Checklist of commercially important fishes of Puducherry coastal waters, east coast of India

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Abstract
The aim of this study is to update the list of fish species in order to increase the knowledge about biodiversity of commercially important fishes of Puducherry coastal waters. This study also concentrated on the availability and threatened status of commercially important fish species. A total of 88 fish species under 36 families and 11 orders has been collected during the study. Order Perciformes were made up to 65% with 23 families and 58 species followed by Clupeidae 15% with 3 families and 13 species. Clupeiformes stand on top in the catch followed by perches and mackerel’s. The study revealed that there were noteworthy variations found in the ichthyofaunal diversity. Among the 36 families, only 27 families were seen in the caught without any depletion. Order Beloniformes and Gadiformes showed sudden appearance in the catch which were not seen for the past 7 years. IUCN status of 88 species were studied, about 63% of species were under least concern and 8% near threatened, 3% vulnerable category, 7% data deficient, 19% not evaluated. Anthropogenic activities affect aquatic habitats leading to loss of many species as well as bring changes in the species composition. Therefore, ichthyofaunal diversity studies on regular basis are essential for sustainable management.

Keywords: Ichthyofaunal diversity, fishery production, iucn status, conservation, Puducherry

1. Introduction
Every realm of the sea is a warehouse of biodiversity which is a residence for multifarious life. Having a deep understanding of biodiversity is an essential element for survival for most of the human past. The description of new species and mapping of their distribution is an important activity in post-enlightenment science (Costello et al. 2013) [1]. Among various living organisms, fishes are most diverse vertebrate occupying various habitats in different types of ecosystem. In terms of biodiversity fishes overtake all other group of organisms (Mustafa S.1999) [2]. Fish are immensely important to human beings as they have long been a staple food item for a longer period. The Indian fisheries sector plays a valuable role in the global fish production and it is the second largest producer of fish in the world. The importance of the fisheries sector in India is revealed by the fact that it employs more than five million people (Anon, 2000) [3], contributes to food and nutritional security and employment, supports livelihoods and raises the socioeconomic status of poor fishing communities. Fishes are involved in the environmental policies as biodiversity and ecological quality indicators (Kestemont et.al..2000, Schnutz et al.2007) [4, 5] and they have been used successfully in biogeographical studies, ecoregion delineations (Abell et al.,2008) [6], conservation evaluations(Moyle and Randall,.1998) [7] and assessments of ecologically acceptable water regime management(Jowett,.1997) [8]. The marine fish diversity of India is in ever-increasing danger due to overfishing of commercially important species. Further, fish may be considered as apt indicators of aquatic biodiversity, since their rich diversity is reflective of a wide range of environmental conditions (Moyle PB, Leidy RA.1992) [9]. It is well known that biodiversity is in world-wide decline (Butchart et al. 2010) [10]. Knowledge of fish diversity of the particular region is considered to be essential not only for their rational management but also for the conservational strategies for the ichthyo-fauna of that region. Considering the above, the present study has been made to provide a well-documented checklist about species composition and IUCN status of commercially important ichthyofaunal diversity of Puducherry coastal waters.
2. Materials and method
2.1 Study area
Puducherry has a coastline of 45 km, with a continental shelf area of about 1000 sq. km and it lies between North Latitudes 11° 46’ and 120° 03’ and East Latitudes 79° 52’ bounded by Bay of Bengal on the East. The diversity study was conducted in the 14 fish landing centres of Puducherry viz. Kanagachettikulam, Periyakalapet, Chinnakalapet, Pillaiachavadi, Solainagar, Vaithikuppam, Kuruchikuppam, Thengaithittu, Veerampattinam, Pudukuppam, Nallavadu, Narambai, Pannithitu and Moorthikuppam from 2016 to 2017.

2.2 Fish collection methods
The collections were done almost on daily basis during morning and evening hours. The major objective of the bio inventory is to identify all the available species in the habitat using all gear combinations. Information regarding the seasonal availability, fish catch, size, quality, value of fish, common name, crafts and gears used etc., has been collected from traditional fishermen of all the coastal villages and recorded. Collected fish samples were brought to the laboratory and preserved in 10% formaldehyde and identification of the species was established by using FAO identification sheets (Fischer and Bianchi, 1984)\textsuperscript{[11]}.  

