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Groupers Resources (Actinopterygii:Perciformes: Epinephelidae) of Andaman and Nicobar Islands, With Two New Records

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Abstract

Revision of the grouper fishes from the Andaman and Nicobar Islands is presented in this paper based on the collections housed in the Zoological Survey of India, Port Blair. Groupers belong to the family Epinephelidae comprising of about 163 species in 16 genera in the world, of which 58 species and 8 genera are known from the Andaman and Nicobar Islands. The family Epinehelidae comprises 8 genera including *Aethaloperca, Anyperodon, Cephalopholis, Cromileptes, Epinephelus, Hyporthodus, Plectropomus* and *Variola.* Grouper species are identified by their colour pattern as well as morpho-meristic characters such as size of the fins, shape and relative size of the head, number of fin rays, scales, gill rakers and body shape. In addition, the pyloric caeca counts and pattern have also been used for identification of species. The use of molecular methods such as DNA fingerprinting and more recently bar-coding has played a major role in resolving taxonomic ambiguity in groupers. The four species *Cromileptes altivelis, Epinephelus lanceolatus, Plectropomus laevis* and *Plectropomus areolatus* are currently classified as Vulnerable according to the IUCN Red List and only bony fish, the giant grouper *Epinephelus lanceolatus,* is protected under the Indian Wildlife Act of 1972. The present study provides two new record *Epinephelus polyspila* Randall and Satapoomin, *Epinephelus poecilonotus* (Temminck and Schlegel) and essential background information for the formulation of a Grouper Management Plan, because there is concern that grouper stocks are being overfished.

Key words: *Review, Groupers, conservation, management, Andaman and Nicobar*

Introduction

The Andaman and Nicobar Islands are situated in the Bay of Bengal between 6º45′ -13° 45′ N and 92º10′ – 94º15′E, and consist of 352 islands 220 islets and rock. Theycover a distance of almost 470 square kilometres over North South, with a coastline of 1962 km, and represent 600,000 km^2 of India's Exclusive Economic Zone (EEZ). The coast is under the influence of a diverse set of oceanographic and ecological conditions. The shelf topography of these islands contains frequent rises supporting coral reefs, which are characterized as fringing reefs on the eastern side and barrier reefs off west; the depressions are known as passages and straits. Besides coral reefs, the shore is composed of rocky and sandy areas and vast stretches of Mangrove swamps with a few freshwater rivers and streams.

The family Epinephelidae currently comprises about 163 species in 16 genera in the world (Eschmeyer and Fong, 2020). They are commonly known as groupers, rockcods and hinds (Heemstra and Randall, 1993). The Epinephelidaeare further classified into 4 sub families, namely Diploprioninae, Epinephelinae, Liopropominae and Grammistinae (Craig, M.T., Y. Sadovy de Mitcheson & P.C. Heemstra 2011). Representatives of 8 genera comprising of 58 species *Aethaloperca rogaa* (Forsskål), *Anyperodon leucogrammicus* (Valenciennes), *Cephalopholis argus* Schneider, *Cephalopholis aurantia* (Valenciennes), *Cephalopholis boenak* (Bloch), *Cephalopholi scyanostigma* (Valenciennes), *Cephalopholis formosa* (Shaw & Nodder), *Cephalopholis leopardus* (Lacepède), *Cephalopholis microprion* (Bleeker), *Cephalopholis miniata* (Forsskål), *Cephalopholis nigripinnis* (Valenciennes), *Cephalopholissex maculata* (Rüppell), *Cephalopholis sonnerati* (Valenciennes), *Cromileptes altivelis* (Valenciennes), *Epinephelus amblycephalus* (Bleeker), *Epinephelus areolatus* (Forsskål), *Epinephelus bleekeri* (Vaillant), *Epinephelus caeruleopunctatus* (Bloch), *Epinephelus chlorostigma* (Valenciennes),

