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Seamount associated fishery of south-west coast of India - a preliminary assessment

K. K. BINEESH, K. V. AKHILESH, E. M. ABDUSSAMAD AND D. PRAKASAN
Central Marine Fisheries Research Institute, P. B. No. 1603, Ernakulam North P. O., Cochin - 682 018, Kerala, India
e-mail: kkbineesh@gmail.com

ABSTRACT

West coast of India accounts for 55% of the total marine capture fishery production of India. Wider continental shelf with high productivity due to coastal upwelling is attributed to this large contribution. Present study shows that fishing in the seamounts, knolls, guyots and ridges in the Arabian Sea too contribute considerably to the landings of west coast. During 2010 and 2011, an estimated 2314 and 1934 t of fishes were landed from seamounts and associated knolls at Kochi (Kerala) in the west coast. Landings were supported mostly by commercially important high value large pelagics, elasmobranchs, carangids and perches. Present study indicates that these areas are under intensive exploitation and more detailed studies are needed for critical status assessment of resources in these vulnerable habitats.

Keywords: Arabian Sea, Fishery, India, Knolls, Seamounts Species diversity, West coast

Introduction

Seamounts are unique environments which support high level biodiversity. Several thousands of seamounts are distributed throughout the world's oceans and their numbers are increasing in each marine survey (Wessel, 2001; Kitchingman and Lai, 2004; Hillier and Watts, 2007; Allain *et al.,* 2006, 2008; Etnoyer *et al.,* 2010). The seamounts of Indian Ocean are the most poorly studied, virtually nothing is known about its biota, habitats and characteristics (Ingole and Koslow, 2005). Satellite data indicate that Indian Ocean has numerous small to moderate sized seamounts, mainly associated with its ridge systems (Craig and Sandwell, 1998; Iyer *et al.,* 2012).

Seamounts attract increasing interest from biogeographic, ecological, economic, fishery and conservation points (Glover and Smith, 2003), due to its diverse fauna. Eight hundred fish species have been recorded from seamounts (Froese and Sampang, 2004; Morato *et al*., 2006; Morato and Clark, 2007), of which many have high commercial value. Seamounts are well known for fish aggregations (for spawning or feeding), making them highly vulnerable to fishing activities (Morato *et al*., 2006). Large aggregations of pelagic fishes are often found in association with seamounts throughout the tropical oceans and are often exploited by fishing fleets (Fonteneau, 1991).

Since early 1980's fisheries have developed for both teleost and crustaceans around the seamounts in the world oceans, particularly due to the discovery of fishing grounds of orange roughy, *Hoplostethus atlanticus*. During 1980, the Soviets developed fisheries across the seamounts of Madagascar, South-West Indian and Mid Indian Ridges, Ninety-East and Broken Ridges in the Indian Ocean, and targeted alfonsino (*Beryx splendens*), rubyfish (*Emmelichthys* spp.) and butterfish (Centrolophidae) (Romanov, 2002).

In the Indian EEZ, seamounts are located along the west coast mostly as part of Chagos-Laccadive Ridge (CLR) (Kitchingman and Lai, 2004; Iyer *et al.,* 2012), but information available about their ecology, bathymetry and biodiversity are scanty (Qasim and Wafar, 1979; Untawale *et al.,* 1989; Parulekar, 1990; Ambiye and Untawale, 1992). The islands of Chagos, the Maldives and the Lakshadweep are above-water parts of the Chagos-Laccadive Ridge. The present article provides information on the distribution and fishery on seamounts, knolls, guyots and ridges off the west coast of India.

Materials and methods

Weekly surveys at the Cochin Fisheries Harbour (CFH), Kochi, Kerala in south-west India were conducted between 2010 and 2011 to determine the catch, species and size composition of the landings. The daily catch data was estimated based on personnel observations carried out during one to three trips per week. The annual estimates of catch were made following the stratified random sampling design, as adopted by the Central Marine Fisheries

Research Institute (CMFRI), Kochi based on Srinath *et al.* (2005). Personnel interviews with fishermen were conducted to understand the geographical locations and to ensure that the catches are from seamounts (between 12°N-14° N and 71°E -72 °E) off south-west India. Seamount distribution map (Fig. 1) was downloaded from GEBCO undersea features names (http://www.ngdc.noaa.gov/gazetteer). Catch composition and size ranges were monitored. Fishes were identified up to species level using Talwar and Kacker (1984) and recent taxonomic keys.

