

## Fish Fauna of the Jordanian Coast, Gulf of Aqaba, Red Sea

MAROOF KHALAF

*Marine Science Station, University of Jordan-  
Yarmouk University, Jordan  
E-mail: m.khalaf@ju.edu.jo*

**ABSTRACT.** This paper presents a fish inventory of the Jordanian Gulf of Aqaba. Fish sampling was conducted by means of different fishing gears, monitoring of local fish market and visual census technique. A total of 507 fish species belonging to 109 families with an average of 4.7 species per family; 18 Chondrichthyes and 489 Ostichthyes. The largest families are as follows (number of species in parentheses): Labridae (51), Pomacentridae (29), Serranidae (25), Apogonidae and Blenniidae (24, each), Gobiidae (21), Carangidae (17) and Syngnathidae (16). Collectively these eight families comprise 40.8% of the fish fauna. The great majority are from benthic habitat (82.8%) and the remaining are pelagic fish. About 30.6% of the fish species feed on invertebrates and fish while 24.8% feed on invertebrates only. The endemic species present 12.8% of the recorded species in the Gulf of Aqaba, and this is slightly less than the percentage of endemic species in the Red Sea and Gulf of Aden, 13.7%. On the Jordanian part of the Gulf of Aqaba seventy six fish species are reported for the first time. Out of them *Gymnothorax monochrous*, *Myripristis xanthacra*, *Corythoichthys haematopterus*, *Syngnathus macrophthalmus*, *Istiblennius flaviumbrinus*, *Enneapterygius destai* and *Grammatorycnus bilineatus* species are first confirmed report for the first time in the entire Gulf. *Novaculichthys macrolepidotus* is extremely rare species and only observed among the sea grass meadow at Al-Mamlah Bay in less than 2 m deep and this species needs special conservation measures. *Sparus auratus*, *Dicentrarchus labrax*, and *Tilapia* sp. were introduced to the Gulf of Aqaba through mariculture projects in the surrounding area.

### Introduction

The Jordanian coastline extends south for about 27 km from the most north-eastern tip of the Gulf of Aqaba. The northern part of the coast is characterized by sandy flats, which extend south for about 5 km, after that the fringing coral

reefs start and extend further south to the border of Saudi Arabia. Coral reef habitat is considered as one of the most complex marine ecosystems in which fish communities reach their highest degree of diversity (Harmelin-Vivien, 1989); many of the reef fishes depend upon coral reef for food as well as shelter (Sutton, 1985). However, coral reef habitats are discontinued by about 3 km of sea grass meadows at the Big Bay (Al-Mamlah Bay) 15 km far from Aqaba town, where the largest sea grass meadow is located (UNEP/IUCN, 1988). The sea grass meadows at the Big Bay (Al-Mamlah) form the highest sea grass biomass, ( $\text{g/m}^3$ ), in comparison with six sea grass meadows (Wahbeh, 1981). Sea grass beds serve as important nursery grounds for the fish larvae. It can settle down in the sea grass and find protection against predators until they are grown up. As juveniles or sub adults some species migrate to the adjacent coral reef habitat. In this respect, sea grass beds play an important role as “a waiting room” for recruiting of the coral reef fish fauna (Parrish, 1989). Deep-sea habitat may be found in some places just a few hundred meters from the seashore.

The Gulf itself extends for about 180 km to the shallow sill (250 m deep) at the straits of Tiran, which separates it from the Red Sea and prevents free water exchange between the two bodies of water. Hence, the Gulf is a semi-enclosed water basin attached to the semi-enclosed Red Sea (Hulings, 1989). It is a part of the Syrian rift system with a width range of 5-25 km, average about 17 km (cited in Badran and Foster, 1998). The maximum depth of the Gulf is 1830 m. It is hyper saline (40.3-41.6 psu), with high surface temperatures (20.5-27.3°C) and represents an almost constant temperature throughout the water column (Reiss and Hottinger, 1984). The waters within this northern portion is characterized by its low productivity and the absence of any fresh water feed from inland sources except rare and very occasional fresh floods that come through wadis (small valleys) between the mountains. Klausewitz (1989) indicated that the bathyal ichthyofauna of the Gulf of Aqaba differs significantly from that of the main branch of the Red Sea, since deep-sea species could not pass the Sill of Tiran.

The Red Sea ichthyofauna is quite well known compared to other parts of the tropical Indo-Pacific Ocean. Over 1248 fish species have been recorded from this almost land looked water body (Goren and Dor, 1994). Ichthyological research in the Red Sea dates back more than 200 years to collection and descriptions of fishes by Peter Forsskål (Klausewitz, 1964, Nielsen, 1993).

Jordan's ichthyology research program started in late seventies, with Post & Svoboda (1980) reporting 6 new records of deep sea fishes from material washed up on the Jordanian shore. The fish fauna of the Jordanian coasts of the Gulf of Aqaba was studied by: Ajiad and Al-Absy (1986), Ajiad (1987), Ajiad and Mahasneh (1987). New species *Thyrsitoides jordanus* have been described by (Ajiad *et al.*, 1987). Wahbeh and Ajiad (1987) conducted a survey of fishes

and reported 105 fish species with two newly reported species from the Jordanian coast. Al-Absy (1988) made a review of the goatfish's family, Mullidae. Krupp (1989) studied the distributional pattern of three species of Anthias fishes at the coral reef. Schumacher *et al.* (1989) described the fish *Pseudanthias heemstrai* as a new species in the Red Sea; Krupp & Paulus (1991, b) reported the new records of an anthias fish *Pseudanthias fasciatus*; Paulus (1992) described *Syngnathus safina* as a new species and *S. macrophthalmus* as a new record along the Jordanian coast; Paulus (1993) indicated the presence of 12 species in the family, Syngnathidae. Khalaf *et al.*, 1996 added 4 new records *i.e.* *Bodianus leucostictus*, *Thunnus alalunga*, *Myripristis chryseres* and *Pterygotrigla hemisticta*.

Khalaf & Disi (1997) developed a comprehensive report, and listed 348 fish species based on specimens deposited at the Marine Science Station, Aqaba. Froukh (2001) worked on taxonomy and ecology of some fish larvae from the Gulf of Aqaba. In addition Randall & Khalaf (2003) reported the labrid fish *Oxycheilinus orientalis*, the sea grass inhabitant as a new record to the Red Sea. Also, Khalaf and Krupp (2003) recorded the presence of *Foa brachygramma* and *Carnax heberi* from the Red Sea. Khalaf (in prep.) indicated the presence of 5 new records to the Gulf of Aqaba. Based on mitochondrial DNA sequences Kochzius *et al.*, (2003) studied the molecular biology and biogeography of lionfish's (Scorpaenidae, Pteroinae) in Aqaba. Khalaf & Zajonz (submitted) revealed the occurrence of 81 species of fish in deep-waters of the Jordanian coast and reported fifteen additional records of deep-dwelling fishes. They recorded *Liopropoma lunulatum* as a new record for the first time from the Red Sea.

Various aspects of ecological and biological studies were conducted on the fishes of Aqaba, such as: Quantitative distribution of butterflyfishes were carried by (Bouchon-Navaro, 1980); trophic relationships among butterflyfishes (Harmelin-Vivien & Bouchon, 1981); correlation of butterflyfishes and coral community by (Bouchon-Navaro & Bouchon, 1989); the distributional patterns of herbivorous reef fishes for the families Acanthuridae, Scaridae & Siganidae was studied by (Bouchon-Navaro and Harmelin-Vivien, 1981); Krupp and Paulus (1991a) studied the territoriality and courtship behavior in the coral reef fish *Pseudanthias heemstrai*. The community structure and biogeography of shore fishes in the Jordanian Gulf of Aqaba was studied by Khalaf & Kochzius (2002a) and in (2002b).

Wahbeh and Ajiad (1985) conducted biological studies on food and feeding habits of the goatfish *Parupeneus barabarinus*. The reproductive biology and growth for three species of fusilier were studied by Wahbeh (1992). Kanan (1998) studied the fish ecology, food and feeding habits, reproduction and growth in six planktivorous fish *Priacanthus hamrur*, *Apogon aureus*, *Sargo-*

*centron diadema*, *Dascyllus trimaculatus*, *Chromis pelloura* and *Teixeirichthys jordani* in the coral reef of the Gulf of Aqaba. Fishing gears, potential problems, fishing trips, and some of statistical data on fish catch were reported by (Khalaf, 2000). Fishery description including questionnaires prepared by the Marine Science Station, a survey team conducted a survey aiming to focus on social and economic aspects of the fishing community (Zibdeh *et al.*, 2003).

Marshall, 1952; Ben-Tuvia & Trewavas, 1986/87; Steintz & Ben-Tuvia, 1995; Tortonese, 1968; Randall, 1994; Baranes and Golani, 1993, they reported on the fish fauna from the southern and western parts of the Gulf of Aqaba. Zoogeographical studies of the Red Sea were carried out by (Goren, 1973; Klauswitz, 1989). Bio-sociological and ecological studies on certain families such as damselfishes (Pomacentridae) (Fishelson *et al.*, 1974; Fricke, 1977), goby (Gobiidae) (Goren 1984 a&b; 1989 & 1992), and Butterflyfishes (Chaetodontidae) (Roberts *et al.*, 1992; Abdallah and Khalaf, submitted). General community structure of the Red Sea shore fishes was reported by (Ben-Tuvia *et al.*, 1983; Rilov & Benayahu, 2000). Other investigations deal with fish communities on artificial reefs along the northern part of the Gulf of Aqaba were reported by (Rilov & Benayahu, 1998; Golani & Diamant, 1999), short species lists for certain areas were recorded by (Clark *et al.*, 1968; Tortonese, 1983).

The checklist in the present study is designed to provide the list of all species that have been collected and deposited at Marine Science Station, Aqaba, photographed both newly captured or that live in their natural habitat, observed in fishermen catches. Also, the fishes deposited in Senckenberg Museum Frankfurt (SMF) collection as well as fishes reported by different authors from the Jordanian coast.

The purpose of this study is to present an updated ichthyological inventory showing high diversity of the fish fauna, with more details on fish habitat, feeding guilds, endemism, and migratory species. This is the first thorough and comprehensive study about the fish fauna along the Jordanian coast of the Gulf of Aqaba.

### Materials and Methods

Fish collection was started at the Marine Science Station (MSSA) in early eighties by Wahbeh and Ajiad (1987). More intensive collection has been conducted by the author over the last 10 years using different methods (*i.e.*) hand-net, gill net, seine net, traps, hooks and lines, quinaldine. Immediately after capture, the fishes were photographed, and meristic counts and morphometric measurement were taken. Additional specimens were obtained from local fishermen during the period 1995-2002. One of the major contributions to the available data in this investigation was gained by the author in a long term monitor-

ing of the shore fish communities for the last seven years. Fish were surveyed by the visual census technique-using SCUBA as described in English *et al.* (1994). Fish catch was also monitored at local fish markets during 1998-2000.

The German team cooperated with MSSA in several aspects of marine studies concerning biological, ecological and systematic studies. They had a massive fish collection deposited in SMF. This collection was mainly collected during 1989-1991, and was used by the author. Also, the author relied on the pertinent literature on fishes of Gulf of Aqua. In those fishes inhabiting more than one habitat, only the most common one is selected for the reported species.

The following references were used for fish identification, trophic groups and habitat occupation: Hilt & Strasbourg (1960); Fishelson (1971); Randall (1983); Do (1984); Filcher & Bianca (1984); Kaftan & Ebersole (1984); Wheeler (1985); Smith & Heemstra (1986); Myers (1991); Sibelius (1993); Randall (1995); Gore & Do (1994); Harmelin-Vivian (1997); Half & Dice (1997); Oman *et al.* (1997); Allen *et al.* (1998); Rico & Benayahu (2000); Golem *et al.* (2002); Half & Kochzius (2002a) and Free & Patly (2000).

