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A review on status, resources, exploitation and management measures of marine catfish fisheries of India

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Abstract
Marine catfish resources are distributed in the tropical Indo-Pacific region and form an important part of demersal fish catches along the entire coastline of India. Out of total catfish catches in India, 99% of the catches are dominated by species of the genus *Tachysurus*. Almost 70% of the catch originated from the west coast. State-wise, the biggest offers were from Kerala and Maharashtra and Karnataka. Among the eight maritime states of India aside from Andhra and Tamil Nadu, the general nature in the production of catfishes is of increasing trend. The fisheries are essentially exploited by automated trawl (33%) trailed by mechanized gill netters (21%), non-automated gear (14%), purse seine (11%) hooks and line (10%) and dol net (5%). Overfishing is a noteworthy issue in catfish fisheries, seems they are abused widely by trawlers and purse seiners. The trademark proliferation, shoaling nature, and relocation of numerous species of marine catfishes made them simple focus for over-exploitation. The management measures for future fishery enhancement can be achieved by either diminishing the fishing pressure or expanding the mesh size of the cod-end of the gear. The control or prohibition on bottom trawling operation will likewise lessen benthic fauna pulverization and the exploitable resources sustaining environment degradation. The status, resources, exploitation and management measures of marine catfish fisheries of India are discussed in this review.

Keywords: Marine catfishes, resources, exploitation, management measures, India

1. Introduction
The marine catfish is a monetarily essential ground fish dispersed broadly in the beachfront waters and framed a generous fishery asset of the nation [1]. Catfishes had shaped vital occasional fisheries along the west and east shores of the nation since the early distinctive days, however, had at times been seen as much else besides of neighborhood significance [1]. With the expansive scale presentation of motorized fishing, especially in the previous two decades, and an unmistakable demersal fishery making its mark, it turned out to be certain that the prior confined nature of the catfish fishery was not a record of the event of greatness of the asset, however just of the constraints in the abuse. Coordinated fishing with more prominent productivity brought about expanded ground fish generation and catfishes framed a reliably critical piece of the demersal catches [1]. The marine catfishes have a place with two families, Plotosidae and Arridae (Tachysuridae). They used to harvest with a wide range of gear, especially in hook and lines and are devoured in fresh or cured conditions. The catfishes are predacious and rapacious. Their air bladders are utilized for the produce of ising glass. The family plotosidae incorporates a couple of species under the genus *Plotosus*. The regular species are *Plotosus canius* and *Plotosus anguillaris* which develop to more than 750 mm long. Family Arridae incorporates a vast number of species which are economically imperative. Although all the species of Arridae are found in India, *Arius thalassinus* and *A. dussumeri* are best available from Kerala and Karnataka.

2. Discussion
2.1 Distribution of Resource
Despite the fact that about twelve species of catfish are caught along the shores of the nation, just five species are of significance from the fisheries perspective. Marine catfishes have a place for the most part with Tachysuridae, consequently, it is not astounding that 99% of the catches are of the four species of this family, *viz., T. tenuispinis, T. thalassinus T. dussumieri*

and *T. serratus*. The initial three are pretty much consistently plenteous in the grounds off west and east coast, *T. serratus* being more limited toward the south-west coast. The main other catfish species of significance is *Osteogeneiosus militaris* which is copiously caught off Saurashtra coast.

Table 1: Distribution of catfish species in India

Sl. No.	Species	Occurrence in Indian waters
1	*Tachysurus caelatus*	Shallow coastal waters of east and west coasts, particularly around the river mouths on the east coast.
2	*T. subrostratus*	Coastal waters, also estuaries and tidal waters along the southeast cost.
3	*T. sona*	Coastal waters, mainly west coast; stray catches from the east coast
4	*T. thalassinus*	All along the west and east coasts, also in estuaries. Seldom in shoals.
5	*T. serratus*	Along the east and west coasts, particularly during monsoon.
6	*T. platystomus*	Along the east and west coasts, abundant in Gulf of Mannar.
7	*T. tenuispinis*	Along the coasts, abundant along SW and NE coasts—large shoals in surface and columnar waters.
8	*T. jella*	Along the coasts, abundant on the east coast, also in estuaries.
9	*T. macuiatus*	Along the east and west coasts, also estuaries and tidal rivers.
10	*T. dussumieri*	Along east and west coasts, large shoals in surface and columnar waters, particularly along SW and SE coasts.
11	*Osteogeneiosus militaris*	Along the coasts, particularly NW and NE.

