
OVERVIEW OF DATA AND INFORMATION AVAILABLE FOR THE IOTC COASTAL FISHERIES CHARACTERIZATION

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Introduction

Although there is no unified definition of small-scale fisheries, most countries have their own operational definitions typically based on some quantitative metrics, such as vessel size and power, gear type, or area of operation ([FAO, Duke University & WorldFish, 2023](#)). In the case of IOTC fisheries, the current definition of coastal and industrial fisheries is mainly driven by the categorisation of fishing vessels by their length overall (LOA) and area of operation, but the terms 'coastal' and 'artisanal' were also included in some resolutions, which generates confusion and impact the reporting performance of some CPCs. Acknowledging these limitations, IOTC Coastal fisheries are regarded as the major contributors to catches of IOTC species in the Indian Ocean, accounting for more than 55% of total annual reported catches in recent years.

At the 17th session of the WPDCS (2021) FAO presented paper [IOTC-2021-WPDCS17-23](#) "*Towards a statistical definition of small-scale fisheries*", as part of an ongoing process to recognize small-scale fisheries as an identifiable segment of fisheries that is important enough to warrant special consideration.

[Preliminary results](#) of trial conducted by the IOTC Secretariat testing the FAO matrix approach were presented at the 19th session of the WPDCS where the WPDCS **RECOMMENDED** that the study on the matrix approach for the characterisation of IOTC fisheries is further extended to cover all IOTC coastal nations and their fisheries, and that outputs of the study are presented to the next session of the meeting.

In addition, the Secretariat develop an interactive [Fisheries identification Wizard](#) designed for support the identification of IOTC fisheries, that was presented at the [WPDCS18](#), and is based on the concept of *métier* as "*... the use of a given fishing gear in a given area, in order to target a single species or group of species, e.g. inshore shrimp trawling, offshore flatfish trammel netting*" (Mesnil and Shepherd, 1990; Laurec et al.,1991)

This document summarizes the information from the testing of the two approaches (FAO matrix approach and IOTC fisheries wizard), together with the reviewed relevant information provided by each CPC through the Fishing Craft Statistics Report (FC) or National Reports (NR), with the ultimate aim of improving the reporting of statistical data to the IOTC as well as their dissemination.

Materials

The IOTC Secretariat has consolidated the FAO matrix document into a single worksheet that allows only one value to be selected for each category, together with a detailed step-by-step guide. The main materials, template, and the original methodology document, were translated to French to facilitate the participation of francophone members. Dedicated remote workshops for CPCs were carried out to discuss the matrix application. The original methodology was presented at the [WPDCS17](#).

A mapping exercise of the IOTC fisheries with the Wizard was carried out during the Eastern and Western regional data workshops ([ERDW](#), [WRDW](#)) conducted by the Data Section of the IOCT Secretariat during the first half of the year and counting with the participation of 20 CPCs.

Results

FAO matrix approach

98 fishing units were identified using the FAO matrix approach in relation with the fisheries from Bangladesh, Comoros, EU, France-Mayotte, Indonesia, Kenya, Maldives, Pakistan, Seychelles, Sri Lanka, South Africa, Tanzania and Thailand (Table 1), with a range of scores from 5 to 37 (Fig 1 a).

Following the matrix approach the scoring allows for an objective characterization of the fishing unit, indicating whether it tends towards small-scale or large-scale. Therefore, the matrix results were explored by a hierarchical clustering analysis which attempts to group objects with similar traits and features together, such that a larger set of objects is divided into smaller sets of objects. The objects in a subset are more similar to other objects in that set than to objects in other sets. A dissimilarity matrix was constructed to understand how similar or dissimilar are the identified fishing units and finally mapped on a cluster dendrogram (Fig. 2).

