INTER-AMERICAN TROPICAL TUNA COMMISSION

TECHNICAL EXPERTS WORKSHOP ON THE MANAGEMENT OF THE CAPACITY OF THE TUNA-FISHING FLEET IN THE EASTERN PACIFIC OCEAN

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TARGET CAPACITY FOR THE TUNA FLEET IN THE EASTERN PACIFIC OCEAN

1. INTRODUCTION

The first meeting of the Permanent Working Group on Fleet Capacity in September 1998 examined the question of the size of the purse-seine fleet that fishes for tunas in the eastern Pacific Ocean (EPO). The document *Considerations regarding limiting the growth in capacity of the international tuna purse-seine fleet in the eastern Pacific Ocean*, prepared for that meeting, concluded that "the current carrying capacity of the fleet, 135,000 metric tons (t), is large enough to generate the amount of fishing effort or mortality required to catch the [average maximum sustainable yield (AMSY)] of yellowfin and the recommended catch of bigeye from the EPO. It is also capable of generating the amount of fishing effort that produced the highest catch of all species combined in the history of the fishery."

This figure, expressed as 158,000 cubic meters (m^3), has been used since 1999 as the target capacity for the purse-seine fleet in various documents and resolutions of the Commission, including the *Plan for Regional Management of Fishing Capacity*, Resolution C-02-03 on the capacity of the tuna fleet operating in the Eastern Pacific Ocean and Document IATTC-72-06, *Target Capacity for the tuna fleet in the Eastern Pacific Ocean*.

Document CAP-11-05, prepared for the 11th meeting of the Permanent Working Group on Fleet Capacity, updated the analysis shown in IATTC-72-06, in order to reflect changes in the management measures implemented through resolutions. In particular, that document presented estimates of purse-seine and longline capacity consistent with the staff's conservation recommendations for 2008-2010 and 2011-2013.

This document provides a new analysis, with estimates of target purse seine fleet capacity based on the relationship between fishing mortality estimates and active purse-seine fleet capacity. Details of the method are given in Document SAC-05-12, to be presented at the upcoming 5th Meeting of the Scientific Advisory Committee. The longline capacity estimates are the same as those presented in the previous analysis because longline catch limits have not changed since then.

2. METHODOLOGICAL CONSIDERATIONS

It is difficult to establish a size to which a fleet should be limited. One approach would be to keep it at a size that can take the maximum harvest from the fishery, while at the same time ensuring the sustainability

of each stock. In the EPO this is complicated by the fact that there are two main fishing gear types (purse-seine and longline) and three main modes of purse-seine fishing (for unassociated schools of tunas and for tunas associated with dolphins and with floating objects), and that more than one species is frequently caught in a single set.

Likewise, the interaction between the concept of maximum harvest and the objective of sustainability of each stock may create a management inconsistency that might be resolved only by developing independent species-specific fishing methods and management objectives. Thus, the question of an "optimal" fleet size depends to a large extent on management objectives. It is clear, however, that excess fishing capacity precludes the implementation of effective and efficient regulatory measures.

For the EPO, however, given the current mix of fishing gears, set types, and species in the fishery, it is logical and prudent to take into account the current allocation of purse-seine catches among the three major categories of set types (dolphin associated, floating object, and unassociated). That allocation is utilized in SAC-05-12.

Another important consideration is the efficiency of the fleet. Because improvements in fishing gear, equipment, and techniques generate more effort and more fishing mortality, any figure for "current" optimal fleet size must be considered an upper limit for the desired target. In the case of the purse-seine fisheries, it also depends largely on the composition of the fleet, as vessels of different capacity classes usually have different fishing efficiencies.

The target fleet capacity will also clearly depend on the productivity of the stocks, which changes over time.

3. TARGET CAPACITY FOR THE PURSE-SEINE FLEET

One general idea in limiting the size of the fleet is that otherwise the catches per vessel will decline, and the economic pressures on individual vessels will be so great that it would be very difficult to sustain an efficient conservation program. An upper limit to target capacity can be calculated based on the relationship between fishing mortality at MSY and fleet capacity.

The fleet size increased rapidly in the early 1970s, reaching about 196,500 m^3 in 1980-1981. It then fell to 121,650 m^3 in 1984, and remained at an average of about 135,000 m^3 until the mid-1990s, when it began to increase again, mirroring the growth of the early 1970s (Figure 1). Purse-seine capacity in 2014 is estimated to be 215,300 m^3.

