NIOZ-RAPPORT 1995 - 9

ECOLOGICAL OBSERVATIONS ON FLATFISH ON THE REEFS AND IN THE INNER BAYS AROUND CURAÇAO, NETHERLANDS ANTILLES

Harm G. van der Geest & Martin Langevoord

Nederlands Instituut voor Onderzoek der Zee

Mariene Ecologie

Netherlands Institute for Sea Research (NIOZ)
P.O. Box 59, 1790 AB Den Burg, Texel
The Netherlands

ISSN 0923 - 3210

Cover design: H. Hobbelink

ECOLOGICAL OBSERVATIONS ON FLATFISH ON THE REEFS AND IN THE INNER BAYS AROUND CURAÇAO, NETHERLANDS ANTILLES

Harm G. van der Geest & Martin Langevoord

NETHERLANDS INSTITUTE FOR SEA RESEARCH

Marine Ecology

NIOZ-RAPPORT 1995 - 9

SAMENVATTING

Dit rapport beschrijft de resultaten van een studie naar het voorkomen van platvissen rond Curaçao. Op de riffen en in de binnenbaaien werden in totaal een zevental verschillende soorten aangetroffen, allen in lage dichtheden en behorende tot de familie van de Bothidae: (*Bothus ocellatus, B. maculiferus*, *B. lunatus* en *Syacium micrurum* en *Citharichthys spilopterus*) en van de Soleidae (*Achirus lineatus* en *Trinectes inscriptus*). De drie *Bothus* soorten kwamen uitsluitend voor op het rif en de verspreiding vertoonde een duidelijk patroon: *B. ocellatus* komt ondiep voor op vooral zandige plaatsen tussen de koralen; *B. maculiferus* komt ook dieper voor en *B. lunatus* wordt aangetroffen vooral op het rif vanaf de rand langs de helling. De twee andere Bothidae en de Soleidae soorten werden uitsluitend in de modderige baaien aangetroffen. Zowel op het rif als in de baaien werden juvenielen en adulten naast elkaar aangetroffen. Dit kan betekenen dat de gehele levenscyclus van de verschillende soorten zich in één en hetzelfde gebied afspeelt. Voortplanting lijkt zich in meerdere soorten uit te strekken over een lange periode en in de drie soorten die onderzocht konden worden (*B. ocellatus, B. maculiferus* en *A. lineatus*) lijken zowel de mannetjes als de vrouwtjes na 1 jaar volwassen te worden. Op grond van otoliet-aflezingen konden voor de meeste soorten de Von Bertalanffy groeicurven bepaald worden. De gevonden maximale leeftijden variëerden van 4 jaar in *B. ocellatus* tot 10 jaar in *A. lineatus.* Maaginhoud analyse toonde aan dat voornamelijk epibenthische prooien geconsumeerd werden.

SUMMARY

This report describes the results of a flatfish study of the inner bays and sandy reef flats around Curaçao. A total of seven species were found, all in low densities, and belonging to the family Bothidae (*Bothus ocellatus, B. maculiferus*, *B. lunatus*, *Syacium micrurum* and *Citharichthys spilopterus*) and to the family Soleidae (*Achirus lineatus* and *Trinectes inscriptus*). The three Bothidae were found only at the reef, but the distribution patterns showed clear differences: *B. ocellatus* was found primarily in the shallow zone on sandy areas; *B. maculiferus* was found also in deeper water and *B. lunatus* appeared to be distributed at the edge of the reef and along the slope. The two other Bothidae and the Soleidae species were found only in muddy areas in the inner bays. At the reef and in the inner bays, juveniles and adults of the same species were distributed in the same areas. This might indicate that the complete life cycle of these species is restricted to these areas. In the species studied (*B. ocellatus, B. maculiferus* and *A. lineatus*) reproduction appeared to occur over a long period of time and both males and females became mature in their second year of life. The Von Bertalanffy growth curves could be established for most species based on otolith readings. The maximum age of the various species varied from 4 years in *B. ocellatus* to 10 years in *A. lineatus*. Stomach content analyses revealed that the main prey items belonged to the epibenthic fauna.

1. INTRODUCTION

Flatfish species are found in a wide range of latitudes all over the world; from the Arctic to equatorial regions, but never further south than 60° (PAULY 1994). Despite their widespread distribution, flatfish only well known in regions with a high commercial fishing pressure, such as temperate regions. Consequently, global distribution of flatfish can be split up in three regions after NORMAN (1934), NELSON (1984) and ESCHMEYER (1990):

1. Temperate/boreal waters. Though containing few flatfish species, individuals per species are very abundant. Therefore flatfish are fished commercially very intensively in these areas.
2. High southern latitudes up to 60°. Very few species, with low biomasses, are found here. No fisheries for flatfish exists near these latitudes (KOCK,1992).
3. Tropical waters. In these waters many species are found but biomasses are low. As a consequence there are few, if any, fisheries.

In addition, TOPP & HOFF (1972) distinguished a Caribbean group in the western Atlantic, extending from the Gulf of Mexico to Brazil, including the Bahamas and Bermuda.

In general, three factors are accepted as necessary for maintenance of populations: recruitment, food and refuge from predation (ANDERSON, 1988; HOUDE, 1989). CUSHING (1986) introduced a fourth factor: succesfull migration of flatfish to juvenile nursery areas. In this context estuarine areas play an important role while being of great ecological importance as habitats for refuge, reproduction, feeding or nursery areas (HECK & ORTH, 1980; YANEZ-ARANCIBIA, 1985; MILLER *et al.*, 1985; DEEGAN *et al.*, 1986; DAY *et al.*, 1989). Nursery areas in temperate regions are well studied, especially the Dutch Wadden Sea (KUIPERS, 1977; VAN DER VEER, 1986; BERGMAN *et al.*, 1989; VAN DER VEER *et al.*, 1991).

MILLER *et al.* (1991) recently indicated that processes determining recruitment might also vary over the range of distribution of a species. Although some studies have been carried out in subtropical and tropical waters (REICHERT & VAN DER VEER, 1991; VAN DER VEER *et al.*, 1994; SÁNCHEZ-GIL *et al.*, 1994; MANICKCHAND- HEILEMAN, 1994), a lot of detailed information is lacking. VAN DER VEER *et al.* (1994; 1995) found in the nursery areas of Puerto Rico low densities compared to temperate (BEVERTON & ILES, 1992) and subtropical nurseries (REICHERT & VAN DER VEER, 1991).

To explain these low densities, two hypotheses have been suggested:

1. High water temperatures in (sub)tropical areas result in high metabolic costs for maintenance in combination with relatively low concentrations of dissolved oxygen. Therefore, less energy remains available for growth and reproduction and this is also why cold-water flatfish reach larger sizes than warm-water species and why warm-water species have a lower age at maturity (PAULY, 1979). This also affects the 'scope for reproduction' and results in low fecundity of adult flatfish in areas with high temperatures and low population densities.
2. JONES (1982) mentioned for tropical nurseries a low benthic biomass related to fast primary production usage and recycling. Consequently, metamorphosing larvae which settle in these nursery areas might suffer from food limitation. If true, this means that the carrying capacity of tropical nursery areas is too low and thus limits flatfish growth more frequently than in temperate waters.

The objective of this study was to test the above hypotheses. As a first step, basic ecological parameters of (sub)tropical flatfish species were obtained. This report describes the results of a baseline study at the reefs and in the inner bays around Curaçao, Netherlands Antilles, in 1995.

2. MATERIAL AND METHODS

2.1. AREA OF STUDY

The study was performed at the reefs and in the bays around Curaçao (Netherlands Antilles), situated between 12°02' and 12°23'N and 68°12' and 69°10'W. At Curaçao there is a prevailing trade wind in the northwesterly direction. Therefore, the south, southwest and west coasts are more sheltered than the north coast (VAN DUYL, 1985). The water temperature at the reef is 27±1 °C.

The southern shoreline consists of rocky cliffs and sandy beaches. These beaches are natural or man-made (beaches of resorts and hotels). The island coastline, especially the south coast, is interrupted by some inner bays. Some of these are in open contact wih the sea, while others are blocked off and without water exchange.

Flatfish were sampled at the reef and in the inner bays. At the reef flatfish were caught by scuba diving with nets. The atlas of the living reefs of Curaçao and Bonaire (VAN DUYL, 1985) was used to select suitable shallow sand flats (between 1 and 10 m water depth) for sampling in front of and in between the fringing reef. At one station, Porto Marie, a few flatfish were also caught in between the double reef at a sand flat at 20 m depth. Sampling in the bay was carried out with small beam trawl nets. Only the most important inner bays were sampled in this way. Figure 1 shows a map of the dive sites and the inner bays where flatfish were caught. Flatfish were collected every month from January until June 1995. At least 20 specimens of each flatfish species were collected per month.

2.2. SAMPLING PROGRAMME

At the reef, flatfish were caught during the first two weeks of each month. Two scuba divers swam next to each other carrying a small drift net of 270 cm length, 75 cm heigth and a mesh size of 1.25 x 1.25 cm with a tickler chain below the net and drifters on top. Small flatfish (1-2 cm) were caught with a small rectangular gauze net of 90 x 45 cm and a mesh size of 1.5 x 1.5 mm, with underneath a lead rope. Flatfish were detected by swimming 0.5 to 1 m above the bottom or by softly disturbing the sediment. As soon as a flatfish was found, the net was circled around it, closed and subsequently the flatfish was taken out of the enclosure by hand and stored in a bag. The collected fish were kept in a sampling net with a mesh size of 5 x 5 mm (Underwater Kinetics) until the end of each dive. Each day two dives were made during daytime, randomly at various locations. Only five flatfish were caught during each sampling dive at the reef sand flats. In addition some flatfish were obtained from a local fisherman, especially during the first months of this programme. This fisherman used the same gear as described above. All flatfish caught were stored in the refrigerator at -7 °C until preparation. Each dive site was sampled only once a month.

Fishing in the inner bays was carried out during daytime at the end of each month. In the open inner bays on the south and north coast flatfish were caught by boat (Boston Whaler, 11 foot, 15 HP outboard motor) and a 1-m aluminium beam trawl (5x5 mm mesh size, two one-kilo lead weights attached to the beam trawl frame). For further description see KUIPERS (1975) and KUIPERS *et al.* (1992). The area swept varied from 25 m^2 to 250 m^2 (mean 55 m^2) and was estimated by means of landmarks. In addition one of the bays, the Piscadera bay, was sampled twice with a beach seine net, while two snorklers kept the lead rope on the bottom and freed it from stones and tree branches when necessary. Figure 2 shows detailed discriptions of the inner bays sampled. The Sta Marta Bay is the westernmost inner bay on the south coast. It was opened permanently in March 1962 after frequent 'closing' of the bay by rocks and mud. The created opening is about 30 m wide and has a depth of about 3 m. The bottom is muddy and the few coral formations present only occur in the opening. No mangroves are present on the bay's shore. The length of the bay is about 1 km and the most inner parts are very shallow and muddy. In the past these inner parts were used as salt marshes. Along the southern coastline, the next bay is Piscadera bay. The opening has a depth of about 6 m which was man-made by dynamite. There is a discharge of partly-cleaned waste water in the inner part of the bay. Mangroves occur on almost the whole shoreline and a few corals can be found near the western shore. The bottom is mainly muddy with shells. The total length of the bay is about 1 km. In Spaansche Water bay the depth varies from 5 to about 10 m. The shore is covered with mangroves on the east side and corals occur mainly in and around the opening. On the west side of Spaansche Water bay are a large number of villas and a *marina*. The total length of the bay is about 2 km and the sediment mainly consists of mud and shells. The only bay on the north side of Curaçao is St. Joris bay, with a strong inward current. The main depth is about 5 m and there are many mangroves. The bottom contains mud, shells and sometimes a few weeds can be found. The other bays, Boca Sta Cruz and Fuik bay, were sampled once, but the bottom contained too many rocks and corals and no further samples were taken.

All samples were sorted out on board immediately and all flatfish were stored on ice in a cooler and transported to the laboratory. In the laboratory fish were stored in the refrigerator at -7 °C until preparation.

2.3. DATA ANALYSIS

Before determination and dissection fish were defrosted in seawater. All flatfish were identified as far as possible with help of FAO-sheets (1978). The family of the Bothidae was identified to species level with help of FAO-sheets (1978) while for the identification of *Syacium* spec. MURAKAMI & AMAOKA (1992) was used. Within the family Soleidae the genera *Trinectes* and *Achirus* were found and identified according to CERVIGÓN (1985).

After species identification, standard length (SL; cm), total length (TL; cm) and wet weight (W; g) were measured. Subsequently, the guts were removed and the gutted weight was determined. From the intestines stomach contents were weighed and analysed when possible. Gonads were weighed and gonad stage was ascertained after RIJNSDORP (1992). Age was measured by counting year rings in the otoliths.

All data of the individual flatfishes of the various species caught during the period of sampling are presented in the Appendix. The data of a sampling survey at the Bahama's is also incorporated.

2.4. STATISTICAL ANALYSIS

Lineair regression was calculated between standard- en total length, total- en gutted wet weight, otolith length and total length and prey- and predator size. Relationships between total length and total wet weight were according to:

$$W=a.TL^b$$

in which W is total wet weight (g) and TL is total length (cm).

The same formula was used to estimate the relationship between total length and gonad/-testis weight and stomach content weight. Annual growth in total length was calculated by fitting the Von Bertalanffy growth equation (VON BERTALANFFY, 1934) through the obtained data:

$$L_t=L_\infty.(1-\exp(-K(t-t_0)))$$

in which t is age (month), L_t length (cm) at age t, L_∞ maximum length (cm) and t_0 is the age (month) at settlement.

The Von Bertalanffy growth equation was also used to estimate the annual growth in total wet weight:

$$W_t=W_\infty.(1-\exp(-K(t-t_0)))^3$$

in which t is age, W_t is the weight (g) at age t, W_∞ is the maximum weight (g) and t_0 is the age at settlement. Estimations of mortality were made with help of the following empirical relationships after PAULY (1980):

$$M=10^{(-0.0066 - 0.279.\log(L_\infty) + 0.6543.\log(K) + 0.4634.\log(T))}$$

$$M=10^{(-0.2107 - 0.0824.\log(W_\infty) + 0.6757.\log(K) + 0.4627.\log(T))}$$

in which L_∞, K (year^{-1}) and W_∞ are the parameters of the Von Bertalanffy growth curve and T is temperature (°C). Longevity was estimated with help of the following empirical relationship (PAULY, 1980):

$$t_{max}=(3/K)+t_0$$

3. RESULTS

3.1. SPECIES COMPOSITION

On the sandy flats between the coastline and the reef and on sandy patches in between the reef, two Bothidae were found: the eyed flounder *Bothus ocellatus* and the peacock flounder *Bothus lunatus*. After the end of this study it became clear that there had been a misdetermination and that the group identified as *B. lunatus* was actually a mixture of two species: *B. lunatus* and *B. maculiferus*. For all individuals of the mixed group, relationships were calculated between otolith length and total fish length (Fig. 3). Two groups could be seen and with the help of few well identified individuals of *B. maculiferus* (by counting pectoral finrays) the two groups could be identified.

Bothus lunatus and *B. maculiferus* could be distinguished by the dorsal profile of the head: *B. lunatus* has a notch above the nostril, while *B. maculiferus'* dorsal profile of the head is not notched. There is also a difference in number of pectoral finrays between *B. maculiferus* and *B. lunatus*, resp. 9 and 11. The eyed flounder *B. ocellatus* and the maculiferus flounder *B. maculiferus* could be distinguished by the blue spots of the maculiferus flounder while male maculiferus flounders also have an extended pectoral fin almost reaching the base of the caudal fin. Eyed flounders were smaller than maculiferus flounder, resp. max 15 cm TL to max 30 cm TL (BOHNSACK & HARPER, 1988), and they lack blue spots. The difference in distance between the eyes of male and female eyed flounders is much bigger than between male and female maculiferus flounders. Their habitats overlap, both species were found on the sand flats in front of the 'drop off' to a depth of 5 to 10 m. In these regions there are tiny coral formations covering up to ±15 % of the floor. Sometimes there were also some weeds growing on these reef sand flats (Playa Jeremi). The peacock flounder, *B. lunatus*, was found in the deeper regions of the reef. Here they occurred on small patchy sand flats in between corals, on top of corals or at the deep sand flat underneath the 'drop off' at depths of 30 to 40 m.

The fourth species caught at the sand flats in front of the reef was the channel flounder *Syacium micrurum*. The channel flounder also belongs to the family of the Bothidae but it has an elongated body and lacks ocellated spots when compared with the three other species mentioned above. The channel flounder is also better camouflaged or covered with sand. Although harder to find, all observed fish were caught. Of all the species found on Curaçao, the channel flounder was the only one which was found both in inner bays and on reef sand flats. It was found in Sta Marta bay in the opening and far behind in the bay.

Of the family Soleidae two species were found in the inner bays. The lined sole *Achirus lineatus* was found frequently in Piscadera bay and Sta Marta bay. These bays are extremely muddy and shells and weeds are only abundant at few places. A few individuals were found in St. Joris bay and Spaansche Water bay where shells are much more abundant. The lined sole looks like the scrawled sole *Trinectes inscriptus* which also occurs in Piscadera bay. Key factor in identifying the scrawled sole was the absence of an interbranchial foramen which occurs in the lined sole. Hair-like cirri on the lined sole were also used to distinguish between these Soleidae. DAWSON (1965) found a maximum length of 23 cm for *A. lineatus*. The few scrawled soles were caught by beach seine at a very small, shallow, extremely muddy place behind in Piscadera bay at the eastern shore. In total five *Citharichthys spilopterus*, belonging to the Bothidae, were caught, varying in size between 3 and 10 cm TL.

Table 1 lists the flatfish species caught, together with catch characteristics: location, length range, weight range and age.

3.2. RELATIONSHIPS

For all species there was a significant correlation ($R>0.99$) between standard length and total length (Fig. 4; Table 2). Standard length varied between the various species caught from 76 to 85% of the total length. Differences between sexes were, if present very small. Gutted wet weight was highly correlated ($R>0.99$) with total wet weight (Fig. 5; Table 3). Gutted wet weight varied between the species caught from 95 to 98% of total wet weight. Differences between sexes were very small.

Total length was also highly correlated ($R>0.97$) with total wet weight (Fig. 6; Table 4). For all species a- and b-values of the length-weight relationship were calculated for the sexes separately. b varied from 2.66 to 3.86 and for 5 species b differed significantly from the value 3. For all species a-values are also calculated with $b=3$.

Except for females of *Achirus lineatus*, and males and females of *Bothus ocellatus*, relationships between gonad/testis weight and total length according to $W=a.TL^3$ were high ($R>0.7$) to very high ($R>0.9$) (Figs. 7 & 8; Tables 5 & 6). Both females and males of *B. ocellatus* started to develop reproductive organs from a length of about 5 cm. Gonad en testis development of *B. maculiferus* started at a length of about 15 cm. *Achirus lineatus* started to develop gonads at a length of about 7 cm and testes at a length of about 4 cm.

Mean food uptake coefficients (a-values of the relationship between stomach content weight (W;g) and total length (TL;cm) according to $W=a.TL^3$) were calculated for all species (Fig. 9; Table 7). Except for *Bothus ocellatus* there was a difference in mean food uptake between sexes. The relative importance of different food items for *B. maculiferus* is shown in Fig.10. With increasing length, the diet variety increased. From 5 cm fish size, fish and crabs were found in the diet as well as shrimps and from 15 cm stomatopoda could also be observed. Copepods were the main diet of juvenile *B. ocellatus* (Fig. 11). With increasing fish size the contribution of copepods and stomatopoda in the diet decreased, while shrimps, fish and crabs became more abundant. No high correlations (R<0.7) were found between prey size and predator size for the different prey types of *B. maculiferus* (Fig.12; Table 8). The variation in food uptake during the day is presented in Fig. 13. For *A. lineatus*, *B. maculiferus* and *B. ocellatus* maximum stomach contents were found at noon. During all times of day individuals with (almost) empty stomachs were also caught.

For *Achirus lineatus*, *Bothus maculiferus* and *B. ocellatus* there was no significant difference between mean gonadosomatic indices of stage 3 and stage 4 spawning females (ANOVA p>0.05) (Fig. 14). Comparing these mean gonad somatic indices of spawning females (gonad stage 3 and 4) between months, also showed no significant difference (ANOVA p>0.05) (Fig. 15).

All species showed a high correlation between total fish length and the maximum otolith length of the sagittas (Fig. 16; Table 9), and these relationships were species-specific.

3.3. AGE AND GROWTH

Densities of the various flatfish species were low. Quantitative density estimates could only be made for the beam trawl catches (Table 10). For *Achirus lineatus* the highest density of less than 2 ind.100m^{-2} was found in Sta Marta bay. Mean density was in the same order in Piscadera bay, while almost no lined soles were caught in Spaansche Water bay and St. Joris bay.

Settlement of a number of species was observed during the study period (Fig. 17). Settlement of *Achirus lineatus* took place from January until June. During these months juvenile fish of a few centimeters (2-3 cm) were caught. Settlement of *Bothus ocellatus* also occurred during a large part of the period from roughly February to June. Settlement of the other species was less clear, for instance only 1 juvenile of *B. maculiferus* was caught.

Total length (cm) and total wet weight (g) were compared with age as revealed by otolith readings (Figs. 18, 19 & 20). Year groups could be divided by the number of rings in the otolith. Correlation between age and length were high for all species (R>0.7). The oldest *Achirus lineatus* caught was 10 years old. In length, 0-group *A. lineatus* grew to about 5 cm, I-group to about 7.5 cm, II-group to about 10 cm and III-group fish to about 13 cm. The oldest *Bothus ocellatus* caught was 4 years old. In length, 0-group *B. ocellatus* grew to about 6 cm, I-group to about 8 cm and III-group to about 12 cm. The oldest *B. maculiferus* caught was 6 years old. In length, 0-group grew to about 12 cm, I-group to about 20 cm, II-group to about 24 cm and III-group to about 26 cm. For each species there were differences in estimated growth between males and females. Parameters of the Von Bertalanffy growth curves are presented in Tables 11 and 12.

With help of empirical relationships (PAULY, 1980) mortality- (M) and longevity- (t_{max}) parameters were calculated. Calculated maximum age of *Achirus lineatus* was about 13 years, of *Bothus ocellatus* about 9 years and of *B. maculiferus* 10 years. Mortality estimates according to the empirical relationships of PAULY (1980) varied from 0.54 y^{-1} to 1.08 y^{-1}. Differences between sexes were small, if present.

4. DISCUSSION

4.1. SPECIES COMPOSITION

Of the flatfish species found in this study at Curaçao, four flatfish species were caught scuba diving at the reefs, three species were caught by beam trawl fishing in the inner bays and one species was caught on both locations. All these flatfish are described for a wide spread area around Curaçao. MANIKCHAND-HEILEMAN (1994) found the same species on the South-American continental shelf from Suriname to Colombia. VAN DER VEER *et al.* (1994) describes *Achirus lineatus*, *Trinectes inscriptus*, *Citharichthys spilopterus* and *Syacium micrurum* in a beam trawl survey around Puerto Rico.

On the sandy flats near the coral reefs only members of the family Bothidae were found. This family is known to be the biggest family of flatfish. The maximium depth where fish were caught was 20 m for *Bothus lunatus*. The fact that this fish was also seen at depths of more than 35 m (pers. obs) and that MANIKCHAND-HEILEMAN (1994) found flatfish at depths of few hundred metres lead to the conclusion that these samples represent an underestimation of the total flatfish species composition around Curaçao.