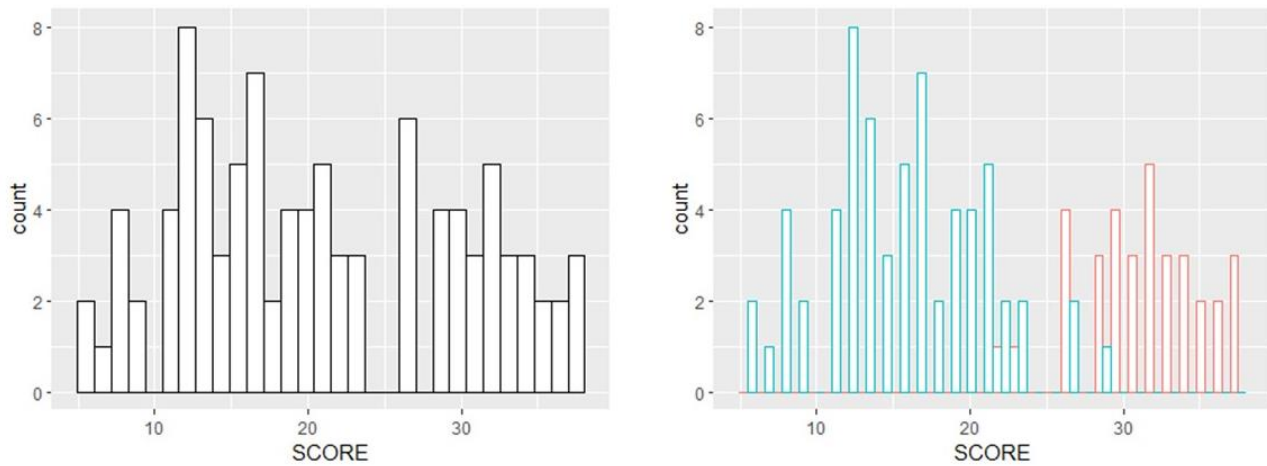


Figure 1. Score values obtained through the application of the matrix to some IOTC fisheries (a), and score values classified as small scale (turquoise) or large scale (coral) group by clustering analysis (b).

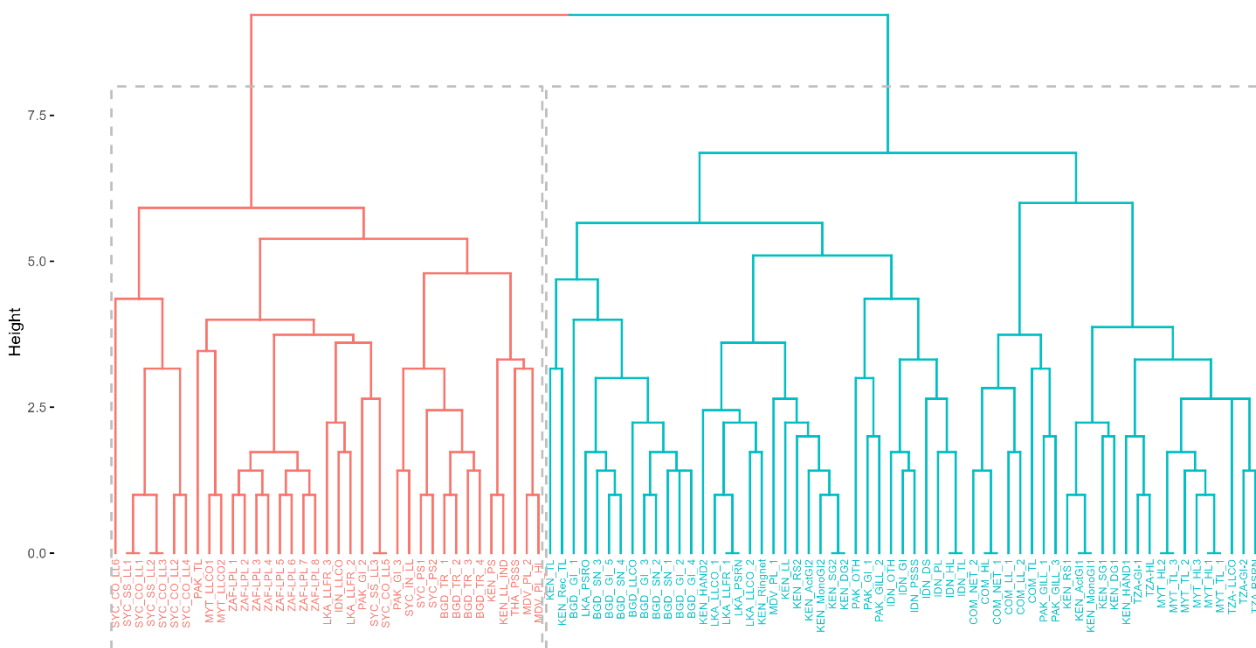


Figure 2. Cluster dendrogram obtained for the fisheries tested against the matrix and assigned to two clusters.

