 ± 18.01
Cp4	56	10.95 ± 1.63	59.18 ± 17.77
Cp5	63	10.95 ± 1.82	46.68 ± 15.50

Table 3: Total number of species and average numbers of species and individuals (average of 7 stations ± standard error of the mean) caught per month during the seasonal beam trawl survey of Gazi bay.

Month	Total number of species.	Mean number of species.	Mean number of individuals.
Dec 1994	66	20.86 ± 3.27	156.29 ± 49.83
Jan 1995	57	18.14 ± 3.13	210.43 ± 107.98
Feb 1995	65	22.43 ± 2.89	180.00 ± 38.45
Mar 1995	69	22.14 ± 4.80	226.00 ± 115.60
Apr 1995	85	27.71 ± 4.68	421.71 ± 173.60
May 1995	59	17.71 ± 4.24	116.86 ± 38.62
Jun 1995	60	15.71 ± 4.45	87.43 ± 37.46
Jul 1995	57	13.71 ± 4.11	43.00 ± 16.42
Aug 1995	73	25.14 ± 3.83	196.57 ± 64.97
Sept 1995	61	18.29 ± 3.28	111.86 ± 39.59
Oct 1995	42	12.86 ± 3.45	54.86 ± 20.10
Nov 1995	45	15.57 ± 1.86	95.14 ± 21.05
Dec 1995	31	11.14 ± 1.28	43.71 ± 11.07
Jan 1996	25	7.00 ± 1.80	26.71 ± 11.22
Feb 1996	33	9.14 ± 1.88	46.71 ± 20.44
Mar 1996	28	9.71 ± 1.02	34.71 ± 7.65
Apr 1996	39	13.86 ± 2.69	58.86 ± 17.34
May 1996	32	8.14 ± 1.78	16.29 ± 3.93
Jun 1996	26	8.43 ± 1.46	32.57 ± 16.82
Jul 1996	29	8.00 ± 2.00	22.29 ± 6.75
Aug 1996	30	7.00 ± 2.53	26.00 ± 11.00
Sep 1996	29	7.57 ± 3.04	47.00 ± 34.04

2.3.2 Comprehensive species list:

All fish species that have to date been recorded from Gazi Bay are listed in Appendix 1; catch data for the different study programmes are summarised in Table 2.4. The species list follows the classification of SMITH & HEEMSTRA (1986). Some species mentioned in the reports of KIMANI *et al.*, (1996) and NTIBA *et al.*, (1993) were not included in the list: (1) *Acropoma hyalosoma* (KIMANI *et al.*, 1996) was excluded from the list as it is not mentioned in SMITH & HEEMSTRA (1986); (2) the congeneric *Tylosurus acus* and *T. melanotus* as listed by KIMANI *et al.*, (1996) are actually one species *Tylosurus acus melanotus* in SMITH & HEEMSTRA (1986); (3) *Scorpaenopsis cirrhosa* (NTIBA *et al.*, 1993) is a misspelling of *Scorpaenopsis gibbosa* and (4) *Scarus vaigiensis* (NTIBA *et al.*, 1993) was an earlier synonym of *Leptoscarus vaigiensis* (SMITH & HEEMSTRA, 1986).

Table 2.4: Summary of the different studies of the ichthyofauna of Gazi bay with indication of the total numbers of individuals (I), species (S) and families (F) recorded, and the number of species that were only caught during the respective survey programmes (Rs). Details on sampling time (D = day, N = night), tide (spring tide and/or neap tide) and sampling method (Bs = beach seine, Bt = beam trawl, Dn = dragnet, Fn = fykenet, R = rotenone and Vc = visual counts).

Duration of study	Method	Reference	N	F	S	R
13 months (March 1991 to April 1992)	Bs Spring (D & N)	Ntiba et al (1993) & Kimani et al (1996)	18135	50	144	49
6 months (October 1993 to March1994)	Bt, Bs, Fn, R, Vc (D)	Van der Velde et al (1994)	2000	42	90	17
2 days (August 1993)	Bs (D)	De Troch et al (1996)	3601	40	74	11
2 months (July 1994 to August 1994)	Bs, Bt (D & N)	Beuls (1995)		35	83	26
4 days (August 1993) 4 days (October 1994) 3 days (July 1996)	Fn, Dn (D & N) Bt (D) Bt (D)	This paper	5655	31	135	38
22 months (December 1994 to September 1996)	Bt Neaps (D)	This paper	14327	49	160	39

All species listed in this paper (Appendix 2.1) are known to associate with the coastal biotopes represented in the study area; they have been reported in the region though not necessarily from the East African coastal waters. Only *Hipposcarus longiceps* is not included in SMITH & HEEMSTRA (1986): they mention the occurrence of two *Hipposcarus* species in the region, but only *H. harid* is identified. *H. longiceps* has been reported from the Indo-Pacific waters, especially in the Indonesian and Japanese coastal waters extending east (LIESKE & MYERS, 1994). Its juveniles associate with coral rubble in lagoons on patch reefs. The eight specimens were all juveniles (less than 50mm SL) and were identified based on the drawing in LIESKE & MYERS (1994).

Very young juveniles (≤20mm SL) could not always be identified to species level due to loss of colour after long storage in formalin. These were listed under higher taxa in the Appendix 2.1: Anguilliformes sp1, Platycephalidae sp1, *Epinephelus* sp1, Teraponidae sp1, Apogonidae sp1, Labridae sp1, *Scarus sp1, Petroscirtes sp1, Favonigobius sp1, Gnatholepis sp3*, Gobiidae sp1, *Naso sp1*, Bothidae sp1, Cynoglossidae sp1, *Arothron sp1*, and *Canthigaster sp1*.

A reference collection has been prepared from the fish caught during the 22 months beam trawl survey. This collection will be deposited at the Marine and Coastal Research Centr, Kenya Marine & Fisheries Research Institute, Mombasa, Kenya.

A total of 346 fish species have been identified in 72 families (Appendix 2.1). Eleven species (*Fowleria aurita, Amblygobius albimaculatus, Cheilio inermis, Lethrinus harak, Paramonacanthus barnardi, Leptoscarus vaigiensis, Pterois miles, Siganus sutor, Saurida gracilis, Syngnathoides biaculeatus,* and *Arothron immaculatus*) and 20 families (Apogonidae, Bothidae, Fistulariidae, Gerreidae, Gobiidae, Labridae, Lethrinidae, Lutjanidae, Monacanthidae, Ostaciidae, Platycephalidae, Pomacentridae, Scaridae, Scorpaenidae, Siganidae, Sphyraenidae, Syngnathidae, Synodontidae, Teraponidae, and Tetraodontidae) were recorded in all six sampling programmes. The Labridae (32 species), Gobiidae (28), Apogonidae (25), Scaridae (15), Tetraondontidae (14), Lethrinidae (13), Pomacentridae (12), Syngnathidae (11), Mullidae (10) and Scorpaenidae (10) were the most speciose families. 180 species (165 excluding the 15 groups of juveniles, see above) and 20 families were only recorded in one study. The families Anguillidae, Aploactinidae, Aulostomidae, Balistidae, Chanidae, Congridae, Dasyatidae, Echeneidae, Kyphosidae, Lobotidae, Nemipteridae, Ophidiidae, Percophidae, Rhinobatidae, Scombridae, Tetrarogidae, Torpedinidae, and Triodontidae were only recorded in one of the six studies and they were represented by a single species. The Eliotridae and Ophichthidae were each represented by 3 species, but were also recorded in one study only. The families Acropomatidae, Callionymidae, Centriscidae, Chirocentridae, Dactylopteridae, Grammistidae, Sillaginidae, and Solenostomidae were also represented by one species, but they were recorded in several studies.

Only 3 species made up 70% of beach seine catches (Annex 3) while this was spread out to more than 15 species for the beam trawl survey (Annex 5). The most abundant pelagic species (i.e. representing >10% of the total catches in the beach seine samples) were *Atherinomorus duodecimalis, A. lacunosus, Gerres acinaces, G. oyena,* and *Herklotsichthys quadrimaculatus.* For the demersal (i.e. beam trawl) catches, *Leptoscarus vaigiensis, Scarus sordidus, Plotosus lineatus, Sebastapistes strongia, Siganus sutor, Apogon fragilis, A. nigripes,* and *Fowleria aurita* were the most abundant species (each constituted >5% of the total catches). Subdominant species (between 0.5% and 10% of beach seine catches and between 0.1% and 5% for beam trawl catches, and/or >100 individuals caught) were *Apogon thermalis, Fowleria aurita, Leiognathus elongatus, Lethrinus harak, Lutjanus fulviflamma, Monodactylus argenteus, Sphyraena barracuda, Stolephorus indicus, Terapon jarbua,* and *T. theraps* for beach seines and *Apogon cookii, Cheilodipterus lineatus, Calostomus spinidens, Scarus russelli, Canthigaster valentini, Cheilio inermis, Halichoeres iridis, Stethojulis strigventer, Gnatholepis sp1, Lethrinus harak, L. nebulosus, Lutjanus fulviflamma, Paramonacanthus barnardi, Parascorpaena mossambica, Petroscirtes breviceps, P. mitratus, Syngnathoides biaculeatus,* and *Saurida undosquamis* for beam trawls. The majority of the species were present in very low densities (<0.05% of the total catches). At the family level, Apogonidae, Atherinidae, Clupeidae, Engraulidae, Gerreidae, Labridae, Lethrinidae, Lutjanidae, Plotosidae, Scaridae, Siganidae, and Teraponidae, were dominant (constituted >5% of the total catches) in the bay.

2.4 DISCUSSION:

Trawling and beach seining as active fishing methods were effective on even ground, while fykenets were used in the rooty channels of the mangrove swamp as passive gears. During the STD II study (NTIBA *et al.*, 1993; KIMANI *et al.*, 1996) a beach seine was used to sample low spring tide waters, both during day and night time. This strategy realised the highest number of the families (representatives of the families Chanidae, Nemipteridae, Kyphosidae, Lobotidae, Echeneidae, Scombridae and Balistidae were not recorded in the other programmes). The STD III study (VAN DER VELDE *et al.*, 1994) also yielded a lot of species that were not recorded during the other programmes, a/o. the batoids *Torpedo fuscomaculata* (Torpedinidae), *Rhinobatos holcorhynchus* (Rhinobatidae) and *Taeniura lymma* (Dasyatidae), the anguilliforms *Anguilla bicolor bicolor* (Anguillidae), *Conger cinereus cinereus* (Congridae), *Myrichthys colubrinus, M. maculosus,* and *Pisodonophis cancrivorus* (Ophichthidae) and the beryciforms *Myripristis kuntee* and *Sargocentron diadema* (Holocentridae). This high number of rarely caught species can be attributed to the use of rotenone in tide pools and sampling on the reef platform, habitats that were not covered in other studies. The batoids, for example, are very abundant on the outer reef slope and constitute an important fishery in the area south of Gazi bay. In the beam trawl surveys presented in this paper, only the relatively even grounds of the bay proper and the major creeks could be sampled. Still, a variety of habitats (e.g. seagrass, macro-algae, rubble, sand, and silt) and environmental gradients (e.g. depth, and salinity) constitute special microhabitats that sustain different species and sizes of fish at the different tidal, diurnal and seasonal temporal scales. The total number of 250 species in 50 families caught during our spatial and seasonal survey (including 77 species and 4 families - Ophidiidae, Tetrarogidae, Percophidae and Triodontidae - which were not previously recorded from the area) is quite high. This can largely be attributed to the large number of samples taken in all major habitats (seagrass beds, macro-algal mats, sandy and muddy unvegetated areas in different depth strata of the bay proper, the major eastern mangrove creek, and the estuarine western creek) and the fact that we covered all seasons (dry season, short and long rains) at least twice. The catch composition of the spatial surveys of De TROCH *et al.* (1996) (see Annex 3) and BEULS (1995) differed significantly from that recorded during our survey. De TROCH *et al.* (1996) sampled with a beach seine, evidently yielding more pelagic species, while BEULS (1995) specifically sampled for gobies in very shallow and muddy habitats near the mouth of the western creek only. The fact that relatively few species were recorded in all six studies largely reflects the different sampling methodologies (e.g. beam trawls vs beach seines) and strategies (different habitats covered, and sampling during different seasons, tidal phase, and time of day) deployed. Further, many species were quite rare occurrences in the bay (species recorded only once: see Appendix 1). Most of these single records (e.g. *Brotula multibarbata, Ambassis gymnocephalus, A. natalensis, A. productus, Epinephelus merra, E. siullus,* *Gnathodentex aureolineatus, Gymnocranius griseus, Scolopsis vosmeri, Kyphosus bigibbus, Platax pinnatus, Abudefduf sexfasciatus, Dascillus carneus, Cheilinus digrammus, Halichoeres iridis, H. hortulanus, Bembrops platyrhynchus* and *Balistes viridescens,* to name but few) are marine stragglers that are known to be typically associated with coral reefs. The high number of species recorded with very low densities (i.e., <10 species made >70% of the catches) seemed to conform to what has been generally observed in tropical to sub-tropical coastal ecosystems (e.g. QUINN, 1980; LITTLE *et al.*, 1988).

Although the ichthyofauna of the bay has been intensively sampled during the past decade, the present species list is probably far from conclusive: many species probably remain to be recorded and the densities of other species are certainly underestimated. The catch compositions of beach seine and beam trawl samples were distinctly different. Only shoaling pelagic species were abundantly collected with beach seines, while seagrass associated demersal species dominated the beam trawl catches. Still, both beach seining and trawling underestimated many species: especially mangrove residents, cryptic and burrowing benthic species and coral reef residents were caught in low numbers. The chubby cardinalfish *Sphaeramia orbicularis*, for example, was quite rare in beach seine and beam trawl catches, but it made up 96% of the fykenet and dragnet catches in a shallow mangrove channel.

The numbers of fish species and families recorded during each sampling programme from Gazi bay are comparable to those recorded from other shallow tropical systems, e.g. the fish fauna's of mangrove systems in tropical Australia (BLABER & MILTON, 1990; ROBERTSON & DUKE, 1990; BLABER *et al.*, 1992; 1995). ROBERTSON & DUKE (1990) for example, reported 128 species representing 43 families of fish from the Alligator creek, northern Australia, and further quotes (a/o), 195 species from the Pichavaram mangrove system in Tamil Nadu, 197 from the Embley estuary (also northern Australia), 140 in the Purari River Mangrove system (Papua New Guinea), and 122 from the mangrove systems in Madagascar. On the hand KULBICKI (1996) reported 255 species representing 36 families from the fringing reefs in the Maumere region (Flors-Indonesia) of the pacific, and LETOURNEUR *et al.* (1997) recorded 231, 177 and 307 fish species from the fringing reefs of Reunion, Moorea and New Caledonia islands, respectively. The numbers are quite varied, depended on the deployed sampling methodologies and strategies, but generally decrease with the increasing latitude. A study with the same beam trawl was carried out on Tudor creek, Mombasa, Kenya, slightly North of Gazi bay (see Annex 1). Tudor creek receives more freshwater and terrigenous alluvium. Also being around Mombasa, a major port and industrial hub in the Kenya coast, the creek experiences more anthropogenic influences than Gazi bay. The study realised comparable results (with Gazi bay) despite the differences in sampling strategy. The dominant species in Tudor creek were however, penaeids and gobies, reflecting the differences in the abiotic environments between the two study sites.

Most of the fish specimens collected in Gazi bay were smaller than 10cm standard length (pers. observ.). Besides adults of small-sized residents (e.g. gobies, blennies, wrasses, cardinal fishes), these included high numbers of juveniles of many species that are important in the artisanal reef fisheries in the vicinity of the bay (e.g. scarids, siganids, lethrinids, bothids, soleids, sphyraenids, serranids, carangids, haemulids, scombrids, leiognathids, lutjanids, and batoids). Gazi bay can therefore be assumed to be an important nursery area for these marine fish species.

2.5 ACKNOWLEDGEMENTS:

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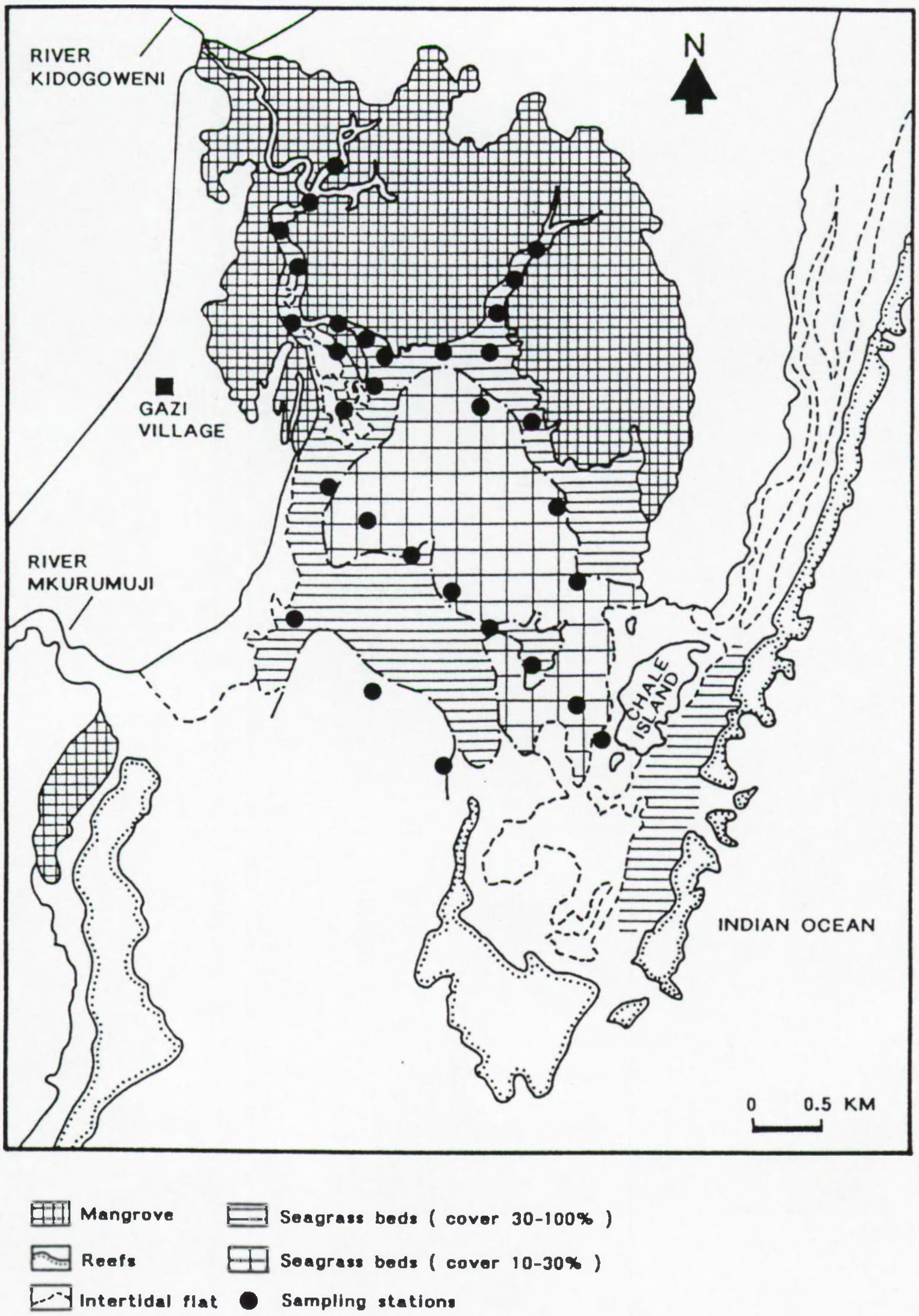
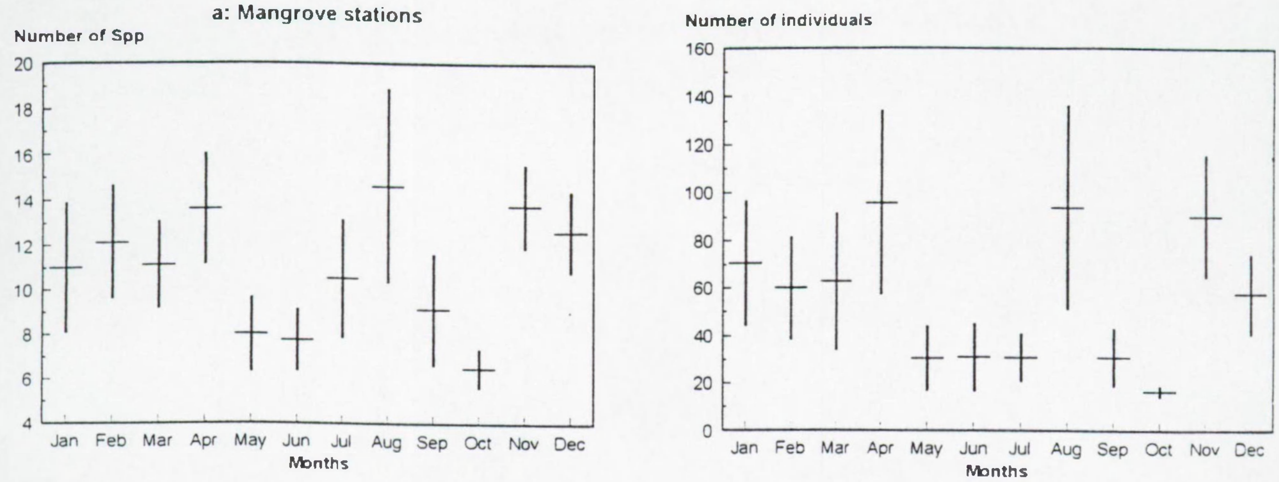
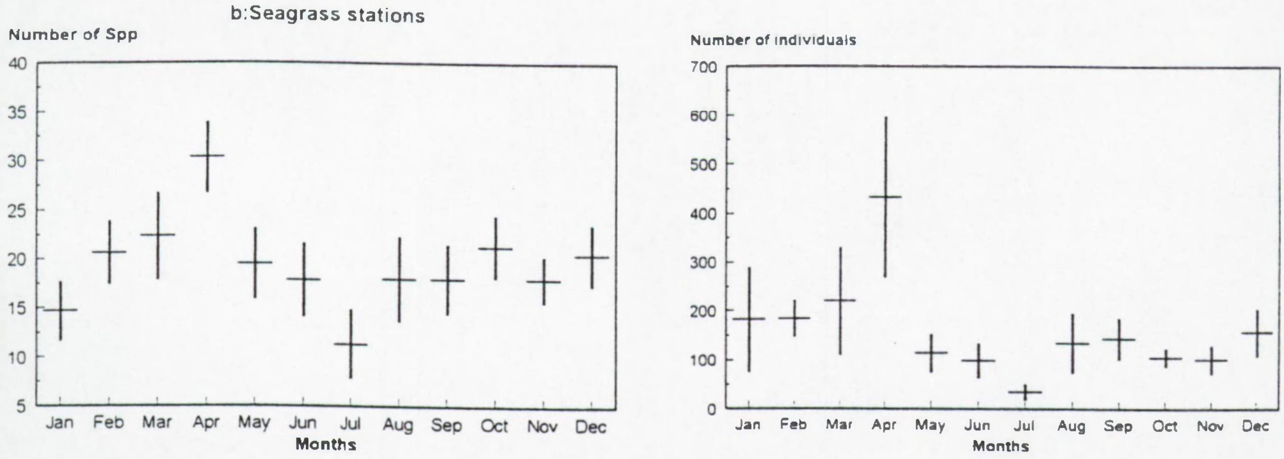


Fig. 2.2: Map of Gazi bay, Kenya with the indication of the beam trawl sampling stations during the 4-day spatial survey.



a: Mangrove stations



b:Seagrass stations

Fig. 2.3: Numbers of fish species and densities (average catch ± standard error) recorded monthly during the seasonal survey (mangrove stations: cp3, cp4, cp5 and m, seagrass stations: T1, T2 and T3: see figure 2.1).

Table 2.1: All fish species recorded during the seasonal and spatial beam trawl surveys in Gazi bay, with indication of the total number of individuals caught (N) and the percentage of tows in which they were recorded (F). The number of specimens recorded with fykenets and dragnets in the mangrove creeks are also included (G).

Species	Seasonal survey		Spatial survey		
	N	F	N	F	G
Anguilliformes sp1			1	2.38	
Echidna polyzona	1	0.32			
Gymnothorax undulatus			17	16.67	
Siderea picta	23	6.49	1	2.38	
Stolephorus indicus	3	0.65			
Plotosus lineatus	1466	7.14	109	4.76	
Plotosus nkunga	1	0.32			
Saurida gracilis	1	0.32	89	71.43	
Saurida undosquamis	102	18.83			
Trachinocephalus myops			12	4.76	
Brotula multibarbata	1	0.32			
Antennarius commersoni	1	0.32			
Ablennes hians	1	0.32			
Neoniphon sammara					2
Fistularia commersonii			4	7.14	
Fistularia petimba	11	3.25			
Halicampus dunckerii	2	0.65			
Hippichthys cyanospilos			3	4.76	
Hippichthys spicifer			1	2.38	
Hippocampus camelopardalis	8	2.27			
Hippocampus capensis	1	0.32			
Hippocampus histrix	2	0.65			
Syngnathoides biaculeatus	116	21.43	45	45.24	
Syngnathus acus	62	12.99			
Trachyrhamphus bicoarctatus	30	4.22	2	4.76	
Solenostomus cyanopterus	2	0.65			
Aeoliscus punctulatus	12	3.25	5	4.76	
Dendrochirus brachypterus	13	3.90	3	7.14	
Parascorpaena mcadamsi	1	0.32			
Parascorpaena mossambica	514	39.29	7	7.14	
Pterois miles	2	0.65	8	14.29	
Scorpaenodes varipinnis	1	0.32			
Scorpaenopsis gibbosa			1	2.38	
Sebastapistes mauritiana			1	2.38	

Table 2.1 (contd.)

	N	F	N	F	G
Sebastapistes strongia			599	71.43	
Synanceia verrucosa			4	2.38	
Ablabys binotatus	1	0.32			
Ptarmus jubatus			1	2.38	
Cociella crocodila	7	1.62	10	14.29	
Grammoplites portuguesus			2	2.38	
Platycephalus indicus	2	0.65	1	2.38	
Papilloculiceps longiceps	20	6.17			
Platycephalidae sp1	2	0.32			
Dactyloptena orientalis	1	0.32			
Ambassis productus	2	0.32			
Epinephelus malabaricus	1	0.32	1	2.38	
Epinephelus merra	1	0.32			
Epinephelus sp1	3	0.65			
Epinephelus suillus			1	2.38	
Grammistes sexlineatus	1	0.32			
Pelates quadrilineatus	38	6.17	26	28.57	2
Teraponidae sp1			1	2.38	
Terapon theraps	5	1.62			
Apogon angustatus	65	0.65			
Apogon coccineus	4	0.32	3	4.76	
Apogon cookii	257	17.53	8	4.76	
Apogon fragilis	896	20.13			
Apogon guamensis	5	0.32	2	4.76	2
Apogon lateralis	30	0.32			
Apogon nigripes	889	28.25	19	7.14	
Apogon nigripinnis	9	0.32			1
Apogon savayensis	12	1.95			
Apogon taeniophorus	10	0.97			
Apogon thermalis	4	0.32	35	11.90	
Apogon perdix			26	4.76	
Apogonidae sp1			2	2.38	
Archamia mozambiquensis	1	0.32	2	2.38	
Cheilodipterus lineatus	113	8.12			
Cheilodipterus quinquelineatus	30	5.19	17	7.14	
Foa brachygramma	9	1.62	141	50.00	
Fowleria aurita	892	44.81	222	64.29	
Sphaeramia orbicularis			2	4.76	1295
Acropoma japonicum	7	1.62			
Plectorhinchus gaterinus	29	5.52			
Lutjanus argentimaculatus			12	9.52	2
Lutjanus ehrenbergii			9	14.29	15
Lutjanus gibbus	1	0.32			
Lutjanus fulviflamma	209	25.65	188	66.67	1

Table 2.1 (contd)

	N	F	N	F	G
Gnathodentex aureolineatus			9	2.38	
Gymnocranius griseus			7	2.38	
Lethrinus crocineus			2	4.76	
Lethrinus elongatus	57	8.77			
Lethrinus harak	384	19.16	19	9.52	1
Lethrinus lentjan	10	1.30	44	19.05	1
Lethrinus mahsena	4	1.30			
Lethrinus mahsenoides	4	0.32	18	2.38	
Lethrinus nebulosus	624	39.61			
Lethrinus ramak			15	7.14	
Lethrinus variegatus	12	2.92			
Lethrinidae larvae	17	2.60			
Platax obicularis	15	3.90			
Platax teira	1	0.32			
Gerres acinaces			2	2.38	
Gerres oyena	18	2.27			3
Parupeneus barberinus	19	4.22	2	4.76	
Parupeneus indicus	3	0.32			
Upeneus tragula	5	1.30	5	11.90	
Upeneus vittatus	1	0.32			
Chaetodon auriga	3	0.97			1
Chaetodon falcula					1
Chaetodon kleinii	2	0.32			
Chaetodon lineolatus	1	0.32			
Chaetodon melannotus	3	0.65			
Caranx ignobilis	2	0.32			
Abudefduf sexfasciatus			4	2.38	
Chrysiptera annulata	2	0.65			
Dascyllus aruanus	2	0.65	13	11.90	
Dascyllus trimaculatus			8	4.76	
Neopomacentrus fuliginosus	10	0.65	8	19.05	2
Plectoroglyphidodon lacrymatus	64	8.77			
Pomacentrus trilineatus	8	1.62			
Stegastes fasciolatus			5	7.14	
Stegastes nigricans			1	2.38	
Anampses caeruleopunctatus	6	1.62			
Anampses meleagrides	2	0.32			
Cheilinus bimaculatus	72	6.17	12	14.29	
Cheilinus chlorourus	1	0.32	4	9.52	
Cheilinus digrammus			3	4.76	
Cheilinus oxycephalus	22	2.60	29	33.33	
Cheilinus trilobatus	8	0.97	1	2.38	
Cheilinus undulatus	57	8.12			
Cheilio inermis	420	36.36	46	33.33	

Table 2.1 (contd)

	N	F	N	F	G
Coris aygula	7	0.97			5
Coris caudimacula	2	0.32			
Coris formosa					1
Cymolutes praetextatus	2	0.32	7	9.52	
Epibulus insidiator	12	2.60	5	4.76	
Halichoeres dussumieri	2	0.32			
Halichoeres hortulanus	4	0.32			
Halichoeres iridis	348	15.91			
Halichoeres nebulosus			2	4.76	
Halichoeres scapularis	5	0.97	1	2.38	
Hologymnosus doliatus	1	0.32			
Labridae sp1			58	2.38	
Labroides dimidiatus	3	0.97	1	2.38	
Novaculichthys macrolepidotus	48	6.17	15	11.90	
Pteragogus flagellifer	2	0.65			
Pteragogus pelycus	1	0.32			
Pteragogus taeniops	2	0.32			
Stethojulis interrupta	1	0.32	5	2.38	
Stethojulis strigiventer	333	26.30	51	40.48	
Thalassoma hardwicke			1	2.38	
Calostomus spinidens	12	1.30	184	57.14	
Leptoscarus vaigiensis	2207	57.79	1064	85.71	
Hipposcarus harid	10	0.97			
Hipposcarus longiceps	8	0.97			
Scarus festivus			5	7.14	
Scarus globiceps	36	1.30	1	2.38	
Scarus psittacus	7	0.32			1
Scarus russelli			160	26.19	
Scarus scaber	58	3.90	16	14.29	
Scarus sordidus	1062	19.81			2
Scarus sp1			3	7.14	
Sphyraena forsteri			3	2.38	
Sphyraena jello	16	3.57			
Sphyraena putnamiae					2
Bembrops platyrhynchus	1	0.32			
Parablennius pilicornis	23	1.30			
Petroscirtes breviceps	171	15.26	26	30.95	
Petroscirtes mitratus	139	16.88	98	66.67	
Petroscirtes sp1			1	2.38	
Synchiropus marmoratus	22	2.60			
Acentrogobius audax	60	8.12			
Amblygobius albimaculatus	30	6.82	4	4.76	
Amblygobius sphynx	1	0.32			
Asterropteryx semipunctatus	6	1.62	45	23.81	

Table 2.1 (contd)

	N	F	N	F	G
Caffrogobius nudiceps	1	0.32			
Drombus key			3	7.14	
Favonigobius melanobranchus	3	0.97			
Favonigobius reichei	19	3.25	10	4.76	
Favonigobius sp1	7	0.32			
Gnatholepis sp1	148	15.58	194	52.38	
Gnatholepis sp2			4	2.38	
Gnatholepis sp3			8	2.38	
Gobiidae sp1	64	6.82			
Oligolepis keiensis	3	0.97			
Oplopomus oplopomus			8	7.14	
Oxyurichthys microlepis			2	2.38	
Oxyurichthys papuensis			2	2.38	
Oxyurichthys sp1	1	0.32			
Periophthalmus koelreuteri			1	2.38	
Yongeichthys nebulosus	71	10.71	4	4.76	
Acanthurus lineatus	2	0.65			
Acanthurus nigrofuscus					2
Ctenochaetus strigosus	1	0.32			
Naso sp1			1	2.38	
Siganus canaliculatus	31	0.32	4	4.76	
Siganus stelatus	16	2.60	2	2.38	5
Siganus sutor	882	46.43	208	66.67	1
Bothus mancus	83	18.51			
Bothus myriaster			2	2.38	
Bothus pantherinus	11	1.30	37	42.86	
Bothidae sp1			22	9.52	
Crossorhombus valderostratus			17	7.14	
Psuedorhombus arsius	1	0.32	2	2.38	
Cynoglossidae sp1			3	2.38	
Cynoglossus attenuatus	3	0.97			
Cynoglossus lachneri			2	4.76	
Paraplagusia bilineata	9	2.27	4	4.76	
Pardachirus marmoratus			11	16.67	
Solea bleekeri	2	0.65			
Paramonacanthus barnardi	172	21.75	10	11.90	
Pseudalutarius nasicornis	1	0.32			
Lactoria cornuta	15	3.25	1	2.38	
Lactoria fornasini	21	5.52	1	2.38	
Ostracion cubicus	5	1.30	1	2.38	
Triodon macropterus	21	3.25			
Amblyrhynchotes honckenii			1	2.38	
Arothron hispidus	1	0.32	29	33.33	
Arothron immaculatus	16	4.87	11	14.29	

Table 2.1 (contd.)

	N	F	N	F	G
Arothron sp1			1	2.38	
Arothron stellatus	2	0.32	6	2.38	
Canthigaster bennetti	29	3.57	28	21.43	
Canthigaster janthinoptera			2	4.76	
Canthigaster solandri	50	9.09	5	7.14	
Canthigaster sp1			1	2.38	
Canthigaster valentini	158	12.99	3	7.14	
Chelonodon laticeps	35	7.14			
Diodon hystrix	5	0.97			
Lophodiodon calori	4	0.97			
TOTAL	14327	308	4307	42	1348

Appendix 2.I: List of all fish species recorded from Gazi bay, Kenya. Based on data from the present study (PSS: seasonal survey, and PSP: spatial survey) and from the reports in NTIBA *et al.*, 1993; and KIMANI *et al.*, 1996 (KIM); VAN DER VELDE *et al.*, 1994 (VDV); BEULS, 1995 (BEU); and DE TROCH *et al.*, 1996 (DET).

Species	PSS	PSP	KIM	VDV	DET	BEU
Class Chondrichthyes						
Order Torpediniformes						
Family TORPEDINIDAE						
Torpedo fuscomaculata Peters, 1855				*		
Order Rajiformes						
Family RHINOBATIDAE						
Rhinobatos holcorhynchus Norman, 1922				*		
Order Myliobatiformes						
Family DASYATIDAE						
Taenura lymma (Forsskal, 1775)				*		
Class Osteichthyes						
Order Anguilliformes						
Family ANGUILLIDAE						
Anguilla bicolor bicolor McClelland, 1844				*		
Anguilliformes sp1		*				
Family CONGRIDAE						
Conger cinereus cinereus Ruppell, 1830				*		
Family MURAENIDAE						
Echidna polyzona (Richardson, 1845)	*					
Gymnothorax richardsoni (Bleeker, 1852)						*
Gymnothorax undulatus (Lacepede, 1803)		*				
Siderea picta (Ahl, 1789)	*	*				*
Family OPHICHTHIDAE						
Myrichthys colubrinus (Boddaert, 1781)				*		
Myrichthys maculosus (Cuvier, 1816)				*		
Pisodonophis cancrivorus (Richardson, 1844)				*		
Order Clupeiformes						
Family CLUPEIDAE						
Herklotsichthys quadrimaculatus (Ruppell, 1837)			*		*	
Pellona ditchela Valenciennes, 1847			*			
Sardinella gibbosa (Bleeker, 1849)			*			
Spratelloides delicatulus (Bennett, 1831)			*			
Family ENGRAULIDAE						
Engraulis japonicus Schlegel, 1846			*			
Stolephorus holodon (Boulenger, 1900)			*			*
Stolephorus indicus (van Hasselt, 1823)	*				*	

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Family CHIROCENTRIDAE						
Chirocentrus dorab (Forsskal, 1775)			*	*		
Order Gonorhynchiformes						
Family CHANIDAE						
Chanos chanos (Forsskal, 1775)			*			
Order Siluriformes						
Family PLOTOSIDAE						
Plotosus lineatus (Thunberg, 1787)	*	*	*	*	*	
Plotosus nkunga Gomon & Taylor, 1982	*		*	*		
Order Aulopiformes						
Family SYNODONTIDAE						
Saurida gracilis (Quoy & Gaimard, 1824)	*	*	*	*	*	*
Saurida tumbil (Bloch, 1795)			*			
Saurida undosquamis (Richardson, 1848)	*		*			
Synodus binotatus Schultz, 1953				*		
Synodus indicus (Day, 1873)			*			
Synodus variegatus Lacepede, 1803			*	*	*	
Trachinocephalus myops (Forster, 1801)		*	*			
Order Ophidiiformes						
Family OPHIDIIDAE						
Brotula multibarbata Temminck & Schlegel, 1846	*					
Order Lophiiformes						
Family ANTENNARIIDAE						
Antennarius commersoni (Latreille, 1804)	*					
Antennarius pictus (Shaw & Nodder, 1794)				*		
Histrio histrio (Linnaeus, 1758)				*		*
Order Atheriniformes						
Family ATHERINIDAE						
Atherinomorus duodecimalis (Valenciennes, 1835)			*		*	
Atherinomorus lacunosus (Forster, 1801)			*			
Order Beloniformes						
Family BELONIDAE						
Ablennes hians (Valenciennes,1846)	*				*	
Tylosurus acus melanotus (Bleeker, 1850)			*			
Tylosurus crocodilus crocodilus (Peron & LeSueur, 1821)					*	*
Family HEMIRAMPHIDAE						
Hemiramphus far (Forssk., 1775)			*			
Hyporhamphus (Reporhamphus) affinis (Gunther, 1866)			*		*	*
Zenarchopterus dispar (Cuvier & Valenciennes, 1829)			*			
Order Beryciformes						
Family HOLOCENTRIDAE						
Myripristis kuntee Cuvier, 1831				*		
Neoniphon sammara (Forsskal, 1775)		*		*		
Sargocentron diadema (Lacepede, 1801				*		

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Order Syngnathiformes Family AULOSTOMIDAE						
Aulostomus chinensis (Linnaeus, 1766)					*	
Family FISTULARIIDAE						
Fistularia commersonii Ruppell, 1838		*		*	*	*
Fistilaria petimba Lacepede, 1803	*		*			*
Family SYNGNATHIDAE						
Acentronura tentaculata Gunther, 1870						*
Halicampus dunckeri (Chabanaud, 1929)	*					
Hippichthys cyanospilos (Bleeker, 1854)		*			*	*
Hyppichthys heptagonus Bleeker, 1849						*
Hippichthys spicifer (Ruppell, 1838)		*		*		*
Hippocampus camelopardalis Bianconi, 1853	*					
Hippocampus capensis Boulenger, 1900	*					
Hippocampus histrix Kaup, 1853	*					*
Syngnathoides biaculeatus (Bloch, 1785)	*	*	*	*	*	*
Syngnathus acus Linnaeus, 1758	*					
Trachyrhamphus bicoarctatus (Bleeker, 1857)	*	*	*		*	
Family SOLENOSTOMIDAE						
Solenostomus cyanopterus Bleeker, 1854	*			*	*	
Family CENTRISCIDAE						
Aeoliscus punctulatus (Bianconi, 1855)	*	*		*	*	
Order Scorpaeniformes						
Family SCORPAENIDAE						
Dendrochirus brachypterus (Cuvier,1829)	*	*			*	*
Pterois miles (Bennett, 1828)	*	*	*	*	*	*
Parascorpaena aurita Ruppell, 1838			*			
Parascorpaena mcadamsi (Fowler, 1938)	*					
Parascorpaena mossambica (Peters, 1855)	*	*	*	*	*	
Scorpaenodes varipinnis Smith, 1957	*					
Scorpaenopsis gibbosa Bloch & Schneider, 1801		*	*			*
Sebastapistes mauritiana (Cuvier, 1829)		*				*
Sebastapistes strongia (Cuvier, 1829)		*			*	*
Synanceia verrucosa Bloch & Schneider, 1801		*				
Family TETRAROGIDAE						
Ablabys binotatus (Peters, 1855)	*					
Family APLOACTINIDAE						
Ptarmus jubatus (Smith, 1935)		*				
Family PLATYCEPHALIDAE						
Cociella crocodila (Tilesius, 1812)	*	*	*			*
Grammoplites portuguesus (Smith, 1953)		*	*			
Papilloculiceps longiceps (Ehrenberg, 1829)	*		*	*		
Platycephalus indicus (Linnaeus, 1758)	*	*	*		*	
Platycephalidae sp1	*					

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Family DACTYLOPTERIDAE						
Dactyloptena orientalis (Cuvier, 1829)	*		*		*	
Order Perciformes						
Family AMBASSIDAE						
Ambassis gymnocephalus (Lacepede, 1801)						*
Ambassis natalensis Gilchrist & Thompson, 1908)						*
Ambassis productus Guichenot, 1866)	*					
Family SERRANIDAE						
Epinephelus malabaricus (Schneider, 1801)	*	*				*
Epinephelus merra Bloch, 1793	*					
Epinephelus sp1 Bloch, 1793	*			*	*	*
Epinephelus suillus (Valenciennes, 1828)		*				
Family GRAMMISTIDAE						
Grammistes sexlineatus (Thunberg, 1792)	*		*			
Family TERAPONIDAE						
Pelates quadrilineatus (Bloch, 1790)	*	*		*	*	*
Terapon jarbua (Forsskal, 1775)			*	*		*
Teraponidae sp1		*				
Terapon theraps (Cuvier, 1829)	*		*			
Family APOGONIDAE						
Apogon angustatus (Smith & Radcliffe, 1911)	*					
Apogon coccineus Ruppell, 1838	*	*				
Apogon cookii Macleay, 1881	*	*	*	*		
Apogon flagelliferus (Smith, 1961)			*			
Apogon fraenatus Valenciennes, 1832			*	*		
Apogon fragilis Smith, 1961	*					
Apogon guamensis Valenciennes, 1832	*	*		*		
Apogon lateralis Valenciennes, 1832	*		*			
Apogon nigripes Playfair & Gunther, 1866	*	*	*	*		
Apogon nigripinnis Cuvier, 1828	*	*				
Apogon nitidus Smith, 1961			*			
Apogon savayensis Gunther, 1871	*			*		
Apogon taeniophorus Regan, 1908	*					
Apogon thermalis Cuvier, 1829	*	*		*	*	
Apogonichthys perdix Bleeker, 1854		*				
Apogonidae sp1		*				
Archamia fucata (Cantor, 1850)				*		
Archamia lineolata (Ehrenbergi, 1829)			*			
Archamia mozambiquensis Smith, 1961	*	*	*	*		
Cheilodipterus lineatus Lacepede, 1802	*		*			
Cheilodipterus quinquelineatus Cuvier, 1828	*	*		*	*	
Foa brachygramma (Jenkins, 1903)	*	*	*	*		*
Fowleria aurita (Valenciennes, 1831)	*	*	*	*	*	*
Siphamia mossambica Smith, 1955)				*		

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Sphaeramia orbicularis (Kuhl & Van Hasselt, 1828)		*		*		*
Family ACROPOMATIDAE						
Acropoma japonicum Gunther, 1859	*		*			
Family HAEMULIDAE						
Diagramma pictum (Thunberg, 1792)			*		*	
Plectorhinchus gaterinus (Forsskal, 1775)	*		*	*		
Plectorhinchus gibbosus (Lacepede, 1802)						*
Plectorhinchus plagiodesmus Fowler, 1935						*
Pomodasys furcatum (Bloch & Schneider, 1801)						*
Pomadasys laurentino (Smith, 1953)			*			
Family LUTJANIDAE						
Lutjanus argentimaculatus (Forsskal, 1775)		*	*		*	
Lutjanus bohar (Forsskal, 1775)			*			
Lutjanus ehrenbergii (Peters, 1869)		*	*			*
Lutjanus fulviflamma (Forsskal, 1775)	*	*	*	*	*	
Lutjanus gibbus (Forsskal, 1775)	*					
Lutjanus guicheri (Fourmanoir, 1775)			*			
Lutjanus russelli (Bleeker, 1849)			*			
Family LETHRINIDAE						
Gnathodentex aureolineatus (Lacepede, 1802)		*				
Gymnocranius griseus (Schlegel, 1844)		*				
Lethrinus crocineus Smith, 1959		*	*			
Lethrinus elongatus Valenciennes, 1830	*		*			
Lethrinus harak (Forsskal, 1775)	*	*	*	*	*	*
Lethrinus lentjan (Lacepede, 1802)	*	*	*		*	
Lethrinus mahsena (Forsskal, 1775)	*		*			
Lethrinus mahsenoides Valenciennes, 1830	*	*	*			
Lethrinus nebulosus (Forsskal, 1775)	*		*			
Lethrinus ramak (Forsskal, 1775)		*		*		
Lethrinus sanguineus Smith, 1955						*
Lethrinus semicinctus (Valenciennes, 1830)			*			
Lethrinus variegatus Ehrenberg, 1830	*			*		
Family NEMIPTERIDAE						
Scolopsis vosmeri (Bloch, 1792)			*			
Family KYPHOSIDAE						
Kyphosus bigibbus Lacepede, 1801			*			
Family EPHIPPIDAE						
Platax orbicularis (Forsskal, 1775)	*				*	
Platax pinnatus (Linnaeus, 1758)			*			
Platax teira (Forsskal, 1775)	*				*	
Family MONODACTYLIDAE						
Monodactylus argenteus (Linnaeus, 1758)			*			*
Monodactylus falciformis Lacepede, 1800			*			

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Family GERREIDAE						
Gerres acinaces Bleeker, 1854		*			*	*
Gerres filamentosus Cuvier, 1829			*		*	*
Gerres oyena (Forsskal, 1775)	*	*	*	*		*
Gerres poeti (Cuvier & Valenciennes, 1829)			*			
Gerres rappi (Barnard, 1927)					*	
Family MULLIDAE						
Mulloides flavolineatus (Lacepede, 1801)					*	
Parupeneus barberinus (Lacepede, 1801)	*	*	*		*	
Parupeneus cinnabarinus (Cuvier, 1829)			*			
Parupeneus indicus (Shaw, 1803)	*		*	*		
Parupeneus macronema (Lacepede, 1801)			*		*	
Parupeneus pleurostigma (Bennett, 1831)			*			
Parupeneus rubescens (Lacepede, 1801)			*			
Upeneus moluccensis (Bleeker, 1855)			*			
Upeneus tragula Richardson, 1846	*	*	*	*	*	
Upeneus vittatus (Forsskal, 1775)	*		*			
SILLAGINIDAE						
Sillago sihama (Forsskal, 1775)			*			*
Family LEIOGNATHIDAE						
Gazza minuta (Bloch, 1797)			*	*	*	
Leiognathus elongatus (Gunther, 1874)			*		*	
Leiognathus equula (Forsskal, 1775)			*			
Leiognathus fasciatus (Lacepede, 1803)					*	
Family LOBOTIDAE						
Lobotes surinamensis (Bloch, 1790)			*			
Family CHAETODONTIDAE						
Chaetodon auriga Forsskal, 1775	*	*				
Chaetodon falcula Bloch, 1793		*				
Chaetodon kleinii Bloch, 1790	*					
Chaetodon lineolatus Quoy & Gaimard, 1831	*					
Chaetodon lunula (Lacepede, 1803)						*
Chaetodon melannotus Bloch & Schneider, 1801	*					
Chaetodon xanthocephalus Bennett, 1832					*	
Heniochus acuminatus (Linnaeus, 1758)			*			
Family CARANGIDAE						
Alectis indicus (Ruppell, 1830)					*	
Caranx ignobilis (Forsskal, 1775)	*		*			
Caranx sexfasciatus Quoy & Gaimard, 1825					*	
Gnathanodon speciosus (Forsskal, 1775)			*			
Scomberoides tol (Cuvier, 1832)			*			
Trachinotus baillonii (Lacepede, 1801)			*			
Trachinotus blochii (Lacepede, 1801)			*			

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Family ECHENEIDAE						
Echeneis naucrates Linnaeus, 1758			*			
Family POMACENTRIDAE						
Abudefduf sexfasciatus (Lacepede, 1801)		*				
Abudefduf vaigiensis (Quoy & Gaimard, 1825)				*		
Chrysiptera annulata (Peters, 1855)	*		*	*		*
Dascyllus aruanus (Linnaeus, 1758)	*	*		*		
Dascyllus carneus Fischer, 1885			*			
Dascyllus trimaculatus (Ruppell, 1829)		*	*			
Neopomacentrus cyanomos (Bleeker, 1856)					*	*
Neopomacentrus fuliginosus (Smith, 1960)	*	*				
Plectoroglyphidodon lacrymatus (Quoy & Gaimard, 1825)	*			*		
Pomacentrus trilineatus Cuvier, 1830	*			*		
Stegastes fasciolatus (Ogilby, 1889)		*				
Stegastes nigricans (Lacepede, 1803)		*				
Family LABRIDAE						
Anampses caeruleopunctatus Ruppell, 1829	*					
Anampses meleagrides Valenciennes, 1840	*					
Cheilinus bimaculatus Valenciennes, 1840	*	*		*		
Cheilinus chlorourus (Bloch, 1791)	*	*		*	*	
Cheilinus digrammus (Lacepede, 1801)		*				
Cheilinus oxycephalus Bleeker, 1853	*	*				
Cheilinus trilobatus Lacepede, 1801	*	*		*		
Cheilinus undulatus Ruppell, 1835	*					
Cheilio inermis (Forsskal, 1775)	*	*	*	*	*	*
Coris aygula Lacepede, 1801	*	*				
Coris caudimacula (Quoy & Gaimard, 1834)	*					
Coris formosa (Bennett, 1834)		*				
Cymolutes praetextatus (Quoy & Gaimard, 1834)	*	*				
Epibulus insidiator (Pallas, 1770)	*	*		*		
Halichoeres dussumieri (Valenciennes, 1839)	*					
Halichoeres hortulanus (Lacepede, 1801)	*					
Halichoeres iridis Randall & Smith, 1982	*					
Halichoeres nebulosus (Valenciennes, 1839)		*				
Halichoeres scapularis (Bennett, 1831)	*	*				
Hologymnosus doliatus (Lacepede, 1801)	*					
Labridae sp1		*				
Labroides dimidiatus (Valenciennes, 1839)	*	*				
Novaculichthys macrolepidotus (Bloch, 1791)	*	*		*		
Pseudojuloides argyreogaster Playfair & Gunther, 1867						*
Pteragogus flagellifer (Valenciennes, 1839)	*			*		
Pteragogus pelycus Randall, 1981	*					
Pteragogus taeniops (Peters, 1855)	*					
Stethojulis interrupta (Bleeker, 1851)	*	*				

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Stethojulis strigiventer (Bennett, 1832)	*	*	*	*	*	
Thalassoma hardwicke (Bennett, 1828)		*				
Xyrichthys novacula (Linnaeus, 1758)						*
Xyrichthys pavo Valenciennes, 1840						*
Family SCARIDAE						
Calotomus spinidens (Quoy & Gaimard, 1824)	*	*		*		
Leptoscarus vaigiensis (Quoy & Gaimard, 1824)	*	*	*	*	*	*
Hipposcarus harid (Forsskal, 1775)	*					
Hipposcarus longiceps (Valenciennes, 1840)	*					
Scarus falcipinnis (Playfair, 1867)			*			
Scarus festivus Valenciennes, 1840		*				
Scarus ghobban Forsskal, 1775			*	*	*	
Scarus globiceps Valenciennes, 1840	*	*				
Scarus japanensis (Bloch, 1788)			*			
Scarus psittacus Forsskal, 1775	*	*	*			
Scarus russelli Valenciennes, 1840		*				
Scarus scaber Valenciennes, 1840	*	*				
Scarus sordidus Forsskal, 1775	*	*	*			
Scarus sp1 Forskal, 1775		*				
Scarus tricolor Bleeker, 1847			*			
Family MUGILIDAE						
Liza macrolepis (Smith, 1846)					*	
Liza vaigiensis (Quoy & Gaimard, 1825)			*			
Mugil cephalus Linnaeus, 1758			*			
Valamugil cunnesius (Valenciennes, 1836)			*			
Valamugil seheli (Forsskal, 1775)			*	*		
Family SPHYRAENIDAE						
Sphyraena barracuda (Walbaum, 1792)			*	*	*	*
Sphyraena chrysotaenia Klunzinger, 1884			*			
Sphyraena forsteri Cuvier, 1829		*				
Sphyraena jello Cuvier, 1829	*		*			
Sphyraena putnamiae Jordan & Seale, 1905		*				
Family PERCOPHIDAE						
Bembrops platyrhynchus (Alcock, 1893)	*					
Family BLENNIIDAE						
Parablennius pilicornis (Cuvier, 1829)	*					
Petroscirtes breviceps (Valenciennes, 1836)	*	*		*	*	*
Petroscirtes mitratus Ruppell, 1830	*	*		*	*	*
Petroscirtes sp1 *Ruppell, 1830*		*				
Family CALLIONYMIDAE						
Synchiropus marmoratus (Peters, 1855)	*			*		
Family GOBIIDAE						
Acentrogobius audax Smith, 1959	*					*
Amblygobius albimaculatus (Ruppell, 1830)	*	*	*	*	*	*

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Amblygobius sphynx (Valenciennes, 1837)	•			•		
Amoya signatus (Peters, 1855)						•
Asterropteryx semipunctatus Ruppell, 1830	•	•			•	
Bathygobius species 9 Bleeker, 1878						•
Caffrogobius nudiceps (Valenciennes, 1827)	•		•			
Callogobius maculipinnis (Fowler, 1918)						•
Drombus key (Smith, 1947)		•				•
Favonigobius melanobranchus (Fowler, 1934)	•					•
Favonigobius reichei (Bleeker, 1953)	•	•			•	•
Favonigobius species 1 Whitley, 1930	•					
Gnatholepis species 1 Bleeker, 1874	•	•			•	•
Gnatholepis species 2 Bleeker, 1874		•				
Gnatholepis sp3 Bleeker, 1874		•				
Gobiidae sp1	•					
Istigobius spence (Smith, 1946)			•			
Monishia sordida Smith, 1959						•
Oligolepis acutipennis (Valenciennes, 1837)					•	
Oligolepis keiensis (Smith, 1938)	•		•			
Oplopomus oplopomus (Valenciennes, 1837)		•	•		•	•
Oxyurichthys microlepis (Bleeker, 1849)		•				
Oxyurichthys ophthalmonema (Bleeker, 1957)						•
Oxyurichthys papuensis (Valenciennes, 1837)		•				•
Oxyurichthys species 1 Bleeker, 1860	•					
Periophthalmus koelreuteri africanus Eggert, 1935		•				
Priolepis inhaca (Smith, 1949)				•		
Yongeichthys nebulosus (Forsskal, 1775)	•	•	•			•
Family ELEOTRIDAE						
Eleotris fusca (Schneider, 1801)						•
Eleotris mauritanus Bennett, 1831						•
Eleotris melanosoma Bleeker, 1852						•
Family ACANTHURIDAE						
Acanthurus lineatus (Linnaeus, 1758)	•		•			
Acanthurus nigrofuscus (Forsskal, 1775)		•				
Acanthurus xanthopterus Valenciennes, 1835			•			
Ctenochaetus strigosus (Bennett, 1828)	•		•			
Naso brevirostris (Valenciennes, 1835)			•	•	•	
Naso sp1 Lacepede, 1802		•				
Family SIGANIDAE						
Siganus canaliculatus (Park, 1797)	•	•	•			
Siganus stellatus Forsskal, 1775	•	•	•	•		
Siganus sutor (Valenciennes, 1835)	•	•	•	•	•	•
Family SCOMBRIDAE						
Rastrelliger kanagurta (Cuvier, 1816)			•			

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Order Pleuronectiformes						
Family BOTHIDAE						
Bothus mancus (Broussonet, 1782)	*		*			
Bothus myriaster (Temminck & Schlegel, 1846)		*	*		*	
Bothus pantherinus (Ruppelp, 1830)	*	*	*	*		*
Bothidae sp1		*				
Crossorhombus valderostratus (Alcock, 1890)		*				
Pseudorhombus arsius Hamilton-Buchanan, 1822)	*	*	*			*
Pseudorhombus elevatus Ogilby, 1912						*
Syacium micrurum Ranzani, 1840						*
Family CYNOGLOSSIDAE						
Cynoglossidae sp1		*				
Cynoglossus attenuatus Gilchrist, 1904	*					
Cynoglossus durbanensis Regan, 1921						*
Cynoglossus lachneri Menon, 1977		*				
Paraplagusia bilineata (Bloch, 1787)	*	*				*
Family SOLEIDAE						
Pardachirus marmoratus (Lacepede, 1802)		*	*	*		
Solea bleekeri Boulenger, 1898	*		*			
Order Tetraodontiformes						
Family BALISTIDAE						
Balistoides viridescens (Bloch & Schneider, 1801)			*			
Family MONACANTHIDAE						
Aluterus scriptus (Osbeck, 1765)			*		*	
Paramonacanthus barnardi Fraser-Brunner, 1941	*	*	*	*	*	*
Pseudalutarius nasicornis (Temminck & Schlegel, 1850)	*					
Stephanolepis auratus (Castelnau, 1861)			*			
Family OSTRACIIDAE						
Lactoria cornuta (Linnaeus, 1758)	*	*	*	*		
Lactoria fornasini (Bianconi, 1846)	*	*		*	*	
Ostracion cubicus Linnaeus, 1758	*	*			*	*
Family TRIODONTIDAE						
Triodon macropterus Lesson, 1830	*					
Family TETRAODONTIDAE						
Amblyrhynchotes honckenii (Bloch, 1795)		*				*
Arothron hispidus Linnaeus, 1758	*	*		*		*
Arothron immaculatus (Bloch & Schneider, 1801)	*	*	*	*	*	*
Arothron meleagris (Bloch & Schneider, 1801)					*	
Arothron sp1 Muller, 1841		*				
Arothron stellatus (Bloch & Schneider, 1801)	*	*				
Canthigaster bennetti (Bleeker, 1854)	*	*			*	*
Canthigaster janthinoptera (Bleeker, 1854)		*				
Canthigaster solandri (Richardson, 1844)	*	*		*		
Canthigaster sp1 Swainson, 1839		*				

Appendix 2.1 (contd)

	PSS	PSP	KIM	VDV	DET	BEU
Canthigaster valentini (Bleeker, 1853)	*	*		*		
Chelonodon laticeps Smith, 1948	*		*			
Sphoeroides pachygaster (Muller & Troschel, 1848)						*
Tylerius spinosissimus (Regan, 1908)					*	
Family DIODONTIDAE						
Cyclichthys spilostylus (Leis & Randall, 1982)				*		
Diodon holocanthus Linnaeus, 1758			*	*		
Diodon hystrix Linnaeus, 1758	*		*			
Lophodiodon calori (Biancon, 1855)	*		*			
Total number of species	159	135	144	90	74	83
Number of rare species	39	38	48	17	11	26
Total number of families	49	31	50	42	40	35

CHAPTER 3:

3.0 EPIBENTHIC COMMUNITIES IN A TROPICAL BAY, GAZI BAY, KENYA. I: SPATIAL ORGANISATION.

3.0.1 ABSTRACT:

We discuss the spatial patterns in the epibenthos communities of Gazi bay, Kenya in the light of the two intensive beam trawl studies we carried out on 12-15 October 1994 and from December 1994 to September 1996. Four distinct fish and invertebrate communities were identified by the multivariate techniques applied to the species-at-site catch (density) data.

The estuarine conditions at the mouth of the River Kidogoweni, at the inner-most end of the west creek, constituted a community dominated by gobies (*Drombus key, Oxyurichthys microlepis,* and *Yongeichthys nebulosus*) and flatfishes (*Pseudorhombus arsius, Cynoglossus lachneri*, and *Paraplagusia bilineata* and their juveniles), and carnivorous (including piscivorous) fish species like *Saurida gracilis, Sebastapistes strongia,* and *Lutjanus fulviflamma.* The estuarine conditions were also conducive for juvenile decapods (shrimps and brachyuran megalopae), and molluscs. The presence of these invertebrates is likely the attraction (for food) to the above carnivores and to the flatfish observed in this area of the bay. This estuarine community was characterised by low densities (< 35 animals per standard 10 minutes tow for both fish and the invertebrates) and less species diversity (< 10 species per standard 10 minutes tow).

The reef platform at the open end of the bay, towards the fringing reef constituted another community characterised by medium fish densities (50-100 fish per standard tow) and species diversities (10-20 species per standard tow). This community was separated on the basis of two labrids (*Cheilinus oxycephalus* and *Cheilio inernis)*, and a tetraodontid (*Ganthigaster bennetti)*, as indicator species for the fish community, and the hermit crabs and the cowries for the invertebrate community. The seagrass beds in the bay and in the creeks constituted a community with comparatively higher fish densities (>100 fish per standard tow) and fish species diversity (15-28 species per standard tow). *Sebastapistes strongia* (Scorpeanidae),

Siganus sutor (Siganidae), *Petroscirtes mitratus* (Blenniidae) and *Leptoscarus vaigiensis* (Scaridae) were the indicator species of the fish community. The cowrie *Cypraea annulus* (Cypraeidae) and *Strombus mutabilis* (Strombidae) and the green tiger prawn *Penaeus semisulcatus* (Penaeidae) were indicator species for the invertebrate community in the same area.

From the long term survey, the TWINSPAN separated the *Thalassodendron ciliatum* dominated seagrass beds in the lagoon, from the mangrove influenced stations in the west creek and on the western shores of the bay with the sea urchin, *Diadema* sp, as the indicator species for the *Thalassodendron* beds.

Some fish species (among them, *Saurida gracilis, Sebastapistes strongia, Singnathoides biaculatus, Pelates quadrilineatus, Fowleria aurita, Lutjanus fulviflamma, Neopomacentrus fulginosus, Cheilio inermis, Stethojulis strigiventer, Calostomus spinidens, Leptoscarus vaigiensis, Petroscirtes mitratus, Gnatholepis sp1, Siganus sutor and Bothus pantherinus)* had an almost global distribution in the area. Some e.g., *Plotosus lineatus* were however quite restricted in distribution. The invertebrate component of the communities was always more restricted in distribution than fish.

The above spatial patterns coincided with the other observations on the bay although differences in the sampling gears and strategies influenced the apparent differences in organisation of the communities. This can be seen especially in the differences between the dominant species and the spatial distribution of the fish densities. Beach seine studies on the one hand, identified pelagic species, e.g., *Herklotsichthys quadrimaculatus, Atherinomorus lacunosus, A. duodecimalis,* and *Gerres acinaces* as the dominant fish species in the bay. These are shoaling species; their densities can be much higher, though highly patchy. Beam trawl studies on the other hand, emphasised more on the ground fish than the pelagic fish.

Running title: Spatial Epibenthic communities of Gazi bay, Kenya.
Key words: Epibenthos, spatial communities, mangroves, seagrass beds, coral reefs, fish, invertebrates, and microhabitats.

3.1 INTRODUCTION:

The association of mangroves, seagrass beds, and coral reefs in shallow coastal waters provide diverse habitats for biota. Mangrove and seagrass habitats are highly productive (for both primary and secondary productivity) and export this productivity in the form of detritus, dissolved organic matter, or as ingested food to the coral reefs within their vicinity. They also provide shelter and protection to many marine and brackish-water fish and invertebrate species. AUSTIN (1971) and AUSTIN & AUSTIN (1971) reported the mangroves in Western Puerto Rico to harbour the juveniles of a number of fish common to the nearby reefs and concluded that the mangrove areas provided effective nurseries for these fishes. Later, MARTIN & COOPER (1981) consistently found many fish species common in the neighbouring reefs in their collections from the grass beds near mangrove shores in the Southwest Puerto Rico. LAL *et al.* (1984) also reported high incidences of reef-related fish species among the fishes in their collections from the near-by mangrove areas, concluding that the mangrove areas were important nursery and foraging grounds for a number of the species from the reefs. In the Indo-Pacific region, JONES & CHASE (1975); BLABER (1980); HARMELIN-VIVIEN (1983); and QUINN & KOJIS (1985) respectively collected large numbers of juvenile coral reef-associated fish from the seagrass beds in Cocos Lagoon, Guam, from mangroves habitats in the Cairns estuary in the vicinity of the Great Barrier Reefs (Australia), from the grassbeds habitats in the Tulear reefs of Madagascar, and from the mangrove habitats in Papua New Guinea. All these studies concluded that the grass beds and mangrove areas provided essential nursery and foraging grounds for reef fishes.

Energy fluxes between such juxtaposed habitats is receiving increasing research attention as a way to explain their interlinked roles. OGDEN & GLADFELTER (1983) pointed out that, seagrass beds and mangrove regions are often excellent fishing grounds for larger reef-related predatory fishes, which relied on the juvenile fishes, and invertebrates that have outgrown the protection from these habitats. TALBOT (1960) actually reported abundant lutjanids from the Tanzanian reefs in the collections made from the nearby mangrove areas. In some cases, for example, the trophic interlinkages have been established between the mangrove swamps, seagrass beds, and the coral reefs (e.g., ODUM & HEALD, 1972; MARGUILLIER *et al.*, 1997; and LETUORNEUR, 1998). Many reef fish species, for example, the apogonids, holocentrids, lutjanids, lethrinids, mullids, muraenids, haemulids, serranids, scorpaenids, fistularids, and aulostomids, are commuter foragers between the coral reefs and the seagrass beds and play a major role in the transfer of energy (PARISH, 1989). Such commuter activities are not "one-way traffic" but a web of interlinkages between these coastal habitats i.e., mangroves - seagrass beds - coral reefs (MARGUILLIER *et al.*, 1997).

Despite the acknowledged value of these coastal habitats to the fisheries and coastal area environmental health, they are lately under extreme anthropogenic influence. Studying fish communities can provide useful information on the existing biotic structures and/or organisation, which may be applicable in the conservation of the species, habitats, or ecosystems as a whole. The studies may also provide information of purely scientific importance, e.g., on changes in the fish and other biota, arising due to habitat manipulations. Species richness, diversity, abundance, and densities are quite common terms in community and population ecology (LETOURNEUR *et al.*, 1997), as they are equally used as parameters to measure change in habitats (BARTELS *et al.*, 1984; CAO *et al*, 1998; ÖHMAN *et al.*, 1998).

Along the eastern African continental margin is a narrow shelf which dips steeply to the abyssal just behind the almost continuous fringing coral reefs (RICHMOND, 1997). These features restrict highly productive areas in "pockets of habitats" in the coastal embayments (e.g., creeks, bays, estuaries, and in lagoons between the reefs and the shore) which provide some expansive shallow waters. The origin and geological background of these features (see chapter 1) is reviewed in RICHMOND (1997). Between November and March, during the southern winter, the Northeast (NE) Trade winds prevail and are the major driving force on the climate in East Africa and in the Western Indian Ocean region at this time of the year (i.e., the NE monsoon season or *Kaskazi* in Kiswahili). The NE Trade winds, coming from the dry landmass in the north, are generally dry winds, and do not bring rains. From May to October, the wind direction completely reverses; the stronger SE Trade winds prevail and mark the SE monsoon season (also known as *kusi* in Kiswahili). These winds veer westerly at the equator and blow on-shore across the ocean waters. They are moisture laden and cause the long rainy season. The effects of these winds coupled with that of the on-shore South Equatorial Current and the long shore East African Coastal Current concentrate dissolved and particulate matter (including seston) in the nearshore and inshore coastal waters. The long rainy period starts in April-May and continues into August, while the short rains fall in November.

The main forcing on the biological processes (e.g., the productivity) in Gazi bay is influenced by the combined effects of the seasonal monsoons, the daily land-sea breezes, the semi-diurnal tides (of ca. 3.5m range), the seasonal magnitudes in currents, and the rainfall pattern. The bay provides a good example of interlinked coastal habitats, having a fringing reef (on the seaward side), seagrass beds of varying vegetative cover (interspersed with bare sand, rubble, and mud) and extensive mangrove swamps (on the landward side). The bay has recently enjoyed concerted research efforts, covering all aspects of the abiotic and biotic processes. Notable among these studies are COPPEJANS *et al.*, 1992, on seagrass-macroalgal cover; RUWA, 1993 on zonation and distribution of mangroves; WOITCHIK, 1993, on mangrove ecosystems; HEMMINGA, 1995 on interlinkages between coastal ecosystems; HEMMINGA *et al.*, 1994 and OHOWA *et al.*, 1997 on the nutrient fluxes and distribution; RUWA & POLK, 1994 on the spat settlement in the tropical oyster and barnacles; SCHRIJVERS *et al.*, 1995a & b on epi- and meio-fauna in mangrove stands; DE TROCH *et al.*, 1996; 1998; KIMANI *et al.*, 1996; MARGUILLIER *et al.*, 1997; and WAKWABI & MEES, (in press) on fish fauna, fish communities, and fish diets; and KITHEKA, 1996 on the water circulation.

In this paper, we synthesise and discuss the results of two intensive beam trawl surveys undertaken on the epibenthos of Gazi bay between 1994 and 1996, and thereby broadly delineate the spatial patterns in the species distribution and abundance.

3.2 MATERIALS AND METHODS:

Thirty-two (32) samples were collected with a beam trawl (1.5m beam length, 6mm-stretched mesh-size) during an intensive survey of the epibenthos in Gazi bay on 12-15 October 1994. The approximate position of the points at which the sample tows were taken (BT1-BT32) are marked on Fig. 3.1. BT denotes "beam trawl". Only one tow was taken at each station. Between December 1994 and September 1996 (inclusive), a further intensive survey was undertaken with the same beam trawl this time fitted with an inner 2mm mesh bag. Samples for this second survey were taken

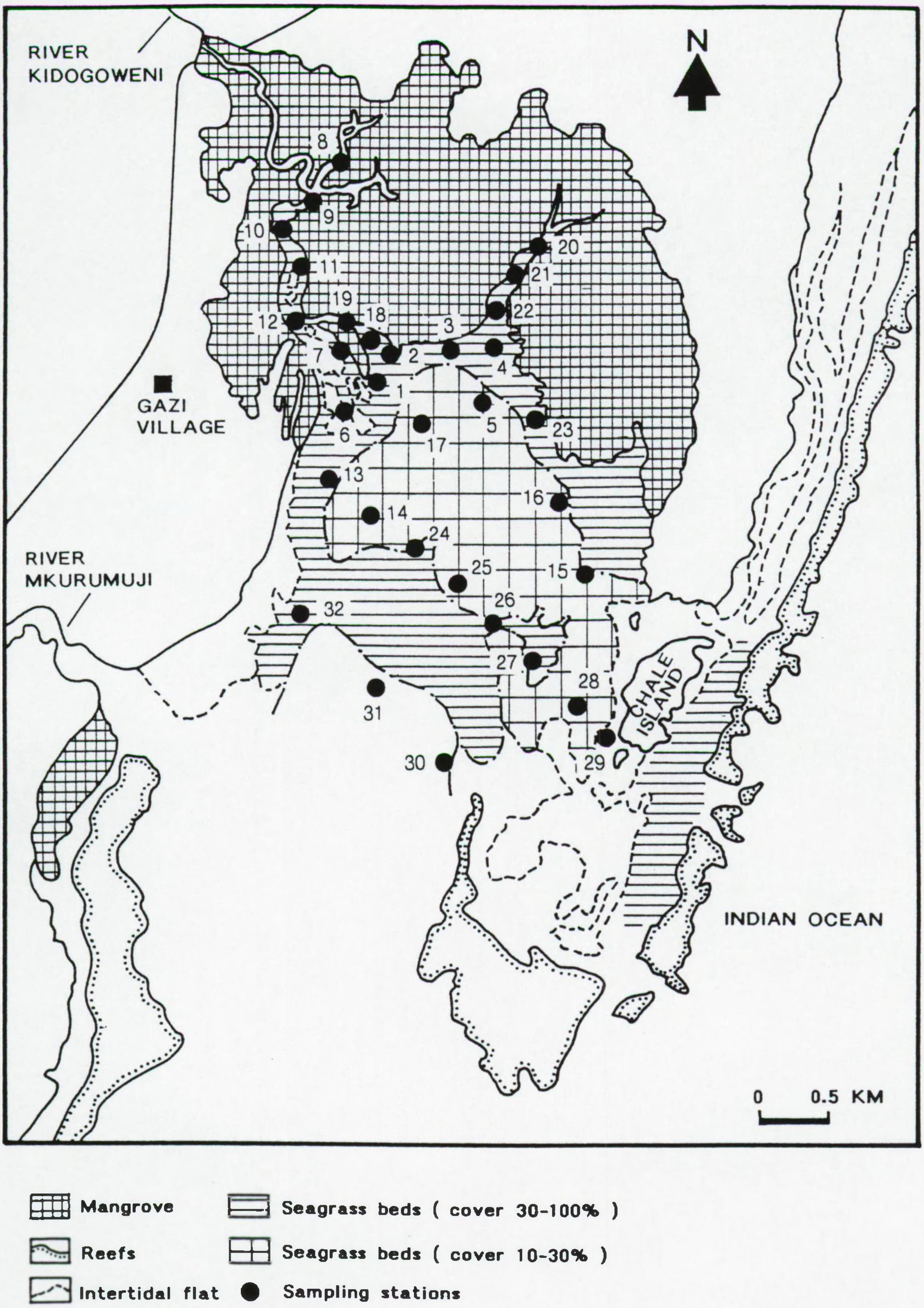


Fig. 3.1 A detailed map of Gazi bay, Kenya with the 32 study sites sampled during the short-term (12-15 October 1994) beam trawl survey.

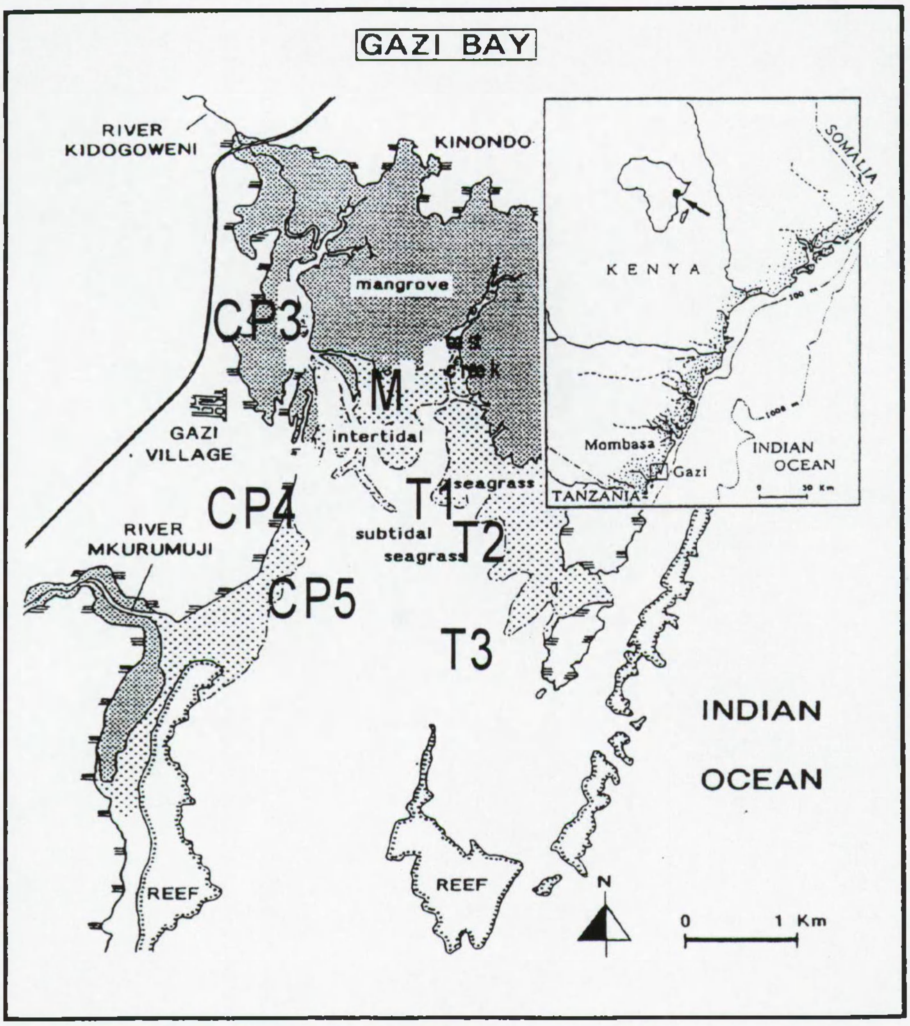


Fig. 3.2 Map of Gazi bay, Kenya showing the position, physical characteristics of the bay (the reef, the creeks, the seagrass beds, and the mangrove cover) and the 7 beam trawl stations sampled in December, 1994-September, 1996.

monthly on every other neap tide. Two replicate tows were always taken at the seven stations: cp3, M, cp4, cp5, T1, T2, & T3 (Fig. 3.2). Cp3, cp4, cp5 were stations located off the mangrove replantation experimental plots in the west creek (cp3) and on the western shores of the bay proper (cp4 & cp5). M was located at the mouth of the west creek, while T1, T2, & T3 were located in the *Thalassodendron* grass beds in the main bay lagoon. All sample tows during the two surveys were taken on an outboard motor powered Zodiac in the counter current direction and were each of 10 minutes duration (actual towing time). Sampling was restricted to daytime. Field and laboratory methods for handling the catches were detailed in Chapter 2.

The generated species-at-site density data were first reduced by excluding all fish species with only 1 individual and caught only once in the catch and the zero catch stations (for the short-term survey of October 1994). All species with less than 7 individuals (<0.05%) in the total catch (pooled for all stations over the sampling period, for the 1994-96 long-term survey), were also reduced from the matrix. These reductions were done to reduce the effects of the very rare species in the density data but also taking care that the reduction does not overly remove the diversity factor these rare species impact on the data (Cao *et al*, 1998). For the short-term survey (Data set I), the reduced data were further standardised by taking the percentages of each species in the tow (representing the station). The non-fish (invertebrates) collected in the beam trawl during this short-term survey were independently treated as a separate data set (Data set II) from the fish catch of the same survey. This (non-fish) data set was not reduced as explained above for the fish data. A large number of the invertebrate species (>38%) were very rare (only one individual and caught only once) in the catch. The data set was however, also standardised by taking the percentages as described for the fish data sets. These percentage data (for fish and for non-fish catch) were then transformed by taking the arcsin-square-root i.e., ((@asin(@sqrt(X/100))*180/@pi for X = the number of each species in each tow) to reduce the effects of the fewer large values in relation to too many small and/or zero values in the matrix (FIELD *et al.*, 1982). For the long term survey data set (Data set III), the catch for each species (including the invertebrates) were pooled for each station and averaged to the tow (i.e., to achieve the catch per standard 10 min tow over the 22 months sampling period for each species at each station). The averaged density data were then transformed (for the same reasons as stated above for the short-term data sets), but this time, by taking the fourth-root of the density of each species at each station (i.e., @sqrt(@sqrt(X) for X = the density of each species at each station).

The transformed data sets were subjected to the multivariate classification methods (TWINSPAN) and ordination methods (DCA) to detect associative patterns. Hill's (HILL, 1973) diversity index (H') was estimated for the generated associative patterns to describe the diversities and/or dominance in the observed communities.

3.3 RESULTS:

3.3.1 Long term patterns (Data set III)

3.3.1.1 Density and diversity:

Considering the pooled catch over the 22 months period (Table 3.1), the average catch per standard 10 min tow was highest at the *Thalassodendron* stations (*T1, T2 & T3*) with 181.6±47.04, 217.2±68.33, and 93.4±18.01 animals per tow respectively; but decreased into the west creek (with *M* having 60.2±12.76 and *cp3* having 58.5±15.93 animals per standard tow) and also towards the mangrove stands on the western shores of the bay where *cp4 & cp5* had 59.2±17.77 & 46.2±15.50 animals per standard tow, respectively. The number of species and the Hill's diversity number (H') appear to increase towards the sea, with the stations in the creek having lower values (cp3 had 58 species with H' = 2.835; M had 63 spp and H' = 3.003), but peaking off at stations *T3* (with 106 spp and H' = 3.592) and *cp5* (72 spp and H' = 3.302). The depression in H' at the *T2* (Table 3.1)was likely due to the higher densities realised at this station.

3.3.1.2 Species composition:

In total over 15700 individuals were caught in 308 beam trawls taken during the 22 months (November 1994 to September 1996) survey of the epibenthos of Gazi bay. These were identified in 161 species and taxa of fishes and invertebrates (Wakwabi & Mees, chapter 2). Only 7 species and taxa dominated the catch, each having > 5% of the summed average catch (Fig 3.3a). These included 2 scarids *Leptoscarus vaigiensis* (14.0% of the total catch) and *Scarus sordidus* (6.8%), a catfish *Plotosus lineatus* (9.3%), three apogonids *Apogon fragilis, Apogon nigripes & Fowleria aurita,* (5.7% each); and a rabbitfish *Siganus sutor* (5.6%). Majority of the species and taxa (about 60%) were each below 0.1% (i.e., with less than 16 individuals) in the total catch.

The relative species composition for the dominant species at each station is presented in Fig. 3.3b-h. Note that *Apogon nigripes*, which was the most dominant species at *cp3* with a relative proportion of 22.7% in the average catch (Fig 3.3b), reduced at the mouth of the creek (stn. *M*, Fig. 3.3c) making only 9.4% of the relative proportion in catch and was very low in the bay (< 5%). *Scarus sordidus* was only important in the bay (i.e. at *T1, T2, cp4, & cp5*) where it constituted 5-12% of the relative proportion in the catches (Fig. 3.3e-3.3g). The species was only 2% and 3%

of the relative proportions at *cp3* and *M* respectively. *Leptoscarus vaigiensis* was however, among the dominant species at all the stations where it made 9-16% of the average catches rate (Fig. 3b-3h). It was also observed that at all the stations (Fig. 3.3b-3.3h), majority of the species were caught in very low densities (grouped under "rest").

Table 3.1: Average catch per standard 10 minutes tow (N_o±SE), total number of species and taxa (SPP), and the Hill's diversity index (H') of the epibenthos collected during the 22 months (December 1994-September 1996) intensive beam trawl survey on Gazi bay, Kenya.

Station	N_o±SE	SPP	H'
cp3	58.5 ± 15.93	58	2.835
m	60.2 ± 12.76	63	3.003
cp4	59.2 ± 17.77	62	3.142
cp5	46.2 ± 15.50	72	3.302
T1	181.6 ± 47.04	86	3.129
T2	217.2 ± 68.33	89	2.868
T3	93.4 ± 18.01	106	3.592

The main bay lagoon stations in the *Thalassodendron* grass beds were the most speciose, although, only 4 species dominated the catches (each with > 5% of the average catch per tow). The number of species with > 5% of the average catch (per tow) increased to ⩾6 at the creek stations *(cp3 & M)* and at *cp5* (Fig. 3.3b, 3.3c, & 3.3h). A single haul through a school of *Plotosus lineatus* was responsible for the highest catch realised for this species at *T2* (Table 3.1), otherwise, *Leptoscarus vaigiensis* was the most dominant species in the catches from the *Thalassodendron* grass beds (stations *T1, T2, & T3*) and at *cp5* (Fig. 3.3e-h). Also noted at the main bay stations was the prevalence of the sea urchins (*Tripneustes gratila* and 2 *Diadema*

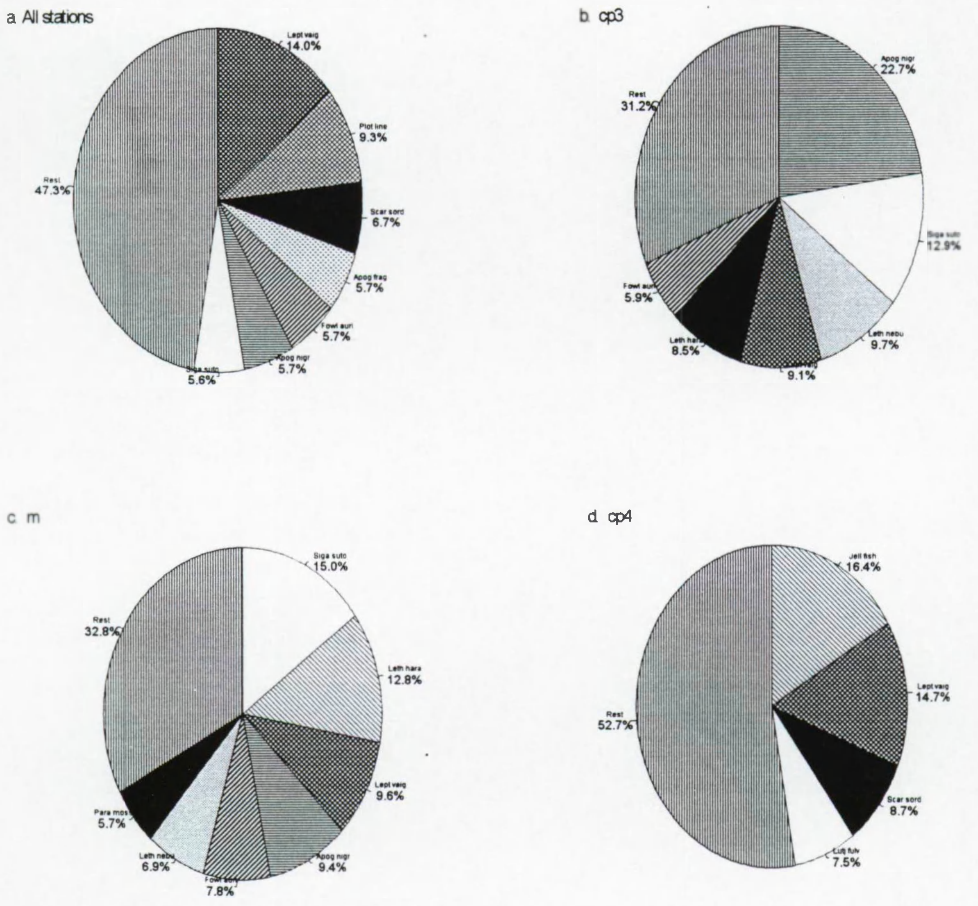


Fig. 3.3 (a-d) Composition of the dominant species and taxa of fish and invertebrates in the epibenthos of Gazi bay, Kenya. Based on the catch data collected during the December, 1994-September, 1996 study: (a) for all stations combined, and (b-h) for the respective study sites (cp3, M, cp4, T1, T2, T3, & cp5). The abbreviated species (and taxa) names represent: Jell fish = jelly fish (Cnidaria); Trip grat = *Tripneustes gratilla* (sea urchin: Echnoidea); and pisces: Plot line = *Plotosus lineatus* (Plotosidae); Para moss = *Parascorpaena mossambica* (Scorpaenidae); Apog frag = *Apogon fragilis*, Apog nigr = *A. nigripes* and Fowl auri = *Fowleria aurita* (all Apogonidae); Lutj fulv = *Lutjanus fulviflamma* (Lutjanidae); Leth hara = *Lethrinus harak* and Leth nebu = *L. nebulosus* (both Lethrinidae); Hali irid = *Halichoeres iridis* (Labridae); Lept vaig = *Leptoscarus vaigiensis* and Scar sord = *Scarus sordidus* (both Scaridae); Siga suto = *Siganus sutor* (Siganidae). Rest = all other species and taxa caught at the station(s).

spp), star fishes (Asteroidea), sea cucumbers (Holothuroidea), jelly fish (Cnidaria), swimming crabs (Portunidae), and squids (Cephalopoda) (Table 3.3). Jelly fish dominated (with > 16%) in the catches at *cp4* (Fig. 3.3d) while the sea urchin *Tripneustes gratilla* was a dominant species at *T2* and *T3*, having made > 6% of relative proportions (Fig 3.3f & 3.3g). Penaeid shrimps occurred with greater affinity towards the mangrove influenced stations where they constituted 4.3%, 2.0%, 2.1%,

& 2.6% at *cp3*, *cp4*, *cp5*, *& M*, respectively) than in the seagrass beds where they were < 1% at each station (Table 3.3). Caridean shrimps on the other hand, had a somewhat global distribution in the bay. It was also apparent from the Fig. 3.3a-h that dominance at all the stations were based on the same species and taxa which seemed to inter-change levels of importance at the different stations.

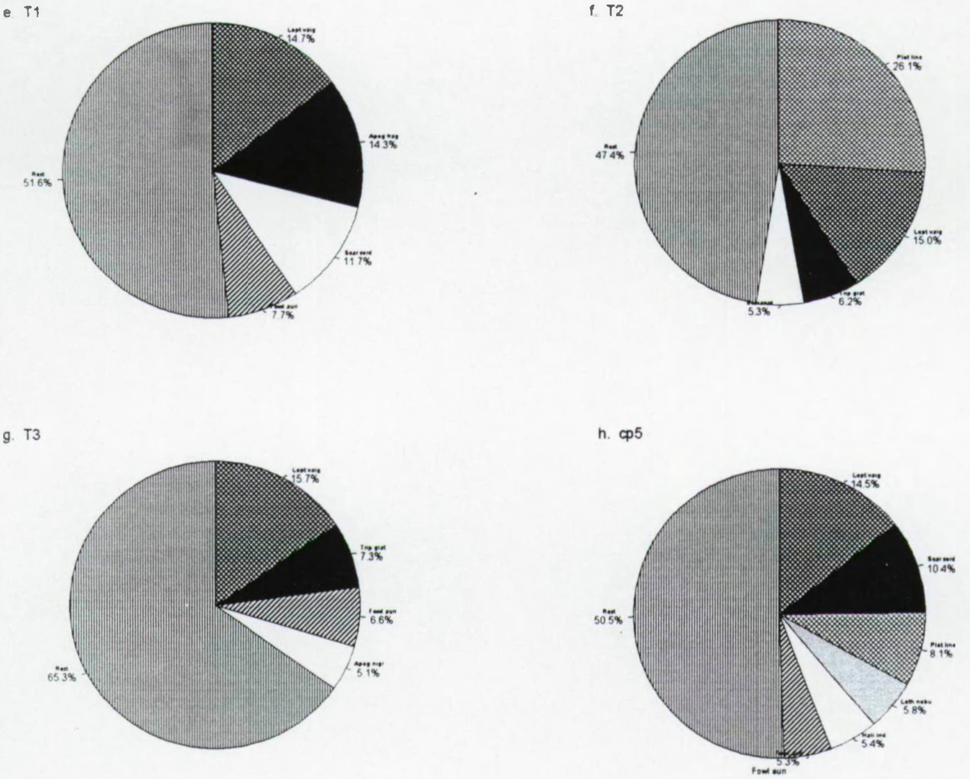


Fig. 3.3 (e-h) Composition of the dominant species and taxa of fish and invertebrates in the epibenthos of Gazi bay, Kenya. Based on the catch data collected during the December, 1994-September, 1996 study: (a) for all stations combined, and (b-h) for the respective study sites (cp3, M, cp4, T1, T2, T3, & cp5). The abbreviated species (and taxa) names represent: Jell fish = jelly fish (Cnidaria); Trip grat = *Tripneustes gratilla* (sea urchin: Echnoidea); and pisces: Plot line = *Plotosus lineatus* (Plotosidae); Para moss = *Parascorpaena mossambica* (Scorpaenidae); Apog frag = *Apogon fragilis*, Apog nigr = *A. nigripes* and Fowl auri = *Fowleria aurita* (all Apogonidae); Lutj fulv = *Lutjanus fulviflamma* (Lutjanidae); Leth hara = *Lethrinus harak* and Leth nebu = *L. nebulosus* (both Lethrinidae); Hali irid = *Halichoeres iridis* (Labridae); Lept vaig = *Leptoscarus vaigiensis* and Scar sord = *Scarus sordidus* (both Scaridae); Siga suto = *Siganus sutor* (Siganidae). Rest = all other species and taxa caught at the station(s).

3.3.2 Short term patterns (Data sets I & II)

From the distribution of the catch (densities and number of species) by tows (Table 3.2, Fig 3.4a & Fig. 3.4b), it was observed that the tows taken from the inner-most of the west creek (i.e., BTs 8, 9, & 10) and the one taken at the inner-most of the east creek (BT 20), had very low catch rates (< 35 individuals per tow) and were less speciose (< 10 species per tow), for both fish and invertebrates. Exception to the above was the invertebrate catch in BT10 (62 individuals in 16 species) (Table 3.2). The rest of the tows taken in the east creek (BTs 21 & 22) and those taken from the reef platform towards the open sea (BTs 25, 26, 27, 30, 31, & 32) had rather intermediate catch rates (> 50 < 100 individuals per tow) and number of species (> 10 < 21 species) of fish (Table 3.2 & Fig. 3.4a). They had however, very low catch (< 10 individuals in the tow) and few species (< 10 in the tow) of the invertebrates (with the exception of the BT32 where 30 individuals in 11 species were realised for this component) (Table 3.2 & Fig. 3.4b). The rest of the tows taken in the west creek and in the bay (with the exception of BTs 3, 5, & 7), had much higher catch rates(> 100 individuals, with BT18 alone having 356) and the highest number of species (15-28 each) (Table 3.2). The invertebrate catch at these stations was quite varied (Table 3.2). The distribution of the incidences of occurrence among the abundant fish species in the different tows (BTs) seemed to suggest that the communities on the bay are quite diverse. No single specie had a 100% frequency of occurrence in the BTs. Among the fish, *Leptoscarus vaigiensis* occurred with the highest frequency (in 87% of the BTs) followed by *Sebastapistes strongia* (77%), *Saurida gracilis* (74%), *Siganus sutor* (71%), *Fowleria aurita* (68%) *Lutjanus fulviflamma* (61%) and *Gnatholepis sp1* and *Petroscirtes mitratus* (each in 58%). Majority (> 65%) of the species were recorded in less than 5 BTs (< 16% frequency of occurrence). As for the invertebrate component, an unidentified anomura species and *Cypraea annulus* were the most frequently collected species occurring in 61% and 55% of the BTs respectively. An even larger majority (> 90%) of the invertebrate species were recorded in less than 5 BTs (< 16% frequency of occurrence).

