Account of Ectoparasites of Epinepheline Groupers in the Exuma Cays, Bahamas

J.M. LEVY[1], K.M. SULLIVAN[1,2], and
M. DE GARINE-WICHATITSKY[1,3]
[1] *Dept. of Biology*
University of Miami
P.O. Box 249118
Coral Gables, Florida 33124 USA
[2] *The Nature Conservancy*
South Florida and Caribbean National Parks Data Center
Everglades National Park
P.O. Box 279
Homestead, Florida 33030 USA
[3]*Ecole Nationale Veterinaire d'Alfort*
7 Avenue du General de Gaulle
94700 Maisons Alfort, France

ABSTRACT

Groupers of the genus *Epinephelus* are important piscivorous reef fishes throughout the western tropical Atlantic. Even though groupers spend a large amount of energy in the removal of ectoparasites, and the presence of cleaning stations and ectoparasites are well documented, descriptive information is lacking on the nature, ecology, and effect of fish ectoparasites on these finfish. Ectoparasites were removed from 63 groupers of the genus *Epinephelus* (*E. striatus, E. fulvus, E. cruentatus,* and *E. guttatus*), captured in the Exuma Cays Land and Sea Park (ECLSP), Bahamas. The ectoparasites collected comprised at least 5 species of crustaceans (*Excorallana* sp., *Alcirona krebsii*, and *Gnathia* sp., *Lepeophtheirus* spp.) and monogenetic platyhelminths (*Neobenedenia* sp.). This paper presents new information on grouper ectoparasite diversity.

KEY WORDS: ectoparasites, groupers, isopods, copepods, monogenetic platyhelminth.

INTRODUCTION

Epinepheline groupers (Family Serranidae) are targeted commercially and recreationally by fishermen throughout the western tropical Atlantic (Thompson and Munro, 1978). Groupers also play an important role in reef communities as top level predators in the food web. Despite their importance in the tropical western Atlantic, there is a lack of specific information on factors that affect the health of groupers, especially the effect and identity of grouper ectoparasites.

Most ectoparasites that affect groupers are facultative in nature, spending little time on the host and not depending on the host for survival. Many studies that have been done on parasites of groupers deal mainly with endoparasites which are easily collected (*e.g.*, Sparks, 1957; Overstreet, 1968; Thompson and Munro, 1978). Furthermore, many other studies either deal with single species descriptions based on rare encounters, or are general non-specific accounts (*i.e.* Thompson and Munro, 1978; Jory and Iversen, 1989). Gaps of information on the host specificity of these ectoparasites and the diversity of ectoparasite species on groupers still remain.

Ectoparasites collected from four species of epinepheline groupers are presented, along with some ecological comments and previous accounts of grouper ectoparasites.

MATERIALS AND METHODS

Ectoparasite Removal

Epinepheline groupers were captured in the Exuma Cays Land and Sea Park (ECLSP), central Bahamas, using West Indian fish traps and PVC pipes, from May to July, 1992. Ectoparasites were collected using a non-destructive method for removing ectoparasites from marine fishes (Moller and Anders, 1986). This method minimizes stress in the fish using fresh water baths to effectively remove the ectoparasites. During the procedure, the groupers were first dipped or immersed in an anesthetic (MS222) bath to anesthetize the fish and avoid injury to the fish. The groupers were then immersed in a fresh water bath for five minutes, transferring any ectoparasites on the fish to the bath water. Ectoparasites that were visible on the skin of the fish, such as the large flabelliferan isopods, were removed manually. After removing all ectoparasites, the groupers were tagged at the base of the dorsal fin with plastic colored tags, injected with an antibiotic to prevent infection, and released at the place of capture. The tagging procedure prevented recapture of the same individuals.