The results suggest a differentiation of two main clusters with total scores ranging from 5 to 29 for the small-scale group and 22 to 37 for the large-scale group.

The small-scale cluster account with 64 fisheries and is mainly characterized by fishing units with vessels less than 15m, outboard or inboard engines less than 100hp, labour intensive or passive gears and no mechanization. In the large-scale cluster the vessel characterization moves to larger vessels, higher power motorization and mechanized gear deployment and hauling (Fig. 3).

In relation with the employment and labour variables, the crew labour conditions are more variable in the small scale while large-scale is mostly dominated for more than 2 paid crew. The time commitment variable shows that in both segments fishers are involved in a full-time schedule, nevertheless, is also reflecting the seasonal condition for small-scale activity affected by monsoon seasons in coastal countries (Fig. 3).

The variables on fishing operations indicate that large-scale fishing activities involve longer trips and take place in more distant fishing grounds. Finally, the variables related with the use of the catch, shows an opposite trend on the level of processing between small and large scale (Fig. 3).

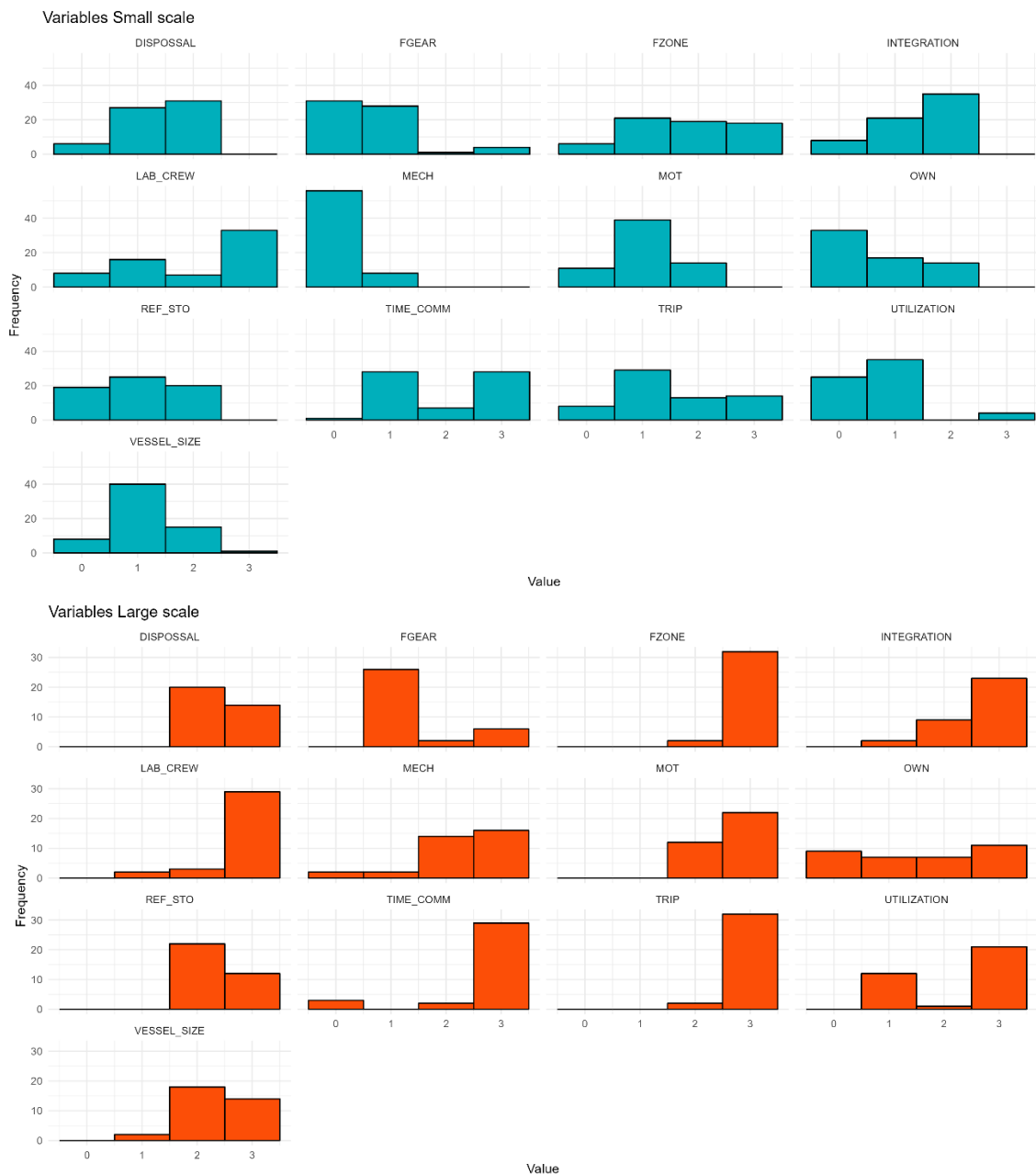


Figure 3. Distribution of the matrix variables for the small-scale and large-scale groups obtained by the cluster analysis.