The systematic arrangement used in this inventory followed Eschmeyer (1990). The genera and species are arranged in alphabetical order. The developed annotated list (Appendix-1) represents all fishes known from Jordanian Gulf of Aqua. The scientific name of the fish and the taxonomic authority are given together with some notes on their habitat, food guilds, endemic, and Red Sea immigrant fish to the Mediterranean Sea and vice-versa. Species listed as Cf. are believed to be undescribed, and need further taxonomic elaboration.

## Results

### *Fish Community Indices*

The total numbers of species are eighteen in Chondrichthyes and 489 in Osteichthyes or 507 in total belonging to 109 families, an average 4.7 species per family. The distribution of species among families was found that 77 fish families are represented by only 1-3 species, 14 families are represented by more than 10 species. In terms of species richness per family the ichthyofauna showed the following ranking (given as n number of species in the family, n% of the total fish fauna): Wrasse abridge (51, 10.1), Pomacentridae (29, 5.7), Seranidae (25, 4.9), Apogonidae and Blenniidae (24, 4.7 each), Gobbiidae (21, 4.1 each), Carangidae (17, 3.4) and Syngnathidae (16, 3.2). These 8 families account for 40.8% of all species. Seventy six fish species are indicated with (\*) in the inventory represents a new reports to the Jordanian coast, including *Gymnothorax monochromes*, *Myripristis xanthurus*, *Corythoichthys haematopterus*, *Syngnathus macrophthalmus*, *Istiblennius flaviumbrinus*, *Enneapterygius decay*

and *Grammatorycnus bilineatus* are the first confirmed report from the Gulf of Aqua (Appendix I).

### **Habitat Occupation**

Ecological analysis of the Jordanian marine fishes indicates that majority of the species (82.8%) inhabit benthic habitat while the rest are true pelagic fish. Among benthic habitat, 51.1% of the fish species inhabit coral and boulders, 11.7% inhabits sandy bottoms, 11.1% are deep benches, 8.3% live in sea grass meadows, and 0.6% are bathydemersal species. Whereas, among, pelagic habitat 9.6% of the fish species are living in open waters, 3.0% are associated with reef, 2.6% are benthopelagic, 1.7% live in shallow water, and only 0.4% are bathypelagic species (Appendix I).

The most abundant shallow water pelagic species are the silver side fish *Atherinomorous lacunosus*, and the clued fish, *Spratelloides gracias*. The most common inhabitant of deep sea fishes are *Ago amanuensis*, *Rhinobatos punctifer*, *Mureanesox cereus*, *Carangoides equal*, *Paracaesio sordid*, *Polysteganus coeruleopunctatus*, *Argyrops spicier*, *Upends davidaromi*, *Trichiurus lectures* and *Thyrsitoides Marley*.

### **Feeding Behaviour**

An analysis of the feeding behaviour of the Jordanian marine fishes indicates that 30.6% of the species feed on fish and invertebrates, while 24.8% feed on invertebrates, the planktivorous fish constitute only 15.9%, 15.0% are omnivores, 7.4% are herbivorous, 4.5% piscivore, 1.6% corallivore and only 0.5% detritivore feeders.

### **Commercially Important Fish Species**

The family Scombridae includes the most important commercial species in Aqaba. It represents more than 70% of the Jordanian marine catch, specially the most abundant migratory species *Katsuwonus pelamis* and *Euthynnus affinis*. Other important commercial fish species are *Decapterus macarellus*, *Decapterus macrosoma*, *Caesio lunaris*, *Caesio suevica* and *Caesio varilineata*.

### **Discussion**

In comparison with the number of fish species collected from the Red Sea 1,248 species (Goren & Dor, 1994) which extends for 1,932 km, this study indicates that the Jordanian coast with only 27 km at the Gulf of Aqaba, hosts 507 fish species which accounts for about 40.6% of the Red Sea fishes. In compari-

son Golani *et al.* (2002) reported that the Mediterranean Sea hosts 650 fish species, and Carpenter *et al.* (1997) published the most comprehensive account of fishes of the Arabian Gulf, reporting 535 species from the Gulf. This clearly indicates that the Jordanian coast is characterized by a high fish diversity, which is attributed to the diversity of habitats existing along the coast such as: coral reef, seagrass meadows, sandy habitats and deep sea fish fauna. Roberts and Ormond (1987) indicated that the species richness is also positively correlated with habitat diversity. Also, Sano *et al.* (1984); reported that different habitats in the reef areas supported different fish assemblages. Habitat complexity provides refuges and barriers that fragment the area and resulting in more heterogeneous assemblages (Sebens, 1991).

Among benthic habitat, more than 50.0% of the fish species inhabits coral and boulders, 11.7% inhabits sandy bottoms, 11.1% are deep benthos, and only 8.3% live in sea grass meadows. The same trend was found by Goren and Dor (1994) for the Red Sea fishes. Khalaf and Kochzius (2002a) found that about 48% of the 202 investigated fish feed on invertebrates and fish and only 41% are planktivorous feeder. Based on personal observations and on the running monitoring programme carried by Marine Science Station, and on the publication of Khalaf and Kochzius (2002a) it can be concluded that: The most abundant coral reef species are *Pseudanthias squamipinnis* (24.1%), *Pomacentrus trichourus* (16.1%), *Paracheilinus octotaenia* (6.4%), *Neopomacentrus miryae* (6.2%), *Chromis dimidiata* (5.6%), *Dascyllus marginatus* (5.0%), *Chromis viridis* (2.7%) and *Dascyllus aruanus* (2.3). In terms of frequency of appearance, the most common species are *Pomacentrus trichourus* (87.3%), *Amphiprion bicinctus* (79.7%), *Pseudanthias squamipinnis* (79.7%), as well as *Chaetodon paucifasciatus*, *Chromis dimidiata*, and *Dascyllus marginatus* (all 72.9%) and *Thalassoma rueppellii* (65.3%).

The scarids, *Leptoscarus vaigensis*, *Calatomus viridescens*; labrids, *Oxycheilinus orientalis*, *Cirrhilabrus rubriventralis*, *Pteragogus pelycus*, *Coris caudimacula*; mullids, *Parupeneus macronema*; and the siganids *Siganus luridus*, *Siganus rivulatus* are among the most common sea grass inhabitants. *Novaculichthys macrolepidotus* is extremely rare species and only observed among the sea grass meadow at Al-Mamlah Bay in less than 2 m deep and this species needs special conservation measures. *Torquigener flavimaculatus* is the common inhabitant of sandy bottoms as well as sea grass meadows, whereas the *Chromis pelloura* inhabits sandy bottoms.

The endemic species represents 12.8% of the recorded species in this study and this is slightly less than (13.7%) percentage in the Red Sea. Those sixty five endemic species belong to 31 families. Thirty of the reported species had migrated from the Red Sea to the Mediterranean through the Suez Canal. How-

ever, only two species migrated from the Mediterranean and reached Aqaba. Three of the collected species, *Sparus auratus*, *Dicentrarchus labrax*, and *Tilapia* sp. were introduced and escaped to the Gulf of Aqaba through aquaculture projects in the surrounding area. One species, *Sparus auratus* had established its population in the northern sandy beach.

Two families, Lutjanidae, and Haemulidae were not common in the Jordanian coast in comparison with their abundance, frequency of appearance and number of species as in the central and southern Red Sea. It is very rare to see a member of these families while diving in Aqaba. Reef structure in the Jordanian coast of Aqaba Gulf is smaller in size than central and southern Red Sea. Accordingly, the existing habitat would not provide the suitable shelter for them. Moreover, the photic zone in Aqaba is confined to a narrow zone, which would affect the productivity in a negative term for large commercial fish.

This study reports for the first time seventy six fish species which represent new records to the Jordanian coast of the Gulf of Aqaba, including: *Gymnothorax monochrous*, *Myripristis xanthacra*, *Corythoichthys haematopterus*, *Syngnathus macrophthalmus*, *Istiblennius flaviumbrinus*, *Enneapterygius destai* and *Grammatorycnus bilineatus* as the first confirmed report from the Gulf of Aqaba representing a new extension.

Further studies still needed, particularly from deeper waters and for the small bottom-dwelling fishes belonging to the families' Gobiidae and Blennidae.

**Acknowledgements.** I would like to express my thanks to the institutions, foundations and to the individuals that have made my work possible: Director and staff of the Marine Science Station, University of Jordan-Yarmouk University, Aqaba, Jordan in particular O. Al-Momani, E. Eid; Dr. Bilal Al-Basheer from Aqaba Special Economic Zone Authority; Senckenberg Research Institute, Office of Ocean and Coastal Resource Management (OCRM/NOS, NOAA) and USAID. F. Krupp, A. Disi, and M. Crospy gave valuable comments.

### References

- Abdallah, M. and Khalaf, M.A.** (Submitted) *Community Structure of Butterflyfishes in the Red Sea and Gulf of Aden*, Aquatic Conservation.
- Ajiad, A.M.** (1987) First record of *Aulacocephalus temmincki* Bleeker, 1857, from the Red Sea and four rare species from Aqaba, Jordan, *Cybium*, **11**(1): 104-105.
- Ajiad, A.M. and Al- Absy, A.H.** (1986) First record of *Lycodontis elegans* (Pisces: Muraenidae) from the Red Sea, *Cybium*, **10**(3): 297-298.
- Ajiad, A.M. and Mahasneh, D.M.** (1987) Redescription of *Ariomma brevimanus* (Klunzinger, 1884) a rare stomateoid from the Gulf of Aqaba (Red Sea), *Cybium*, **10**(2): 135-142.
- Ajiad, A.M., Jafari, R. and Mahasneh, D.** (1987) *Thyrsitoides jordanus* (Teleosti: Gempylidae): A new species from the Gulf of Aqaba (Red Sea), *J. Mar. Biol. Ass. India*, **24**(1-2): 12-14.