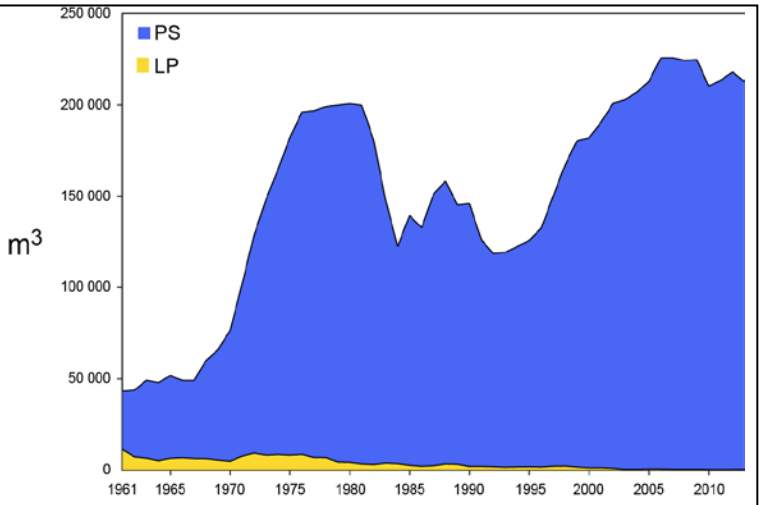

FIGURE 1. Carrying capacity, in cubic meters of well volume, of the purse-seine (PS) and pole-and-line (LP) in the EPO, 1961-2013

Restrictions on fishing for yellowfin in the Commission's Yellowfin Regulatory Area (CYRA) made the fishing season shorter during the late 1960s, and by 1970 and through 1977 the fishery was open to unrestricted fishing only 3 or 4 months per year. This clearly coincided with the period of fleet expansion during those years. The length of the fishing season increased gradually during the late 1970s, and there were no restrictions from the early 1980s until 1997. Again, this coincided clearly with the drastic reductions in fleet size followed by a period of relatively low fleet size. Tellingly, when the size of the fleet began to increase again in recent years, there was a need for restrictions once more, beginning in 1998.

Results for a weighted average of the exploitation of yellowfin and bigeye tuna are shown in Figure 2 (from SAC-05-12). The regression equation in Figure 2 produces an estimate of active capacity of 176,707 m^3 at the level of MSY. Figure 2 also shows what is defined as effective capacity (active capacity multiplied by the fraction of the year fishing is allowed and adjusted for the *corralito* closure specified in Resolution C-13-01). As can be seen in the figure, the current effective capacity is very close to the capacity at MSY. Table 1 lists target capacity estimates from the previous analysis in CAP-11-05, Shrader and Squires (SAC-04-INF B), and this document.