Extending the area of sampling and/or intensifying sampling will result in the identification of more flatfish species around Curaçao. The problems with the identification with *Bothus lunatus* and *B. maculiferus* also indicate that it cannot be excluded that also during this survey other species were collected but not identified. Species that might be expected are *Achirus achirus, Bothys robinsi* and *Trinectes maculatus*. *A. achirus* can only be distinguished from *A. lineatus* by the lower number of pectoral fin rays (CERVIGON, 1985). *T. maculatus* can be distinguished from *A. lineatus* because *T. maculatus* lacks dorsal spots (DICKSON HOESE & MOORE, 1977). *B. robinsi* is also a subtropical- tropical species (MILLER *et al.*, 1991) and it resembles *B. ocellatus*. It can be distinguished from *B. ocellatus* by two large black spots on the median rays of the caudal fin, one anterior to the other (GUTHERZ, 1967). These spots are even present on very small specimens.

4.2. DISTRIBUTION

The various flatfish species found clearly had their own species-specific distribution, although overlap did occur. Most apparent was the difference between the coral reefs and the inner bays. There appeared to be a zonation between the *Bothus* species found. *B. ocellatus* was found primarily in the shallow zone on sandy areas or patches. *B. maculiferus* was found also in deeper water and *B. lunatus* appeared to be distributed at the edge of the reef and along the slope. In the inner bays flatfish were found in muddy areas. Members of the family Soleidae were found and a few times a *Syacium micrurum* (Bothidae). *Achirus lineatus* and *Trinectes inscriptus* were also found in Puerto Rico in bay-like lagoons surrounded by mangroves (VAN DER VEER *et al.*, 1994). *A. lineatus* was most common in the inner bays, albeit in low numbers, although differences in abundance could be observed between bays.

At the reefs and in the inner bays, juveniles and adults of at least a number of species were found in the same habitat. This suggests that some flatfish species might complete their whole life cycle in the same type of habitat. This might be especially true for *Achirus lineatus*. In the various inner bays both juveniles and adults were found together. In combination with the low water exchange of the bays, this might even suggest that each bay contains an isolated (sub)population. For the *Bothus* populations at the reefs it is less clear whether the Curaçao population should be considered an isolated population.

For all flatfish species, low densities were found both at the reef and in the inner bays, Differences in density could be seen between inner bays. It is unclear whether this is the result of low settlement or of high juvenile mortality. According to PIHL & VAN DER VEER

(1992) and GIBSON (1994) habitat type will be of importance for flatfish distribution in the bays. For instance *Achirus lineatus* was found mostly in muddy areas and less between shells and weed areas. These observations support the view that lagoons and inner bays with exchange with the sea can be of great ecological importance as they might function as nursery areas (MILLER *et al.*, 1985; DAY *et al.*, 1989). The sampled inner bays in this study appear to do so for *A. lineatus* and maybe *Trinectes inscriptus*.

These differences in distribution between the *Bothus* species at the reef and the Soleidae in the inner bays, might have consequences for the food intake of the different species. At the reef visibility is high and it might be expected that the *Bothus* species will be visual hunters. In the inner bays, sediments are muddy and visibility is low. No detailed analyses of stomach contents in relation to species and size is available. However, the preliminary data suggest that the *Bothus* species at the reefs prey especially on epibenthic food items. This is in accordance with expectations. Reef areas lack the presence of large areas with high numbers of benthic infauna. The situation in the inner bays is not clear at present.

4.3. REPRODUCTION

Settlement and reproduction of *Bothus ocellatus*, *B. maculiferus*, and *B. lunatus* appears to take place on the sand flats near the reef. Mating of *B. maculiferus* was observed at a sand flat, at 3 m depth. Reproduction and settlement of *Achirus lineatus* and maybe *Trinectes inscriptus* occurs in the inner bays.

The size-frequency distributions of *Bothus ocellatus* and *Achirus lineatus* show that settlement occurs roughly every month in these species during this sampling programme. For *A. lineatus* the same settlement period was found at Puerto Rico (VAN DER VEER *et al.*, 1994). Also the fact that there is no significant difference in mean gonadosomatic indices of spawning females between months might suggest that reproduction takes place every month. A fish was never caught with 'jelly' gonads, indicating that all mature fish reproduce. This explains a relatively low correlation between length and gonad weight: both ripening, spawning and spent females are present continuously.

Reproduction appears to start at an early age and a small size. Female gonads of *Bothus ocellatus* begin to develop at ±5 cm total length and male testis also at ±5 cm total length and an age of about one year old. This means that recruitment to the adult stock takes place at the age of one year old. For *B. maculiferus*, with female gonad development at ±15 cm and male testis development at ±13 cm total length, this recruitment takes place at the age of 2 years (I-group). However, recruitment at the age of one can not be excluded because no juvenile females were caught. Recruitment to the adult stock from *Achirus lineatus* takes place at the age of 2 years (I-group).

4.4. GROWTH

When comparing a en b parameters of the length-weight relationship according to $W=a*L^b$, differences are found. Other studies mention for *Bothus lunatus* a and b of resp. 0.0064 and 3.19 (BOHNSACK & HARPER, 1988) and for *Achirus lineatus* resp. 0.0448 and 2.85 (DAWSON, 1965), but the interpretation of a en b values is complicated (BEVERTON & HOLT, 1993).

Growth of fish in both length and weight can be described by a sigmoid curve approaching an upper asymptote with increasing age (BEVERTON & HOLT, 1993). The Von Bertalanffy growth curves in both length and weight are rough estimates to describe growth over the lifespan. We assumed that due to the almost equal environmental conditions (temperature (growth ceases at lower temperatures (PAULY, 1994)) and food abundancy) during a year, there will be no seasonal influence superimposed on the sigmoid pattern. Because sampling took place only from January to June and no data are available for the months July to December, a correct determination of the settlement period is not possible. Therefore, the assumption is made that settlement takes place during the whole year and correction for t_0 (beginning of the settlement period) was made by the calculation of these curve-fits. The estimated growth curves are the mean of all the different growth curves that can be calculated from every moment during one year when settlement occurs. When we assume that settlement takes place in all months, the curves will be the mean growth-curves for July (t_0=6). The lack of data for 0-group from July to December causes only a wrong fit for the first year. More proper growth curves can be calculated when an exact determination of the settlement period is made.

Another factor influencing the estimation of the growth curves is the difficulty of year-ring analysis of otoliths. Due to the almost equal environmental conditions during the seasons, year-rings are not clearly marked. Because of the lack of adequate literature of flatfish around Curaçao there is the danger of misdetermination of few individuals, also influencing the growth estimations.

In this simple model of growth we assumed that single values of the constants of length and weight and parameter K will suffice to describe growth of all individual ages. This implies that all individuals of a given age are the same size. Looking at the individual data points there is a large deviation in both length and weight at every age. The first explanation for this large deviation is the wide range in settlement time as described above, which means that several growth curves can be calculated for each t_0. Other reasons are described above. Looking at the growth in weight curves it can be seen that the inflexion point of the sigmoid curve has not been reached for all three species. The inflexion always occurs at a value of $w=0.296*W_{max}$ (BEVERTON & HOLT, 1993).

The parameter K in the Von Bertalanffy growth curve may be given a physiological interpretation. It has the tendency to increase with all factors causing 'stress' (and with all factors causing an increase of O_2 consumption) (PAULY, 1980).

The distribution of different food types at different length classes *of Bothus ocellatus* en *B. maculiferus* gives an indication that there is no competition for food between these two species. One should take into account that these distributions are based on a few fish stomach contents. The variation in food uptake during the day with a maximum at about noon might indicate that these flatfish species mainly use sight for fouraging. Flatfish caught have a tendency to vomit, consequently a lot of fish are caught with empty stomachs, even during daytime.

5. FUTURE RESEARCH AND POTENTIAL APPLICATIONS

Future research should in the first place concentrate on filing the gap of basic information for the second part of the year. A complete time series will allow a calculation of more accurate basic relationships.

As soon as this type of information is available, research can concentrate on the test of the two hypotheses about 'scope for reproduction' and 'carrying capacity'. To determine the 'scope for reproduction', fecundity in relation to fish size must be determined. This means both the calculation of total energy stored in reproduction as well as an estimation of numbers of eggs and egg sizes produced. To test the 'carrying capacity' hypothesis it is necessary to obtain insight in the growth conditions of the flatfish at the reefs and in the inner bays. These growth conditions can be analysed by comparing observed growth with laboratory experiments on maximum growth in relation to temperature under excess food conditions.

The results of this and future flatfish research can be applied for environmental protection of the coral reef environment. The run-off of the mainland enters the inner bays and might act as a source of pollution for the reef environment. Analyses of the composition of flatfish from the various habitats might offer insight into what extent the reefs around Curaçao are under the stress of environmental pollution.

Acknowledgements. Thanks are due to the staff of Carmabi, Curaçao for their continuous support. We want to thank especially Dr. W. Bakhuis and Dr. D. Debrot for providing the necessary facilities. Prof. dr. R.P.M. Bak and the University of Amsterdam made this project possible. P.A. Walker corrected the English text and Dr. ir. H.W. van der Veer supervised the project.

6. REFERENCES

ANDERSON, J.T., 1988. A review of size dependent survival during pre-recruitment stages of fishes in relation to recruitment.-J. Northw. Atl. Fish. Sci. **8**: 55- 66.

BERGMAN, M.J.N., H.W. VAN DER VEER, A. STAM & D. ZUIDEMA, 1989. Transport mechanisms of larval plaice (*Pleuronectes platessa* L.) from the coastal zone into the Wadden Sea nursery area. Rapp. P.-v. Réun. Cons. perm. int. Explor. Mer **191**: 43-49.

BERTALANFFY, L. VON, 1934. Untersuchungen über die Gesetzlichkeit des Wachtums. I. Allgemeine Grundlagen der Theorie, mathematische und physiologische Gesetzlichkeiten des Wachtums bei Wassertieren. Wilhelm Roux. Arch. Entw. Mech. **131**: 613-652

BEVERTON, R.J.H., 1992. Patterns of reproductive strategy parameters in some marine teleost fishes. J. Fish Biol. **41**(Suppl. B): 137-160.

BEVERTON, R.J.H. & S.J. HOLT, 1993. On the dynamics of exploited fish populations. Chapman & Hall.

BEVERTON, R.H.J. & T.C. ILES, 1992. Mortality rates of 0-group plaice (*Pleuronectes platessa* L.), dab (*Limanda limanda* L.) and turbot (*Scophthalmus maximus* L.) in European waters II. Comparison of mortality rates and construction of life table for 0-group plaice.-Neth. J. Sea Res. **29**: 49-59.

BOHNSACK, J.A. & D.E. HARPER, 1988. Length-weight relationships of selected marine reef fishes from the southeastern United States and The Caribbean. NOAA Tech. Mem. NMFS-SEFC-215: 31 pp.

CERVIGÓN, F., 1985. Las especies de los generos *Achirus* y *Trinectes* (Pisces, Soleidae) de las costas de Venezuela.-Fundacion Cientifica Los Roques, Monografía **2**: 1-83.

CUSHING, D.H., 1986. The migration of larval and juvenile fish from spawning ground to nursery ground. J. Cons. perm. int. Explor. Mer. **43**: 43-49.

DAWSON, C.E., 1965. Length-weight relationships of some Gulf of Mexico fishes. Trans. Am. Soc. **94**: 279-280.

DAY, J. W., C.A.S. HALL, W.M. KEMP & A. YÁÑEZ-ARANCIBIA, 1989. Estuarine ecology. Wiley & Sons. New York

DEEGAN, L.A., J.W. DAY JR, J.G. GOSSELINK, G. SOBERON-CHAVEZ & P. SÁNCHEZ-GIL, 1986. Relationships among physical characters, vegetation distribution and fisheries yield in Gulf of Mexico estuaries. IN D.A. WOLFE. Estuarine variability (pp. 83-100). Academic Press. New York

DICKSON HOESE, H. & R.H. MOORE, 1977. Fishes of the Gulf of Mexico, Texas, Louisiana and adjacent waters. Texas A&M University Press, college station and London: 1-322.

DUYL, F.C. VAN, 1985. Atlas of the living reefs of Curaçao and Bonaire. PhD thesis, Vrije Universiteit Amsterdam.

ESCHMEYER, W.N., 1990. Catalog of the genera of recent fishes. California Academy of Sciences. San Franisco.

FAO species identification sheets for fishery purposes. Vol. 1, ed. W. FISHER, Rome 1978.

GIBSON, R.N., 1994. Does habitat quality and quantity affect recruitment in the juvenile stages of flatfishes? Neth. J. Sea Res. (in press).

GUTHERTZ, E.J., 1967. Field guide in the flatfishes of the family Bothidae in the western North Atlantic. US Fish. Wild. Serv. Circ. **263**: 1-47.

HECK JR., K.L. & R.J. ORTH, 1980. Seagrass habitats: the role of habitat complexity, competition and predation in structuring associated fish and motile macroinvertebrates assemblages. In V.S. KENNEDY. Estuarine perspectives (pp. 449-464). Academic press. New York.

HOUDE, E.D., 1989. Comparative growth, mortality, and energetics of marine fish larvae: Temperature and implied latitudinal effects. Fish. Bull. **87**: 471-495.

JONES, R., 1982. Ecosystems, food chains and yields. In: D. Pauly & G. I. Murphy. Theory and management of tropical fisheries. ICLARM Conf. Proc. **9**: 195-239.

KOCK, K.H., 1992. Antarctic fish and fisheries. Cambridge University Press. Cambridge.

KUIPERS, B.R., 1975. On the efficiency of a two-meter beamtrawl for juvenile plaice (*Pleuronectes platessa*). Neth. J. Sea Res. **9**: 69-85.

KUIPERS, B.R., 1977. On the ecology of juvenile plaice on a tidal flat in the Wadden Sea. Neth. J. Sea Res. **11**: 56-91.

KUIPERS, B.R., B. MACCURRIN, J.M. MILLER, H.W. VAN DER VEER & J.IJ. WITTE, 1992. Small trawls in juvenile flatfish research: their development and efficiency. Neth. J. Sea Res. **29**: 109-117.

MANICKCHAND-HEILEMAN, S.C., 1994. Distribution and abundance of flatfish on the South American continental shelf from Suriname to Colombia. Neth. J. Sea Res. **32**: 441-452.

MILLER, J.M., J.S. BURKE & G.R. FITZHUGH, 1991. Early life history patterns of Atlantic North American flatfish: likely and (unlikely) factors controlling recruitment. Neth. J. Sea Res. **27**: 261-275.

MILLER, J.M., L.B. CROWDER & M.L. MOSER, 1985. Migration and utilization of estuarine nurserie by juvenile fishes and evolutionary perspective. Contr. Mar. Sci. **27**(Suppl.): 338-352.

MURAKAMI, T. & K. AMAOKA, 1992. Review of the genus *Syacium* (Paralichtyidae) with the description of a new species from Ecuador and Columbia. Bull. Fac. Fish. Hokkaido Univ. **43**: 61-95.

NELSON, J.S., 1984. Fishes of the world. John Wiley & Sons. New York.

NORMAN, J.R., 1934. A systematic monograph of the flatfishes (Heterosomata). British museum (Natural History). London.

PAULY, D., 1979. Gill size and temperature as governing factors in fish growth: a generalization of Von Bertalanffy's growth formula. Ber. Inst. Meeresk. **63**: 1-200.

PAULY, D., 1980. On the interrelationships between natural mortality, growth parameters and mean environmental temperature in 175 fish stocks. J. Cons. perm. int. Explor. Mer. **39**: 175-192.

PAULY, D., 1994. A framework for latitudinal comparisons of flatfish recruitment. Neth. J. Sea Res. **32**: 107-118.

PIHL, L. & H.W. VAN DER VEER, 1992. Importance of exposure and habitat structure for the population density of 0-group plaice, *Pleuronectes platessa* L. in coastal nursery areas. Neth. J. Sea Res. **29**: 145-152.

REICHERT, M.J.M. & H.W. VAN DER VEER, 1991. Settlement, abundance, growth and mortality of juvenile flatfish in a subtropical tidal estuary (Georgia, U.S.A.). Neth. J. Sea Res. **27**: 375-391.

RIJNSDORP, A.D., 1992. Long-term effects of fishing in North Sea plaice: disentangling genetic and phenotypic plasticity in growth, maturation and fecundity. PhD thesis, University of Amsterdam.

SÁNCHEZ-GIL, P., F. ARREGUÍN-SÁNCHEZ & M.C. GARCÍA-ABAD, 1994. Ecological strategies and recruitment of *Syacium gunteri* (Pisces: Bothidae) in the southern Gulf of Mexico shelf. Neth. J. Sea Res. **32**: 433-439.

TOPP, R.W. & F.H. HOFF, 1972. Flatfishes (Pleuronectiformes). Memoirs of the Hourglass Cruises. Mar. Res. Lab., Fla. Dept. Nat. Resources. **197**: 1-135.

VEER, H.W. VAN DER, 1986. Immigration, settlement and density-dependent mortality of a larval and early post-larval 0-group plaice (*Pleuronectes platessa*) population in the western Wadden Sea. Mar. Ecol. Prog. Ser. **29**: 223-236.

VEER, H.W. VAN DER, C. ALIAUME, J.M. MILLER, E.J. ADRIAANS, J.IJ.WITTE & A. ZERBI, 1994. Ecological observations on juvenile flatfish in a tropical coastal system, Puerto Rico. Neth. J. Sea Res. **32**: 453-460.

VEER, H.W. VAN DER, M.J.N. BERGMAN, R. DAPPER & J.IJ. WITTE, 1991. Population dynamics of an intertidal 0-group flounder *Platichthys flesus* population in the western Dutch Wadden Sea. Mar. Ecol. Prog. Ser. **73**: 141-148.

YÁÑEZ-ARANCIBIA, A., 1985. Fish community ecology in estuaries and coastal lagoons: towards an ecosystem integration. Editorial Universitaria UNAM-PUAL-ICML. Mexico.

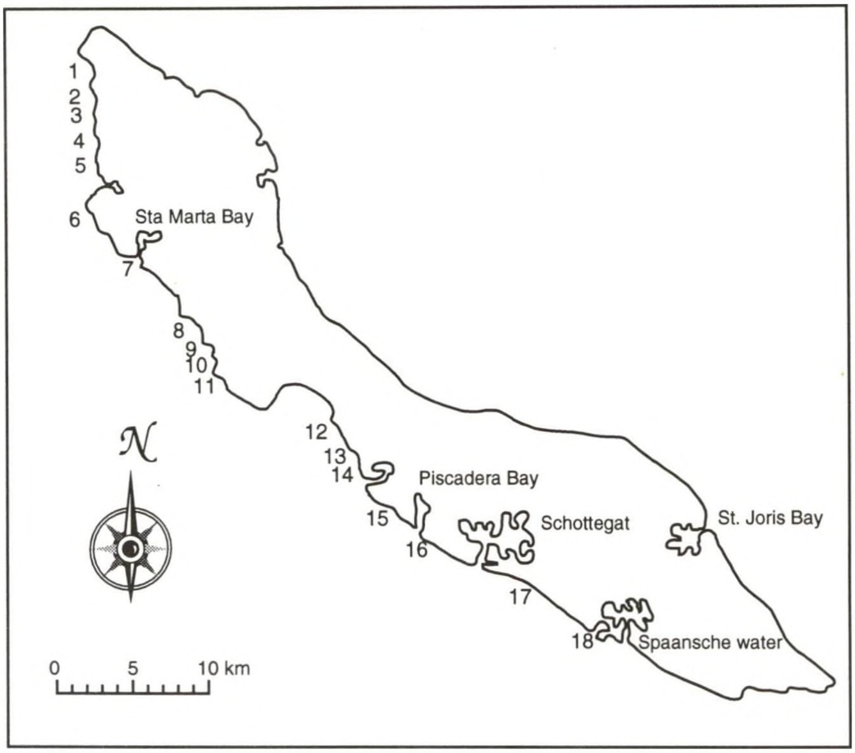

FIG. 1. Map of Curaçao and the inner bays and the sampling stations. 1: Playa Kalki; 2: Grote Knip; 3: Kleine Knip; 4: Playa Jeremi; 5: Playa Lagun; 6: Playa Manalina; 7: Coral Cliff; 8: Cas Abao; 9: Porto Marie; 10: Daaibooibaai; 11: Rif St. Marie; 12: Pestbay; 13: Vaersenbay; 14: Boca St. Michiel; 15: Blauwbay; 16: Carmabi/Caribbean Hotal; 17: Seaquarium/Jan Thiel; 18: Caracasbay.

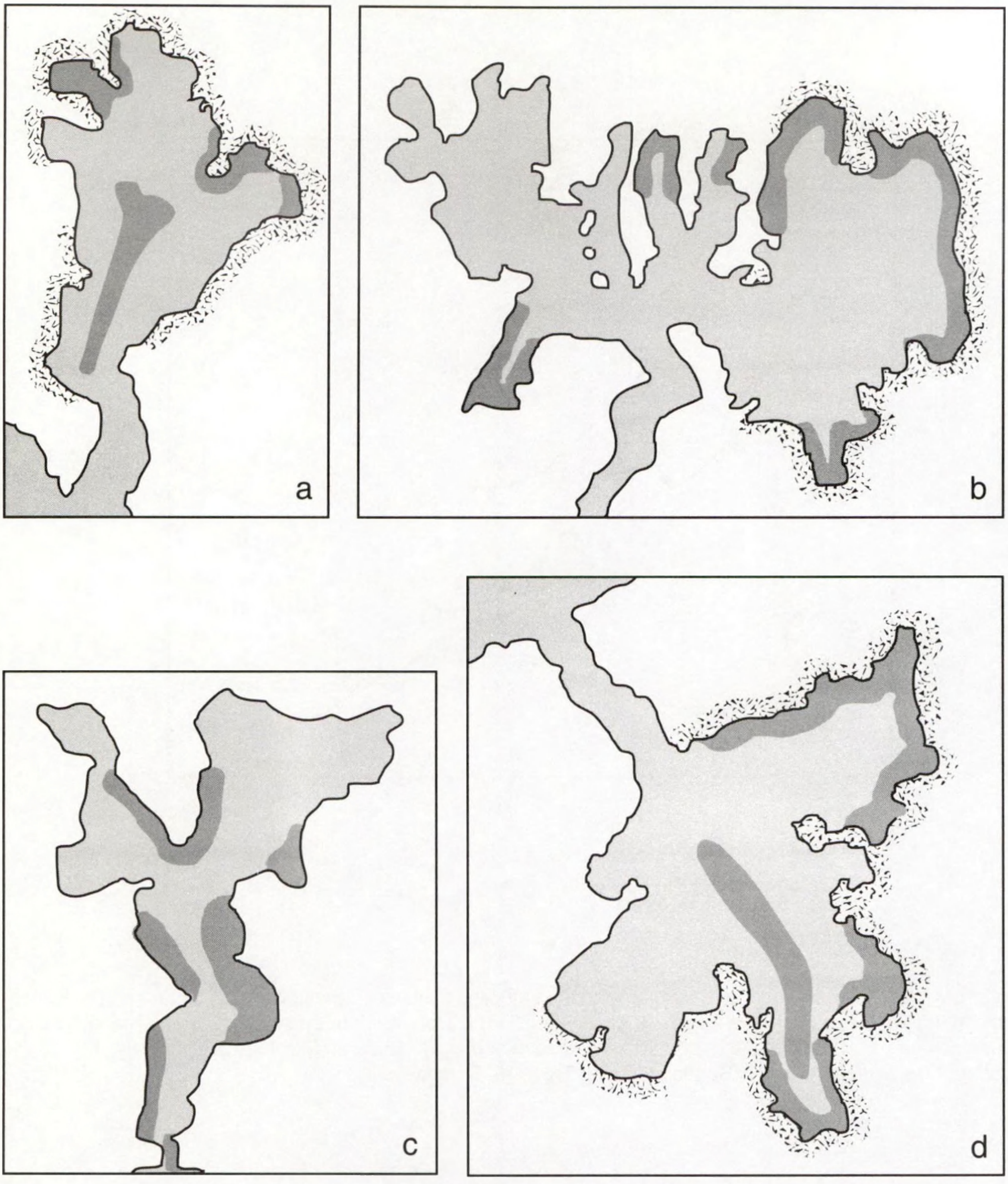

FIG. 2. Detailed description of the four inner bays where sampling was carried out with a beantrawl. a: Piscadera bay; b: Spaansche Water bay; c: Sta Marta bay; d: St. Joris bay. Grey areas indicate the sampling sites. Lines indicate mangroves.