Epinephelus coioides (Hamilton), *Epinephelus corallicola* (Valenciennes), *Epinephelus epistictus* (Temminck and Schlegel), *Epinephelus erythrurus* (Valenciennes), *Epinephelus fasciatus* (Forsskål), *Epinephelus faveatus* (Valenciennes), *Epinephelus flavocaeruleus* (Lacepède), *Epinephelus fuscoguttatus* (Forsskål), *Epinephelus heniochus* Fowler, *Epinephelus hexagonatus* (Bloch & Schneider), *Epinephelus lanceolatus* (Bloch), *Epinephelus longispinis* (Kner), *Epinephelus macrospilos* (Bleeker), *Epinephelus malabaricus* (Bloch & Schneider), *Epinephelus melanostigma* Schultz, *Epinephelus merra* Bloch, *Epinephelus morrhua* (Valenciennes) *Epinephelus miliaris* (Valenciennes), *Epinephelus ongus* (Bloch), *Epinephelus poecilonotus* (Temminck and Schlegel), *Epinephelus polyphekadion* (Bleeker), *Epinephelus polyspila* Randall and Satapoomin, *Epinephelus polystigma* (Bleeker), *Epinephelus quoyanus* (Valenciennes), *Epinephelus radiatus* (Day), *Epinephelus retouti* Bleeker 1868, *Epinephelussex fasciatus* (Valenciennes), *Epinephelus spilotoceps* Schultz, *Epinephelus tauvina* (Forsskål), *Epinephelus tukula* Morgans, *Epinephelus undulosus* (Quoy&Gaimard), *Hyporthodus octofasciatus* (Griffin), *Gracila albomarginata* (Fowler & Bean), *Plectropomus areolatus* (Rüppell), *Plectropomus laevis* (Lacepède), *Plectropomus maculatus* (Bloch), *Hyporthodus octofasciatus* (Griffen 1926), *Plectropomus pessuliferus* (Fowler), *Variola albimarginata* Baissac and *Variolalouti* (Forsskål) are reported to be present in Andaman and Nicobar Islands (Rajan, 2002, 2003 and 2015, Rajan *et al*. 2013).Groupers are generally identified using a combination of their morphological features and meristic characters as reported in the FAO catalogue on groupers (Heemstra and Randall, 1991, 1993 and Matthew Craig 2011). This is because several species of groupers resemble each other in colour pattern and appearance, which often leads to misidentification.

Some species occur in depths of 100 to 200 m (occasionally to 500 m), however the majority inhabit depths of less than 100 m, and juveniles are often found in tide pools. Most groupers are ambush predators, hiding amongst the coral and rocks. Groupers are popular marine food fish of high market value in many parts of the world and many are currently being exported in whole frozen form. Groupers constitute the main focus of the commercial fisheries and an important component of the catch in Andaman and Nicobar Islands. The buying price of a fish varies with size and species. The price of per kilogram may vary from Rupees 800 to 1000 depending upon the buying category used by the buyer. A common practice is to divide the groupers into red and black categories with [red/black] being more highly valued. The fresh chilled fish are packed in thermo cool boxes with ice and are exported daily by air. Chennai is the main grouper export market. Lack of data makes it nearly impossible to compare the catch from different years and to show the true trend in the grouper fishery.

There is a dedicated fishery for "perches" along the coast of Andaman and Nicobar Islands using hook and line, gill nets and traps which includes a targeted fishery for groupers. This fishery targets habitats that are generally hard, covered with dense growth of coral, rocks and sea fans, and rich in groupers.

Materials and methods

Groupers were collected from the fish landing centre of Andaman and Nicobar Islands as well as in the field with the help of SCUBA. The fresh fish samples were photographed. Besides the morphological features like colour pattern, shape and relative size of the head and body, data such as the total length, standard length, total body weight, body depth, and number of spines and rays were also recorded.