Sorting and Identification

After dipping each fish, bath contents were sieved (0.5 mm mesh size) and fixed in 10% buffered formalin. Specimens were later transferred to 70% ethanol prior to sorting and identification. Collected specimens were identified to species or genus level using Richardson (1905), Schultz (1969), Menzies and Kruczynsky (1983), Kensley and Schotte (1989) for the isopods; Kabata (1979, 1988) for the copepods; and Beverly-Burton (1984), Dyer *et al.* (1992) for the monogenetic platyhelminth. In addition, identified species and specimens that could not be identified to species

level, along with voucher specimens, were sent to Dr. Jan Landsberg of the Florida Department of Natural Resources for identification and confirmation.

RESULTS

Grouper Species Summary

Ectoparasites from 63 individual fish, representing four species of epinepheline groupers, were examined, 44 were Nassau groupers (*Epinephelus striatus*), 13 were coneys (*Epinephelus fulvus*), 3 were graysbys (*Epinephelus cruentatus*), and 2 were red hinds (*Epinephelus guttatus*).

Ectoparasite Species Summary

The ectoparasites collected comprised at least five species representing two phyla; 4 species from Phylum Arthropoda and 1 species from P. Platyhelminthes (Table 1). The arthropods included 3 species from Order Isopoda (*Excorallana* sp., *Alcirona krebsii*, and *Gnathia* sp.) and at least 1 species from Subclass Copepoda (*Lepeophtheirus* spp.). The organisms from Phylum Platyhelminthes comprised of a single species of helminth from Class Monogenea (*Neobenedenia* sp.).

DISCUSSION

Following is a presentation of the ectoparasites encountered along with ecological comments and previous records of ectoparasites on epinepheline groupers.

Isopods

More than 450 species of isopods are known to be parasitic on fish and invertebrates. These parasitic species can be found in the suborders Flabellifera, Gnathiidea, and Epicaridea, with epicarideans being exclusive parasites of crustaceans. Suborders Flabellifera and Gnathiidea are represented in this study. Parasitic isopods from the suborder Flabellifera contain families of isopods that include both facultative parasites (Aegidae and Corallanidae), isopods that are also free-living and do not depend on the host for survival, and obligatory parasites (Cymothoidae), isopods that remain attached to the host throughout their life and depend on the host for survival. Suborder Gnathiidea consists of a small number of species whose larvae are only parasitic, while the adults are free-living (Schultz, 1969; Kabata, 1970, 1985; McLaughlin, 1980; Moller and Anders, 1986; Rafi, 1988; Kensley and Schotte, 1989; Grabda, 1991).

For years, isopods have been known to parasitize epinepheline groupers, but reports have either been brief or dealt with other species of

Table 1. Taxonomic classification of Epinepheline grouper ectoparasites collected at Exuma Cays, Bahamas (classifications after Bowman and Abele, 1982 for crustaceans; and Beverly-Burton, 1984 for the helminths).

Phylum Arthropoda
Subphylum Crustacea Pennant, 1777

Class Malacostraca Latreille, 1806
Subclass Eumalacostraca Grobben, 1892
Superorder Peracarida Calman, 1904
Order Isopoda Latreille, 1817
Suborder Flabellifera Sars, 1882
Family Corallanidae Hansen, 1890
Excorallana sp. Stebbing, 1904
Alcirona krebsi Hansen, 1890
Suborder Gnathiidea Leach, 1814
Family Gnathiidae Harger, 1879
Gnathia sp. Leach, 1814

Class Maxillopoda Dahl, 1856
Subclass Copepoda Milne-Edwards, 1840
Order Siphonostomatoida Thorell, 1859
Family Caligidae Burmeister, 1835
Lepeophtheirus spp. Nordmann, 1832

Phylum Platyhelminthes
Class Monogenea Carus, 1863
Order Dactylogyrida Bykhovsky, 1937
Family Capsalidae Baird, 1853
Neobenedenia sp. Yamaguti, 1963

epinepheline groupers found in different localities other than the Caribbean. Thompson and Munro (1978) found parasitic isopods clinging to the nostrils of groupers from Jamaica, but no identifications or details were provided. Rokicki (1985) found that the Serranidae was one of the families most often infected with isopod parasites, when looking at the isopod parasites of fish from North-West African waters. His accounts included grouper genera and parasite species not found in the Caribbean. Studies that have dealt with isopod parasites of epinepheline groupers of the Caribbean have focused mainly on cymothoid isopods that are large, easily collected, and more often encountered because of their rôle as obligatory parasites. Facultative parasites from other families of Suborder Flabellifera have been overlooked because of the difficulty in collection

