INTER-AMERICAN TROPICAL TUNA COMMISSION
COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

75TH MEETING

CANCUN (MEXICO)
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DOCUMENT IATTC-75-07b REV

CONSERVATION RECOMMENDATIONS

Resolutions C-04-09 and C-06-02 on the conservation of tunas in the eastern Pacific Ocean (EPO) establish measures for the conservation of yellowfin and bigeye tuna during 2004-2007. This paper makes recommendations for yellowfin and bigeye for 2007-2009 and for an annual limit on the catch of swordfish in the southeastern Pacific Ocean, and suggests clarification of Resolution C-05-02 concerning northern albacore tuna. It also recommends that the growing capacity of the purse-seine fleet be addressed. Summaries of the stock assessments for all species are provided in Document IATTC-75-06, *Tunas and billfishes in the eastern Pacific Ocean in 2006*.

The *ad hoc* meeting of the Commission in February 2007 asked the staff to provide information on possible area closures that would reduce catches of juvenile yellowfin and bigeye tuna, and to estimate the total allowable catches (TACs) for each species. These recommendations, therefore, include those measures, in addition to the seasonal closure that has been in effect during 2004-2007. Two points suggested by individual delegations at the February meeting, a closure of a large area to all fishing and measures affecting fish-aggregating devices (FADs), are also addressed.

1. FLEET CAPACITY

The major issue that must be addressed to facilitate conservation of the stocks and the economic viability of the fisheries for yellowfin and bigeye tunas is that of the size of the purse-seine fleet. On May 13, 2007, the carrying capacity of the purse-seine fleet fishing or expected to fish in the EPO was 228,157 m^3. While Resolution C-02-03 on capacity has limited entry, there is still room for some additional vessels to enter the fishery within the terms of the Resolution.

The staff recommends that the Commission examine means to reduce the fleet size toward the Commission's target of 158,000 m^3 as soon as possible.

2. YELLOWFIN TUNA

The stock assessment for yellowfin is similar to that of 2006. The base case assessment indicates that the spawning stock size has declined from a high point in 2001 to about 95% of the level corresponding to the average maximum sustainable yield (AMSY). The fishing mortality corresponding to the AMSY is 0.96 (*F multiplier*) times the average fishing mortality rate for the last three years. The historical status of the stock is shown in the plot in Figure 1. The trajectory starts in 1977, near the edge of the green section of the graph, and the large red dot at the end represents the average of 2004-2006.

Since 2002 recruitment has been less than the average for 1985-2002. It is possible that this lesser recruitment will persist in the future, which would produce reduced catches relative to those possible during 1987-2003.

At the beginning of 2007 the carrying capacity of the purse-seine fleet was 7% greater than the average for 2004-2006. To simply maintain the effect of Resolution C-04-09, the period during which purse-seining was permitted (46 weeks) should be reduced.[1]

The base case assessment did not include a stock-recruitment relationship; if that were incorporated (the alternative assessment) the *F multiplier* would be 0.65. The staff has attributed the increase in

[1] closure = 365 – *F multiplier* × (365 – 42)/(1 + capacity increase)