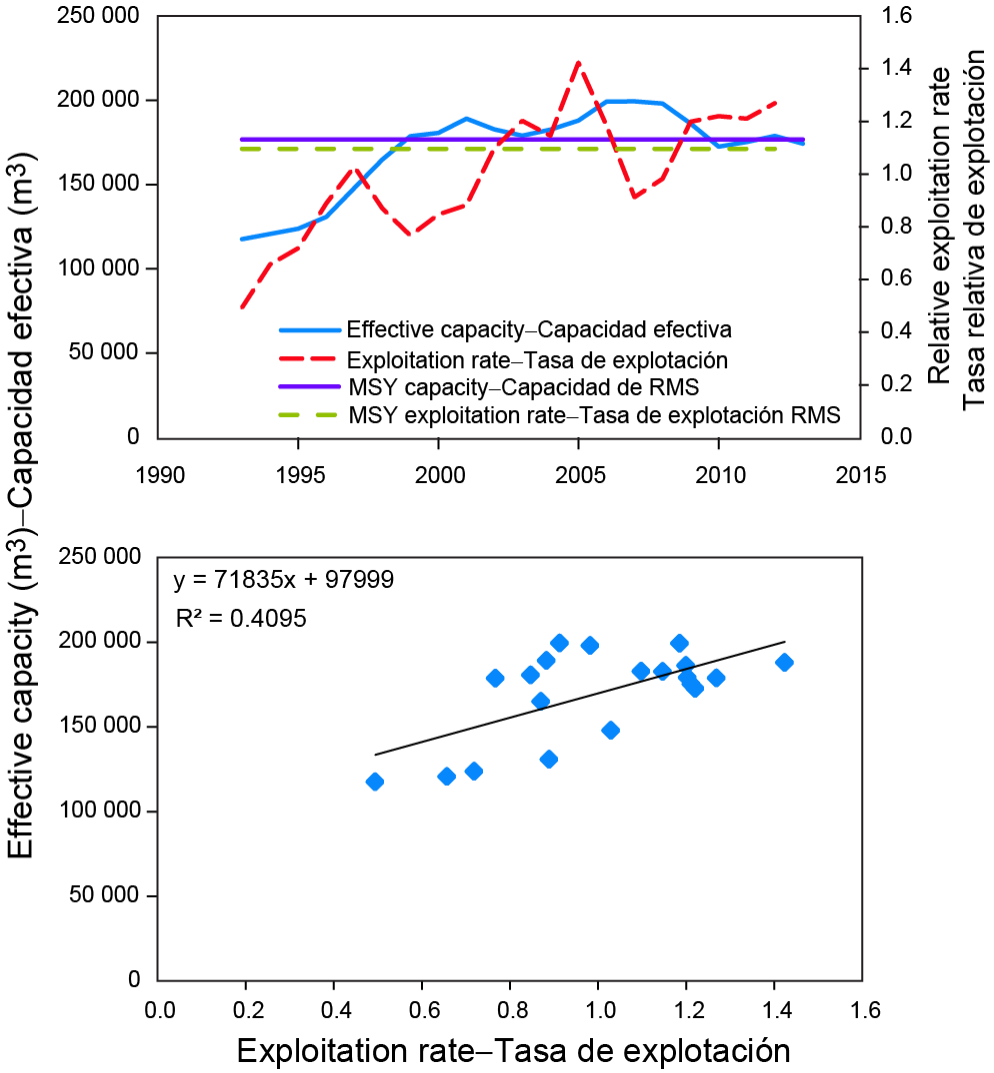

FIGURE 2. Comparison of a weighted average of relative exploitation rate for yellowfin and bigeye with effective capacity, 1993-2012.

Target capacity estimates for the purse-seine fleet range from 155,798 m^3 to 176,707 m^3. Those estimates bracket the target of 158,000 m^3 in Resolution C-02-03 (originally expressed in metric tons in Resolution C-00-01).

	CAP-11-05		SAC-04-INF B		Present
Target active purse-seine capacity	155,798	172,141	167,000	171,000	176,707
Percent increase in target capacity compared to target of 158,000 m^3	-1.4%	9.0%	5.7%	8.2%	11.8%

TABLE 1. Comparison of estimates of target capacity

4. TARGET CAPACITY FOR THE LONGLINE FLEET

What is usually considered the longline tuna fleet in the EPO consists mostly of industrial vessels over 24 m in overall length, with freezing capability, referred to in recent IATTC resolutions and other documents as LSTLVs (large-scale tuna longline vessels).

The problem of establishing a target capacity for this fleet is in some respects similar to that for the purse-seine fleet. However, the data for the purse-seine fleet are much more extensive and detailed; for example, only recently have catch and effort data been available for all the major longline fleets fishing in the EPO, and those only for the last few years, annual data for some large-scale fleets and for the numerous artisanal vessels in the EPO are unavailable, and the Commission's Regional Vessel Register is more complete for purse-seine vessels than it is for longline vessels. However, even if it were complete, the Register in many cases simply lists all longline vessels authorized to fish in the EPO, and would not be useful for determining which vessels were actually fishing in the EPO.

One important difference between the purse-seine and longline fisheries is that the latter generally catch large fish, so most of their catches in the EPO consist of bigeye tuna and, to a lesser extent, yellowfin and albacore tuna. Skipjack is seldom taken by the longline fleet. Billfishes are also an important target of this fishery, especially swordfish and marlins, as well as several types of sharks.

The issue of longline effort has been discussed extensively in recent years, and the question of the number of LSTLVs and of the "optimal" longline capacity was discussed in 2004 in document IATTC-72-06. There is less of an issue with capacity for the LSTLV fleets: as shown in Figure 3, a noticeable declining trend is evident in longline effort in the EPO.

In considering a target capacity for the longline fleet in the EPO, the approach of calculating that capacity based on bigeye tuna catch limits was applied. The resulting upper limits for longline capacity are much higher than the number of hooks being fished in the EPO. This is a consequence of the fact that longline catches in recent years, especially for the Japanese fleet, are substantially lower than the catch limits recommended in IATTC-78-06b and IATTC-81-06b. Calculations are shown in the Table 2. The estimated capacity for the four major longline fleets ranges from 140,406,000 to 169,167,000 hooks. An upward adjustment by another 6,860,000 hooks would incorporate fleets other than the four major ones. Those longline capacity estimates for Japan are all lower than the 133,000,000 hooks estimated in IATTC-72-06, which included Japanese capacity only.