Results and discussion

Traditional approaches to species identification in groupers is often difficult due to the presence of several colour morphs within a single species and a wide variation in the colour pattern between juveniles and adults and live and dead individuals of the same species. Under mentioned species are often confused but can be identified reliably from external morphological characters such as *Epinephelus coioides, E. tauvina* and *E. malabaricus* (Heemstra and Randall, 1993). Supportive techniques are needed to confirm the taxonomic status of groupers, which are very important both from fisheries and aquaculture points of view.

Aethaloperca rogaa

Anyperodon leucogrammicus

Cepholopholis argus

Cephalopholis aurantia

Cephalopholis boenak

Cephalopholis formosa

Cephalopholis leopardus

Cephalopholis miniata

Cephalopholis nigripinnis

Cephalopholis polyspila (New record)

Cephalopholis sexmaculata

Cephalopholis sonnerati

Cromileptes altivelis

Epinephelus areolatus

Epinephelus bleekeri

Epinephelus caeruleopunctatus

Epinephelus chlorostigma

Epinephelus coioides

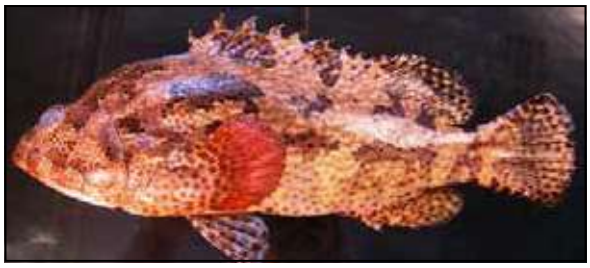
Epinephelus epistictus

Epinephelus erythrurus

Epinephelus fasciatus

Epinephelus flavocaeruleus

Epinephelus heniochus



Epinephelus fuscoguttatus

Epinephelus hexagonatus

Epinephelus lanceolatus

Epinephelus longispinis

Epinephelus macrospilos

Epinephelus malabaricus

Epinephelus merra

Epinephelus miliaris

Epinephelus ongus

Epinephelus poecilonotus (New record)

Epinephelus polystigma

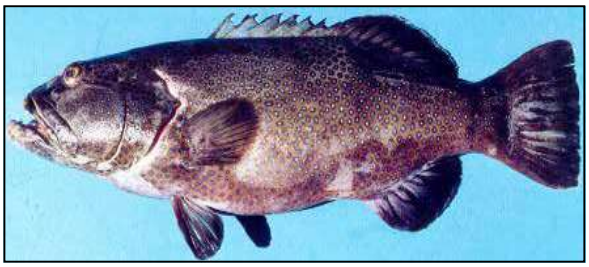
Epinephelus polyphekadion

Epinephelus radiatus

Epinephelus retouti

Epinephelus undulosus

Epinephelus tukula



Plectropomus areolatus

Plectropomus laevis

Variolaalbim arginata

Plectropomus pessuliferus

Plectropomus maculatus

Variola louti

All the species of the genus *Epinephelus and Hypothrodus* have 10-11 spines and 14 - 18 rays on the dorsal fin. The anal fin has 3 spines and 7 - 10 rays; genus *Cephalopholis* has 9 spines and 13 - 17 rays on the dorsal fin (Table1). *Epinephelus malabaricus* has been confused with *E. coioides*. These two groupers are best differentiated by colour. *E. malabaricus* has well-spaced small black spots on the head, body and fins and scattered larger whitish spots and blotches on the head and body,whereas *E. coioides* has larger orange -brown spots and lacks whitish spots. Faded museum specimens of the two species may be difficult to differentiate. *E. malabaricus* occurs on protected reefs and adjacent mangrove habitats, common in the catches of these islands. *Plectrpomus laevis* has two colour phases, one whitish or pale yellowish with 5 dark brown to black saddle-like bars with scattered small dark-edged blue spots. The second phase is brown, olivaceous, red with pale bars and numerous small dark-edged blue spots.