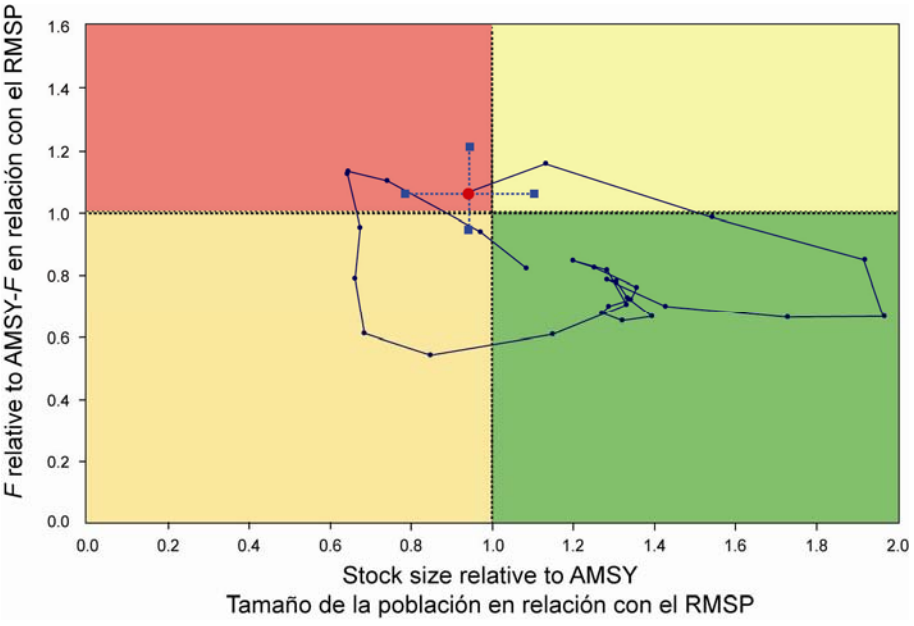

FIGURE 1.

recruitment and stock size after 1985 to a regime change that led to greater spawning biomasses, rather than to dependence of recruitment on spawning stock size. Nevertheless, it is possible that this interpretation is wrong, and that the increase in recruitment after 1985 was related to a stock-recruitment relationship, in which moderate stock reductions cause recruitment to decline. If that were the case, the stock would currently be overfished.

Regardless of the recruitment, the total catch and stock size could be increased if the average size of the yellowfin in the catch were increased. The longline fishery catches the largest fish, but takes less than 5% of the total catch. The purse-seine fishery takes yellowfin of a wide range of sizes, depending on set type. Increasing the proportion of the catch made by longlines or by purse-seine sets on tunas associated with dolphins, particularly offshore, would increase the sustainable yields and the biomass. Area closures might be used to increase the yield per recruit of yellowfin, but their effect cannot be precisely forecast. Juvenile yellowfin tuna are taken mostly in inshore areas, and restricting fishing by vessels carrying observers in an area such as that shown in Figure 2 would increase the yield per recruit of yellowfin tuna, but would not on its own resolve the issue of too much fishing. The proposal is for large vessels only as it might be difficult for small vessels to fish in offshore areas. The Appendix gives the catches of large vessels inside the proposed area and an indication of its possible effect.

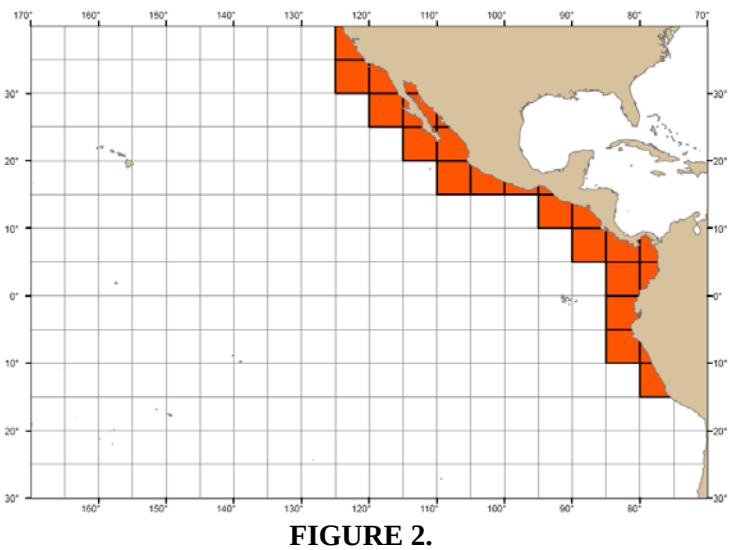

FIGURE 2.

The staff recommends that the

Commission:

1. (a) Extend the closure periods for the purse-seine fishery in Resolution C-06-02 by an additional 32 days, to 74 days, and that the closure period be extended further if the carrying capacity of the purse-seine fleet continues to increase; or

   (b) Set a TAC of 200,000 metric tons [2] (t) for yellowfin taken by purse seine in the EPO, but that the Director be authorized to increase the limit by up to four increments of 30,000 t each if he concludes, from examination of available data, that such increments would pose no significant risk to the stock. If the limit, including any increments authorized by the Director, is reached, purse-seining for tunas will cease.

2. Examine the effectiveness of closing coastal areas, such as that shown in Figure 2 to purse-seine vessels fishing for tropical tunas that are required by the AIDCP to carry observers, with the objective of improving the yield per recruit of yellowfin tuna. The examination might include closing an area for one quarter of the year and evaluating the result.

In case of Option 1(b), the Director should give CPCs one month's notice of the date on which he estimates that the catch limit will be reached.