(Data source: Mukundan) [2]

2.2 State-wise distribution of resources

Catfishes frame vital fisheries along the coasts of Kerala, Maharashtra, Tamil Nadu, Andhra Pradesh, Karnataka, Gujarat, West Bengal and Odisha pretty much in a specific order of wealth. Catfishes contributed around 10% of the nation's ground-fish caches and 4-6% of the aggregate marine fish landings. Almost 70% of the catch originated from the west coast. State-wise, the biggest offers were from Kerala and Maharashtra and Karnataka, since the vast scale presentation of purse seiners, is likewise quick ascending to a top position [3]. Though there were great catfish landings in Kerala, Maharashtra, Gujarat and Tamil Nadu, their rates in the total fish catches of the particular states were not as high as those in West Bengal, Odisha, Karnataka, and Goa. The low rates of catfish in the total fish catch in Kerala, Maharashtra and Gujarat were obviously because of the more prospering mackerel and oil sardine fisheries in Kerala and Bombay duck in Maharashtra and Gujarat. The most astounding biomass of catfish has been along the coasts of Kerala, trailed by Karnataka, Goa and South Maharashtra and the least in the Gulf of Mannar [4]. The time of abundance of catfish is January-June off Maharashtra Coast, April-September of Karnataka and Kerala, July-September in the Gulf of Mannar, and March to June and December-January of the Andhra Coast. *Tachysuru sthalassinus* is the single vital species of catfish among the five species that bolster the fisheries for catfishes. With a similarly more extensive dissemination yet with lesser commitment, the next vital species of catfish is *T. tenuispinis. T. tenuispinis* is in any case, more plentiful along the West Bengal, Odisha, Andhra and in north Tamil Nadu than in other maritime states. In south Tamil Nadu, Kerala, Karnataka and Maharashtra, *T. dussumieri* seems to rule [5]. *Osteogeneious militaris* seems, by all accounts, to be endemic to Gujarat, where it is a fishery of importance. Correspondingly *T. serratus* is more copious of south Tamil Nadu and Kerala than they are in other states. *T. jella* is found in plentiful along the east coast of India [5].

2.3 Region wise distribution of resources

Along the south-west coast, the business fishing grounds are for the most part kept to 35 m depth and considerably more limited amid the SW monsoon months of May-September. *Tachysurusdussumieri* and *T. tenuispinis* are the species that add to the main part of the catfish landings, other essential species being *T. thalassinus* and *T. serratus* [6-8]. Along the south-east coast, there is a rich fishery for some species of catfish *T. thalassinus*, *T. dussumieri*, *T. tenuispinis*, *T. caelatus* and *T. platystomus* are financially vital, afflict with the exception of the first being occasional. The main fishing grounds are in the Gulf of Mannar and Palk Bay; species like *T. maculatus* and even *O. militaris* may occasionally be caught in amounts from Palk Bay [9]. The depth of fishing from time to time surpasses 15-20 m.

The principle catfish fisheries in the north-east area are along the Andhra coast [10]. The business fishery is for the most part in the shallow coastal areas of under 40 m depth. The fishery is fundamentally maintained by *T. thalassinus*, *T. caelatus*, *T. tenuispinis*, *T. dussumieri T. jeila* and *T. maculatus* are additionally caught however more in West Bengal and Odisha waters [4, 8].

In the northwest segment of Gujarat, Maharashtra and Goa, the exploited region is a coastal strip up to 40-50 m depth, however exploratory trawling has been completed to more than 100 m depth. *T. thalassinus*, *T. dussumieri*, *T. sona*. *T. tenuispinis*, *T. jella*and *O. militaris* are the species economically caught [8].

2.4 Depth wise Distribution

Catfishes are for the most part bounteous in shallower waters, of fewer than 50 m depth. Rao *et al.* [11] has concentrated the depth appropriation of catfishes along the latitude 15°00' N to 22°00' N and found that the catch rates are high from all depths (5 to 85 m), however with higher fixations in 41-60 m depths in all latitude zones. *T. tiiaiassinus* and *T. tenuispinis* have two pinnacle plenitudes in two depth runs, the first being 30-50 m and the second 60-80 m [8, 10]. Both the species have high plenitude in shallow grounds (less than 50 m depth) in April-June and October-December and in more profound grounds in July-September [10]. *Tachysurus thalassinus* is the most dominant species occurred beyond 50 m depth belt whereas shoaling species like *T. tenuispinis* and *T. dussumieri* are reported from grounds less than 50 m [12].