Fish species with rather global distribution (not-withstanding the variation in abundance) over the seagrass beds-macroalgal mats in the study area included *Saurida gracilis**, *Singnathoides biaculeatus*, *Sebastapistes strongia**, *Pelates quadrilineatus*, *Fowleria aurita*, *Lutjanus fulviflamma*, *Neopomacentrus fulginosus*, *Cheilio inermis*, *Stethojulis strigiventer*, *Calostomus spinidens*, *Leptoscarus* *vaigiensis*, *Petroscirtes mitratus*, *Gnatholepis Species 1*, *Siganus sutor*, and *Bothus pantherinus** (* recorded also from the estuarine BTs 8, 9, & 10). *Lethrinus harak* was recorded only in the west creek (BTs 11, 12, 18, & 19), while almost all, except for the 5 specimens in BT2, of *Plotosus lineatus* were caught in BT13. *Dascillus aruanus*, *Cheilinus bimaculatus*, *Novaculichthys macrolepidotus*, *Petroscirtes breviceps*, *Paramonacanthus barnardi* and *Canthigaster bennetti*, were caught from the bay lagoon where *P. barnardi* and *N. macrolepidotus* were only recorded from the reef platform towards the entrance from the reefs, *C. bimaculatus*, *P. breviceps*, and *D. aruanus* in BTs across the bay (east and west); and *G. bennetti* mostly on the west side of the bay. The other important cardinalfish (*Foa brachygramma*), emperor (*Lethrinus lentjan*), and wrasse (*Cheilinus oxycephalus*) were distributed only on the western side of the bay and extended into the west creek (with minor incidences to the east of the bay). The only other fish species recorded from the estuarine BTs (8, 9, &10) in the west creek were three gobies *Drombus key**, *Oxyurichthys microlepis**, *Yongeichthys nebulosus*, three flatfishes *Psuedorhombus arsius**, *Cynoglossus lachneri*, and *Paraplagusia bilineata* and unidentified bothid juveniles* and cynoglossid juveniles (* recorded only in the estuarine BTs).

As already indicated (in the methods section) about the invertebrates catch rates during the short-term survey, only two species: *Arcuatula capensis* (with a total catch of 944) and *Cypraea annulus* (490) were caught in large numbers. In fact *A. capensis* was caught only in 5 tows (5 BTs) while *C. annulus* was caught in 17 tows (17 BTs). Only 2 species (*C. annulus* and the Anomura species 1) were present in more than 50% of the 32 tows (BTs); while only 4 species had > 100 individuals in the pooled (all tows together) total catch.

Table 3.2: Summarised fish and invertebrates catch data, numbers of individuals (No) and number of species (SPP) during the short-term beam trawl survey on Gazi bay, Kenya in October 1994 .

Station	Fish		Invertebrates	
	No	SPP	No	SPP
BT1	117	17	52	19
BT2	181	17	145	40
BT3	35	10	61	9
BT4	120	16	15	6
BT5	53	12	2	2
BT6	206	27	168	10
BT7	18	5	2	2
BT8	13	6	22	4
BT9	7	3	5	4
BT10	16	9	62	18
BT11	147	22	29	16
BT12	123	18	39	15
BT13	253	23	919	21
BT14	152	28	156	25
BT15	185	15	177	17
BT16	133	17	197	10
BT17	90	25	28	11
BT18	356	23	83	18
BT19	133	16	18	7
BT20	33	7	8	1
BT21	51	14	8	5
BT22	63	13	2	2
BT23	218	19	20	6
BT24	234	23	11	8
BT25	55	18	2	2
BT26	61	18	10	10
BT27	71	19	19	9
BT28	173	9	126	14
BT29	0	0	0	0
BT30	71	20	8	6
BT31	66	21	8	7
BT32	50	12	30	11
MEAN	112.4	16.2	78.4	10.8
H'	3.092		2.537	

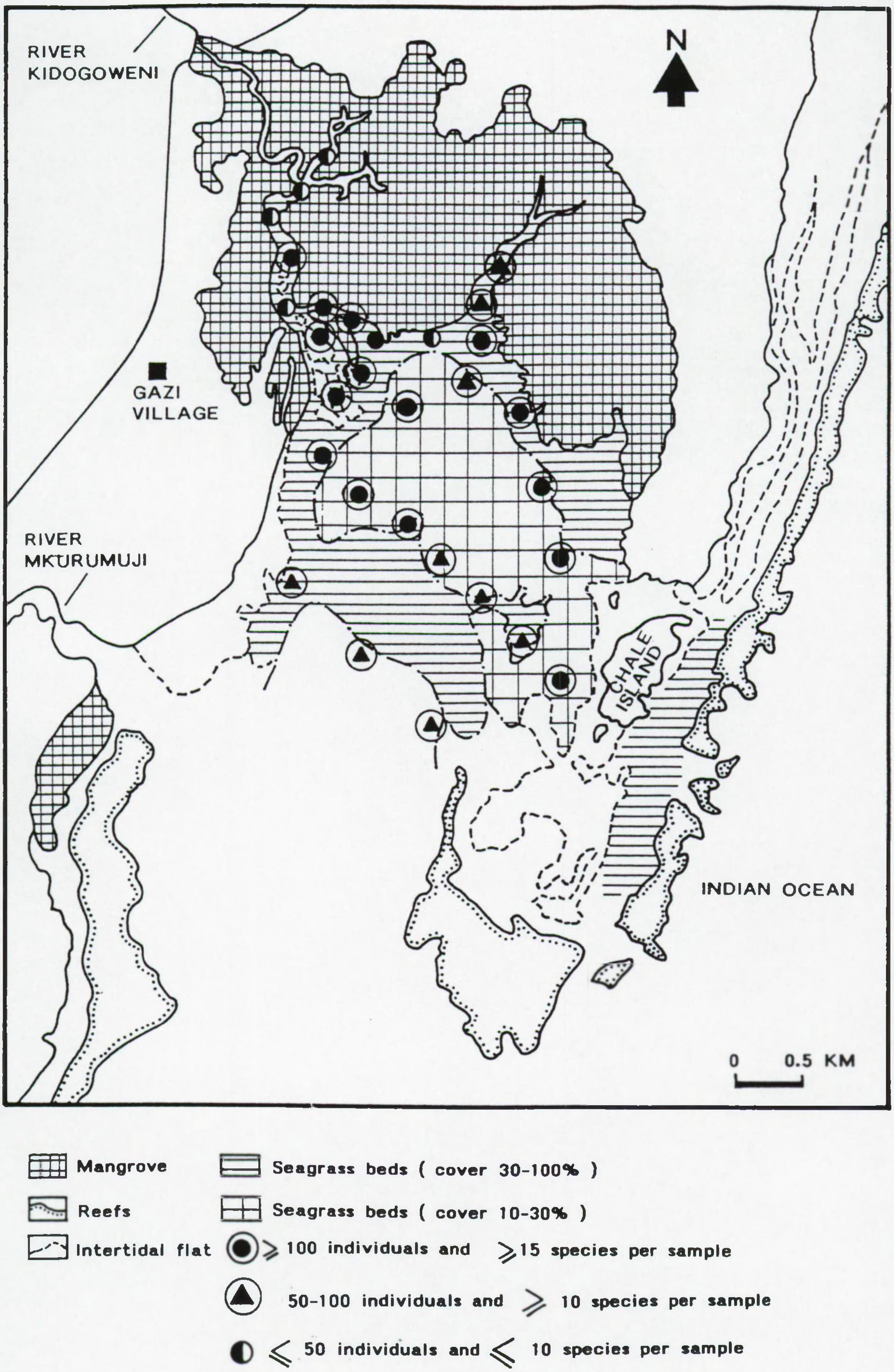


Fig. 3.4(a) Distribution of the density and species diversity of Epibenthic fish in Gazi bay, Kenya. Based on the catch data from the intensive beam trawl survey of 12-15 October, 1994.

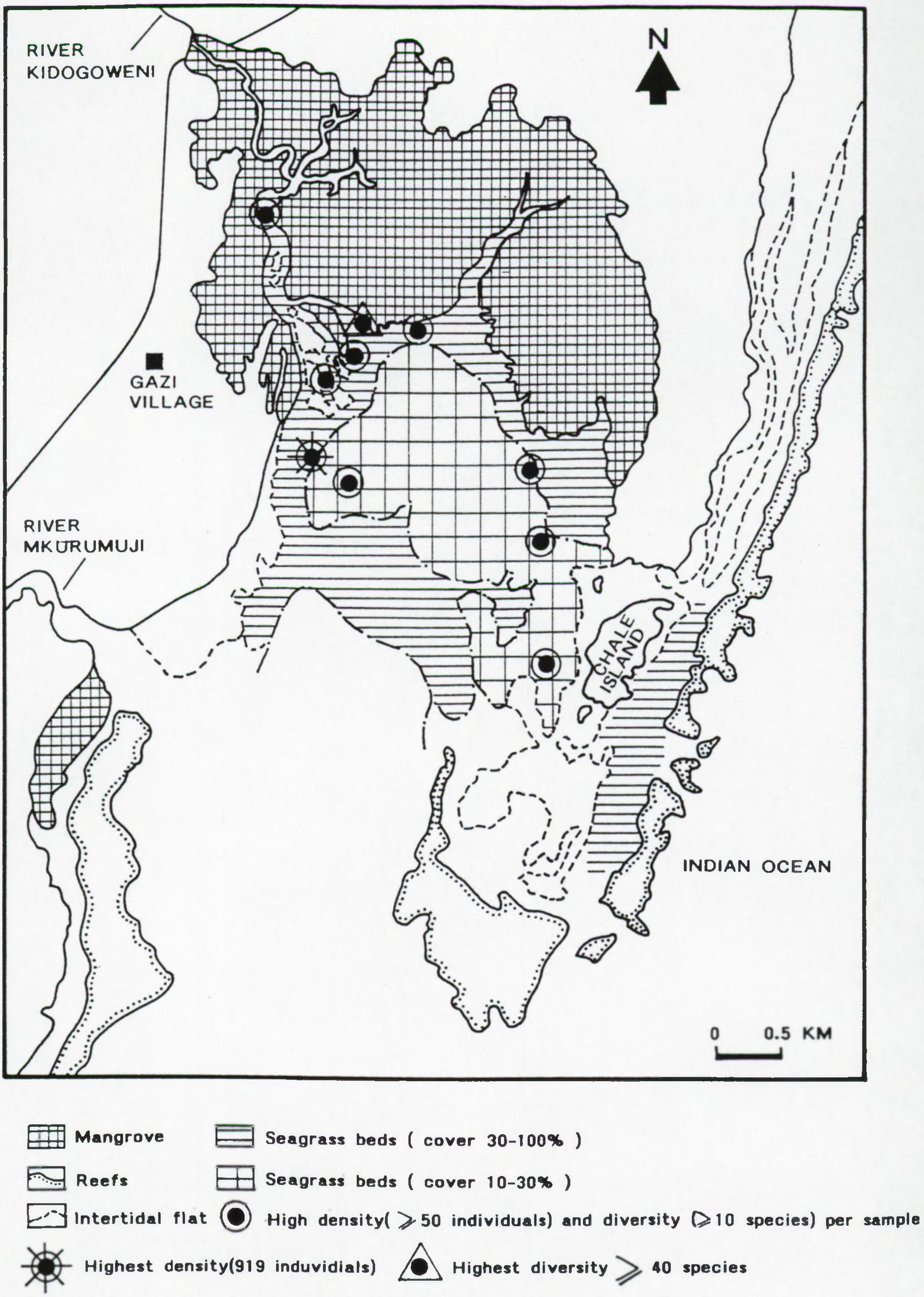


Fig. 3.4b: Distribution of the density and species diversity of epibenthic invertebrates in Gazi bay, Kenya. Based on the catch data from the intensive beam trawl survey of 12-15 October, 1994.

Table 3.3: Percentage composition of the invertebrate component: caridean shrimps (cari), penaeid shrimps (pena), crabs (brac), jelly fishes (cnid), squids (ceph), sea cucumbers (holo), starfishes (aste), and sea urchins (echi) in the beam trawl catches during the long-term survey on Gazi bay, Kenya.

STATION	cari	pena	brac	cnid	ceph	holo	aste	echi
Cp3	1.24	4.30	0.50	-	-	-	-	-
M	2.94	2.60	-	0.23	0.23	-	-	-
Cp4	0.77	2.00	-	16.44	0.08	-	-	-
Cp5	0.30	2.10	0.10	1.87	-	0.10	-	0.59
T1	0.53	0.88	0.05	1.60	0.10	-	0.03	4.80
T2	0.42	0.04	-	0.46	0.11	-	0.12	10.10
T3	1.31	0.05	0.05	0.58	0.05	0.15	0.05	9.39

3.3.3 Associations (classification and ordination)

The first data set on fish (short-term survey) was split into three major groups by the TWINSPAN (Two Way INdicator SPecies ANalysis): a divisive multivariate technique. The third group (III) constituting the estuarine stations (BTs 8, 9, & 10) at the innermost west creek, was separated at the first dichotomy (Fig. 3.5) from the rest of the stations with *Drombus key* (Gobiidae) as the indicator species for this group. The first and second main groups (I & II) were separated at the 2nd dichotomy (Fig 3.5). BTs 14, 25, 26, 27, 30, 31, & 32; on the reef platform at the entrance from the

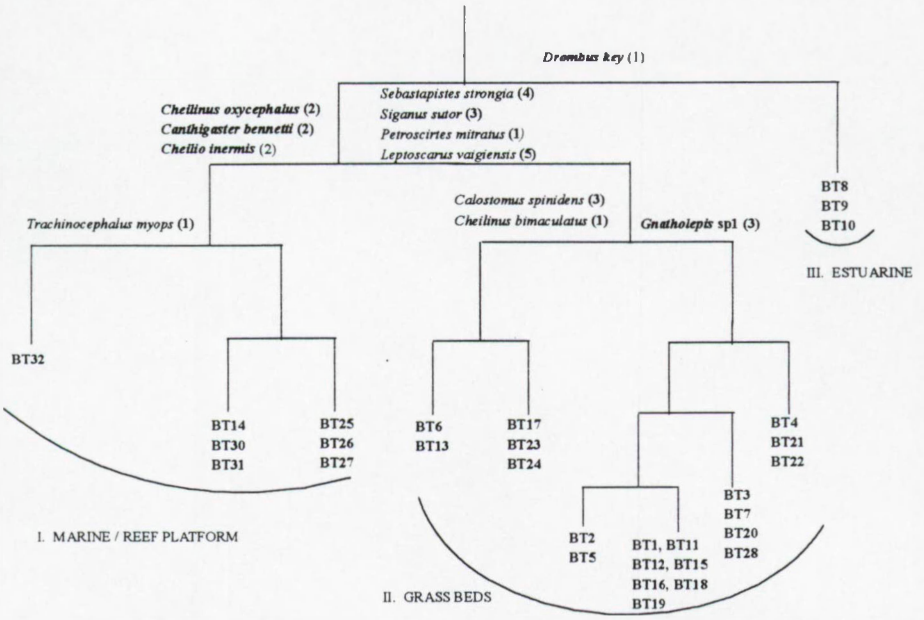


Fig. 3.5: Community structure of the epibenthos of Gazi bay, Kenya: based on the fish catch data of the short-term beam trawl survey (12-15th October, 1994).

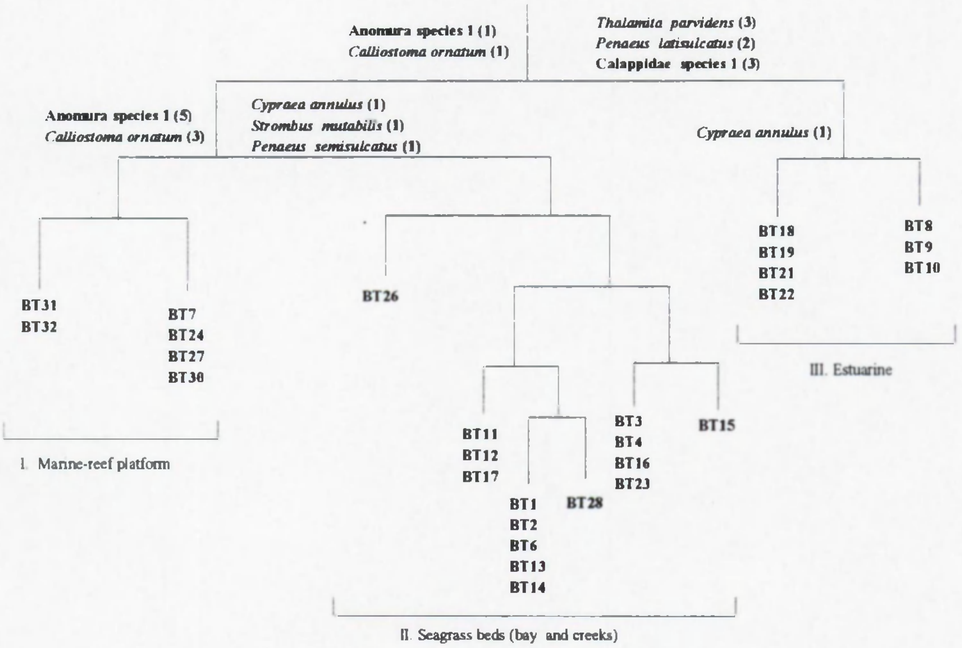


Fig. 3.6 Community structure of the epibenthos in Gazi bay, Kenya: based on the invertebrate catch data from the short-term beam trawl survey (12-15th October, 1994).

reefs were all in group I. *Cheilinus oxycephalus* and *Cheilio inermis* (Labridae), and *Canthigaster bennetti* (Tetraodontidae) were the indicator species for this group.

Group II was constituted by the rest BTs 1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, & 28, which were located in the sea grass beds in the west creek, the east creek and in the bay with *Sebastapistes strongia* (Scorpaenidae), *Siganus sutor* (Siganidae), *Petroscirtes mitratus* (Blenniidae) and *Leptoscarus vaigiensis* (Scaridae) as the indicator species. This pattern coincides with the observed distribution in the densities and numbers of species discussed in the preceding section.

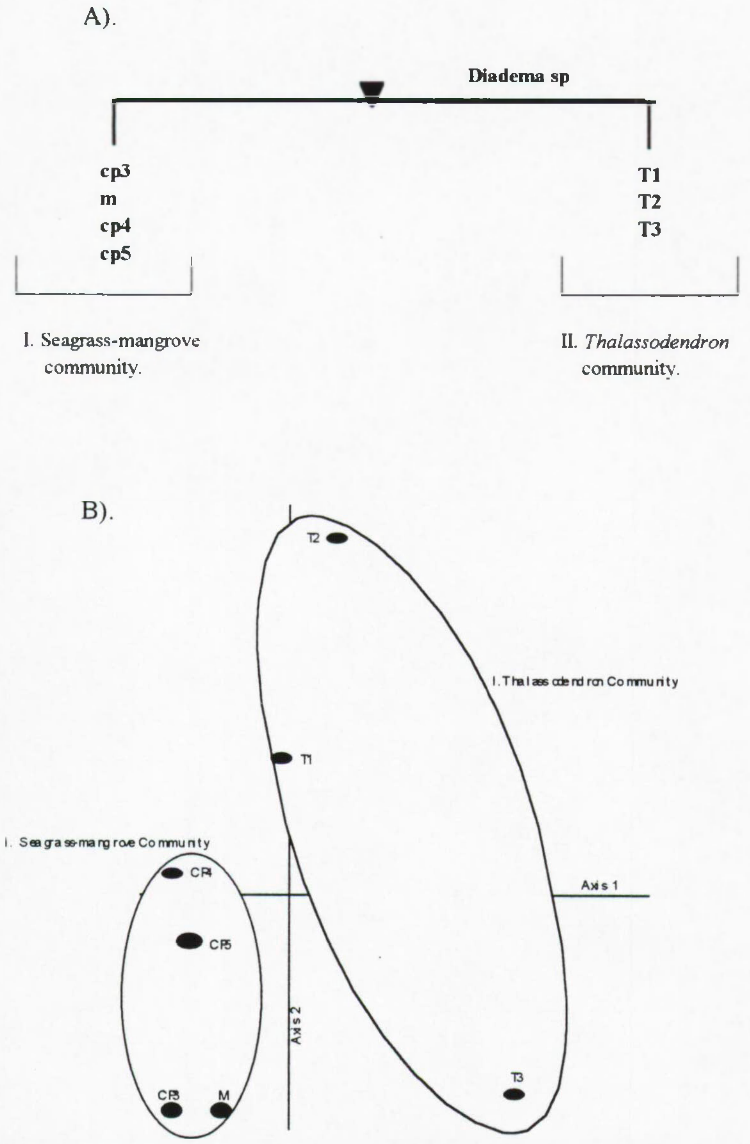


Fig. 3.7 Epibenthos community structure in Gazi bay, Kenya, based on the beam trawl study of December, 1994-September, 1996: (a) Hierarchical clusters from the TWINSPAN, and (b) a plot from the DCA outputs.

The TWINSPAN of the invertebrates' data matrix (Data set II) separated also three main groups (Fig. 3.6). At the 1st dichotomy, BTs 8, 9, 10, 18, 19, 21, & 22 were separated from the rest with the swimming crab, *Thalamita parvidens* (Portunidae), the western king prawn, *Penaeus latisulcatus* (Penaeidae), and the box crabs, Calappidae species 1 as indicator species for this group (III). Hermit crabs (Anomura species 1) and a molluscan *Calliostoma ornatum* were indicator species for the rest of the BTs. At the 2nd division, BTs 7, 24, 27, 30, 31, & 32 constituted group I with Anomura species l and *Calliostoma ornatum* as the indicator species, while BTs 1, 2, 3, 4, 6, 11, 12, 13, 14, 15, 16, 17, 23, 26, & 28 with the cowries *Cypraea annulus* (Cypraeidae) and *Strombus mutabilis* (Strombidae), and the green tiger prawn *Penaeus semisulcatus* (Penaeidae) as indicator species, formed group II (Fig. 3.6). All the BTs in group II were located in seagrass beds habitat. Suffice here to observe that the fish (Fig. 3.5) and non-fish (Fig. 3.6) groupings seemed to follow the same pattern. The inclusion of BTs 18, 19, 21 & 22 with the estuarine BTs 8, 9, & 10 from the west creek in Fig. 3.6 was rather exceptional for the invertebrates. BTs 27, 30, 31, & 32 were still grouped together in the two results from TWINSPAN. The same can be observed for the BTs in the seagrass beds. It was also noted that *Leptoscarus vaigiensis* and *Penaeus semisulcatus* which independently rely on the seagrass beds and macro-algal mats for their distributions (PRICE & JONES, 1975; MOHAMED *et al.*, 1981; STAPLES *et al.*, 1985 for *P. semisulcatus*; and SMITH & HEEMSTRA, 1986; RICHMOND, 1997; LIESKE & MYERS (1994) for *L. vaigiensis*) were both indicator species for the BTs from this habitat. The same spatial pattern (as in Fig. 6) was observed (not presented here) when the 2 short-term data sets (fish and invertebrates data sets) were combined and run in the TWINSPAN excluding only those species and taxa with <5 individuals in the total catch.

The TWINSPAN output from the long-term data set III (Fig 3.7a) and the DCA plot (Fig. 3.7b) of the same data, grouped together the *Thalassodendron* stations (*T1, T2, & T3*), separating them from the Mangrove-seagrass associated stations (*cp3, M, cp4 & cp5*) in the other group. *Diadema* species, the sea urchins that were quite abundant in the bay, were the indicator species for the *Thalassodendron* stations in group II. When the TWINSPAN was done with the original long-term survey data set (without reduction: results not presented here), the same spatial pattern as in Fig. 3.7a emerged. Even when monthly densities were considered (also not shown here), the spatial pattern remained the same, separating between the *Thalassodendron* stations and the seagrass-mangrove-associated stations.

The approximate fish community structure in Gazi bay considering the catch data from beach seines and beam trawls is presented in Fig. 3.8. Four communities were identified: i) associated with the estuarine conditions at river mouths, (ii) includes the seagrass beds with mangrove influence on the eastern side of the bay, in the eastern creek and part the western creek, (iii) the seagrass beds with mangrove influence on the western side of the bay including the entrance to the western creek (m in Fig. 3.2) and the area around the oyster farm (cp3 in Fig. 3.2) and (iv) in the *Thalassodendron* beds including the reef platform towards the open sea.

3.4 DISCUSSION:

A complete list of fish species so far recorded from Gazi bay was presented in Chapter 2. Beam trawling as a sampling strategy collects basically only those species relatively closer to the seabed (epi-hyper-benthos within 0-0.5m off the ground for our trawl design). Other studies carried out on the fish faunas of Gazi bay used different gears with varied sampling strategies. Their results were equally varied (VAN DER VELDE *et al.*, 1994; KIMANI *et al.*, 1996; DE TROCH *et al.*, 1996; and our results in Chapter 2). We believe that the observed spatial patterns in species distribution and their abundance were due to the diversity and dynamics of the microhabitats in the bay. KIMANI *et al.* (1996) and DE TROCH *et al.* (1996) for example, used beach seines in their studies and reported, respectively, *Herklotsichthys quadrimaculatus* and *Atherinomorus lacunosus*, and *Gerres acinaces* and *Atherinomorus duodecimalis*, as the most abundant species in the area. Likewise, BEULS (1995) sampled at the mouth of the west creek with a beach seine, but emphasising on the gobies and reported *Siganus sutor, Foa brachygramma, Sebastapistes strongia,* and *Leptoscarus vaigiensis* as the most abundant species. VAN DER VELDE *et al.* (1994) reported *Fowleria aurita, Siganus sutor, Leptoscarus vaigiensis* and *Apogon thermalis* as the most abundant species, while in our 2 sampling strategies (this report), we report *Leptoscarus vaigiensis* and *Sebastapistes strongia* (in the short term survey) and *Plotosus lineatus, Apogon fragilis, Apogon nigripes, Fowleria aurita, Leptoscarus vaigiensis, Scarus sordidus,* and *Siganus sutor* (in the long-term survey) as the most abundant and therefore important fish in the bay.

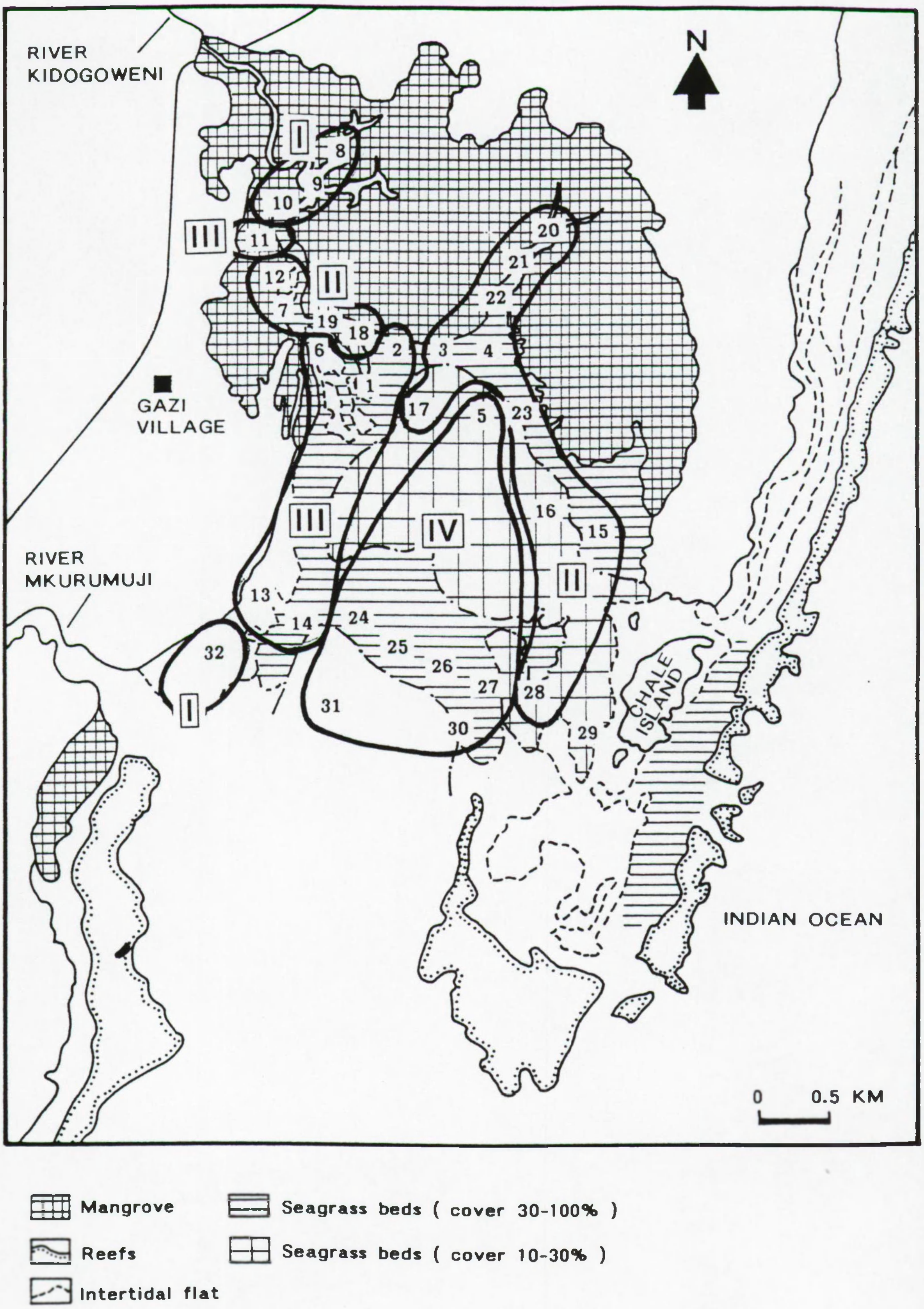


Fig. 3.8: The approximate epibenthic fish community pattern in Gazi bay, Kenya.

The VAN DER VELDE *et al.* (1994) study sampled with a beam trawl (as we did), but also used rotenone and other fishing methods. Having made sample collections close to the two river mouths (Kidogoweni and Mukurumuji), the VAN DER VELDE *et al.* (1994) study identified the estuarine community (in the upper west creek and at the River Mukurumuji). They also identified the *Thalassodendron* beds community in the lagoon. The same communities patterns emerged from our data (Figs 3.5, 3.7 & 3.8) and that of DE TROCH *et al.*, 1996 (Annex 3).

This study provides an in-depth assessment on the spatial patterns of fish and macro-invertebrates in the epibenthos of Gazi bay. The species distribution were greatly overlapping, but when considered separately and thematically, each species apparently had a distinct pattern of distribution in the area, which is thought to depend on the available amenities that specific micro/macro-habitats offer in time and space. The large numbers of rare species in these studies was equally reminiscent to the very dynamic nature of the habitats that provide for the shifting niche environment for the respective species. We suspect that these rare species were either reef stragglers on solitary foraging trips into the seagrass beds, e.g., the barracudas; emperors, the seranids (groupers), snappers, trevallies, or creptic species, e.g., the shrimpfishes, some of the gobies, wrasses, blennies, cardinalfishes, flatfishes, butterflyfishes, damselfishes, pipefishes, seahorses, and scorpionfishes (LIESKE & MYERS, 1994). The suspicion on strugglers was also reported in WEINSTEIN & BROOKS (1983) who had observed generally low numbers of larger juveniles of *Ophidiodon marginata, Urophycis regia,* and *Centropristis striata* (a/o) in the polyhaline seagrass meadows and tidal creeks at Vaucluse shores and concluded that these species were not "residents" but "visitors" on feeding forays. For the schooling species e.g., the plotosids, clupeids, and engraulids, they can only be caught depending on whether or not the shoal is hit in the tow at the time of sampling. Some species were however well spread out in the area and always occurred abundantly, for example the seagrass parrotfish (*Leptoscarus vaigiensis*), the African whitespotted rabbitfish (*Siganus sutor*), and the crosseyed cardinalfish (*Fowleria aurita*). All the recorded species and taxa have been identified to associate with the mangrove environment at least during sometime in their life cycles (MATTHES & KAPETSKY, 1988).

The invertebrate populations were more restricted in their distribution than the fish, probably due to their limited mobility. Although it was also apparent that their distribution followed the distribution of the respective types of habitats. For example, the sea urchins are reliant on the seagrass and the macro-algae for food and cover. The sea urchins were therefore delimited in distribution to these habitats in the bay area. The intertidal area on the western shores of the bay has wide patches of unvegetated soft sediments (sandy-mud). This area was prevalent with the soft-bodied cnidaria and molluscs, probably for the ease of foraging on the in-faunas in the sediments. The hermit crabs would prefer the grassy and weedy areas for camouflage, as does the green tiger prawn (*Penaeus semisulcatus*). Their prevalence on the seagrass beds can therefore be explained on the basis of these habitats.

DAVIS (1988) observed that fish communities are complex and constantly changing due to both short-term and long-term fluctuations in the environment. The conjectural patterns in diversities and densities are therefore in response to the dynamics in the environment, sometimes predetermined, sometimes stochastic. In fact ALLEN & BARKER (1990) concluded that the magnitude of utilisation of the Epibenthic habitats had more influence on the spiritual as well as temporal patterns in larval fish recruitment than purely temporal factors (e.g., lowered salinity during long winters). We are of the opinion that Gazi bay provided a complex of habitats and microhabitats as a result of the inter-linkages between the coral reef, the seagrass beds, macro-algal mats, and the mangroves. The complexity of these habitats was reflected in the observed differences in species abundance from the respective studies (especially in relation to the reefs, *Thalassodendron* beds, non-*Thalassodendron* areas, the mangroves, and to the estuaries) in the bay. These were the bases upon which the spatial communities seem to have build, themselves being modified in time and space by the prevailing environmental factors. The temporal pattern in these communities is receiving separate attention.

3.5 ACKNOWLEDGEMENTS:

We appreciate and acknowledge the efforts of An Boone who carried out the initial analysis of the samples and the data of the short-term (October, 1994) survey. We are also grateful to Mr Bruyneel Marcel for assisting with the cartographic work, and to Bregje Beyst for her helpful comments on and review of the manuscript.

CHAPTER 4

4.0 EPIBENTHOS COMMUNITIES IN A TROPICAL BAY (GAZI BAY, KENYA). II: TEMPORAL PATTERNS.

4.0.1 ABSTRACT:

Temporal patterns in the epibenthos of Gazi bay, Kenya are discussed. The epibenthos was intensively sampled for 22 months (December 1994-September 1996) with a beam trawl of 1.5m beam length and 2mm mesh size. All samples were collected during daytime on every other neap tide. An initial assessment of the same data for the spatial community organisation in the epibenthos of Gazi bay, separated the stations in the *Thalassodendron* dominated grass beds from those in the west creek and on the western part of the bay (see chapter 3). These communities were thus adapted in the analysis and discussion of the temporal patterns in this chapter.

There were seasonal trends in species composition and density of the epibenthos in association with the major oceanographic and climatic changes in the region. Densities were bimodal with a major peak in April and a minor peak in August, but remained generally low in May-July and in September-February. The peaks shifted in height and position when the data were analysed by community and by station. This shifting was thought to be due to the differential activities in the species at the respective stations. The sharp drop in density and species diversity in May was probably in response to the change in salinity. It was further noted from the cluster analysis, that the dry periods and the NEM season were more speciose than the wet period's clusters. This observation somehow reaffirmed the supposition that the rainfall pattern was influential on the epifauna community patterns in Gazi bay.

Our sampling strategy was insensitive to the shorter-term diel and tidal influences. These may have remained latent in the observed clusters, and could probably explain the masked seasonal trends in anomalous clusters. We, therefore, observe that the seasonal timing of the monsoons and the rainfall pattern influenced the apparent community patterns in the epifauna of Gazi bay. The conjunctural composition of these communities was, however, predetermined by the spatial structures.

4.1 INTRODUCTION:

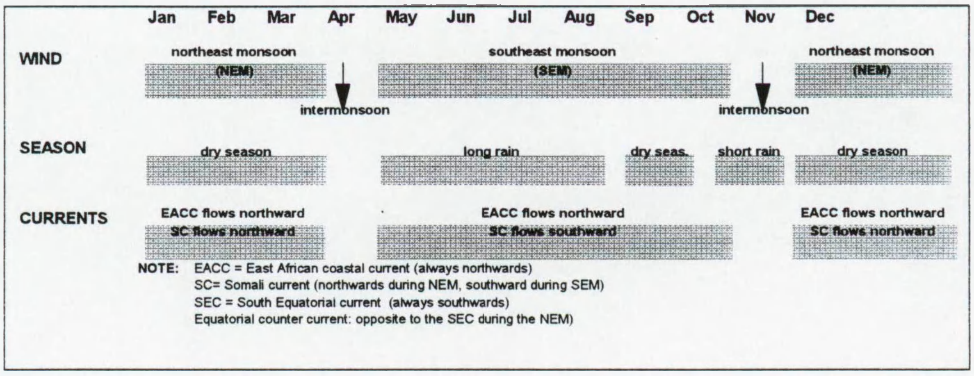
Fish communities in coastal habitats are subject to the complex and ever changing interactions between individuals and populations, and to the daily, tidal, seasonal and annual environmental variations (DAVIS, 1988).

While spatial structures pre-determine the expanse of the available habitats, moderation of these structures through environmental fluctuations in time tends to influence their occupancy by specific species or taxa. The churning effects from tidal currents and wave action, combine with those of the coastal currents and the seasonal monsoons to influence the production and dynamics (fetch and distribution) of nekton in the nearshore coastal waters. In the Eastern African region, major coastal habitats include mangrove swamps and forests, rocky shores, sandy beaches, seagrass beds-macroalgal mats (interspersed with bare soft mud, bare sand and/or rubble), and coral reefs (including reef platforms). The coastline is intermittently broken by river mouths, creeks, and bays. The coral reef is almost continuous (fringing the shores) on a narrow continental shelf that tapers off sharply into abyssal on the seaward side (RICHMOND, 1997).

The overriding climatic feature in the region is the reversing monsoons) (RICHMOND, 1997). Between December and March, the Northeast trade (NET) winds are prevalent (Fig 1.3 & Fig. 4.1). Being dry winds from the desert in the north, the NET cause the dry weather experienced during the Northeast monsoon (NEM) season. Wind direction reverses in April-May to the Southeast trade (SET) winds, which prevail during the Southeast monsoon (SEM) season (April-October). The SET winds are laden with moisture and bring rains to the Eastern African coastal region. The long rainy period is in May-August, while the short rainy period is in November (Figs. 1.3 & 4.1).

The magnitudes of the South Equatorial Current (SEC), the Equatorial Counter Current (ECC), East African Coastal Current (EACC), and the Somali Current (being the major oceanic and coastal currents in the region) also swing with the monsoons (DUING & SCHOTT, 1978; RICHMOND, 1997) (Fig. 1.3). The confluence between the southerly flowing Somali Current (SC) and the northerly flowing East African Coastal Current (EACC) in November-March (NEM) create a temporary up-welling off the Somali-Kenyan coasts which magnifies the effects of the offshore bound Equatorial Counter Current during this time of the year. Between May-

October, the SC flows in the reverse direction. Together with the EACC, the SC continues northwards giving prominence to the onshore SEC. This cycle in currents and winds effect transport of plankton and nekton into nearshore coastal waters, from where the tidal currents and the localised land-sea breezes flush them further inshore. Tides ebb and flood twice in every 24hrs with two neaps and two springs (intertwined with the lunar cycle) in a month.



NOTE: EACC = East African coastal current (always northwards)
SC= Somali current (northwards during NEM, southward during SEM)
SEC = South Equatorial current (always southwards)
Equatorial counter current: opposite to the SEC during the NEM)

Fig. 4.1: A schematic diagram on the seasonal patterns in wind, currents and rainfall in the Western Indian Ocean (WIO) region (see also Fig 1.3).

Most marine organisms tend to time their reproduction and recruitment cycles to the patterns in marine productivity. Studies on marine organisms in the East African coastal waters consistently associate reproductive and recruitment activities to the monsoon seasons and the rainfall patterns in the region. For example, NZIOKA (1979 & 1983) observed the peak in spawning among East African reef fishes to occur in December-March (i.e., during the NEM season). This was found to coincide with the peak primary productivity of the water, which had been reported to occur in November-April (Grey & Babenard, 1976 in NZIOKA, 1983). Earlier, OKERA (1974) had reported the two clupeids *Sardinella albella* and *S. gibbosa* to spawn with a peak in November, just ahead of the peak in primary production.

MUTAGYERA (1979) reported the best catch rates of *Thenus orientalis* (Scyllaridae) and *Metanephrops andamanicus* (Nephropidae) from the Kenya coastal waters in June-August (i.e., during the SEM season). During this time of the year, the two rivers (Sabaki and Tana) swell with floods and probably provide the appropriate muddy habitat required by the nephrops during their nursery stages. The complete disappearance of the two species from the fishery during the NEM season was connected with the spawning emigrations into the deeper (offshore) waters or to tarrains inaccessible with the Otter trawl.

RUWA & POLK (1994) on the other hand, observed the best oyster (*Crassostrea cucullata*) and barnacle (*Balanus amphitrite*) spat settlement in Gazi bay to occur during the SEM season. WAKWABI & JACCARINI (1993) provide even further evidence on seasonal spawning in (and recruitment of larval) penaeids in Tudor creek, Kenya. Both tidal and lunar cycles were also observed to influence the timing and intensities of the penaeid larval recruitment in the backwaters of Tudor creek (WAKWABI & JACCARINI, 1993). These findings on penaeids were corroborative to studies reported from other areas (e.g., SUBRAHMANYAM, 1967; PENN, 1975; PRICE, 1979; STAPLES, 1980; GARCIA & LE RESTE, 1981; MOTOH, 1981; ROTHLISBERG *et al.*, 1983). GARCIA (1989) observed that penaeids are so highly sensitive to yearly fluctuations in the coastal environment that it directly affects the onset in spawning, timing of inshore larval recruitment, growth, survival, and subsequent emigration of the main cohorts out of the nursery lagoons. These processes are in fact always moderated by the prevailing oceanographic conditions (ROTHLISBERG, 1982).

The list of seasonally linked biological activities in marine organisms relating to the production is inexhaustible. Spawning, recruitment, feeding, and other biological processes especially in marine fish are all synchronised to the peaks in food availability and optimum protection for optimised benefits. Studies on this subject are well documented in e.g., BLABER *et al.* (1992) on the Gulf of Carpentaria, tropical Australia; WHITFIELD (1998) for the sub-tropical estuaries in South Africa; and HORN *et al.* (1999) for intertidal fishes. The magnitudes in the prevailing winds, and in oceanic and tidal currents, and wave action in the coastal waters, may, for example, concentrate (or wash off) plankton and nekton into (or out of) the coastal waters at their different phases. The combined effects of vertical migration in planktonic penaeid larvae, with those of the onshore winds, and currents (both oceanic and tidal), work in concert to transport eggs and larvae (plankton) across the oceanic water masses from the offshore spawning grounds into the nearshore and inshore waters. ROTHLISBERG (1982) modelled the advection of penaeid larvae and provides good evidence on the role oceanographic parameters play in the transportation of plankton (and for that matter nekton) from the offshore waters into the nearshore and inshore waters.

Short-term and long-term fluctuations in species composition and abundance in the coastal habitats is subject to the way individual species respond to the changing environment in these habitats (see e.g., GIBSON & YOSHIYAMA, 1999 for intertidal fish communities). On the basis of the length and modes of utilisation, fish species may be classified as resident or transient species to a given type of habitat. Residents specialise to some degree to adopt themselves to the prevalent conditions (both biotic e.g., predation and competition, and abiotic e.g., to the varying water depths, temperature, salinity, light intensity, current direction and strength) in the habitat (GIBSON, 1999; GIBSON & YOSHIYAMA, 1999; ZANDER *et al.*, 1999). Strong currents and wave action can inhibit or enhance movement of some species (especially transient species) into tidally influenced habitats (GIBSON, 1999; GIBSON & YOSHIYAMA, 1999). Also, the risk of predation and variation in tidal height may limit certain species to activity cycles that preclude the times of day and/or tidal phase when the principal predators are highly active (see GERKING, 1994 on the Optimum Foraging Theory; and HORN *et al.*, 1999 on the behaviour of fish in intertidal habitats). RÖNNBÄCK *et al.* (1999) found that the tidal height was a limitation to the foraging rhythms among carnivorous fishes, which relied on fish and shrimps in tidally, inundated mangrove swamps. They conclude that this preclusion of carnivorous fish from the shallower rooty mangrove area, in itself, makes the mangrove swamps important nursery grounds to the vagile faunas as it provides them food and refugia from intense predation. The carnivores could negotiate their way in and out of the mangrove areas or just lag at the mangrove edge (with the flooding and ebbing tides on a diel rhythm). This strategy enabled the carnivores to feed on the larger emigrants as they moved out to deeper waters from the protective shallower rooty waters. This pattern of events in the life of a fish pre-empts the diel, tidal, and seasonal rhythms or patterns of activities in the species and therefore result in observable communities in time and space.

In this paper, we discuss the temporal patterns in the Epibenthic communities of Gazi bay, Kenya. We have separately addressed the spatial community structure (WAKWABI & MEES, Chapter 3, this report). Having sampled only the neap tides and daytime, we may have precluded taxa and species that were less active during these phases of tide and day. The sampling was however intensive and was undertaken on a longer time series.

4.2 MATERIALS AND METHODS:

4.2.1 Study area, field and laboratory work:

Samples were collected monthly on every other neap tide between December 1994 and September 1996 (both months inclusive) with a beam trawl (1.5m beam length, 2mm inner-mesh) at the stations: cp3, cp4, cp5, M, T1, T2, & T3 (Fig. 4.2). Station cp3 was located in seagrass beds in the west creek near the oyster farm and the cp3 mangrove replantation experimental plot. Cp4 and cp5 were located in the shallower seagrass beds on the western shores of the bay. They were also located off the mangrove replantation experimental plots on this side of the bay. Station M was located in the seagrass beds at the mouth of the west creek. Stations T1, T2, & T3 were located in the deeper main bay lagoon. Mostly monospecific Thalassodendron ciliatum grass beds dominate the area. The station names were therefore derived from these relationships.

Two replicate tows were taken at each station on all sampling occasions. Details on the actual sampling and sample handling procedures in the field and in the laboratory are discussed elsewhere (WAKWABI & MEES, Chapter 2, this report). Two distinct spatial communities (one combining the stations in the *Thalassodendron ciliatum* beds and the other combining the rest of the stations) were identified during an earlier assessment of the catch data realised from this study (chapter 3, this report). These communities were therefore adapted for the rest of the discussion in this paper (chapter).

4.2.2 Data analysis:

Monthly catch rates (numbers caught per standard 10 minutes tow) for each species and all species and taxa together were estimated from the replicas. This was done separately for each station, for the two communities (the seagrass-mangrove associated community and the *Thalassodendron* community, and for the whole bay (having combined all stations together).

In order to standardise the scale for temporal patterns in the density data, the relative proportion (percentage) of the monthly average catch was determined against the annual totals (of the averages). For the patterns in the dominant species, their relative proportion (percentage) in the monthly catch was taken, grouping together all the other species and taxa in the monthly catches as "others".

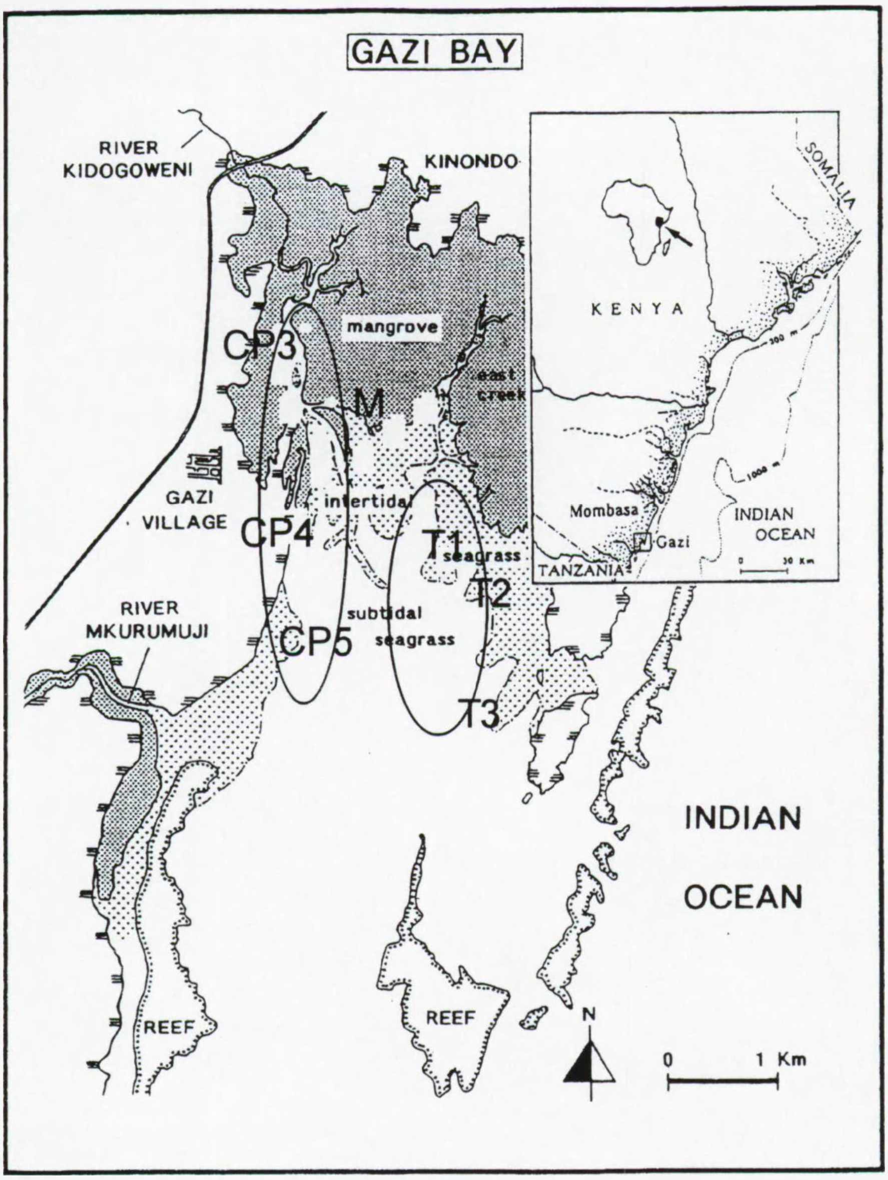


Figure 4.2: Map of Gazi bay, Kenya showing the position, physical features and the beam trawl stations (cp3, cp4, cp5, M, T1, T2, & T3) sampled during the December 1994-September 1996 intensive survey on the epibenthos. The abbreviated names of stations are discussed in methods. The two spatial communities are circled out (see text for details).

TWINSPAN (Two Way INdicator SPecies ANalysis) (HILL, 1979; VAN TONGEREN, 1987) was used with the averaged catch in the standard 10 minutes tow to generate possible temporal patterns. The monthly catch data were averaged over a 12 months (one annual) cycle and used in this analysis. For the grouped community (i.e., *Thalassodendron* and mangrove-cum-seagrass communities) and all stations treatments, the mean catch per standard tow were computed from the summed up average catches (for the respective groups of stations) and divided by the number of stations to get the average catch in the tow for the group before the TWINSPAN procedures.

Before the TWINSPAN, the data were fourth-root transformed. The rare species (those with single occurrence in the matrix and those with < 0.05% of the total in the group) were excluded from the analysis.

4.3 RESULTS:

4.3.1 Densities

In Fig. 4.3, we examined on a percentage scale, the monthly catch rates (numbers caught per standard 10 minutes tow): (a) for the combined all stations, *Thalassodendron* community stations and seagrass-mangrove associated community stations, (b) for the respective stations in the seagrass-mangrove associated community (i.e., cp3, cp4, cp5 & m), and (c) for the respective stations in the *Thalassodendron* community (T1, T2 & T3).

Two peaks in density (catch per standard 10 minutes tow) were observed in April (major) and in August (minor) for all grouped data (i.e., for all stations pooled together, and for the two communities (Fig. 4.3a). Lowest densities were realised in July (representing 2.9%, 1.9%, & 5% for all stations, for the seagrass-mangrove associated community, and for the *Thalassodendron* community, respectively) and in October (2.4%, 1.3%, & 2.8% for the same groups as above) (Fig. 4.3a). The April peak was also consistent at the cp3, cp4, m, T2 and T3 stations (Fig. 4.3b & Fig. 4.3c). The other stations (T1 and cp5) had this peak in March. The August peak was only consistent at cp3, cp4, cp5, and T1. An additional peak (though quite erratic) was observed at each station (Fig. 4.3b & Fig. 4.3c). There was a January peak at cp3, m, cp4, and T2. This peak was observed in December and February at T3 and in December at cp5 and T1 (Fig. 4.3b & Fig. 4.3c).

4.3.2 Temporal assemblages

The full list of the species and taxa which were used in the cluster analyses is appended (Appendix 4.1) for the ease of reference.

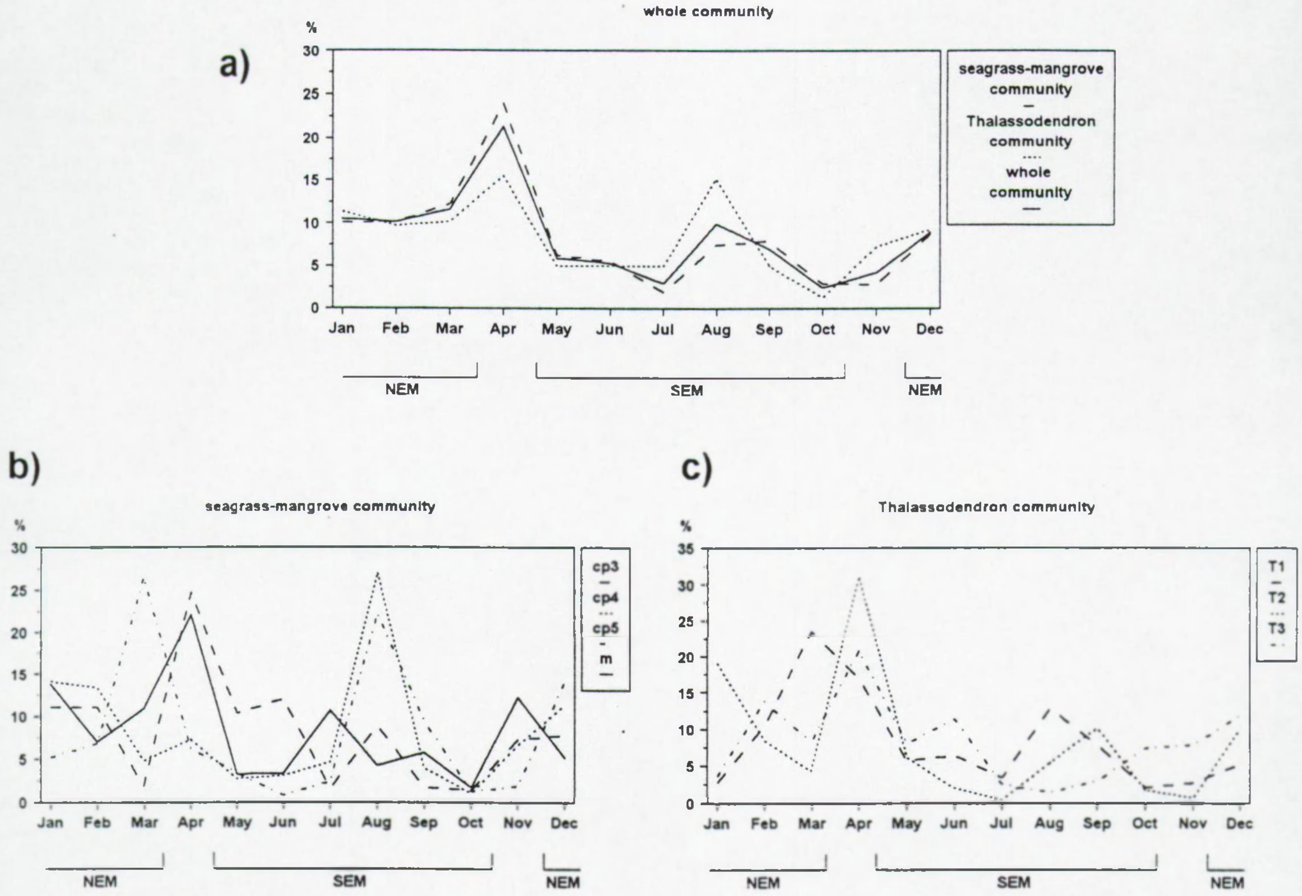


Figure 4.3: The relative monthly proportions (%) of the average catch: (a) in all stations combined (all stns), combined *Thalassodendron* community stations (T stns) and combined seagrass-mangrove associated community stations (C stns), (b) at the respective seagrass-mangrove associated community stations (cp3, cp4, cp5, & M), and c) at the respective *Thalassodendron* community stations (T1, T2, & T3).

4.3.2.1 All stations pooled data:

The pooled catch (all stations) data matrix produced four clusters (Fig. 4.4). Cluster I was anomalous having grouped together samples from the months of March, April and August (dry and wet months). Cluster II was composed of samples from the wet season months (May, June and July), Cluster III were samples from the dry months of September and December, and Cluster IV, having grouped together the samples from October, November, January, and February, was anomalous for both the monsoon and rainfall seasons (Fig. 4.4).

Cluster IV with 16 species and taxa was separated at the first level in the TWINSPAN dichotomy with *Petroscirtes breviceps* and *Paramonacanthus barnardi* as negative indicator species (Fig. 4.4). Preferential species in this cluster included the parrotfish (*Calostomus spinidens*), several gobies (*Acentrogobius audax, Favongobius reichei, Gnatholepis* sp 1 and *Goby* sp 1), the shrimpfish *(Aeoliscus punctulatus*), some wrasses *(Cheilinus bimaculatus, Cheilio inermis* and *Novaculichthys macrolepidoyus*), the tropical lefteye flounder (*Bothus mancus*), the longsnout pipefish (*Syngnathus acus*), the blackspot emperor (*Lethrinus harak*), the prawns (*Penaeus monodon* and *Penaeus* sp 1, crabs (Decapoda) and the sea urchin *Tripneustes gratilla*.

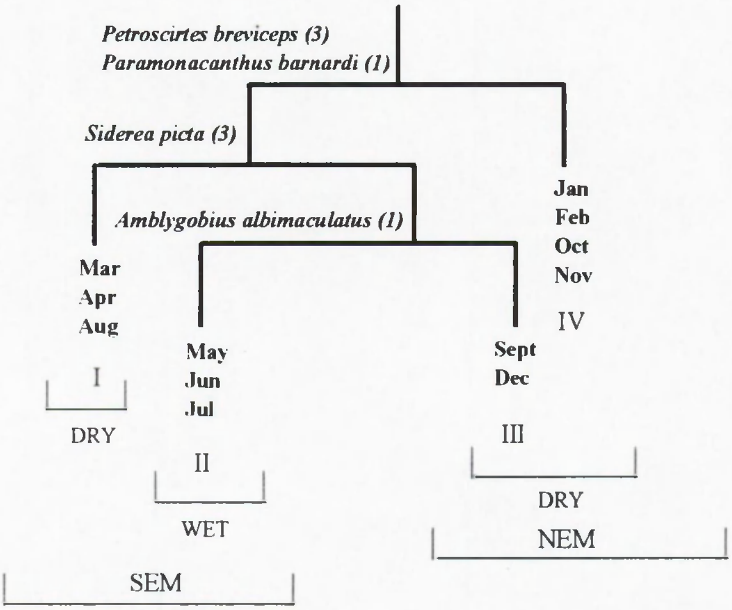


Figure 4.4: Hierarchical cluster of months based on the averaged monthly species-at-site catch of epibenthos from Gazi bay, Kenya: all stations pooled together.

Cluster III (Fig. 4.4) had 30 preferential species and taxa. These included the striped eel-catfish (*Plotosus lineatus),* the seagrass parrotfish (*Leptoscarus vaigiensis),* emperors *(Lethrinus elongatus* and *L. variagatus),* wrasses (*Cheilinus bimaculatus, C. undulatus, C. trilobatus, Cheilio inermis*, and *Novaculichthys macrolepidotus)*, gobies (*Acentrogobius audax*, *Gnatholepis sp 1, Goby* sp 1, and *Yongeichthys nebulosus*), the shrimpfish (*Aeoliscus punctulatus*), the giraffe seahorse (*Hippocampus camelopadalis)* the madagascar flathead (*Papilloculiceps longiceps*), box fish (*Lactoria fornasini* and *Lactoria cornuta*), blaasops *Canthigaster bennetti* and *C. solandri*), the scorpionfish *Dendrochirus brachypterus, Parascorpaena mossambica*, the trumpeter thornfish *Pelates quadrilineatus,* the tropical lefteye flounder (*Bothus mancus*), the longsnout pipefish (*Syngnathus acus*), the whitespotted rabbitfish (spinefoot) *Siganus sutor*, the brushtooth lizardfish (*Saurida undosquamis)*, the white prawn (*Penaeus indicus*), caridea and crabs (Decapoda).

Cluster II was separated from group III at the 3rd level with the butterfly goby (*Amblygobius albimaculatus*) as the indicator species (Fig. 4.4). This cluster grouped together 16 preferential species, which included the bullethead parrotfish (*Scarus sordidus*), cardinal fish (*Apogon savayensis, Cheilodipterus quinquelineatus* and *Foa brachygramma*), the three-ribbon wrasse (*Stethojulis strigiventer*), the alligator pipefish (*Syngnathoides biaculatus*), the orbicular batfish (*Platax orbicularis*), and the blackspotted sweetlip (*Plectorhynchus gaterinus*). Also included in the cluster were gobies (*Amblygobius albimaculatus*), blenies (*Petroscirtes breviceps* and *P. mitratus*), the blackspot snapper (*Lutjanus fulviflamma),* prawns (*Penaeus monodon* and *Penaeus* sp 1), and the sea urchin (*Tripneustes gratilla)*.

Cluster I which was the largest with 37 preferential species and taxa, split off from cluster II and cluster III at the 2nd division with the speckled moray eel (*Siderea picta*) as the indicator species (Fig. 4.4). The preferential species and taxa in this cluster included the scarids (*Calostomus spinidens, Scarus globiceps,* and *Leptoscarus vaigiensis*), wrases (*Cheilinus bimaculatus, Epibulus insidiator* and *Stethojulis strigiventer*), gobies (*Amblygobius albimaculatus, Acentrogobius audax,* and *Gnatholepis sp 1*) and emperors (*Lethrinus elongatus, L. harak, L. nebulosus,* and lethrinid larvae). Other species and taxa in the cluster were: the slenderspine pursemouth (*Gerres oyana*), the blackspot snapper (*Lutjanus fulviflamma),* the longhorn cowfish (*Lactoria cornuta*), the marbled dragonet (*Synchiropus marmoratus*), the shrimpfish (*Aeoliscus punctulatus*), *Siderea picta,* the blackspotted sweetlip (*Plectorhinchus gaterinus*), the jewel damselfish (*Plectoroglyphidodon lacrymatus*), the blue spotted blaasop (*Chelonodon laticeps*), the wedgetail filefish (*Paramonacanthus barnardi*), pipefish (*Syngnathus acus* and *Trachyrhamphus bicoarctatus*), the trumpeter (*Pelates quadrilineatus*), the tropical lefteye flounder (*Bothus mancus),* the brushtooth lizardfish (*Saurida undosquamis*), the striped eel-catfish (*Plotosus lineatus*), cardinalfish (*Cheilodipterus lineatus* and *Fowleria aurita*), the golden scorpionfish (*Parascorpaena mossambica*), caridea (Decapoda), and jelly fish (Cnidaria).

4.3.2.2 *Thalassodendron* associated community:

Three clusters emerged from the grouped *Thalassodendron* community stations (Fig. 4.5). Cluster I was constituted by the samples from March, cluster II combined the samples of July with those from December-February, while cluster III was constituted by the samples of April-June.

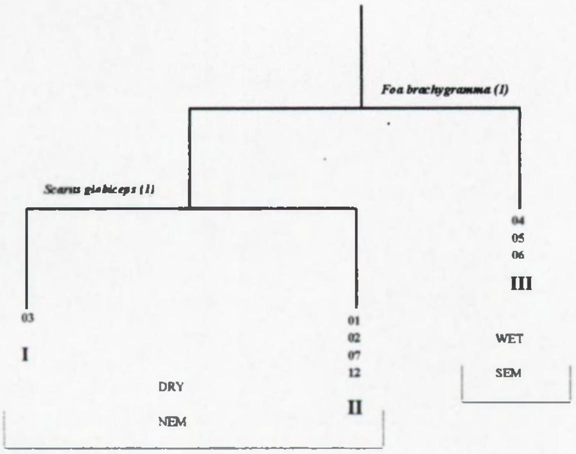


Figure 4.5: Hierarchical cluster of months based on the averaged monthly species-at-site catch of epibenthos from Gazi bay, Kenya: only *Thalassodendron* community stations.

The preferential species/taxa in Cluster I were *Lethrinus lentjan, L. variagatus, Stethojulis strigiventer, Acentrogobius audax, Favonogobius reichei, Gobius sp, Yongeichthys nebulosus, Arothron immaculatus, Penaeus indicus, P. monodon, Penaeus sp, Dendrochirus brachypterus, Trachyrhamphus bicoarctatus, Lactoria cornuta, L. fornasini, Aeoliscus punctulatus, Cheilinus bimaculatus, C. trilobatus*, brachyurans, and holothurians. This cluster was separated at the second level in the TWINSPAN dichotomy (Fig. 4.5) with *Scarus globiceps* as the indicator species. The sagarssum fish *Histrio histrio* (Linnaeus), the dusky pipefish *Halicampus dunckerii* (Chabanaud), the bluespotted tamarin *Anampses caeruleopunctatus* Ruppell, the clown coris *Coris aygula* Lacepede, and the four-bar porcupinefish *Lophodiodon calori* (Bianconi) were also preferential species in this cluster.

The second cluster (II) which also separated at the second level in the TWINSPAN dichotomy (Fig. 4.5) had among the preferential species, *Calostomus spinidens, Leptoscarus vaigiensis, Scarus sordidus, Bothus mancus, Lethrinus elongatus, L. harak, L. nebulosus*, lethrinid larvae, *Siganus sutor, Cheilio inermis, Parascorpaena* *mossambica*, *Apogon cookii*, *A. fragilis*, *A. nigripes*, *Fowleria aurita*, *Stethojulis strigiventer*, *Syngnathus acus*, *Cheilinus undulatus*, *Halichoeres iridis*, *Novaculichthys macrolepidotus*, *Saurida undosquamis*, *Chelonodon laticeps*, *Paramonacanthus barnardi*, *Penaeus indicus*, *P. monodon*, *Amblygobius albimaculatus*, *Gnatholepis sp1*, *Canthigaster bennetti*, *Plotosus lineatus*, *Plectorhynchus gaterinus*, *Diadema spp*, *Tripneustes gratilla*, cephalopods, asteroidea and the lanternbelly *Acropoma japonica* Gunther.

Note that clusters II and I were representative of the dry period and together, they contained 61 preferential species/taxa (65% of the total number of species and taxa in the matrix).

The third cluster (Fig. 4.5) corresponded to the long rainy period. The cluster was separated from the rest at the first level with *Foa brachygramma* as the indicator species (Fig. 4.5). Preferential species and taxa for the cluster were: *Hipposcarus harid*, *Scarus globiceps*, *S. sordidus*, *Apogon savayensis*, *A. taeniophorus*, *Cheilodipterus quinquelineatus*, *Foa brachygramma*, *Siderea picta*, *Syngnathoides biaculeatus*, *Papilloculiceps longiceps*, *Canthigaster solandri*, *C. valentini*, *Plectoroglyphidodon lacrymatus*, *Pomacentrus trilineatus*, *Lutjanus fulviflamma*, *Platax orbicularis*, *Cheilodipterus lineatus*, *Petroscirtes breviceps*, *Synchiropus marmoratus*, *Cheilinus oxycephalus*, *Epibulus insidiator*, *Pelates quadrilineatus*, carideans, and cnidarians. Others were the black-black butterflyfish *Chaetodon melannotus* Bloch & Schneider, the footballer damselfish *Chrysptera annulata* (Peters), the zigzag sandwrasse *Halichoeres scapularis* (Bennett), the threetooth pufferfish *Triodon macropterus* Lesson, the bluestreak cleanerwrasse *Labroides dimidiatus* (Valenciennes), the cocktail wrasse *Pteragogus flagellifer* (Valenciennes), the staryfish goby *Asterropteryx semipunctatus* Ruppell, the yellow boxfish *Ostracion cubicus* Linnaeus, and the porcupinefish *Diodon hystrix* Linnaeus. In total, these were 33 species/taxa (35% of the total in the matrix).

4.3.2.3 Seagrass-Mangrove associated community:

Fig. 4.6 represents the clusters in the pooled seagrass-mangrove associated community stations. Four main clusters were identified: Cluster I combined samples from the dry months (January-March). This cluster was separated at the second level in the TWINSPAN dichotomy (Fig. 4.6) with *Leptoscarus vaigiensis* and Gobiidae sp1 as the indicator species. The second (II) and the third (III) clusters were separated at the 3rd level in the dichotomy with *Gnatholepis* sp1 as the indicator species. These clusters grouped together samples from April, July, August and December in cluster II, and those from June and September in cluster III. The fourth cluster (IV), which peeled off the rest at the first level dichotomy (with *Acentrogobius audax* and *Petroscirtes mitratus* as indicator species), combined samples from May with those from October and November. This cluster was consistent even when the indicator species were excluded from the analysis (result not shown here). The other clusters were however affected with such alterations in the matrix.

The preferential species and taxa (41 in total) for cluster I were: *Scarus scaber, S. sordidus, Lethrinus elongatus,* Lethrinid larvae, *Siganus stellatus, Anampses caeruleopunctatus, Cheilinus undulatus, Halichoeres iridis, Stethojulis strigiventer, Apogon cookii, A. fragilis, Siderea picta, Triodon macropterus, Bothus pantherinus, Paraplagusia bilineata, Paramonacanthus barnardi, Plectorhynchus gaterinus, Plectoroglyphidodon lacrymatus, Chelonodon laticeps, Parupeneus barberinus, Platax orbicularis, Epinephelus sp, Acentrogobius audax, Asterropteryx semipunctatus, Favonigobius reichei, Dendrochirus brachypterus, Plotosus lineatus, Trachyrhamphus bicoarctatus, Lactoria cornuta, L. fornasini, Petroscirtes mitratus, Synchiropus marmoratus, Canthigaster solandri, Penaeus sp.* and cephalopods. The straight-lined thornfish *Terapon theraps* (Cuvier), the pickhandle barracuda *Sphyraena jello* Cuvier, the blackthroat goby *Favonigobius melanobranchus* (Fowler), the kei goby *Oligolepis keiensis* (Smith), the fourline tonguefish *Cynoglossus attenuatus* Gilchrist, and the blackhand sole *Solea bleekeri* Boulenger, were also preferential in this cluster.

Amblygobius albimaculatus, Gnatholepis sp1, Yongeichthys nebulosus, Saurida undosquamis, Bothus mancus, Lethrinus harak, Cheilio inermis, Papilloculiceps longiceps, and the cnidarians (i.e., 9 species and taxa) were preferential for cluster II. The third cluster (III) had only 5 preferential species. These included *Apogon nigripes, Fistularia petimba, Petroscirtes breviceps, Pelates quadrilineatus,* and *Penaeus indicus*.

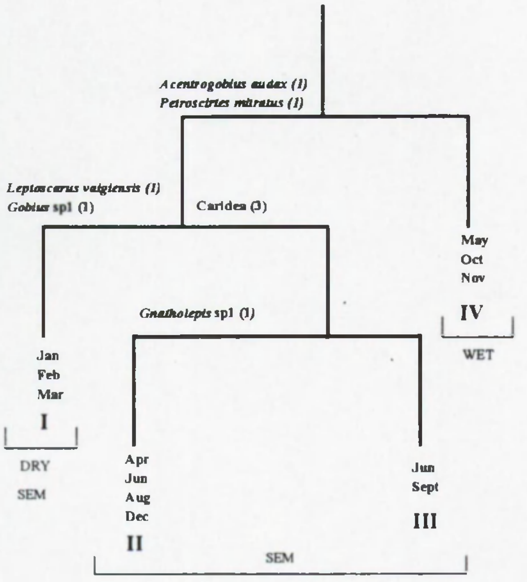


Figure 4.6: Hierarchical cluster of months based on the averaged monthly species-at-site catch of epibenthos from Gazi bay, Kenya: only seagrass-mangrove associated community stations.

The preferential species in the last cluster (IV) in this matrix were: *Leptoscarus vaigiensis, Lethrinus nebulosus, Siganus sutor, Parascorpaena mossambica, Fowleria aurita, Syngnathoides biaculeatus, Syngnathus acus, Cociella crocodila, Lutjanus fulviflamma, Arothron immaculatus, Canthigaster valentini, Aeoliscus punctulatus, Novaculichthys macrolepidotus, Neopomacentrus fuliginosus, Gerres oyena, Gobius sp1*, and the decapods: *Penaeus indicus, P. monodon,* brachyurans and Caridea.

Apart from cluster I, the rest of the clusters in this matrix were rather anomalous having grouped together months from different monsoon and rain seasons. Cluster I contained (as preferential species) over 50% of the total number of the species/taxa in the matrix.

4.3.3 Temporal species composition:

In Fig. 4.7 we present the relative proportions (by percentage) of the most abundant species and taxa during the 22 months intensive beam trawl study in Gazi bay. It is notable that *Leptoscarus vaigiensis* was the single omnipresent species having occurred throughout the bay and almost throughout the study period. It was especially most prevalent during the second half of the year when it reached >20% in relative proportion of the catch rates at cp3 and in the *Thalassodendron* community. The other abundant species were intermittent in the catches at the respective stations.

The other five abundant species at cp3 were *Apogon nigripes, Fowleria aurita, Lethrinus harak, L. nebulosus,* and *Siganus sutor*. Of these, only *L. vaigiensis* and *F. aurita* were dominant in July splitting the other dominants between January-June and August-December (Fig. 4.7a). The two emperors (*Lethrinus harak* and *L. nebulosus*) were more important (>30%) in January-April while the whitespotted rabbitfish (*Siganus sutor)* was (>20%) in August-October. The blackfoot cardinal (*Apogon nigripes)* was most abundant at this station in April-June (making upto 40%) and in August-September (when it was >30%). In general, the six dominant species were almost always (except in March and July) over 60% of the monthly catch rates at this station (Fig. 4.7a).

At the station M (Fig. 4.7b), the general trend abundance was same as described for cp3, except that there were no semi-annual groupings. The seven dominant species made over 90% of the total catch in November, but were just about 50% in June and December. Again, the two emperors (*Lethrinus harak* and *L. nebulosus)* were dominant (>30%) in January-March and the whitespotted rabbitfish was dominant (>30%) in August-November. The depression in densities in June had about the same effects on all the seven dominant species (namely: *Apogon nigripes, Fowleria aurita, Leptoscarus vaigiensis, Lethrinus harak, L. nebulosus, Parascorpaena mossambica,* and *Siganus sutor*) at this station.

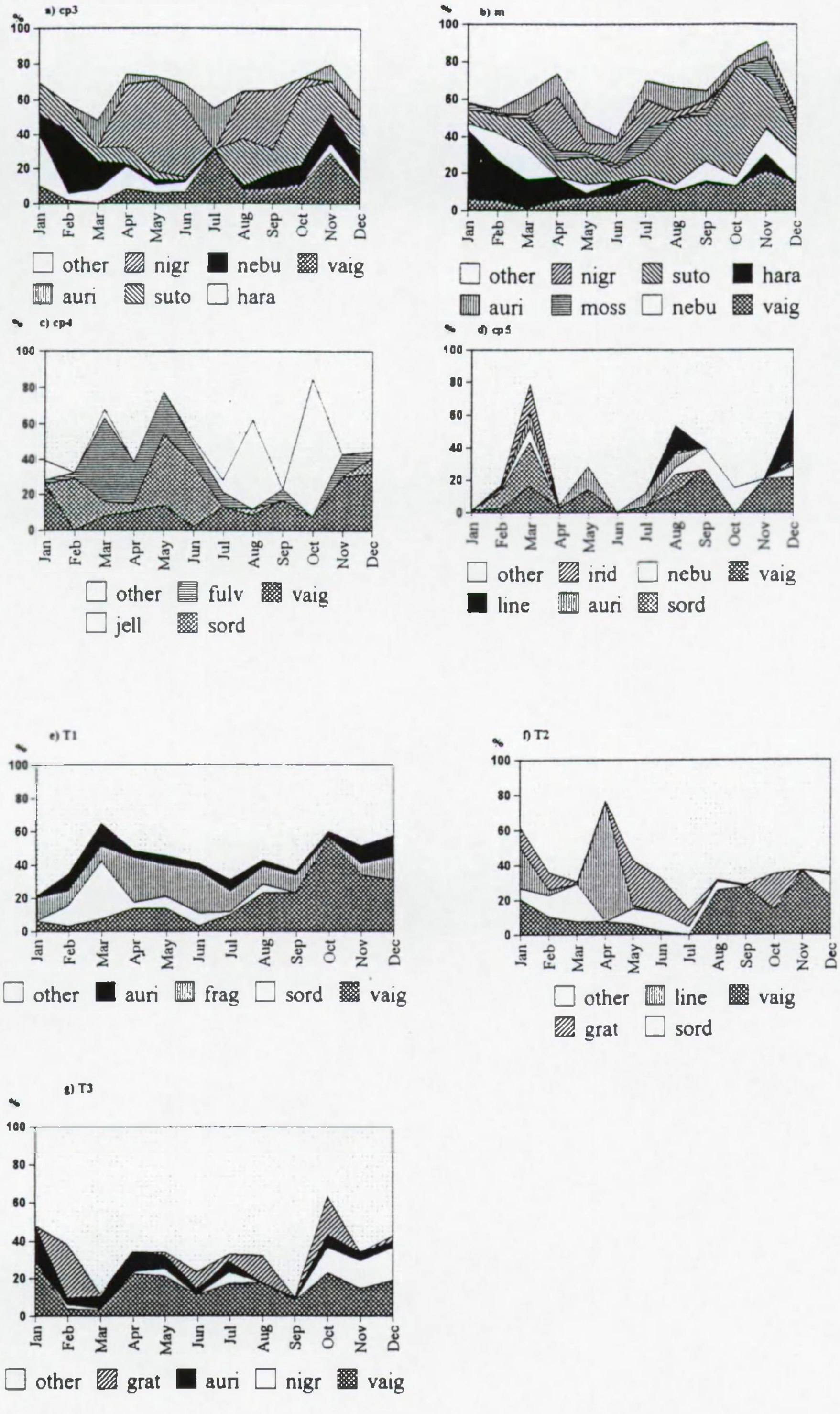


Figure 4.7: The relative proportions (percentage) of the dominant fish species and other taxa in the averaged monthly catch at each station (a) cp3, (b) M, c) cp4, (d) cp5, (e) T1, (f) T2 and (g) T3 fished during the intensive beam trawl survey of Gazi bay, Kenya in from December 1994 to September 1996 (both months inclusive). The abbreviated names of species and taxa represent (in alphabetical order of the abbreviations): auri = *Fowleria aurita* (Pisces: Apogonidae), frag = *Apogon fragilis* (Pisces: Apogonidae), fulv = *Lutjanus fulviflamma* (Pisces: Lutjanidae), grat = *Tripneustes gratilla* (Echnoidea: Toxopneustidae), hara = *Lethrinus harak* (Pisces: Lethrinidae), irid = *Halichoeres iridis* (Pisces: Labridae), jell = Cnidaria (jelly fish), line = *Plotosus lineatus* (Pisces: Plotosidae), moss = *Parascorpaena mossambica* (Pisces: Scorpaenidae), nebu = *Lethrinus nebulosus* (Pisces: Lethrinidae), nigr = *Apogon nigripes* (Pisces: Apogonidae), other = all other species and taxa together, sord = *Scarus sordidus* (Pisces: Scaridae), suto = *Siganus sutor* (Pisces: Siganidae), vaig = *Leptoscarus vaigiensis* (Pisces: Scaridae).

The number of dominant species (and/or taxa) and the level of dominance reduced in the bay to 4 species/taxa and to <50% of the pooled average densities (with the exception of the number of species/taxa at the cp5) (Figs. 4.7b-4.7g). At cp4 (Fig. 4.7c) the year was split between *Scarus sordidus* and *Lutjanus fulviflamma* on the one side (February-June), and the jellyfish (Cnidaria) on the other side (July-October). *Leptoscarus vaigiensis* was predominant in November-January. The catch rate among the dominant species/taxa at cp5 (Fig. 4.7d) peaked in March, August and in December. The bulk of rare species constituted the larger proportion of the catch during the rest of the year. All the 5 dominant species (*Halichoeres iridis, Plotosus lineatus, Fowleria aurita, Scarus sordidus, Leptoscarus vaigiensis* and *Lethrinus nebulosus)* were highly seasonal at this station with zero catch in June (Fig. 4.7d).

The pooled proportion of the four dominant species (*Apogon fragilis, Fowleria aurita, Leptoscarus vaigiensis,* and *Scarus sordidus*) at T1 was almost equal to the proportions of the pooled rare species (i.e., dominants: "others" ≅ 50:50 by percentage) (Fig. 4.7e). *S. sordidus* predominated in March, *A. Fragilis* in April-June, and *L. Vaigiensis* in August-December. *F. aurita* was about same proportion the year round. At T2 (Fig. 4.7f), *S. sordidus* was again dominant in March (>10%) and *L. Vaigiensis* in August-December (> 20%). *Plotosus lineatus* was got in the highest proportion (made >70% of the total catch) at this station in April. The sea urchin, *Tripneustes gratilla* was abundant in May-June and in October (Fig. 4.7f). The pooled rare species/taxa constituted a higher proportion (>60%) of the catch for most of the year (except in January and in April when the dominant species shot up to > 60%). This proportion was about 2:3 (dominants: rares) at the T3 station where *L. Vaigiensis* was almost uniformly represented the year round (Fig. 4.7g). The proportion of the sea urchin *Tripneustes gratilla* still followed the same pattern as at T2 with an extra peak in February. *A. nigripes* reappears among the dominants at this (cp5) station with a higher proportion in October-December. The species was less important or not at all caught from the rest of the stations in the bay.

4.4 DISCUSSION:

4.4.1 Densities:

The observed patterns in densities were consistent with our earlier observations on the ichthyofauna of Gazi bay (WAKWABI & MEES, Chapter 2, this report). The temporary up-welling at the confluence of the Somali current and the East African Coastal Current during the NEM season bring to the surface nutrient rich water. This water is probably fluxed inshore due to the pile-up effects bringing with it the production. Note that the EACC is very weak (<1knot) at this time, therefore the transportation energy in the current is greatly dissipated. This means that nekton in the nearshore waters will easily be taken further inshore by the tidal currents. This may explain the high productivity in Gazi bay during this season as opposed to the SEM, when the EACC is very strong (>5knots) (see RICHMOND, 1997). The high productivity associated with the NEM was responsible for the high diversity and density observed to occur in the epibenthos during the season. April was in the inter-monsoon period when there was slight calm in the winds, currents and waves (WAKWABI & NGULI, unpublished data). The observed peaks in catch rates may be as a result of this calm. It is possible that the dry season community, which was species richer, reached the peak at this time of the year.

The August peaks were most likely the result of production due to the allochthonous inputs by the torrential floods during the long rains. These peaks were less speciose and minor suggesting that they were limited to the reproductive cycles among fewer (probably restricted to the resident) species. It is also possible, that the stronger Southeast Trade winds (10 knots) (WAKWABI & NGULI, unpublished data), acting in concert with the strong East African Coastal Current (EACC) and the northerly flowing Somali Current (SC) (RICHMOND, 1997) rids off the production from the coastal waters into the oceanic waters. This may have lowered the suitability of the inshore waters (including Gazi bay) to the recruiting nekton.

The long rainy season starts in April-May, and May is usually the wettest month in the year. Since the majority of fish in the bay were marine reef associated species (see chapter 6, this report); the depression in water salinity could also explain the observed low densities and species diversity during this season. The short rainy period was also seen to have caused the depression in densities and in species diversity in October-November.

The above observations somehow corroborate the findings from earlier studies undertaken on the productivity of Gazi bay. OSORE (1994) found peak densities in zooplankton to occur in March-June. Holoplankton alone was highest in March-June and October-January while the peaks in the meroplankton varied with taxa. In fact, density in fish larvae was highest in May. DE SOUZA (1988) on the other hand, reported peak primary production in Gazi bay to have occurred in October. In the offshore waters, this (phytoplankton) production was highest between November and April i.e., during the Northeast monsoon season (Grey & Babenard, 1976 in NZIOKA, 1983). This must be the production that sustained the October-January peak in the holoplankton densities observed by OSORE (1994). Most of these studies were however on a short time scale (less than one-year duration). There was however some coincidence of the observed patterns in the epibenthos with the rest of the productive cycles in the bay.

4.4.2 Cluster analyses:

The observed clusters seemed to split along the rainfall patterns and the monsoons seasons in the region. There was some consistency of clusters corresponding to the wet season (May through August) and to the dry season (December through April). However, the actual timing of these clusters against the seasonal patterns was sometimes masked by species activities causing anomalous (non-season defined) groupings of the months.

When all stations were treated together, the wet and dry seasons were well separated. The dry season was also well defined in the seagrass-mangrove-associated community and the *Thalassodendron* community matrices. The wet periods however failed to discriminate from the community matrices.

The SEM season clusters were generally species poorer than the NEM season clusters. This was particularly evident in the "all stations" pooled data matrix where two species (*Leptoscarus vaigiensis* and *Fowleria aurita*) were preferential for the May and August cluster, and seven species for the cluster combining June, July, September and October. November and December were separate clusters with 35 and 28 preferential species respectively. Together with the January-April cluster, the three NEM clusters had a total of 77 preferential species/taxa (about 90% of the total number in the matrix). As for the seagrass-mangrove associated community, the dry period (January-March) cluster alone had 41 preferential species out of the 74 species (i.e., > 55%) in the dichotomy. This proportion was 60 out of 96 species (> 62%) for the *Thalassodendron* community. When the same data were treated separately for each station, the same general pattern as depicted in the pooled matrices was observed (not presented here) despite the localised differences due to specific species and/or taxa expressions. The discussion advanced above on the relationship between the densities and the seasonal oceanographic changes is equally relevant here. That, there was always the tendency to cluster wet months separate from the dry months. It was also notable that the clusters were quite heterogeneous in taxa. This could be due to the differences in rhythmic timings among closely related species probably to allow for resource sharing (see HORN *et al*, 1999). The observed grouping of months and species/taxa could also have been subject to the diurnal and tidal influences on the activity patterns of the specific species and/or groups of species. We suspect that these diurnal and/or tidal influences were possibly the cause of the masked seasonal patterns. Note that the masking effect was more pronounced in the station by station and at the community level matrices, than it was in the "all stations" pooled data matrix. For example, manipulations in the data matrices (i.e., by excluding some species from the analyses) had some profound effects (not shown here) on the resultant clusters (of months and species). This implied that some single species trends tended to force clusters of months that do not have a common seasonal factor. The grouping of September and October in Fig. 4.4, of April in Fig. 4.5, and of May, September and December in Fig. 4.6 were thought to be inconsistent with the respective clusters. These groupings tended to mask the anticipated seasonal trends.

Time of tide (in the semi-diurnal tidal cycle) and time of day have profound influence on the rhythmic activities of specific species and taxa residing and/or transient in the intertidal areas (e.g., ZANDER *et al.*, 1999 & GIBSON, 1999). Resident species tend to synchronise their activities within the tidal cycle and modulate these against the diel rhythms to achieve optimum benefits of the resources in the habitat (GIBSON, 1999). Rhythmic activities among transient species are on the other hand subject to the diel, tidal and seasonal changes in the habitats and are usually responsible for the periodic swells in species diversity. KITHEKA (1996) observed that tidal influences were a dominant forcing in Gazi bay especially in so far as nutrient and salinity distribution processes were concerned. The tides acting in concert with the onshore winds and longshore currents mix the bay waters, creating almost homogeneous conditions. We propose that this forcing had some role in the observed conjunctural clusters in the epifauna of this bay. To discern the tidal effects however, a more frequent sampling scheme should have sufficed.

4.4.3 Temporal species patterns:

The observed differential pre-dominance by species/taxa at the respective stations confirmed that the spatial structures, through predetermined microhabitats, were pre-eminent in the organisation of the epibenthic communities in Gazi bay. Again, the rainfall pattern and the monsoon seasons seemed to determine the occurrence and preponderance of the abundant species in the epibenthos. The larger proportions of rare species (pooled by months) in relation to the dominant species (also pooled by months) especially in the bay lagoon (at stations T1, T2, T3, cp4 and cp5) pay suggestive evidence to a more dynamic system of micro-habitats in this area as opposed to the (probably) more specialised micro-habitats in the west creek.

4.5 CONCLUSION:

Our coverage of almost two annual cycles lends strength to the observed seasonal patterns. Factors which are expected to influence the temporal patterns in marine epifauna (and more so, the ichthyofauna in the epibenthos) are those related to the diurnal cycles in the biotic and abiotic environment, tidal and seasonal wave action, seasonal temperatures, and the influx of transient and/or visiting forager species (ZANDER *et al.,* 1999). Our observations confirmed that there were much higher catch rates in the beam trawl during the calm inter-monsoon periods. These rates dropped and remained quite low during the long rainy period, when also the numbers of species were greatly reduced. At species level, the preponderance of any one species at the sampled stations was independent of the rest of the bay. This strongly supported the supposition that the spatial structures played a major role in the organisation of the observed community patterns. The patterns were constantly moderated by the temporal changes in the habitats.

We find this supposition in agreement with the observations advanced in e.g., ROBERTSON & DUKE (1990) on the mangrove fishes of Tropical Australia, and in BLABER *et al.*, 1992 on seagrass fishes in the same general area. That spatial factors (ROBERTSON & DUKE *op citi*) and habitat structures (BLABER *et al., op citi*) played major roles in predetermining the fish communities. ALLEN & BARKER (1990) observed that, the factors, which determine the recruitment and densities of larval fish in coastal waters, operated on a larger spatial scale with slight modifications due to temporal changes. We observe that temporal factors are usually multi-facetted. The rainfall pattern, among other factors, indeed had a role in modifying the patterns in the clusters and the densities of the epibenthos in Gazi bay.

Our study was based on the species-at-site catch data collected at standardised tidal (neaps) and diel (daytime) conditions. We can only explain the observed patterns on the basis of these conditions. The fish collected in our beam trawls were mostly the small sized adults of resident fish species (e.g., the blenies, cardinalfishes, damselfishes, gobies, lizardfishes, pipefishes, scorpionfishes, seahorses, shrimpfishes, trumpetfishes, wrasses); juveniles of some larger sized residents (e.g., the eels, filefishes, flatfishes, goatfishes, parrotfishes, puffers, rabbitfishes, trunkfishes); and transient juveniles (e.g., catfishes, emperors, groupers, grunters, penaeid prawns, snappers, sweetlips,). Some of the fish species were juveniles of larger stragglers known to associate with estuarine, mangrove and/or seagrass beds (e.g. the giant trevally *Caranx ignobilis,* and the barracuda *Sphyraena jello).*

4.6 ACKNOWLEDGEMENTS:

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4.7 **APPENDIX 4.1**: Full list of fish species and other taxa (including their Common/English names) referred to in the cluster analysis.

Species names	Common/English names for species
Pisces	
Family MURAENIDAE (moray eels)	
Siderea picta (Ahl, 1789)	Speckled siderial/paintspotted moray
Family PLOTOSIDAE (eel catfish)	
Plotosus lineatus (Thunberg, 1787)	Striped eel-catfish
Family SYNODONTIDAE (lizardfishes)	
Saurida undosquamis (Richardson, 1848)	Largescale/brushtooth lizardfish
Family ANTENNARIIDAE (anglers)	
Histrio histrio (Linnaeus, 1758)	Sargassumfish
Family FISTULARIIDAE (cornetfishes / flutemouths)	
Fistilaria petimba Lacepede, 1803	Red cornetfish/serrate flutemouth
Family SYNGNATHIDAE (seahorses and pipefishes)	
Halicampus dunckeri (Chabanaud, 1929)	Dusky pipefish
Hippocampus camelopardalis Bianconi, 1853	Giraffe seahorse
Hippocampus capensis Boulenger, 1900	Knysna seahorse
Hippocampus histrix Kaup, 1853	Thorny seahorse
Syngnathoides biaculeatus (Bloch, 1785)	Alligator pipefish
Syngnathus acus Linnaeus, 1758	Longsnout pipefish
Trachyrhamphus bicoarctatus (Bleeker, 1857)	Double-ended pipefish
Family SOLENOSTOMIDAE (ghost pipefishs)	
Solenostomus cyanopterus Bleeker, 1854	Ghost pipefish
Family CENTRISCIDAE (shrimpfishes)	
Aeoliscus punctulatus (Bianconi, 1855)	Shrimpfishes
Family SCORPAENIDAE (scorpionfishes)	
Dendrochirus brachypterus (Cuvier,1829)	Shortfin turkeyfish
Parascorpaena mossambica (Peters, 1855)	Golden scorpionfish
Family PLATYCEPHALIDAE (flatheads)	
Cociella crocodila (Tilesius, 1812)	Crocodile flathead
Papilloculiceps longiceps (Ehrenberg, 1829)	Madagascar flathead
Family SERRANIDAE (rockcods/groupers/seabasses)	
Epinephelus malabaricus (Schneider, 1801)	Malabar rockcod
Epinephelus merra Bloch, 1793	Honeycomb rockcod
Epinephelus species Bloch, 1793	
Family TERAPONIDAE (thornfishes)	
Pelates quadrilineatus (Bloch, 1790)	Trumpeter
Terapon theraps (Cuvier, 1829)	Straight-lined thornfish
Family APOGONIDAE (cardinal fishes)	
Apogon angustatus (Smith & Radcliffe, 1911)	Broadstriped cardinal
Apogon cookii Macleay, 1881	Blackbanded cardinal
Apogon fragilis Smith, 1961	Fragile cardinal
Apogon nigripes Playfair & Gunther, 1866	Blackfoot cardinal
Apogon savayensis Gunther, 1871	Ghost cardinal

Appendix 4.1 contd.

