

## **Necessity to review and update fish taxonomic guidelines in the Northern Indian Ocean with special reference to Sri Lanka.**

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### **Abstract**

Sri Lanka has the privilege of having the FAO fishery resources book published in 1994, one of the most used species identification guidelines in marine research and assessments. As almost three decades passed, a study was carried out to detect the new changes in marine fish identification after 1995. Our study revealed that, new updates have been emerged including 11 new marine fish species have been identified in Sri Lankan waters. Apart from that, new fishery resources have been introduced to the Sri Lankan fishery industry. . In addition, our study indicated that some of the vital commercially viable fish family groups contained conspicuous changes in the taxonomical details of the species. The results showed that 70.6% of the species names of the Family Leiognathidae included in the FAO guidebook have been changed. Also, the changes in the scientific names occur in the Family Gerridae (42.9%), Family Ehippidae (33.3%), Family Haemulidae (31.3%) and, followed by several elasmobranchs including Dasyatidae (54.5%) and Rhinobatidae (50.0%). Therefore, we conclude that the necessity of reviewing and updating available taxonomic literature in Sri Lanka and it is a timely requisite for the arrival of a new fishery resources guideline for Sri Lanka.

### **Introduction**

Accurate identification of fish and other aquatic organism to the species level is essential in stock assessments, by-catch analyses, biodiversity assessments and tropic valuations to obtain accurate and unbiased decisions.. Therefore, species identification guidelines and keys play a vital tool to support to identify the species based on morphological features. There are different types of identification guides, conventional and modern, such as photo identifications, dichotomous keys, and web-based identification portals. Recently, several modern technical applications have also been introduced for fish species identification, like image recognition systems (IRSs), interactive electronic keys, and computer-based morphometric identification (Lleonart et al., 2006 ;

Fischer,2014;). However, the fish resources identification series published by the Fisheries and Agriculture Organization (FAO) are recognized as one of the most used and well-documented materials. FAO has published a series of books targeting the fishery resources of several coastal countries. As an island nation in tropics, Sri Lanka owns tremendous fishery resources, including pelagic fish, demersal fish, shellfish, sharks, and rays. Identifying these resources up to the species level is a crucial task as it is a fundamental component in assessing the stocks and biodiversity in the country and the Indian Ocean region. Sri Lanka got the privilege of owning the FAO marine fishery identification guide in 1994 (De Bruin et al., 1995). Even today, this guide can be introduced as the most convenient and used identification guide to find the fish species' names, especially during field studies.

Though De Bruin et al., (1995) described many species separated by families with basic and convenient morphological features of the fish, the necessity of reviewing and updating available information in the guide has been emerged. In particular, some of the new species have been identified and distribution of oceanic fish species has been changed over the time due to the environmental changes that occur with climate change (Biswas et al., 2005; Booth et al., 2017; Dueri, 2017). Also, anthropogenic activities thrive the changes in the species composition in several areas in the Indian Ocean (Cheung et al., 2013; Goldin and Athalye, 2012). On the other hand, the scientific names of several species have been changed. So, we focused on the changes happening in the North Indian Ocean region, especially referring to the Sri Lankan marine waters and uplifting the idea of updating or the new arrival of the fish taxonomic guidelines published by FAO.

## **Methodology**

FAO publications related to marine fishery resources were used and species guides and catalogues for the Indian Ocean and common species catalogues were listed. The new species records for the Indian Ocean and Sri Lanka were searched through the literature. The updated names and accepted names were compared and checked in De Bruin et al., (1995). Then the species names were assessed considering the most common fish families using the Fish Base (Froese and Pauly, 2024) and WoRMS World Register of Marine Species (WoRMS Editorial Board, 2024) databases. The percentages of the updated names were calculated as the number of updated scientific names divided by the available scientific names of the family.

## Results

Initial investigations showed that several nations in the Indian Ocean such as Sri Lanka (De Bruin et al., 1995), Pakistan (Bianchi, 1995), Kenya (Anam and Mostarda, 2012) and Somalia (Sommer et al., 1996) own fish identification field guides produced by the FAO. Also, common marine fish species catalogues are available for the Western Indian Ocean (volume 1-6) and Eastern Indian Ocean. Further, the fish species catalogues series had been published with 18 different volumes related to different fish groups. Many of these identifications were published between 1990-2000, almost two decades ago. Very few have been published within the 2010 to 2019 period (Fig.1).