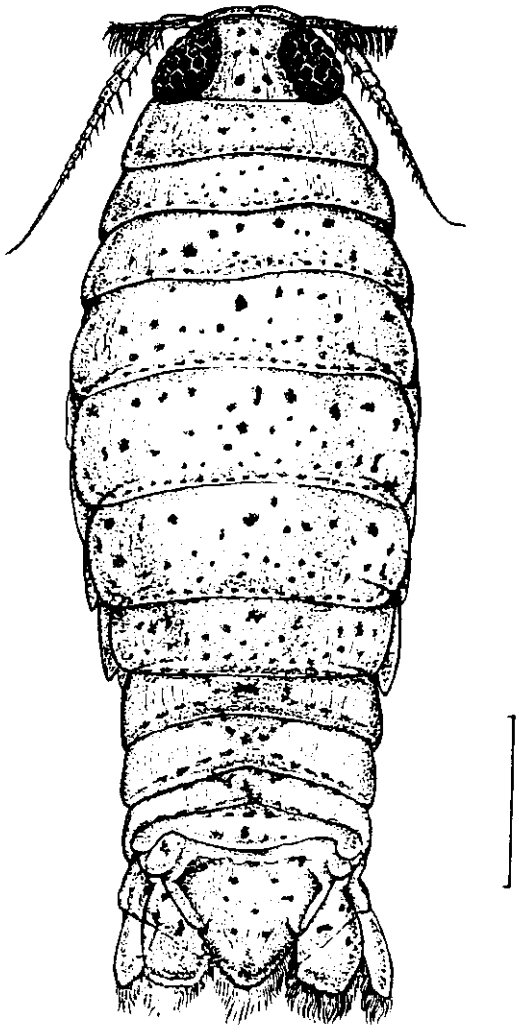

Figure 1. *Excorallana* sp. (bar = 1.0 mm).

due to the small amount of time they spend on the host. Except for single species descriptions and general accounts, little information is available on the nature and effect of isopod parasites on epinepheline groupers of the Caribbean.

***Excorallana* sp.** (Figure 1)

This genus is well represented in the Gulf of Mexico and Caribbean with 9 common species. These isopods are known to live on the benthos and have been reported from intertidal rubble, seagrass beds, algae, sponges, and corals. Some members of the genus *Excorallana* also are known to be external facultative parasites of fish (Richardson, 1905; Schultz, 1969; Menzies and Kruczynsky, 1983; Kensley and Schotte, 1989). The only records encountered of members of this genus parasitizing groupers in the Caribbean were of *Excorallana tricornis* on the nose of *Epinephelus itjara* and on the gills of *Epinephelus morio* in the Dry Tortugas, Florida (Menzies and Kruczynsky, 1983). In addition, E. tricornis was reported on the gills of rays and squirrel fish in Puerto Rico (Kensley and Schotte, 1989). This species may not have been removed by the baths because of their firm attachment to the fish. Specimens were collected manually from the skin, the buccal cavity, and the nostrils. It is believed that these facultative parasites are mostly ovigerous females that feed on the blood of the fish and return to their demersal mode of life after feeding. The species collected here had expanded mid-guts due to large blood meals. The collected specimens were only identified to genus level because only females were encountered, but they are believed to be females of *Excorallana tricornis*. Their genus has been confirmed as *Excorallana* sp. by Dr. Jan Landsberg (pers. comm.).

Alcirona krebsii Hansen, 1890 (Figure 2)

This species is common in the Caribbean and Gulf of Mexico and has been previously found in Bermuda; the Florida Keys, the Yucatan Peninsula, U.S. Virgin Islands, and Venezuela. It is a facultative parasite of fish, but more commonly inhabits sponges and dead coral (Richardson, 1905; Schultz, 1969; Menzies and Kruczynsky, 1983; Kensley and Schotte, 1989). The only record of this species parasitizing groupers is given by Richardson (1905), when he found *A. krebsii* on the fin of a hamlet grouper. In this study, only one specimen of this species was encountered. This may be due to the lack of parasitic modifications in the species and its nature as a facultative parasite. Like *Excorallana* sp., this species feeds on the blood of the host. This was confirmed on this specimen by the expanded and dark brown to red-colored mid-gut. The attachment site on the fish of this species is not known.