Species names	Common/English names
Apogon taeniophorus Regan, 1908	Ninestripe cardinal
Cheilodipterus lineatus Lacepede, 1802	Tiger cardinal
Cheilodipterus quinquelineatus Cuvier, 1828	Sharptooth cardinal
Foa brachygramma (Jenkins, 1903)	Foa
Fowleria aurita (Valenciennes, 1831)	Crosseyed cardinal
Family ACROPOMATIDAE (lanternbellies)	
Acropoma japonicum Gunther, 1859	Lanternbelly
Family HAEMULIDAE (rubberlips/sweetlips and grunters)	
Plectorhinchus gaterinus (Forsskal, 1775)	Blackspotted rubberlip
Family LUTJANIDAE (snappers)	
Lutjanus fulviflamma (Forsskal, 1775)	Dory snappers/blackspot snapper
Family LETHRINIDAE (emperors)	
Lethrinus elongatus Valenciennes, 1830	Longnose emperor
Lethrinus harak (Forsskal, 1775)	Blackspot emperor
Lethrinus lentjan (Lacepede, 1802)	Redspot emperor
Lethrinus nebulosus (Forsskal, 1775)	Blue emperor
Lethrinus variegatus Ehrenberg, 1830	Variegated emperor
Family EPHIPPIDAE (batfishes)	
Platax orbicularis (Forsskal, 1775)	Orbicular batfish
Family GERREIDAE (purse mouths)	
Gerres oyena (Forsskal, 1775)	Slenderspine pursemouth
Family MULLIDAE (goatfishes)	
Parupeneus barberinus (Lacepede, 1801)	Dash-dot goatfish
Family CHAETODONTIDAE (butterfly fishes)	
Chaetodon lineolatus Quoy & Gaimard, 1831	Lined butterfish
Chaetodon melannotus Bloch & Schneider, 1801	Black-black butterflyfish
Family POMACENTRIDAE (damselfishes)	
Chrysiptera annulata (Peters, 1855)	Footballer
Neopomacentrus fuliginosus (Smith, 1960)	Sooty damsel
Plectoroglyphidodon lacrymatus (Quoy & Gaimard, 1825)	Jewel damsel
Pomacentrus trilineatus Cuvier, 1830	Threeline damsel
Family LABRIDAE (wrasses)	
Anampses caeruleopunctatus Ruppell, 1829	Bluespotted tamarin
Cheilinus bimaculatus Valenciennes, 1840	Two-spot wrasse
Cheilinus oxycephalus Bleeker, 1853	Snooty wrasse
Cheilinus trilobatus Lacepede, 1801	Tripletail wrasse
Cheilinus undulatus Ruppell, 1835	Humphead wrasse
Cheilio inermis (Forsskal, 1775)	Cigar wrasse
Coris aygula Lacepede, 1801	Clown coris
Epibulus insidiator (Pallas, 1770)	Slingjaw
Halichoeres iridis Randall & Smith, 1982	Rainbow wrasse
Halichoeres scapularis (Bennett, 1831)	Zigzag sandwrasse
Labroides dimidiatus (Valenciennes, 1839)	Bluestreak cleaner wrasse
Novaculichthys macrolepidotus (Bloch, 1791)	Seagrass wrasse

Appendix 4.1 contd.

Species names	Common/English names
Pteragogus flagellifer (Valenciennes, 1839)	Cocktail wrasse
Stethojulis strigiventer (Bennett, 1832)	Three-ribbon wrasse
Family SCARIDAE (parrotfishes)	
Calostomus spinidens (Quoy & Gaimard, 1824)	Spinytooth parrotfish
Leptoscarus vaigiensis (Quoy & Gaimard, 1824)	Seagrass parrotfish
Hipposcarus harid (Forsskal, 1775)	Longnose parrotfish
Scarus globiceps Valenciennes, 1840	Roundhead parrotfish
Scarus scaber Valenciennes, 1840	Fivesaddle parrotfish
Scarus sordidus Forsskal, 1775	Bullethead parrotfish
Family SPHYRAENIDAE (barracudas)	
Sphyraena jello Cuvier, 1829	Pickhandle barracuda
Family BLENNIIDAE (blennies)	
Petroscirtes breviceps (Valenciennes, 1836)	Sabretooth blenny
Petroscirtes mitratus Ruppell, 1830	Floral blenny
Family CALLIONYMIDAE (dragonets)	
Synchiropus marmoratus (Peters, 1855)	Marbled dragonet
Family GOBIIDAE (gobies)	
Acentrogobius audax Smith, 1959	Mangrove goby
Amblygobius albimaculatus (Ruppell, 1830)	Butterfly goby
Asterropteryx semipunctatus Ruppell, 1830	Starryfin goby
Favonigobius melanobranchus (Fowler, 1934)	Blackthroat goby
Favonigobius reichei (Bleeker, 1953)	Tropical sand goby
Gnatholepis sp 1	Weeper
Gobiidae sp	
Oligolepis keiensis (Smith, 1938)	Kei goby
Yongeichthys nebulosus (Forsskal, 1775)	Shadow goby
Family SIGANIDAE (rabbitfishes)	
Siganus stellatus Forsskal, 1775	Starspotted rabbitfish
Siganus sutor (Valenciennes, 1835)	Whitespotted rabbitfish
Family BOTHIDAE (lefteye flounders/flatfishes)	
Bothus mancus (Broussonet, 1782)	Tropical flounder
Bothus pantherinus (Ruppelp, 1830)	Leopard flounder
Family CYNOGLOSSIDAE (tonguefishes/flatfishes)	
Cynoglossus attenuatus Gilchrist, 1904	Fourline tonguefish
Paraplagusia bilineata (Bloch, 1787)	Fringelip tonguefish
Family SOLEIDAE (soles)	
Solea bleekeri Boulenger, 1898	Blackhand sole
Family MONACANTHIDAE (filefishes)	
Paramonacanthus barnardi Fraser-Brunner, 1941	Wedgetail filefish
Family OSTRACIIDAE (box fishes)	
Lactoria cornuta (Linnaeus, 1758)	Longhorn cowfish
Lactoria fornasini (Bianconi, 1846)	Backspine cowfish
Ostracion cubicus (Linnaeus, 1758)	Boxy/yellow boxfish

Appendix 4.1 contd.

Species names	Common/English names
Family TRIODONTIDAE (threetooth puffer)	
Triodon macropterus Lesson, 1830	Threetooth puffer
Family TETRAODONTIDAE (blaasops)	
Arothron immaculatus (Bloch & Schneider, 1801)	Blackedged blaasop
Canthigaster bennetti (Bleeker, 1854)	Exquisite toby
Canthigaster solandri (Richardson, 1844)	False-eye toby
Canthigaster valentini (Bleeker, 1853)	Model toby/back-saddled toby
Chelonodon laticeps Smith, 1948	Bluespotted blaasop
Family DIODONTIDAE (burrfishes and porcupinefishes)	
Diodon hystrix Linnaeus, 1758	Porcupinefish
Lophodiodon calori (Biancon, 1855)	Fourbar porcupinefish
Other taxa (non fish)	
Cnidaria (jellyfish)	
Crustacea	
Decapoda	
Brachyura (crabs)	
Caridea (shrimps)	
Family PENAEIDAE (prawns)	
Penaeus indicus H. Milne Edwards, 1837	White prawn
Penaeus monodon Fabricius 1798	Giant tiger prawn
Penaeus sp	
Mollusca	
Cephalopoda (squids)	
Echonodermata	
Echinoidea (sea urchins)	
Family: Diadematidae	
Diadema spp	
Family: Toxopneustidae	
Tripneustes gratilla Linnaeus	
Holothuroidea (seacucumber)	
Asteroidea (starfishes)	

CHAPTER 5

5.0 THE DIETS OF JUVENILE FISHES IN A TROPICAL MANGROVE BAY, GAZI BAY, KENYA.

5.0.1 ABSTRACT

The diets of 1182 fishes that were abundant in the beam trawl catches from Gazi bay, Kenya are discussed. Most of these were juveniles of 33 species representing 16 teleost families. 75% of the gutted specimens (belonging to 10 species) were investigated for seasonal and size related changes in diets. The stomach fullness index (F.I.) was generally very low and the stomach contents were at a very advanced state of digestion. The most important identified prey items were algae, strands of macrophytes, hydrozoids, bryozoids, pisces, crustaceans, molluscs, annelids, foraminiferans, ascidian tadpole larvae, chaetognaths, egg, arachnids and medusae. Crustaceans were the most represented preys across the predators both in terms of consumed numbers and biomass. Amphipods, especially gammarids, were the most preferred prey by almost all (97%) of the investigated species.

Four trophic guilds were identified in the TWINSPAN based on the percent composition of the ingested biomass: omnivores, piscivores, zooplanktivores, and benthic carnivores. The omnivorous guild included, in the increasing order of omnivory: *Scarus sordidus, Leptoscarus vaigiensis* (Scaridae), *Siganus sutor* (Siganidae), *Pteroscirtes breviceps* (Blenniidae), *Paramonacanthus barnardi* (Monacanthidae), *Canthigaster valentini, C. bennetti* (Tetraodontidae), *Pteroscirtes mitratus* (Blenniidae), and *Novaculichthys macrolepidodus* (Labridae). These species relied mainly on plant and other structural material, whose importance diminished with increasing omnivory. They also took other small invertebrates especially those closely associated with the algae, seagrass, bryozoa and hydrozoa (e.g., amphipods, foraminiferans, harpacticoids, isopods, medusae, molluscs, ostracods and polychaetes). This guild had generally the narrowest niche (mean H' = 0.976±0.167).

The piscivores guild included (in decreasing importance of piscivory): *Saurida undosquamis* (Synodontidae), *Cheilinus bimaculatus* (Labridae), *Cheilodipterus quinquelineatus, Fowleria aurita* (Apogonidae), *Lethrinus elongatus* (Lethrinidae), *Parascorpaena mossambica* (Scorpaenidae), and *Lutjanus fulviflamma* (Lutjanidae). Their

diets mainly constituted Pisces and decapods with a slightly wider niche (mean H' = 1.088±0.0220) than the preceding guild. *Saurida undosquamis* was strictly piscivorous and had the most narrow niche of all investigated species (H' = 0.032).

The third guild of benthic carnivores included (in decreasing order of specialisation): *Apogon lateralis* (Apogonidae), *Lethrinus harak* (Lethrinidae), *Apogon cookii* (Apogonidae), *Cheilinus oxycephalus* (Labridae), *Bothus pantherinus* (Bothidae), *Plectorhynchus gaterinus* (Haemulidae), *Syngnathoides biaculeatus* (Syngnathidae), *Cheilio inermis* (Labridae), and *Lethrinus nebulosus* (Lethrinidae). They relied on amphipods, polychaetes and tanaids as the main prey items. On average these fish took more prey items and had a more varied and broader niche (mean H' = 1.521±0.205).

The zooplanktivorous guild had the broadest niche (mean H' = 1.652±0.218) and included two specialised zooplankton feeders: *Trachyrhamphus bicoarctatus* (Syngnathidae) and *Dascillus aruanus* (Pomacentridae). The remaining zooplanktivores were *Neopomacentrus fulginosus* (Pomacentridae), *Apogon fragilis* (Apogonidae), *Pelates quadrilineatus* (Teraponidae), *Stethojulis strigiventer* (Labridae), *Apogon nigripes* (Apogonidae), and *Plotosus lineatus* (Plotosidae) (in decreasing order of niche specialisation). The principal prey item identifying this guild was calanoid copepods which constituted 40-97%G of the diets among other zooplankton.

Most of the species were generalist feeders, some with opportunistic tendencies, and had wide prey spectra with overlapping diets. There was also overlap in diets between younger (smaller) and older (larger) individuals of the same species. Some seasonal patterns in prey selection were observed although the same items constituted the diets in all the seasons. The long rainy season (May-August), for example, is characterised by a peak in primary and secondary productivity. Younger fish took advantage of this, and fed mainly on juvenile copepods, ostracods, and molluscs.

5.1 INTRODUCTION

Food and space are the principal factors determining interrelationships between fish and their habitats. The way different fish populations utilise their food and space resources is expressed in spatial and temporal patterns. LETOURNEUR (1996) noted that the emergent patterns in fish communities on the fringing reefs of Reunion were dictated by the way in which the different populations used the reef resources in time and space. It has also been shown that fish "move" horizontally and vertically in time and space to feed and/or to escape predation (SARAWA & AZUMA, 1992). Activity rhythms in fish are in-fact synchronised "trade-offs" between foraging efficiency and predation-risk avoidance. Food is therefore a core factor in structuring fish communities.

Fish diets differ as much between juveniles and adults of the same species as they do between different species (EDGAR & SHAW, 1995). Diet composition, for example, is influenced by the dynamics in both the fish population and the prey populations (MOLINERO & FLOS, 1992). ALHEIT & SCHEIBEL (1982) observed that ontogenetic shifts in diet are abrupt and timed to some "critical size/stage" which is species and season dependent. Such patterns in resource use among closely associated fish populations tend to be expressed in discrete ecological entities.

The proponents of the guild concept in fisheries (AUSTEN *et al.*, 1994), having borrowed ROOT's (1967) idea, based their definition of the guild on the mutual exclusion or co-exploitation of resources in the habitat by closely related or associated fish species or populations. Trophic guilds are therefore functional groups of fish based on their food and feeding habits. As a tool for fisheries research and management, the guild structure can be used to evaluate the degree of environmental health in relation to the well being of the fish populations.

The fish and fish communities of Gazi bay have received quite some attention this decade, notable a/o. are VAN DER VELDE *et al.*, 1994; DE TROCH *et al.*, 1996; KIMANI *et al.*, 1996; and WAKWABI & MEES, in press. MWAMSOJO (1994) and BEULS (1995) respectively worked on the feeding ecology of the chubby cardinalfish (*Sphaeramia obicularis* APOGONIDAE) and the feeding ecology of the gobiids: *Amoya signatus, Favonigobius reichei* and *Gnatholepis sp1* of Gazi bay. DE TROCH *et al.* (1998) described the diets of abundant pelagic species sampled with a beach seine from the bay. In all the studies, both micro- and macrofauna were in the principal diets of the investigated fish species. Earlier in the period under review, the diversity and community structure of the epi-hyperbenthic macrofauna in the seagrass beds and the zooplankton of Gazi bay had been the foci in the studies of DEGRAER (1993) and OSORE (1994), respectively. Treated together with the findings on diets and feeding ecology, it is conclusive that these faunas play a major role in the apparent assemblages of fish populations in Gazi bay. MARGUILLIER *et al.* (1997) has in-fact demonstrated that the mangrove and seagrass ecosystems in Gazi bay are trophically interlinked through migratory feeding. Resident fishes in the mangrove swamps migrate to and from the seagrass beds to feed.

The present paper describes the diets of the juvenile fishes collected during an intensive beam trawl survey on Gazi bay, Kenya.

5.2 MATERIALS AND METHODS

5.2.1 Study area:

Gazi bay (Fig. 1) is located on the Kenyan coast off the Western Indian Ocean. It stretches about 1.75km at the narrowest and about 3.5km at the widest sections and measures about 3.25km long. It is endowed with a variety of habitats ranging from the fringing reefs and a reef platform on the seaward side, through varied vegetative cover of seagrass beds and macro-algal mats interspersed with bare soft mud, loose sands and rubble substrata in the bay proper and in the creeks, to the estuarine mangrove swamps and/or extensive sandy beaches (where there is less or no mangrove cover) on the landward side. The physical features, hydrography, and vegetative cover of the bay are well documented in COPPEJANS & GALLIN (1989), COPPEJANS *et al.* (1992), VAN AVESAATH *et al.* (1993), KITHEKA (1996) and OHOWA *et al.* (1997).

5.2.2 Sampling strategy:

Fish were collected using a beam trawl (1.5m beam length and 2*2mm stretched mesh) in 7 stations (Fig.5.1). Stations cp3, cp4, and cp5 were located near the mangrove re-plantation experimental plots in the west creek (cp3) and on the western shores of the

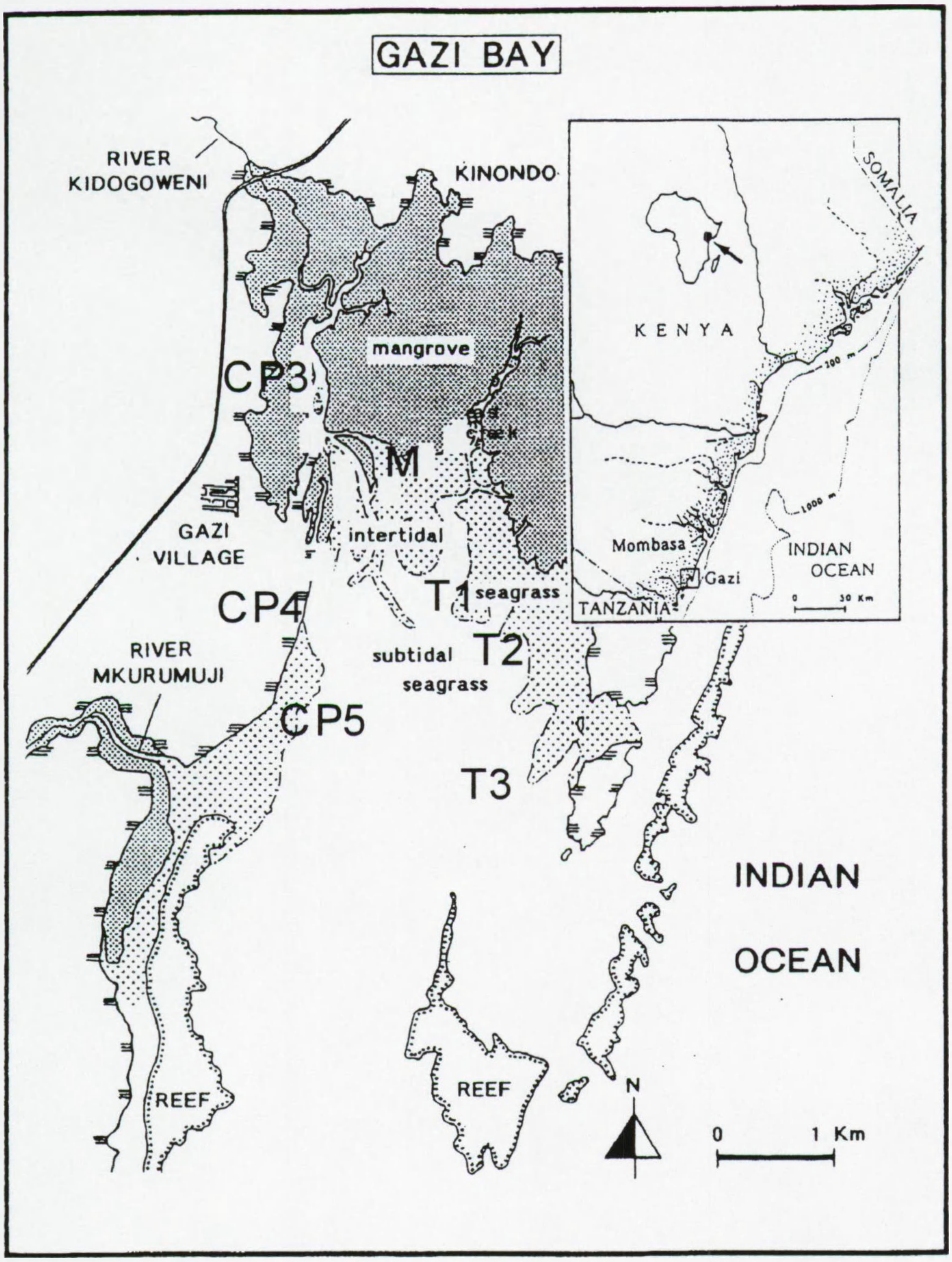


Fig 5.1: The map of Gazi bay, Kenya showing the position of the bay, the physical features, vegetative cover, and the approximate position of the stations sampled during the beam trawl study (December 1994- September 1996).

bay (cp4 & cp5). M was located at the mouth of the west creek, while T1, T2, and T3 were located in the *Thalassodendron* seagrass beds in the main bay lagoon.

Samples were collected monthly on every other neap tide during daytime between November 1994 and September 1996. All fish were sorted out of the debris, and first anaesthetised in benzoate solution to avoid regurgitation of the stomach contents, before fixation in 10% saline formaldehyde solution. Details on the field sampling procedures were discussed in WAKWABI & MEES (chapter 2, this document).

5.2.3 Laboratory methods:

5.2.3.1 Handling specimens:

The fish were identified to species level using SMITH & HEEMSTRA (1986), FISCHER & BIANCHI (1984) and BIANCHI (1985) as the principal identification keys, counted, and the standard length (SL) was recorded for each specimen to the nearest mm (using a normal fish measuring board).

The ten most abundant species were selected for the study of seasonal dietary changes. The specimens were selected from the samples collected during the dry season (January, March, and April), the long rainy season (May and August) and the short rainy season (November). On all occasions, at least 10 specimens were selected from the modal size classes. Gut contents of another 23 species (also abundant but less representative in the annual cycle) were also analysed but on a less rigorous scale. At least 10 specimens were gutted for each species (see Table 5.2 for summarised data on the gutted species).

5.2.3.2 Gutting & Ashing:

The fish viscera were opened and the stomach was secured from the oesophagus end to the beginning of the intestine. The stomach was opened under a binocular microscope and its contents were washed into an embryo dish with distilled and demonised water. The wet weight (WW) of the gutted fish was determined. The fish was then dried at 60°C for 10 days, and ashed (at 540°C) to determine the dry weight (DW) and the ash free dry weight (AFDW). All weights (WW, DW, & ash weight) were taken on a SAUTER KG.D-7470 balance to the nearest mg.

5.2.3.3 Stomach contents:

The stomach contents were sorted under a binocular microscope which was fitted with a drawing mirror. Preys were identified where possible to higher taxa, using HAYWARD & RYLAND (1995) and RICHMOND (1997) as guides, and counted. Plant material together with the other periphyton (namely hydrozoids and bryozoids) could not be enumerated due to the advanced levels of digestion, could not be separated. These material were lumped together under "*aufwuchs*", a borrowed term (from limnology) that refers to the periphyton community (plants and animals adhering to parts of rooted aquatic macrophytes or to other objects projecting above the bottom sediments) (ODUM, 1971; SINGLETON & SAINSBURY, 1978; DAVIS & WALKER, 1986). The rest of the faunas in the stomach contents were treated separately as they were innumerable.

To determine the actual size of the prey (e.g., peracaridian and eucaridian crustaceans, stomatopods, brachyuran megalopae and pisces), a line tracing of the length was made using a drawing mirror on a binocular microscope. Head length or tail lengths were traced for the partly digested pisces (where standard lengths could not be taken). Carapace lengths (or width in crabs), length of uropods, tail lengths, or length of the chaela, were traced for the partly digested shrimps and crabs. Only total lengths of the larger peracarids were traced. All the line tracings were later actuated by a digitiser. The rest of the preys or their parts (see Tables 5.1 & 5.4) were only enumerated. The stomach contents were dried (as a whole or by specific groups/taxa) for 2hrs at 110°C, and the dry weights (DW) determined to the nearest 0.001mg on a METTLER M3 balance.

Using established length-weight regressions (for DWs and/or AFDWs) (Table 5.1) (HAMERLYNCK, 1993, MESS, 1994) the actuated lengths were converted to biomass (in mgAFWDs). For larval stages of the peracarids and eucarids (including small isopods, leptostracans, zoea, post larvae, and megalopae), and all other preys (excluding the peracarids and eucarids, polychaetes, and pisces) were allocated assigned ash free dry weights (Table 5.1) from the literature (HAMERLYNCK, 1993; MEES, 1994). Based on the numbers of preys in a stomach, these biomass together with the assigned AFDWs for the smaller preys (see Table 5.1) were used to estimate the total consumed biomass (mgAFDW) in each stomach.

5.2.4 Mathematical methods:

Four complementary indices were calculated to assess the diets of the investigated fish: index of stomach fullness (F.I.), the frequency of occurrence (%F), and both numerical and gravimetrical indices for assessing the diet composition. These indices are fairly well discussed and explained in HYNES (1950), BERG (1979), and HYSLOP (1980). The index of stomach fullness (F.I.), as a momentary measure of the amount of ingested food, is estimated as the percent ratio of the total mass (AFDW) of the ingested prey over the total body mass (AFDW) of the predator, i.e.:

$$F.i = \frac{totalweigh\ t(AFDW\ )of\ stomach\ contents}{total\,body(AFDW\ )ofthefish} \times 100$$

The estimated ash free dry weight of the stomach contents was used to compute the F.I..

Diversity of the diets in the investigated stomachs was estimated from the frequency of

$$\%N_i = \frac{\text{number of individuals of prey item}_i}{\text{total number of ingested prey}} \times 100$$

occurrence (%F) of prey items in the investigated stomachs; i.e.,

$$\%F_i = \frac{\text{number of stomachs with prey item}_i}{\text{total number of with food}} \times 100$$

As an index, %F does not give information on the quantities of the food ingested and also fails to discriminate between the observed frequencies. It however provides first-hand information on the spectrum of dietary choices available to the predator within its habitat.

The relative importance by number and by weight of prey, were estimated as the numerical (%N) and gravimetrical (%G) percentages of the total ingested food: where;

$$\%N_i = \frac{\text{number of individuals of prey item}_i}{\text{total number of ingested prey}} \times 100$$

and

$$\%G_i = \frac{\text{AFDW prey item}_i}{\text{total AFDW of the ingested food}} \times 100$$

"*Aufwuchs*" were not accounted for in the numerical index.

The gravimetrical (%G) data (averaged for each species) were arcsin-root transformed and subjected to the Two Way INdicator SPecies ANalysis (TWINSPAN) (Hill, 1979) and indirect ordination (DCA) (Jongman *et al.*, 1987) to identify the trophic guilds. These data included all the 33 investigated species, and to achieve a better classification of the feeding guilds, the prey items were categorised under higher taxa. The grouping was done on the basis of each fish species taking into consideration the importance of certain items in the diets of the respective species. Therefore all prey items with < 5%G of the total consumed biomass by the species (and which could not be grouped under a taxon) were lumped together (for that species) under "others". To be able to discern the temporal patterns and the ontogenetic shifts in the diets of the 10 most abundant species, the TWINSPAN was performed on their stomach contents, this time for each individual predator in the species.

The Shannon-Wiener's diversity index (H') (SHANNON & WIENER, 1963) was calculated on the ingested prey biomass to assess the breadth of the feeding niche occupied by the studied fish species, where:

$$H' = -\sum_{i=1}^{n} p_i(Ln(p_i))$$

and

$$with\ p_i = \frac{N_i}{N_t} = relative\ biomass\ (mgAFDW)$$

of prey item$_i$ in the stomach contents;

5.3 RESULTS

Results of the stomach contents analyses are summarised in Table 5.2. In total, 1182 individuals in 33 species representing 16 teleost families were investigated. Of these, 890 individuals of the 10 most abundant species (marked with *), were assessed for seasonal and size related shifts in diets. The remaining 23 species, were only assessed for the diet composition. 8% of the gutted specimens had empty stomachs. Most of these empty stomachs were recorded in two apogonids, the crosseyed cardinal *Fowleria aurita* and the fragile cardinal *Apogon fragilis* (Table 5.2). Most species had wide options for prey selection, although at the individual level, only few items were actually taken in the diets. The average number of ingested prey, the average ingested biomass, and the mean index of stomach fullness were good indications on the size of prey, modes of feeding, and the levels of engorgement for the species. For example, the combination of a low value of the ingested biomass with a low F.i. denoted a comparatively lesser engorgement (Table 5.2). The most narrow prey spectra were found in the brushtooth lizardfish *Saurida undosquamis* (which preyed basically on pisces), and in the humpback cardinalfish *Apogon lateralis* (which relied only on the gammarid amphipods and medusae). The observed differences in the diversity (H') of diets denoted different levels of specialisation (lower H') and/or generalisation (higher H') within the guild (Table 5.2). The omnivores and piscivores were comparatively more specialised (mean H' $\cong$ 1.0) than the benthic carnivores and the zooplanktivores (mean H' >1.5) in their choice of diets.

Generally, the diets included algae, seagrass, hydrozoids, nematodes, foraminiferans, annelids, molluscs, chaetognaths, ostracods, copepods, malacostracans, arachinids, insects, pycnogonids, eggs, medusae, bryozoids, ascidian tadpole larvae, and pisces. The relative importance (%F, %N, and %G) of the different prey items in the diets of all investigated species is presented in Fig. 5.2(a-c).

5.3.1 Frequency of prey occurrence:

All investigated species (except *Saurida undosquamis*), had some proportion of gammarid amphipods in their diets (Fig. 5.2a). Over 60% of the 33 species took eggs, ostracods, adult calanoids, juvenile (or small sized) and adult harpacticoids, tanaids, caprellid amphipods, isopods and gastropods in their diets. Brachyurans, bryozoids and the ascidian tadpole larvae were restricted to the diets of just about 20% of the 33 species.

5.3.2 Numerical diet composition:

Numerically, calanoid copepods were the most ingested prey (Fig. 5.2b). They constituted 39%N of the total number of prey in all the investigated stomachs (excluding "aufwuchs" which could not be accounted for on this scale). Harpacticoid copepods accounted for 23%N, while amphipods and eggs were 12%N and 10%N (respectively) of the total ingested preys in all the investigated stomachs (pooled together). The rest of the preys together made up the difference (15%N).

5.3.3 Gravimetrical diet composition:

Gravimetrically, pisces were the most important prey item having contributed > 44%G of the total ingested biomass in all the examined stomachs (Fig. 5.2c). Decapods (with > 22%G of the total consumed biomass) were the next important group followed by "aufwuchs" which constituted 11.5%G of the total ingested biomass. Copepods and amphipods were less important on this scale, having contributed each less than 10%G of the total consumed biomass (Fig. 5.2c).

Table 5.1 List of the assigned biomass values, the length-ash free dry weight (AFDW) and other morphometric regressions used to estimate the prey biomass. All lengths (L), total lengths (TL), carapace length (CL), and carapace width (CW) are in mm; and dry weights (DW) and ashfree dry weights (AFDW) are in mg.

Taxa				Weight
Nematoda				assigned value: 0.003
Faraminifera				assigned value: 0.001
Ascidiacae				
	Ascidian tadpoles			assigned value: 0.01
Annelida				
	Polychaete larvae			assigned value: 0.03
	Polychaetes:			$\ln AFDW = -7.139 + 2.489 \ln L$
Mollusca				
	Bivalva larvae			assigned value: 0.001
	Gastropoda larvae			assigned value: 0.2
Chaetognatha				assigned value: 0.5
Crustacea				
	Ostracoda:			assigned value: 0.014
	Copepoda			
		Calanoida		assigned value (copepodites): 0.008
		Calanoida		assigned value (adults): 0.016
		Harpacticoida		assigned value (copepodites): 0.002
		Harpacticoida		assigned value (adults): 0.004
		Euphausidae		assigned value: 0.016
	Peracarida			
		Cumacea		$\ln AFDW = -6.078 + 2.525 \ln TL$
		Mysidacea		$\ln AFDW = -6.107 + 2.867 \ln SL$
		Isopoda		assigned value (small): 0.001
		Isopoda		$\ln AFDW = -5.857 + 2.863 \ln TL$
		Amphipoda		
			Gammaridae	$\ln DW = -6.301 + 2.849 \ln SL$*
			Caprellidae	$\ln AFDW = -5.857 + 2.863 \ln TL$
		Tanaidacea		$\ln DW = -4.241 + 1.644 \ln SL$*
		Leptostraca		assigned value: 0.014
	Eucarida			
		Caridea		Assigned value (zoea): 0.175
				Assigned value (postlarvae): 0.238
				$\ln AFDW = -7.684 + 3.321 \ln TL$
			Penaeidae	see Caridea
		Stomatopoda		see Caridea
		Brachyura		assigned value (zoea): 0.050
				assigned value (megalopae): 0.189
				$\ln AFDW = -3.967 + 3.164 \ln CW$
Pygnogonia				assigned value: 0.1
Hemiptera				assigned value: 0.1
Medusae				assigned value: 0.008
Oribatid mites				assigned value: 0.001
Pisces				assigned value (eggs): 0.025
				$\ln AFDW = -7.851 + 3.460 \ln SL$

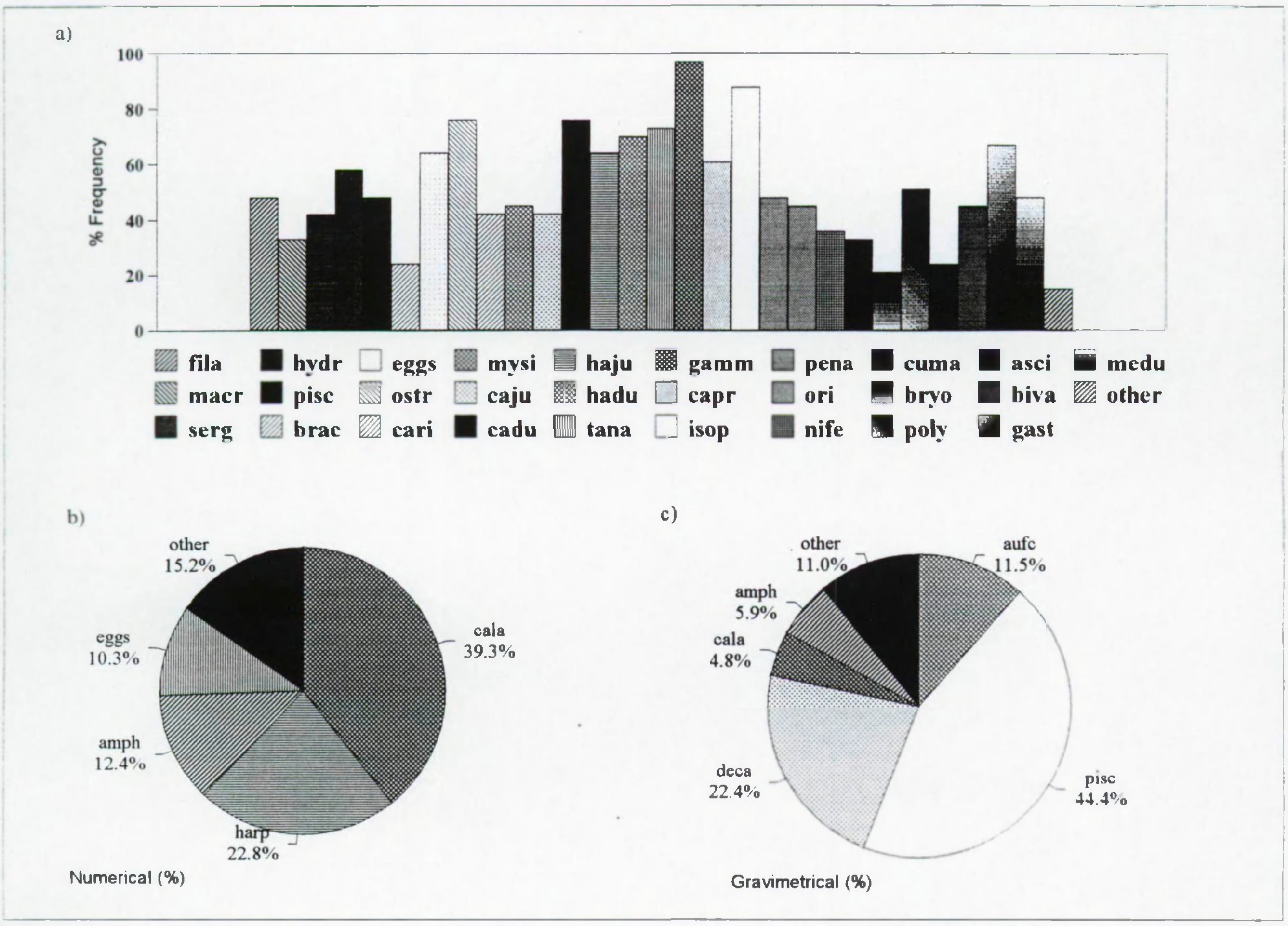


Fig. 5.2: The overall: a) % frequency, b) % numerical, and c) % gravimetrical proportions of the different prey items (types) in the diets of the abundant demersal fishes of Gazi bay, Kenya. For the full names of the preys see Table 5.4.

5.3.4 Feeding guilds:

TWINSPAN (Fig. 5.3a) and DCA (Fig. 5.3b) identified four feeding guilds on the basis of the gravimetric composition of the diets. These were omnivores, piscivores, benthic carnivores, and zooplanktivores. In the TWINSPAN dichotomy (Fig. 5.3a), omnivores were separated from the rest at the first division with "aufwuchs" as the positive indicator prey item. Piscivores were separated at the second level with pisces as the indicator prey. The other two guilds (zooplanktivores and benthic carnivores) were separated at the third level (Fig. 5.3a). Calanoid copepods were the indicator prey for the zooplanktivores while amphipods were the preferential prey for the benthivores. The above classification was confirmed by the results of the CA and DCA (Fig. 5.3b). Piscivorous species fed mainly on pisces, decapods and

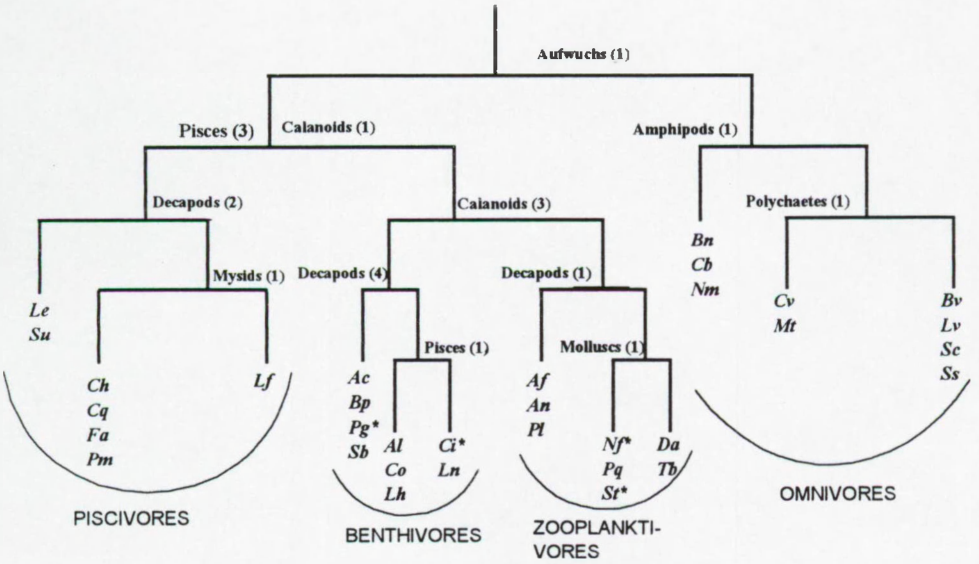


Fig. 5.3a: The hierarchical clusters of feeding guilds from the TWINSPAN of the stomach contents (% gravimetrical) data from the abundant fishes caught by the beam trawl in Gazi bay, Kenya. For the full names of fish species, see Table 5.2.

mysids; zooplanktivores on calanoid and harpacticoid copepods, isopods and chaetognaths; benthic carnivores on tanaids, amphipods, polychaetes and "others"; and the omnivores on “aufwuchs”, molluscs and medusae as preferential preys. Further sub-divisions in the guilds were based on the proportions of these principal dietary items *vis-à-vis* the other items in the diet.

5.3.4.1. Piscivores:

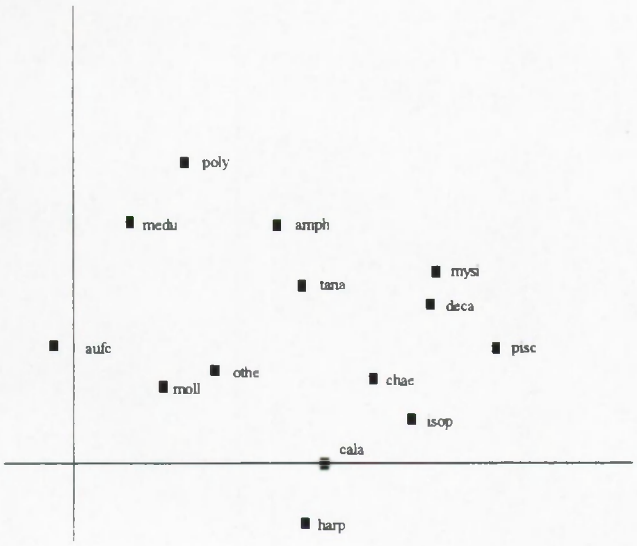
The species grouped under piscivores were the sharptooth cardinalfish *Cheilodepterus quinquelineatus*, the crosseyed cardinalfish *Fowleria aurita* (both Apogonidae); the two-spot wrasse *Cheilinus bimaculatus* (Labridae); the longface/longnose emperor *Lethrinus elongatus* (Lethrinidae); the blackspot snapper *Lutjanus fulviflamma* (Lutjanidae); the golden scorpionfish *Parascorpaena mossambica* (Scorpaenidae); and the brushtooth lizardfish *Saurida undosquamis* (Fig. 5.3a & 5.3b). Over 60%G of the ingested biomass in this guild were pisces and about 27%G were decapods (Fig. 5.4b). The numerical composition of the diets was >50%N amphipods (Fig. 5.5b). At species level (Fig. 5.7a & 5.7b), *Saurida undosquamis* preyed principally on pisces (100%G and > 85%N) with the narrowest feeding niche (H’ = 0.03) (Table 5.2). *Lethrinus* *elongatus* combined pisces (> 70%G), with amphipods (≅ 20%N), harpacticoids (> 30%N) and tanaids (≅ 20%N). On the other hand, *Cheilinus bimaculatus*, *Cheilodipterus quinquelineatus*, *Fowleria aurita*, and *Parascorpaena mossambica* relied most on pisces and decapods (> 90%G of the ingested biomass). They also preyed on amphipods (> 30%N in *C. bimaculatus*, *F. aurita*, and *P. mossambica*); molluscs (> 20%N in *C. bimaculatus*); eggs (> 45%N in *F. aurita*); copepods (> 60%N in *C. quinquelineatus*); and tanaids (>15%N in *P. mossambica*). *Lutjanus fulviflamma* preyed on mysids (> 75%N and about 15%G of the diet) in addition to pisces and decapods. The guild had a narrow prey spectrum (mean H' = 1.1 ± 0.22) (Table 5.2).

5.3.4.2. Omnivores:

Almost 90%G of the total ingested biomass in this guild was "aufwuchs" (Fig. 5.4a). A larger portion of the numerical composition of the diets (excluding "aufwuchs") was constituted by harpacticoid copepods which were > 50%N (Fig. 5.5a).

Over 90%G of the ingested biomass by the seagrass parrotfish *Leptoscarus vaigiensis*, the bullethead parrotfish *Scarus sordidus* (both Scaridae); and the whitespotted rabbitfish *Siganus sutor* (Siganidae) was "aufwuchs" (Fig. 5.6a). These three species had the narrowest feeding niche (H' ≤ 0.35) in the guild (Table 5.2). The diets of the sabretooth blenny *Petroscirtes breviceps* and the floral blenny *P. mitratus* (both Blenniidae), the back-saddled toby (model toby) *Canthigaster valentini* (Tetraodontidae) and the wedgetail filefish *Paramonacanthus barnardi* (Monacanthidae) was >60%G "aufwuchs". The rest of the diets were ostracods and harpacticoid copepods in the sabretooth blenny (each > 30%N of the diet); harpacticoid copepods and tanaids (30%N and 20%N, respectively) in the floral blenny; harpacticoids and polychaetes (>25%N & 30%N, respectively) in back-saddled toby; and amphipods (>50%N) in the wedgetail filefish (Fig. 5.6b). The other two species, the exquisite toby *Canthigaster bennetti* (Tetraodontidae) and the seagrass wrasse *Novaculichthys macrolepidotus* (Labridae), took much less of "aufwuchs" (about 32%G in the former and < 20%G in the later). The exquisite toby preyed more on amphipods (40%G and 30%N) and molluscs (30%G and > 20%N) while the

i) Prey items



ii) Fish species (predators)

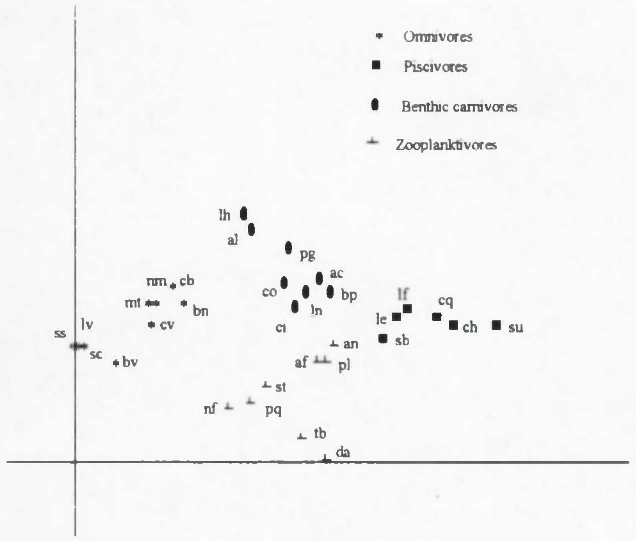


Fig. 5.3b: Clusters of (i) prey and (ii) feeding guild from the DCA of the stomach contents (% gravimetrical) data of the abundant fishes caught by the beam trawl in Gazi bay, Kenya. For the full names of fish species and prey items, see Tables 5.2 and 5.4.

seagrass wrasse preyed mostly on medusae (30%G & 30%N) and molluscs (> 30%G & 20%N) (Fig. 5.6a & 5.6b). The narrowest prey spectrum was taken by this guild (mean H' = 0.98±0.17) (Table 5.2).

5.3.4.3. Benthic carnivores:

Included in the cluster of benthic carnivores were the blackbanded cardinal *Apogon cookii* and the humpback cardinal *A. lateralis* (both Apogonidae); the leopard flounder *Bothus pantherinus* (Bothidae); the blackspotted sweetlip/rubberlip *Plectorhynchus gaterinus* (Haemulidae); the snooty wrasse *Cheilinus oxycephalus*, the cigar wrasse *Cheilio inermis (*both Labridae); the blackspot emperor *Lethrinus harak*,

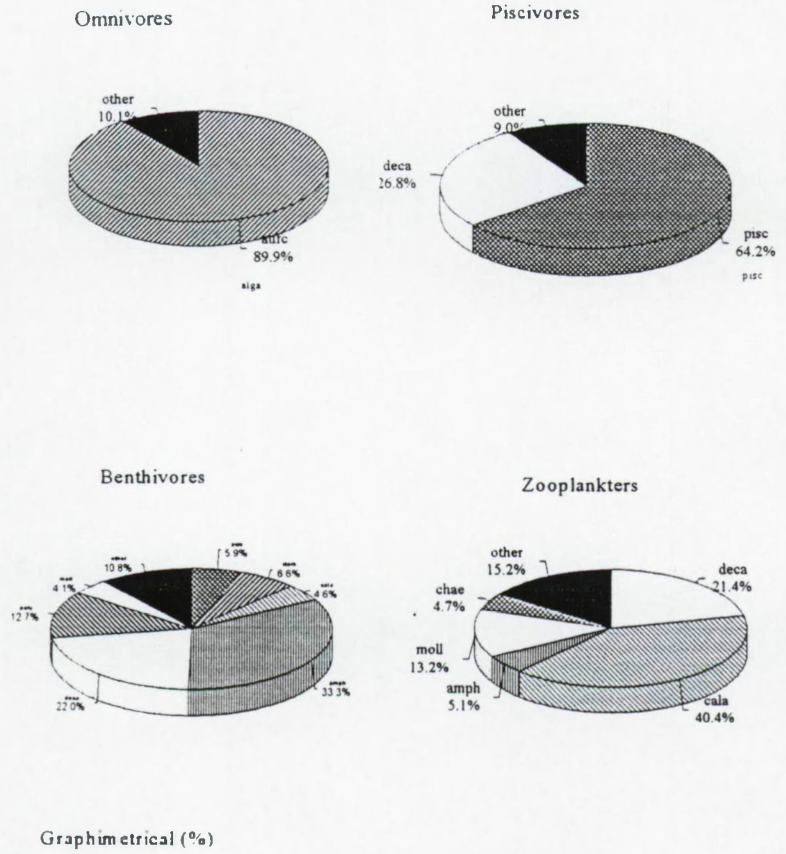


Fig. 5.4: The relative composition of prey items in the stomach contents of the abundant a) omnivorous, b) piscivorous, c) benthic carnivorous, and d) zooplanktivorous fish caught by the beam trawl from Gazi bay, Kenya. For the full names of preys, see Table 5.4.

the blue emperor *L. nebulosus* (both Lethrinidae); and the alligator pipefish *Syngnathoides biaculeatus* (Syngnathidae) (Fig. 5.3a). These fish relied mainly on benthic macro-fauna (e.g., amphipods, decapods, and polychaetes) from which they derived most (> 68%) of the ingested biomass (Fig. 5.3b & Fig. 5.4c). The principal items in their diets were amphipods (> 33%G). They also took pisces (6%G) and copepods (5%), though numerically, copepods (>40%N) were also very important (Fig 5.5c). The two apogonids (*Apogon lateralis* and *A. cookii*) and the labrid *Cheilinus oxycephalus*, had very few (≤ 5) preys per individual stomach (*A. lateralis* gave very poor results for any meaningful comparison) (Table 5.2).

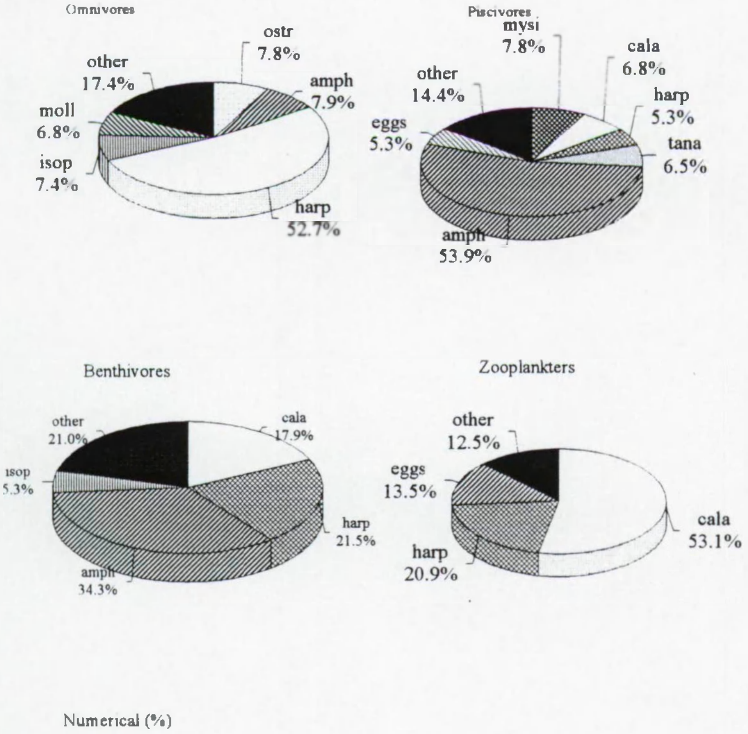


Fig. 5.5: Relative composition of prey items in diets taken by the abundant (a) omnivorous, b) piscivorous, c) benthic carnivorous, and d) zooplanktivorous fish caught by the beam trawl from Gazi bay Kenya. See Table 5.4 for full names of the prey items.

The guild had on average a broad prey spectrum (upto 30 prey types) with a mean diversity index H' = 1.521±0.205 (Table 5.2). The detailed diet for each species is summarised in Figs. 5.8a & 5.8b.

5.3.4.4. Zooplanktivores:

The fragile cardinal *Apogon fragilis* and the blackfoot cardinal *A. nigiripes* (both Apogonidae); the three-ribbon wrasse *Stethojulis strigiventer* (Labridae); the striped eel-catfish *Plotosus lineatus* (Plotosidae); the zebra humbug *Dascyllus aruanus,* the sooty damsel *Neopomacentrus fulginosus* (both Pomacentridae); the double-ended pipefish *Trachyrhamphus bicoarctatus* (Syngnathidae) and the trumpeter thornfish *Pelates quadrilineatus* (Teraponidae) formed the cluster of zooplanktivores (Figs. 5.3a, 5.3b & 5.4d). Both calanoid and harpacticoid copepods were the main prey, taken in varying abundance, but being numerically the most important and the most ingested preys (74%N) (Fig. 5.5d). In terms of ingested biomass, calanoids (> 40%G) and decapods (> 21%) were important (Fig. 5.4d). The gravimetrical and numerical composition of the diets in this guild is presented in Figs. 5.9a & 5.9b. Due to the preferred prey size, the guild ingested large numbers (up to 473 preys per stomach) and had the broadest prey spectrum (11-30 prey items) with a comparatively higher index of diversity (mean H' = 1.65 ± 0.22) in the diets (Table 5.2). It was also noted that the species taking the largest numbers of preys had the

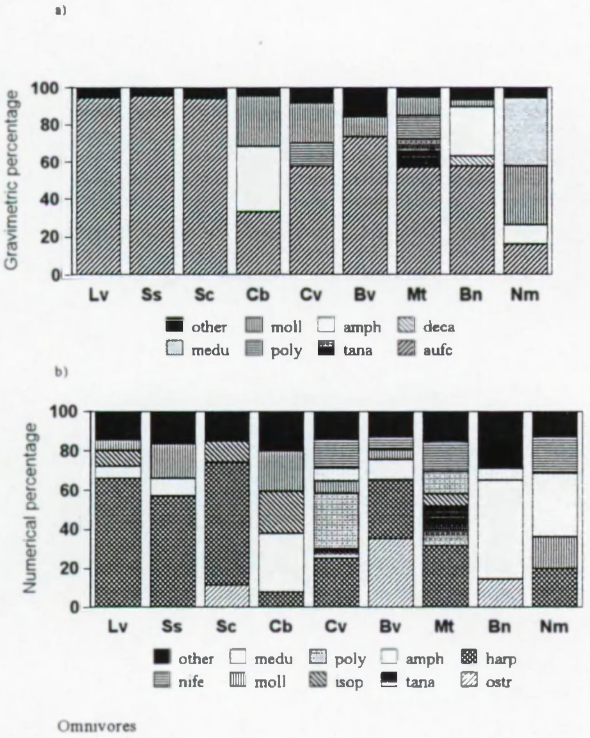


Fig. 5.6: The relative (a) % gravimetrical and (b) % numerical composition of the diets taken by the investigated omnivorous fish species of Gazi bay, Kenya. See Tables 5.2 & 5.4 for the full names of the fish species and the ingested prey items.

lowest diversity index in the guild. *Trachyrhamphus bicoarctatus* (with H' = 0.641) was for example a more specialised zooplanktivore (taking mostly the calanoid copepods) than was *Plotosus lineatus* which greatly mixed its diets (H' = 2.387) (see Table 5.2).

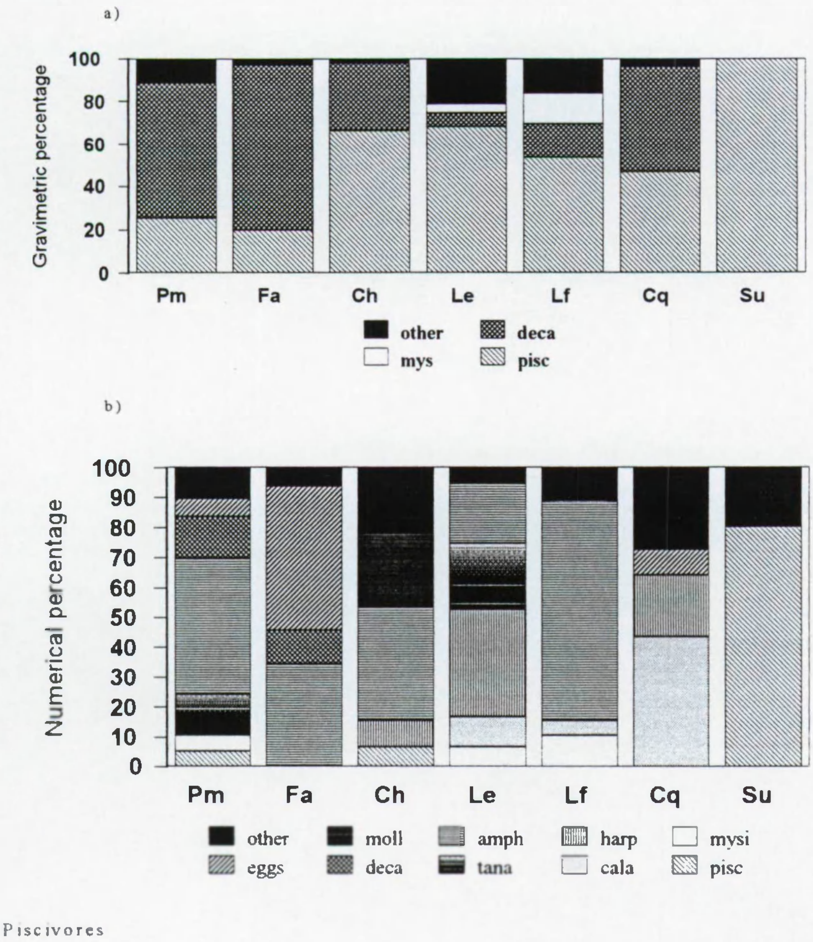


Fig. 5.7: The relative (a) % gravimetrical and (b) % numerical composition of the diets taken by the investigated piscivorous fish species of Gazi bay, Kenya. See Tables 5.2 & 5.4 for the full names of fish species and the ingested prey items.

5.3.5 Seasonal and Ontogenetic shifts in diets:

5.3.5.1. *Cheilio inermis* (pisces: LABRIDAE)

The stomachs with food had a mean F.i value of 0.70±0.20, with peaks in January (2.05) and in May (0.73) (Table 5.5). This species had the widest prey spectrum (30 prey taxa) and quite a diverse diet (H' = 2.171). Each stomach contained on average 22 preys and 0.72mgAFDW of biomass (Table 5.2). The bulk ingested biomass was contributed by amphipods (36%G), stomatopods (22%G), molluscs (12%G), and pisces (11%G) (Fig. 5.8a). Gammarid amphipods (>33%N), and both calanoid (27%N) and harpacticoid (22%N) copepods, were the most important preys numerically (Fig. 5.8b).

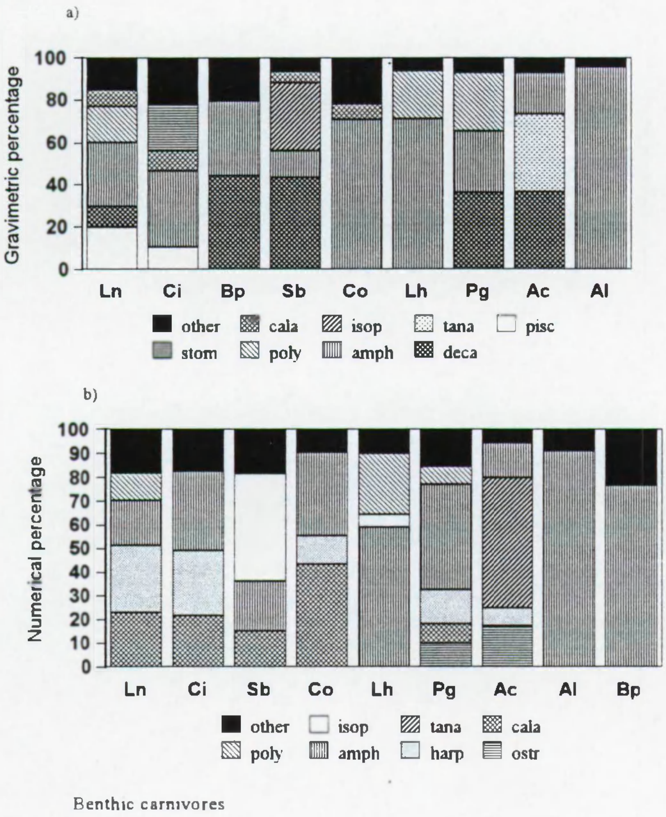


Fig. 5.8: The relative (a) % gravimetrical and (b) % numerical composition of the diets taken by the investigated benthic carnivorous fish species of Gazi bay, Kenya. See Tables 5.2 & 5.4 for the full names of the fish species and the ingested prey items.

Four feeding groups were identified in the TWINSPAN (Table 5.3). The groups separate on the basis of tanaids, calanoid copepods, harpacticoid copepods, gammarid amphipods, isopods, and caprellid amphipods as the major prey items (Annex 6: three dimentional tables on stomach contents). The first group (GI) consisted of fish in the size range of 21-40mmSL and was constituted mainly by the May and August samples (the long rainy season) for having fed on juvenile copepods (both harpacticoids and calanoids) and gammarid amphipods. Group II which included fish in 21-50mm SL, was representative of the three seasons (dry, long rainy, and short rainy seasons) and had fed on tanaids, and adult copepods (calanoids and harpacticoids) together with gammarid amphipods. The third group (GIII) was made of fish of 41-125mm SL. This group had fed on caprellid amphipods and molluscs in addition to the gammarid amphipods and was representative for both dry and long rainy seasons. The fourth group was constituted by 5 specimens, quite heterogenous in size (36-125mm SL) and drawn from April (1), August (3) and November (1). This group was identified from the rest at the 1st division with "other" as indicator prey; and had fed on juvenile harpacticoid copepods, gammarid amphipods, caprellid amphipods, and "other" as preferential prey.

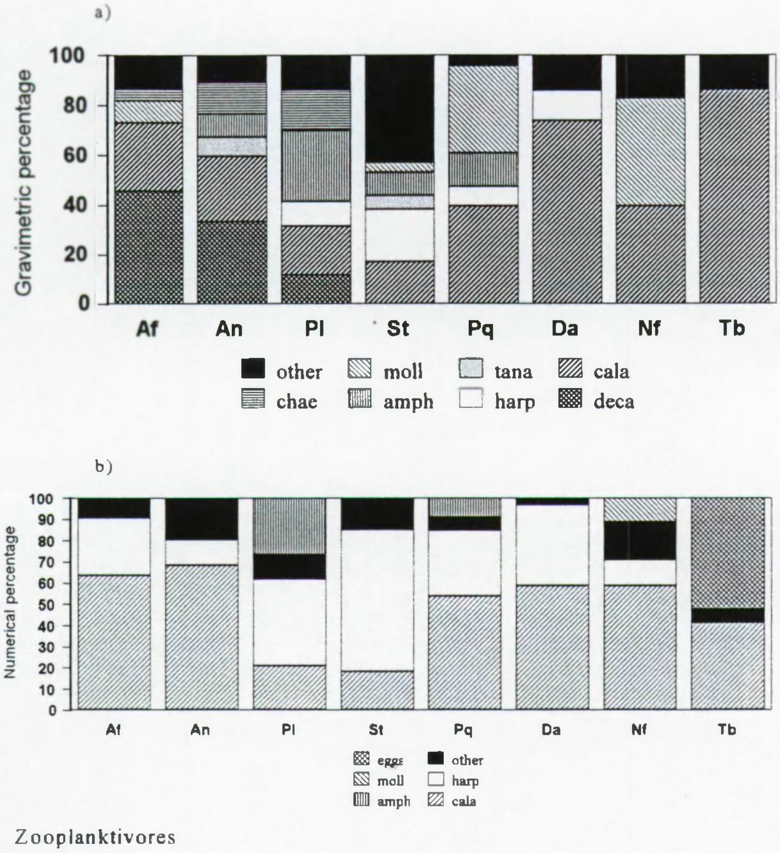


Fig. 5.9: The relative (a) % gravimetrical and (b) % numerical composition of the diets taken by the investigated zooplanktivorous fish species from Gazi bay, Kenya. See Tables 5.2 & 5.4 for the full names of the fish species and the ingested prey items.

5.3.5.2. *Apogon fragilis* (pisces: APOGONIDAE)

The mean index of stomach fullness was 1.18±0.25 and peaked in January (3.78) and May (1.14) (Table 5.5). The average number of prey per stomach was 28 and ingested biomass was 0.80mgAFDW per stomach (Table 5.2). The species fed from a choice of 25 different prey taxa although only few contributed to the bulk of the ingested biomass; i.e., decapods e. g.

carideans, penaeids, and sergestids (46%G), and calanoid copepods (27%G) (Fig 5.9a). Copepods (including both calanoid and harpacticoid copepods) were over 90%N of the ingested preys (calanoid copepods alone were 63%N) (Fig. 5.9b).

The feeding activities of *A. fragilis* were apparently synchronised to the availability of amphipods, copepods, and tanaids as was deduced from the TWINSPAN (Table 5.3, see also Annex 6: three dimentional tables on stomach contents). The first group (GI) was constituted of fish of 31-60mm SL of the March and April (the dry season) samples for having fed on tanaids, decapods and amphipods. GII was composed of the 21-40mm SL belonging mostly to the January, March and April samples, and had fed on copepods (juvenile and adult calanoid and harpacticoid copepods), isopods, ostracods, and amphipods. GIII, which was mostly in the 21-40mm SL and of May and August samples had fed on adult harpacticoids and amphipods as major preys.

5.3.5.3. *Apogon nigripes* (pisces: APOGONIDAE)

The stomachs of *A. nigripes* contained on average 24 preys and 1.010mgAFDW of biomass each, and had a mean F.I. 0.75±0.26 (Table 5.2). The F.i. was lower during the long rainy season (0.55) than during the short rainy season(0.98) and dry season (0.97) (Table 5.5). The species had a wide prey spectrum (30 prey taxa) and a diverse diet (H' = 2.143). Decapods (inclusive of the brachyurans, carideans, penaeids and sergestids) were >33%G, and together with the calanoid copepods (26%G), and chaetognaths (12%G) constituted the bulk of the ingested biomass; while calanoid and harpacticoid copepods made up to 80%N of the diet (Figs. 5.9a & 5.9b).

The pattern emerging from the TWINSPAN on the gravimetric data (Table 5.3) does not have a clear seasonal or ontogenetic shift although the two groups were hinged on the presence and/or absence of copepods in the diets.

5.3.5.4. *Fowleria aurita* (pisces: APOGONIDAE)

Only 30% of the gutted specimens had food in their stomachs with a mean F.i. 1.94±0.86, which peaked (4.88) in August (at the end of the long rainy season) (Table 5.5). The species had taken a total of 11 different prey taxa in their diets with an average of one prey and 2.5mgAFDW biomass per stomach (Table 5.2). Decapods (mainly caridean and penaeid shrimps) constituted over 77%G of the consumed biomass while pisces made up 20%G (Fig.

5.7a). Numerically, eggs (were 48%N), gammarid amphipods (34%N), and penaeid shrimps (11%N) were the most taken prey (Fig. 5.7b). Despite the wide range of preys, individual fishes engorged their stomachs with single large preys.

The TWINSPAN output (Table 5.3) did not have a clear seasonal or ontogenetic pattern (see also Annex 6: the 3D tables on stomach contents).

5.3.5.5. *Lethrinus nebulosus* (pisces: LETHRINIDAE)

All of the examined stomachs contained food with an average F.i. of 0.53±0.09, and a peak F.I. (1.13) in August (at the end of the long rainy season) (Table 5.5). On average each stomach contained 14 preys and 0.653mgAFDW biomass. The species had a prey spectrum of 25 taxa (Table 5.2). Numerically, harpacticoid copepods (>28%N), calanoid copepods (23%N), amphipods (19%N), and polychaetes (11.3%N) were the most important prey. Eggs were also taken in large quantities making up to 14%N of the diets (Fig. 5.8b). The bulk of the ingested biomass (Fig. 5.8a) was contributed by amphipods (> 30%G), pisces (20%G), polychaetes (17%G), and decapods (brachyurans, carideans, and penaeids)(10%G). The diet was diverse (H' = 2.231) (Table 5.2).

Three feeding groups were identified by TWINSPAN (Table 5.3 and Annex 6: the 3D tables on stomach contents). The first group, seemed to have specialised on the main prey items (calanoid and harpacticoid copepods and gammarid amphipods) and was constituted by fish of 21-40mm SL. The group was equally represented in the dry and long rainy seasons. GII included fish of 11-40mm SL with a mode at 21-30mm. This group was more generalist having fed in addition to tanaids, eggs, and caprellid amphipods. It is noted that the group only fed on harpacticoid copepods. Together with GIII, these were mainly dry season samples (January, March and April). The GIII group included slightly larger fish of 21-50mm SL and had fed on polychaetes in addition to the copepods and gammarid amphipods.

5.3.5.6. *Parascorpaena mossambica* (pisces: SCORPAENIDAE)

This species had taken 18 different prey taxa in their diets. Each stomach contained on average only 2 prey and 6.11mgAFDW of biomass (Table 5.2). The mean index of stomach fullness was 1.62±0.57, the highest value (4.99) being recorded in May (at the beginning of the long rainy season) (Table 5.5). F.i. was lower (0.63) during the dry season (January – April) (Table 5.5). Numerically, the most important prey were amphipods (caprellids and gammarids together) which had accounted for >45%N. Tanaids (14%N), and decapods (including brachyurans, penaeids and sergestids) (14%N) were also numerically important (Fig. 5.7b). On the gravimetrical scale (Fig. 5.7a) the decapods made >63%G and pisces made >25%G of the ingested biomass. Penaeids accounted for 54%G.

Two major groups were identified from the TWINSPAN (Table 5.3). Group I was equally spread over the three seasons and contained fish in 21-50mm SL. This group had fed on amphipods, tanaids and pisces (see Annex 6: 3D tables on stomach contents). The other group was not represented in the short rainy season, had fish of 31-50mm SL and had fed principally on decapods, and mysids.

5.3.5.7. *Plotosus lineatus* (pisces: PLOTOSIDAE)

P. lineatus had a mean F.i. of 0.76±0.16, and contained on average 16 prey and 0.26mgAFDW of biomass each (Table 5.2). The F.i. was higher during the long rainy season (1.16) than the during the dry season (0.42) (Table 5.5). In total, 22 prey taxa were taken. Harpacticoid copepods were the most ingested prey (>40%N) while most of the ingested biomass (>30%G) was made by amphipods (Figs. 5.9a & 5.9b). Other important preys were: calanoid copepods, decapods (carideans and penaeids) and chaetognaths (> 20%G, 11.5%G and 16%G, respectively).

Two main feeding groups were identified from the emergent pattern of the TWINSPAN (Table 5.3 and Annex 6: 3D tables on stomach contents). The first group had fed on harpacticoid copepods (both juveniles and adults), juvenile calanoid copepods, and chaetognaths. This group was constituted of fish in 21-30mm SL and belonged to the dry season (January and April) and wet season (May and August) samples. The second group was more generalist in diets having fed on calanoid copepods (both juveniles and adults), adult harpacticoids, ostracods, isopods, and gammarid amphipods. It contained fish in 21-40mm SL and most of the August sample (at the end of the long rainy season). The total absence of this species in the samples of March and November was also notable.

5.3.5.8. *Leptoscarus vaigiensis* (pisces: SCARIDAE)

The species had a mean F.i. of 1.02±0.11, which was higher during the dry season (1.54 in January, 1.32 in March, and 1.89 in April) than during the wet seasons (0.6 in May) (Table 5.5). The average ingested biomass was 1.086mgAFDW. "Aufwuchs" was the principal diet having constituted over 94%G of the total ingested biomass (Fig. 5.6a). Aufwuchs were present in more than 50%F of the examined stomachs. The rest of the diet (Fig. 5.6b) was a variety of benthic invertebrates, notably: copepods (both harpacticoids and calanoids), molluscs (bivalves and gastropods), foraminiferans, isopods, amphipods, tanaids, oribatid mites, and ostracods. These were however only 6% of the ingested biomass (Fig. 5.6b). Younger individuals (<30mm SL) took a more animal prey than the older ones (>30mm SL). Despite the wide range of preys (18 items), only 5 items were taken per fish giving a very low diversity index (H'=0.34) (Table 5.2) which strongly supported specialised herbivory in the species.

Available prey types, size of fish, and season seem to interact in determining the diets taken by the juveniles of *L. vaigiensis*. Results of the TWINSPAN (Table 5.3) depict two main feeding groups separating fish of 11-30mm SL of the dry season (January-April) in GI from the fish of 21-40mm SL of all the three seasons in GII (Table 5.3). The GI fish were more generalist having fed on juvenile and adult copepods (both calanoids and harpacticoids), foraminiferans, medusae, amphipods (caprellids and gammarids), isopods, and tanaids. The GII fish had fed on harpacticoid copepods, molluscs, ostracods, and arachnids (mites) (Annex 6: 3D tables on stomach contents).

5.3.5.9. *Scarus sordidus* (pisces: SCARIDAE)

All examined stomachs had food with a mean index of stomach fullness (F.i.) 0.61± 0.04 (Table 5.2). The F.i. was higher during the dry season (0.8) than during the long rainy season (0.5) (Table 5.5). The stomachs contained on average 1.44mgAFDW of ingested biomass. Of this biomass > 95%G was "aufwuchs" (Fig. 5.6a) recorded in 65%F of the investigated stomachs. Over 40% of the investigated stomachs had harpacticoid copepods, 30% had molluscs, and 25% had amphipods. The numerical composition of the diets is presented in Fig. 5.6b. It should be pointed out that this numerical diets constituted only 5%G of the gravimetrical scale.

Three main feeding groups were identified in the TWINSPAN (Table 5.3 and Annex 6: 3D tables on stomach contents). Mainly fish of 31-50mm SL caught during the dry season (January-April) and the long rainy season (May and August) made up the GI. This group had fed on "aufwuchs" and molluscs. GII was a younger group of fish of 21-40mm SL and was mainly formed by fish caught during the long rainy season. In addition to "aufwuchs" and molluscs, this group had also fed on harpacticoid copepods. GIII was a rather generalist of fish having fed on tanaids, amphipods (both caprellids and gammarids), and isopods in addition to "aufwuchs" and molluscs. The group was constituted by fish of 31-40mm SL caught during the dry season (specifically in January).

5.3.5.10. *Siganus sutor* (pisces: SIGANIDAE)

The gutted fish had a mean index of stomach fullness 1.06±0.07 which was higher (1.56) in November (the short rainy season), but remained about 1.0 during the long rainy and the dry seasons (Table 5.5). "Aufwuchs" constituted the bulk of the ingested biomass (> 94%G, Fig. 5.6a), and were present in all the stomachs. In addition, each stomach had on average 13 prey (Table 5.2). The average ingested biomass was 2.23mgAFDW. The numerical composition of these diets is presented in Fig. 5.6b.

Three feeding groups were separated on the basis of size and season (Table 5.3 & Annex 6: 3D tables on stomach contents). Group I (GI) was constituted by fish of 21-30mm and 51-60mm SL caught during the dry season (March-April). The fish had fed on a more generalist diet, which included "aufwuchs", adult calanoid, both juvenile and adult harpacticoid copepods, ostracods, gammarid amphipods, and gastropods. The other two groups also fed on "aufwuchs", but GII had taken adult harpacticoid copepods while GIII had fed on juvenile harpacticoid copepods (the two stages of the harpacticoids being the flexing prey items about which the dichotomy splits). GII was made up of fish of 21-40mm SL collected in the dry season (January) and the short rainy season (November), while fish of 21-30mm SL drawn from the long rainy season (May and August) samples were grouped in GIII.

5.4 DISCUSSION

Studying fish stomach contents as a means to assess their diets is like tracing information from destroyed archive records. The difficulty can be surmounting when one has to decide between what was really valuable food and what was accidentally ingested. ALHEIT & SCHEIBEL (1982) observed increasing amounts of detritus in the stomach contents of the tomtate grunts in proportion to their body size (being absent in the juveniles). This could have meant that the larger fish were eating more detritus than their juveniles were, if only they did not observe *in-situ* the feeding behaviour of the larger fish. Our difficulty in separating the components of "aufwuchs" is a point in question. The choice of an appropriate method to measure the proportion of different dietary items in the stomach contents can also be critical on the levels of precision one wishes to achieve. In the reviews of BERG (1979) and HYSLOP (1980), it is suggested that the applied indices (i.e., F.i., %F, %N, and %G), when used in combination with each other, can provide the best achievable description of the diets in fish.

It was evident from the values of the Shannon-Wiener's (SHANNON & WIENER, 1963) diversity index (H') that the different members of the guilds preyed upon the principal items (items that defined the guild) in varying proportion of importance, replacing them with other items that were less equally preferred by the other members in the guild. Each guild contained both specialised feeders (relying most on the principal prey(s)) and generalised feeders (which took more diversified diets). Based on the values of H' in our results, *Leptoscarus vaigiensis, Scarus sordidus*, and *Siganus sutor* for the omnivores (they relied most on "aufwuchs"); *Saurida undosquamis* for the piscivores (preyed almost only on fish); *Apogon lateralis* for the benthic carnivores (although, the number of stomachs with food in this species were too few to make this observation valid); and *Trachyrhampus bicoarctatus* and *Dascillus aruanus* among the zooplanktivores were more specialised in their diets. The rest of the species relied on more diversified diets. WASHINGTON (1984) reviewed the application of different indices of diversity, and together with COLWELL & FUTUYJAMA (1971) found the Shannon-Wiener's diversity index (H') justifiable as a measure of diversity in the diets taken by fish.

Essentially, there was food resource partitioning within and between the species and within and between the guilds. The within species partitioning was based on the size of predator and season, suggesting ontogenetic shifts in diets. This was specifically observed among the omnivorous species, and also in *Cheilio inermis, Apogon fragilis*, and in *Lethrinus nebulosus*. The tendency to rely most on the most prevalent preys was also observed between individuals of the same species (c.f. the wide prey spectra but fewer prey items in the stomachs). The between species, and within and between guild food resource partitioning was on the other hand, based on type and size of the ingested prey items. The omnivorous guild ingested mostly the small invertebrates closely associated with the plant structures (e.g., hydrozoids, bryozoids, harpacticoids, isopods, medusae, molluscs, ostracods, and amphipods). Judging from the comparison between the numbers of ingested prey against their biomass, it is noticeable that piscivores and the benthic carnivores took comparatively larger preys while zooplanktivores took mostly smaller sized prey. Although the same prey pool supplied nutrition to the different species examined in this study, the diets taken by each species differed even at the level of stage of development whereby some fish relied more on juvenile stages while others on the adult stages of the preys.

Pisces were numerically not important prey, but constituted over 64% of the ingested biomass. Amphipods were numerically the most important prey for the piscivores and benthic carnivores, as calanoid copepods were for the zooplanktivores. Calanoid copepods contributed the highest prey biomass for zooplanktivores, and amphipods for the benthic carnivores. Decapods contributed almost equally to the prey biomass taken by zooplanktivores and benthic carnivores. All guilds had a wide selection of prey under "others".

The present study therefore shows that the investigated fishes foraged on a wide variety of organism (including flora and fauna) with a high level of inter- and intraspecific dietary overlaps. At the species level, most member species of the four guilds employed rather opportunistic feeding strategies, taking wide prey spectra. The individuals within the species took mixed diets with size related differentiation. Prey diversification has been reported elsewhere as a strategy to reduce the somewhat diffuse competition within the guilds (AUSTEN *et al.*, 1994) and within the species (SCHLACHER & WOOLDRIDGE, 1996). The variety of prey items ingested by individual fishes may also bear relationship to the size or the stage in the life-cycle of the fish, the time of feeding and the time of capture. Almost all fish (with the exception of the apogonids and the scorpaenids) in our investigation were juveniles (see Table 5.2).

From our results, there was some indication of a relationship between the size and stage of the ingested prey and the seasonal productive cycles of the preys and predators. This was evident, for example, in the way juvenile and adult copepods featured in the diets of some species (e.g., in *Apogon fragilis, Plotosus lineatus,* and in *Siganus sutor).*The synchrony between the productive dynamics of the predator and those of the prey was in agreement with the reported seasonal peaks in productivity on Gazi bay especially during the long rainy seasons (DESOUZA, 1988; DEGRAER, 1993; MWALUMA, 1994; MWALUMA *et al.*, 1993; SHIMBIRA, 1994; WAWIYE, 1993; OSORE, 1994; OHOWA *et al.*, 1997) as a result of the additional nutrient influx (HEMMINGA *et al.*, 1994a; 1994b; KAZUNGU *et al.*, 1994; OHOWA, 1997). The same seasonal patterns have been also reported in Tudor creek, just north of Gazi bay (i.e., REAY & KIMARO, 1984; GROVE *et al.*, 1985; KIMARO, 1986; REVIS, 1988; KIMARO & JACCARINI, 1989; OKEMWA, 1990; WAKWABI & JACCARINI, 1993; KASYI, 1994; WAKWABI & MEES, in press). The increased production during the wet seasons was the basis of the diet allocation during these times of the year. The long rainy season for example, coincides with the arrival of the younger fish in the bay. These younger fish were consistently identified by the TWINSPAN on the gravimetric diets as summarised in Table 5.3. It was also the period when juvenile copepods, molluscs, and amphipods were respectively the most important preys. At the end of the long rainy season (in August), the fish and the macrofauna have grown. The fish were thus seen to have taken the larger sized prey (including the larger copepods) in their diets towards the end of the long rainy season.

The index of stomach fullness (F.i.) closely reflected these seasonal changes. Note that our samples were taken only during the day and on the neap tides. Since most fish feed with some rhythm (SAWARA & AZUMA, 1992) it was not possible to fully identify the feeding cycles with our data. In most cases, the stomach contents were at a very advanced state of digestion, hence the low F.I. values. The chance that we may have overestimated or underestimated one or the other of the prey items is also possible. We however think that in the circumstances, we have described the diets of the abundant demersal fishes of Gazi bay.

The concept and use of trophic guilds as a tool to describe the apparent patterns of interrelationships in fish communities has overwhelming application in ecological and fisheries studies (AUSTEN *et al.*, 1994). Gazi bay provides a complex of habitats, with a very diverse ichthyofauna (chapter 2). This complexity in habitats supports dense populations of micro- and macrofauna at both the benthic (RUWA, 1990; DEGRAER, 1993;) and the planktonic (OSORE, 1994) levels. The dynamics in these populations predetermine the role of the bay in the life histories of the fishes in the various habitats. ORNELLAS & COUTINHO (1998) observed that, temporal variations in distribution and abundance of marine fish species is influenced both by changes in structural complexity of the habitats and by the variation in recruitment of planktonic larvae. Many studies, (a/o., STONER, 1980; BELL *et al.*, 1987; SOGARD, 1992; CARR, 1994; CONNOLLY, 1994a & b; TUPPER & BOUTILIER, 1997); have related the distribution and abundance of fish to the types and number of available habitats. For example, vegetated habitats are attractive to fish because they provide refugia from predation and food from high secondary production in a variety of microhabitats. STONER (1980) and GORE *et al.* (1981) observed that, macro-floral biomass in seagrass communities influenced the abundance and species diversity of the macro-invertebrates. Seagrass areas are therefore important feeding grounds for both juvenile and adult fishes (ADAMS, 1976; OGDEN & ZIEMAN, 1977; LIVINGSTON, 1982; MARGUILLIER *et al.*, 1997), hence their nursery role (POLLARD, 1984; LASIAK, 1986). The rooty mangrove areas also provide refugia and food to juvenile and adult fish (LEY *et al.*, 1999; RÖNNBÄCK *et al.*, 1999).

In this study we have taken the premise that within each guild, the species interrelated on the basic prey item(s), namely: "aufwuchs" for the omnivores; pisces and decapods for the piscivores; calanoid copepods for the zooplanktivores; and amphipods for the benthic carnivores. The species in the four guilds did not as a rule concentrate on the same major prey item(s). This observation was also noted in McDermott & Fives (1995). The variation in diets by sizes of fish is in agreement with the foraging theory on the maximisation of energy intake in relation to expended energy on prey capture (Gee, 1988; Gerking, 1994). Within the species and between the species, the diets varied defining the different levels of dietary specialisation. The H' (diversity in diets) overlapped between species in different guilds, but each guild was well separated from the other on the basis of the mean H'.

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Table 5.2. List of the gutted fish species with their abbreviated names (Abbr.) arranged in the TWINSPAN Guild clusters and ranked in ascending order of the diversity in diets as measured by H' (the Shannon-Wiener's diversity index). The table includes information on the number of gutted fish (S), the size range (min-max) in mmSL and recorded maximum attainable size (L∞ mmSL) for the species. The rest of the table represents the numbers of empty stomachs (E) and different prey items in the diets (P), the average number of ingested preys (excluding the plant and other structural materials) (Pi) and average ingested biomass (B mgAFDW) per stomach, and the mean (±se of the mean) index of stomach fullness (F.I.). An * denotes that the species was also considered for the seasonal and ontogenetic shifts in diets.

Species	Abbr.	S	min – max	L∞	E	P	Pi	B	F.I.±se	H'
OMNIVORES										0.976±0.167
*Scarus sordidus**	Ss	65	21 - 50	400	0	18	6	1.44	0.61±0.04	0.295
*Leptoscarus vaigiensis**	Lv	123	16 - 45	350	0	21	5	1.09	1.02±0.11	0.34
*Siganus sutor**	Sc	75	19 - 55	450	0	24	13	2.23	1.06±0.07	0.345
Pteroscirtes breviceps	Bv	10	38 - 46	70	0	17	14	1.29	1.64±1.05	1.045
Paramonacanthus barnardi	Bn	10	24 - 77	90	0	17	9	1.10	0.13±0.02	1.25
Canthigaster valentini	Cv	10	18 - 48	110	0	20	14	1.09	0.53±0.17	1.295
Canthigaster bennetti	Cb	10	17 - 27	100	0	16	7	0.55	0.71±0.12	1.352
Petroscirtes mitratus	Mt	10	21 - 45	60	0	16	8	0.41	0.33±0.07	1.367
Novaculichthys macrolepidotus	Nm	11	25 - 45	150	0	16	10	0.53	0.38±0.05	1.496
PISCIVORES										1.088±0.220
Saurida undosquamis	Su	10	21 - 50	500	3	3	1	101.39	9.74±3.12	0.032
Cheilinus bimaculatus	Ch	11	54 - 72	150	2	15	4	6.28	0.70±0.37	0.746
Cheilodipterus quinquelineatus	Cq	11	20 - 50	120	1	13	12	5.19	3.78±1.05	1.061
*Fowleria aurita**	Fa	94	25 - 65	90	68	11	1	2.49	1.94±0.86	1.159
*Parascorpaena mossambica**	Pm	85	21 - 72	100	41	18	2	6.11	1.62±0.57	1.462
Lutjanus fulviflamma	Lf	23	28 - 59	350	0	20	59	20.323	3.68±0.80	1.868
BENTHIVORES										1.521±0.205
Apogon lateralis	Al	10	45 - 56	100	7	2	1	0.14	0.05±0.03	0.182
Lethrinus harak	Lh	10	29 - 40	600	0	10	10	0.60	0.32±0.11	1.247
Apogon cookii	Ac	20	20 - 70	100	9	8	5	0.25	0.48±0.16	1.303
Cheilinus oxycephalus	Co	29	20 - 43	170	4	13	3	0.28	0.41±0.14	1.388
Bothus pantherinus	Bp	10	33 - 66	300	0	12	29	3.07	1.74±0.41	1.561
Plectorhinchus gaterinus	Pg	10	40 - 100	500	0	16	66	10.00	0.53±0.09	1.782
Syngnathoides biaculeatus	Sb	10	97 - 135	290	0	12	28	1.30	0.66±0.13	1.822
*Cheilio inermis**	Ci	111	21 - 125	500	3	30	21	0.72	0.70±0.20	2.171
Lethrinus nebulosus	Ln	65	17 - 45	870	0	25	14	0.65	0.53±0.09	2.231

Table 5.2 contd.

Species	Abbr.	S	min – max	L∞	E	P	Pi	B	F.I. ± se	H'
ZOOPLANKTIVORES										1.652±0.218
Trachyrhamphus bicoarctatus	Tb	10	85 - 124	390	0	11	473	3.62	1.49±0.14	0.641
Dascyllus aruanus	Da	10	18 - 32	100	0	14	323	4.10	3.6±0.67	0.851
Neopomacentrus fulginosus	Nf	10	28 - 45	110	0	27	353	7.88	2.64±1.6	1.509
*Apogon fragilis**	Af	131	21 - 43	50	67	25	28	0.80	1.18±0.25	1.81
Pelates quadrilineatus	Pq	10	17 - 25	240	0	19	69	0.97	3.25±1.12	1.909
*Apogon nigripes**	An	80	21 - 52	70	22	30	24	1.01	0.75±0.26	2.143
*Plotosus lineatus**	Pl	61	20 - 68	300	11	22	16	0.26	0.76±0.16	2.387

CHAPTER 6

6.0 THE TROPHIC ORGANIZATION IN THE FISH FAUNAS OF A TROPICAL BAY (GAZI BAY, KENYA).

6.0.1 SUMMARY

The trophic organisation of the ichthyofauna of Gazi bay, Kenya is discussed. Over 330 species of fish were recorded in the bay between 1991 and 1996. The majority (>70%) of these species were marine reef associate species, about 20% were brackish water species, and 9% were euryhaline species. *Eleotris mauritanus* Bennett (Eleotridae) and *Hyppichthys heptagonus* Bleeker (Syngnathidae), which are both stenohaline brackish water species, were also recorded in the bay.

A big percentage (>63%) of the recorded species were carnivorous fish, 20% were omnivorous species, and 4% were herbivorous. The diets of other 45 species were not determined. At species to species level, herbivores had higher density (over all mean catch per standard 10 minutes tow was 21.3 ± 9.51 se) than carnivores (3.9 ± 1.04 se) and omnivores (1.9 ± 0.41 se). On the spatial distribution, herbivores were more important in the *Thalassodendron* (mainly, *Thalassodendron ciliatum* monospecific) seagrass community, carnivores were important in the mangrove-seagrass associated community (outside the *Thalassodendron* beds), and the omnivores were important in the mangrove creek and in the bay towards the reefs.

On the temporal scale, the onset of the long rainy season in May was accompanied with a drop in the total catch, in catch rates densities, and in the number of species in the bay after a peak in April. These values remained higher during the dry season (December-April) and were relatively lower during the wet seasons (May-August). Due to the cummulative numbers over many species, carnivores may appear to be the most prevalent trophic group in the bay, but when considered at numbers of individual per species, herbivores were the dominant group in the *Thalassodendron* community. The higher density of carnivores and omnivores in the seagrass-mangrove associated community was probably a response to the concentration of benthic invertebrates and juvenile and small sized fish in these very shallow waters.

On the basis of the diets taken by the fish, 32% could take pisces, 24% were zooplanktivores, and 45% were benthic feeders. 52% of the total fish species in Gazi bay could take benthic macrofauna in their diets. Few species could rely on algae. Only 61 species could take filamentous algae, 19 could take macro-algae, and only 3 species could take phytoplanton in their diet.

Running Title: Trophic organisation in Gazi bay, Kenya.

Key words: Ichthyofauna, carnivores, omnivores, herbivores, spatial distribution, and temporal patterns.

6.1 INTRODUCTION:

Diets of fish are as diverse as the fish themselves stretching from those that rely on terrestrial production, to those that depend on marine production in the abyssal depths. Characins of the Amazon basin rely on seeds, fruits, flowers, and leaves from the Amazon forests (GOULDING, 1980; 1981; LOWE-MCCONNELL, 1987; GERKING, 1994). Some ambassids e.g., *Ambassis natalensis* Gilchrist & Thompson and *A. productus* Guichenot (SKELTON, 1993), some terapontids e.g., *Terapon jarbua* Forsskal (PAXTON *et al.*, 1989), and some gobies e.g., *Periophthalmus kalolo* Lesson (MURDY, 1989), reportedly relish on terrestrial insects among other prey. Among the labrids, *Cheilinus undulatus* Ruppell takes even toxic fauna in their diets (MYERS, 1991), while *Labroides dimitiatus* (Valenciennes) lives on cleaning ecto-parasites and mucus from other fish (WESTNEAT, 1997). Most fish, however, rely for food on the organisms in the aquatic habitats they occupy. But even among these, the degree of diversity is intriguing. Mullets, for example, sweep detritus from the seabed especially in estuaries from which they derive particulate organic matter and benthic microfauna and flora for their nutrition (WHITFIELD, 1998). Goatfishes (Mullidae) on the other hand, use chemosensory in their barbels to detect preys in the sand and holes in the sediments (LIESKE & MYERS, 1994). A number of fish species rely on the whole range of zoobenthos for nutrition (WHITFIELD, 1998). Others skim the water column for food from the seston.

On the basis of the ingested material, fish species may be grouped in any of the three trophic categories: herbivorous, carnivorous, or omnivorous (for those that take plant and animal diets either in combination or interchangeably). Herbivores rely most on floral material ranging from nannoplankton to algae and macrophytes. They are a rather difficult group to define, as most, if not all, fish take animal prey in their diets at least during some part of their life cycles (GERKING, 1994). In our results (chapter 5), juveniles of herbivorous fish species, namely *Siganus sutor, Leptoscarus vaigiensis, Scarus sordidus, Canthigaster bennetti and C. valentini*, were categorised as omnivores as they had ingested appreciable quantities (about 50%) of assorted benthic and epiphytic invertebrates (i.e., bryozoids, hydrozoids, foraminiferans, gastropods, bivalves, ostracods, harpacticoids, medusae, and sponges). According to HORN (1989) and HORN & OJEDA (1999), herbivory is defined on the basis of the proportion of plant:animal materials taken in the diet. A 50% plant proportion in diets has been proposed (HORN, 1989) and adopted (HORN & OJEDA, 1999) as a basis for categorising a fish species under herbivory.

Within the broad trophic groups, fish species can further be grouped on the basis of their modes of feeding (strategies), selection and combination of different food items (prey types) in their diets, and on the periodicity in feeding. Among the herbivores for example, there are phytoplankton feeders, grazers and browsers. Phytoplanktivores filter water and fine sediments through their gill rakers for phytoplankton. They may also be grouped as filter feeders. Grazers crop benthic, epilithic, and epiphytic algae (sometimes with parts of the substrata on which the algae is growing) and parts of macrophytes, while browsers bite and tear, nip or pick at the algae and/or macrophytes (GERKING, 1994). Other groups based on the feeding strategies include the lie-in-wait predators, e.g., the Moray eels (Muraenidae), the Conger eels (Congridae), some Groupers (Seranidae), Scorpionfishes (Scorpaenidae), Frogfishes (Antennariidae) (also employ the lure strategy), and the Flatfishes (Bothidea); hunters of mobile benthos, e.g. soldierfishes and squirrelfishes (Holocentridae), cardinalfishes (Apogonidae), and snappers (Lutjanidae); scrapers and biters, e.g., some parrotfishes (Scaridae), and the Puffers (Tetraodontidae); probers, e.g., some wrasses (Labridae), and pipefishes and Seahorses (Syngnathidae); stalkers and crushers, e.g., the puffers, some wrasses, filefishes (Monacanthidae) and triggerfishes (Balistidae) (HIATT & STRASBURG, 1960). Groupings based on time of feeding include diurnal feeders, nocturnal feeders, and crepuscular feeders. Diurnal feeders are active during the day, nocturnal feeders at night and crepuscular feeders during the twilight hours.