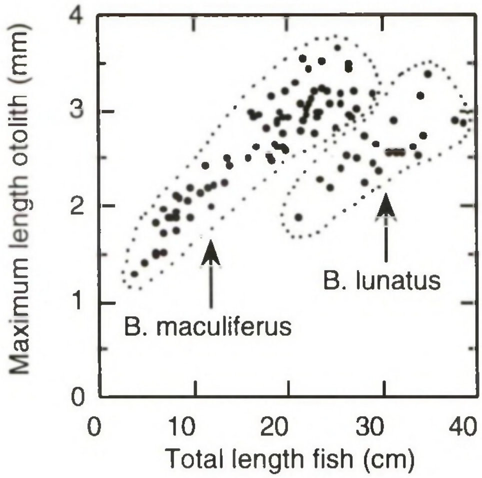

FIG. 3. Total length-otolith length relationships for the mixed group of *B. maculiferus* and *B. lunatus*.

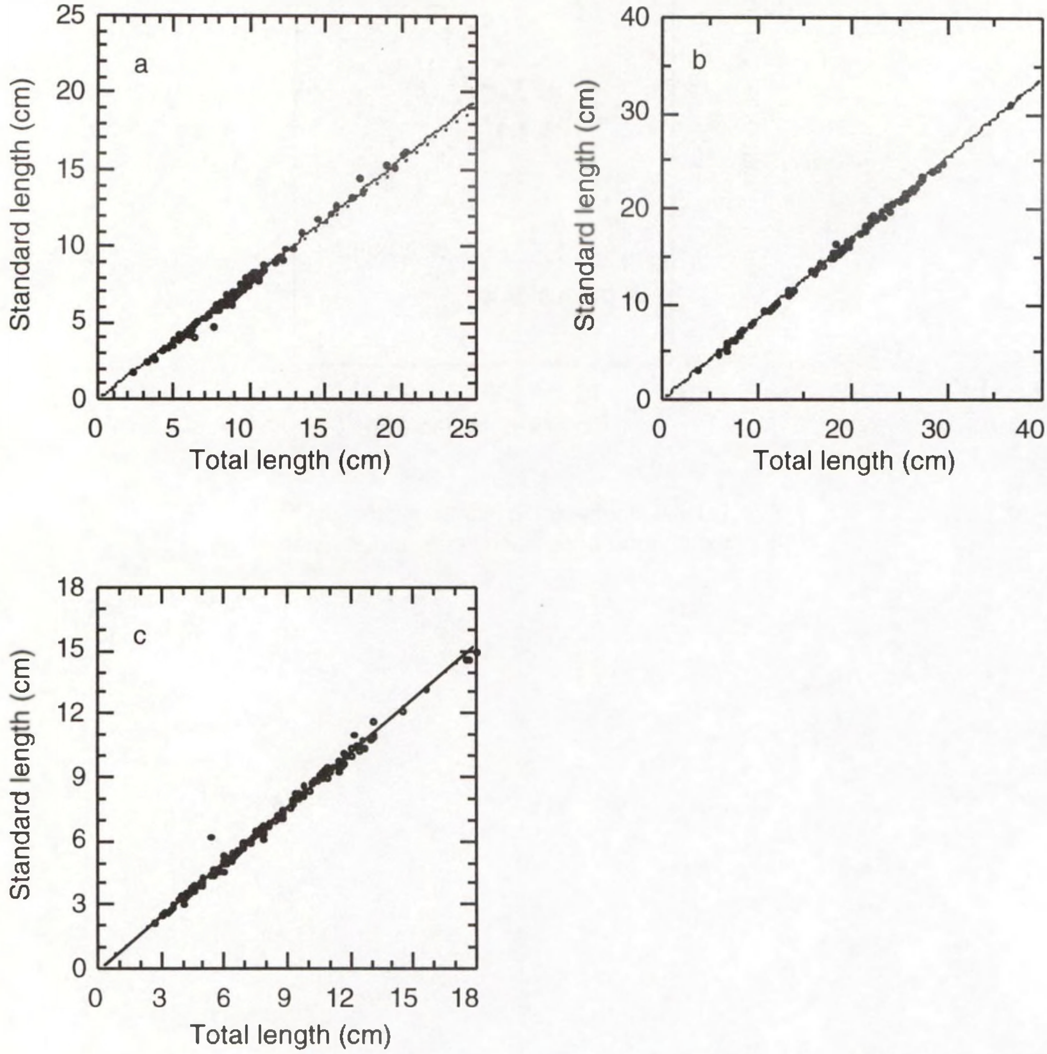

FIG. 4. Total length-standard length relationships for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao. Parameters of the drawn curve fits are given in Table 2.

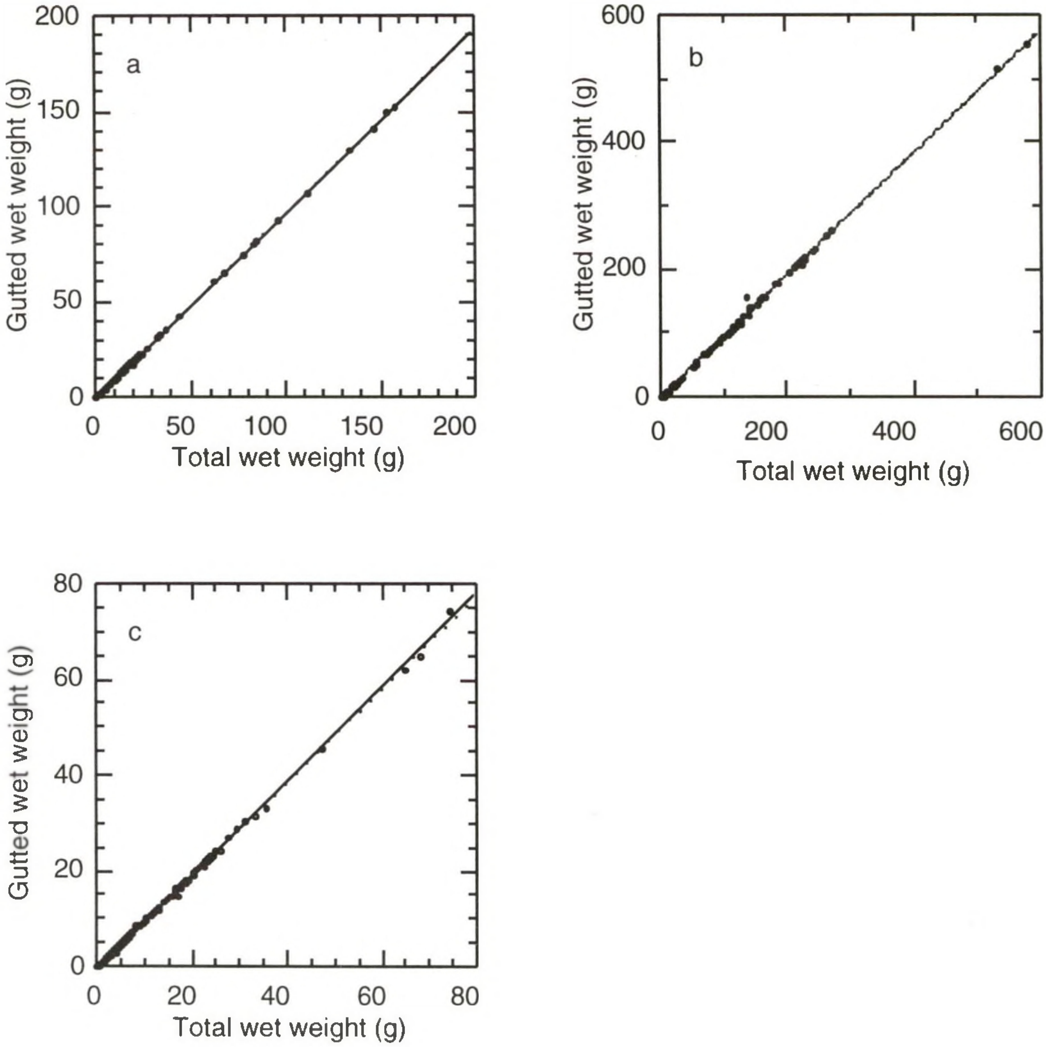

FIG. 5. Total wet weight-gutted wet weight relationships for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao. Parameters of the drawn curve fits are given in Table 3.

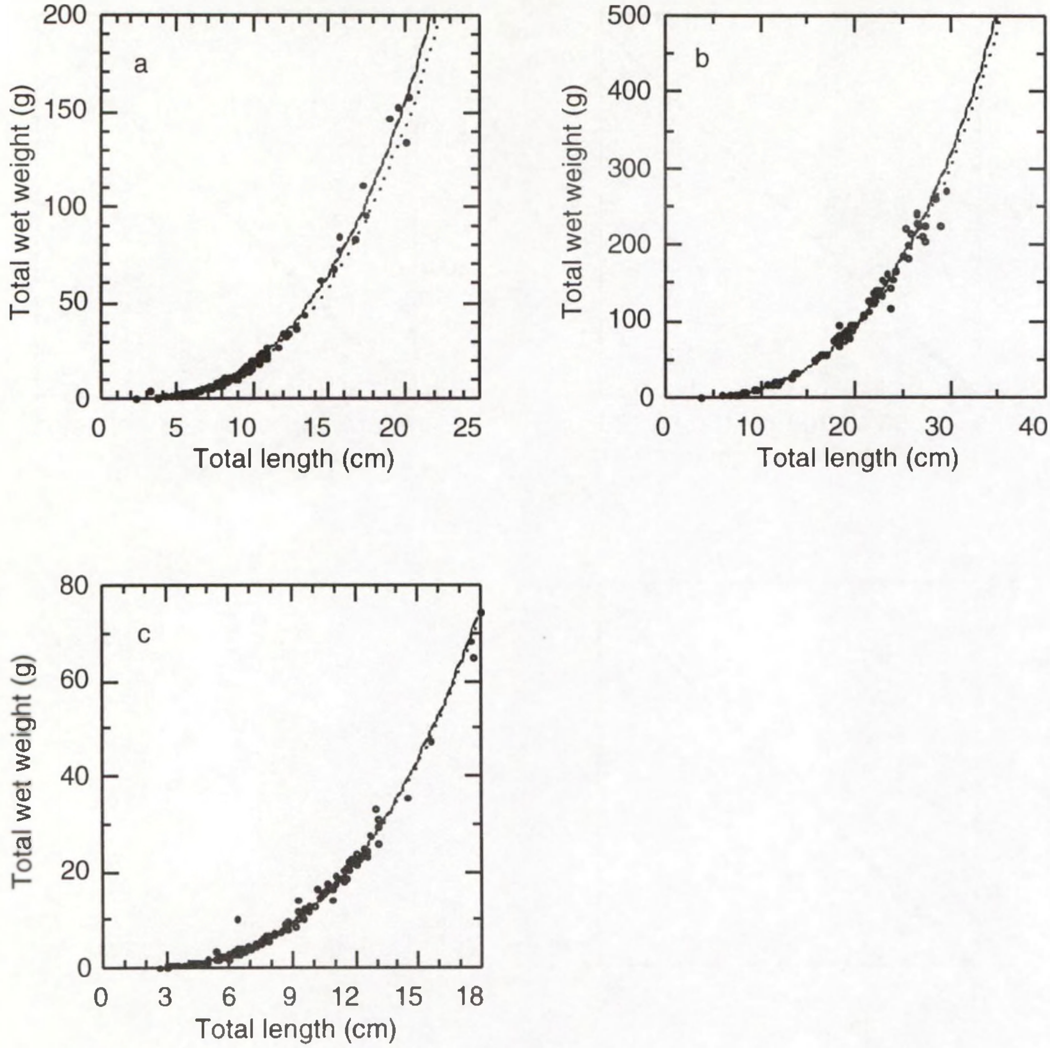

FIG. 6. Total length-total wet weight relationships for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao. Parameters of the drawn curve fits are given in Table 4.

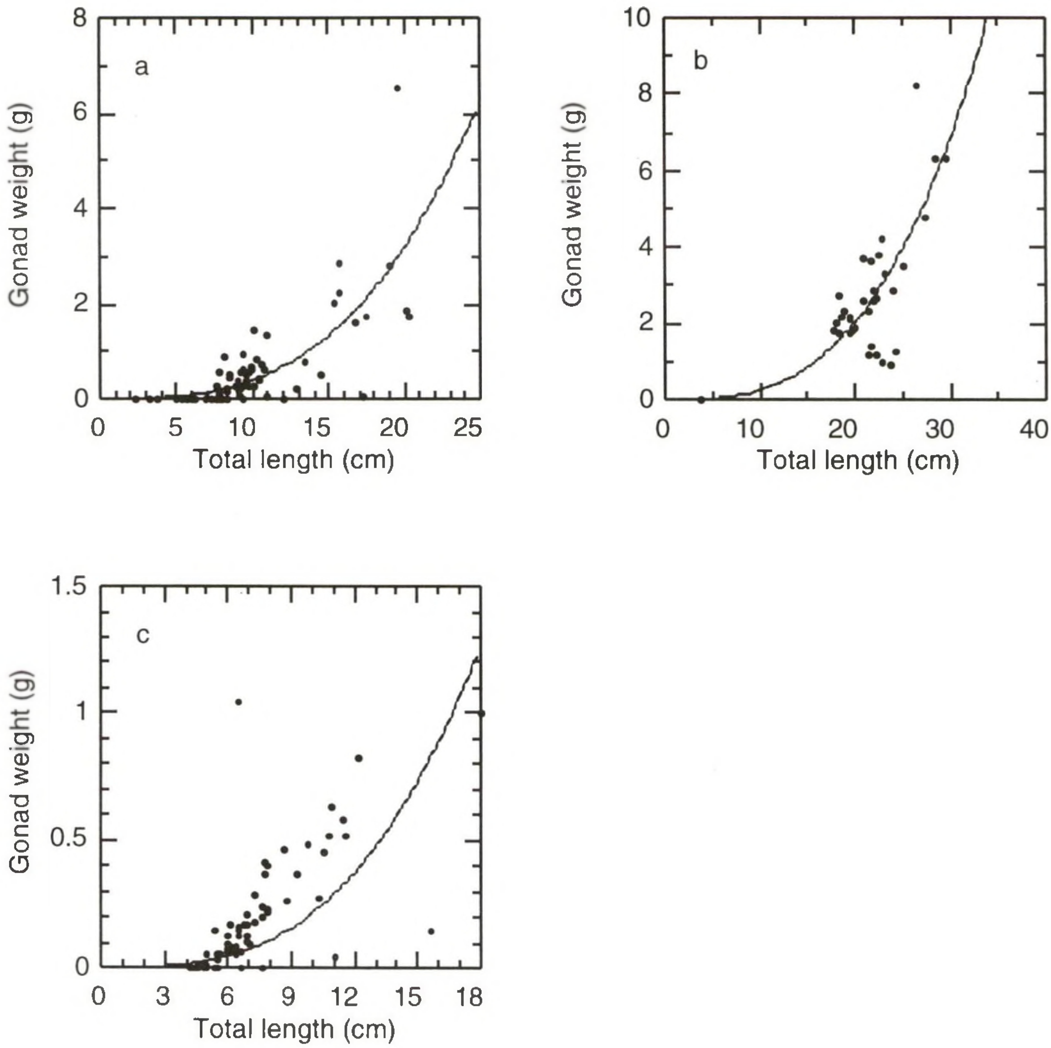

FIG. 7. Total length-gonad weight relationships for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao. Parameters of the drawn curve fits are given in Table 5.

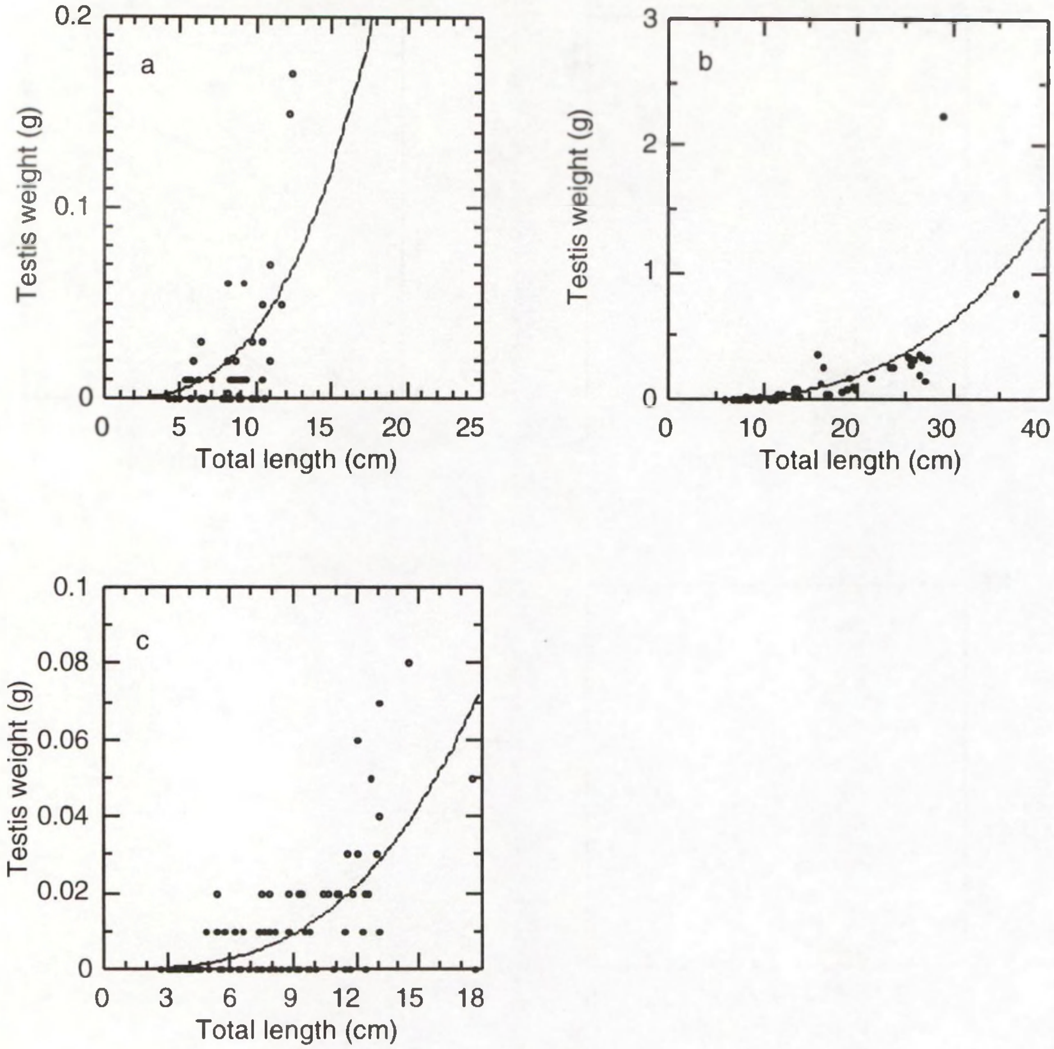

FIG. 8. Total length-testis weight relationships for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao. Parameters of the drawn curve fits are given in Table 6.

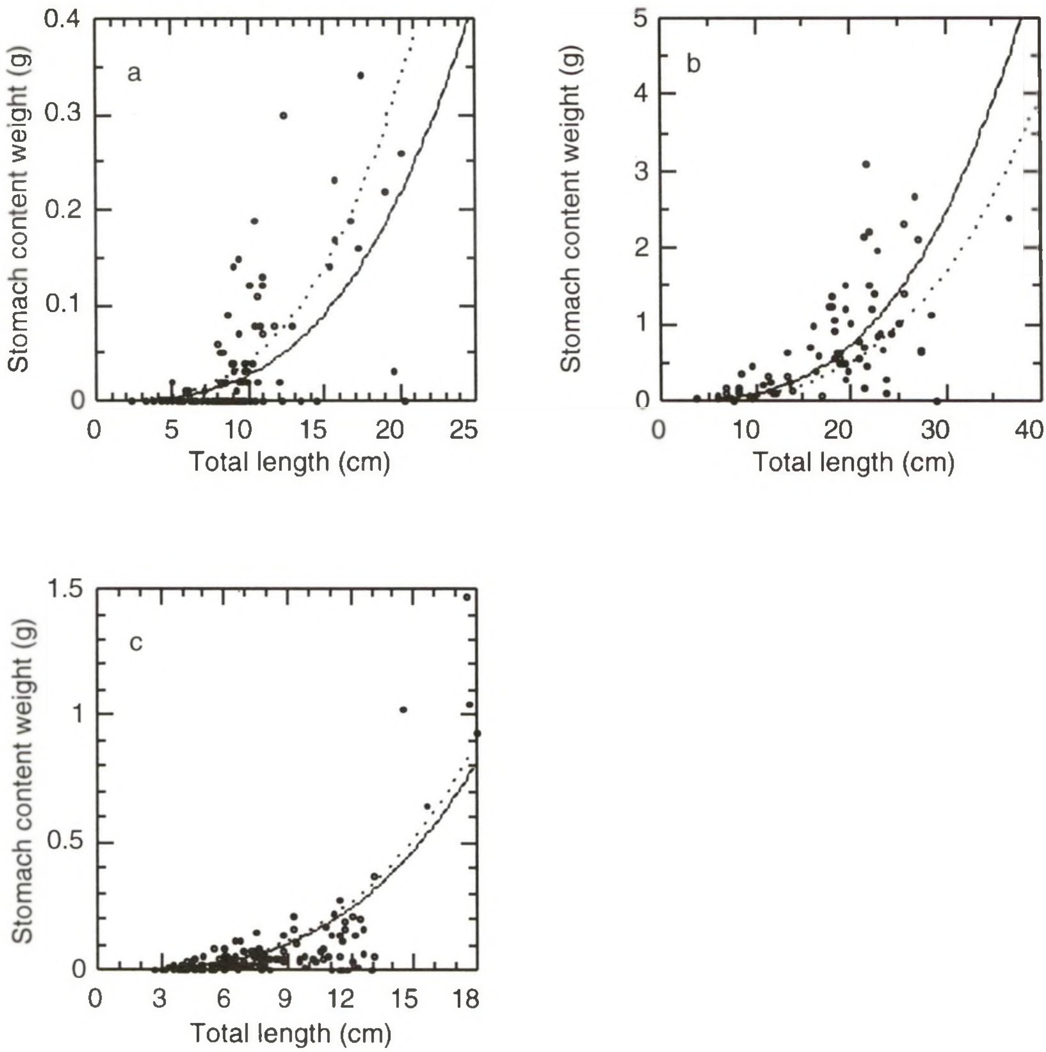

FIG. 9. Total length-stomach content weight relationships for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao. Parameters of the drawn curve fits are given in Table 7.