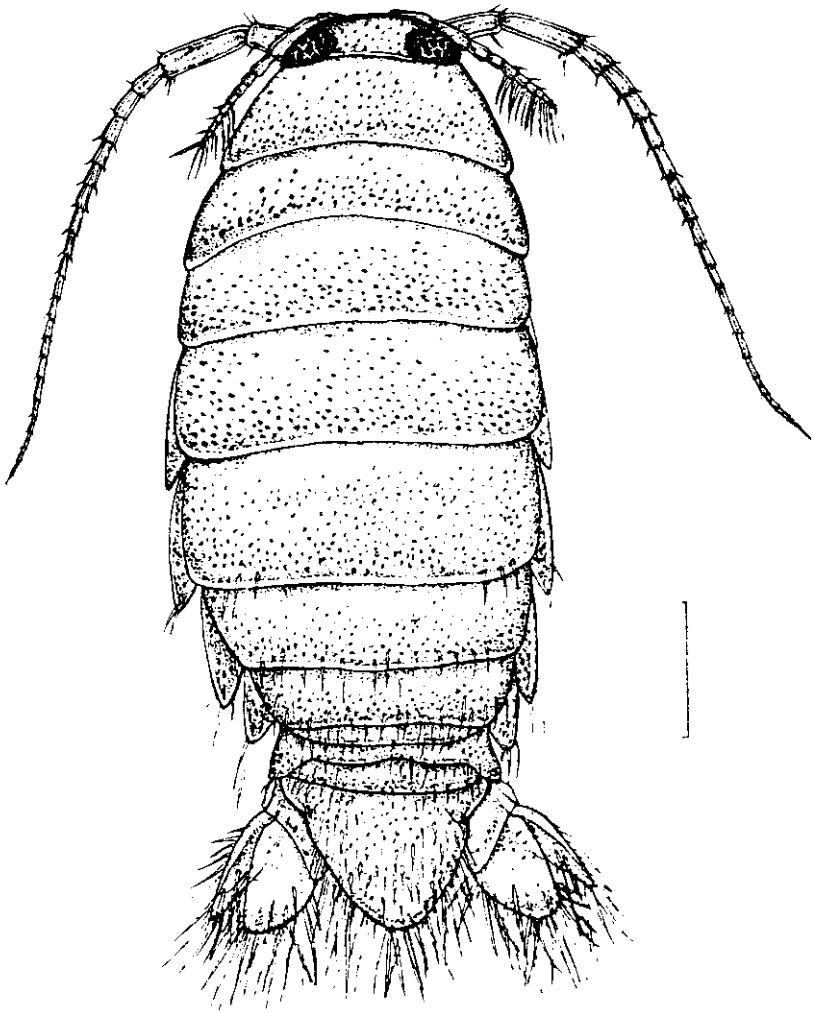

Figure 2. *Alcirona krebsii* (bar = 1.0 mm).

***Gnathia* sp.** (Figure 3)

Species of this genusa are all marine and are commonly found in coastal waters. Little is known about these organisms because adult males and females differ greatly in appearance and only males are used for identification purposes. They are also unique because of their mode of life. Only the praniza larvae are parasitic on fish. Adult males and females are commonly found in burrows in sponges or other refuges on the bottom where they do not feed, concentrating on reproduction, after which they die. Planktonic larvae hatch from eggs, metamorphose to praniza larvae and attach themselves to teleost fish. They feed on the blood of the host and have been found most often attached to the gills, but can be found on the fins, skin, or in the buccal cavity. After a few molts, the larvae metamorphose into adults and leave the fish to settle on the bottom (Schultz, 1969; Kabata, 1970; Menzies and Kruczynsky, 1983; Moller and Anders, 1986; Kensley and Schotte, 1989; Grabda, 1991).