On the basis of prey selection and combination, fish can be grouped variously as detritivores, benthivores, zooplanktivores, piscivores, and coral pickers, a/o. A fish species does not necessarily belong to one or the other of these groups. The same species can shift between different modes of carnivory, herbivory and/or omnivory depending on the stage of development (ontogenetic), availability of food (temporal), and/or levels of competition (GERKING, 1994). The giant blue damselfish *Microspathodon dorsalis* (Gill) Pomacentridae, was found to be a browser on a new territory and a grazer on the algal turf (MONTGOMERY, 1980). A number of seabreams (Sparidae) shift between carnivory, omnivory and herbivory with age (WHITFIELD, 1998). The Zebra *Diplotus cervinus hottentotus* (Smith) are exclusively carnivorous juveniles (VAN DER ELST, 1988; MANN & BUXTON, 1993) and herbivorous adults (VAN DER ELST, 1988). The Blacktail *Diplotus sargus capensis* (Smith) changes from carnivorous juveniles (CHRISTENSEN, 1978; WHITFIELD, 1985) to omnivorous adults (JOUBERT & HANEKOM, 1980) with a complete modification of the relevant anatomical structures to cope with the change of diet between animal and plant food material (WHITFIELD, 1998). The White steenbras *Lithognathus lithognathus* (Cuvier), the Sand steenbras *Lithognathus mormyrus* (Linnaeus), the White stumpnose *Rhabdosargus globiceps* (Cuvier), the Cape stampnose *R. holubi* (Steindachner), the Natal stumpnose *R. sarba* (Forsskal), the Bigeye stumpnose *R. thorpei* Smith, and the Strepie *Sarpa salpa* (Linnaeus) shift diets between carnivory and omnivory with the juveniles having rather restricted diets than their sub-adults and adults (TALBOT, 1955; BLABER, 1974; 1984; JOUBERT & HANEKOM, 1980; DAY *et al.*, 1981; WOOLDRIDGE & BAILEY, 1982; BUXTON & KOK, 1983; GERKING, 1984; WHITFIELD, 1984; 1985; 1988; SCHLEYER & WALLACE, 1986; VAN DER ELST, 1988; BENNETT, 1993; SCHLACHER & WOOLDRIDGE, 1996).

Ontogenetic and temporal shifts in diets are however not confined to sparids. It is observed across a wide spectrum of fish species and families (GERKING 1994; WHITFIELD, 1998; HORN *et al.*, 1999). ALHEIT & SCHEIBEL (1982) observed it among the haemulids in Bermuda. EDGAR & SHAW (1995) in fact observed that differences in diets between juveniles and adults of the same fish species can be as great as those between same sized fish of different species. A number of fish species have the ability to switch their feeding habits in response to seasonal, diel, and other temporal changes in the availability of food. Fish feeding in tidally inundated biotopes, e.g. mangrove swamps, estuaries, and intertidal reef flats and lagoons, synchronise their foraging activities with the tidal as well as lunar cycles (SAWARA & AZUMA, 1992; DE MARTINI, 1999; GIBSON, 1999; GIBSON & YOSHIYAMA, 1999; HORN & OJEDA, 1999; NORTON & COOK, 1999; PFISTER, 1999; PROCHAZKA *et al.*, 1999; RÖNNBÄCK *et al.*, 1999; ZANDER *et al.*, 1999). This trophic adaptability was probably what DILL (1983) must have inferred in the observation that fish must possess foraging behaviours that are sufficiently plastic to respond to any given food situation.

Yet, there are various levels of specialisation in the diets taken by fish. These specialisation in types of prey, time of feeding, and modes of capture enable the species to maximise nutritional benefits at different levels of competition.

The food or feeding groups discussed above, are in fact what ichthyologists refer to as feeding guilds. In the words of ROOT (1967), a "guild" is a group of species that exploit the same class of environmental resources in a similar manner. In other words, a guild is a specialised group of species towards a given environmental amenity, in this case, food. A feeding guild of fish is therefore a loosely and sometimes subjectively group of fish species thought to utilise a common food resource in a given habitat, hence, it is a functional group. Species living together and sharing the same food resources tend to specialise into species-specific spatial requirements e.g., occupying very restricted feeding areas within the same general habitat. This specialisation at microhabitat scale is the niche specialisation. Because sharing of resources leads to competition, species in a guild may adapt mutualistic feeding behaviours and/or strategies to maximise their benefits with less competition (MCNALLY, 1983). Specialised modes of feeding, differential feeding times, and diversification of the diets are perhaps some of the mutual behaviours and strategies in fish feeding adapted towards this goal. Diversity in diets determine whether a species is a specialist, a generalist, or an opportunist feeder. Specialist feeders have very restricted diets and feed from very restricted microhabitats. Generalist feeders have wide prey spectra and can feed from a wide variety of microhabitats. Opportunist feeders have versatile diets and feeding behaviour. They can take preys that are not in their usual diets, and can also feed from habitats strange to their normal foraging grounds. LARKIN (1956) observed that many fish species have a relatively wide tolerance to habitat types, flexibility in feeding habits, and in general share many resources of their environment with several other species. Most fish are therefore generalist feeders taking advantage of the available resources but not compromising the costs/benefits of the diet (GERKING, 1994). According to DIAMOND (1978), a species may have a greater range of diet or foraging techniques in the absence of competition. Specialist feeders are usually characterised by some remarkable adaptations and their populations will greatly suffer at the lose of their preferred specialised food base.

These, so varied degrees of differences in fish diets, makes it difficult to group fish according to their diets. No single trophic category can fully describe a species or family of fish. The difficulties are even further complicated by the very nature of fish food. The excursion through fish stomachs can be itself horrendous, especially when the food is already at advanced stages of digestion and whether or not the fish chews its food. To surmount these problems, various methods have been proposed and deployed with success in the analysis of fish diets (e.g., BERG, 1979 & HYSLOP, 1980). From the foregoing discussion, placement of a fish in a feeding category, either as a guild or as a trophic level, may depend a lot on the time in the history of the fish, time of day, time of tide and/or the season, and also on the strategy deployed during the study.

Although a lot of literature exist on the food, diets, feeding ecology, and trophic organisations in fish of selected taxa and/or study areas, very few such studies have been undertaken in the Kenya coastal and marine waters. Notably, the works of NZIOKA (1981, 1982 & 1985) were focussed on the reef fishes, the Monocle breams *Scolopsis bimaculatus* Ruppell (Scolopsidae), and the Spotted grunt *Pomadasys opercularis* (Playfair) (Haemulidae).

On Gazi bay alone, the studies of MWAMSOJO (1994) on the Chubby cardinalfish *Sphaeramia orbicularis* (Cuvier) Apogonidae; BEULS (1995) on the Gobiidae *Amoya signatus* (Peter), *Favonigobius reichei* (Bleeker) and *Gnatholepis* sp 1; MARGUILLIER *et al.* (1997) on trophic interlinkages in the bay; DE TROCH *et al.* (1998) on the diets of the abundant pelagic fishes; and this study will form the basis for the orientation of related research in the future. Suffice here to mention that the present study is perhaps the first comprehensive study of the fish communities in the East African coastal waters. To achieve a complete synthesis of the trophic organisation on Gazi bay will require a lot more effort and studies on the different levels of production and consumption. Such work requires long-term integrated data on the food and feeding habits for most of the fishes that constitute the communities in the area (GERKING, 1994).

As already pointed out in the preceding sections of this report on the fish and diets of fish in Gazi bay, the dynamics of the fish communities rely on those of the supporting prey populations. This statement receives overwhelming support from the general observation in GERKING (1994), that, "a large number of fish species have the ability to switch between food and feeding habits in response to temporal changes in the food availability as well as to the "BOOM-and-BUST feeding economy". This is the concept of "Trophic Adaptability". Success of a given species depends a lot on its ability to achieve optimum foraging efficiency and protection cover (SAWARA & AZUMA, 1992). The successes and/or failures in the establishment of a species delimit the extent of its niche, and therefore determines the role of the species in the community at large. Dominant species in an area are therefore those species whose amenities are fully met by the habitat. Rare species, then, are most likely, the stragglers, solitary hunters, or simply displaced individuals. Rarity and/or dominance of species in a given area may also be a result of the deployed sampling techniques. We have previously demonstrated (Chapter 2) that these differences were the source of the differences observed in the species recorded during the various sampling campaigns on Gazi bay. CAO *et al.* (1998) cautions on handling rare species in community studies, especially so, in communities where the rare species constitute the bulk of the species richness in the area.

WHITFIELD (1998) provides a comprehensive and extensive coverage on the ecology and trophic organisations of estuarine fishes in the sub-tropical and temperate estuaries of southern Africa. It is apparent from these works that the trophic organisations in all the reviewed estuaries were parallel, having large numbers of juveniles and carnivorous (including piscivorous) fishes. The juveniles are known to take advantage of the protection and high food production in the estuaries (WHITFIELD, 1994; RÖNNBÄCK *et al.*, 1999), while the carnivores take advantage of these concentration of the juvenile fishes and other macrofauna and benthos on whom they draw their diets (HORN *et al.*, 1999; RÖNNBÄCK *et al.*, 1999). Species diversities in these estuaries were, however, quite varied in relation to latitude, and with the type of the estuary. RÖNNBÄCK *et al.* (1999) adds credence to the role of mangrove swamps as refugia and feeding grounds for both juvenile and adult fishes. Here, young and small sized fish and shrimps concentrate in the shallow rooty waters, especially so in *Rhyzophora* and *Avicennia* stands, to feed and to hide away from predation. The larger sized and adult predators move in and out of the mangrove swamps and their environs with the flooding and ebbing tide to take advantage of these concentrations and emigrating larger juveniles and sub-adults.

MARGUILLIER *et al.* (1997) detected isotopic carbon signals equivalent to those from seagrass in the muscles of the orbiculate cardinalfishes, *Sphaeramia orbicularis* (pisces: Apogonidae) in Gazi bay, Kenya. The species, which was thought to be strictly a mangrove resident, is a crepuscular feeder whose diet is mainly composed of gammarid amphipods, tanaidaceans, and decapods (MEES *et al.*, in press). In MARGUILLIER *et al.* (1997) it was suggested that the species moved out to the near-by grass-beds at the edge of the mangroves to feed, and to retreat back into the mangrove for protection. The species was hardly caught in the day samples collected from the seagrass beds. The crepuscular habit is thought to be an adaptation of the species to avoid visual predators during day and the nocturnal feeders during night.

In this paper, we attempt to synthesise a trophic structure for the ichthyofauna of Gazi bay on the basis of the data so far reported on the abundant fish species in the bay. The objective is to elucidate the trophic organisation in the bay, during the period under review (1991-1996).

6.2 MATERIALS AND METHODS:

Data available on FISHBASE (1998) was used to categorise the fish species recorded from Gazi bay (Chapter 2) in trophic groups: i.e., as herbivores, omnivores, and carnivores. Where there was no appropriate information on the diets taken by a species, it was listed as unknown. The categories were then used with the temporal data and applied to the spatial communities of the epibenthos to delineate the trophic organisation in the bay especially within the epibenthos communities (i.e., the *Thalassodendron* community and the seagrass-mangrove associated community) (Fig. 6.1). The separation of these communities was discussed in chapter 3 and 4 (this document).

The epibenthos data were taken from a time series beam trawl study undertaken in December 1994-September 1996 with the sampling stations shown in Fig. 6.1. Details of the sampling strategies and techniques were already discussed elsewhere.

6.3 RESULTS:

6.3.1 Ichthyofauna:

The full list of fish species recorded from Gazi bay between 1991 and 1996 is presented in column 1 of Table 6.1. The species list is based on the combined results of the intensive and extensive sampling programmes undertaken on the pelagic and demersal icthyofauna of the bay during the referred period. In total, over 330 species and taxa were recorded.

In the second column (Table 6.1), we define the water salinity limits for each species either as a marine, brackish-marine, brackish-freshwater, or euryhaline. It was noted that, the Belly pipefish *Hippichthys heptagonus* Bleeker (Syngnathidae) and the Widehead sleeper *Eleotris mauritanus* Bennett (Eleotridae); which are reported to occur only in freshwater to brackishwater habitats (DAWSON, 1985; HOESE, 1986), were also recorded from Gazi bay. Twenty-nine (29) species (13%) were euryhaline, 65 species (20%) can live in brackish to marine waters, while the majority (234 species being ≥ 70%) were typically stenohaline marine species. Notable among the euryhaline species were *Anguilla bicolor bicolor* (Anguillidae) McClelland, *Chanos chanos* (Chanidae) (Forsskal), *Pellona ditchela* (Clupeidae) Valenciennes, *Ambassis gymnocephalus* (Lacepede), *A. natalensis* Gilchrist & Thompson and *A. productus* Guichenot (all Ambassidae), *Epinephelus malabaricus* (Serranidae) (Schneider); *Lutjanus argentimaculatus* (Forsskal), *L. ehrenbergii* (Peters) and *L. russelli* (Bleeker) (all Lutjanidae), *Liza macrolepis* (Smith), *Mugil cephalus* Linnaeus (both Mugillidae), *Sphyraena barracuda* (Walbaum) and *S. jello* Cuvier (both Sphyraenidae). Majority of the species

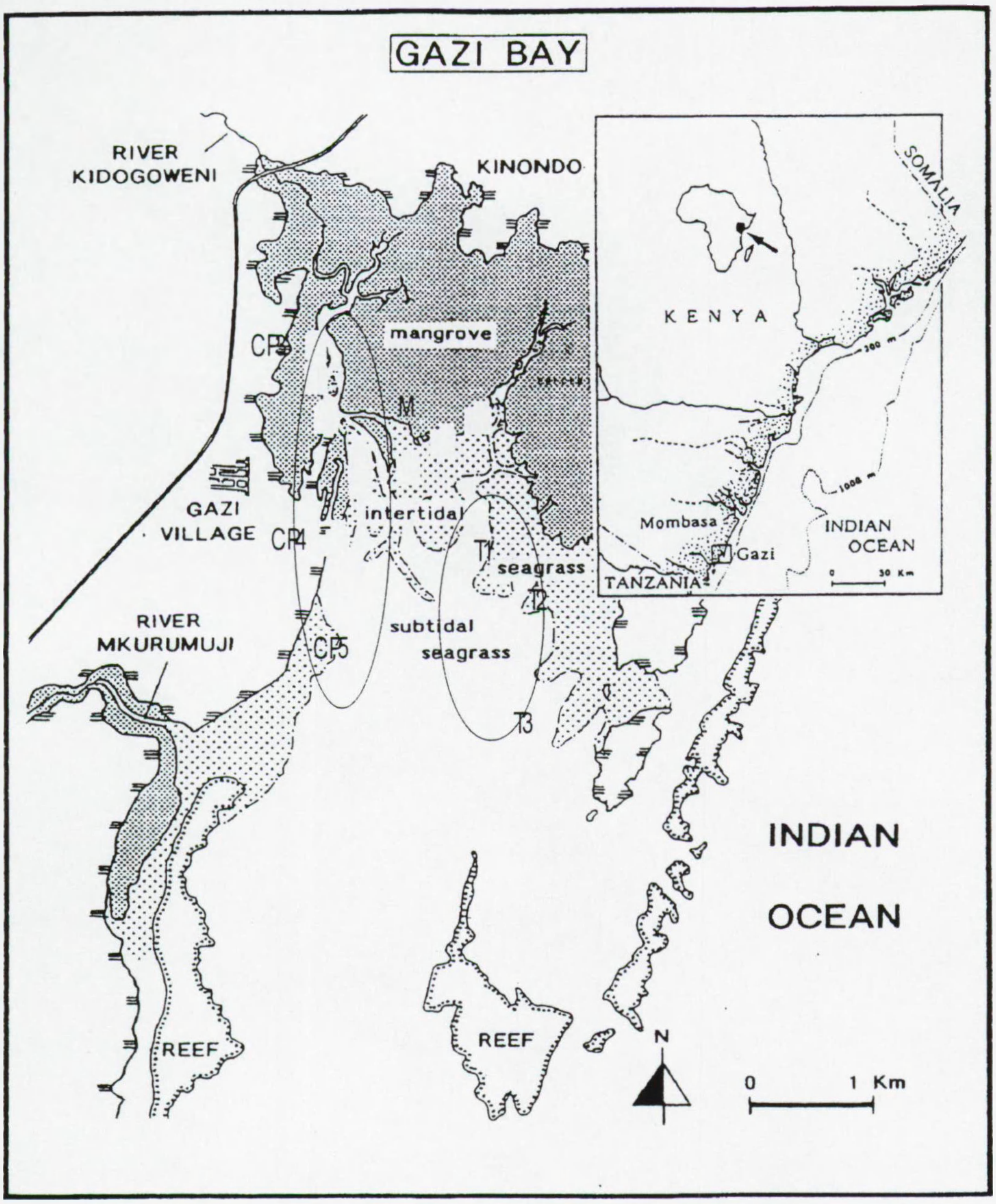


Figure 6.1: Map of Gazi bay, Kenya showing the position, physical features, and the study sites (cp3, M, T1, T2, T3, cp4, & cp5) sampled during the 22 months (December 1994 – September 1996) intensive beam trawl survey of the epibenthos. The spatial communities i.e., *Thalassodendron* community (T1, T2, & T3) and mangrove-seagrass associated community (cp3, M, cp4, & cp5) of the epibenthos (see elsewhere in this document for details) are delineated.

do not have known migratory trends. However, *Gerres filamentosus* Cuvier (Gerreidae) *Eleotris fusca* (Schneider) and *E. melanosoma* Bleeker (both Eleotridae), are amphidromous. *Pellona ditchella* (Clupeidae) is anadromous as opposed to *Anguilla bicolor bicolor*

(Anguillidae), *Chanos chanos* (Chanidea), *Terapon jarbua* (Terapontidae), and *Mugil cephalus* (Mugillidae) which are catadromous. On the other hand, *Stolephorus indicus* (Engraulidae), *Ablennes hians* and *Tylosurus crocodilus crocodilus* (Belonidae), *Scarus sordidus* (Scaridae), and *Rastrelliger kanagurta* (Scombridae) are oceanodromous.

Column 3 in the Table 6.1, provides information on the habitats with which the species are commonly associated: i.e., on or near the reefs, in the lagoons, on tidal flats, in the seagrass beds, in mangrove areas, on the seabed, or/and in the water column. Note that the majority (≥ 65%) of the fish species recorded in Gazi bay were reef associated marine fishes.

In column 4, (Table 6.1) we have categorised the species according to their diets in three trophic groups, either as herbivores, omnivores, or carnivores. The diets taken by the species were also listed under very broad groups. 63.4% (210 species) of the recorded species were carnivorous, 18.4% (61 species) were omnivorous, and 4.2% (14 species) were herbivorous. The diets of 45 species were not determined. In this list we have grouped the two scarids (*Leptoscarus vaigiensis* and *Scarus sordidus*), and the siganid (*Siganus sutor*) among omnivores on the basis of the results we obtained from stomach analysis. It should be pointed out that our specimens were all juveniles and had taken in large proportions of animal preys in their diets. We have, however, discussed these three species under herbivory in the rest of this article.

On the basis of the prey items, 107 species (32.3%) in Gazi bay could take pisces in their diets, 171 species (51.7%) could take in macrofauna alongside other food items in their diets, 148 species (about 45%) were benthic feeders (i.e., on meiobethos, epibenthos and hyperbenthos). Eighty-one (81) species (24.5%) were zooplankton and nekton feeders. Only 5 species were insectivorous, i.e., *Ambassis natalensis* Gilchrist & Thompson, *A. productus* (Guichenot) (both Ambassidae), *Terapon jarbua* (Forsskal) (Terapontidae), *Monodactylus falciformis* Lacépède (Monodactylidae), and *Periophthalmus koelreuteri africanus* Eggert (Gobiidae). Two species known to take ecto-parasites from other fish, i.e., *Heniochus acuminatus* (Linnaeus) Chaetodontidae and *Labroides dimidiatus* (Valenciennes) Labridae were also recorded in Gazi bay. A total of 61 species can take filamentous algae in their diets, 19 species can take macroalgae (some e.g., the Scribbled filefish *Aluterus scriptus* (Osbeck) Monacanthidae could also eat seagrass), and only 3 species could take phytoplankton. These Phytoplanktivores included the Gold stripe sardine *Sardinella gibbosa* (Bleeker), the blue sprat *Spratelloides delicatulus* (Bennett), and the Japanese anchovy *Engraulis japonicus* Schlegel. Thirteen species, among them, several chaetodontids, some scarids, and tetraodontids could also ingest coral heads. All diodontids and some labrids specialise in hard-shelled invertebrates (e.g., molluscs, and echinoderms) for food.

6.3.2 Temporal patterns in the epibenthos:

In Table 6.2, we present the catch data of an intensive beam trawl survey on the epibenthos of Gazi bay carried out in December 1994-September 1996. The mean catch rate for the whole bay during the period, ranged between 8.1±1.7 individuals per standard 10 minutes tow (n = 14 tows every month) in may 1996 and 210.9±82.5 individuals per standard 10 minutes tow (n = 14 tows) in April 1995. There was always a peak in the catch in April and a drop in May. This was the case even during the second year of sampling when the catches were generally lower than the first year. Note also that the species richness (numbers of species) dropped in May. The lowest number of species (25) was recorded in January 1996, while the highest (85) was in April 1995 when the highest catch (2952 animals) was also realised.

In Table 6.3, the catch data is summarised by the trophic groups. In total, 161 species and taxa were collected. Carnivores were represented in 100 species and taxa (62% of the species), omnivores by 35 species and taxa (22%), and herbivore by 11 species (7%). In terms of numbers caught carnivores made up to 54.7% of the mean catch rate and were caught at the rate of 3.92±1.04 individuals per standard 10 minutes tow for the entire bay. The same values for the herbivores and omnivores were 32.7%, 21.33±9.51; and 9.2%, 1.90±0.41, respectively. The spatial distribution of these catches in the bay is presented in Table 6.3. Note that at species level, herbivores were a more important trophic group on the bay than the numerous carnivorous species, with the omnivores pulling the trail. Carnivores constituted higher proportion of the fauna especially outside the *Thalassodendron* seagrass beds (i.e. at stations cp3, cp5 and m) (Table 6.3). Herbivores were more concentrated in the *Thalassodendron* beds (stations T1, T2, & T3) while the omnivores were more concentrated in the west creek (at cp3) and towards the reefs (at T3).

Considering the catch rates for the whole bay, the most important species, having contributed each >5% of the catch rates, were *Leptoscarus vaigiensis, Plotosus lineatus, Scarus sordidus, Siganus sutor, Fowleria aurita, Apogon nigripes*, and *A. fragilis* in the decreasing order of importance. At community level, *L. vaigiensis, P. lineatus, A. fragilis, S. sordidus*, and *F. aurita* were the most dominant species in the catch from the *Thalassodendron* community. The sea urchin *Tripneustes gratilla* was also important in this community having made about 6% of the combined catch rates. In the same order of importance, *L. vaigiensis, S. sutor, A. nigripes, Lethrinus harak, L. nebulosus, F. aurita, S. sordidus, Parascorpaena mossambica* were dominant in the seagrass-mangrove-associated community. Jellyfish were also recorded in large numbers from this community (5% of the combined catch rate). It is notable that in all treatments, a herbivorous species was always the most dominant in the catch proportions.

In Fig.4.7 (chapter 4) is the temporal and spatial representation of the 14 species and taxa that dominated in the catch. Note that none of the fish species were omnivorous, 3 were herbivores and 9 were carnivores. It was also very apparent that even at the dominance levels, herbivory was more prominent at species level. Among the herbivores, *Leptoscarus vaigiensis* was caught throughout the year with a peak in April, August, and November–January. *Scarus sordidus* was caught with a peak in February and March; *Siganus sutor* had a peak in April, September and November; while *Tripneustes gratilla* (Echinodermata) peaked in January–February, May–June, and in October. The other sea urchin, *Diadema sp.*, was also common in the bay. As for the carnivorous species, *Lethrinus harak* was abundant in January–April; *L. nebulosus* in November–March; *Cheilio inermis* in August–March; *Parascorpaena mossambica* in November–April; *Apogon fragilis* was abundant throughout the year with a peak in April; *A. nigripes* was abundant in April–June and in November–December; *Fowleria aurita* was also abundant throughout the year but peaked in March, August and in November; *Halichoeres iridis* was only in January–March; while *Plotosus lineatus* was abundant in January, April and in August.

Figures 6.2-6.4 depict the temporal patterns of the trophic groups. In each case, the entire catch data was treated as a whole in (a) and by the spatial communities in (b) and in (c). Carnivorous species were predominant (Fig 6.2). They were most numerous as a group, with the highest density (Fig. 6.3) followed by the omnivores with herbivores keeping to the lowest in all the three treatments. At the species levels, however, herbivores predominate in density in the combined all stations (Fig. 6.4a) and in the *Thalassodendron* community (Fig. 6.4b). Omnivores and carnivores were still dominants in the seagrass-mangrove-associated community even at the species level (Fig. 6.4c).

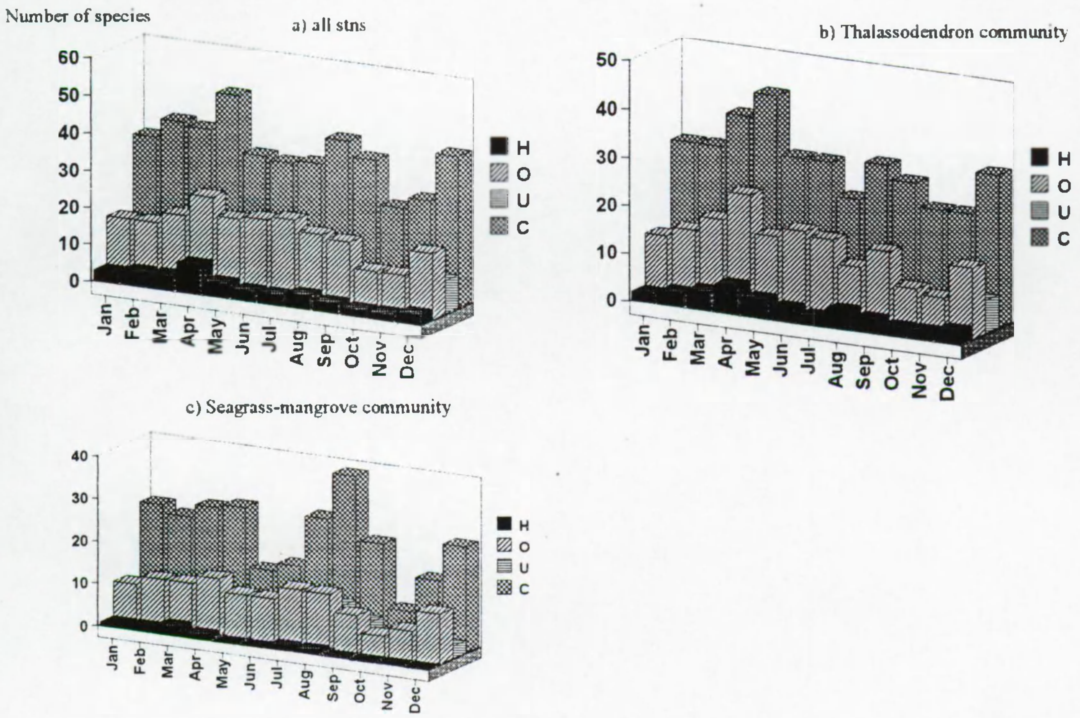


Figure 6.2: Distribution of the recorded fish species (by numbers) in trophic groups: a) for the whole bay's combined catch; b) for the *Thalassodendron* community and c) for the Mangrove-seagrass associated community. C = carnivores, O = omnivores, H = herbivores, and U = unknown diet.

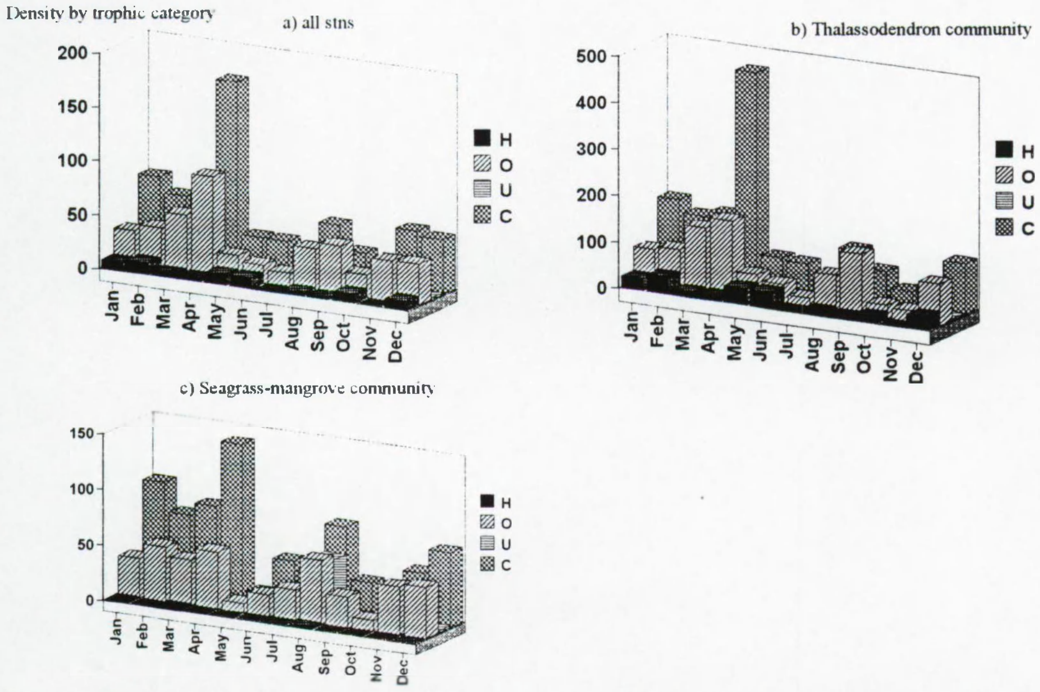
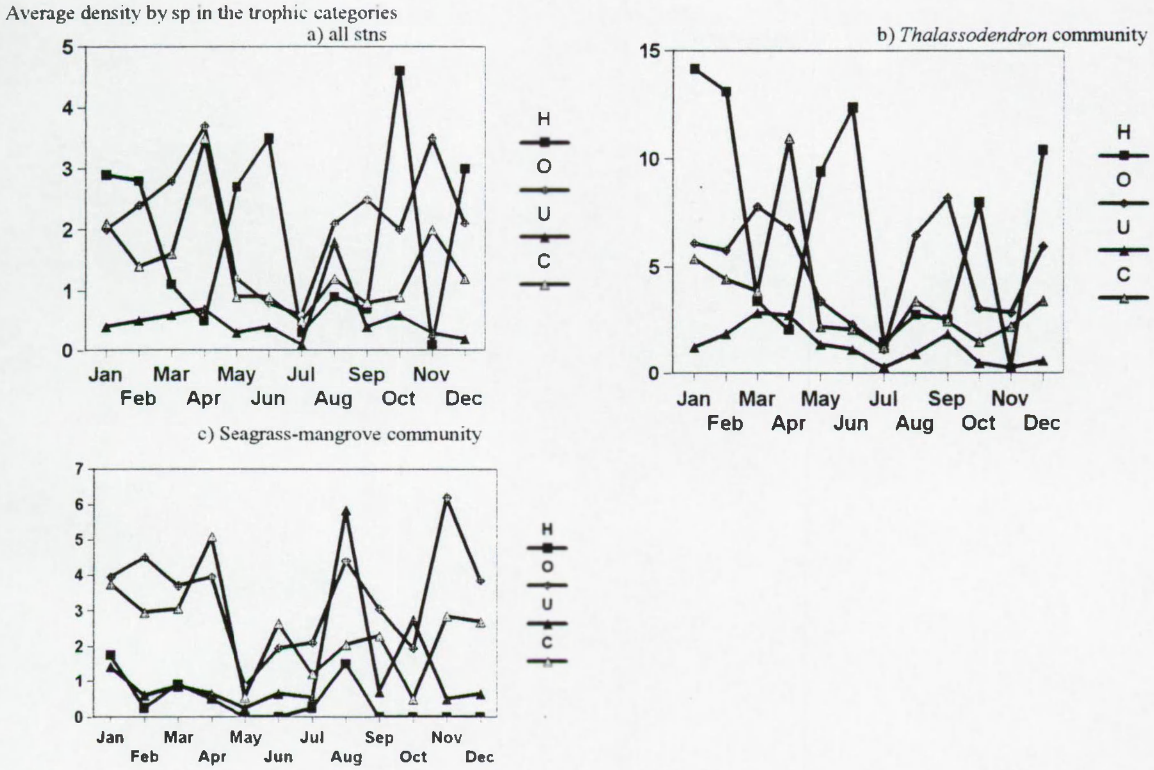


Figure 6.3: Distribution by trophic groups (carnivores, omnivores, and herbivores); of the catch rates (i.e., numbers caught per standard 10 minutes tow): a) for the whole bay combined, b) for the *Thalassodendron* community, and c) for the Mangrove-seagrass associated community stations.


Average density by sp in the trophic categories

a) all stns

b) *Thalassodendron* community

c) Seagrass-mangrove community

Figure 6.4: Distribution by trophic groups (C = carnivores, O = omnivores, and H = herbivores) of the catch rates within the group at species level (average catch per species in the group per standard 10 minutes tow) for a) the whole bay combined, b) the *Thalassodendron* community, and c) the mangrove-seagrass associated community.

There was an apparent seasonal pattern in the herbivores, whereby there was a general decrease of herbivores in March–April, in July–September, and in November especially in the *Thalassodendron* community (Fig. 6.4a &b). This density was very low throughout the year in the seagrass-mangrove-associated community with small peaks in January, March and in August (Fig 6.4c). The density of carnivores and omnivores peaked in April, September, and in November in all the three data treatments (i.e., all stations pooled data in Fig. 6.4a, the *Thalassodendron* community in Fig. 6.4b, and the seagrass-mangrove associated community data in Fig. 6.4c). The omnivores were prominent most of the year in the seagrass-mangrove-associated community. A large catch of *Plotosus lineatus* contributed to the observed dominance of carnivores in April.

6.4 DISCUSSION:

The 12 dominant fish species collected in the beam trawls; namely, *Apogon fragilis*, *A. nigripes*, and *Fowleria aurita* (Apogonidae), *Cheilio inermis* and *Halichoeres iridis* (Labridae), *Lethrinus harak* and *L. nebulosus* (Lethrinidae), *Plotosus lineatus* (Plotosidae), *Leptoscarus vaigiensis* and *Scarus sordidus* (Scaridae), *Parascorpaena mossambica* (Scorpaenidae), and *Siganus sutor* (Siganidae); were most likely the core of residents, while the majority of the rest were transient species in the bay.

To understand the temporal patterns in the trophic composition of fish in Gazi bay, we need to look at the hydrographic changes associated with the seasonal rainfall and the monsoons in the region. The salinity in the bay drops in May from 35-38ppt to 0-30ppt at the start of the long rainy season (KITHEKA, 1996; OHOWA *et al.*, 1997). However, due to the strong Southeast monsoon winds and the combined effects of the strong South Equatorial Current and the East African Coastal Current (JOHNSON *et al.*, 1982; RICHMOND, 1997; WAKWABI & NGULI, unpublished data), the depression in salinity does not last the entire long rainy season. Also, during the Northeast monsoon season, the stonger reversed Somali Current meets with the East African Coastal Current just north of Kenya (JOHNSON *et al.*, 1982; RICHMOND, 1997; WAKWABI & NGULI, unpublished data). This confluence causes a pile up of marine waters on the East African coast forcing a localised upwelling at the confluence and the westerly Equatorial Counter Current (RICHMOND, 1997). These processes influence the water quality in the coastal embayments along the East African shores, especially in terms of production and salinity distribution. Gazi bay is only separated from the open sea by the reef. Its hydrography is therefore greatly influenced by the oceanographic processes in the adjacent seawaters. According to KITHEKA (1996), the tides, onshore winds, and seasonal river run-off are the main forcing on the bay. These processes are therefore, responsible for importing nekton and production into the bay. OSORE (1994) observed a peak in zooplankton densities and biomass in Gazi bay to occur in March, May and November. Among the meroplankton, a peak in fish eggs was observed in March, May, and July (OSORE, *op. citi*). It is possible that the bulk of this is washed into the bay by the combined effects of the onshore winds, the South Equatorial Current, and the tidal currents. The local upwelling during the Northeast Monsoon season brings to surface nutrient rich waters responsible for the high productivity.

The sharp drop in total catch, catch rates and the species richness in the bay during the month of May, was most likely due to the drop in salinity. Note that most of the species were caught in very low numbers. This suggesting that the species were probably only visiting foragers in the bay, most of them from the coral reefs in the vicinity.

We have previously observed that fish communities are organised against the existing spatial structures and modified by the temporal changes in the habitats. Food and space are the two most important structures that determine the conjunctural composition of fish communities. Separate studies on the meiobenthos (SCHRIJVERS *et al.*, 1995a), hyperbenthos (DEGRAER, 1993), epibenthos (SCHRIJVERS *et al.*, 1995b;), epiphytic faunas (DEGRAER, 1993, DE TROCH *et al.*, in press), necton (OSORE, 1994), phytal (DESOUZA, 1988; COPPEJANS & GALLINI, 1989; COPPEJANS *et al.*, 1992) and fish (VAN DER VELDE *et al.*, 1994; DE TROCH *et al.*, 1996; KIMANI *et al.*, 1996; WAKWABI & MEES, this report) on Gazi bay, reported a highly diversified and seasonal productivity. For example, in the seagrass beds within the main bay lagoon, the diversity of microhabitats offered by the leaves, stems, and roots of the homogeneously distributed, monospecific *Thalassodendron ciliatum* (COPPEJANS *et al.*, 1992) predetermined the diversity of the epifauna associated with these microhabitats (DEGRAER, 1993; DE TROCH *et al.*; in press).

The above observations corroborate those reported from other studies undertaken elsewhere (e.g., STONER, 1980; LIVINGSTONE, 1982; BELL *et al.*, 1987; CONNOLLY, 1994). The stalky nature of the grasses also provide refugia for juvenile fishes (CONNOLLY, 1994; TUPPER & BOUTILIER, 1997) as do the pneumatophore and prop roots in mangrove areas (LEY *et al.*, 1999; RÖNNBÄCK *et al.*, 1999). There was a very large proportion of carnivorous fish species in the bay. Their number per species was however, always lower compared to the herbivores. This high proportion of herbivores at the individual level suggests that the herbivores were the predominant trophic group in the bay. Most of the young carnivorous and omnivorous fish move into the shallow shore waters to avoid predation and to take advantage of the other juveniles and invertebrates in these very shallow areas (LASIAK, 1986; LASIAK & MCLACHLAN, 1987; HARRIS & CYRUS, 1996; LAEGDSGAARD & JOHNSON, 1995; TUPPER & BOUTILIER, 1997; RÖNNBÄCK *et al.*, 1999; ZANDER *et al.*, 1999). Hence, the observed preponderance of carnivores and omnivores in the seagrass-mangrove associated community, was probably for this same purposes.

The role of Gazi bay as a nursery and foraging ground for different fish species is therefore very apparent. The observed inverted trophic structure in terms of the numbers of species and total catch in Gazi bay, may be testimony that the bulk of the production on the bay is utilised by non-resident carnivorous species.

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ANNEXES

ANNEX 1

THE EPIBENTHOS IN THE BACKWATERS OF A TROPICAL MANGROVE CREEK (TUDOR CREEK, MOMBASA, KENYA).

Enock O. Wakwabi[1] & Jan Mees[2]

1. Kenya Marine & Fisheries Research Institute, P.O. Box 81651, Mombasa, Kenya.

2. Marine Biology Section, Zoology Institute, University of Gent, K. L. Ledeganckstraat 35, B-9000 GENT, Belgium.

ABSTRACT

The epibenthos of the backwaters of Tudor creek (Mombasa, Kenya), a mangrove-bordered seasonal estuary, was sampled fortnightly with a beam trawl from May 1995 to April 1996. A total of 6396 specimens was collected in 96 tows. Almost 63% of these specimens belonged to 72 species of teleost fish (in 37 families). Penaeid (4 species) and caridean shrimp constituted 27% and 8% of the total catch respectively, while stomatopods and squids were quite rare. At family level, Penaeidae contributed most to the total catch. Gobiidae (15%), Lutjanidae (9%), Plotosidae (9%), Acropomatidae (6%), Gerreidae (5%), and Synodontidae (4%) were the most important fish families. Gobiidae was the most diverse family with 8 species, followed by Apogonidae and Lutjanidae with 5 species each, and Penaeidae with 4 species. *Yongeichthys nebulosus* (Gobiidae), *Penaeus monodon, P. semisulcatus* and *Metapenaeus monoceros* (Penaeidae), *Plotosus lineatus* (Plotosidae), *Lutjanus fulviflamma* (Lutjanidae), *Acropoma japonicum* (Acropomatidae), *Gerres oyena* (Gerreidae), and *Saurida undosquamis* (Synodontidae) were the dominant species (each contributed for more than 4% to the total catch).

A TWINSPAN of the catch data identified three monsoon driven communities. *Penaeus monodon, Lutjanus fulviflamma* and *Gerres oyena* were the dominant species in the dry period (January to April), while *P. semisulcatus* and Caridea dominated the community in the long rainy season (May to August), and *Acropoma japonicum* and *Plotosus lineatus* were important during the short rains (September to December). *Metapenaeus monoceros* was abundant in all seasons and *Yongeichthys nebulosus* reached high densities in both short rains and dry seasons. The short rains community

had the highest numbers of species and densities, while those of the long rainy season were lowest. The three communities had very strong dominance of only a few species, conforming to the general observation that tropical estuarine or coastal ecosystems tend to be very diverse but with very low densities for the majority of species. The restricted size ranges for all individuals caught during this study may be due to two processes: selectivity of the gear and/or dynamic replacement of the populations through seasonal recruitment and fast size progression. All individuals collected during this study were juveniles. This fact and the observed monthly size distributions suggest that most species utilise the area as a nursery.

INTRODUCTION

Tudor creek is located to the Northwest of Mombasa Island, Kenya (4°S, 40°E). It extends some 10km inland, has a surface area of approximately 20km^2 at mean sea level and comprises shallow channels, mudbanks and mangrove forests (WAKWABI & JACCARINI, 1993). The seasonal pattern of the equatorial currents (the South Equatorial Current and the Equatorial counter Current) across the western Indian Ocean, and the reversing longshore East African Coastal Current together with the monsoon winds (Northeast monsoons in November to March and the Southeast monsoons in April to October), influence the magnitude and velocity of the tidal currents in Tudor creek (NORCONSULT, 1975) and the rainfall seasonality in the region. This influence predetermines the tidal flux, and productivity on Tudor creek (WAKWABI & JACCARINI, 1993). The creek (Fig. 1) can be devided into three sections: a marine mouth area, the middle creek area, and the upper hinterland end. The mouth area is a deep (ca 30m) river-like channel with extensive rocky substrata and unvegetated sandy sediments and banks, receiving direct marine influence through tidal fluxing. The upper end is shallow (generally <1m) and split into different channels, some ending into river mouths. Three seasonal rivers (Kombeni, Tsatu and Mtsapuni) flow into the creek. This upstream area is bordered with a dense mangrove forest (mostly *Rhyzophora mucronata* Lamk., and *Avicenia marina* (Forsk) Vierh.) on extensive silty mudbanks and mudflats. The surface water salinity and temperature here vary seasonally, diurnally and tidally; and the area supports brackish to freshwater species. In the middle area, the creek is not split into different channels. It is on average 1-2km wide but shallow (<5m) except for the deep (>20m) mid channel. Tidal influence is greatly reduced, and salinity (34-36psu), surface water temperature (24-32°C), dissolved oxygen concentration (78-84% saturation) and turbidity (1.5-2.5m secchi disc depth) are quite different from the respective parameters at the mouth area (i.e., 35psu, 25-29°C, 92-95% and 3-6m, respectively) (LITTLE *et al.* 1988, WAKWABI & JACCARINI, 1993). This study focuses on the middle area of the creek, more specifically on two shallow channels with soft silty substrates that are bordered with dense mangrove forests. Its selection was based on earlier observations on the distribution of freshly settled penaeid postlarvae and juveniles: this area was found to be an important nursery area for several species of penaeids and probably for teleost fish (WAKWABI, 1996).

Research findings have consistently pointed to the important role shallow areas and estuaries play in the early life histories of different marine and brackish water organisms (e.g., LAEGDSGAARD & JOHNSON, 1995; POLLARD & HANNAN, 1994; WILLIAMSON *et al.*, 1994; AND BLABER *et al.*, 1992 on the Australian mangrove associated systems; SCHMITTER-SOTTO & GAMBOA-PEREZ, 1995 on the Yucatan peninsular, Mexico; HUSSAIN & SAMAD, 1995 and FOUDA & AL-MUHARRAMI, 1995 on the Arabian sea coasts of Pakistan and Oman; and SEDBERRY & CARTER, 1993 on the tropical lagoons in Belize, Central America; are but few explicit references to the nursery role of mangrove lined coastal ecosystems). GILLANDERS (1997), WHITFIELD (1997), HARRIS & CYRUS (1996), CYRUS & FORBES (1996), KNEIB & KNOWLTON (1995), HERKE (1995), and WHITFIELD & KOK (1992) are valuable accounts on the importance of estuaries as nursery grounds. Recently, MARGUILLIER *et al.* (1997), DE TROCH *et al.* (1996) and KIMANI *et al.* (1996) have reported on the trophic relationships, and the fish communities on Gazi Bay, Kenya and seem to agree on high diversity and suggest the importance of the mangrove-seagrass beds-coral reef interlinkage to juveniles of marine fishes on the bay. The only study on the fish fauna of Tudor creek is a beach seine and plankton survey reported in LITTLE *et al.* (1988). WAKWABI (1988) and WAKWABI & JACCARINI (1993) focused on the penaeids. Early postlarval and juvenile fish were observed to migrate into the creek. The species composition differed significantly between the mouth area and inner reaches of the creek, but no clear temporal variation in the community structure was observed. Like many other studies in estuarine areas (QUINN, 1980), the fish community of Tudor creek was found to be very diverse but with very few dominant species. The creek was found to be an important nursery and feeding ground for the often commercially important teleost fishes (especially carangids, clupeids, haemulids, lethrinids, lutjanids and siganids) (LITTLE *et al.*, 1988) and penaeids (WAKWABI, 1988; WAKWABI & JACCARINI 1993).

The objectives of this study were (1) to describe the structural characteristics (species composition, density, diversity, size composition) of the epibenthic community (i.e. demersal fish and invertebrates) of the shallow, mangrove-bordered areas in the middle reaches of the creek and (2) to investigate seasonal variation in these communities.

MATERIALS AND METHODS

A 1.5m beam trawl with a 2mm meshed inner bag was towed on foot by wading through shallow shore waters of 0.5-1m depth in two adjacent tidal channels (Figure 1). Samples were always taken during daytime from 2 hours before to 2 hours after low water spring tide between May 1995 and April 1996. Two replicate tows were made in each channel making a total of four tows on each sampling date and a total of eight tows for each month, excepting June 1995, August 1995 and February 1996 when only one spring tide was sampled. On each occasion the net was towed for about 20m, sweeping a surface area of approximately 30m^2.

In the field, all animals caught in the net were sorted out of the debris and preserved in a 8% formaldehyde-seawater solution for storage. In the laboratory, the animals were later sorted, identified, counted and measured to the nearest 1mm. All fish and penaeids were identified to species level using the keys provided by MOTOH (1981), SMITH & HEEMSTRA (1986), FISCHER & BIANCHI (1984) and BIANCHI (1985). All other invertebrate groups, together accounting for less than 10% of the total catch, were only identified to higher taxonomic levels: Stomatopoda, Cephalopoda and Caridea were recorded as such. Standard body length was measured for all fishes (distance from the tip of the snout to the base of the tail), except for representatives of the Plotosidae (total length). Total lengths were taken for all crustacea (stomatopods, penaeid and caridean shrimp): distance from the tip of the rostrum to the end of the telson). For squids, the total body length was measured excluding the arms.

Prior to multivariate analyses, the data of each sampling date were pooled (4 samples: 2 stations and 2 trawls per station) and fourth-root transformed. Rare species, i.e. species constituting less than 0.5% of the total catch of any one sample, were eliminated from the data matrix. These reduced pooled catch data were then subjected to TWINSPAN (Two Way Indicator Species Analysis, a divisive classification technique) and a correspondence analysis (an indirect ordination technique). After the identification of seasonally defined communities, these were characterised by their average density and diversity. Diversity was calculated as Hill's diversity numbers of the order 0 and 1 (HILL, 1973): N_0 is the number of species in a sample; N_1 is equivalent to the Shannon-Weaver diversity index:

$$N_1 = exp\ (H')$$

$$H' = \sum_{i=1}^{n} p_i \log(p_i)$$

and

$$p_i = N_i/N_t = \textit{the relative abundance of the } i^{th} \textit{ species;}$$

RESULTS

Species composition

For a complete species list and the total numbers of individuals caught for each species or taxon per sampling date we refer to Appendix 1. The data reported in this study are summarised and compared with those reported by LITTLE *et al.* (1988). From a total of ninety six tows, 6396 specimens were collected, belonging to 79 species or higher taxa. 4023 (62.9%) of the specimens belonged to 72 species of teleost fish (in 37 families). Penaeids (4 species) and caridean shrimp constituted 27.45% and 8.02% of the total catch respectively, while stomatopods and cephalopods were quite rare (0.36% and 1.27% respectively). At the family level, Penaeidae contributed most to the total catch. Gobiidae (15.35%), Lutjanidae (8.65%), Plotosidae (8.61%), Acropomatidae (6.24%), Gerreidae (5.00%), and Synodontidae (4.32%) were the most important fish families. Gobiidae was the most diverse family with 8 species, followed by Apogonidae and Lutjanidae with 5 species each, and Penaeidae with 4 species. *Yongeichthys nebulosus* (Gobiidae), *Penaeus monodon*, *P. semisulcatus* and *Metapenaeus monoceros* (Penaeidae), *Plotosus lineatus* (Plotosidae), *Lutjanus fulviflamma* (Lutjanidae), *Acropoma japonicum* (Acropomatidae), *Gerres oyena* (Gerreidae), and *Saurida undosquamis* (Synodontidae) were the dominant species (each contributed for more than 4% to the total catch).

Seasonality

The catch in number of individuals and species was generally quite variable. On a monthly basis (Appendix 1), the highest number of species (41) was recorded in November and the lowest (14) in June. The rest of the months had an intermediate number of species, varying between 18 and 35. In the short rainy season (September through December) the mean number (±SE of the mean, N=4 months) of species (34.25±2.29) was high as compared to the dry season (January through April: 29.25±2.95) and the long rainy season (May through August: 22.0±3.56). Mean monthly density (catch in numbers per $30m^2$ ±SE of the mean, N=8 tows) was lowest (15.75±8.02) in August and highest (123.63±42.19) in February (Table 1). The short rainy season again had a higher mean density (652.25±103.6) compared to the long rainy season (394.25±128.7) and the dry season (598.5±157.0) based on the pooled monthly totals (N=4 months).

Size composition

The minimum and maximum sizes recorded for the most abundant and characteristic species recorded in this study are presented together with their adult size in Table 2. It is apparent that all landed individuals were juveniles. All individuals caught in this study fall within restricted size ranges which may reflect on the selectivity of the gear. This limited size range may also suggest an apparent restriction of the life stages of the species in these backwaters pointing more to a transitional population as opposed to a residential one. Note that even the gobies and blennies, which should have larger size ranges in this area, display the same limited size range. Since this study did not undertake selectivity assessment of the used gear, it may not be easy to fully explain the observed size ranges. The transition pattern may however strongly suggest the role of these backwaters as nursery grounds, especially for the penaeids and for most commercially important fish species.

Multivariate analyses

Three distinct epifauna communities, clearly corresponding to the “short rains-dry-long rains” seasonal pattern, emerged from the TWINSPAN (Figure 2) and correspondence analysis (Figure 3a&b). In the first TWINSPAN division, all long rain samples are split off from the rest, with *Metapenaeus monoceros, Caridea, Penaeus semisulcatus* and *Lutjanus fulviflamma* as indicator species. In a second division, the dry season samples are separated from the short rains samples. *P. monodon, P. indicus* and *L. fulviflamma* are indicator species for dry season. The three communities are characterised in Figures 3 and 4. The dry season (January-April) community was characterised by high densities of *Penaeus monodon, Lutjanus fulviflamma* and *Gerres oyena*. The long rains (May-August) community was dominated by *Penaeus semisulcatus* and Caridea, while the short rains (September-December) community was dominated by *Acropoma japonicum* and *Plotosus lineatus*. *Metapenaeus monoceros* was abundant in all seasons and *Yongeichthys nebulosus* reached high densities in both short rains and dry seasons. The short rains community had the highest number of species (N_0) and density, but the diversity index (N_1) was very low for all the seasons (Table 3). The three communities are therefore based on the seasonal occupancy of a few species which recruit in this area only during a limited period of stay determined by the changing seasonal environment on the creek.

DISCUSSION

The recorded numbers of 72 fish species in 37 teleost families are comparable to those recorded by LITTLE *et al.* (1988) (83 species in 38 families). Five teleost families (Acropomatidae, Monodactylidae, Percorphidae, Serranidae, and Dactylopteridae) caught in this study were, however, not reported by LITTLE *et al.* (1988). This difference is carried further at the species level: only 24 species are shared between the two studies. These differences can be attributed to differences in sampling strategy and gear: we sampled 2 muddy, intertidal channels with a beam trawl net, while LITTLE *et al.* (1988) used a beach seine over sandy substrata.

Leaving out the invertebrate component, it is evident that the fish community of Tudor creek is a typical, tropical shallow-water community where few species constitute the bulk of the catch (>70%) despite a large number of species (QUINN, 1980). Indeed, six fish species (*Yongeichthys nebulosus, Plotosus lineatus, Lutjanus fulviflamma, Acropoma japonicum, Gerres oyena,* and *Saurida undosquamis*) together constituted 70.35% of the total fish catch. Most of the reported species (85%) each constituted less than 1% of the total catch.

The multivariate statistical techniques employed on the catch data for the beam trawl study in the backwaters of Tudor creek identified three communities of the epibenthos tied to the rain pattern. The short rainy season had more species while the long rainy season had the least diversity. In terms of numbers, the three communities had very strong dominance of few species conforming to the general observation that tropical estuarine or coastal ecosystems tend to be very diverse but with very low densities for the majority of species (QUINN, 1980). The restricted size ranges for all individuals caught during this study may be largely due to two processes: selectivity of the gear and/or dynamic replacement of the populations through seasonal recruitment, fast size progression and emigration. Only juvenile stages of most (in fact all) species were caught. The different species probably occupy these waters for a very limited period to feed and/or to escape from predation. For the penaeid component of the epibenthos, the backwaters are an important nursery for their newly settling postlarvae and juvenile stages (WAKWABI, 1988; 1996; WAKWABI & JACCARINI, 1993). Most abundant juvenile fishes are second and third order consumer species (LITTLE *et al*, 1988), confirming the feeding and protection roles of this area. Though the emerging community structure is based on the rainfall pattern, rains *per se* are not necessarily the causative factor. They probably determine the resultant food and protective conditions in these waters, which are parhaps the most important and overriding requirements of the juvenile stages of the fish and crustacean populations encountered here.

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Table 1: Monthly catch rates (numbers/standard tow = 30m^2) of the beam trawl on Tudor creek in May 1995 through April 1996 (means estimated on eight tows per month).

Month	Total catch	Catch/30m^2 (±se)
May 95	628	78.50 (17.38)
June 95	135	16.88 (8.40)
July 95	508	63.50 (21.54)
Augast 95	126	15.75 (8.02)
September 95	540	67.50 (20.21)
October 95	955	119.38 (36.41)
November 95	614	76.75 (31.25)
December 95	500	62.50 (17.71)
January 96	620	77.50 (17.99)
February 96	989	123.63 (42.19)
March 96	563	70.38 (19.40)
April 96	222	27.75 (12.77)

Table 2: The minimal (min), maximal (max), modal (M) and the maximum attainable size (L8) sizes (mm SL) of the abundant and common species and/or taxa caught (with >0.3% of the total catch) during the beam trawl study (May 1995 through April 1996) on Tudor creek. § and * respectively, denote BIANCHI (1985) and/or SMITH & HEEMSTRA (1986) as source of the L8.

Species	Abreviation	Number	min.	max.	M	L8
Spratelloides delicatulus	Spra deli	112	16	39	16-20	70§*
Plotosus lineatus	Plot line	552	20	155	71-75	300§*
Saurida undosquamis	Saur undo	277	20	125	46-50	450§*
Hemirhamphus far	Hemi far	65	17	135	21-25	440§*
Syngnathus acus	Syng acus	19	84	151		300*
Cociella crocodila	Coci croc	9	63	80		500*
Apogon lateralis	Apog late	61	8	85	46-50	100*
Acropoma japonicum	Acro japo	400	9	88	16-20	200*
Plectorhynchus gaterinus	Plec gate	16	14	99		500§*
Lutjanus fulviflamma	Lutj fulv	547	14	105	36-40	350§*
Monodactylus argenteus	Mono arge	74	10	36	16-20	250§*
Gerres oyena	Gerr oyen	309	12	63	31-35	250§*
Leiognathus equula	Leio equu	65	10	42	16-20	420§*
Caranx ignobilis	Cara igno	5	31	50		1650§*
Valemugil saheli	Vale sahe	21	23	39	16-20	500§*
Sphyraena jello	Sphy jell	182	21	20	26-30	1500§*
Petroscirtes sp	Petr spec	21	17	44		70*
Amblygobius albimaculatus	Ambl albi	21	17	35		180*
Oligolepis keiensis	Olig keie	162	15	110	46-50	70*
Yongeichthys nebulosus	Yong nebu	745	11	100	16-20	180*
Bothus mancus	Both manc	43	23	155		420*
Caridea	Cari mix	625	10	67	16-20	30§
Metapenaeus monoceros	Meta mono	625	15	105	56-60	200§
Penaeus indicus	Pena indi	107	18	178	31-35	230§
Penaeus monodon	Pena mono	727	8	152	51-55	340§
Penaeus semisulcatus	Pena semi	297	13	130	56-60	230§
Cephalopoda	Squi mix	76	7	144	26-30	900§

Table 3

Hill's diversity indices for the seasonal catch of the beam trawl study on Tudor creek in May 1995 through April 1996.

Season	N_t	N_0	H'	N_1
Long rains	1269	39	0.218	1.243
Short rains	2607	67	0.162	1.176
Dry	2394	48	0.191	1.211

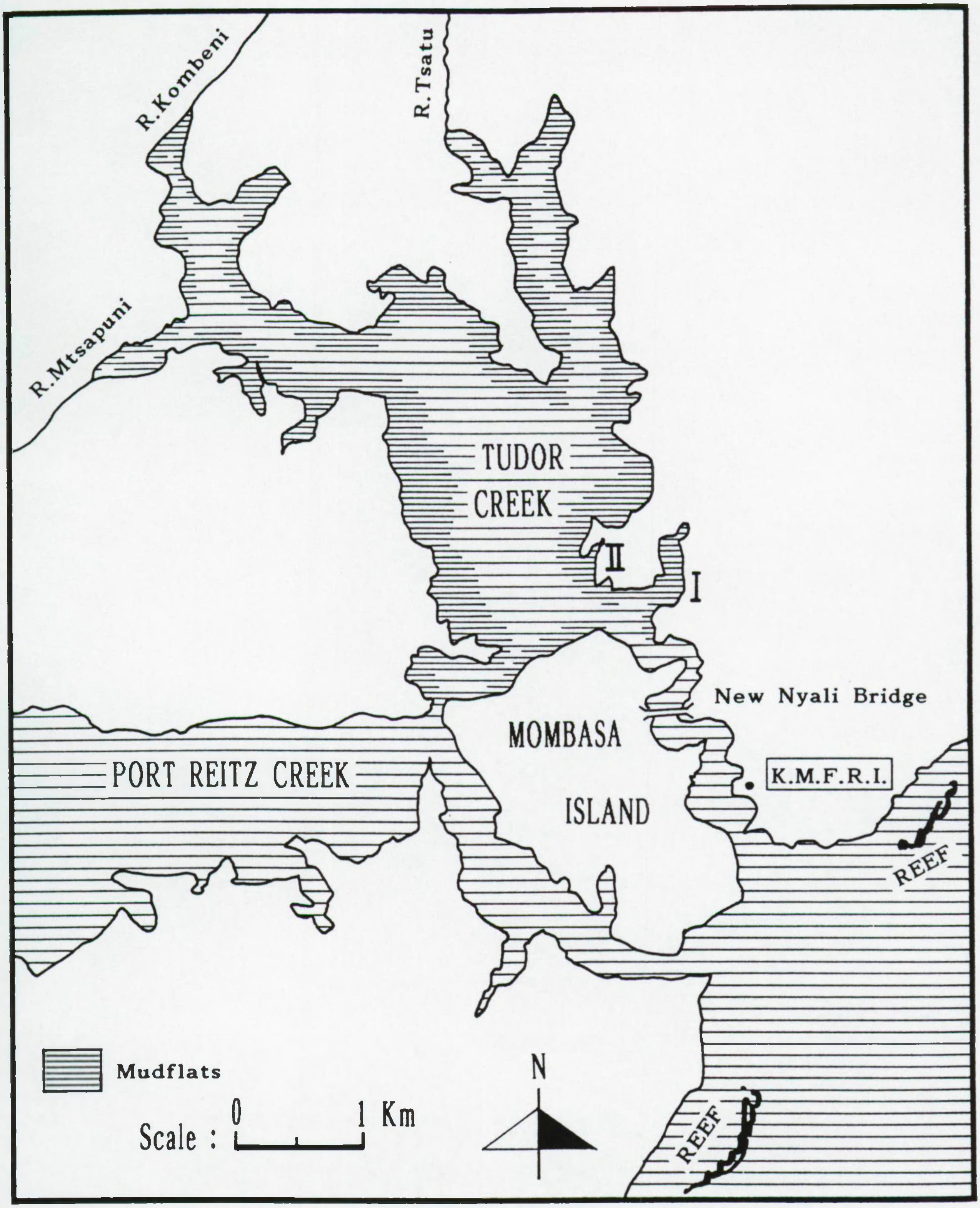

Figure 1: Map of Tudor creek showing the tidal flats/mangrove cover, the seasonal rivers (Tsatu, Kombeni and Mtsapuni) and the sampling sites I and II.

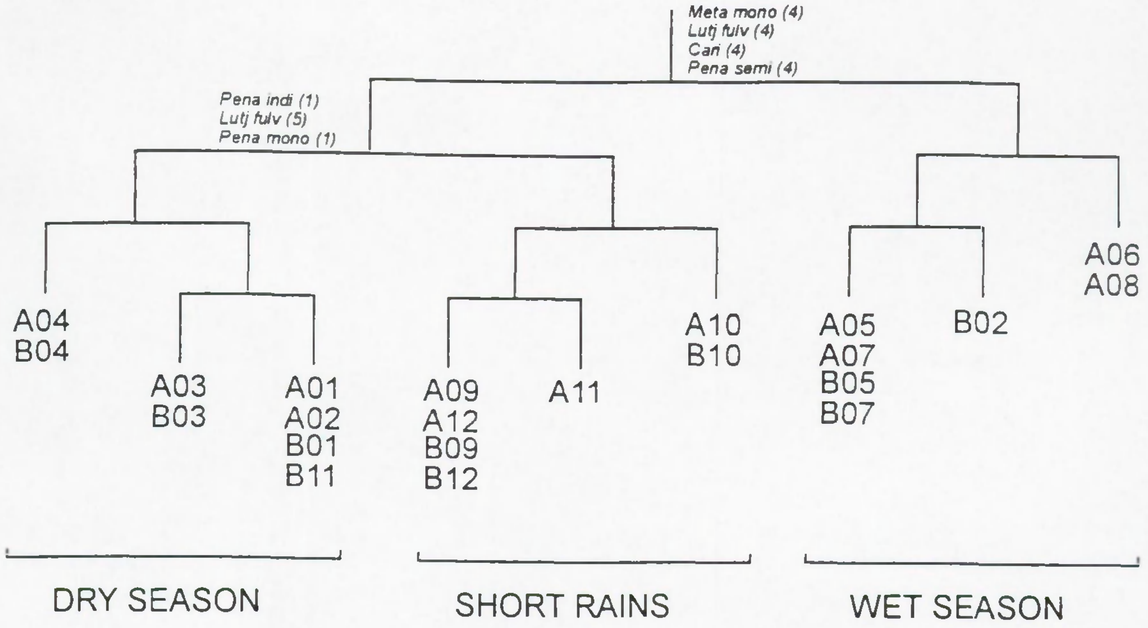

Figure 2: Results of the Two Way Indicator Species Analysis (TWINSPAN) of the beam trawl data for Tudor creek (May 1995 through April 1996).

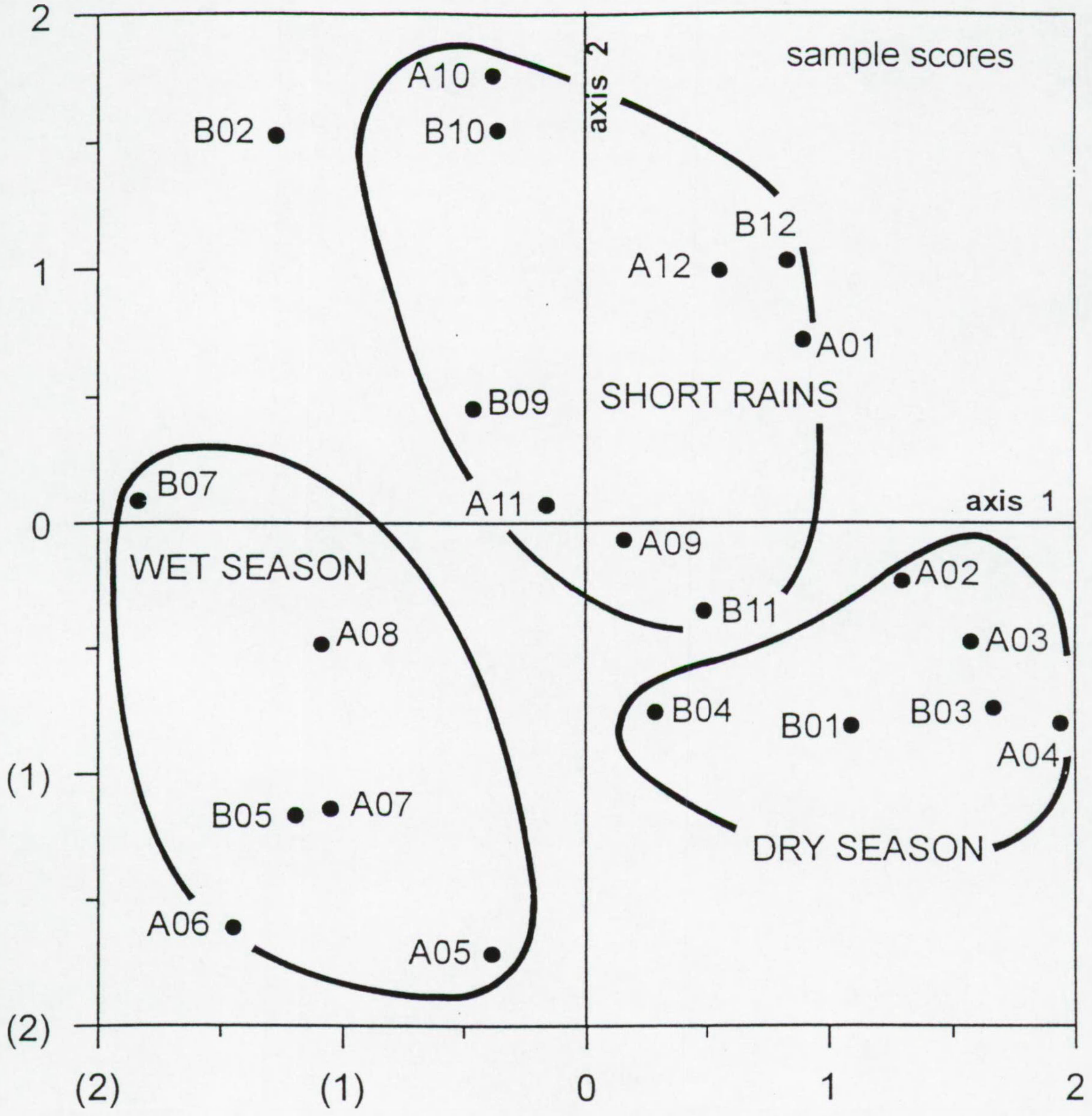

Figure 3a: Sample scores of the correspondance analysis with the ordination plots depicting the three seasonal epibenthic communities on Tudor creek during the beam trawl study (May 1995 through April 1996).

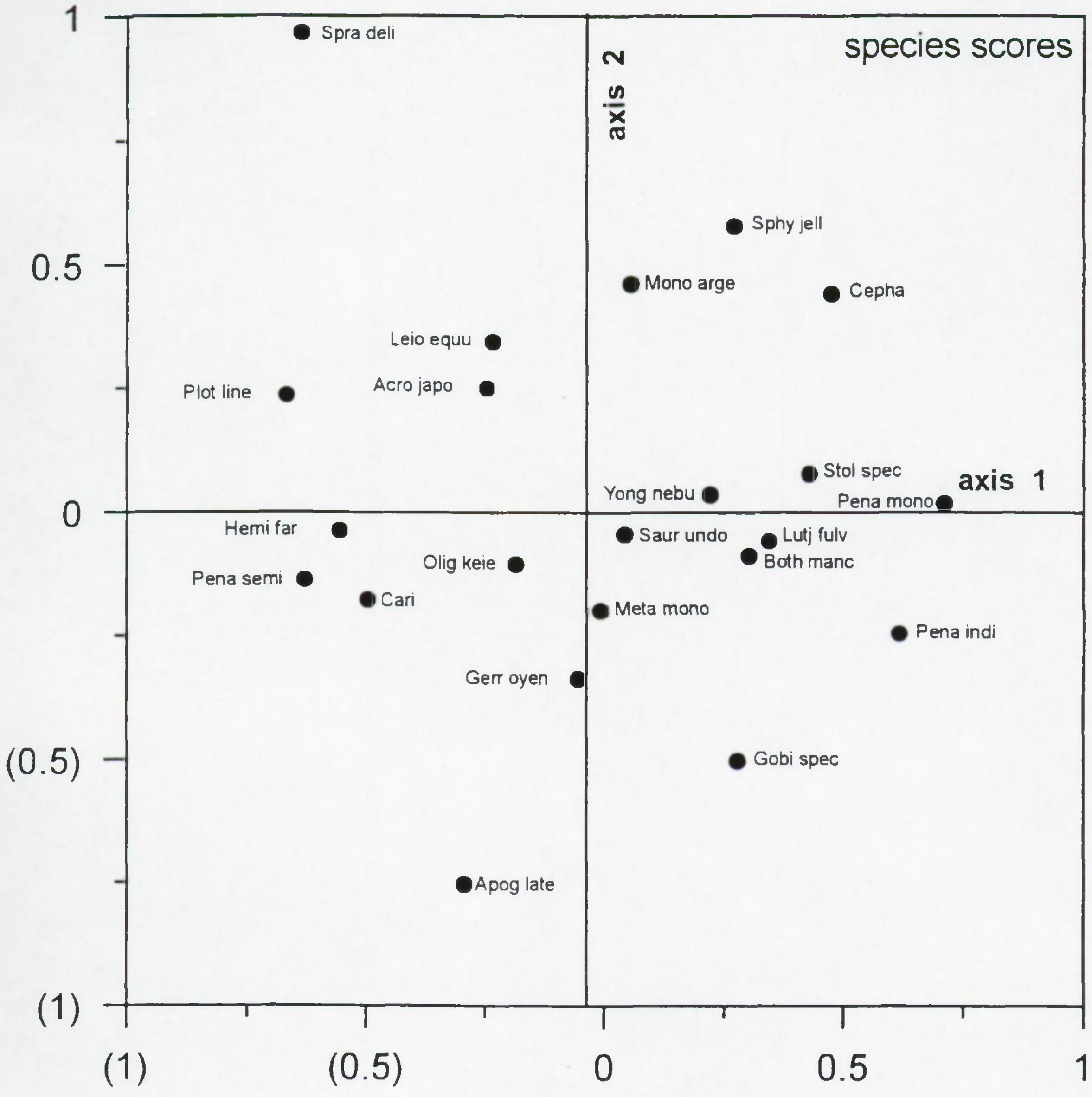

Figure 3b: Species scores of the correspondance analysis with the ordination plots depicting the epibenthic communities on Tudor creek during the beam trawl study (May 1995 through April 1996).

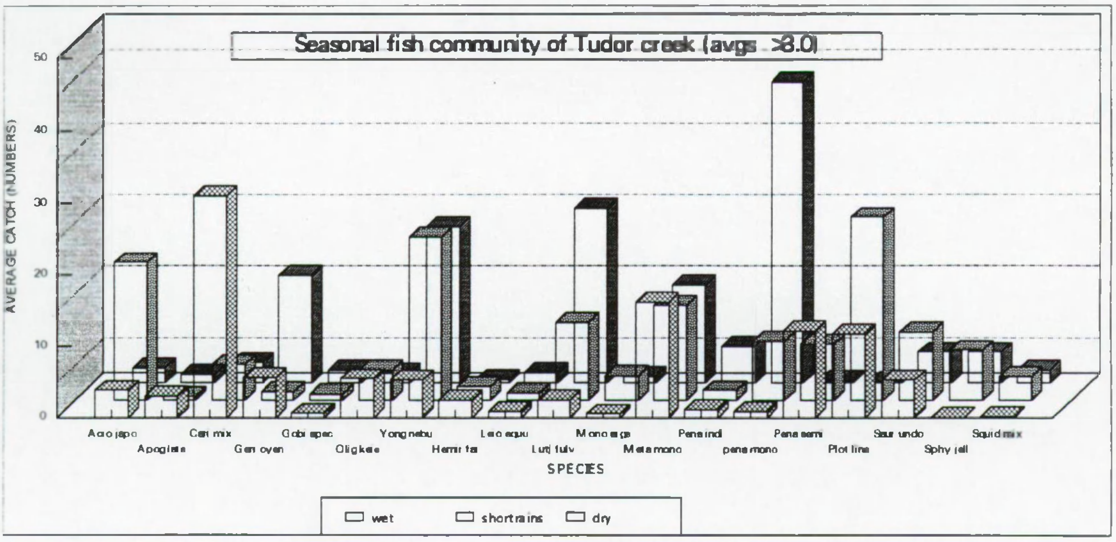

Fig. 4: Seasonal (long rainy season, short rainy season and dry season) epibenthic communities of Tudor creek, Mombasa, Kenya including only species with an average catch of > 3 individuals in the monthly tows (total area = 120m^2) of the beam trawl study (May 1995-April 1996). Names of species and taxa as in Fig. 2.

Appendix 1

	May 95	Jun 95	Jul 95	Aug 95	Sep 95	Oct 95	Nov 95	Dec 95	Jan 96	Feb 96	Mar 96	Apr 96	Total	%
Acropomatidae														
Acropoma japonicum	9	4	26	7	5	230	29	44	9	22		15	400	6
Antennariidae														
Antennarius hispadus								2					2	0
Apogonidae*														
Apogon lateralis	20	9	5	3	6		2		4	10	2		61	1
Apogon nigripes								2			6	2	10	0
Apogon savayensis					1	3					11		15	0
Apogon sp	3		2	2		1	1			3	1		13	0
Fowleria aurita							2		4	8			14	0
Atherinidae*														
Atherinomorus duodecimalis						4	3						7	0
Belonidae*														
Tylosurus acus							4						4	0
Blenniidae*														
Petroscirtes sp			3		7	5		2			2	2	21	0
Bothidae*														
Bothus mancus	3		2		10	7	1	5	3	1	2	9	43	1
Pseudorhombus arsius			2		1								3	0
Carangidae*														
Caranx ignobilis*	1		1				1			2			5	0
Clupeidae*														
Spratelloides delicatulus	2		3		4	34		1		67	1		112	2
Cynoglossidae*														
Paraplagusia bilineata*							2						2	0
Dactylopteridae														
Dactyloptena orientalis							1		1				2	0
Engraulidae*														
Stolephorus indicus*	2					1							3	0
Stolephorus sp						1	31		1	10			43	1
Ephippudae*														
Platax obicularis				2							1		3	0
Gerreidae*														
Gerres filamentosus*					3						7		10	0
Gerres oyena*	24	17	20	6	9	1	7	2	100	84	5	34	309	5
Gerres sp							1						1	0
Gobiidae*														
Acentrogobius audax							7						7	0
Amblygobius albimaculatus							1		2	9	4	7	23	0
Cryptocentrus octofaciatus							2						2	0
Gnatholepis sp					3								3	0
Gobius sp		1	7		2		12		20	5	1		48	1
Oligolepis keiensis	24	12	21	8	19	21	12	15	3	9	6	2	152	2
Oxyurichthys ophthalmonema							4						4	0
Yongeichthys nebulosus	29	6	25	3	68	40	65	192	73	106	136	2	745	12
Haemulidae*														
Plectorhynchus gaterinu	3					1		4	2	2	3	1	16	0
Pomadasys olivaceum						8							8	0
Hemiramphidae*														
Zenarchopterus dispar*			13										13	0
Hemirhamphus far*	2		27			27	3			1		5	65	1
Leiognathidae*														
Leiognathus equula*	1		9		5	12			4	32		2	65	1
Leiognathus bindu					2								2	0
Lethrinidae*														
Lethrinus harak*	1							2			3		6	0
Lethrinus sp										2			2	0
Lutjanidae*														
Lutjanus argentimaculat	1									1			2	0
Lutjanus fulviflamma*	22	2	5		33	42	72	27	95	151	89	9	547	9
Lutjanus ehrenbergii			1										1	0
Lutjanus sp					2					1			3	0
Lutjanus fulvus							1						1	0
Monodactylidae														
Monodactylus argenteus	2		4		6	41	2	7	8	3	1		74	1
Mugilidae*														
Valemugil saheli						3		15	1	2			21	0
Mullidae*														
Upeneus tragula*	2							3	1				6	0
Upeneus vittatus						4			1				5	0
Ostraciidae*														
Lactoria cornuta*								2					2	0
Lactoria fornasini						1	1						2	0
Platycephalidae*														
Cociella crocodila*	2		2	1	2		1		1				9	0
Papilloculiceps longiceps*					1			5					6	0
Platycephalus sp									3	3	2	3	11	0
Percophidae														
Bembrops platyrhynchus					1								1	0
Plotosidae*														
Plotosus lineatus*		14	77	49	167	226	15	2	1		1		552	9
Pomacentridae*														
Chrysoptera annulata						1							1	0
Plectroglyphidodon lacry	11	1	3					1					16	0
Scorpaenidae*														
Dendrochirus brachypterus						2	2	8					12	0
Parascorpaena mossambica*							1						1	0
Synanceia verrucosa							1						1	0
Serranidae														
Cephalopholis argus				1									1	0
Epinephelus fauvina										1			1	0
Siganidae*														
Siganus canaliculatus					1				7	2	1		11	0
Sillaginidae*														
Sillago sihama*			3										3	0
Sphyraenidae*														
Sphyraena jello*					10	54	13	35	46	22		2	182	3
Syngnathidae*														
Syngnathus acus	3		7	2			1	1					14	0
Syngnathus biaculeatus*									1				1	0
Syngnathus sp									2	2			4	0
Synodontidae*														
Saurida undosquamis	32	5	24	2	64	43	16	30	22	15	21	3	277	4
Teraponidae*														
Terapon jarbua*	1	1		1									3	0
Tetraodontidae*														
Arothron immaculatus						3		1	1			1	6	0
Arothron nigripunctatus							1						1	0
Canthigaster solandri							1						1	0
Caridea	218	26	119	9	31	7	29	13	33	21		7	513	8
Penaeidae														
Metapenaeus monoceros	128	19	41	6	39	61	103	10	23	41	89	65	625	10
Penaeus indicus	14				9	4	5	4	4	25	23	19	107	2
Penaeus monodon				11	8	29	61	33	135	292	134	24	727	11
Penaeus semisulcatus	65	18	54	9	11	23	89	3		21		4	297	5
Stomatopoda	3		2		1			5	3	1	4	4	23	0
Cephalopoda				2	9	14	7	24	6	12	7		81	1
Total	628	135	508	124	540	954	613	500	620	989	563	222	6396	
Number of species	28	14	28	18	32	33	41	31	33	35	27	22		

ANNEX 2

ASPECTS OF THE BIOLOGY AND FEEDING ECOLOGY OF THE ORBICULATE CARDINAL FISH *SPHAERAMIA ORBICULARIS* (CUVIER, 1928) (TELEOSTEI: APOGONIDAE) IN A KENYAN MANGROVE FOREST

by

Jan MEES(1), Godlove U. MWAMSOJO(2) & Enock O. WAKWABI(3)

SUMMARY

The orbiculate cardinal fish *Sphaeramia orbicularis* is the most abundant teleost among the root system of the extensive mangrove forests bordering Gazi bay, Kenya. The species was never recorded from the bay proper and it can thus be considered to be a true mangrove resident. The sampled population clearly consisted of two cohorts: the modes were approximately 65 mm and 80mm. Most individuals with standard lengths >40 mm had mature gonads; the number of eggs ranged from 4,700 to 10,000. *S. orbicularis* are carnivores, mainly feeding on small epi- and hyperbenthic crustaceans. Numerically, gammaridean amphipods and tanaids were the dominant prey categories in the stomachs of both size classes. Individuals belonging to the smaller cohort mainly supplemented their diet with harpacticoid copepods, while larger fishes also fed on postlarval brachyuran crabs and caridean shrimp. The latter two taxa were important prey items in gravimetrical terms. A preliminary analysis of the otoliths revealed 21 stress marks and 20 striations. An attempt to validate these growth rings indicated that the average age of fishes in the samples ranged from 11 (smaller cohort) to 15 (larger cohort) months.

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[1] Marine Biology Section, Zoology Institute, University of Gent, K.L. Ledeganckstraat, B-9000 Gent, Belgium. Email: Jan.Mees@rug.ac.be

[2] Tanzania Fisheries Research Institute (TAFIRI), P.O. Box 9750, Dar Es Salaam, Tanzania

[3] Kenya Marine and Fisheries Research Institute (KMFRI), P.O. Box 81651, Mombasa, Kenya

INTRODUCTION

The orbiculate or chubby cardinal fish *Sphaeramia orbicularis* (CUVIER, 1828) is widespread in the tropical and subtropical areas from Pacific and Indian Ocean regions. It typically forms small aggregations in very shallow water (0.1 to 1 m) among mangroves, rocks, debris, or piers of shallow sheltered shorelines (FISHBASE, 1998) and also occurs in the undercut caves and crevices of submerged coral and lime stone reefs (ALLEN, 1975; KUITER, 1992). Along the East African coast it has been reported to occur south to Maputo, Mozambique (SMITH & HEEMSTRA, 1986). It is distributed north to the Ryukyu Islands (southern Japan), south to Vanuatu and New Caledonia and east to the Caroline, Gilbert and Mariana Islands in Micronesia. The species has further been recorded from the Andaman Islands (India), Singapore, Indonesia, Papua New Guinea, the Philippines, Hong Kong and Taiwan (ALLEN, 1975; FISHBASE, 1998).

Sphaeramia orbicularis (Actinopterygii, Perciformes, Apogonidae, Apogoninae) has a short, compressed body covered with ctenoid scales. It is characterised by two separate dorsal fins, a large oblique mouth, a well-developed membrane between the last ventral fin ray and the abdomen, an emarginate caudal fin, an anal fin with 2 spines and 9 soft ray, and pectoral fins with 12 soft rays. There are 26 scales along the lateral line. The first gill arch has 24-27 gill rakers. The colour is greenish-grey with a dark vertical (diagonally oriented) bar whose width is about half the eye diameter; it starts from the origin of the 1st dorsal fin to just in front of the vent. The maximum size is 10 cm standard length (ALLEN, 1975; SMITH & HEEMSTRA, 1986).

Not much is known about the biology of *Sphaeramia orbicularis*. They are paternal mouth brooders (ALLEN, 1975; SHAO & CHEN, 1986; KUITER, 1992). Courtship and spawning have been reported to occur fortnightly (shortly before new moons and full moons). The average brood size for 72 to 89 mm standard length incubating males ranges from 6,100 to 11,700 eggs. Hatching takes place after 8 days at temperatures between 27 and 30°C (ALLEN, 1975). The larval phase is pelagic and sexual maturity is attained at 7 cm by the males and 6 cm by the females. The only study reporting on its feeding ecology (ALLEN, 1975) was done on a population living in a rather a-typical, man-made environment: a pool-like enclosure with concrete walls on three sides and the floor of a house as a roof (Palau Archipelago, Western Caroline Islands). The species was shown to be an opportunistic carnivore, feeding at night (early evening and just before daybreak), primarily on insects and a variety of benthic and planktonic crustaceans (ALLEN, 1975). Still, it was obvious that many prey were attracted by the lights in the vicinity of the house. The aim of this study was to investigate the diet of *S.*

orbicularis in its natural, most typical habitat, i.e. between the roots of mangrove trees. Further, some basic information about the biology of the species is provided.

MATERIAL AND METHODS

Study area

Gazi Bay (Kenya) is located some 50 km north of the Tanzanian border and 60 km south of Mombasa Island (4°22'S, 39°30'E). The bay is between 1.75 and 3.50 km wide and 3.25 km long. Samples were taken in the mangrove forest bordering a side creek of the major creek in the eastern part of the bay. This creek has no freshwater input and is characterised by dense seagrass and macro-algae cover. The dominant mangrove species in the proximal vicinity of the sampling spot was *Rhizophora mucronata*, while *Sonneratia alba* and *Avicennia marina* were also present. The most abundant seagrasses were *Enhalus acoroides*, *Thalassia hemprichii* and *Thalassodendron ciliatum*, while *Halimeda opuntia*, *Sargassum binderi* and *Gracilaria crassa* were the dominant seaweeds. Average water depth at the sampling spot was 0.4 m (low tide) to 1.1 m (high tide). In the bay proper, the mean tidal range during the sampling period was between 0.8 m (neap tide) and 2.8 m (spring tide) (cf. Tide tables for Kenya ports and Dar Es Salaam Harbours of 1993).

Sampling

Daytime samples were taken on the 11th, 12th and 13th of August 1993; both day and night collections were made on the 18th of the same month. Sampling was always done at low tide. Ten fyke nets with the following specifications were used: mesh sizes of 18 mm stretched in the cod-end and 26 mm near the mouth, mouth opening of 0.86 m^2, wing length of 1.77 m. These were installed at low tide in such a way that they closed off a specific area with mangrove trees. On some occasions a dragnet (mesh size 20 mm stretched, length 5 m) was used. Fish were sometimes chased into the fyke nets from between the network of *Rhizophora mucronata* roots where they took refuge. All fishes were immediately anaesthetised in a benzocaine (ethylamino-4-benzoate) solution in seawater to prevent regurgitation of stomach contents and to avoid unnecessary suffering. The samples were then preserved in a 10% formaldehyde-seawater solution. Half of the daysample of August 18 was preserved in 70% ethanol for otolith analysis. Surface water temperature and salinity were measured with a mercury thermometer and a refractometer, respectively. Temperature was 25-26°C and salinity was 35.

Analysis of samples and data analysis

All fish were identified to species level and counted. Both standard length (distance from the tip of the snout to the beginning of the caudal fin) and total length (distance from the tip of the snout to the tip of the caudal fin) of the specimens were measured to the nearest 1 mm. The Bhattacharya method for the detection and separation of cohorts was applied to the length-frequency data. Individuals were pooled into 2 mm size classes prior to analysis. The ashfree dry weight (ADW) of 50 *Sphaeramia orbicularis* was measured to the nearest 1 µg after drying at 60°C for 5 days and burning at 550°C for 2 hours. The sex of fishes was determined after exposing the gonads through slits made along the abdomen. Fecundity was estimated by counting the number of eggs in ripe ovaries extracted from mature females (6 individuals between 62 and 78mm standard length). Otoliths (sagittae) from 16 fishes with known standard length and sex were extracted, fixed on slides, polished with sand papers (numbers 500 and 1000) and cleaned with a piece of soft leather soaked in wet aluminium powder. Stomach content analyses were performed on 60 individuals taken from the modal length classes (see below, 30 individuals were taken from both day and night samples). All food items in the stomach were identified to a high taxonomic level (Table II). For several small taxa (harpacticoid copepods, ostracods, brachyuran zoeae and megalopae,...) assigned dry weight (DW) values, independent of the animal's length, were used. All other animals were measured, and their DW prior to digestion was calculated from length-DW regressions established for animals collected from the same area. SL-DW regressions were established for Gammaridae, Lysianassidae, Corophiidae, Tanaidacea, Aegidae and Caridea. The original size of incomplete prey items was calculated from regressions relating the length of unbroken parts, e.g. head capsule, urosome, pleosome, telson or carapace, to total length. Food composition is expressed as gravimetric percentage (%G):

$$\%G = \frac{\text{DW prey type i}}{\text{total DW of the ingested food}} \times 100$$

which can be converted into energy units or to g carbon, as numerical percentage (%N):

$$\%N = \frac{\text{number of items of prey type i}}{\text{total number of prey items ingested}} \times 100$$

and as percentage frequency (%F), i.e. the percentage of stomachs in which a certain prey item occurs.

RESULTS AND DISCUSSION

The fish fauna of Gazi Bay has been studied intensively between 1991 and 1996. A variety of sampling gear has been deployed in all important habitats of the bay proper and in the major creeks intersecting the mangrove forests (VAN DER VELDE *et al.*, 1994; KIMANI *et al.*, 1996; DE TROCH *et al.*, 1996, 1998). An up-to-date species list is presented in WAKWABI & MEES (submitted). This is the first study to report on fishes present between the root system of the mangrove trees bordering Gazi Bay. A total of 1351 fishes (22 species belonging to 13 families) were collected from between the mangrove roots, 95.6% of which

Table I: List of fish species caught with fyke nets in the mangrove creeks of Gazi Bay.

Family	Species	% Abundance
Apogonidae	*Apogon guamensis*	0.15
	Apogon nigripes	0.07
	Sphaeramia orbicularis	95.86
Acanthuridae	*Acanthurus nigrofuscus*	0.15
Chaetodontidae	*Chaetodon auriga*	0.07
	Chaetodon fulcula	0.07
Gerridae	*Gerres oyena*	0.22
Holocentridae	*Neoniphon sammara*	0.15
Labridae	*Coris aygula*	0.37
	Coris formasa	0.07
Lethrinidae	*Lethrinus harak*	0.07
	Lethrinus lentjan	0.07
Lutjanidae	*Lutjanus argentimaculatus*	0.15
	Lutjanus ehrembergi	1.11
	Lutjanus fulviflamma	0.07
Pomacentridae	*Neopomacentrus fulignosus*	0.15
Scaridae	*Scarus sordidus*	0.15
	Scarus psittacus	0.07
Siganidae	*Siganus stellatus*	0.37
	Siganus sutor	0.07
Sphyraenidae	*Sphyraena putnamiae*	0.15
Theraponidae	*Pelates quadriliniatus*	0.15

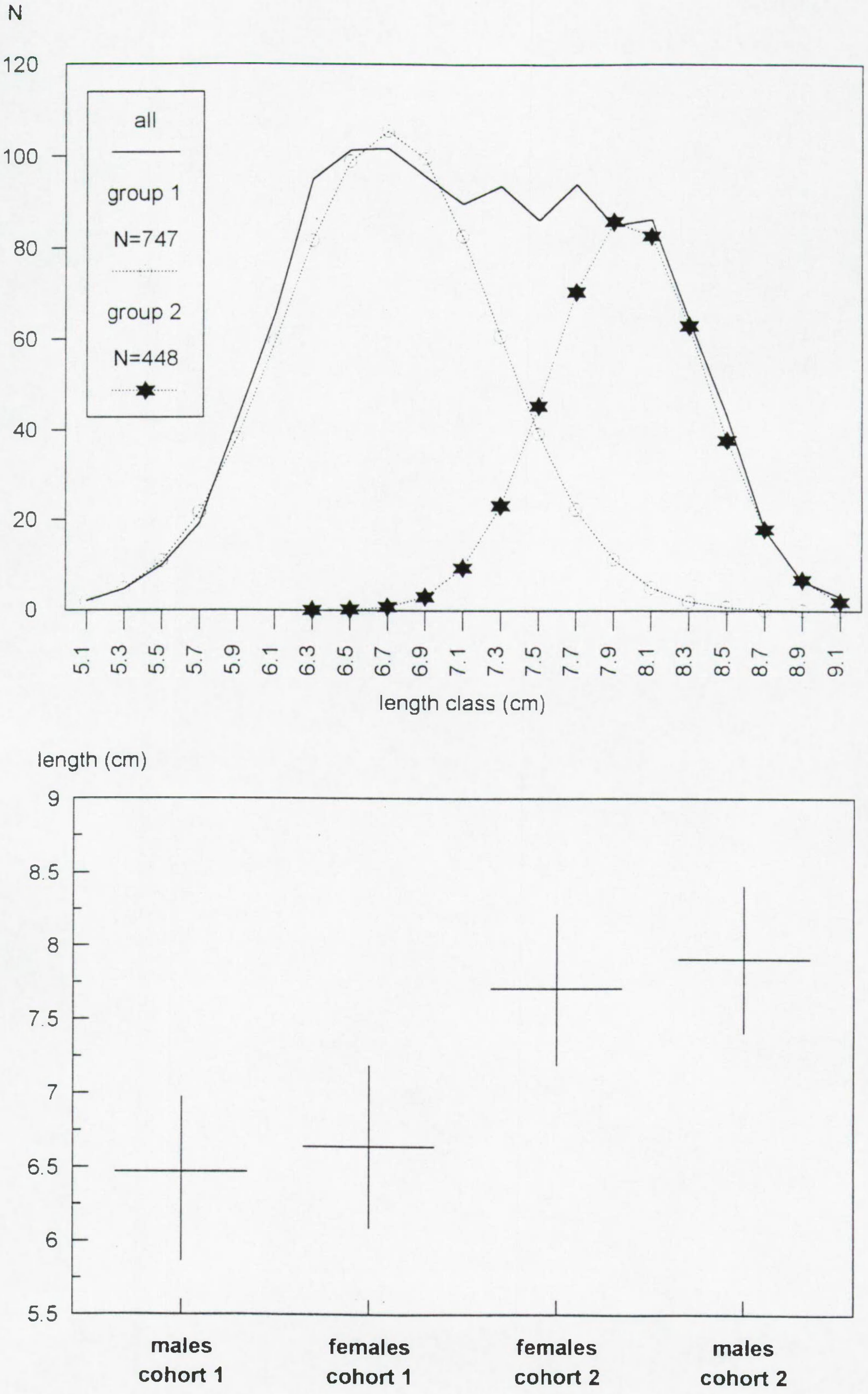

Figure 1. Length-frequency distribution of *Sphaeramia orbicularis*. Top: normal distributions fitted to the composite distribution with the Bhattacharya method. Bottom: mean length and standard errors of males and females of the smaller (1) and larger (2) cohorts.

were *Sphaeramia orbicularis* (Table 1). This species has rarely been caught in the bay proper; it can thus be considered to be a true mangrove resident.

