
UPDATED RESULTS ON THE IMPLEMENTATION OF THE FAO MATRIX APPROACH FOR THE CHARACTERIZATION OF SELECTED IOTC FISHERIES

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Introduction

[IOTC 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. Acknowledging the limitations of the current definition, 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 2021 meeting of the IOTC Working Party on Data Collection and Statistics (WPDCS), FAO presented paper [IOTC-2021-WPDCS17-23](#), “Towards a statistical definition of small-scale fisheries”, to assist national management and enable inter-comparability of data and information on small-scale fisheries.

The proposed approach seeks to avoid misleading or inappropriate characterizations of fisheries as *small-scale* or *large-scale*, which can sometimes occur when a single criterion (such as vessel length or area of operation) is emphasized as in the case of IOTC.

In line with the FAO approach and following the recommendation by the WPDCS17 to trial its application to all current IOTC fisheries, the Secretariat conducted a voluntary pilot survey using the FAO matrix to classify fisheries for tuna and tuna-like species from some selected CPCs. The outcomes were presented in [IOTC-2022-WPDCS18-16](#), “Preliminary results of the implementation of the FAO matrix approach for the characterization of selected IOTC fisheries” and several issues were identified during the pilot phase, which helped the Secretariat in preparing an improved format for CPCs to complete the matrix.

The WPDCS18 (para 124) THANKED the CPCs that participated voluntarily in the exercise of filling up the FAO matrix and ENCOURAGED all other participants and CPCs to contribute to this initiative by working with the IOTC Secretariat on the application of the FAO methodology for the characterization of their national fisheries.

Materials and Methods

The Secretariat request to the CPCs who expressed their interest in participating in this exercise to compile one fisheries characterization matrix for each fishery for which information on nominal catches has been reported to the IOTC Secretariat for the years 2017-2021, including those identified as *industrial* with respect to current IOTC definitions.

The procedure to apply the matrix is described in [IOTC-2022-WPDCS18-INF03](#).

For ease of completion, the IOTC Secretariat has consolidated the matrix into a single worksheet that allows only one value to be selected for each category (Fig 1), 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.

Matrix for characterizing the scale of fishing units						
COUNTRY:						
Contact Person:						
INSTRUCTIONS		For each category (columns) select the option from the drop-down menu which most closely describes the fishing unit.				
Fishing Unit	Main Gear	Number of vessels	Number of fishers	Target specie(s)	VESSEL	
					Size of fishing vessel	Motorization
					<i>Although vessel size isn't necessarily an indicator of fishing scale and intensity, it is an important characteristic when paired with variables such as motorization and mechanisation. The four categories give a range of sizes which cover the majority of vessels (including shore-based activities) which occur globally</i>	<i>Indicates the presence of an engine on board, its horse power (hp) and whether it is outboard or inboard. In the case of multiple engines, consider the main one only.</i>
					(0) No vessel	
					(1) < 12m, < 10GT	
					(2) ≤ 24m, < 50GT	
					(3) > 24m, > 50GT	

Figure 1. Worksheet template prepared by the Secretariat.

The Secretariat also offered two remote workshop sessions (English and French) to present and discuss the methodology with participants from Comoros, Maldives, Thailand, Seychelles, Iran, Madagascar, Malaysia and Indonesia.

Results

Indonesia, Maldives, Pakistan, and Sri Lanka provided responses to the matrix questionnaire with different levels of detail and according to the complexity of their fisheries in the first trial, which together with the matrices provided by Bangladesh and Comoros, resulting in data for 47 fishing units identified with total scores values ranging from 5 to 37 (Table 1).

