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on the Management of Tuna Fishing Capacity**

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**Measurement of the Global Fishing Capacity  
of Large-Scale Tuna Purse Seiners**

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**1. Introduction**

One of the main objectives of the FAO Project on the "Management of tuna fishing capacity: conservation and socio-economics" (funded by Japan) is to measure fishing capacity of the most important tuna fleets at the regional and global scale.

The 2<sup>nd</sup> Meeting of Technical Advisory Committee (TAC) of the FAO Project, which was held in Madrid (15-18 March 2004) recommended to update the tuna fishing capacity estimates published in the FAO Fisheries Circular No. 982 (Joseph, 2003). This Circular entitled "Managing Fishing Capacity of the World Tuna Fleet", included an estimation of both the number of vessels and the technological fishing capacity (in terms of tonnes of carrying capacity) of the world's active large-scale tuna purse seine fleet. These estimates refer to 2000.

The 2<sup>nd</sup> TAC also recommended FAO to promote the development of a global record of tuna fishing vessels.

The main objective of this paper is to estimate fishing capacity of the world's active large-scale tuna purse seine fleet. By active vessels, we refer to vessels that have been actively fishing during 2004, regardless of time spent fishing. The difficulties to estimate fishing capacity are discussed. In addition, the development of a global record of tuna fishing vessels by FAO, useful to monitor changes in tuna fishing capacity is also discussed.

## 2. Definitions

Fishing capacity can be defined either in reference to the characteristics of a fishing vessel or its ability to catch fish. It can be estimated either on an input or output basis and with reference to a range of indicators. A general definition of fishing capacity is the maximum amount of fish (or fishing effort) that can be produced over a period of time (e.g. a year or a fishing season) by a vessel or a fleet if fully utilized, and for a given resource condition (FAO, 2003).

In technological terms the word "capacity" is used to when describing physical measures of the vessel (e.g., hull capacity and the ability to hold fish) as well as the operational or technical efficiency of a fishing vessel and its gear. In this study, the "vessel or fleet carrying capacity" was used as a proxy for fishing capacity. This carrying capacity (hold capacity) was used to represent the capacity of a vessel or fleet to carry fish and it is assumed to be related to the ability of a vessel to catch fish under normal fishing conditions. Fish carrying capacity is measured for most tuna fishing vessels as the tonnage of fish that can be stored on the vessel when it is fully loaded, or the storage area measured in cubic meters.

A study conducted by Gillett and Lewis (2003) concluded that although the use of carrying capacity as a proxy for the tuna purse seiners fishing capacity has its shortcomings, there are no obvious alternatives. According to this study, carrying capacity is presently the best option for measuring fishing capacity of tuna purse seine vessels.

The concept of capacity utilization also deserves some attention while dealing with fishing capacity. Capacity utilization is the degree to which vessels are fully utilized. From an input measurement perspective, this may relate to the ratio of the number of days actually fished to the number of days the boat could potentially fish under normal working conditions. From an output measurement perspective, capacity utilization is the ratio of the actual catch to the maximum potential catch (if fully utilized), given prevailing resource conditions (FAO, 2004).

## 3. Tuna Agencies and Programs' vessel registers

Most of the Tuna Agencies and Programs have adopted resolutions to establish registers of vessels authorized to operate in their areas of competence. These registers can be accessed through their websites which are listed below.

- Commission for the Conservation of Southern Bluefin Tuna (CCSBT),
- Forum Fisheries Agency (FFA),
- Indian Ocean Tuna Commission (IOTC), and
- Inter-American Tropical Tuna Commission (IATTC),
- International Commission for the Conservation of Atlantic Tunas (ICCAT),

- Secretariat of the Pacific Community (SPC).

However, there is no single source to obtain a list of the world's tuna purse seine vessels. The following paragraphs briefly outline the relevant resolutions or recommendations to establish those registers and describe the information being stored within the registers.

CCSBT's "Resolution on Illegal, unregulated and unreported fishing (IUU) and establishment of a CCSBT record of vessels over 24 meters authorized to fish for southern bluefin tuna" (adopted in 2003) agreed that the Commission shall establish and maintain an CCSBT record of fishing vessels larger than 24 meters in length overall (LOA) authorized to fish for southern bluefin tuna. This list shall include: (i) name of vessel, register number, (ii) previous name (if any), (iii) previous flag (if any), (iv) previous details of deletion from other registries (if any), (v) international radio call sign (if any), (vi) type of vessels, length and gross registered tonnage (GRT), (vii) name and address of owner(s) and operator(s), (viii) gear used and (ix) time period authorized for fishing and/or transshipping.