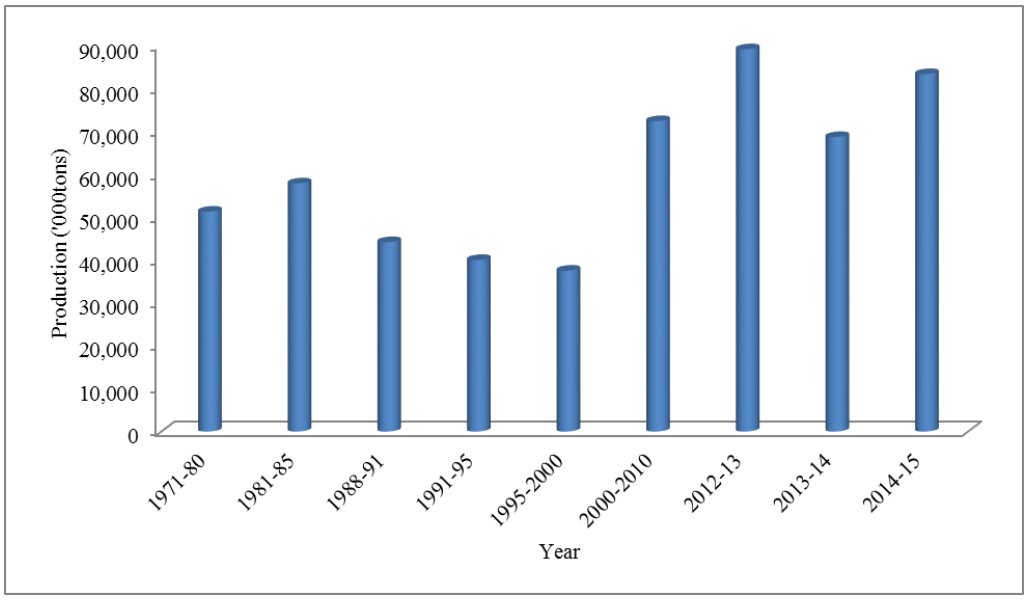

Fig 1: Trend of catfishes landings in India (Source: CMFRI Annual Report [13])

2.5. Production trend of marine catfishes

The assessed potential marine catfish accessible for exploitation in the Indian EEZ is 1, 23,000 t out of which 60,000 t is from depths underneath 50 m and 63,000 t from over 50 m depth [14]. The contribution of catfish to the demersal landings has been decreased from 24.6% in 1970 to 8.0% in 2005 [15]. The expansive scale mechanization in 1971-1980 saw a climb in the landings to the tune of 51,271 t taken after by the purse seine fishing in Karnataka and Kerala which has additionally pushed the landings to 57,860 t in 1981-1985 periods. From that point, the production gradually declined to 40,008 t in 1991-1995 [16]. Yearly catfish yield along west coast alone structures 70% of the aggregate catfish catch of India and the commitment by south-west coast is 54% in the catch of the west coast, chiefly from Kerala (29%) and Maharashtra (20%), with Karnataka additionally having as of late ascended to the top position after the presentation of the purse-seines. The annual landings of catfishes drastically decreased from 22,158 t (1970 - 74) to a mere 1,219 t (1995 - 98) along the southwest coast of India [17]. In the year 2009-2010 catch increments up to 72,378 t and in the year 2013 production goes up to 89141 t. From the year 2013 the catch again goes in declining pattern up to 68,675 t in 2014 and in the year 2015 catch increments to 83,354 t. In both the Andhra and Tamil Nadu states, the assessed landings, notwithstanding, were portrayed by diminishing patterns [18]. Average catch during 2003-2005 of *Trichiurus* species as a percentage of the historical maximum catch (baseline catch) during 1970-2002 in Kerala shows a declining trend [19].