There is an area of overlap around the threshold defining the ranking of the small and large segments, noting that where large-scale fisheries are scored at 22 and 23 the variables driving the final ranking are mechanisation and utilisation of the catch, meaning that although these fisheries share the other characteristics of small-scale, they are fully mechanised, and the fish are processed or treated with value-added methods (Fig. 1b, Fig.3).

On the other hand, when some artisanal fishing units score 26-29, they indicate fisheries that are not mechanised but have shorter trips than large-scale fisheries and that the fish are sold directly to traders rather than being processed on board and/or delivered to processors (Fig. 1b, Fig.3).

IOTC Fisheries identification wizard

As described in IOTC-2022-WPDCS18-13_Rev3, the application of the wizard approach results in a type of fishery that derives from the combination of purpose, vessel size, and their area of operation (to remain consistent with the RAV requirements) and other gear-related characteristics, introducing a more fine-grained characterization compared to current definitions (Table 2).

Table 2: proposed definitions of IOTC fishery types by fishery purpose, vessel size, and area of operation. ANJ = Areas of National Jurisdiction, ABNJ = Areas Beyond National Jurisdiction, AFVs = Authorised Fishing Vessels

Purpose	Vessel size	Area of operation	Type	AFVs
Recreational	< 24 m	NJA only	Recreational	NO
Subsistence	< 15 m	NJA only	Subsistence	NO
Commercial	< 15 m	NJA only	Small-scale	NO
Commercial	15 – 24 m	NJA only	Semi-industrial	NO
Commercial	< 24 m	Includes other NJAs and / or ABNJs	Semi-industrial (ABNJ)	YES
Commercial	≥ 24 m	Anywhere	Industrial	YES
Scientific	≥ 24 m	Anywhere	Exploratory	YES

As part of the workshop's outcomes 158 fisheries from Bangladesh, Comoros, China, European Union, Indonesia, India, Iran, Kenya, Madagascar, Maldives, Mozambique, Malaysia, Oman, Seychelles, Sri Lanka, Somalia, Tanzania and Thailand were identified using the IOTC fisheries identification wizard (Table 3).

Following the proposed approach, where purpose plays an important role in defining the type of fishery, the results of the mapping exercise indicate that more around 47% of the mapped fisheries are characterized as small-scale, followed by the industrial fisheries with 23%. Recreational and scientific purposes account for 5% and 1.3% respectively (Fig. 4). Semi Industrial fisheries account for 13% of the mapped fisheries, and mostly occurred on the ANJ (only one fishery for ABNJ). Subsistence fisheries account for 11% of the mapped fisheries under this exercise, nevertheless discussions that took place at the workshops indicated that for some coastal countries fishing purpose is both subsistence and commercial and are essentially inseparable.

Therefore, one of the proposals discussed was to consider the scale (small/medium/large) as the foremost factor driving the characterisation of fisheries under the exercise, which is in turn dependent mainly on the size of the vessels and the area of operation according to the characteristics of the exercise. Under this reclassification the small-scale component represents 57% of the fisheries, including commercial and subsistence fisheries that account for 80% and 20% respectively into the small-scale category (Fig.5). The large-scale fishery represents 25% of the mapped fisheries dominated by the commercial industrial fisheries and with a 5% of Scientific

exploratory fisheries. Medium scale commercial fisheries account for a 13% and finally recreational fisheries, as is independent of the vessel size and area of operation, keep the same values with both types of categorizations.