Statistic	China	Japan	Korea	Chinese Taipei	Total hooks (1000s)
Average catch (t) per 1000 hooks, 2005-2009	0.17	0.32	0.74	0.27	
C-06-02 catch limits	2,639	34,076	12,576	7,953	
C-06-02 hooks (1000s)	15,193	107,345	17,076	29,553	169,167
IATTC-78-06b catch limits	2,190	28,283	10,438	6,601	
IATTC-78-06 hooks	12,608	89,096	14,173	24,529	140,406
C-10-01 catch limits	2,507	32,372	11,947	7,555	
C-10-01 hooks (1000s)	14,433	101,977	16,222	28,074	160,706
Average bigeye catch (t), 2005-2009	1,999	15,804	7,214	4,832	29,849
Other members average catch = 2,178 t				Hooks (1000s) =	6,860
Adjusted C-10-01 hooks, taking other members into account					167,566
Average reported hooks (1000s) by all members, 2005-2009					102,497

TABLE 2. Longline capacity estimates in terms of number of hooks

5. CONCLUSION

It is clear that tradeoffs of many types must be carefully considered in establishing a target capacity for both the purse-seine and longline components of the EPO tuna fleet, because, at least as regards bigeye

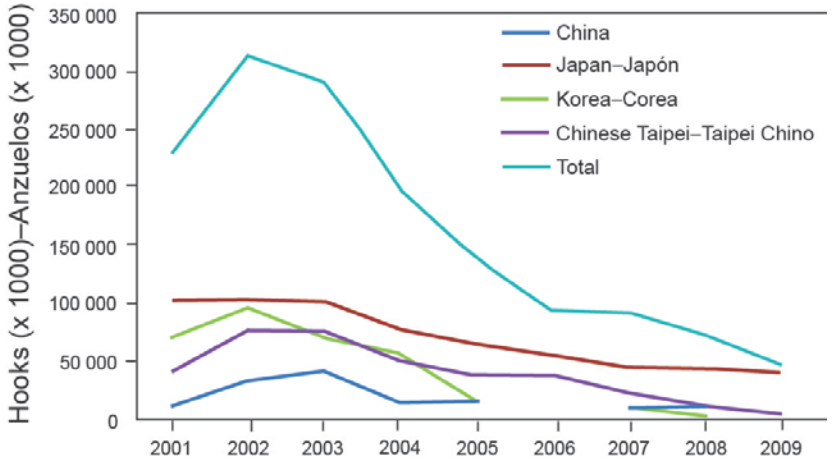

FIGURE 3. Reported number of hooks set in the EPO by the four major longline fleets.

tuna, the optimal size of one fleet depends on that of the other. However, it is clear that the current capacity of the purse-seine fleet, estimated at nearly 215,000 m^3 in 2014, is well above the level that would result in longer fishing seasons and economic benefits, and facilitate management and conservation of bigeye and yellowfin tuna. The current purse-seine closures in C-13-01 are estimated to have resulted in effective capacity in 2014 of about 176,963 m^3, which is close to the estimate of active capacity at MSY. Similarly, it is clear that the current longline fleet size is considerably below the level corresponding to current conservation recommendations.

A target capacity of 158,000 m^3 still seems appropriate from the point of view of optimizing the capacity of the purse-seine fleet with respect to yellowfin tuna.

For bigeye tuna the situation is more complex, both because longline and purse-seine fishing are important, and because the effective effort on bigeye could possibly be reduced by means other than reducing the capacity of the fleet. The choice of what reduction in fishing effort should be used as a target is one the Commission has made in recent years with time and area closures. The latest Commission conservation recommendation, C-13-01, is consistent with recommendations made by the scientific staff.

It is also clear that a different set of considerations would be needed if the purse-seine fleet were to be optimized to fish for skipjack. With current fishing practices, a target fleet capacity in that case would need to take into account the interactions between bigeye and skipjack in the purse-seine fishery.

Considering the limited data available, especially for the longline fleet, the composition of the fleet, by individual vessel, possible future changes in efficiency, and bycatch issues, the optimal capacity for both will continue to be a moving target. The management choices regarding these targets should be made by the Commission.