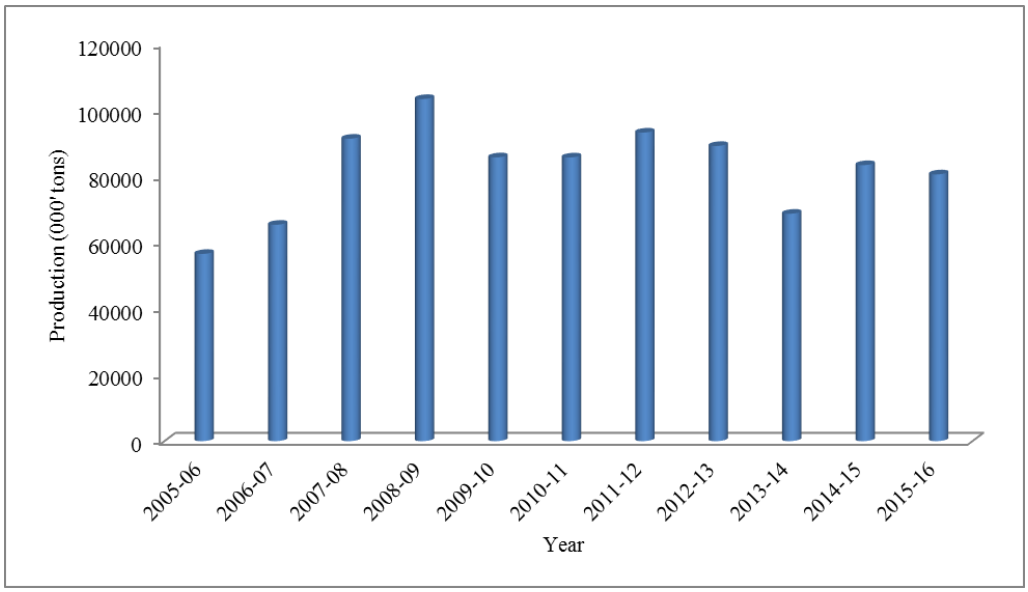

Fig 2: Production (000'tonnes) trend of marine catfishes (1970-2015; Source, CMFRI, Annual Report [3].

2.6. Type of resources (pelagic/ demersal)

Marine catfishes are demersal in nature. The catfishes have been seen to be most thick over inshore sloppy ranges especially in 30-80 m depths. Fishery review that secured the range from 55 to 360 m depth for one year concluded catfish a vital part of the catches from the seaward waters in all months aside from September-October [20], While better catch rates were recorded for the most part from the 55 to 90 m depth, high catch rates were seen in 91-125 m zone in February-April. The southern zone was wealthier than the northern. The

bigger fish have been acquired from the more profound waters. More than 90% of the aggregate catfish catch is acknowledged from less than 50 m depth zone in spite of the augmentation of fishing into more profound grounds up to 100 m. The peak breeding period of marine catfishes in Indian waters varies from April to August [21].

2.7. Gears used for catching

The asset is essentially exploited by automated trawl (33%) trailed by mechanized gill netters (21%), non-automated gear (14%), purse seine (11%) hooks and line (10%) and dol net (5%). In the north-west coast, the trawl net landed 38% of the aggregate catfish catch, trailed by gill net (25%), purse seine (16%), dol net (8%), hook and line (7%) and non-automated gear (7%). On the south west coast, this asset is tapped by non-motorized gears, for example, gill nets, hook and line, boat seines, rampani and yendi and automated gear, trawl [22]. The trawlers contributed 37% of the aggregate catfish catch of southwest area, gillnetters landed 23%, purse seine 19%, hooks and line 12% and non-mechanized gear 6%. North-east coast was arrived by gill-netters taken after by non-automated gear (24%), trawl net (20%) and hooks and lines (17%). In the south east the trawl landed 47% of the aggregate catch, the non-automated gear caught 38% taken after by gill-netters 12% [23]. Drift nets are of impressive significance along the Gujarat coast, purse seines are essential in Karnataka and to a lesser degree in Kerala. In the drift net catches the predominant species are *T. dussumieri* and *T. caelatus*. Among the maritime states on the east coast *viz*., West Bengal, Odisha, Andhra and Tamil Nadu, hooks and line, boat seines and bottom set gillnets seem, by all accounts, to be the main gears of operation for catfishes.