Table 1. Scoring matrix for the 47 fishing units identified

FUNIT	VESSEL_SIZE	MOT	FGEAR	MECH	REF_STO	LAB_CREW	OWN	TIME_COMM	TRIP	FZONE	DISPOSSAL	UTILIZATION	INTEGRATION	SCORE
COM_HL	1	0	1	0	0	0	0	1	0	1	0	0	1	5
COM_NET_1	1	0	1	0	0	0	0	1	0	1	0	0	1	5
COM_NET_2	1	1	1	0	0	0	0	1	0	1	1	0	1	7
PAK_GILL_3	1	1	1	0	0	0	0	1	1	1	1	1	0	8
COM_LL_2	1	0	1	0	2	0	0	1	1	1	0	0	1	8
COM_LL_1	1	1	1	0	2	0	0	1	1	2	1	0	1	11
PAK_GILL_1	1	1	1	0	0	1	1	1	1	2	2	1	0	12
COM_TL	1	1	3	0	0	0	0	1	1	3	1	0	1	12
LKA_LLFR_1	1	1	0	0	1	3	0	1	2	2	1	0	1	13
LKA_PSRN	1	1	0	0	1	3	0	1	2	2	1	0	1	13
PAK_GI_1	1	1	1	1	1	1	0	1	2	1	1	1	1	13
LKA_LLCO_1	1	1	0	0	1	3	0	1	2	2	1	0	2	14
PAK_OTH	1	1	0	0	0	1	0	1	2	2	2	3	1	14
IDN_DS	2	2	0	0	1	1	0	2	1	2	2	1	2	16
IDN_HL	1	1	0	0	1	1	0	2	3	3	2	1	2	17
IDN_TL	1	1	0	0	1	1	0	2	3	3	2	1	2	17
LKA_LLCO_2	2	1	0	0	1	3	0	1	2	2	2	1	2	17
PAK_GILL_2	1	1	1	1	1	1	1	1	3	2	2	1	1	17
MDV_PL_1	2	2	0	0	2	3	0	3	1	2	1	0	2	18
IDN_PL	2	2	0	0	2	1	0	2	3	3	2	1	2	20
BGD_LLCO	1	1	0	0	2	3	2	1	2	2	2	1	1	18
BGD_GI_2	1	1	1	0	2	3	2	1	2	3	2	1	0	19
BGD_SN_1	1	1	1	0	2	3	2	1	3	2	2	1	0	19
BGD_GI_1	1	1	1	0	2	3	2	3	1	3	2	1	0	20
BGD_SN_2	1	2	1	0	2	3	2	1	3	2	2	1	0	20
IDN_OTH	2	2	1	1	1	1	0	2	2	3	2	1	2	20
BGD_GI_3	1	2	1	0	2	3	2	1	3	3	2	1	0	21
BGD_GI_4	2	1	1	0	2	3	2	1	3	3	2	1	0	21
BGD_SN_3	2	1	1	0	2	3	2	1	3	2	2	1	1	21
IDN_GI	2	1	1	1	2	1	0	2	3	3	2	1	2	21
BGD_SN_4	2	2	1	0	2	3	2	1	3	2	2	1	1	22
LKA_PSRO	2	2	1	0	2	3	1	1	3	2	2	1	2	22
BGD_GI_5	2	2	1	0	2	3	2	1	3	3	2	1	1	23
IDN_PSSS	2	2	2	1	2	1	0	2	3	3	2	1	2	23
LKA_LLFR_2	2	2	1	1	2	3	1	3	3	3	2	1	2	26
MDV_PL_HL	2	2	0	0	2	3	2	3	2	3	2	3	2	26
PAK_GI_2	2	2	1	3	2	1	1	3	3	3	2	1	2	26
IDN_LLCO	2	2	1	2	2	3	2	2	3	3	2	1	2	27
MDV_PL_2	3	2	0	0	2	3	2	3	2	3	2	3	2	27
LKA_LLFR_3	3	3	1	1	2	3	2	3	3	3	2	2	2	30
PAK_TL	2	2	3	3	2	1	1	3	3	3	2	3	2	30
BGD_TR_1	2	3	3	2	2	3	2	3	3	3	2	3	3	34
PAK_GI_3	3	3	1	3	3	2	2	3	3	3	3	3	2	34
BGD_TR_2	3	3	3	2	2	3	2	3	3	3	2	3	3	35
BGD_TR_3	3	3	3	2	3	3	2	3	3	3	3	3	3	37
BGD_TR_4	3	3	3	3	3	3	2	3	3	3	2	3	3	37

Following the FAO approach, and in order to characterizing the scale of fishing activity, 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 (Fig. 2) and finally mapped on a dendrogram (Fig. 3).