The large sized commercially important groupers, *Epinephelus fuscoguttatus, E. malabaricus* and *E. coioides* were present in these islands. The smaller species like the reticulated groupers *E. macrospilos* and *E. merra* were abundant in the catch. The size range of the species collected indicated that mostly juveniles were collected in the case of the larger species whereas almost all size classes of the smaller species were obtained. According to Rajan (2002) 43 species of groupers have been reported from Andaman and Nicobar Islands, of which *E. areolatus, E. malabaricus* and *Plectropomus spp.* were dominant and the same species were also dominant in this study. Many species of groupers resemble each other morphologically and in certain species even the meristic characters have been found to overlap. This makes identification a difficult

task. Groupers have been misidentified in early literature (Heemstra and Randall, 1993). Total dependence on the colour pattern for identification could be the major reason for this misidentification. This could be the reason for the mentioning species like *E. tauvina*in earlier records. The species were identified using their colour pattern as well as meristic characters as suggested by Heemstra and Randall (1993). It was found that 58 species of groupers belonging to the 8 genera *Aethaloperca, Anyperodon, Cephalopholis, Cromileptes, Epinephelus, Hyporthodus, Plectropomus* and *Variola*were available in these waters, *E. malabaricus*, *E. coioides*, *E. polyphekadion*, *E. merra*, *E. longispinis*, *E. coeruleopunctatus*and *C. formosa*. *E. malabaricus* were found to be the dominant species off the coast of Andaman and Nicobar Islands.

Conservation and Management

Export of grouper fishery in Andaman Islands started in the year 1996 and it was initially started in Havelock Islands, with realization of the income potential the fishery expanded throughout Andaman and Nicobar Islands. At present the grouper fishery is mainly carried out by the fishermen of Gutapara, Wandoor of South Andaman, now it is expanded to middle and north Andaman Islands. In general these fishermen visit almost all areas of Andaman Islands for grouper fishing. Catches of groupers rose from 202t in 1997 to 750t in 2015. Ready cash for the sale of grouper provide an incentive to fishermen, which promoted and encouraged fishing without much care about the overfishing and stock collapse. This site specificity and the relatively slow growth rate of groupers make them particularly vulnerable to over-fishing. In addition, some groupers use localized spawning sites to which they migrate from distances of several kilometres; and these sites are often exploited by local fishermen who catch large numbers of fishes during the brief spawning period of 1 or 2 weeks.

This removal of a considerable number of reproductively active fish from the population may be detrimental to sustained yields of the fishery. No regulation in catch is responsible for serious depletion of populations of this grouper species particularly *Epinephelus lanceolatus*. In recognition of this problem the collection of this species is totally banned and is protected under the Indian Wildlife Act, 1972. Species such *Cromileptes altivelis, Epinephelus fuscoguttatus, E.lanceolatus, Plectropomus laevis, P.areolatus* and *P.pessuliferus* have always been favourites due to their high market value. Unfortunately these are species which are listed in the IUCN Red List as either *"Near threatened*" or "*Vulnerable*" thus stressing the vulnerability of groupers to intense fishing effort. When a fishery targets a single species, it is possible to overfish the species quickly in the locality where the fishery has started first.

An extremely important factor affecting the success of a size limit in increasing yields is the degree of survival of undersized fish that are taken and released. For commercial use, the removal of groupers less than average maturity length of 12 inches from the medium size grouper and 16 inches from the large size grouper can be prohibited. The current level of catch and effort data collection is not adequate for monitoring and assessment requirements of the resource. Exporters and buyers could be encouraged to submit their daily purchase sheets on monthly basis. The most commonly caught species are *Aethaloperca rogaa*, *Anyperodon leucogrammicus*, *Cephalopholis argus C. miniata C. sonnerati, Epinephelus areolatus, E. coioides, E. flavocaeruleus, E. longispinis*, *E. malabaricus, E. polyphekadion, Plectropomus areolatus*, *P. laevis*, *P. maculatus*, *P. pessuliferus*, *Variola albimarginata* and *V.Louti,* it is suggested that these species be used as the indicator species. However, species such as *E. fuscoguttatus*, *V. louti*and *C. argus* were seen to contribute more towards the overall catch composition. On the other hand, *P. pessuliferus*, which now has a higher value are caught in greater quantities and contribute highest to the current catch composition. *Cromileptes altivelis* is very rare species and it should be protected. More comprehensive surveying is needed to provide a more accurate estimate. However, these results do provide a good benchmark for management.

