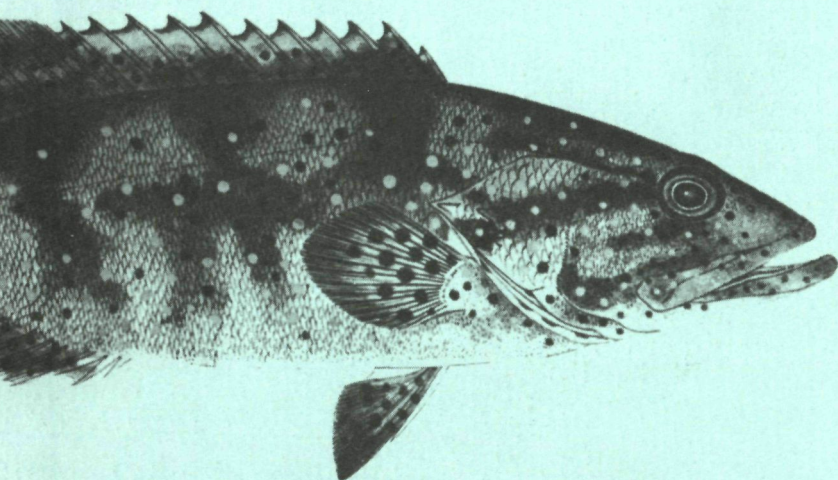
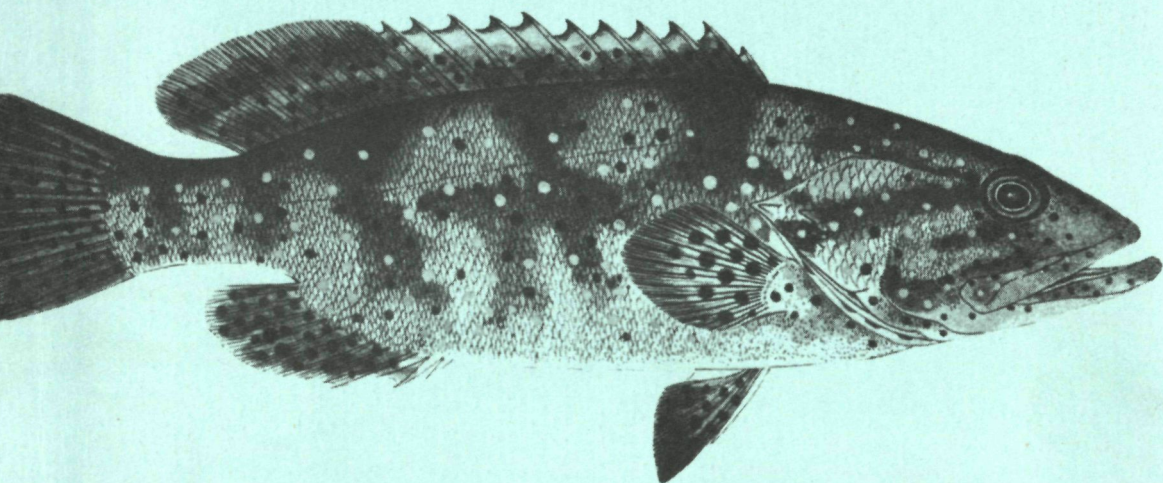


# **GROUPE ABSTRACTS**



**BRACKISHWATER AQUACULTURE INFORMATION SYSTEM**



# **GROUPE A B S T R A C T S**

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**Bibliography Series No. 8**

## FOREWORD

There are various species of grouper distributed all over the world. They thrive in coral reefs and stony environment. Majority of the groupers belong to the genus *EPINEPHELUS* meaning "clouded over", alluding to the membrane supposedly covering the eye.

This species is characterized by an oblong body usually with spots and blotches and having a very large mouth. A highly carnivorous organism, it feeds on fish, crustaceans and cephalopods. Biologically, groupers are protogynous hermaphrodites.

Groupers are considered important food fish specially in Kuwait, Indonesia, Malaysia, Thailand and the Philippines. Unfortunately, culture of grouper in ponds and cages has not reached commercial scale. Bulk of production is based on commercial catches.

Due to the insufficient supply of fingerlings, artificial breeding has been done in Singapore, Thailand and the Philippines. Cage culture experiments were conducted in Hong-Kong, Indonesia, Malaysia, Singapore, and Thailand. In the Philippines, polyculture experiments on grouper and tilapia produced high yields.

This special issue of the Brackishwater Aquaculture Information System (BRAIS) project hopes to provide references to biologists, technologists and individuals interested in grouper.

**Marubeth C. Ortega**  
**BRAIS Project Coordinator**



## **PREFACE**

The Brackishwater Aquaculture Information System (BRAIS) project partially funded by the International Development Research Centre of Canada and implemented by SEAFDEC Aquaculture Department through the SEAFDEC Library has undertaken a literature search on grouper species specifically on the genus *EPINEPHELUS*.

This issue contains 179 references on the culture, biology, diseases, nutrition, catch fisheries, and taxonomy of grouper species. Of the total, 13 references, as indicated by double asterisk, are still to be acquired.

References are arranged alphabetically by author and numbered sequentially. Provided at the end are Author, Title, Subject, Taxonomic and Geographic indexes.

**BRACKISHWATER AQUACULTURE INFORMATION SYSTEM  
SEAFDEC Aquaculture Department  
Tigbauan, Iloilo, Philippines**

## SAMPLE ENTRIES

### Conference Paper/Monograph analytic

- 2 \_\_\_\_\_ 3  
 1—38 Chulavitayanukool, P. [1985]. [Effect of 'Ve' on maturation of] 4  
 grouper.] IN: [Proceedings of the 3rd Seminar on Coastal  
 5 [Aquaculture, 22-24 May 1985. [Thailand], Brackishwater  
 Fisheries Division, Department of Fisheries, Ministry of  
 8 [Agriculture and Cooperatives. p.1-6. 3 tables (Text in  
 Thai) \_\_\_\_\_ 11

### Monograph

- 33 Chua, T-E. ; Teng, S-K. 1978. [Family unit concept for rearing] 5  
 [fishes in floating net-cages.] Penang, School of Biological  
 Sciences, Universiti Sains Malaysia. 26p. 7 figs (Project  
 report/Universiti Sains Malaysia; no. USM/IFS/CTE 8)

### Serial Article

- 34 Chua, T-E. ; Teng, S-K. 1978. [Floating fishpens for rearing fishes] 11  
 [in Malaysia.] [Asian Aquacult., 1(1): 4,6-7. \_\_\_\_\_ 10  
 6 \_\_\_\_\_ 9  
 7 \_\_\_\_\_

### Thesis

- 152 Teng, S-K. 1979. Studies on the culture of the estuary grouper,  
 EPINEPHELUS SALMOIDES Maxwell (Pisces, Serranidae)  
 in floating net-cages. [(Ph.D. Thesis, School of Biological  
 12 [Sciences, Universiti Sains Malaysia)] 423p.

### Legend:

- |                            |                      |
|----------------------------|----------------------|
| 1) Entry Number            | 8) Imprint           |
| 2) Author (s)              | 9) Volume Number     |
| 3) Publication Date        | 10) Issue Number     |
| 4) Analytical Title        | 11) Collation        |
| 5) Title of Monograph      | 12) Degree for which |
| 6) Title of Serial Article | Thesis submitted and |
| 7) Serial Title            | name of Institution  |



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## **ACKNOWLEDGEMENT**

We wish to thank the following persons for their valuable contribution to this volume: **LUISA PACINO** and **CAROL UNGGUI** of the Library, and **EFREN ABANCIO** and **LEO CABABASAY** of the Computer Unit.



## LIST OF ABBREVIATED TITLES

<u>Abbreviated Title</u>	<u>Complete Title</u>
Acta Parasitol.Pol.	Acta Parasitologica Polonica
Annu.Rep.Leganes Res. Stn.Aquacult.Dep. SEAFDEC	Annual Report. Leganes Research Station. Aquaculture Department SEAFDEC
Annu.Rep.Songkhla Fish. Stn.Dep.Fish.	Annual Report. Songkhla Fisheries Station. Department of Fisheries
Annu.Res.Rep.KISR	Annual Research Report. Kuwait Institute for Scientific Research
Asian Aquacult. Bangladesh J.Zool.	Asian Aquaculture Bangladesh Journal of Zoology
Bull.Fish.Exp.Stn. Okayama Prefect.	Bulletin of Fisheries Experiment Station, Okayama Prefecture
Bull.Inst.Oceanogr. Fish., Cairo	Bulletin of the Institute of Oceanography and Fisheries, Cairo
Bull.Inst.Zool. Acad.Sin.	Bulletin. Institute of Zoology, Academia Sinica
Bull.Jpn.Soc.Sci.Fish.	Bulletin of the Japanese Society of Scientific Fisheries
Bull.Mar.Sci.	Bulletin of Marine Science
Bull.Nakai Reg.Fish. Res.Lab.	Bulletin of Nakai Regional Fisheries Research Laboratory
Bull.Natl.Sci.Mus. (Japan)	Bulletin of the National Science Museum (Japan)

Bull.Taiwan Fish.Res. Inst.	Bulletin of the Taiwan Fisheries Research Institute
Cell Tissue Res.	Cell Tissue Research
China Fish.Mon.	China Fisheries Monthly
Comp.Biochem.Physiol.	Comparative Biochemistry and Physiology
Environ.Biol.Fish.	Environmental Biology of Fishes
Fish.Bull.	Fisheries Bulletin
Fish.Today	Fisheries Today
ICLARM Newsl.	ICLARM Newsletter
Indian Biol.	Indian Biology
Indian J.Fish.	Indian Journal of Fisheries
INFOFISH Mark.Dig.	INFOFISH Marketing Digest
Int.J.Environ.Anal. Chem.	International Journal of Environmental Analytical Chemistry
J.Exp.Mar.Biol.Ecol.	Journal of Experimental Marine Biology and Ecology
J.Fac.Mar.Sci.Jeddah	Journal of the Faculty of Marine Science of Jeddah
J.Fish Biol.	Journal of Fish Biology
J.Fish.China	Journal of Fisheries of China
J.Ichthyol.	Journal of Ichthyology
J.Mar.Biol.Assoc.India	Journal of Marine Biological Association of India
J.World Maricult.Soc.	Journal of the World Mariculture Society
Kuwait Bull.Mar.Sci.	Kuwait Bulletin of of Marine Science
Laporan Penelitian Perikanan Laut/Mar. Fish.Res.Rep.	Laporan Penelitian Perikanan Laut/Marine Fisheries Research Report
Mar.Biol.	Marine Biology
Oceanol.Limnol.Sin.	Oceanologia et Limnologia Sinica



PCARRD Monit.  
Philipp.J.Sci.

Proc.Annu.Meet.World  
Maricult.Soc.

Proc.Gulf Caribb.  
Fish.Inst.

R&D J.  
Singapore J.Prim.Ind.

Thai Fish.Gaz.

PCARRD Monitor  
Philippine Journal of  
Science  
Proceedings of the Annual  
Meeting World  
Mariculture Society  
Proceedings of the Gulf  
and Caribbean Fisheries  
Institute  
R&D Journal  
Singapore Journal of  
Primary Industries  
Thai Fisheries Gazzette

# **GROUPE ABSTRACTS**

- 1        Abdullah, M.A.S.; Akatsu, S.; Al-Abdul-Elah, K.M.; Teng, S-K. 1983. ,Refinement of spawning and larval rearing techniques in hamoor (EPINEPHELUS TAUVINA). Annu.Res.Rep.KISR, 1983: 55-57. 3 tables

Experiments on the spawning and larval rearing of EPINEPHELUS TAUVINA were carried out. Methods are described and results discussed. Main factors considered in the experiment are temperature and salinity. (R.P.G.)

- 2        Abu-Hakima, R.; Al-Abdul-Elah, K.M.; El-Zahr, C.R. 1981. Gonad development in food fishes of Kuwait. Annu.Res.Rep.KISR, 1981: 84-87. 1 fig; 1 plate

Samples of gonads from commercial catches of selected fishes (EPINEPHELUS TAUVINA, ACANTHOPAGRUS CUVIERI, ACANTHOPAGRUS LATUS, OTOLITHES ARGENTEUS, PAMPUS ARGENTEUS, POMADASYS ARGENTEUS) were collected monthly. Maturation stage of each species of fish was determined. (D.V.Z.)

- 3        Abu-Hakima, R.; Al-Abdul-Elah, K.M.; Teng, S-K. 1983. Reproductive biology of EPINEPHELUS TAUVINA (Forsk.) (Family: Serranidae) in Kuwaiti waters. Safat, Kuwait Institute for Scientific Research. 24p. (Tech.rep./KISR; no.1000) (for acquisition)\*\*

Gonad maturation in E. TAUVINA is examined over one annual reproductive cycle from September 1979 to September 1980. There is one major spawning period from April to June in E. TAUVINA. The histological changes in the gonads are described in 5 developmental stages in both the males and the females. E. TAUVINA is a protogynous hermaphrodite. Sexual transition occurs in individuals 55-75cm in length, and is correlated to spawning activity. Fecundity estimates for E. TAUVINA 35.1cm to 62.3cm ranged from 850,186 to 2,904,912. (ASFA)



- 4 Akatsu, S.; Al-Abdul-Elah, K.M.; Ghazai, N.; Teng, S-K. 1982. Effects of salinity and water temperature on larval rearing and fingerling production of hamoor (EPINEPHELUS TAUVINA). Annu.Res.Rep.KISR, 1982: 56-59. 2 tables

The present study was intended to investigate some key problems in the larval rearing techniques of hamoor (EPINEPHELUS TAUVINA) in Kuwait. Salinity and temperature were chosen because both are key factors affecting survival and growth of most marine fish larvae. Results indicated that survival and growth of the larvae were significantly affected in brackishwater of 25ppt for 21-40 days old larvae. High temperature (27-31C) is necessary to enhance survival of the larvae, the optimum range being 27-29C for newly hatched to 12 days old and 29-31C for 19-33 days old. (R.P.G.)

- 5 Akatsu, S.; Al-Abdul-Elah, K.M.; Teng, S-K. 1983. Effects of salinity and water temperature on the survival and growth of brown-spotted grouper larvae (EPINEPHELUS TAUVINA, Serranidae). J.World Maricult.Soc., 14: 624-635.

Effect of salinity and temperature on the growth and survival of EPINEPHELUS TAUVINA larvae were studied. A salinity of 25 to 39ppt, increasing at a rate of 4-5ppt/week and 39 to 25ppt decreasing at the same rate per week, was used. It was observed that at early larval stages there was no significant difference between treatments. However, for later larval stages, growth and survival were significantly higher at a constant salinity of 25ppt. Salinity tolerance limit was also investigated. At a constant salinity of 39ppt, newly-hatched to 12-day old larvae and 19-33 day old larvae were subjected to various temperatures. Best survival and growth were noted at 27-29C for newly-hatched to 12-day old and at 30-31C for 19-33 day old larvae. (MODIFIED AUTHOR'S ABSTRACT)

- 6 Al-Abdul-Elah, K.M.; Akatsu, S.; Teng, S-K. 1985. Hatchery and fingerling production of marine fishes in Kuwait. Kuwait Bull.Mar.Sci., (6): 65-79. (Text in Arabic)

This report includes three major section dealing into the establishment of a marine fish hatchery for fingerling production in Kuwait. Section one deals with the hatchery techniques for some of the local species. This includes broodstock maintenance, egg collection and egg hatching. It also includes the techniques of larval rearing in detail. Section two deals with some of the research problems of larval rearing and suggested solutions. Section three is concerned with future research towards solving the problems impeding the success of a large-scale commercial hatchery. The hatching of the following local fishes was studied: Maid (LIZA MACROLEPIS), Sheim (ACANTHOPAGRUS LATUS), Sobaity (ACANTHOPAGRUS CUVIERI); Safy (SIGANUS ORAMIN); hamoor (EPINEPHELUS TAUVINA). Both sobaity and hamoor were selected for further study. This selection was based on the results of work carried out from 1976 to 1980. Research is still in progress for finalization of the hatchery techniques for sobaity and hamoor. (AUTHOR'S ABSTRACT)

- 7 Al-Baharna, W.S. 1986. Serranidae (groupers). IN: Fishes of Bahrain. Bahrain, Ministry of Commerce and Agriculture, Directorate of Fisheries. p.221.

Characteristics inherent to groupers (Serranidae) are described. (D.V.Z.)

- 8 Al-Hassan, L.A.J. 1982. Use of electrophoresis in the identification of fish stock, and its future application in the Arabian Gulf. J.Fac.Mar.Sci.Jeddah, 2: 81-84. (for acquisition)\*\*

The use of electrophoresis in the biochemical identification of fish stocks is discussed. The application of the method in determining gene frequencies of some of the fish stocks of the Arabian Gulf is considered, namely: EPINEPHELUS TAUVINA, HILSA ILISHA, and PENAEUS SEMISULCATUS. (ASFA)

- 9 Al-Judaimi, M.M.; Jafri, A.K.; George, K.A. 1981. Proximate composition and nutritive value of some important food

fishes from the Arabian Gulf.  
Fish.Bull., 79(1): 211-212. 1 table

Fishes obtained from local fish market were examined as to proximate composition and nutritive value for the use of consumers, dieticians and fishing industry as a whole. Total length, protein content, fat content, moisture, ash and energy of each sample species were determined. (D.V.Z.)

- 10 Al-Zarka, S.; Coche, A.G. 1985. Prospects of aquaculture in the Arabian world. Kuwait Bull.Mar.Sci., (6): 15-29. (Text in Arabic)

Fish rearing in the Arab world is important for different reasons: it is an additional protein resource for human consumption, it can be used to control water plants, to increase fish stocks or to make use of salt lands not good for agriculture. Fish rearing differs in each country; it can be at an experimental stage, on a small scale in the countryside, or on a large scale for industrial production. This paper presents the main cultured fish species both on an experimental and commercial basis according to each method followed in each country. The possibilities of fish rearing in the Arab world are also discussed. (AUTHOR'S ABSTRACT)

- 11 Arsjad, M. 1982. Sea bass and grouper culture programme in Jakarta Province. IN: Report of Training Course on Seabass Spawning and Larval Rearing, Songkhla, Thailand, 1-20 Jun 1982. Manila, South China Sea Fisheries Development and Coordinating Programme. p.79. 2 figs (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.39)

A brief account is given on the current fisheries activities in Jakarta. Marine fish culture is a relatively new venture in the province. The programme on sea bass (*LATES CALCARIFER*) and grouper (*EPINEPHELUS*) culture involving cage culture is described. (R.P.G.)

- 12 Awang, A. 1982. Programme for the culture



of sea bass and related species by the Fisheries Division, at the West Coast of Peninsular Malaysia. IN: Report of Training Course on Seabass Spawning and Larval Rearing, Songkhla, Thailand, 1-20 Jun 1982. Manila, South China Sea Fisheries Development and Coordinating Programme. p.84-85. (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.39)

The fisheries Division of the Ministry of Agriculture, Malaysia, has generated interest in the culture of sea bass (*LATES CALCARIFER*), grouper (*EPINEPHELUS TAUVINA/SALMOIDES*), red snapper (*LUTJANUS ARGENTIMACULATUS*) and spotted snapper (*LUTJANUS JOHNI*) due to increasing demand. Due to limited seed supply, cages were stocked with a combination of these species. Hatcheries were constructed to answer the shortage of seed supply. The two hatcheries in operation produce *MACROBRACHIUM*, marine shrimp and sea bass seed. Three more hatcheries will be in operation soon and two demonstration and experimental pond stations will be used in promoting grow-out pond technology. (R.P.G.)