2.3 Gear combinations
Various types of fishing gears are used by the fishermen of Puducherry region for exploiting different types of fishes. The major part of marine fish landings in Puducherry was from mechanised sector (86.7%). Motorised and non-motorised sectors contributed 13.3% and 0.04% respectively (Grinson George et al. 2016)\textsuperscript{[12]}. The motorized sector includes gillnets, seine nets, hooks & lines and bagnets. All small boats and catamarans with low sea worthiness take on single day fishing with unfixed voyage times based on the season and the fishery resource which they target. Multiday and single day trawlers together contributed 82% of the total catch (FRAD, CMFRI, 2017)\textsuperscript{[13]}.

3. Results
A total of 88 commercially important fish species belonging to 36 families and 11 orders were reported from all landing centres of Puducherry. Out of 88 species, 84 species were teleost and the remaining were cartilaginous (Table: 1). In general, the fishes belong to the class Actinopterygii were found to be dominant. The best represented order was Perciformes (65%) with 23 families and 58 species followed by Clupeiformes (15%) with 3 families and 13 species. Other families were each represented by 1 to 3 species (Fig: 1). Among 88 species, 40 species were caught regularly (45%), 33 species were less available (38%), 9 species shows rare occurrence (10%) and 6 species (Hilsha ilisha, Hilsha other, Harpodon nehereus, Eel, Bregmaceros, Elagatis) were very rare (7%) (Fig.2). In present study, as per IUCN 2016 red list status, out of 88 species, about 63% of species were under the status of least concern and 8% near threatened, 3% vulnerable category, 7% data deficient, 19% not evaluated categories (Fig. 3).

4. Discussion
The focus of the present study is to establish the list of commercially important fish species with its IUCN status. In this study visual illustrations and descriptive statistics were used to study the fish diversity in Puducherry. Among fin fishes, the pelagic group was dominant which contributed about 70.3% of the total catch followed by demersal fin fish (29.6%). The major fish species representing the fish landings along Puducherry coast were sardines including oil sardines, Indian mackerel, seer fish, pomfrets, carangids, perches (sea bass and Leiognathus), Clupeidae family was represented by 7 species. These species (Table: 1). A total of 23 families falls under Perciformes in which the Carangidae family was dominated by holding 11 species followed by Scombridae with 9 species. Family Sciaenidae and Polynemidae were also contributed with a reasonable of 5 species each. 13 species were recorded in order Clupeiformes under three families. Out of this, Clupeidae family was represented by 7 species. These observation were common in most of marine environment. The presence of large number of species in these two orders could also be explained by the fact that they found favourable condition which allows them to develop and grow (Leveque et al., 1991)\textsuperscript{[20]}. The present finding was supported by Kumaran et al., (2012)\textsuperscript{[21]} in Griypmepeta estuary, Yanam and Kuppan et al., (2016)\textsuperscript{[22]} from east coastal region, Chennai. Among the 36 families, only 27 families were seen in the observation were common in most of marine environment. The presence of large number of species in these two orders could also be explained by the fact that they found favourable condition which allows them to develop and grow (Leveque et al., 1991)\textsuperscript{[20]}. The present finding was supported by Kumaran et al., (2012)\textsuperscript{[21]} in Griypmepeta estuary, Yanam and Kuppan et al., (2016)\textsuperscript{[22]} from east coastal region, Chennai. Among the 36 families, only 27 families were seen in the...
Elagatis) were in downfall status owing to human activities such as over fishing, modification of water quality etc. (Konan Gervias et al., 2014) [24]. It has been came to know that 2 groups viz., Belone & Hemiramphus and Lactarius were resurface again in the catch during 2015 to 2017 which were not seen before 2015 (Puducherry Fisheries Statistics, 2017) [25].

Among the total 88 species reported during the study, 40 species were available (45%), 33 species were less available (38%), 9 species were rare (10%) and 6 species were very rare (7%) (Fig.2) based on the availability status recorded by Department of Fisheries and Fishermen Welfare, Puducherry. From the various detailed studies on fishery resources reported by the scientists of CMFRI (2006) [26], it is understood that 65% of the commercially important fish varieties in marine waters are overfished. Over exploitation indicates that fisheries prompted changes in the ecosystem owing to low productivity of the coastal waters and high density of fishing craft. The number of mechanised and motorised vessels went amassed due to ultimate demand for seafood and subsequent price escalation. Various developmental programmes of Central and State Governments such as subsidies for diesel engines, new gears and gear materials, vessels and financial assistance to fishermen and cooperative societies (Srivastava et al., 1991) [27] zipped up the modernization in fishing process. Present estimated number of fishing vessels of almost all the types seem to be far excess than the actual number required to produce the sustainable yield (Mohammed Kasim and Vivekanandan, CMFRI, 2011) [28]. In simple words, coastal biodiversity is at risk and marine environments are threatened (Imtiyaz et al., 2011) [29] due to intensified human activities (Dulvy et al., 2014) [30].