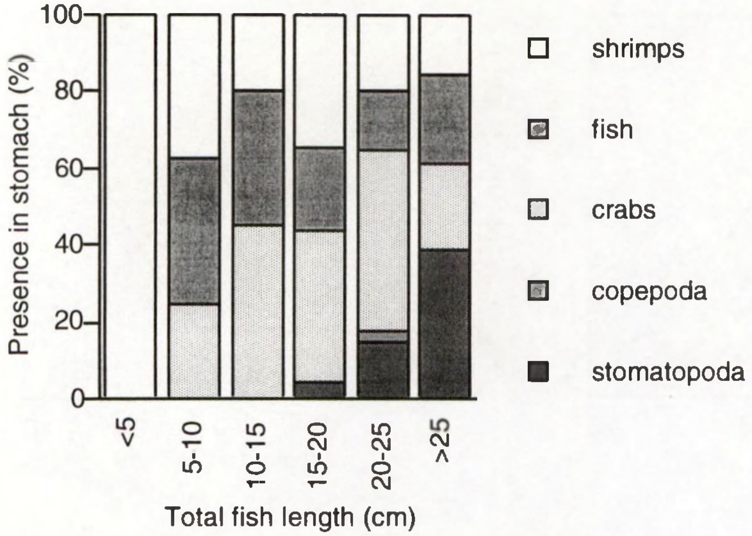

FIG. 10. Percentage of different food types (%) at different lenght classes present in stomachs of *Bothus maculiferus*, caught from January till June 1995 around Curaçao.

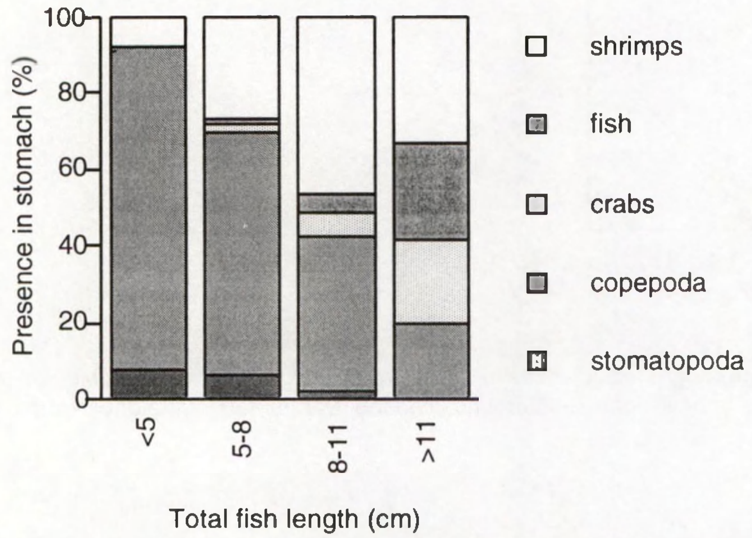

FIG. 11. Percentage of different food types (%) at different lenght classes present in stomachs of *Bothus ocellatus*, caught from January till June 1995 around Curaçao.

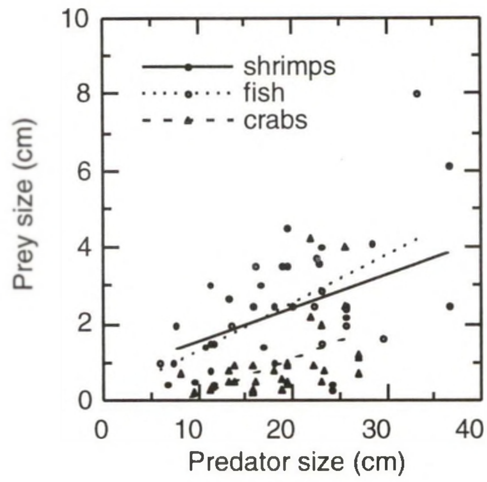

FIG. 12. Predator size-prey size (cm) relationships for *Bothus maculiferus* with different types of prey. Parameters of the drawn curve-fits are given in Table 8.

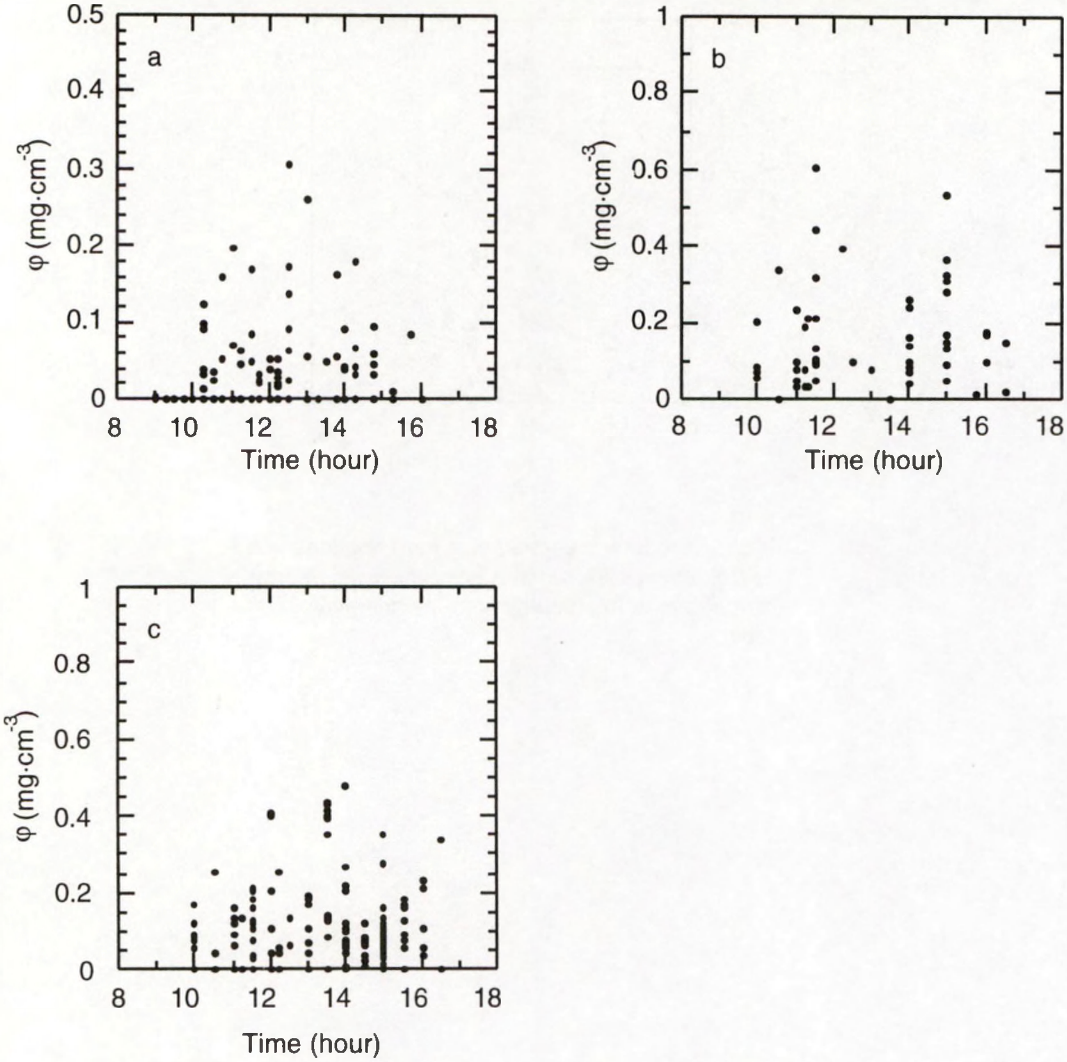

FIG. 13. Variation in food uptake coefficient (mg·cm^{-3}) during the day for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao.

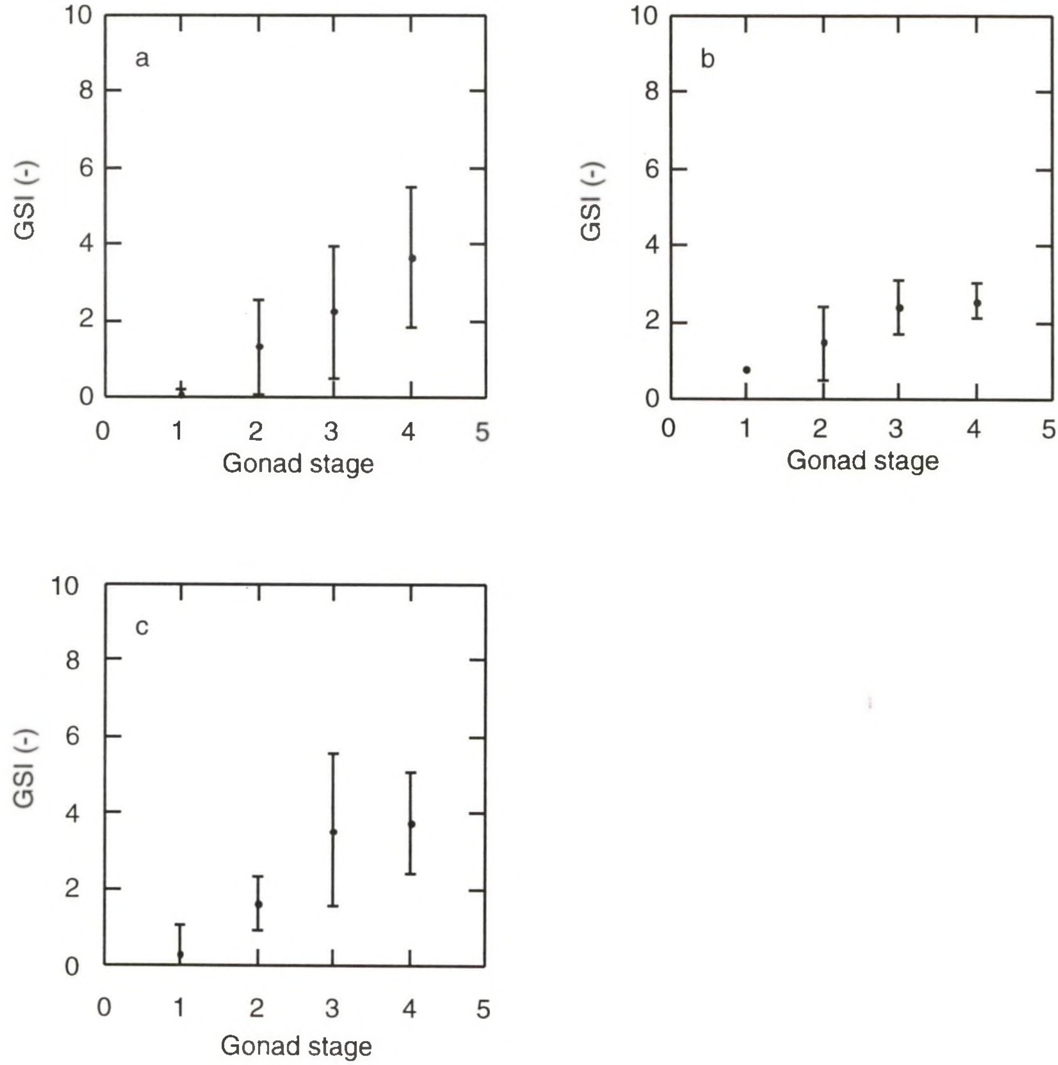

FIG. 14. Mean Gonadosomatic Indices (GSI;-) per gonad stage for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao. The vertical bars indicate standard deviations.

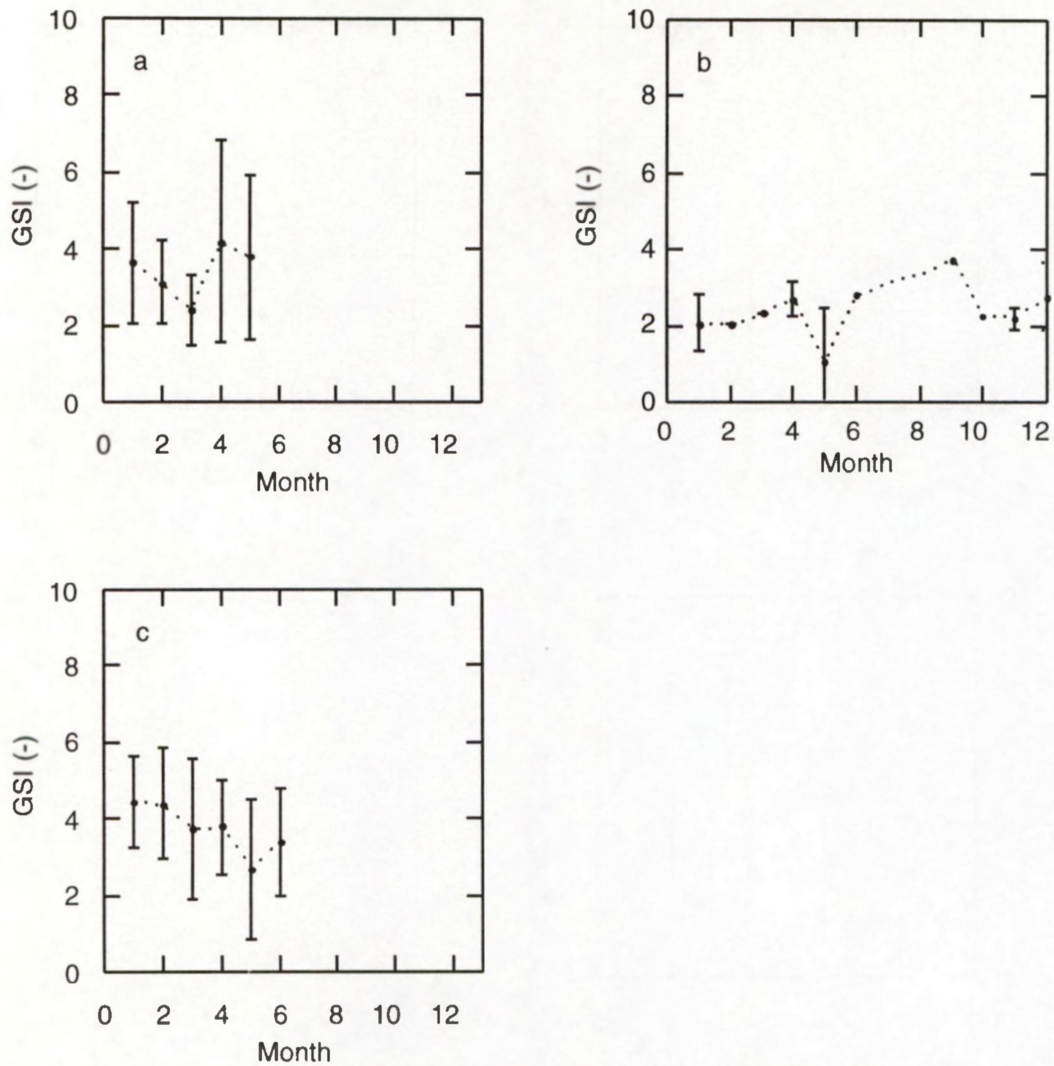

FIG. 15. Monthly variations in Gonadosomatic Indeces (GSI;-) of spawning females (gonad stage 3 and 4) for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao. The vertical bars indicate standard deviations.

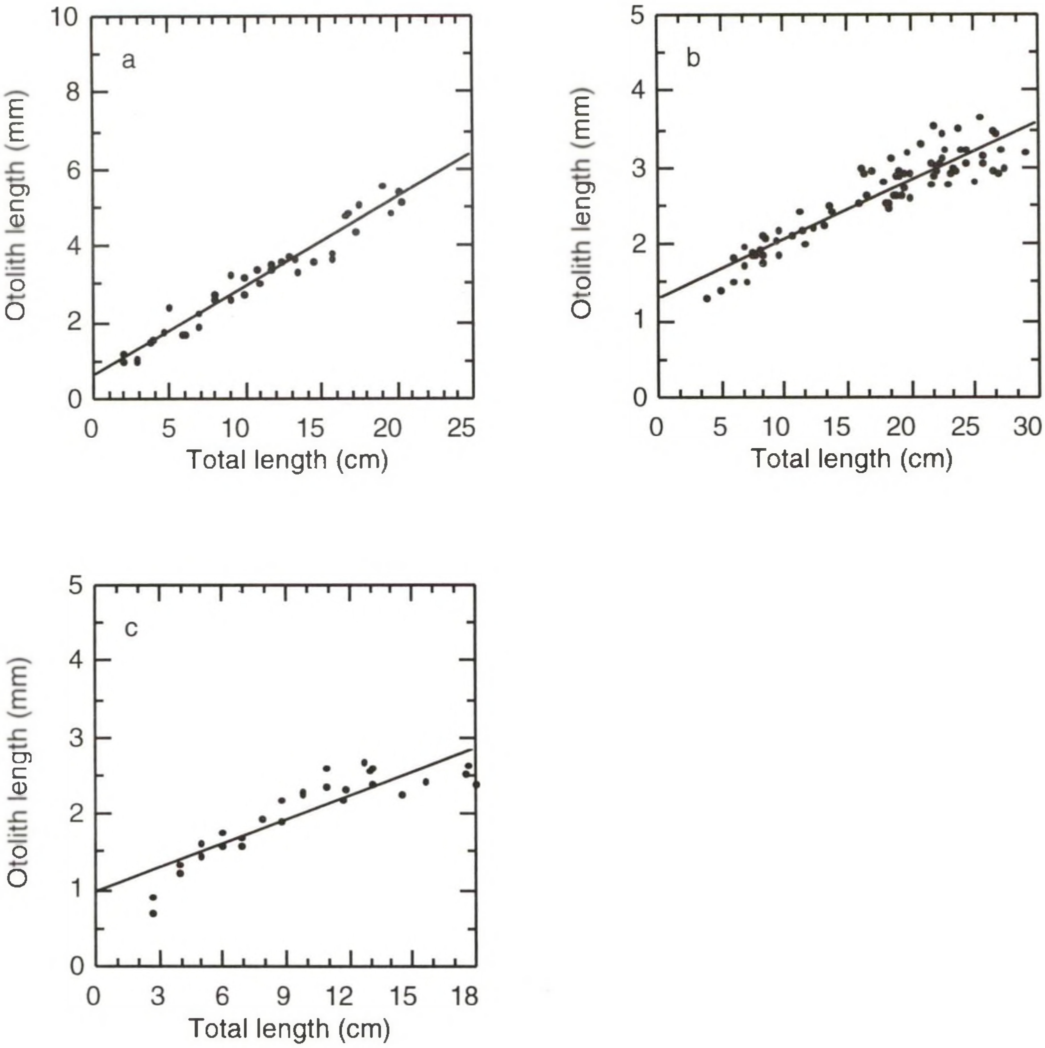

FIG. 16. Otolith length-total length relationships for a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao. Parameters of the drawn curve-fits are given in Table 9.

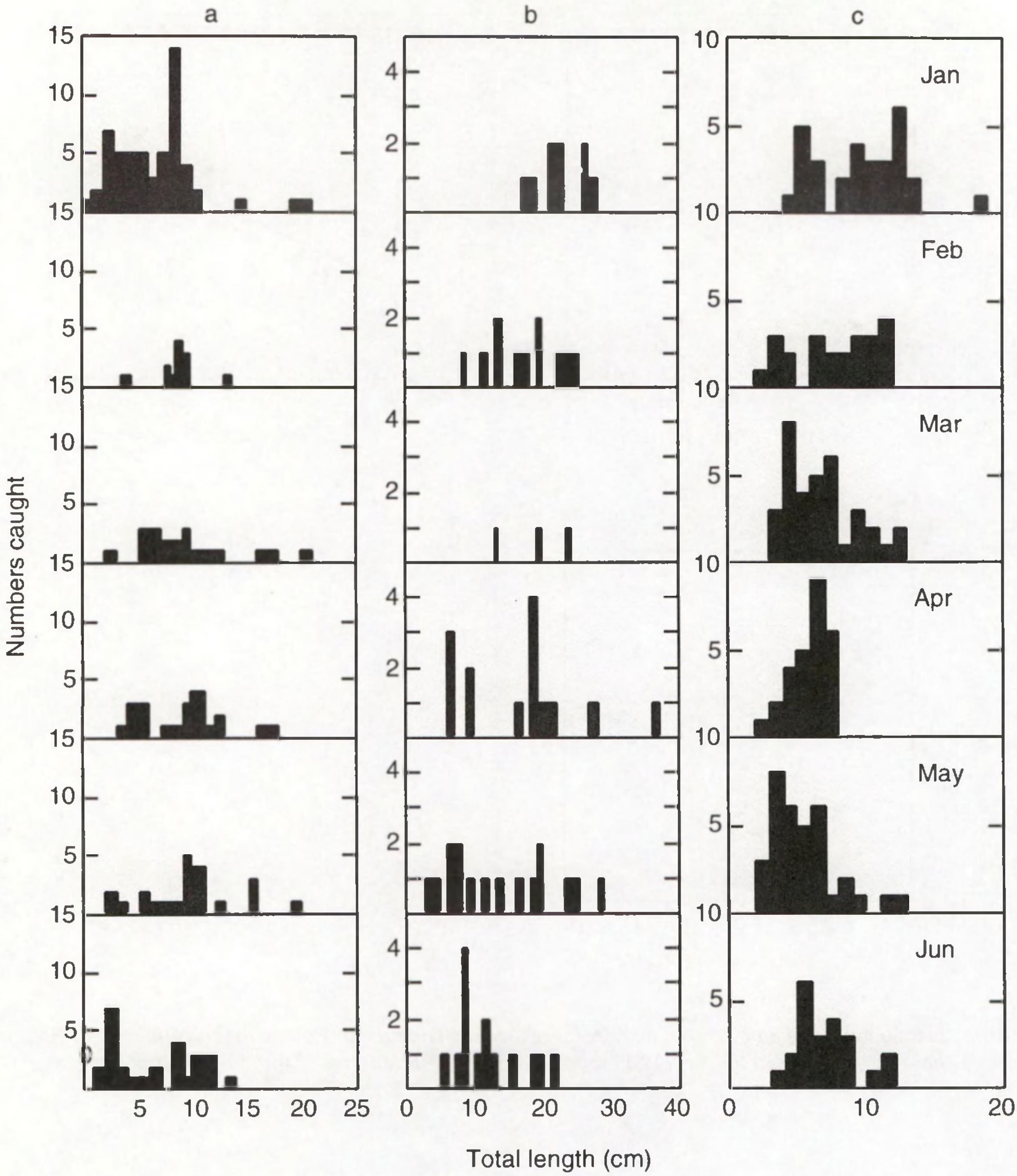

FIG. 17. Size-frequency distributions of a: *Achirus lineatus*, b: *Bothus maculiferus* and c: *Bothus ocellatus* caught from January till June 1995 around Curaçao.