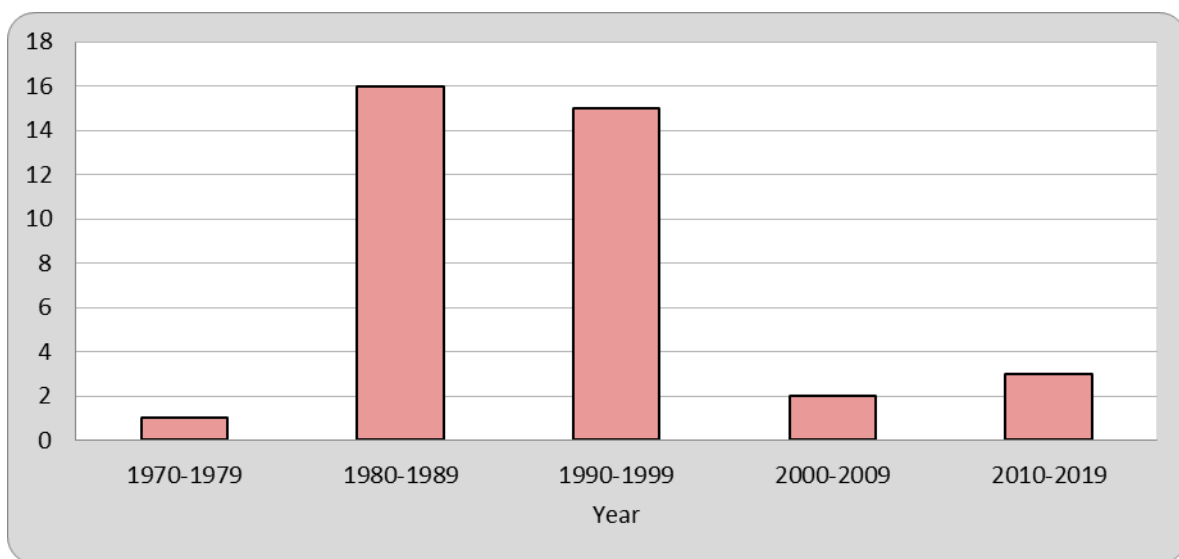


Fig 1. Number of FAO publications relate to fish and fishery resources identification over the past decades from 1970 to 2020.

Considering the results obtained for updated or altered species scientific names according to the common fish families, the highest percentage could be seen in Family Leiognathidae ( 70.6%). Apart from that, Families such as Gerridae (42.9%), Ehippidae (33.3%), and Haemulidae (31.3%) showed a considerably high levels related to updated species names in the recent past. Also, Carangidae, the most common pelagic fish Family in the Sri Lankan waters, contained 14.3% updated scientific names. Notedly, Lethrinidae, one of the most common demersal families, does not show any updates in the scientific species name. However, the family Lutjanidae contains 7.1% of updates from the available species list (Fig. 2).