Results and discussion

Fishing areas and methods

Three seamounts locally known as "*Manchappara* (Bassas de 'Pedro Bank'), *Kora* (Cora Divh Bank) and *Bank* (Sesostris Bank) (Fig. 1), and several other knolls and ridges called "*paru, thitta"* off the west coast are intensively fished throughout the year and the catches are landed mainly at Cochin Fisheries Harbour, a major landing centre in the west coast of India. These seamounts are recognised off Karnataka coast with varying size and at different depths ranging from 43 m – 2300 m (Iyer *et al.,* 2012). These seamounts are intensively fished throughout the year by approximately 100 - 130 mechanised fishing vessels (42 to 72 feet OAL), which operate drift gillnets, longlines, and handlines depending on season and resource availability. They undertake mainly multiday fishing (8-22 days) operations. The operational depth over the seamounts ranged between 16-300 m. Fishing is carried out both during day and night hours. The surface fishing drift gillnets have size of 1000 to 2500 m length, 15 m height and mesh size of 11 inches. They operate during night hours and targets tunas, pelagic sharks, rainbow runner, groupers and sword fish. Longlines which target sharks, rays, tunas, billfishes and other medium sized fishes employ hooks No. 0-3 and use about 500-2500 hooks at a time depending on ground conditions. The common baits are scads (*Decapterus russelli*, *Decapterus macarellus* and *Selar crumenophthalmus*), sardines (*Sardinella* spp., *Dussumieria* spp.), flying fishes (*Exocoetus* spp.) and squids. Live flying fishes (*Exocoetus* spp.) kept in containers are used while targeting sailfishes. Hand lines with smaller hooks (hooks no. 8, 9 and 10) mainly targeted groupers, snappers, pigface breams and trevallies along rocky areas of 20-70 m depth. Fishing on seamounts depends on the availability of high value fishes (sharks, tunas, groupers, billfishes and marlins) and fishing operation generally ceases during monsoon (June-September).

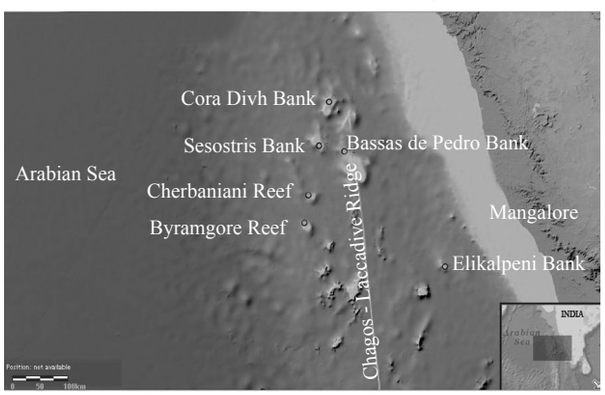

Fig. 1. Map showing the positions of seamounts along the south-west coast of India

Fish landings

During 2010 and 2011, a toal of 2314 and 1934 t of fishes were landed respectively from seamounts and associated knolls at Cochin Fisheries Harbour (Kochi), Kerala. Major groups contributing to the fishery were tunas, sailfishes, carangids, elasmobranchs, swordfishes, groupers and snappers. Estimated landings of major groups (Fig. 2) indicate that major portion of commercially important demersal groups and large pelagic fishes landed at Cochin are from knolls and seamounts.

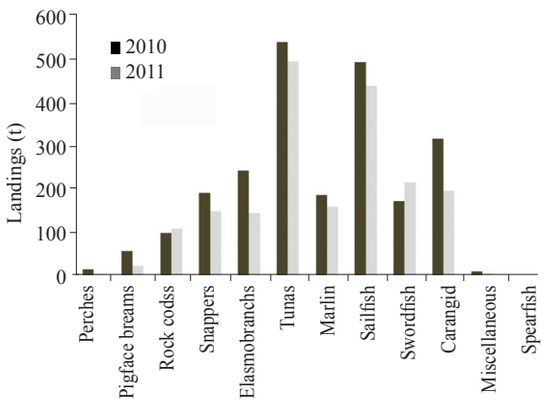

Fig. 2. Estimated landings of major groups exploited from seamounts and knolls off south-west coast of India, landed at Cochin Fisheries Harbour during 2010 and 2011

Month-wise catch data of important groups and their contribution to fishery at Cochin (Fig. 3) indicates a clear seasonal pattern for the seamount fishery. During 2010, major landings were observed during February-March, with 39% of total landings followed by September-October (19%). In 2011, major landings recorded during February-March (35%) followed by May-June (25 %) and September–October (19%).