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References

Craig, M.T. & Hastings, P.A. (2007). A molecular phylogeny of the groupers of the subfamily Epinephelinae (Serranidae) with a revised classification of the Epinephelini. *Ichthyol Res* 54: 1–17.

Craig, M.T., Y. Sadovy de Mitcheson & P.C. Heemstra (2011). *Groupers of the World: A Field and Market Guide*. CRC Press, Grahamstown, South Africa, NISC. 1-424.

Eschmeyer, W.N. & Fong, J.D. (2016). Species of Fishes by family/subfamily. http://research.calacademy.org/research/ichthyology/catalog/Species By Family. htmlonline version.

Heemstra, P. C. & Randall, J. E. (1993). Groupers of the World (Family *Serranidae,* Subfamily *Epinephelinae).* An annotated and illustrated catalogue of the grouper, rockcod, hind, coral grouper and lyretail species known to date. *FAO species catalogue,* **16**: 1-382.

James, P. S. B. R., Murthy, V. S. R. and Nammalwar, P. 1996. Groupers and Snappers of India: biology and exploitation. In :*Biology, fisheries and culture of tropical groupers and snappers*. Ed. Arreguin-Sanchez, F., Munro, J. L., Balgos, M. C. and Pauly, D., ICLARM Conference Proceedings, **48:** 106-136.

Mathew, G., Nammalwar, P., Chakraborthy, S. K., Livingstone, P., Philipose, K. K. & Hamsa, K.M.S.A. (2000). Exploited resources of major perches in India. In *Marine Fisheries Research and Management* (eds Pillai, V. N. and Menon, N. G.), Central Marine Fisheries Research Institute, Cochin, pp. 636–655.

Mok, H.K. (1979). Coelomic organs of Perciform fishes (Teleostei). *Dissertation Abstracts International Biological Sciences and Engineering,* **39(7):**3096-3097.

Oren, O. H. 1981. *Aquaculture of grey mullets*, Cambridge University Press, Cambridge CB2 1 RP, U.K., pp. 1-507.

Rajan, P.T. (2003). *A field guide to marine food fishes of Andaman and Nicobar islands.* Zool. Surv. India Publication, Kolkata, pp. 1-260.

Rajan, P.T.,Sreeraj, C.R. & Titus Immanuel (2013). Fishes of Andaman and Nicobar Islands: A Checklist. *J. Andaman Sci. Assoc.* 18 (1) 47-87.

Rajan, P.T. (2002). *Field Guide of Grouper Fishes (Family: Serranidae, Sub Family: Epinephelinae) and Snapper Fishes (Family : Lutjanidae) of Andaman and Nicobar Islands.* (Published-Director, ZSI, Calcutta), 103pp.

Randall, J.E. & Heemstra, P.C. (1991). Revision of Indo-Pacific groupers (Perciformes: Serranidae: Epinephelinae), with descriptions of five new species. *Indo-Pacific fishes*, no.20, 332pp.

W.L. & Craig, M.T. ( ). Casting the percomorph net widely: the importance of broad taxonomic sampling in the search for the placement of serranid and percid . *Copeia* 1:35–55 310

Zismann, L. (1981). Means of identification of grey mullet fry for culture. In *Aquaculture of grey mullets.* Ed.Oren, O. H., Cambridge University Press, Cambridge CB2 1 RP, U.K., pp. 17-63.

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