- 13      Axelrod, H.R.; Burgess, W.E.; Emmens, C.W. 1985. [*EPINEPHELUS*]. IN: Exotic Marine Fishes. Neptune City, T.F.H. Publications. p.357-362. 7 illus.

A brief description and an illustration is provided for each grouper species. It includes common name of the species, distribution, previous scientific name, if any, and meristic characteristics. (D.V.Z.)

- 14      Baddar, M.K.; Mathews, C.P. 1981. Seasonal fluctuations in catch, effort and catch-per-unit-effort in Kuwait's fin fishery. Annu.Res.Rep.KISR, 1981: 130-132. 1 fig; 1 table

In 1979, a finfish sampling programme was established to provide basis for estimating total fish landings from Kuwait's fin fisheries, to determine total effort exerted, and fluctuations in catch-per-unit-effort. A table showing the summary of total

landings, total effort and catch-per-unit-effort is provided.  
Species covered are LUTJANUS COCCINEUS, EPINEPHELUS TAUVINA, and  
POMADASYSGRARGENTEUS. (D.V.Z.)

- 15 Baddar, M.K. 1982. Length-weight relationship and age determination of hamoor (EPINEPHELUS TAUVINA).  
Annu.Res.Rep.KISR, 1982: 76-77. 1 fig

Studies on the age structure of the commercially caught hamoor (EPINEPHELUS TAUVINA) from January to June 1982 indicated that majority of the commercial catches consist of three to six year-old fish. Older fish comprise only a small portion of the total catch because they leave Kuwait waters after attaining a length of about 80cm or about 10 years of age. (R.P.G.)

- 16 Baddar, M.K. 1984. Preliminary stock assessment of hamoor (EPINEPHELUS TAUVINA). IN: Proceedings of the Third Shrimp and Fin Fisheries Management Workshop, Fin Fisheries Session, 4-5 Dec 1982. Vol. 3. Ed. by Mathews, C.P. s.l., s.n. p.186-240. (for acquisition)\*\*

The results of sampling surveys of hamoor (EPINEPHELUS TAUVINA) in Kuwait's waters are discussed with respect to assessment of stock. Data regarding total length, weight, sex and otolith reading are presented. (ASFA)

- 17 Baguis, R.; Mazellier, P.; Bennett, J.; Christian, E. 1976. [EPINEPHELUS]. IN: Poissons de Polynesie. 3rd ed. [Papeete], Les Editions du Pacifique. p.94-103. 14 illus

Physical characteristics of each grouper species is given. A colored illustration is provided for easy identification. (D.V.Z.)

- 18 Bardach, J.E. 1958. On the movements of certain Bermuda reef fishes. Ecology,

39(1): 139-146.

This study investigated the movements of reef fishes, permanence of their residence in certain areas, and their tendency to return to their "home" reef after transfer. The study was conducted between the periods Jul 1955 to Sep 1956. The fishes were tagged and recaptured repeatedly. Behavioral observations of these fishes were also studied. (MODIFIED AUTHOR'S ABSTRACT)

- 19 Ben-Tuvia, A. 1978 Immigration of fishes through the Suez canal. Fish.Bull., 76 (1): 249-255.

The number of Red sea fishes in the eastern Mediterranean amounts to 36 species. Twelve immigrants, namely: SPRATELLOIDES DELICATULUS, HERKLOTSICHTHYS PUNCTATUS, TYLOSURUS CHORAM, SEBASTAPISTES NUHALIS, EPINEPHELUS TAUVINA, AUTISTHES PUTA, PELATES QUADRILINEATUS, SILAGO SIHAMA, RHONSICUS STRIDENS, CRENIDENS CRENIDENS, RASTRELLIGER KANAGURTA, SCOMBEROMORUS COMMERSON, were found in the last 12 yr. The southward migration, from the Mediterranean to the Red sea is almost negligible. Only LIZA AURATA, DICENTRARCHUS PUNCTATUS, and perhaps CARCHARHINUS PLUMBEUS can be regarded as Mediterranean immigrants. (AUTHOR'S ABSTRACT)

- 20 Bouain, A.; Siau, Y. 1983. Observations on the female reproductive cycle and fecundity of three species of groupers (EPINEPHELUS) from the southeast Tunisian seashores. Mar.Biol., 73: 211-220. 17 figs; 3 tables

In the present work, the oocytic structures of three species of groupers (EPINEPHELUS AENEUS, E. ALEXANDRINUS and E. GUAZA) have been studied. The oocytic maturation cycle is described, showing phases of ooplasmic pH changes and of vitellogenesis. The ripening is completed over 2 yr. The oocytes being recruited in shifts, they are also released in shifts 2 yr later inducing a spawning in several "waves". The macroscopic recognition of characteristic ripening stages has been used to count oocytes during spawning. We have stated the total potential fecundity of these groupers and pointed out the differences between them. (AUTHOR'S ABSTRACT)



- 21 Chao, T.M. 1984. Studies on the transmissibility of lymphocystis disease occurring in sea bass (LATES CALCARIFER Bloch). Singapore J.Prim.Ind., 12(1): 11-16. 4 figs; 3 tables

This is the first record of spontaneous lymphocystis disease occurring in netcage-reared sea bass (LATES CALCARIFER Bloch) in Singapore. It was found that the dermal disease could be transmitted by direct application to traumatized fins and by cohabitation transfer in sea bass. It is, however, not transmissible from sea bass to grouper (EPINEPHELUS TAUVINA Forskal), also a commonly netcage-cultured species. (AUTHOR'S ABSTRACT)

- 22 Chen, C-P.; Hsieh, H-L.; Chang, K-H. 1980. Age and growth of the grouper, EPINEPHELUS DIACANTHUS (Cuvier et Valenciensis) in the waters of northern Taiwan. Bull.Inst.Zool., Acad.Sin., 19(1): 1-9. 9 figs; 4 tables

Age of three hundred eighty EPINEPHELUS DIACANTHUS collected monthly from June 1975 to October 1977 were determined through scale reading. It was observed that the annual ring formation occurs during March to April. The standard length was back-calculated at the time of ring formation. (MODIFIED AUTHOR'S ABSTRACT)

- 23 Chen, C-P.; Hsieh, H-L.; Chang, K-H. 1980. Some aspects of the sex change and reproductive biology of the grouper, EPINEPHELUS DIACANTHUS (Cuvier et Valenciensis). Bull.Inst.Zool., Acad.Sin., 19(1): 11-17. 7 figs; 3 tables

Three hundred and eighty specimens of the grouper, EPINEPHELUS DIACANTHUS (Cuvier et Valenciensis), collected monthly from June 1975 to October 1977, were used in this study. This grouper is protogynous. Sex changes occurred during the non-reproductive period from age 2+ to 6+, but mainly between ages 2+ and 3+. Spawning occurred during April and May of each year. The minimum

body size for reproductive activity is estimated at 125mm (standard length). The fecundity ranged from  $63 \times 10^{**3}$  to  $233 \times 10^{**3}$ , and is linearly related to the standard length. (AUTHOR'S ABSTRACT)

- 24      Chen, F.Y.; Chow, T.M.; Chao; Lim, R. .1977. Artificial spawning and larval rearing of the grouper, EPINEPHELUS TAUVINA (Forsk.) in Singapore. Singapore J.Prim.Ind., 5(1): 1-21.

The grouper (EPINEPHELUS TAUVINA) is a protogynous hermaphrodite. Induced breeding trials on this fish were conducted in Jan-Apr 1977. Artificially fertilized eggs hatched within 24 hours, and the larvae metamorphosed into juveniles on the 33rd day at 27C. Cultured rotifer (BRACHIONUS PLICATILIS) and cladoceran (DIAPHONOSOMA sp.) were given as live larval food from the 3rd to 15th day and from the 10th day, respectively. The major breakthrough achieved in the induced breeding of the protogynous hermaphroditic grouper was due to the successful acceleration of sex reversal of adult females through hormonal manipulation. It had reduced much time which would otherwise be required for the natural transformation of female into male. (AQUADOC)

- 25      Chen, F.Y. 1979. Progress and problems of netcage culture of grouper (EPINEPHELUS TAUVINA F.) in Singapore. Proc.Annu.Meet.World Maricult.Soc., 10: 260-271.

Studies on the netcage culture are conducted at the floating experimental fishfarm. The floating structure with 32 cage units, and its effect on current movement are described. Cost-benefit analysis based on a production of  $40\text{kg/m}^{**2}/\text{yr}$  demonstrates the economic viability of grouper culture in Singapore. Large-scale production is, however, hampered by a shortage of fingerlings and feeds (trash fish). Scientific breakthrough on the breeding of the protogynous hermaphrodite has been achieved in early 1977. It is largely due to the success in inducing sex inversion of adult females to functional males. Technical details and problems of induced sex inversion, spawning and larval rearing are discussed at length. Research into substituting trash fish with dry pelleted feeds in the weaning of juveniles is encouraging. This is discussed briefly together with the diseases encountered. (AQUADOC)

- 26 Cheng, J. 1982. Economics of marine fish farming in Hong Kong. IN: Report of the Training Course on Small-scale Pen and Cage Culture for Finfish, Los Banos, Laguna, Philippines, 26-31 Oct 1981; Aberdeen, Hong Kong, 1-13 Nov 1981. Manila, South China Sea Fisheries Development and Coordinating Programme. p.141-145. (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.34)

Cage culture and impoundment culture are the two methods of marine fish farming practiced in Hong Kong. Cage culture is by far the most common. Most of the operators of the mariculture farms are small scale fishermen engaged in trapping, purse seining, gill netting, hand lining, and shrimp trawling. The cultured fish are fed with trash fish daily. Groupers and perches are commonly stocked and harvested after 12-24 months depending on the size at initial stocking. The economics of the system is presented. One of the advantage of the enterprise is that it requires less capital input. Marine fish farming is however, a high risk venture due to occurrences of natural disasters like typhoons, red tides, pollution and diseases. The uncertain supply of fish seed is also a major problem. (AQUADOC)

- 27 Cheng, Q.; Yang, W. 1983. New species of the family Serranidae - EPINEPHELUS STIGMOGRAMMATUS. Oceanol.Limnol.Sin., 14(5): 506-509. 2 figs (Text in Chin)

This paper describes a new species of Serranidae found in the South China Sea in 1956-1964. Holotype and paratype specimens are deposited in the Institute of Oceanology, Academia Sinica. Description of this new species is presented. E. STIGMOGRAMMATUS closely resembles E. EPISTICTUS but differs in some characteristics. These characteristics are presented in the table. (MODIFIED AUTHOR'S ABSTRACT)

- 28 Chou, R.; Wong, F.J. 1985. Preliminary observations on the growth and dietary performance of grouper, EPINEPHELUS TAUVINA (Forsk.) in floating netcages



and fed dry pelleted diet from autofeeders. Singapore J.Pri.Ind., 13(2): 84-91. 5 tables

A preliminary experiment was conducted to compare the growth and performance of grouper, *EPINEPHELUS TAUVINA* (Forsk. 1775), fed dry pelleted feed dispensed from autofeeders and manually on trashfish. Grow-out size of 200g was used and the experiment was conducted in floating netcages in the coastal waters off Singapore. The results showed that there was little difference in the growth and dietary performance of grouper fed either diet. The application of the findings is discussed, especially from the point of view of diet and feeding improvement and the use of dry feeds in fish culture. (AUTHOR'S ABSTRACT)

- 29 Chow, K.W. 1984. Diet development for sea bass, grouper and penaeid shrimp culture in Malaysia (a survey of fish feeds and initiation of programme). IN: Malaysia: Coastal Aquaculture Development. Rome, Food and Agriculture Organization of the United Nations. p.1-18. 2 figs; 4 tables; 1 annex

The Coastal Aquaculture Development Project at Johore was established to develop aquaculture in Malaysia. With regard to feeding requirements under intensive culture conditions the following species were selected: *PENAEUS MONODON*, *PENAEUS MERGUIENSIS*, *LATES CALCARIFER*, *EPINEPHELUS TAUVINA*, *SIGANUS* spp. A survey of raw materials and feed milling industries was conducted to determine available resources and to ascertain capabilities of the feed mills. Needed equipments to produce feeds for research purposes were also determined. Results of the study are discussed. Composition of Malaysian feedstuff and diet for the mentioned species is presented in tables. (D.V.Z.)

- 30 Chua, T-E.; Teng, S-K. 1977. Floating fishpens for rearing fishes in coastal waters, reservoirs and mining pools in Malaysia. Malaysia, Ministry of Agriculture. 36p. 20 figs; 7 tables (Fisheries bulletin/Ministry of Agriculture, Malaysia; no.20)

This paper describes the construction and employment of floating fish pens for use in cage culture of fish such as *LATES CALCARIFER*, *EPINEPHELUS TAUVINA*, *SIGANUS CANALICULATUS* and *ELEUTHERONEMA TETRADACTYLUM*. The paper gives details on choice of culture site, handling and transportation of fry, and fish diseases. Later sections are devoted to production and yield, economic aspects of the culture system, and the problem of seed supply. (R.P.G.)

- 31 Chua, T-E.; Teng, S-K. 1978. Economic production of estuary grouper, *EPINEPHELUS SALMOIDES* Maxwell, reared in floating net-cages. IN: International Foundation for Science and Universiti Sains Malaysia Regional Meeting on Aquaculture, Muka Head Biological Field Station, Penang, 1978. Stockholm, International Foundation for Science. p.101-187. (Provisional report/International Foundation for Science; no.2)

The factors affecting production of estuary grouper *E. SALMOIDES* in floating net-cages are discussed. The concept of economic production in cage culture is outlined. Economic production of estuary grouper could be attained by providing suitable site with good water quality; ensuring proper management of the farm and regular maintenance of cages; preventing diseases and ensuring efficient treatment; providing optimum stocking density, balanced diet, optimal feeding frequency; manipulating behavior of fish by providing hiding space as well as manipulating its physiological characteristics such as the use of growth promoters. The environmental parameters (e.g., dissolved oxygen content, water temperature, salinity, water current, bacteria count, pH, bottom sediments, etc.) are described with regards to their effects on growth and production of fish, and their importance in site selection. Among the problems outlined are fouling, which demanded considerable amount of labour force and money, predators, poaching and cannibalism. Production could be increased by as high as 230% if hiding space (using used car tyres) of 251cm\*\*2 per fish was provided, stocking density increased to 156fish/cm\*\*3, appropriate feeding frequency and formulated feeds incorporated with growth promoters. (AQUADOC)

- Chua, T-E.; Teng, S-K. 1978. Effects of feeding frequency on the growth of young estuary, *EPINEPHELUS TAUVINA* (Forsk.) , cultured in floating net-cages. *Aquaculture*, 14(1): 31-47.

Studies on the effects of feeding frequency on the growth of young estuary groupers (*EPINEPHELUS TAUVINA*) with initial size ranging from 16.2 to 16.9cm in total length were conducted in floating net-cages. Seven feeding frequencies in the order of one feeding in 5 days, 4 days, 3 days, 2 days, 1 day, two feedings daily and three feedings daily were studied. Optimal growth and good food conversion ratio as well as higher survival rate were obtained in groups fed to satiation with one feeding in 2 days. Weight gains were substantially reduced in groups fed to satiation with one feeding in 5, 4 or 3 days and were not enhanced when the feeding frequencies were increased to two or three feedings daily. The fact that food conversion ratios were similar in fish fed satiation with one feeding in 5, 4, 3 and 2 days suggests food intake to be important as a growth limiting factor. Total food intake per feeding was appreciably higher in fish fed once in 2 days. The intake of food was found to be closely related to the amount of food remaining in the stomach, intake being maximal when the stomach was empty. The food deprivation time in estuary groupers was found to be about 36hrs at which over 95% of the food was digested and less than 0.5% body weight of food remained in the stomach. Hence, feeding the fish at 48-h intervals, i.e., once in 2 days, greatly enhanced maximum intake and efficient utilization of the food. (AQUADOC)

- Chua, T-E.; Teng, S-K. 1978. Family unit concept for rearing fishes in floating net-cages. Penang, School of Biological Sciences, Universiti Sains Malaysia. 26p. 7 figs (Project report/Universiti Sains Malaysia; no. USM/IFS/CTE 8)

This paper presents the possibility of rearing finfishes in floating cages utilizing the family unit concept. This concept was realized because of the available manpower within the family. Advantages of the family culture system are outlined and the costs with reference to its technical and commercial feasibility are analyzed. The experimental fish farm shows that the income of the fish farmer can be increased if floating cages are operated on a family unit basis. (MODIFIED AUTHOR'S ABSTRACT)



- 34 Chua, T.E.; Teng, S-K. 1978. Floating fishpens for rearing fishes in Malaysia. Asian Aquacult., 1(1): 4,6-7.

The floating fishpen system is among the most productive means of fish production through aquaculture. Advantages, production and yield, technical considerations and economic aspects of employing floating fishpens for rearing fishes is presented. (R.P.G.)

- 35 Chua, T-E.; Teng, S-K. 1978. Relative growth and production of the estuary grouper, EPINEPHELUS SALMOIDES Maxwell reared in floating net-cages. Penang, School of Biological Sciences, Universiti Sains Malaysia. 23p. (Project report/Universiti Sains Malaysia; no. USM/IFS/CTE 5) (Also in: Mar.Biol., 54:363-374, 1979)

Growth and production of the estuary grouper, EPINEPHELUS SALMOIDES, reared at different stocking densities were studied. Result showed that fish stocked at 60/m<sup>3</sup> grew equally fast with food conversion ratio, mortality rate and condition factor comparable to those stocked at 15 and 30/m<sup>3</sup>. In addition, production was not significantly different from fish stocked at 90 and 120/m<sup>3</sup>. 15-16g grouper takes 7-8 months to grow to a marketable size of more than 500g at a stocking density of 15fish/m<sup>3</sup>, 8-9 months at densities of 30-60fish/m<sup>3</sup> and 11-12 months at 90-120fish/m<sup>3</sup>. (MODIFIED AUTHOR'S ABSTRACT)

- 36 Chua, T-E. 1979. Site selection, structural design, construction, management and production of floating cage culture system in Malaysia. [Penang], School of Biological Sciences, Universiti Sains Malaysia. 25p.

Rearing of finfishes in cages proved to be technically and commercially feasible in Malaysia. Elements to be considered to determine the success of cage culture system are site selection, cage facilities and management of the farm. In this paper, the three elements are discussed in detail. (D.V.Z.)



- 37 Chua, T-E.; Teng, S-K. 1982. Effects of food ration on growth, condition factor, food conversion efficiency, and net yield of estuary grouper, *EPINEPHELUS SALMOIDES* Maxwell, cultured in floating net cages. *Aquaculture*, 27(3): 273-283.