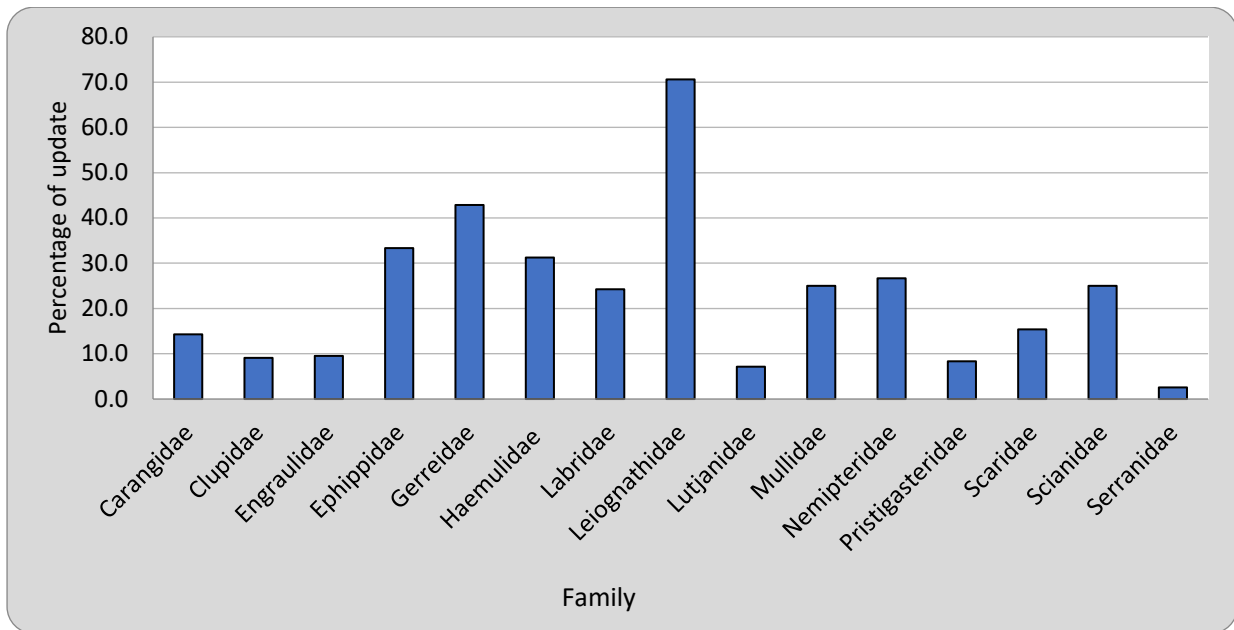


Fig.2. Percentage of updates of the available fish species in the most common fish families in De Bruin et al., (1995) (N=61).

The present analysis indicated that, among all the families of sharks, skates and rays mentioned in De Bruin et al., (1995), the rays group shows the highest percentage in the alternation of scientific names (Dasyatidae 54.5%) followed by Rhinobatidae (50.0%) (Fig. 3).

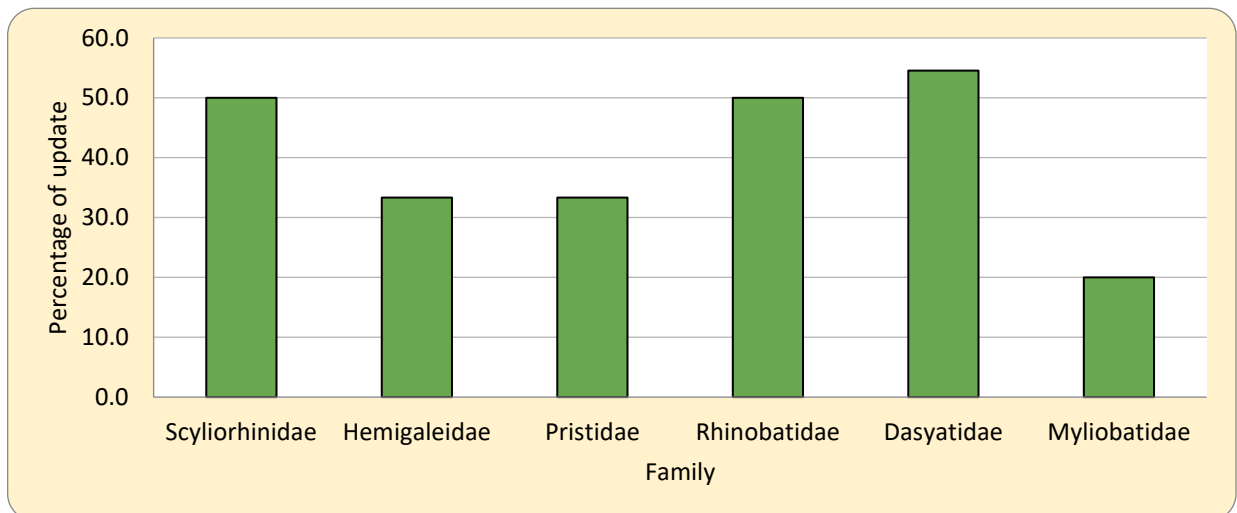


Fig.3. Percentage of updates of the available species of the sharks, skates and rays in the FAO marine fishery resources identification guide for Sri Lanka (N=12).

The family Carcharhinidae and Family Sphyrnidae, the most common shark family in Sri Lanka, showed no species name updates. However, 13 species of pelagic sharks have been identified by the Jayathilaka et al., 2016 while Fernando et al., 2019 has identified 13 species including new

shark species belong to genera *Centrophorus*, and *Chiloscyllium*. Peiris et al.,2021 have recorded 17 species of sharks during their study. Out of these species 12 species should be included into the FAO fishery resources guide. (Table:1)

Table.1. Shark species that newly recoded after De Bruin et al., (1995).

Family	Species	Source
Pseudotriakidae	<i>Planonasus indicus</i>	Fernando et al.,2019
Triakidae	<i>Iago omanensis</i>	
Hexanchidae	<i>Hexanchus griseus</i>	
Lamnidae	<i>Isurus paucus</i>	
Centrophoridae	<i>Centrophorus uyato</i>	
Somniosidae	<i>Centroscymnus owstonii</i>	
Alopiidae	<i>Alopias superciliosus</i>	Jayathilaka et al.,2016
Alopiidae	<i>Alopias pelagicus</i>	Balawardhana, et al., 2023.
Odontaspidae	<i>Carcharias taurus</i>	
Carcharhinidae	<i>Carcharhinus obscurus</i>	
Carcharhinidae	<i>Carcharhinus plumbeus</i>	
Carcharhinidae	<i>Carcharhinus leucas</i>	Peiris, et al. 2021.