Table 2: Some important landing sites with means of exploitation of catfishes

Centres	Trawl net	Gill net	Hooks and line	Purse seine
Waltair	*T. thalassinus*	*T. tenuispinis*	*T. thalassinus*	-
Mandapam	*T. thalassinus*	-	-	-
Cochin	*T. thalassinus*	*T.dussumieri and T. serratus*	-	*T. dussumieri*
Calicut	*T. tenuispinis*	*T. dussumieri*	*T. tenuispinis*	-
Mangalore	*T. tenuispinis*	*T. tenuispinis*	-	*T. dussumieri*
Veraval	*T. dussumieri*	*T. dussumieri*	-	-

(Data source: Alagaraja and Srinath, 1987,Appanasastry and Kasim) [8, 23]

2.8. Vessels used for catching

There are diverse sorts of vessel utilized as a part of catching marine catfishes. The main crafts utilized incorporate conventional boats like cattamaran, dug-out canoe. Dug-out canoe is utilized for the most part along the west coast of India. Catamaran is utilized along the east coast of India. The asset is primarily exploited by automated trawlers (33%). Mechanized trawlers are utilized as a part of a large portion of the regions of India for catching marine catfishes. In the south-eastarea, automated trawl constitutes of around 47% of aggregate catches.

2.9. Issues in the management of catfish Resources

The issue of fishery management directions is serious and complex in a tropical nation like India where the marine capture fisheries are multispecies and the asset clients have a place with multi sectors and difficult to implement and authorize inferable from political or financial reasons [22]. Overfishing is a noteworthy issue in catfish fisheries. Because of motorization catfishes are abused widely by trawlers and purse seiners. The catfishes are for the most part caught as a by-catch in a trawl net. The growth rate of catfishes is slow as compared to other demersal fisheries, as a result, they get recruited early to the fishery, and a large majority is exploited before attaining first maturity [14]. By-catch from bottom trawling is a noteworthy issue in catfish fisheries in light of the fact that a colossal measure of catfish is caught as by-catch amid automated trawling which results in the loss of juveniles unpredictably [22, 24]. Constantly the bottom trawl catch consists of a large number of juveniles, sub-adult and column dwelling 1-2 yrs fishes. Regularly the juveniles and sub-adults of 7-20 cm shaped the mass (numerical) of the catch at the greater part of the focuses along the south-west and south-east coasts. The Impact of this bottom clearing has brought on harm to the ground-fishes maintainability as well as on the bottom living niches and the biota which shape the prey for demersal fisheries. This kind of juvenile fishery from the nursery grounds has brought about both growth and recruitment overfishing.

The trademark proliferation, shoaling nature and relocation (migration) of numerous species of marine catfishes made them simple focus for over-exploitation [22, 25]. Catfishes exhibit diurnal vertical and horizontal migration towards the coast and parallel to the coast during monsoon season [25]. The migration of catfishes parallel to the coast is observed below 17^0 N at both west and east coast. This has resulted in an excessive harvest of brooders or spawners in that particular part of coast resulting in recruitment overfishing [26]. In catfishes, the males assume a vital part in parental care. The eggs after fertilization are held by the males in the mouth for incubation and these males get isolated subsequent to breeding and move in expansive shoals. This nature has prompted the particular fishing and vast scale catch of males along the Karnataka coast by the purse-seiners working there. A large number of eggs measuring a few tons have been demolished accordingly a seemingly endless amount of time. Due to this gestation phenomenon, males are more susceptible to fishing [14].

2.10. Utilization and Marketing

The catfishes are generally used fresh as are promoted specifically to neighborhood buyers. Bigger fish of *T. thalassinus, T. dussumieri, T. tenuispinis, T. serratus* and *T. caelatus* are filleted while fresh and cured by salting and sun-drying [4, 27]. This is promoted in the market in villages. Bigger fish are likewise once in a while opening length-wise, the viscera expelled and the fish pit cured for extraordinary markets like Sri Lanka and some East Asian countries. Small-sized catfish are utilized, alongside the different catch of trash fish, for the production of fish meal or fish protein concentrate. Researchers have demonstrated that *T. jella* gives an item containing more than 90% protein [28]. The air-bladders of bigger catfish are utilized as a part of the production of isinglass.