FFA maintains a "Regional Register of Foreign Fishing Vessels" operating in the western and central Pacific. All foreign fishing vessels (regardless of the length of the vessels) wishing to obtain tuna fishing licences or permits from any of the FFA member countries must first register with the FFA and be in good standing on the regional register. In addition to the usual information required in this type of registers, information on daily freezing capacity (by method, capacity (mt/day) and temperature) and storage capacity (by method, capacity (m<sup>3</sup>), and temperature) is requested.

IOTC's "Resolution concerning registration and exchange of information on vessels, including flag of convenience vessels, fishing for tropical tunas in the IOTC area of competence" (adopted in 1998) recommended that all Contracting Parties and Non-Contracting Parties cooperating with the IOTC with vessels fishing for tropical tunas in the IOTC area shall submit to the Secretary a list of their respective vessels greater than 24 m in LOA that have fished for tropical tunas in the Area during the previous year, and may submit to the Secretary, on a voluntary basis, a list of their respective vessels of less than 24 m in LOA that have fished for tropical tunas. These lists should contain nearly the same information as mentioned above.

IATTC's "Resolution on a regional vessel register" (adopted in 2000) recommended to establish and maintain a record of vessels that have been authorized to fish in the Convention Area for species under the purview of the Commission. The information included in this register is similar to that of the registers maintained by the other organizations, but in this case, in addition, fish hold capacity in cubic meters, and carrying capacity in metric tons are required and serve as a basis for monitoring the capacity of the EPO fleet.

ICCAT's "Recommendation concerning the establishment of a record of vessels over 24 meters authorized to operate in the Convention Area" (adopted in 2002) requires that each ICCAT Contracting Party, Cooperating non-Contracting Party, Entity or Fishing Entity submit the list of its large-scale fishing vessels that are authorized to operate in the Convention Area. This list should include similar information as that of CCSBT.

SPC does not maintain a list of vessels licensed to fish in the western and central Pacific Ocean, but it maintains a list of vessels covered by the various types of data held by its Oceanic Fisheries Programme. SPC also holds some vessel and gear attribute information.

#### 4. Sources of information

As mentioned in the previous section, not all Tuna Agencies and Programs are compiling information on fishing capacity (or its proxies such as carrying capacity) on a regular basis. Furthermore, some of those Tuna Agencies and Programs' registers include a high proportion of inactive vessels. For these reasons, using only the information contained in these registers to estimate the active fishing capacity would be ineffective. The following sources of information were used.

- *Pacific Ocean*: The IATTC vessel register and the information provided by IATTC's Secretariat on active/inactive vessels, was used to estimate the carrying capacity for the eastern Pacific Ocean. For the western and central Pacific Ocean, the data obtained by Gillett and Lewis (2003) were adjusted to fit the selected intervals of carrying capacity (400 tonnes). The sources for this study were the FFA regional register and the SPC tuna fishery database complemented with other industry and governmental data. Gillett and Lewis (2003) estimated the carrying capacity in cubic meters, and in this paper, a conversion factor from cubic meters to tonnes was applied (1 tonne = 1.17051 cubic meter). These data are only for vessels licensed in the waters off Pacific island countries and do not include domestic fisheries.
- *Indian Ocean*: The IOTC vessel register as well as information provided by IOTC's Secretariat on active/inactive vessels, was used to estimate the carrying capacity for the Indian Ocean.
- *Atlantic Ocean*: A variety of sources, mostly from governmental agencies such as the "Institut de Recherche pour le Développement", "Instituto Español de Oceanografía" and the "Instituto Nacional de Investigaciones Agrícolas de Venezuela" were used. The fleets included in this update are those of Spain, France, Venezuela and the so-called Nei fleet<sup>1</sup>. These are the most important purse-seine fleets presently operating in the Atlantic and the only ones for which information was available.

#### 5. Estimates of the number and carrying capacity of the active large-scale tuna purse seiners

The estimates of the number and carrying capacity of the world's active large-scale tuna purse seiners, for 2004<sup>2</sup> are presented in Table 1. However, the potential carrying capacity may be somewhat greater than the one shown in Table 1 below, since this study only includes active vessels.

The information is presented by 400 tonnes intervals of carrying capacity (the same intervals as those used by Joseph (2003)). Some purse-seine vessels operate in more than one ocean in the same years. In order to avoid duplicates, each vessel has been assigned to a single ocean.