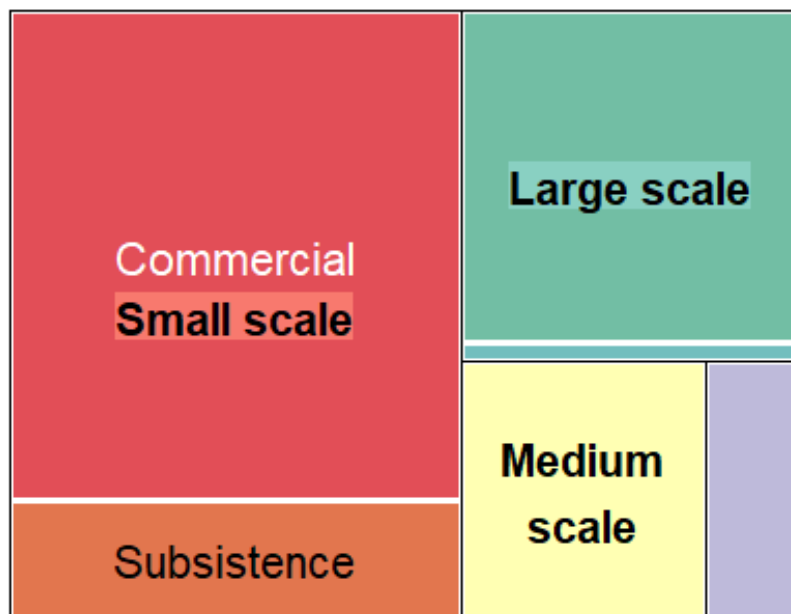
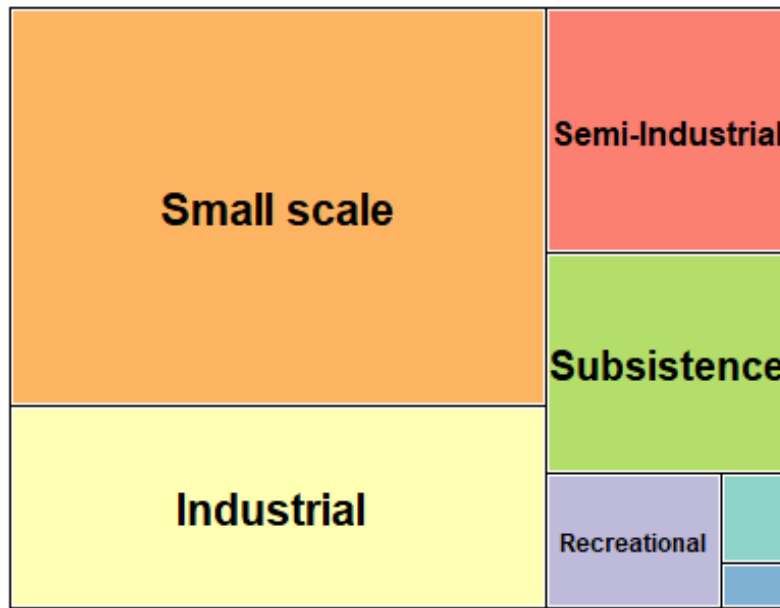


Figure 4. Characterization of the IOTC fisheries mapped by the IOTC fisheries wizard by type and purpose (top) and by scale (bottom).

Final considerations

The application of the FAO matrix approach allows the identification of a threshold that can potentially explain the characterisation of IOTC fisheries. One of the most meaningful outcomes of this exercise is that the matrix, together with the IOTC wizard mapping, allowed that a smaller segment (subsistence) into the small-scale to be identified, providing a better understanding of coastal fisheries within the IOTC for which no information on fishing crafts had been previously reported.

Although there are still some discrepancies in the terminology used (small-scale, subsistence, artisanal), most of the fisheries statistical data submitted and disseminated by the IOTC Secretariat are stratified by fishery, so that a better characterisation of the scale of fishing activity could improve the reporting of statistical data and, consequently, the implementation of IOTC Resolutions.