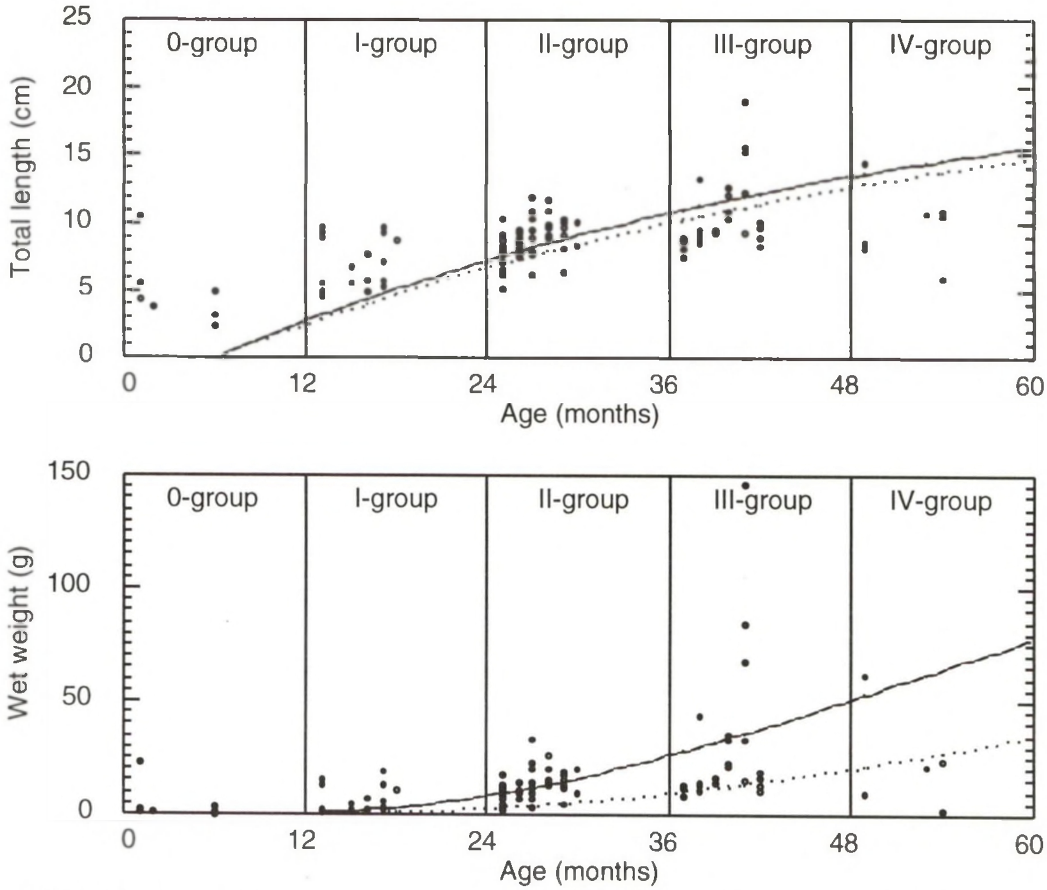

FIG. 18. von Bertalanffy growth curves, expressed in total length (top) and total wet weight (bottom) fitted through 0-IV group *Achirus lineatus*, caught from January till June 1995 around Curaçao. Parameters are given in Tables 11 and 12.

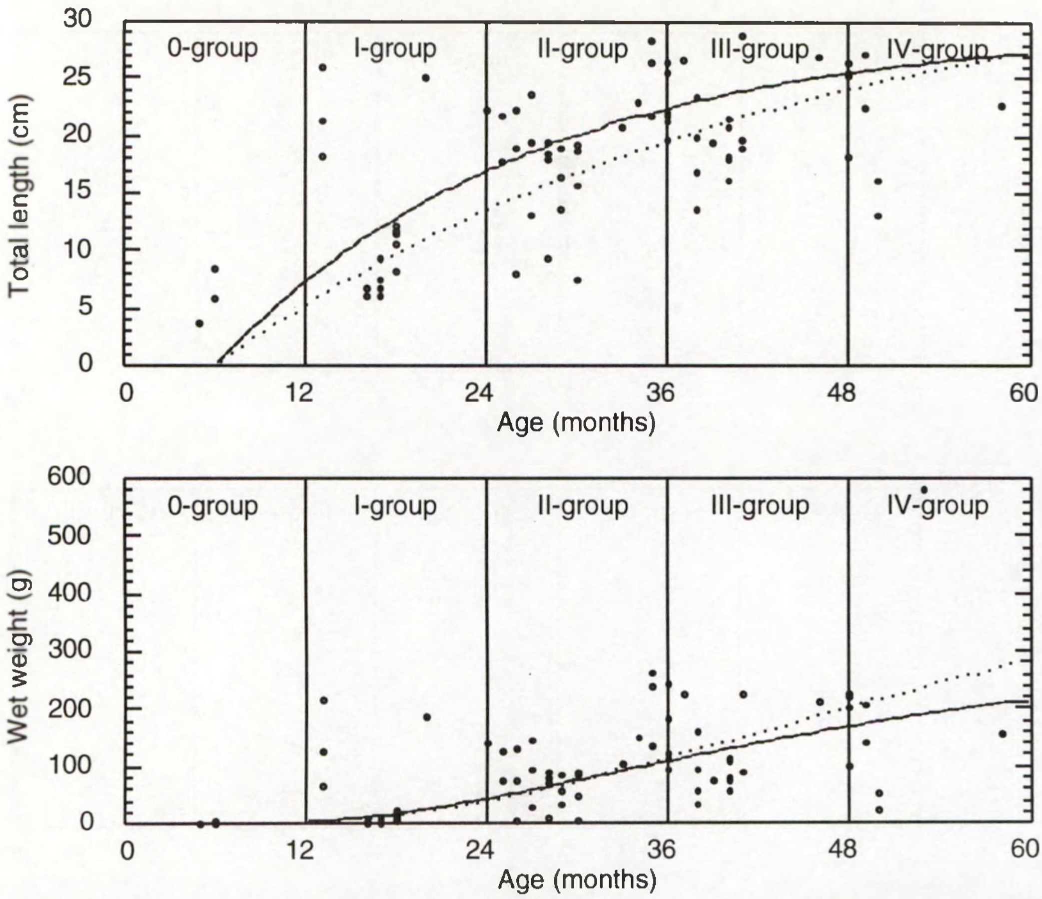

FIG. 19. von Bertalanffy growth curves, expressed in total length (top) and total wet weight (bottom) fitted through 0-IV group *Bothus maculiferus*, caught from January till June 1995 around Curaçao. Parameters are given in Tables 11 and 12.

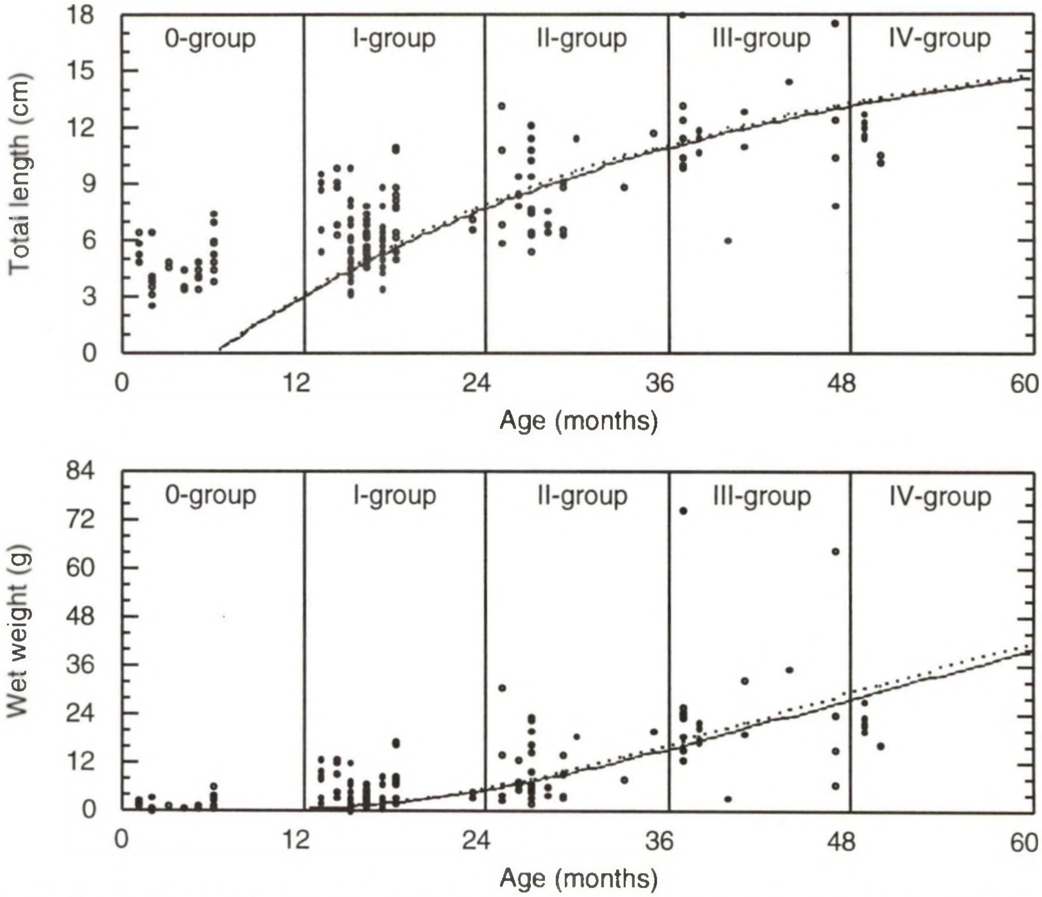

FIG. 20. von Bertalanffy growth curves, expressed in total length (top) and total wet weight (bottom) fitted through 0-IV group *Bothus ocellatus*, caught from January till June 1995 around Curaçao. Parameters are given in Tables 11 and 12.

TABLE 1

Species composition of flatfish caught from January until June 1995 around Curaçao. For each species habitat, total length range (TL;cm), total wet weight range (W;g) and total number of fish caught are given, for males (m) and females (f) separately.

Species		Habitat		TL-range		W-range		n
		reef	bay	min	max	min	max	
Achirus lineatus	f		x	2.3	20.2	0.16	157.45	68
	m		x	4.3	12.3	1.07	33.58	47
Bothus ocellatus	f	x		4.2	18.0	0.78	74.58	67
	m	x		2.6	17.6	0.12	68.27	104
Bothus maculiferus	f	x		3.7	29.6	0.53	270.40	35
	m	x		5.9	36.7	2.23	579.39	50
Bothus lunatus	f	x		21.1	33.1	121.84	416.60	9
	m	x		23.5	38.5	151.40	662.10	13
Syacium micrurum	f	x	x	12.6	21.5	18.58	90.57	5
	m	x	x	10.1	22.6	9.23	116.40	6
Trinectus inscriptus			x	4.1	5.6	1.07	3.32	4
Citharichtys spilopterus		x	x	3.7	12.6	0.40	17.10	5

TABLE 2

Parameters of the total length (TL;cm) - standard length (SL;cm) relationship according to SL=a·TL for the various species caught at Curaçao between January and June 1995, for males (m) and females (f) separately, together with standard error (SE) and correlation coefficient (R).

Species		a	SE	R
A. lineatus	f	0.783	0.0032	1.00
	m	0.765	0.0039	0.99
B. ocellatus	f	0.847	0.0043	0.99
	m	0.842	0.0017	1.00
S. micrurum	f	0.831	0.0022	1.00
	m	0.841	0.0165	0.99
B. maculiferus	f	0.844	0.0022	1.00
	m	0.840	0.0017	1.00
B. lunatus	f	0.840	0.0015	1.00
	m	0.842	0.0034	0.99
T. inscriptus	f/m	0.789	0.0049	1.00
C. spilopterus	f/m	0.818	0.0048	1.00

TABLE 3

Parameters of the total wet weight (W_t;g) - gutted wet weight (W_g;g) relationship according to $W_t=a \cdot W_g$ for the various species caught at Curaçao between January and June 1995, for males (m) and females (f) separately, together with standard error (SE) and correlation coefficient (R).

Species		a	SE	R
A. lineatus	f	0.967450	0.000853	1.00
	m	0.961470	0.002106	1.00
B. ocellatus	f	0.969530	0.003910	1.00
	m	0.957670	0.001599	1.00
S. micrurum	f	0.961120	0.002261	1.00
	m	0.949260	0.003498	1.00
B. maculiferus	f	0.957430	0.006625	1.00
	m	0.960050	0.001419	1.00
B. lunatus	f	0.954490	0.004116	1.00
	m	0.966630	0.003055	1.00
T. inscriptus	f/m	0.970860	0.015283	1.00
C. spilopterus	f/m	0.968880	0.008545	1.00

TABLE 4

Parameters of the total length (TL;cm) - total wet weight (W;g) relationship according to **A**: $TL=a \cdot W^b$ and **B**: $TL=a \cdot W^3$ for the various species caught at Curaçao between January and June 1995, for males (m) and females (f) separately, together with standard error (SE) and correlation coefficient (R).

A

Species		a	b	SE	R
A. lineatus	f	0.0182	2.99	0.085	0.97
	m	0.0104	3.22	0.046	0.99
B. ocellatus	f	0.0113	3.08	0.068	1.00
	m	0.0093	3.15	0.024	1.00
S. micrurum	f	0.0103	2.97	0.109	0.99
	m	0.0082	3.06	0.062	0.99
B. maculiferus	f	0.0345	2.66	0.098	0.97
	m	0.0220	2.80	0.056	0.99
B. lunatus	f	0.0149	2.92	0.169	0.99
	m	0.0078	3.11	0.346	0.99
T. inscriptus	f/m	0.0052	3.78	0.295	0.99
C. spilopterus	f/m	0.0010	3.86	0.540	0.97

B

Species		a	SE	R
A. lineatus	f	0.0192	0.0002	0.99
	m	0.0176	0.0002	0.99
B. ocellatus	f	0.0129	0.0001	1.00
	m	0.0127	0.0001	1.00
S. micrurum	f	0.0094	0.0002	1.00
	m	0.0100	0.0001	1.00
B. maculiferus	f	0.0117	0.0002	0.97
	m	0.0112	0.0002	0.99
B. lunatus	f	0.0115	0.0002	0.99
	m	0.0115	0.0004	0.95
T. inscriptus	f/m	0.0185	0.0009	0.98
C. spilopterus	f/m	0.0078	0.0006	0.97

TABLE 5

Parameters of the total length (TL;cm) - gonad weight (W;g) relationship according to TL=a·W^3 for the various species caught at Curaçao between January and June 1995, for males (m) and females (f) separately, together with standard error (SE) and correlation coefficient (R).

Species	a	SE	R
A. lineatus	0.00040	0.000033	0.74
B. ocellatus	0.00022	0.000025	0.47
B. ocellatus	0.00015	0.000006	0.85
S. micrurum	0.00014	0.000033	0.79
B. maculiferus	0.00025	0.000016	0.74
B. lunatus	0.00033	0.000025	0.89

TABLE 6

Parameters of the total length (TL;cm) - testis weight (W;g) relationship according to TL=a·W^3 for the various species caught at Curaçao between January and June 1995, for males (m) and females (f) separately, together with standard error (SE) and correlation coefficient (R).

Species	a	SE	R
A. lineatus	0.000036	0.000005	0.61
B. ocellatus	0.000013	0.000004	0.00
S. micrurum	0.000019	0.000001	0.99
B. maculiferus	0.000023	0.000003	0.64
B. lunatus	0.000033	0.000022	0.00

TABLE 7

Parameters of the total length (TL;cm) - stomach content weight (W;g) relationship according to TL=a·W^3 for the various species caught at Curaçao between January and June 1995, for males (m) and females (f) separately, together with standard error (SE) and correlation coefficient (R).

Species		a	SE	R
A. lineatus	f	0.000027	0.000003	0.60
	m	0.000042	0.000008	0.50
B. ocellatus	f	0.000140	0.000006	0.93
	m	0.000154	0.000011	0.79
S. micrurum	f	0.000039	0.000006	0.65
	m	0.000126	0.000012	0.97
B. maculiferus	f	0.000091	0.000013	0.00
	m	0.000062	0.000007	0.68
B. lunatus	f	0.000097	0.000023	0.43
	m	0.000104	0.000037	0.50

TABLE 8

Parameters of the predator size (TL;cm) - prey size (P;cm) relationship for *Bothus maculiferus* according to P=a·TL+b (caught at Curaçao between January and June 1995), together with correlation coefficient (R).

Prey	a	b	R
shrimps	0.71	0.09	0.44
fish	0.05	0.13	0.63
crabs	-0.71	0.09	0.49

TABLE 9

Parameters of the otolith length (OL;mm) - total length (TL;cm) relationships according to OL=a·TL+b for the various species caught at Curaçao between January and June 1995, correlation coefficient (R).

Species	a	b	R
A. lineatus	0.233	0.632	0.97
B. lunatus	0.057	0.871	0.79
B. ocelatus	0.105	0.995	0.88
B. maculiferus	0.078	1.299	0.92
S. micrurum	0.255	0.552	0.99

TABLE 10

Mean densities of *Achirus lineatus* in the inner bays of Curaçao over the period January until June 1995.

Location	$n.100m^{-2}$
Picadera bay	1.51
Sta Marta bay	1.89
Spaansche Water bay	0.14
St. Joris bay	0.20

TABLE 11

Parameters L∞ (cm), K ($year^{-1}$) and R-values of the Von Bertalanffy growth in total length. Also shown: calculated mortality (M;$year^{-1}$) and longevity (t∞; $year^{1}$) values of flatfish caught from January till June 1995 around Curaçao.

† data from Dawson, 1963.

Species		t_0	L∞	K	R	M	t∞	n
Achirus lineatus	f	6	23.0†	0.252	0.90	0.768	12	68
	m	6	23.0†	0.228	0.90	0.719	14	47
Bothus ocellatus	f	6	18.0	0.372	0.78	1.060	9	67
	m	6	18.0	0.384	0.83	1.083	8	103
Bothus maculiferus	f	6	29.6	0.568	0.00	1.217	5	35
	m	6	36.7	0.305	0.62	0.764	10	50

TABLE 12

Parameters W∞ (cm), K ($year^{-1}$) and R-values of the Von Bertalanffy growth in total wet weight (W;g). Also shown: calculated mortality (M;$year^{-1}$) and longevity (t∞; $year^{1}$) values of flatfish caught from January till June 1995 around Curaçao.

† data calculated from L∞ (Table 11) with length-weight relationships (Table 4).

Species		t_0	W∞†	K	R	M	t∞	n
Achirus lineatus	f	6	232.3	0.264	0.74	0.734	12	68
	m	6	232.3	0.168	0.53	0.541	18	47
Bothus ocellatus	f	6	84.2	0.336	0.39	0.939	9	67
	m	6	84.2	0.348	0.73	0.962	9	103
Bothus maculiferus	f	6	303.8	0.493	0.00	1.096	6	35
	m	6	552.9	0.358	0.65	0.840	8	50

Appendix I. Catch data of the eyed flounder *Bothus ocellatus* around Curaçao in January-June 1995.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
			13.1	11.0	29.34	28.69		0.01	7		BO22	3
			15.6	13.2	47.41	45.41	0.15		1	0.65	BO23	3
			7.6	6.5	5.73	5.42	0.00		1	0.07	BO24	1
8/27/94		Klein Curaçao	14.5	12.2	35.56	33.28		0.08	2	1.02	BO6	3
9/30/94		San Michiel	8.8	7.4	7.91	7.77		0.01	1		BO9	2
11/5/94		Santa Cruz	17.6	14.6	64.87	61.75		0.00	1	1.05	BO15	3
11/5/94		Westpunt	12.4	10.5	23.94	23.02		0.00	1	0.20	BO16	3
11/5/94		Westpunt	10.4	8.9	15.32	14.86		0.02	1		BO11	3
11/5/94		Westpunt	7.2	6.1	4.57	4.42		0.00	1		BO12	1
11/5/94		Westpunt	6.6	5.4	3.49	3.37	0.06		2		BO13	1
11/6/94		Hala Kanoa	17.5	14.6	68.27	64.54		0.05	2	1.47	BO8	5
11/22/94		San Michiel	7.9	6.6	6.47	6.34		0.00	2		BO5	3
11/22/94		Hala Kanoa	11.7	9.7	20.23	19.49		0.00	1	0.16	BO7	2
1/10/95		Boca Sami	9.6	8.1	12.51	12.11		0.00	1		BO1	1
1/10/95		Boca Sami	9.2	7.7	9.99	9.76		0.00	1		BO2	1
1/10/95		Boca Sami	10.0	8.4	12.94	12.67		0.00	1		BO3	3
1/10/95		Boca Sami	11.6	10.1	22.10	21.44		0.00	1	0.19	BO4	4
1/10/95		Boca Sami	18.0	15.0	74.58	74.50	1.00		2	0.93	BO14	3
1/17/95	14.30	Carmabi	8.7	7.3	7.89			0.00	1		BO17	1
1/19/95	14.30	Carmabi	6.8	5.7	4.06	3.90		0.00	1	0.02	BO18	2
1/19/95	14.30	Carmabi	9.8	8.2	12.70	12.03	0.49		3	0.01	BO19	3
1/20/95	14.30	Carmabi	12.0	10.0	21.46	20.66		0.03	2	0.21	BO20	4
1/20/95	14.30	Carmabi	8.6	7.1	8.98	8.43	0.46		4		BO21	5
1/21/95	14.30	Carmabi	9.1	7.6	8.64	8.32		0.00	1		BO25	1
1/21/95	14.30	Carmabi	5.3	4.4	1.91	1.03		0.02	1		BO26	0
1/21/95	14.30	Carmabi	5.9	4.6	1.94	1.86		0.00	1		BO27	0
1/21/95	14.30	Carmabi	4.9	4.0	1.35	1.27	0.00		1	0.01	BO32	0
1/21/95	14.30	Carmabi	6.6	5.6	3.16	2.98	0.00		1	0.02	BO33	1
1/21/95	14.30	Carmabi	10.9	9.0	14.03			0.00	1	0.05	BO34	2
1/23/95	14.30	Carmabi	12.7	10.4	27.59	26.79		0.05	2		BO28	4
1/23/95	14.30	Carmabi	11.5	9.5	18.47	17.52	0.52			0.12	BO29	3
1/23/95	14.30	Carmabi	13.1	11.7	31.01	30.36		0.04	3	0.05	BO30	2
1/23/95	14.30	Carmabi	11.4	9.2	20.09	19.53		0.00		0.05	BO31	4
1/25/95	15.00	Carmabi	10.5	9.1	15.60	14.87	0.45		4	0.07	BO35	3
1/25/95	15.00	Carmabi	12.5	10.4	24.12	23.24		0.02	2	0.06	BO36	3
1/25/95	15.00	Carmabi	12.4	10.3	24.54	24.01		0.02	2		BO37	3