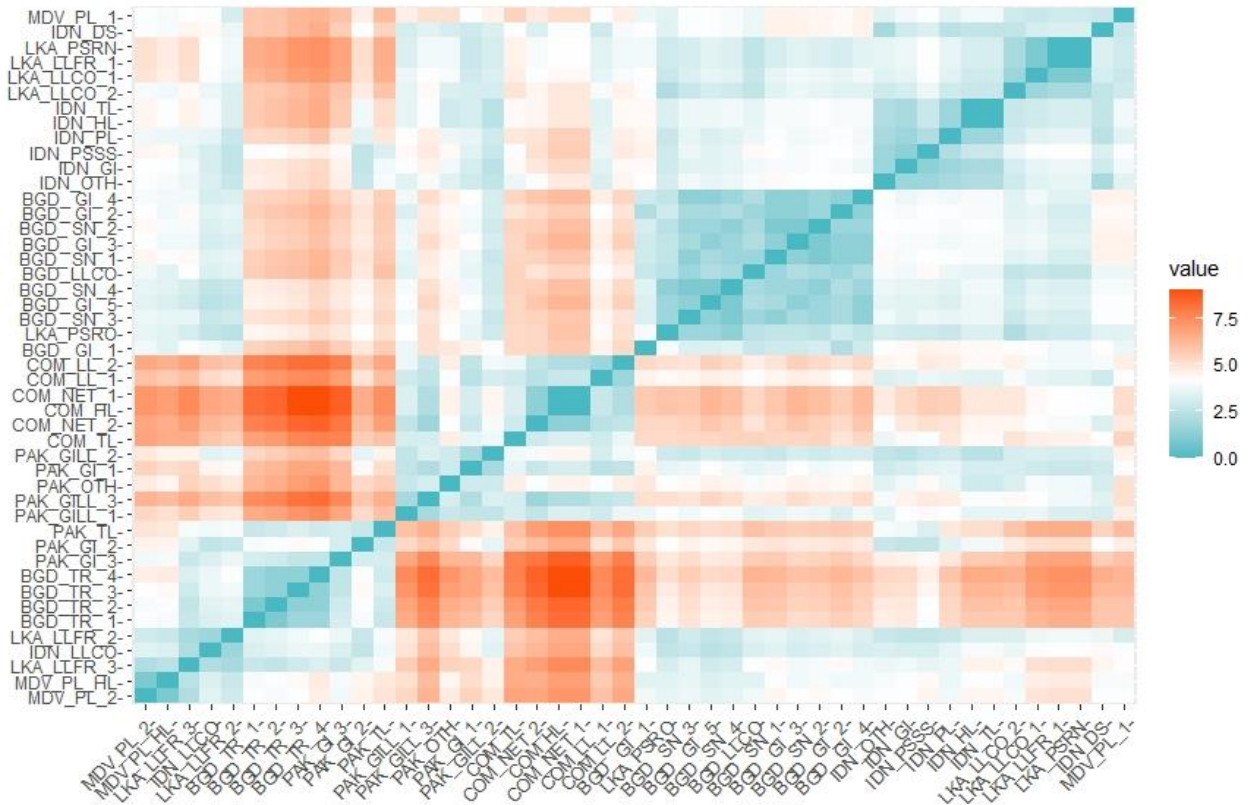


Figure 2. Gradient dissimilarity matrix representation between the identified fishing units. Coloured gradient values represent the dissimilarity level between the different elements of the matrix.