The effects of food ration on the growth and yield of the estuary grouper raised in floating net-cages were investigated. The optimum ration given on alternate days was 5% body weight (wet) which gave the best mean fish weight, uniform condition factor with time, relatively good survival rate, and greatest efficiency of food conversion. The maintenance, optimum and maximum food rations were 1.41, 5.75, and 9.0% body weight (wet), respectively. The fish were more uniform in size when fed 5-8% body weight. Though the yields at the end of the experiment were higher with high ration rates, the differences between rations of 5 and 9.1% body weight was 26.8 and 33.6%, whilst that between 5% and 2% body weight was 596%. For economic production, the ration should be approximately 5% of body weight supplied every 2 days. (AQUADOC)

- 38 Chulavitayanukool, P. [1985] Effect of 'Ve' on maturation of grouper. IN: Proceedings of the 3rd Seminar on Coastal Aquaculture, 22-24 May 1985. [Thailand], Brackishwater Fisheries Division, Department of Fisheries, Ministry of Agriculture & Cooperatives. p.1-6. 3 tables (Text in Thai)

Three concentrations of DL-alpha-tocopherol acetate ('Ve'), 0, 200 and 400mg/kg feed, were fed to female groupers (*EPINEPHELUS MALABARICUS*) to induce maturation. Observation for gravid females was conducted at 15 days intervals throughout the experiment. The results showed that female groupers fed on 'Ve' at 400mg/kg feed gave the highest percentage of maturation and the largest number of eggs which can be used for artificial fertilization. (AUTHOR'S ABSTRACT)

- 39 Chulavitayanukool, P.; Puthinuawarat, C.; Sutemchaikul, N. [1985] Study on the artificial propagation of grouper, *EPINEPHELUS MALABARICUS* (Bloch and

Schneider). IN: Proceedings of the 3rd Seminar on Coastal Aquaculture, 22-24 May 1985. [Thailand], Brackishwater Fisheries Division, Department of Fisheries, Ministry of Agriculture & Cooperatives. p.9-21. 7 figs; 4 tables (Text in Thai)

Artificial propagation of grouper, *EPINEPHELUS MALABARICUS* (Bloch and Schneider) was conducted at Satul Brackishwater Fisheries Station during Oct-Dec 1983. Forty females and forty males of 3.5-6.0kg each were put separately in floating net cages. The male fish were fed with methyl testosterone (MT) at the rate of 1mg/kg fish on every second day. Ten females were matured and received two hormonal injections to induced spawning. The first injection consisted of 2.0mg of Chinese carp pituitary extract + 400-500IU HCG/kg recipient, while the second injection consisted of 4.0mg of Chinese carp pituitary extract + 800-1000IU HCG/kg recipient. A single injection of 2.0mg Chinese carp pituitary extract + 500IU HCG/kg recipient were introduced to the males at the same time with the second injection of the females. Artificial fertilization was conducted and larvae hatched out at 19 hours after fertilization in 29-30ppt seawater at the water temperature of 29-30C. Marine rotifer (*BRACHIONUS PLICATILIS*), at the density of 5-10 organisms/ml, were fed to the larvae at 2-13 days after hatching. On days 14-45 after hatching, the larvae were fed on ARTEMIA. After day 45, minced fishmeat were fed to the larvae until they metamorphosed into juveniles. (AUTHOR'S ABSTRACT)

40

Diamant, A.; Shpigel, M. 1985. Interspecific feeding associations of grouper (Teleost: Serranidae) with octopuses and moray eels in the Gulf of Eilat (Aqaba). *Environ.Biol.Fish.*, 13(2): 153-159. 1 figs; 2 tables

Temporary interspecific feeding associations between grouper (*Serranidae*) and moray eels or octopuses in the Red Sea were observed 41 times during over 400 scuba dives. Such behavior is a feeding tactic adopted by groupers in which small organisms, escaping the primary (= nuclear) predators (eel or octopus), are caught by the groupers. Eels or octopuses, due to their body structure or shape, gain access to crevices that most fishes cannot enter. This feeding tactic increases the diversity of food resources used by their associates by making normally inaccessible food items available to them. *Serranidae* from many parts of the



world exploit normally unavailable food resources in this fashion. It appears that this is a learned behavior which increases food diversity and feeding efficiency. (AUTHOR'S ABSTRACT)

- 41 Doiphode, P.V.; Naik, R. 1975. On the occurrence of a giant rock-cod, EPINEPHELUS MALABARICUS (Bloch and Schneider) in the estuarine water of River Mandovi, Goa. J.Mar.Biol.Assoc.India, 17(2): 244-245.

A giant rock-cod, EPINEPHELUS MALABARICUS (Bloch and Schneider) measuring 210cm in total length was caught in a stake net on 17th August 1977 in the estuarine water of River Mandovi, Goa. The fish, a female in the third stage of maturity, is the first record from estuaries of Goa. (ASFA)

- 42 Downing, N.; Tubb, R.A.; El-Zahr, C.R.; McClure, R.E. 1985. Artificial reefs in Kuwait, northern Arabian Gulf. Bull.Mar.Sci., 37(1): 157-178.

Three experimental artificial reefs, constructed from scrap motor car tires were deposited in 10m of water off the southern Kuwait coast in May 1981. Each reef occupied a bottom area of approximately 25m\*2. Two of the reefs were 0.8m high and differed in the spacial arrangement of tires used to build them. The third, a high profile reef, measured 2.4m high. Nine surveys of the fish attracted to the reefs were carried out over the following 12 months. The nature and extent of invertebrate colonization was monitored using pre-weighed patches of motor car tires fixed to the tops of the reef tires. At least 50 species of fish, representing 33 families were observed on the artificial reefs between May 1981 and April 1982. The species composition of the fish communities showed few differences between the three reefs. The high profile reef attracted a greater biomass of fish more rapidly than either of the two low profile reefs, although in terms of the outer surface area of each reef average standing crops were similar. Sport fish made up of 86% of the total standing crop of all the reefs, and over 50% of the fish biomass was accounted for by the grouper EPINEPHELUS TAUVINA and by the barracuda SPHYRAENA JELLO. The high profile reef attracted more than four times the biomass of grouper than did either of the low profile reefs. (AUTHOR'S ABSTRACT)



- 43 El-Dakour, S.; George, K.A. 1981. Growth of hamoou (EPINEPHELUS TAUUVINA) fed on different protein: energy ratios. Annu.Res.Rep.KISR, 1981: 75-77. 2 figs

Two experiments on nutritional requirement of E. TAUUVINA are presented in this paper. In experiment one, crude protein-energy requirement was investigated utilizing diets containing 25, 31, 35, 45 and 57% protein levels and having the same energy content (23.4-24.3kJg<sup>-1</sup>). In experiment two, E. TAUUVINA was subjected to pellets containing different moisture contents. Growth of E. TAUUVINA in both experiments is graphically illustrated. (D.V.Z.)

- Elizalde, L.P.; Marcial, B.D. 1983. Fresh venture: lapu-lapu in ponds. Fish.Today, 5(1): 34-37. 1 table

There are about 40 species of groupers found in Philippine waters. Production of which decreased from 23,631 in 1976 to 19,731MT in 1980. Some experimental findings are given in this paper. Techniques of rearing grouper in ponds is discussed and economics of utilizing a one-hectare pond is provided. (D.V.Z.)

- 45 Ezzat, A.A.; Mikhail, M.Y.; Wadie, W.F.; Hashem, M.T. 1982. Length-weight relationship and condition factor of EPINEPHELUS AENEUS and EPINEPHELUS ALEXANDRINUS in the Egyptian Mediterranean waters. Bull.Inst.Oceanogr.Fish.Cairo, 8(1): 173-185. 5 figs; 6 tables

The present study showed a clear difference in the value of the constant 'n' (number of groups), this may be attributed to the different ecological conditions in the studied regions. Also, variations in the rate of growth were observed. For the same length group it can be concluded that the observed and calculated weights for fishes were higher in Alexandria region than in Salloum Bay. Also, the condition factor for both species was higher in Alexandria than in Salloum Bay. This is due to the higher productivity of Alexandria region. (AUTHOR'S ABSTRACT)

- 46 Food and Agriculture Organization of the United Nations. 1974. Family: Serranidae: [Groupers]. IN: FAO Species Identification Sheets for Fishery Purposes. Eastern Indian Ocean (Fishing Area 57) and Western Central Pacific (Fishing Area 71). Vol.4. Ed. by Fischer, W. & P.J.P. Whitehead. s.l., s.n. p.(Code) SERRAN Epin 4-12.

Characteristics of twelve species of grouper and their distinguishing characters between and among species occurring in the area are described. Size, distribution, fishery and principal forms of utilization are included. (D.V.Z.)

- 47 Food and Agriculture Organization of the United Nations. 1983. Diets for warm-water carnivores: grouper (EPINEPHELUS TAUVINA), sea bass (LATES CALCARIFER), sea bream (SPARUS AURATUS). IN: Fish Feeds and Feeding in Developing Countries. Rome, Food and Agriculture Organization of the United Nations. 67,70. 1 table

Nutritional requirements of warm water carnivores differ from freshwater species, the latter requires more protein. Trash fish in combination with predetermined proportions of dry ingredients will yield desired protein content. A table on the Oregon-type moist pellets for sea bass and grouper is provided. (D.V.Z.)

- 48 Ghorab, H.M.; Bayoumi, A.R.; Hassan, A.A. 1983. Studies on the fish of the family Serranidae from the northwestern region of the Red Sea. Bull.Inst.Oceanogr.Fish.Cairo, 9: 256-263.

In this study, fish belonging to the family Serranidae were collected from the northwestern region of the Red Sea. They were carefully studied and defined as to their genera and species. They included 3 genera and 13 species of serranid fish; 3 other species are still under investigation. Keys and geographic distribution are given. (AUTHOR'S ABSTRACT)



- 49      Gloerfelt-Tarp, T.; Kailola, P.J. (eds.)  
          [1985] Serranidae. IN: Trawled Fishes  
          of Southern Indonesia and Northwestern  
          Australia. [St. Ives, N.S.W.],  
          Australian Development Assistance Bureau.  
          p.128-137. 44 illus.

Members of the Serranidae family are described. Each species  
 is represented by an illustration. (R.P.G.)

- 50      Gor Yaman, R.B.Ab. 1982. Cage culture of  
          finfish in Peninsular Malaysia. IN:  
          Report of the Training Course on  
          Small-scale Pen and Cage Culture for  
          Finfish, Los Banos, Laguna, Philippines,  
          26-31 Oct 1981; Aberdeen, Hong Kong, 1-13  
          Nov 1981. Prepared by Rafael D. Guerrero  
          III and V. Soesanto. Manila, South China  
          Sea Fisheries Development and  
          Coordinating Programme. p.173-176.  
          (Workshop reports/South China Sea  
          Fisheries Development and Coordinating  
          Programme; no.34)

Finfish cage culture is a recent development in Malaysia and  
 is being carried out in a few areas namely, Langkawi Island, Kedah;  
 Kuala Setiu Lagoon, Trengganu; Penang Island; and Straits of  
 Johore. The major species cultured are grouper (*EPINEPHELUS* spp.),  
 sea perch (*LATES CALCARIFER*), rabbitfish (*SIGANUS JAVUS*), and  
 Russell's snapper (*LUTJANUS RUSSELLI*). The species are fed with  
 trash fish and a growth rate of 0.6kg and 1.3kg in 10-12 months  
 have been observed for grouper and sea perch, respectively. Fry of  
 these species are caught from the wild through the use of beach  
 seines and is currently inadequate to sustain large scale culture  
 operations. The breeding of these species in hatcheries is  
 envisioned to overcome the shortage. Cage culture of freshwater  
 species is also practised particularly in Chenderoh Lake and Tasik  
 Merah in Perak. The species commonly cultured in freshwater cages  
 are bighead carp (*ARISTICHTHYS NOBILIS*), silver carp  
 (*HYPOPHthalmichthys molitrix*), grass carp (*CTENOPHARYNGODON*  
*IDELLA*), common carp (*CYPRINUS CARPIO*), tilapia (*TILAPIA MOSSAMBICA*  
 and *T. NILOTICA*), manble goby (*OXYELEOTRIS MARMORATUS*), rohu (*LABEO*  
*ROHITA*), and giant gourami (*OSPHRONEMUS GOURAMI*). Also cultured are  
*TRICHOGASTER PECTORALIS*, *HELOSTOMA TEMMINCKI* and *LEPTORBUS*



HOEVENII. The supply of fry for these species is adequate due to the breeding techniques developed for these species. (W.L.C.)

- 51 Hashimoto, Y.; Yasumoto, T. 1965. Note on ciguatera poisoning in Okinawa and the toxin of a grouper, EPINEPHELUS FUSCOGUTTATUS Forskal. Bull.Jpn.Soc.Sci.Fish., 31(6): 452-458. 6 tables

High incidence of toxicity was found in EPINEPHELUS FUSCOGUTTATUS. This paper presents a survey of the toxic species in Okinawa and preliminary experiments on the extraction of toxin from this species were carried out. The validity of the story on the loss of toxicity during storage was also examined. (R.P.G.)

- 52 Hassan, I.A.; Sayuthi, S.; Chu, S.C. 1984. Fabrication of feed suitable for smallholder aquaculture. IN: Malaysia: Coastal Aquaculture Development. Rome, Food and Agriculture Organization of the United Nations. p.261-277. 2 figs; 10 tables

This report reviews basic techniques for the preparation of pelleted feed which are considered suitable for small-scale farmers (individual or group basis). Experiments carried out on fish nutrition are also discussed. Formulated feeds are given to shrimp (PENAEUS MONODON), sea bass, grouper and rabbitfish. (AUTHOR'S ABSTRACT)

- 53 Herre, A.W.C.T. 1953. EPINEPHELUS Bloch. IN: Check List of Philippine Fishes. Washington D.C., United States Government Printing Office. 347-361. (Research report/U.S. Fish and Wildlife Service; no.20)

This is a check list of EPINEPHELUS species found in the Philippines. Range of distribution of each species is given. (D.V.Z.)

- 54 Herre, A.W.C.T. 1958. Marine fishes in Philippine rivers and lakes. Philipp.J.Sci., 87(1): 65-88.

This article provides a list of marine fishes found in Philippine rivers and lakes. Fishes are classified according to the following: a)marine fishes returning to the sea or brackishwater to spawn, b)marine fishes known to occur in fresh water but no definite Philippine record of such occurrence, c)fishes of marine origin now living and breeding in fresh water, d)fishes of marine origin now living and breeding in fresh water but known to enter brackish and salt water at times, and e)freshwater fishes entering salt water and apparently breeding freely in fresh, brackish and salt water. (D.V.Z.)

- 55 Hiatt, R.W.; Strasburg, D.W. 1960. Family Serranidae. IN: Ecological Monographs, vol.3 no.1. p.82.

A brief description on the food and feeding habits of grouper species is provided. Sex, size, and remarks on its digestive tract is included. (D.V.Z.)

- 56 Higuchi, M.; Hussain, N.A.; Akatsu, S.; El-Zahr, C.R.; Al-Ahmad, T.; Al-Ghemlas, K. 1979. Studies on the development of large-scale fingerling techniques of selected Kuwait fishes. Annu.Res.Rep.KISR, 1979: 39-40.

In 1979, during the spawning season, February to June, important species of fish in Kuwait were selected for natural spawning in concrete tanks or for induced breeding utilizing human chorionic gonadotropin. Species of fish collected were ACANTHOPAGRUS LATUS, ACANTHOPAGRUS CUVIERI, EPINEPHELUS TAUVINA and SIGANUS ORAMIN. (D.V.Z.)

- 57 Hilmy, A.M.; El-Domiaty, N.A.; Said, M. 1976. Some aspects of the haematology of



four Red Sea fish species during their spawning period.

Bull.Inst.Oceanogr.Fish. Cairo, 6:  
205-214. (for acquisition)\*\*

An investigation was made of some species of the haematology of 4 marine fish species, EPINEPHELUS FASCIATUS, E. SUMMANA, E. AREOLATUS, and E. TAUVINA taken from the Mar. Biol. Stn. at Ghardaga (Red Sea). The number of erythrocytes, haemoglobin content and haematocrit values during the spawning period was investigated. Visible differences can be observed in these parameters among the different species. This variability may be corroborated that the more active type of fishes have higher values than the less active species. Marked quantitative differences in the values of these parameters exist between the sexes of the same species being always lower in females than in males. The preparation period and the spawning process may cause this considerable decrease. The species studied have the same correlation between the number of erythrocytes, haemoglobin content and haematocrit values as that previously arrived at for fresh water fishes and other vertebrates. (ASFA)

- 58 Hongkong. Agriculture and Fisheries Department; Malaysia. Division of Fisheries, Ministry of Agriculture. 1978. Cage culture of marine fish in east coast peninsular Malaysia. Manila, South China Sea Fisheries Development and Coordinating Programme. 66p. (Working paper/South China Sea Fisheries Development and Coordinating Programme; no.69)

Cage culture of marine fish was initially identified as a possible activity to provide employment for poor fishermen at a Kuala Besut Small-scale Fisheries Development pilot site, Kuala Besut, Trengganu, Malaysia. The following work describes the preliminary hydrographic and biological surveys made to determine the feasibility of starting a pilot cage culture project in the area. Subsequently, a plan of work was drafted and actual implementation was started. Activities include the collection of suitable fish for stocking the demonstration cages, the construction of cages using designs found successful in other areas and rearing of selected species of fish in the cages. This work is continuing and future work plans have been formulated



Environmental conditions and results of the trial culture operations are being monitored. Training of local counterpart staff and fish farmers is a part of this work. (AUTHOR'S ABSTRACT)

- 59      Hu, S.H.; Lin, K-J. 1985. Experiment on the feeding of EPINEPHELUS SALMONOIDES (sic) (LACEPEDE) fry. Bull.Taiwan Fish.Res.Inst., (38): 167-179. 7 figs; 6 tables (Text in Chin)

Feeding trials of grouper EPINEPHELUS SALMONOIDES (sic) fry were carried out using 9 different handy foods for 28 days with water temperature ranged from 27-31C at 8:30 AM and 28-34C at 2:30 PM. Experiments showed trash fishes or shrimp meat mixed with eel feed had better results than single food were used alone. Diets with low levels of protein gave less weight gain. Feeding frequency indicated that grouper fry fed 3 times per day were better than they fed 1, 5, or 7 times per day. The weight gain, length increase daily feeding rate, daily growth rate, food conversion and survival rate of the fry were described and discussed. (AUTHOR'S ABSTRACT)

- 60      Huang, T-S.; Lin, K-J.; Yen, C-L.; Lin, C-Y.; Chen, C-L. 1986. Experiments on the artificial propagation (sic) of black spotted grouper, EPINEPHELUS SALMOIDES (Lacepede) - I. Hormone treatment, ovulation of spawners and embryonic development. Bull.Taiwan Fish.Res.Inst., (40): 241-258. 27 figs; 4 tables; 6 plates (Text in Chin)

EPINEPHELUS SALMOIDES being an important commercial species, the development of propagation techniques is necessary to produce enough fry for rearing purposes. Results of the experiment on artificial propagation are as follows: spawning occurred from April to June; female E. SALMOIDES was induced to spawn using 1IU HCG per gram of fish weight; stripping of milt was difficult due to its limited amount; produced eggs are pelagic and spherical having an average diameter of 0.863mm. Development of eggs to fry is discussed in detail. (MODIFIED AUTHOR'S ABSTRACT)

- 61      Hussain, N.A.; Saif, M.; Ukawa, M. 1975.