Species composition

Landings from seamounts comprised 103 species belonging to 31 families and 64 genera (Table 1). Out of this, 53 species were abundant in the landings. The most frequently caught species were *Istiophorus platypterus, Katsuwonus pelamis, Thunnus albacares, Aprion*

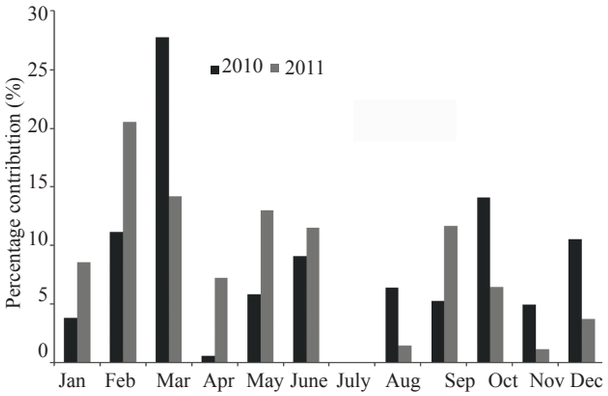

Fig. 3. Monthly landings (%) of major groups exploited from seamounts and knolls off south-west coast of India, landed at Cochin Fisheries Harbour during 2010 and 2011

virescens, Pinjalo pinjalo, Epinephelus spp.*, Lutjanus* spp. and *Acanthocybium solandri, Coryphaena hippurus,* sharks *Carcharhinus* spp. and rays *Taeniurops meyeni* and *Himantura fai.*

Tunas supported a good fishery from seamounts. Their average annual contribution was 533 and 489 t during 2010 and 2011 respectively, which represented 23-25% of the total landings from seamounts. Tunas in the landings were represented mainly by yellow fin, *Thunnus albacares* (59-69%) and skipjack, *Katsuwonus pelamis* (23-39%) and small portion of longtail tuna *Thunnus tonggol* (7%).

Landing of sailfish, *Istiophorus platypterus* from seamounts was 487 t during 2010 and 416 t during 2011. Marlins were represented by *Istiompax indica* with 186 t and 159 t during 2010 and 2011 respectively and swordfish *Xiphias gladius* with 172 and 215 t.

An estimated 313 and 195 t of carangids were landed from seamounts at Cochin during 2010 and 2011 respectively. During 2010, *Caranx* spp. dominated with average landings of 165 t followed by *Elegatis bipinnulata,* with 122 t. Contribution of *Caranx* spp. declined to 150 t followed by *E. bipinnulata* with 38 t during 2011.

Elasmobranch fishery was supported by more than 30 species belonging to 13 families (Table 1). Maximum diversity was observed in Carcharhiniformes and Myliobatiformes, which contributed major portion of fishery at Cochin. *T. meyeni, Carcharhinus limbatus, Carcharhinus brevipinna, Alopias superciliosus, Alopias pelagicus, Sphyrna lewini and Himantura fai* were the most abundant species landed. Elasmobranch landings during the period ranged between 242 and 144 t. Sharks dominated the landings representing 70% and 55 % during 2010 and 2011 respectively, followed by rays.

During 2010, snappers, rock cods, pigface breams and perches accounted for 191 t, 100 t, 59 t and 18.3 t respectively from seamounts, while during 2011 landing from seamounts were dominated by snappers 150 t, rock cods 109 t, pigface breams 26 t and perches 6 t (Fig. 2).

Fishing gears like longlines, gillnets and handlines operating in the seamounts associated ridge areas primarily target high value fish resources like groupers, perches, large carangids and tunas (*Katsuwonus pelamis, Thunnus albacares, Thunnus tonggol* and *Gymnosarda unicolor*) where they aggregate for spawning and feeding. Similar aggregations of elasmobranchs, billfishes and tunas in association with seamounts are found in all tropical oceans and these are exploited by fishing fleets (Fonteneau, 1991; Itano and Holland, 2000).

The seamounts along the west coast of India consistently aggregates commercially important fish groups and are intensively exploited. Abdussamad *et al.* (2012) stated that, tunas are mainly caught from seamounts along the south-west coast of India. Large aggregation of myctophids have been reported near Angria Bank and Ratnagiri knolls (16^{o} 19 N-72 ^{o}5 E) off Maharashtra (Kumaran, 1978) which forms a major food item of commercially important large pelagics. Silas (1985) commented that Angria Bank in northern Arabian Sea is an important fish spawning ground. The knolls off Beypore (11^{o} 22 N- 74^{o} 21 E), Periyapani (12^{o} 24 N-71^{o} 52 E), Ezhukalpanathitta (11^{o} 26 N-74^{o} 08 E), Chinnapani, Vizhinjam paru (off Kerala) are also known to support good fishery.