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<sup>1</sup> Not Elsewhere Included. Refers to vessels that cannot be linked directly to a State or fishing entity, for whatever reason.

<sup>2</sup> The estimates for the western and central Pacific refer to 2003.

According to the information received, the proportion of vessels fishing in different oceans during the same period was very low (less than 10 vessels out of 519).

**Table 1.** Number and carrying capacity of the active large-scale tuna purse seiners, by 400 tonne intervals, in 2004.

Carrying capacity ranges (tonnes)		Atlantic	Indian	Eastern Pacific	Western and Central Pacific <sup>3</sup>	Global
<401	Number of Vessels	2	0	62	11	75
	Carrying Capacity (tonnes)	636	0	15210	2938	18784
401-800	Number of Vessels	25	1	36	25	87
	Carrying Capacity (tonnes)	15406	800	21931	15637	53774
801-1200	Number of Vessels	8	7	83	106	204
	Carrying Capacity (tonnes)	8367	7530	86653	105804	208354
1201-1600	Number of Vessels	8	21	25	41	95
	Carrying Capacity (tonnes)	10388	27036	33925	53828	125177
1601 – 2000	Number of Vessels	0	24	6	18	48
	Carrying Capacity (tonnes)	0	43996	10467	37628	92091
>2000	Number of Vessels	0	9	1	0	10
	Carrying Capacity (tonnes)	0	24297	2799	0	27096
Total by Ocean	Number of Vessels	43	62	213	201	519
	Carrying Capacity (tonnes)	34797	103659	170985	215835	525276

Table 2 summarizes the estimations made for both 2000 (Joseph, 2003) and 2004.

**Table 2.** Total number and carrying capacity of the active large-scale tuna purse seiners for 2000 and 2004.

		Atlantic	Indian	Eastern Pacific	Western and Central Pacific	Global
Total by Ocean (2000)	Number of Vessels	53	67	205	246	571
	Carrying Capacity (tonnes)	48064	126554	184945	233133	592696
Total by Ocean (2004)	Number of Vessels	43	62	213	201	519
	Carrying Capacity (tonnes)	34797	103659	170985	215835	525276

### 5.1. Number of vessels

The difference in the number of purse seiners for the Atlantic fleet in 2000 and 2004 can be mostly explained by accounting for the fleets of Ghana, not estimated in the 2004 study, since this information could not be obtained. If these vessels were still active, this would mean that the number of purse seiners in the Atlantic Ocean has been more or less stable since 2000. In the Indian Ocean and the Eastern Pacific Ocean, the number of purse seiners in 2004 is quite similar to that of 2000. The differences in number of vessels in the western and central Pacific Ocean are mainly explained by the fact that the study done by Gillett and Lewis (2003) did not include the domestic fisheries.

<sup>3</sup> The conversion factor used to transform cubic meters into tonnes was 1.17051.

### **5.2. Carrying capacity**

According to the information obtained, the global active carrying capacity have somewhat decreased between 2000 and 2004 (by 67 420 tonnes or approximately a10 per cent). The largest decrease in carrying capacity occurred in the Indian Ocean (almost a 20 percent). A similar decrease (approximately 8 per cent) is estimated for both the eastern Pacific and the western and central Pacific.

As it was mentioned before, the 2004 estimates for the Atlantic Ocean do not include the Ghanaian fleet. It is probably the reason for the large decrease in the carrying capacity that has been observed in the Atlantic (almost 30 per cent). If it is assumed that the Ghanaian fleet have remained more or less stable during this period, this decrease would be of only 13 per cent.

### **6. Discussion**

The major difficulties faced when updating the estimates of the world's large-scale tuna purse seine fleet are listed below.

- Presently, there is no precise and practical definition of what should be considered as large-scale purse seiners.
- There is no single source to obtain a list of the world's tuna purse seine vessels.
- The interest of the Tuna Agencies and Programs in collecting data on fishing capacity is very heterogeneous and public vessel registers rarely include information on the fish hold capacity in cubic meters and/or carrying capacity in tonnes.
- Even if most of the Tuna Fishery Bodies have established their own registers of vessels licensed to fish in their areas of competence, it is difficult to ascertain which of the vessels included in those lists were actively fishing for tuna during the previous year and to what extent.
- Some of the large-scale purse seiners are not included in the regional registers since they only fish in domestic waters.
- In the case of WCPO information was only provided in cubic meters, and a conversion factor (1.17051) was used to transform cubic meters in tonnes.
- Purse-seine fleets frequently transfer their operations from one ocean to another in response to changing conditions and therefore, duplication should be avoided when estimating global carrying capacity of these vessels.