3. BIGEYE TUNA

The stock assessment results are generally similar to those of previous assessments, except that the recruitments in 2001 and 2002 are now estimated to be less than they were estimated to be in 2006.

The stock remains below the AMSY level, but a recent large recruitment has mitigated the overfishing. The stock is expected to approach the level corresponding to the AMSY in 2010, and subsequently to decline. The fishing mortality corresponding to the AMSY is 0.83 times the average fishing mortality rate during 2004-2006. The historical status of the stock is shown in the plot in Figure 3. The trajectory starts in 1977, at the lower right of the graph, and the large red dot at the end represents the average of 2004-2006.

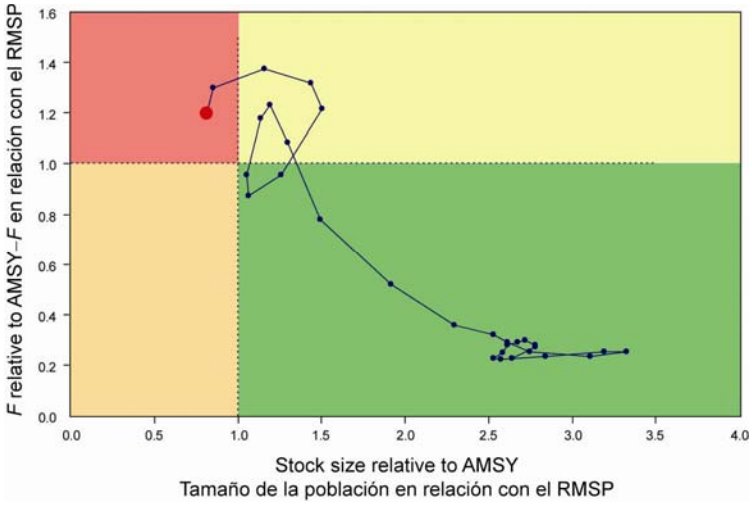

FIGURE 3.

The base case assessment did not include a stock-recruitment relationship; if that were incorporated (the alternative assessment) the *F multiplier* would be 0.59.

The staff recommendation is based on the base case assessment. In contrast to yellowfin, there is no information in the history of the fishery that supports a stock-recruitment relationship in which moderate stock reductions cause recruitment to decline. However, the steepness of the stock-recruitment relationship is difficult to estimate, and there remains a possibility that inferences made using the base case assessment underestimate the extent to which the stock is overfished.

[2] The initial TAC and range for yellowfin tuna are calculated as the AMSY during the period of low recruitment (1975-1982), with the increments such that four increments would produce a TAC equal to the AMSY during the period of high recruitment (1983–2001).

The staff has made an evaluation of the effect of closing the area shown in Figure 4 to fishing by large purse-seiners. The absolute effect is uncertain because the response of fishermen, the variability of the stocks, and the variability of the environment cannot be predicted, but it would be likely to lead to a reduction of bigeye and skipjack catches and to increased catches of yellowfin. If that were coupled with restrictions in fishing inshore (Figure 1), at least some of the increase in yellowfin catches would probably be made up of large fish taken in association with dolphins. An indicative evaluation of the effect of closing the area for a year is given in the Appendix.

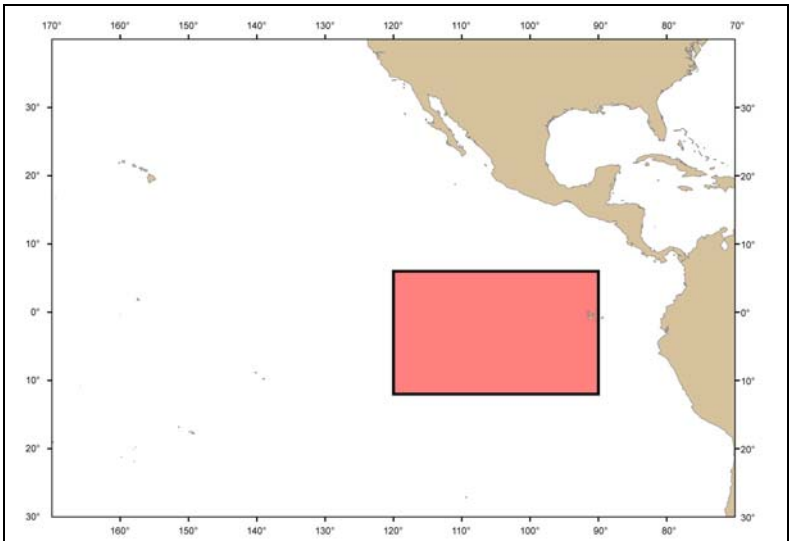

FIGURE 4.