Species from this genus are well known in the Caribbean (Menzies and Kruczynsky, 1983; Kensley and Schotte, 1989). Specimens from this study could not be identified to species level because the praniza from many species and the females are very similar in appearance and only the adult males are used in identifications. Because of this, host species-specificity is impossible and all is known is that *Gnathia* sp. praniza larvae are parasitic on marine fishes. No records were found of *Gnathia* sp. parasitizing groupers of the Caribbean. All specimens collected had extended mid-guts (pereonites 4-6) with obscured segmentation, due to the large blood meals. Because of their small size, the attachment site on the groupers was not discernible to the unaided eye.

Copepods

Subclass Copepoda contains the largest number of crustacean parasites. It is estimated that some 1,800 species of copepods are parasitic on fish and these are found in three orders: Siphonostomatoida, Poecilostomatoida, and Cyclopoida. Orders Siphonostomatoida and Poecilostomatoida are primarily marine, while Order Cyclopoida contains exclusively freshwater species (Kabata, 1988; Schram, 1986). Order Siphonostomatoida is represented in this study.

Copepods have received the most attention in the literature out of all crustacean parasites. They are prevalent and abundant, and affect many commercially important species of fishes and invertebrates (Kabata, 1970, 1979; Moller and Anders, 1986); Grabda, 1991). Most copepod parasite studies mainly focus on parasites of fish found in the more productive temperate and cooler oceanic regions, and not subtropical and tropical regions, where groupers are prevalent. Kabata (1979, 1988) looked at the

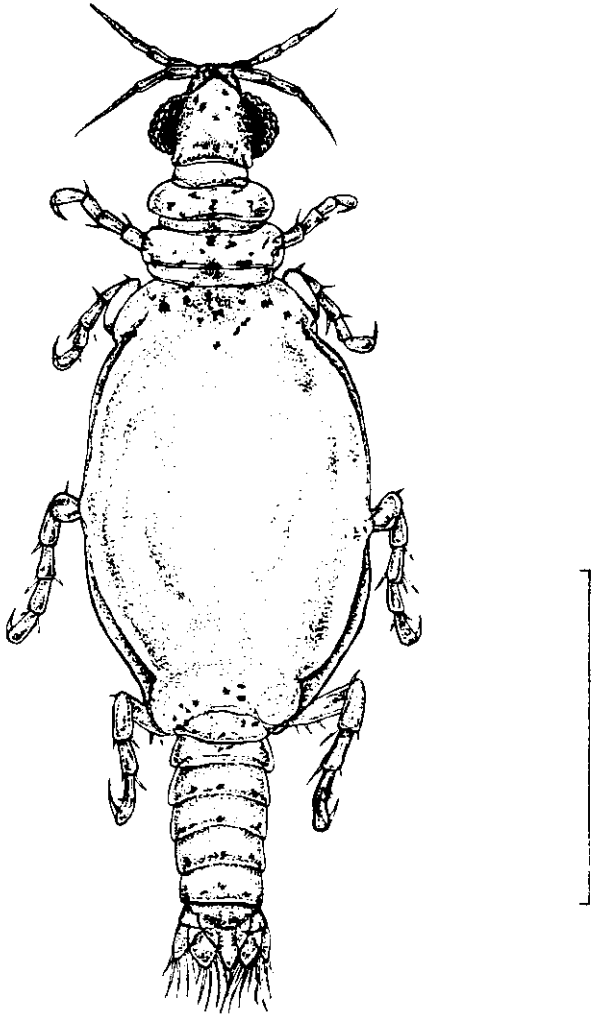

Figure 3. *Gnathia* sp. (bar = 1.0 mm).

copepod parasites affecting British and Canadian fishes. In addition, there have been numerous reports of copepods parasitizing epinepheline grouper species not found in the Caribbean, such as in Australia and South East Asia, where groupers are cultured (Beumer *et al.*, 1983). Except for single species descriptions and general accounts, little information is available on the copepod parasites that affect Caribbean fish, especially epinepheline groupers.