Seamounts and associated knolls are rich areas of biodiversity. Present study confirmed the presence of new species like Indian Bunquelovely, *Symphysanodon xanthopterygion*, Pillai's anthias, *Pseudanthias pillai* and *Liopropoma randalli* from the seamounts of west coast of India. Occurrence of elasmobranchs like *Rhynchobatus australiae*, *Dasyatis microps*, *Aetomylaeus vespertilio, Mobula tarapacana, Mobula kuhlii,* and *Hexanchus griseus* reported from these areas call for an in depth study on fish diversity of seamounts. An early biogeographic study of 92 seamounts suggested that 15% of the species collected were endemic to individual seamounts (Wilson and Kaufmann, 1987). More research is needed to know the actual diversity of these seamounts.

Results of the present study indicate an increasing trend in the fishing efforts in areas around seamounts along the south-west coast of India, during recent years especially for elasmobranchs, large pelagics and billfishes. This may ultimately lead to overexploitation of species, as reported from several parts of the world. Considering the boom and bust nature of many seamount fisheries (Koslow *et al.,* 2000), a cautious approach is needed to manage the seamount fishery of India. Seamounts and their associated ecosystems are considered as important component in the fishery along the west coast, as they act as breeding, feeding and nursery grounds of the

Table 1. List of commercially important fish species landed at Cochin Fisheries Harbour (Kochi), Kerala from seamounts, off south-west coast of India

Family	Species	Size range (cm)	Status in fishery	IUCN status
Hexanchidae	*Hexanchus griseus*	87-260	Occasional	Near Threatened
	Heptranchias perlo	80-140	Occasional	Near Threatened
Ginglymostomatidae	*Nebrius ferrugineus*	120- 300	Occasional	Vulnerable
Stegostomatidae	*Stegostoma fasciatum*	80-160	Frequent	Vulnerable
Rhincodontidae	*Rhincodon typus*	95-260	Rare	Vulnerable
Alopiidae	*Alopias pelagicus*	110-226	Abundant	Vulnerable
	Alopias superciliosus	112-335	Abundant	Vulnerable
	Alopias vulpinus	126-312	Abundant	Vulnerable
Lamnidae	*Isurus oxyrinchus*	112-207	Frequent	Near Threatened
Carcharhinidae	*Carcharhinus albimarginatus*	92-217	Frequent	Near Threatened
	Carcharhinus altimus	140-187	Frequent	Data Deficient
	Carcharhinus amboinensis	104-260	Frequent	Data Deficient
	Carcharhinus leucas	90-340	Frequent	Near Threatened
	Carcharhinus limbatus	107-286	Frequent	Near Threatened
	Carcharhinus longimanus	100-140	Frequent	Near Threatened
	Galeocerdo cuvier	106-440	Abundant	Near Threatened
	Prionace glauca	180-342	Occasional	Near Threatened
	Triaenodon obesus	80-148	Rare	Near Threatened
Sphyrnidae	*Sphyrna zygaena*	120-322	Rare	Near Threatened
	Sphyrna lewini	120-387	Abundant	Near Threatened
Rhinobatidae	*Rhina ancylostoma*	120-175	Occasional	Vulnerable
Rhynchobatidae	*Rhynchobatus australiae*	180-270	Occasional	Vulnerable
Dasyatidae	*Pteroplatytrygon violacea*	38-78	Abundant	Least Concern
	Dasyatis microps	120-186	Occasional	Data Deficient
	Taeniurops meyeni	102-180	Abundant	Vulnerable
	Himantura granulata	106-120	Rare	Near Threatened
	Himantura fai	90-165	Abundant	Least Concern
Myliobatidae	*Aetomylaeus vespertilio*	160-220	Rare	Endangered
	Manta birostris	320-440	Occasional	Vulnerable
	Mobula tarapacana	110-260	Occasional	Data Deficient
	Mobula kuhlii	90-118	Occasional	Data Deficient
	Mobula japanica	120-314	Abundant	Near Threatened
Istiophoridae	*Istiophorus platypterus*	160-340	Abundant	Least Concern
	Istiompax indica	260-410	Abundant	Data Deficient
Xiphiidae	*Xiphias gladius*	120-210	Occasional	Least Concern
Coryphaenidae	*Coryphaena hippurus*	80-110	Abundant	Least Concern
Menidae	*Mene maculata*	16-28	Occasional	Not Evaluated
Rachycentridae	*Rachycentron canadum*	60-163	Abundant	Least Concern
Scombridae	*Acanthocybium solandri*	130-202	Occasional	Least Concern
	Scomberomorus commerson	82-144	Abundant	Near Threatened
	Thunnus albacares	64-168	Abundant	Near Threatened
	Gymnosarda unicolor	110-228	Frequent	Least Concern
	Katsuwonus pelamis	52-86	Abundant	Least Concern
	Thunnus tonggol	56-98	Abundant	Data Deficient
	Auxis thazard	52-62	Occasional	Least Concern
Gempylidae	*Ruvettus pretiosus*	83-114	Occasional	Data Deficient
Fistulariidae	*Fistularia commersonii*	74-110	Occasional	Not Evaluated
Zeidae	*Zenopsis conchifer*	34-56	Occasional	Not Evaluated
Lutjanidae	*Aprion virescens*	72-98	Abundant	Not Evaluated