- Al-Absy, A.H.** (1988) Review of the goatfishes (Pisces: Perciformes: Mullidae) in the Gulf of Aqaba, Red Sea, *Fauna of Saudi Arabia*, **9**: 152-168.
- Allen G.R., Steene R. and Allen, M.** (1998) *Guide to Angelfishes and Butterflyfishes*, Odyssey Press.
- Badran, M.I. and Foster, P.** (1998) Environmental quality of the Jordanian coastal waters of the Gulf of Aqaba, Red Sea, *Aquatic Ecosystem Health and Management*, **1**: 83-97.
- Baranes, A. and Golani, D.** (1993) An annotated list on deep-sea fishes collected in the northern Red Sea, Gulf of Aqaba, *Israel J. Zool.*, **39**: 299-336.
- Ben-Tuvia, A. and Trewavas, E.** (1986/1987) *Atrobucca geniae*, a new species of sciaenid fish from the Gulf of Elat (Gulf of Aqaba), Red Sea, *Israel J. Zool.*, **34**(1-2): 15-21.
- Ben-Tuvia, A., Diamant, A., Baranes, A. and Golani, D.** (1983) Analysis of a coral reef fish community in shallow-waters of Nuweiba, Gulf of Aqaba, Red Sea, *Bull Inst Oceanogr Fish*, **9**: 193-206.
- Bouchon-Navaro, Y.** (1980) Quantitative distribution of the Chaetodontidae on a fringing reef of the Jordanian coast (Gulf of Aqaba, Red Sea), *Mar. Biol.*, **63**: 79-86.
- Bouchon-Navaro, Y. and Harmelin-Vivien, M.L.** (1981) Quantitative distribution of herbivorous fishes in the Gulf of Aqaba (Red Sea), *Mar. Biol.*, **63**: 79-86.
- Bouchon-Navaro, Y. and Bouchon, C.** (1989) Correlations between chaetodontid fishes and coral communities of the Gulf of Aqaba (Red Sea), *Environ. Biol. Fish.*, **25**(1-3): 47-60.
- Clark, E., Ben-Tuvia, A. and Steintz, H.** (1968) Observations on a coastal fish community, dah-lak Archipelago, Red Sea, *Sea. Fish. Res. Stn. Haifa Bull.*, **49**: 15-31.
- Carpenter, K., Krupp, F., Jones, D.J and Zajonz, U.** (1997) *FAO Species Identification Guide for Fishery Purposes. The Living Marine Resources of Kuwait, Eastern Saudi Arabia, Bahrain, Qatar and the United Arab Emirates*, 311 p. FAO, Rome.
- Debelius H.** (1993) *Indian Ocean Tropical Fish Guide*, Aquaprint Verlags GmbH, Germany, 298 p.
- Dor, M.** (1984) *Checklist of the Fishes of the Red Sea*, Jerusalem, 437 p.
- English, C., Wilkinson, C. and Baker, V. (eds).** (1994) *Survey Manual for Tropical Marine Resources*, Australian Institute of Marine Science, Townsville, 368 p.
- Eschmeyer, W.N.** (1990) *Catalog of the Genera of Recent Fishes*, Spec. Publ. California Academy of Sciences, San Francisco, 695 p.
- Fischer, W. and Bianchi, G. (eds.).** (1984) *FAO Species Identification Sheets for Fishery Purposes*, Western Indian Ocean. Rome, 5 vols.
- Fishelson, L.** (1971) Ecology and distribution of the benthic fauna in the shallow waters of the Red Sea, *Ma. Biol.*, **10**: 113-133.
- Fishelson, L., Popper, D. and Avidor, A.** (1974) Biosociology and ecology of Pomacentrid fishes around the Sinai Peninsula (northern Red Sea), *J. Fish. Biol.*, **6**: 119-133.
- Fricke, H.W.** (1977) Community structure, social organization and ecological requirements of coral reef fishes (Pomacentridae), *Helgol Wissenschaftliche Meeresunters*, **30**: 412-426.
- Froese, R. and Pauly, D., Editors.** (2000) *FishBase 2000: Concepts, Design and Data Sources*, ICLARM, Los Baños, Laguna, Philippines, 344 p.
- Froukh, F.** (2001) *Studies on Taxonomy and Ecology of Some Fish Larvae from the Gulf of Aqaba*, Faculty of Science, University of Jordan. Master thesis, p. 128.
- Golani, D. and Diamant, A.** (1999) Fish colonization of an artificial reef in the Gulf of Eilat, Northern Red Sea, *Environ. Biol. Fish.*, **54**: 275-282.
- Golani, D., Orsi-Relini, L., Massuti, E. and Qugnard, J.** (2002) *CIEM Atlas of Exotic Species in the Mediterranean*, CIESM. Monaco, p. 254.
- Goren, M.** (1973) *Zoogeography of the Fishes of the Indian Ocean. The Biology of the Indian Ocean*, Springer-Verlag, pp: 451-464.

- Goren, M.** (1984a) A new species of *Oplopomps* Smith 1959 from Elat, northern Red Sea (Pisces: Gobiidae), *Senckenberg. Biol.*, **65**(1-2): 19-23.
- Goren, M.** (1984b) Three new species and two new records for the Red Sea of invertebrate associated gobies (gobiidae, Pisces), *Cybium*, **8**(1): 71-82.
- Goren, M.** (1989) *Oplopomus reichei* (Pisces: Gobiidae) new record from the Red Sea, *Israel J. Zool.*, **34**: 149-153.
- Goren, M.** (1992) *Obliquogobius turkayi*, a new species of gobiid fish from the deep water of the central Red Sea (Pisces: Gobiidae). *Senckenberg, Marit.*, **22**(3-6): 265-270.
- Goren, M. and Dor, M.** (1994) *An Update Checklist of the Fishes of the Red Sea*, CLOFERS II. - Jerusalem, 120 p.
- Harmelin-Vivien, M.L.** (1989) Reef fish community structure: an Indo-Pacific comparison, In: Harmelin-Vivien ML, Bourlière F (eds) *Vertebrates in Complex Tropical Systems*, Springer, Berlin Heidelberg New York, pp. 21-60.
- Harmelin-Vivien, M.L.** (1997) *Ichthyofauna des Recifs Corallines de Tulear (Madagascar): Ecologie et Relations Trophiques*, Sc. D. Thesis, University of Marseille, 165 p.
- Harmelin-Vivien, M.L. and Bouchon-Navaro, Y.** (1981) Trophic relationships among chaetodontid fishes in the Gulf of Aqaba (Red Sea), *Proc. Int. Coral Reef Symp.*, No. **42**: 537-544.
- Hiatt, R.W. and Strasburg, D.W.** (1960) Ecological relationship of the fish fauna of the Marshall Island, *Ecol. Monog.*, **30**: 65-127.
- Hulings, N.C.** (1989) *A Review of Marine Science Research in the Gulf of Aqaba*, The University of Jordan Press, Amman, Jordan, 267 p.
- Kanan, N.M.** (1998) *Studies on Planktivorous Fish Ecology in Coral Reef of the Gulf of the Gulf of Aqaba*. Master Thesis, p. 119.
- Kaufman, L.S. and Ebersole, J.P.** (1984) Microtopography and the organization of two assemblages of coral reef fishes in the West Indies, *J. Exp. Mar. Biol. Ecol.*, **78**: 253-268.
- Khalaf, M.A.** (2000) *Fishery Statistical Reports of Jordan*, Submitted to PERSGA office, Jeddah (Report).
- Khalaf, M.A.** (submitted) Five additional records of fishes to the Gulf of Aqaba, including *Mola mola* (Forsskål, 1775), a new record for the Red Sea, *Zoology in the Middle East*.
- Khalaf, M.A. and Krupp, F.** (2003) Two new records of fishes from the Red Sea, *Zoology in the Middle East* **30**: 55-59.
- Khalaf, M.A., Disi, A.M. and Krupp, F.** (1996) Four new records of fishes from the Red Sea, *Fauna of Saudi Arabia*, **15**: 402-406.
- Khalaf, M.A. and Disi, A.M.** (1997) *Fishes of the Gulf of Aqaba*, Marine Science Station. No. **8**, p. 252.
- Khalaf, M.A. and Kochzius, M.** (2002a) Community structure and biogeography of shore fishes in the Gulf of Aqaba, Red Sea, *Helgol. Mar. Res.*, **55**: 252-284.
- Khalaf, M.A. and Kochzius, M.** (2002b) Changes in trophic community structure of shore fishes at an industrial site in the Gulf of Aqaba, Red Sea, *Mar. Ecol. Prog. Ser.*, **10**: 239-250.
- Khalaf, M.A. and Zajonz, U.** (submitted) Fifteen additional records of deep-dwelling fishes from the Gulf of Aqaba, including *Liopropoma lunulatum* (Guichenot, 1863) new record for the Red Sea. *Senckenbergiana marit.*
- Klausewitz, W.** (1964) Die Erforschung der Ichthyofauna des Roten Meers. In Klunzinger CB (1870, reprint) *Synopsis der Fische des Rothen Meers*. J. Cramer, Weinheim, p. V-XXXVI.
- Klausewitz, W.** (1989) Evolutionary history and zoogeography of the Red Sea ichthyofauna, *Fauna of Saudi Arabia*, **10**: 310-337.
- Krupp, F.** (1989) Beobachtungen an Fahnenbarschen im Roten Meer, *Natur. Und. Museum*, **119** (8): 262-266.

- Krupp, F. and Paulus, T.** (1991a) Territoriality and courtship in the coral-reef fish *Pseudanthias heemstrai* (Performes: Serranidae), *Revue fr. Aquariol.*, **18**(2): 43-46.
- Krupp, F. and Paulus, T.** (1991b) First record of the coral-reef fish *Pseudanthias fasciatus* (komahara, 1954) from the Red Sea (Perciformes: Serranidae) *Fauna of Saudi Arabia*, **12**: 388-392.
- Kochzius, M., Soller, R., Khalaf, M.A. and Blohm, D.** (2003) Molecular phylogeny of the lionfishes genera *Dendrochirus* and *Pterois* (Scorpaenidae, Pteroinae) based on mitochondrial DNA sequences, *Mol. Phylo-genet. Evol.*, **28**: 396-403.
- Marshall, N.B.** (1952) The 'Manihine Expedition to the Gulf of Aqaba 1948-1949'. IX. Fishes, *Bull. Brit. Mus. (Nat. Hist.), Zool.*, **1**(8): 221-252.
- Myers, R.F.** (1991) *Micronesian Reef Fishes: A Practical Guide to the Identification of the In-shore Marine Fishes of the Tropical Central and Western Pacific*, Coral Graphica, USA, 298 p.
- Nielsen, J.G.** (1993) Peter Forsskål – a pioneer in Red Sea ichthyology, *Israel J. Zool.*, **39**: 283-286.
- Öhman, M.C., Rajasuriya A. and Ólafsson, E.** (1997) Reef fish assemblages in north-west Sri Lanka: distribution patterns and influences of fishing practices, *Env. Biol. Fish.*, **49**: 54-61.
- Parrish, J.D.** (1989) Fish communities of interacting shallow-water habitats in tropical oceanic regions, *Mar. Ecol. Prog. Ser.*, **58**: 143-160.
- Paulus, T.** (1992) *Syngnathus safina* n. sp. And first record of *S. macrophthalmus* Duncker, 1915 from the Gulf of Aqaba, Red Sea (Pisces: Osteichthyes: Syngnathidae), *Senckenbergiana boil.*, **72**(1-3): 27-33.
- Paulus, T.** (1993) *Morphologie und Ökologie Syntop Lebender. Syngnathidae (Pisces: Teleosti) de Roten Meers*, Ph.D. thesis, Universität Mainz., Germany, 160 p.
- Post, von, A. and Svoboda, A.** (1980) Strandfunde mesopelgischer fische aus dem Golf von Akaba, *Archiv. Fuer Fischereiwissenschaft*, **30**(2-3): 137-143.
- Randall, J.E.** (1983) *Red Sea reef fishes*. London; Immel Publishing.
- Randall, J.E.** (1994) Twenty-two records of fishes from the Red Sea, *Fauna of Saudi Arabia*, **14**: 259-275.
- Randall, J.E.** (1995) *The Complete Divers' & Fishermen's Guide to Coastal Fishes of Oman*, Crawford House Publishing Pty Ltd. Australia, 439 p.
- Randall, J.E. and Khalaf, M.A.** (2003) Redescription of the Labrid fish *Oxycheilinus orientalis* (Günther), a Senior Synonym of *O. rhodochrous* (Günther), and first record from the Red Sea, *Zool. Stud.*, **42**(1): 135-139.
- Rilov, G. and Benyahu, Y.** (1998) Vertical artificial structures as an alternative habitat for coral reef fishes in disturbed areas, *Mar Environ. Res.*, **45**: 431-451.
- Rilov, G. and Benyahu, Y.** (2000) Fish assemblages on natural versus vertical artificial reefs: the rehabilitation perspective, *Mar. Biol.*, **136**: 931-942.
- Reiss, Z. and Hottinger, L.** (1984) *The Gulf of Aqaba. Ecological micropaleontology*, Ecological study 50. Springer-Verlag, Berlin, 354 p.
- Roberts, C.M. and Ormond, R.F.G.** (1987) Habitat complexity and coral reef diversity and abundance on Red Sea fringing reefs, *Mar. Ecol. Prog. Ser.*, **41**: 1-8.
- Roberts C.M., Shepherd, A.R.D. and Ormond, R.F.G.** (1992) Large scale variation in assemblages structure of Red Sea butterflyfishes and angelfishes, *J. Biogeogr.*, **19**: 239-250.
- Sano, M., Shimizo, M. and Nose, Y.** (1984) Changes in structure of coral reef fish communities by destruction of hermatypic corals: Observational and experimental views, *Pac. Sci.*, **38** (1): 51-79.