Longline catches have declined to less than the levels allowed by Resolution C-06-02, making the impact of this fishery less than envisaged in the Resolution. On the other hand, the growth in the carrying capacity of the purse-seine fleet has militated against the effect of the Resolution in limiting purse-seine catches.

Recent catches of bigeye tuna		
	Purse-seine	Longline
2003	54,509	59,666
2004	67,337	43,354
2005	68,699	43,433
2006	71,195	30,271

Further measures are necessary to allow the stock to be maintained at or above the AMSY level.

The AMSY has been significantly reduced by purse-seine catches of small bigeye, and measures that encourage purse-seine vessels to avoid catching bigeye while fishing for skipjack would be beneficial. The aggregation of fish by FADs is a major part of the fishing effort for that fishery, but there is little information available about deployment and disposition of FADs. Such information is critical as a basis for any decisions about management of the use of FADs.

The combined fishing effort (longline and purse-seine) should be reduced to 83% of the level of 2004-2006. Reductions of differing amounts for each of the two fleets could also achieve the goal of producing the AMSY, as shown in Figure 5.

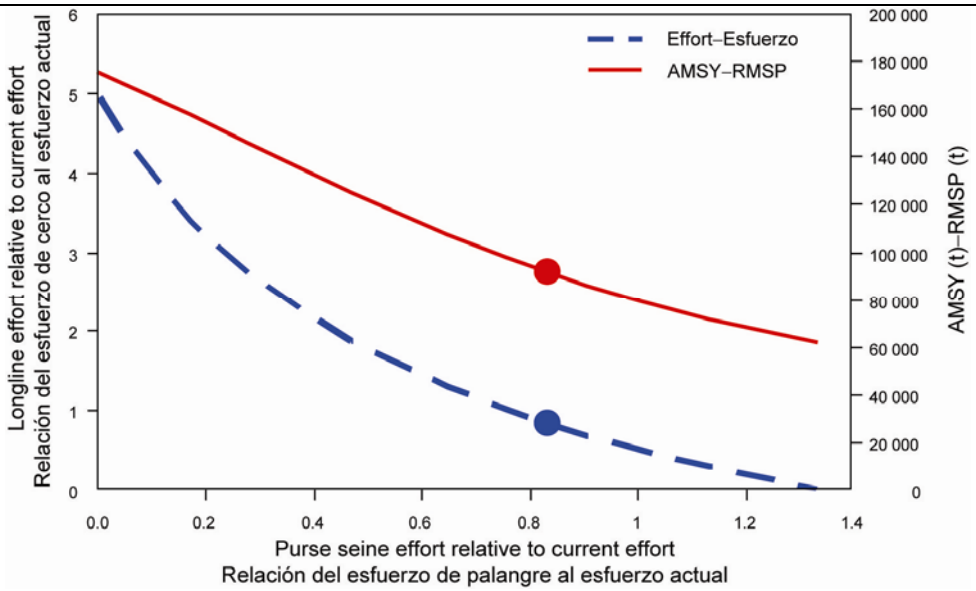

FIGURE 5. The dashed line shows combinations of longline and purse-seine fishing effort (compared to 2004-2006 levels) that will produce the AMSY. The solid line shows the relationship between the AMSY for the whole fishery and purse-seine effort when longline effort is adjusted appropriately to produce the AMSY.

The staff recommends that the Commission:

1. Determine the appropriate adjustments to the balance of the longline and purse-seine fisheries, and note the following three examples of different reductions in each of the two fisheries that would achieve an AMSY level with a different mix of the two gears.