Appendix I: Continued.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
1/25/95	15.00	Carmabi	6.5	5.3	2.78	2.65		0.00	1	0.02	BO38	0
1/25/95	15.00	Carmabi	5.5	4.5	2.04	1.93		0.00	1	0.02	BO39	1
1/25/95	15.00	Carmabi	5.3	4.5	1.73	1.63	0.00		1	0.02	BO40	0
1/25/95	15.00	Carmabi	12.3	10.5	23.22	22.64		0.01	2	0.01	BO41	4
1/25/95	15.00	Carmabi	5.9	5.0	2.55	2.39	0.13		3	0.02	BO42	2
1/26/95	15.00	Carmabi	13.1	10.9	26.09	24.30		0.07	2	0.37	BO43	3
1/26/95	15.00	Carmabi	12.5	10.8	23.35	22.24		0.02	2	0.16	BO44	3
2/2/95	15.00	Grote Knip	8.4	7.0	7.36	7.12		0.00	1	0.04	BO45	2
2/7/95	13.00	Plaja Lagun	11.4	9.5	18.25	17.26		0.00		0.27	BO46	3
2/7/95	13.00	Plaja Lagun	4.2	3.6	0.89	0.84	0.00		1	0.00	BO47	0
2/7/95	13.00	Plaja Lagun	7.8	6.5	6.55	6.16	0.40		3	0.05	BO48	2
2/7/95	13.00	Plaja Lagun	11.8	10.0	22.29	21.79		0.02	2	0.00	BO49	3
2/21/95	14.00	Carmabi	9.8	8.6	12.68	12.28		0.00		0.05	BO50	1
2/21/95	14.00	Carmabi	9.2	7.9	11.92	11.29	0.37		4	0.21	BO51	1
2/21/95	14.00	Carmabi	10.7	9.3	17.38	16.84		0.02	2	0.09	BO52	3
2/21/95	14.00	Carmabi	6.5	5.4	3.47	3.27	1.05		4	0.03	BO53	0
2/21/95	16.00	Carmabi	9.5	8.2	12.46	12.00		0.01	2	0.03	BO59	2
2/21/95	16.00	Carmabi	6.9	5.7	4.63	4.32	0.17		4	0.07	BO60	1
2/21/95	16.00	Carmabi	10.2	8.7	16.37	15.52	kapot		3	0.04	BO61	4
2/20/95	14.00	Caracasbaai	6.3	5.4	3.11	3.01		0.00		0.03	BO54	1
2/20/95	14.00	Caracasbaai	4.0	3.1	0.67	0.65		0.00	1	0.00	BO55	0
2/20/95	14.00	Caracasbaai	7.8	6.1	5.64	5.26	0.22		4	0.02	BO56	2
2/20/95	14.00	Caracasbaai	2.6	2.2	0.12	0.10		0.00	1	0.00	BO57	0
2/22/95	10.00	Caracasbaai	3.8	3.3	0.51	0.50		0.00	1	0.00	BO58	0
2/24/95	13.30	Caracasbaai	3.6	3.1	0.47	0.43		0.00	1	0.02	BO62	0
2/24/95	13.30	Caracasbaai	3.2	2.7	0.33	0.29		0.00	1	0.00	BO63	0
2/28/95	11.30	Blauwbaai	11.1	9.5	18.81	17.77		0.02	2	0.22	BO67	5
2/28/95	11.30	Blauwbaai	11.5	9.7	20.73	20.12		0.03	2	0.00	BO68	3
2/28/95	11.30	Blauwbaai	8.8	7.1	9.64	8.88	0.26		2	0.14	BO69	1
2/28/95	11.30	Blauwbaai	10.6	9.0	16.50	16.08		0.02	2	0.04	BO70	4
3/2/95	14.00	Caribean H.	5.5	4.7	2.01	1.82		0.00	1	0.08	BO71	1
3/3/95	15.00	Caribean H.	7.8	6.5	6.82	6.63		0.01	2	0.02	BO66	1
3/6/95	14.00	Caribean H.	8.1	6.9	7.04	6.83		0.00	1	0.04	BO64	1
3/6/95	14.00	Caribean H.	9.8	8.1	11.83	11.49		0.01	1	0.01	BO65	1
3/7/95	13.00	Caribean H.	7.6	6.4	6.14	5.89		0.01	2	0.02	BO72	2
3/7/95	13.00	Daaibooibaai	7.4	6.2	4.88	4.69		0.01	2	0.07	BO73	2

Appendix I: Continued.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
3/7/95	13.00	Pl. Jeremi	4.1	3.4	0.67	0.64		0.00	1	0.00	BO74	1
3/9/95	15.00	Pl. Jeremi	12.1	10.4	23.45	22.45		0.06	2	0.03	BO75	2
3/9/95	15.00	Pl. Jeremi	10.9	9.5	16.41	15.54	0.63		4	0.05	BO76	2
3/9/95	15.00	Pl. Mansalina	11.4	9.8	20.34	18.98	0.58		4	0.14	BO77	2
3/9/95	15.00	Vaersenbaai	12.2	11.0	22.53	21.12	0.82		4	0.14	BO78	2
3/9/95	15.00	Vaersenbaai	7.7	6.6	6.46	6.04	0.41		4	0.05	BO79	2
3/6/95	14.00	Vaersenbaai	7.6	6.5	5.60	5.23	0.24		4	0.09	BO80	2
3/6/95	14.00	Vaersenbaai	6.8	5.7	4.39	4.17	0.13		4	0.03	BO81	1
3/6/95	14.00	Vaersenbaai	6.1	5.2	3.06	2.93	0.07		3	0.05	BO82	1
3/6/95	14.00	Vaersenbaai	4.4	3.7	1.09	1.05	0.00		1	0.01	BO83	1
3/6/95	15.30	Pestbaai	7.2	6.0	4.48	4.23	0.29		3	0.02	BO84	1
3/14/95	16.30	Coral Clif	3.9	3.4	0.83	0.75		0.00		0.02	BO85	1
3/14/95	16.30	Coral Clif	3.1	2.6	0.30	0.25		0.00	1	0.00	BO86	1
3/6/95	15.30	Pestbaai	5.0	4.2	1.38	1.25		0.00	1	0.02	BO87	1
3/6/95	15.30	Pestbaai	4.8	4.0	1.22	1.17		0.01		0.00	BO88	0
3/6/95	15.30	Pestbaai	4.8	4.0	1.25	1.15	0.00		1	0.01	BO89	1
3/16/95	13.30	Blauwbaai	9.4	8.2	11.20	10.75		0.02	2	0.11	BO90	
3/16/95	13.30	Blauwbaai	6.0	5.1	2.85	2.60	0.10		4	0.09	BO91	1
3/16/95	13.30	Blauwbaai	6.5	5.5	3.48	3.12	0.15		4	0.12	BO92	2
3/16/95	13.30	Blauwbaai	4.2	3.6	0.95	0.88		0.00		0.03	BO93	1
3/3/95	15.00	Daaibooibaai	5.6	4.7	2.34	2.25		0.00		0.01	BO94	1
3/3/95	15.00	Daaibooibaai	3.3	2.7	0.39	0.36		0.00	1	0.01	BO95	1
3/14/95	15.00	Plaja Kalki	9.5	8.0	10.13	9.70		0.01		0.04	BO96	2
3/14/95	15.00	Plaja Kalki	4.6	3.9	1.25	1.20		0.00	1	0.01	BO97	0
3/7/95	11.30	Plaja Lagun	4.6	3.7	1.05	0.96		0.00	1	0.01	BO98	1
3/7/95	11.30	Plaja Lagun	6.3	5.1	10.18	10.12	0.05		4	0.02	BO99	2
3/7/95	11.30	Plaja Lagun	4.4	3.7	0.89	0.81		0.00	1	0.01	BO100	1
3/7/95	11.30	Plaja Lagun	5.5	4.6	1.94	1.87		0.00	1	0.00	BO101	2
3/7/95	11.30	Plaja Lagun	10.3	8.9	14.85	13.98	0.27		4	0.03	BO102	2
4/3/95	13.00	Daaibooibaai	7.5	6.4	5.11	4.83		0.02	2	0.03	BO103	1
4/3/95	13.00	Daaibooibaai	7.2	6.1	4.90	4.54	0.18		4	0.07	BO104	1
4/3/95	13.00	Daaibooibaai	6.5	5.5	3.70	3.39	0.13		4	0.02	BO105	2
4/3/95	13.00	Daaibooibaai	6.1	5.1	2.91	2.71	0.17		4	0.01	BO106	1
4/3/95	13.00	Daaibooibaai	4.6	3.8	1.05	0.94	0.00			0.01	BO107	1
4/3/95	11.30	Cas Abao	4.5	3.7	0.99	0.89	0.00		1	0.00	BO108	0
4/5/95	15.30	Caribbean H	4.8	3.9	1.38	1.29	0.02		2	0.02	BO109	1

Appendix I: Continued.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)'	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
4/5/95	10.30	Porto Marie	3.4	2.8	0.40	0.37		0.00	1	0.01	BO110	0
4/5/95	15.30	Carmabi	7.6	6.4	6.12	5.63	0.20		4	0.07	BO111	2
4/5/95	15.30	Carmabi	5.4	4.4	1.89	1.80	0.05		1	0.02	BO112	1
4/5/95	15.30	Carmabi	5.0	4.2	1.53	1.44	0.05			0.01	BO113	1
4/5/95	15.30	Carmabi	4.9	4.1	1.36	1.20		0.00	1	0.02	BO114	1
4/7/95	10.00	Playa Lagun	7.4	6.2	5.05	4.63		0.25		0.05	BO115	1
4/7/95	10.00	Playa Lagun	6.2	5.1	3.05	2.93		0.01	1	0.02	BO116	1
4/7/95	10.00	Playa Lagun	6.2	5.2	3.09	2.85		0.01	1	0.04	BO117	1
4/7/95	10.00	Playa Lagun	6.5	5.5	3.13	2.98		0.00	1		BO118	1
4/7/95	10.00	Playa Lagun	2.4	2.1	0.16	0.13					BO119	0
4/7/95	15.00	Caribbean H	7.2	5.9	4.92	4.62				0.01	BO120	2
4/6/95	11.30	Caracasbaai	6.8	5.8	4.22	3.87	0.21		4	0.01	BO121	2
4/6/95	11.30	Caracasbaai	6.0	5.0	3.06	2.92		0.00		0.00	BO122	3
4/6/95	11.30	Caracasbaai	3.6	2.8	0.53	0.46		0.00	1	0.01	BO123	0
4/12/95	11.00	Pestbaai	6.3	5.4	3.01	2.72	0.09		4	0.04	BO124	1
4/12/95	11.00	Pestbaai	5.3	4.4	1.90	1.81		0.01	1	0.02	BO125	1
4/14/95	10.00	Blauwbaai	7.9	6.7	6.53	6.04	0.23		4	0.04	BO126	1
4/14/95	10.00	Blauwbaai	6.9	5.9	4.12	3.84	0.11		4	0.03	BO127	1
4/14/95	10.00	Blauwbaai	5.7	4.6	2.50	2.30		0.01	2	0.01	BO128	1
4/14/95	10.00	Blauwbaai	5.6	4.7	2.34	2.15	0.05		3	0.01	BO129	1
5/2/95	12.30	Daaibooibaai	4.2	3.4	0.78	0.71	0.00		1	0.01	BO130	0
5/11/95	11.30	Caribbean H	7.9	6.4	6.98	6.68		0.01	2	0.06	BO131	1
5/11/95	11.30	Caribbean H	12.9	10.8	33.02	31.82		0.03		0.00	BO132	3
5/11/95	11.30	Caribbean H	4.4	3.8	0.89	0.82		0.00		0.01	BO133	0
5/11/95	11.30	Caribbean H	5.4	4.5	2.05	1.95				0.02	BO134	1
5/12/95	12.15	Plaja Lagun	8.8	7.3	8.80	8.49		0.02		0.04	BO135	1
5/12/95	12.15	Plaja Lagun	6.1	5.0	2.84	2.60	0.08		3	0.01	BO136	1
5/12/95	12.15	Plaja Lagun	3.4	2.8	0.44	0.37		0.00	1	0.01	BO137	0
5/12/95	12.15	Plaja Lagun	5.5	4.6	2.03	1.84		0.00	1	0.01	BO138	1
5/12/95	10.30	Jeremi	6.3	5.2	3.05	2.92	0.07		3	0.01	BO139	2
5/12/95	10.30	Jeremi	3.5	2.9	0.48	0.45				0.00	BO140	0
5/12/95	10.30	Jeremi	2.4	2.0	0.13	0.09				0.00	BO141	0
5/12/95	10.30	Jeremi	3.1	2.6	0.33	0.29				0.00	BO142	
5/2/95	11.00	Porto Marie	6.6	5.4	3.88	3.72		0.01		0.00	BO143	2
5/2/95	11.00	Porto Marie	5.5	4.7	2.45	2.21	0.03		3	0.02	BO144	1
5/2/95	11.00	Porto Marie	4.0	3.3	0.79	0.75		0.00	1	0.00	BO145	0

Appendix I: Continued.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
5/2/95	11.00	Porto Marie	3.5	2.9	0.50	0.47		0.00	1	0.00	BO146	1
5/3/95	14.00	Coral Cliff	5.7	4.7	2.37	2.23		0.01	1	0.04	BO147	1
5/3/95	14.00	Coral Cliff	3.8	3.2	0.67	0.61				0.00	BO148	0
5/3/95	11.30	Cas Abao	6.5	5.3	3.62	3.38	0.16		3	0.05	BO149	1
5/3/95	11.30	Cas Abao	3.5	3.0	0.53	0.48				0.00	BO150	0
5/3/95	11.30	Cas Abao	3.1	2.6	0.35	0.28				0.00	BO151	0
5/15/95	13.30	Pestbaai	4.9	3.9	1.27	1.18	0.01		2	0.01	BO152	0
5/15/95	13.30	Pestbaai	6.0	4.9	2.72	2.57		0.00	1	0.03	BO153	1
5/15/95	13.30	Pestbaai	2.3	2.0	0.13	0.11				0.00	BO154	0
5/15/95	13.30	Pestbaai	4.3	3.5	0.93	0.88	0.00		1	0.01	BO155	1
5/15/95	13.30	Pestbaai	3.7	3.2	0.59	0.53				0.02	BO156	0
5/15/95	12.00	Blauwbaai	8.8	7.3	9.12	8.47		0.01	2	0.03	BO157	2
5/15/95	12.00	Blauwbaai	2.6	2.2	0.21	0.18				0.00	BO158	0
5/15/95	12.00	Blauwbaai	9.2	8.0	14.17	13.52		0.02		0.16	BO159	2
5/15/95	12.00	Blauwbaai	4.6	3.9	1.17	1.05	0.01			0.04	BO160	1
5/15/95	12.00	Blauwbaai	11.0	9.3	19.10	18.07	0.04		3	0.14	BO161	3
5/15/95	12.00	Blauwbaai	6.7	5.6	3.67	3.33	0.17		3	0.12	BO162	1
5/15/95	12.00	Blauwbaai	5.0	4.2	1.77	1.61	0.00			0.05	BO163	1
6/5/95	11.00	Plaja Lagun	5.4	4.4	1.84	1.69	0.00		1	0.01	BO164	1
6/5/95	11.00	Plaja Lagun	11.4	9.5	18.89	18.24		0.01	1	0.00	BO165	2
6/5/95	11.00	Plaja Lagun	8.1	6.7	7.11	6.88		0.01	1	0.00	BO166	1
6/5/95	11.00	Plaja Lagun	5.4	4.6	2.09	1.93		0.00	1	0.02	BO167	1
6/5/95	12.30	Jeremi	7.8	6.7	7.00	6.60		0.02	2	0.03	BO168	1
6/2/95	14.00	Daaibooibaai	8.5	7.2	8.13	8.71		0.39	3	0.04	BO169	1
6/2/95	14.00	Daaibooibaai	6.2	5.2	3.26	3.12		0.13	2	0.01	BO170	1
6/7/95	11.15	Kleine Knip	10.8	9.4	16.84	14.51	0.52		4	0.17	BO171	1
6/7/95	11.15	Kleine Knip	11.0	9.4	17.57	16.60		0.02	5	0.00	BO172	1
6/9/95	13.30	Vaersenbaai	5.9	5.3	2.83	2.60	0.06		4	0.00	BO173	0
6/9/95	13.30	Vaersenbaai	7.7	6.6	6.86	6.18	0.37		4	0.00	BO174	1
6/9/95	13.30	Vaersenbaai	5.3	6.2	3.14	2.90	0.15		4	0.00	BO175	0
6/9/95	13.30	Vaersenbaai	5.0	4.3	1.93	1.72	0.05		4	0.00	BO176	1
6/9/95	13.30	Vaersenbaai	4.4	3.7	1.13	1.02		0.00	1	0.03	BO177	0
6/2/95		Grote Knip	5.9	5.1	2.41	2.26		0.00	3	0.00	BO178	0
6/20/95	15.00	Carmabi	7.5	6.5	5.85	5.60		0.00		0.15	BO179	0
6/20/95	15.00	Carmabi	3.9	3.3	0.77	0.74		0.00		0.00	BO180	0
6/21/95	16.00	Blauwbaai	7.0	6.0	4.13	3.92	0.10		4	0.02	BO181	0

Appendix I: Continued.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
6/21/95	16.00	Blauwbaai	8.8	7.5	8.81	8.50		0.01	2	0.07	BO182	1
6/21/95	16.00	Blauwbaai	6.0	5.1	2.81	2.69	0.07		3	0.05	BO183	0
6/22/95		Daaibooibaai	6.4	5.3	3.69	8.87		0.00	1	0.02	BO184	1
6/26/95	12.11	Sint Joris baai	4.9	4.2	1.35	1.30		0.00	1	0.00	BO185	0

Appendix II. Catch data of the *Bothus maculiferus* around Curaçao in January-June 1995.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
10/18/94		Klein Curaçao	22.8	19.1	153.66	143.99	4.23		2	1.96	PF3	4
10/18/94		Klein Curaçao	23.0	19.7	151.08	142.36	3.32		3	0.87	PF5	2
10/28/94		Klein Curaçao	27.0	22.9	211.66	202.22		0.14	2	2.12	PF7	3
11/5/94		Santa Cruz	21.9	18.5	137.37	128.45	2.92		3	2.22	PF9	2
8/27/94		Klein Curaçao	23.7	20.1	117.16	111.18	0.91		1	0.10	PF10	5
11/22/94		San Michiel	26.4	22.2	240.02	230.26		0.20	2		PF12	2
8/20/94		San Michiel	25.0	20.9	186.86	179.25	3.53			1.01	PF14	1
11/22/94		Hala Kanoa	28.4	23.9	260.85	251.92	6.32		3	1.14	PF16	2
11/5/94		Santa Cruz	23.9	19.7	155.32	150.67	2.88		3		PF18	
9/30/94		San Michiel	20.9	17.6	104.66	99.19	3.74		3	0.55	PF19	2
12/30/94		Klein Curaçao	19.8	16.4	95.19	91.36		0.09	2	0.40	PF21	2
12/30/94		Klein Curaçao	18.3	16.3	96.59	92.42	1.73		3	1.04	PF22	3
12/30/94		Klein Curaçao	21.7	18.3	123.74	117.21	3.63		3	0.45	PF23	2
12/30/94		Klein Curaçao	25.6	21.7	201.43	193.45		0.32	2	1.41	PF24	3
12/30/94		Klein Curaçao	21.4	18.1	113.01	108.45	1.19		2	0.16	PF25	2
12/30/94		Klein Curaçao	26.6	22.3	227.59	219.63		0.37	2		PF26	3
12/30/94		Klein Curaçao	25.4	21.2	220.33	212.99		0.34	2		PF27	3
12/30/94		Klein Curaçao	26.4	22.1	243.66	233.30	8.25		3		PF28	2
1/10/95		Boca Sami	17.8	15.0	75.09	70.98	1.86		3	1.22	PF30	2
1/10/95		Boca Sami	21.7	18.2	128.50	120.36	1.44		3	3.11	PF31	2
1/10/95		Boca Sami	21.3	17.8	127.51	113.75	2.35		3	2.15	PF32	1
1/10/95		Boca Sami	22.4	18.9	141.38	133.45	3.78		3	1.40	PF33	4
1/10/95		Boca Sami	26.8	22.4	223.91	215.09		0.34	2	2.69	PF34	3
1/10/95		Boca Sami	27.3	23.1	204.55	196.20		0.31	2	0.65	PF35	4
1/10/95		Boca Sami	26.0	21.7	216.00	209.29		0.31			PF36	1
1/10/95		Boca Sami	22.7	19.1	133.62	156.56	0.97		2	0.84	PF38	6
1/19/95		Carmabi	18.2	15.3	67.51	66.55		0.06	2	0.57	PF40	1
?			29.6	24.8	270.40	262.47	6.35		2		PF42	
?			22.2	18.8	140.79	137.93	1.19		2		PF43	2
2/1/95	15.75	Carmabi	17.0	14.1	55.56	53.41		0.04	2	0.06	PF47	3
2/2/95	11.50	Grote Knip	11.4	9.3	17.19	16.16		0.01	1	0.31	PF48	
2/2/95	11.50	Grote Knip	22.3	19.4	133.04	125.58	2.65			1.20	PF49	2
2/2/95	11.50	Grote Knip	23.5	19.2	161.42	156.22		0.26	2	0.67	PF50	3
2/7/95	13.00	Plaja Lagun	19.0	15.9	74.19	70.96		0.09	4	0.55	PF51	2
2/5/95		St Michiel	24.3	20.6	164.15	154.78	1.30		2	0.88	PF52	6
2/20/95	14.00	Caracasbaai	16.1	13.3	54.13	50.53		0.12	2	0.99	PF53	4

Appendix II: continued.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
2/20/95	14.00	Caracasbaai	8.1	6.9	5.64	5.22		0.00	1	0.14	PF54	2
2/22/95	10.00	Caracasbaai	13.7	11.5	32.11	30.63		0.03		0.14	PF55	3
2/21/95	15.00	Carmabi	13.1	11.0	24.92	23.38		0.08	2	0.63	PF56	4
2/26/95		Caracasbaai	19.9	17.0	93.58	88.92	1.87		4	1.01	PF58	3
3/2/95	14.00	Mansalina	19.4	16.5	77.57	73.80	1.74		4	0.30	PF59	3
3/6/95	14.00	Vaersenbaai	19.5	16.4	96.24	92.40	2.17		4	0.50	PF60	2
3/14/95	16.30	Coral Clif	23.8	20.2	145.37	141.62		0.25	2	0.30	PF61	2
3/14/95	15.00	Plaja Kalki	13.2	11.5	27.51	26.07		0.02	1	0.31	PF64	2
			22.0	19.3	123.12	115.33	2.61		4	1.53	PF65	3
			25.6	21.2	183.76	177.14		0.27	3	2.32	PF66	3
4/3/95	11.00	Cas Abao	36.7	31.0	531.15	514.31		0.84	5	2.40	PF67	
4/3/95	11.00	Cas Abao	18.5	15.3	81.97	77.64	2.18		4	0.63	PF68	2
4/3/95	11.00	Cas Abao	27.4	23.5	226.10	213.99	4.79		3	0.67	PF69	
4/3/95	11.00	Cas Abao	18.0	15.0	76.86	72.23	2.06		4	1.36	PF70	3
4/5/95	10.30	Porto Marie	6.9	5.2	2.53	3.20		0.00	1	0.11	PF71	1
4/7/95	10.00	Playa Lagun	19.5	16.4	91.28	84.25	2.10		4	1.52	PF72	2
4/7/95	10.00	Playa Lagun	18.1	15.4	72.75	68.12	2.03		4	1.22	PF73	2
4/7/95	15.00	Caribean Hotel	6.7	5.9	4.27	3.87		0.00		0.11	PF74	1
4/7/95	15.00	Caribean Hotel	9.5	8.1	11.05	9.96		0.01	1	0.46	PF75	2
4/7/95	15.00	Caribean Hotel	6.0	5.1	2.65	2.35		0.01	1	0.07	PF76	1
4/7/95	15.00	Caribean Hotel	16.2	13.8	56.92	53.32		0.26	3	0.40	PF77	3
4/10/95	16.30	overk.Pisc.B	18.4	15.5	80.13	75.02	2.78		4	0.91	PF78	3
4/14/95	10.00	Blauwbaai	20.8	17.4	109.75	102.80	2.63		4	0.77	PF81	3
4/14/95	10.00	Blauwbaai	21.5	18.3	112.28	106.59		0.16	6	0.72	PF82	3
4/17/95	16.00	Plaja Lagun	9.4	7.8	9.65	8.90		0.01		0.08	PF83	2
5/11/95	11.30	Caribean Hotel	11.3	9.5	16.87	15.74				0.31	PF84	2
5/11/95	11.30	Caribean Hotel	9.5	8.1	10.53	9.89		0.03	3	0.03	PF85	1
5/12/95	12.15	Plaja Lagun	3.7	3.0	0.53	0.46	0.00			0.02	PF86	0
5/12/95	10.30	Plaja Jeremi	7.6	6.3	4.78	4.41		0.01		0.00	PF87	1
5/2/95	10.30	Porto Marie			579.39	553.60		0.91	3	6.82	PF88	4
5/3/95	14.00	Coral Cliff	6.0	5.0	2.45	2.25		0.01		0.03	PF89	1
5/3/95	14.00	Coral Cliff	13.6	11.3	31.93	30.26		0.09	3	0.24	PF90	2
5/3/95	14.00	Coral Cliff	19.1	15.8	89.11	85.62		0.17	4	0.49	PF91	3
5/3/95	11.30	Cas Abao	6.8	5.7	3.91	3.57		0.01	1	0.19	PF93	1
5/18/95	11.30	Grote Knip	7.4	6.2	5.02	4.62				0.18	PF94	1
5/18/95	11.30	Grote Knip	4.8	4.1	1.27	1.16				0.01	PF95	1
5/18/95	11.30	Grote Knip	16.5	14.4	56.43	53.50		0.05	2	0.59	PF96	2