According to the literature review on new species found in Sri Lanka, we could find 12 new records from Sri Lankan marine water. Among them, four species are elasmobranchs.

Table .2. New fish species records in Sri Lankan marine water

Family	Species	Source
Berycidae	<i>Beryx mollis</i> Abe, 1959	Aluwihare et al.,2024
Dasyatidae	<i>Maculabatis arabica</i> Manjaji-Matsumoto & Last, 2016	Fernando et al., 2019
Dasyatidae	<i>Brevitrygon manjajiae</i> Last, Weigmann & Naylor, 2023	Last et al., 2023
Gobiidae	<i>Gobiopterus brachypterus</i> (Bleeker, 1855)	Ott,2011
Gobiidae	<i>Mugilogobius tigrinus</i> Larson, 2001	Ott,2011
Megachasmidae	<i>Megachasma pelagios</i>	Fernando et al., 2015
Rhinobatidae	<i>Acroteriobatus variegatus</i> (Nair & Lal Mohan, 1973)	Fernando et al., 2015
Somniosidae	<i>Centroscymnus owstonii</i> Garman, 1906	Fernando et al., 2015
Tetragonuridae	<i>Tetragonurus pacificus</i> Abe, 1953	Aluwihare et al., 2023
Trachipteridae	<i>Desmodema polystictum</i> (Ogilby, 1898)	Rathnasuriya et al., 2019
Tripterygiidae	<i>Helcogramma alkamr</i> Holleman, 2007	Holleman, 2007.

## Discussion

Undoubtedly, the FAO fishery identification guide published in 1994(De Bruin et al., 1995) is being the most commonly used and most convenient taxonomic guideline to identify the marine fish species in Sri Lanka. However, our finding reveals that the species' scientific names have been updated or altered with time as almost three decades have been passed. Especially in the family Leiognathidae (pony fish), one of the most common fish categories in the small-scale fishery. Not only that, but also critical fish groups such as Sweet lips (family Haemulidae), parrot fish (family Scaridae), Carangids(Family Carangidae), herrings and sardines (Family Clupidae), anchovies (Family Engraulidae), snappers (Family Lutjanidae), Groupers (Family Serranidae) show alternation in the species name. according to the recent studies, new fishery resources have been introduced specially in the shark fishery. Further, the study reveals that more shark species have been newly recorded and need to be included at a commonly used guide such as be FAO fishery guidebook. These findings emphasise the necessity of the updated fishery identification guides in Sri Lanka.

Nevertheless, according to the fishery surveys and genetic studies, there are new marine species records. For an example, new species fish were recorded during the Dr. Fridtjof Nansen survey in Sri Lanka in 2018 (Krakstad et al., 2018). These new findings should be considered in an updated version of the fish identification guides. Also, due to climate change, many physical and chemical parameters such as salinity, sea surface temperature, alkalinity, and suspended solids have been changed in the Indian Ocean (Dalpadado et al., 2023; Elepathage and Tang, 2020 ; Ummenhofer et al., 2021). The consequences of these environmental alternations have led to the distribution of new species and the extinction of the existing fish species. Moreover, the high fishing pressure in the Indian Ocean causes stock depletion and species extinction from the natural habitat. As almost three decades passed, the fish composition of the ocean could be changed due to natural or anthropogenic activities. Hence, updating the species list of marine fishery resources in Sri Lanka is a timely prerequisite.

Not only the taxonomical details but also the conservational status of the species has been changed. Some species have been listed as vulnerable, and some are protected through legislation and acts. Hence, presenting this information in the guide is vital to species identification. Also, conservational status details help to get sound statistics for the Sri Lankan fishery industry. In addition, accurate fish identification is very much important for various biological assessments such as biodiversity assessments, bycatch analysis and tropic studies. Also, the beginners or

taxonomic students need to have precise literature. Therefore, we believe that it is very necessary to review and update fish taxonomic guidelines in Sri Lanka.

## Conclusion

The FAO guidebooks especially (De Bruin et al., 1995) is the vital resource in identifying marine fishery resources in Sri Lanka. As almost three decades have been passed by and updates of the scientific names occur, it is necessary to update the guidelines to obtain sound information from the fishery industry of Sri Lanka. This will ensure the accurate marine assessments targeting the sustainability of marine living resources.

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