2.11. Management measures for future fishery enhancement

It is obvious that the fishing pressure on the catfish fisheries in the nearshore waters is high, regularly over the level required to get the MSY. This can be helped by either diminishing the fishing pressure or expanding the mesh size of the cod-end of the gear [4]. The catch and landing of gestating males by purse seine ought to be restricted absolutely up and down the distributional range; this could be effectively accomplished since the talented fishermen can identify the catfish shoals and abstain from fishing them amid spawning season. The execution of this management will decrease the egg/larval demolition and henceforth enhance and reinforce recruitment. There is a need of controlling or prohibiting mechanized trawl in the coastal zones up to 30 m depth up and down the coast and the unbridled operation of mini-trawlers ought to be managed [29]. This management will decrease growth overfishing and in this way, step by step help to improve the stock. The control or prohibition on this bottom trawling operation will likewise lessen benthic fauna pulverization and the exploitable resources sustaining environment degradation. The fishing effort must be controlled in like manner in the inshore waters, especially for trawlers and purse-seiners, amid the breeding months of August to November. Nonetheless, the present business catch information uncovered that more than 90% of the aggregate catfish catch is acknowledged from less then 50 m depth zone [29] in spite of the expansion of fishing into more profound grounds up to 100 m. In this manner, to make fishing controls more efficient, it is beneficial to catch them amid the shoreward movement stage by particular gears without creating recruitment or growth overfishing. The current production from northern regions can be improved further by responsible fishing by using non-selective eco-friendly gears like hook and line and mid-water trawling in 30-100 m, for a sustainable fisheries yield [29]. The production of catfishes can be increased in both northern and southern regions by the active co-operation of all stakeholders and fishermen. The susceptibility to recruitment overfishing during the period of September-November, and December-February has been brought into the concern of state governments to impose a ban on the purse seining in that respective areas to stop overfishing and to make the fisheries sustainable.

3. Conclusion

Catfishes along south-west coast once pronounced as crumpled, have hinted at a recovery in the current past. The waning production and poor enlistment along the south-west and south-east areas now request execution of management, for example, forbidding coastal bottom trawling, controlling purse seining of gestating males, and so on. Every single such measure is hindering to the financial target of the business and hence subject to stand up to. In this manner, it ought to first be chosen that whether the transient financial increases ought to take inclination over the certified approach of accomplishing a practical yield whereby shielding the resources from overexploitation. In light of a legitimate concern for both, it is consequently, important to detail appropriate administration systems for every district/maritime state contingent upon the size of the issue. In a tropical nation like India where the marine catch fisheries are multispecies and the users have a place with multi sectors and difficult to implement and uphold attributable to political or financial reasons. Here the fisheries administration is seen as a cost, while because of the absence of administration, frequently there is crowding, over venture and overcapitalization in the fishing Industry. In such a setting fisheries administration has turned into an advantage and subsequently ought to be considered as a need for future improvement. With the current situation with logical information on fish stocks, biotic and abiotic information construct, past involvement in light of nature of resources, extra research input, together with talented and justification fisher folk's interest, it is conceivable to accomplish reasonable fisheries assets administration and preservation.

4. Reference

1. CMFRI. Annual Report 2013-14. Central Marine Fisheries Research Institute, Cochin, 2014, 274.
2. Mukundan C. General features of the catfish fisheries. *In:* Marine catfish resources of India: Exploitation and prospects. Bulletin No. 40. CMFRI, Cochin. 1987a, 1-4
3. CMFRI. Annual Report 2014-15. Central Marine Fisheries Research Institute, Cochin, 2015, 279.
4. Mukundan C. Some special features of catfish fisheries for consideration in developmental programs. In: Marine catfish resources of India: Exploitation and prospects. Bulletin No. 40. CMFRI, Cochin, 1987b, 88-88.
5. Rao KV. The distribution pattern of the major exploited marine fishery resources of India. In: Proceedings of the symposium on living resources of the seas around India, 1973, Mandapam Camp, 1973, 101.
6. Menon NG, Bande VN. Taxonomic considerations and general distribution of commercially important catfishes. In: Marine catfish resources of India: Exploitation and prospects. Bulletin No. 40. CMFRI, Cochin, 1987, 5-11.
7. Menon NG, Balachandran K, Zacharia PU, Raje SG, Khan M. Marine catfish resources of India. In: Marine Fisheries Research and Management (Eds. Pillai, V.N. and Menon, N.G.). CMFRI Cochi. 2000, 579-603.
8. Appanasastry Y, Kasim MH. The fishery and catch statistics of catfishes. Bulletin No. 40. CMFRI, Cochin. 1987, 12-57.
9. Menon NG. On a new myxosporidian, *Henneguya tachysurus* sp. Nov. from the marine catfish *Tachysurus thalassinus* (Ruppell) from the Gulf of Mannar. Journal of the Marine Biological Association of India. 1979; 21(1, 2):196-199.
10. Sekharan KV. The depth distribution of the catfishes *Tachysurus thalassinus* (Hupp.) and *Tachysurus tenuispina* (Day) in the south-western Bay of Bengal. Indian Journal of Fisheries. 1973a; 20(1):191-202.
11. Rao KV, K Dorairaj, Kagwade PV, Punwani DM. Results of the exploratory fishing operation of the Govt, of India vessels at Bombay base for the period 1961-67. Proc. IPFC. Symposium on demersal fishes, 13th season III. 1972, 402-430.
12. Menon NG, Balachandran, Raje SG, Zacharia PU, Ferozkhan M, Appanna SY *et al*. (Eds.) Proceedings of the Second Workshop on Scientific Results of FORV Sagar Sampada, (Department of Ocean Development, New Delhi). 1996, 305-314.
13. CMFRI. Annual Report 2015-16. Central Marine Fisheries Research Institute, Cochin. 2016, 294.
14. Raje SG, Vivekanandan E. Vulnerability of catfish to fishing: an investigation based on the landings at Mumbai. Indian Journal of Fisheries. 2008; 55(3):227-233.