The 2<sup>nd</sup> Meeting of Technical Advisory Committee (TAC) of the FAO Project recommended that FAO should promote the development of a global record of tuna fishing vessels. In the framework of the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (Compliance Agreement) (FAO, 1995), FAO had developed a prototype database to store and exchange vessel information in accordance with article VI of the Compliance Agreement. This database has been named the "High Seas Vessels Authorization Record (HSVAR)" and contains information on large-scale vessels provided by some of the Parties to the Compliance Agreement. The usefulness of this global record to monitor the possible increases or decreases of the fishing capacity would depend on the inclusion in it of accurate information regarding the carrying capacity of the vessel, the active or non active status of the vessel, and the regions in which the vessel

was actively fishing for tuna during the previous year, information not provided for in Article VI of the Agreement and so far, none of this information is included in the database.

The appropriate approach for obtaining information on fishing capacity might be to develop a global data base specifically to monitor changes in tuna fishing capacity. Initially, possibly only large-scale purse seiners should be included in this data base and this could be extended to gradually cover also the longline and the pole-and-line fleets. A precise and practical definition of what should be considered as large-scale tuna vessels should be agreed. The information would be released on a regional basis, and after eliminating the duplications, on the global basis (as tables presented above).

The Tuna Agencies and Programs could compile the above-mentioned information in their areas of competence, and to possibly provide this information to FAO every year for their compilation on the global scale. Such a process has already been proposed within the framework of the Coordinating Working Party on Fishery Statistics (CWP). FAO could liaise directly only with the Tuna Fishery Bodies, while they would directly liaise with national authorities to prevent those authorities being contacted both by FAO and the Tuna Fishery Bodies.

The surveys should be repeated yearly using as much as possible reliable sources of information to make sure that the results are comparable. Collaboration with the industry should be pursued.

For each vessel, the information provided should at least include: name of vessel and/or register number, flag, type of vessel, length and gross registered tonnage (GRT), hold capacity in cubic meters and/or carrying capacity in tonnes and, area and time in which the vessel was actively fishing. Additional information on target species, landings, crew, capacity utilization etc. would be desired. Specially, information on the capacity utilization would be very important to monitor the degree to which a tuna fleet is fully utilized. Of course, individual vessel information should be treated as confidential and the information released to the general public would be aggregated at a regional level, as presented in the tables above, to avoid these problems of confidentiality. The aggregated information could be disseminated through the FAO Fisheries Global Information System (FIGIS).

While setting up the record of tuna fishing capacity, with the aim of monitoring future changes in fishing capacity, it would be also important to make every effort to retrieve historical information on the fishing capacity.

In March 2005, the Meeting of Ministers of Fisheries at FAO recommended the establishment by FAO of a global record of fishing vessels and the Secretariat is currently undertaking a feasibility study of the various options for creating such a database, building on existing vessel records as far as possible. This would obviously have implications for the tuna vessel database proposed above.

## 7. Acknowledgements

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- Forum Fisheries Agency (FFA),
- Inter-American Tropical Tuna Commission (IATTC),
- Indian Ocean Tuna Commission (IOTC),
- International Commission for the Conservation of Atlantic Tunas (ICCAT),
- Institut de Recherche pour le Développement (IRD);
- Instituto Español de Oceanografía (IEO),
- Instituto Nacional de Investigaciones Agrícolas de Venezuela (INIA)
- Secretariat of the Pacific Community (SPC), and

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## 8. References

**FAO.** 1995. Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (Compliance Agreement). Rome.

**FAO.** 2000. Report of the Technical Consultation on the Measurement of Fishing Capacity. *FAO Fisheries Report* No. 615. Rome, FAO.

**Joseph, J.** 2003. Managing fishing capacity of the world tuna fleet. *FAO Fisheries Circular*. No. 982. Rome, FAO.

**Gillett, R. & Lewis, A.** 2003. A survey of purse seine fishing capacity in the Western and Central Pacific Ocean, 1988 to 2003. Gillett, Preston and Associates.

**Ward, J.M.; Kirkley, J.E.; Metzner, R. & Pascoe, S.** 2004. Measuring and assessing capacity in fisheries. 1. Basic concepts and management options. *FAO Fisheries Technical Paper*. No. 433/1. Rome, FAO.