Sphaeramia orbicularis: some basic data

During sampling time the fishes were aggregated and resting among the rhizophores. Both during daytime and at night, they were relatively inactive, performing few movements over very short distances (0.5 – 2 m). The fish were observed to be more active during the late afternoon and the early morning (dusk and dawn), moving out of their hiding places into the open areas of the creek and around seaweed and seagrass beds. Local density was estimated at 11 individuals per m^2. A sex ratio of 1:1 was observed. Size ranged from 34 to 91 mm standard length (the factor to convert standard length to total length is 1.35). Length-frequency distributions of both males and females were bimodal (Figure 1). The modes were approximately 65 mm for the smaller cohort and 80 mm for the larger cohort. The length-ashfree dry weight regression was found to be ADW = 0.0002 + 4.526SL ($p<0.001$, N=49). Note that this regression has limited applicability as it is derived from fish taken from a narrow size range (42-80 mm SL). Most of the fishes of both cohorts had mature or almost mature gonads. All individuals of > 40 mm SL were mature. This is considerably smaller than the length at maturity of 60-70 mm SL reported by ALLEN (1975). The number of eggs per egg mass for mature ovaries (N=6, 62-78 mm SL) ranged from 4,712 to 10,031. This is comparable to the numbers reported by ALLEN (1975). The average diameter of a ripe egg was 0.4 mm. Two types of growth rings were observed on the otoliths. About 21 widely spaced (44 µm) stress marks separated by some 20 closely packed (2 µm) striations were noted (not shown here). The standard length of a newly hatched *Sphaeramia orbicularis* is 3.3 mm, and the smallest postlarvae measure around 10 mm (ALLEN, 1975). The average growth rate of 12 mm long postlarval fish is around 4.5 mm per month and juveniles ranging from 12 to 20 mm SL grow at a rate of 4.81 mm per month (ALLEN, 1975). The time taken by a fish to enter the postlarval phase equals approximately 45 days and the age of a 55 mm individual can be estimated to be 10.9 months. The number of stress marks in a sagitta of a 55 mm individual (21) approximates the number of neap and spring tides for an 11 month period (per. Observ.). Individuals belonging to the smaller and larger cohort may thus be approximately 11 and 15 months old, respectively. The validation of the small striations between the stress marks is more complicated. They probably are daily growth rings, but this leaves eight days per lunar month during which no growth increment is recorded in the otolith. This is not necessarily due to counting errors but can be due to poor feeding conditions or increased predation pressure related to the neap-spring tidal cycle.

Feeding

The fish used for stomach content analyses were selected on the basis of the observed bimodal length distributions and the sex ratio: from both day and night samples fifteen males and fifteen females were analysed from each mode (i.e. from the modal length classes of the smaller and larger cohorts). A total of 18 prey categories were recorded from the stomachs of 60 *Sphaeramia orbicularis* (Table II). Only two stomachs of the day time samples contained no food and were excluded from further analyses.

Table II: Diet composition of Sphaeramia orbicularis in Gazi Bay

Taxon	Number of items recorded		Percentage frequency	
	Day	Night	Day	Night
Amphipoda, Gammaridea	61	261	70	100
Tanaidacea	99	5	23	14
Copepoda, Harpacticoida	16	52	27	43
Caridea	25	17	47	50
Isopoda	9	38	20	54
Brachyura, megalopae	3	19	10	39
Ostracoda	2	13	7	29
Brachyura, zoeae	10	1	7	3.5
Gastropoda	2	8	7	14
Cumacea	-	7	-	14
Amphipoda, Caprellidea	4	1	7	3.5
Mysidacea	3	1	7	3.5
Brachyura, postlarvae	1	2	3	7.0
Fish larvae	2	1	7	3.5
Polychaeta	-	2	-	3.5
Leptostraca	-	2	-	3.5
Stomatopoda	-	2	-	7.0
Pycnogonida	1	-	3	-

Numerical and gravimetrical diet composition is presented for each cohort in Figure 2 and the frequencies of occurrence of the different prey categories are presented in Table 2. For both size classes, the stomachs contained more food items at night. During the day, fish belonging to the smaller cohort mainly fed on gammaridean amphipods, tanaids, small postlarval

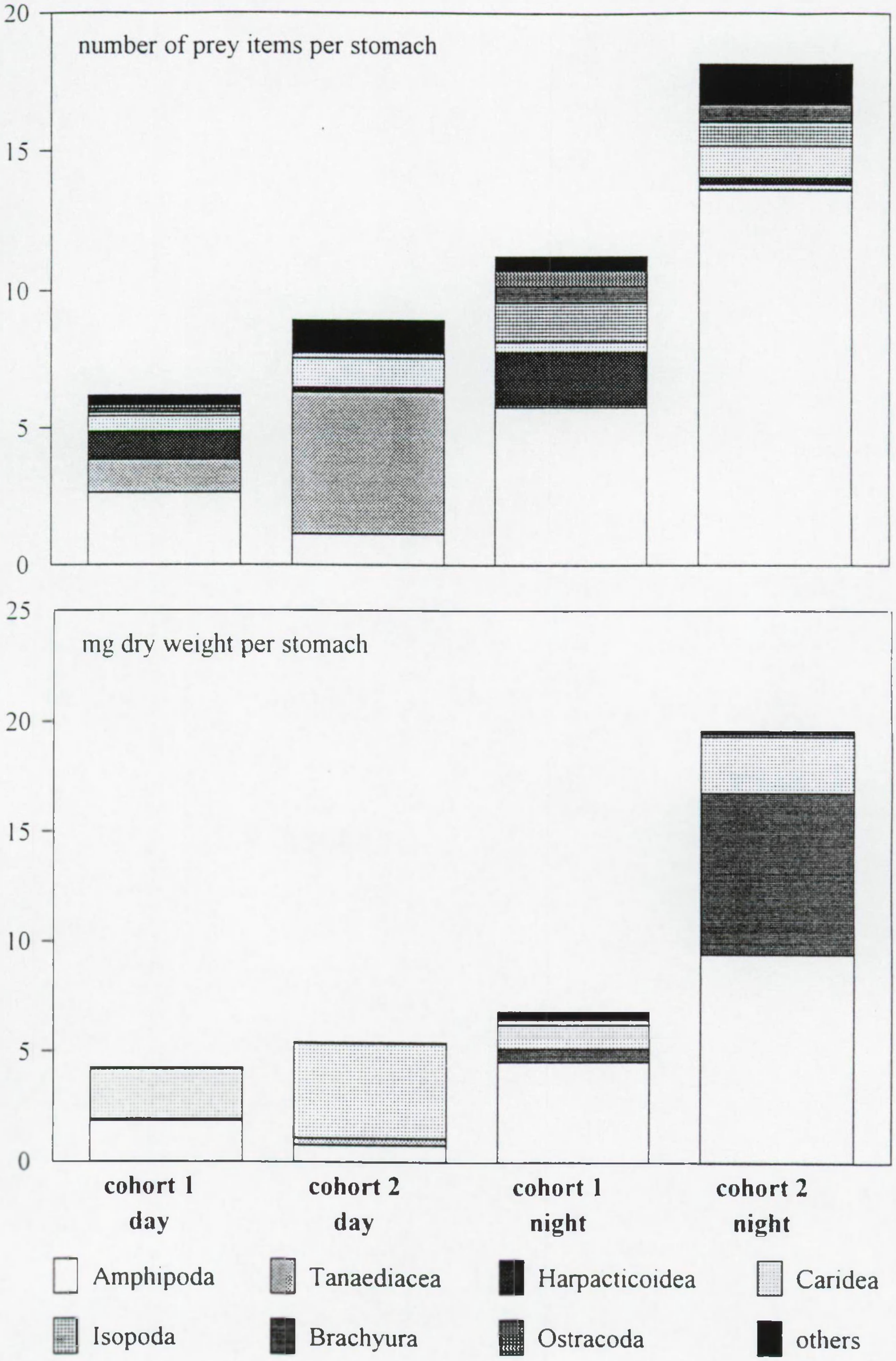

Figure 2. Numerical (top) and gravimetrical (botom) composition of the diet of both cohorts of *Sphaeramia orbicularis* sampled during day time and at night.

carideans and harpacticoid copepods, while fish of the larger cohort preyed almost exclusively on tanaids, supplementing their diet with few gammaridean amphipods and carideans. During the night, smaller individuals mainly took amphipods and harpacticoids (and a few isopods), while larger individuals fed almost exclusively on amphipods. In gravimetrical terms, Amphipoda Gammaridea and Caridea contributed for more than 95% to the diet of both cohorts during daytime and of the smaller cohort at night. Brachyuran crabs were also important (40% gravimetrically) in the diet of the larger cohort at night. *S. orbicularis* is an opportunistic carnivore, exploiting a variety of small epibenthic, hyperbenthic and planktonic prey. They are probably crepuscular feeders. The stomach contents of fishes sampled at night then reflect the feeding activities performed during the previous dusk.

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ANNEX 3

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FISH COMMUNITIES IN A TROPICAL BAY (GAZI BAY, KENYA): SEAGRASS BEDS VS. UNVEGETATED AREAS

by

M. DE TROCH[1], J. MEES[1], I. PAPADOPOULOS[1] and E. O. WAKWABI[2]

([1]*Marine Biology Section, Zoology Institute, University of Gent, K.L.Ledeganckstraat 35, B-9000 Gent, Belgium*; [2]*Kenya Marine and Fisheries Research Institute, Mombasa, Kenya*)

ABSTRACT

The fish fauna of seagrass beds and unvegetated areas in Gazi Bay (Kenya) was sampled in 9 stations with a beach seine. A total of 3601 fishes (> 95 % juveniles) was caught, comprising 75 species (40 families). The spatial patterns in the fish communities were investigated with multivariate statistical techniques.

A first community occurred in the downstream part of a major river-fed creek and was characterised by a low density and diversity. These were sandy bottom stations with sparse seagrass vegetation. The dominant species of this community were *Leiognathus elongatus* and *Bothus myriaster*.

A second community occurred in the upstream part of the same creek, and was characterised by a high density and diversity. *Gerres acinaces* and *Atherinomorus duodecimalis* were the dominant species. A third community occurred in the stations of the shallow part of the bay and was characterised by a high diversity but a lower density. The dominant species were *Apogon thermalis* and *G. acinaces*. Both latter communities occurred in stations with dense seagrass beds.

KEY WORDS: fish, community, seagrass, Kenya.

INTRODUCTION

Seagrass beds are an important biotope in tropical coastal ecosystems. They are among the most productive ecosystems of the world (MCROY & MCMILLAN, 1977). As nursery areas for juvenile fishes, they contribute to exploited fish stocks and to the productivity of coral reefs (MCROY & HELFFERICH, 1977). The exchange processes between seagrass beds, mangroves and coral reefs are complex and fragile. Knowledge about the biodiversity and the interactions between the different systems, their communities and the constituting species is a prerequisite for the rational management of these biotopes.

The aim of this study is to describe the fish fauna of seagrass beds and to compare it with fish communities occurring in unvegetated areas. The feeding ecology of the dominant species and the trophic organization of the ichthyofauna in Gazi Bay will be published elsewhere (DE TROCH *et al.*, in prep.).

MATERIALS AND METHODS

Study area

The samples were taken in Gazi Bay, Kenya (4°03′ ZB) (Fig. 1). Gazi Bay (also called Maftaha Bay) is situated 50 km north to the Tanzanian border and 60 km to the south of Mombasa. The bay is between 1.75 and 3.5 km wide and 3.25 km long. The Kidogoweni river enters the bay through the so-called western creek, which is bordered by mangroves. Beside this western creek (surface area ± 18 ha), there is also an eastern creek (2.7 ha) which has no freshwater input. In both major creeks and in the bay proper dense seagrass beds occur (percentage of cover between 30 and 100% in the creeks and 10 to 30% in the lagoon). The downstream part of the western creek is characterised by a sparse seagrass vegetation on a sandy bottom (SLIM, 1995).

Sampling

Samples were taken from two hours before to two hours after low-water springtide on the 17th (western creek) and 18th of August 1993 (eastern creek) with a beach seine net (1.20 m depth, 25 mm stretched mesh size). As the net was 80 m long, a single semicircular haul was considered to sweep an area of about 509 m^2. After being taken from the water, all fish were preserved in a 10% formaldehyde-seawater solution.

Six stations were located in the western creek (Fig. 1). The first two stations (1 and 2) were the most upstream ones and were characterised by a dense seagrass vegetation. Apart from species as *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule uninervis* and *Thalassia hemprichii*, in the western creek some pioneers were found which lack in the eastern creek (*Halophila ovalis* and *H. stipulacea*) (VAN AVESAATH *et al.*, 1993). The three downstream stations of the western creek (3, 4 and 5) were characterised by a sandy, unvegetated bottom. Station 6 was the most seaward station in front of the mouth of the western creek and was characterised by quite dense seagrass beds.

The other samples were taken in the intertidal and low-subtidal seagrass beds in the eastern part of the bay (mouth of the eastern creek). The seagrass beds of these sites are dense, with *Thalassodendron ciliatum* as dominant species. In this area, the vegetation is more diverse and denser compared to the seagrass vegetation in the western creek and more epiphytic algae were found (VAN AVESAATH *et al.*, 1993).

Analysis of the samples

All fishes were identified to the species level using the keys provided by SMITH & HEEMSTRA (1986) and BIANCHI (1985). The number of individuals per species was counted and the standard length (SL) was measured to the nearest millimetre. A data matrix with the numbers caught per station was constructed. Density (N per 100 m^2) of the different species can be estimated by dividing these numbers by 5.

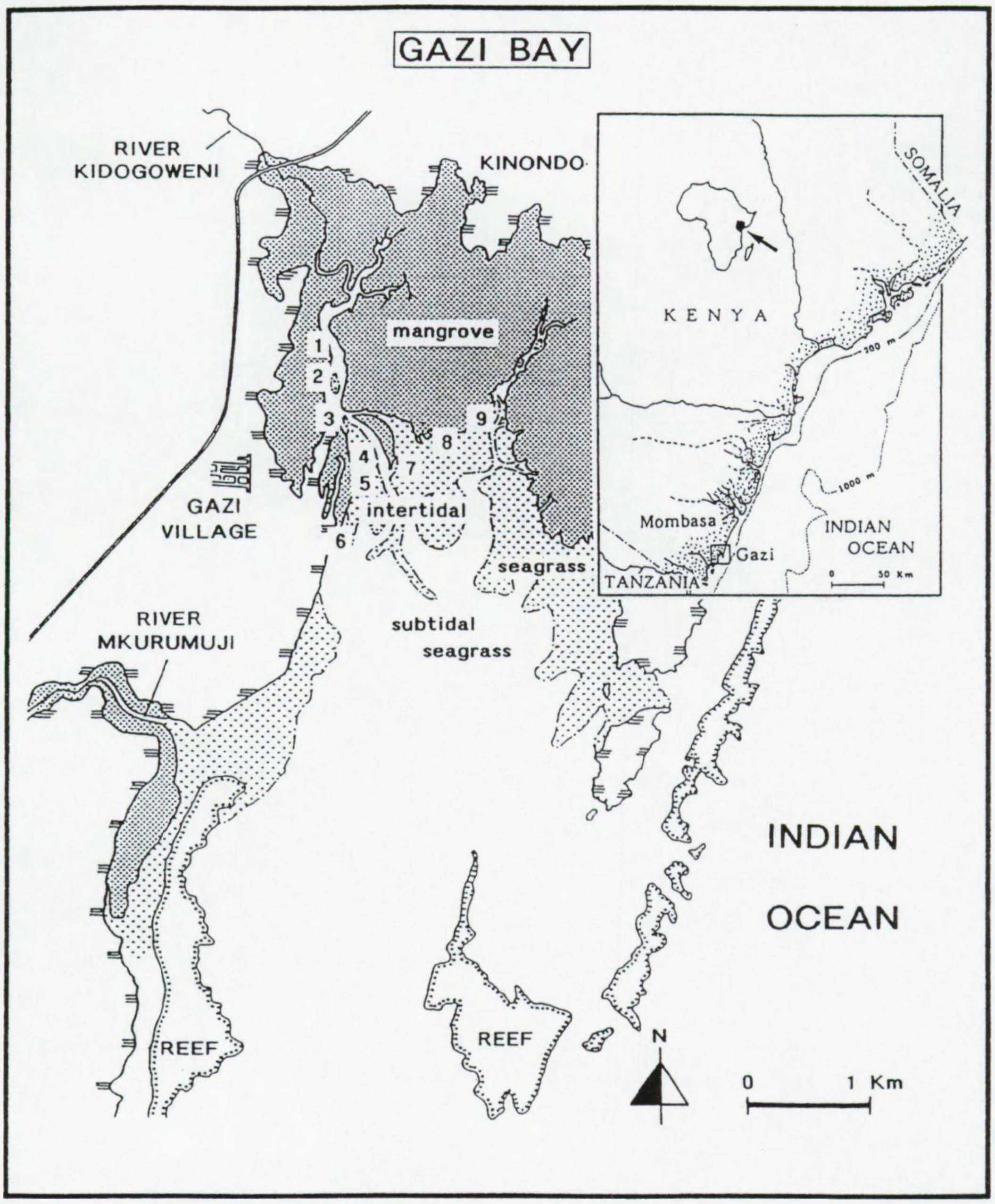

Fig. 1. Map of Kenya with situation of Gazi Bay (COPPEJANS *et al.*, 1992). Detail of Gazi Bay (SLIM, 1994) with indication of the sampling stations.

Data analysis

Prior to statistical analysis, the density data were fourth root transformed. Spatial patterns in the fish communities were investigated with multivariate statistical techniques. The samples were grouped in clusters based on their species composition with a group-average sorting classification based on the Bray-Curtis dissimilarity index and a TWINSPAN (Two-Way

INdicator SPecies ANalysis). The data were also subjected to an indirect ordination method (correspondence analysis).

Diversity was calculated using Hill's diversity indices of the order 0, 1, 2 and $+\infty$ (HILL, 1973), where

N_0 is the number of species in a sample,
N_1 is equivalent to the Shannon-Weaver index:

$$N_1 = \exp(H')$$

$$H' = -\sum_{i=1}^{n} p_i(\log p_i)$$

$$\text{with } p_i = \frac{N_i}{N_t} = \text{the relative abundance of the } i^{th} \text{ species}$$

N_2 is the reciprocal of the Simpson dominance index:

$$N_2 = \frac{1}{\sum_{i=1}^{n} p_i^2}$$

N_∞ is the reciprocal value of the proportional abundance of the dominant species $(1/p_1)$.

RESULTS

Species composition

A total of 3601 fishes was caught, comprising 75 species belonging to 40 families (see Appendix I). In the stations situated in the western creek, an average of 450 fishes per station was collected; in the eastern creek this amount was smaller (300 fishes per station). The highest number of individuals (903) was caught in the most seaward station of the western creek (station 6).

Gerres acinaces, *Atherinomorus duodecimalis*, *Leiognathus elongatus*, *Apogon thermalis* and *Herklotsichthys quadrimaculatus* were the most abundant species, together accounting for 67.6% of the total number of fish collected. Twenty nine species (39% of the 75 species caught) were only collected in the western creek, eighteen species (24%) only in the eastern stations. Twenty eight species (37%) were caught in both subareas.

Length-frequency distributions

The length-frequency distributions of the different species, with the corresponding number of individuals (N), are summarized in Appendix II. The minimum and maximum recorded standard lengths, the mean length and the modal length class are given, together with the maximal recorded length (L_∞) taken from the literature (mainly SMITH & HEEMSTRA, 1986). The majority of individuals were caught as juveniles (> 95%). Only *Plotosus lineatus*, *Trachyrhamphus bicoarctatus*, *Platycephalus indicus* and *Sphyraena barracuda* were occasionally encountered as adults.

Identification of communities

The result of the cluster analysis based on the density data shows a high dissimilarity between the different stations (Fig. 2). The stations of the downstream part of the western creek (stations 3, 4 and 5) form a first cluster ('west downstream'). The upstream stations of the western creek (stations 1 and 2) and the most seaward station (station 6) form a second cluster ('west upstream'), with station 6 quite dissimilar to the two other stations. A third cluster ('east') consists of the stations of the eastern part of the bay (stations 7, 8 and 9).

Also in TWINSPAN (results not shown), the downstream stations of the western creek are separated from the rest in a first division with *Siganus sutor* as indicator species. A second division isolates the most seaward station (station 6). The indicator species is *Ablennes hians*, which was only caught in station 6 (8 individuals). In a last division, station 1 (most upstream in the western creek) is separated from the stations of the eastern part (7, 8 and 9), which form one group together with station 2.

In the ordination plot of the first and the third axis of the correspondence analysis (Fig. 3), the same three groups can be distinguished: one community occurs in the upstream part of the western creek, a second community

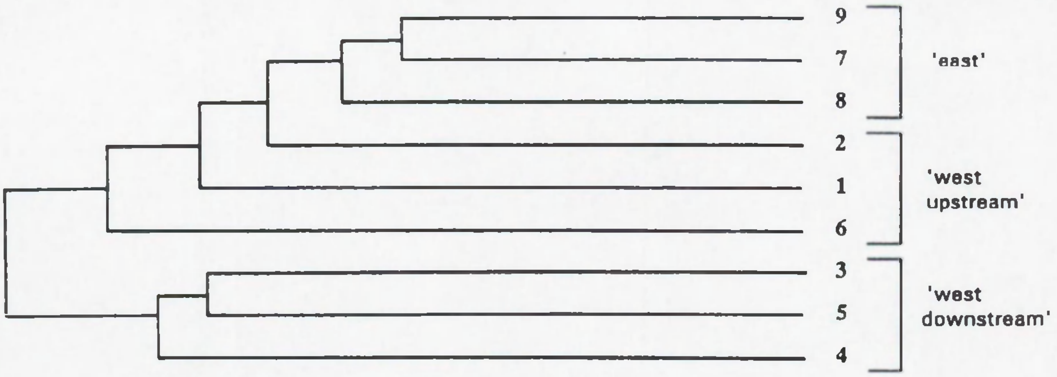

Fig. 2. Result of the cluster analysis.

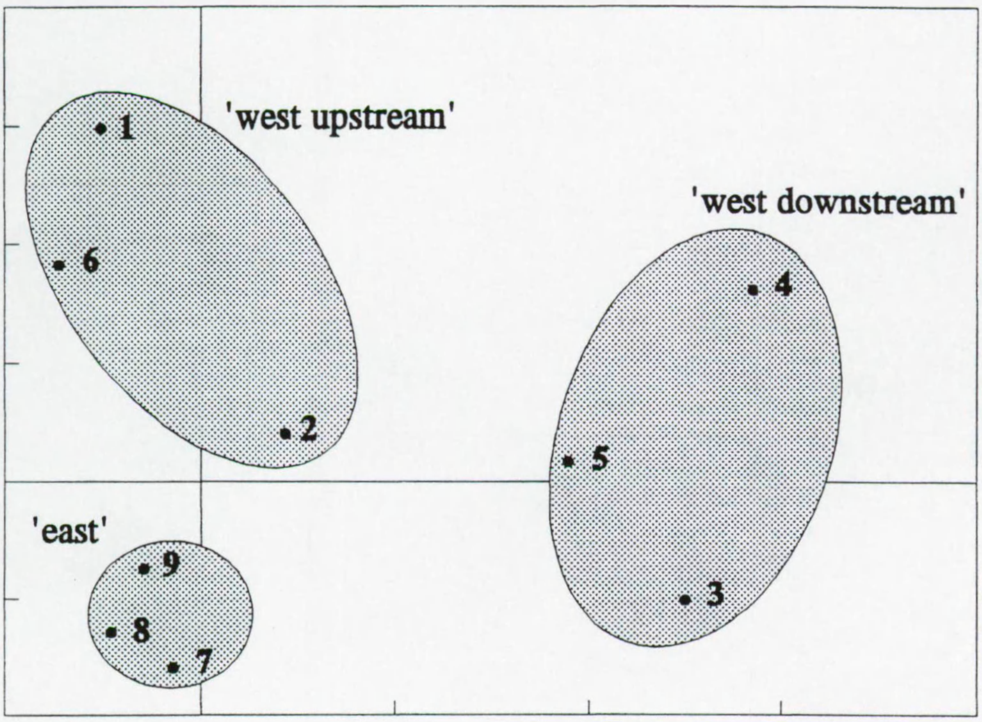

Fig. 3. Result of the correspondence analysis: ordination plot of the first and the third axis.

occurs in the downstream part of the western creek and a third one occurs in the eastern part of the bay.

Characterisation of communities

The density, species composition and diversity of the three communities identified with the multivariate techniques were compared (Fig. 4). The mean densities (mean number of individuals per station) of the three communities were quite different (Fig. 4A). For the community of the downstream part of the western creek the mean density was low (95 ± 109 individuals per station). The community of the upstream part of the western creek was characterised by a higher mean density (806 ± 71 individuals per station). The community of the eastern part of the bay showed an intermediate density with 300 ± 216 individuals per station.

The fish community of the downstream part of the western creek was dominated by *Leiognathus elongatus* (254 individuals, 89%) (Fig. 4B). *Gerres acinaces* (917 individuals, 38%) was the dominant species in the community occurring in the upstream part of the western creek. The other abundant species were mainly schooling species like *Atherinomorus duodecimalis* (26%), *Herklotsichthys quadrimaculatus* (9%), *Stolephorus indicus* (5%) and *Plotosus lineatus* (4%). Quite a number of species was only caught

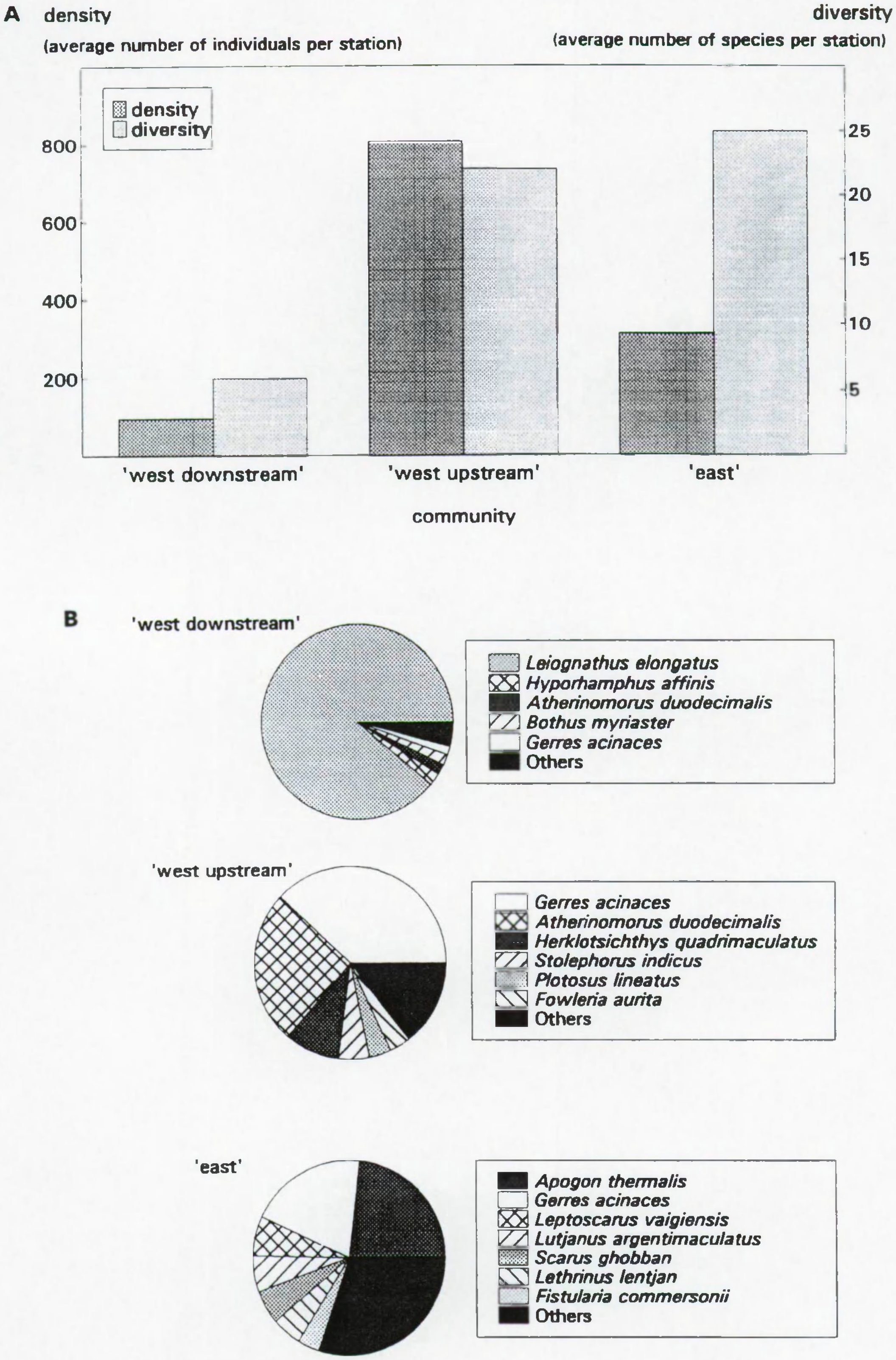

Fig. 4. Density and diversity (A) and species composition (B) of the identified communities.

TABLE I

Hill's diversity indices for the different stations.

	1	2	3	4	5	6	7	8	9
N_0	26	21	9	4	6	20	20	35	21
N_1	9.5	2.2	6.6	1.2	4.6	2.3	12.7	9.2	12.3
N_2	6.6	1.4	4.3	1.1	4.0	1.5	9.8	5.1	8.7
N_∞	3.9	1.2	1.8	1.0	3.2	1.3	5.4	3.1	4.1

in the most upstream station (station 1) of the western creek: *Platax orbicularis*, *Gerres filamentosus*, *Gazza minuta*, *Alectis indicus*, *Caranx sexfasciatus*, *Liza macrolepis* and *Naso brevirostris*. 71% of the individuals of *Sphyraena barracuda* were caught in this station, suggesting that this toppredator enters the creeks to feed on juvenile fishes.

In the eastern community the two dominant species were *Apogon thermalis* (23%) and *Gerres acinaces* (20%). Many species (30%) were caught in this community, mostly in low numbers which explains its high diversity and lower density (Fig. 4A).

The diversity (mean number of species per station) showed another pattern (Fig. 4A). Diversity was low in the community of the downstream part of the western creek (average of 6 species per station). In the communities of the upstream part of the western creek and the eastern part, a higher mean number of species was caught (22 and 25 species per station, respectively). The highest number of species ($N_0 = 35$) was found in station 8 of the eastern creek (dense seagrass beds). The lowest diversity ($N_0 = 4$) was noted in station 4 over sandy bottom (Table I). N_1 indicates the diversity s.s. and is highest for station 7 ($N_1 = 12.7$) and station 9 ($N_1 = 12.3$), both situated in the eastern part of the bay. With increasing order of the diversity index, the importance of the abundant species is increasing and the influence of the species richness decreases. The highest values for N_2 and N_∞ were obtained for two stations (7 and 9) of the eastern part of the bay and for the most upstream station of the western creek (station 1) (Table I).

DISCUSSION

Three communities were identified with the 3 multivariate statistical techniques: one occurred in the upstream part of the western creek and the most seaward station at the mouth of the western creek (borderline), the second occurred in the downstream part of the western creek and the third was located in the eastern part of the study area.

The separation of the western creek in an upstream and a downstream part is mainly based on differences in density, diversity and species composition.

The low density and diversity of the fish community of the downstream part can be explained by the fact that seagrasses are sparse between the sand banks at these sampling stations. For instance, *Siganus sutor* (indicator species in TWINSPAN) is a species typically occurring in seagrass beds and it was found to be absent in the downstream community.

The communities of the upstream part of the western creek and the eastern part of the bay have similar diversities and species compositions. A number of species were found only in these two communities: *Synodus variegatus*, *Fistularia commersonii*, *Parascorpaena mossambica*, *Lutjanus fulviflamma*, *Lethrinus lentjan*, *Parupneus barberinus*, *Scarus ghobban*, *Petroscirtes mitratus*, *Petroscrites breviceps*, *Amblygobius albimaculatus*, *Siganus sutor* and *Paramonacanthus barnardi*. This similarity is linked to the seagrass vegetation, which is well developed in both subareas. The diverse and dense vegetation results in an increased complexity of the environment which is known to determine the suitability of a habitat for certain species and stages (HECK & ORTH, 1980). The shelter from predators provided by the seagrasses is important for juvenile animals. In the western creek, freshwater input from the Kidogoweni river results in a higher turbidity. Thus further reducing predation risk by visual predators.

VAN DER VELDE *et al.* (1994) studied the fish fauna of Gazi Bay using a beam trawl. They found *Fowleria aurita*, *Siganus sutor*, *Leptoscarus vaigiensis* and *Apogon thermalis* to be the dominant species in Gazi Bay. These species were also caught in this study but in lower numbers. *Gerres acinaces* and schooling, pelagic species (*Atherinomorus duodecimalis*, *Herklotsichthys quadrimaculatus*, *Stolephorus indicus*) were not collected with the beam trawl.

LITTLE *et al.* (1988) investigated the ichthyofauna of Tudor Creek (north to Gazi Bay, near Mombasa) with a beach seine. In contrast with the results of VAN DER VELDE *et al.* (1994), pelagic and schooling species formed an important part of the catch. *Gerres oyena* was abundant in Tudor Creek but was not caught with the beach seine in Gazi Bay (54 individuals were caught with the beam trawl by VAN DER VELDE *et al.* (1994)). A remarkable similarity of Gazi Bay with the results of Tudor Creek is the abundance of *Plotosus lineatus* in a lagoon site at the mouth of the estuary, which was also found in station 6 of this study. A number of species were only collected in station 6: *Ablennes hians*, *Dendrochirus brachypterus*, *Sebastapistes strongia*, *Dactyloptena orientalis*, *Lethrinus lentjan*, *Upeneus tragula*, *Lactoria fornasini*, *Ostracion cubicus*, *Arothron immaculatus*, *Arothron meleagris*. This explains the dissimilarity and the separation of this station in the multivariate techniques.

This community analysis shows that there is high correlation between the diversity of the ichthyofauna in seagrass beds and the density and the diversity of the seagrasses. There is not necessarily a positive correlation with the density of the fishes. In the upstream community of the western creek, a high density and diversity was found, but this was not the case in the community of the eastern creek (low density and high diversity).

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ANNEX 4

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DIETS OF ABUNDANT FISHES FROM BEACH SEINE CATCHES IN SEAGRASS BEDS OF A TROPICAL BAY (GAZI BAY, KENYA)

MARLEEN DE TROCH (1), JAN MEES (1) AND ENOCK WAKWABI (1, 2)
(1) University of Gent (RUG), Institute of Zoology, Marine Biology Section,
K.L.Ledeganckstraat 35, B-9000 Gent, Belgium
(2) Kenya Marine and Fisheries Research Institute, P.O. Box 81651, Mombasa, Kenya
e-mail: Marleen.Detroch@rug.ac.be

Abstract. The composition of the diet of 14 fish species that were common in beach seine catches over the seagrass beds of Gazi Bay (Kenya) was investigated. Three trophic guilds could be distinguished based on dietary diversity and on the numerical and gravimetrical composition of the diet. *Herklotsichthys quadrimaculatus*, *Stolephorus indicus* and *Atherinomorus duodecimalis* were planktivores. Their stomach fulness index was low and the diet was not diverse. The main food items were harpacticoid and calanoid copepods and brachyuran zoea and megalopae. *Apogon thermalis*, *Fowleria aurita*, *Paramonacanthus barnardi*, *Mulloides flavolineatus*, *Lutjanus fulviflamma*, *L. argentimaculatus* and *Gerres acinaces* were benthivores, mainly feeding on small epi- and hyperbenthic prey. Their diet was very diverse and it was dominated by Amphipoda (Gammaridea), Tanaidacea and Mysidacea. Their fulness indices were low, but a little bit higher than those observed for the planktivores. A third group were the « piscivores »: *Bothus myriaster*, *Fistularia commersonii*, *Sphyraena barracuda* and *Plotosus lineatus*. The dominant items in the food spectrum of these species were postlarval fishes and large nektonic invertebrates (gammaridean amphipods, mysids, shrimp and crabs). Their diet was not diverse and the fulness index was much higher than that of the other species examined. All other species caught were further classified according to the following feeding guilds: herbivores, planktivores, benthivores (epi- and hyperbenthivores) and piscivores. The ichthyofauna of Gazi Bay was clearly dominated by benthivores.

Key words: feeding ecology, trophic organization, fish, seagrass beds, Kenya

INTRODUCTION

This study presents data on the trophic organisation of the fish fauna of a shallow East-African bay (Gazi Bay, Kenya). The fish fauna of Gazi Bay has received considerable attention in recent years (VAN DER VELDE *et al.*, 1994, DE TROCH *et al.*, 1996, KIMANI *et al.*, 1996, WAKWABI & MEES, unpublished data). For this study, fish were sampled in 9 stations with a beach seine over seagrass beds and unvegetated areas. A total of 3601 fishes belonging to 75 species and 40 families were caught (>95% juveniles). Multivariate analysis of the catch data revealed that 3 communities could be distinguished (DE TROCH *et al.*, 1996): a first community occurred in the downstream part of the river-fed western creek, were sandy bottoms with sparse seagrass vegetation occur. The fish community was characterised by low density and diversity and is not considered further. The two other communities were characterised by a high fish diversity. One community occurred in the upstream part of the western creek and was dominated by *Gerres acinaces* Bleeker, 1854 and *Atherinomorus duodecimalis* (Valenciennes, 1835). The other community was found in the shallow areas of the bay proper and in the mouth area of the eastern creek. There, the dominant species were *Apogon thermalis* Cuvier, 1829 and *G. acinaces* Bleeker, 1854.

Individuals in the dominant size-classes of the most abundant and characteristic species of these latter communities were selected for analysis of stomach contents. For the remaining fish species caught, information about their trophic guild was taken from the literature and from FISHBASE (1995).

The aim of this study was to investigate the diet of some common fishes whose diet is poorly documented to date and to get an idea of the trophic organisation of fishes in a typical East-African bay.

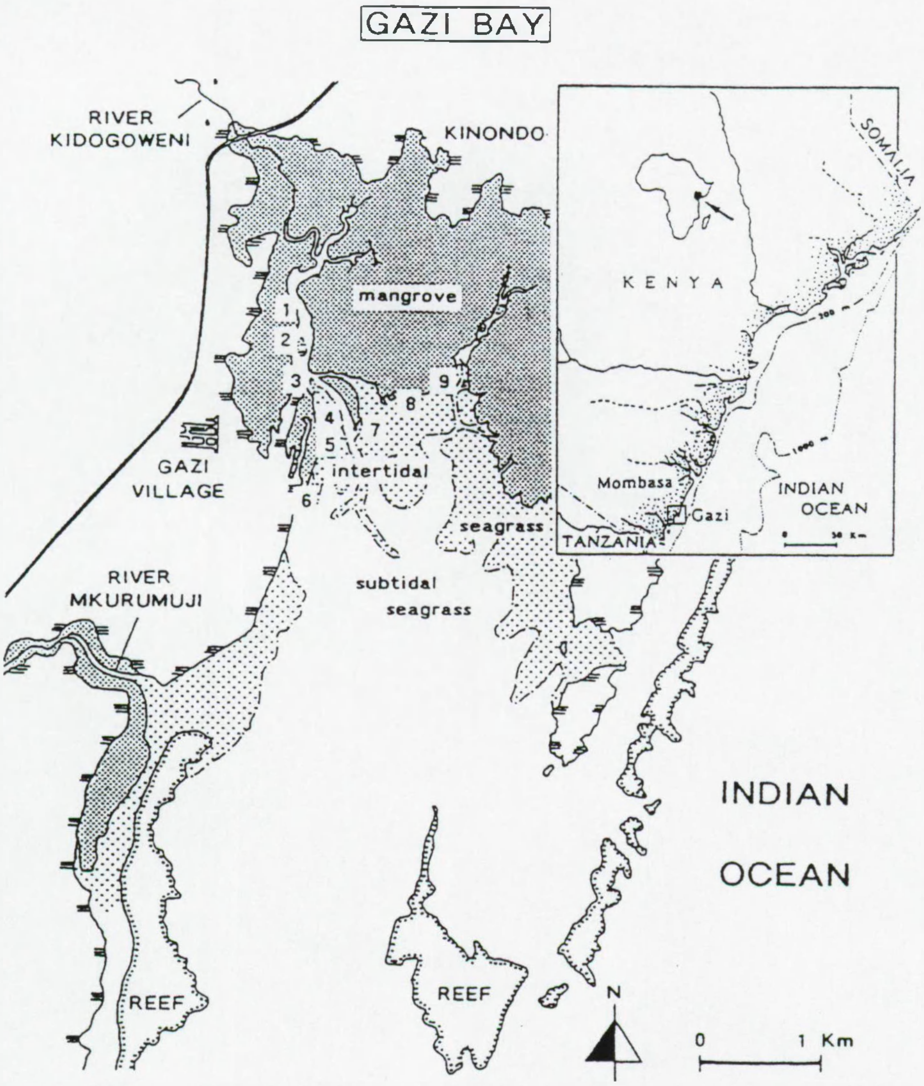

Fig. 1. – Map of Kenya with situation of Gazi Bay (COPPEJANS *et al.*, 1992). Detail of Gazi Bay (SLIM, 1995) with indication of the sampling stations.

MATERIAL AND METHODS

Study area

Gazi Bay (Kenya) is located some 50 km north of the Tanzanian border and 60 km south of Mombasa Island (4°22'S, 39°30'E). The bay is between 1.75 and 3.50 km wide and 3.25 km long and is bordered with mangroves. Two major creeks characterize the system (Fig. 1). The Kidogoweni river enters the bay through the so-called western creek (surface area ± 18 ha). The eastern creek (2.7 ha) has no freshwater input. In both major creeks and in the bay proper dense seagrass beds occur (percentage of cover between 30 and 100% in the creeks and 10 to 30% in the lagoon). The downstream part of the western creek is characterised by a sparse seagrass vegetation on a sandy bottom (SLIM, 1995).

Sampling

Samples were taken from two hours before to two hours after low-water springtide on the 17th (western creek) and 18th of August 1993 (eastern creek) with a beach seine net (1.20 m depth, 25 mm stretched mesh size). As the net was 80 m long, a single semi-circular haul was considered to sweep an area of about 509 m^2. All fish were immediately anaesthetized in a benzocaine solution (ethylamino-4-benzoate in seawater) to prevent regurgitation of the stomach content, and subsequently preserved in a 10% formaldehyde-seawater solution.

The location of the sampling stations is shown in Fig. 1. In each station, one sample was taken. Six stations were located in the western creek. The other three samples were taken in the intertidal and shallow subtidal seagrass beds in the eastern part of the bay (mouth of the eastern creek). The seagrass vegetation in each of these sampling stations is discussed by DE TROCH *et al.* (1996).

Diet analysis

In the laboratory all fishes were identified to species level using the keys provided by SMITH & HEEMSTRA (1986) and BIANCHI (1985). The number of individuals per species was counted and the standard length (SL) was measured to the nearest millimetre.

For all common species (>10 individuals) on which no dietary data was available, the length-frequency distribution was used to select the dominant length class. A list of species examined in this study, together with the length class and the sampling station is given in Table I.

A total of 456 fishes were selected for diet analysis. The fishes were dissected and the entire stomach was removed. For *Atherinomorus duodecimalis* (Valenciennes, 1835), *Mulloides flavolineatus* (Lacepède, 1801), *Fistularia commersonii* Rüppell 1838, *Gerres acinaces* Bleeker, 1854, *Lutjanus fulviflamma* (Forsskål, 1775) and *Lutjanus argentimaculatus* (Forsskål, 1775) the content of the stomach and the digestive tracts was considered as the stomach content *sensu lato*. All items present in the stomachs were identified to a high taxonomic level (Table II) and counted. The average number of prey (and prey biomass) per individual is indicated in the results as an indication for the difference in prey abundance (and average represented biomass). The numerical percentage (%N) of each prey item in the diet of a fish was calculated as:

$$\%N_i = \frac{number\ of\ individuals\ of\ prey\ item_i}{total\ number\ of\ ingested\ prey}\ x\ 100$$

TABLE I

List of the fish species used for stomach analysis, with indication of the sampling stations, the modal length class (SL in mm), the number of individuals analyzed and the abbreviations used

Species	***station***	***length***	***number***	***abbreviation***
Herklotsichthys quadrimacu-latus	1	70-73	15	He
Stolephorus indicus	1	40-45	10	StS
	1	70-75	10	StL
Plotosus lineatus	6	210-220	15	Pl
Atherinomorus duodecimalis	2	33-35	15	At
Fistularia commersonii	7,8	150-290	20	FiE
	1	135-285	8	FiW
Apogon thermalis	8	30-33	15	ApE
	1	35-38	15	ApW
Fowleria aurita	1	20-25	15	Fo
Lutjanus fulviflamma	8	75-110	12	LuF
Lutjanus argentimaculatus	1,8	20-120	72	LuA
Gerres acinaces	1,6,8	50-130	181	Ge
Mulloides flavolineatus	8	80-95	10	Mu
Sphyraena barracuda	1,2	90-350	18	Sp
Bothus myriaster	2	30-150	10	Bo
Paramonacanthus barnardi	7,8	25-45	15	Pa

All prey items were measured and their ashfree dry weights (AFDW) prior to ingestion were calculated from length-AFDW regressions (Table II). For regressions using DW (dry weight), AFDW was calculated as 10% of this DW. The original size of incomplete prey items was calculated from regressions relating unbroken parts to total length, e.g. a telson. For nematodes, foraminifers, harpacticoids, calanoids, ostracods, cladocers and brachyuran larvae assigned AFDW values were used (Table II) (MEES, 1994). Diet composition could then also be expressed as gravimetrical percentage (%G):

$$\%G_i = \frac{AFDW\ prey\ item_i}{total\ AFDW\ of\ the\ ingested\ food}\ x\ 100$$

TABLE II

List of the assigned biomass values, the length-ashfree dry weight (AFDW) and other morphometric regressions used to calculate the biomass of the different prey items. All lengths (L), total lengths (TL) and carapax width (CW) are in mm; all dry weights (DW), ashfree dry weights (AFDW) and assigned values are in mg

Nematoda	assigned value: 0.003
Foraminifera	assigned value: 0.001
Annelida	
Oligochaeta	ln AFDW = -6.030 + 1.813 ln L
Polychaeta	ln AFDW = -7.139 + 2.489 ln L
Mollusca	
Bivalvia	ln AFDW = -4.052 + 2.817 ln L
Crustacea	
Copepoda	
Calanoida	assigned value (adult): 0.016
Harpacticoida	assigned value (copepodite): 0.002
	assigned value (adult): 0.004
Ostracoda	assigned value: 0.014
Cladocera	*Daphnia* species: 0.01
Peracarida	
Cumacea	ln AFDW = -6.078 + 2.525 ln TL
Mysidacea	
Mesopodopsis spec.	ln AFDW = -6.107 + 2.867 ln SL
Other Mysidacea	ln AFDW = -6.120 + 2.994 ln SL
Isopoda (idem *Tardigrada*)	ln AFDW = -5.857 + 2.863 ln TL
Amphipoda	
Gammaridae	ln DW = -6.301 + 2.849 ln SL
Corophidae	ln DW = -6.435 + 2.681 ln SL
Other Amphipoda	ln AFDW = -5.857 + 2.863 ln TL
Tanaidacea	ln DW = -4.241 + 1.644 ln SL
Eucarida - Decapoda	
Caridea	
Crangon crangon	ln AFDW = -7.684 + 3.321 ln TL
	TL = -0.6 + 8.7 AP
	TL = -0.4 + 3.82 CL
	TL = -0.4 + 6.1 TE
Brachyura	
zoea	assigned value: 0.050
megalopa	assigned value: 0.189
adult	ln AFDW = -3.967 + 3.164 ln CW
Pisces	ln AFDW = -7.851 + 3.460 ln SL
fish eggs	assigned value: 0.025

A standardized way to measure or evaluate the weight (DW, dry weight) of the ingested food, is to express the amount of food as a percentage of the total fish weight, according to the formula for the fulness index (FI) defined by HUREAU (1969) (BERG, 1979):

$$FI = \frac{DW\ of\ stomach\ content}{total\ body\ DW} \times 100$$

To estimate the dry weight of the stomach content, this content was dried during 5 days at 60°C and weighted to 0.1 mg using a Sauter-balance.

The fulness index was not calculated for *Plotosus lineatus* (Thunberg, 1787) and *Sphyraena barracuda* (Walbaum, 1792) as the dry weight of these large species was not estimated. Empty stomachs were not included in the calculations.

To assess niche breadth the Shannon-Wiener diversity index (HILL, 1973) was calculated as:

$$H' = \sum_{i=1}^{n} p_i (\log p_i)$$

$$with\ p_i = \frac{N_i}{N_t} = relative\ abundance\ of\ prey\ item_i$$

RESULTS

Diet composition of dominant species

The stomach contents of the examined species are discussed in terms of numerical (%N) and gravimetrical (%G) percentages (Figs 2-3).

***Herklotsichthys quadrimaculatus* (Rüppell, 1837) (Blueline herring)**

An average of 93 prey items was present in the ingested contents per individual. This average corresponds to a biomass of 3.3 mg AFDW per individual.

Numerically, harpacticoids were the dominant prey (69.7% of the total number of ingested prey). Other important prey items were brachyuran zoea larvae and Mollusca (mainly gastropods), which accounted for 9.3%N and 8.4%N, respectively. Ostracods (4.2%) and calanoid copepods (3.4%) were less important in the total food spectrum. Other prey items were brachyuran megalopa larvae (1.7%), isopods (1.4%N), tanaids (0.9%N) and gammaridean amphipods (0.3%N). Gravimetrically, the diet was dominated by megalopa larvae (54.2%G) and molluscs (17.3%G). The numerically dominant harpacticoids represented only 7.8% of the total amount of ingested biomass.

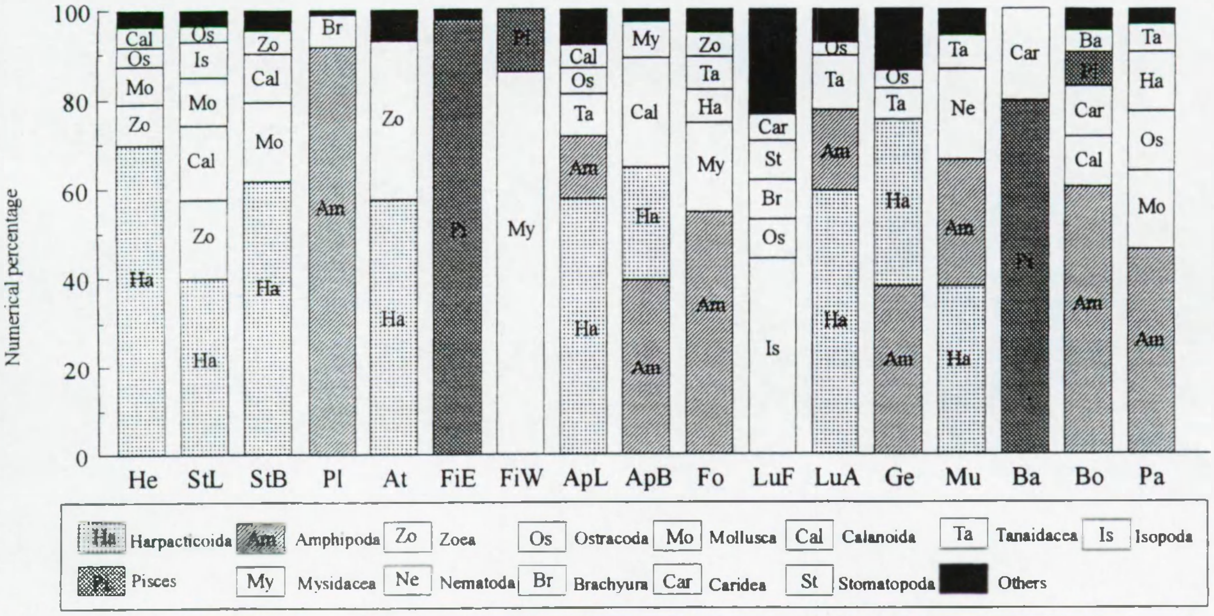

Fig. 2. – Numerical diet composition of the investigated fish species (abbreviations see Tabel I)

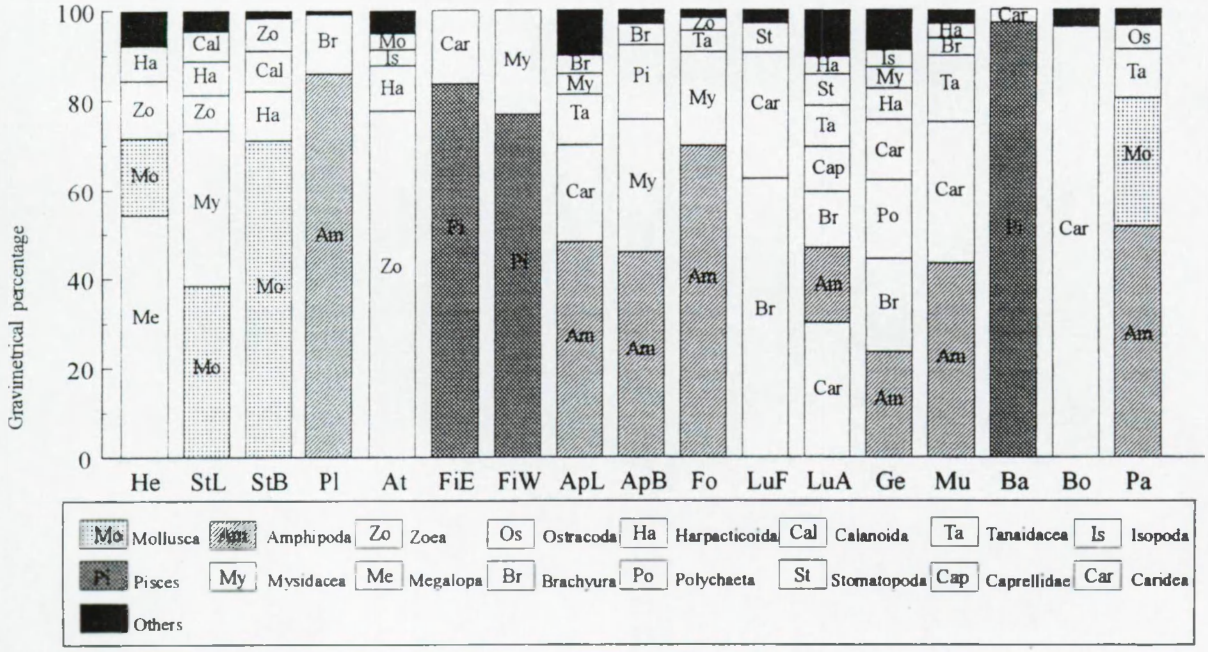

Fig. 3. – Gravimetrical diet composition of the investigated fish species (abbreviations see Tabel I)

Stolephorus indicus (van Hasselt 1823) (Indian anchovy)

Since the length-frequency distribution of this species was clearly bimodal, individuals of two length classes were considered : 40-45 mm : StS (*Stolephorus indicus* small) and 70-75 mm : StL (*Stolephorus indicus* large).

An average number of 11.2 prey items was found in the individuals of the 40-45 mm length class. This corresponds to an average biomass of 0.6 mg AFDW. Individuals of the second length class contained an average of 38.4 prey and 0.46 mg AFDW per individual.

In both length classes harpacticoids were numerically dominant (39.8%N for StS, 61.7%N for StL). Other important prey were zoea larvae (17.7%N for StS, 5.2%N for StL), calanoids (16.8%N for StS, 10.7%N for StL) and molluscs (mainly gastropods) (10.6%N for StS, 17.7%N for StL). The diet resembles that of *Herklotsichthys quadrimaculatus* in terms of prey species, but not in the relative importance of each item *e.g.* calanoids were more important in the foodspectrum of *S. indicus*.

In terms of biomass, the Indian anchovy mainly utilised molluscs (gastropods) (38.4%G for StS, 71.0%G for StL). The main difference between both length classes was the contribution of mysids to the diet: these were absent from the stomachs of the larger (70-75 mm) individuals, while they formed an important prey (35%G) for the smaller (40-45 mm) individuals.

Plotosus lineatus (Thunberg 1787) (Striped eel-catfish)

An average of 37 prey items was found in the stomachs analysed. This corresponds to an average biomass uptake of 111 mg AFDW per fish. Numerically, the diet was dominated by amphipods (90.7%N) and Brachyura (8.4%N). The remaining prey (0.9%N) were Polychaeta and Caridea. The gravimetrical composition was also dominated by amphipods (85.6%G) and Brachyura (14.1%G). The other prey items counted for only 0.4% of the biomass.

Atherinomorus duodecimalis (Valenciennes 1835) (Tropical silverside)

An average of 170 prey items per individual was found, corresponding to an average biomass of 3.9 mg AFDW per fish. The food spectrum was dominated by harpacticoids (57.5%N) and zoea larvae (35.4%N). Calanoids (2.7%), isopods (1.4%), molluscs (1.3%) and prey species that were only occasionally found (foraminifers, ostracods, megalopa larvae, amphipods, brachyurans, tanaids, oligochaetes and shrimp) together accounted for 7.1%N of the diet.

Zoea larvae (77.6%G) dominated in gravimetrical terms. The tropical silverside contained an average of 3 mg AFDW of zoea larvae per individual. The numerically dominant harpacticoids represented 10.1% of the total gravimetrical composition. The other prey items were quite negligible in the total ingested biomass.

Fistularia commersonii (Rüppell 1838) (Smooth flutemouth)

The diets of individuals of the smooth flutemouth from the eastern creek (FiE) and the western creek (FiW) were compared.

In the analysis of the specimens from the eastern creek (FiE), an average of 4 prey items was found (14.8 mg AFDW). The dominant prey item was Pisces (97.6%N). Caridea and Amphipoda both accounted for 1.3%N. The importance of fish is also shown in the gravimetrical composition, where they constituted 83.7% of the ingested biomass. Caridea were more important gravimetrically (16.3%G) than numerically.

An average of 28 prey items per fish was found (18.1 mg AFDW) in the individuals from the western creek (FiW). Here mysids (86%N), 23.9 mysids per fish, dominated the diet. Pisces represented 14%N. The gravimetrical composition was similar to that of the individuals from the western creek. The major part was formed by fish (76.8%G). This corresponds to an average of 4.2 mg AFDW per individual. The remaining 23.2%G was mysids.

Apogon thermalis (Cuvier 1829) (Masked cardinal)

The individuals of the masked cardinal were taken from the eastern (30-33 mm standard length : ApE) and the western (35-38 mm standard length : ApW) creek.

In the individuals of the eastern creek, an average of 10.5 prey per individual was found (average biomass : 0.7 mg AFDW per fish). The masked cardinal fed primarily on harpacticoids (57.6%N). The other half of the diet consisted of gammaridean amphipods (13.9%N), tanaids (9.5%N), calanoids (5.7%N) and ostracods (5.1%). The 'other' prey (8.2%) were mysids, caridean shrimp, brachyuran crabs, isopods, Caprellidea, tardigrads and molluscs. The gravimetrical composition was dominated by Amphipoda (48.1%G) and Caridea (21.9%G).

The individuals of the western creek contained an average of 9 prey items per individual (0.9 mg AFDW per fish). Compared to the individuals of the eastern creek, the same prey items were consumed but amphipods (39.3%N) were the most important prey. Half of the diet was numerically composed of harpacticoids (25.2%) and mysids (24.4%).

Gravimetrically, the diet was also dominated by amphipods (45.7%G) but mysids (29.9%G) replaced the Caridae from the diet of individuals from the eastern creek . Pisces accounted for 16.6% of the ingested biomass, but were numerically low.

Fowleria aurita (Valenciennes 1831) (Crosseyed cardinal)

An average of 3.7 prey per fish were counted (0.6 mg AFDW per fish). Amphipods were numerically dominant (54.5%N). Mysids accounted for 20% of the total number of ingested prey. Tanaids and harpacticoids both represented 7.3%N, while the numerical percentage of the zoea larvae was 5.5%. The diet was supplemented with calanoids, Caridea and Polychaeta.

The gravimetrical composition emphasizes the importance of amphipods (69.7%G) in the diet. Mysidacea are the second most important source of energy (20.9%G) and tanaids represented 4.7%G.

Lutjanus fulviflamma (Forsskål 1775) (Dory snapper)

Very few prey items (average of 3 per individual) were found per fish, corresponding to an average biomass uptake of 11.9 mg AFDW.

The diet of *L. fulviflamma* (Dory snapper) was numerically dominated by isopods (mainly Sphaeromatidae): 44.1%N. Other important prey were ostracods (8.8%N), brachyurans (8.8%N), stomatopods (8.8%N) and caridean shrimp (5.9%N). The 'other' prey were mainly polychaetes (2.9%N) and unidentified crustacean material (1.1%N).

The gravimetrical composition was principally brachyurans (62.3%G), shrimp (27.3%G) and stomatopods (6.4%G).

Lutjanus argentimaculatus (Forsskål 1775) (River snapper)

An average of 22 prey items per fish was found, corresponding to a biomass of 1.2 mg AFDW.

L. argentimaculatus mainly fed on harpacticoids (59.3%N). A smaller percentage was covered by amphipods (18.1%N), tanaids (12.0%N) and ostracods (3.0%N).

Gravimetrically, the important food sources were shrimp (29.8%G), amphipods (16.8%G), brachyurans (12.7%G), caprellids (10.0%G), tanaids (9.3%G), stomatopods (6.8%G) and harpacticoids (4.2%G).

Gerres acinaces (Bleeker 1854) (Smallscale pursemouth)

The diet of the smallscale pursemouth, with an average of 31 prey items per individual (2.9 mg AFDW), was composed of amphipods (38.0%N), harpacticoids (37.1%N), tanaids (7.4%N) and ostracods (4.5%N). The 'other' prey were isopods, polychaetes and shrimps.

Gravimetrically, the diet is more diverse with prey-items like amphipods (23.6%G), brachyurans (20.8%G), polychaetes (19.2%G), shrimps (13.6%G), tanaids (7.0%G), mysids (4.7%G), isopods (3.8%G), megalopae larvae (2.1%G) and harpacticoids (1.6%G).

The stomach content of *G. acinaces* was characterised by high amounts of detritus (mainly fine macrophytal material) and sediment particles. An average of 85% of the stomach content weight was attributed to sediment and detritus.

Mulloides flavolineatus (Lacepède 1801) (Yellowstripe goatfish)

An average of 20 prey items per fish was found (0.96 mg AFDW). Numerically the diet of the yellowstripe goatfish was dominated by harpacticoids (37.9%N), amphipods (28.3%N) and nematodes (20%N). Other prey were tanaids (7.6%N), ostracods (2.0%N), brachyurans (1.5%N), Caridea (1.0%N), isopods (1.0%N) and polychaetes (0.5%N).

In gravimetrical terms amphipods dominated as they accounted for almost half (43%G) of the ingested biomass. The numerically low Caridea, constituted 31.8% of the gravimetrical composition. Nematodes were gravimetrically insignificant (1.2%G).

Sphyraena barracuda (Walbaum 1792) (Great barracuda)

An average of only 1 prey item per fish was found. Still, the average biomass uptake was 1327.3 mg AFDW per individual. Both numerically and gravimetrically (79.3% N and 97% G), the dominant prey items were Pisces. The diet was supplemented with caridean shrimp (20%N, 3%G).

Bothus myriaster (Temminck & Shlegel 1846) (Disc flounder)

An average of 8 prey items was found per fish (68.5 mg AFDW). Amphipods (60%N) dominated the diet. Calanoids and brachyurans were of secondary importance (both 11%N). Other prey items were Caridea, Pisces, Harpacticoida and Cumacea. Gravimetrically, the diet was dominanted by Caridea (96%G).

Paramonacanthus barnardi (Fraser-Brunner 1941) (Wedgetail filefish)

An average number of 45 prey items and 2.1 mg AFDW was found. Numerically, amphipods dominated the diet (46.1%N). This percentage corresponds to an average of 20 amphipods per fish. The second important prey were gastropod molluscs (almost one fifth). Ostracods and harpacticoids were less important (both 13%N). Other prey were tanaids, isopods, caprellids, foraminifers, tardigrads, calanoids, shrimp, brachyuran zoea larvae and nematodes.

Amphipods (51.5%G) were also dominant in the gravimetrical composition. Molluscs represented one fourth of the gravimetrical composition.

Others

For the remaining species caught the trophic guild to which they belong is given in Table III. This classification is based on information available in the literature and in FishBase (1995).

TABLE III

Species list with number of individuals in the communities of the western (N_{ind} west) and eastern (N_{ind} west) creeks and both communities pooled (N_{total}) together with the trophic guild

species	N_{total}	N_{ind} *west*	N_{ind} *east*	*trophic guild*	*source*
Gerres acinaces	1095	917	178	benthivore	Smith & Heemstra (1986), present study
Atherinomorus duodecimalis	622	622	-	planktivore	present study
Apogon thermalis	228	21	207	benthivore	present study
Herklotsichthys quadrimaculatus	227	225	2	planktivore	Milton *et al.* (1994), present study
Stolephorus indicus	128	128	-	planktivore	Whitehead (1985), present study
Fowleria aurita	100	85	15	benthivore	Sano *et al.* (1984), present study
Plotosus lineatus	88	88	-	piscivore	Van Waeyenberg (1994), present study

species	N_{total}	N_{ind} *west*	N_{ind} *east*	*trophic guild*	*source*
Lutjanus argentimaculatus	87	33	54	benthivore	Kulbicki *et al.* (1993), present study
Leptoscarus vaigiensis	60	2	58	herbivore	Sousa & Dias (1981)
Lethrinus lentjan	60	15	45	benthivore	Carpenter & Allen (1989)
Scarus ghobban	55	6	49	herbivore	Sano *et al.* (1984), Anderson & Hafiz (1987)
Lutjanus fulviflamma	53	21	32	benthivore	Sano *et al.* (1984), present study
Scarus spec.	53	42	11	herbivore	Smith & Heemstra (1986)
Siganus sutor	46	23	23	herbivore	Woodland (1990), Robins *et al.* (1991)
Fistularia commersonii	46	13	33	piscivore	present study
Leiognathus fasciatus	41	41	-	benthivore	Blaber (1980), Fischer *et al.* (1990)
Paramonacanthus barnardi	35	7	28	benthivore	present study
Petroscirtes mitratus	28	15	13	herbivore	Sano *et al.* (1984)
Petroscirtes breviceps	28	1	27	herbivore	Sano *et al.* (1984)
Parupeneus barberinus	22	17	5	benthivore	Sano *et al.* (1984)
Sphyraena barracuda	20	18	2	piscivore	Randall (1967), present study
Stethojulis strigiventer	19	1	18	benthivore	Sano *et al.* (1984)
Amblygobius albimaculatus	17	3	14	herbivore	Sano *et al.* (1984)
Parascorpaena mossambica	14	9	5	unknown	-
Mulloides flavolineatus	13	2	11	benthivore	present study
Syngnathoides biaculeatus	11	-	11	planktivore	Smith & Heemstra (1986)
Cheilio inermis	10	-	10	piscivore	Sano *et al.* (1984)
Bothus myriaster	10	10	-	piscivore	present study
Cheilodipterus quinquelineatus	8	-	8	benthivore	Sano *et al.* (1984), Paxton *et al.* (1989)
Ablennes hians	8	8	-	piscivore	Fischer *et al.* (1990)
Sebastapistes strongia	7	7	-	unknown	-
Pterois miles	5	1	4	unknown	-
Oplopomus oplopomus	6	-	6	benthivore	Sano *et al.* (1984)
Synodus variegatus	6	5	1	benthivore	Paulin *et al.* (1989)
Gazza minuta	4	4	-	piscivore	Blaber (1980)
Solenostomus cyanopterus	4	-	4	planktivore	Myers (1991)
Pelates quadrilineatus	4	-	4	benthivore	Smith & Heemstra (1986)
Platax teira	3	2	1	unknown	-
Tylosurus crocodilus crocodilus	1	-	1	piscivore	Randall (1967), Blaber (1980)
Canthigaster bennetti	3	1	2	herbivore	Myers (1991)

species	N_{total}	N_{ind} *west*	N_{ind} *east*	*trophic guild*	*source*
Aluterus scriptus	3	-	3	benthivore	Randall (1967), Myers (1991)
Alectis indicus	3	3	-		piscivore Fischer & Bianchi (1984), Fischer *et al.* (1990)
Cheilinus chlorourus	2	2	-	benthivore	Sano *et al.* (1984)
Gerres rappi	2	-	2	benthivore	Woodland (1984)
Upeneus tragula	2	2	-	benthivore	Sano *et al.* (1984)
Ostracion cubicus	2	2	-	herbivore	Myers (1991), Cornic (1987)
Gerres filamentosus	2	2	-	benthivore	Blaber (1980)
Lethrinus harak	2	2	-	benthivore	Carpenter & Allen (1989)
Asterropteryx semipunctatus	2	-	2	herbivore	Sano *et al.* (1984)
Liza macrolepis	2	2	-	herbivore	Skelton (1993), Thomson & Luther (1984)
Dendrochirus brachypterus	2	2	-	unknown	-
Arothron meleagris	2	2	-	herbivore	Randall (1985), Guzman & Lopez (1991)
Trachyrhamphus bicoarctatus	2	2	-	benthivore	Smith & Heemstra (1986)
Leiognathus elongatus	1	1	-	benthivore	James (1984)
Lactoria fornasini	1	1	-	unknown	-
Caranx sexfasciatus	1	1	-	piscivore	Honebring (1990), Salini *et al.* (1994)
Epinephelus spec.	1	-	1	unknown	-
Dactyloptena orientalis	1	1	-	unknown	-
Naso brevirostris	1	1	-	herbivore	Randall (1985)
Parupeneus macronema	1	-	1	benthivore	Fischer *et al.* (1990)
Platax orbicularis	1	1	-	unknown	-
Aulostomus chinensis	1	-	1	piscivore	Randall (1985)
Aeoliscus punctulatus	1	-	1	planktivore	Smith & Heemstra (1986)
Platycephalus indicus	1	-	1	piscivore	Fischer *et al.* (1990)
Chaetodon xanthocephalus	1	-	1	herbivore	Cornic (1987)
Diagramma pictum	1	-	1	benthivore	Jones *et al.* (1992)
Tylerius spinosissimus	1	-	1	unknown	-
Oligolepis acutipennis	1	-	1	benthivore	Sano *et al.* (1984)
Arothron immaculatus	1	1	-	herbivore	Randall (1985)
Neopomacentrus cyanomos	1	1	-	herbivore	Parrish (1989)

Fulness index (FI)

The mean fulness indices together with the standard errors are shown in Fig. 4.

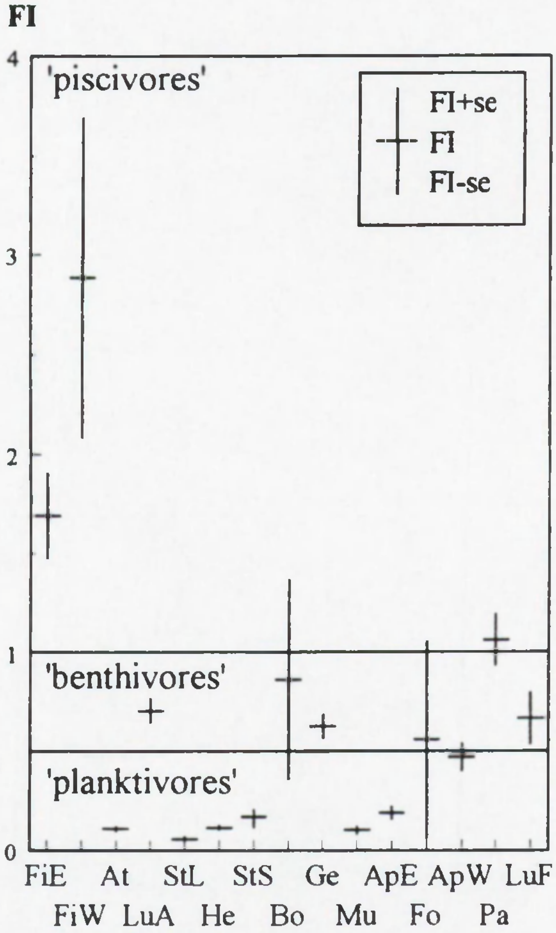

Fig. 4. – Fulness index (FI) together with the standard error (se)

For most species the fulness index was lower than 0.5: *Atherinomorus duodecimalis* (FI = 0.109 ± 0.008), *Stolephorus indicus* (70-75mm) (FI = 0.060 ± 0.011), *Herklotsichthys quadrimaculatus* (FI = 0.115 ± 0.009), *S. indicus* (40-45 mm) (FI = 0.172 ± 0.056), *Mulloides flavolineatus* (FI = 0.102 ± 0.016), *Apogon thermalis* (30-33mm) (FI = 0.189 ± 0.031), *A. thermalis* (35-38mm) (FI = 0.473 ± 0.066).

Five species had a fulness index between 0.5 and 1: *Lutjanus argentimaculatus* (FI = 0.71 ± 0.06), *Bothus myriaster* (FI = 0.864 ± 0.502), *Gerres acinaces* (FI = 0.63 ± 0.06), *Fowleria aurita* (FI = 0.561 ± 0.497) and *L. fulviflamma* (FI = 0.67 ± 0.13).

The fulness index of the other species had a value between 1 and 3: *Fistularia commersonii* in the eastern creek (FI = 1.692 ± 0.218) and in the western creek (FI = 2.889 ± 0.802) and *Paramonacanthus barnardi* (FI = 1.066 ± 0.129).

Diversity of the diet

The diet was most diverse for *Lutjanus fulviflamma* (H'=0.89), *Paramonancanthus barnardi* (H'=0.81), *Apogon thermalis* (35-38 mm) (H'=0.79), *Fowleria aurita* (H'=0.77), *Apogon thermalis* (33-36 mm) (H'=0.74), *Mulloides flavolineatus* (H'=0.72) and *Gerres acinaces* (H'=0.71) (Fig. 5). This group corresponds to the species that mainly fed on benthic (hyper- and epibenthic) prey. A second group was characterised by a lower dietary diversity ranging from 0.4 to 0.55 : *Atherinomorus duodecimalis* (H'=0.44), *Lutjanus fulviflamma* (H'=0.45), *Stolephorus indicus* (70-75mm) (H'=0.51) and *Herklotsichthys quadrimaculatus* (H'=0.53). This group mainly fed on harpacticoids (except *Lutjanus fulviflamma*) and were considered to be 'planktivores' in this study. The diet of two species had an intermediate diversity : *Stolephorus indicus* (40-45mm) (H'=0.64) and *Bothus myriaster* (H'=0.66). The 'piscivores' *Plotosus lineatus* (H'=0.15), *Fistularia commersonii* (eastern creek) (H'=0.06), *F. commersonii* (western creek) (H'=0.18) and *Sphyraena barracuda* (H'=0.22) had the least diverse diet.

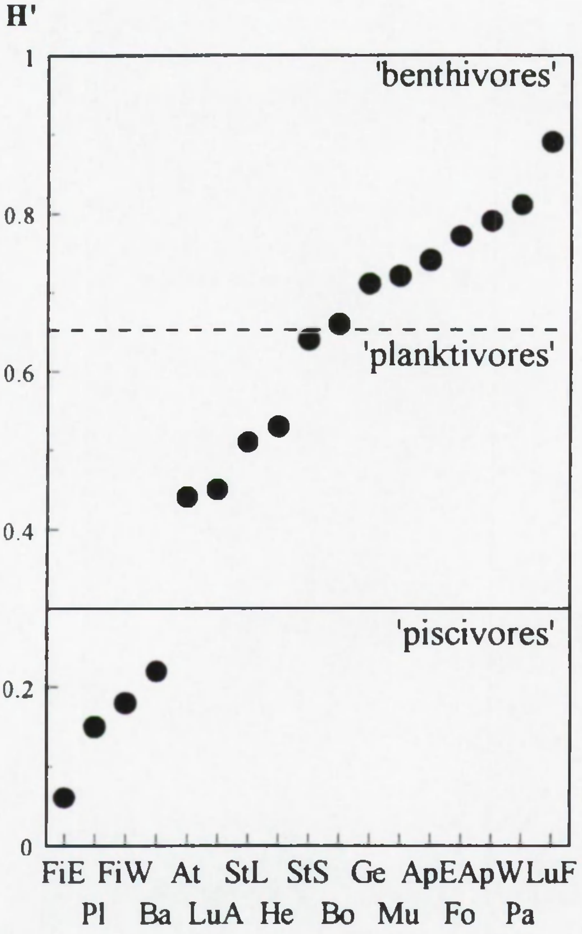

Fig. 5. – Diversity of the diet (Shannon-Wiener index H')

DISCUSSION

Based on the numerical and gravimetrical composition of the diet, the fulness index and the diversity of the diet four guilds (SIMBERLOFF & DAYAN, 1991) could be distinguished. *Herklotsichthys quadrimaculatus*, *Stolephorus indicus* and *Atherinomorus duodecimalis* were planktivores which mainly fed on harpacticoid and calanoid copepods and brachyuran zoeae and megalopae. They were characterised by a low fulness index and an average diversity of the diet of 0.53. These species mainly fed on planktonic prey. Harpacticoid copepods may also have been taken from the leaves of seagrasses, where they are very abundant (DE TROCH, unpublished data). The guild of the planktivores thus needs a broad interpretation. Species feeding on epiphytic organisms were also included in this guild. PARRISH (1989) separated the planktivores based on whether they feed on pelagic holoplankton or « demersal » meroplankton. VAN DER VELDE *et al.* (1994) used the guild planktivore/benthivore for species feeding on merozooplankton and benthic organisms.

The diet of *Apogon thermalis*, *Fowleria aurita*, *Paramonacanthus barnardi*, *Mulloides flavolineatus*, *Lutjanus argentimaculatus*, *L. fulviflamma* and *Gerres acinaces* was mainly composed of amphipods, tanaids and mysids. On average, their diet was very diverse (H'=0.74) and the fulness index was intermediate. They were considered to belong to the guild of the « benthivores ».

The data suggest that this guild can actually be divided in 3 subguilds, based on the sub-compartment of the benthos they preferentially utilise. Species feeding predominantly on mysids and amphipods (e.g. *Apogon thermalis*, *Fowleria aurita*) can be considered to be « hyperbenthivores » i.e. they feed in the water layers close to the substratum (the uppermost benthic compartment or hyperbenthal) where these taxa are known to occur abundantly (MEES & JONES, 1997; MEES, unpublished data). Species like *Paramonacanthus barnardi*, *Mulloides flavolineatus*, *Lutjanus argentimaculatus* and *L. fulviflamma* mainly consume tanaids, amphipods, isopods, molluscs, ostracodes, polychaetes... and can be considered to be « epibenthivores ». They feed on taxa that live in close association with the substratum or that are attached to the seagrasses. *Gerres acinaces* is an « endobenthivore », as shown by the high amounts of sediment in their stomach. They take their prey by filtering the sediment through the gills.

The food composition of *Plotosus lineatus*, *Fistularia commersonii*, *Sphyraena baracuda* and *Bothus myriaster* was dominated by fish and nektonic macrocrustaceans (caridean shrimp, large amphipods, crabs and mysids). Their diet had a very low diversity (average H'=0.15) and the fulness index was higher than that of the other species examined. PARRISH (1989) also used the guild of piscivores, while MORTON (1990) made a distinction between intermediate carnivores (feeding on macrobenthos and small fishes) and topcarnivores (exclusively feeding on fishes).

The trophic guild of « herbivores » (not encountered during the stomach analysis performed for this study) is broad and can also be divided into several subguilds. Species feeding on algae and seagrasses, as well as detritivores and corallivores were placed in this guild. Only juveniles of the corallivorous species were caught in the seagrass beds, where they are supposed to feed on non-corallivorous material. Some scientists have approached this problem by lumping herbivores and coral feeders together (PARRISH, 1989). « Non-carnivore » would be a better term instead of « herbivore ».

In the community of the western creek, half of the individuals (49%) were benthivores (Fig. 6A). This is correlated with the high densities of *Gerres acinaces* and *Lutjanus argentimaculatus*. Also planktivores were important in this community (40%). In terms of number of species (Fig. 6B), the community was also dominated by benthivores (37%). The high density of planktivores was attributable to a low number of species (7% of the total number of species in the community). This can be explained by the monospecific schooling behaviour of species like *Herklotsichthys quadrimaculatus*, *Stolephorus indicus* and *Atherinomorus duodecimalis*.

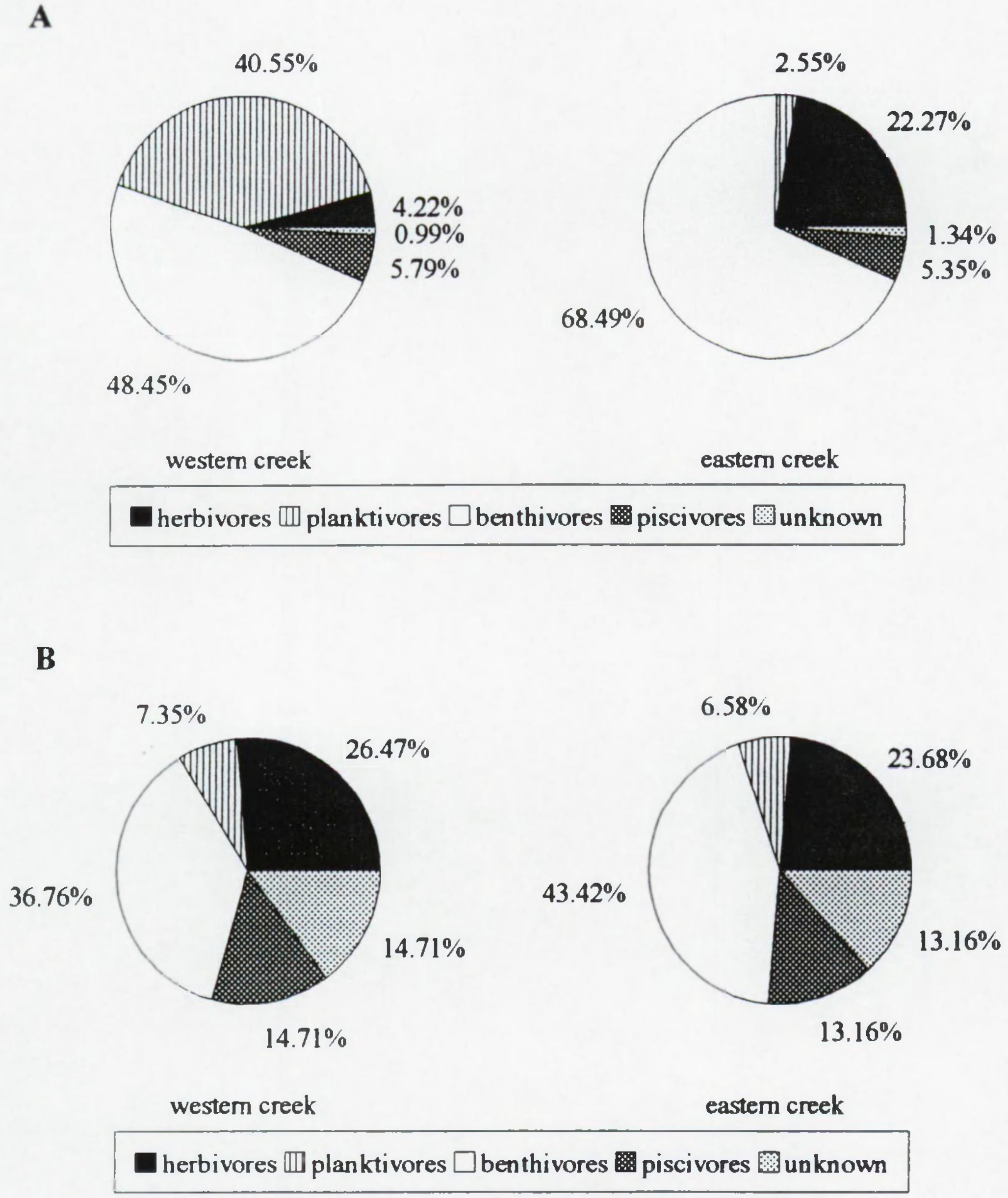

Fig. 6. – Trophic composition of the ichthyofauna occurring in the eastern and the western creek : (A) based on the densities, (B) based on the number of the species.

The fish community of the eastern creek was also dominated by benthivores (69% of the total density, Fig. 6A), corresponding to 43% of the total number of species (Fig. 6B). In this community, the densities and number of herbivorous species were remarkably higher (22% of the total density, 24% of the number of species) than in the community occurring in the western creek (less than 5% of the total density but 26% of the number of species).

It should be stated that the data obtained in this study were based on a single sampling campaign where mainly juvenile fishes were caught. The results and conclusions characterizing different guilds are thus based on dietary information for juvenile fishes. The same is true for the relevance of using niche breadth and fulness index. Additional data from a temporal study are currently being analyzed by E.O. Wakwabi.

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ANNEX 5

Epibenthos data, Gazi Bay, December 1994-September 1996

December 94

	cp31294A	cp31294B	m1294A	m1294B	T11294A	T11294B	T21294A	T21294B	T31294A	T31294B	cp41294A	cp41294B	cp51294A	cp51294B	Sum
Scar sord		9.00	7.00				55.00				11.00	2.00			84.00
Scar glob															0.00
Scar scab										3.00					3.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig	1.00	2.00	8.00		44.00		34.00	65.00	9.00	21.00		45.00	20.00	12.00	261.00
Both manc	3.00	2.00					1.00					1.00	1.00	1.00	9.00
Both pant															0.00
Psue arsi															0.00
Leth hara											3.00	10.00	4.00	4.00	21.00
Leth lent										1.00					1.00
Leth mahs															0.00
Leth elon					1.00		1.00			1.00					3.00
Leth nebu	3.00	9.00	7.00	1.00	7.00		6.00	6.00	4.00	4.00	3.00	3.00	1.00	9.00	63.00
Leth vari															0.00
Leth lars															0.00
Siga cana	1.00	1.00	3.00					1.00		1.00		1.00			8.00
Siga stel															0.00
Chei inei		3.00	4.00		7.00		17.00	10.00	1.00	6.00	1.00	6.00	5.00	9.00	69.00
Para mcad															0.00
Para moss		1.00	2.00		7.00		6.00	5.00	5.00	6.00	3.00	7.00	2.00	3.00	47.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag					18.00		11.00	1.00		2.00		12.00			44.00
Apog nigr		2.00	4.00		5.00		22.00	3.00	2.00	37.00					75.00
Apog cook					3.00				3.00						6.00
Apog taen															0.00
Fos brach															0.00
Fowl aur			1.00		22.00		15.00	6.00		1.00		2.00	2.00	1.00	50.00
Stet stri		2.00	1.00		5.00		3.00	3.00		1.00			1.00		16.00
Cori avgu								1.00							1.00
Cori caud									2.00						2.00
Side pict			1.00		1.00										2.00
Syng acus														1.00	1.00
Syng biac									2.00	1.00					3.00
Hali scap															0.00
Hali ind							5.00	6.00					1.00	2.00	14.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu														1.00	1.00
Acan line															0.00
Cyno arte															0.00
Coci croc															0.00
Plat indi															0.00
Plat lars															0.00
Plat lati															0.00
Papi long							1.00			2.00					3.00
Tera ther															0.00
Poma tril															0.00
Plec laci												2.00			2.00
Saur grac															0.00
Saur undo							2.00				1.00	1.00	1.00	2.00	7.00
Chel lati													1.00		1.00
Gerr oven															0.00
Lutj gibb															0.00
Lutj fulv							1.00	2.00				4.00	1.00		8.00
Paru barb															0.00
Upen vitt															0.00
Plat ter															0.00
Plat obic															0.00
Arot imma												1.00			1.00
Arot hisp															0.00
Arot stel															0.00
Pena indi			1.00												1.00
Pena mono													1.00		1.00
Pena semi															0.00
Pena sp1	1.00											2.00		3.00	6.00
Gobi sp1									3.00						3.00
Cari shri			4.00												4.00
Acen auda														1.00	1.00
Epin sp1															0.00
Gram sexl															0.00
Fist petu															0.00
Call nudi															0.00
Onat sp1			3.00		3.00		2.00					2.00	1.00	1.00	12.00
Favo mela													1.00		1.00
Favo resc									1.00					1.00	2.00
Favo sp1															0.00
Dend brac								2.00		1.00					3.00
Crabs															0.00
Cant benn										5.00					5.00
Cant sola								1.00							1.00
Cant vale							1.00			5.00					6.00
Plot line					1.00									45.00	46.00
Plot nkun															0.00
Trac bico					1.00										1.00
Plec gute					1.00										1.00
Squids					1.00										1.00
Diad spp								106.00							106.00
Pseu nasi															0.00
Para barn							2.00		5.00	1.00					8.00
Brot mult															0.00
Starfish							1.00	2.00							3.00
Ambl albi															0.00
Chae line															0.00
Trip grat								9.00	7.00						16.00
Jelly															0.00
Lact corn															0.00
Lact forn								1.00	1.00	1.00					3.00
Chei line								1.00							1.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr									6.00	1.00					7.00
Petr brev							1.00					3.00			4.00
Petr mutr							2.00	1.00		1.00			1.00		5.00
Sync marm															0.00
Olig kese															0.00
Abla bino								1.00							1.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came									1.00	1.00					2.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi															0.00
Nava maci									3.00	7.00					10.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Ambu prod										2.00					2.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

December 94 (contd.)

	cp31294A	cp31294B	m1294A	m1294B	T11294A	T11294B	T21294A	T21294B	T31294A	T31294B	cp41294A	cp41294B	cp51294A	cp51294B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chae tril									1.00	5.00					6.00
Chae oxyc									1.00						1.00
Chae undu							3.00								3.00
Cheil bim							2.00	7.00							9.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec										1.00					1.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad		1.00	2.00									1.00			4.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igne															0.00
Bemp plat															0.00
Chae quin										1.00					1.00
Sum	9	32	48	1	127	0	194	240	57	119	22	105	44	96	1094
Count	6	11	15	2	17	1	24	23	19	28	7	19	17	17	206
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	3	9	8	1	44	0	55	106	9	37	11	45	20	45	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
January 95

	cp30195A	cp30195B	m0195A	m0195B	T10195A	T10195B	T20195A	T20195B	T30195A	T30195B	cp40195A	cp40195B	cp50195A	cp50195B	Sum
Scar sord		1.00						56.00							57.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp harr															0.00
Calo spin															0.00
Lept vaig	15.00		1.00	10.00	5.00	2.00	95.00	86.00			20.00	27.00		1.00	262.00
Both manc	1.00		2.00	1.00	1.00	1.00					1.00				7.00
Both pant															0.00
Psue arsi									1.00						1.00
Leth hara	37.00	3.00		69.00	13.00		2.00						4.00	17.00	145.00
Leth lent									1.00						1.00
Leth mahs															0.00
Leth elon							4.00	5.00				1.00			10.00
Leth nebu	19.00		3.00			5.00	15.00	17.00			3.00	12.00			74.00
Leth vari															0.00
Leth larv				2.00											2.00
Siga cana	19.00	5.00	2.00	12.00		1.00		2.00			6.00	4.00		1.00	52.00
Siga stel	4.00			3.00											7.00
Chei iner					2.00	1.00	18.00	8.00			4.00	1.00			34.00
Para mead															0.00
Para moss	11.00	2.00		5.00	2.00		10.00	32.00			10.00	6.00			78.00
Scor vari															0.00
Apog angu															0.00
Apog savu															0.00
Apog frag	13.00	1.00		47.00	13.00	2.00									76.00
Apog nigr				1.00			12.00	28.00			19.00				60.00
Apog cook															0.00
Apog taen															0.00
Foa brach															0.00
Fowl aur	1.00				1.00			1.00				2.00			5.00
Stet stri					1.00			1.00				2.00			4.00
Cori aygu							4.00	2.00							6.00
Cori caud															0.00
Side pict	1.00						1.00								2.00
Syng acus			1.00		10.00										11.00
Syng biac	1.00				1.00	1.00		1.00				1.00			5.00
Hali scap															0.00
Hali irid	1.00			1.00			36.00	49.00	4.00						91.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu	1.00						1.00					6.00			8.00
Acan line	1.00														1.00
Cyno atte															0.00
Coci croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long															0.00
Tera ther															0.00
Poma tril															0.00
Plec lact															0.00
Saur grac															0.00
Saur undo				2.00	1.00						5.00	1.00			9.00
Chel lati															0.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv								2.00			2.00		1.00	2.00	7.00
Paru barb															0.00
Upen vitt															0.00
Plat tei															0.00
Plat obic															0.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono															0.00
Pena semi															0.00
Pena sp1	2.00		2.00								2.00	1.00	2.00	3.00	12.00
Gobi sp1															0.00
Cari shri						2.00	1.00	2.00			1.00				6.00
Acen auda											7.00		2.00		9.00
Epin sp1				1.00											1.00
Gram sexl															0.00
Fist peti															0.00
Cafl nudi															0.00
Onut sp1				3.00	4.00			1.00			4.00			12.00	24.00
Favo mela															0.00
Favo reic			1.00											5.00	6.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn															0.00
Cant sola								1.00							1.00
Cant vala															0.00
Plot line							2.00	214.00							216.00
Plot nikun									1.00						1.00
Trac bico					2.00			1.00							3.00
Plec gate											1.00				1.00
Squids															0.00
Dead spp					7.00	3.00									10.00
Pecu nasi															0.00
Para barn								2.00							2.00
Brot mult															0.00
Starfish							1.00	1.00							2.00
Ambl albi								2.00							2.00
Chae line															0.00
Trip grat							61.00	42.00							103.00
Jelly											20.00				20.00
Lact corn															0.00
Lact forn							1.00	2.00							3.00
Chei line															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr													1.00		1.00
Petr brev								1.00							1.00
Petr mitr								1.00			1.00				2.00
Sync marm															0.00
Olig kete														1.00	1.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili											1.00	1.00			2.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter pelv															0.00
Epib insi															0.00
Nova macr							2.00	2.00							4.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer											1.00				1.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
January 95 (contd.)

	cp30195A	cp30195B	m0195A	m0195B	T10195A	T10195B	T20195A	T20195B	T30195A	T30195B	cp40195A	cp40195B	cp50195A	cp50195B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tri															0.00
Chei oxyc															0.00
Chei undu									1.00		1.00				2.00
Cheil bun							6.00	9.00							15.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec										1.00					1.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad	1.00			1.00	1.00							1.00			4.00
Sphy jell															0.00
Oxyu sp1														1.00	1.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp pla															0.00
Chei quin															0.00
Sum	128	12	12	158	64	18	272	571	8	1	109	66	10	43	1472
Count	17	6	8	15	16	10	19	29	6	2	20	15	6	10	179
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	37	5	3	69	13	5	95	214	4	1	20	27	4	17	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

February 95

	cp30295A	cp30295B	m0295A	m0295B	T10295A	T10295B	T20295A	T20295B	T30295A	T30295B	cp40295A	cp40295B	cp50295A	cp50295B	Sum
Scar sord	4.00	5.00		12.00	39.00	11.00	12.00	37.00		50.00	34.00	17.00	2.00	5.00	228.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp harl															0.00
Calo spin										7.00					7.00
Lept vaig	1.00	2.00		4.00	1.00	7.00									15.00
Both manc	1.00	1.00			1.00	6.00				1.00	1.00		1.00	1.00	13.00
Both pant															0.00
Peue arsi															0.00
Leth hara	4.00	1.00		17.00							13.00		7.00	5.00	47.00
Leth lent															0.00
Leth mahs															0.00
Leth elon					1.00	1.00				1.00					3.00
Leth nebu	19.00	33.00		14.00	14.00	5.00	6.00			11.00	8.00	3.00	1.00		114.00
Leth vari										1.00					1.00
Leth larv															0.00
Siga cana	8.00	14.00		9.00	8.00	6.00	10.00	5.00			2.00	2.00	1.00	1.00	66.00
Siga stel				1.00											1.00
Chei iner				3.00	8.00	1.00				8.00	7.00	3.00			30.00
Para mead															0.00
Para moss		5.00		1.00	23.00	14.00	8.00	7.00		9.00	3.00	3.00			73.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag					3.00	35.00	73.00	6.00							117.00
Apog nigr								7.00							7.00
Apog cook								9.00							9.00
Apog taen															0.00
Foa brach															0.00
Fowl aur				2.00	30.00	12.00	8.00	9.00		7.00	17.00	5.00			90.00
Stet stri				1.00	1.00			1.00			4.00				7.00
Cori aygu															0.00
Cori caud															0.00
Side pict				1.00											1.00
Syng acus											1.00				1.00
Syng biac					1.00			1.00							2.00
Hali scap															0.00
Hali trid				1.00	2.00	3.00						1.00			7.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu					1.00									1.00	2.00
Acan line					1.00										1.00
Cyno arte	1.00	1.00													2.00
Coei croc							2.00								2.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long	1.00											1.00			2.00
Tera ther	1.00	1.00													2.00
Poma tri															0.00
Plec lacr		3.00						1.00			6.00				10.00
Saur grac															0.00
Saur undo		2.00		1.00	1.00						4.00	1.00	4.00	1.00	14.00
Chel lun							1.00	1.00							2.00
Gerr oyen													1.00		1.00
Lutj gibb															0.00
Lutj fulv				2.00								5.00	11.00	3.00	21.00
Paru barb															0.00
Upen vitt															0.00
Plat teir															0.00
Plat obic															0.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi		1.00													1.00
Pena mono	3.00	4.00		3.00	1.00	6.00									17.00
Pena semi															0.00
Pena sp1		7.00		3.00	2.00	6.00					5.00		1.00		24.00
Gobi sp1		5.00			14.00	12.00	5.00								36.00
Cari shri		2.00		2.00	1.00										5.00
Acen auda						5.00		1.00			5.00	2.00	3.00	2.00	18.00
Epin sp1															0.00
Gram text															0.00
Fist peti															0.00
Call mich															0.00
Gnat sp1				1.00	13.00	14.00	5.00				2.00	3.00	1.00	1.00	40.00
Favo mela															0.00
Favo retc						3.00							2.00	2.00	7.00
Favo sp1															0.00
Dend brac															0.00
Crabs										1.00					1.00
Cant benn															0.00
Cant sola															0.00
Cant vale								1.00		3.00					4.00
Plot line						15.00	9.00	2.00							26.00
Plot nkun															0.00
Trac bice															0.00
Plec gate					1.00		2.00								3.00
Squids				2.00		2.00	3.00								7.00
Diad spp					1.00					17.00					18.00
Pseu nani															0.00
Para barn					1.00	1.00	2.00	6.00							10.00
Brot mult						1.00									1.00
Starfish						1.00									1.00
Ambl albi							1.00				2.00				3.00
Chae line															0.00
Trip grai							1.00		43.00	19.00					63.00
Jelly															0.00
Lact corn				1.00									1.00		2.00
Lact forn															0.00
Chei line															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev															0.00
Petr mitr	2.00	1.00		2.00	4.00		2.00				6.00	3.00			20.00
Sync marm					3.00	2.00		1.00				2.00			8.00
Olig kene															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste serru															0.00
Para bili															0.00
Hipp cape															0.00
Hipp carne															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc							1.00								1.00
Diad hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi															0.00
Nova macr										3.00					3.00
Dact orie							1.00								1.00
Acro japo							2.00								2.00
Echi poly								1.00							1.00
Loph calo								1.00							1.00
Amba prod															0.00
Anam caer					1.00										1.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
February 95 (contd.)

	cp30295A	cp30295B	m0295A	m0295B	T10295A	T10295B	T20295A	T20295B	T30295A	T30295B	cp40295A	cp40295B	cp50295A	cp50295B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu					4.00										4.00
Cheil bim					1.00			5.00		25.00					31.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec									1.00						1.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell													1.00		1.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plai															0.00
Chei quin															0.00
Sum	45	88	0	83	182	169	154	102	44	163	120	51	37	22	1260
Count	12	18	1	22	30	24	21	20	3	16	18	15	15	11	226
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	19	33	0	17	39	35	73	37	43	50	34	17	11	5	

ANNEX 5 (contd.)