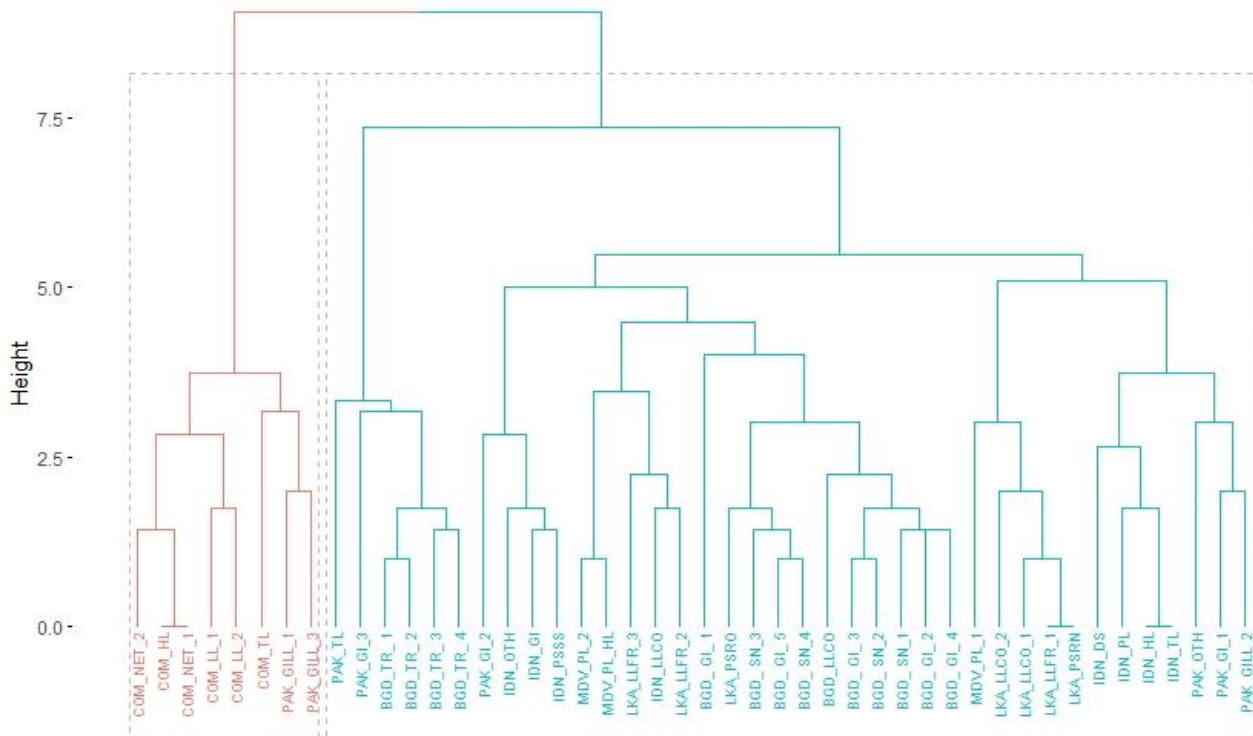


Figure 3. Fishing units identified and grouped by hierarchical clustering analysis.

The results suggest a differentiation of two main clusters with total scores ranging from 5 to 12 (A-Red) and 13 to 37 (B-light green) respectively. The cluster A is characterized by fishing units with vessels less than 12m., no mechanization, crew is composed by the individual or family members, fisher who operates their own vessel and fishers who are occupied with other full time seasonal activities when not fishing (such as farming) The matrix contains 13 variables that respond to different elements to characterise the fishing units, of which mechanisation, labour/crew, and time commitment are likely to be the main drivers in defining the clusters (Fig.4).