On the Culture of EPINEPHELUS TAUVINA  
(Forsk.) . Kuwait, Kuwait Institute for  
Scientific Research. 12p.

Adults EPINEPHELUS TAUVINA are reared in large concrete tanks. The unstimulated or natural spawning of the matured fishes starts in late April and early May when the average water temperature reaches 25C. The fertilized eggs measure 0.77mm in diameter while the hatched larvae are 1.4-1.5mm in total length. The development of the characteristic dorsal and ventral spines is observed. The adult spawning behavior, growth and feeding of larvae is briefly described. (AUTHOR'S ABSTRACT)

- 62 Hussain, N.A.; Abdullah, M.A.S. 1977. Length-weight relationship, spawning season and food habits of six commercial fishes in Kuwaiti waters. Indian J.Fish., 24(1/2): 181-194. 6 figs

The length-weight relationship, spawning season and food habits of six commercially important fishes: EPINEPHELUS TAUVINA, POMADASYS ARGENTEUS, ACANTHOPAGRUS LATUS, ACANTHOPAGRUS CUVIERI, OTOLITHES ARGENTEUS and PAMPUS ARGENTEUS were investigated. Among these six species, the length-weight measurements were found to be best fitted by the following equation:  $W=aL^{*b}$ , with 'b' varying from 2.761841 in POMADASYS ARGENTEUS to 3.058208 in PAMPUS ARGENTEUS. The peak spawning season of the fishes occurs around spring-time, from Feb to May. The feeding tendency of E. TAUVINA, A. CUVIERI, and O. ARGENTEUS is predominantly piscivorous, while PAMPUS ARGENTEUS is omnivorous and POMADASYS ARGENTEUS as well as A. LATUS feed mainly on crabs. (AUTHOR'S ABSTRACT)

- 63 Hussain, N.A.; Higuchi, M. 1980. Larval rearing and development of the brown spotted grouper, EPINEPHELUS TAUVINA (Forsk.) . Aquaculture, 19(4): 339-350. 3 figs

EPINEPHELUS TAUVINA (Forsk.) has spawned naturally in captivity. The larvae were reared to metamorphosis using rotifers, ARTEMIA nauplii, copepods and minced shrimp meat. The developmental stages from hatching through metamorphosis are described. Larvae grew from 2.25mm total length at hatching, to 31.40mm by day 50. Two mortality peaks were observed: the first between days 4 and 5,



and the second between days 24 and 35. The first peak corresponded to first feeding and the unsuitability of rotifers, and the second, to the change from feeding ARTEMIA nauplii to copepods which were not available in sufficient quantities. (AUTHOR'S ABSTRACT)

- 64 Ismail, W. 1976. Culture experiment on siganid, SIGANUS VIRGATUS and grouper, EPINEPHELUS spp. in the lagoon of Pari Island, Jakarta Bay. Laporan Penelitian Perikanan Laut/Mar.Fish.Res.Rep., (1): 1-36. 4 figs; 5 tables

Rabbitfish and groupers were reared in floating net cages in Jakarta Bay. It was observed that supplementary feeds like pellets, seaweeds and fish chow showed positive increase in weight of the cultured species. Mortality was found to be higher in cages with rabbitfish without supplementary feeding. (MODIFIED AUTHOR'S ABSTRACT)

- 65 Ismail, W.; Nuraini, S. 1983. Study on fish fries (sic) of rabbit fish and grouper (EPINEPHELUS spp.) collected by bamboo trap ("bubu") in Pari Island (Jakarta Bay). Laporan Penelitian Perikanan Laut/Mar.Fish.Res.Rep., (25): 53-61.

A study on fish fries (sic) of rabbitfish (SIGANUS spp.) and grouper (EPINEPHELUS sp.), had been conducted in Pari Island from January 1981-March 1982. A fishing gear locally called "bubu", a stationary bamboo trap, was used for this purpose. The average catch per "bubu" was 3 fishes, wherein the composition was 21.7% siganids, 6.7% of groupers and others. Rabbitfish collected from coral reef area was dominated by SIGANUS VIRGATUS (51.2%), and that of sea grass (ENHALUS spp.) area was dominated by SIGANUS GUTTATUS (84.9%). (AUTHOR'S ABSTRACT)

- 66 Jafri, A.K.; Al-Judaimi, M.M.; George, K.A. 1979. Development and production of formulated feeds for aquaculture in Kuwait. Annu.Res.Rep.KISR, 1979: 52-54. 2 figs



Major efforts have been directed towards developing a nutritionally adequate and low-cost diet for cultured species in Kuwait. Formulated feeds for ACANTHOPAGRUS LATUS and PENAEUS SEMISULCATUS were achieved as a result of a series of growth trials. Feeding trials were conducted on EPINEPHELUS TAUVINA fingerlings using moist pellets. Composition of formulated feeds for each species is presented. (D.V.Z.)

- 67 James, P.S.B.R.; Soundararajan, R.; Rodrigo, J.X. 1980. Preliminary studies on culture of finfishes in cages in the coastal waters of Palk Bay at Mandapam. IN: Symposium on Coastal Aquaculture, Cochin, 12-18 Jan 1980. Abstracts. Cochin, The Marine Biological Association of India. p.70-71.

The possibility of culturing economically important fishes in low cost cages suspended in coastal waters was investigated. Results of the preliminary study on culture of SIGANUS spp., EPINEPHELUS spp. and SILLAGO SIHAMA in cages fabricated with different materials are given. (MODIFIED AUTHOR'S ABSTRACT)

- 68 Joglekar, A. 1979. Mulletts of Kuwait Bay and intraspecific variation of cultured and wild hamoor, EPINEPHELUS TAUVINA (Forsk.) . Annu.Res.Rep.KISR, 1979: 45-46.

Discussed in this article are the characteristics of EPINEPHELUS TAUVINA and different species of mullet. Specimens of E. TAUVINA raised from artificial spawning were examined and compared with samples from Kuwait markets. For mullet, a brief description of its physical characters is provided for each species. (D.V.Z.)

- 69 Kafuku, T.; Fukusho, K.; Ogawa, J.; Tokukase, T. 1976. Preliminary survey report on favorable area and favorable species for the marine culture of fish and shellfish. Laporan Penelitian

A survey was conducted to determine suitable areas and favorable species for the culture of fish and shellfish. Species of fish considered are: SCOMBEROMORUS spp., STOLEPHORUS spp., RASTRELLIGER sp., LUTJANUS spp., EPINEPHELUS spp., ARIUS spp., SARDINELLA spp., LEIOGNATHUS sp., LATES CALCARIFER, milkfish and clupeid fish. Small bays specially Rata Bay seems suitable for rearing LATES CALCARIFER, EPINEPHELUS spp. and LUTJANUS spp. in floating cages. Pen culture of milkfish seem promising in Benoa Bay and small bays in the eastern part of Madura. Shellfishes being considered for culture are: ANADARA sp., GAFRARIUM TUMIDUON, AMUSSIUM PLEURONECTES and PLACUNA PLACENTA. Favorable areas for shellfish culture are Lampung and Madura strait. (D.V.Z.)

- 70 Kamohara, T. 1967. [EPINEPHELUS] IN:  
Fishes of Japan in Color. Japan,  
Hoikusha Publishing Co., Ltd. p.60-61.

Physical characteristics of each species belonging to the genus EPINEPHELUS is described. Its distribution is also included. (D.V.Z.)

- 71 Kanazawa, A. 1984. Feed formulation for  
penaeid shrimp, sea bass, grouper and  
rabbitfish culture in Malaysia. IN:  
Malaysia: Coastal Aquaculture  
Development. Rome, Food and Agriculture  
Organization of the United Nations.  
p.61-78. 1 fig; 8 tables; 5 appendices

To study feeding requirements of fish and shrimp, the following species present in the coastal waters of Malaysia were selected: PENAUS MONODON, P. MERGUIENSIS, LATES CALCARIFER, EPINEPHELUS TAUVINA, LUTIANUS JOHNI, SIGANUS CANALICULATUS, AND S. JAVUS. Composition of formula diet and vitamin mixture for each species is presented in tables. (D.V.Z.)

- 72 Katayama, M. 1960. Genus EPINEPHELUS  
Bloch, 1793. IN: Serranidae (pisces).



[Tokyo], Biogeographical Society of Japan.  
p.64-108.

Fishes with the genus EPINEPHELUS are described in general.  
Identification keys to the species of EPINEPHELUS is given. A  
description of each species is provided. (D.V.Z.)

- 73 Kawamura, G.; Kitamura, Y. Vertical eye  
movements in fish.  
Bull.Jpn.Soc.Sci.Fish., 47(2): 161-164.  
(Text in Jpn)

The observations and analyses of eye movements on three  
groupers, EPINEPHELUS MOARA, EPINEPHELUS sp., and E.  
SEPTEMFASCIATUS which were resting motionless on the bottom of an  
aquarium revealed that these fishes move their eyes vertically only  
with saccadic movement, and the maximum degree of their vertical  
saccade was measured at 65 degrees, 50 degrees and 30 degrees for  
respective species. Four restrained fishes, CYPRINUS CARPIO,  
CARASSIUS AURATUS LANGSDORFI, SAROTHERODON MOSSAMBICUS, and LEPOMIS  
MACHIOCHIRUS did not show any vertical pursuit eye movement to  
vertically moving horizontal stripes in their visual field. The  
results were considered to suggest that it is difficult to  
stabilize the retinal image of vertically moving object in these  
fishes, or a possibility of some nerve system which specially  
analyses a vertically moving image. (AUTHOR'S ABSTRACT)

- 74 Kayano, Y.; Oda, T. 1986. Rearing  
experiment of red spotted grouper  
EPINEPHELUS AKAARA larvae using a large  
tank. Bull.Fish.Exp.Stn.Okayama  
Prefect., (1): 66-70. 6 figs; 3 tables  
(Text in Jpn)

Larvae of the captive broodstock reared in pond were cultured  
in a 30-l concrete tank. ARTEMIA nauplii and an artificial diet  
were used as food. The larvae started to feed on the 9th day. A  
total of 3,015 juveniles were produced at day 41. However, survival  
rate was only 0.4% during the period 0-10 days. (MODIFIED AUTHOR'S  
ABSTRACT)

- 75 Kayano, Y.; Oda, T. 1986. Spawning of red



grouper EPINEPHELUS AKAARA reared in tank.  
Bull.Fish.Exp.Stn.Okayama Prefect., (1):  
151-154. 4 figs (Text in Jpn)

Sixty-one broodstock reared in ponds were used in the study.  
Spawning occurred 25 June 1986 and continued up to mid-September.  
Water temperature during the spawning period was more than 20C.  
Total number of eggs collected was 37,568 x 10\*\*3, 36.6% of which  
were floating. There were variations observed as to ratio of  
floating eggs to sinking eggs. Hatching rate was higher at the peak  
of spawning period rather than at the beginning or at the end.  
Frequency of abnormal larvae was observed to be high at the  
beginning and at the end and slightly low at the peak of spawning.  
(MODIFIED AUTHOR'S ABSTRACT)

- 76 Kohno, H. 1986, 1987. Introduction to  
lapu-lapu (EPINEPHELUS) of the  
Philippines. Asian Aquacult., 8(6), 9(1):  
8-11; 5,10. (Part of a series)

An overview of the Philippine grouper (EPINEPHELUS) fishery is  
discussed supplemented with local vernaculars indicating the  
various epinepheline fishes. A table on yearly production is  
provided. The different species of grouper found in the archipelago  
are comparatively described. (W.P.G.)

- 77 Kungvankij, P.; Tiro, L.B., Jr.; Pudadera,  
B.P.; Corre, K.; Potestas, I.O.;  
Borlongan, E.; Unggui, A.; Gustilo, L.;  
Taleon, G.A. 1984. Verification studies  
on the breeding and seed production of  
sea bass LATES CALCARIFER, and  
preliminary study on the production of  
EPINEPHELUS TAUVINA. Annu.Rep.Leganes  
Res.Stn.Aquacult.Dep.SEAFFDEC, (1984):  
36-46.

Sea bass broodstocks were induced, using puberogen and HCG  
hormones, to spawn. After spawning, eggs were collected, washed and  
placed in hatching tanks. BRACHIONUS, ARTEMIA nauplii, adult  
ARTEMIA and minced trash fish were given at day 3, 10, 20, and 30,  
respectively. The larvae at 40 days old were about 3-4cm in size.  
Survival rates ranged from 6-12%. This preliminary success prompted

the standardization of mass production technology. A similar verification study was conducted on EPINEPHELUS TAUUVINA. Aside from HCG (human chorionic gonadotropin), the chinese carp pituitary gland was used to induce spawning. Since a few milt was obtained from the male, only 20,000 eggs were fertilized out of over 500,000 eggs obtained. Only 50% hatched. (MODIFIED AUTHOR'S ABSTRACT)

- 78 Kungvankij, P.; Tiro, L.B., Jr.; Pudadera, B.P.; Potestas, I.O. 1986. Induced spawning and larval rearing of grouper. IN: The First Asian Fisheries Forum, Manila, 26-31 May 1986. Ed. by J.L. Maclean, L.B. Dizon, L.V. Hosillos. Manila, The Asian Fisheries Society. p.663-666.

Broodstock of grouper were induced to spawn by hormone injection. The hormones used for this experiment were HCG + pituitary gland and LHR-a. The results showed that at the dosages of 500IU HCG + 3mg of pituitary gland per 1kg of fish for 1st injection and 1,000IU HCG + 3mg of PG per 1kg of fish at the final injection at an interval of 24hrs, the treated fish spawned naturally in spawning tank 12hrs after the final injection. At lower dosage of 500IU HCG + 3mg PG at 12hrs interval or 500IU HCG + 3mg PG at 24hrs interval or using 10mg LRH-a at 12hrs interval the eggs can be artificially fertilized only by stripping. The larval rearing experiment was conducted in a 250-liter figerglass tank at the stocking density of 2500 larvae per tank. Feed used in this experiment were (a) ISOCHRYISIS + sea urchin egg; (b) ISOCHRYISIS + BRACHIONUS and (c) TETRASELMIS + BRACHIONUS. The experimental results showed that newly hatched larvae fed with ISOCHRYISIS mixed with sea urchin eggs and then switched to BRACHIONUS on day 10, gave the best survival rate (9% at day 30). (AUTHOR'S ABSTRACT)

- 79 Kuronuma, K.; Abe, Y. 1972. Serranidae. IN: Fishes of Kuwait. Kuwait, Kuwait Institute for Scientific Research. 59-61.

A brief description of grouper species is provided. It includes physical characteristics and range of distribution. (D.V.Z.)

- 80 Kusuma, A.R.A. 1982. Sea bass and grouper culture in Bali. IN: Report of Training



Course on Seabass Spawning and Larval Rearing, Songkhla, Thailand, 1-20 Jun 1982. Manila, South China Sea Fisheries Development and Coordinating Programme. p.81. (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.39)

Fisheries in Bali comprise marine and inland fisheries and fishing is carried out using traditional gears and crafts. The development of coastal aquaculture is discussed with respect to the sea bass (*LATES CALCARIFER*) and grouper (*EPINEPHELUS*) culture projects which is envisioned to increase fishermen's income and provide additional jobs for fishermen and their families. (R.P.G.)

- 81      Lanjumin, L. 1982. Development of cage culture for finfish in Riau Archipelago - Riau Province, Indonesia. IN: Report of the Training Course on Small-scale Pen and Cage Culture for Finfish, Los Banos, Laguna, Philippines, 26-31 Oct 1981; Aberdeen, Hongkong, 1-13 Nov 1981. Prepared by R.D. Guerrero, III and V. Soesanto. Manila, South China Sea Fisheries Development and Coordinating Programme. p.165-166. (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.34)

Riau Archipelago has ten sites where fishermen culture grouper and sea bass in cages (3 x 4 x 6m) built with closely attached wood or palm fronds to discourage poachers and pests. Fingerlings are collected within the vicinity by traps. Fishes are fed with low grade trash fishes which abound in the area. An average of 800 fish in a cage are fed with 3,000kgs of fresh trash fish until harvest time - five to six months later. Mean mortality is about 25%. (R.P.G.)

- 82      Lee, E.S. 1982. Cage culture of marine finfish in Singapore. IN: Report of the Training Course on Small-scale Pen and Cage Culture for Finfish, Los Banos, Laguna, Philippines, 26-31 Oct 1981;



Aberdeen, Hong Kong, 1-13 Nov 1981.  
 Prepared by Rafael D. Guerrero III and V.  
 Soesanto. Manila, South China Sea  
 Fisheries Development and Coordinating  
 Programme. p.197-199. (Workshop  
 reports/South China Sea Fisheries  
 Development and Coordinating Programme;  
 no.34)

The main types of fish cultured in Singapore are groupers  
 (EPINEPHELUS TAUVINA), sea bass (LATES CALCARIFER), snappers  
 (LUTJANUS), and other fishes. The floating rafts normally consists  
 of a wooden framework made out of 2 x 3 or 3 x 4 inch wood joined  
 by nuts or nails; floating units made from plastic drums, metal  
 drums and styrofoams; polyethylene netting; and cement sinkers  
 about 1/4 to 1 ton each as anchorage. Fingerlings of about 100g  
 (3-4") are reared for about 6-8 months or until reaching marketable  
 size of 600-800g. The fish were fed with trash fish at about 5-10%  
 body weight once a day. Problems of the culture system are  
 enumerated. (AQUADOC)

83

Leis, J.M.; Rennis, D.S. 1983.  
 Epinephelinae - groupers, rock-cods,  
 coral trout. IN: Larvae of Indo-Pacific  
 Coral Reef Fishes. Sydney, New South  
 Wales University Press; Honolulu,  
 University of Hawaii Press. p.79-83. 2  
 figs

Larvae of fishes belonging to the family Epinephelinae is  
 described. Morphology and pigmentation of the larvae are included.  
 Larvae of the family Epinephelinae was compared with other larvae  
 belonging to different families. (D.V.Z.)