Purse-seine : longline reduction – *F multipliers*	73% : 1.06%	83% : 83%	93% : 0.66%
Longline catch at AMSY	50,229	38,210	28,828
Purse-seine catch at AMSY	49,476	53,308	56,109
AMSY	99,704	91,518	84,937

2. If it wishes to make equal reductions (83%:83%) compared to the provisions of Resolution C-06-02

   2.1. Reduce the catch limits for longline fishing to 83% of their previous values, to:

China	2,190
Japan	28,283
Korea	10,438
Chinese Taipei	6,601

   and, for other CPCs, to the greater of 83% of the 2001 catches or 500 t, and

   2.2. Choose one of the three following options for purse-seine limits:

      2.2.1. In addition to the yellowfin closure in 1 (a) above, close the purse-seine fishery on floating objects in the EPO for an additional 35 days[3]; or

      2.2.2. Set a TAC for bigeye tuna taken by purse-seine, and prohibit sets on floating objects after the catch limit has been reached. The initial TAC would be 48,000 t[4], but the Director

[3] Closure = 365 – *F multiplier* × (365 – 42)/(1 + capacity increase)

[4] The initial value of the TAC is 90% of the AMSY for the purse-seine catches. Four increments would provide a TAC of 70,000 t, to accommodate uncertainty in the most recent estimates of recruitment.

would be authorized to increase the limit by up to four increments of 5,500 t each, if he concludes, from examination of available data, that such increases would pose no significant risk to the stock; or

2.2.3. Limit the total annual catch of bigeye tuna by each purse-seine vessel in such a way that the sum of the individual-vessel limits equals 68,000 t[5], and prohibit further sets on floating objects by any vessel that reaches its limit. A vessel's catch of bigeye would be estimated either by the observer or, at the request of the captain, by sampling of the vessel's catch conducted by IATTC staff members at the time of unloading. If the latter option is chosen, the vessel would be responsible for reasonable costs of the sampling.

3. Require that vessels that use FADs mark the FADs in accordance with international standards for marking fishing gear, and maintain a record of the numbers of FADs on board at the beginning and end of each fishing trip and of the numbers and positions of FADs deployed at sea, and make this information available to the Commission.

The estimates of the bigeye catches referred to in section 2.2, except for the observer estimate in 2.2.3, should be calculated on the basis of species composition sampling of unloadings, and the Director should give the CPCs one month's notice of the date on which he estimates that the catch limit will be reached.

4. SOUTHEASTERN PACIFIC SWORDFISH

The stock assessment for southeastern Pacific swordfish (east of 150°W and south of 5°S) indicates that the stock is currently above the level corresponding to the AMSY, but that the current catches are slightly above the AMSY level. The staff assessment for 2004 suggested that the stock was overfished. As a precautionary measure, **the staff recommends that** the annual catches be limited to 13,000 t, by allocating limits to the CPCs involved in the fishery.

5. NORTHERN ALBACORE TUNA

The staff's assessment for northern albacore has not been updated. For clarity, **the staff recommends that** the meaning of the words "current levels" in paragraph 1 of Resolution C-05-02 should be specified.

[5] It is likely that individual vessel limits will produce a total catch less than the sum of the individual limits, and this would reduce catches by more than the initial TAC plus two increments.

APPENDIX: CATCHES INSIDE AND OUTSIDE TWO POTENTIAL CLOSED AREAS

Catches, expressed in metric tons (t), are based on estimates by observers aboard purse-seine vessels >363 t, and include both retained and discarded catch. The catch data from a trip were not used if the observer reports did not contain estimated stratification of catch by size category (<2.5kg, 2.5-15 kg, and >15 kg); this excluded about 15% of the trips, mostly from the northern part of the fishing area (Figure A-1). Section 1 contains estimates of the average purse-seine catches of tunas during 1994-2006 inside and outside the coastal closure area proposed by the staff (Figure 2); Section 2 contains estimates of average purse-seine catches of tunas during 1994-2006 inside and outside the offshore closure area at 90°W-120°W - 6°N-12°S proposed at the *ad hoc* meeting in February 2007 (Figure 4). Each section provides an estimate of changes in catches if the area were closed and an equivalent amount of fishing was carried out outside the area.

1. COASTAL CLOSURE AREA

Figure A-1 shows the distribution of catches of yellowfin (YFT) and bigeye (BET) tuna <15 kg in sets on unassociated schools (NOA) and on floating objects (OBJ) in the EPO.

The average annual purse-seine catches, including discards, of yellowfin, bigeye, and skipjack tunas in the EPO, by size category, inside and outside the proposed coastal closure area during 1994-2006 are shown in Table A-1.