- Schumacher, H., Krupp, F. and Randall, J.E.** (1989) *Pseudanthias heemstrai*, a new species of anthiine fish (Perciformes: Serranidae) from the Gulf of Aqaba, Red Sea, *Fauna of Saudi Arabia*, **10**: 338-346.
- Sebens, K.P.** (1991) Habitat structure and community dynamics in marine benthic systems. In: Bell, S.S., McCoy, E.D., Mushinsky, H.R. (eds.), *Habitat Structure: The Physical Arrangement of Objects in Space*, Chapman and Hall, New York, pp: 211-234.
- Smith, M.M. and Heemstra, P.C. (eds.)**. (1986) *Smiths' Sea Fishes*. Berlin; Springer-Verlag, 1047.
- Steinitz, H. and Ben-Tuvia, A.** (1995) Fishes from Eylath (Gulf of Aqaba), Red Sea. Second report, *Sea. Fish. Res. Sta. Haifa Bull.*, **11**: 3-15.
- Sutton, M.** (1985) Patterns of spacing in a coral reef fish in two habitats on the Great Barrier Reef, *Anim. Behav.*, **33**: 1322-1337.
- Torontese E.** (1968) Fishes from Eilat (Red Sea), *Sea Fish. Res. Haifa.*, **51**: 6-30.
- Tortonese, E.** (1983) List of fishes observed near Jeddah (Saudi Arabia), *J. Fac. Mar. Sci. Jeddah* **3**: 105-110.
- UNEP/IUCN.** (1988) *Coral Reefs of the World*, UNEP Regional Seas Directories and Bibliographies. IUCN, Gland, Switzerland and Cambridge, UK/UNEP, Nairobi, Kenya.
- Wahbeh, M.I.** (1981) Distribution, biomass, biometry and some associated fauna of the seagrass community in the Jordanian Gulf of Aqaba, *Proc 4th Int Coral Reef Symp.*, **2**: 453-459.
- Wahbeh, M.I.** (1992) Some aspects of reproduction and growth of three species of fusilier (Pisces: Caesionidae) from Aqaba, Red Sea, *Jordan, Dirasat*, **19B**: 157-172.
- Wahbeh, M.I. and Ajiad, A.** (1985) The food and feeding habits of the goatfish, *Parupeneus barberinus* (Lacépède), from Aqaba, *Jordan. J. Fish Biol.*, **27**: 147-154.
- Wahbeh, M.I. and Ajiad, A.** (1987) Some fishes from the Jordanian coast of the Gulf of Aqaba, *Dirasat*, **1**: 137-154.
- Wheeler, A.** (1985) *The World Encyclopedia of Fishes*, London, 368 p, 501 Pls.
- Zibdeh, M., Khalaf, M.A. and Al-Najjar, T.** (2003) *Environment, Social and Cultural Implications of Aqaba Fishers and Fishing Industry in Aqaba*, Report to UNESCO office Amman.

## Appendix I

### Marine Fish Inventory of the Jordanian coast, Gulf of Aqaba, Red Sea

(Specimen, a = collected & deposited at Marine Science Station, b = Photographed or seen under water during coral reef fish visual census, c = observed in local fishermen catch, d = Senckenberg Museum Frankfurt collection; e = BMNH British Museum Natural History); (Literature record, 1 = Wahbeh & Ajiad 1987, 2 = Khalaf & Disi 1997, 3 = Khalaf & Khozius 2002, 4 = Khalaf & Zajonz submitted, 5 = Thomas Paulus 1993, 6 = Post & Svoboda 1980, 7 = Schuhmacher *et al.*, 1989; 8 = Krupp and Paulus 1991b, 9 = Khalaf *et al.*, 1996), 10 = Randall & Khalaf, 2003, 11 = Khalaf & Krupp (Submitted), 12 = Khalaf (In prep.); (Habitat, CB = Corals & Boulders, SAA = Seagrass & Algae, SB = Sandy bottom, DB = Deep Benthos, Bad = Bathydemersal, OS = open sea, AR = Associated with Reef, SW = Shallow Water; BP = Benthopelagic, Bap = Bathypelagic); (Trophic group, C = corallivore, D = detritivore, H = Herbivore, IF = Invertebrate Feeder, IFF = Invertebrate and Fish Feeder, O = Omnivore, Pi = Piscivore, Pl = planktivore); (Remarks, E = Endemic to Red Sea & Gulf of Aden; RSM = Red Sea Migrants; MSM = Mediterranean Sea migrants, Aq = Escaped from mariculture projects), Species with an \* are reported for the first time in Aqaba and species with \*\* are a new records to the Gulf of Aqaba.

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<b>Lamnidae</b>						
<i>Isurus oxyrinchus</i> , Rafinesque, 1810	a,c	1		OS	IFF	
<b>Alopiidae</b>						
<i>Alopias pelagicus</i> Nakamura, 1935	a,b,c	4	OS	IFF		
<b>Stegostomatidae</b>						
<i>Stegostoma fasciatum</i> (Hermann, 1783)	a,b,c	2	SB		IF	
<b>Rhincodontidae</b>						
<i>Rhincodon typus</i> Smith, 1828	b,c	2		OS	IFF	
<b>Carcharhinidae</b>						
<i>Carcharhinus plumbeus</i> (Nardo, 1827)	a,b,c	2;4		SW	IFF	
<i>Carchahinus sorrah</i> (Valenciennes, 1939)	a,b,c	2		AR	IFF	
<i>Galeocerdo cuvier</i> (Péron & Lesueur, 1822)	a,b,c	2;4		OS	O	
<b>Triakidae</b>						
<i>Iago omanensis</i> (Norman, 1939)	a,b,c	4	DB		IFF	
<i>Mustelus mosis</i> Hemprich & Ehrenberg, 1899	a,b,c,d	2;4	DB	IFF	E	
<b>Sphyrnidae</b>						
<i>Sphyrna lewini</i> (Griffith & Smith, 1834)	a,b,c	2		OS	IFF	
<b>Rhinobatidae</b>						
<i>Rhinobatos punctifer</i> Campagno & Randall, 1987	a,b,c	2;4		BP	IFF	E
<b>Narcinidae</b>						
<i>Heteronarce bentuviai</i> (Baranes & Randall, 1989)	a,b,c	2;4	DB		IFF	E
<b>Torpenidae</b>						
<i>Torpedo panthera</i> Olfers, 1831	a,b,c	1;2;3;4	SB		IFF	E
<i>Torpedo sinuspersici</i> Olfers, 1831	d		DB			
<b>Dasyatidae</b>						
<i>Himantura uarnak</i> Forsskål, 1775)	a.b.c	2	CB		IF	RM
<i>Taeniura lymma</i> (Forsskål, 1775)	b	1;2	CB		IF	
<b>Myliobatidae</b>						
<i>Aetobatus narinari</i> (Euphrasen, 1790)	a,b,c	2	SAA	OS	IF	
<b>Mobulidae</b>						
<i>Mobula diabolus</i> (Shaw, 1804)	a,b,c	2		OS	PI	
<b>Muraenidae</b>						
<i>Echidna nebulosa</i> (Ahl, 1789)	a,b,c,d	2	CB		IFF	
<i>Echidna polyzona</i> (Richardson, 1845)*	a,b,c		CB		IF	
<i>Echidna</i> sp.*	a,c				IFF	
<i>Gymnothorax buroensis</i> (Blecker, 1857)*	d				IFF	
<i>Gymnothorax flavimarginatus</i> (Rüppell, 1830)*		d		CB	IFF	
<i>Gymnothorax griseus</i> (Lacèpe, 1803)	a,b,c,d	1;2;3	CB		Pi	

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<i>Gymnothorax javanicus</i> (Bleeker, 1859)*	d		CB		IFF	
<i>Gymnothorax johnsoni</i> (Smith, 1962)	a,b,c,d	2;4	DB			
<i>Gymnothorax monochrous</i> (Bleeker, 1856)**	d		CB		IFF	
<i>Gymnothorax nudivomer</i> (Günther, 1867)	a,b,c	2;3	CB		IFF	
<i>Pseudanthias heemstrai</i> Schumacher & Randall, 1989	a,b,c,d	2;7	CB		Pl	E
<i>Pseudanthias squamipinnis</i> (Peters, 1855)	a,b,c	1;2;3	CB		Pl	
<i>Pseudogramma polyacanthum</i> (Bleeker, 1856)	d		CB			
<b>Moronidae</b>						
<i>Dicentrarchus labrax</i> (Linnaeus, 1758)	a,b,c	2		IFF	Aq	
<b>Pseudochromidae</b>						
<i>Chlidichthys rubiceps</i> Lubbock, 1975*	d					E
<i>Haliophis guttatus</i> (Forsskål, 1775)*	a,b,d		CB			
<i>Pseudochromis dixurus</i> Lubbock, 1975*	a,b,e		CB		IFF	E
<i>Pseudochromis flavivertex</i> Rüppell, 1835	a,b,d,e	2;3	SB		O	E
<i>Pseudochromis fridmani</i> Klausowitz, 1968	a,b,e	2;3	CB		O	E
<i>Pseudochromis olivaceus</i> Rüppell, 1835	a,b	2;3	CB		O	E
<i>Pseudochromis pesi</i> Lubbock, 1975	a,b,e	2	SB		O	
<i>Pseudochromis springeri</i> Lubbock, 1975	a,b	3	CB		O	E
<b>Plesiopidae</b>						
<i>Callopleksiops altivelis</i> (Steindachner, 1903)	a,b	2	CB			
<i>Plesiops nigricans</i> (Rüppell, 1828)*	d		CB			
<b>Terapontidae</b>						
<i>Terapon jarbua</i> (Forsskål, 1775)	a,b,c,d	2	DB		O	
<b>Kuhliidae</b>						
<i>Kuhlia mugil</i> (Forster, 1801)	a,b,c,d	2	CB		IF	
<b>Priacanthidae</b>						
<i>Priacanthus hamrur</i> (Forsskål, 1775)	a,b,c,d	1;2;3	CB		Pl	
<i>Priacanthus sagittarius</i> Starnes, 1988	a,b,c	4	DB		IF	
<b>Priacanthidae</b>						
<i>Pristigenys niphonia</i> (Cuvier, 1829)	a,b,c	4	DB		IF	
<b>Apogonidae</b>						
<i>Apogon aureus</i> (Lacepède, 1802)	a,b,c,d	1;2;3	CB		Pl	
<i>Apogon taeniatus</i> Cuvier, 1828	a,b,c	2	CB		Pl	
<i>Apogon cyanosoma</i> Bleeker, 1853	a,b,c	2;3	CB		Pl	
<i>Apogon coccineus</i> Rüppell, 1838*	d		CB		IF	
<i>Apogon cookii</i> Macleay, 1881*	d				Pl	
<i>Apogon endekataenia</i> Bleeker, 1852*	d				IF	
<i>Apogon exostigma</i> (Jordan & Starks, 1906)	a,b,c,d	2;3	CB		Pl	
<i>Apogon fleurieu</i> (Lacepède, 1802)*	a,b,c		CB		Pl	