Epibenthos data. Gazi Bay. December 1994-September 1996
March 95

	cp30395A	cp30395B	m0395A	m0395B	T10395A	T10395B	T20395A	T20395B	T30395A	T30395B	cp40395A	cp40395B	cp50395A	cp50395B	Sum
Scar sord			4.00	10.00	170.00	158.00	16.00	29.00			1.00	4.00	1.00	73.00	466.00
Scar glob									8.00	6.00					14.00
Scar scab									9.00	2.00					11.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig					53.00	6.00		14.00	1.00				43.00		117.00
Both manc		1.00			1.00								1.00		3.00
Both pant															0.00
Psue arsi															0.00
Leth hara	1.00		9.00		1.00										11.00
Leth lent						7.00									7.00
Leth mahs															0.00
Leth elon							4.00								4.00
Leth nebu				6.00	32.00	21.00		6.00	6.00					24.00	95.00
Leth vari										2.00					2.00
Leth larv															0.00
Siga cana			7.00	13.00	18.00	12.00		1.00	1.00					5.00	57.00
Siga stel															0.00
Chei iner			1.00		19.00	18.00	8.00	6.00	2.00	3.00			1.00	6.00	64.00
Para mcad															0.00
Para moss			2.00	1.00	15.00	11.00		3.00	2.00		1.00	1.00		22.00	58.00
Scor vari															0.00
Apog angu															0.00
Apog sava									4.00						4.00
Apog frag			2.00	1.00	42.00	37.00				2.00					84.00
Apog nigr									1.00						1.00
Apog cook					4.00	3.00		11.00		1.00					19.00
Apog taen															0.00
Fou brach															0.00
Fowl auri			2.00	8.00	38.00	82.00		16.00	10.00					23.00	179.00
Stet stri				1.00	4.00	3.00		5.00	3.00						16.00
Cori aygu															0.00
Cori caud															0.00
Side pict					1.00	1.00									2.00
Syng acus									3.00						3.00
Syng biac					2.00										2.00
Hali scap															0.00
Hali trid				1.00	9.00			22.00					47.00		79.00
Hali hort															0.00
Hali dunc										1.00					1.00
Yong nebu				1.00	6.00	7.00	1.00		1.00						16.00
Acan line															0.00
Cyno atte															0.00
Coci croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long				1.00					1.00						2.00
Tera ther	1.00					1.00									2.00
Poma tril									2.00						2.00
Plec lacr			2.00		2.00			1.00							5.00
Saur grac															0.00
Saur undo			1.00				1.00			1.00	3.00				6.00
Chel lati	1.00		2.00		2.00		10.00								15.00
Gerr oyen		1.00													1.00
Lutj gibb															0.00
Lutj fulv			3.00								7.00	14.00	1.00	2.00	27.00
Paru barb						2.00								1.00	3.00
Upen vitt															0.00
Plat tere															0.00
Plat obic															0.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi					1.00										1.00
Pena mono															0.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1						2.00			2.00		1.00				5.00
Cari shri			4.00			4.00	3.00	1.00	4.00						16.00
Acen auda					1.00						3.00	1.00			5.00
Epin sp1															0.00
Gram texl								1.00							1.00
Fist peti															0.00
Cafl nudi															0.00
Onat sp1					5.00	6.00	1.00		1.00			1.00			14.00
Favo mela															0.00
Favo retc															0.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn															0.00
Cant sola									1.00						1.00
Cant vale									1.00						1.00
Plot line					2.00									1.00	3.00
Plot nkun															0.00
Trac bico										12.00				1.00	13.00
Plec gate					4.00	5.00					1.00				10.00
Squids															0.00
Diad spp									3.00	1.00					4.00
Pseu nasi															0.00
Para barn					6.00			1.00						2.00	9.00
Brot mult															0.00
Starfish															0.00
Ambl albi					1.00	2.00					1.00				4.00
Chae line					1.00										1.00
Trip grat					11.00	10.00	2.00		2.00						25.00
Jelly					15.00	4.00	5.00		2.00	2.00			2.00		30.00
Lact corn							2.00							1.00	3.00
Lact forn															0.00
Chei line															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev															0.00
Petr mitr					7.00	5.00			2.00				2.00		16.00
Sync marm															0.00
Olig kete															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist									1.00						1.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter poly									1.00						1.00
Epib insi				2.00											2.00
Nova macr					2.00				4.00	2.00			1.00		9.00
Dact orie															0.00
Acro japo								1.00							1.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
March 95 (contd.)

	ep30395A	ep30395B	m0395A	m0395B	T10395A	T10395B	T20395A	T20395B	T30395A	T30395B	ep40395A	ep40395B	ep50395A	ep50395B	Sum
Hali dussi															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc									1.00						1.00
Chei undu						1.00									1.00
Chel birn					1.00	1.00		1.00						1.00	4.00
Chry annu								1.00							1.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin									5.00						5.00
Sum	3	2	39	45	476	409	53	120	84	35	18	21	99	162	1566
Count	4	3	13	12	32	26	12	18	30	13	9	6	10	14	202
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	1	1	9	13	170	158	16	29	10	12	7	14	47	73	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
April 95

	ep30495A	ep30495B	m0495A	m0495B	T10495A	T10495B	T20495A	T20495B	T30495A	T30495B	ep40495A	ep40495B	ep50495A	ep50495B	Sum
Scar sord				5.00	11.00	13.00						4.00			33.00
Scar glob									9.00	13.00					22.00
Scar scab										1.00					1.00
Scar psit									7.00						7.00
Hipp hars										7.00					7.00
Calo spin									3.00						3.00
Lept vaig	26.00			13.00	35.00	55.00	50.00	37.00	48.00	33.00	3.00	6.00		1.00	307.00
Both manc		2.00	2.00		2.00	2.00	3.00								11.00
Both pant															0.00
Psue arsi															0.00
Leth hara	35.00	4.00	8.00	21.00		1.00					3.00	3.00			75.00
Leth lent															0.00
Leth mahs									4.00						4.00
Leth elon					1.00										1.00
Leth nebu	5.00				7.00	11.00	10.00	20.00		1.00					54.00
Leth vari									1.00						1.00
Leth lars										5.00					5.00
Siga cana	28.00	2.00	1.00	21.00	8.00	17.00	10.00	9.00	7.00	13.00	2.00				118.00
Siga stel	2.00														2.00
Chei mer				2.00		4.00	2.00	5.00	2.00	3.00					18.00
Para mead										1.00					1.00
Para moss	5.00			16.00	8.00	11.00	9.00	4.00	2.00	3.00					58.00
Scor vari															0.00
Apog angu															0.00
Apog sava									1.00						1.00
Apog frag	5.00	2.00		4.00	90.00	56.00	2.00	6.00							165.00
Apog nigr	101.00	15.00	3.00	83.00	20.00	17.00	15.00	19.00		3.00					276.00
Apog cook					8.00		9.00	8.00		1.00					26.00
Apog taen									3.00						3.00
Fox brach									5.00						5.00
Fowl aur	18.00			12.00	16.00	11.00	3.00	11.00	17.00	6.00					94.00
Stet stri	3.00	2.00		6.00	13.00	6.00	6.00	11.00	24.00	11.00					82.00
Con aygu															0.00
Con caud															0.00
Side pict		1.00			1.00	1.00			1.00	2.00					6.00
Syng acus	1.00							1.00							2.00
Syng biac	1.00	1.00		2.00	4.00	3.00			4.00	6.00		2.00		1.00	24.00
Hali scap										1.00					1.00
Hali ind					6.00	5.00	3.00	28.00							42.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu															0.00
Acan line															0.00
Cyno arte															0.00
Coci croc															0.00
Plat indi															0.00
Plat lars															0.00
Plat lati															0.00
Papi long					1.00	1.00				1.00					3.00
Tera ther															0.00
Poma tri										2.00					2.00
Plec lacr	2.00						1.00								3.00
Saur grac															0.00
Saur undo	1.00			1.00	1.00	1.00	1.00			1.00		4.00	2.00		12.00
Chel lab					1.00			1.00							2.00
Gerr oyen														7.00	7.00
Lutj gibb															0.00
Lutj fulv	2.00			8.00	2.00			1.00			12.00	10.00		5.00	40.00
Paru barb	1.00	1.00		4.00			1.00		1.00						8.00
Upen vitt						1.00									1.00
Plat teir															0.00
Plat obic	1.00					2.00						2.00			5.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono															0.00
Pena semi															0.00
Pena sp1	20.00		2.00	4.00							1.00				27.00
Gobi sp1															0.00
Cari shri		7.00		8.00	8.00			1.00	9.00	1.00					34.00
Acen auda											4.00	5.00	4.00	2.00	15.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti				1.00											1.00
Caff mudi															0.00
Gnat sp1			1.00	4.00	1.00	4.00	1.00	3.00	4.00	6.00	2.00	4.00	1.00	7.00	38.00
Favo mela															0.00
Favo reti														2.00	2.00
Favo sp1															0.00
Dend brac							1.00								1.00
Crabs															0.00
Cant benn															0.00
Cant sola					2.00		1.00	1.00							4.00
Cant vale					5.00		3.00	5.00							13.00
Plot line						3.00		1011.00	3.00						1017.00
Plot nkun															0.00
Trac bico							1.00								1.00
Plec gute					4.00	1.00		2.00							7.00
Squids												1.00			1.00
Diad spp							6.00								6.00
Pseu nasi															0.00
Para barn					6.00	1.00	3.00	6.00							16.00
Brot mult															0.00
Starfish															0.00
Ambl albi				2.00				1.00							3.00
Chae line															0.00
Trip grat					3.00	3.00	11.00	8.00							25.00
Jelly					1.00	11.00							6.00		18.00
Lact corn					1.00										1.00
Lact forn												1.00			1.00
Chei line						1.00									1.00
Chae aur							1.00		1.00						2.00
Chae klei							2.00								2.00
Chae mela							2.00								2.00
Trio macr															0.00
Petr brev	5.00				5.00	37.00	1.00	9.00	3.00	7.00		8.00			75.00
Petr mitr	6.00				10.00	12.00	1.00	4.00	4.00	4.00					41.00
Sync marm					3.00	5.00		5.00							13.00
Olig kene															0.00
Abla bino															0.00
Ambl sphy															0.00
Ante semi										2.00					2.00
Para bili													1.00		1.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag				1.00											1.00
Aeol punc															0.00
Diod hyst							1.00								1.00
Ante comm															0.00
Pter poly															0.00
Epib insi									2.00	1.00					3.00
Nova macr										2.00					2.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer												2.00			2.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data. Gazi Bay. December 1994-September 1996
April 95 (contd.)

	ep30495A	ep30495B	m0495A	m0495B	T10495A	T10495B	T20495A	T20495B	T30495A	T30495B	ep40495A	ep40495B	ep50495A	ep50495B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc									6.00	4.00					10.00
Chei undu	1.00				2.00	1.00									4.00
Cheil bim							2.00								2.00
Chry annu								1.00							1.00
Dasc arua							1.00		1.00						2.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad	6.00				1.00							2.00			9.00
Sphy jell	1.00													1.00	2.00
Oxyu spl															0.00
Pter mile															0.00
Stol indi									1.00						1.00
Cara igno															0.00
Bemp plat															0.00
Chei quin									3.00	1.00					4.00
Sum	276	37	17	218	287	297	163	1218	176	142	27	54	14	26	2952
Count	24	11	7	21	34	31	32	28	29	30	8	15	6	9	285
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	101	15	8	83	90	56	50	1011	48	33	12	10	6	7	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
May 95

	cp30595A	cp30595B	m0595A	m0595B	T10595A	T10595B	T20595A	T20595B	T30595A	T30595B	cp40595A	cp40595B	cp50595A	cp50595B	Sum
Scar sord				2.00		16.00		25.00	3.00		12.00	2.00			60.00
Scar glob															0.00
Scar scab										1.00					1.00
Scar psit															0.00
Hipp hari										2.00					2.00
Calo spin															0.00
Lept vaig		8.00	2.00		30.00	2.00	17.00		23.00	5.00	5.00				92.00
Both manc					1.00										1.00
Both pant															0.00
Psue arni															0.00
Leth hara		5.00		1.00									1.00		7.00
Leth lent															0.00
Leth mahs															0.00
Leth elon															0.00
Leth nebu		3.00			8.00		1.00	2.00	4.00		2.00				20.00
Leth vari															0.00
Leth larv															0.00
Siga cana		6.00			9.00	2.00		1.00	5.00						23.00
Siga stel															0.00
Chei iner		1.00			2.00	2.00	2.00	2.00	3.00	2.00			1.00	1.00	16.00
Para macd															0.00
Para moss		4.00	1.00		1.00		1.00			1.00					8.00
Scor vari															0.00
Apog angu															0.00
Apog sava								2.00							2.00
Apog frag					40.00	2.00									42.00
Apog nigr		70.00			2.00	3.00	11.00		5.00		3.00		1.00		95.00
Apog cook					1.00	4.00	1.00	4.00	11.00						21.00
Apog taen															0.00
Fon brach										1.00					1.00
Fowl auri		3.00	2.00	3.00	6.00	5.00	1.00	12.00	9.00						41.00
Stet stri		1.00			5.00	4.00	3.00	10.00	18.00						41.00
Cori aygu															0.00
Cori caud															0.00
Side pict									2.00						2.00
Syng acus															0.00
Syng biac		5.00			1.00		3.00	1.00	3.00	2.00					15.00
Hali scap										1.00					1.00
Hali trid		1.00			1.00		7.00								9.00
Hali hort							4.00								4.00
Hali dunc															0.00
Yong nebu		1.00													1.00
Acan line															0.00
Cyno atte															0.00
Coci croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long						1.00									1.00
Tera ther															0.00
Poma tril															0.00
Plec lacr		4.00		4.00											8.00
Saur grac															0.00
Saur undo					1.00	1.00								1.00	3.00
Chel lati															0.00
Gerr oven															0.00
Lutj gibb															0.00
Lutj fulv								1.00			4.00	3.00			8.00
Paru barb					1.00										1.00
Upen viti															0.00
Plat teir										1.00					1.00
Plat obic															0.00
Arot mmra	1.00	1.00													2.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono															0.00
Pena semi															0.00
Pena sp1		4.00		1.00							1.00	1.00			7.00
Gobi sp1															0.00
Cari shri									1.00						1.00
Acen auda					1.00										1.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Cafl madi															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn															0.00
Cant sola							1.00								1.00
Cant vale						3.00	15.00	1.00	12.00						31.00
Plot line								5.00							5.00
Plot nkun															0.00
Trac bico										1.00					1.00
Plec gate								1.00							1.00
Squids					1.00				1.00						2.00
Diad spp							39.00								39.00
Peru nasi															0.00
Para barn					2.00	2.00	6.00		3.00						13.00
Brot mult															0.00
Starfish							1.00			1.00					2.00
Ambl albi									1.00						1.00
Chae line															0.00
Trip grat					19.00	8.00	50.00	28.00	3.00						108.00
Jelly					14.00	3.00									17.00
Lact corn															0.00
Lact forn															0.00
Chei line								2.00							2.00
Chae auri						1.00									1.00
Chae klei															0.00
Chae mela															0.00
Trio macr								4.00	2.00						6.00
Petr brev		4.00	5.00		3.00			2.00							14.00
Petr mitr		5.00			2.00		2.00								9.00
Sync marm															0.00
Olig kese					1.00										1.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi										1.00					1.00
Para bili															0.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi															0.00
Nova macr															0.00
Dact orie															0.00
Aero japo							2.00	1.00							3.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
May 95 (contd.)

	cp30595A	cp30595B	m0595A	m0595B	T10595A	T10595B	T20595A	T20595B	T30595A	T30595B	cp40595A	cp40595B	cp50595A	cp50595B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu					2.00		5.00	2.00							9.00
Cheil bim								1.00							1.00
Chry annu															0.00
Dasc arua															0.00
Para pil															0.00
Holo spec															0.00
Ostr cubi									1.00						1.00
Able hian															0.00
Sole bles															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile													1.00		1.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin										2.00					2.00
Sum	1	126	10	11	154	59	172	107	110	21	27	6	4	2	810
Count	2	18	5	6	25	17	21	21	20	14	7	4	5	3	168
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	1	70	5	4	40	16	50	28	23	5	12	3	1	1	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
June 95

	cp30695A	cp30695B	m0695A	m0695B	T10695A	T10695B	T20695A	T20695B	T30695A	T30695B	cp40695A	cp40695B	cp50695A	cp50695B	Sum
Scar sord					9.00	11.00	8.00	2.00		1.00	7.00	7.00			45.00
Scar glob															0.00
Scar scab										35.00					35.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig									25.00						25.00
Both manc															0.00
Both pant															0.00
Psue arsi															0.00
Leth hara					1.00										1.00
Leth lent									1.00						1.00
Leth mahs															0.00
Leth elon															0.00
Leth nebu		2.00			3.00	2.00	2.00		1.00						10.00
Leth vari															0.00
Leth lars															0.00
Siga cana		2.00	1.00		3.00	4.00	1.00		2.00	3.00	4.00				20.00
Siga stel															0.00
Chei inet					1.00	4.00	6.00		3.00	4.00					18.00
Para mcad															0.00
Para moss		2.00	1.00		1.00	2.00	1.00								7.00
Scor vari															0.00
Apog angu															0.00
Apog sava									1.00						1.00
Apog frag					37.00	29.00				20.00					86.00
Apog rugr					4.00		9.00	1.00							14.00
Apog cook			3.00		4.00	1.00	2.00	1.00	5.00	3.00					19.00
Apog taen										7.00					7.00
Fou brach									1.00	1.00					2.00
Fowl aur		9.00	2.00		3.00	8.00			7.00	1.00		2.00			32.00
Stet str					3.00	3.00	4.00		7.00	13.00		1.00			31.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus															0.00
Syng biac					2.00				2.00		1.00	1.00	1.00		7.00
Hali scap										3.00					3.00
Hali ind															0.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu		1.00													1.00
Acan line															0.00
Cyno arte															0.00
Coei eroc															0.00
Plat indi															0.00
Plat lars									2.00						2.00
Plat lati															0.00
Papi long	1.00									1.00					2.00
Tera ther											1.00				1.00
Poma tril									1.00						1.00
Plec lact							1.00								1.00
Saur grac		1.00													1.00
Saur undo		1.00	2.00												3.00
Chel lati											1.00	1.00			2.00
Gerr oyen															0.00
Lutj gibb					1.00										1.00
Lutj fulv											1.00	4.00			5.00
Paru barb															0.00
Upen vitt															0.00
Plat tea															0.00
Plat obic		1.00				1.00									2.00
Arot imma														1.00	1.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono											1.00				1.00
Pena semi						1.00									1.00
Pena sp1		1.00													1.00
Gobi sp1															0.00
Cari shri		3.00						1.00	1.00	1.00		3.00			9.00
Acen auda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Call nudi															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo retc															0.00
Favo sp1			7.00												7.00
Dend brac															0.00
Crabs															0.00
Cant benn										1.00					1.00
Cant sola					1.00				3.00	1.00					5.00
Cant vale					2.00	1.00	6.00		9.00	5.00					23.00
Plot line															0.00
Plot nkun															0.00
Trac bico															0.00
Plec gate							1.00		1.00						2.00
Squids															0.00
Diad spp							1.00		1.00						2.00
Pseu nasi															0.00
Para barn					2.00	5.00	4.00		1.00	3.00					15.00
Brot mult															0.00
Starfish															0.00
Ambl albi								1.00							1.00
Chae line															0.00
Trip grat					42.00	28.00	3.00	17.00	11.00	10.00					111.00
Jelly				1.00	2.00						1.00				4.00
Lact corn															0.00
Lact forn									1.00	1.00					2.00
Chei line					8.00					5.00					13.00
Chae auri															0.00
Chae klei															0.00
Chae mela									1.00						1.00
Trio macr					1.00	3.00		1.00							5.00
Petr brev					1.00										1.00
Petr mutr															0.00
Sync marm															0.00
Olig kese															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bib															0.00
Hipp cape															0.00
Hipp came									1.00						1.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter peli															0.00
Epib insi															0.00
Nova macr										3.00					3.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi									1.00						1.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
June 95 (contd.)

	cp30695A	cp30695B	m0695A	m0695B	T10695A	T10695B	T20695A	T20695B	T30695A	T30695B	cp40695A	cp40695B	cp50695A	cp50695B	Sum
Hali duss									2.00						2.00
Pter flag									1.00						1.00
Stet inte									1.00						1.00
Chei tril															0.00
Chei oxyc									4.00	3.00					7.00
Chei undu															0.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Abla hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell													2.00		2.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp pint															0.00
Chei quin									1.00	1.00					2.00
Sum	1	23	16	1	131	103	49	24	98	126	17	19	3	1	612
Count	2	11	7	2	22	16	15	8	30	24	9	8	3	2	159
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	1	9	7	1	42	29	9	17	25	35	7	7	2	1	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

July 95

	ep30795A	ep30795B	m0795A	m0795B	T10795A	T10795B	T20795A	T20795B	T30795A	T30795B	ep40795A	ep40795B	ep50795A	ep50795B	Sum
Scar sord					1.00	1.00	1.00								3.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig				17.00	8.00	1.00				8.00	5.00				39.00
Both manc			1.00					1.00			1.00				3.00
Both pant															0.00
Prue arsi															0.00
Leth hara				1.00											1.00
Leth lent															0.00
Leth mahs															0.00
Leth elon					4.00										4.00
Leth nebu					1.00										1.00
Leth vari										1.00					1.00
Leth larv								3.00							3.00
Siga cana				17.00	7.00					1.00	2.00				27.00
Siga stel															0.00
Chei iner				1.00	3.00	2.00		4.00		1.00					11.00
Para mcad															0.00
Para moss				2.00	1.00						1.00				4.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag					1.00	16.00									17.00
Apog nigr				22.00	1.00	3.00				3.00					29.00
Apog cook					8.00	8.00				13.00					29.00
Apog taen															0.00
Foa brach															0.00
Fowl aur			1.00	5.00	3.00	3.00				3.00					15.00
Stet stri				5.00	1.00					4.00					10.00
Cori aygu															0.00
Cori caud															0.00
Side pict						1.00									1.00
Syng acus			1.00								1.00				2.00
Syng biac				1.00	3.00										4.00
Hali scap															0.00
Hali irid					2.00										2.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu			1.00	1.00											2.00
Acan line															0.00
Cyno arte															0.00
Coci croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long															0.00
Tera ther															0.00
Poma tril										1.00					1.00
Plec lacr					1.00										1.00
Saur grac															0.00
Saur undo				1.00	1.00										2.00
Chel lati						1.00									1.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv				1.00							1.00	4.00			6.00
Paru barb				1.00											1.00
Upen vitt															0.00
Plat tetr															0.00
Plat obic													1.00		1.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi						2.00									2.00
Pena mono															0.00
Pena semi															0.00
Pena sp1			1.00				2.00								3.00
Gobi sp1															0.00
Cari shri			1.00		1.00							1.00			3.00
Acen auda											1.00	1.00			2.00
Epin sp1															0.00
Oram sexl															0.00
Fist peti															0.00
Catl nudi															0.00
Gnat sp1														1.00	1.00
Favo mela			1.00												1.00
Favo reic				1.00											1.00
Favo sp1															0.00
Dend brac							1.00								1.00
Crabs															0.00
Cant benn															0.00
Cant sola															0.00
Cant vale										2.00					2.00
Plot line						1.00									1.00
Plot nkun															0.00
Trac bico															0.00
Plec gate				1.00						1.00					2.00
Squids						1.00									1.00
Diad spp										7.00					7.00
Pseu nasi															0.00
Para barn				3.00	5.00	6.00	1.00	1.00							16.00
Brot mult															0.00
Starfish															0.00
Ambl albi						1.00									1.00
Chae line															0.00
Trip grat						1.00		2.00		2.00					5.00
Jelly				1.00	1.00						2.00	2.00			6.00
Lact corn															0.00
Lact forn															0.00
Chei line						1.00	1.00								2.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev															0.00
Petr mitr					2.00	4.00		2.00		1.00		1.00			10.00
Sync marm															0.00
Olig kene															0.00
Abla hinc															0.00
Ambl sphy															0.00
Arte semi				1.00											1.00
Para bili				1.00											1.00
Hipp caps															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter pely															0.00
Epib insi															0.00
Nova macr															0.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo								1.00							1.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
July 95 (contd.)

	ep30795A	ep30795B	m0795A	m0795B	T10795A	T10795B	T20795A	T20795B	T30795A	T30795B	ep40795A	ep40795B	ep50795A	ep50795B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chet tril															0.00
Chet ornc										1.00					1.00
Chet undu					3.00										3.00
Cheil bim								1.00							1.00
Chry annu															0.00
Dasc arua															0.00
Para pul															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan				1.00											1.00
Pela quad				1.00											1.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi														2.00	2.00
Cara igne															0.00
Bamp plai															0.00
Chet quin										1.00					1.00
Sum	0	0	7	85	58	53	6	15	0	50	14	9	1	3	301
Count	1	1	8	22	22	18	6	9	1	17	9	6	2	3	125
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	0	0	1	22	8	16	2	4	0	13	5	4	1	2	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

August 95

	ep30895A	ep30895B	m0895A	m0895B	T10895A	T10895B	T20895A	T20895B	T30895A	T30895B	ep40895A	ep40895B	ep50895A	ep50895B	Sum
Scar sord	5.00			1.00		26.00	6.00	7.00	1.00		10.00	2.00	25.00		83.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari															0.00
Calo spin					1.00										1.00
Lept vaig		6.00	2.00		93.00	13.00	11.00	15.00	2.00	3.00	15.00	15.00	17.00	12.00	204.00
Both manc				1.00	1.00						2.00	5.00	3.00	1.00	13.00
Both pant											2.00	5.00	3.00		10.00
Psue arsi															0.00
Leth hara															0.00
Leth lent															0.00
Leth mahs															0.00
Leth elon						4.00							4.00		8.00
Leth nebu	2.00		1.00	1.00	1.00		1.00				7.00	6.00	8.00	1.00	28.00
Leth vari															0.00
Leth lars															0.00
Siga cana	7.00	7.00	2.00	1.00	3.00	4.00	7.00	2.00			7.00	2.00	6.00	6.00	54.00
Siga stel															0.00
Chei iner					3.00	8.00	3.00	1.00		3.00	3.00	3.00	13.00	4.00	41.00
Para mcad															0.00
Para moss	1.00	1.00			14.00	1.00	4.00	1.00	1.00		4.00	5.00	2.00	2.00	36.00
Scor vari															0.00
Apog angu															0.00
Apog sava								2.00							2.00
Apog frag						55.00					1.00				56.00
Apog nigr	16.00	15.00	2.00		5.00	21.00	2.00							6.00	67.00
Apog cook							7.00	4.00						3.00	14.00
Apog taen															0.00
Foa brach										1.00					1.00
Fowl auri	1.00	1.00	2.00	3.00	12.00	5.00	10.00	11.00			14.00	6.00	17.00	2.00	84.00
Stet stri		2.00			10.00	10.00	16.00	8.00			7.00	5.00	3.00		61.00
Cori aygu															0.00
Cori caud															0.00
Side pict				1.00	2.00				1.00						4.00
Syng acus	1.00														1.00
Syng biac		2.00			4.00			1.00			2.00	1.00	2.00	1.00	13.00
Hali scap															0.00
Hali irid					2.00	7.00	1.00						3.00	1.00	14.00
Hali hort															0.00
Hali dunc										1.00					1.00
Yong nebu															0.00
Acan line															0.00
Cyno atte															0.00
Coci croc															0.00
Plat indi													1.00		1.00
Plat larv															0.00
Plat lati															0.00
Papi long		1.00					1.00								2.00
Tera ther															0.00
Poma tril															0.00
Plec lacr					1.00	10.00									11.00
Saur grac															0.00
Saur undo				2.00	4.00			1.00		1.00		4.00		2.00	14.00
Chel lati							1.00								1.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv														3.00	3.00
Paru barb								1.00				1.00	3.00		5.00
Upen vitt															0.00
Plat ter															0.00
Plat obic												1.00	1.00		2.00
Arot imma															0.00
Arot hisp									1.00						1.00
Arot stel								2.00							2.00
Pena indi															0.00
Pena mono															0.00
Pena semi		1.00													1.00
Pena sp1	1.00														1.00
Gobi sp1															0.00
Cant shm	1.00		2.00	1.00	1.00								2.00		7.00
Acen auda	2.00										1.00	2.00	1.00		6.00
Epin sp1	2.00														2.00
Gram sexl															0.00
Fist peti		2.00		1.00									1.00	1.00	5.00
Caff mudi															0.00
Gnat sp1		2.00			4.00			1.00			2.00				9.00
Favo mela		1.00													1.00
Favo reic											1.00				1.00
Favo sp1															0.00
Dend brac														1.00	1.00
Crabs															0.00
Cant benn															0.00
Cant sola					1.00	3.00	4.00	2.00							10.00
Cant vale						2.00	1.00								3.00
Plot line					14.00	94.00	3.00						16.00	20.00	147.00
Plot nkun															0.00
Truc bico						3.00	3.00								6.00
Plec gate											1.00				1.00
Squids							2.00								2.00
Diad spp							15.00		2.00	4.00					21.00
Pseu nasi													1.00		1.00
Para barn					3.00	7.00	3.00	2.00			2.00	8.00		4.00	29.00
Brot mult															0.00
Starfish															0.00
Ambl albi											1.00				1.00
Chae line															0.00
Trip grat					18.00				4.00					6.00	28.00
Jelly						1.00		1.00	1.00		134.00	42.00	1.00	2.00	182.00
Lact corn															0.00
Lact forn												1.00			1.00
Chei line					2.00		8.00	2.00							12.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev													3.00		3.00
Petr mitr					1.00										1.00
Sync marm													1.00		1.00
Olig kete															0.00
Abla bino															0.00
Ambl sphy											1.00				1.00
Aste semi					1.00										1.00
Para bili						1.00						2.00			3.00
Hipp cape															0.00
Hipp carne						1.00					1.00				2.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc													1.00		1.00
Diod hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi					2.00		2.00								4.00
Nova macr															0.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
August 95 (contd.)

	ep30895A	ep30895B	m0895A	m0895B	T10895A	T10895B	T20895A	T20895B	T30895A	T30895B	ep40895A	ep40895B	ep50895A	ep50895B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu						1.00	6.00								7.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pih								3.00			7.00	8.00	5.00		23.00
Holo spec													1.00		1.00
Ostr cubi				2.00					1.00				1.00		4.00
Able hian										1.00					1.00
Sole blee														1.00	1.00
Sole cyan															0.00
Pela quad						1.00					2.00			3.00	6.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Berop plat															0.00
Chei quin															0.00
Sum	39	41	11	14	203	278	117	67	14	14	227	124	145	82	1376
Count	12	13	7	11	26	23	24	20	10	8	24	21	29	22	250
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	16	15	2	3	93	94	16	15	4	4	134	42	25	20	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

September 95

	cp30995A	cp30995B	m0995A	m0995B	T10995A	T10995B	T20995A	T20995B	T30995A	T30995B	cp40995A	cp40995B	cp50995A	cp50995B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari										1.00					1.00
Calo spin															0.00
Lept vaig			5.00	6.00	34.00	27.00	4.00	17.00	3.00	2.00	6.00	2.00	13.00	13.00	132.00
Both manc											2.00	1.00	1.00		4.00
Both pant															0.00
Psue arsi															0.00
Leth hara			1.00												1.00
Leth lent															0.00
Leth mahs															0.00
Leth elon					1.00	2.00							2.00		5.00
Leth nebu		1.00	3.00	5.00	3.00	4.00		1.00			2.00		7.00	5.00	31.00
Leth vari									2.00	2.00					4.00
Leth larv	1.00											1.00			2.00
Siga cana	3.00		7.00	12.00	12.00	25.00	1.00	148.00	3.00		7.00		2.00	5.00	225.00
Siga stel															0.00
Chei iner					8.00	10.00	2.00	6.00	2.00		3.00		2.00		33.00
Para mead															0.00
Para moss			3.00			3.00				1.00				3.00	10.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag					4.00	29.00	15.00	6.00							54.00
Apog nigr		8.00	3.00		7.00	12.00	4.00	5.00			1.00		3.00	4.00	47.00
Apog cook					3.00	9.00		5.00							17.00
Apog taen															0.00
Foa brach															0.00
Fowl auri				4.00	8.00				1.00			1.00			14.00
Stet stri				3.00	3.00	4.00		1.00							11.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus				2.00											2.00
Syng biac					2.00						1.00				3.00
Hali scap															0.00
Hali irid								3.00							3.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu				4.00							2.00	1.00			7.00
Acan line															0.00
Cyno arte															0.00
Coci croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lato															0.00
Papi long						1.00									1.00
Tera ther															0.00
Poma tril															0.00
Plec lacr					1.00										1.00
Saur grac															0.00
Saur undo		1.00		2.00	2.00	2.00					4.00	2.00	4.00	4.00	21.00
Chel lati					1.00							1.00			2.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv				1.00	1.00						2.00	1.00	1.00	2.00	8.00
Paru barb					1.00										1.00
Upen vitt															0.00
Plat ten															0.00
Plat obic															0.00
Arot imma					1.00								1.00	1.00	3.00
Arot hisp															0.00
Arot stel															0.00
Pena indi		1.00													1.00
Pena mono			1.00			1.00					1.00	1.00			4.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1			1.00		2.00										3.00
Cari shri			4.00	4.00	2.00	1.00									11.00
Acen auda								2.00				1.00			3.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti		1.00													1.00
Caff rudi															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac		1.00													1.00
Crabs						2.00									2.00
Cant benn					2.00	1.00	2.00	1.00		1.00					7.00
Cant sola					2.00	4.00									6.00
Cant vale						7.00									7.00
Plot line															0.00
Plot nkun															0.00
Trac bico															0.00
Plec gate															0.00
Squids															0.00
Diad spp						1.00			5.00						6.00
Pseu nasi															0.00
Para barn				1.00	1.00	5.00	1.00	2.00						1.00	11.00
Brot mult															0.00
Starfish															0.00
Ambl albi															0.00
Chae line															0.00
Trip grac					7.00	12.00	1.00	4.00							24.00
Jelly													1.00	5.00	6.00
Lact corn											3.00	3.00			6.00
Lact forn			2.00		1.00								3.00	1.00	7.00
Chei line															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr			1.00												1.00
Petr brev					1.00										1.00
Petr mitr								1.00	1.00						2.00
Sync marm															0.00
Olig kere															0.00
Abla bino															0.00
Ambl sphy															0.00
Arte sema				1.00											1.00
Para bili					2.00										2.00
Hipp cape															0.00
Hipp camo															0.00
Hipp hist															0.00
Upen trag					2.00										2.00
Aeol punc						1.00									1.00
Diod hyst						2.00		2.00							4.00
Ante comm															0.00
Pter pelv															0.00
Epib insi															0.00
Nova macr								3.00	4.00						7.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi								1.00							1.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
September 95 (contd.)

	cp30995A	cp30995B	m0995A	m0995B	T10995A	T10995B	T20995A	T20995B	T30995A	T30995B	cp40995A	cp40995B	cp50995A	cp50995B	Sum
Hali dust															0.00
Pter flag															0.00
Stet unic															0.00
Chei tril									2.00						2.00
Chei oxyc									2.00						2.00
Chei undu					2.00										2.00
Chel binn															0.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad								1.00							1.00
Sphy jell											1.00		1.00		2.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno													2.00		2.00
Bemp plat														1.00	1.00
Chei quin															0.00
Sum	4	13	31	45	116	165	30	209	25	7	35	15	43	45	783
Count	3	7	12	13	29	24	9	19	11	6	14	12	15	13	187
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	3	8	7	12	34	29	15	148	5	2	7	3	13	13	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

October 95

	ep31095A	ep31095B	m1095A	m1095B	T11095A	T11095B	T21095A	T21095B	T31095A	T31095B	ep41095A	ep41095B	ep51095A	ep51095B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig	1.00	1.00	1.00	2.00	18.00	28.00	12.00		19.00	16.00	1.00				99.00
Both manc								1.00	1.00				1.00	1.00	4.00
Both pant															0.00
Psue arsi															0.00
Leth hara															0.00
Leth lent															0.00
Leth mahs															0.00
Leth elon						1.00				1.00					2.00
Leth nebu	2.00			1.00		1.00	1.00						2.00		7.00
Leth vari															0.00
Leth lars															0.00
Siga cana	7.00	1.00	2.00	11.00						1.00			2.00		24.00
Siga stel															0.00
Chet mer					2.00	7.00	1.00		2.00	5.00					17.00
Para mead															0.00
Para moss						1.00	2.00			1.00	1.00				5.00
Scor vari															0.00
Apog angu															0.00
Apog tava															0.00
Apog frag						1.00									1.00
Apog nigr		1.00			2.00	2.00	1.00			20.00					26.00
Apog cook									1.00						1.00
Apog taen															0.00
Fou brach															0.00
Fowl aur				1.00		3.00	15.00		6.00	5.00					30.00
Stet stri						2.00	3.00			3.00					8.00
Cori aygu															0.00
Cori caud															0.00
Side pict									1.00						1.00
Syng acus					1.00				1.00	1.00					3.00
Syng biac				2.00			1.00								3.00
Hali scap															0.00
Hali ind						5.00	8.00		4.00	9.00					26.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu															0.00
Acan linc															0.00
Cyno arte															0.00
Coci croc	1.00														1.00
Plat indi															0.00
Plat lars															0.00
Plat lati															0.00
Papi long										1.00					1.00
Tera ther															0.00
Poma tril															0.00
Plec lacr							1.00			1.00					2.00
Saur grac															0.00
Saur undo								1.00		2.00					3.00
Chel lan									1.00						1.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv				2.00										1.00	3.00
Paru barb															0.00
Upen vitt															0.00
Plat tes															0.00
Plat obic															0.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono	2.00										1.00		3.00		6.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1							1.00	1.00	2.00						4.00
Cari shri	1.00						1.00		1.00				1.00		4.00
Acen nuda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Caff nudi															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo resc															0.00
Favo sp1															0.00
Dend brac										1.00					1.00
Crabs	1.00													1.00	2.00
Cant benn															0.00
Cant sola										1.00					1.00
Cant vale					1.00										1.00
Plot linc															0.00
Plot nkun															0.00
Trac bico															0.00
Plec gate															0.00
Squids															0.00
Diad spp								7.00	3.00						10.00
Pseu nasi															0.00
Para barn								1.00		1.00					2.00
Brot mult															0.00
Starfisf															0.00
Ambl albi															0.00
Chae linc															0.00
Trip grat					7.00		17.00		10.00	20.00					54.00
Jelly											10.00		1.00		11.00
Lact corn									1.00						1.00
Lact forn										1.00					1.00
Chei linc					1.00										1.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev															0.00
Petr mitr															0.00
Sync marm															0.00
Olig kete															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came								1.00							1.00
Hipp hist							1.00								1.00
Upen trag										1.00					1.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi															0.00
Nova macr							3.00		1.00	3.00					7.00
Dact orie															0.00
Aero japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
October 95 (contd.)

	ep31095A	ep31095B	m1095A	m1095B	T11095A	T11095B	T21095A	T21095B	T31095A	T31095B	ep41095A	ep41095B	ep51095A	ep51095B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu									2.00	2.00					4.00
Cheil bim							3.00								3.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin															0.00
Sum	15	3	3	19	32	51	71	12	56	96	13	0	10	3	384
Count	8	4	3	7	8	11	17	7	17	22	5	1	7	4	121
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	7	1	2	11	18	28	17	7	19	20	10	0	3	1	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
November 95

	cp31195A	cp31195B	m1195A	m1195B	T11195A	T11195B	T21195A	T21195B	T31195A	T31195B	cp41195A	cp41195B	cp51195A	cp51195B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab								1.00							1.00
Scar psit															0.00
Hipp hari															0.00
Calo spin										1.00					1.00
Lept vaig	2.00	25.00	18.00	16.00	18.00	19.00		13.00	11.00	13.00	25.00	1.00	2.00	2.00	165.00
Both manc					1.00									1.00	2.00
Both pant										1.00					1.00
Ptue arsi															0.00
Leth hara		5.00	11.00	4.00							4.00			2.00	26.00
Leth lent															0.00
Leth mahs															0.00
Leth elon						1.00									1.00
Leth nebu	9.00	8.00	18.00	5.00	3.00			1.00	1.00		2.00	3.00			50.00
Leth vari															0.00
Leth larv															0.00
Siga cana	5.00	12.00	32.00	9.00	2.00	2.00		4.00	1.00	1.00	4.00			3.00	75.00
Siga stel															0.00
Chei iner		1.00	1.00	1.00	4.00	2.00		2.00	2.00	4.00		1.00			18.00
Para mead															0.00
Para moss	2.00	3.00	8.00	12.00	1.00	2.00			1.00		9.00	1.00			39.00
Scor vari															0.00
Apog angu									3.00	62.00					65.00
Apog sava															0.00
Apog frag						7.00		2.00		24.00					33.00
Apog nigr					4.00	12.00		6.00	3.00	20.00					45.00
Apog cook															0.00
Apog taen															0.00
Foa brach															0.00
Fowl auri		9.00	12.00	2.00	9.00	3.00		1.00	7.00	1.00	1.00				45.00
Stet stri															0.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus			1.00					1.00			1.00				3.00
Syng biac					1.00						1.00				2.00
Hali scap															0.00
Hali irid					1.00	1.00				1.00					3.00
Hali hort															0.00
Hali dunc															0.00
Yong nabu													1.00		1.00
Acan linc															0.00
Cyno arte															0.00
Coei croc				2.00											2.00
Plat indi															0.00
Plat larv															0.00
Plat lati					1.00										1.00
Paps long			1.00							1.00					2.00
Tera ther															0.00
Poma tril															0.00
Plec laer															0.00
Saur grac															0.00
Saur undo		1.00	2.00		1.00										4.00
Chel lun															0.00
Gerr oyen													2.00		2.00
Lutj gibb															0.00
Lutj fulv		2.00	2.00			1.00					4.00	7.00		2.00	18.00
Paru barb															0.00
Upen vitt															0.00
Plat teir															0.00
Plat obic															0.00
Arot imma	1.00											1.00			2.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono											1.00	1.00	2.00	2.00	6.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1				2.00	1.00						2.00				5.00
Cant shri	1.00	1.00	2.00								3.00				7.00
Acen auda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Call nudi															0.00
Onat sp1	1.00	1.00										4.00			6.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac						1.00			1.00						2.00
Crabs															0.00
Cant benn															0.00
Cant sola					1.00										1.00
Cant vale		1.00			1.00	1.00									3.00
Plot linc															0.00
Plot nkun															0.00
Trac bico															0.00
Plec gate															0.00
Squids															0.00
Diad spp															0.00
Pseu nasi															0.00
Para barn					1.00	1.00		1.00							3.00
Brot mult															0.00
Starfish															0.00
Ambl albi										1.00					1.00
Chae linc															0.00
Trip grat															0.00
Jelly															0.00
Laet corn															0.00
Laet fern															0.00
Chei linc															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev															0.00
Petr mitr															0.00
Sync marm															0.00
Olig kete															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape									1.00						1.00
Hipp carne															0.00
Hipp hist															0.00
Upen trag								1.00							1.00
Aeol punc			1.00					1.00	1.00						3.00
Diod hyst															0.00
Ante comm					1.00										1.00
Pter poly															0.00
Epib insi															0.00
Nova macr						1.00						1.00			2.00
Dact orie															0.00
Acro japo											1.00				1.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
November 95 (contd.)

	ep31195A	ep31195B	m1195A	m1195B	T11195A	T11195B	T21195A	T21195B	T31195A	T31195B	ep41195A	ep41195B	ep51195A	ep51195B	Sum
Hali duss															0.00
Pter flag								1.00							1.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu					2.00										2.00
Ched burn						1.00									1.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad	2.00	2.00									8.00				12.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin															0.00
Sum	23	71	109	53	53	55	0	35	32	130	66	20	7	12	666
Count	9	14	14	10	19	16	1	14	12	13	15	10	5	7	159
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	9	25	32	16	18	19	0	13	11	62	25	7	2	3	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
December 95

	ep31295A	ep31295B	m1295A	m1295B	T11295A	T11295B	T21295A	T21295B	T31295A	T31295B	ep41295A	ep41295B	ep51295A	ep51295B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig	6.00		2.00		12.00	9.00	3.00	5.00	13.00	4.00	1.00	2.00			57.00
Both manc		1.00	1.00	1.00									1.00		4.00
Both pant															0.00
Psue arsi															0.00
Leth hara	2.00												1.00		3.00
Leth lent															0.00
Leth mahs															0.00
Leth elon															0.00
Leth nebu	3.00	1.00	1.00		1.00	1.00		1.00	1.00		1.00				10.00
Leth vari				1.00	1.00		1.00								3.00
Leth lars															0.00
Siga cana	17.00		4.00	2.00	2.00	2.00			2.00						29.00
Siga stel															0.00
Chei iner								1.00	1.00	2.00					4.00
Para mcad															0.00
Para moss	7.00		1.00	1.00	4.00	2.00		2.00	4.00		5.00	1.00	1.00		28.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag	6.00				3.00	9.00		1.00						1.00	20.00
Apog rupp					2.00	10.00		15.00	3.00						30.00
Apog cook					6 00		4.00	2.00	6.00	3.00					21.00
Apog taen															0.00
Foa brach															0.00
Fowl auri	11.00				1.00	4.00		2.00	7.00	1.00	1.00				27.00
Stet stri															0.00
Con aygu															0.00
Con caud															0.00
Side pict															0.00
Syng acus					1.00		1.00			1.00					3.00
Syng biac					1.00										1.00
Hali scap															0.00
Hali irid								6.00	7.00						13.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu	2.00							1.00			3.00				6.00
Acan line															0.00
Cyno atte		1.00													1.00
Coci croc				1.00											1.00
Plat indi															0.00
Plat lars															0.00
Plat lati															0.00
Papi long	1.00														1.00
Tera ther															0.00
Poma tril															0.00
Plec lacr															0.00
Saur grac															0.00
Saur undo	1.00														1.00
Chel lati															0.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv											1.00			1.00	2.00
Paru barb															0.00
Upen vitt															0.00
Plat tetr															0.00
Plat obic															0.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena nudi				1.00							3.00	1.00			5.00
Pena mono															0.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1															0.00
Cari shn			2.00												2.00
Acen auda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Caff nudi															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn															0.00
Cant sola															0.00
Cant vale					2.00	2.00			4.00						8.00
Plot line									1.00						1.00
Plot nkun															0.00
Trac bicc															0.00
Plec gate															0.00
Squids															0.00
Diad spp															0.00
Pseu nasi															0.00
Para barn					3.00	5.00	1.00		4.00		1.00				14.00
Brot mult															0.00
Starfish															0.00
Ambl albi															0.00
Chae line															0.00
Trip grat															0.00
Jelly															0.00
Lact corn					1.00										1.00
Lact forn											1.00				1.00
Chei line															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev															0.00
Petr mitr									5.00						5.00
Sync marm															0.00
Olig keie															0.00
Abla hians															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter pely															0.00
Epib insi															0.00
Nova macr															0.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
December 95 (contd.)

	ep31295A	ep31295B	m1295A	m1295B	T11295A	T11295B	T21295A	T21295B	T31295A	T31295B	ep41295A	ep41295B	ep51295A	ep51295B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu								3.00							3.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able bian															0.00
Sole blec				1.00											1.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu spl															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin															0.00
Sum	56	3	11	8	40	44	10	39	58	11	17	4	3	2	306
Count	11	4	7	8	15	10	6	12	14	6	10	4	4	3	114
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	17	1	4	2	12	10	4	15	13	4	5	2	1	1	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

January 96

	ep30196A	ep30196B	m0196A	m0196B	T10196A	T10196B	T20196A	T20196B	T30196A	T30196B	ep40196A	ep40196B	ep50196A	ep50196B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig							5.00	3.00	15.00	7.00	1.00				31.00
Both manc			2.00			1.00		2.00							5.00
Both pant															0.00
Psue arsi															0.00
Leth hara	1.00														1.00
Leth lent															0.00
Leth mahs															0.00
Leth elon															0.00
Leth nebu			1.00	2.00	1.00	1.00		1.00	1.00	1.00		1.00			9.00
Leth vari															0.00
Leth lars															0.00
Siga cana								1.00	2.00						3.00
Siga stel															0.00
Chei inet							2.00	2.00	2.00						6.00
Para macad															0.00
Para moss	2.00			1.00				2.00	1.00	1.00	1.00				8.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag								39.00							39.00
Apog nigr								6.00							6.00
Apog cook								1.00	14.00	1.00					16.00
Apog taen															0.00
Fos brach															0.00
Fowl auri								2.00	11.00	3.00					16.00
Stet stri							1.00	2.00	1.00						4.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus															0.00
Syng biac									1.00						1.00
Hali scap															0.00
Hali ind															0.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu				4.00	6.00	6.00					2.00				18.00
Acan line															0.00
Cyno arte															0.00
Coei croc															0.00
Plat indi					1.00										1.00
Plat larv															0.00
Plat lati															0.00
Papi long															0.00
Tera ther															0.00
Poma tril															0.00
Plec lacr															0.00
Saur grac															0.00
Saur undo															0.00
Chel lan									1.00						1.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv				1.00	2.00	1.00					2.00				6.00
Paru barb															0.00
Upen viti															0.00
Plat tei															0.00
Plat obic															0.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono					1.00										1.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1				1.00	4.00										5.00
Cari shri															0.00
Acen nuda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Caff nudi															0.00
Onat sp1											1.00				1.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn															0.00
Cant sola															0.00
Cant vale									2.00						2.00
Plot line															0.00
Plot nkun															0.00
Trac bico															0.00
Plec gate								1.00							1.00
Squids															0.00
Diad spp															0.00
Pseu nasi															0.00
Para barn					1.00			1.00							2.00
Brot mult															0.00
Starfish															0.00
Ambl albi			1.00								1.00				2.00
Chae line															0.00
Trip grut															0.00
Jelly															0.00
Lact corn															0.00
Lact forn															0.00
Chei line															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev															0.00
Petr mitr															0.00
Sync marm															0.00
Olig kere															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Acol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi															0.00
Nova macr															0.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo									2.00						2.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
January 96 (contd.)

	cp30196A	cp30196B	m0196A	m0196B	T10196A	T10196B	T20196A	T20196B	T30196A	T30196B	cp40196A	cp40196B	cp50196A	cp50196B	Sum
Hali duss															0.00
Pter flag															0.00
Stat inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu															0.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin															0.00
Sum	3	0	4	9	16	9	8	63	53	13	8	1	0	0	187
Count	3	1	4	6	8	5	4	14	13	6	7	2	1	1	75
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	2	0	2	4	6	6	5	39	15	7	2	1	0	0	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
February 96

	cp30296A	cp30296B	m0296A	m0296B	T10296A	T10296B	T20296A	T20296B	T30296A	T30296B	cp40296A	cp40296B	cp50296A	cp50296B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept virg				1.00		7.00	27.00	16.00	3.00	9.00			2.00		65.00
Both manc									1.00				1.00		2.00
Both pant															0.00
Psue arsi															0.00
Leth hara				3.00											3.00
Leth lent															0.00
Leth mahs															0.00
Leth elon															0.00
Leth nebu						7.00	1.00			4.00					12.00
Leth vari															0 00
Leth larv	2.00														2.00
Siga cana						5.00	1.00	1.00					1.00		8.00
Siga stel															0.00
Chei iner														1.00	1.00
Para mead															0.00
Para moss					1.00	2.00	4 00	3.00	3.00	1.00				1.00	15.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag	1.00														1.00
Apog nigr						10.00	5.00	5.00	4.00	1.00					25.00
Apog cook									6.00						6.00
Apog taen															0.00
Foa brach															0.00
Fowl aur						1.00	2.00		3.00	1.00			1.00		8.00
Stet stri															0.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus															0.00
Syng biac							1.00								1.00
Hali scap															0.00
Hali irid					1.00	7.00	9.00	9.00	7.00	6.00			1.00		40.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu					2.00	1.00									3.00
Acan line															0.00
Cyno arie															0.00
Coei croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long															0.00
Tera ther															0.00
Poma tril															0.00
Plec lacr					3.00	2.00		6.00							11.00
Saur grac															0.00
Saur undo						1.00									1.00
Chel lati															0.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv				1.00								1.00	1.00	1.00	4.00
Paru barb															0.00
Upen vitt															0.00
Plat terr															0.00
Plat obic															0.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono												1.00			1.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1	1.00									1.00					2.00
Cant shri				1.00											1.00
Acen suda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Call nudi							1.00								1.00
Gnat sp1															0.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac					1.00										1.00
Crabs	2.00	3.00													5.00
Cant benn															0.00
Cant sola															0.00
Cant vale															0.00
Plot line								2.00							2.00
Plot niksn															0.00
Trac bico															0.00
Plec gate															0.00
Squids															0.00
Diad spp															0.00
Pseu nasi															0.00
Para barn							1.00								1.00
Brot mult															0.00
Starfish															0.00
Ambl albi				4.00								2.00	1.00		7.00
Chae line															0.00
Trip grat						10.00	19.00	21.00	9.00	10.00					69.00
Jelly					1.00	1.00	7.00	4.00	5.00	2.00					20 00
Lact corn															0.00
Lact form						1.00			1.00						2.00
Chei line															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr		1.00													1.00
Petr brev															0.00
Petr mitr															0.00
Sync marm															0.00
Olig kene															0.00
Abla hino															0.00
Ambl sphy															0.00
Aste sens															0.00
Para bili															0.00
Hipp capi															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc					2.00										2.00
Diod hyst															0.00
Antc comm															0.00
Pter poly															0.00
Epib insi															0.00
Nova macr															0.00
Dact orie															0.00
Aero japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
February 96 (contd.)

	cp30296A	cp30296B	m0296A	m0296B	T10296A	T10296B	T20296A	T20296B	T30296A	T30296B	cp40296A	cp40296B	cp50296A	cp50296B	Sum
Hali dasc															0.00
Pter flag															0.00
Stet mte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu															0.00
Cheil han							2.00	2.00							4.00
Chry annu															0.00
Dasc arua															0.00
Para pli															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin															0.00
Sum	6	4	0	10	11	55	80	69	42	35	0	4	8	3	327
Count	5	3	1	6	8	14	14	11	11	10	1	4	8	4	100
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	2	3	0	4	3	10	27	21	9	10	0	2	2	1	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

March 96

	cp30396A	cp30396B	m0396A	m0396B	T10396A	T10396B	T20396A	T20396B	T30396A	T30396B	cp40396A	cp40396B	cp50396A	cp50396B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab	1.00	1.00	2.00	1.00											5.00
Scar psit															0.00
Hipp harr															0.00
Calo spin															0.00
Lept vaig			2.00		2.00	10.00	1.00	1.00	2.00	3.00	5.00		1.00	1.00	28.00
Both manc															0.00
Both pant															0.00
Psue arsi															0.00
Leth hara	1.00		10.00	3.00					1.00	2.00					17.00
Leth lent															0.00
Leth mahs															0.00
Leth elon															0.00
Leth nebu		4.00	9.00	9.00	3.00				2.00	2.00	1.00				30.00
Leth vari															0.00
Leth larv						2.00						1.00			3.00
Siga cana		2.00	3.00							1.00					6.00
Siga stel			2.00							2.00					4.00
Chei iner						1.00		1.00	1.00	1.00					4.00
Para mead															0.00
Para moss	1.00			1.00											2.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag					1.00	5.00									6.00
Apog nigr															0.00
Apog cook								1.00							1.00
Apog taen															0.00
Foa brach															0.00
Fowl auri	4.00		3.00	3.00	6.00	3.00			1.00		2.00				22.00
Stet stri					3.00	2.00		1.00	2.00						8.00
Cori aygu															0.00
Cori caud															0.00
Side pict	1.00														1.00
Syng acus	1.00									6.00	1.00				8.00
Syng biac															0.00
Hali scap															0.00
Hali trid															0.00
Hali horr															0.00
Hali dunc															0.00
Yong nebu											1.00	1.00	1.00		3.00
Acan line															0.00
Cyno atte															0.00
Coci croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long															0.00
Tera ther															0.00
Poma tril															0.00
Plec lacr						1.00							1.00		2.00
Saur grac															0.00
Saur undo															0.00
Chel lati		1.00													1.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv	1.00	1.00	5.00	5.00	1.00						5.00	3.00		2.00	23.00
Paru barb															0.00
Upen vitt															0.00
Plat tetr															0.00
Plat obsc															0.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono		1.00				2.00									3.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1															0.00
Cant shri				1.00											1.00
Acen nuda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Caff nudi															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn															0.00
Cant sola															0.00
Cant vale															0.00
Plot line															0.00
Plot nkun															0.00
Trac bico			1.00												1.00
Plec gate															0.00
Squids															0.00
Diad spp								11.00							11.00
Pseu nasi															0.00
Para barn															0.00
Brot mult															0.00
Starfish															0.00
Ambl albi					2.00										2.00
Chae line															0.00
Trip grat					1.00			1.00							2.00
Jelly				1.00	7.00	1.00	4.00	1.00			1.00	2.00	1.00		18.00
Lact corn															0.00
Lact forn															0.00
Chei line								4.00	6.00	19.00					29.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev															0.00
Petr mitr															0.00
Sync marm															0.00
Olig kene															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc								2.00							2.00
Diod hyst															0.00
Ante comm															0.00
Pter pelv															0.00
Epib insi															0.00
Nova macr															0.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
March 96 (contd.)

	ep30396A	ep30396B	m0396A	m0396B	T10396A	T10396B	T20396A	T20396B	T30396A	T30396B	ep40396A	ep40396B	ep50396A	ep50396B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu															0.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Abla hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin															0.00
Sum	10	10	37	24	26	27	5	23	15	36	16	7	4	3	243
Count	8	7	10	9	10	10	3	10	8	9	8	5	5	3	105
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	4	4	10	9	7	10	4	11	6	19	5	3	1	2	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
April 96

	cp30496A	cp30496B	m0496A	m0496B	T10496A	T10496B	T20496A	T20496B	T30496A	T30496B	cp40496A	cp40496B	cp50496A	cp50496B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab							1.00								1.00
Scar prit															0.00
Hipp harr															0.00
Calo spin															0.00
Lept vaig			2.00	1.00	4.00	2.00	12.00	14.00	11.00	4.00		1.00	1.00		52.00
Both manc															0.00
Both pant															0.00
Prue arsi															0.00
Leth hara	1.00		3.00	4.00	2.00										10.00
Leth lent															0.00
Leth mahs															0.00
Leth elon					3.00			1.00	3.00				1.00	6.00	14 00
Leth nebu					2.00			1.00		1.00					4.00
Leth vari															0 00
Leth larv															0.00
Siga cana			1.00	1.00	1.00	3.00		3.00	2 00						11.00
Siga stel															0.00
Chei iner							1.00	1.00	2.00	2.00			1.00		7.00
Para mcad															0.00
Para moss				1.00			8 00								9.00
Scor vari								1.00							1.00
Apog angu															0.00
Apog sava										2.00					2.00
Apog frag			1.00		13.00	23.00		4.00					6.00	1.00	48.00
Apog nigr									1.00						1.00
Apog cook							13.00			6.00					19.00
Apog taen															0.00
Foa brach															0.00
Fowl auri		1.00	11.00	13.00	3.00	1.00	5.00	7.00	12.00	12.00			1.00		66.00
Stet stri				1.00		2.00	6.00	2.00	1.00	5.00	1.00		1.00		19.00
Cori aygu															0.00
Cori caud															0.00
Side pict						1.00									1.00
Syng acus				3.00						1.00					4.00
Syng biac					1.00			1.00	1.00	2.00					5.00
Hali scap															0.00
Hali urid								3.00							3 00
Hali hort															0.00
Hali dunc															0.00
Yong nebu											1.00	1.00			2.00
Acan line															0.00
Cyno atte															0.00
Coci croc															0.00
Plat indi															0 00
Plat larv															0.00
Plat lati															0 00
Papi long															0.00
Tera ther															0.00
Poma tril															0.00
Plec lacr									3.00	2.00					5.00
Saur grac															0.00
Saur undo															0.00
Chel lati															0.00
Gerr oyen		2.00									4.00				6.00
Lutj gibb															0.00
Lutj fulv			1.00	2.00	1.00	2.00									6 00
Paru barb															0.00
Upen vitt															0.00
Plat tetr															0 00
Plat obsc					2.00	1.00				1.00		1.00			5.00
Arot imma															0.00
Arot hisp															0.00
Arot stel															0.00
Pena indi		1.00				1.00							1.00		3.00
Pena mono			3.00	2.00	3.00	3.00						2.00	2.00		15.00
Pena semi															0 00
Pena sp1															0.00
Gobi sp1															0.00
Cari shri				2.00	1.00		5.00	4.00	4.00	4.00		1.00			21.00
Acen auda															0 00
Epin sp1															0.00
Gram sexl															0.00
Fist peti										1.00					1.00
Call nudi															0.00
Gnat sp1								1.00	1.00						2.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn															0.00
Cant sola				1.00											1.00
Cant vale															0.00
Plot line															0.00
Plot nkun															0.00
Trac bico															0.00
Plac gate															0.00
Squids															0.00
Diad spp															0.00
Pseu nasi															0.00
Para barn								1.00							1.00
Brot mult															0.00
Starfist															0.00
Ambl albi															0.00
Chae line															0.00
Trip grat															0.00
Jelly															0.00
Lact corn															0.00
Lact forn															0.00
Chei line						1.00		3.00	8 00	6.00					18.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev			2.00		17.00			8.00	2.00	4.00					33.00
Petr mitr					2.00			3.00	1.00						6.00
Sync marm															0.00
Olig kete															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi									1.00						1.00
Nova macr															0.00
Dact orie															0.00
Aero japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
April 96 (contd.)

	cp30496A	cp30496B	m0496A	m0496B	T10496A	T10496B	T20496A	T20496B	T30496A	T30496B	cp40496A	cp40496B	cp50496A	cp50496B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu										2.00					2.00
Chel burn									1.00						1.00
Chry annu															0.00
Dasc arua															0.00
Para psi															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad					1.00										1.00
Sphy jell			1.00								1.00			3.00	5.00
Oxyu spl															0.00
Pter mule															0.00
Stol indi															0.00
Cara igno															0.00
Hemp plat															0.00
Chei quin															0.00
Sum	1	4	25	31	56	40	51	58	54	55	7	6	14	10	412
Count	2	4	10	12	16	12	9	18	17	17	5	6	9	4	141
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	1	2	11	13	17	23	13	14	12	12	4	2	6	6	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

May 96

	cp30596A	cp30596B	m0596A	m0596B	T10596A	T10596B	T20596A	T20596B	T30596A	T30596B	cp40596A	cp40596B	cp50596A	cp50596B	Sum
Sear sord															0.00
Sear glob															0.00
Sear scab															0.00
Sear put															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig			1.00				2.00		2.00	5.00			1.00	4.00	15.00
Both manc															0.00
Both pant															0.00
Psue arsi															0.00
Leth hara		1.00											1.00	1.00	3.00
Leth lent															0.00
Leth mahs															0.00
Leth elon							1.00								1.00
Leth nebu		1.00		2.00											3.00
Leth vari															0.00
Leth larv															0.00
Siga cana			3.00	3.00										2.00	8.00
Siga stel															0.00
Chei iner					1.00		2.00		2.00						5.00
Para mead															0.00
Para mors						1.00							1.00		2.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag						1.00									1.00
Apog nigr			1.00	1.00						1.00					3.00
Apog cook					7.00				1.00						8.00
Apog taen															0.00
Fou brach															0.00
Fowl aun						1.00	1.00		1.00	2.00				5.00	10.00
Stet stri							2.00								2.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus			1.00	2.00			1.00		1.00						5.00
Syng biac									2.00	1.00		1.00			4.00
Hali scap															0.00
Hali ind															0.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu															0.00
Acan line															0.00
Cyno atte															0.00
Cori croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long															0.00
Tera ther															0.00
Poma tril															0.00
Plec lacr										1.00					1.00
Saur grac															0.00
Saur undo															0.00
Chel inn										1.00					1.00
Gerr oyen													1.00		1.00
Lutj gibb															0.00
Lutj fulv				1.00								1.00		1.00	3.00
Paru barb															0.00
Upen vitt															0.00
Plat teir															0.00
Plat obic															0.00
Arot imma													1.00		1.00
Arot hisp															0.00
Arot stel															0.00
Pena indi									1.00				1.00		2.00
Pena mono			1.00												1.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1				1.00											1.00
Cun shri			1.00							1.00					2.00
Acen suda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist pett														1.00	1.00
Caff nudi															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn															0.00
Cant sola							1.00								1.00
Cant vale	4.00						4.00								8.00
Plot line															0.00
Plot nkun															0.00
Trac bico															0.00
Plec gate															0.00
Squids															0.00
Diad spp															0.00
Pseu nasi															0.00
Para barn					1.00	1.00									2.00
Brot mult															0.00
Starfisf															0.00
Ambl albi			1.00										1.00		2.00
Chae line															0.00
Trip grat															0.00
Jelly															0.00
Lact corn															0.00
Lact forn															0.00
Chei line							3.00	1.00	1.00	3.00					8.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev				2.00					2.00	2.00					6.00
Petr miti										1.00					1.00
Sync marm															0.00
Olig kete															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter pely															0.00
Epib insi									1.00	1.00					2.00
Nova macr															0.00
Dact orie															0.00
Aero japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
May 96 (contd.)

	cp30596A	cp30596B	m0596A	m0596B	T10596A	T10596B	T20596A	T20596B	T30596A	T30596B	cp40596A	cp40596B	cp50596A	cp50596B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu															0.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sola blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Hemp plat															0.00
Chei quin															0.00
Sum	4	2	9	12	9	4	17	1	14	19	0	2	7	14	114
Count	2	3	8	8	4	5	10	2	11	12	2	3	8	7	85
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	4	1	3	3	7	1	4	1	2	5	0	1	1	5	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
June 96

	cp30696A	cp30696B	m0696A	m0696B	T10696A	T10696B	T20696A	T20696B	T30696A	T30696B	cp40696A	cp40696B	cp50696A	cp50696B	Sum
Scar sord	1.00	1.00		1.00											3.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig	4.00	6.00		4.00	1.00	8.00	2.00		1.00		1.00				27.00
Both manc															0.00
Both pant															0.00
Psue arsi															0.00
Leth hara	3.00	5.00	2.00	1.00											11.00
Leth lent															0.00
Leth mahs															0.00
Leth elon															0.00
Leth nebu															0.00
Leth vari															0.00
Leth larv															0.00
Siga cana	1.00			2.00		1.00	4.00						1.00		9.00
Siga stel															0.00
Chei iner															0.00
Para mead															0.00
Para moss	3.00	6.00													9.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag															0.00
Apog nigr	33.00	31.00	1.00	4.00	2.00	1.00	1.00	1.00							74.00
Apog cook	2.00						3.00								5.00
Apog taen															0.00
Foa brach															0.00
Fowl aun		10.00					1.00								11.00
Stet stri															0.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus										1.00	1.00				2.00
Syng biac	3.00	6.00							1.00	1.00					11.00
Hali scap															0.00
Hali irid															0.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu															0.00
Acan line															0.00
Cyno arte															0.00
Coci croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long															0.00
Tera ther															0.00
Poma tril															0.00
Plec lacr									1.00						1.00
Saur grac															0.00
Saur undo							1.00								1.00
Chel lan						1.00	1.00								2.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv	3.00	1.00	1.00	1.00						1.00					7.00
Paru barb															0.00
Upen vitt															0.00
Plat teir															0.00
Plat obic															0.00
Arot imma											1.00				1.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono	2.00	1.00	2.00	1.00											6.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1															0.00
Cari shri															0.00
Acen auda															0.00
Epin sp1															0.00
Oram sexd															0.00
Fist peti															0.00
Cafl nuch															0.00
Onat sp1						1.00									1.00
Favo mela															0.00
Favo retc															0.00
Favo sp1															0.00
Dend brac				1.00											1.00
Crabs															0.00
Cant benn															0.00
Cant sola					1.00										1.00
Cant vale							1.00	4.00							5.00
Plot line															0.00
Plot nkun															0.00
Trac bico															0.00
Plec gate															0.00
Squids															0.00
Diad spp															0.00
Pseu nasi															0.00
Para barn					1.00			1.00							2.00
Brot mult															0.00
Starfish															0.00
Ambl albi															0.00
Chae line															0.00
Trip grat															0.00
Jelly															0.00
Lact corn															0.00
Lact forn															0.00
Chei line															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev	1.00	1.00	1.00	3.00	1.00	5.00	1.00			1.00		1.00			15.00
Petr mitr	1.00	6.00	1.00	2.00			2.00								12.00
Sync marm															0.00
Olig kere															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste senu															0.00
Para bih															0.00
Hipp cape															0.00
Hipp carne															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi															0.00
Nova macr															0.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
June 96 (contd.)

	cp30696A	cp30696B	m0696A	m0696B	T10696A	T10696B	T20696A	T20696B	T30696A	T30696B	cp40696A	cp40696B	cp50696A	cp50696B	Sum
Hali duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu															0.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell											1.00			3.00	4.00
Oxyu sp1															0.00
Pter mile										1.00					1.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin						1.00		2.00	1.00	2.00					6.00
Sum	57	74	8	20	6	18	17	8	4	7	4	1	1	3	228
Count	13	12	7	11	6	8	11	5	5	7	5	2	2	2	96
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	33	31	2	4	2	8	4	4	1	2	1	1	1	3	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
July 96

	ep30796A	ep30796B	m0796A	m0796B	T10796A	T10796B	T20796A	T20796B	T30796A	T30796B	ep40796A	ep40796B	ep50796A	ep50796B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig		6.00	5.00		5.00					1.00	3.00		1.00		21.00
Both manc															0.00
Both pant															0.00
Psue arsi															0.00
Leth hara			1.00												1.00
Leth lent															0.00
Leth mahs															0.00
Leth elon															0.00
Leth nebu			3.00		3.00										6.00
Leth vari															0.00
Leth larv															0.00
Siga cana			1.00		4.00						1.00				6.00
Siga stel			1.00												1.00
Chei mer															0.00
Para mcad															0.00
Para moss			15.00	1.00							1.00				17.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog trag			3.00												3.00
Apog nigr															0.00
Apog cook												2.00			2.00
Apog taen															0.00
Foa brach															0.00
Fowl auri		5.00	8.00		4.00						1.00	1.00		2.00	21.00
Stet stri												1.00		1.00	2.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus		1.00								1.00			1.00		3.00
Syng biac					1.00							2.00		2.00	5.00
Hali scap															0.00
Hali trid															0.00
Hali hort															0.00
Hali dunc															0.00
Yona nebu															0.00
Acan line															0.00
Cyno arte															0.00
Coci eroc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Papi long															0.00
Tera ther															0.00
Poma tril															0.00
Plec lacr															0.00
Saur grac															0.00
Saur undo															0.00
Chel lati															0.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv			2.00												2.00
Paru barb															0.00
Upen vitt															0.00
Plat teir															0.00
Plat obic															0.00
Arot imma					1.00										1.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono			6.00		5.00										11.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1															0.00
Cari shri												1.00			1.00
Acen auda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti			1.00										1.00		2.00
Caff nudi															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn													1.00		1.00
Cant sola												5.00		2.00	7.00
Cant vale											2.00	7.00			9.00
Plot line												2.00			2.00
Plot nkun															0.00
Trac bico			1.00		2.00										3.00
Plec gate															0.00
Squids															0.00
Diad spp															0.00
Pseu nasi															0.00
Para barn		2.00												1.00	3.00
Brot mult															0.00
Starfish															0.00
Ambl albi															0.00
Chae line															0.00
Trip grat															0.00
Jelly															0.00
Lact corn															0.00
Lact fem															0.00
Chei line															0.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev	1.00	2.00									1.00	3.00		3.00	10.00
Petr nutr		2.00	2.00												4.00
Sync marm															0.00
Olig kete															0.00
Abla binc															0.00
Ambl sphy															0.00
Atte semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Acol punc															0.00
Diod hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi															0.00
Nova macr					1.00										1.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
July 96 (contd.)

	cp30796A	cp30796B	m0796A	m0796B	T10796A	T10796B	T20796A	T20796B	T30796A	T30796B	cp40796A	cp40796B	cp50796A	cp50796B	Sum
Hab duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu													1.00		1.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pil															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan		1.00													1.00
Pela quad															0.00
Sphy jell															0.00
Oxyu spl															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin											1.00	3.00	2.00	3.00	9.00
Sum	1	19	49	1	26	0	0	0	0	2	10	27	7	14	156
Count	2	8	14	2	10	1	1	1	1	3	8	11	7	8	77
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	1	6	15	1	5	0	0	0	0	1	3	7	2	3	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996

August 96

	cp30896A	cp30896B	m0896A	m0896B	T10896A	T10896B	T20896A	T20896B	T30896A	T30896B	cp40896A	cp40896B	cp50896A	cp50896B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp harr															0.00
Calo spin															0.00
Lept vaig		3.00	2.00	2.00	9.00	5.00	12.00	30.00							63.00
Both manc								2.00							2.00
Both pant															0.00
Psue arsi															0.00
Leth hars															0.00
Leth lent															0.00
Leth mahs															0.00
Leth elon						1.00									1.00
Leth nebu															0.00
Leth vari															0.00
Leth larv															0.00
Siga cana	14.00	4.00		17.00	2.00	3.00		1.00							41.00
Siga stel								1.00							1.00
Chei iner						3.00	3.00	2.00							8.00
Para mead															0.00
Para moss		1.00													1.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag							2.00								2.00
Apog nigr															0.00
Apog cook							1.00								1.00
Apog taen															0.00
Foa brach															0.00
Fowl aur		3.00	1.00	1.00	1.00	2.00	2.00	3.00							13.00
Stet stri				1.00			2.00	4.00							7.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus		2.00					2.00								4.00
Syng biac					1.00										1.00
Hali scap															0.00
Hali irid															0.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu															0.00
Acan line															0.00
Cyno atte															0.00
Coci croc			1.00												1.00
Plat indi															0.00
Plat larv															0.00
Plat lati															0.00
Paps long															0.00
Tera ther															0.00
Poma tril															0.00
Plec laer															0.00
Saur grac															0.00
Saur undo			1.00												1.00
Chel lati		3.00													3.00
Gerr oyen															0.00
Lutj gibb															0.00
Lutj fulv					2.00										2.00
Paru barb															0.00
Upen vitt															0.00
Plat teir															0.00
Plat obic															0.00
Arot imma		2.00										1.00			3.00
Arot hisp															0.00
Arot stel															0.00
Pena indi															0.00
Pena mono															0.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1															0.00
Cari shri															0.00
Acen auda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Call mich															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo reic															0.00
Favo sp1															0.00
Dend brac		1.00													1.00
Crabs															0.00
Cant benn															0.00
Cant sola		1.00				1.00	1.00								3.00
Cant vale							2.00	1.00							3.00
Plot line															0.00
Plot nkun															0.00
Trac bico								1.00							1.00
Plec gate															0.00
Squids			1.00												1.00
Diad spp															0.00
Pseu nasi															0.00
Para barn	1.00					2.00									3.00
Brot mult															0.00
Starfish															0.00
Ambl albi															0.00
Chae line															0.00
Trip grat															0.00
Jelly															0.00
Lact corn			1.00												1.00
Lact torn															0.00
Chei line								1.00							1.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev				2.00		2.00	1.00								5.00
Petr mitr						1.00		1.00							2.00
Sync marm															0.00
Olig kete															0.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp came															0.00
Hipp hist															0.00
Upen trag															0.00
Aeol punc				1.00											1.00
Diod hyst															0.00
Ante comm															0.00
Pter pely															0.00
Epib insi															0.00
Nova macr															0.00
Dact orie															0.00
Acro japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer															0.00
Labr dimi															0.00

ANNEX 5 (contd.)

Epibenthos data. Gazi Bay. December 1994-September 1996
August 96 (contd.)

	ep30896A	ep30896B	m0896A	m0896B	T10896A	T10896B	T20896A	T20896B	T30896A	T30896B	ep40896A	ep40896B	ep50896A	ep50896B	Sum
Hab duss															0.00
Pter flag															0.00
Stet inte															0.00
Chei tril															0.00
Chei oxyc															0.00
Chei undu								5.00							5.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pili															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin															0.00
Sum	15	20	7	24	15	20	28	52	0	0	0	1	0	0	182
Count	3	10	7	7	6	10	11	13	1	1	1	2	1	1	74
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	14	4	2	17	9	5	12	30	0	0	0	1	0	0	

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
September 96

	cp30996A	cp30996B	m0996A	m0996B	T10996A	T10996B	T20996A	T20996B	T30996A	T30996B	cp40996A	cp40996B	cp50996A	cp50996B	Sum
Scar sord															0.00
Scar glob															0.00
Scar scab															0.00
Scar psit															0.00
Hipp hari															0.00
Calo spin															0.00
Lept vaig	2.00				4.00	9.00	59.00	55.00				1.00			130.00
Both manc															0.00
Both pant															0.00
Psue arsi															0.00
Leth hara															0.00
Leth lent															0.00
Leth mahs															0.00
Leth elon															0.00
Leth nebu	1.00						1.00						1.00		3.00
Leth vari															0.00
Leth larv															0.00
Siga cana						1.00	6.00	4.00					1.00		12.00
Siga stel															0.00
Chei iner						8.00	3.00	5.00							16.00
Para mead															0.00
Para moss															0.00
Scor vari															0.00
Apog angu															0.00
Apog sava															0.00
Apog frag								1.00							1.00
Apog isar						2.00	4.00	2.00							8.00
Apog cook					1.00		10.00	6.00							17.00
Apog taen															0.00
Fox brach															0.00
Fowl auri								19.00							19.00
Stet stri							2.00	2.00							4.00
Cori aygu															0.00
Cori caud															0.00
Side pict															0.00
Syng acus						1.00	1.00	1.00	1.00						4.00
Syng biac					1.00			2.00		1.00					4.00
Hali scap															0.00
Hali ind								2.00							2.00
Hali hort															0.00
Hali dunc															0.00
Yong nebu															0.00
Acan line															0.00
Cyno atte															0.00
Coci croc															0.00
Plat indi															0.00
Plat larv															0.00
Plat lab															0.00
Papi long															0.00
Tera ther															0.00
Poma tri							2.00								2.00
Plec laci															0.00
Saur grac															0.00
Saur undo															0.00
Chel lab															0.00
Gerr oyen															0.00
Lutj gibh															0.00
Lutj fulv															0.00
Paru barb															0.00
Upen vitt															0.00
Plat teu															0.00
Plat obsc															0.00
Arot imma						1.00									1.00
Arot hisp															0.00
Arot stel															0.00
Pena indi	2.00														2.00
Pena mono															0.00
Pena semi															0.00
Pena sp1															0.00
Gobi sp1															0.00
Cari shri								1.00							1.00
Acen auda															0.00
Epin sp1															0.00
Gram sexl															0.00
Fist peti															0.00
Caff nudi															0.00
Gnat sp1															0.00
Favo mela															0.00
Favo retc															0.00
Favo sp1															0.00
Dend brac															0.00
Crabs															0.00
Cant benn					1.00		5.00	9.00							15.00
Cant sola							2.00	4.00							6.00
Cant vale							10.00	18.00		1.00					29.00
Plot line															0.00
Plot nkun															0.00
Trac buco															0.00
Plec gate															0.00
Squids															0.00
Diad spp															0.00
Pseu nasi															0.00
Para barn						4.00	2.00						4.00		10.00
Brot mult															0.00
Starfish															0.00
Ambl albi															0.00
Chae line															0.00
Trip grat															0.00
Jelly															0.00
Lact corn															0.00
Lact forn															0.00
Chei line								3.00		22.00					25.00
Chae auri															0.00
Chae klei															0.00
Chae mela															0.00
Trio macr															0.00
Petr brev	1.00											1.00	1.00		3.00
Petr mitr						1.00		1.00					1.00		3.00
Sync marm															0.00
Olig kere													1.00		1.00
Abla bino															0.00
Ambl sphy															0.00
Aste semi															0.00
Para bili															0.00
Hipp cape															0.00
Hipp carne								2.00							2.00
Hipp hist															0.00
Upen trag															0.00
Acol punc							1.00								1.00
Diod hyst															0.00
Ante comm															0.00
Pter poly															0.00
Epib insi															0.00
Nova macr															0.00
Dact orie															0.00
Acto japo															0.00
Echi poly															0.00
Loph calo															0.00
Amba prod															0.00
Anam caer							1.00	1.00							2.00
Labr dimi									1.00						1.00

ANNEX 5 (contd.)

Epibenthos data, Gazi Bay, December 1994-September 1996
September 96 (contd.)

	ep30996A	ep30996B	m0996A	m0996B	T10996A	T10996B	T20996A	T20996B	T30996A	T30996B	ep40996A	ep40996B	ep50996A	ep50996B	Sum
Hali dus															0.00
Pter flag															0.00
Stet inte															0.00
Chei tri															0.00
Chei oxyc															0.00
Chei undu							1.00	1.00		3.00					5.00
Cheil bim															0.00
Chry annu															0.00
Dasc arua															0.00
Para pib															0.00
Holo spec															0.00
Ostr cubi															0.00
Able hian															0.00
Sole blee															0.00
Sole cyan															0.00
Pela quad															0.00
Sphy jell															0.00
Oxyu sp1															0.00
Pter mile															0.00
Stol indi															0.00
Cara igno															0.00
Bemp plat															0.00
Chei quin															0.00
Sum	6	0	0	0	7	27	110	139	2	27	0	2	9	0	329
Count	6	1	1	1	5	9	17	21	3	5	1	3	7	1	81
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max	2	0	0	0	4	9	59	55	1	22	0	1	4	0	

ANNEX 5 contd.