84

Lim, P-E. 1985. Prepared diets in cultured  
 groupers. IN: Proceedings of the 2nd  
 International Conference on Warm Water  
 Aquaculture - Finfish, Brigham Young  
 University Hawaii Campus, 5-8 Feb 1985.  
 Ed. by R. Day and T.L. Richards. Hawaii,  
 Brigham Young University Hawaii Campus.  
 p.381-400. 1 fig; 7 tables

The effects of formulated diets on growth of groupers in

controlled conditions were studied. The sources of protein used were fish meal, bone meat, soya bean meal and with trash fish as a control. The experiments were conducted for 10 weeks and growth response to the test diet was calculated in terms of % weight gain, specific growth rate, feed conversion and protein efficiency ratio. The results indicated a good growth on the animal protein diet (121.65% weight gain) as compared to the soya meal diet (35.84% weight gain). Food conversion ratio (FCR) for the fish meal diet was 1.41 and for bone meat diet was 1.66. The protein efficiency ratio (PER) were 1.84 and 1.41 for these diets, respectively. Soya bean diet was 3.5 and 0.71 for FCR and PER, respectively. The results suggested that probably 10 essential amino acids are required by the fish. (AUTHOR'S ABSTRACT)

- 85 Lin, K-J.; Yen, C-L.; Huang, T-S.; Liu, C-Y.  
; Chen, C-L. 1986. Experiment of fry  
nursing of EPINEPHELUS SALMONOIDES (sic)  
(Lacepede) and its morphological study.  
Bull.Taiwan Fish.Res.Inst., (40):  
219-240. 10 figs; 4 tables (Text in Chin)

Two female EPINEPHELUS SALMOIDES caught from the wild were induced to spawn using human chorionic gonadotropin. The fry produced through artificial propagation was reared to fingerling stage. Development of the fry is discussed in detail. (MODIFIED AUTHOR'S ABSTRACT)

- 86 Loi, J.S.; Chua, K.T. 1984. Ovary and  
kidney cell cultures of grouper  
(EPINEPHELUS TAUVINA Forskal). Singapore  
J.Prim.Ind., 12(2): 147-151. 2 figs; 2  
tables

Cell lines of fish origin are available but there has been no method to prepare primary cell cultures or a continuous line from our local grouper (EPINEPHELUS TAUVINA Forskal), a tropical marine fish. This paper describes the technique for preparation of cultures from ovary, kidney, spleen, heart, liver and swim bladder of the grouper. It was found that ovary and kidney are the organs which grow best and there is the possibility for development of a cell line from these cultures. (AUTHOR ABSTRACT)



- 87 Madhavi, R.; Rao, H.K. 1983. New didymozoid trematode INDOGLOMERITREMA EPINEPHELI new-genus new-species from the marine fish EPINEPHELUS TAUVINA from the Bay of Bengal India. Acta Parasitol.Pol., 28(25-37): 261-266. (for acquisition)\*\*

A new didymozoid trematode INDOGLOMERITREMA EPINEPHELI gen. et. sp. nov. collected from the gills of E. TAUVINA from the Bay of Bengal is described. Encystment in pairs in characteristic cysts, extension of host blood capillaries into the cyst cavity, the long filiform body with 2 sets, single ovary, single vitellarium and single uterine loop are distinguishing features of the genus INDOGLOMERITREMA. (ASFA)

- 88 Maneewong, S.; Akkayanont, P.; Pongmaneerat, J.; Iizawa, M. 1986. Larval rearing and development of grouper, EPINEPHELUS MALABARICUS (Bloch and Schneider). IN: Report of Thailand and Japan Joint Coastal Aquaculture Research Project, [Thailand], Apr 1984-Jan 1986. Tokyo, Japan International Cooperation Agency. p.39-52. 10 figs (Report/Thailand and Japan Joint Coastal Aquaculture Research Project; no.2)

An experiment on the larval rearing of grouper EPINEPHELUS MALABARICUS was conducted in a water-flow system with cultured copepod TIGRIOPUS JAPONICUS serving as additional food. The ordinary rearing system conducted simultaneously was comparatively evaluated with the said system. No reliable results on the survival and growth were obtained from these two rearing trials. Some meristic characteristics of the larvae and juvenile were described as well as morphological observations. The rotifer, BRACHIONUS PLICATILIS was examined to determine whether its size would be suitable as a starter food for the larvae. The amount of rotifer consumed was also investigated for 2-15 day-old larvae. Finally, the difficulty in rearing the larvae is discussed. (MODIFIED AUTHOR'S ABSTRACT)

- 89 Manzano, V.B. 1985. Polyculture system using grouper (EPINEPHELUS TAUVINA) and



**Tilapia (T. MOSSAMBICA) in brackishwater pond. R&D J., 2(1): 43-50. 8 tables**

Tilapia and grouper were polycultured at stocking rates of 15,000-20,000 tilapia per 1,000 grouper/ha. Grouper yield (kg/ha/crop) is greater since they fed on tilapia fingerlings. Tilapia yield, on the other hand, is higher in a monoculture system but total fish production in both systems compared showed no difference since the low yield of tilapia under the polyculture system is compensated by the high yield of grouper. (MODIFIED AUTHOR'S ABSTRACT)

- 90      Manzano, V.B. [1986] Polyculture systems using groupers (EPINEPHELUS TAUUVINA) and tilapia (T. MOSSAMBICA) in brackishwater ponds. 13p. 8 tables (unpublished)

The study was conducted to determine the optimum stocking ratio of tilapia and grouper cultured in brackishwater ponds. There were seven treatments triplicated in completely random design. Both fishes obtained higher recovery, growth and production in the polyculture system rather than in monoculture. A ratio of 1:20 grouper to tilapia proved to be the most effective. (MODIFIED AUTHOR'S ABSTRACT)

Masuda, H.; Araga, C.; Yoshino, T.(cont.)  
1980. [EPINEPHELUS] IN: Coastal Fishes of Southern Japan. Ed. by Faculty of Marine Science and Technology, Tokai University. Tokyo, Tokai University Press. p.213-216.

Distinguishing characteristic of each grouper species is provided. Distribution of each species is included. (D.V.Z.)

- 92      Mathews, C.P.; Samuel, M.; Baddar, M.K.  
1985. Sexual maturation, length and age in some species of Kuwaiti fish related to their suitability for aquaculture. Kuwait Bull.Mar.Sci., (6): 243-256. (Text in Arabic)

The fisheries biology of hamoor (*EPINEPHELUS TAUVINA*), hamra (*LUTJANUS COCCINEUS*) and newaiby (*OTOLITHES ARGENTEUS*) is described with particular reference to the relation between sexual maturation, size and age. Hamoor and hamra reach maturity first at two to three years of age at minimum sizes of 25-30cm (total length). Hamoor spawn from March to June and hamra spawn from April to August but it seems unlikely that they spawn successfully in Kuwait waters. Newaiby mature at approximately one year of age and reach a total length of 22.5cm and spawn from January to June. These data are useful in choosing species for aquaculture. The evidence presented suggest that hamra are as suitable for aquaculture as are hamoor, but the latter was selected in Kuwait because of its higher value and market preference. (AUTHOR'S ABSTRACT)

- 93 Matsumura, S.; Fukuda, T. 1984. Catch of red grouper *EPINEPHELUS AKAARA* in Okayama Prefecture. Bull.Fish.Exp.Stn.Okayama Prefect., (59): 18-25. 5 figs; 2 tables (Text in Jpn)

Grouper catch was studied based on fishery statistics. Catch of grouper decreased from 27.75T in 1955 to 11T in 1968. The decrease was a result of an environmental change rather than overfishing. The main fishing gear used was gill net followed by hook and line, and long line. Total length of fish caught by gill net range from 14-25cm. (MODIFIED AUTHOR'S ABSTRACT)

- 94 Matsumura, S.; Fukuda, T. 1986. Catch of red spotted grouper *EPINEPHELUS AKAARA* by gill net boats and some biological observation. Bull.Fish.Exp.Stn.Okayama Prefect., (1): 27-32. (Text in Jpn)

Data on the catch of *EPINEPHELUS AKAARA* were collected from six commercial boats during Apr 1985 to Mar 1986. Size, gonad and stomach contents were examined on specimens taken during May-Jul 1985. Growth and feeding of juveniles reared for 165 days were observed. (MODIFIED AUTHOR'S ABSTRACT)

- 95 Mikhail, M.Y.; Ezzat, A.A.; Hashem, M.T.; Wadie, W.F. 1982. Fluctuations in fat



and water contents of two species of  
serranid fishes in the Egyptian  
Mediterranean waters.

Bull.Inst.Oceanogr.Fish.Cairo, 8(1):  
123-144.

The study of fluctuations in the fats and water contents of  
EPINEPHELUS AENEUS and EPINEPHELUS ALEXANDRINUS revealed that the  
amount of hepatic lipids was higher than muscle lipid. In different  
fish species, fat content shows individual variations and young  
fish usually contains lower fat content than adult. However, for  
both species under study, it was observed that fat content in the  
muscle of youngs was higher than in adults, although water content  
was generally higher in the youngs than adults. This study also  
revealed the presence of an inverse relationship between fat and  
water content for both species in muscle and liver. The present  
work showed that the amount of hepatic fat is lower in pre-spawners  
and spawners. The amount of hepatic fat in EPINEPHELUS ALEXANDRINUS  
is less than E. AENEUS, while flesh fat are higher in E.  
ALEXANDRINUS than in E. AENEUS in both youngs and adults.  
(AUTHOR'S ABSTRACT)

96

Mito, S.; Ukawa, M.; Higuchi, M. 1967. On  
the larval and young stages of a serranid  
fish, EPINEPHELUS AKAARA (Temminck et  
Schlegel). Bull.Naikai  
Reg.Fish.Res.Lab., (25): 337-347. 12  
figs; 2 tables (Text in Jpn)

A serranid fish, EPINEPHELUS AKAARA (Temminck et Schlegel), is  
the only commercially important species belonging to the genus  
EPINEPHELUS in the Seto Inland Sea. In this paper, the  
morphological characteristics of the larvae are described.  
Furthermore, the ecology and rearing techniques are discussed. The  
main characteristic feature of the larvae is the extraordinary  
prolongation of the 2nd dorsal and ventral spine. The ratio of the  
spine length to body length attain the maximum when the fish is  
5-12mm TL, thereafter, it decreases rapidly with growth. The rays  
of all fins are completely differentiated at a stage of about 12mm  
TL. The body is nearly transparent when alive, and pigment cells  
are less visible until the stage of about 25mm TL. After this  
stage, many melanophores and orange pigment cells develop rapidly  
all over the body surface when larvae change their habits from  
pelagic to benthic. It is difficult to estimate the growth of the  
larvae because of the remarkable fluctuation in growth among the  
larvae reared under the same conditions, however, they seem to



attain 3.7mm TL within 7 days after hatching, 6.2mm in 13 days, 12.7mm in 21 days, 24.5mm in 25-26 days, 31.4mm in 36 days, 49.4mm in 45 days and 70mm in 81 days. (MODIFIED AUTHOR'S ABSTRACT)

- 97 Mok, T.K. 1979. Report on assessment of suitability of cage culture of marine fish in Phangnga Bay Thailand. Manila, South China Sea Fisheries Development and Coordinating Programme. 29p. (South China Sea Fisheries Development and Coordinating Programme; SCS-SWE/THA/79/WP/1)

In a survey of the two chosen areas, Ko Pan Yi and Ko Khiam in Phangnga Bay, Thailand, general observations were made on their topography, natural shelter, bottom condition, water depth and movement; and hydrographic measurements were taken of temperature, salinity, pH and dissolved oxygen at selected sites. The suitability of these areas for cage culture of marine fish was assessed along with recommendations for choice of suitable sites, culture species, design of raft and cage, and culture operation. Suggested areas of emphasis for complementary work are also discussed. (AUTHOR'S ABSTRACT)

- 98 Monkolprasit, S. 1983. Systematic studies of coral-cods (Serranidae) from the Andaman Sea (Phuket Province) Thailand. Bangkok, Kasetsart University. 12p. (Kasetsart University Fishery Research Bulletin; no.14)

Phuket Province is located on Phuket Island, the largest island of Thailand, it also includes twenty-six small islands, they are in the Andaman Sea. Fish fauna in those islands are more or less rich and diverse in different areas of study. One of the most interesting groups is Serranids, the coral-cods family. They are recognized as being abundant in tropical seas. Most of them are edible and several are ornamental species. Thirty-seven species so far were collected in the water around Phuket and adjacent islands. There are eleven genera, they are: ANTHIAS, ANYPERODON, CEPHALOPHOLIS, CROMILEPTES, DIPLOPRION, EPINEPHELUS, GRAMMISTES, PLECTROPOMA, POGONOPERCA, PROMICROPS and VARIOLA. Some nine of eleven genera have only one species of each. Four species of the serranids are found to be new records of fish fauna from Thai-waters. (AUTHOR'S ABSTRACT)

but are different from those of immature fish. Estradiol treatment induces ultrastructural changes in the hepatocytes of immature fish that are similar to those found in vitellogenic fish, including proliferation of rough endoplasmic reticulum and Golgi apparatus, and an increase in glycogen and lipid, all indicative of enhanced metabolic activity. (ASFA)

- 109 Ng, T.B.; Tam, P.P.L.; Woo, N.Y.S. 1985. Pharmacological dose of 17 $\beta$ -oestradiol produces minimal metabolic stimulation but evokes hepatic necrosis in the immature female serranid EPINEPHELUS AKAARA. J.Fish Biol., 26(2): 217-222. 5 figs

Pharmacological dose of 17 $\beta$ -oestradiol elevated the concentration of the liver and serum lipid of the immature female grouper, EPINEPHELUS AKAARA. Contrary to the previous study of Ng, et al. (1984), many serum and hepatic changes were not observed in the present study when a ten-fold larger dose of the steroid was administered. No changes were noted on serum concentrations of calcium, glucose and protein, and hepatic concentrations of water and glycogen. Activities of enzymes regulating gluconeogenesis, glycolysis, krebs cycle, transamination and glycogen synthesis were unaffected. Fishes treated with high dose of oestradiol showed early degenerative features like swollen mitochondria and vesiculated endoplasmic reticulum. In some cases, hepatocytes of treated fishes had disorganized arrays of organelles in the cytoplasm. The above results caution against the use of a pharmacological dose of 17 $\beta$ -oestradiol. (MODIFIED AUTHOR'S ABSTRACT)

- 110 Okamoto, M. 1983. Studies on the behavioral character of fishes around the artificial seaweed farm plant. Bull.Jpn.Soc.Sci.Fish., 49(5): 687-692. 3 figs; 2 tables (Text in Jpn)

The behavior and gathering factor of fishes around the artificial seaweed farm plant anchored by two chains at a depth of 43 meters off Taiwan in Japan Sea were investigated. This was carried out by direct observation, by echosounder and by an automatic recording device. The following were observed: 23



species of fish, mostly young, were found around the plant and settles near the plant in spring or summer; adult fishes gather around the plant temporarily; distribution and activity of fishes varied according to stage and species; young fishes except EPINEPHELUS AWOARA belong to all day dependent type; adult fishes belong to daytime dependent shelf; and E. AWOARA and some OPLEGNATHUS FASCIATUS moved vertically between the shelf and the bottom along the anchor chain of the plant. (MODIFIED AUTHOR'S ABSTRACT)

- 111 Olsen, D.A.; LaPlace, J.A. 1979. Study of a Virgin Islands grouper fishery based on a breeding aggregation. Proc.Gulf Caribb.Fish.Inst., (31): 130-144. 8 figs; 4 tables

Virgin Islands grouper fishery has been under fishing pressure for the past ten years. A study based on breeding aggregate indicated a decline starting with 1973-74 season and a continuity in the size frequency distribution between the 1967 year class and older fish (estimated between 15 to 20 years old). Despite a 31% increase of trap effort in 1975-76 season, a decrease of 56% in trap catch and 76% decrease in Catch per Unit Effort (CPUE) were realized. The decrease in the over-all total catch, although with increased effort, was attributed to a) the discontinuity in the 1974-75 age structure, b) increased individual fish size of the 1976 catch, and c) particularly the spawning failure in 1976. In conclusion, the Virgin Islands grouper fishery is in need of immediate management action. (W.P.G.)

- 112 Pagdilao, C.R. 1987. Harnessing grouper fishery for the small fisherman. PCARRD Monit., 15(1): 3.

This article provides an overview of the grouper fishery locally known as "lapu-lapu", a commercially important marine fish. Grouper production and its market potential are given. Recommendation on how to manage grouper resources is mentioned. (D.V.Z.)

- 113 Patro R.; Prasad, R. 1979. Chromosomes of



Mean lorica length of rotifers reared in high density and high temperature decreased, 76% and selecting rotifers utilizing a net also decreased lorica length, 59%. Grouper larvae reared up to day 20 using the produced rotifers mentioned above has a survival rate of 1.4% and 6.9%, respectively. There was no significant difference observed in survival and amount of feed. Juveniles (day 20) were reared using the following different diets: artificial diet, ARTEMIA nauplii, rotifers and MOINA. It was noted that survival was high in juveniles fed with ARTEMIA and artificial diet. Juveniles fed with rotifers and MOINA did not produce good results.  
(MODIFIED AUTHOR'S ABSTRACT)

- 106 New, M.B. 1986. Aquaculture diets of postlarval marine fish of the super-family Percoidae, with special reference to sea bass, sea breams, groupers and yellowtail: a review. Kuwait Bull.Mar.Sci., (7): 75-148. 10 tables

Commercial aquaculture of marine and brackishwater fish belonging to the Percoidae is increasing, particularly in S.E. Asia, Japan and the Mediterranean, and potential for its application in the Arabian Gulf has been demonstrated. Since food accounts for the greatest proportion of rearing costs, its nutritional adequacy and cost effectiveness is critical to commercial success. Apart from the review of Jauncey and Ross (1982) on the feeding of tilapias, none of the existing reviews of fish nutrition has adequately covered work on the Percoidae. This review attempts to fill the gap using the reviews on Millikin (1982), Jauncey and Ross (1982) and Jauncey (1982) to provide a general introduction to each topic. Research work on the nutrition of marine Percoidae post larvae only is covered. Emphasis has been placed on reviewing work on the dietary requirements of grouper (EPINEPHELUS spp.), European sea bass (DICENTRARCHUS LABRAX), red sea bream (CHRYSOPHRYS MAJOR), gilt head sea bream (SPARUS AURATA) and yellowtail (SERIOLA QUINQUERADIATA), with some references to other species such as sobaity (ACANTHOPAGRUS CUVIERI) and sea bass (LATES CALCARIFER). Comments are made on some of the commercial feeds available for the marine Percoidae. (AUTHOR'S ABSTRACT)

- 107 Ng, C.S.; Chin, Y.N.; Lim, P.Y.; Tan, C.E.; Yeap, S.E.; Nikkuni, S.; Bito, M. 1983. Changes in quality of white pomfret,

Chinese pomfret and grouper during  
ice storage. Bull.Jpn.Soc.Sci.Fish.,  
49(5): 769-775. 8 figs; 1 table (Text in  
Jpn)

Specimens of white pomfret, Chinese pomfret and grouper which are commonly consumed in Singapore were stored in ice for as long as 33 days and examined for changes in freshness, the amount of free and expressible drips, and in protein and lipid. The K value and trimethylamine were found to be suitable freshness indices for these fishes. The subcutaneous meat of a grouper (body weight:7.2kg) showed roughly comparable levels of bacterial count ( $10^{*5}$  -  $10^{*6}$ g) when incubated at 20 and 30C, irrespective of the duration of ice-storage. The K value reached 20% after 23 days. Free drip from meat ranged from 1.0 to 2.8% and the expressible drip from 10.3 to 30.3% during storage. The salt-soluble nitrogen from the meat did not decrease significantly during the storage, nor did the viscosity of the saline extract. The skin portion did not show detectable rancidity, and the peroxide value and TBA number of the lipid extracted were low throughout. (AUTHOR'S ABSTRACT)

108

Ng, T.B.; Woo, N.Y.S.; Tam, P.P.L.; Au, C.Y.W. 1984. Changes in metabolism and hepatic ultrastructure induced by estradiol and testosterone in immature female EPINEPHELUS AKAARA Teleostei Serranidae. Cell Tissue Res., 236(3): 651-660. (for acquisition)\*\*

Estradiol injections increase serum level of Ca, amino acid, glucose, protein, ammonia and creatinine in immature E. AKAARA, and also increase levels of total lipid, cholesterol, phospholipid and esterified fatty acids. Hepatic protein, glycogen and lipid concentrations also arise after estradiol treatment, and some hepatic enzymes participating in the metabolism of nitrogen, lipid and carbohydrate, show increased activity. Serum vitellogenin levels are increased. Testosterone treatment increases serum protein, total lipid, cholesterol, amino acid and ammonia levels, and also hepatic glycogen content, but in contrast to estradiol treatment, testosterone does not change serum vitellogenin, glucose, Ca, phospholipid, esterified fatty acid and creatinine levels, nor the hepatic lipid and protein content. A small number of hepatic enzymes shows an increased activity. Vitellogenic fish



- 99      Montero, G.A.; Poblete, R.L., Jr. 1986.  
         Production and marketing of cultured fish  
         in Bahrain. INFOFISH Mark.Dig., (5):  
         45-46. 1 photo

People in Bahrain are traditionally seafood eaters. Unfortunately, it is not self-sufficient in terms of fish supply. Because of this, the Bahrain Fisheries Directorate (BFD) in collaboration with the Food and Agriculture Organization established a project to test viability of fish farming. The fish farm project began to experiment with *OREOCHROMIS AUREUS*. Presently, it has ventured into the culture of mullet (*LIZA* spp.), rabbitfish (*SIGANUS CANALICULATUS*) and grouper (*EPINEPHELUS* spp.) It is also experimenting on the possibility of growing rabbitfish and groupers in fish cages. Problems on the local conditions of the fish farm and lack of expertise are now being solved. Harvested mullets are well accepted by local consumers. Future activities of the project includes construction of more ponds with a capacity of 2000 fish each and venturing on other cultured fishes. A table on retail prices of fresh fish is provided. (D.V.Z.)