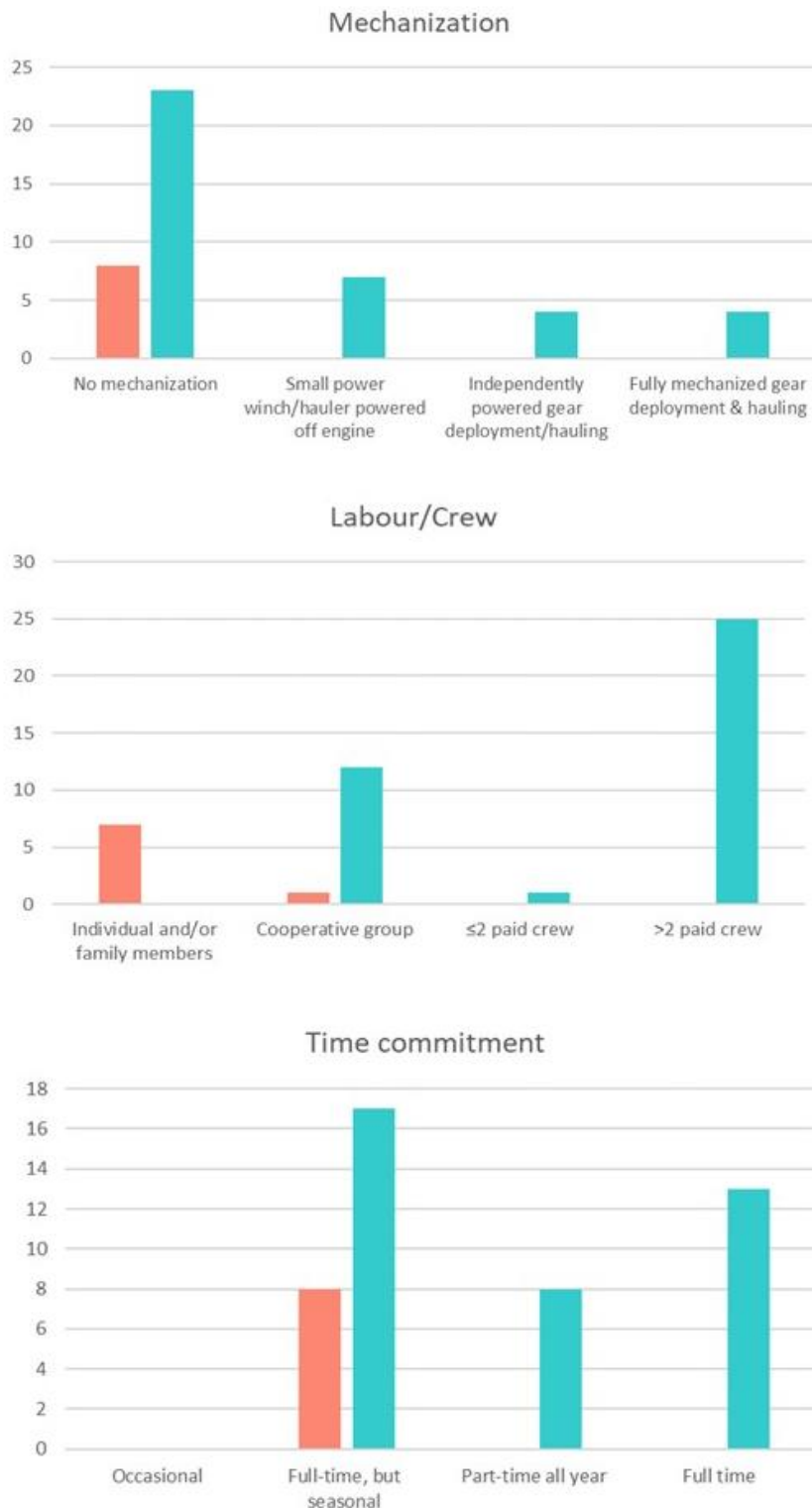


Figure 4. Matrix distribution of the categories 1) mechanisation, 2) labour/crew and 3) time commitment for the two main clusters identified.

IOTC current definition of artisanal and industrial fisheries is mainly driven by the categorisation of fishing vessels by their length overall (LOA) and area of operation. Using the matrix approach, the area of operation does not seem to be determinant to classify fishing units into the two clusters obtained in this exercise. In the case of vessel size all the fishing units included in cluster A were characterized by the lower score values of this variable (Fig.5). It is important to note that although the matrix lower size value is <12 meters, most of the fishing units identified in the cluster A correspond to vessels of less than 6m according to the information provided by the workshop participants and described in the National reports for the concerned fleets. On the other hand, although the 24 metres length overall threshold is one of the criteria used by the IOTC to classify fisheries as *industrial*, there is a significant number of fishing units with vessels classified as coastal and over 25 metres in length.