***Lepeophtheirus* spp.** (Figure 4)

There are about 100 described species in this genus. They are exclusive parasites of marine teleosts and are prevalent in temperate or cooler waters. Because of their flattened appearance, they are streamlined, and are able to move freely on the surface of the host with ease. They are believed to feed on the tissue fluids of fish with their piercing mandibles (Kabata, 1979, 1988; Moller and Anders, 1986; Grabda, 1991).

The organisms collected in this study could not be identified to species level and it is believed that they are composed of more than one species; dominated by one species and rare occurrences of one to two other species. Dr. Jan Landsberg (pers. comm.) has confirmed their genus as Lepeophtheirus. These copepods were mainly attached to the surface of the groupers and were numerous. Little information is available on this genus in subtropical and tropical regions and no substantial records were found of these copepods affecting epinepheline groupers of the Caribbean.

Monogeneans

There are about 1,500 described species of monogenean platyhelminths that parasitize freshwater and marine fish. These worms are generally ectoparasites on the body surface or gills of fishes using the opistohaptor for attachment, and feeding on mucus, epithelium, and blood. They are mainly hermaphroditic with a ciliated larvae that is free-swimming before it attaches permanently to the host to metamorphose to the adult. These worms have a direct life cycle, with only one host. Usually the opistohaptor and the sexual organs are used in identification of species (Beverly-Burton, 1984; Kabata, 1985; Moller and Anders, 1986; Grabda, 1991).

Most studies encountered that deal with platyhelminth parasites on Caribbean fish concentrate on the easier to collect endoparasitic digenetic trematodes. Thompson and Munro (1978) reported digenetic trematodes encysted in the viscera of groupers caught around Jamaica. Overstreet (1968) reported digenetic trematodes on Nassau and Black groupers of Biscayne Bay, Florida. Sparks (1957) reported digenetic trematodes on several epinepheline grouper species in the Bahamas. It remains that no

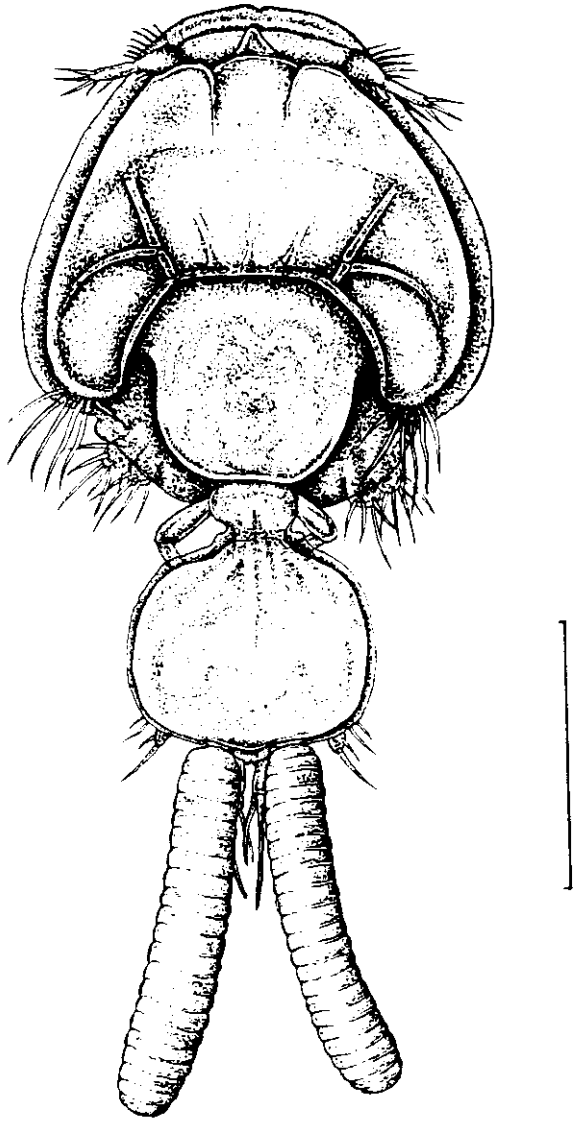

Figure 4. *Lepeophtheirus* sp. (bar = 1.0 mm).

information was available on the monogenetic platyhelminths that affect epinepheline groupers of the Caribbean.