Table 3. Fisheries mapped through the IOTC fisheries Wizard

CPC	Fishery	Purpose	Type	Category	Scale	CPC	Fishery	Purpose	Type	Category	Scale
BGD	GE[SU]	Subsistence	Subsistence	Subsistence	Small scale	IND	DL.FR[EX]TR	Scientific	Exploratory	Exploratory	Large scale
BGD	GE.AS[SS]	Commercial	Small scale	Coastal	Small scale	IND	GD+HL+TL[SS]TN	Commercial	Small scale	Coastal	Small scale
BGD	GS.AS[SU]	Subsistence	Subsistence	Subsistence	Small scale	IND	GD+DL[SI]TN	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
BGD	GS[SS]	Commercial	Small scale	Coastal	Small scale	IND	GD+HL+TL[SS]NS	Commercial	Small scale	Coastal	Small scale
COM	HL[SS]	Commercial	Small scale	Coastal	Small scale	IND	RN-FS[SS]	Commercial	Small scale	Coastal	Small scale
COM	TL.NM[SS]	Commercial	Small scale	Coastal	Small scale	IND	RN-FS[SI]	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
COM	DL[SS]	Commercial	Small scale	Coastal	Small scale	IND	HL+TL[SS]	Commercial	Small scale	Coastal	Small scale
EU.ESP	PS-FS[IN]TR	Commercial	Industrial	Industrial	Large scale	IND	HL+TL+DL[SI]	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
EU.ESP	PS-DF[IN]TR	Commercial	Industrial	Industrial	Large scale	IND	DL[SS]	Commercial	Small scale	Coastal	Small scale
EU.FRA	PS-FS[IN]TR	Commercial	Industrial	Industrial	Large scale	IND	DL[SS]	Commercial	Small scale	Coastal	Small scale
EU.FRA	PS-DF[IN]TR	Commercial	Industrial	Industrial	Large scale	IND	PL.NM-FS[SS]TR	Commercial	Small scale	Coastal	Small scale
EU.ITA	PS-FS[IN]TR	Commercial	Industrial	Industrial	Large scale	IND	PL.NM-FS[SI]TR	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
EU.ITA	PS-DF[IN]TR	Commercial	Industrial	Industrial	Large scale	IND	BS[SS]	Commercial	Small scale	Coastal	Small scale
EU.MYT	SL.DE[IN]SA	Commercial	Industrial	Industrial	Large scale	IND	TR[SS]	Commercial	Small scale	Coastal	Small scale
EU.MYT	SL.DE[SS]SA	Commercial	Small scale	Coastal	Small scale	IND	TR[SI]	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
EU.MYT	HL-FS[SS]YA	Commercial	Small scale	Coastal	Small scale	IND	UN[SS]	Commercial	Small scale	Coastal	Small scale
EU.PRT	DL.DF[IN]SW	Commercial	Industrial	Industrial	Large scale	IND	UN[SS]	Commercial	Small scale	Coastal	Small scale
EU.REU	SL.DE[IN]SA	Commercial	Industrial	Industrial	Large scale	IND	GD[SS]	Commercial	Small scale	Coastal	Small scale
EU.REU	SL.DE[SS]SA	Commercial	Small scale	Coastal	Small scale	IND	GD[SI]	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
EU.REU	HL-FS[SS]YA	Commercial	Small scale	Coastal	Small scale	IND	TL[SS]	Commercial	Small scale	Coastal	Small scale
IDN	DS[SS]	Commercial	Small scale	Coastal	Small scale	IND	HL[SI]	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
IDN	GD.AS[SS]	Commercial	Small scale	Coastal	Small scale	IND	HR[SS]	Commercial	Small scale	Coastal	Small scale
IDN	GS[SS]	Commercial	Small scale	Coastal	Small scale	IND	GE[SU]	Subsistence	Subsistence	Subsistence	Small scale
IDN	GD.AS[IN]	Commercial	Industrial	Industrial	Large scale	IND	HL[SU]	Subsistence	Subsistence	Subsistence	Small scale
IDN	HL.NM-FS[SS]	Commercial	Small scale	Coastal	Small scale	IND	TL[SU]	Subsistence	Subsistence	Subsistence	Small scale
IDN	HL-FS[IN]	Commercial	Industrial	Industrial	Large scale	IND	BS[SU]	Subsistence	Subsistence	Subsistence	Small scale
IDN	RN-FS[SS]	Commercial	Small scale	Coastal	Small scale	IND	TR[SU]	Subsistence	Subsistence	Subsistence	Small scale
IDN	PS-FS[SS]	Commercial	Small scale	Coastal	Small scale	IND	HR[SU]	Subsistence	Subsistence	Subsistence	Small scale
IDN	PS-FS[IN]	Commercial	Industrial	Industrial	Large scale	IND	DS[SU]	Subsistence	Subsistence	Subsistence	Small scale
IDN	PL-FS[SS]	Commercial	Small scale	Coastal	Small scale	IRN	DL[SS]TR	Commercial	Small scale	Coastal	Small scale
IDN	TL.NM-FS[SS]	Commercial	Small scale	Coastal	Small scale	IRN	GD.AS[SS]	Commercial	Small scale	Coastal	Small scale
IDN	LN[SS]	Commercial	Small scale	Coastal	Small scale	IRN	GD.AS[IN]	Commercial	Industrial	Industrial	Large scale
IDN	SL.DE[SS]	Commercial	Small scale	Coastal	Small scale	IRN	PS-FS[IN]TR	Commercial	Industrial	Industrial	Large scale
IDN	SL.DE[IN]	Commercial	Industrial	Industrial	Large scale	IRN	TL.NM[SS]	Commercial	Small scale	Coastal	Small scale