Appendix II: continued.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
5/18/95	11.30	Grote Knip	18.9	15.7	83.83	80.60		0.08	3	0.65	PF97	2
5/18/95	11.30	Grote Knip	23.2	19.9	163.82	154.62				3.92	PF98	3
5/18/95	13.30	Plaja Kalki	28.9	24.3	225.30	208.15		2.25	3	0.00	PF99	3
5/21/95		Klein Curaçao	19.6	16.1	89.61	83.40	1.81		3		PF102	3
5/21/95		Klein Curaçao	24.4	20.4	141.30	135.25					PF103	2
6/5/95	11.00	Plaja Lagun	11.7	9.8	19.41	18.55		0.02	3	0.12	PF104	1
6/5/95	12.30	Plaja Jeremi	7.4	6.3	4.84	4.84		0.01	1	0.04	PF106	2
6/2/95	14.00	Daabooibaai	8.3	7.0	6.81	6.22				0.05	PF107	1
6/2/95	14.00	Daabooibaai	8.2	6.9	6.13	5.66		0.01	1	0.09	PF108	1
6/7/95	11.15	Kleine Knip	10.6	9.2	16.39	15.43		0.01	1	0.23	PF109	1
6/7/95	11.15	Kleine Knip	18.8	15.6	85.41	80.92	2.35			0.51	PF110	2
6/7/95	11.15	Kleine Knip	21.5	25.4	194.16	185.92				0.38	PF111	3
6/2/95		Grote Knip	8.5	7.2	7.12	6.39		0.01		0.34	PF112	0
6/20/95	15.00	Carmabi	5.9	4.9	2.23	2.08		0.00		0.03	PF113	0
6/20/95	15.00	Carmabi	12.2	10.2	22.96	22.22		0.04		0.09	PF114	1
6/20/95	15.00	Carmabi	11.5	9.6	20.29	19.14		0.04	2	0.26	PF115	1
6/21/95	16.00	Blauwbaai	15.8	13.4	48.91	46.43		0.35	3	0.70	PF116	2
6/21/95	16.00	Blauwbaai	19.3	16.2	89.10	85.18		0.11	2	1.20	PF117	2
6/22/95	15.00	Daaibooi	8.2	7.0	7.48	6.98		0.03	1	0.17	PF119	1

Appendix III. Catch data of the peacock flounder *Bothus lunatus* around Curaçao in January-June 1995.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
12/6/94		Vaarsenbaai	28.1	23.7	232.45	224.19	6.60		5	0.86	PF1	2
12/6/94		Vaarsenbaai	25.6	21.7	198.98	188.49	6.47		3	3.85	PF2	1
10/11/94		Klein Curaçao	26.3	22.1	200.31	194.30	4.62		2		PF4	1
8/25/94		Caracas baai	31.2	26.5	359.21	353.13		0.22	2		PF6	3
9/15/94		Caracas baai	35.0	29.6	456.26	443.55		0.41	3		PF11	4
11/22/94		San Michiel	31.5	26.4	371.29	356.29	11.50		2		PF13	2
11/29/94		Klein Curaçao	21.1	17.7	121.84	114.31	1.89		4	1.90	PF15	
11/20/94		Newport	30.6	25.6	300.41	293.59		0.21	2		PF20	3
12/30/94		Klein Curaçao	33.7	27.9	432.17	419.63		0.51	2	1.19	PF29	2
1/10/95		Boca Sami	27.2	23.0	212.54	205.88		0.42			PF37	2
1/10/95		Boca Sami	34.5	29.0	429.23	412.28		0.56		4.47	PF39	3
			28.3	23.9	264.31	254.31	4.17		2	1.87	PF41	2
1/21/95		Nieuwpoort	29.5	24.8	262.39	256.24		0.35	2	1.01	PF44	2
1/25/95		Carmabi	34.2	29.0	425.22	414.59		0.65			PF45	2
1/31/95	11.50	Daaibooibaai	33.1	27.8	416.60	391.22	14.13		3	4.55	PF46	4
1/25/95		Vaersenbaai	29.1	24.2	273.75	265.17	6.88		4	0.96	PF57	3
3/14/95	15.00	Plaja Kalki	37.7	31.5	662.10	644.07		0.72	3	0.00	PF63	4
4/12/95	11.00	Pestbaai	29.3	24.4	285.33	274.62		0.36	2	3.78	PF79	3
5/3/95	11.30	Cas Abao	24.6	20.7	189.92	179.91	5.33		4	0.67	PF92	2
5/8/95	10.30	Jan Thiel	38.5	32.3	661.60	626.75		0.58		14.20	PF100	5
5/21/95		Klein Curaçao	32.2	38.2	528.72	510.61		10.86	3	2.20	PF101	3
6/22/95	16.30	Rif St Marie	23.5	19.4	151.40	147.21		1.56		0.13	PF118	2

Appendix IV. Catch data of the lined sole *Achirus lineatus* around Curaçao in January-June 1995.

Date m/d/y	Time	Haul #	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
1/9/95	10.00	1	Piscadera bay	3.0	2.3	0.42	0.40				0.00	AL5	0
1/9/95	10.00	1	Piscadera bay	3.2	2.4	0.46	0.44				0.00	AL4	0
1/9/95	10.30	2	Piscadera bay	0.8							0.00		
1/9/95	11.30	4	Piscadera bay	9.0	6.9	12.76	12.47	0.33			0.00	AL3	1
1/9/95	11.30	4	Piscadera bay	9.7	7.4	15.78	14.97		0.00		0.00	AL2	1
1/9/95	12.00	5	Piscadera bay	5.6	4.3	2.64	2.33	0.00			0.00	AL1	0
1/10/95	12.10	16	Piscadera bay	10.5	8.0	22.40	21.42	0.75		4	0.02	AL6	0
1/10/95	12.10	16	Piscadera bay	2.2	1.7	0.17				1	0.00	AL7	0
1/10/95	12.30	18	Piscadera bay	2.8	2.1	0.32				1	0.00	AL8	0
1/10/95	12.30	18	Piscadera bay	8.7	6.7	11.41	10.99		0.01	5	0.09	AL9	2
1/10/95	12.30	18	Piscadera bay	10.3	7.9	18.17	17.25	0.41		4	0.19	AL10	2
1/10/95	12.30	18	Piscadera bay	9.3	7.0	15.41	14.38	0.95		4	0.00	AL11	1
1/10/95	12.30	18	Piscadera bay	8.1	6.3	9.09	8.78		0.00	2	0.00	AL12	4
1/10/95	12.30	18	Piscadera bay	8.8	6.8	10.42	10.15		0.00	2	0.00	AL13	5
1/11/95	10.30	22	Piscadera bay	8.2	6.1	9.28	8.99	0.19		5	0.00	AL14	4
1/25/95		seine	Piscadera bay	9.1	6.9	13.47	13.23	0.08		2	0.00	AL53	2
1/25/95		seine	Piscadera bay	8.1	6.1	8.30	8.30		0.06	2	0.00	AL54	2
1/12/95	10.15	31	St Marta bay	2.5	2.0	6.25	6.25			1	0.00	AL15	0
1/12/95	10.30	32	St Marta bay	8.5	6.4	9.84	9.30	0.46		4	0.00	AL16	4
1/12/95	10.45	33	St Marta bay	4.2	5.3	1.30	1.26			1	0.00	AL17	0
1/12/95	10.45	33	St Marta bay	3.7	2.8	0.77	0.73			1	0.00	AL18	0
1/12/95	10.45	33	St Marta bay	5.0	3.9	2.47	2.36		0.00	1	0.02	AL19	1
1/12/95	10.55	34	St Marta bay	5.2	3.9	2.15	2.05	0.00		1	0.00	AL20	2
1/12/95	10.55	34	St Marta bay	8.2	6.3	9.33	9.11		0.01	2	0.00	AL21	2
1/12/95	11.15	36	St Marta bay	7.2	5.5	5.35	5.17	0.00		1	0.00	AL22	2
1/12/95	11.35	38	St Marta bay	3.0	2.2	0.36	0.34			1	0.00	AL23	0
1/13/95	9.00	40	St Marta bay	20.2	16.2	157.45	151.60	1.77		3	0.00	AL24	6
1/13/95	9.00	40	St Marta bay	14.5	11.8	62.30	60.64	0.52		2	0.00	AL25	4
1/13/95	9.00	40	St Marta bay	5.9	4.5	2.87							
1/13/95	9.00	40	St Marta bay	7.8	5.9	7.62	7.42	0.09		2	0.00	AL26	2
1/13/95	9.00	40	St Marta bay	4.3	3.2	1.07	1.04		0.00	1	0.00	AL27	0
1/13/95	9.00	40	St Marta bay	3.6	2.7	0.71	0.69			1	0.00	AL28	0
1/13/95	9.00	40	St Marta bay	2.7	2.0	0.25	0.24			1	0.00	AL29	0
1/13/95	9.15	41	St Marta bay	6.4	4.9	4.22	4.10		0.00	1	0.00	AL30	2
1/13/95	9.15	41	St Marta bay	5.6	4.2	2.76	2.71		0.00	1	0.00	AL31	1
1/13/95	9.15	41	St Marta bay	7.5	5.8	8.60	7.98	0.00		1	0.00	AL32	3

Appendix IV: Continued

Date m/d/y	Time	Haul #	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
1/13/95	9.15	41	St Marta bay	6.1	4.6	3.51	3.39	0.00		1	0.00	AL33	2
1/13/95	9.45	43	St Marta bay	8.3	6.3	8.20	7.99		0.00	1	0.00	AL34	2
1/13/95	10.15	45	St Marta bay	7.9	6.0	7.50	7.33	0.03		1	0.00	AL35	2
1/13/95	10.15	45	St Marta bay	8.1	6.2	8.04	7.83		0.00	1	0.02	AL36	3
1/13/95	10.15	45	St Marta bay	8.8	7.0	11.66	11.35	0.31		3/4	0.00	AL37	3
1/13/95	10.15	45	St Marta bay	8.2	6.3	9.36	9.08	0.24		3/4	0.05	AL38	2
1/13/95	10.15	45	St Marta bay	8.4	6.4	10.41	10.14	0.49		3/4	0.00	AL39	2
1/13/95	10.15	45	St Marta bay	8.8	6.6	11.43	11.19		0.01	2	0.00	AL40	2
1/13/95	10.15	45	St Marta bay	8.9	6.9	13.08	12.81	0.41		3/4	0.00	AL41	3
1/13/95	10.15	45	St Marta bay	7.9	5.9	8.18	7.97		0.00	2	0.06	AL42	2
1/13/95	10.15	45	St Marta bay	4.5	3.4	1.44	1.40			1	0.00	AL43	2
1/24/95	9.00	109	St Marta bay	1.7	1.3	0.06	0.06			1	0.00	AL49	0
1/24/95	9.00	109	St Marta bay	19.5	15.2	152.85	148.91	6.56		3	0.03	AL50	7
1/24/95	9.30	110	St Marta bay	6.5	5.1	4.23	4.08		0.00	1	0.00	AL51	2
1/24/95	9.30	110	St Marta bay	4.5	3.4	1.18	1.14		0.00	1	0.00	AL52	1
1/19/95	9.45	83	Spaansche Water bay	2.6	1.9	0.25	0.23			1	0.00	AL44	0
1/19/95		88	Spaansche Water bay	2.1	1.6	0.12	0.12			1	0.00	AL45	0
1/20/95		92	Spaansche Water bay	4.6	3.5	1.45	1.39			1	0.00	AL46	1
1/20/95		93	Spaansche Water bay	2.2	1.7	0.12	0.12			1	0.00	AL47	0
1/20/95		93	Spaansche Water bay	1.2	1.0	0.02	0.02			1	0.00	AL48	0
2/14/95	10.25	115	Piscadera bay	9.6	7.7	13.67	13.22	0.28		4	0.03	AL55	5
2/14/95	10.25	115	Piscadera bay	9.1	6.8	12.68	12.44		0.06	2	0.00	AL56	3
2/14/95	10.25	115	Piscadera bay	9.4	7.3	14.01	13.48	0.26		4	0.02	AL57	2
2/14/95	10.25	115	Piscadera bay	9.5	7.3	14.15	13.60	0.51		4	0.02	AL58	3
2/14/95	9.45	112	Piscadera bay	8.5	6.9	11.05	?	0.43		4	0.00	AL59	2
2/14/95	9.45	112	Piscadera bay	8.8	6.1	10.29	10.05		0.01		0.00	AL60	3
2/14/95	14.25	118	Piscadera bay	4.1	3.3	1.04	0.99	0.00	0.00	1	0.00	AL61	0
2/14/95	14.25	118	Piscadera bay	8.9	6.7	9.24	8.93	0.25		4	0.00	AL62	2
2/15/95	13.40	127	St Marta bay	7.6	4.8	7.52	7.29	0.31		4	0.00	AL63	2
2/15/95	13.40	127	St Marta bay	8.1	6.1	9.81	9.26		0.02		0.00	AL64	2
2/15/95	13.40	127	St Marta bay	8.6	6.4	11.13	10.35		0.02		0.00	AL65	3
2/15/95	13.05	125	St Marta bay	9.6	7.9	14.01	13.67		0.03	2	0.00	AL66	2
2/15/95	14.25	129	St Marta bay	7.7	6.2	7.40	7.14		0.00	1	0.00	AL67	2
2/15/95	14.25	129	St Marta bay	9.4	7.6	14.61	13.95	0.61		4	0.15	AL68	2
2/15/95	14.25	129	St Marta bay	3.7	2.7	0.66	0.63	0.00			0.00	AL69	0
2/20/95	11.00	diving	Spaansche Water bay	13.3	11.0	43.71	42.26	0.78		4	0.00	AL70	3

Appendix IV: Continued

Date m/d/y	Time	Haul #	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
3/20/95	14.50	143	Piscadera bay	7.8	5.9	6.95	6.80	0.02			0.00	AL71	2
3/20/95	14.50	143	Piscadera bay	6.8	5.2	5.00	4.80	0.01		2	0.00	AL72	1
3/20/95	15.30	144	Piscadera bay	9.4	7.2	14.69	13.79	0.00			0.07	AL73	3
3/20/95	15.55	147	Piscadera bay	6.1	4.7	3.55	3.46				0.00	AL74	1
3/20/95	14.40	141	Piscadera bay	7.8	5.9	6.93	6.73	0.01			0.00	AL75	2
3/21/95	10.33	150	Piscadera bay	2.7	2.0	0.21	0.18				0.00	AL76	0
3/21/95	10.48	151	Piscadera bay	5.7	4.2	2.74	2.64				0.01	AL77	2
3/21/95	10.22	149	Piscadera bay	9.5	7.4	16.85	16.28	0.37		4	0.00	AL78	3
3/20/95	13.45	139	Piscadera bay	8.9	6.9	11.59	11.27		0.01	1	0.04	AL79	2
3/21/95	10.15	148	Piscadera bay	17.3	14.4	111.00	107.36	0.04			0.16	AL80	5
3/27/95	11.55	160	St Marta bay	11.0	8.4	23.08	22.44	0.05		1	0.00	AL81	2
3/28/95	14.10	170	St Marta bay	20.0	16.0	133.16	129.69	1.85		4	0.26	AL82	6
3/27/95	11.10	158	St Marta bay	5.4	4.1	2.40	2.36	0.00	0.00	1	0.01	AL83	1
3/27/95	10.52	156	St Marta bay	10.4	7.9	20.24	19.60	0.46		4	0.08	AL84	2
3/27/95	11.10	158	St Marta bay	9.6	7.6	14.44	13.52	0.54		4	0.04	AL85	2
3/28/95	15.15	176	St Marta bay	8.0	6.0	9.20	8.91	0.00		1	0.00	AL86	2
3/28/95	15.15	176	St Marta bay	12.0	9.3	33.60	32.22	0.03			0.02	AL87	2
3/27/95	11.30	159	St Marta bay	6.1	4.5	3.52	3.38		0.01		0.00	AL88	2
3/27/95	13.11	165	St Marta bay	5.5	4.1	2.30	2.07		0.01		0.00	AL89	1
3/28/95	14.10	170	St Marta bay	16.7	13.2	83.32	80.95	1.62		4	0.19	AL90	5
4/20/95	12.05	177	St Marta bay	10.4	8.2	22.65	21.93		0.01	1	0.00	AL91	3
4/20/95	12.05	177	St Marta bay	5.0	3.8	1.89	1.81	0.00		1	0.00	AL92	1
4/20/95	12.05	177	St Marta bay	12.8	9.8	36.10	35.13	0.23		3	0.08	AL93	3
4/20/95	13.35	183	St Marta bay	11.7	8.9	26.18	25.31		0.05	3	0.08	AL94	2
4/20/95	12.25	179	St Marta bay	10.9	8.4	26.65	25.50		0.02		0.12	AL95	2
4/20/95	12.32	180	St Marta bay	17.4	13.5	95.41	92.40	1.75		4	0.34	AL96	5
4/20/95	12.32	180	St Marta bay	5.7	4.3	2.81	2.69		0.01	1	0.00	AL97	1
4/20/95	12.32	180	St Marta bay	16.5	13.4	85.91	83.88				0.11	AL98	4
4/28/95	11.22	213	Piscadera bay	4.2	3.1	1.06	1.02			1	0.00	AL99	1
4/28/95	11.22	213	Piscadera bay	7.7	5.9	7.71	7.43	0.54		4	0.00	AL100	1
4/28/95	11.22	213	Piscadera bay	5.5	4.0	2.34	2.17			1	0.00	AL101	1
4/28/95	11.22	213	Piscadera bay	4.1	3.0	1.04	1.00			1	0.00	AL102	0
4/28/95	11.22	213	Piscadera bay	3.8	2.9	0.85	0.75			1	0.00	AL103	0
4/28/95	11.39	214	Piscadera bay	9.8	7.6	15.35	14.73	0.66		4	0.03	AL104	2
4/28/95	11.39	214	Piscadera bay	4.4	3.1	1.23	1.13			1	0.00	AL105	0
4/26/95	9.53	186	Piscadera bay	10.0	7.7	19.79	19.00	1.44		4	0.00	AL106	2

Appendix IV: Continued

Date m/d/y	Time	Haul #	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
4/26/95	11.05	191	Piscadera bay	8.9	6.7	12.70	12.04	0.36		4	0.14	AL107	2
4/26/95	11.17	192	Piscadera bay	9.1	6.9	12.57	12.04	0.20		4	0.00	AL108	2
4/26/95	10.11	188	Piscadera bay	9.1	7.0	14.20	13.18	0.57		4	0.01	AL109	2
4/26/95	10.53	190	Piscadera bay	12.2	9.2	32.98	31.74		0.15	4	0.00	AL110	3
4/26/95	10.11	188	Piscadera bay	10.9	8.8	21.77	20.23	1.34		4	0.13	AL111	3
5/22/95	13.55	216	St Marta bay	15.3	12.2	68.15	65.24	2.04		4	0.14	AL112	3
5/22/95	13.45	215	St Marta bay	12.3	9.8	33.58	31.75		0.17	4	0.30	AL113	3
5/22/95	14.40	219	St Marta bay	8.1	6.3	11.60	11.04	0.91		4	0.05	AL114	2
5/22/95	14.40	219	St Marta bay	10.1	8.1	17.94	17.21		0.00		0.00	AL115	2
5/22/95	14.40	219	St Marta bay	15.6	12.6	85.00	82.20	2.89		4	0.17	AL116	3
5/22/95	14.40	219	St Marta bay	10.3	7.9	18.92	18.29		0.05		0.00	AL117	2
5/22/95	14.40	219	St Marta bay	19.0	15.4	146.66	141.45	2.84		4	0.22	AL118	3
5/22/95	14.40	219	St Marta bay	15.7	12.5	76.87	74.39	2.23		4	0.23	AL121	5
5/22/95	14.25	218	St Marta bay	10.7	8.3	21.56	20.66	0.62		4	0.08	AL119	4
5/22/95	14.25	218	St Marta bay	9.3	7.0	13.23	12.67		0.01	2	0.00	AL120	1
5/23/95	12.22	222	St. Joris bay	7.1	5.3	5.41	5.07		0.01	2	0.01	AL122	1
5/23/95	12.08	221	St. Joris bay	10.4	8.2	19.24	18.72		0.03		0.00	AL123	2
5/23/95	12.22	222	St. Joris bay	9.8	7.7	19.26	18.40	0.65		4	0.02	AL124	1
5/23/95	11.48	220	St. Joris bay	9.4	7.3	15.91	15.04		0.01		0.02	AL125	3
5/22/95	14.08	217	St Marta bay	9.7	7.5	15.49	15.00		0.00		0.00	AL126	2
5/22/95	14.08	217	St Marta bay	6.4	4.1	4.28	4.01		0.03		0.00	AL127	2
5/26/95	12.05	230	Piscadera bay	2.3	1.8	0.17	0.15				0.00	Al128	0
5/26/95	12.05	230	Piscadera bay	2.3	1.7	0.17	0.14				0.00	Al129	0
5/26/95	12.05	230	Piscadera bay	5.3	4.2	2.37	2.19		0.01	1	0.00	Al130	1
5/26/95	12.05	230	Piscadera bay	5.8	4.4	3.21	2.90		0.02	2	0.01	Al131	1
5/26/95	12.05	230	Piscadera bay	9.1	7.0	13.48	12.42		0.01	1	0.00	Al132	2
5/30/95	14.00	ring	Piscadera bay	3.3	2.4	0.51	0.48				0.00	Al133	0
	14.00	ring	Piscadera bay	8.9	7.0	12.88	12.64		0.00		0.03	Al134	3
6/23/95	14.00	ring	Piscadera bay	10.6	7.8	23.55	22.70		0.00		0.11	Al135	4
6/23/95	14.00	ring	Piscadera bay	3.3	2.4	0.49	0.41				0.00	Al136	0
6/23/95	14.00	ring	Piscadera bay	2.5	1.8	0.21	0.18				0.00	Al137	0
6/23/95	14.00	ring	Piscadera bay	2.2	1.5	0.15	0.10				0.00	Al138	0
6/23/95	14.00	ring	Piscadera bay	1.9	1.4	0.07	0.06				0.00	Al139	0
6/23/95	14.00	ring	Piscadera bay	1.9	1.4	0.09	0.07				0.00	Al140	0
6/23/95	14.00	ring	Piscadera bay	6.9	5.1	5.54	5.05				0.00	Al141	2
6/23/95	14.00	ring	Piscadera bay	10.2	8.2	20.18	19.50	0.86			0.04	Al142	2