***Neobenedenia* sp.** (Figure 5)

This genus is common in the Caribbean and contains ten species that are parasitic on marine teleosts. They are well known parasites of tropical and subtropical fishes, especially groupers in Australia and other parts of the world (Beumer *et al.*, 1983; Beverly-Burton, 1984). *Neobenedenia melleni*, in particular, has been well studied because of the damage it causes to tropical aquarium fishes and to some cultured fishes (Beverly-Burton, 1984; Dyer *et al.*, 1992). This genera has also been reported recently on epinepheline groupers of the Caribbean. Dyer *et al.* (1992) described *N. pargueraensis* n. sp. from *Epinephelus guttatus* in Puerto Rico. Although there have been some scattered reports, information is lacking on the monogeneans of epinepheline groupers in the Caribbean. In this study, the monogeneans appeared to be a single species, *Neobenedenia melleni*. Dr. Jan Landsberg (pers. comm.) has confirmed the presence of one species, and its genus as *Neobenedenia*.

SUMMARY

In summary, it is likely that several new species of ectoparasites may be unique to epinepheline groupers, but it is unknown how widely distributed ectoparasitic species are. In all, more than 500 ectoparasites were collected from sixty-three fish, with the potential presence of eight to ten ectoparasite species. Species level identification was not possible for previously described or possible new ectoparasite species because of the small number of specimens encountered and the absence of type specimens. Genera of the unidentified species have been confirmed, and thus presented. Future attention to the collection and studies of grouper ectoparasites may provide information on (1) the importance of ectoparasites, especially facultative ones, in the ecology of groupers, (2) infection rates and etiology of grouper ectoparasites, and (3) the overall diversity of Caribbean reef systems.

ACKNOWLEDGMENTS

The authors would like to thank: Robert Sluka of the University of Miami; Mark Chiappone of The Nature Conservancy; Sophie Ducornez of the Ecole Nationale Veterinaire d' Alfort; the staff of the Exuma Cays Land and Sea Park; the Bahamas National Trust; and Dr. Jan Landsberg of the Florida Department of Natural Resources (DNR). Chris Mills provided the illustrations. Sea and Sky Foundation provided logistical support and aerial photographs of survey sites.

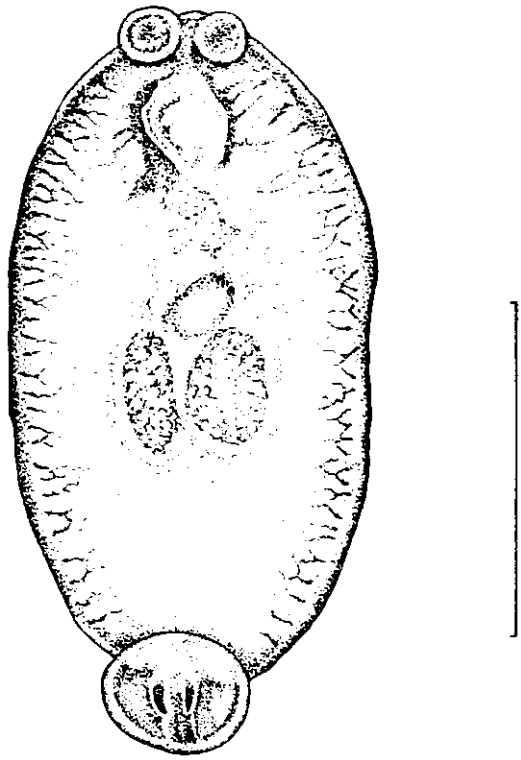

Figure 5. *Neobenedenia* sp. (bar = 1.0 mm).

LITERATURE CITED

Beumer, J.P., L.D. Ashburner, M.E. Burbury, E. Jette, and D.J. Latham. 1983. *A checklist of the parasites of fishes from Australia and its adjacent Antarctic territories.* Commonwealth Agricultural Bureaux, England. 99 pp.