Table 3. Fisheries mapped through the IOTC fisheries Wizard (continuation)

CPC	Fishery	Purpose	Type	Category	Scale	CPC	Fishery	Purpose	Type	Category	Scale
KEN	RR[RC]TR	Recreational	Recreational	Recreational	Recreational	OMN	HL[SS]TR	Commercial	Small scale	Coastal	Small scale
KEN	BS[SU]NI	Subsistence	Subsistence	Subsistence	Small scale	OMN	GD.AS[IS]NS	Commercial	Semi-Industrial	Semi-Industrial (ABNU)	Medium scale
KEN	GS.AS[SU]NS	Subsistence	Subsistence	Subsistence	Small scale	OMN	GS[SS]	Commercial	Small scale	Coastal	Small scale
KEN	HL[SU]NS	Subsistence	Subsistence	Subsistence	Small scale	OMN	TP[SS]	Commercial	Small scale	Coastal	Small scale
KEN	BS[SS]NI	Commercial	Small scale	Coastal	Small scale	OMN	HL-FS[IN]TR	Commercial	Industrial	Industrial	Large scale
KEN	GS[SS]NS	Commercial	Small scale	Coastal	Small scale	OMN	GD.AS[IN]TR	Commercial	Industrial	Industrial	Large scale
KEN	SL.SH[SS]TR	Commercial	Small scale	Coastal	Small scale	SOM	GS+SL[SS]TR	Commercial	Small scale	Coastal	Small scale
KEN	RN-FS[SJ]NS	Commercial	Semi-Industrial	Semi-Industrial	Medium scale	SOM	HL[RC]	Recreational	Recreational	Recreational	Recreational
KEN	TL-FS[SS]NS	Commercial	Small scale	Coastal	Small scale	SOM	HL[RC]	Recreational	Recreational	Recreational	Recreational
KEN	TR[SJ]NI	Commercial	Semi-Industrial	Semi-Industrial	Medium scale	SOM	GS.SB[SU]TR	Subsistence	Subsistence	Subsistence	Small scale
KEN	DL.DF[IN]TR	Commercial	Industrial	Industrial	Large scale	SOM	HL[SS]	Commercial	Small scale	Coastal	Small scale
KEN	DL.FR[EX]TR	Scientific	Exploratory	Exploratory	Large scale	SOM	GD[SS]TR	Commercial	Small scale	Coastal	Small scale
LKA	DL.FR[IN]TR	Commercial	Industrial	Industrial	Large scale	SOM	BS[SS]NI	Commercial	Small scale	Coastal	Small scale
LKA	DL[SJ]TR	Commercial	Semi-Industrial	Semi-Industrial	Medium scale	SOM	HL[RC]	Recreational	Recreational	Recreational	Recreational
LKA	DL[SS]TR	Commercial	Small scale	Coastal	Small scale	SOM	HL-FS[SU]TR	Subsistence	Subsistence	Subsistence	Small scale
LKA	GD.AS[IN]TR	Commercial	Industrial	Industrial	Large scale	SYC	DL.DF[IN]SW	Commercial	Industrial	Industrial	Large scale
LKA	GD.AS[SS]TR	Commercial	Small scale	Coastal	Small scale	SYC	DL.DF[IN]TR	Commercial	Industrial	Industrial	Large scale
LKA	RN-FS[SS]NS	Commercial	Small scale	Coastal	Small scale	SYC	DL[SJ]SW	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
LKA	RN-FS[SJ]NS	Commercial	Semi-Industrial	Semi-Industrial	Medium scale	SYC	DL[SJ]TR	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
LKA	RN-FS[IN]NS	Commercial	Industrial	Industrial	Large scale	SYC	DL.FR[IN]SW	Commercial	Industrial	Industrial	Large scale
LKA	HL-FS[SS]TR	Commercial	Small scale	Coastal	Small scale	SYC	DL.FR[IN]TR	Commercial	Industrial	Industrial	Large scale
LKA	BS[SS]NI	Commercial	Small scale	Coastal	Small scale	SYC	PS-FS[IN]TR	Commercial	Industrial	Industrial	Large scale