15. Pillai VN, Menon NG. Marine Fisheries Research and Management, CMFRI, Kochin, 2000, 495.
16. Vivekanandan E, Srinath M, Pillai VN, Immanuel S, Kurup KN. Marine fisheries along the southwest coast of India. Assessment, Management and future directions for coastal fisheries in Asian countries, World Fish Centre, Penang, 2003, 757-792.
17. Krishnamoorthi B. Cat fish; General remarks and future approach. In: Marine catfish resources of India: Exploitation and prospects. Bulletin No. 40. CMFRI, Cochin, 1987, 89-90.
18. Mohamed KS, Sathianandan TV, Zacharia PU, Asokan PK, Krishnakumar PK, Abdurahiman KP *et al*. Depleted and collapsed marine fish stocks along southwest coast of India-A simple criterion to assess the status, 2010, 67-76
19. Bapat SV, Deshmukh VM, Krishnamoorthi B, Muthiah C, Kagwade PV, Ramamirtham CP *et al*. Fishery resources of the Exclusive Economic Zone of the northwest coast of India. Bulletin No. 40. CMFRI, Cochin, 1982, 86.
20. Menon NG, Muthiah C. Biology of the important species of catfishes. In: Marine catfish resources of India: Exploitation and prospects. Bulletin No. 40. CMFRI, Cochin, 1987, 60-69.
21. Menon NG, Balachandran K, Zacharia PU, Raje SG, Khan M. Marine catfish resources of India. In: Marine Fisheries Research and Management (Eds. Pillai, V.N. and Menon, N.G.). CMFRI Cochi, 2000, 579-603.
22. Alagaraja K, Srinath M. Assessment of the resources of important species of catfishes. In: Marine catfish resources of India: Exploitation and prospects. Bulletin No. 40. CMFRI, Cochin, 1987, 70-87.
23. Anon. Marine catfish resources of India; Exploitation and prospects. Bulletin No. 40. CMFRI, Cochin, 1987, 40
24. James PSBR, Bande VN, Menon NG, Balachandran K. The catfish resources of south west coast of India-prospects and management problems. In CMFRI Bulletin: National Symposium on Research and Development in Marine Fisheries Sessions I & II. CMFRI, Kochi. 1987; (44):78-94.
25. Menon NG, Balachandran K, Zacharia PU. Conservation needs and Management strategies for migratory Marine Catfish resources. In: M. Mohan Joseph, N.R. Menon and N. Unnikrishnsn Nair (Eds.), Fourth Indian Fisheries Forum Proceedings, Asian Fisheries Society (Indian Branch), 24-28 November, 1996, Kochi. 1999, 411-415.
26. Devaraj MVSR, Murty VS, Sathiadhas R, Joshi KK. The new economic policy and perspective for marine fisheries research and development in India. Fishing Chimes. 1998; 18(5):18-29.
27. Gopakumar K, Shenoy AV. Comparative evaluation of fish protein concentrate and functional fish protein concentrate from cat fish. Fishery Technology. 1977; 14(1):84-88.
28. Joseph MM, Jayaprakash AA. Status of exploited marine fishery resources of India. Kochi: Central Marine Fisheries Research Institute. 2003, 157.
29. Anon. Report of working group on revalidation of the potential marine fisheries of the Exclusive Economic Zone. (MPEDA, Cochin). 1991, 57.