![Fig 2: Availability of recorded fish species in the study area](image2)

### 4.1 Threatened Status

While evaluating the threat status of 88 fish species, 6 species comes under near threatened (NT), 3 species are vulnerable, 53 least concern, 5 species have deficient data and data about 17 species did not drop under any threat category so it was placed in not evaluated group (Table 1). In present study, as per IUCN 2016 [31] red list status out of 88 species, about 63% of species were under least concern and 8% near threatened, 3% vulnerable category, 7% data deficient, 19% not evaluated categories (Fig. 3).

![Fig 3: IUCN status of fishes](image3)

The coastal waters of Puducherry receive discharges from 4 major industrial complexes including untreated municipal sewage from urban settlements and tourist resorts (Ramachandran, 2001) [32]. The other source of marine pollution includes tourism activities which lead to dumping of plastic and other solid wastes by tourists on the beaches. Recreational activities like tourism lead to loss of habitats, habitat degradation, the spread of disease, pollution, and unsustainable fishing practices are directly related to the actions of humans and recovery from these problems is rarely straightforward.
### Table 1: Systematic position of the fishes collected in the study with threat status

| Order and suborder | Family & subfamily | Name of species | Common Name | Vernacular name | IUCN/status |
|--------------------|--------------------|-----------------|-------------|----------------|--------------|
| Order 1: Lamniformes | Family 1: Carcharhinidae | 1 | *Rhizoprionodon acutus*, Rüppell, 1837 | Milk shark | Pall surra | LC/AV |
| Order 2: Myliobatiformes | Family 2: Dasyatidae | 2 | *Dasyatis zugei*, Müller & Henle, 1841 | Pale-edged stingray | Chamburaka-kah | NT/AV |
| Subclass: 1: elasmobranchii | Subfamily: Dasyatinae | 3 | *Himantura uarnak*, Gil, 1879 | Honey combed stingray | Pulli-thirukkai | VU/AV |
| Subclass: actinopterygii | | 4 | *Dasyatis jenkinsii*, Annadale, 1900 | Sharpnose stingray | Sen-thirukkai | VU/AV |
| Super order: Gnathostomata | | | | | |
| Order 2: Myliobatiformes | | | | | |
| Subclass: 1: elasmobranchii | Subfamily: Dasyatinae | 5 | *Sardinella longiceps*, Valenciennes, 1847 | Indian oil sardine | Mathi | LC/AV |
| Subclass: 2: actinopterygii | Subfamily: Clupeidae | 6 | *Sardinella alsabella*, Valenciennes, 1847 | White sardine | Therakuthuva | LC/AV |
| Order 3: Clupeiformes | | 7 | *Hilsa ilisha*, Hamilton & Buch., 1822 | Hilsa shad | Karuvallam | LC/VR |
| Suborder: Clupeoidei | | 8 | *Hilsa toli*, Valenciennes, 1847 | Toli shad | Chuida | LC/VR |
| Subclass: 1: elasmobranchii | Subfamily: Dorosomatinae | 9 | *Anodontostoma chacunda*, Hamilton, 1822 | Chacunda gizzard | Poikendai | LC/AV |
| Subclass: actinopterygii | Subfamily: Pristigasterinae | 10 | *Ophisthopterus tardo*, Cuvier, 1829 | Shad Tardoore | Thalporuva | LC/AV |
| Order 4: Perciformes | Family 4: Engraulidae | 11 | *Engraulis japonica*, Hamilton, 1822 | White fin wolf herring | Mulivalai | LC/R |
| Suborder: Perciformes | | 12 | *Colia dussumieri*, Valenciennes, 1848 | Golden anchovy | Thova | LC/LA |
| Subfamily: Engraulinae | | 13 | *Stolephorus commersonii*, Lacepède, 1803 | Commerson’s anchovy | Therangunn | LC/RA |
| Family 5: Chirocentridae | | 14 | *Moustached thryssa*, Schneider, 1801 | Moustached thryssa | Poruva | LC/AV |
| Subfamily: Pteropominae | | 15 | *Thryssa vitrirostris*, Gilchrist & Thompson, 1908 | Orange mouth thryssa | Nedumporuva | LC/RA |
| Subfamily: Pristidae | | 16 | *Chirocentrus nasus*, Swainson, 1839 | White-finned thryssa | Mullivalai | LC/R |
| Subfamily: Engraulinae | | 17 | *Chirocentrus dorab*, Forsskål, 1775 | Dorab herring | Karivalai | LC/R |
| Subclass: 1: elasmobranchii | Subfamily: Squilidae | 18 | *Lates calcarifer*, Bloch, 1790 | Sea bass | Koduva | NE/AV |
| Subclass: actinopterygii | Subfamily: Carangidae | | | | | |
| Order 1: Lamniformes | | | | | |
| No. | Scientific Name                                            | Common Name                        | IUCN Status | Location |
|-----|-----------------------------------------------------------|------------------------------------|-------------|----------|
33   | Chorinemas lvstian, Forsskål, 1775                       | Double spotted queen fish          | DD/R        |          |