	Pristipomoides multidens	48-92	Abundant	Not Evaluated
	Lutjanus bohar	62-84	Abundant	Not Evaluated
	Lutjanus kasmira	14-22	Abundant	Not Evaluated
	Lutjanus lutjanus	16-30	Abundant	Not Evaluated
	Pinjalo pinjalo	36-76	Abundant	Not Evaluated
Lethrinidae	*Lethrinus mahsena*	22-48	Abundant	Not Evaluated
Emmelichthyidae	*Erythrocles acarina*	26-68	Abundant	Not Evaluated
Priacanthidae	*Pristigenys refulgens*	14-28	Occasional	Not Evaluated
Berycidae	*Beryx splendens*	16-22	Occasional	Not Evaluated
Carangidae	*Selar crumenophthalmus*	13-28	Occasional	Not Evaluated
	Trachinotus mookalee	64-92	Occasional	Not Evaluated
	Decapterus macarellus	26-38	Abundant	Least Concern
	Decapterus macrosoma	24-36	Abundant	Not Evaluated
	Megalaspis cordyla	38-52	Occasional	Not Evaluated
	Caranx ignobilis	60-145	Abundant	Not Evaluated
	Caranx sexfasciatus	30-102	Abundant	Least Concern
	Caranx melampygus	64-116	Abundant	Not Evaluated
	Caranx tille	30-90	Abundant	Not Evaluated
	Carangoides fulvoguttatus	84-110	Occasional	Not Evaluated
	Carangoides gymnostethus	48-90	Occasional	Not Evaluated
	Seriolina nigrofasciata	38-44	Occasional	Not Evaluated
	Naucrates ductor	13-18	Occasional	Not Evaluated
	Alectis indicus	36-128	Abundant	Not Evaluated
	Seriola dumerili	46-82	Occasional	Not Evaluated
	Seriola rivoliana	68-96	Occasional	Not Evaluated
	Scomberoides lysan	44-96	Occasional	Not Evaluated
	Scomberoides commersonnianus	56-110	Abundant	Not Evaluated
	Elagatis bipinnulata	90-160	Abundant	Not Evaluated
Serranidae	*Variola louti*	13-76	Abundant	Least Concern
	Variola albimarginata	44-78	Abundant	Least Concern
	Plectropomus leopardus	46-70	Abundant	Near Threatened
	Plectropomus areolatus	44-70	Abundant	Vulnerable
	Epinephelus radiatus	44-67	Abundant	Least Concern
	Epinephelus poecilonotus	44-62	Abundant	Least Concern
	Epinephelus longispinis	40-60	Abundant	Least Concern
	Epinephelus latifasciatus	42-60	Abundant	Data Deficient
	Epinephelus fuscoguttatus	46-86	Abundant	Near Threatened
	Epinephelus flavocaeruleus	40-73	Abundant	Least Concern
	Epinephelus fasciatus	22-36	Abundant	Least Concern
	Epinephelus epistictus	44-60	Rare	Data Deficient
	Epinephelus diacanthus	30-48	Abundant	Near Threatened
	Epinephelus chlorostigma	47-72	Abundant	Least Concern
	Epinephelus areolatus	22-32	Abundant	Least Concern
	Cephalopholis urodeta	20-28	Abundant	Least Concern
	Cephalopholis sonnerati	44-56	Abundant	Least Concern
	Cephalopholis miniata	31-40	Abundant	Least Concern
	Cephalopholis formosa	26-31	Abundant	Least Concern
	Aethaloperca rogaa	36-56	Occasional	Not Evaluated
Kyphosidae	*Kyphosus vaigiensis*	34-58	Occasional	Not Evaluated
Acanthuridae	*Naso brevirostris*	30-46	Occasional	Least Concern
	Naso sp. 1		Occasional	
	Naso sp. 2		Occasional	
Mullidae	*Parupeneus* sp. 1		Rare	
	Parupeneus sp. 2		Rare	

major fishery resources. Continuous monitoring of the fishery and resources from these areas is needed to ensure sustainable fishery.

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