For the purposes of this analysis, the area in which the catches illustrated in Figure A-1 were made was divided into northern and southern coastal areas (covering the coastal closure area in Figure 2) and northern and southern offshore areas (Figure A-2).

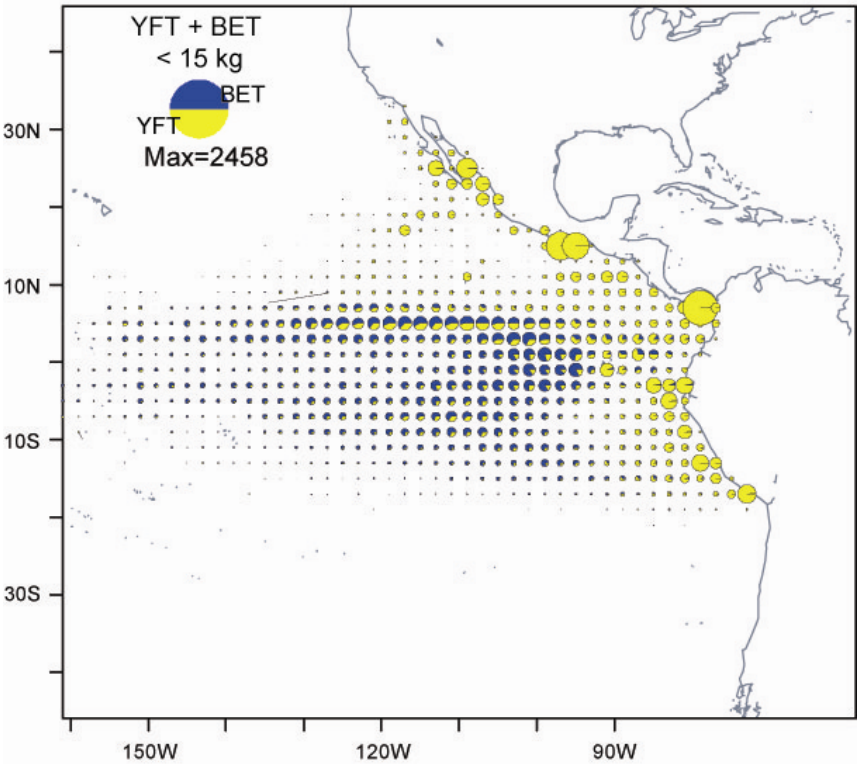

FIGURE A-1.

An approximation of the effect of a closure was made by allocating sets made within the coastal closure area to sets in the offshore areas. The allocations were restricted so that sets associated with dolphins (DEL) or floating objects did not change to the other mode, and that sets on unassociated schools in the northern and southern coastal areas were restricted to the fishing modes shown in the table below.

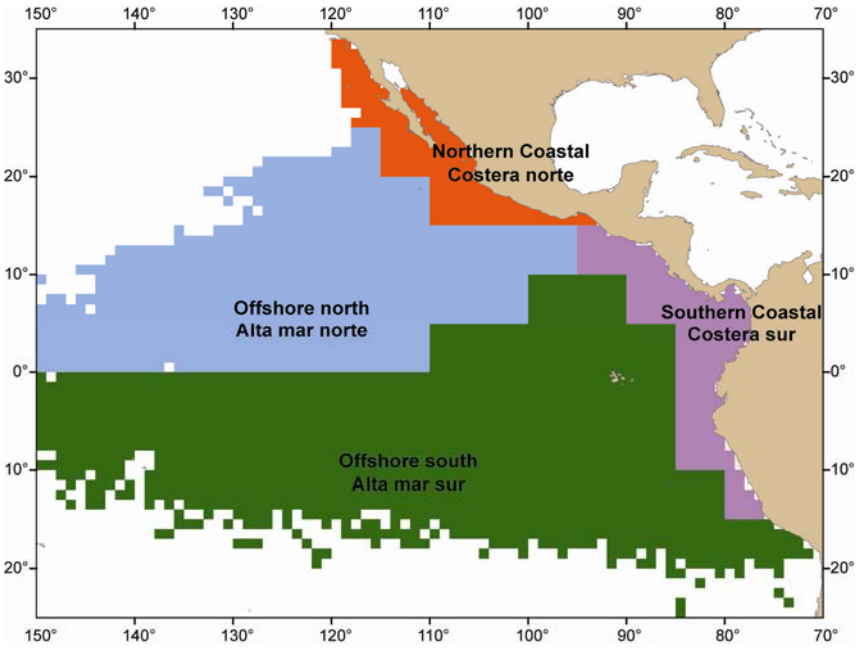

FIGURE A-2.