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<i>Apogon fraenatus</i> Valenciennes, 1832	a,b,d	3	CB		PI	
<i>Apogon isus</i> Randall & Bohlke, 1981*	b					
<i>Apogon kallopterus</i> Bleeker, 1856	a,b,c,d	2			PI	
<i>Apogon multitaeniatus</i> Cuvier, 1828*	a,b,d				PI	
<i>Apogon nigrofasciatus</i> Lachner, 1953	a,b,d	2;3	CB		PI	
<i>Apogon pseudotaeniatus</i> Gon, 1986	a,b,d	4			PI	
<i>Archamia fucata</i> (Cantor, 1849)*	a,b,		CB		PI	
<i>Cheilodipterus lachneri</i> Klausewitz, 1959b	a,b,c,d	2;3	CB		IFF	E
<i>Cheilodipterus arabicus</i> (Gmelin, 1789)*	a,b,d		CB		IFF	
<i>Cheilodipterus macrodon</i> (Lacepède, 1802)	a,b,c	2;3	CB		IFF	
<i>Cheilodipterus novemstriatus</i> (Rüppell, 1838)	a,b,c,d	1;2;3	CB		IFF	
<i>Cheilodipterus quinquelineatus</i> Cuvier, 1828	a,b,d		CB		IFF	
<i>Foa brachygramma</i> (Jenkins, 1903)	d	11	SB		PI	
<i>Fowleria variegata</i> (Valenciennes, 1832)	a,b		CB		PI	
<i>Neamia octospina</i> Smith & Radcliffe, 1912	a,b,d	2				
<i>Siphamia permutata</i> Klausewitz, 1966*	d		CB		IF	
<b>Acropomatidae</b>						
<i>Gymnothorax nudivomer</i> (Günther, 1867)	a,b,c	2;3	CB		IF	
<i>Gymnothorax rueppelliae</i> (McClelland, 1844)*	d		CB		IFF	
<i>Gymnomuraena zebra</i> (Shaw, 1797)		2	CB		IF	
<i>Gymnothorax</i> sp.	a,b,c	2			IFF	
<b>Muraenesocidae</b>						
<i>Muraenesox cinereus</i> (Forsskål, 1775)	a,b,c	2;4	DB		IFF	RM
<b>Congridae</b>						
<i>Conger cinereus</i> Rüppell, 1830	a,b,c,d	2	CB		IFF	
<i>Gorgasia silheri</i> Klausewitz, 1962		2	SAA		PI	E
<i>Rhynchoconger trewavasae</i> Ben-Tuvia, 1993	a,b,c	4	DB			RM
<b>Ophichthidae</b>						
<i>Callechelys marmorata</i> (Bleeker, 1853)*	b		SB		IFF	
<i>Muaenichthys gymnotus</i> (Bleeker, 1857)*	d				IFF	
<i>Myrichthys maculosus</i> (Cuvier, 1816)	a,b,c	2	SB		IFF	
<i>Ophichthus echeloides</i> (D'Ancona, 1928)	a,b	4	SB		IFF	E
<i>Pisodonophis</i> (Richardson, 1848)	a,b,c	2	SB		IFF	
<b>Clupeidae</b>						
<i>Etrumeus teres</i> (DeKay, 1842)	a,b,c	2		SW	PI	RM
<i>Herklotsichthys quadrimaculatus</i> (Rüppell, 1834)	a,b,c	2		SW	PI	
<i>Spratelloides delicatulus</i> (Bennett, 1832)*	a,b,d,c			SW	PI	RM
<i>Spratelloides gracilis</i> (Temminck & Schlegel, 1846)*	a,c,d			SW	PI	

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<b>Sternoptychidae</b>						
<i>Maurolicus muelleri</i> (Gmelin, 1789)	b	4;6		OS	IFF	
<b>Stomiidae</b>						
<i>Astronesthes martensii</i> Klunzinger, 1871	d	4;6		BP	IFF	
<i>Stomias affinis</i> Günther, 1887		1;4;6		BP	PI	
<b>Synodontidae</b>						
<i>Saurida gracilis</i> (Quoy & Gaimard, 1824)	a,b,c,d	3	CB		Pi	RM
<i>Saurida tumbil</i> (Bloch, 1795)	a,b,c	2;4	SB		IFF	
<i>Saurida undosquamis</i> (Richardson, 1848)	a,b,c	2	DB		IFF	
<i>Synodus doaki</i> Russell & Cressey, 1979	a,b,c	4	DB		Pi	
<i>Synodus englemani</i> Schultz, 1953*	d				Pi	
<i>Synodus hoshinonis</i> Tanaka, 1917	a,b,c		SB		Pi	
<i>Saurus japonicus</i> Ben-Tauvia and Steinitz, 1952*	d				Pi	
<i>Synodus variegatus</i> (Lacepède, 1803)	a,b,c	2;3	SB		Pi	
<i>Trachinocephalus myops</i> (Forster, 1801)	a,b,c,d	2	SB		Pi	
<b>Paralepididae</b>						
<i>Lestidiops jayakari</i> (Boulenger, 1889)		4;6		BP		
<b>Chanidae</b>						
<i>Chanos chanos</i> (Forsskål, 1775)	a,b,c	12		BP	O	
<b>Myctophidae</b>						
<i>Benthosema pterotum</i> (Alcock, 1890)		4;6		BaP		
<i>Diaphus coeruleus</i> (Klunzinger, 1871)		4;6		BaP		
<b>Batrachoididae</b>						
<i>Thalassothia cirrhosa</i> (Klunzinger, 1871)	a,b,c,d	4	CB		IFF	
<b>Lophiidae</b>						
<i>Lophiomus setigerus</i> (Vahl, 1797)	a,b,c	4	DB			
<b>Antennariidae</b>						
<i>Antennarius coccineus</i> (Lesson, 1831)*	d		CB		IFF	
<i>Antennarius commerson</i> (Latreille, 1804)	a,b,c	2	CB		IFF	
<b>Moridae</b>						
<i>Physiculus marisrubri</i> Brüß, 1986	a,b,c	2;4		BP		E
<b>Ophidiidae</b>						
<i>Acropoma japonicum</i> Günther, 1859	a,b,c	2;4	DB			
<b>Malacanthidae</b>						
<i>Branchiostegus sawakinensis</i>						
Amirthalingam, 1969	a,b,c	2;4	DB		IF	
<i>Malacanthus brevirostris</i> Guichenot, 1848*	a,b		DB		IF	



Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<b>Rachycentridae</b>						
<i>Rachycentron canadum</i> (Linnaeus, 1766)	a,b,c	2		OS	IFF	RM
<b>Echeneidae</b>						
<i>Echeneis naucrates</i> Linnaeus, 1758	a,b,c	2		OS	IFF	
<i>Remora remora</i> (Linnaeus, 1758)	a,b,c	2		OS	IF	
<b>Carangidae</b>						
<i>Alectis ciliaris</i> (Bloch, 1787)	a,b,c	2		BP	IFF	
<i>Alepes djedaba</i> (Forsskål, 1775)	a,b,c	2		AR	IFF	RM
<i>Carangoides bajad</i> (Forsskål, 1775)	a,b,c	2		SW	IFF	
<i>Carangoides equula</i> (Temminck & Schlegel, 1844)	a,b,c	2;4		BP	IFF	
<i>Carangoides fulvoguttatus</i> (Forsskål, 1775)	a,b,c	2;3		AR	IFF	
<i>Caranx ignobilis</i> (Forsskål, 1775)	a,b,c	2		AR	IFF	
<i>Carnax heberi</i> (Bennett, 1830)	a,b,c	11				
<i>Decapterus macarellus</i> (Cuveir, 1833)	a,b,c,d	2		OS	PI	
<i>Decapterus macrosoma</i> Bleeker, 1851	a,b,c	2;3		OS	IF	
<i>Decapterus russelli</i> (Rüppell, 1830)	a,b,c	2;4		OS	PI	
<i>Elagatis bipinnulata</i> (Quoy & Gaimard, 1825)	a,b,c	2		OS	IFF	
<i>Gnathanodon speciosus</i> (Forsskål, 1775)	a,b,c	2;3	CB		IFF	
<i>Naucrates ductor</i> (Linnaeus, 1758)	a,b,c	2;4		OS	IFF	
<i>Scomberoides lysan</i> (Forsskål, 1775)	a,b,c	2		OS	IFF	
<i>Seriola dumerili</i> (Risso, 1810)	a,b,c	1;2		OS	IFF	
<i>Seriolina nigrofasciata</i> (Rüppell, 1829)	a,b,c	2		OS	IFF	
<i>Trachurus indicus</i> Necrasov, 1966	a,b,c,d	2;4		OS	IFF	
<b>Coryphaenidae</b>						
<i>Coryphaena hippurus</i> Linnaeus, 1758	a,b,c	2		OS	IFF	
<b>Bramidae</b>						
<i>Taractichthys steindachneri</i> (Döderlein, 1883)	a,b,c	2;4		BP		
<b>Lutjanidae</b>						
<i>Lutjanus bohar</i> (Forsskål, 1775)	a,b,c	1;2	CB		IFF	
<i>Lutjanus ehrenbergii</i> (Peters, 1869)	a,b,c	2	CB		IFF	
<i>Lutjanus kasmira</i> (Forsskål, 1775)*	a,b,c		CB		IFF	
<i>Macolor niger</i> (Forsskål, 1775)		1		AR	IFF	
<i>Paracaesio sordida</i> Abe & Shinohara, 1962	a,b,c	2;4		OS	PI	
<i>Pristipomoides filamentosus</i> (Valenciennes, 1830)	a,b,c	4	DB		IFF	
<i>Pristipomoides sieboldii</i> (Bleeker, 1854-57)	a,b,c	4	DB		IFF	
<i>Pristipomoides typus</i> (Bleeker, 1852)		1	DB		IFF	

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<b>Caesionidae</b>						
<i>Caesio lunaris</i> Cuvier, 1830	a,b,c	1;2;3		AR	P1	E
<i>Caesio striata</i> Rüppell, 1830	a,b,c,d	2		AR	P1	
<i>Caesio suevica</i> Klunzinger, 1884	a,b,c,d	2;3		AR	pl	
<i>Caesio varilineata</i> Carpenter, 1987	a,b,c,d	2;3		AR	pl	
<i>Pterocaesio chrysozona</i> (Cuvier, 1830)	a,b,c	2		AR	pl	
<b>Nemipteridae</b>						
<i>Parascolopsis eriomma</i> (Jordan & Richardson, 1909)	a,b,c	2;4	DB		IF	IFF
<i>Scolopsis ghanam</i> (Forsskål, 1775)	a,b,c,d	2;3	SB			
<b>Gerreidae</b>						
<i>Gerres methueri</i> (Günther, 1861)*	d		SB		IF	IFF
<i>Gerres oyena</i> (Forsskål, 1775)	a,b,c,d	1;2;3	SB			
<b>Haemulidae</b>						
<i>Diagramma pictum</i> (Thunberg, 1792)	a,b,c,d	2;3		AR	IFF	RM
<i>Plectorhinchus gaterinus</i> (Forsskål, 1775)	a,b,c	1;2	CB		IFF	
<i>Plectorhinchus schotaf</i> (Forsskål, 1775)	a,b,c	2	CB		IFF	
<i>Pomadasys stridens</i> (Forsskål, 1775)	a,b,c,d	2	SB		IFF	
<b>Lethrinidae</b>						
<i>Gymnocranius grandoculis</i> (Valenciennes, 1830)	a,b,c	2	CB		IFF	IFF
<i>Lethrinus borbonicus</i> Valenciennes, 1830	a,b,c	2	SAA		IF	
<i>Lethrinus mahsena</i> (Forsskål, 1775)	a,b,c	2	CB		IF	
<i>Lethrinus nebulosus</i> (Forsskål, 1775)	a,b,c	2	CB		IF	
<i>Lethrinus obsoletus</i> (Forsskål, 1775)	d		SAA		IF	
<i>Lethrinus variegatus</i> Valenciennes, 1830	a,b,c,d	2	SAA		IF	
<i>Monotaxis grandoculis</i> (Forsskål, 1775)	a,b,c	1;2;3	CB		IF	
<b>Sparidae</b>						
<i>Acanthopagrus bifasciatus</i> (Forsskål, 1775)	a,b,d	1;2	CB		IF	E
<i>Argyrops filamentous</i> (Valenciennes, 1830)	a,b,c,d	2	DB		IF	
<i>Argyrops spinifer</i> (Forsskål, 1775)	a,b,c	2;4	DB		IF	
<i>Diplodus noct</i> (Valenciennes, 1830)	a,b,c,d	1;2;3	SB		O	
<i>Polysteganus coeruleopunctatus</i> (Klunzinger, 1870)	a,b,c,d	2;4	DB		IF	
<i>Rhabdosargus sarba</i> (Forsskål, 1775)	a,b,c,d	2	SB		IF	
<i>Sparus auratus</i> Linnaeus, 1758	a,b,c	2	SB		IF	
<b>Sciaenidae</b>						
<i>Atrobucca geniae</i> Ben-Tuvia & Trewawas, 1987	a,b,c	4	DB			E