Beverly-Burton, M. 1984. Monogenea and Turbellaria. Pages 5-209 *in* L. Margolis and Z. Kabata, eds. *Guide to the parasites of fishes of Canada.* Part I. Department of Fisheries and Oceans, Ottawa.

Bowman, T.E. and L.G. Abele. 1982. Classification of the recent Crustacea. Pages 1-25 in L.G. Abele, ed. *The Biology of Crustacea, Vol. 1, Systematics, the fossil record, and biogeography.* Academic Press, New York.

Dyer, W.G., E.H. Williams, Jr., and L. Bunkley-Williams. 1992. *Neobenedenia pargueraensis* n. sp. (Monogenea: Capsalidae) from the red hind, *Epinephelus guttatus*, and comments about *Neobenedenia melleni. J. Parasitol.* **78**(3):399-401.

Grabda, J. 1991. *Marine fish parasitology.* Polish Scientific Publishers, Warsawa, Poland. 306 pp.

Jory, D.E. and E.S. Iversen. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (south Florida)—black, red, and Nassau groupers. *U.S. Fish Wildl. Serv. Biol. Rep.* **82**(11.110). U.S. Army Corps of Engineers, TR EL-82-4. 21 pp.

Kabata, Z. 1970. *Crustacea as enemies of fishes.* T.F.H. Publications, Inc., Jersey City, NJ. 171 pp.

Kabata, Z. 1979. *Parasitic Copepoda of British fishes.* The Ray Society, London. 468 pp.

Kabata, Z. 1985. *Parasites and diseases of fish cultured in the tropics.* Taylor & Francis, Inc., Philadelphia. 318 pp.

Kabata, Z. 1988. Copepoda and Branchiura. Pages 3-127 *in* L. Margolis and Z. Kabata, eds. *Guide to the parasites of fishes of Canada.* Part II. Crustacea. Department of Fisheries and Oceans, Ottawa.

Kensley, B. and M. Schotte. 1989. *Guide to the marine isopod crustaceans of the Caribbean.* Smithsonian Institution Press, Washington D.C. 308 pp.

Menzies, R.J. and W.L. Kruczynski. 1983. Isopod Crustacea (exclusive of Epicaridea). *Memoirs of the Hourglass Cruises* **6**(1): 1-126.

McLaughlin, P.A. 1980. *Comparative morphology of recent Crustacea.* W.H. Freeman and Co., San Francisco. 177 pp.

Moller, H. and K. Anders. 1986. *Diseases and parasites of marine fishes.* Verlag Moller, Kiel, Germany. 365 pp.

Overstreet, R.M. [1968] Digenetic trematodes of marine teleost fishes from Biscayne Bay, Florida. University of Miami, Coral Gables. FL 188 pp. Unpubl. Ph.D.

Rafi, F. 1988. Isopoda. Pages 129-148 *in* L. Margolis and Z. Kabata, eds. *Guide to the parasites of fishes of Canada. Part II. Crustacea.* Department of Fisheries and Oceans, Ottawa

Richardson, H. 1905. A monograph on the isopods of North America. *Bulletin of the United States National Museum* 54. 727 pp.

Rokicki, J. 1985. Biology of adult Isopoda (Crustacea) parasitizing fishes of North-West Africa. *Acta. Ichthyol. Piscat.* **25** (1).

Schram, F.R. 1986. *Crustacea.* Oxford University Press, New York. 606 pp.

Schultz, G.A. 1969. *How to know the marine isopod crustaceans.* Wm. C. Brown Co. Publishers, Dubuque, IA. 359 pp.

Sparks, A.K. 1957. Some digenetic trematodes of marine fishes of the Bahamas Islands. *Bull. Mar. Sci.* **7**(3):255-265.

Thompson, R. and J.L. Munro. 1978. Aspects of the biology and ecology of Caribbean reef fishes: Serranidae (hinds and groupers). *J. Fish Biol.* **12**:115-146.