34   | Elagatis bipinnulata, Quoy & Gaimard, 1825               | Rainbow runner                     | LC/VR       |          |
35   | Alepes djedaba, Forsskål, 1775                          | Shrimp scad                         | LC/LA       |          |
36   | Atropus atropot Bloch & Schneider, 1801                 | Leftbally travelly                  | NE/LA       |          |
37   | Atule mate, Cuvier, 1833                                | Yellow tail scad                    | LC/RA       |          |
38   | Carangoides chrysophrys, Valenciennes, 1833             | Large nose travelly                 | LC/LA       |          |
39   | Gnathanodon speciosus, Forsskål, 1775                   | Golden travelly                     | LC/RA       |          |
40   | Decapterus russeli, Ruppell, 1830                        | Indian scad                         | LC/LA       |          |
41   | Megalaspis cordyla, Linnaeus, 1758                       | Torpedo scad                        | LC/LA       |          |
42   | Trachinotus mookalee, Cuvier, 1832                      | Indian pompano                      | LC/RA       |          |
43   | Leioignathus bindus, Valenciennes, 1835                 | Orange fin pony fish                | LC/AV       |          |
44   | Leioignathus brevirostris, Valenciennes, 1835           | Short nose pony fish                | NE/LA       |          |
45   | Gagga minuta, Bloch, 1795                               | Toothed pony fish                   | LC/AV       |          |
46   | Dendrophysa russeli, Cuvier, 1830                       | Goat croaker                        | LC/RA       |          |
47   | Johnius belangeri, Cuvier, 1830                         | Belangers croaker                   | NE/LA       |          |
48   | Nibea maculata, Schneider, 1801                         | Blotched croaker                    | NE/LA       |          |
49   | Protonotus diacanthus, Lacepode, 1802                    | Spotted croaker                     | Panna       |          |
50   | Otilothoides biuritius, Cantor, 1849                     | Bronze croaker                      | NE/LA       |          |
51   | Upeneus moluccensis, Bleeker, 1855                      | Gold banded goatfish                | ![](http://www.fisheriesjournal.com) |          |
52   | Upeneus vittatus, Lacepode, 1801                         | Striped goatfish                    | ![](http://www.fisheriesjournal.com) |          |
53   | Sphyraena jello, Cuvier, 1829                           | Pick handle barracuda               | NE/LA       |          |
54   | Sphyraena obtusa, Cuvier, 1829                          | Obtuse barracuda                    | ![](http://www.fisheriesjournal.com) |          |
55   | Sphyraena heptadactyla, Cuvier, 1829                    | Four finger thread fin              | ![](http://www.fisheriesjournal.com) |          |
56   | Polyneus indicus, Shaw, 1804                            | Indian fin fish                     | ![](http://www.fisheriesjournal.com) |          |
57   | Polyneus paradiseus, Linnaeus, 1758                     | Paradise thread fin                 | ![](http://www.fisheriesjournal.com) |          |
58   | Polyneus xanthias, Bloch & Schneider, 1801              | Black spot thread fin               | ![](http://www.fisheriesjournal.com) |          |
59   | Trichiurus lepturus, Linnaeus, 1758                      | Large head hair tail                | ![](http://www.fisheriesjournal.com) |          |
60   | Trichiurus xanthias, Lacepode, 1802                      | Spanish mackerel                    | ![](http://www.fisheriesjournal.com) |          |
62   | Euthynus affinis, Cantor, 1850                          | Kawa kawa                           | ![](http://www.fisheriesjournal.com) |          |
63   | Scomberomorus guttatus, Bloch & Schneider, 1801         | Indopacific king mackerel           | ![](http://www.fisheriesjournal.com) |          |
64   | Katsuwonus pelamis, Linnaeus, 1758                      | Skipjack tuna                       | ![](http://www.fisheriesjournal.com) |          |
65   | Thunnus albarea, Bonnaterre, 1788                       | Yellow fin tuna                     | ![](http://www.fisheriesjournal.com) |          |
66   | Thunnus oceanus, Lowe, 1839                             | Big eye tuna                        | ![](http://www.fisheriesjournal.com) |          |