- 100     Morgan, G.R. 1983. Application of  
         length-based stock assessments to  
         Kuwait's fish stocks. ICLARM Newsl.,  
         6(4): 3-4. 2 tables; 1 photo

Age of fish by means of otoliths were determined and length composition data were collected for the three species namely: *EPINEPHELUS TAUVINA*, *LUTJANUS COCCINEUS* and *OTOLITHES ARGENTEUS*. Results of the study are presented in a table. (D.V.Z.)

- 101     Munro, I.S.R. 1967. Rock-cod, reef-cod,  
         coral-cod, coral-trout, groupers, hinds.  
         Family Epinephelidae. IN: The Fishes of  
         New Guinea. Port Moresby, Department of  
         Agriculture, Stock and Fisheries.  
         p.264-278.

This article describes the distinguishing features of species belonging to the Family Epinephelidae. It includes a detailed identification key for each species. (D.V.Z.)

- 102      Munro, I.S.R. 1982. [EPINEPHELUS] IN:  
         Marine and Freshwater Fishes of Ceylon.  
         Delhi, Soni Reprints Agency. 111-114.

A brief description on the physical characteristics of the grouper species is provided. Inherent features of each species is included for easy identification. (D.V.Z.)

- 103      Munro, J.L.; Gaut, V.C.; Thompson, R.;  
         Reeson, P.H. 1973. Spawning seasons of  
         Caribbean reef fishes. J.Fish Biol., 5:  
         69-84. 8 figs

Observations are recorded on the time of spawning of 83 species of Caribbean reef fishes. Details of seasonal variations in the percentage of sexually active fishes are given for 35 species. The majority of species spawn mostly when water temperatures are minimal, in Feb, Mar, and Apr. The expected biomass of reef fish eggs in the plankton is about twelve times greater in the above mentioned period than in the period from Jun to Dec. Normal recruitment to insular fisheries may be very greatly dependent upon the success of parent stocks spawning elsewhere in the Caribbean and the abundance of recruits to a particular area may be dependent upon the speed and direction of the prevailing currents which carry larvae and juveniles to the insular shelves. (AUTHOR'S ABSTRACT)

- 104      Nagelkerken, W. 1980. [EPINEPHELUS]. IN:  
         Coral Reef Fishes of Aruba, Bonaire and  
         Curacao (Netherlands Antilles). Curacao,  
         Island Territory of Curacao. p.27-33. 9  
         illus

Characteristics of each species of grouper found in the coral reefs of Aruba, Bonaire and Curacao are described. (D.V.Z.)

- 105      Nanba, Y.; Oda, T. 1984. On the  
         investigation of proper diets for the  
         larvae of red spotted grouper EPINEPHELUS  
         AKAARA. Bull.Fish.Exp.Stn.Okayama  
         Prefect., (59): 43-47. 3 figs; 3 tables  
         (Text in Jpn)



6 marine percoids from the Indian Sea.  
Indian Biol., 11(1-2): 9-12. (for  
acquisition)\*\*

The prevalence of 48 acrocentrics in the diploid complements of most of the teleosts has led to the hypothesis that 48 acrocentrics represent the primitive karyotype of this group of fish. This study of 6 spp. of marine percoids [EPINEPHELUS TAUVINA, LUTJANUS ARGENTIMACULATUS, CARANX SANSUN, GAZZA MINUTA, JOHNIUS CARUTTA AND J. VOGLERII], belonging to as many as 5 distinct families supports the hypothesis. The chromosome complements of 4 families of percoids are described for the 1st time, while the 5th was studied before from the 3 species. (ASFA)

- 114 Pauly, D. 1986. Simple method for estimating the food consumption of fish populations from growth data and food conversion experiments. Fish.Bull., 84(4): 827-839. 4 figs; 4 tables

A method was derived to estimate consumption per unit biomass through experimental and field data. The results of food conversion experiments were used to estimate food consumption of EPINEPHELUS GUTTATUS and HOLACANTHUS BERMUDENSIS. (MODIFIED AUTHOR'S ABSTRACT)

- 115 Rahim, Z.; Aziz, K.M.S.; Huq, M.I.; Saled, H. 1985. Isolation of AEROMONAS HYDROPHILA from the wounds of five species of brackish water fish of Bangladesh. Bangladesh J.Zool., 13(1): 37-42. (for acquisition)\*\*

AEROMONAS HYDROPHILA was isolated from the wounds of 11 brackishwater fish belonging to five species: PLATOSUS ANGUILLARIS, LATES CALCARIFER, EPINEPHELUS MEGACHIR, LABEO ROHITA and SAROTHERODON NILOTICA, common in Bangladesh. Infected wounds of the fish are described. A high incidence of AEROMONAS-infected wounds in fish indicated that handling of infected fish may enhance transmission of AEROMONAS HYDROPHILA to susceptible individuals. (ASFA)

- 116 Randall, J.E.; Ben-Tuvia, A. 1983. Review

of the groupers (Pisces: Serranidae: Epinephelinae) of the Red Sea, with description of a new species of CEPHALOPHOLIS. Bull.Mar.Sci., 33(2): 373-426. 27 figs

This paper describes the different species of groupers (Serranidae: Epinephelinae) found in the Red Sea. For each species, identification keys which includes synonyms, diagnosis, illustration, distribution, habitat, and size are presented.  
(MODIFIED AUTHOR'S ABSTRACT)

- 117 Ruangpanit, N.; Maneewong, S.; Tattanon, T.; Kraisingdecha, P.; Akkayanont, P.; Rojanapitayagul, S. 1986. Preliminary study on rearing fry of grouper, EPINEPHELUS MALABARICUS. IN: Report of Thailand and Japan Joint Coastal Aquaculture Research Project, [Thailand], Apr 1984-Jan 1986. Tokyo, Japan International Cooperation Agency. p.35-38. 2 figs (Report/Thailand and Japan Joint Coastal Aquaculture Research Project; no.2)

Rearing experiments on the fry and larvae of EPINEPHELUS MALABARICUS were conducted at NICA in 1984 and 1985. Feeding the fry and larvae with rotifer and TETRASELMIS SP. at different densities and sizes was explored. The methods employed and the results of each experiment are discussed. (R.P.G.)

- 118 Sadiq, M.; Zaidi, T.H. 1983. Study of various factors affecting digestion of fish tissue prior to mercury determination. Int.J.Environ.Anal.Chem., 16(1): 57-66. (for acquisition)\*\*

The effect of temperature on digestion, the acid combinations and their quantities, and the time required for digestion of fish tissue were investigated using hamour (EPINEPHELUS TAUVINA) body tissue. Concentrations of Hg in fish tissue digested for four hours at 80+/-2C and 95+/-2C were statistically similar and significantly higher than in tissue digested at 60+/-2C. Eight acid combinations



were investigated as digestion media and a 1:2 mixture of concentrated HNO sub(3):H sub(2)SO sub(4) proved to be the best. A quantity of 15ml of this digestion media was found to be sufficient to digest approximately two grams of wet fish tissue. The use of 25ml of digestion media resulted in significantly reduced Hg concentration whereas 10ml was not sufficient to digest two grams of fish tissue. Mercury determinations made from the samples prepared by the best combination of all the experimental conditions showed a good agreement with those of samples prepared in Teflon Acid Digestion Bombs. This study has pointed the necessity of developing a uniform standard procedure for digesting fish tissue prior to Hg determination. (ASFA)

- 119 Sakares, W.; Sukbanteang, S. [1985]  
Experiment on cage culture of EPINEPHELUS  
TAUVINA (Forsk.) at different density.  
IN: Proceedings of the 3rd Seminar on  
Coastal Aquaculture, 22-24 May 1985.  
[Thailand], Brackishwater Fisheries  
Division, Department of Fisheries,  
Ministry of Agriculture & Cooperatives.  
p.22-29. 1 fig; 3 tables (Text in Thai)

Grouper (EPINEPHELUS TAUVINA Forskal) at 3 different sizes, 61.20, 103.36 and 149.44g were reared in 1 x 1 x 1.5m cages for 180 days at the rate of 30, 45 and 60/m\*\*2, respectively. Trash fish were fed daily. Non-significant difference (P>0.05) of the growth rate and survival rate among the experiments. Although, the production and the net weight per cage of the experiments resulted significantly difference (sic) (P<0.01). The highest production at the average 29.68+/-4.38kg/cage were taken from stocking rate of 60ind/m\*\*2. Those of which showed the average increasing weight at 23.41+/-1.74kg/cage. The survival rate was 96.67+/-4.41% and the average weight of each fish was 508.83+/-70.54kg. The food conversion rate was 8.82:1. (AUTHOR'S ABSTRACT)

- 120 Sale, P.F.; Douglas, W.A. 1981. Precision  
and accuracy of visual census technique  
for fish assemblages on coral patch reefs.  
Environ.Biol.Fish., 6(3/4): 333-339. 1  
fig; 5 tables

A visual census technique is described in which the results of three separate enumeration of fish at a site are combined to

produce a 'best estimate' of the fish fauna present. Its precision and accuracy are examined and compared to those of censuses obtained by modifications of the technique. Visual censuses can display high repeatability, but they seldom (if ever) completely sample the fish present at a site. Accuracy varies with technique used. In our test, the preferred method yielded 82% of species and 75% of individuals known to be present and potentially censusable at the time the observations were made. Visual censuses are of censusable accuracy to ichthyocide collections of unenclosed sites, but the two methods sample different components of the total fish fauna. It is important when using visual censuses to remember that their accuracy is not 100%. (AUTHOR'S ABSTRACT)

- 121 Samuel, M. 1984. Palatability and acceptability tests conducted on three fish species at the Kuwait Institute for Scientific Research. IN: Proceedings of the Third Shrimp and Fin Fisheries Management Workshop, Fin Fisheries Session, 4-5 Dec 1982. Vol. 3. Ed. by Mathews, C.P. s.l., s.n. p.1-7. (for acquisition)\*\*

A study was undertaken to determine the public acceptance and palatability of 3 species of fish not commonly consumed in Kuwait: *ARIUS THALASSINUS*, *EPINEPHELUS TAUVINA* and *LUTJANUS COCCINEUS*. Analysis shows that people interviewed could not distinguish between the 3 once they were filleted, frozen, thawed and fried. (ASFA)

- 122 Samuel, M.; Mathews, C.P. 1986. Assessment of stocks of hamra (*LUTJANUS COCCINEUS*) and hamoor (*EPINEPHELUS TAUVINA*) from the Arabian Gulf. IN: The First Asian Fisheries Forum, Manila, 25-31 May 1986. s.l., s.n. p.258. (Abstract only)

Surplus yield and dynamic pool models were applied to data on catch, effort, growth and mortality obtained from 1980 to 1984. A surplus yield model was fitted successfully to the hamoor data but for hamra the data were too variable to provide an acceptable fit. Very marked changes in the distribution of effort in the north western Arabian Gulf have changed the pattern of landings for both species. Therefore the surplus yield approach did not provide very



helpful data for either species. Aging of both these species can be carried out routinely, and so the dynamic pool approach provided useful estimates of mortality and growth rates. For hamoor, the two approaches provided broadly consistent results. These models suggest that both fisheries are exploited at or near MSY, although some increase in the volume and value of hamra landings would be possible. Bio-economic data for the Kuwaiti fishery suggest that the value of the hamra fishery could be increased by approximately KD 300,00/year. (AUTHOR'S ABSTRACT)

- 123 Seale, A. 1914. Fishes of Hongkong.  
Philipp.J.Sci., 9(1): 59-79. 2 plates

This article is a collection of fishes found in Hongkong markets. Almost all of the species listed are consumed as food by the people of Hongkong. A brief description of each species is provided. (D.V.Z.)

- 124 Selvaraj, G.S.D.; Rajagopalan, M. 1973.  
Some observations on the fecundity and spawning habits of the rock cod, EPINEPHELUS TAUVINA (Forsk.) Indian J.Fish., 20(2): 668-671. 2 figs; 1 table

Some observations on the fecundity and spawning behaviour of EPINEPHELUS TAUVINA (Forsk.) trawled at depths between 35 and 45 meters along the southwest coast of India are dealt with here. (AUTHOR'S ABSTRACT)

- 125 Shen, S-C. 1984. [EPINEPHELUS]. IN:  
Coastal Fishes of Taiwan. Taipei, Department of Zoology, National Taiwan University. p.39-41. 3 plates

Brief description of the physical characteristic of each grouper species is provided. Distribution of the species is included. (D.V.Z.)

- 126 Shunbo, F.; Zarba, M.; Ali, M.; Samhan, O.; Omar, N. 1984. Toxic organic and heavy

metal pollutants in two commercial fish species from Kuwait. Annu.Res.Rep.KISR, 1984: 120-122. 1 fig; 2 tables

Presence of cadmium (Cd), lead (Pb), mercury (Hg) and four polyaromatic hydrocarbons (PAHs) which are known to be toxic to EPINEPHELUS TAUVINA and HILSA ILISHA was investigated. Results of analyzing the intercalibration sample for PAHs using different methods, and muscle and liver analysis for the presence of heavy metals are presented in tables. (D.V.Z.)

- 127 Silitonga, R. 1982. Sea bass and grouper culture programme in Lampung Province. IN: Report of Training Course on Seabass Spawning and Larval Rearing, Songkhla, Thailand, 1-20 Jun 1982. Manila, South China Sea Fisheries Development and Coordinating Programme. p.82. (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.39)

The identification of sea bass fry is still very difficult for the fishermen of Lampung Province. Mature breeders have not yet been observed to abound in these vicinities but it has been given a major concern. Second in priority is the grouper. The programme of sea bass and grouper culture in Lampung is a pilot project of the Directorate General of Fisheries of Indonesia and construction of cages for these two finfishes in coastal areas is now at its developmental stage. (R.P.G.)

- 128 Sin, O.K. 1981. Malaysia: review of finfish breeding (brackish-salt water). IN: Annexes to Induced Fish Breeding in Southeast Asia; Report of a Workshop held in Singapore, 25-28 Nov 1980. Ed. by F.B. Davy and A. Chouinard. Singapore, International Development Research Center. (Microfiche copy, positive, card 2)

Finfish aquaculture in the brackish-salt water environments in Malaysia is in its early stage of development. The two main cultured species are grouper (EPINEPHELUS sp.) and sea bass (LATES CALCARIFER), which the former contributes more than one half of the



total production of about 200t/yr. Culture of other species in cages such as snapper (*LUTJANUS* sp.), rabbitfish (*SIGANUS* sp.), horse mackerel (*CORANX* sp.), and threadfin (*ELEUTHERONEMA* sp.) is included. The fry are collected from natural sources, for grouper the estimated fry collected per year is slightly more than 200,000 and less than 200,000 for sea bass. Researches on the techniques of gonadal maturation, induced spawning, larval rearing and gamete preservation are being undertaken. (R.S.O.)

- 129 Singapore. Primary Production Department. Ministry of National Development. 1983. Manual on floating net-cage fish farming in Singapore's coastal waters. Singapore, Primary Production Department, Ministry of National Development. 24p. (PP Pamphlet no. 39)

Discussed in the manual are suitable finfishes for floating net-cage culture. Species of fish included are *EPINEPHELUS TAUVINA*, *LATES CALCARIFER* and *LUTJANUS JOHNI*. Also discussed are site selection, net-cage construction, culture methods and economics of the culture system. (D.V.Z.)

- 130 Singhagraiwan, T.; Tanomkiat, T.; Pakdee, K. 1982. Cage culture of marine finfish in Thailand. IN: Report of the Training Course on Small-scale Pen and Cage Culture for Finfish, Los Banos, Laguna, Philippines, 26-31 Oct 1981; Aberdeen, Hong Kong, 1-13 Nov 1981. Prepared by R.D. Guerrero III and V. Soesanto. Manila, South China Sea Fisheries Development and Coordinating Programme. p.207-212. 3 figs (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.34)

The locations of the 5 fisheries stations that conduct experiments in cage culture are described briefly. Species used in cage culture include sea bass (*LATES CALCARIFER*), grouper (*EPINEPHELUS TAUVINA*, *EPINEPHELUS* spp.), snapper (*LUTJANUS SEBAE*, *L. JOHNI*, *L. RUSSELLI*) and rabbitfish (*SIGANUS* sp.). A description of the various cages used in the different stations is also given.

A design of the cage used in Rayong Marine Fisheries Station and its various specifications is illustrated. (W.L.C.)

- 131 Stevenson, D.K. 1977. Management of a tropical fish pot fishery for maximum sustainable yield. Proc.Gulf Caribb.Fish.Inst., (30): p.95-115.

Research on the pot fishery of 10 selected fishes of fish for the purpose of estimating growth and mortality rates was conducted. Exploitation of fishes was also determined. Methods and results of the study are discussed in detail. (D.V.Z.)

- 132 Sudradjat, A. 1982. Research programme on cage culture in Bintan Island, Riau Province, Indonesia. IN: Report of the Training Course on Small-scale Pen and Cage Culture for Finfish, Los Banos, Laguna, Philippines, 26-31 Oct 1981; Aberdeen, Hong Kong, 1-13 Nov 1981. Prepared by Rafael D. Guerrero III and V. Soesanto. Manila, South China Sea Fisheries Development and Coordinating Programme. p.167-172. (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.34)

The mariculture potential of groupers and rabbitfishes is discussed. Species considered are EPINEPHELUS TAUVINA, E. MALABARICUS, E. MERRA, PLECTROPOMUS MACULATUS, and P. LEOPARDUS for the serranids and SIGANUS CANALICULATUS, S. GUTTATUS, S. JAVUS, and S. CHRYSOSPILOS for the rabbitfishes. Outlined are the various experimental procedures for the development of the mariculture of these species. (W.L.C.)