Ranked catch: Gazi bay

Total	tot	%	cp3	av	%	m	av	%	T1	av	%	T2	av	%	T3	av	%
Lept vaig	2207	14.0	Apog nigr	13.3	22.7	Siga suto	9.0	15.0	Lept vaig	26.6	14.7	Plot line	56.7	26.1	Lept vaig	14.6	15.7
Plot line	1466	9.3	Siga suto	7.5	12.9	Leth hara	7.7	12.8	Apog frag	26.0	14.3	Lept vaig	32.6	15.0	Trip grat	6.8	7.3
Scar sord	1062	6.8	Leth nebu	5.7	9.7	Lept vaig	5.8	9.6	Scar sord	21.2	11.7	Trip grat	13.5	6.2	Fowl auri	6.1	6.6
Apog frag	896	5.7	Lept vaig	5.3	9.1	Apog nigr	5.7	9.4	Fowl auri	14.0	7.7	Scar sord	11.5	5.3	Apog nigr	4.7	5.1
Fowl auri	892	5.7	Leth hara	5.0	8.5	Fowl auri	4.6	7.7	Trip grat	8.2	4.5	Siga suto	10.1	4.7	Stet stri	4.2	4.5
Apog nigr	889	5.7	Fowl auri	3.5	5.9	Leth nebu	4.2	6.9	Siga suto	7.6	4.2	Hali irid	9.0	4.1	Apog cook	3.4	3.6
Siga suto	882	5.6	Para moss	2.6	4.4	Para moss	3.4	5.7	Leth nebu	6.7	3.7	Diad spec	8.4	3.9	Chei line	3.2	3.4
Trip grat	633	4.0	Pena spec	1.6	2.8	Apog frag	2.6	4.4	Apog nigr	6.7	3.7	Apog nigr	8.4	3.9	Chei iner	3.1	3.4
Leth nebu	624	4.0	Apog frag	1.3	2.2	Scar sord	1.9	3.2	Chei iner	6.0	3.3	Apog frag	7.7	3.5	Apog angu	3.0	3.2
Para moss	514	3.3	Scar sord	1.2	2.0	Cari shri	1.8	2.9	Plot line	5.9	3.3	Fowl auri	7.4	3.4	Scar sord	2.5	2.7
Chei iner	420	2.7	Petr mitr	1.0	1.8	Lutj fulv	1.8	2.9	Para moss	5.8	3.2	Chei iner	5.7	2.6	Scar scab	2.3	2.5
Leth hara	384	2.4	Syng biac	0.9	1.5	Pena mono	0.9	1.4	Stet stri	3.9	2.1	Para moss	5.1	2.3	Apog frag	2.2	2.3
Stet stri	333	2.1	Cari shri	0.7	1.2	Stet stri	0.9	1.4	Para barn	3.3	1.8	Apog cook	4.6	2.1	Siga suto	2.1	2.2
Jell fish	332	2.1	Petr brev	0.7	1.2	Petr brev	0.7	1.1	Petr brev	3.3	1.8	Leth nebu	4.5	2.1	Cant vale	2.0	2.1
Hali irid	306	1.9	Pena mono	0.6	1.0	Saur undo	0.7	1.1	Apog cook	3.2	1.8	Stet stri	4.5	2.1	Leth nebu	2.0	2.1
Apog cook	257	1.6	Both manc	0.5	0.9	Pena spec	0.6	1.0	Jell fish	2.8	1.6	Cant vale	3.3	1.5	Diad spec	2.0	2.1
Diad spec	240	1.5	Pela quad	0.5	0.9	Chei iner	0.6	1.0	Gnat spec	2.5	1.4	Para barn	2.3	1.1	Para moss	1.9	2.0
Lutj fulv	209	1.3	Lutj fulv	0.5	0.8	Gnat spec	0.5	0.9	Hali irid	2.4	1.3	Cheil bim	1.9	0.9	Hali irid	1.7	1.8
Para barn	172	1.1	Stet stri	0.5	0.8	Syng acus	0.5	0.8	Petr mitr	2.3	1.3	Chei line	1.3	0.6	Scar glob	1.6	1.8
Petr brev	171	1.1	Plec lacr	0.4	0.7	Yong nebu	0.5	0.8	Gobi spec	1.6	0.9	Chei undu	1.2	0.5	Nova macr	1.5	1.6
Cant vale	158	1.0	Saur undo	0.3	0.5	Both manc	0.5	0.8	Syng biac	1.4	0.8	Petr brev	1.1	0.5	Syng biac	1.4	1.5
Gnat spec	148	0.9	Syng acus	0.3	0.5	Ambl albi	0.4	0.6	Yong nebu	1.3	0.7	Petr mitr	1.0	0.5	Cari shri	1.2	1.3
Petr mitr	139	0.9	Crab spec	0.3	0.5	Petr mitr	0.3	0.5	Cant vale	1.2	0.7	Jell fish	1.0	0.5	Cheil bim	1.2	1.3
Cari shri	136	0.9	Siga stel	0.3	0.5	Siga stel	0.3	0.5	Pena mono	1.0	0.6	Cari shri	0.9	0.4	Chei oxyc	1.0	1.1
Syng biac	116	0.7	Gobi spec	0.3	0.5	Favo spec	0.3	0.5	Plec lacr	1.0	0.5	Cant sola	0.9	0.4	Petr brev	1.0	1.0
Chei line	113	0.7	Chel lati	0.2	0.4	Plec lacr	0.3	0.5	Cari shri	1.0	0.5	Cant benn	0.8	0.4	Petr mitr	0.9	1.0
Saur undo	102	0.6	Cant vale	0.2	0.4	Syng biac	0.2	0.4	Leth elon	1.0	0.5	Leth elon	0.7	0.3	Para barn	0.8	0.9
Both manc	83	0.5	Chei iner	0.2	0.4	Gobi spec	0.2	0.4	Both manc	0.8	0.5	Chel lati	0.7	0.3	Chei quin	0.8	0.9
Pena spec	81	0.5	Pena indi	0.2	0.4	Paru barb	0.2	0.4	Chei undu	0.8	0.5	Gnat spec	0.7	0.3	Syng acus	0.8	0.8
Pena mono	73	0.5	Arot imma	0.2	0.4	Coci croc	0.2	0.3	Leth hara	0.8	0.5	Syng biac	0.5	0.3	Trac bico	0.6	0.6
Cheil bim	72	0.5	Yong nebu	0.2	0.4	Para barn	0.2	0.3	Saur undo	0.8	0.4	Plec lacr	0.5	0.2	Gnat spec	0.5	0.6
Yong nebu	71	0.5	Gnat spec	0.2	0.3	Pela quad	0.2	0.3	Plec gate	0.7	0.4	Both manc	0.5	0.2	Jell fish	0.5	0.6
Apog angu	65	0.4	Papi long	0.2	0.3	Fist peti	0.1	0.2	Cant sola	0.7	0.4	Nova macr	0.5	0.2	Calo spin	0.5	0.5
Gobi spec	64	0.4	Tera ther	0.1	0.2	Ceph spec	0.1	0.2	Chei line	0.6	0.4	Syng acus	0.4	0.2	Chei undu	0.5	0.5
Plec lacr	64	0.4	Fist peti	0.1	0.2	Hali irid	0.1	0.2	Syng acus	0.6	0.3	Saur undo	0.3	0.1	Hipp hari	0.5	0.5
Syng acus	62	0.4	Para barn	0.1	0.2	Side pict	0.1	0.2	Sync marm	0.6	0.3	Plec gate	0.3	0.1	Apog taen	0.5	0.5
Acen auda	60	0.4	Leth larv	0.1	0.2	Scar scab	0.1	0.2	Lutj fulv	0.6	0.3	Gobi spec	0.3	0.1	Leth vari	0.4	0.4
Scar scab	58	0.4	Gerr oyen	0.1	0.2	Jell fish	0.1	0.2	Diad spec	0.5	0.3	Lutj fulv	0.3	0.1	Trio macr	0.4	0.4
Leth elon	57	0.4	Side pict	0.1	0.2	Apog cook	0.1	0.2	Side pict	0.4	0.2	Cori aygu	0.3	0.1	Foal brac	0.4	0.4
Chei undu	53	0.3	Cyno atte	0.1	0.2	Papi long	0.1	0.2	Trac bico	0.4	0.2	Trac bico	0.3	0.1	Chei tril	0.4	0.4
Cant sola	50	0.3	Acen auda	0.1	0.2	Epib insi	0.1	0.2	Pena spec	0.4	0.2	Star fish	0.3	0.1	Plec lacr	0.4	0.4
Nova macr	48	0.3	Epin spec	0.1	0.2	Aeol punc	0.1	0.2	Acen auda	0.3	0.2	Sync marm	0.3	0.1	Apog sava	0.4	0.4
Pela quad	38	0.2	Paru barb	0.1	0.2	Leth larv	0.1	0.2	Leth lent	0.3	0.2	Acro japo	0.3	0.1	Gobi spec	0.4	0.4
Scar glob	36	0.2	Plat obic	0.1	0.2	Chel lati	0.1	0.2	Chel lati	0.3	0.2	Ceph spec	0.2	0.1	Cant benn	0.3	0.3
Chel lati	35	0.2	Dend brac	0.1	0.2	Aste semi	0.1	0.2	Plat obic	0.3	0.2	Ambl albi	0.2	0.1	Papi long	0.3	0.3
Chei quin	30	0.2	Hali irid	0.1	0.2	Ostr cubi	0.1	0.2	Ambl albi	0.3	0.2	Aeol punc	0.2	0.1	Side pict	0.3	0.3
Trac bico	30	0.2	Apog cook	0.1	0.2	Favo reic	0.1	0.2	Ceph spec	0.2	0.1	Trio macr	0.2	0.1	Scar psit	0.3	0.3
Ambl albi	30	0.2	Scar scab	0.1	0.2	Lact forn	0.1	0.2	Paru barb	0.2	0.1	Hali hort	0.2	0.1	Poma tril	0.3	0.3
Cant benn	29	0.2	Chei undu	0.0	0.1	Pena indi	0.1	0.2	Pela quad	0.2	0.1	Lact forn	0.2	0.1	Leth elon	0.3	0.3
Plec gate	29	0.2	Sole cyan	0.0	0.1	Lact corn	0.1	0.2	Cheil bim	0.2	0.1	Dend brac	0.2	0.1	Lact forn	0.3	0.3
Para pili	23	0.1	Sphy jell	0.0	0.1	Trac bico	0.1	0.2	Pena indi	0.2	0.1	Apog sava	0.2	0.1	Cant sola	0.3	0.3
Side pict	23	0.1	Trio macr	0.0	0.1	Favo mela	0.0	0.1	Cant benn	0.2	0.1	Acen auda	0.1	0.1	Epib insi	0.3	0.3
Chei oxyc	22	0.1	Pena semi	0.0	0.1	Upen trag	0.0	0.1	Papi long	0.2	0.1	Para pili	0.1	0.1	Saur undo	0.2	0.2
Trio macr	21	0.1	Acan line	0.0	0.1	Para bili	0.0	0.1	Nova macr	0.2	0.1	Hipp came	0.1	0.1	Leth larv	0.2	0.2
Lact forn	21	0.1	Favo mela	0.0	0.1	Sole cyan	0.0	0.1	Trio macr	0.2	0.1	Leth larv	0.1	0.1	Hali scap	0.2	0.2
Papi long	20	0.1	Cant sola	0.0	0.1	Plec gate	0.0	0.1	Arot imma	0.1	0.1	Yong nebu	0.1	0.1	Plot line	0.2	0.2
Favo reic	19	0.1	Saur grac	0.0	0.1	Cant sola	0.0	0.1	Para bili	0.1	0.1	Diod hyst	0.1	0.1	Leth mahs	0.2	0.2
Paru barb	19	0.1	Coci croc	0.0	0.1	Epin spec	0.0	0.1	Aeol punc	0.1	0.1	Anam caer	0.1	0.0	Leth hara	0.1	0.1
Pena indi	18	0.1				Trio macr	0.0	0.1	Favo reic	0.1	0.1	Loph calo	0.1	0.0	Hipp came	0.1	0.1
Gerr oyen	18	0.1	sum	58.5		Sphy jell	0.0	0.1	Crab spec	0.1	0.1	Epib insi	0.1	0.0	Both manc	0.1	0.1
Leth larv	17	0.1	count	58.0		Sole blee	0.0	0.1	Lact corn	0.1	0.1	Lact corn	0.1	0.0	Chel lati	0.1	0.1

ANNEX 5 contd.

Ranked catch: Gazi bay

Total	tot	%				m	av	%	T1	av	%	T2	av	%	T3	av	%
Sphy jell	16	0.1	Total contd	tot	%	Dend brac	0.0	0.1	Lact forn	0.1	0.1	Chae mela	0.1	0.0	Aste semi	0.1	0.1
Siga stel	16	0.1	Dasc arua	2	0.0	Leth vari	0.0	0.1	Diod hyst	0.1	0.1	Chae klei	0.1	0.0	Dend brac	0.1	0.1
Arot imma	16	0.1	Pter flag	2	0.0				Upen trag	0.1	0.1	Leth hara	0.1	0.0	Holo spec	0.1	0.1
Plat obic	15	0.1	Cara igno	2	0.0	sum	60.2		Dend brac	0.1	0.1	Pena spec	0.1	0.0	Leth lent	0.1	0.1
Lact com	15	0.1	Pter taen	2	0.0	count	64.0		Epib insi	0.1	0.1	Chei quin	0.1	0.0	Plec gate	0.1	0.1
Ceph spec	15	0.1	Chry annu	2	0.0				Leth larv	0.1	0.1	Poma tril	0.1	0.0	Plat larv	0.1	0.1
Dend brac	13	0.1	Sole cyan	2	0.0				Pena semi	0.0	0.0	Arot stel	0.1	0.0	Cori caud	0.1	0.1
Leth vari	12	0.1	Plat larv	2	0.0				Chae auri	0.0	0.0	Scar scab	0.1	0.0	Ostr cubi	0.1	0.1
Epib insi	12	0.1	Plat indi	2	0.0				Calo spin	0.0	0.0	Paru barb	0.1	0.0	Labr dimi	0.1	0.1
Calo spin	12	0.1	Sole blee	2	0.0				Brot mult	0.0	0.0	Chry annu	0.1	0.0	Amba prod	0.1	0.1
Aeol punc	12	0.1	Arot stel	2	0.0				Star fish	0.0	0.0	Papi long	0.1	0.0	Loph calo	0.1	0.1
Apog sava	12	0.1	Pter mile	2	0.0				Acan line	0.0	0.0	Coci croc	0.1	0.0	Hali dunc	0.1	0.1
Fist peti	11	0.1	Hipp hist	2	0.0				Chae line	0.0	0.0	Hipp hist	0.0	0.0	Siga stel	0.1	0.1
Both pant	11	0.1	Hali dunc	2	0.0				Olig keie	0.0	0.0	Dasc arua	0.0	0.0	Ambl albi	0.1	0.1
Neop fuli	10	0.1	Acan line	2	0.0				Plat lati	0.0	0.0	Leth vari	0.0	0.0	Hali duss	0.1	0.1
Crab spec	10	0.1	Chae klei	2	0.0				Aste semi	0.0	0.0	Scor vari	0.0	0.0	Stol indi	0.0	0.0
Hipp hari	10	0.1	Pena semi	2	0.0				Hipp came	0.0	0.0	Chae auri	0.0	0.0	Pter mile	0.0	0.0
Leth lent	10	0.1	Holo doli	1	0.0				Ante comm	0.0	0.0	Pter flag	0.0	0.0	Able hian	0.0	0.0
Apog taen	10	0.1	Oxyu spec	1	0.0				Anam caer	0.0	0.0	Siga stel	0.0	0.0	Chae mela	0.0	0.0
Para bili	9	0.1	Able hian	1	0.0				Leth vari	0.0	0.0	Abla bino	0.0	0.0	Lact corn	0.0	0.0
Sync marm	9	0.1	Cten stri	1	0.0				Plat indi	0.0	0.0	Dact one	0.0	0.0	Hipp hist	0.0	0.0
Foal brac	9	0.1	Bemp plat	1	0.0				Chei quin	0.0	0.0	Upen trag	0.0	0.0	Pter flag	0.0	0.0
Star fish	8	0.1	Hipp cape	1	0.0				Tera ther	0.0	0.0	Side pict	0.0	0.0	Pter pely	0.0	0.0
Hipp came	8	0.1	Psue arsi	1	0.0				Upen vitt	0.0	0.0	Labr dimi	0.0	0.0	Upen trag	0.0	0.0
Hipp long	8	0.1	Upen vitt	1	0.0				Lutj gibb	0.0	0.0	Echi poly	0.0	0.0	Stet inte	0.0	0.0
Chei tril	8	0.1	Plat lati	1	0.0							Gram sexl	0.0	0.0	Hipp cape	0.0	0.0
Poma tril	8	0.1	Saur grac	1	0.0				sum	181.6		Caff nudi	0.0	0.0	Psue arsi	0.0	0.0
Scar psit	7	0.0	Lutj gibb	1	0.0				count	87.0		Pela quad	0.0	0.0	Both pant	0.0	0.0
Coci croc	7	0.0	Caff nudi	1	0.0										Chae auri	0.0	0.0
Favo spec	7	0.0	Pseu nasi	1	0.0							sum	217.2		Dasc arua	0.0	0.0
Cori aygu	7	0.0	Gram sexl	1	0.0							count	90.0		Aeol punc	0.0	0.0
Acro japo	7	0.0	Plat teir	1	0.0										Star fish	0.0	0.0
Aste semi	6	0.0	Arot hisp	1	0.0										Para mcad	0.0	0.0
Hali scap	5	0.0	Plot nkun	1	0.0										Plat obic	0.0	0.0
Ostr cubi	5	0.0	Brot mult	1	0.0										Pena indi	0.0	0.0
Upen trag	5	0.0	Stet inte	1	0.0										Plat teir	0.0	0.0
Diod hyst	5	0.0	Ante comm	1	0.0										Arot hisp	0.0	0.0
Tera ther	5	0.0	Echi poly	1	0.0										Fist peti	0.0	0.0
Hali hort	4	0.0	Dact one	1	0.0										Yong nebu	0.0	0.0
Anam caer	4	0.0	Pter pely	1	0.0										Favo reic	0.0	0.0
Holo spec	4	0.0	Ambl sphy	1	0.0										Plot nkun	0.0	0.0
Loph calo	4	0.0	Chae line	1	0.0										Lutj fulv	0.0	0.0
Leth mahs	4	0.0	Abla bino	1	0.0										Crab spec	0.0	0.0
Olig keie	3	0.0	Para mcad	1	0.0										Ceph spec	0.0	0.0
Labr dimi	3	0.0	Scor vari	1	0.0										Paru barb	0.0	0.0
Chae auri	3	0.0	Epin mala	1	0.0												
Chae mela	3	0.0													sum	93.4	
Stol indi	3	0.0	Sum	15974											count	107.0	
Epin spec	3	0.0	Count	428													
Favo mela	3	0.0															
Cyno atte	3	0.0															
Cori caud	2	0.0															
Hali duss	2	0.0															
Amba prod	2	0.0															
Cymo prae	2	0.0															

ANNEX 5 contd.

Ranked catch: Gazi bay

cp4	av	%	cp5	av	%	Dec 94	sum	%	Jan 95	sum	%	Feb 95	sum	%	Mar 95	sum	%
Jell fish	9.7	16.4	Lept vaig	6.7	14.5	Lept vaig	261	23.9	Lept vaig	262	17.8	Scar sord	228	18.1	Scar sord	466	29.5
Lept vaig	8.7	14.7	Scar sord	4.8	10.4	Diad spec	106	9.7	Plot line	216	14.7	Apog frag	117	9.3	Fowl auri	179	11.3
Scar sord	5.1	8.7	Plot line	3.7	8.1	Scar sord	84	7.7	Leth hara	145	9.8	Leth nebu	114	9.0	Lept vaig	117	7.4
Lutj fulv	4.5	7.5	Leth nebu	2.7	5.8	Apog nigr	75	6.9	Trip grat	103	7.0	Fowl auri	90	7.1	Leth nebu	95	6.0
Para moss	2.9	4.8	Hali irid	2.5	5.4	Chei iner	69	6.3	Hali irid	91	6.2	Para moss	73	5.8	Apog frag	84	5.3
Leth nebu	2.6	4.4	Fowl auri	2.5	5.3	Leth nebu	63	5.8	Para moss	78	5.3	Siga suto	66	5.2	Hali irid	79	5.0
Fowl auri	2.5	4.2	Leth hara	2.1	4.6	Fowl auri	50	4.6	Apog frag	76	5.2	Trip grat	63	5.0	Chei iner	64	4.0
Siga suto	2.0	3.4	Chei iner	2.0	4.3	Para moss	47	4.3	Leth nebu	74	5.0	Leth hara	47	3.7	Para moss	58	3.7
Leth hara	1.6	2.8	Lutj fulv	1.9	4.0	Plot line	46	4.2	Apog nigr	60	4.1	Gnat spec	40	3.2	Siga suto	57	3.6
Acen auda	1.5	2.5	Siga suto	1.7	3.6	Apog frag	44	4.0	Scar sord	57	3.9	Gobi spec	36	2.9	Jell fish	30	1.9
Chei iner	1.5	2.5	Para moss	1.7	3.6	Leth hara	21	1.9	Siga suto	52	3.5	Cheil bim	31	2.5	Lutj fulv	27	1.7
Saur undo	1.4	2.3	Gnat spec	1.1	2.5	Trip grat	16	1.5	Chei iner	34	2.3	Chei iner	30	2.4	Trip grat	25	1.6
Gnat spec	1.1	1.9	Saur undo	1.0	2.1	Stet stri	16	1.5	Gnat spec	24	1.6	Plot line	26	2.1	Apog cook	19	1.2
Apog nigr	1.0	1.8	Jell fish	0.9	1.9	Hali irid	14	1.3	Jell fish	20	1.4	Pena spec	24	1.9	Petr mitr	16	1.0
Stet stri	1.0	1.6	Both manc	0.7	1.5	Gnat spec	12	1.1	Cheil bim	15	1.0	Lutj fulv	21	1.7	Yong nebu	16	1.0
Yong nebu	0.8	1.4	Acen auda	0.7	1.5	Nova macr	10	0.9	Pena spec	12	0.8	Petr mitr	20	1.6	Stet stri	16	1.0
Petr brev	0.8	1.3	Apog nigr	0.6	1.4	Both manc	9	0.8	Syng acus	11	0.7	Acen auda	18	1.4	Cari shri	16	1.0
Para pili	0.7	1.2	Leth elon	0.6	1.3	Cheil bim	9	0.8	Diad spec	10	0.7	Diad spec	18	1.4	Chel lati	15	0.9
Both manc	0.6	1.1	Favo reic	0.5	1.2	Para barn	8	0.7	Leth elon	10	0.7	Pena mono	17	1.3	Gnat spec	14	0.9
Pela quad	0.6	1.1	Para barn	0.5	1.2	Lutj fulv	8	0.7	Saur undo	9	0.6	Lept vaig	15	1.2	Scar glob	14	0.9
Apog frag	0.6	1.0	Gerr oyen	0.5	1.1	Siga suto	8	0.7	Acen auda	9	0.6	Saur undo	14	1.1	Trac bico	13	0.8
Pena spec	0.6	1.0	Sphy jell	0.5	1.1	Trio macr	7	0.6	Yong nebu	8	0.5	Both manc	13	1.0	Leth hara	11	0.7
Syng biac	0.6	1.0	Pena mono	0.5	1.0	Saur undo	7	0.6	Both manc	7	0.5	Plec lacr	10	0.8	Scar scab	11	0.7
Para barn	0.5	0.8	Pena spec	0.4	0.9	Cant vale	6	0.5	Lutj fulv	7	0.5	Para barn	10	0.8	Plec gate	10	0.6
Petr mitr	0.5	0.8	Apog frag	0.4	0.8	Apog cook	6	0.5	Siga stel	7	0.5	Apog cook	9	0.7	Para barn	9	0.6
Cari shri	0.5	0.8	Petr brev	0.3	0.7	Pena spec	6	0.5	Cori sygu	6	0.4	Sync marm	8	0.6	Nova macr	9	0.6
Pena mono	0.4	0.7	Syng biac	0.3	0.7	Chei tril	6	0.5	Favo reic	6	0.4	Apog nigr	7	0.6	Hipp long	8	0.5
Cant vale	0.4	0.7	Stet stri	0.3	0.6	Cant benn	5	0.5	Cari shri	6	0.4	Hali irid	7	0.6	Leth lent	7	0.4
Plec lacr	0.4	0.6	Trip grat	0.3	0.6	Petr mitr	5	0.5	Fowl auri	5	0.3	Ceph spec	7	0.6	Saur undo	6	0.4
Ambl albi	0.3	0.5	Para pili	0.2	0.5	Pela quad	4	0.4	Syng biac	5	0.3	Calo spin	7	0.6	Plec lacr	5	0.3
Both pant	0.3	0.5	Chei quin	0.2	0.5	Petr brev	4	0.4	Pela quad	4	0.3	Stet stri	7	0.6	Chei quin	5	0.3
Lact corn	0.3	0.5	Fist peti	0.2	0.4	Cari shri	4	0.4	Stet stri	4	0.3	Favo reic	7	0.6	Acen auda	5	0.3
Syng acus	0.2	0.4	Yong nebu	0.2	0.4	Scar scab	3	0.3	Nova macr	4	0.3	Cari shri	5	0.4	Gobi spec	5	0.3
Cant sola	0.2	0.4	Lact form	0.2	0.4	Chei undu	3	0.3	Trac bico	3	0.2	Cant vale	4	0.3	Ambl albi	4	0.3
Plat obic	0.2	0.3	Arot imma	0.2	0.4	Dend brac	3	0.3	Lact form	3	0.2	Chei undu	4	0.3	Cheil bim	4	0.3
Pena indi	0.2	0.3	Paru barb	0.2	0.4	Leth elon	3	0.3	Side pict	2	0.1	Leth elon	3	0.2	Diad spec	4	0.3
Para bili	0.2	0.3	Petr mitr	0.2	0.4	Papi long	3	0.3	Ambl albi	2	0.1	Nova macr	3	0.2	Apog sava	4	0.3
Gerr oyen	0.2	0.3	Cari shri	0.1	0.3	Gobi spec	3	0.3	Chei undu	2	0.1	Ambl albi	3	0.2	Leth elon	4	0.3
Arot imma	0.2	0.3	Both pant	0.1	0.3	Lact form	3	0.3	Para barn	2	0.1	Plec gate	3	0.2	Plot line	3	0.2
Chei quin	0.2	0.3	Apog cook	0.1	0.3	Syng biac	3	0.3	Star fish	2	0.1	Papi long	2	0.2	Paru barb	3	0.2
Plec gate	0.1	0.2	Pela quad	0.1	0.3	Star fish	3	0.3	Petr mitr	2	0.1	Acro japo	2	0.2	Syng acus	3	0.2
Sphy jell	0.1	0.2	Syng acus	0.1	0.2	Favo reic	2	0.2	Para bili	2	0.1	Coci croc	2	0.2	Both manc	3	0.2
Lact form	0.1	0.2	Cant sola	0.1	0.2	Side pict	2	0.2	Leth larv	2	0.1	Chel lati	2	0.2	Lact corn	3	0.2
Gobi spec	0.1	0.2	Pena indi	0.1	0.2	Cori caud	2	0.2	Cant sola	1	0.1	Cyno atte	2	0.2	Poma tril	2	0.1
Chel lati	0.1	0.2	Cara igno	0.1	0.2	Amba prod	2	0.2	Cten stri	1	0.1	Yong nebu	2	0.2	Tera ther	2	0.1
Anam caer	0.1	0.2	Stol indi	0.1	0.2	Hipp came	2	0.2	Anam caer	1	0.1	Syng biac	2	0.2	Papi long	2	0.1
Plot line	0.1	0.2	Plat obic	0.1	0.2	Plec lacr	2	0.2	Psue arsi	1	0.1	Lact corn	2	0.2	Pter taen	2	0.1
Apog cook	0.1	0.2	Olig kete	0.1	0.2	Leth lent	1	0.1	Plot nkun	1	0.1	Tera ther	2	0.2	Neop fuli	2	0.1
Leth larv	0.1	0.2	Ambl albi	0.1	0.2	Cori sygu	1	0.1	Leth lent	1	0.1	Echi poly	1	0.1	Leth vari	2	0.1
Sync marm	0.1	0.2	Lact corn	0.1	0.2	Pena mono	1	0.1	Olig kete	1	0.1	Loph calo	1	0.1	Syng biac	2	0.1
Ceph spec	0.0	0.1	Favo mela	0.0	0.1	Arot imma	1	0.1	Plec gate	1	0.1	Aeol punc	1	0.1	Side pict	2	0.1
Nova macr	0.0	0.1	Bemp plat	0.0	0.1	Yong nebu	1	0.1	Epin spec	1	0.1	Dact orie	1	0.1	Epib insi	2	0.1
Favo reic	0.0	0.1	Trio macr	0.0	0.1	Abla bino	1	0.1	Acan line	1	0.1	Crab spec	1	0.1	Cymo prae	2	0.1
Acro japo	0.0	0.1	Para bili	0.0	0.1	Pena indi	1	0.1	Oxyu spec	1	0.1	Anam caer	1	0.1	Chae line	1	0.1
Hipp came	0.0	0.1	Aeol punc	0.0	0.1	Chei quin	1	0.1	Holo spec	1	0.1	Sphy jell	1	0.1	Chei oxyc	1	0.1
Ambl sphy	0.0	0.1	Nova macr	0.0	0.1	Chel lati	1	0.1	Petr brev	1	0.1	Brot mult	1	0.1	Chei undu	1	0.1
Chei undu	0.0	0.1	Pter mile	0.0	0.1	Plec gate	1	0.1	Trio macr	1	0.1	Star fish	1	0.1	Gram sexl	1	0.1
Leth elon	0.0	0.1	Pseu nasi	0.0	0.1	Cant sola	1	0.1				Syng acus	1	0.1	Acro japo	1	0.1
Paru barb	0.0	0.1	Oxyu spec	0.0	0.1	Holo spec	1	0.1	sum	1473		Pena indi	1	0.1	Cant vale	1	0.1
Tera ther	0.0	0.1	Trac bico	0.0	0.1	Favo mela	1	0.1				Side pict	1	0.1	Pter pely	1	0.1
Hali irid	0.0	0.1	Sole blee	0.0	0.1	Acen auda	1	0.1				Leth vari	1	0.1	Cant sola	1	0.1
Papi long	0.0	0.1	Ostr cubi	0.0	0.1	Syng acus	1	0.1				Holo spec	1	0.1	Hipp hist	1	0.1
			Crab spec	0.0	0.1	Ceph spec	1	0.1				Gerr oyen	1	0.1	Holo doli	1	0.1
sum	59.2		Holo spec	0.0	0.1	Chei oxyc	1	0.1				Acan line	1	0.1	Chry annu	1	0.1
count	62.0		Sync marm	0.0	0.1	Chei line	1	0.1				Siga stel	1	0.1	Epin mala	1	0.1
			Chei undu	0.0	0.1	Trac bico	1	0.1							Pena indi	1	0.1
			Cheil bim	0.0	0.1							sum	1260		Gerr oyen	1	0.1
			Cant benn	0.0	0.1	sum	1094								Apog nigr	1	0.1
			Dend brac	0.0	0.1										Hali dunc	1	0.1
			Plat indi	0.0	0.1												
			Plec lacr	0.0	0.1										sum	1582	
			Chel lati	0.0	0.1												
			sum	46.2													
			count	72.0													

ANNEX 5 contd

Ranked catch: Gazi bay

Apr 95	sum	%	May 95	sum	%	Jun 95	sum	%	Jul 95	sum	%	Aug 95	sum	%	Sep 95	sum	%
Plot line	1017	34.5	Trip gral	108	13.2	Trip gral	111	18.1	Lept vaig	39	13.0	Lept vaig	204	14.8	Siga suto	225	28.7
Lept vaig	307	10.4	Apog nigr	95	11.6	Apog frag	86	14.1	Apog nigr	29	9.6	Jell fish	182	13.2	Lept vaig	132	16.9
Apog nigr	276	9.3	Lept vaig	92	11.2	Scar sord	45	7.4	Apog cook	29	9.6	Plot line	147	10.7	Apog frag	54	6.9
Apog frag	165	5.6	Scar sord	60	7.3	Scar scab	35	5.7	Siga suto	27	9.0	Fowl aur	84	6.1	Apog nigr	47	6.0
Siga suto	118	4.0	Apog frag	42	5.1	Fowl aur	32	5.2	Apog frag	17	5.6	Scar sord	83	6.0	Chei iner	33	4.2
Fowl aur	94	3.2	Stet stri	41	5.0	Stet stri	31	5.1	Para barn	16	5.3	Apog nigr	67	4.9	Leth nebu	31	4.0
Stet stri	82	2.8	Fowl aur	41	5.0	Lept vaig	25	4.1	Fowl aur	15	5.0	Stet stri	61	4.4	Trip gral	24	3.1
Petr brev	75	2.5	Diad spec	39	4.8	Cant vale	23	3.8	Chei iner	11	3.7	Apog frag	56	4.1	Saur undo	21	2.7
Leth hara	75	2.5	Cant vale	31	3.8	Siga suto	20	3.3	Petr mitr	10	3.3	Siga suto	54	3.9	Apog cook	17	2.2
Para moss	58	2.0	Siga suto	23	2.8	Apog cook	19	3.1	Stet stri	10	3.3	Chei iner	41	3.0	Fowl aur	14	1.8
Leth nebu	54	1.8	Apog cook	21	2.6	Chei iner	18	2.9	Diad spec	7	2.3	Para moss	36	2.6	Para barn	11	1.4
Hali irid	42	1.4	Leth nebu	20	2.4	Para barn	15	2.5	Lutj fulv	6	2.0	Para barn	29	2.1	Cari sbri	11	1.4
Petr mitr	41	1.4	Jell fish	17	2.1	Apog nigr	14	2.3	Jell fish	6	2.0	Trip gral	28	2.0	Stet stri	11	1.4
Lutj fulv	40	1.4	Chei iner	16	2.0	Chei line	13	2.1	Trip gral	5	1.7	Leth nebu	28	2.0	Para moss	10	1.3
Gnat spec	38	1.3	Syng biac	15	1.8	Leth nebu	10	1.6	Syng biac	4	1.3	Para pili	23	1.7	Lutj fulv	8	1.0
Cari sbri	34	1.2	Petr brev	14	1.7	Cari sbri	9	1.5	Leth elon	4	1.3	Diad spec	21	1.5	Cant benn	7	0.9
Scar sord	33	1.1	Para barn	13	1.6	Syng biac	7	1.1	Para moss	4	1.3	Apog cook	14	1.0	Yong nebu	7	0.9
Pena spec	27	0.9	Hali irid	9	1.1	Para moss	7	1.1	Cari sbri	3	1.0	Hali irid	14	1.0	Nova macr	7	0.9
Apog cook	26	0.9	Petr mitr	9	1.1	Favo spec	7	1.1	Pena spec	3	1.0	Saur undo	14	1.0	Cant vale	7	0.9
Trip gral	25	0.8	Chei undu	9	1.1	Apog taen	7	1.1	Scar sord	3	1.0	Syng biac	13	0.9	Lact forn	7	0.9
Syng biac	24	0.8	Lutj fulv	8	1.0	Chei oxyc	7	1.1	Both manc	3	1.0	Both manc	13	0.9	Jell fish	6	0.8
Scar glob	22	0.7	Plec lacr	8	1.0	Cant sola	5	0.8	Leth larv	3	1.0	Chei line	12	0.9	Diad spec	6	0.8
Jell fish	18	0.6	Neop fuli	8	1.0	Lutj fulv	5	0.8	Chei undu	3	1.0	Plec lacr	11	0.8	Cant sola	6	0.8
Chei iner	18	0.6	Para moss	8	1.0	Trio macr	5	0.8	Chei line	2	0.7	Both pant	10	0.7	Lact corn	6	0.8
Para barn	16	0.5	Leth hara	7	0.9	Jell fish	4	0.7	Syng acus	2	0.7	Cant sola	10	0.7	Leth elon	5	0.6
Acen auda	15	0.5	Pena spec	7	0.9	Saur undo	3	0.5	Yong nebu	2	0.7	Gnat spec	9	0.7	Both manc	4	0.5
Sync marm	13	0.4	Trio macr	6	0.7	Nova macr	3	0.5	Hali irid	2	0.7	Leth elon	8	0.6	Pena mono	4	0.5
Cant vale	13	0.4	Plot line	5	0.6	Hali scap	3	0.5	Acen auda	2	0.7	Chei undu	7	0.5	Diod hyst	4	0.5
Saur undo	12	0.4	Hali bort	4	0.5	Plat larv	2	0.3	Stol indi	2	0.7	Cari sbri	7	0.5	Leth vari	4	0.5
Both manc	11	0.4	Acro japo	3	0.4	Hali duss	2	0.3	Pena indi	2	0.7	Acen auda	6	0.4	Acen auda	3	0.4
Chei oxyc	10	0.3	Saur undo	3	0.4	Papi long	2	0.3	Plec gate	2	0.7	Pela quad	6	0.4	Syng biac	3	0.4
Pela quad	9	0.3	Side pict	2	0.2	Chel lab	2	0.3	Cant vale	2	0.7	Trac bico	6	0.4	Gobi spec	3	0.4
Paru barb	8	0.3	Ceph spec	2	0.2	Plec gate	2	0.3	Saur undo	2	0.7	Fist peti	5	0.4	Hali irid	3	0.4
Plec gate	7	0.2	Chei quin	2	0.2	Plat obic	2	0.3	Cheil bim	1	0.3	Paru barb	5	0.4	Arot imma	3	0.4
Hipp hari	7	0.2	Arot imma	2	0.2	Diad spec	2	0.3	Chei quin	1	0.3	Side pict	4	0.3	Chei oxyc	2	0.3
Gerr oyen	7	0.2	Star fish	2	0.2	Foal brac	2	0.3	Paru barb	1	0.3	Ostr cubi	4	0.3	Chei tril	2	0.3
Scar psit	7	0.2	Hipp hari	2	0.2	Lact forn	2	0.3	Plat obic	1	0.3	Epib insi	4	0.3	Chei undu	2	0.3
Diad spec	6	0.2	Apog sava	2	0.2	Sphy jell	2	0.3	Aste semi	1	0.3	Cant vale	3	0.2	Cara igno	2	0.3
Side pict	6	0.2	Chei line	2	0.2	Chei quin	2	0.3	Ambl albi	1	0.3	Para bili	3	0.2	Sphy jell	2	0.3
Plat obic	5	0.2	Acen auda	1	0.1	Leth lent	1	0.2	Pela quad	1	0.3	Petr brev	3	0.2	Crab spec	2	0.3
Leth larv	5	0.2	Paru barb	1	0.1	Pter flag	1	0.2	Gnat spec	1	0.3	Lutj fulv	3	0.2	Leth larv	2	0.3
Foal brac	5	0.2	Plat ter	1	0.1	Lutj gibb	1	0.2	Para bili	1	0.3	Papi long	2	0.1	Syng acus	2	0.3
Chei quin	4	0.1	Cari sbri	1	0.1	Stet inte	1	0.2	Plot line	1	0.3	Plat obic	2	0.1	Petr mitr	2	0.3
Cant sola	4	0.1	Cant sola	1	0.1	Leth hara	1	0.2	Favo mela	1	0.3	Ceph spec	2	0.1	Para bili	2	0.3
Leth mahs	4	0.1	Aste semi	1	0.1	Labr dimi	1	0.2	Loph calo	1	0.3	Hipp came	2	0.1	Upen trag	2	0.3
Chei undu	4	0.1	Olig keie	1	0.1	Arot imma	1	0.2	Favo reic	1	0.3	Arot stel	2	0.1	Chel lab	2	0.3
Ambl albi	3	0.1	Scar scab	1	0.1	Pena mono	1	0.2	Sole cyan	1	0.3	Epin spec	2	0.1	Paru barb	1	0.1
Plec lacr	3	0.1	Trac bico	1	0.1	Pena semi	1	0.2	Chei oxyc	1	0.3	Apog sava	2	0.1	Labr dimi	1	0.1
Apog taen	3	0.1	Plec gate	1	0.1	Pena spec	1	0.2	Ceph spec	1	0.3	Favo mela	1	0.1	Fist peti	1	0.1
Papi long	3	0.1	Ambl albi	1	0.1	Cant benn	1	0.2	Chel lati	1	0.3	Pena spec	1	0.1	Trio macr	1	0.1
Calo spin	3	0.1	Both manc	1	0.1	Hipp came	1	0.2	Dend brac	1	0.3	Sole blee	1	0.1	Pena indi	1	0.1
Epib insi	3	0.1	Chae auri	1	0.1	Ambl albi	1	0.2	Plec lacr	1	0.3	Favo reic	1	0.1	Aste semi	1	0.1
Chel lab	2	0.1	Foal brac	1	0.1	Petr brev	1	0.2	Poma tril	1	0.3	Sync marm	1	0.1	Aeol punc	1	0.1
Favo reic	2	0.1	Hali scap	1	0.1	Apog sava	1	0.2	Leth nebu	1	0.3	Holo spec	1	0.1	Petr brev	1	0.1
Syng acus	2	0.1	Ostr cubi	1	0.1	Plec lacr	1	0.2	Leth hara	1	0.3	Aeol punc	1	0.1	Dend brac	1	0.1
Aste semi	2	0.1	Yong nebu	1	0.1	Saur grac	1	0.2	Side pict	1	0.3	Aste semi	1	0.1	Leth hara	1	0.1
Nova macr	2	0.1	Papi long	1	0.1	Poma tril	1	0.2	Leth vari	1	0.3	Ambl sphy	1	0.1	Hipp hari	1	0.1
Siga stel	2	0.1	Cheil bim	1	0.1	Tera ther	1	0.2				Petr mitr	1	0.1	Bemp plat	1	0.1
Poma tril	2	0.1	Pter mile	1	0.1	Chae mela	1	0.2	sum	301		Plec gate	1	0.1	Papi long	1	0.1
Dasc arua	2	0.1				Yong nebu	1	0.2				Able hian	1	0.1	Pela quad	1	0.1
Chae mela	2	0.1	sum	818								Lact forn	1	0.1	Plec lacr	1	0.1
Anam caer	2	0.1				sum	612					Ambl albi	1	0.1			
Chae klei	2	0.1										Pseu gasi	1	0.1	sum	783	
Chae auri	2	0.1										Pena semi	1	0.1			
Sphy jell	2	0.1										Dend brac	1	0.1			
Cheil bim	2	0.1										Calo spin	1	0.1			
Chry annu	1	0.0										Syng acus	1	0.1			
Stol indi	1	0.0										Arot hisp	1	0.1			
Lact forn	1	0.0										Hali dunc	1	0.1			
Trac bico	1	0.0										Chel lati	1	0.1			
Ceph spec	1	0.0										Plat indi	1	0.1			
Upen trag	1	0.0										Foal brac	1	0.1			
Para bili	1	0.0															
Chei line	1	0.0										sum	1376				
Lact corn	1	0.0															
Diod hyst	1	0.0															
Dend brac	1	0.0															
Upen vitt	1	0.0															
Scar scab	1	0.0															
Apog sava	1	0.0															
Para macad	1	0.0															
Leth vari	1	0.0															
Leth elon	1	0.0															
Hali scap	1	0.0															
Fist peti	1	0.0															
sum	2952																

ANNEX 5 contd.

Ranked catch: Gazi bay

Oct 95	sum	%	Nov 95	sum	%	Dec 95	sum	%	Jan 96	sum	%	Feb 96	sum	%	Mar 96	sum	%
Lept vaig	99	25.8	Lept vaig	165	24.8	Lept vaig	57	18.6	Apog frag	39	20.9	Trip grat	69	21.1	Leth nebu	30	12.3
Trip grat	54	14.1	Siga suto	75	11.3	Apog nigr	30	9.8	Lept vaig	31	16.6	Lept vaig	65	19.9	Chei line	29	11.9
Fowl auri	30	7.8	Apog angu	65	9.8	Siga suto	29	9.5	Yong nebu	18	9.6	Hali irid	40	12.2	Lept vaig	28	11.5
Apog nigr	26	6.8	Leth nebu	50	7.5	Para moss	28	9.2	Apog cook	16	8.6	Apog nigr	25	7.6	Lutj fulv	23	9.5
Hali irid	26	6.8	Apog nigr	45	6.8	Fowl auri	27	8.8	Fowl auri	16	8.6	Jell fish	20	6.1	Fowl auri	22	9.1
Siga suto	24	6.3	Fowl auri	45	6.8	Apog cook	21	6.9	Leth nebu	9	4.8	Para moss	15	4.6	Jell fish	18	7.4
Chei iner	17	4.4	Para moss	39	5.9	Apog frag	20	6.5	Para moss	8	4.3	Leth nebu	12	3.7	Leth hara	17	7.0
Jell fish	11	2.9	Apog frag	33	5.0	Para barn	14	4.6	Chei iner	6	3.2	Plec lacr	11	3.4	Diad spec	11	4.5
Diad spec	10	2.6	Leth hara	26	3.9	Hali irid	13	4.2	Apog nigr	6	3.2	Siga suto	8	2.4	Syng acus	8	3.3
Stet stri	8	2.1	Lutj fulv	18	2.7	Leth nebu	10	3.3	Lutj fulv	6	3.2	Fowl auri	8	2.4	Stet stri	8	3.3
Leth nebu	7	1.8	Chei iner	18	2.7	Cant vale	8	2.6	Gobi spec	5	2.7	Ambl albi	7	2.1	Apog frag	6	2.5
Nova macr	7	1.8	Pela quad	12	1.8	Yong nebu	6	2.0	Both manc	5	2.7	Apog cook	6	1.8	Siga suto	6	2.5
Pena mono	6	1.6•	Cari shri	7	1.1	Pena indi	5	1.6	Stet stri	4	2.1	Crab spec	5	1.5	Scar scab	5	2.1
Para moss	5	1.3	Gnat spec	6	0.9	Petr mitr	5	1.6	Siga suto	3	1.6	Cheil bim	4	1.2	Chei iner	4	1.6
Chei undu	4	1.0	Pena mono	6	0.9	Both manc	4	1.3	Cant vale	2	1.1	Lutj fulv	4	1.2	Siga stel	4	1.6
Gobi spec	4	1.0	Gobi spec	5	0.8	Chei iner	4	1.3	Para barn	2	1.1	Yong nebu	3	0.9	Yong nebu	3	1.2
Cari shri	4	1.0	Saur undo	4	0.6	Syng acus	3	1.0	Loph calo	2	1.1	Leth hara	3	0.9	Pena mono	3	1.2
Both manc	4	1.0	Para barn	3	0.5	Leth vari	3	1.0	Ambl albi	2	1.1	Lact forn	2	0.6	Leth larv	3	1.2
Cheil bim	3	0.8	Syng acus	3	0.5	Chei undu	3	1.0	Chel lati	1	0.5	Gobi spec	2	0.6	Trip grat	2	0.8
Lutj fulv	3	0.8	Cant vale	3	0.5	Leth hara	3	1.0	Syng biac	1	0.5	Both manc	2	0.6	Para moss	2	0.8
Saur undo	3	0.8	Hali irid	3	0.5	Lutj fulv	2	0.7	Pena mono	1	0.5	Leth larv	2	0.6	Ambl albi	2	0.8
Syng biac	3	0.8	Aeol punc	3	0.5	Cari shri	2	0.7	Plat indi	1	0.5	Plot line	2	0.6	Aeol punc	2	0.8
Syng acus	3	0.8	Coci croc	2	0.3	Saur undo	1	0.3	Gnat spec	1	0.5	Aeol punc	2	0.6	Plec lacr	2	0.8
Leth elon	2	0.5	Chei undu	2	0.3	Coci croc	1	0.3	Plec gate	1	0.5	Pena mono	1	0.3	Side pict	1	0.4
Plec lacr	2	0.5	Syng biac	2	0.3	Papi long	1	0.3	Leth hara	1	0.5	Para barn	1	0.3	Apog cook	1	0.4
Para barn	2	0.5	Gerr oyen	2	0.3	Syng biac	1	0.3				Syng biac	1	0.3	Trac bico	1	0.4
Crab spec	2	0.5	Arot imma	2	0.3	Cyno atte	1	0.3	sum	187		Saur undo	1	0.3	Cari shri	1	0.4
Papi long	1	0.3	Nova macr	2	0.3	Sole blee	1	0.3				Cari shri	1	0.3	Chel lati	1	0.4
Lact corn	1	0.3	Dend brac	2	0.3	Lact corn	1	0.3				Dend brac	1	0.3			
Coci croc	1	0.3	Papi long	2	0.3	Lact forn	1	0.3				Trio macr	1	0.3	sum	243	
Chel lati	1	0.3	Both manc	2	0.3	Plot line	1	0.3				Chei iner	1	0.3			
Lact forn	1	0.3	Plat lati	1	0.2							Apog frag	1	0.3			
Chei line	1	0.3	Leth elon	1	0.2	sum	306					Caff nudi	1	0.3			
Cant vale	1	0.3	Pter flag	1	0.2												
Upen trag	1	0.3	Hipp cape	1	0.2							sum	327				
Cant sola	1	0.3	Calo spin	1	0.2												
Hipp hist	1	0.3	Upen trag	1	0.2												
Hipp came	1	0.3	Cheil bim	1	0.2												
Dend brac	1	0.3	Acro japo	1	0.2												
Side pict	1	0.3	Both pant	1	0.2												
Apog frag	1	0.3	Cant sola	1	0.2												
Apog cook	1	0.3	Ante comm	1	0.2												
			Yong nebu	1	0.2												
sum	384		Scar scab	1	0.2												
			Ambl albi	1	0.2												
			sum	666													

ANNEX 5 contd.

Ranked catch: Gazi bay

Apr 96	sum	%	May 96	sum	%	Jun 96	sum	%	Jul 96	sum	%	Aug 96	sum	%	Sep 96	sum	%
Fowl auri	66	16.0	Lept vaig	15	13.2	Apog nigr	74	32.5	Lept vaig	21	13.5	Lept vaig	63	34.6	Lept vaig	130	39.5
Lept vaig	52	12.6	Fowl auri	10	8.8	Lept vaig	27	11.8	Fowl auri	21	13.5	Siga suto	41	22.5	Cant vale	29	8.8
Apog frag	48	11.7	Apog cook	8	7.0	Petr brev	15	6.6	Para moss	17	10.9	Fowl auri	13	7.1	Chei line	25	7.6
Petr brev	33	8.0	Chei line	8	7.0	Petr mitr	12	5.3	Pena mono	11	7.1	Chei iner	8	4.4	Fowl auri	19	5.8
Cari shri	21	5.1	Siga suto	8	7.0	Leth hara	11	4.8	Petr brev	10	6.4	Stet stri	7	3.8	Apog cook	17	5.2
Stet stri	19	4.6	Cant vale	8	7.0	Fowl auri	11	4.8	Cant vale	9	5.8	Petr brev	5	2.7	Chei iner	16	4.9
Apog cook	19	4.6	Petr brev	6	5.3	Syng biac	11	4.8	Chei quin	9	5.8	Chei undu	5	2.7	Cant benn	15	4.6
Chei line	18	4.4	Syng acus	5	4.4	Siga suto	9	3.9	Cant sola	7	4.5	Syng acus	4	2.2	Siga suto	12	3.6
Pena mono	15	3.6	Chei iner	5	4.4	Para moss	9	3.9	Leth nebu	6	3.8	Cant sola	3	1.6	Para barn	10	3.0
Leth elon	14	3.4	Syng biac	4	3.5	Lutj fulv	7	3.1	Siga suto	6	3.8	Cant vale	3	1.6	Apog nigr	8	2.4
Siga suto	11	2.7	Leth hara	3	2.6	Chei quin	6	2.6	Syng biac	5	3.2	Para barn	3	1.6	Cant sola	6	1.8
Leth hara	10	2.4	Apog nigr	3	2.6	Pena mono	6	2.6	Petr mitr	4	2.6	Arot imma	3	1.6	Chei undu	5	1.5
Para moss	9	2.2	Lutj fulv	3	2.6	Cant vale	5	2.2	Para barn	3	1.9	Chel lati	3	1.6	Syng acus	4	1.2
Chei iner	7	1.7	Leth nebu	3	2.6	Apog cook	5	2.2	Trac bico	3	1.9	Both manc	2	1.1	Stet stri	4	1.2
Lutj fulv	6	1.5	Stet stri	2	1.8	Sphy jell	4	1.8	Apog frag	3	1.9	Petr mitr	2	1.1	Syng biac	4	1.2
Petr mitr	6	1.5	Ambl albi	2	1.8	Scar sord	3	1.3	Syng acus	3	1.9	Lutj fulv	2	1.1	Petr brev	3	0.9
Gerr oyen	6	1.5	Pena indi	2	1.8	Chel lati	2	0.9	Stet stri	2	1.3	Apog frag	2	1.1	Leth nebu	3	0.9
Sphy jell	5	1.2	Epib insi	2	1.8	Para barn	2	0.9	Apog cook	2	1.3	Coci croc	1	0.5	Petr mitr	3	0.9
Plec lacr	5	1.2	Para moss	2	1.8	Syng acus	2	0.9	Fist peti	2	1.3	Syng biac	1	0.5	Pena indi	2	0.6
Plat obic	5	1.2	Cari shri	2	1.8	Arot imma	1	0.4	Lutj fulv	2	1.3	Aeol punc	1	0.5	Hali irid	2	0.6
Syng biac	5	1.2	Para barn	2	1.8	Saur undo	1	0.4	Plot line	2	1.3	Apog cook	1	0.5	Poma tril	2	0.6
Syng acus	4	1.0	Chel lati	1	0.9	Plec lacr	1	0.4	Chei undu	1	0.6	Dend brac	1	0.5	Hipp came	2	0.6
Leth nebu	4	1.0	Petr mitr	1	0.9	Cant sola	1	0.4	Cant benn	1	0.6	Saur undo	1	0.5	Anam caer	2	0.6
Hali irid	3	0.7	Leth elon	1	0.9	Pter mile	1	0.4	Nova macr	1	0.6	Chei line	1	0.5	Aeol punc	1	0.3
Pena indi	3	0.7	Pena mono	1	0.9	Gnat spec	1	0.4	Cari shri	1	0.6	Lact corn	1	0.5	Apog frag	1	0.3
Yong nebu	2	0.5	Fist peti	1	0.9	Dend brac	1	0.4	Leth hara	1	0.6	Trac bico	1	0.5	Labr dimi	1	0.3
Gnat spec	2	0.5	Plec lacr	1	0.9				Siga stel	1	0.6	Ceph spec	1	0.5	Cari shri	1	0.3
Chei undu	2	0.5	Gerr oyen	1	0.9	sum	228		Arot imma	1	0.6	Siga stel	1	0.5	Arot imma	1	0.3
Apog sava	2	0.5	Cant sola	1	0.9				Sole cyan	1	0.6	Para moss	1	0.5	Olig keie	1	0.3
Side pict	1	0.2	Apog frag	1	0.9							Leth elon	1	0.5			
Fist peti	1	0.2	Gobi spec	1	0.9				sum	156					sum	329	
Scor vari	1	0.2	Arot imma	1	0.9							sum	182				
Cheil bim	1	0.2															
Para barn	1	0.2	sum	114													
Pela quad	1	0.2															
Apog nigr	1	0.2															
Scar scab	1	0.2															
Cant sola	1	0.2															
Epib insi	1	0.2															
sum	412																

ANNEX 5 contd.

Average catch by species per month (catch data pooled for all stations and replicas) in Gazi Bay (Dec 1994-Sept 1996)

	Dec94	Jan95	Feb95	Mar95	Apr95	May95	Jun95	Jul95	Aug95	Sep95	Oct95	Nov95	Dec95	Jan96	Feb96	Mar96	Apr96	May96	Jun96	Jul96	Aug96	Sep96	sum	%
Scar sord	12.0	8.1	32.6	66.6	4.7	8.6	6.4	0.4	11.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	151.7	6.7
Scar.glob	0.0	0.0	0.0	2.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.2
Scar.scab	0.4	0.0	0.0	1.6	0.1	0.1	5.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.0	0.0	8.3	0.4
Scar.psit	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Hipp.hari	0.0	0.0	0.0	0.0	1.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.1
Calo.spin	0.0	0.0	1.0	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.1
Lept.vaig	37.3	37.4	2.1	16.7	43.9	13.1	3.6	5.6	29.1	18.9	14.1	23.6	8.1	4.4	9.3	4.0	7.4	2.1	3.9	3.0	9.0	18.6	315.3	14.0
Both.manc	1.3	1.0	1.9	0.4	1.6	0.1	0.0	0.4	1.9	0.6	0.6	0.3	0.6	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	11.9	0.5
Both.pant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.1
Psue.arsi	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Leth.hara	3.0	20.7	6.7	1.6	10.7	1.0	0.1	0.1	0.0	0.1	0.0	3.7	0.4	0.1	0.4	2.4	1.4	0.4	1.6	0.1	0.0	0.0	54.9	2.4
Leth.lent	0.1	0.1	0.0	1.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.1
Leth.mahs	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Leth.elon	0.4	1.4	0.4	0.6	0.1	0.0	0.0	0.6	1.1	0.7	0.3	0.1	0.0	0.0	0.0	0.0	2.0	0.1	0.0	0.0	0.1	0.0	8.1	0.4
Leth.nebu	9.0	10.6	16.3	13.6	7.7	2.9	1.4	0.1	4.0	4.4	1.0	7.1	1.4	1.3	1.7	4.3	0.6	0.4	0.0	0.9	0.0	0.4	89.1	4.0
Leth.vari	0.0	0.0	0.1	0.3	0.1	0.0	0.0	0.1	0.0	0.6	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.1
Leth.larv	0.0	0.3	0.0	0.0	0.7	0.0	0.0	0.4	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.1
Siga.suto	1.1	7.4	9.4	8.1	16.9	3.3	2.9	3.9	7.7	32.1	3.4	10.7	4.1	0.4	1.1	0.9	1.6	1.1	1.5	0.9	5.9	1.7	126.0	5.6
Siga.stel	0.0	1.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.1	0.1	0.0	2.3	0.1
Chel.iner	9.9	4.9	4.3	9.1	2.6	2.3	2.6	1.6	5.9	4.7	2.4	2.6	0.6	0.9	0.1	0.6	1.0	0.7	0.0	0.0	1.1	1.5	60.0	2.7
Para.mcad	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Para.moss	6.7	11.1	10.4	8.3	8.3	1.1	1.0	0.6	5.1	1.4	0.7	5.6	4.0	1.1	2.1	0.3	1.3	0.3	1.3	2.4	0.1	0.0	73.4	3.3
Scor.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Apog.angu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.4
Apog.sava	0.0	0.0	0.0	0.6	0.1	0.3	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	1.7	0.1
Apog.frag	6.3	10.9	16.7	12.0	23.6	6.0	11.3	2.4	8.0	7.7	0.1	4.7	2.9	5.6	0.1	0.9	6.9	0.1	0.0	0.4	0.3	0.1	128.0	5.7
Apog.nigr	10.7	8.6	1.0	0.1	39.4	13.6	2.0	4.1	9.6	6.7	3.7	6.4	4.3	0.9	3.6	0.0	0.1	0.4	10.6	0.0	0.0	1.1	127.0	5.6
Apog.cook	0.9	0.0	1.3	2.7	3.7	3.0	2.7	4.1	2.0	2.4	0.1	0.0	3.0	2.3	0.9	0.1	2.7	1.1	0.7	0.3	0.1	2.4	36.7	1.6
Apog.taen	0.0	0.0	0.0	0.0	0.4	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.1
Foa.brach	0.0	0.0	0.0	0.0	0.7	0.1	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.1
Fowl.auri	7.1	0.7	12.9	25.6	13.4	5.9	4.6	2.1	12.0	2.0	4.3	6.4	3.9	2.3	1.1	3.1	9.4	1.4	1.6	3.0	1.9	2.7	127.4	5.7
Stet.stri	2.3	0.6	1.0	2.3	11.7	5.9	4.4	1.4	8.7	1.6	1.1	0.0	0.0	0.6	0.0	1.1	2.7	0.3	0.0	0.3	1.0	0.6	47.6	2.1
Cori.aygu	0.1	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Cori.caud	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Side.pict	0.3	0.3	0.1	0.3	0.9	0.3	0.0	0.1	0.6	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	3.3	0.1
Syng.acus	0.1	1.6	0.1	0.4	0.3	0.0	0.0	0.3	0.1	0.3	0.4	0.4	0.4	0.0	0.0	1.1	0.6	0.7	0.3	0.4	0.6	0.6	8.9	0.4
Syng.biac	0.4	0.7	0.3	0.3	3.4	2.1	1.0	0.6	1.9	0.4	0.4	0.3	0.1	0.1	0.1	0.0	0.7	0.6	1.6	0.7	0.1	0.6	16.6	0.7
Hali.scap	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Hali.irid	2.0	13.0	1.0	11.3	6.0	1.3	0.0	0.3	2.0	0.4	3.7	0.4	1.9	0.0	5.7	0.0	0.4	0.0	0.0	0.0	0.0	0.3	49.7	2.2
Hali.hort	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Hali.dunc	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Yong.nebu	0.1	1.1	0.3	2.3	0.0	0.1	0.1	0.3	0.0	1.0	0.0	0.1	0.9	2.6	0.4	0.4	0.3	0.0	0.0	0.0	0.0	0.0	10.1	0.4
Acan.line	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Cyno.atte	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Coci.croc	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	1.0	0.0
Plat.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Plat.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Plat.lati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Papi.long	0.4	0.0	0.3	0.3	0.4	0.1	0.3	0.0	0.3	0.1	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.1
Tera.ther	0.0	0.0	0.3	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Poma.tril	0.0	0.0	0.0	0.3	0.3	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.1	0.1
Plec.lacr	0.3	0.0	1.4	0.7	0.4	1.1	0.1	0.1	1.6	0.1	0.3	0.0	0.0	0.0	1.6	0.3	0.7	0.1	0.1	0.0	0.0	0.0	9.1	0.4
Saur.grac	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Saur.undo	1.0	1.3	2.0	0.9	1.7	0.4	0.4	0.3	2.0	3.0	0.4	0.6	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	14.6	0.6
Chel.lati	0.1	0.0	0.3	2.1	0.3	0.0	0.3	0.1	0.1	0.3	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.3	0.0	0.4	0.0	5.0	0.2
Gerr.oyen	0.0	0.0	0.1	0.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.9	0.1	0.0	0.0	0.0	0.0	2.6	0.1
Lutj.gibb	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Lutj.fulv	1.1	1.0	3.0	3.9	5.7	1.1	0.7	0.9	0.4	1.1	0.4	2.6	0.3	0.9	0.6	3.3	0.9	0.4	1.0	0.3	0.3	0.0	29.9	1.3
Paru.barb	0.0	0.0	0.0	0.4	1.1	0.1	0.0	0.1	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.1
Upen.vitt	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Plat.teir	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Plat.obic	0.0	0.0	0.0	0.0	0.7	0.0	0.3	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	2.1	0.1
Arot.imma	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.4	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.4	0.1	2.3	0.1
Arot.hisp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Arot.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Pena.indi	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.7	0.0	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.3	2.6	0.1
Pena.mono	0.1	0.0	2.4	0.0	0.0	0.0	0.1	0.0	0.0	0.6	0.9	0.9	0.0	0.1	0.1	0.4	2.1	0.1	0.9	1.6	0.0	0.0	10.4	0.5
Pena.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Pena.sp1	0.9	1.7	3.4	0.0	3.9	1.0	0.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.6	0.5
Gobi.sp1	0.4	0.0	5.1	0.7	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.7	0.0	0.7	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	9.1	0.4
Cari.shri	0.6	0.9	0.7	2.3	4.9	0.1	1.3	0.4	1.0	1.6	0.6	1.0	0.3	0.0	0.1	0.1	3.0	0.3	0.0	0.1	0.0	0.1	19.4	0.9
Acen.suda	0.1	1.3	2.6	0.7	2.1	0.1	0.0	0.3	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6	0.4
Epin.sp1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Gram.sexl	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Fist.peti	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.3	0.0	0.0	1.6	0.1
Caff.nudi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Gnat.sp1	1.7	3.4	5.7	2.0	5.4	0.0	0.0	0.1	1.3	0.0	0.0	0.9	0.0	0.1	0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	21.1	0.9
Favo.mela	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Favo.reic	0.3	0.9	1.0	0.0	0.3	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.1
Favo.sp1	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Dend.brac	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	1.9	0.1
Crabs	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.1
Cant.benn	0.7	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	2.1	4.1	0.2
Cant.sola	0.1	0.1	0.0	0.1	0.6	0.1	0.7	0.0	1.4	0.9	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	1.0	0.4	0.9	7.1	0.3
Cant.vale	0.9	0.0	0.6	0.1	1.9	4.4	3.3	0.3	0.4	1.0	0.1	0.4	1.1	0.3	0.0	0.0	0.0	1.1	0.7	1.3	0.4	4.1	22.6	1.0
Plot.line	6.6	30.9	3.7	0.4	145.3	0.7	0.0	0.1	21.0	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0	209.4	9.3
Plot.nkun	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Trac.bico	0.1	0.4	0.0	1.9	0.1	0.1	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.4	0.1	0.0	4.3	0.2
Plec.gate	0.1	0.1	0.4	1.4	1.0	0.1	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.2
Squids	0.1	0.0	1.0	0.0	0.1	0.3	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	2.1	0.1
Diad spp	15.1	1.4	2.6	0.6	0.9	5.6	0.3	1.0	3.0	0.9	1.4	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	34.3	1.5
Pseu.nasi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0

ANNEX 5 contd.

Average catch by species per month (catch data pooled for all stations and replicas) in Gazi Bay (Dec 1994-Sept 1996)

	Dec94	Jan95	Feb95	Mar95	Apr95	May95	Jun95	Jul95	Aug95	Sep95	Oct95	Nov95	Dec95	Jan96	Feb96	Mar96	Apr96	May96	Jun96	Jul96	Aug96	Sep96	sum	%
Para.barn	1.1	0.3	1.4	1.3	2.3	1.9	2.1	3.3	4.1	1.6	0.3	0.4	2.0	0.3	0.1	0.0	0.1	0.3	0.3	0.4	0.4	1.4	24.6	1.1
Brot.mult	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Starfisf	0.4	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.1
Ambl.albi	0.0	0.3	0.4	0.6	0.4	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.3	1.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	4.3	0.2
Chae.line	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Trip.grat	2.3	14.7	9.0	3.6	3.6	15.4	15.9	0.7	4.0	3.4	7.7	0.0	0.0	0.0	9.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	90.4	4.0
Jelly	0.0	2.9	0.0	4.3	2.6	2.4	0.6	0.9	26.0	0.9	1.6	0.0	0.0	0.0	2.9	2.6	0.0	0.0	0.0	0.0	0.0	0.0	47.4	2.1
Lact.corn	0.0	0.0	0.3	0.4	0.1	0.0	0.0	0.0	0.0	0.9	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	2.1	0.1
Lact.forn	0.4	0.4	0.0	0.0	0.1	0.0	0.3	0.0	0.1	1.0	0.1	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.1
Chei.line	0.1	0.0	0.0	0.0	0.1	0.3	1.9	0.3	1.7	0.0	0.1	0.0	0.0	0.0	0.0	4.1	2.6	1.1	0.0	0.0	0.1	3.6	16.1	0.7
Chae.auri	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Chae.klei	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Chae.mela	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Trio.macr	1.0	0.1	0.0	0.0	0.0	0.9	0.7	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.1
Petr.brev	0.6	0.1	0.0	0.0	10.7	2.8	0.1	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.9	2.1	1.4	0.7	0.4	24.4	1.1
Petr.mitr	0.7	0.3	2.9	2.5	5.9	1.3	0.0	1.4	0.1	0.3	0.0	0.0	0.7	0.0	0.0	0.0	0.9	0.1	1.7	0.6	0.3	0.4	19.9	0.9
Sync.marm	0.0	0.0	1.1	0.0	1.9	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.1
Olig.kele	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0
Abla.bino	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Ambl.sphy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Aste.semi	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
Para.bili	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.1	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.1
Hipp.cape	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Hipp.came	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.1	0.1
Hipp.hist	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Upen.trag	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Aeol.punc	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.4	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.1	0.1	1.7	0.1
Diod.hyst	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Ante.comm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Pter.pely	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Epib.insi	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0	1.7	0.1
Nova.macr	1.4	0.6	0.4	1.3	0.3	0.0	0.4	0.0	0.0	1.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	6.9	0.3
Dact.orie	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Acro.japo	0.0	0.0	0.3	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Echi.poly	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Loph.calo	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Amba.prod	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Anam.caer	0.0	0.1	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9	0.0
Labr.dimi	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0
Hali.duss	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Pter.flag	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Stet.inte	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Chei.tril	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.1
Chei.oxyc	0.1	0.0	0.0	0.1	1.4	0.0	1.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.1
Chei.undu	0.4	0.3	0.6	0.1	0.6	1.3	0.0	0.4	1.0	0.3	0.6	0.3	0.4	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.7	0.7	8.1	0.4
Cheil.bim	1.3	2.1	4.4	0.6	0.3	0.1	0.0	0.1	0.0	0.0	0.4	0.1	0.0	0.0	0.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	10.3	0.5
Chry.annu	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Dasc.arua	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Para.pili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.1
Holo.spec	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Ostr.cubi	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Able.hian	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Sole.blee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Sole.cyan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.0
Pela.quad	0.6	0.6	0.0	0.0	1.3	0.0	0.0	0.1	0.9	0.1	0.0	1.7	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	5.4	0.2
Sphy.jell	0.0	0.0	0.1	0.0	0.3	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.6	0.0	0.0	0.0	2.3	0.1
Oxyu.spl	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Pter.mile	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0
Stol.indi	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Cara.igno	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Bemp.plat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Chel.quin	0.1	0.0	0.0	0.7	0.6	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.3	0.0	0.0	4.3	0.2
Cten.stri	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Cymo.prae	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Holo.doli	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Pter.taen	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Neop.fuli	0.0	0.0	0.0	0.3	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.1
Hipp.long	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.1
Epin.mala	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	cp31294	m1294	T11294	T21294	T31294	cp41294	cp51294	cp30195	m0195	T10195	T20195	T30195	cp40195	cp50195	cp30295	m0295	T10295	T20295	T30295	cp40295	cp50295	cp30395	m0395
Scar sord	4.5	3.5	0.0	27.5	0.0	6.5	0.0	0.5	0.0	0.0	28.0	0.0	0.0	0.0	4.5	6.0	25.0	24.5	25.0	25.5	3.5	0.0	7.0
Scar.glob	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.scab	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.psit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calo.spin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0
Lept.vaig	1.5	4.0	22.0	49.5	15.0	22.5	16.0	7.5	5.5	3.5	90.5	0.0	23.5	0.5	1.5	2.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Both.manc	2.5	0.0	0.0	0.5	0.0	0.5	1.0	0.5	1.5	1.0	0.0	0.0	0.5	0.0	1.0	0.0	3.5	0.0	0.5	0.5	1.0	0.5	0.0
Both.pant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psue.arsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.hara	0.0	0.0	0.0	0.0	0.0	6.5	4.0	20.0	34.5	6.5	1.0	0.0	0.0	10.5	2.5	8.5	0.0	0.0	0.0	6.5	6.0	0.5	4.5
Leth.lent	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.mahs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.elon	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.5	0.0	0.0	0.0	1.0	0.0	0.5	0.0	0.0	0.0	0.0
Leth.nebu	6.0	4.0	3.5	6.0	4.0	3.0	5.0	9.5	1.5	2.5	16.0	0.0	7.5	0.0	26.0	7.0	9.5	3.0	5.5	5.5	0.5	0.0	3.0
Leth.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Leth.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Siga.suto	1.0	1.5	0.0	0.5	0.5	0.5	0.0	12.0	7.0	0.5	1.0	0.0	5.0	0.5	11.0	4.5	7.0	7.5	0.0	2.0	1.0	0.0	10.0
Siga.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.iner	1.5	2.0	3.5	13.5	3.5	3.5	7.0	0.0	0.0	1.5	13.0	0.0	2.5	0.0	0.0	1.5	4.5	0.0	4.0	5.0	0.0	0.0	0.5
Para.mcad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.moss	0.5	1.0	3.5	5.5	5.5	5.0	2.5	6.5	2.5	1.0	21.0	0.0	8.0	0.0	2.5	0.5	18.5	7.5	4.5	3.0	0.0	0.0	1.5
Scor.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.angu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.sava	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.frag	0.0	0.0	9.0	6.0	1.0	6.0	0.0	7.0	23.5	7.5	0.0	0.0	0.0	0.0	0.0	0.0	19.0	39.5	0.0	0.0	0.0	0.0	1.5
Apog.nigr	1.0	2.0	2.5	12.5	19.5	0.0	0.0	0.0	0.5	0.0	20.0	0.0	9.5	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0
Apog.cook	0.0	0.0	1.5	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0
Apog.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fos.brach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fowl.auri	0.0	0.5	11.0	10.5	0.5	1.0	1.5	0.5	0.0	0.5	0.5	0.0	1.0	0.0	0.0	1.0	21.0	8.5	3.5	11.0	0.0	0.0	5.0
Stet.stri	1.0	0.5	2.5	3.0	0.5	0.0	0.5	0.0	0.0	0.5	0.5	0.0	1.0	0.0	0.0	0.5	0.5	0.5	0.0	2.0	0.0	0.0	0.5
Cori.sygu	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cori.caud	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Side.pict	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syng.acus	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Syng.biac	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.5	0.0	1.0	0.5	0.0	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0
Hali.scap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.irid	0.0	0.0	0.0	5.5	0.0	0.0	1.5	0.5	0.5	0.0	42.5	2.0	0.0	0.0	0.0	0.5	2.5	0.0	0.0	0.5	0.0	0.0	0.5
Hali.hort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.dunc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yong.nebu	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.5	0.0	3.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.5
Acan.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Cyno.atte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coci.croc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Plat.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.lati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Papi.long	0.0	0.0	0.0	0.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
Tera.ther	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Poma.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.lacr	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.5	0.0	0.5	0.0	3.0	0.0	0.0	1.0
Saur.grac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saur.undo	0.0	0.0	0.0	1.0	0.0	1.0	1.5	0.0	1.0	0.5	0.0	0.0	3.0	0.0	1.0	0.5	0.5	0.0	0.0	2.5	2.5	0.0	0.5
Chel.lati	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.5	1.0
Gerr.oyen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0
Lutj.gibb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.fulv	0.0	0.0	0.0	1.5	0.0	2.0	0.5	0.0	0.0	0.0	1.0	0.0	1.0	1.5	0.0	1.0	0.0	0.0	0.0	2.5	7.0	0.0	1.5
Paru.barb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.vitt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.teir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.obic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.imma	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.hisp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.indi	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.mono	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	1.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0
Pena.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.sp1	0.5	0.0	0.0	0.0	0.0	1.0	1.5	1.0	1.0	0.0	0.0	0.0	1.5	2.5	3.5	1.5	4.0	0.0	0.0	2.5	0.5	0.0	0.0
Gobi.sp1	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	13.0	2.5	0.0	0.0	0.0	0.0	0.0
Cari.shri	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.5	0.0	0.5	0.0	1.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	2.0
Acen.suda	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	3.5	1.0	0.0	0.0	2.5	0.5	0.0	3.5	2.5	0.0	0.0
Epin.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gram.sexl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fist.peti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caff.nudi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gnat.sp1	0.0	1.5	1.5	1.0	0.0	1.0	1.0	0.0	1.5	2.0	0.5	0.0	2.0	6.0	0.0	0.5	13.5	1.5	0.0	2.5	1.0	0.0	0.0
Favo.mela	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.reic	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	2.5	0.0	0.0	1.5	0.0	0.0	0.0	2.0	0.0	0.0
Favo.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dend.brac	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crabs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Cant.benn	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.sola	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.vale	0.0	0.0	0.0	0.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	0.0	0.0	0.0	0.0
Plot.line	0.0	0.0	0.5	0.0	0.0	0.0	12.5	0.0	0.0	0.0	108.0	0.0	0.0	0.0	0.0	0.0	7.5	5.5	0.0	0.0	0.0	0.0	0.0
Plot.nkun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trac.bico	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.gate	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	1.0	0.0	0.0	0.0	0.0	0.0
Squids	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.5	0.0	0.0	0.0	0.0	0.0
Diad.spp	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	8.5	0.0	0.0	0.0	0.0
Pseu.nasi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	T10395	T20395	T30395	cp40395	cp50395	cp30495	m0495	T10495	T20495	T30495	cp40495	cp50495	cp30595	m0595	T10595	T20595	T30595	cp40595	cp50595	cp30695	m0695	T10695	T20695
Scar sord	164.0	22.5	0.0	2.5	37.0	0.0	2.5	12.0	0.0	0.0	2.0	0.0	0.0	1.0	8.0	12.5	1.5	7.0	0.0	0.0	0.0	10.0	5.0
Scar glob	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar scab	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Scar psit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp hari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Calo spin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lept vaig	29.5	7.0	0.5	0.0	21.5	13.0	6.5	45.0	43.5	40.5	4.5	0.5	4.0	1.0	16.0	8.5	14.0	2.5	0.0	0.0	0.0	0.0	0.0
Both manc	0.5	0.0	0.0	0.0	0.5	1.0	1.0	2.0	1.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Both pant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psue arsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth hara	0.5	0.0	0.0	0.0	0.0	19.5	14.5	0.5	0.0	0.0	3.0	0.0	2.5	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0
Leth lent	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth mahs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth elon	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth nebu	26.5	3.0	3.0	0.0	12.0	2.5	0.0	9.0	15.0	0.5	0.0	0.0	1.5	0.0	4.0	1.5	2.0	1.0	0.0	1.0	0.0	2.5	1.0
Leth vari	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Siga suto	15.0	0.5	0.5	0.0	2.5	15.0	11.0	12.5	9.5	10.0	1.0	0.0	3.0	0.0	5.5	0.5	2.5	0.0	0.0	1.0	0.5	3.5	0.5
Siga stel	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel iner	18.5	7.0	2.5	0.0	3.5	0.0	1.0	2.0	3.5	2.5	0.0	0.0	0.5	0.0	2.0	2.0	2.5	0.0	1.0	0.0	0.0	2.5	3.0
Para mcad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para moss	13.0	1.5	1.0	1.0	11.0	2.5	8.0	9.5	6.5	2.5	0.0	0.0	2.0	0.5	0.5	0.5	0.5	0.0	0.0	1.0	0.5	1.5	0.5
Scor vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog angu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog sava	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog frag	39.5	0.0	1.0	0.0	0.0	3.5	2.0	73.0	4.0	0.0	0.0	0.0	0.0	0.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	33.0	0.0
Apog nigr	0.0	0.0	0.5	0.0	0.0	58.0	43.0	18.5	17.0	1.5	0.0	0.0	35.0	0.0	2.5	5.5	2.5	1.5	0.5	0.0	0.0	2.0	5.0
Apog cook	3.5	5.5	0.5	0.0	0.0	0.0	0.0	4.0	8.5	0.5	0.0	0.0	0.0	0.0	2.5	2.5	5.5	0.0	0.0	0.0	1.5	2.5	1.5
Apog taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Foa brach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Fowl auri	60.0	8.0	5.0	0.0	11.5	9.0	6.0	13.5	7.0	11.5	0.0	0.0	1.5	2.5	5.5	6.5	4.5	0.0	0.0	4.5	1.0	5.5	0.0
Stet stri	3.5	2.5	1.5	0.0	0.0	2.5	1.0	9.5	8.5	17.5	0.0	0.0	0.5	0.0	4.5	6.5	9.0	0.0	0.0	0.0	0.0	3.0	2.0
Cori sygu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cori caud	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Side pict	1.0	0.0	0.0	0.0	0.0	0.5	0.0	1.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Syng acus	0.0	0.0	1.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syng biac	1.0	0.0	0.0	0.0	0.0	1.0	1.0	3.5	0.0	5.0	1.0	0.5	2.5	0.0	0.5	2.0	2.5	0.0	0.0	0.0	0.0	1.0	0.0
Hali scap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Hali irid	4.5	11.0	0.0	0.0	23.5	0.0	0.0	5.5	15.5	0.0	0.0	0.0	0.5	0.0	0.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali hort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali dunc	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yong nebu	6.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Acan line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyno atte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coci croc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat lati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Papi long	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Tera ther	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poma tril	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec lacr	1.0	0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.5	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Saur grac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Saur undo	0.0	0.5	0.5	1.5	0.0	0.5	0.5	1.0	0.5	0.5	2.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.5	0.5	1.0	0.0	0.0
Chel lati	1.0	5.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gerr oyen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj gibb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Lutj fulv	0.0	0.0	0.0	10.5	1.5	1.0	4.0	1.0	0.5	0.0	11.0	2.5	0.0	0.0	0.0	0.5	0.0	3.5	0.0	0.0	0.0	0.0	0.0
Paru barb	1.0	0.0	0.0	0.0	0.5	1.0	2.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen vitt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat teir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Plat obic	0.0	0.0	0.0	0.0	0.0	0.5	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0
Arot imma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot hisp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena indi	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena mono	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Pena sp1	0.0	0.0	0.0	0.0	0.0	10.0	3.0	0.0	0.0	0.0	0.5	0.0	2.0	0.5	0.0	0.0	0.0	1.0	0.0	0.5	0.0	0.0	0.0
Gobi sp1	1.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cari shri	2.0	2.0	2.0	0.0	0.0	3.5	4.0	4.0	0.5	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	1.5	0.0	0.0	0.5
Acen auda	0.5	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	3.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gram sexl	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fist peti	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caff nudi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gnat sp1	5.5	0.5	0.5	0.5	0.0	0.0	2.5	2.5	2.0	5.0	3.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo mela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo reic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
Dend brac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crabs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant benn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant sola	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Cant vale	0.0	0.0	0.5	0.0	0.0	0.0	0.0	2.5	4.0	0.0	0.0	0.0	0.0	0.0	1.5	8.0	6.0	0.0	0.0	0.0	0.0	1.5	3.0
Plot line	1.0	0.0	0.0	0.0	0.5	0.0	0.0	1.5	503.5	1.5	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plot nkun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trac bico	0.0	0.0	6.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Plec gate	4.5	0.0	0.0	0.5	0.0	0.0	0.0	2.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Squids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Diad spp	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	19.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Pseu nasi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	T30695	cp40695	cp50695	cp30795	m0795	T10795	T20795	T30795	cp40795	cp50795	cp30895	m0895	T10895	T20895	T30895	cp40895	cp50895	cp30995	m0995	T10995	T20995	T30995	cp40995
Scar.sord	0.5	7.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	2.5	0.5	13.0	6.5	0.5	6.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0
Scar.glob	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.scab	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.psit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Calo.spin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lept.vaig	12.5	0.0	0.0	0.0	8.5	4.5	0.0	4.0	2.5	0.0	3.0	1.0	53.0	13.0	2.5	15.0	14.5	0.0	5.5	30.5	10.5	2.5	4.0
Both.manc	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.0	0.5	0.5	0.0	0.0	3.5	2.0	0.0	0.0	0.0	0.0	0.0	1.5
Both.pant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0
Psue.arsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.hara	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Leth.lent	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.mahs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.elon	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	1.5	0.0	0.0	0.0
Leth.nebu	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.0	1.0	0.5	0.5	0.0	6.5	4.5	0.5	4.0	3.5	0.5	0.0	1.0
Leth.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Leth.larv	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5
Siga.suto	2.5	2.0	0.0	0.0	8.5	3.5	0.0	0.5	1.0	0.0	7.0	1.5	3.5	4.5	0.0	4.5	6.0	1.5	9.5	18.5	74.5	1.5	3.5
Siga.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.iner	3.5	0.0	0.0	0.0	0.5	2.5	2.0	0.5	0.0	0.0	0.0	0.0	5.5	2.0	1.5	3.0	8.5	0.0	0.0	9.0	4.0	1.0	1.5
Para.mcad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.moss	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.5	0.0	1.0	0.0	7.5	2.5	0.5	4.5	2.0	0.0	1.5	1.5	0.0	0.5	0.0
Scor.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.angu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.sava	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.frag	10.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0	27.5	0.0	0.0	0.5	0.0	0.0	0.0	16.5	10.5	0.0	0.0
Apog.nigr	0.0	0.0	0.0	0.0	11.0	2.0	0.0	1.5	0.0	0.0	15.5	1.0	13.0	1.0	0.0	0.0	3.0	4.0	1.5	9.5	4.5	0.0	0.5
Apog.cook	4.0	0.0	0.0	0.0	0.0	8.0	0.0	6.5	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0	1.5	0.0	0.0	6.0	2.5	0.0	0.0
Apog.taen	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Foa.brach	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fowl.auri	4.0	1.0	0.0	0.0	3.0	3.0	0.0	1.5	0.0	0.0	1.0	2.5	8.5	10.5	0.0	10.0	9.5	0.0	2.0	4.0	0.0	0.5	0.5
Stet.stri	10.0	0.5	0.0	0.0	2.5	0.5	0.0	2.0	0.0	0.0	1.0	0.0	10.0	12.0	0.0	6.0	1.5	0.0	1.5	3.5	0.5	0.0	0.0
Cori.aygu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cori.caud	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Side.pict	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syng.acus	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Syng.biac	1.0	1.0	0.5	0.0	0.5	1.5	0.0	0.0	0.0	0.0	1.0	0.0	2.0	0.5	0.0	1.5	1.5	0.0	0.0	1.0	0.0	0.0	0.5
Hall.scap	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.irid	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.5	0.0	0.0	2.0	0.0	0.0	0.0	1.5	0.0	0.0
Hali.hort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.dunc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yong.nebu	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	1.5
Acan.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyno.atte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cocl.croc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Plat.larv	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.lati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Papi.long	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Tera.ther	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poma.tril	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.lacr	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Saur.grac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saur.undo	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.5	0.5	2.0	1.0	0.5	1.0	2.0	0.0	0.0	3.0
Chel.lati	0.0	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
Gerr.oyen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.gibb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.fulv	0.0	2.5	0.0	0.0	0.5	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.5	0.5	0.0	0.0	1.5
Paru.barb	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	1.5	0.0	0.0	0.5	0.0	0.0	0.0
Upen.vitt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.teir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.obic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Arot.imma	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Arot.hisp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.indi	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Pena.mono	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	1.0
Pena.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.sp1	0.0	0.0	0.0	0.0	0.5	0.0	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gobi.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.0	0.0	0.0
Cari.shri	1.0	1.5	0.0	0.0	0.5	0.5	0.0	0.0	0.5	0.0	0.5	1.5	0.5	0.0	0.0	0.0	1.0	0.0	4.0	1.5	0.0	0.0	0.0
Acen.auda	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	1.5	0.5	0.0	0.0	0.0	1.0	0.0	0.5
Epin.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gram.sexl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fist.peti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0
Caff.nudi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gnat.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.0	2.0	0.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.mela	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.reic	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dend.brac	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0
Crabs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Cant.benn	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.5	0.0
Cant.sola	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	3.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
Cant.vale	7.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0
Plot.line	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	54.0	1.5	0.0	0.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0
Plot.nkun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trac.bico	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.gute	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Squids	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diad spp	0.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	7.5	3.0	0.0	0.0	0.0	0.0	0.5	0.0	2.5	0.0
Pseu.nasi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	cp50995	cp31095	m1095	T11095	T21095	T31095	cp41095	cp51095	cp31195	m1195	T11195	T21195	T31195	cp41195	cp51195	cp31295	m12195	T11295	T21295	T31295	cp41295	cp51295	cp30196
Scar sord	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.glob	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.scab	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.psit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calo.spin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lept.vaig	13.0	1.0	1.5	23.0	6.0	17.5	0.5	0.0	13.5	17.0	18.5	6.5	12.0	13.0	2.0	3.0	1.0	10.5	4.0	8.5	1.5	0.0	0.0
Both.manc	0.5	0.0	0.0	0.0	0.5	0.5	0.0	1.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.5	1.0	0.0	0.0	0.0	0.0	0.5	0.0
Both.pant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psue.arsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.hara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	7.5	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5
Leth.lent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.mahs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.elon	1.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.nebu	6.0	1.0	0.5	0.5	0.5	0.0	0.0	1.0	8.5	11.5	1.5	0.5	0.5	2.5	0.0	2.0	0.5	1.0	0.5	0.5	0.5	0.0	0.0
Leth.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0
Leth.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Siga.suto	3.5	4.0	6.5	0.0	0.0	0.5	0.0	1.0	8.5	20.5	2.0	2.0	1.0	2.0	1.5	8.5	3.0	2.0	0.0	1.0	0.0	0.0	0.0
Siga.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.iner	1.0	0.0	0.0	4.5	0.5	3.5	0.0	0.0	0.5	1.0	3.0	1.0	3.0	0.5	0.0	0.0	0.0	0.0	0.5	1.5	0.0	0.0	0.0
Para.mcad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.moss	1.5	0.0	0.0	0.5	1.0	0.5	0.5	0.0	2.5	10.0	1.5	0.0	0.5	5.0	0.0	3.5	1.0	3.0	1.0	2.0	3.0	0.5	1.0
Scor.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.angu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.sava	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.frag	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	1.0	12.0	0.0	0.0	3.0	0.0	6.0	0.5	0.0	0.0	0.5	0.0
Apog.nigr	3.5	0.5	0.0	2.0	0.5	10.0	0.0	0.0	0.0	0.0	8.0	3.0	11.5	0.0	0.0	0.0	0.0	6.0	7.5	1.5	0.0	0.0	0.0
Apog.cook	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	4.5	0.0	0.0	0.0
Apog.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Foa.brach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fowl.auri	0.0	0.0	0.5	1.5	7.5	5.5	0.0	0.0	4.5	7.0	6.0	0.5	4.0	0.5	0.0	5.5	0.0	2.5	1.0	4.0	0.5	0.0	0.0
Stet.stri	0.0	0.0	0.0	1.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cori.aygu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cori.caud	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Side.pict	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syng.acus	0.0	0.0	0.0	0.5	0.0	1.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0
Syng.biac	0.0	0.0	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Hall.scap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hall.irid	0.0	0.0	0.0	2.5	4.0	6.5	0.0	0.0	0.0	0.0	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	3.0	3.5	0.0	0.0	0.0
Hall.hort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hall.dunc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yong.nebu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.0	0.0	0.5	0.0	1.5	0.0	0.0
Acan.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyno.atte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coci.croc	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Plat.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.lati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Papi.long	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tera.ther	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poma.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.lacr	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saur.grac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saur.undo	4.0	0.0	0.0	0.0	0.5	1.0	0.0	0.0	0.5	1.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.lati	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gerr.oyen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.gibb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.fulv	1.5	0.0	1.0	0.0	0.0	0.0	0.0	0.5	1.0	1.0	0.5	0.0	0.0	5.5	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0
Paru.barb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.vitt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.teir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.obic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.imma	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.hisp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	2.0	0.0	0.0
Pena.mono	0.0	1.0	0.0	0.0	0.0	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gobi.sp1	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carl.shri	0.0	0.5	0.0	0.0	0.5	0.5	0.0	0.5	1.0	1.0	0.0	0.0	0.0	1.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Acen.suda	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gram.sexl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fist.peti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caff.nudi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gnat.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.mela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.reic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dend.brac	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crabs	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.benn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.sola	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.vale	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	0.0
Plot.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Plot.nkum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trac.bico	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.gate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Squids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diad.spp	0.0	0.0	0.0	0.0	3.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseu.nast	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	m0196	T10196	T20196	T30196	cp40196	cp50196	cp30296	m0296	T10296	T20296	T30296	cp40296	cp50296	cp30396	m0396	T10396	T20396	T30396	cp40396	cp50396	cp30496	m0496	T10496
Scar.sord	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.glob	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.scab	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.psit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calo.spin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lept.vaig	0.0	0.0	4.0	11.0	0.5	0.0	0.0	0.5	3.5	21.5	6.0	0.0	1.0	0.0	1.0	6.0	1.0	2.5	2.5	1.0	0.0	1.5	3.0
Both.manc	1.0	0.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Both.pant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psue.arsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.hara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.5	6.5	0.0	0.0	1.5	0.0	0.0	0.5	3.5	1.0
Leth.lent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.mahs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.elon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Leth.nebu	1.5	1.0	0.5	1.0	0.5	0.0	0.0	0.0	3.5	0.5	2.0	0.0	0.0	2.0	9.0	1.5	0.0	2.0	0.5	0.0	0.0	0.0	1.0
Leth.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.larv	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Siga.suto	0.0	0.0	0.5	1.0	0.0	0.0	0.0	0.0	2.5	1.0	0.0	0.0	0.5	1.0	1.5	0.0	0.0	0.5	0.0	0.0	0.0	1.0	2.0
Siga.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Chel.iner	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.5	1.0	0.0	0.0	0.0	0.0	0.0
Para.mcad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.moss	0.5	0.0	1.0	1.0	0.5	0.0	0.0	0.0	1.5	3.5	2.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Scor.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.angu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.sava	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.frag	0.0	0.0	19.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.5	18.0
Apog.nigr	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.cook	0.0	0.0	0.5	7.5	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Apog.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Foa.brach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fowl.auri	0.0	0.0	1.0	7.0	0.0	0.0	0.0	0.0	0.5	1.0	2.0	0.0	0.5	2.0	3.0	4.5	0.0	0.5	1.0	0.0	0.5	12.0	2.0
Stet.stri	0.0	0.0	1.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.5	1.0	0.0	0.0	0.0	0.5	1.0
Cori.sygu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cori.caud	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Side.pict	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Syng.acus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	3.0	0.5	0.0	0.0	1.5	0.0
Syng.biac	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Hali.scap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.irid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	9.0	6.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.hort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.dunc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yong.nebu	2.0	6.0	0.0	0.0	1.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0
Acan.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyno.atte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coci.croc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.indi	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.lati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Papi.long	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tera.ther	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poma.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.lacr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	3.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Saur.grac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saur.undo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.lati	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gerr.oyen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Lutj.gibb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.fulv	0.5	1.5	0.0	0.0	1.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	1.0	1.0	5.0	0.5	0.0	0.0	4.0	1.0	0.0	1.5	1.5
Paru.barb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.viti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.teir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.obic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Arot.imma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.hisp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5
Pena.mono	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.5	3.0
Pena.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gobi.sp1	0.5	2.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cari.shri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5
Acen.suda	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gram.seal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fist.peti	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coff.nudi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gnat.sp1	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.mela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.reic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dend.brac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crabs	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.benn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.sola	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Cant.vale	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plot.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plot.nkun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trac.bico	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.gute	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Squids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diad.spp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0
Pseu.nasi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	T20496	T30496	cp40496	cp50496	cp30596	m0596	T10596	T20596	T30596	cp40596	cp50596	cp30696	m0696	T10696	T20696	T30696	cp40696	cp50696	cp30796	m0796	T10796	T20796	T30796
Scar sord	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.glob	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.scab	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.psit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calo.spin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lept.vaig	13.0	7.5	0.5	0.5	0.0	0.5	0.0	1.0	3.5	0.0	2.5	5.0	2.0	4.5	1.0	0.5	0.5	0.0	3.0	2.5	2.5	0.0	0.5
Both.manc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Both.pant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psue.arsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.hara	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.0	4.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Leth.lent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.mahs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.elon	0.5	1.5	0.0	3.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.nebu	0.5	0.5	0.0	0.0	0.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.0	0.0
Leth.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Siga.suto	1.5	1.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	1.0	0.5	1.0	0.5	2.0	0.0	0.0	0.5	0.0	0.5	2.0	0.0	0.0
Siga.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Chel.iner	1.0	2.0	0.0	0.5	0.0	0.0	0.5	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.mcad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.moss	4.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0
Scor.vari	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.angu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.sava	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.frag	2.0	0.0	0.0	3.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0
Apog.nigr	0.0	0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.5	0.0	0.0	32.0	2.5	1.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.cook	6.5	3.0	0.0	0.0	0.0	0.0	3.5	0.0	0.5	0.0	0.0	1.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Foa.brach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fowl.auri	6.0	12.0	0.0	0.5	0.0	0.0	0.5	0.5	1.5	0.0	2.5	5.0	0.0	0.0	0.5	0.0	0.0	0.0	2.5	4.0	2.0	0.0	0.0
Stet.stri	4.0	3.0	0.5	0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cori.aygu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cori.caud	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Side.pict	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syng.acus	0.0	0.5	0.0	0.0	0.0	1.5	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.5	0.0	0.0	0.0	0.5
Syng.biac	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.5	0.0	4.5	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Hall.scap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hall.irid	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hall.hort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hall.dunc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yong.nebu	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acan.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyno.atte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coci.croc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.lati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Papi.long	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tera.ther	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poma.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.lacr	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saur.grac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saur.undo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.lati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gerr.oyen	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.gibb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.fulv	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.5	2.0	1.0	0.0	0.0	0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Paru.barb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.vitt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.teir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.obic	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.imma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0
Arot.hisp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.indi	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.mono	0.0	0.0	1.0	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.5	0.0	0.0
Pena.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gobi.sp1	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cari.shri	4.5	4.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acen.auda	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gram.sexl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fist.peti	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Caff.nudi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gnat.sp1	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.mela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.reic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dend.brac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crabs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.benn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.sola	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.vale	0.0	0.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plot.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plot.nkun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trac.bico	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.0	0.0
Plec.gate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Squids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diad.spp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseu.nasi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	cp40796	cp50796	cp30896	m0896	T1110896	T20896	T30896	cp40896	cp50896	cp30996	m0996	T10956	T20996	T30996	cp40996	cp50996
Scar.sord	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.glob	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.scab	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scar.psit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.bari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calo.spin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lept.vaig	1.5	0.5	1.5	2.0	7.0	21.0	0.0	0.0	0.0	1.0	0.0	6.5	57.0	0.0	0.5	0.0
Both.manc	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Both.pant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psue.arsi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.hara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.lent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.mahs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.elon	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.nebu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5
Leth.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leth.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Siga.suto	0.5	0.0	9.0	8.5	2.5	0.5	0.0	0.0	0.0	0.0	0.0	0.5	5.0	0.0	0.0	0.5
Siga.stel	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.iner	0.0	0.0	0.0	0.0	1.5	2.5	0.0	0.0	0.0	0.0	0.0	4.0	4.0	0.0	0.0	0.0
Para.mcad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.moss	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scor.vari	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.angu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.sava	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apog.frag	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Apog.nigr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0
Apog.cook	1.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	8.0	0.0	0.0	0.0
Apog.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fox.brach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fowl.auri	1.0	1.0	1.5	1.0	1.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0	0.0	0.0
Stet.stri	0.5	0.5	0.0	0.5	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Cori.aygu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cori.caud	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Side.pict	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syng.acus	0.0	0.5	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.5	0.0	0.0
Syng.biac	1.0	1.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.5	0.0	0.0
Hali.scap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.irid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Hali.hort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.danc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yong.nebu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acan.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyno.atte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coci.croc	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.larv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.lati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Papi.long	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tera.ther	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poma.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Plec.lacr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saur.grac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saur.undo	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.lati	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gerr.oyen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.gibb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lutj.fulv	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paru.barb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.vitt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.teir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plat.obic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.imma	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Arot.hisp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arot.stel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.mono	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pena.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gobi.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cari.shri	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Acen.auda	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gram.sexl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fist.peti	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caff.nudi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gnat.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.mela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.reic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Favo.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dend.brac	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crabs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cant.benn	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	7.0	0.0	0.0	0.0
Cant.sola	2.5	1.0	0.5	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
Cant.vale	4.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.5	0.0	0.0
Plot.line	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plot.nkun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trac.bico	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plec.gate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Squids	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diad.spp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pseu.nasi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994-Sept 1996)

	cp31294	m1294	T11294	T21294	T31294	cp41294	cp51294	cp30195	m0195	T10195	T20195	T30195	cp40195	cp50195	cp30295	m0295	T10295	T20295	T30295	cp40295	cp50295	cp30395	m0395
Para.barn	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0	0.0	0.0	0.0	0.0	0.0
Brot.mult	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Starfisf	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.albi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	1.0	0.0	0.0	0.0
Chae.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trip.grat	0.0	0.0	0.0	4.5	3.5	0.0	0.0	0.0	0.0	0.0	51.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	31.0	0.0	0.0	0.0	0.0
Jelly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lact.corn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Lact.forn	0.0	0.0	0.0	0.5	1.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.line	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.auri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.klei	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.mela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trio.macr	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Petr.brev	0.0	0.0	0.0	0.5	0.0	1.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Petr.mitr	0.0	0.0	0.0	1.5	0.5	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.5	0.0	1.5	1.0	2.0	1.0	0.0	4.5	0.0	0.0	0.0
Sync.marm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.5	0.0	1.0	0.0	0.0	0.0
Olig.kele	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Abla.bino	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.sphy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aste.seml	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.bili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.cape	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.came	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.trag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aeol.punc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Diod.hyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ante.comm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.pely	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epib.insi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Nova.macr	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0
Dact.orie	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Acro.japo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Echi.poly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Loph.calo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Amba.prod	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anam.caer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Labr.dimi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.duss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.flag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stet.inte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.tril	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.oxyc	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.undu	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Cheil.bim	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.5	2.5	12.5	0.0	0.0	0.0	0.0
Chry.annu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dasc.arua	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.pili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.spec	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Ostr.cubi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Able.hian	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.blee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.cyan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pela.quad	0.5	1.0	0.0	0.0	0.0	0.5	0.0	0.5	0.5	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphy.jell	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Oxyu.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.mile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stol.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cara.igno	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bemp.plat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.quin	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cten.stri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymo.prae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.doli	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neop.fuli	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.long	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.mala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd. ANNEX 5 contd.