67   | Thunnus tonggol, Bleeker, 1851                          | Long tail tuna                      | ![](http://www.fisheriesjournal.com) |          |
69   | Pampus argentus, Euphrasen, 1788                         | Silver pomfrets                     | ![](http://www.fisheriesjournal.com) |          |
71   | Pampus chinensis, Euphrasen, 1788                        | Chinese silver pomfret              | ![](http://www.fisheriesjournal.com) |          |
72   | Isthmurus platypetra, Shaw, 1792                        | Indo-Pacific sail fish              | ![](http://www.fisheriesjournal.com) |          |
73   | Makaira indica, Cuvier, 1832                            | Black Marlin                        | ![](http://www.fisheriesjournal.com) |          |
74   | Mugil cephalus, Linnaeus, 1758                          | Flathead mullet                     | ![](http://www.fisheriesjournal.com) |          |
75   | Cynoglossus macrostomus, Norman, 1928                   | Malabar tongue sole                 | ![](http://www.fisheriesjournal.com) |          |
| #  | Common Name                                           | Scientific Name                               | Family          | Status    | Region  |
|----|-------------------------------------------------------|-----------------------------------------------|-----------------|-----------|---------|
| 75 | Speckled tongue sole                                  | Cynoglossus puncticeps, Richardson, 1846       | Soleidae        |           | NE/LA   |
| 76 | Speckled tongue sole                                  | Cynoglossus puncticeps, Richardson, 1846       | Soleidae        |           | NE/LA   |
| 77 | Oriental tongue sole                                  | Euryglossa orientalis, Bloch & Schneider, 1801 | Soleidae        |           | NE/LA   |
| 78 | Engraved catfish                                      | Arius caelatus, Valenciennes, 1840            | Ariidae         |           | NT/LA   |
| 79 | Thin spine sea catfish                                | Arius tenuispinis, Day, 1877                  | Ariidae         |           | NT/LA   |
| 80 | Giant catfish                                         | Arius thalassinus, Rüppell, 1837              | Ariidae         |           | NT/LA   |
| 81 | Soldier catfish                                       | Osteogeneiosus militaris, Linnaeus, 1758       | Ariidae         |           | NE/LA   |
| 82 | Greater lizard fish                                   | Saurida tumbil, Bloch, 1795                    | Synodontidae    |           | LC/LA   |
| 83 | Brush tooth lizardfish                                | Saurida undosquamis, Richardson, 1848          | Synodontidae    |           | LC/LA   |
| 84 | Bombay duck                                           | Harpadon nehereus, Hamilton, 1822             | Synodontidae    |           | LC/LA   |
| 85 | Indian pike-conger                                    | Congresox talabonoides, Bleeker, 1853          | Ariidae         |           | NE/VR   |
| 86 | African flying fish                                   | Cheilopogon nigricans, Bennett, 1840          | Exocoetidae     |           | LC/LA   |
| 87 | African flying fish                                   | Cheilopogon nigricans, Bennett, 1840          | Exocoetidae     |           | LC/LA   |
| 88 | Codlet                                                | Bregmaceros bathymaster, Jordan & Boltman, 1890 | Bregmacerotidae |           | LC/VR   |

LC - least concern, NT- Near Threatened, VU- Vulnerable, DD- Data Deficient, NE- Not Evaluated, AV- Available, VR- Very Rare, R- Rare, LA- Less Available
5. Conclusion
Biodiversity, the variation of life on Earth, is a major factor in its resilience. It is regularly to be overlooked species that are the most important to healthy ecosystems. There are promising fisheries technologies which have been developed and are being practised for improving fish biodiversity and nutrition. Loss of habitat threatens habitat specialists with extinction risk. The stress on major ecosystems has resulted in erosion of biodiversity due to various anthropogenic activities. This study attempted to record the diversity of commercially important fishes and fishery status of Puducherry coastal waters and also to open up arguments and considerations on the importance of conservation management, and further points to new directions on this frontier.

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