- 133 Sudradjat, A.; Oedin, H.; Amini, S. 1985. Effect of feeding methods on the growth of estuarine grouper, EPINEPHELUS TAUVINA (Forsk.) , cultured in floating net-cages. J.Penelitian Budidaya Pantai (Coast.Aquacult.Res.J.), 1(1): 45-54.



## 2 figs; 7 tables

Studies on the effect of feeding methods on the growth of estuarine grouper were conducted in floating net-cages with four feeding methods in the order of two feedings daily (4%, 5%, 8% of body weight) and one feeding in two days (4% of body weight) were studied. Optimal growth and good feed conversion ratio as well as feed efficiency were obtained in groups fed to the satiation with one feeding every 2 days. (AUTHOR'S ABSTRACT)

- 134 Sugama, K. 1982. Programme of research and development on marine finfish culture in Banten Bay, West Java. IN: Report of Training Course on Seabass Spawning and Larval Rearing, Songkhla, Thailand, 1-20 Jun 1982. Manila, South China Sea Fisheries Development and Coordinating Programme. p.83-84. (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.39)

Banten Bay covers a coastal area of mangrove swamps, tidal flats and estuaries. Among the finfishes found suitable for culture in this area are: rabbitfish (SIGANUS spp.), grouper (EPINEPHELUS spp.), and sea bass (LATES CALCARIFER). Development researches are carried out by the Marine Culture Research and Development. (R.P.G.)

- 135 Sukhawongs, S.; Tanakumcheep, N.; Chungyampin, S. 1977. Feeding experiment on artificial diet for greasy grouper, EPINEPHELUS TAUVINA in nylon net cages. Annu.Rep.Songkhla Fish.Stn.Dep.Fish., 1977: 79-90. 3 tables

Wild greasy grouper EPINEPHELUS TAUVINA were collected from the Songkhla Lake. There were four nylon net cages to stock the fish at a rate of 100 fish per cage, an average weight 33, 35, 26.5 and 23.6 grams per fish, respectively. They were fed chicken feed for a period of 7 months. The average weight gains per fish were 645.5%, 660.0%, 762.6% and 854.2%, respectively. The diet conversion were 3.48, 3.21, 3.62 and 3.67, respectively. The survival rate of greasy grouper in four nylon net cages were 93%,

- 136 Sukhawongs, S.; Tanakumcheep, N.;  
Chungyampin, S. 1978. Feeding  
experiment on artificial diet for greasy  
grouper, EPINEPHELUS TAUVINA in nylon  
cages. Annu.Rep.Songkhla  
Fish.Stn.Dep.Fish., 1978: 103-117. 2  
figs; 5 tables

EPINEPHELUS TAUVINA were reared in 8 nylon cages stocked with 50 fish/cage having an initial size ranging from 20-30g and 10-15cm for the first 4 cages and the remaining 4 cages with 60-70g and 15-22cm fish. The fish were fed with dietary protein level of 30%, 40%, 45% and 50% for 4 months and the resulting survival, growth and feed conversion values were determined. The highest weight gain was determined at 50% protein while a slight reduction of weight gain was observed at 30%, 40% and 45% protein level. The lowest feed conversion value (2.59) was recorded in the last four cages stocked with bigger fish and the highest (5.22) in the first four cages. The survival rates were 80%, 100%, 84% and 96% in the first four cages and 84%, 84%, 92% and 84% in the last four cages.  
(MODIFIED AUTHOR'S ABSTRACT)

- 137 Sukhawongs, S.; Tanakumcheep, N.;  
Chungyampin, S. 1980. Rearing  
EPINEPHELUS TAUVINA. Thai Fish.Gaz.  
33(4): 447-455. (Text in Thai)

Possible rearing of EPINEPHELUS TAUVINA in net cages was studied. Net cages of 6m length, 5m breadth, 2m depth with a mesh size of 3-4cm was utilized. Stocking density was 10ind/sq.m. Given trash fish or pellet as food, food conversion rate was 3.6:1. Culture period reached 7 months with an average weight of 0.5kg and a survival rate of 95%. (D.V.Z.)

- 138 Takeda, M.; Kurata, Y. 1984. Crabs of the  
Ogasawara Islands. 7.Third report on the  
species obtained from stomachs of fishes.  
Bull.Natl.Sci.Mus.(Japan) Ser.A, 10(4):  
195-202. (for acquisition)\*\*



Fragments of carapaces and chelipeds found in stomach contents of DENTEX TUMIFRONS (Temminck et Schlegel) (Renkodai), EPINEPHELUS FASCIATUS (Forskaal) (Akahata), and PARUPENEUS PLEUROSTIGMA (Bennett) (Ryukyu-himejii) from the Ogasawara Islands were identified. A new species of the family Goneplacidae, LOPHOPLAX SEXTUBERCULATA sp.nov., is described, and some rare species are systematically noted and figured. (ASFA)

- 139 Tam, P.P.L.; Ng, T.B.; Woo, N.Y.S. 1983. Effects of oestradiol-17 beta and testosterone on the histology of pituitary, liver, ovary and skin of previtellogenic EPINEPHELUS AKAARA (Teleostei, Serranidae). Cell Tissue Res., 231(3): 579-592. (for acquisition)\*\*

The pituitary gland of the red grouper, EPINEPHELUS AKAARA, was studied by histochemical techniques, and the prolactin cells, corticotrops, somatotrops, gonadotrops, thyrotrops, pars intermedia cells and neurohypophyseal cells, were identified. Oestradiol-17 beta treatment caused PAS-positive cells in the proximal pars distalis, presumably a mixture of gonadotrops and thyrotrops, to undergo hypertrophy, vacuolation and degranulation of cytoplasmic glycoprotein granules. Disappearance of cytoplasmic granules was also evident in the PAS-positive pars intermedia cells. Destrogen-treated fish also showed an increase in the hepatosomatic index, and hepatocytes enlarged in size, their nuclear diameter increased and large vacuoles were found in the cytoplasm. These changes in the liver were paralleled by a secretion of vitellogenin into the serum and an increased production of mucus by the thickened skin epithelium. (ASFA)

- 140 Tan, K.S. 1973. Fisheries biological study of groupers in the South China Sea. Singapore, Marine Fisheries Research Department, SEAFDEC. vol.3. p.31-61. (Working papers/Marine Fisheries Research Department, SEAFDEC)

Biology of grouper was studied based on the data collected by the research vessel of the Marine Fisheries Research Department, SEAFDEC, from Feb to Dec 1973. Catch and species composition, age and growth of the fish were determined. Reproduction is discussed

at length. (D.V.Z.)

- 141 Tan, S.M.; Tan, K.S. 1974. Biology of the tropical grouper, *EPINEPHELUS TAUVINA* (Foskal) (sic). I. A preliminary study on hermaphroditism in *E. TAUVINA*. Singapore J.Pri.Ind., 2(2): 123-133.

In view of the commercial importance of *EPINEPHELUS TAUVINA* (Foskal) (sic) as a fish for farming, there is a need to study its reproductive biology. Gonadal histology has demonstrated that the grouper is a protogynous hermaphrodite with females transforming into males at around 650-750mm body length. Hence males tend to be larger than females although there is some overlap. There is indication that the spawning season occurs in August and that the minimum size for spawning is around 450-500mm body length.

(AUTHOR'S ABSTRACT)

- 142 Tan, S.M.; Lim, P.Y.; Tetsushi, S.; Hooi, K.K. 1982. [Fam. Serranidae: *EPINEPHELUS*]. IN: Colour Guide to the Fishes of the South China Sea and the Andaman Sea. Singapore, Primary Production Department; Marine Fisheries Research Department, SEAFDEC. p.22-24. 16 illus

A brief description of each species of grouper is provided. Methods by which it is captured is included. (D.V.Z.)

- 143 Tanakumcheep, N.; Chungyampin, S. 1978. Study on distribution and abundance of juvenile fishes (greasy grouper) in the Sakom river Songkhla province. Annu.Rep.Songkhla Fish.Stn.Dep.Fish., 1978: 265-281. 4 figs; 3 tables

The study on distribution and abundance of juveniles greasy grouper in the Sakom river Songkhla province was conducted during December 1977 to November 1978. The juveniles were collected under a makeshift 50cm bushy shelter by a 1m diameter scoop net. Based on the result, juveniles of 1.5-5.0cm were found distributed along the



river after the distance of 2,000m from the mouth of the river.  
Physico-chemical properties of the water are provided. (MODIFIED  
AUTHOR'S ABSTRACT)

- 144 Tandavanitj, S. 1986. Parasites of brown spotted grouper fry (*EPINEPHELUS TAUVINA* Forskal) in nursery pond. IN: The First Asian Fisheries Forum, Manila, 25-31 May 1986. s.l., s.n. p.151. (Abstract only)

Pathological examinations for parasitic disease were conducted on fry of brown spotted groupers on 17 Sep to 31 Oct 1984 at Phuket Brackishwater Fisheries Station. Six species of parasites were found on the gills and skin of fish: i.e., protozoa: *CRYPTOCARYON* sp., monogenea trematode: *GYRODACTYLUS* sp., *BENEDENIA* sp. and fungi. (AUTHOR'S ABSTRACT)

- 145 Tanomkiat, T. 1982. Programme on cage culture at the Phang Nga small-scale fisheries-assisted project, Phang Nga Province, Thailand. IN: Report of the Training Course on Small-scale Pen and Cage Culture for Finfish, Los Banos, Laguna, Philippines, 26-31 Oct 1981; Aberdeen, Hongkong, 1-13 Nov 1981. Prepared by R.D. Guerrero, III and V. Soesanto. Manila, South China Sea Fisheries Development and Coordinating Programme. p.213. (Workshop reports/South China Sea Fisheries Development and Coordinating Programme; no.34)

Sea bass fry from the Phuket fisheries station hatchery and grouper and snapper fingerlings collected from Phang Nga Bay were cultured in net cages at Phang Nga Province. Fishermen cooperators were motivated to assist in the construction and maintenance of net cages. Sea bass were harvested after one year while grouper and snapper were harvested after 5-6 months. (R.P.G.)

- 146 Tareen, I.U.; Al-Yamani, F.; Hadi, L.A. 1979. Investigations on bacterial

diseases and parasites of fish and  
methods for their control.  
Annu.Res.Rep.KISR, 1979: 58-60. 2 plates

In 1979, efforts were directed towards maximum survival and providing optimal conditions required for healthy fishes. This study aims to identify diseases, their control and its preventive measures. Diseases of ACANTHOPAGRUS LATUS, EPINEPHELUS TAUVINA, MUGIL CEPHALUS, SIGANUS ORAMIN and other shrimp species were identified. Causes and control of the identified diseases are discussed in this paper. (D.V.Z.)

- 147 Tareen, I.U.; Hadi, L.A. 1981. Mariculture diseases and methods of control.  
Annu.Res.Rep.KISR, 1981: 107-109.

Maintaining healthy fishes depends upon knowledge of causative agents and determining effective methods of control. In this article, diseases of EPINEPHELUS TAUVINA, ACANTHOPAGRUS CUVIERI, OREOCHROMIS SP. and MUGIL CEPHALUS were identified. Symptoms of diseases were described and methods of control were provided. (D.V.Z.)

- 148 Teng, S-K.; Chua, T-E.; Lai, H.C. 1977. Construction and management of floating net-cages for culturing the estuary grouper, EPINEPHELUS TAUVINA (Forsk.) in Penang, Malaysia. IN: Joint SCSP/SEAFDEC Workshop on Aquaculture Engineering, Tigbauan, Iloilo, 27 Nov - 3 Dec 1977. Manila, South China Sea Fisheries Development and Coordinating Programme. p.359-371. (Technical report/South China Sea Fisheries Development and Coordinating Programme; SCS/GEN/77/15)

Net cages used for culturing EPINEPHELUS TAUVINA are contained in a floating wooden platform made of Chengai Pasir wood, HOPEA ODONATA which is resistant to saltwater and bores. Sealed polyethylene containers are used as floats. Grouper seed are collected from the wild, sorted out and disinfected. Stocking is done according to size. Young fish are fed with either fish or young shrimp. Food is gradually replaced by pellet food consisting of trash fish, fish meal, chicken feed, vitamins and minerals with



wheat flour as binder. The most common disease - redboiled disease, caused by *VIBRIO* sp. is controlled by vibramycin and sodium sulfamethazone baths or terramycin injections. (AQUADOC)

- 149      Teng, S-K.; Chua, T-E. 1977. Effect of stocking density on the growth of estuary grouper, *EPINEPHELUS SALMOIDES* Maxwell, cultured in floating net cages. Penang, School of Biological Sciences, Universiti Sains Malaysia. 18p. 4 figs; 4 tables (Project report/Universiti Sains Malaysia; no. USM/IFS/CTE 2) (Also in: Aquaculture, 15:273-287, 1978)

Studies on the effect of stocking density on the growth of estuary grouper (*EPINEPHELUS SALMOIDES*) were conducted in floating net-cages. Four stocking densities (15, 30, 60 and 120fish/m<sup>2</sup>) and two sizes of fish (26±0.2g and 15.2±0.1g) were studied. Results of the present study indicate that fish at stocking density of 60fish/m<sup>2</sup> grew equally fast and showed comparable food conversion ratio and survival rate as those at lower stocking densities of 15 and 30fish/m<sup>2</sup>. The net-yield of fish at a stocking density of 60fish/m<sup>2</sup> was 1.9 and 3.5 times that of fish at densities of 30 and 15fish/m<sup>2</sup> respectively. However, at 120fish/m<sup>2</sup>, a remarkable decrease in the weight-gain per fish, mean fish weight, efficiency of food conversion as well as survival rate were recorded. The possible effects of stocking density on the growth of estuary grouper under cage-culture conditions were discussed. (AUTHOR'S ABSTRACT)

- 150      Teng, S-K.; Chua, T-E.; Lim, P-E. 1977. Preliminary observation on the dietary protein requirement of estuary grouper, *EPINEPHELUS TAUVINA* (Forsk.) cultured in floating net-cages. Penang, School of Biological Sciences, Universiti Sains Malaysia. 15p. (Technical report/Universiti Sains Malaysia; no.USM/IFS/CTE 3) (Also in: Aquaculture, 15:257-271, 1978)

Dietary protein requirement of *EPINEPHELUS TAUVINA* reared in floating net-cages was studied. Six experimental diets containing protein at concentrations between 20 and 70% were used. Sun-dried

tuna muscle was utilized as the source of protein. After 12 weeks, it was observed that weight gains were linearly dependent on their initial weights. Basing on the response-curve, the level of dietary protein which produced maximum weight-gain was estimated to be at 50%. Statistically, weight-gain of fish at 40% was not significantly different compared to 50% protein. Feed conversion ratio was also recorded at levels 40% and 50%. Growth was greatly depressed when fed 20% and 30% protein. With diets containing 50%, 60% and 70% protein, growth was not greatly enhanced. Basing on the results, 40% protein is the most economical when formulating fish feed. (MODIFIED AUTHOR'S ABSTRACT)

- 151 Teng, S-K.; Chua, T-E. 1978. Use of hiding space to increase the stocking density and production of estuary grouper, EPINEPHELUS SALMOIDES reared in floating net-cages. Penang, School of Biological Sciences, Universiti Sains Malaysia. 18p. (Project report/Universiti Sains Malaysia; no.USM/IFS/CTE 6) (Also in: Aquaculture 16: 219-232, 1979)

Growth and production of estuary grouper, EPINEPHELUS SALMOIDES reared in floating net-cages with artificial shelter were studied. Seven combinations of artificial shelter and stocking density were used. Old car tyres were suspended in the net-cages to provide hiding space for the fish. It was observed that provision of artificial shelter of 251cm<sup>3</sup>/fish, stocking density could be increased to 156fish/m<sup>3</sup> thus increasing production by 230%. Other effects of the artificial shelter are also discussed. (MODIFIED AUTHOR'S ABSTRACT)

- 152 Teng, S-K. 1979. Studies on the culture of the estuary grouper, EPINEPHELUS SALMOIDES Maxwell (Pisces, Serranidae) in floating net-cages. (Ph.D. Thesis, School of Biological Sciences, Universiti Sains Malaysia) 423p.

In this study, food and feeding, nutritional requirement and effect of stocking density on the growth of the estuary grouper, EPINEPHELUS SALMOIDES, were studied. It was observed that 40% dietary protein was the optimum level for the young grouper. Using old car tyres as artificial hides, the optimum stocking density of



60fish/cu.m. could be increased to 156/cu.m. without affecting growth rate. Eight culture techniques, varying from traditional to intensive, were developed to determine highest production rate taking into consideration economics of each culture method. During the study, basic environmental parameters inside and outside the net-cages were monitored. (MODIFIED AUTHOR'S ABSTRACT)

- 153 Teng, S-K.; Akatsu, S.; Al-Abul-Elah, K.M.; Al-Marzouk, A.; Downing, N.; Al-Zahr, C.R.; Al-Ghemlas, K. 1981. Spawning, fingerling production and market-size culture of hamoor (*EPINEPHELUS TAUVINA*) in Kuwait. Annu.Res.Rep.KISR, 1981: 71-74. 2 figs; 1 table

Natural spawning occurred to both wild and cultured broodstock. The larvae was used for the large-scale production of fingerlings conducted in 0.5m\*\*3 tanks. The following experiments were carried out in relation to fingerling production: effect of temperature on growth and survival, effect of stocking density on growth and survival, early weaning of fish from rotifers to *ARTEMIA* nauplii, and rearing of fingerlings to marketable size in cages. (D.V.Z.)

- 154 Thailand. Phuket Brackishwater Fisheries Station and Phang Nga Provincial Fisheries Office. [1985] Preliminary studies on cage culture of grouper, *EPINEPHELUS TAUVINA* Forskal. IN: Proceedings of the 3rd Seminar on Coastal Aquaculture, 22-24 May 1985. [Thailand], Brackishwater Fisheries Division, Department of Fisheries, Ministry of Agriculture & Cooperatives. p.242-249. 3 tables (Text in Thai)

Demonstration on cage culture of grouper, *EPINEPHELUS TAUVINA* Forskal to fish farmer of Small Scale Fisheries Development Project was held at Bau Kog Krai, Tambon Marui, Amphur Tupud, Phang Nga Province. A thousand of grouper with range 135-208g in weight and 4 cages of 3 x 3 x 2.5m\*\*3 were used in this study. The first group, fish were reared in 2 cages with density of 200ind/cage and the second group was 300ind/cage. The survival rate was 97.4% and food conversion rate was 5.7. After rearing, 3-5 months, the production

was 549.90kg (60,489Baht). The benefit was 8,732Baht/cage. By using quality trash fish as feed, the rearing time was reduced from 6-8 months to 3-5 months. (AUTHOR'S ABSTRACT)

- 155 Thompson, R.; Munro, J.L. 1983. Biology, ecology and bionomics of the hinds and groupers, Serranidae. IN: Caribbean Coral Reef Fishery Resources. 2nd Ed. Ed. by J.L. Munro. Manila, International Center for Living Aquatic Resources Management. p.59-81. 15 figs; 23 tables (Contribution/ICLARM; no.125)

Relationships among the species of the Family Serranidae are traced based on their morphological features, geographical distribution, bionomics and life history, and population dynamics. (R.P.G.)