LKA	TL-FS[SS]TR	Commercial	Small scale	Coastal	Small scale	SYC	PS-DF[IN]TR	Commercial	Industrial	Industrial	Large scale
MDG	SL.SH[SJ]TR	Commercial	Semi-Industrial	Semi-Industrial	Medium scale	SYC	PS[IN]TR	Commercial	Industrial	Industrial	Large scale
MOZ	PS-FS[SS]NS	Commercial	Small scale	Coastal	Small scale	SYC	HL[SS]	Commercial	Small scale	Coastal	Small scale
MOZ	SL.SH[SS]	Commercial	Small scale	Coastal	Small scale	THA	PS-FS[SJ]NI	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
MOZ	DL[SJ]TR	Commercial	Semi-Industrial	Semi-Industrial	Medium scale	THA	PS-AF[SJ]NI	Commercial	Semi-Industrial	Semi-Industrial	Medium scale
MOZ	GS[SS]NS	Commercial	Small scale	Coastal	Small scale	THA	PS[IN]TR	Commercial	Industrial	Industrial	Large scale
MOZ	HL.NM-FS[RC]	Recreational	Recreational	Recreational	Recreational	TZA	RN-FS[SS]NS	Commercial	Small scale	Coastal	Small scale
MOZ	HL.NM-FS[SS]NS	Commercial	Small scale	Coastal	Small scale	TZA	HL-FS[SS]TR	Commercial	Small scale	Coastal	Small scale
MOZ	HL-FS[SJ]	Commercial	Semi-Industrial	Semi-Industrial	Medium scale	TZA	GS.SB[SU]TR	Subsistence	Subsistence	Subsistence	Small scale
MOZ	HR[SS]	Commercial	Small scale	Coastal	Small scale	TZA	HL-FS[SU]TR	Subsistence	Subsistence	Subsistence	Small scale
MOZ	HR[SU]	Subsistence	Subsistence	Subsistence	Small scale	TZA	RN-FS[SS]NS	Commercial	Small scale	Coastal	Small scale
MYS	DL.DF[IN]TR	Commercial	Industrial	Industrial	Large scale	TZA	GD.AS[SS]TR	Commercial	Small scale	Coastal	Small scale
MYS	DL.DF[IN]AL	Commercial	Industrial	Industrial	Large scale	TZA	GS[SS]SW	Commercial	Small scale	Coastal	Small scale
MYS	PS-FS[SJ]NS	Commercial	Semi-Industrial	Semi-Industrial	Medium scale	TZA	GD+HL+TL[SS]TR	Commercial	Small scale	Coastal	Small scale
MYS	HL-FS[SS]NS	Commercial	Small scale	Coastal	Small scale	TZA	HL+TL+DL[SS]TR	Commercial	Small scale	Coastal	Small scale
MYS	GD.AS[SS]NS	Commercial	Small scale	Coastal	Small scale	TZA	TL.ME-FS[SS]TR	Commercial	Small scale	Coastal	Small scale
MYS	TR[SJ]NS	Commercial	Semi-Industrial	Semi-Industrial	Medium scale	TZA	DL[SS]TR	Commercial	Small scale	Coastal	Small scale
OMN	PS-DF[IN]TR	Commercial	Industrial	Industrial	Large scale	TZA	HL.ME-FS[RC]TR	Recreational	Recreational	Recreational	Recreational
OMN	BS[SS]	Commercial	Small scale	Coastal	Small scale	TZA	RR[RC]TR	Recreational	Recreational	Recreational	Recreational
OMN	CN[SS]	Commercial	Small scale	Coastal	Small scale	TZA	TL.ME-FS[RC]TR	Recreational	Recreational	Recreational	Recreational
OMN	CN[SU]	Subsistence	Subsistence	Subsistence	Small scale	TZA	DL.DF[IN]TR	Commercial	Industrial	Industrial	Large scale
						TZA	PS-FS[IN]TR	Commercial	Industrial	Industrial	Large scale
						TZA	PS-DF[IN]TR	Commercial	Industrial	Industrial	Large scale

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