Appendix IV: Continued

Date m/d/y	Time	Haul #	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
6/27/95	14.40	255	Piscadera bay	8.8	6.9	10.59	10.30		0.00		0.04	AI143	1
6/27/95	14.41	249	Piscadera bay	10.1	8.0	19.48	17.59	0.28		2	0.12	AI144	3
6/27/95	14.42	249	Piscadera bay	2.3	1.7	0.16	0.15	0.00			0.00	AI145	0
6/27/95	14.43	249	Piscadera bay	8.4	6.2	10.49	9.53		0.01		0.02	AI146	3
6/29/95	12.30	272	St Marta bay	11.2	8.5	28.29	26.90				0.43	AI147	9
6/29/95	11.37	269	St Marta bay	4.9	3.6	1.66	1.59	0.00			0.02	AI148	0
6/29/95	11.37	269	St Marta bay	5.9	4.2	2.96	2.86	0.00			0.01	AI149	4
6/29/95	11.28	268	St Marta bay	6.2	4.9	3.69	3.53				0.02	AI150	1
6/27/95	11.39	250	Piscadera bay	9.8	7.4	16.84	16.28	0.60		2	0.02	AI151	3
6/27/95	11.39	250	Piscadera bay	3.1	2.4	4.16	4.14	0.00			0.00	AI152	0
6/27/95	11.39	250	Piscadera bay	2.9	2.3	0.46	0.45				0.00	AI153	0
6/27/95	11.39	250	Piscadera bay	2.2	1.7	0.15	0.14				0.00	AI154	0
6/27/95	11.39	250	Piscadera bay	2.9	2.2	0.40	0.40				0.00	AI155	0
6/27/95	11.39	250	Piscadera bay	2.1	2.8	0.13	0.12				0.00	AI156	0
6/29/95	12.58	274	St Marta bay	13.2	10.5	46.00	45.88				0.60	AI157	8
6/29/95	12.58	274	St Marta bay	11.6	9.3	38.69	37.77				0.09	AI158	4
6/29/95	12.19	271	St Marta bay	8.3	6.2	9.82	9.56	0.01		7	0.02	AI159	2
6/29/95	12.19	271	St Marta bay	11.0	8.4	23.74	23.20		0.07	2	0.07	AI160	4

Appendix V. Catch data of the channel flounder *Syacium micrurum* around Curaçao in January-June 1995.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
2/7/95		St.Cruz	21.5	17.9	90.57	87.29	1.65		4	0.31	SM2	3
2/15/95	15.15	Sta Marta bay	10.4	7.8	10.84	9.53		0.01	1	0.20	SM3	2
3/3/95	15.00	Daaibooibaai	17.8	14.8	56.32	54.11	0.33		4	0.27	SM8	?
3/7/95	13.00	Plaja Jeremi	12.6	10.5	18.58	17.85	0.11		2	0.09	SM4	3
3/7/95	13.00	Plaja Jeremi	14.7	12.3	31.31	29.89	0.12		2	0.14	SM5	3
3/7/95	13.00	Plaja Jeremi	22.6	19.7	116.40	110.40	0.21		3	1.54	SM6	5
3/16/95	13.30	Blauwbaai	15.5	13.1	33.75	32.61		0.09	2	0.20	SM7	3
5/11/95	11.30	Caribbean Hotel	10.3	8.3	10.69	10.11		0.01	1	0.21	SM9	2
5/12/95	10.30	Jeremi	10.3	8.4	10.21	9.64		0.01	2/3	0.09	SM10	3
5/6/95	12.30	Jeremi	15.2	12.5	33.25	31.53	1.01		3	0.24	SM11	3
?		Jeremi	10.1	8.4	9.23	8.84		0.03	2/3	0.00	SM12	2

Appendix VI. Catch data of the scrawled sole *Trinectes inscriptus* around Curaçao in January-June 1995.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
1/25/95		Piscadera bay	5.6	4.4	3.32	3.27		0.00	1	-	Ti1	2
1/25/95		Piscadera bay	5.0	3.9	2.47	2.40		0.00	1	-	Ti2	1
5/30/95	14.00	Piscadera bay	4.3	3.4	1.24	1.16		0	1	-	Ti3	1
5/30/95	14.00	Piscadera bay	4.1	3.3	1.07	0.94		0	1	-	Ti4	0

Appendix VII. Catch data of the bay whiff *Citharichthys spilopterus* around Curaçao in January-June 1995.

Date m/d/y	Time	Location	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
2/15/95	129	Sta Marta bay	9.7	8.1	6.28	6.02	0.18		2	0.01	CS1	2
3/27/95	161	Sta Marta bay	10.0	8.1	5.33	5.24		<0.01	juv		CS3	0
3/27/95	162	Sta Marta bay	9.4	7.6	6.96			<0.01			CS2	2
6/22/95	217	Sta Marta bay	3.7	3.0	0.40	0.39			juv	<0.01	CS4	
			12.6	10.3	17.10							

Appendix VIII

Catch data of the eyed flounder *Bothus ocellatus* collected from 26 - 31 May 1995 at Abaco Island, the Bahama's. Individuals were deep-frozen, subsequently stored in 70% alcohol and afterwards analysed in the laboratory. Data have been corrected for shrinkage in length (2%) and in weight (50%). Sampling stations refer to Sandy Key Reef (1,2); Pelican Cay (3); Tillo Key (4,5,6,19); Great Cistern (7,9); Spoil Banks (8); Harbour (10,11,12,14); Wildlife Refuge (13) and Lowers Bank (20). Fanny Bay (15,17,18).

Based on all data, the following relationships and Von Bertalanffy growth curves were estimated (for more information see text):

Relationships

		a	SE	R
Total length - Standard length	f	0.830	0.001	1.00
(Sl = a * TL)	m	0.834	0.001	1.00
Total length - Wet weight	f	0.0138	0.00	0.99
(W = a * TL^3)	m	0.0152	0.00	0.99
Total length - Gonad/Testis weight	f	0.000^{2}	0.00	0.68
(W = a * TL^3)	m	1.6510^{-5}	0.00	0.74
Food uptake coefficient (a)	f	5.9710^{-5}	0.00	0.38
(Food = a * TL^3)	m	5.6710^{-5}	0.00	0.72
Wet weight - Gutted wet weight	f	0.94	0.001	1.00
(Wgut = a * Wwet)	m	0.96	0.005	1.00

Von Bertalanffy growthcurves

		K	R	M	t_∞	n
Total length	f	0.3079	0.75	0.953	10	98
	m	0.3042	0.54	0.945	10	78
Total wet weight	f	0.2617	0.65	0.807	11	98
	m	0.2343	0.79	0.749	12	78

Appendix VIII: Continued.

Haul	Date	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
	5/31/95	3.8	3.0	3.06	0.50			0	0.01	BO1	0
7	5/30/95	2.3	1.8	1.84	0.12			0	0.01	BO10	0
4	5/29/95	7.3	6.0	6.12	5.91		0.00	1		BO100	1
4	5/29/95	11.4	9.1	9.29	19.41	0.41			0	BO101	
4	5/29/95	8.5	6.9	7.04	8.33	0.11			0.03	BO102	1
4	5/29/95	8.6	7.1	7.24	8.64	0.14			0.02	BO103	2
4	5/29/95	7.9	6.4	6.53	7.91		0.03	2		BO104	1
4	5/29/95	7.1	5.8	5.92	5.47	0.06		2	0	BO105	1
4	5/29/95	8.3	6.7	6.84	8.59	0.15		2	0	BO106	2
4	5/29/95	8.0	6.6	6.73	7.03		0.00	2	0.03	BO107	3
4	5/29/95	8.5	6.9	7.04	7.91	0.11		2	0.02	BO108	2
4	5/29/95	9.5	7.8	7.96	12.30	0.24		6	0.01	BO109	2
7	5/30/95	4.3	3.5	3.57	0.89			0	0	BO11	0
4	5/29/95	7.9	6.3	6.43	6.15	0.05		2	0.01	BO110	1
4	5/29/95	3.7	3.0	3.06	0.76			0	0	BO111	0
4	5/29/95	3.3	2.6	2.65	0.41			0	0	BO112	0
4	5/29/95	3.6	2.9	2.96	0.48			0	0	BO113	0
4	5/29/95	4.0	3.2	3.27	0.82		0.00	0	0	BO114	0
4	5/29/95	3.6	2.9	2.96	0.61		0.00	0	0	BO115	0
4	5/29/95	3.4	2.8	2.86	0.53			0	0	BO116	0
4	5/29/95	3.3	2.7	2.76	0.44			0	0	BO117	0
4	5/29/95	3.3	2.7	2.76	0.39			0	0	BO118	0
4	5/29/95	2.8	2.3	2.35	0.32			0	0	BO119	0
7	5/30/95	3.6	2.9	2.96	0.56			0	0	BO12	0
4	5/29/95	9.1	7.4	7.55	12.14		0.02	2	0.06	BO120	
4	5/29/95	7.4	6.0	6.12	5.92	0.06		2	0	BO121	2
4	5/29/95	7.2	5.9	6.02	4.65	0.06			0.03	BO122	1
4	5/29/95	8.0	6.3	6.43	6.64		0.00	2	0	BO123	2
4	5/29/95	10.5	8.5	8.67	16.64		0.02	2	0.05	BO124	4
4	5/29/95	9.8	8.0	8.16	11.30	0.18		2		BO125	3
4	5/29/95	9.3	7.6	7.76	12.00	0.00	0.02	2		BO126	3
4	5/29/95	8.0	6.5	6.63	6.29	0.08		2	0.02	BO127	2
4	5/29/95	7.7	6.2	6.33	6.36	0.06		2	0.08	BO128	2
4	5/29/95	8.2	6.7	6.84	7.58	0.12			0.03	BO129	2
2	5/27/95	7.4	6.1	6.22	5.61	0.17			0.04	BO13	2
4	5/29/95	8.8	7.2	7.35	8.29	0.12		2	0.01	BO130	2
4	5/29/95	8.3	6.7	6.84	8.55	0.17			0.01	BO131	2
4	5/29/95	7.3	6.0	6.12	5.35	0.02				BO132	
4	5/29/95	8.3	6.6	6.73	8.53		0.02	2		BO133	2
4	5/29/95	8.0	6.4	6.53	6.59	0.14		2	0.06	BO134	2
4	5/29/95	9.4	7.8	7.96	12.47		0.02		0.04	BO135	2
4	5/29/95	8.9	7.3	7.45	9.64	0.14		2	0.09	BO136	2
4	5/29/95	7.7	6.3	6.43	6.53	0.14		3		BO137	2
4	5/29/95	7.4	6.1	6.22	5.73		0.00	2	0.02	BO138	1
4	5/29/95	8.2	6.8	6.94	7.11	0.14		2	0.07	BO139	1
2	5/27/95	6.7	5.5	5.61	3.74		0.00	1	0	BO14	1
4	5/29/95	8.3	6.8	6.94	8.27		0.00	2	0.01	BO140	2
4	5/29/95	9.2	7.6	7.76	8.70	0.17		3	0.01	BO141	2
4	5/29/95	7.4	6.0	6.12	5.47	0.03		2	0.02	BO142	1
4	5/29/95	8.1	6.5	6.63	6.88	0.15			0.04	BO143	1
4	5/29/95	7.7	6.4	6.53	5.47	0.06		2	0.02	BO144	1

Appendix VIII: Continued.

Haul	Date	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
4	5/29/95	7.8	6.4	6.53	6.47	0.12		3	0.08	BO145	1
4	5/29/95	7.8	6.3	6.43	7.12		0.00	2		BO146	2
4	5/29/95	9.0	7.5	7.65	10.79	0.23			0.03	BO147	1
4	5/29/95	8.0	6.5	6.63	6.65	0.14			0.01	BO148	1
4	5/29/95	7.1	5.8	5.92	5.23	0.05		2	0.01	BO149	1
3	5/27/95	8.4	6.9	7.04	6.12		0.00	1	0.02	BO15	2
4	5/29/95	7.9	6.3	6.43	6.27	0.17		3	0.06	BO150	1
4	5/29/95	7.4	6.1	6.22	6.27	0.05		2	0.01	BO151	1
4	5/29/95	7.4	6.0	6.12	5.70	0.12			0.02	BO152	1
4	5/29/95	8.3	6.7	6.84	7.45	0.08		2		BO153	1
4	5/29/95	7.4	5.9	6.02	5.83	0.09		2	0.04	BO154	1
4	5/29/95	9.3	7.6	7.76	10.74	0.14		3	0.04	BO155	2
4	5/29/95	4.0	3.2	3.27	0.76		0.00	1	0	BO156	0
4	5/29/95	3.7	3.0	3.06	0.73			1	0	BO157	0
4	5/29/95	4.1	3.3	3.37	0.85		0.00	1	0	BO158	0
4	5/29/95	4.1	3.3	3.37	0.70		0.00	1	0	BO159	0
3	5/27/95	8.6	7.1	7.24	7.79	0.38			0.13	BO16	2
4	5/29/95	3.8	3.0	3.06	0.77		0.00	1	0	BO160	0
4	5/29/95	4.2	3.4	3.47	0.94		0.00	1	0	BO161	0
4	5/29/95	4.1	3.3	3.37	1.02		0.00	1	0	BO162	0
4	5/29/95	3.0	2.4	2.45	0.21		0.00	1	0	BO163	0
4	5/29/95	4.1	3.3	3.37	0.91			1	0	BO164	0
4	5/29/95	3.0	2.3	2.35	0.23			1	0	BO165	0
4	5/29/95	3.3	2.6	2.65	0.48		0.00	1	0	BO166	0
4	5/29/95	2.8	2.3	2.35	0.21		0.00	1	0	BO167	0
4	5/29/95	3.3	2.6	2.65	0.42		0.00	1		BO168	0
4	5/29/95	4.1	3.2	3.27	0.88		0.00	1		BO169	0
3	5/27/95	5.3	4.3	4.39	0.24		0.00	1	0	BO17	0
4	5/29/95	4.1	3.3	3.37	0.88		0.00	1		BO170	0
4	5/29/95	3.6	2.9	2.96	0.56			1		BO171	0
4	5/29/95	3.3	2.7	2.76	0.45			1		BO172	0
4	5/29/95	3.8	3.2	3.27	0.77		0.00	1		BO173	0
4	5/29/95	4.2	3.5	3.57	1.03			1		BO174	0
4	5/29/95	4.0	3.3	3.37	0.79			1		BO175	0
4	5/29/95	4.0	3.3	3.37	0.59		0.00	1		BO176	0
4	5/29/95	3.4	2.9	2.96	0.48			1		BO177	0
4	5/29/95	3.4	2.8	2.86	0.53		0.00	1		BO178	0
4	5/29/95	3.2	2.6	2.65	0.36			1		BO179	0
3	5/27/95	3.4	2.8	2.86	0.44			0	0	BO18	0
4	5/29/95	3.8	3.2	3.27	0.64			1		BO180	0
4	5/29/95	3.7	3.2	3.27	0.86			1		BO181	0
4	5/29/95	3.4	2.8	2.86	0.50			1		BO182	0
4	5/29/95	3.2	2.5	2.55	0.36		0.00	1		BO183	0
4	5/29/95	3.8	3.0	3.06	0.73		0.00	1		BO184	0
4	5/29/95	2.9	2.3	2.35	0.30		0.00	1		BO185	0
4	5/29/95	3.2	2.5	2.55	0.44		0.00	1		BO186	0
4	5/29/95	3.8	3.1	3.16	0.73			1		BO187	0
4	5/29/95	2.7	2.2	2.24	0.27			1		BO188	0
4	5/29/95	3.1	2.4	2.45	0.33		0.00	1		BO189	0
8	5/31/85	5.9	4.8	4.90	2.36		0.00	1	0.03	BO19	1
	5/31/95	4.8	3.9	3.98	1.03			0	0.01	BO2	0
8	5/31/85	4.8	3.9	3.98	1.27		0.00	0	0.01	BO20	0

Appendix VIII: Continued.

Haul	Date	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
8	5/31/85	4.2	3.3	3.37	0.80			0	0	BO21	0
8	5/31/85	4.1	3.3	3.37	0.82		0.00	0	0	BO22	0
8	5/31/85	4.2	3.4	3.47	0.94			0	0	BO23	0
8	5/31/85	4.3	3.4	3.47	0.80			0	0	BO24	0
8	5/31/85	3.9	3.1	3.16	0.55		0.00	0	0	BO25	0
8	5/31/85	4.8	3.9	3.98	1.27		0.00	0	0	BO26	0
8	5/31/85	4.6	3.7	3.78	0.95			0	0	BO27	0
8	5/31/85	4.7	3.8	3.88	1.08		0.00	0	0	BO28	0
8	5/31/85	3.6	2.9	2.96	0.48		0.00	0	0	BO29	0
	5/31/95	4.6	3.8	3.88	1.12			0	0.01	BO3	0
8	5/31/85	4.0	3.2	3.27	0.62		0.00	0	0	BO30	0
8	5/31/85	3.9	3.1	3.16	0.62			0	0	BO31	0
8	5/31/85	3.5	2.8	2.86	0.44		0.00	0	0	BO32	0
8	5/31/85	3.0	2.4	2.45	0.26		0.00	0	0	BO33	0
8	5/31/85	3.5	2.8	2.86	0.45			0	0	BO34	0
8	5/31/85	2.7	2.2	2.24	0.20			0	0	BO35	0
8	5/31/85	4.7	3.9	3.98	1.26			0	0	BO36	0
20	5/26/95	5.8	4.7	4.80	2.08		0.00	0	0.01	BO37	
20	5/26/95	5.0	4.0	4.08	1.38		0.00	0	0	BO38	0
20	5/26/95	4.4	3.5	3.57	1.00			0	0	BO39	0
	5/31/95	4.5	3.8	3.88	1.02			0	0.01	BO4	0
17	5/31/95	4.6	3.7	3.78	1.06		0.00	0	0	BO40	0
17	5/31/95	3.5	2.7	2.76	0.42			0	0	BO41	0
19	5/26/95	7.7	6.0	6.12	4.64	0.09		2		BO42	1
19	5/26/95	7.7	6.0	6.12	5.12	0.05			0	BO43	1
18	5/31/95	5.2	4.3	4.39	1.76		0.00	0	0	BO44	0
18	5/31/95	4.2	3.4	3.47	0.89		0.00	0		BO45	0
12	5/30/95	4.4	3.5	3.57	0.83			0		BO46	0
14	5/30/95	5.8	4.7	4.80	2.42		0.00	0	0	BO47	0
14	5/30/95	4.5	3.7	3.78	1.06		0.00	0	0.01	BO48	0
14	5/30/95	4.6	3.7	3.78	1.32		0.00	0		BO49	0
	5/31/95	4.4	3.6	3.67	0.80			0	0.01	BO5	0
14	5/30/95	4.6	3.8	3.88	1.21			0		BO50	0
14	5/30/95	4.6	3.8	3.88	1.11		0.00	0	0.01	BO51	0
14	5/30/95	4.1	3.4	3.47	0.82		0.00	0	0	BO52	0
13	5/31/95	8.8	7.1	7.24	7.74	0.12		2	0	BO53	
11	5/30/95	8.9	7.2	7.35	9.30		0.02	1	0.01	BO54	
11	5/30/95	6.1	5.0	5.10	2.71		0.00	0	0.04	BO55	
11	5/30/95	4.6	3.8	3.88	1.18		0.00	0	0	BO56	
15	5/31/95	5.1	4.2	4.29	1.64		0.00	0		BO57	
15	5/31/95	4.6	3.7	3.78	1.09		0.00	0	0	BO58	
15	5/31/95	4.5	3.6	3.67	1.00			0	0	BO59	
7	5/30/95	2.3	1.9	1.94	0.11			0	0.01	BO6	0
15	5/31/95	4.2	3.3	3.37	0.76			0	0	BO60	
4	5/29/95	8.3	6.8	6.94	7.80	0.05			0	BO61	
4	5/29/95	9.5	7.8	7.96	10.52	0.14		2	0.02	BO62	
4	5/29/95	8.2	6.6	6.73	6.45		0.00	2		BO63	
4	5/29/95	7.7	6.2	6.33	5.79	0.05		2	0.04	BO64	
4	5/29/95	9.2	7.5	7.65	9.85		0.03	2	0.03	BO65	2
4	5/29/95	8.5	6.8	6.94	7.89	0.20			0.01	BO66	2
4	5/29/95	7.8	6.3	6.43	5.21	0.11		2	0.01	BO67	2
4	5/29/95	9.4	7.6	7.76	10.76	0.18			0.06	BO68	1

Appendix VIII: Continued.

Haul	Date	TL (cm)	SL (cm)	Total wet weight (g)	Gutted wet weight (g)	Gonad weight (g)	Testis weight (g)	Gonad stage	Stomach content weight (g)	Otolith #	Age (year)
4	5/29/95	8.6	6.9	7.04	7.95		0.02	2		BO69	2
7	5/30/95	3.5	2.8	2.86	0.48			0	0.01	BO7	0
4	5/29/95	9.3	7.5	7.65	9.98	0.11		2	0	BO70	2
4	5/29/95	8.4	6.8	6.94	7.23	0.08		2	0.01	BO71	2
4	5/29/95	7.9	6.2	6.33	5.53	0.06		2	0	BO72	1
4	5/29/95	8.6	6.8	6.94	8.59	0.11		2	0	BO73	2
4	5/29/95	9.1	7.4	7.55	9.26	0.20		3	0.06	BO74	1
4	5/29/95	8.8	7.0	7.14	7.83	0.06		2	0	BO75	2
4	5/29/95	9.4	7.6	7.76	11.92		0.02	2	0	BO76	1
4	5/29/95	7.1	5.7	5.82	5.15	0.05		2	0	BO77	1
4	5/29/95	7.6	6.1	6.22	4.94	0.06		2	0.01	BO78	1
4	5/29/95	8.7	7.1	7.24	7.91	0.17		3	0.03	BO79	2
7	5/30/95	2.8	2.4	2.45	0.26			0	0.01	BO8	0
4	5/29/95	4.2	3.4	3.47	0.80		0.00	0	0.01	BO80	0
4	5/29/95	3.7	2.9	2.96	0.50		0.00	0	0	BO81	0
4	5/29/95	3.2	2.6	2.65	0.35			0	0	BO82	0
4	5/29/95	3.5	2.8	2.86	0.44		0.00	0	0	BO83	0
4	5/29/95	3.9	3.1	3.16	0.64		0.00	0	0	BO84	0
4	5/29/95	3.5	2.8	2.86	0.41		0.00	0	0	BO85	0
4	5/29/95	9.1	7.4	7.55	10.76		0.02	2	0.01	BO86	3
4	5/29/95	8.9	7.2	7.35	9.11		0.02	2	0.02	BO87	2
4	5/29/95	10.6	9.1	9.29	20.06		0.02	2		BO88	2
4	5/29/95	9.6	7.8	7.96	11.65	0.14		2	0.06	BO89	2
7	5/30/95	2.6	2.1	2.14	0.17			0	0.01	BO9	0
4	5/29/95	9.5	7.7	7.86	11.26		0.02	2	0.04	BO90	3
4	5/29/95	9.3	7.6	7.76	11.59	0.14		2	0.03	BO91	3
4	5/29/95	8.0	6.4	6.53	6.79		0.00	2	0.02	BO92	3
4	5/29/95	9.4	8.5	8.67	18.76		0.02	2	0.07	BO93	3
4	5/29/95	8.3	6.7	6.84	8.64	0.12		3	0.04	BO94	2
4	5/29/95	8.6	6.9	7.04	8.83	0.11		2	0	BO95	3
4	5/29/95	8.4	6.8	6.94	8.18	0.09		2	0.02	BO96	2
4	5/29/95	8.6	6.9	7.04	8.64		0.03	2	0	BO97	
4	5/29/95	8.3	6.7	6.84	7.50	0.11		2	0	BO98	2
4	5/29/95	7.8	6.3	6.43	6.33	0.09		2	0.01	BO99	1

CONTENTS