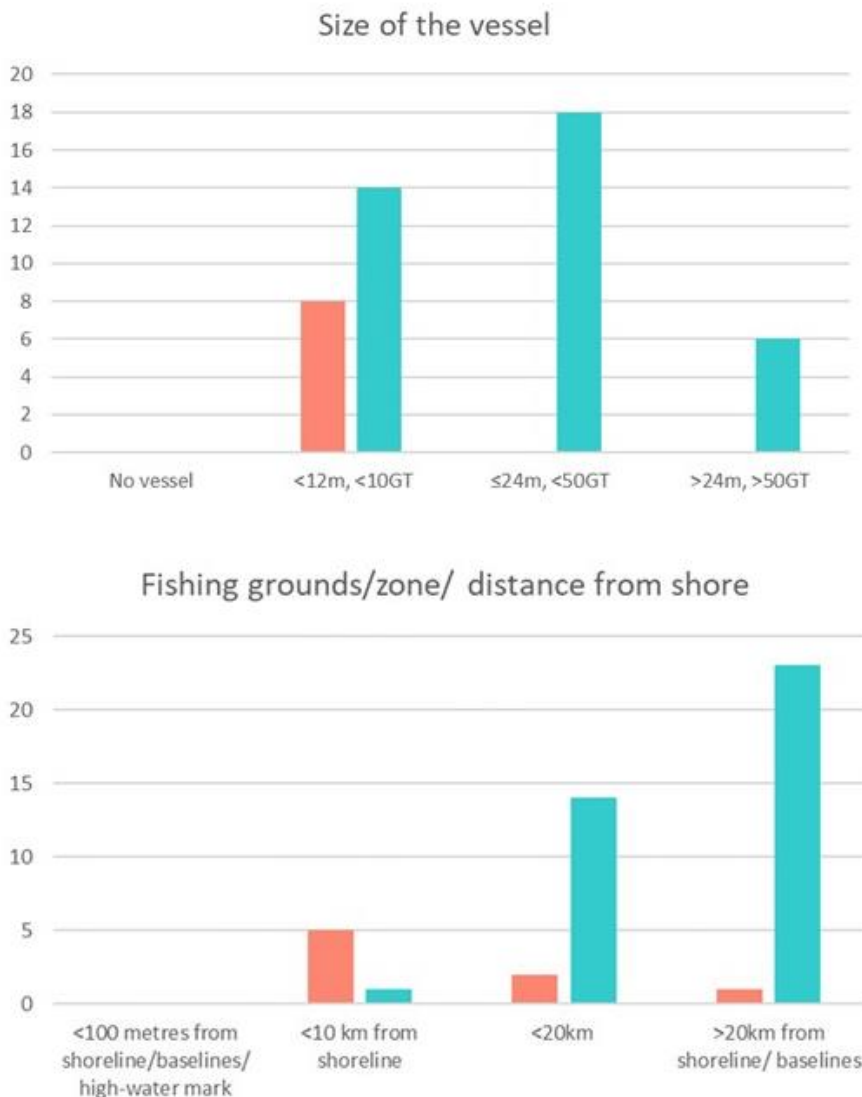


Figure 5. Matrix distribution of vessel size and fishing ground characterization for the two clusters obtained.

Although the number of fishing units included in this study is insufficient to represent the complexity and diversity of active IOTC fisheries, this exercise enabled the characterisation of several fishing units for which no information on fishing crafts had been previously reported.

This represents an opportunity for a better understanding of coastal fisheries within the IOTC, with implications for the quality of reported catch data, the structure and composition of fleets, and the correct characterisation of the concept of *coastal* or "*small-scale*" fisheries per se.

References

[IOTC-2021-WPDCS17-23](#). Towards a statistical definition of Small-Scale Fisheries.

[IOTC-2022-WPDCS18-16](#). Preliminary results of the implementation of the FAO matrix approach for the characterization of selected IOTC fisheries

[IOTC-2022-WPDCS18-INF03](#). FAO matrix for the characterization of fishing activities.