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<b>Mullidae</b>						
<i>Mulloidichthys flavolineatus</i> (Lacepède, 1801)	a,b,c,d	1;2;3	SB		IF	
<i>Mulloidichthys vanicolensis</i> (Valenciennes, 1831)	a,b,c,d	2	SB		IF	
<i>Parupeneus cyclostomus</i> (Lacepède, 1801)	a,b,c,d	1;2;3	CB		IFF	
<i>Parupeneus forsskali</i> (Fourmanoir & Guézé, 1976)	a,b,c,d	1;2;3	CB		IFF	E
<i>Parupeneus heptacanthus</i> (Lacepède, 1802)	a,b,c	2;4	DB		IFF	
<i>Parupeneus macronema</i> (Lacepède, 1801)	a,b,c,d	1;2;3	SAA		IFF	
<i>Parupeneus rubescens</i> (Lacepède, 1801)	a,b,c,d	2;3;4	SAA		IFF	
<i>Upeneus moluccensis</i> (Bleeker, 1855)	a,b,c	2	SB		IF	RM
<i>Upeneus pori</i> Ben-tuvia & Golani, 1989	a,b,c	2	SB		IF	RM
<i>Upeneus davidaromi</i> Golani, 2001	a,b,c	2;4	DB			
<b>Pempheridae</b>						
<i>Parapriacanthus ransonneti</i> Steindachner, 1870*	b		CB		PI	
<i>Pempheris vanicolensis</i> Cuvier, 1831	a,b,c,d	2;3	CB		IF	RM
<b>Kyphosidae</b>						
<i>Kyphosus vaigiensis</i> (Quoy & Gaimard, 1825)	a,b,c,d	2	SB		O	
<b>Ephippidae</b>						
<i>Platax orbicularis</i> Forsskål, 1775	a,b,c	2		OS	O	
<b>Chaetodontidae</b>						
<i>Chaetodon auriga</i> Forsskål, 1775	a,b,c,d	1;2;3	CB		O	
<i>Chaetodon austriacus</i> Rüppell, 1836	a,b,c,d	1;2;3	CB		C	
<i>Chaetodon fasciatus</i> Forsskål, 1775	a,b,c,d	1;2;3	CB		O	E
<i>Chaetodon jayakari</i> Norman, 1939	a,b,c	4	DB			
<i>Chaetodon lineolatus</i> Cuvier, 1831*	b		CB		O	
<i>Chaetodon melannotus</i> Bloch & Schneider, 1801	a,b,c,d	1;2;3	CB		C	
<i>Chaetodon paucifasciatus</i> Ahl, 1923	a,b,c,d	1;2;3	CB		O	E
<i>Chaetodon semilarvatus</i> Cuvier, 1831	a,b,c	1;2	CB		C	E
<i>Chaetodon trifascialis</i> Quoy & Gaimard, 1825	a,b,c	2;3	CB		C	
<i>Heniochus diphreutes</i> Jordan, 1903	a,b,c,d	2;3	SAA		PI	
<i>Heniochus intermedius</i> Steindachner, 1893	a,b,c,d	1;2;3	CB		O	E
<b>Pomacanthidae</b>						
<i>Apolemichthys xanthotis</i> (Fraser-Brunner, 1951)	a,b,c	1;2;3	CB		O	
<i>Centropyge multispinis</i> (Playfair, 1867)	a,b,c	1;2;3	CB		O	

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<i>Genicanthus caudovittatus</i> (Günther, 1860)	a,b,c,d	1;2;3		AR	Pl	
<i>Pomacanthus imperator</i> (Bloch, 1787)	a,b,c	1;2;3	CB		IF	
<i>Pomacanthus maculosus</i> (Forsskål, 1775)	a,b,c	2	CB		IF	
<i>Pygoplites diacanthus</i> (Boddaert, 1772)	a,b,c,d	1;2;3	CB		IF	
<b>Pentacerotidae</b>						
<i>Histiopertus typus</i> Temminck & Schlegel, 1844	a,b,c	4	DB			
<b>Cichlidae</b>						
<i>Tilapia</i> sp.*	a,b,c					Aq
<b>Pomacentridae</b>						
<i>Abudefduf sexfasciatus</i> (Lacepède, 1801)	a,b,c,d	2	CB		O	
<i>Abudefduf sordidus</i> (Forsskål, 1775)	a,b,c	2	CB		O	
<i>Abudefduf vaigiensis</i> (Quoy & Gaimard, 1825)	a,b,c	1;2;3	CB		O	
<i>Amblyglyphidodon flavilatus</i> Allen & Randall, 1980	a,b,c,d	2;3	CB		Pl	E
<i>Amblyglyphidodon leucogaster</i> (Bleeker, 1847)	a,b,c,d	1;2;3	CB		O	
<i>Amphiprion bincinctus</i> Rüppell, 1830	a,b,c	1;2;3	CB		O	E
<i>Chromis dimidiata</i> (Klunzinger, 1871)	a,b,c,d	1;2;3	CB		O	
<i>Chromis pellowra</i> Randall & Allen, 1982	a,b,c,d	2;3;4			Pl	E
<i>Chromis pembae</i> Smith, 1960	a,b,c,d	2;3	CB		Pl	
<i>Chromis ternatensis</i> (Bleeker, 1856)	a,b,d	3	CB		Pl	
<i>Chromis trialpha</i> Allen & Randall, 1980*	a,b,d		CB		Pl	E
<i>Chromis viridis</i> (Cuvier, 1830)	a,b,c	1;2;3	CB		Pl	
<i>Chromis weberi</i> Fowler & Bean, 1928	a,b,c	2;3	CB		Pl	
<i>Chrysiptera annulata</i> (Peters, 1855)	a,b	2	CB		H	
<i>Chrysiptera unimaculata</i> (Cuvier, 1830)	a,b	2	CB		H	
<i>Dascyllus aruanus</i> (Linnaeus, 1758)	a,b,c	2;3	CB		O	
<i>Dascyllus marginatus</i> (Rüppell, 1829)	a,b,c	1;2;3	CB		O	
<i>Dascyllus trimaculatus</i> (Rüppell, 1829)	a,b,c	1;2;3	CB		O	
<i>Neopomacentrus miryae</i> Dor & Allen, 1977	a,b,c	2;3		SW	Pl	
<i>Neoglyphidodon melas</i> (Cuvier, 1830)	a,b,c,d	2;3	CB		C	
<i>Plectroglyphidodon lacrymatus</i> (Quoy & Gimard, 1825)	a,b,d	2	CB		H	
<i>Plectroglyphidodon leucozonus</i> (Bleeker, 1859)	a,b,d	2	CB		H	
<i>Pomacentrus albicaudatus</i> Baschieri-Salvadori, 1955*	b,d		CB		H	E
<i>Pomacentrus aquilus</i> Allen & Randall, 1980*	a,b,d		CB		H	
<i>Pomacentrus sulfureus</i> Klunzinger, 1871	a,b,c,d	2;3	CB		O	
<i>Pomacentrus trichourus</i> Günther, 1867	a,b,c,d	1;2;3	CB		IFF	
<i>Pomacentrus trilineatus</i> Cuvier, 1830	a,b	3	CB			

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<i>Stegastes nigricans</i> (Lacepède, 1802)		1	CB		O	
<i>Teixeirichthys jordani</i> (Rutter, 1897)	a,b,c,d	1	SAA		PI	
<b>Cirrhitidae</b>						
<i>Cirrhitichthys oxycephalus</i> (Bleeker, 1855)*	a,b		CB		IFF	
<i>Oxycirrhites typus</i> Bleeker, 1857	a,b	2	CB		IF	
<i>Paracirrhites forsteri</i> (Schneider, 1801)	a,b	2	CB		IFF	
<b>Mugilidae</b>						
<i>Crenimugil crenilabis</i> (Forsskål, 1775)	a,b,c,d	2;3	SB		D	
<b>Sphyraenidae</b>						
<i>Sphyraena barracuda</i> (Walbaum, 1792)	a,b,c	2		OS	Pi	RM
<i>Sphyraena flavicauda</i> Rüppell, 1838	a,b,c	2	SAA	OS	Pi	
<i>Sphyraena forsteri</i> Cuvier, 1829*	c,d			OS	Pi	
<i>Sphyraena putnamae</i> Jordan & Seale, 1905	a,b,c	2		OS	Pi	
<b>Labridae</b>						
<i>Anampses caeruleopunctatus</i> Rüppell, 1829	a,b,c	2;3	CB		IF	
<i>Anampses lineatus</i> Randall, 1972	a,b,c	2;3	CB		IF	
<i>Anampses melegrides</i> Valenciennes, 1840	a,b,c	2;3	CB		IF	
<i>Anampses twistii</i> Bleeker, 1856	a,b,c,d	1;2;3	CB		IF	
<i>Bodianus anthioides</i> (Bennett, 1832)	a,b,c	1;2;3	CB		IF	
<i>Bodianus axillaris</i> (Bennett, 1832)	a,b,c	2;3	CB		IF	
<i>Bodianua diana</i> (Lacepède, 1801)	a,b,c	2;3	CB		IF	
<i>Bodianus leucosticticus</i> (Bennett, 1832)	a,b,c	2;4;9	DB		IF	
<i>Bodianus opercularis</i> (Guichenot, 1847)	a,b,c	2	DB		IF	
<i>Cheilinus fasciatus</i> (Bloch, 1791)*	a,b,c,d		CB		O	
<i>Cheilinus lunulatus</i> (Forsskål, 1775)	a,b,c	2	CB		O	
<i>Cheilinus mentalis</i> Rüppell, 1828	a,b,c,d	2;3	CB		O	
<i>Cheilinus trilobatus</i> (Lacepède, 1801)	a,b,c,d	1;2;3	CB		O	E
<i>Cheilinus undulatus</i> Rüppell, 1829	a,b,c	2	CB		O	
<i>Cheilio inermis</i> (Forsskål, 1775)	a,b	2;3	SAA		O	
<i>Choerodon robustus</i> (Günther, 1862)	a,b,c	1;2;4	DB		IFF	
<i>Cirrhilabrus blatteus</i> Springer & Randall, 1974	a,b	2	DB		PI	E
<i>Cirrhilabrus rubriventralis</i> Springer & Randall, 1974	a,b,d	2;3	SAA		PI	E
<i>Coris aygula</i> Lacepède, 1801	a,b,c,d	1;2;3	CB		IF	
<i>Coris caudimaculata</i> (Quoy & Gaimard, 1834)	a,b,c,d	1;2;3	SAA		IF	
<i>Coris gaimard</i> (Quoy & Gaimard, 1824)	a,b,c	3	CB		IF	
<i>Coris variegata</i> (Rüppell, 1835)	a,b,c,d	2;3	SB		IF	
<i>Epibulus insidiator</i> (Pallas, 1770)*	b		CB		IFF	
<i>Gomphosus caeruleus</i> Lacepède, 1801	a,b,c,d	2;3	CB		IF	E
<i>Halichoeres hortulanus</i> (Lacepède, 1801)	a,b,c	2	CB		IF	