- 156 Tseng, W-Y.; Ho, S-K. [1979] Induced breeding and early development of red grouper (*EPINEPHELUS AKAARA*, Temminck & Schlegel) in Hong Kong. [Hong Kong], Marine Science Laboratory, Department of Biology, The Chinese University of Hong Kong] 16p. 1 fig; 3 tables

Red grouper, *EPINEPHELUS AKAARA*, was induced to spawn successfully. Seven fishes, 2 females and 5 males, were injected intramuscularly with puberogen. After 2 injections, 37,000 eggs were stripped from one female. Eggs were fertilized using dry method. 24 hours after, eggs hatched at 25C and 30ppt having a 75% hatching rate. Stripping, fertilization, embryonic development, hatching and growth of larvae are discussed. (MODIFIED AUTHOR'S ABSTRACT)

- 157 Tseng, W-Y.; Poon, C.T. [1979] Study of the hybridization between red grouper, *EPINEPHELUS AKAARA* and white-spotted green grouper, *E. AMBLYCEPHALUS*. Hong Kong, Marine Science Laboratory, Department of Biology, The Chinese University of Hong Kong. 14p. 6 figs; tables



Six trials were carried out to study the hybridization between EPINEPHELUS AKAARA (red grouper) and E. AMBLYCEPHALUS (white-spotted green grouper). 2-5 male red grouper and 1-3 female white-spotted green grouper were selected. The fishes were intramuscularly injected with HCG. After the first injection, spawning behavior begun. It was observed that eggs exhibited by active females were more mature compared to those exhibited by inactive ones. Eggs were fertilized using dry method. Development of eggs to larvae was observed and discussed. (D.V.Z.)

- 158 Tseng, W-Y.; Ho, S-K.; Poon, K.L. 1979. Transportation of fingerlings of EPINEPHELUS BRUNNEUS (Bloch). China Fish.Mon., (316): 11-13.

A study was made on the importation of EPINEPHELUS BRUNNEUS fingerlings into Hongkong. A total of 75,495 fingerlings of EPINEPHELUS BRUNNEUS was imported from Taiwan to Hongkong in 14 shipments from July 15 to November 3, 1978. Capturing and feeding of fry, transportation method, control of temperature, oxygenation and mortality were studied. (AUTHOR'S ABSTRACT)

- 159 Tseng, W-Y.; Poon, C.T. 1983. Hybridization of EPINEPHELUS species. Aquaculture, 34: 177-182. 3 tables

Hybridization was achieved between cultured female white-spotted green grouper (EPINEPHELUS AMBLYCEPHALUS) and wild male red grouper (E. AKAARA). Human chorionic gonadotropin was used to induce maturation, and the eggs were fertilized by the dry method. Larval rearing to juveniles was achieved, feeding fertilized oyster eggs, rotifers, and brine shrimp nauplii. (AUTHOR'S ABSTRACT)

- 160 Tseng, W-Y. 1983. Prospects for commercial netcage culture of red grouper (EPINEPHELUS AKAARA T. & S.) in Hong Kong. J. World Maricult. Soc., 14: 650-660. 7 figs

The red grouper (EPINEPHELUS AKAARA T. & S.) is non

gregarious. It likes to inhabit crevices and caverns which are formed by the reefs and artificial materials in natural waters. They have a wide tolerance to salinity, temperature and oxygen requirement. Crustaceans and fish seem to be their favorite food. Live fish have a high market demand in Hong Kong. More than 70% of the live fish is provided directly or indirectly from aquaculture. Around 25,000 cages are engaged in culture at present, and 600-900 tons of cultured fish are produced annually. Natural fingerlings are the main seed source, but there is still a 30-50 % shortage of fingerlings, and although indeed spawning was successful two years ago, mass production of fingerlings still has a long way to go. Several culture methods such as cage culture is predominant, with a very bright and promising future. (AUTHOR'S ABSTRACT)

- 161 Tseng, W-Y.; Ho, S-K. [1983] Status of red grouper culture in Hong Kong. IN: International Conference on Development and Management of Tropical Living Aquatic Resources, Serdang, Selangor, Malaysia, 2-5 Aug 1983. Abstracts. s.l., s.n p.15. (Abstract only)\*\*

This is a discussion paper outlining the history of development of red grouper (EPINEPHELUS AKAARA) culture in Hong Kong. It compares the organization of farms involved in red grouper culture with illustration of the work procedures and the problems of the industry. A discussion is given of the ways in which the industry may be improved and developed. (AUTHOR'S ABSTRACT)

- 162 Tsu, Y-T.; Chang, C.L.; Cheng, C-T. 1963. EPINEPHELUS Bloch, 1793. IN: Fish Fauna of the East China Sea. Peking, Scientific Publishing Agency. p.213-221. (Text in Chin)

A description of the characteristics of each species of the genus EPINEPHELUS is presented. Identification keys are given. (D.V.Z.)

- 163 Ukawa, M.; Higuchi, M.; Mito, S. 1966. Spawning habits and early life history of a serranid fish, EPINEPHELUS AKAARA



(Temminck et Schlegel). Jpn.J.Ichthyol.,  
13(4/6): 156-161. 2 figs

Spawning behavior of EPINEPHELUS AKAARA was observed from mid-Jul to early Sep 1965 at the Hakatashima Station, Ehime Prefecture. The hatched larvae were reared for about 2 weeks. Its early developmental stages is described. (MODIFIED AUTHOR'S ABSTRACT)

- 164 Umali, A.F. 1936. Groupers and the sea basses. IN: Edible Fishes of Manila. Manila, Bureau of Printing. p.126-133. (Popular bulletin/Commonwealth of the Philippines, Department of Agriculture and Commerce; no.6)

A general identification key to the species of groupers and sea basses found in Manila markets is outlined. In addition, specific description is provided for each species. (D.V.Z.)

- 165 Vadiya, V. 1984. Reproductive systems of EPINEPHELUS AENEUS and EPINEPHELUS ALEXANDRINUS (Serranidae) from the Southeastern Mediterranean. J.Ichthyol. 24(3): 77-81. 3 tables

An investigation of the reproductive system of two species of the genus EPINEPHELUS provided a more accurate description of the functioning of the reproductive organs. Both species function first as females; subsequently, the ovaries develop into testes. (AUTHOR'S ABSTRACT)

- 166 Waldman, J.R. 1984. Striped bass in Gregory's "Fish skull" actually a grouper. Copeia, (3): 793-794.

Monograph on fish skulls by William King Gregory is today's best known study of the osteichthyan skull. However, examination of the osteological preparations revealed that the illustration labelled as striped bass skull was actually the skull of a grouper. Comparative studies made on fish skulls are discussed to support such finding. (D.V.Z.)

- 167 Weber, M.; de Beaufort, L.F. 1931.  
EPINEPHELUS Bloch. IN: The Fishes of the  
Indo-Australian Archipelago:  
VI. Perciformes (continued) Families:  
Serranidae, Theraponidae, Sillaginidae,  
Emmelichthyidae, Bathyclupeidae,  
Coryphaenidae, Carangidae,  
Rachycentridae, Pomatomidae,  
Lactariidae, Manidae, Leiognathidae,  
Mullidae. New Delhi, A.J. Reprints  
Agency. p.14-25. 3 figs

This article describes the genus EPINEPHELUS in general and  
each species belonging to the genus in particular. An  
identification key is presented in detail for each species.  
(D.V.Z.)

- 168 Withler, F.C.; Lim, L.C. 1982. Preliminary  
observations of chilled and deep-frozen  
storage of grouper (EPINEPHELUS TAUVINA)  
sperm. Aquaculture, 27(4): 389-392.

Trials of chilled (5-10C) and cryogenic storage of grouper  
sperm revealed that sperm suspended in two different solutions  
containing 10% dimethyl sulfoxide (DMSO) were active after 2 days  
of chilled and deep-frozen storage, whereas those suspended in the  
same solutions containing 10% glycerol were not. Sperm suspended in  
the 10% DMSO solutions were more active after chilled storage than  
those in undiluted milt under the same conditions. (AQUADOC)

- 169 Wong, C. 1982. Harvesting and marketing of  
cultured marine fish in Hong Kong. IN:  
Report of the Training Course on  
Small-scale Pen and Cage Culture for  
Finfish, Los Banos, Laguna, Philippines,  
26-31 Oct 1981. Aberdeen, Hong Kong, 1-13  
Nov 1981. Prepared by Rafael D. Guerrero  
III and V. Soesanto. Manila, South China  
Sea Fisheries Development and  
Coordinating Programme. p.137-140.  
(Workshop reports/South China Sea  
Fisheries Development and Coordinating  
Programme; no.34)



The demand for live marine fish in Hong Kong is high. The most popular species cultured are the red grouper (*EPINEPHELUS AKAARA*), mud grouper (*E. BRUNNEUS*), yellow grouper (*E. AWOARA*), red pargo (*CHRYSOPHRYS MAJOR*), white seabream (*MYLIO BERDA*), yellow-finned seabream (*M. LATUS*), gold-lined seabream (*RHABDOSARGUS SARBA*), red snapper (*LUTJANUS SANGUINEUS*), Russell's snapper (*L. RUSSELLI*) and John's snapper (*L. JOHNI*). The fish are transferred with the use of scoop nets from the culture cages to carrier boats equipped with holding tanks. Fishes cultured in impoundments are harvested with seines and transported to landing points where the fish are weighed and sold. The fish are maintained live with the use of aerators and water circulating systems. A list of the common species cultured and their corresponding prices (1980 figures) are given. (AQUADOC)

- 170 Wong, S-Y.; Ong, B.; Chua, T-E. 1979. Isolation, identification of causative agent of 'red boil disease' in grouper (*EPINEPHELUS SALMOIDES*) and its possible control by vaccination. IN: Proceedings of the International Workshop on Pen and Cage Culture of Fish, Tigbauan, Iloilo, Philippines, 11-22 Feb 1979. Ottawa, International Development Research Centre; Tigbauan, Iloilo, Philippines, SEAFDEC Aquaculture Department. 15p. 2 figs; 5 tables

This report presents initial results on the isolation and identification of the causative agent of the 'red boil disease' and possible immunization of estuary groupers. This disease was observed to cause mortality to majority of the grouper population. Methods of isolation and identification of the bacteria are described. Outcome of the vaccine administered to immunize groupers is discussed. (D.V.Z.)

- 171 Wongsomnuk, S.; Parnichsuka, P.; Danayadol, Y. 1978. Experiments on nursing of grouper, *EPINEPHELUS TAUVINA* (Forsk.) with various mixed feeds. Annu.Rep.Songkhla Fish.Stn.Dep.Fish., 1978: 97-102.

Experiments on the nursing of grouper, *EPINEPHELUS TAUVINA* with various mixed feeds was conducted for 3 months. Results of the

experiments indicated higher protein requirement for smaller fish. Highest growth rate was observed in the first month using formula 4 which raised the total length by 49.56% and body weight by 220.90%. In the second month, total length and body weight increased by 23.57% and 61.67%, respectively, for those fed with formula 1 feeds. Finally, in the third month, formula 2 exhibited the highest increase in total length by 17.65% and body weight by 74.18%.  
(MODIFIED AUTHOR'S ABSTRACT)

- 172 Woo, N.Y.S. 1982. Metabolic and osmoregulatory changes in response to reduced salinities in the red grouper, EPINEPHELUS AKAARA (Temminck & Schlegel), and the black sea bream, MYLIO MACROCEPHALUS (Basilewsky). J.Exp.Mar.Biol.Ecol., 65: 139-161. 10 figs

Red groupers (EPINEPHELUS AKAARA Temminck & Schlegel) and black sea breams (MYLIO MACROCEPHALUS Basilewsky) were transferred from 30ppt into 3, 7, 12, 20, and 30ppt salinity. Fish were sampled at 0, 6, 24, 96, 168 and 336h after transfer. Serum osmolality, glucose, protein, Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>+</sup>, liver glycogen, liver protein, muscle water and haematocrit were determined. In general, transient disturbances in these variables were observed after transfer. For both species, no tissue hydration was observed upon acclimation to different salinities, whereas a progressive increase in haematocrit value was found as salinity decreased. Liver glycogen of both species, however, was higher in hypo-osmotic salinities. Serum Na<sup>+</sup> of the red groupers declined upon acclimation to 70‰ salinity but the opposite was found for the black sea breams. The results indicate that both species are extremely euryhaline, and physiological stress is unlikely to occur within the salinity regime of 7 to 30ppt. Comparatively, the black sea bream appears to be a more efficient osmoregulator. (AUTHOR'S ABSTRACT)

- 173 Woo, N.Y.S.; Wu, R.S.S. 1984. Changes in biochemical composition in the red grouper, EPINEPHELUS AKAARA (Temminck & Schlegel), and the black sea bream, MYLIO MACROCEPHALUS (Basilewsky), during hypoxic exposure. Comp.Biochem.Physiol., 77A(3): 475-482. 10 figs



Red groupers and black sea breams exposed to 4 and 2.5mg O<sub>2</sub> per liter for 1-7hr showed no increase in serum and tissue lactate concentration and only slight changes in other tissue metabolites and electrolytes. In both species subjected to 1mg O<sub>2</sub> per liter, there was marked hyperglycaemia, hyperlactaemia, hepatic glycogenolysis and elevation of hepatic lactate content, but the lactate and glycogen contents of the muscles were unaffected. Both species can obtain enough oxygen to prevent anaerobiosis at 4 to 2.5mg O<sub>2</sub> per liter and fermentation of hepatic glycogen to lactate is the principal pathway of energy production in 1mg O<sub>2</sub> per liter. In both species, serum Na<sup>+</sup>, K<sup>+</sup> and Ca<sup>2+</sup> concentrations were unchanged after exposure to 4 to 2.5mg O<sub>2</sub> per liter but all three parameters were elevated after exposure to 1mg O<sub>2</sub> per liter, suggesting that osmoregulatory failure could occur in extremely hypoxic conditions. The black sea bream, but not the red grouper, accumulated lipids in the liver in addition to lactate when exposed to all levels of hypoxia. (AUTHOR'S ABSTRACT)

- 174 Wu, R.S.S.; Woo, N.Y.S. 1983. Tolerance of hypo-osmotic salinities in thirteen species of adult marine fish: implications for estuarine fish culture. *Aquaculture*, 32: 175-181. 3 tables

Thirteen species of adult marine fish were exposed to hypo-osmotic salinities for more than 2 weeks. Twelve species survived at 10ppt, six species at 5ppt and three at 3ppt. No abnormal behavior was observed, but the water content of muscle increased in all species. Shallow-water, inshore species generally appeared to be more tolerant to changes in salinity than deep-water, offshore species. Tolerance of hypo-osmotic salinities varied within a single family or genus. For most species tested, the critical tolerance limit is about 5 to 10ppt, and above 10ppt all species survived without apparent abnormal behavior. The present results suggest that many marine fish are euryhaline than expected, and could be selected for farming in estuaries, provided the production is not reduced in fluctuating salinities. (AUTHOR'S ABSTRACT)

- 175 Wu, R.S.S.; Woo, N.Y.S. 1984. Respiratory responses and tolerance to hypoxia in two marine teleost, EPINEPHELUS AKAARA

(Temminck & Schiegel) and MYLIO  
MACROCEPHALUS (Basilewsky).  
Hydrobiologia, 119(3): 209-217. 7 figs

Respiratory responses and tolerance to hypoxia were investigated in red grouper and black sea bream. Neither species showed abnormal behavior when exposed to 2mg oxygen per liter but tolerance of both species was similar under extreme hypoxic conditions. Both species exhibited a reduction in opercular beating rate during hypoxia. The general levels of venous PO<sub>2</sub> showed direct relationship to ambient PO<sub>2</sub> and reduced after an hour exposure to various levels of hypoxia. (MODIFIED AUTHOR'S ABSTRACT)

- 176 Xu, B.; Li, J.; Zhou, H. 1985.  
Observations on the development of egg  
and larvae of red spotted grouper.  
J.Fish.China, 9(4): 369-374. 14 figs; 1  
table (Text in Chin)

Fertilized eggs of red spotted grouper, EPINEPHELUS AKAARA (Temminck et Schlegel), obtained by induced spawning were observed and studied as it developed into larvae. Eggs are spherical in shape measuring  $0.74 \pm 0.03$ mm in diameter. Yolk is colorless, transparent, with single oil globule measuring  $0.15 \pm 0.01$ mm in diameter. The larval development of red spotted grouper is found to be similar with other serranids, such as the brown spotted grouper (EPINEPHELUS TAUVINA Forskal) in Kuwait waters, white-spotted green grouper (E. AMBLYCEPHALUS Bleeker) and green grouper (E. AWOARA Temminck et Schlegel) in the East China Sea. (MODIFIED AUTHOR'S ABSTRACT)

- 177 Yang, H-C.; Chen, T-P. 1971. EPINEPHELUS  
AMBLYCEPHALUS (Bleeker). IN: Common Food  
Fishes of Taiwan. Taiwan, Joint  
Commission on Rural Reconstruction. p.52.  
1 fig (Text in Chin)

The physical morphology of EPINEPHELUS AMBLYCEPHALUS is described. Its distribution and fishing gear used for capturing this species is mentioned. (D.V.Z.)

- 178 Yeh, S-L.; Luo, W-S.; Ting, Y-Y. 1986.



Studies on the sexual conversion of grouper with hormone treatment.  
Bull.Taiwan Fish.Res.Inst., (41):  
241-258. 3 figs; 3 tables; 16 plates  
(Text in Chin)

EPINEPHELUS FARIO is an important commercial food fish in Southeast Asia. In this paper, results of the experiment on induced sex reversal of E. FARIO are presented. Maturation stages of gonads until sex reversal periods are discussed. (MODIFIED AUTHOR'S ABSTRACT)

- 179 Yen, J-L.; Yen, J-C. 1985. Cage culture of some marine economic fishes in Penghu.  
Bull.Taiwan Fish.Res.Inst., (38):  
157-165. 4 figs; 1 table (Text in Chin)

Six local economical marine species were cultured in floating cages in Penghu Bay. The preliminary results are: 1)red sea bream P. MAJOR grew from 89.52g to 1096.12g in 15 months with survival rate of 72.90%, yellow fin porgy A. LATUS grew from 52.95g to 308.21g in 16 months and russel's snapper from 176.36g to 358.60g in 10 months; 2)grouper (EPINEPHELUS sp.) grew from 61.5g to 835.80g in 10 months, the survival rate was 72.90%, leopard grouper P. LEOPARDUS cultured from 166.67g to 757.66g in 16 months with survival rate of 58.00%; 3)rudder fish G. PUNCTATA which is vegetation eater grew from 33.58g to 184.00g in 16 months, the survival rate was 38.38%. (AUTHOR'S ABSTRACT)

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