Average monthly catch b Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	T10395	T20395	T30395	cp40395	cp50395	cp30495	m0495	T10495	T20495	T30495	cp40495	cp50495	cp30595	m0595	T10595	T20595	T30595	cp40595	cp50595	cp30695	m0695	T10695	T20695
Para.barn	3.0	0.5	0.0	0.0	1.0	0.0	0.0	3.5	4.5	0.0	0.0	0.0	0.0	0.0	2.0	3.0	1.5	0.0	0.0	0.0	0.0	3.5	2.0
Brot.mult	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Starfisf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.albi	1.5	0.0	0.0	0.5	0.0	0.0	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5
Chae.line	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trip.grat	10.5	1.0	1.0	0.0	0.0	0.0	0.0	3.0	9.5	0.0	0.0	0.0	0.0	0.0	13.5	39.0	1.5	0.0	0.0	0.0	0.0	35.0	10.0
Jelly	9.5	2.5	2.0	0.0	1.0	0.0	0.0	6.0	0.0	0.0	0.0	3.0	0.0	0.0	8.5	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.0
Lact.corn	0.0	1.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lact.forn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0
Chae.auri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.klei	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.mela	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trio.macr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	2.0	0.5
Petr.brev	0.0	0.0	0.0	0.0	0.0	2.5	0.0	21.0	5.0	5.0	4.0	0.0	2.0	2.5	1.5	1.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Petr.mitr	6.0	0.0	1.0	0.0	1.0	3.0	0.0	11.0	2.5	4.0	0.0	0.0	2.5	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sync.marm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Olig.kele	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Abla.bino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.sphy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aste.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Para.bili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.cape	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.came	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hist	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.trag	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aeol.punc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diod.hyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ante.comm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.pely	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epib.insi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nova.macr	1.0	0.0	3.0	0.0	0.5	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dact.orie	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acro.japo	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Echi.poly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loph.calo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amba.prod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anam.caer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labr.dimi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.duss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.flag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stet.inte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.oxyc	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.undu	0.5	0.0	0.0	0.0	0.0	0.5	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chell.bim	1.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chry.annu	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dasc.arua	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.pili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.spec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostr.cubi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Able.hian	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.blee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.cyan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pela.quad	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphy.jell	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxyu.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.mile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Stol.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cara.igno	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bemp.plat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.quin	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Cten.stri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymo.prae	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.doli	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.taen	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neop.full	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0
Hipp.long	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.mala	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	T30695	cp40695	cp50695	cp30795	m0795	T10795	T20795	T30795	cp40795	cp50795	cp30895	m0895	T10895	T20895	T30895	cp40895	cp50895	cp30995	m0995	T10995	T20995	T30995	cp40995
Para.barn	2.0	0.0	0.0	0.0	1.5	5.5	1.0	0.0	0.0	0.0	0.0	0.0	5.0	2.5	0.0	5.0	2.0	0.0	0.5	3.0	1.5	0.0	0.0
Brot.mult	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Starfisf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.albi	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trip.grat	10.5	0.0	0.0	0.0	0.0	0.5	1.0	1.0	0.0	0.0	0.0	0.0	9.0	0.0	2.0	0.0	3.0	0.0	0.0	9.5	2.5	0.0	0.0
Jelly	0.0	0.5	0.0	0.0	0.5	0.5	0.0	0.0	2.0	0.0	0.0	0.0	0.5	0.5	0.5	88.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0
Lact.corn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Lact.forn	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	1.0	0.5	0.0	0.0	0.0
Chel.line	2.5	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.auri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.klei	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.mela	0.5	0.0	0.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trio.macr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Petr.brev	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.5	0.0	0.0	0.0
Petr.mitr	0.0	0.0	0.0	0.0	0.0	3.0	1.0	0.5	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0
Sync.marm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Olig.kele	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Abla.bino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.sphy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aste.semi	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Para.bili	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Hipp.cape	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.came	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.trag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Aeol.punc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0
Diod.hyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0
Ante.comm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.pely	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epib.insi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nova.macr	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.0	0.0
Dact.orie	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acro.japo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Echi.poly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loph.calo	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amba.prod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anam.caer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labr.dimi	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Hali.duss	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.flag	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stet.inte	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Chel.oxyc	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Chel.undu	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	3.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Cheil.bim	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chry.annu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dasc.arua	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.pili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	7.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0
Holo.spec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Ostr.cubi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Able.hian	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.blee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Sole.cyan	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pela.quad	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	1.0	1.5	0.0	0.0	0.0	0.5	0.0	0.0
Sphy.jell	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Oxyu.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.mile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stol.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cara.igno	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bemp.plat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.quin	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cten.stri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymo.prae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.doli	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neop.full	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.long	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.mala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	cp50995	cp31095	m1095	T11095	T21095	T31095	cp41095	cp51095	cp31195	m1195	T11195	T21195	T31195	cp41195	cp51195	cp31295	m12195	T11295	T21295	T31295	cp41295	cp51295	cp30196
.barn	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	4.0	0.5	2.0	0.5	0.0	0.0
t.mult	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
eflsf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
l.albi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
e.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.grat	0.0	0.0	0.0	3.5	0.5	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3.0	0.0	0.0	0.0	0.0	0.0	5.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
t.corn	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
t.form	2.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
l.line	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
e.auri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
e.klei	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
e.meda	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
o.macr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
brev	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.mitr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0
.marm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
g.kele	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
s.bino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
bl.sphy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
e.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
a.bill	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
p.cupe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
p.rume	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
p.hist	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
m.trag	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
l.punc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
d.hyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
e.comm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.poly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.lnei	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
a.macr	0.0	0.0	0.0	0.0	1.5	2.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
t.orie	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.japo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
l.poly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
h.calo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
a.prod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
m.caer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.dimi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
duss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.flag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
l.lute	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
d.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
l.oxyc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
l.undu	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0
ll.bim	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.annu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
c.arua	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
a.pili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.spec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
cubi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
e.blan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
e.bloc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
e.cyan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
quad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.jell	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.mile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
a.igno	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
p.plat	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
l.quin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n.stri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
no.prue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
o.doll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
p.full	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
p.long	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n.mala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	m0196	T10196	T20196	T30196	cp40196	cp50196	cp30296	m0296	T10296	T20296	T30296	cp40296	cp50296	cp30396	m0396	T10396	T20396	T30396	cp40396	cp50396	cp30496	m0496	T10496
Para.barn	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brot.mult	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Starfisf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.albi	0.5	0.0	0.0	0.0	0.5	0.0	0.0	2.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trip.grat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	20.0	9.5	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Jelly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	5.5	3.5	0.0	0.0	0.0	0.5	4.0	2.5	0.0	1.5	0.5	0.0	0.0	0.0
Lact.corn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lact.forn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	12.5	0.0	0.0	0.0	0.0	0.5
Chae.auri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.klei	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.mela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trio.macr	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Petr.brev	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5
Petr.mitr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Sync.marm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Olig.kele	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Abla.bino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.sphy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aste.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.bili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.cape	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.came	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.trag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aeol.punc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Diod.hyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ante.comm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.pely	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epib.insi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nova.macr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dact.orie	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acro.japo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Echi.poly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loph.calo	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amba.prod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anam.caer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labr.dimi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.duss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.flag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stet.inte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.oxyc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.undu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cheil.bim	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chry.annu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dasc.arua	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.pili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.spec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostr.cubi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Able.hian	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.blee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.cyan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pela.quad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Sphy.jell	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Oxyu.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.mile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stol.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cara.igno	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bemp.plat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.quin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cten.stri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymo.prae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.doli	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neop.fuli	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.long	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.mala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994 Sept 1996)

	T20496	T30496	cp40496	cp50496	cp30596	m0596	T10596	T20596	T30596	cp40596	cp50596	cp30696	m0696	T10696	T20696	T30696	cp40696	cp50696	cp30796	m0796	T10796	T20796	T30796
Para.barn	0.5	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Brot.mult	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Starfisf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.albi	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trip.grat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jelly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lact.corn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lact.forn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.line	1.5	7.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.auri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.klei	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.mela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trio.macr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Petr.brev	4.0	3.0	0.0	0.0	0.0	1.0	0.0	0.0	2.0	0.0	0.0	1.0	2.0	3.0	0.5	0.5	0.5	0.0	1.5	0.0	0.0	0.0	0.0
Petr.mitr	1.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	3.5	1.5	0.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0
Sync.marm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Olig.kele	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Abla.bino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.sphy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aste.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.bili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.cape	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.came	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.hist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.trag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aeol.punc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diod.hyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ante.comm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.pely	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epib.insi	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nova.macr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Dact.orie	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acro.japo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Echi.poly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loph.calo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amba.prod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anam.caer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labr.dimi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hali.duss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.flag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stet.inte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.oxyc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.undu	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cheil.bim	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chry.annu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dasc.arua	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.pili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.spec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostr.cubi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Able.hian	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.blee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.cyan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Pela.quad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphy.jell	0.0	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.5	0.0	0.0	0.0	0.0	0.0
Oxyu.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.mile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stol.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cara.igno	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bemp.plat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.quin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cten.stri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymo.prae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.doli	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neop.full	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.long	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.mala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Average monthly catch by species per stations in Gazi Bay: pooled replicas (Dec 1994-Sept 1996)

	cp40796	cp50796	cp30896	m0896	T1110896	T20896	T30896	cp40896	cp50896	cp30996	m0996	T10996	T20996	T30996	cp40996	cp50996
Para.barn	0.0	0.5	0.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	2.0
Brot.mult	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Starfisf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.albi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trip.grat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jelly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lact.corn	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lact.forn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.line	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5	11.0	0.0	0.0
Chae.auri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.klei	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chae.mela	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trio.macr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Petr.brev	2.0	1.5	0.0	1.0	1.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.5
Petr.mitr	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.5
Sync.marm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Olig.kele	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Abla.bino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ambl.sphy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aste.semi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.bili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.cape	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.came	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Hipp.hist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Upen.trag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aeol.punc	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Diod.hyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ante.comm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.pely	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epib.insi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nova.macr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dact.orie	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acro.japo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Echi.poly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loph.calo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amba.prod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anam.caer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Labr.dimi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Hali.duss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.flag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stet.inte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.tril	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.oxyc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.undu	0.0	0.5	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.5	0.0	0.0
Cheil.bim	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chry.annu	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dasc.arua	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Para.pili	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.spec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ostr.cubi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Able.hian	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.blee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sole.cyan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pela.quad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphy.jell	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxyu.sp1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.mile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stol.indi	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cara.igno	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bemp.plat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chel.quin	2.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cten.stri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cymo.prae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holo.doli	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pter.taen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neop.fuli	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hipp.long	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epin.mala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEX 5 contd.

Spatial survey data: Fish

	BT1	BT2	BT3	BT4	BT5	BT6	BT7	BT8	BT9	BT10	BT11	BT12	BT13	BT14	BT15	BT16	BT17	BT18	BT19	BT20	BT21	BT22	BT23	BT24	BT25	BT26	BT27	BT28	BT30	BT31	BT32	Sum	Freq
Angu spec										1																						1	1
Gymn undu		1									1	2						3			2											9	5
Plot line		4											105																			109	2
Saur grac	1		1	2		1		5	4	3	4	1	5	3	5	1	2	7	1			1	1	1				2	9	4	9	73	23
Trac myop							2																								10	12	2
Fist comm						1																								1		2	2
Hipp spec																											1					1	1
Syng biac					2						2	1	1	9	1	1		1						2	1	2	3			2		28	13
Trac bico										1																			1			2	2
Aeol punc																													4	1		5	2
Dend brac											1	1					1															3	3
Pter mile						1							1				2										1					5	4
Para mosc		1																								1	5					7	3
Scor gibb						1																										1	1
Seba mair	1																															1	1
Seba stro	9	97	1	15	17	38	8			1	38	43	17	9	19	15	8	144	31	5	1		14	17		2		15	1			565	24
Syna verr			1																	1			1					1				4	4
Ptar jub																													1			1	1
Coci croc						4					2						1										1					8	4
Gram port																													2			2	1
Plat indi												1																				1	1
Epin mala																							1									1	1
Epin sual																						1										1	1
Pela quad	1	6									1				2	1	1	2		3				3								20	9
Tera spec																														1		1	1
Apog cocc		1			2																											3	2
Apog cook																										6	2					8	2
Apog guam																					1	1										2	2
Apog nigr																										11	4			4		19	3
Apog ther														1			1							15	17							34	4
Apog spec																															2	2	1
Apog perd				4		21																										25	2
Arch moza																											2					2	1
Chei quin																	3								3		11					17	3
Foa brac	3										3	7	2	13			2	7	1				9	33	2	1	3		1	1		88	15
Fowl aur	2	9	1	4	1	1					1		1	3	28	14	5	20	7		6	6	7	7	1	2	2					128	21
Spha obtu						1															1											2	2
Lutj fulv	4	2	6	10		5					2	6	8	2	2	6		6	16	5	1	2		1		1					5	90	19
Gnat aure									1																							1	1
Gymn gris		7																														7	1
Leth cruc				1	1																											2	2
Leth hara											13	1						2	3													19	4
Leth lent											10		2					8					2	17	1		2		2			44	8
Leth mahs						18																										18	1
Leth rama												5		8			2															15	3
Gerr acin		2																														2	1
Steg nigr																1																1	1
Paru barb					1																											1	1
Upen trag																						1										1	1
Abud sexf																						4										4	1
Dasc arua						1								2		1								8								12	4
Dasc trim					7	1																										8	2
Neop fulv	1			1							1						1					1					1					6	6
Steg fasc																					1	2					1					4	3
Chei bima						1							2										1	4					2	2		12	6
Chei chlo																		1				1	1			1						4	4
Chei diag																1								1								2	2
Chei oxyc						4						1		1			1							1	5		2		5	1		21	9
Chei tril																								1								1	1
Chei unif					1	4								9	6		2	1						2	1	5	3		4	2		40	12
Cymo prae	1												4	1															1			7	4
Epib insi																3																3	1
Hali nebu						1								1																		2	2
Hali scap																												1				1	1
Labr dimi																									1							1	1
Nova macr														1										1	1				7	5		15	5
Labr spec																												58				58	1
Stet inte	5																															5	1
Stet stri				4		5					3			1	5	1	1	1	1			2	4	1	2	6						37	14
Thal hard																1																1	1
Calo spin	9			5		21						1	10	9			5	5	3				14	26		4	1		15	3		131	15
Lepi vaig	60	23	20	31	15	43	4				20	11	80	34	60	51	33	80	28	11	28	36	79	66	7	11	13	1	1	5		851	27
Scar fest				3													1					1										5	3
Scar glob																	1															1	1
Scar russ	1			27	2							1			31	7	10	11	3		1		66									160	11
Scar scap	1										10						1		1		1		2									16	6
Scar juve												1					1	1														3	3
Sphy fors																															3	3	1
Pter heev													1	6		1	1							1					1	1	1	13	8
Pter mitr				5		1	1				4		1	8	12	9	1	2	3	5	3	4	1	2	2			5				69	18
Pter juve		1																														1	1
Amel albi													1																			1	1
Aste semi		3			1						2				4	16		9	3		3		2									43	9
Paro resc																															9	9	1
Drom key								1	1	1																						3	3
Gnat juve																								8								8	1
Gnat spe1	12	14	2	4	2						2	10	3	8	6	2		17	13	3			1		1	2		84				186	18
Gnat spe2	1																															1	1
Oplo oplo						4							1	3																		8	3
Oxyu micr										2																						2	1
Oxyu papu																															2	2	1
Peri koel														1																		1	1
Yong nebu		1								3																						4	2
Naso spec				1																												1	1
Siga cana		2			2																											4	2
Siga suto	4	7	1	3		17					25	27	1	9	2	3	3	25	18		1	2	10	16	1	1		1		1		178	22
Both myri	2																															2	1
Both pant			1	1				3	2	1	1	1		4	2			2	1										4	2		25	13
Both juve										1		3	1																	17		22	4
Cros vaid																													6	10		16	2
Pseu arsi								2																								2	1
Cyno lach								1			1																					2	2
Cyno spec										3																						3	1
Para bili						2		1																								3	2
Pard marm						2	3							1										1					2	1	1	11	7
Para barn														1											4				1	1		7	4
Lact corn																		1														1	1
Lact forn														1																		1	1
Ostr cubi																								1								1	1
Arot hisp			1			1							4				1						2		1	1		6		1	1	19	10
Arot imma						6							1	1				1					1								1	11	6
Arot stel																															6	6	1
Arot spec	1																															1	1
Cant benn						1							1	3							1				3	3	13		2	1		28	9
Cant jans	1	1																														2	2
Cant sola													1												2							3	2
Cant vale														1												1	1					3	3
Cant juve																		1														1	1
Total catch	120	182	35	121	54	207	18	13	8	17	147	124	254	154	185	135	91	358	133	33	51	65	219	236	56	61	72	174	72	67	50	3512	113
Species	20	18	10	17	13	28	5	6	4	10	22	19	24	30	15	19	26	25	16	7	14	15	20	25	19	18	20	10	21	22	12	530	17

ANNEX 5 contd.
Spatial survey data: Invertebrates

	BT1	BT2	BT3	BT4	BT5	BT6	BT7	BT8	BT9	BT10	BT11	BT12	BT13	BT14	BT15	BT16	BT17	BT18	BT19	BT20	BT21	BT22	BT23	BT24	BT25	BT26	BT27	BT28	BT30	BT31	BT32	Tot	Freq
Troc spec													1																			1	1
Call orna	4	4				1					1		18	30	1									1		1	8		1	1	1	72	13
Call spe1																					1											1	1
Tric cape															2											1						3	2
Tric spe1														1												1						2	2
Neri spe1	3	1											1	1																		6	4
Neri spe2		3				4							4	2													1					14	5
Rhin sine		1				1																										2	2
Plan sulc	2		1										3																			6	3
Plan spe1													3																			3	1
Ceri deco	1																															1	1
Stro muta			1									1	6	5	5	3	2	4					1									28	9
Stro spe1															4			2														6	2
Nati gual		1								1			4		3		1															10	5
Poly didy		1																														1	1
Triv pell		1																														1	1
Cypr annu	5	6	45	9		2					4		19	3	138	179	15	32	7		2	1	15					8				490	17
Cypr helv																								1								1	1
Cypr mone															1	5																6	2
Cypr tigr																												1				1	1
Amo pust			1																													1	1
Nass spe1	2									4																						6	2
Nass spe2										1																						1	1
Nass spe3	1	6																														7	2
Nass albe														1																		1	1
Nass coro														1				1														2	2
Nass oliv										3								2														5	2
Nass plic		1																														1	1
Lati spe1	1	1								1			6	45	9												1	93				157	8
Fusi ocel														1																		1	1
Volv cape		1	2																													3	2
Volv zona		18																														18	1
Canc isab																														1		1	1
Conu spon											1		1			1																3	3
Conu spe1												1																				1	1
Conu text												1					1															2	2
Tere spe1										1																						1	1
Turr spe1										1			1	1																		3	3
Bull spe1	1										1																					2	2
Bull ampu						1						1					2															4	3
Atys nauc															1	2																3	2
Burs spe1	17	16				1					1		20	21					1													77	7
Burs spe2	2	8																														10	2
Mang spe1		14																										1				15	2
Pleu spe1																												1				1	1
Anod aden												1																				1	1
Dola scap															3																	3	1
Cera spe1																								1	1							2	2
Dori spe1															2																	2	1
Dori spe2		2																			1											3	2
Opis spe1																										1	3	1				5	3
Opis spe2			2																									3				5	2
Opis spe3						2																					1	1				4	3
Opis spe4																											1					1	1
Opis spe5																													1			1	1
Opis spe6										5																						5	1
Opis spe7																											1					1	1
Opis spe8																										1						1	1
Opis spe9	1											2																				3	2
Opis spe10												1																				1	1
Tell altr	1	1									1	1		1																		5	5
Tell spe1										1																						1	1
Arcu cape		1				144						3	794	2																		944	5
Tach spe1														1																		1	1
Pinc cape														1																		1	1
Pita abbr													1																			1	1
Biva spe1								1		1																						2	2
Sepi spe1	1																															1	1
Loli spe1		1							1																							2	2
Gono dact																												1				1	1
Stom spe1		2		1												1		3			1		1									9	6
Stom spe2		1																														1	1
Pena japo		1																														1	1
Pena lati		1						3		8	1							4	1													18	6
Pena semi		1							1	2	3	9	1	1			1	13	1							1						34	11
Pena juve		2																														2	1
Mata mono		3						16		16	2							3													9	49	6
Alph spe1										2																						2	1
Alph spe2		3									2						1															6	3
Alph spe3										3								1														4	2
Alph spe4					1																											1	1
Porc spe1																		3														3	1
Pala spe1		6				6							2	2	1	2							1	3		1						24	9
Pala spe2		1																														1	1
Proc spe1											1						1															2	2
Anom spe1	5	20	7	2		6	1				1	6	23	24	3		2	6						2			1	10	3	1	6	129	19
Brac spe1	1																														1	2	2
Brac spe2				1																												1	1
Leuc spe1																														2	7	9	2
Leuc spe2		1																													1	2	2
Leuc spe3													1	6															1			8	3
Cala spe1	1	1							2	5			8	1	1			2	1												1	23	10
Cala spe2																														1		1	1
Cala spe3														1																		1	1
Macr spe1																								1								1	1
Maja spe1									1																					1		2	2
Maja spe2			1									2						2										2				7	4
Maja spe3																													1			1	1
Maja spe4					1																							2				3	2
Maja spe5																2																2	1
Maja spe6																1							1									2	2
Char hell		1		1							2	2						1														7	5
Char hopl											1																					1	1
Port arge										1																						1	1
Port conv							1																									1	1
Port tran	1													1	1									1								4	4
Port gran		1									1			1																		3	3
Port orbi													2																	1	1	4	3
Port spe1		2																													1	3	2
Port spe2								2																								2	1
Port spe3																															1	1	1
Port spe4																															1	1	1
Thal dema																										1						1	1
Thal edwa																				8												8	1
Thal parv		4								6	6							2	3		3	1						1				26	8
Thal pois												7																				7	1
Thal prym																	1															1	1
Thal spe1		2												1												1	2					6	4
Xant spe1																1								1								2	2
Xant spe2	2																1															3	2
Macr depr												1																				1	1
Macr mill		3																1														4	2
Uca urvi		1																														1	1
Aste spe1				1																			1									2	2
Aste spe2															1																	1	1
Ophi vale																			4													4	1
Ophi wahl			1																													1	1
Ophi spe1																		1											1			2	2
Echi spe1																									1	1						2	2
Holo spe1															1																	1	1
Holo spe2																												1				1	1
Total	52	145	61	15	2	168	2	22	5	62	29	39	919	155	177	197	28	83	18	8	8	2	20	11	2	10	19	126	8	8	30	2431	78
Species	19	40	9	6	2	10	2	4	4	18	16	15	21	25	17	10	11	18	7	1	5	2	6	8	2	10	9	14	6	7	11	335	11

ANNEX 6 contd.

Trophic organisation in Gazi bay

	cp1	m	T1	T2	T3	cp4	cp5	sum
Scar sord	1.18	1.91	21.18	11.55	2.50	5.14	4.82	48.27
Scar glob	0.00	0.00	0.00	0.00	1.64	0.00	0.00	1.64
Scar scab	0.09	0.14	0.00	0.09	2.32	0.00	0.00	2.64
Scar psit	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.32
Hipp harl	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.45
Calo spin	0.00	0.00	0.05	0.00	0.50	0.00	0.00	0.55
Lept vaig	5.32	5.77	26.64	32.59	14.64	8.68	6.68	100.32
Both manc	0.55	0.50	0.82	0.45	0.14	0.64	0.68	3.77
Both pant	0.00	0.00	0.00	0.00	0.05	0.32	0.14	0.50
Psue arsi	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05
Leth hara	4.95	7.68	0.82	0.09	0.14	1.64	2.14	17.45
Leth lent	0.00	0.00	0.32	0.00	0.14	0.00	0.00	0.45
Leth mahs	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.18
Leth elon	0.00	0.00	0.95	0.73	0.27	0.05	0.59	2.59
Leth nebu	5.68	4.18	6.68	4.55	2.00	2.59	2.68	28.36
Leth vari	0.00	0.05	0.05	0.05	0.41	0.00	0.00	0.55
Leth larv	0.14	0.09	0.09	0.14	0.23	0.09	0.00	0.77
Siga suto	7.55	9.05	7.59	10.14	2.09	2.00	1.68	40.09
Siga stel	0.27	0.32	0.00	0.05	0.09	0.00	0.00	0.73
Chei iner	0.23	0.59	5.95	5.73	3.14	1.45	2.00	19.09
Para macd	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05
Para moss	2.59	1.41	5.82	5.09	1.91	2.86	1.68	23.36
Scor vari	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05
Apog angu	0.00	0.00	0.00	0.00	2.95	0.00	0.00	2.95
Apog sava	0.00	0.00	0.00	0.18	0.36	0.00	0.00	0.55
Apog frag	1.27	2.64	26.00	7.68	2.18	0.59	0.36	40.73
Apog nigr	13.27	5.68	6.68	8.36	4.73	1.05	0.64	40.41
Apog cook	0.09	0.14	3.18	4.64	3.41	0.09	0.14	11.68
Apog taen	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.45
Foal brac	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.41
Fowl aur	3.45	4.64	13.95	7.41	6.14	2.50	2.45	40.55
Stet str	0.45	0.86	3.86	4.50	4.23	0.95	0.27	15.14
Cori aygu	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.32
Cori caud	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.09
Side pict	0.14	0.14	0.41	0.05	0.32	0.00	0.00	1.05
Syng acus	0.27	0.50	0.59	0.36	0.77	0.23	0.09	2.82
Syng biac	0.86	0.23	1.36	0.55	1.36	0.59	0.32	5.27
Hali scap	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.23
Hali irid	0.09	0.14	2.36	8.95	1.73	0.05	2.50	15.82
Hali hort	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.18
Hali dunc	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.09
Yong nebu	0.23	0.50	1.32	0.14	0.05	0.82	0.18	3.23
Acan line	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.09
Cyno atle	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Coci croc	0.05	0.18	0.00	0.09	0.00	0.00	0.00	0.32
Plat indi	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.09
Plat larv	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.09
Plat lati	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05
Papi long	0.18	0.09	0.18	0.09	0.32	0.05	0.00	0.91
Tera ther	0.14	0.00	0.05	0.00	0.00	0.05	0.00	0.23
Poma tril	0.00	0.00	0.00	0.09	0.27	0.00	0.00	0.36
Plec lacr	0.41	0.27	0.95	0.50	0.36	0.36	0.05	2.91
Saur grac	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Saur undo	0.32	0.68	0.77	0.32	0.23	1.36	0.95	4.64
Chel lin	0.23	0.09	0.27	0.68	0.14	0.14	0.05	1.59
Gerr oyen	0.14	0.00	0.00	0.00	0.00	0.18	0.50	0.82
Lutj gibb	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05
Lutj fulv	0.45	1.77	0.59	0.32	0.05	4.45	1.86	9.50
Paru barb	0.09	0.23	0.18	0.09	0.05	0.05	0.18	0.86
Upen vitt	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05
Plat teir	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05
Plat obic	0.09	0.00	0.27	0.00	0.05	0.18	0.09	0.68
Arot imma	0.23	0.00	0.14	0.00	0.00	0.18	0.18	0.73
Arot hisp	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05
Arot stel	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.09
Fena indi	0.23	0.09	0.18	0.00	0.05	0.18	0.09	0.82
Fena mono	0.59	0.86	1.00	0.00	0.00	0.41	0.45	3.32
Fena temi	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.09
Fena spec	1.64	0.59	0.36	0.09	0.00	0.59	0.41	3.68
Gobi spec	0.27	0.23	1.59	0.32	0.36	0.14	0.00	2.91
Cari shri	0.73	1.77	0.95	0.91	1.23	0.45	0.14	6.18
Acen nuda	0.09	0.00	0.32	0.14	0.00	1.50	0.68	2.73
Epin spec	0.09	0.05	0.00	0.00	0.00	0.00	0.00	0.14
Gram sexl	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05
Fist petu	0.14	0.14	0.00	0.00	0.05	0.00	0.18	0.50
Call nudi	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05
Gnat spec	0.18	0.55	2.50	0.68	0.55	1.14	1.14	6.73
Favo mala	0.05	0.05	0.00	0.00	0.00	0.00	0.05	0.14
Favo reic	0.00	0.09	0.14	0.00	0.05	0.05	0.55	0.86
Favo spec	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.32
Dend brac	0.09	0.05	0.09	0.18	0.14	0.00	0.05	0.59
Crab spec	0.27	0.00	0.09	0.00	0.05	0.00	0.05	0.45
Cant benn	0.00	0.00	0.18	0.77	0.32	0.00	0.05	1.32
Cant sola	0.05	0.05	0.73	0.86	0.27	0.23	0.09	2.27
Cant vale	0.23	0.00	1.23	3.32	2.00	0.41	0.00	7.18
Plot line	0.00	0.00	5.91	56.73	0.18	0.09	3.73	66.64
Plot nkun	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05
Trac bico	0.00	0.09	0.36	0.27	0.59	0.00	0.05	1.36
Plec gate	0.00	0.05	0.73	0.32	0.09	0.14	0.00	1.32
Ceph spec	0.00	0.14	0.23	0.23	0.05	0.05	0.00	0.68
Diad spec	0.00	0.00	0.55	8.41	1.95	0.00	0.00	10.91
Pseu nasi	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05
Para barn	0.14	0.18	3.32	2.32	0.82	0.50	0.55	7.82
Brot mult	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05
Star fish	0.00	0.00	0.05	0.27	0.05	0.00	0.00	0.36
Ambl alti	0.00	0.36	0.27	0.23	0.09	0.32	0.09	1.36
Chae line	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05
Trip gran	0.00	0.00	8.18	13.50	6.82	0.00	0.27	28.77
Jell fish	0.00	0.14	2.82	1.00	0.55	9.73	0.86	15.09
Lact corn	0.00	0.09	0.09	0.09	0.05	0.27	0.09	0.68
Lact forn	0.00	0.09	0.09	0.18	0.27	0.14	0.18	0.95
Chei line	0.00	0.00	0.64	1.32	3.18	0.00	0.00	5.14
Chae aur	0.00	0.00	0.05	0.05	0.05	0.00	0.00	0.14
Chae klei	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.09
Chae mela	0.00	0.00	0.00	0.09	0.05	0.00	0.00	0.14
Trio macr	0.05	0.05	0.18	0.23	0.41	0.00	0.05	0.95
Petr brev	0.68	0.68	3.27	1.09	0.95	0.77	0.32	7.77
Petr mitr	1.05	0.32	2.32	1.05	0.91	0.50	0.18	6.32
Sync marm	0.00	0.00	0.59	0.27	0.00	0.09	0.05	1.00
Olig kese	0.00	0.00	0.05	0.00	0.00	0.00	0.09	0.14
Abla bino	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05
Amb l sphy	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
Aste semi	0.00	0.09	0.05	0.00	0.14	0.00	0.00	0.27
Para bili	0.00	0.05	0.14	0.00	0.00	0.18	0.05	0.41
Hipp cape	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05
Hipp came	0.00	0.00	0.05	0.14	0.14	0.05	0.00	0.36
Hipp hist	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.09
Upen trag	0.00	0.05	0.09	0.05	0.05	0.00	0.00	0.23
Aeol punc	0.00	0.09	0.14	0.23	0.05	0.00	0.05	0.55
Diod hyst	0.00	0.00	0.09	0.14	0.00	0.00	0.00	0.23
Ante comm	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05
Pter poly	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05
Epib insi	0.00	0.09	0.09	0.09	0.27	0.00	0.00	0.55
Nova macr	0.00	0.00	0.18	0.45	1.45	0.05	0.05	2.18
Dact orie	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05
Acro japo	0.00	0.00	0.00	0.27	0.00	0.05	0.00	0.32
Echi poly	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05
Loph calo	0.00	0.00	0.00	0.09	0.09	0.00	0.00	0.18
Amba prod	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.09
Anam caer	0.00	0.00	0.05	0.09	0.00	0.14	0.00	0.27
Labr dimi	0.00	0.00	0.00	0.05	0.09	0.00	0.00	0.14
Hali duss	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.09
Pter flag	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.09
Stet inte	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05

1 'Carnivores

	cp1	m	T1	T2	T3	cp4	cp5	sum
Both manc	0.55	0.50	0.82	0.45	0.14	0.64	0.66	3.8
Both pent	0.00	0.00	0.00	0.00	0.05	0.32	0.14	0.5
Leth hara	4.95	7.68	0.82	0.09	0.14	1.64	2.14	17.5
Leth lent	0.00	0.00	0.32	0.00	0.14	0.00	0.00	0.5
Leth mahs	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.2
Leth elon	0.00	0.00	0.95	0.73	0.27	0.05	0.59	2.6
Leth nebu	5.68	4.18	6.68	4.55	2.00	2.59	2.68	28.4
Leth vari	0.00	0.05	0.05	0.05	0.41	0.00	0.00	0.5
Leth larv	0.14	0.09	0.09	0.14	0.23	0.09	0.00	0.8
Chei iner	0.23	0.59	5.95	5.73	3.14	1.45	2.00	19.1
Para moss	2.59	3.41	5.82	5.09	1.91	2.86	1.68	23.4
Apog angu	0.00	0.00	0.00	0.00	2.95	0.00	0.00	3.0
Apog sava	0.00	0.00	0.00	0.18	0.36	0.00	0.00	0.5
Apog frag	1.27	2.64	26.00	7.68	2.18	0.59	0.36	40.7
Apog nigr	13.27	5.68	6.68	8.36	4.73	1.05	0.64	40.4
Apog cook	0.09	0.14	3.18	4.64	3.41	0.09	0.14	11.7
Apog taen	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.5
Foal brac	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.4
Fowl aur	3.45	4.64	13.95	7.41	6.14	2.50	2.45	40.5
Stet str	0.45	0.86	3.86	4.50	4.23	0.95	0.27	15.1
Cori aygu	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.3
Cori caud	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.1
Side pict	0.14	0.14	0.41	0.05	0.32	0.00	0.00	1.0
Syng acus	0.27	0.50	0.59	0.36	0.77	0.23	0.09	2.8
Syng biac	0.86	0.23	1.36	0.55	1.36	0.59	0.32	5.3
Hali scap	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.2
Hali irid	0.09	0.14	2.36	8.95	1.73	0.05	2.50	15.8
Hali hort	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.2
Hali dunc	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.1
Yong nebu	0.23	0.50	1.32	0.14	0.05	0.82	0.18	3.2
Cyno atle	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.1
Coci croc	0.05	0.18	0.00	0.09	0.00	0.00	0.00	0.3
Plat indi	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.1
Plat larv	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.1
Papi long	0.18	0.09	0.18	0.09	0.32	0.05	0.00	0.9
Saur undo	0.32	0.68	0.77	0.32	0.23	1.36	0.95	4.6
Gerr oyen	0.14	0.00	0.00	0.00	0.00	0.18	0.50	0.8
Lutj fulv	0.45	1.77	0.59	0.32	0.05	4.45	1.86	9.5
Paru barb	0.09	0.23	0.18	0.09	0.05	0.05	0.18	0.9
Acen nuda	0.09	0.00	0.32	0.14	0.00	1.50	0.68	2.7
Epin spec	0.09	0.05	0.00	0.00	0.00	0.00	0.00	0.1
Fist petu	0.14	0.14	0.00	0.00	0.05	0.00	0.18	0.5
Gnat spec	0.18	0.55	2.50	0.68	0.55	1.14	1.14	6.7
Favo mala	0.05	0.05	0.00	0.00	0.00	0.00	0.05	0.1
Favo reic	0.00	0.09	0.14	0.00	0.05	0.05	0.55	0.9
Favo spec	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.3
Dend brac	0.09	0.05	0.09	0.18	0.14	0.00	0.05	0.6
Plot line	0.00	0.00	5.91	56.73	0.18	0.09	3.73	66.6
Trac bico	0.00	0.09	0.36	0.27	0.59	0.00	0.05	1.4
Plec gate	0.00	0.05	0.73	0.32	0.09	0.14	0.00	1.3
Lact corn	0.00	0.09	0.09	0.09	0.05	0.27	0.09	0.7
Lact forn	0.00	0.09	0.09	0.18	0.27	0.14	0.18	1.0
Sync marm	0.00	0.00	0.59	0.27	0.00	0.09	0.05	1.0
Olig kese	0.00	0.00	0.05	0.00	0.00	0.00	0.09	0.1
Hipp came	0.00	0.00	0.05	0.14	0.14	0.05	0.00	0.4
Hipp hist	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.1
Upen trag	0.00	0.05	0.09	0.05	0.05	0.00	0.00	0.2
Aeol punc	0.00	0.09	0.14	0.23	0.05	0.00	0.05	0.5
Diod hyst	0.00	0.00	0.09	0.14	0.00	0.00	0.00	0.2
Epib insi	0.00	0.09	0.09	0.09	0.27	0.00	0.00	0.5
Loph calo	0.00	0.00	0.00	0.09	0.09	0.00	0.00	0.2
Amba prod	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.1
Anam caer	0.00	0.00	0.05	0.09	0.00	0.14	0.00	0.3
Labr dimi	0.00	0.00	0.00	0.05	0.09	0.00	0.00	0.1
Hali duss	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.1
Chei tril	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.4
Chei undu	0.05	0.00	0.82	1.18	0.45	0.05	0.05	2.6
Sole blee	0.00	0.05	0.00	0.00	0.00	0.00	0.05	0.1
Sole cyan	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.1
Pela quad	0.55	0.18	0.18	0.05	0.00	0.64	0.14	1.7
Sphy jell	0.05	0.05	0.00	0.00	0.00	0.14	0.50	0.7
Pter mile	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.1
Stol indi	0.00	0.00	0.00	0.00	0.05	0.00	0.09	0.1
Cara igno	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.1
Chei quin	0.00	0.00	0.05	0.09	0.82	0.18	0.23	1.4
Cymo prae	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.1
Ceph spec	0.00	0.14	0.23	0.23	0.05	0.05	0.00	0.7
sum	37.0	37.1	95.7	122.4	43.5	27.2	28.5	391.3
count	77							
mean catch	0.48	0.48	1.24	1.59	0.56	0.35	0.37	5.08
se	0.20	0.15	0.41	0.76	0.13	0.09	0.09	1.33

ANNEX 6 contd.

Trophic organisation in Gazi bay

	cp3	m	T1	T2	T3	cp4	cp6	sum
Chei tril	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.36
Chei oxyc	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00
Chei undu	0.05	0.00	0.82	1.18	0.45	0.05	0.05	2.59
Cheil bim	0.00	0.00	0.18	1.86	1.18	0.00	0.05	3.27
Chry annu	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.09
Dasc aru	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.09
Para pili	0.00	0.00	0.00	0.14	0.00	0.68	0.23	1.05
Holo spec	0.00	0.00	0.00	0.00	0.14	0.00	0.05	0.18
Ostr cubi	0.00	0.09	0.00	0.00	0.09	0.00	0.05	0.23
Able hian	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05
Sole blee	0.00	0.05	0.00	0.00	0.00	0.00	0.05	0.09
Sole cyan	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.09
Pela quad	0.55	0.18	0.18	0.05	0.00	0.64	0.14	1.73
Sphy jell	0.05	0.05	0.00	0.00	0.00	0.14	0.50	0.73
Oxyu spec	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05
Pter mile	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.09
Stol indi	0.00	0.00	0.00	0.00	0.05	0.00	0.09	0.14
Cara igno	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09
Bemp plat	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05
Chei quin	0.00	0.00	0.05	0.09	0.82	0.18	0.23	1.36
Cten stri	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Cymo pres	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.09
Holo doli	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05
Pter tean	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.09
Neop fuli	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.45
Hipp long	0.00	0.00	0.18	0.18	0.00	0.00	0.00	0.36
Epin male	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05
sum	58.55	60.23	181.81	217.55	93.41	59.18	46.68	717.50
count	162							
mean catch	0.36	0.37	1.12	1.34	0.58	0.37	0.29	4.43
sr	0.11	0.10	0.29	0.43	0.12	0.10	0.07	0.97

ANNEX 6 contd.

Trophic organisation in Gazi bay (contd.)

2 omnivores

	cp3	m	T1	T2	T3	cp4	cp5	sum
Scar sord	1.18	1.91	21.18	11.55	2.50	5.14	4.82	48.3
Lept vaig	5.32	5.77	26.64	32.59	14.64	8.68	6.68	100.3
Siga suto	7.55	9.05	7.59	10.14	2.09	2.00	1.68	40.1
Acan line	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.1
Poma tri	0.00	0.00	0.00	0.09	0.27	0.00	0.00	0.4
Plec lacr	0.41	0.27	0.95	0.50	0.36	0.36	0.05	2.9
Plat obic	0.09	0.00	0.27	0.00	0.05	0.18	0.09	0.7
Arot imma	0.23	0.00	0.14	0.00	0.00	0.18	0.18	0.7
Arot hisp	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.0
Pena indi	0.23	0.09	0.18	0.00	0.05	0.18	0.09	0.8
Pena mono	0.59	0.86	1.00	0.00	0.00	0.41	0.45	3.3
Pena semi	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.1
Pena spec	1.64	0.59	0.36	0.09	0.00	0.59	0.41	3.7
Gobi spec	0.27	0.23	1.59	0.32	0.36	0.14	0.00	2.9
Cari shri	0.73	1.77	0.95	0.91	1.23	0.45	0.14	6.2
Crab spec	0.27	0.00	0.09	0.00	0.05	0.00	0.05	0.5
Cant benn	0.00	0.00	0.18	0.77	0.32	0.00	0.05	1.3
Cant sola	0.05	0.05	0.73	0.86	0.27	0.23	0.09	2.3
Cant vale	0.23	0.00	1.23	3.32	2.00	0.41	0.00	7.2
Para barn	0.14	0.18	3.32	2.32	0.82	0.50	0.55	7.8
Ambl albi	0.00	0.36	0.27	0.23	0.09	0.32	0.09	1.4
Chae line	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.0
Chae auri	0.00	0.00	0.05	0.05	0.05	0.00	0.00	0.1
Chae klei	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.1
Chae mela	0.00	0.00	0.00	0.09	0.05	0.00	0.00	0.1
Trio macr	0.05	0.05	0.18	0.23	0.41	0.00	0.05	1.0
Petr brev	0.68	0.68	3.27	1.09	0.95	0.77	0.32	7.8
Petr mitr	1.05	0.32	2.32	1.05	0.91	0.50	0.18	6.3
Aste semi	0.00	0.09	0.05	0.00	0.14	0.00	0.00	0.3
Nova macr	0.00	0.00	0.18	0.45	1.45	0.05	0.05	2.2
Chei oxyc	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.0
Cheil bim	0.00	0.00	0.18	1.86	1.18	0.00	0.05	3.3
Chry annu	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.1
Dasc arua	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.1
Para pili	0.00	0.00	0.00	0.14	0.00	0.68	0.23	1.0
Ostr cubi	0.00	0.09	0.00	0.00	0.09	0.00	0.05	0.2
Cten stri	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Neop fuli	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.5
sum	20.82	22.36	73.05	68.86	31.41	21.77	16.77	255.05
count	38							
mean catch	0.55	0.59	1.92	1.81	0.83	0.57	0.44	6.71
se	0.24	0.28	0.89	0.92	0.39	0.26	0.21	3.00

3 herbivores

	cp3	m	T1	T2	T3	cp4	cp5	sum
Scar glob	0.00	0.00	0.00	0.00	1.64	0.00	0.00	1.6
Scar scab	0.09	0.14	0.00	0.09	2.32	0.00	0.00	2.6
Scar psit	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.3
Hipp harr	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.5
Calo spin	0.00	0.00	0.05	0.00	0.50	0.00	0.00	0.5
Siga stel	0.27	0.32	0.00	0.05	0.09	0.00	0.00	0.7
Enad spec	0.00	0.00	0.55	8.41	1.95	0.00	0.00	10.9
Trip grat	0.00	0.00	8.18	13.50	6.82	0.00	0.27	28.8
sum	0.36	0.45	8.77	22.05	14.09	0.00	0.27	46.00
count	8							
mean catch	0.05	0.06	1.10	2.76	1.76	0.00	0.03	5.75
se	0.03	0.04	1.01	1.85	0.78	0.00	0.03	3.52

4 Herbivores with Scar sord, Lept vaig and Siga suto

	cp3	m	T1	T2	T3	cp4	cp5	sum
Scar sord	1.16	1.91	21.18	11.55	2.50	5.14	4.82	48.3
Lept vaig	5.32	5.77	26.64	32.59	14.64	8.68	6.68	100.3
Siga suto	7.55	9.05	7.59	10.14	2.09	2.00	1.68	40.1
Scar glob	0.00	0.00	0.00	0.00	1.64	0.00	0.00	1.6
Scar scab	0.09	0.14	0.00	0.09	2.32	0.00	0.00	2.6
Scar psit	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.3
Hipp harr	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.5
Calo spin	0.00	0.00	0.05	0.00	0.50	0.00	0.00	0.5
Siga stel	0.27	0.32	0.00	0.05	0.09	0.00	0.00	0.7
Enad spec	0.00	0.00	0.55	8.41	1.95	0.00	0.00	10.9
Trip grat	0.00	0.00	8.18	13.50	6.82	0.00	0.27	28.8
sum	14.41	17.18	64.18	76.32	33.32	15.82	13.45	234.68
count	11							
mean catch	1.31	1.56	5.83	6.94	3.03	1.44	1.22	21.33
se	0.79	0.91	2.87	3.05	1.29	0.87	0.70	9.51

5 Omnivores without Scar sord, Lept vaig and Siga suto

	cp3	m	T1	T2	T3	cp4	cp5	sum
Acan line	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.1
Poma tri	0.00	0.00	0.00	0.09	0.27	0.00	0.00	0.4
Plec lacr	0.41	0.27	0.95	0.50	0.36	0.36	0.05	2.9
Plat obic	0.09	0.00	0.27	0.00	0.05	0.18	0.09	0.7
Arot imma	0.23	0.00	0.14	0.00	0.00	0.18	0.18	0.7
Arot hisp	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.0
Pena indi	0.23	0.09	0.18	0.00	0.05	0.18	0.09	0.8
Pena mono	0.59	0.86	1.00	0.00	0.00	0.41	0.45	3.3
Pena semi	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.1
Pena spec	1.64	0.59	0.36	0.09	0.00	0.59	0.41	3.7
Gobi spec	0.27	0.23	1.59	0.32	0.36	0.14	0.00	2.9
Cari shri	0.73	1.77	0.95	0.91	1.23	0.45	0.14	6.2
Crab spec	0.27	0.00	0.09	0.00	0.05	0.00	0.05	0.5
Cant benn	0.00	0.00	0.18	0.77	0.32	0.00	0.05	1.3
Cant sola	0.05	0.05	0.73	0.86	0.27	0.23	0.09	2.3
Cant vale	0.23	0.00	1.23	3.32	2.00	0.41	0.00	7.2
Para barn	0.14	0.18	3.32	2.32	0.82	0.50	0.55	7.8
Ambl albi	0.00	0.36	0.27	0.23	0.09	0.32	0.09	1.4
Chae line	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.0
Chae auri	0.00	0.00	0.05	0.05	0.05	0.00	0.00	0.1
Chae klei	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.1
Chae mela	0.00	0.00	0.00	0.09	0.05	0.00	0.00	0.1
Trio macr	0.05	0.05	0.18	0.23	0.41	0.00	0.05	1.0
Petr brev	0.68	0.68	3.27	1.09	0.95	0.77	0.32	7.8
Petr mitr	1.05	0.32	2.32	1.05	0.91	0.50	0.18	6.3
Aste semi	0.00	0.09	0.05	0.00	0.14	0.00	0.00	0.3
Nova macr	0.00	0.00	0.18	0.45	1.45	0.05	0.05	2.2
Chei oxyc	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.0
Cheil bim	0.00	0.00	0.18	1.86	1.18	0.00	0.05	3.3
Chry annu	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.1
Dasc arua	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.1
Para pili	0.00	0.00	0.00	0.14	0.00	0.68	0.23	1.0
Ostr cubi	0.00	0.09	0.00	0.00	0.09	0.00	0.05	0.2
Cten stri	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Neop fuli	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.5
sum	6.77	5.64	17.64	14.59	12.18	5.95	3.59	66.36
count	35							
mean catch	0.19	0.16	0.50	0.42	0.35	0.17	0.10	1.90
se	0.06	0.06	0.15	0.13	0.09	0.04	0.03	0.41

ANNEX 6 contd.

TWINSPAN 3D table on fish stomach contents.

```
ORDER OF SPECIES INCLUDING RARER ONES
  2 pisc   !  3 deca    !  4 mysi    !  5 cala    !  6 harp    !  9 isop    ! 13 chae    !  7 tana
  8 amph   ! 10 polc    ! 14 othe    !  1 alga    ! 11 moll    ! 12 medu    !
```

```
ORDER OF SAMPLES
 24   le  ! 33   su  !  4   pm  !  9   fa  ! 22   ch  ! 32   cq  ! 26   lf  ! 11   bp
 17   sb  ! 29   pg  ! 30   ac  ! 21   co  ! 25   lh  ! 31   al  !  5   ln  !  6   ci
  7   af  !  8   an  ! 10   pl  ! 12   nf  ! 20   st  ! 27   pq  ! 13   da  ! 16   tb
 14   cb  ! 23   nm  ! 28   bn  ! 15   cv  ! 19   mt  !  1   lv  !  2   ss  !  3   sc
 18   bv  !
```

```
            23  2321123223    11221112211   1
            434922617901515678020736438591238

   2 pisc   5533545-------32-----------------  000
   3 deca   1-554535444---23442-------1------  000
   4 mysi   1-----311--2---------------------  000
   5 cala   --------1--2--2233343455---------  001
   6 harp   ------------------2-322----------  001
   9 isop   --------4---------1---2----------  001
  13 chae   ----------------123--------------  001
   7 tana   2---------4------2--1-------3----  01
   8 amph   ------2423355544-23-23--423------  01
  10 polc   ---------3--3-3------------22----  01
  14 othe   3-11111112231-3232234113111211113  01
   1 alga   ------------------------435555555  1
  11 moll   -------2-------22--414--34132---2  1
  12 medu   -------------1-----------4-------  1

            000000000000000000000000111111111
            000000011111111111111111000111111
            001111100000000011111111   001111
              0000100001111100011111
                       00011   00011
```

ANNEX 6 contd.
TWINSPAN 3D table on stomach contents of *Cheilio inermis*.

```
ORDER OF SPECIES INCLUDING RARER ONES
   5 haju     !   8 gamm     !   2 deca     !   3 caju     !   1 ostr     !   4 cadu     !   6 hadu     !   7 tana
  10 isop     !  11 biva     !  12 gast     !  13 medu     !   9 capr     !  14 othe     !



ORDER OF SAMPLES
  61 ci080225 !  51 ci050224 !  52 ci050327 !  63 ci080427 !  64 ci080526 !  56 ci050730 !  58 ci050927 !  68 ci080935
  69 ci081039 !  53 ci050431 !  62 ci080321 !  65 ci080637 !  45 ci040777 !  72 ci081346 !  84 ci082571 !  87 ci082862
  92 ci083311 ! 101 ci110333 ! 107 ci110948 !  39 ci040196 !  27 ci030863 !  30 ci031242 !  37 ci031944 !  44 ci040630
  47 ci040942 !  50 ci050145 !  86 ci082765 !  89 ci083055 !  95 ci083692 ! 102 ci110436 !   2 ci010228 !  16 ci011742
  17 ci011844 !  42 ci040452 !  55 ci050638 !  60 ci080127 !  67 ci080831 !  70 ci081141 !  76 ci081742 ! 100 ci110232
 103 ci110557 ! 104 ci110649 !  18 ci011958 !  32 ci031448 !  35 ci031743 !  36 ci031844 !  48 ci041044 !  77 ci081843
   3 ci010321 !   4 ci010427 !   5 ci010532 !   6 ci010631 !   7 ci010733 !   8 ci010830 !   9 ci010928 !  29 ci031145
  31 ci031347 !  34 ci031641 !  38 ci032042 !  43 ci040537 !  54 ci050530 !  57 ci050835 ! 105 ci110732 !   1 ci010130
  10 ci011042 !  11 ci011143 !  15 ci011642 !  12 ci011345 !  13 ci011444 !  49 ci041155 !  14 ci011545 !  19 ci012074
  23 ci030461 ! 106 ci110842 !  22 ci030362 !  41 ci040370 !  97 ci083882 !  20 ci030161 !  21 ci030264 !  46 ci040855
  59 ci051052 !  71 ci081246 !  74 ci081546 !  75 ci081645 !  88 ci082955 !  93 ci083411 !  25 ci030661 !  26 ci030765
  28 ci030961 !  33 ci031541 !  73 ci081445 !  81 ci082260 !  96 ci083788 !  24 ci030563 !  78 ci081938 !  79 ci082049
  80 ci082148 !  91 ci083210 !  94 ci083510 !  98 ci083981 !  82 ci082352 !  83 ci082455 !  85 ci082668 !  66 ci080736
  90 ci083112 !  40 ci040210 !  99 ci084010 ! 108 ci111067 !

                                      11          1         111                     1          1
                    6556655665664788900323344558890 11456677000133347      23334550 111114112024922457778922237892778999
                    1123468893255247217970747069522672507060348256873456789914834751015239493621701691458356833164890148

   5 haju           44444-221331------------------------1----------------------------------------------------1------3---  000
   8 gamm           -13342255555566566654445424444455544445555212134122313333-3122331232--33442-24443344342123314--3-333  000
   2 deca           -4----2------------3-----4--------------------------------------------------------------------------  00100
   3 caju           --32-5532--------------------2-------------------------------143-----------------------------------1  00100
   1 ostr           4----------------------------------------------2-22-1------------------------8--------------------2-  00101
   4 cadu           ---33---------------4343433444---2--33--2-2444335234532455455432--124--------------------24--23-----  00101
   6 hadu           ---1-------------1----2----2-24111-3-323-2212232343324431333--23222---3--2-------11-----------------  00101
   7 tana           ------------2------------------12---------3------33-3-3--------355454644441232-2-----2--------------  00101
  10 isop           2-----------1----1-1----------1-1-4222-2--1-----11111111---12---1-111--1-----1--3-21--1---2--1222---  0011
  11 biva           ---------------1----1------1--1---------------------------------------------------------1------11111  0011
  12 gast           --------------------------------------------------3----------------------------3------------------43  0011
  13 medu           ---------------2----2-----------------------1-----1-----------------------2--------------1---2-11---  0011
   9 capr           --------2---------------------------2-----4444431----------------23--------553444444445554554554544-  01
  14 othe           ------1------------------2---2-2---------------1-------------2-------------2-----------------------3  1

                    0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
                    0000000000000000000000000000000000000000000000000000000000000000000000000001111111111111111111111111
                    0000000000000000000011111111111111111111111111111111111111111111111111111110000000000000000000000111
                    0000000111111111111100000000000000000000000000000000000000000001111111111000000000000000000001111000
                    0111111000001111111100000000000000000111111111111111111111111110000000111100011111111111111111
                     0000110011100000001000000000011111111111000000111111111111111110000111      0000000001111111


                           1
                    88869490
                    23560098

   5 haju           ---1----  000
   8 gamm           121331--  000
   2 deca           --------  00100
   3 caju           --------  00100
   1 ostr           --------  00101
   4 cadu           --------  00101
   6 hadu           --------  00101
   7 tana           --------  00101
  10 isop           32------  0011
  11 biva           111-----  0011
  12 gast           555-----  0011
  13 medu           --------  0011
   9 capr           2-33----  01
  14 othe           ---44666  1

                    00011111
                    11100111
                    111
                    111
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Apogon fragilis.*

```
ORDER OF SPECIES INCLUDING RARER ONES
   2 deca      !   7 tana     !   8 amph      !   1 ostr      !   6 hadu      !   9 isop      !  10 asci      !   3 caju
   4 cadu      !   5 haju     !  11 othe      !


ORDER OF SAMPLES
  24  af03135 !  29  af03185 !  38  af04014 !  41  af04153 !  22  af03084 !  34  af03243 !  21  af03073 !  25  af03145
  26  af03155 !  27  af03165 !  28  af03175 !  31  af03205 !  33  af03223 !  35  af03253 !  17  af03024 !  16  af03013
  23  af03115 !  30  af03195 !  36  af03263 !  32  af03213 !  37  af03273 !  19  af03044 !  49  af04405 !  53  af05122
  56  af05172 !  58  af05202 !   1  af01012 !   3  af01032 !   6  af01062 !  11  af01112 !   2  af01022 !   5  af01052
   7  af01072 !   8  af01082 !   9  af01092 !  10  af01102 !  12  af01122 !  13  af01132 !  14  af01142 !  15  af01152
   4  af01042 !  39  af04074 !  40  af04133 !  52  af05112 !  42  af04193 !  45  af04253 !  50  af04424 !  60  af08115
  44  af04243 !  46  af04264 !  61  af08123 !  20  af03054 !  48  af04393 !  54  af05134 !  57  af05192 !  43  af04203
  47  af04313 !  59  af08075 !  62  af08184 !  63  af08204 !  64  af11046 !  18  af03034 !  51  af05062 !  55  af05162


                 22342322222333112333314555   1     11111 34544564462455445666155
                 4981241567813576306279936813612578902345490225004610847379234815

   2 deca        5556----------------------3--2----2----------------------------- 00
   7 tana        111-5556666666555445422---1------------------------------------- 00
   8 amph        -1------------233443455---1---311221111-4-------55444----------- 00
   1 ostr        --------------------------333----3-----2-----------5-6---------- 010
   6 hadu        ----321--------3--3321----33314333223222----666644432---------3- 010
   9 isop        -------------------1--1----1---11111-111----------2------------- 010
  10 asci        -----------------------------1--2------1------------4-1--------- 010
   3 caju        -----------------------5554444243-443443---------------3-------- 011
   4 cadu        -----2-------------33-----444454555455455666------4------------3 011
   5 haju        ---------------------1-22222222223122232------------1-1--------- 011
  11 othe        --------------------------1-------------------------4-5666666555 1

                 0000000000000000000000000000000000000000000000000000001111111111
                 0000000000000000000000011111111111111111111111111111110000000011
                 00001111111111111111111000000000000000000000111111111101111111
                     00000000000111111110000000000000000011110000000001 0000001
                     001111111110000001100011111111111111    000000011
                       000000001000011     00001111111111    0000111
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Apogon fragilis*.

```
ORDER OF SPECIES INCLUDING RARER ONES
   3 cari     !  4 mysi     !  5 caju     !  6 cadu     !  7 haju     ! 14 serg     ! 22 chae     !  2 ostr
  16 euph     ! 17 asci     ! 20 lept     !  8 hadu     ! 10 gamm     ! 12 isop     !  9 tana     ! 11 capr
  13 pena     ! 19 ceph     !  1 pisc     ! 15 cuma     ! 18 biva     ! 21 eggs     !


ORDER OF SAMPLES
  43  af04203 !  18  af03034 !  47  af04313 !  20  af03054 !  42  af04193 !  44  af04243 !  45  af04253 !  46  af04264
  48  af04393 !  50  af04424 !  54  af05134 !  60  af08115 !  61  af08123 !   1  af01012 !   2  af01022 !   3  af01032
   4  af01042 !   5  af01052 !   6  af01062 !   7  af01072 !   8  af01082 !   9  af01092 !  10  af01102 !  11  af01112
  12  af01122 !  13  af01132 !  14  af01142 !  15  af01152 !  39  af04074 !  40  af04133 !  51  af05062 !  52  af05112
  53  af05122 !  55  af05162 !  56  af05172 !  57  af05192 !  58  af05202 !  16  af03013 !  19  af03044 !  23  af03115
  32  af03213 !  36  af03263 !  37  af03273 !  17  af03024 !  21  af03073 !  22  af03084 !  25  af03145 !  26  af03155
  27  af03165 !  28  af03175 !  31  af03205 !  33  af03223 !  34  af03243 !  35  af03253 !  30  af03195 !  49  af04405
  24  af03135 !  29  af03185 !  38  af04014 !  41  af04153 !  59  af08075 !  62  af08184 !  63  af08204 !  64  af11046


               4142444445566         111111345555555112333122222233333422345666
               3870245680401123456789012345901235678693267712567813450949819234

    3 cari     -------------3-------2------------------------------------------0000
    4 mysi     -------------1--------------------------------------------------0000
    5 caju     -------------424-443-4443443---5-535----------------------------0000
    6 cadu     ------------44545445554455456636-3------3-3----------2---------- 0000
    7 haju     --------1----222-22231222232----2-212-1-------------------------0000
   14 serg     -----------------------2----------------------------------------0000
   22 chae     ------------------------------5--5-5----------------------------0000
    2 ostr     ---5------6--3-3--3-3------2------------------------------------0001
   16 euph     --------4-------------------------------------------------------0001
   17 asci     --------4----------2---1---1-------1----------------------------0001
   20 lept     -56-------------------------------------------------------------0001
    8 hadu     -3-3646426-64343-33332213222---------31-332-13-------2---------- 001
   10 gamm     ---4-5-54---413-41-12-1-111----------3533432--------------1----- 001
   12 isop     ------------2--1-1-1111--111------------1---------------1------- 001
    9 tana     -------------1-----------------------5255445556666665642111----- 01
   11 capr     ---------------------2--------------------4------------5-------- 01
   13 pena     ---------------------------------------------------------556---- 01
   19 ceph     6---------------------------------------------------------------01
    1 pisc     ---------------------------------------------------------------51
   15 cuma     -------------------------------------------------------------6-- 1
   18 biva     --------------------------------------------------------------66 1
   21 eggs     ---------------------------------------------------------------41

               0000000000000000000000000000000000000000000000000000000000001111
               011111111111111111111111111111111111111111111111111111111111
                0000000000000000000000000000000000000000000000000000000001111
                0000000000000000000000000000000000001111111111111111111
                0011111111111111111111111111111111111000000000000000011
                  000000000111111111111111111111111110000001111111111
```

ANNEX 6 contd.

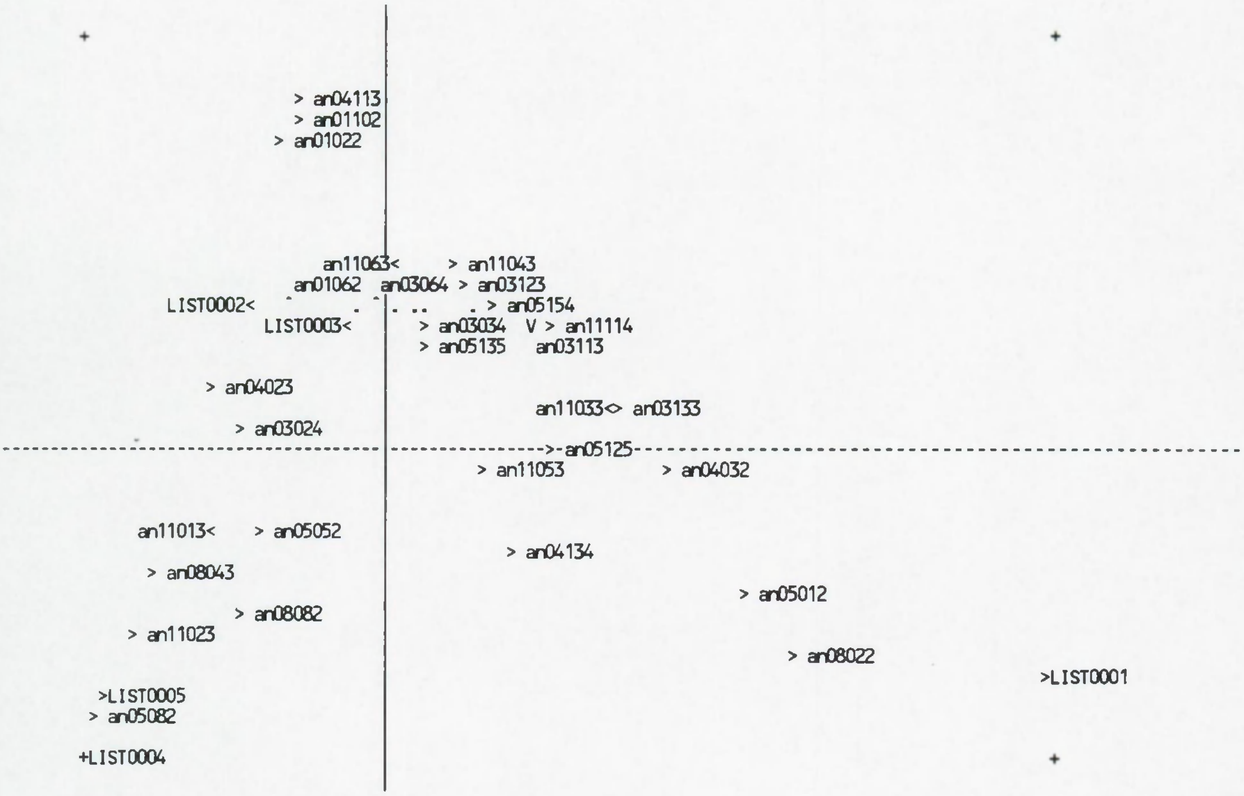
TWINSPAN 3D table on stomach contents of *Apogon nigripes*.

```
 ORDER OF SPECIES INCLUDING RARER ONES
   13 jiso      !   9 gama      !  15 serg      !  14 pena      !  10 capr      !  11 isop      !   8 tana      !  20 gast
   19 asct      !   6 haju      !   4 caju      !  21 lept      !  17 euph      !  16 cuma      !   7 hadu      !  23 chae
   12 giso      !   5 cadu      !   3 cari      !  18 poly      !   2 ostr      !   1 brac      !  22 eggs      !

ORDER OF SAMPLES
    1 an010229 !   3 an010629 !   4 an010926 !  25 an040930 !  42 an080528 !  44 an080826 !  30 an050521 !  31 an050623
   34 an051024 !  39 an080229 !  40 an080327 !  43 an080727 !  45 an081026 !  52 an110633 !  53 an110831 !  23 an040627
   28 an050123 !  32 an050725 !  26 an041137 !  27 an041340 !  46 an081247 !  38 an051543 !  55 an111243 !  10 an030542
   12 an030736 !  14 an030933 !  15 an031039 !  16 an031137 !  17 an031236 !  18 an031334 !  37 an051352 !  54 an111143
    9 an030440 !  29 an050224 !  35 an051143 !  36 an051252 !  47 an110133 !  48 an110234 !  49 an110332 !  50 an110435
   51 an110531 !   7 an030244 !  11 an030643 !  13 an030842 !  20 an040230 !   6 an011329 !  19 an040129 !   5 an011027
    8 an030340 !  21 an040329 !  22 an040526 !  24 an040728 !  33 an050824 !  41 an080430 !   2 an010330 !


                        24433334445522322435111111135 23344455 112 1  22234
                     1345240149035233826768502456787499567890171306958124312

   13 jiso           ----43---------------------------------1--------------- 111
    9 gama           12-13355444545534332-111--------131213-2--1--22-------- 111
   15 serg           444---------------------------------2------------------ 110
   14 pena           ---4-------------------2------------------------------- 110
   10 capr           2--------------434---2----------------2---------------- 110
   11 isop           -3-------1-------------1----------1---1-----13--------- 10
    8 tana           1-2--3--232-3----2-----333-322-33--------4443445555555- 10
   20 gast           --------------------------------------------3---------- 0111
   19 asct           ----------------------1-----------1------1------------- 0111
    6 haju           --------------------------------------------1---------- 0111
    4 caju           ----------------------1---------------------2---------- 0111
   21 lept           -------------------3----------------------------------- 0110
   17 euph           ------------------23----------------------------------- 0110
   16 cuma           ----------------------1-----1--1---------1------------- 0110
    7 hadu           ------------------435-122232222---2------2112---------- 0110
   23 chae           ---------------------44-----3-------------------------- 0101
   12 giso           ------------------2--211--------1-32--1-1-------------- 0101
    5 cadu           ----------------------2444444444334444344333----------- 01001
    3 cari           ---------------------------3----------3---------------- 01001
   18 poly           ----------------------1-----------3--2----------------- 01000
    2 ostr           ------------------------------------1-1-2-------------- 01000
    1 brac           ----------------------1-------------3-22--------------- 01000
   22 eggs           ---------------------------2--------------------------5 00

                     0000000000000000000000000000000000000000000000000000001
                     000000000000000000111111111111111111111111111111111111
                     000111111111111111000000000000000000000001111111111111
                        011111111111111000111111111111111111110000111111111
                         00000000000111   001111111111111111111    001111111
                         00111111111        000000000111111111
```

ANNEX 6 contd.

Apogon nigripes contd. (CA)

```
 Samp: Sample scores
 nigripes
   CA  Canonical axes:  0  Covariables:   0  Scaling:  2
Horizontal: Axis 1, vertical: Axis 2 Scale number 7
Scale :   2.671310E-01 units/cm,  so 1 unit =       3.743481 cm.
Coordinates lower left corner:   -1.2358 ,   -1.7061
     (located 2nd line from bottom, character 9, indicated by + )
Coordinates upper right corner:    2.6376 ,    2.1673
    (located 2nd line from top, character 109, indicated by + )
Axes (if drawn) go through the origin of the ordination

Single item  an03084:    44 ,   24
Single item  an03093:    37 ,   24
Single item  an03103:    41 ,   24
Single item  an04012:    49 ,   24
Single item  an11083:    43 ,   24
 The following items are close together, so they are indicated as a list in the
 plot
 List of items          1
 an01033   an01092   an08032   an08102
 List of items          2
 an01132   an03044   an04052   an04062   an04093   an05102   an08072
 List of items          3
 an03054   an03073
 List of items          4
 an04072   an05022   an05062   an05072   an08124   an11124
 List of items          5
 an05114   an08052
```



```
 Samp: Sample scores
 nigripes
   CA  Canonical axes:  0  Covariables:   0  Scaling:  2
Horizontal: Axis 1, vertical: Axis 3 Scale number 7
Scale :   3.324414E-01 units/cm,  so 1 unit =       3.008049 cm.
Coordinates lower left corner:   -1.2358 ,   -1.5808
     (located 2nd line from bottom, character 9, indicated by + )
Coordinates upper right corner:    3.5846 ,    3.2396
    (located 2nd line from top, character 109, indicated by + )
Axes (if drawn) go through the origin of the ordination

Single item  an03054:    30 ,    8
Single item  an04134:    45 ,   13
Single item  an05154:    42 ,   13
 The following items are close together, so they are indicated as a list in the
 plot
 List of items          1
 an01033   an01092   an08032   an08102
 List of items          2
 an01132   an03044   an04052   an04062   an04093   an05102   an08072
 List of items          3
 an04072   an05022   an05062   an05072   an08124   an11124
 List of items          4
 an05082   an05114


                                 |
        +                > an04113                                                                          +
                                 |
                                 |
                                 |
                        > an01022|
                                 |
                                 |
                         > an01102
                                 |
                         > an01062
                                 |
                                 |
                                 |
                                 |
                                 |> an11063
                                 |
                                 |
                                 |    > an11043
                                 |
                                 |
        >LIST0003    > an08082   | > an11083
                                 |     > an03123
         >LIST0004     > an05052 |        an11053                  > an08022
          > an08052         an05135<         > an05125                                 >LIST0001
-------------------------------->|an03064.--.->-an11114-------->-an05012-------------------------------------------------------
            > an11023            |    an03113<      > an03133
                  > an11013      |      > an04012
              > an08043          |                  > an11033
                                 |  > an03084           > an04032
              an03024<           |> an03103
                      an03073<   |  > an03034
                              > an03093
                   > an04023     |
                                 |
                                 |
        +            >LIST0002   |                                                                          +
                                 |
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Fowleria aurita.*

```
ORDER OF SPECIES INCLUDING RARER ONES
   2 brac     !   5 pena     !   1 pisc     !   3 cari     !   4 gamm     !



ORDER OF SAMPLES
   3  fa03273 !    9  fa04133 !    2  fa03182 !    4  fa04053 !   14  fa05114 !   15  fa08044 !   17  fa08104 !   19  fa11015
  20  fa11024 !   21  fa11056 !   22  fa11085 !   18  fa08153 !    1  fa03162 !    8  fa04124 !    5  fa04063 !    6  fa04083
   7  fa04093 !   11  fa05033 !   12  fa05043 !   10  fa04184 !   13  fa05063 !   16  fa08054 !


                    11112221     11111
                3924457901281856712036

   2 brac       31--------------------  0
   5 pena       -3333333333233--------  0
   1 pisc       ---------------------2  1
   3 cari       -------------------232  1
   4 gamm       ------------11333331--  1

                0000000000000011111111
                0111111111111100000111
                 0000000000011
                 01111111111
                  0000000001
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Lethrinus nebulosus*.

```
ORDER OF SPECIES INCLUDING RARER ONES
   1 cala       !   2 hapa      !   4 gamm      !   7 eggs      !   3 tana      !   5 capr      !   6 poly      !   8 othe



ORDER OF SAMPLES
  16  ln03012 !  52  ln08072 !  17  ln03022 !  18  ln03032 !  34  ln04093 !  51  ln08062 !  40  ln05053 !  42  ln05073
  35  ln04104 !  54  ln08092 !  59  ln11042 !  64  ln11092 !   1  ln01012 !   8  ln01081 !  10  ln01102 !  50  ln08052
   4  ln01042 !   7  ln01072 !  61  ln11062 !   3  ln01033 !  38  ln05032 !  41  ln05063 !  43  ln05083 !  44  ln05093
  47  ln08022 !  65  ln11102 !   2  ln01023 !  12  ln01121 !  13  ln01132 !  14  ln01142 !   6  ln01062 !   9  ln01091
  26  ln04014 !  57  ln11022 !  15  ln01152 !  24  ln03092 !  29  ln04044 !  23  ln03082 !  30  ln04053 !  31  ln04064
  36  ln05014 !  62  ln11072 !  63  ln11082 !   5  ln01053 !  20  ln03052 !  37  ln05024 !  11  ln01112 !  32  ln04074
  45  ln05103 !  49  ln08042 !  53  ln08082 !  56  ln11012 !  58  ln11032 !  60  ln11052 !  19  ln03043 !  22  ln03072
  48  ln08032 !  21  ln03062 !  25  ln03103 !  55  ln08102 !  39  ln05042 !  27  ln04024 !  28  ln04034 !  33  ln04084
  46  ln08012 !


                151135443556  15  6 344446 111  25122233366 231344555612422532234
                62784102549418004713813475223469675493016235071259368092815597836

   1 cala       66455534-2-------------------------------------1-------324353----   0
   2 hapa       --41-2-235663443221-------222222--1113--------4-11---11-11221----   0
   4 gamm       --233255-3--5455665666666623321-33431--13---113352444534-12-2-11-   0
   7 eggs       --------------------------555566-----------------------------------0
   3 tana       --------5---------4----------2---4-312-2---------------3---------   1
   5 capr       ------------------------------1-4-5453544--------------------------1
   6 poly       -------------------------------------43546566645355443434553--2--   1
   8 othe       --1--------------2-----1---11--44--2----23-----111---324---56666   1

                00000000000000000000000000000000111111111111111111111111111111111
                00000000111111111111111111111111000000000000000000000000000011111
                00111111000000000000000000111111000000000111111111111111111101111
                  011111000011111111111111000011001111111000000000000011111
                   00011    00000011111111        00011110000011111111000111
                            00001101111111               0011101111111
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Parascorpaena mossambica.*

```
ORDER OF SPECIES INCLUDING RARER ONES
   1 pisc     !   5 tana     !   6 amph     !   2 brac     !   3 stom     !   8 othe     !   4 mysi     !   7 pena


ORDER OF SAMPLES
  11  m030337 !   3  m010639 !  21  m032160 !  50  m110140 !  59  m111234 !  14  m030940 !  15  m031038 !  52  m110537
  57  m111040 !   1  m010136 !  10  m030238 !  13  m030638 !  16  m031127 !  18  m031530 !  20  m032027 !  26  m040431
  33  m050237 !  35  m050521 !  41  m080544 !  42  m080642 !  44  m081329 !  46  m081630 !  48  m081850 !  49  m081933
  51  m110442 !  53  m110634 !  54  m110740 !  55  m110840 !  56  m110943 !  58  m111126 !  60  m111429 !  36  m050623
  38  m050840 !  12  m030540 !  24  m040234 !  27  m040535 !  29  m040731 !  31  m041250 !  32  m050158 !   2  m010437
  34  m050448 !  30  m041032 !   7  m011238 !   8  m011336 !   9  m011440 !  17  m031428 !  40  m080142 !  22  m032842
   4  m010836 !  25  m040333 !  39  m050944 !  43  m081041 !   6  m011140 !   5  m011039 !  19  m031726 !  23  m033072
  28  m040632 !  37  m050745 !  45  m081535 !  47  m081747 !


                  1 2551155 11112233444444555555633122233 33   142 234  122344
                  131094527103680635124689134568068247912240789702459365938757

   1 pisc         45555--------------------------3--------------------1------- 000
   5 tana         2----4353-----2--------------------------------------------- 000
   6 amph         ----123-3454553555555555555555533 22-----12------------------ 000
   2 brac         ---------1---------------------23445555--------2------------ 001
   3 stom         ---------------------------------------55-----1------------- 001
   8 othe         -----------2-----------------1-----------255551-----1------- 01
   4 mysi         ----------------------------------1-----------445455-------- 1
   7 pena         --------------1--------------------------3-------2--45555555 1

                  000000000000000000000000000000000000000000000011111111111111
                  000000000000000000000000000000000000000001111100000011111111
                  000001111111111111111111111111111111111101111011111011111111
                  0111100000000000000000000000000011111111      01111
                       000011111111111111111111111100000011
                           000000000000000000000011001111
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Plotosus lineatus.*

```
ORDER OF SPECIES INCLUDING RARER ONES
   5 haju     !   3 caju     !   6 hadu     !  11 chae     !  12 othe     !   4 cadu     !   9 isop     !   1 ostr
   8 capr     !  10 jiso     !   7 gamm     !   2 deca     !


ORDER OF SAMPLES
   13  L011427 !  16  L040323 !  22  L041021 !  43  L082160 !  25  L050125 !  44  L082359 !  47  L082640 !  45  L082453
   18  L040524 !  27  L050323 !  28  L050425 !  29  L050523 !   4  L010426 !   6  L010628 !   8  L010827 !   3  L010327
   10  L011026 !  12  L011326 !  19  L040621 !   7  L010727 !  33  L081135 !  34  L081235 !  35  L081331 !  36  L081435
   37  L081535 !  38  L081631 !  42  L082035 !  49  L082839 !  39  L081735 !  40  L081835 !  41  L081935 !  48  L082721
   50  L082939 !  15  L040225 !  21  L040925 !  23  L041120 !  30  L080465 !   2  L010226 !   5  L010528 !  11  L011226
   20  L040722 !   9  L010926 !  26  L050225 !  17  L040423 !  24  L041220 !  32  L080765 !  46  L082568 !   1  L010127
   14  L011526 !  31  L080564 !


               112424441222    111 33333344344451223  12 21234 13
               36235475878946830297345678299018051302510967426141

   5 haju      -2-----3666645323352113311--1------------------2--  00
   3 caju      -----1-5------------1111------------------26545---  010
   6 hadu      1---1-------5356553-232342232312144--656553-3-----  010
  11 chae      ----655-------------------------------------------  010
  12 othe      6656-41-----344----------1------------------------  010
   4 cadu      --5---2------------54544444544443------------5----  01100
   9 isop      --1---1-------1-------------1--21--------35-------  01100
   1 ostr      --------------------12-1222-2---1-------------5---  01101
   8 capr      ----------------------3--2--54545-----------------  01101
  10 jiso      --------------------4332241--22-------------------  01101
   7 gamm      1-----2-----22-----334443354343325566-4-3------2--  0111
   2 deca      -----------------------------------------------666  1

               00000000000000000000000000000000000000000000000111
               00000000000000000001111111111111111111111111111
               00000001111111111110000000000000000000000001111
               0000111000001111111000000000000000000111111
                      011110001111000000000000000011110000011
                                   00000000011111
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Leptoscarus vaigiensis.*

```
ORDER OF SPECIES INCLUDING RARER ONES
   6 tana      !   8 capr      !   9 isop      !   3 cal       !   7 gamm      !   4 haju      !  12 medu      !  13 fera
   5 hada      !   1 alga      !   2 ostr      !  11 gast      !  10 biva      !  14 orim      !


ORDER OF SAMPLES
  50  v041023 !   7  v010718 !  15  v011519 !  51  v041133 !  74  v051426 !  10  v011019 !  21  v012131 !  14  v011416
  22  v012235 !  45  v040522 !  58  v041834 !   9  v010918 !   3  v010318 !   5  v010516 !   2  v010217 !   8  v010817
  12  v011218 !  13  v011316 !   6  v010620 !  11  v011119 !  41  v040124 !  43  v040323 !  44  v040421 !  46  v040623
  33  v030325 !  37  v030727 !  31  v030125 !  32  v030223 !  34  v030421 !  36  v030628 !  24  v012433 !  25  v012535
   1  v010117 !   4  v010418 !  16  v011635 !  17  v011734 !  19  v011933 !  26  v012635 !  27  v012734 !  28  v012835
  29  v012936 !  30  v013031 !  42  v040224 !  52  v041235 !  55  v041535 !  59  v041934 !  61  v050139 !  63  v050336
  64  v050440 !  66  v050640 !  67  v050738 !  68  v050837 !  71  v051127 !  75  v051527 !  77  v051730 !  83  v080244
  84  v080343 !  86  v080543 !  87  v080642 !  88  v080743 !  90  v080944 !  91  v081045 !  95  v081426 !  97  v081626
  98  v081727 ! 102  v110133 ! 103  v110233 ! 110  v110931 ! 111  v111031 ! 114  v111321 ! 118  v111724 ! 120  v111925
 122  v112138 ! 123  v112228 !  62  v050237 !  72  v051228 !  79  v051926 !  85  v080445 !  93  v081228 !  94  v081328
  96  v081530 !  99  v081827 ! 105  v110433 ! 112  v111124 ! 113  v111225 ! 121  v112022 !  65  v050536 !  69  v050940
  23  v012334 !  48  v040823 ! 106  v110535 ! 107  v110633 ! 108  v110731 !  18  v011834 !  53  v041332 !  56  v041635
  82  v080144 !  35  v030521 !  38  v030821 !  39  v030922 !  40  v031022 !  47  v040722 !  49  v040924 !  54  v041432
  57  v041735 !  60  v042035 !  78  v051826 !  80  v052026 !  89  v080842 ! 104  v110335 ! 109  v110833 ! 115  v111425
 116  v111523 ! 117  v111622 ! 119  v111822 ! 101  v082029 !  20  v012031 !  70  v051038 !  76  v051626 !  81  V052126
  73  v051326 ! 100  v081926 !  92  v081130 !


                                                                                111111111        1111    111
               5 157121245     11 1444433333322  111222234555666666777888889999900111122267789999011266240001558333
               0751401425893528236113463712464514679678902259134678157346780157823014802322953469523159386788362589

   6 tana      -------------33333------222---32-------------------------------------------------------------------- 000
   8 capr      3333321-1--2-3-------------------------------------------------------------------------------2------ 000
   9 isop      --2----21-12211112111--11--------21----------1------------------------------------------------------ 000
   3 cal       2----22-----------2-2-----2-2--------------------------------2-------------------------------------- 00100
   7 gamm      -----23-22-2----2---11-2----------2-------------------------------------------------------------11-- 00100
   4 haju      ---------1--------------1-2121----------------------1--------------------2-------------------------- 00101
  12 medu      2----------22-22---------------1------------------------------------------------2------------------- 00101
  13 fera      -2---1-----1112-1211------------11------------------1-------------2-1------------------------------- 00101
   5 hada      3222-2-21222223333333333233333------------------------------------------------------------1124111232 0011
   1 alga      3333344444443333333333344433334444444444444444444444444444444444444444444444444444444444444444444444 01
   2 ostr      ------------3-------------------------------------------------------------------------------22--2---- 01
  11 gast      3--------------------------------------------------------------------------------------------------- 01
  10 biva      --------------------1--------------------------------------------------------1111211111------1------ 1
  14 orim      ---------------------------------------------1---------1--------------------3-----------------1----- 1

               0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
               0000000000000000000000000000001111111111111111111111111111111111111111111111111111111111111111111111
               0000000000001111111111111111110000000000000000000000000000000000000000000000000000000000000000000000
               0000011111110000001111111111110000000000000000000000000000000000000000000000000000000001111111111111
               0111100111110111110000001111110000000000000000000000000000000000000000000011111111111111100000000000111
                      00001 011110001110011110011111111111111111111111111111111111111111000000000000011000000111100 0


                        1111111     1
               44455678800111102778709
               07947080949567910061302

   6 tana      -----------------------  000
   8 capr      -----------------------  000
   9 isop      -----------------------  000
   3 cal       -------------------33--  00100
   7 gamm      -1-----------------3---  00100
   4 haju      --1-----------------22-  00101
  12 medu      ---------------------3-  00101
  13 fera      --------1------1-------  00101
   5 hada      3232223222222233-------  0011
   1 alga      44444444444444444333 44-  01
   2 ostr      -----------------------  01
  11 gast      ----------------3333---  01
  10 biva      -----1-----1-1-2-1----3  1
  14 orim      ---------1------------3  1

               00000000000000000000001
               1111111111111111111111
               0000000000000000111111
               1111111111111111000011
               1111111111111111
               0000000000000001
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Leptoscarus vaigiensis.*

```
ORDER OF SPECIES INCLUDING RARER ONES
   6 tana     !   9 isop     !   3 cadu     !   7 gamm     !  11 gast     !   2 ostr     !   8 capr     !  12 medu
   1 alga     !   5 hadu     !  13 fera     !   4 haju     !  10 biva     !  14 orim     !


ORDER OF SAMPLES
   1  V011518 !   3  V031023 !   2  V011533 !   4  V041023 !   6  V051038 !   7  V051128 !   8  V081043 !   5  V041033
   9  V081028 !  10  V111033 !  11  V111223 !


                     11
              13246785901

   6 tana     332--------  000
   9 isop     2211---1---  000
   3 cadu     2222-32----  001
   7 gamm     2-21-22----  001
  11 gast     --3333-----  001
   2 ostr     3-22-----2-  01
   8 capr     3-1433-3---  01
  12 medu     2-12-2--3--  01
   1 alga     44444444444  10
   5 hadu     33132222322  10
  13 fera     1----11-11-  10
   4 haju     -2-1-1--2-2  11
  10 biva     ---11111211  11
  14 orim     -----1-1111  11

              00000001111
              0011111
                01111
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Scarus sordidus*.

```
ORDER OF SPECIES INCLUDING RARER ONES
   1 alga     !  2 harp     !  6 moll     !  3 tana     !  4 amph     !  5 isop     !  7 othe     !


ORDER OF SAMPLES
  23 s030836  !  45 s051026  !   4 s010437  !  11 s011137  !  18 s030340  !  26 s040143  !  27 s040241  !  29 s040445
  31 s040641  !  32 s040745  !  34 s040950  !  38 s050332  !  44 s050930  !  50 s080531  !  46 s080133  !  16 s030138
  47 s080233  !  64 s081921  !  28 s040343  !  56 s081125  !   3 s010336  !  12 s011236  !  20 s030540  !  51 s080635
   5 s010536  !  17 s030238  !  36 s050140  !  40 s050527  !  41 s050630  !  43 s050834  !  13 s011338  !  37 s050232
  55 s081032  !  22 s030736  !  30 s040535  !  39 s050427  !  54 s080931  !  59 s081423  !  60 s081524  !  61 s081623
  62 s081721  !  65 s082022  !  21 s030636  !  24 s030936  !  33 s040830  !  35 s041030  !  52 s080733  !  53 s080834
  57 s081224  !  58 s081322  !  48 s080332  !  49 s080431  !  63 s081821  !   9 s010936  !  14 s011437  !  25 s031036
   7 s010736  !   8 s010840  !  10 s011038  !  15 s011537  !   1 s010140  !   6 s010638  !  19 s030436  !  42 s050726
   2 s010236  !


                    24 11222333345414625 125 13444135233556666223355555446 12  11  14
                    35418679124840667486320157601337520949012514352378893945780516922

    1 alga          77777777777777767766666655545555455554454555545544454455555455554 0
    2 harp          1--------------1--1--122-21212-2-2223444434334434433411311----1-- 0
    6 moll          --------------1---22-------111443---343223----1---422-----------4 0
    3 tana          -----------------------------------------------------42-332433232 1
    4 amph          --------------------21--222443--------------------223333-1-1222-3 1
    5 isop          11-----------------21----1----1----------------------1113--1-1--- 1
    7 othe          ---------------111------------3--3-2----2-------------323333-2--3 1

                    00000000000000000000000000000000000000000000000000000111111111111
                    00000000000000000000000011111111111111111111111111111000000000001
                    0000000000000000001111110000001111111111111111111111100011111111
                    00000000000000011100111100011100000011111111111111111   00001111
                    001111111111111               00011100000000000000111
                      0000000000001                     00000011111111
```

ANNEX 6 contd.

TWINSPAN 3D table on stomach contents of *Siganus sutor*.

```
 ORDER OF SPECIES INCLUDING RARER ONES
   4 mysi      !   9 tana      !  15 asci      !  18 Gast      !   3 cari      !  14 hemi      !  16 nema      !   2 ostr
   8 hara      !   6 cala      !  10 gama      !   1 alga      !  20 nife      !   5 calj      !   7 harj      !  12 isop
  17 Biva      !  11 capa      !  13 jani      !  19 medu      !  21 orim      !


ORDER OF SAMPLES
  39 sc040429 !  41 sc040629 !  28 sc031330 !  33 sc031826 !  40 sc040530 !  27 sc031228 !  31 sc031630 !  35 sc032030
  19 sc030454 !  24 sc030954 !  16 sc030151 !  20 sc030552 !  22 sc030752 !  25 sc031053 !  54 sc050954 !  64 sc080929
  70 sc110531 !  74 sc110933 !  17 sc030253 !  18 sc030355 !  42 sc040729 !  32 sc031727 !  44 sc040930 !  62 sc080728
   4 sc010426 !  38 sc040330 !   1 sc010140 !   3 sc010331 !   5 sc010527 !   7 sc010726 !   8 sc010828 !   9 sc010931
  11 sc011138 !  12 sc011240 !  13 sc011328 !  14 sc011436 !  15 sc011537 !  21 sc030652 !  26 sc031128 !  34 sc031930
  43 sc040830 !  66 sc110131 !  69 sc110432 !  71 sc110631 !  72 sc110733 !  73 sc110831 !  75 sc111035 !   2 sc010236
  56 sc080130 !   6 sc010635 !  23 sc030851 !  36 sc040129 !  48 sc050333 !  58 sc080326 !  67 sc110232 !  57 sc080227
  61 sc080628 !  65 sc081028 !  52 sc050750 !  55 sc051050 !  46 sc050133 !  47 sc050224 !  51 sc050623 !  53 sc050852
  68 sc110334 !  10 sc011033 !  30 sc031527 !  49 sc050419 !  50 sc050521 !  59 sc080427 !  29 sc031430 !  45 sc041030
  60 sc080530 !  63 sc080828 !  37 sc040230 !


                 342342331212225677114346 3      111112234667777 5 2345656655445561345524663
                 918307159460254404782242481357891234516436912352663688771525671380090995037

   4 mysi        2-------------------------------------------------------------------------- 00000
   9 tana        33443---32----------------------------------------2------------------------ 00000
  15 asci        ----3---------------------------------------------------------------------- 00000
  18 Gast        44-------------------------------------------------5----------------------- 00000
   3 cari        -------------------------4------------------------------------------------- 00001
  14 hemi        -------------------------------------------------44------------------------ 00001
  16 nema        -------------------1----34--------1-----------122-1------------------------ 00001
   2 ostr        33-34----133342333-------3-2-434-1342-44-332442333-33--34-2---------------- 0001
   8 hara        44343143221323-34223333243224444434432424321-3243422-22--3-------1------2-1 0001
   6 cala        3----344322223-3--21-------------------------------------4----------------- 001
  10 gama        31--1----111--1221222333--------------------1--3-3--121------------------24 001
   1 alga        44555545555554555555555544554455555555554555555554-5-445445555555566666655555 01
  20 nife        ---------------1--------------------------------1---------1---------------- 01
   5 calj        ----------1---------------------------------------------------3------------ 10
   7 harj        -2------1-11111--1-1--1--4-------------2112-1------22--3312123221-------223 10
  12 isop        -11--------111-21----112----------------11-1----21-1---3-3--------------23- 10
  17 Biva        -----------1------------------------------------1--1--1---11--------------- 10
  11 capa        ---------1-------------------------------------2----44-4------------------- 11
  13 jani        ------------------------------------------------2------44------------------ 11
  19 medu        -------------------------------3---------3-------3--2-44---2--------------- 11
  21 orim        --------------------------------------------------------1------------------ 11

                 000000000000000000000000000000000000000000000000000111111111111111111111111
                 000000000000000000000000111111111111111111111111111000000111111111111111111
                 000001111111111111111111000000000000000000000000001000111000000000000011111
                 0011100000000011111111110000000000000000000000001 1      000000111111100001
                      0000011110000111111001111111111111111111111         0011110111111
                      00011        000111  0000000000000000000011
```