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<i>Halichoeres marginatus</i> Rüppell, 1835	a,b,c,d	2;3	CB		IF	
<i>Halichoeres nebulosus</i> (Valenciennes, 1839)	a,b	2	CB		IF	
<i>Halichoeres scapularis</i> (Bennett, 1832)	a,b	2;3	SAA		IF	
<i>Hemigymnus fasciatus</i> (Bloch, 1792)	a,b,c	1;2;3	CB		IF	
<i>Hologymnosus annulatus</i> (Lacepède, 1801)	a,b,c	1;2;3	CB		IFF	
<i>Labroides dimidiatus</i> (Valenciennes, 1839)	a,b,d	2;3	CB		IF	
<i>Larabicus quadrilineatus</i> (Rüppell, 1835)	a,b,d	2;3	CB		C	E
<i>Macropharyngodon bipatitus bipartitus</i> Smith, 1957	a,b	3	CB			
<i>Novaculichthys macrolepidotus</i> (Bloch, 1791)	a,b	12	SAA			
<i>Oxycheilinus arenatus</i> (Valenciennes, 1840)	a,b,c	2	CB		O	
<i>Oxycheilinus diagrammus</i> (Lacepède, 1801)	a,b,c,d	2	CB		O	
<i>Oxycheilinus orientalis</i> (Günther, 1862)	a,b,c	10	SAA		O	
<i>Paracheilinus octotaenia</i> Fourmanoir, 1955	a,b,d	2;3	CB		Pl	E
<i>Pseudocheilinus evanidus</i> Jordan & Evermann, 1903	a,b,d	2;3	CB		Pl	
<i>Pseudocheilinus hexataenia</i> (Bleeker, 1857)	a,b,d	2;3	CB		Pl	
<i>Pteragogus cryptus</i> Randall, 1981	a,b,d	2;3	CB			
<i>Pteragogus pelycus</i> Randall, 1981	a,b,c	2;3	SAA			
<i>Stethojulis albobittata</i> (Bonnaterre, 1788)	a,b,d	2;3	CB		IF	
<i>Stethojulis interrupta</i> (Bleeker, 1851)	a,b	2;3	CB		IF	
<i>Thalassoma rueppellii</i> (Klunzinger, 1871)	a,b,c,d	2;3	CB		IFF	E
<i>Thalassoma lunare</i> (Linnaeus, 1758)	a,b,c,d	2;3	CB		IFF	
<i>Wetmorella nigropinnata</i> (Seale, 1901)*	a,b,d		CB		IF	
<i>Xyrichtys melanopus</i> (Bleeker, 1857)	a,b,c	2	SB		IF	
<i>Xyrichtys niger</i> (Steindachner, 1901)*	d		SB		IF	
<i>Xyrichtys pavo</i> (Valenciennes, 1840)	a,b,c	2;3	SB		IF	
<i>Xyrichtys pentadactylus</i> (Linnaeus, 1758)	a,b,c	2	SB		IF	
<b>Scaridae</b>						
<i>Calotomus viridescens</i> (Rüppell, 1835)	a,b,c,d	2;3	SAA		H	E
<i>Cetoscarus bicolor</i> (Rüppell, 1835)	a,b,c	2	CB		H	
<i>Chlorurus genazonatus</i> (Randall & Bruce, 1983)	a,b,c	2	CB		H	E
<i>Chlorurus gibbus</i> (Rüppell, 1829)	a,b,c	2;3	CB		H	
<i>Chlorurus sordidus</i> (Forsskål, 1775)	a,b,c,d	2;3	CB		H	
<i>Hipposcarus harid</i> (Forsskål, 1775)	a,b,c	2;3	CB		H	
<i>Leptoscarus vaigiensis</i> (Quoy & Gaimard, 1824)	a,b,c	2;3	SAA		H	
<i>Scarus collana</i> Rüppell, 1835	a,b,c	2	CB		H	E
<i>Scarus ferrugineus</i> Forsskål, 1775	a,b,c	1;2;3	CB		H	
<i>Scarus frenatus</i> Lacepède, 1802*	b,c		CB		H	
<i>Scarus fuscopurpureus</i> (Klunzinger, 1871)	a,b,c,d	2;3	CB		H	

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<i>Scarus ghobban</i> Forsskål, 1775	a,b,c	2;3	CB		H	
<i>Scarus niger</i> Forsskål, 1775	a,b,c,d	2;3	CB		H	
<i>Scarus psittacus</i> Forsskål, 1775	a,b,c	2;3	CB		H	
<b>Pinguipedidae</b>						
<i>Parapercis hexophthalma</i> (Cuvier, 1829)	a,b,c,d	1;2;3	SB		IFF	
<i>Parapercis somaliensis</i> Schultz, 1968	a,b,c	2;4	DB		IFF	
<b>Trichonotidae</b>						
<i>Trichonotus nikii</i> Clark & von Schmidt, 1966	b,d	2	SB		PI	E
<b>Uranoscopidae</b>						
<i>Uranoscopus fuscomaculatus</i> Kner, 1868	a,b,c,d	1;2;3	DB		IFF	
<i>Uranoscopus marisrubri</i> Brüss, 1987	a,b,c	2;4	Bad		IFF	E
<b>Blenniidae</b>						
<i>Alloblennius pictus</i> (Lotan, 1969)*	d		CB			
<i>Alticus kirkii</i> (Günther, 1868)*	a,b,		CB			
<i>Antennablennius hypenetes</i> (Klunzinger, 1871)*	d		CB			
<i>Aspidontus dussumieri</i> (Valenciennes, 1836)*	a,b		CB		O	
<i>Asidontus taeniatus taeniatus</i> Quoy & Gaimard, 1834*	b	3	CB		O	
<i>Atrosalarias fuscus fuscus</i> (Rüppell, 1838)*	b		CB			
<i>Belezeniella flaviumbrinus</i> (Rüppell, 1830)**	d		CB		O	E
<i>Cirripectes castaneus</i> (Valenciennes, 1836)	a,b,d	3	CB		H	
<i>Ecsenius aroni</i> Springer, 1971	b,d	2;3	CB		IF	E
<i>Ecsenius midas</i> Strack, 1969*	b		CB		IF	
<i>Ecsenius frontalis</i> (Valenciennes, 1836)	b,d	3	CB		IF	E
<i>Ecsenius gravieri</i> (Pellegrin, 1906)	a,b,d	2;3	CB		IF	E
<i>Ecsenius nalolo</i> Smith, 1959	b,d	2	CB		IF	
<i>Exallias brevis</i> (Kner, 1868)	a,b,d	1;2;3	CB		C	
<i>Istiblennius edentulus</i> (Schneider & Forster, 1801)	a,b,d	2	CB		O	
<i>Istiblennius periophthalmus</i> (Valenciennes, 1836)	b,d		CB		O	
<i>Istiblennius rivulatus</i> (Rüppell, 1830)*	d		CB			
<i>Meiacanthus nigrolineatus</i> Smith-Vaniz, 1969	a,d	2;3	CB		PI	E
<i>Petroscirtes ancylodon</i> Rüppell, 1835	d				IF	
<i>Petroscirtes mitratus</i> Rüppell, 1830	b,d		SAA		IF	
<i>Plagiotremus rhinorhynchus</i> (Bleeker, 1852)*	a,b		CB		Pi	
<i>Plagiotremus tapeinosoma</i> (Bleeker, 1857)	a,b	2;3	CB		Pi	
<i>Plagiotremus townsendi</i> (Regan, 1905)	b	3	CB		Pi	
<i>Salarias fasciatus</i> (Bloch, 1786)	a,b	2	CB		H	

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<b>Tripterygiidae</b>						
<i>Enneapterygius abeli</i> (Klausewitz, 1960)	d				IF	
<i>Enneapterygius destai</i> Clark, 1980**	d				IF	E
<b>Callionymidae</b>						
<i>Callionymus filamentosus</i> Valenciennes, 1837	a,b,c,d	4	SB			RM
<b>Gobiidae</b>						
<i>Amblyeleotris steinitzi</i> (Klausewitz, 1974)	a,b	2;3	SB			
<i>Amblyeleotris sungami</i> (Klausewitz, 1969)	a,b	2;3	SB			
<i>Amblygobius albimaculatus</i> (Rüppell, 1830)	a,b	2;3	SAA			
<i>Amblygobius hectori</i> (Smith, 1957)*	a,b		CB		O	
<i>Asterropteryx semipunctatus</i> Rüppell, 1830*	b		SB			
<i>Bathygobius cyclopterus</i> (Valenciennes, 1837)	a,b,d	2				
<i>Bryaninops natans</i> Larson, 1985	b	2	CB		PI	
<i>Ctenogobiops maculosus</i> (Fourmanoir, 1955)*	b		SB			E
<i>Eviota guttata</i> Lachner & Kamella, 1978*	b,d		CB			
<i>Eviota sebreei</i> Jordan & Seale, 1906*	b		CB			
<i>Fusigobius longispinus</i> (Goren, 1978)*	a,b	2;3	SB			
<i>Coryphopterus neophytus</i> (Günther, 1877)*	b		SB			
<i>Gnatholepis anjerensis</i> (Bleeker, 1851)	a,b	2;3	CB			
<i>Gobiodon citrinus</i> (Rüppell, 1838)	a,b,d	2;3	CB			
<i>Gobiodon reticulatus</i> Playfair, 1867	a,b	2	CB			
<i>Istigobius docoratus</i> (Herre, 1927)	a,b,d	3	SB			
<i>Lotilia graciliosa</i> Klausewitz, 1960	b	3	SB			
<i>Priolepis cincta</i> (Regan, 1908)	a,b	2	SB			
<i>Trimma flavicaudata</i> *	b					
<i>Valenciennea puellaris</i> (Tomiyama, 1956)	a,b	2;3	SB			
<i>Vanderhorstia</i> sp. Smith, 1959*	b		SB			
<b>Microdesmidae</b>						
<i>Ptereleotris evides</i> (Jordan & Hubbs, 1925)	a,b	2	CB		PI	
<b>Acanthuridae</b>						
<i>Acanthurus nigricans</i> (Linnaeus, 1958)	a,b,c	2	CB		H	E
<i>Acanthurus nigrofuscus</i> (Forsskål, 1775)	a,b,c,d	2;3	CB		H	
<i>Acanthurus sohal</i> (Forsskål, 1775)	a,b,c	2;3	CB		H	E
<i>Ctenochaetus striatus</i> (Quoy & Gaimard, 1825)	a,b,c,d	2;3	CB		D	
<i>Naso hexacanthus</i> (Bleeker, 1855)*	a,b,c			BP	PI	
<i>Naso lituratus</i> (Forster, 1801)	a,b,c	2	CB		H	
<i>Naso unicornis</i> (Forsskål, 1775)	a,b,c	2;3	CB		H	
<i>Zebrasoma veliferum</i> (Bloch, 1795)	a,b,c,d	1;2;3	CB		H	



Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<i>Zebrasoma xanthurum</i> (Blyth, 1852)	a,b,c,d	1;2;3	CB		H	
<b>Siganidae</b>						
<i>Siganus argenteus</i> (Quoy & Gaimard, 1825)	a,b,c	1;2;3	SAA		H	
<i>Siganus luridus</i> (Rüppell, 1829)	a,b,c	1;2;3	SAA		H	RM
<i>Siganus rivulatus</i> Forsskål, 1775	a,b,c	1;2;3	SAA		H	E, RM
<i>Siganus stellatus</i> (Forsskål, 1775)	a,b,c	2	CB		H	
<b>Trichiuridae</b>						
<i>Trichiurus lepturus</i> Linnaeus, 1758	a,b,c,d	1;2;4		BP	IFF	
<b>Gempylidae</b>						
<i>Thyrsitoides marleyi</i> Fowler, 1929	a,b,c	1;2;4	DB		IFF	E
<b>Scombridae</b>						
<i>Auxis thazard thazard</i> (Lacepède, 1800)	a,b,c	2		OS	IFF	
<i>Euthynnus affinis</i> (Cantor, 1849)	a,b,c	1;2;3		OS	IFF	
<i>Grammatorcyus biliniatus</i> (Rüppell, 1836)**	a,b,c			OS	IFF	
<i>Gymnosarda unicolor</i> (Rüppell, 1836)	a,b,c	2		OS	Pi	
<i>Katsuwonus pelamis</i> (Linnaeus, 1758)	a,b,c	2		OS	IFF	
<i>Rastrelliger kanagurta</i> (Cuvier, 1816)	a,b,c	2		OS	PI	RM
<i>Sarda orientalis</i> (Temminck & Schlegel, 1844)	a,b,c	2		OS	IFF	
<i>Scomber japonicus</i> Houttuyn, 1782	a,b,c,d	2		OS	IFF	
<i>Scomberomorus commerson</i> (Lacepède, 1801)	a,b,c	2		OD	Pi	RM
<i>Thunnus alalunga</i> (Bonnaterre, 1788)	a,b,c	2;9		OS	IFF	MM
<i>Thunnus tonggol</i> (Bleeker, 1851)	a,b,c	2		OS	IFF	
<b>Istiophoridae</b>						
<i>Istiophorus platypterus</i> (Shaw, 1792)	a,b,c	2		OS	IFF	
<b>Ariommatidae</b>						
<i>Ariomma brevimanus</i> (Klunzinger, 1884)	a,b,c	2;4	DB		PI	
<b>Bothidae</b>						
<i>Arnoglossus tapeinosoma</i> (Bleeker, 1865)		1			IFF	
<i>Bothus pantherinus</i> (Rüppell, 1830)	a,b,c	1;2;3;4	SB		IFF	
<b>Pleuronectidae</b>						
<i>Samaris cristatus</i> Gray, 1831	a,b,c	2;3	DB		IF	
<b>Soleidae</b>						
<i>Pardachirus marmoratus</i> (Lacepède, 1802)	a,b,c,d	1;2;3	SB		IF	
<i>Soleichthys heterorhinos</i> (Bleeker, 1856)	a,b	2	SB		IF	
<b>Cynoglossidae</b>						
<i>Paraplagusia bilineata</i> (Bloch, 1787)	d	1	DB		IF	
<i>Cynoglossus</i> sp.	a,b,c	4	DB		IF	

Continued,

Scientific name	Documentation		Habitat		Trophic group	Remarks
	Specimen	References	Benthic	Pelagic		
<b>Balistidae</b>						
<i>Abalistes stellaris</i> (Bloch & Schneider, 1801)	a,b,c	2	DB		O	
<i>Balistapus undulatus</i> (Park, 1797)	a,b,c	2;3	CB		O	
<i>Odonus niger</i> (Rüppell, 1836)	a,b,c	1;2	CB		O	
<i>Pseudobalistes fuscus</i> (Bloch & Schneider, 1801)	a,b,c	1;2;3	CB		O	
<i>Rhinecanthus assasi</i> (Forsskål, 1775)	a,b,c	1;2	CB		IF	
<i>Sufflamen albicaudatum</i> (Rüppell, 1829)	a,b,c,d	1;2;3	CB		IF	E
<b>Monacanthidae</b>						
<i>Aluterus monoceros</i> (Linnaeus, 1758)	a,b,c	2	CB		O	
<i>Aluterus scriptus</i> (Osbeck, 1765)	a,b,c	2;3		AR	O	
<i>Amanes scopas</i> (Cuvier, 1829)	a,b,c	1;2;3	CB		O	
<i>Cantherhines pardalis</i> (Rüppell, 1837)	a,b,c	1;2;3	CB		O	
<i>Paramonacanthus pusillus</i>	a,b,c,d	2;3	SAA		O	E
<i>Pervagor randalli</i> Hutchins, 1986	a,b,c,d	2;3	CB		O	E
<i>Thamnaconus modestoides</i> (Barnard, 1927)	a,b,c	2;4	DB		O	E
<b>Ostraciidae</b>						
<i>Ostracion cubicus</i> Linnaeus, 1758	a,b,c,d	1;2;3	CB		O	
<i>Ostracion cyanurus</i> Rüppell, 1828	a,b,c,d	1;2;3	CB		O	
<i>Tetrosomus gibbosus</i> (Linnaeus, 1758)	a,b,c	1;2;3	SAA		IF	RM
<b>Tetraodontidae</b>						
<i>Arothron diadematus</i> (Rüppell, 1829)	a,b,c	1;2;3	CB		O	E
<i>Arothron hispidus</i> (Linnaeus, 1758)	a,b,c,d	2;3	SB		O	
<i>Arothron stellatus</i> (Bloch & Schneider, 1801)	a,b,c	2;3;4	SAA		O	
<i>Canthigaster coronata</i> (Vaillant & Sauvage, 1875)	a,b,c,d	1;3	SAA		O	
<i>Canthigaster margaritata</i> (Rüppell, 1829)	a,b,c,d	1;2;3	CB		O	E
<i>Canthigaster pygmaea</i> Allen & Randall, 1977	a,b,d	3	CB		O	
<i>Lagocephalus sceleratus</i> (Gmelin, 1789)	a,b,c,d	2;4		BP		
<i>Torquigener flavimaculosus</i> Hardy & Randall, 1983	a,b,d	2;3	SAA		IF	RM
<b>Diodontidae</b>						
<i>Cyclichthys spilostylus</i> (Leis & Randall, 1981)	a,b,c,d	2;3	CB		IF	RM
<i>Diodon hystrix</i> Linnaeus, 1758	a,b,c	2	CB		IF	
<b>Molidae</b>						
<i>Masturus lanceolatus</i> (Liènard, 1840)*	b			OS	O	

## أسماك الساحل الأردني في خليج العقبة- البحر الأحمر

### معروف خلف

محطة العلوم البحرية ، الجامعة الأردنية ، جامعة اليرموك ،  
المملكة الأردنية الهاشمية

المستخلص. تقدم هذه الدراسة مسحاً شاملاً لأسماك الساحل الأردني من خليج العقبة. تم جمع عينات الأسماك بواسطة عدة طرق استخدم فيها طرق صيد مختلفة ، ومراقبة سوق السمك المحلي ، وتقنية الإحصاء البصري للأسماك. حيث يبلغ المجموع الكلي لعدد هذه الأسماك ٥٠٧ نوعاً تتبع ١٠٩ عائلة ينتمي (١٨) نوعاً منها الأسماك الغضروفية ، بينما ينتمي (٤٨٩) نوعاً إلى الأسماك العظمية ، أي بمعدل ٧, ٤ نوع للعائلة. أشارت النتائج أن العائلات التالية تعتبر أكبر العائلات ( عدد الأنواع بين قوسين): عائلة اللبروس (٥١)، والفتية (٢٩)، وعائلة الهامور (٢٥)، وعائلات البليني وديك البحر (٢٤ لكل عائلة)، والقويون (٢١)، وعائلة أسماك البياض (١٧)، وعائلة الأسماك الأنبوبية (١٦ لكل عائلة). تشكل هذه العائلات الثمانية ما نسبته ٨, ٤٠٪ من مجموع الأسماك المسجلة. تنتمي معظم الأنواع للأسماك القاعية (٨, ٨٢٪) والبقية تتبع للأسماك الأوقيانسية. تقتات ٦, ٣٠٪ من أنواع الأسماك على كل من اللافقاريات والأسماك، بينما تقتات ٨, ٢٤٪ على اللافقاريات فقط. تشكل الأسماك المستوطنة ما نسبته ٨, ١٢٪ من مجموع الأنواع المسجلة في هذه الدراسة، وهذا أقل قليلاً من نسبة الأسماك المستوطنة في البحر الأحمر وخليج عدن ، والتي تشكل نسبة ٧, ١٣٪ من مجموع الأسماك المعروفة في البحر الأحمر. تسجل هذه الدراسة ولأول مرة ٧٦ نوعاً من الأسماك في الساحل الأردني لخليج العقبة، من ضمنها *Gymnothorax monochrous*, *Myripristis xantheta*, *Corythoichthys haematopterus*, *Syngnathus macrophthalmus*, *Istiblennius flaviumbrinus*, *Grammatorycnus bi-lineatus* و *Enneapterygius destai* أنواعاً تسجل لأول مرة في خليج العقبة. وتعتبر سمكة *Novaculichthys macrolepidotus* والتي تعيش في

حقوق الأعشاب الموجودة في منطقة المملح على عمق ٢م تقريباً نادرة جداً، ويحتاج هذا النوع إلى إجراءات حماية، أما الأسماك *Dicentrar-* *Sparu auratus* ، *chus labrax* و *Tilapia sp.* فقد تم إدخالها إلى البحر عن طريق مشاريع تربية الأسماك في المناطق المجاورة.

## تأثير أحد المصبات الأرضية على البيئة البحرية القريبة من الشاطئ بخليج أبي قير - الإسكندرية - مصر

محمد حمودة المأموني

المعهد القومي لعلوم البحار والمصايد - الإسكندرية - مصر

المستخلص. توجد أنشطة عديدة بمحاذاة ساحل خليج أبي قير ، تشمل هذه الأنشطة مجالات الشركات الصناعية ، والزراعة ، والصيد ، وخدمات وتسهيلات شركات البترول ، وكذلك عديد من التجمعات السكانية. أحد هذه الأنشطة الصناعية يقوم بصرف دائم لمياه تم استخدامها في عملية إنتاج الأسمدة. حيث يتم ضخ مياه الصرف هذه مباشرة في مياه البحر ، وتحديدًا في المنطقة القريبة من الشاطئ.

لبيان مدى تأثير دخول مياه الصرف هذه على البيئة البحرية ، تم تعيين كل من كمية المواد العالقة في مياه البحر في منطقة الدراسة ، وكذلك تم قياس محتوى المواد العالقة من الصوديوم ، والبوتاسيوم ، والكالسيوم ، والمغنسيوم ، والحديد ، والنحاس ، والرصاص ، والزنك . كما تم التعرف على نوعية رواسب القاع والظروف الإقانيوغرافية السائدة في منطقة الدراسة.

أظهرت النتائج أن نوعية مياه الصرف هذه ليس لها تأثير سلبي على البيئة البحرية .