Set type within coastal closure area	Set type(s) in offshore areas	North or South coastal areas
DEL	DEL or NOA	Both
OBJ	OBJ or NOA	Both
NOA	NOA or DEL	North
NOA	NOA or OBJ	South

The technical details of the approximation are as follows. The sets transferred to the offshore area are apportioned among set types in the average proportion of those set types during 1994-2006; thus, if 40% of sets in the offshore area during that period were made on dolphins, 40% on floating objects, and 20% on unassociated tunas, 100 sets made on dolphins transferred from the coastal area would be apportioned as 67 dolphin sets, 33 unassociated sets, and 0 floating-object sets. In addition, it is assumed that the catch per set by the apportioned sets will equal the average catch per set by the set type to which the set is transferred.

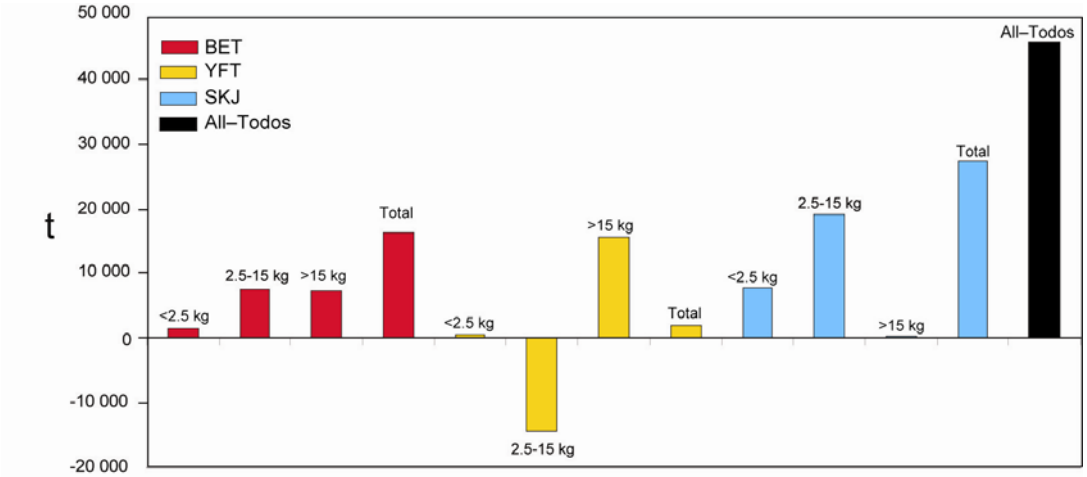

FIGURE A-3. Average change in annual catch, by species, with closure of coastal area

As shown in Figure A-3, a year-long closure of the coastal fishery could result in lower catches of yellowfin <15 kg and higher catches of >15 kg yellowfin, accompanied by some increases in the catches of bigeye and skipjack for that year. The increase in the catch of yellowfin is underestimated because no yield-per-recruit analyses have been made. The increase in catches of bigeye < 15 kg should be examined further.

The majority of yellowfin catches inside the coastal area are taken in the southern coastal area (Table A-2), and most of those catches are taken in the first and second quarters of the year (Table A-3).

2. OFFSHORE CLOSURE AREA

This section presents estimates of the catches of tunas during 1994-2006 inside and outside the proposed offshore closure area (Figure 4).

Table A-4 shows the average annual purse-seine catches of yellowfin, bigeye, and skipjack tunas, by size category, inside and outside the offshore closure area illustrated in Figure 4 during 1994-2006. Overall, 62% of all bigeye caught in the EPO is taken inside this area, but only about half the bigeye <2.5 kg. However, only 18% of the catches of yellowfin and 44% of the catches of skipjack are made in this area.

An approximation of the effect of a closure of the offshore area was made by allocating sets inside the area to sets outside of the area in proportion to the average proportion of those sets in the 1994-2006 time period. In addition, the assumption is made that the catch per set by the displaced sets will equal the average catch per set by the set type to which the set is transferred.

As shown in Figure A-4, the catches of bigeye and skipjack would be likely to be reduced by closing the area, but catches of yellowfin would be increased.

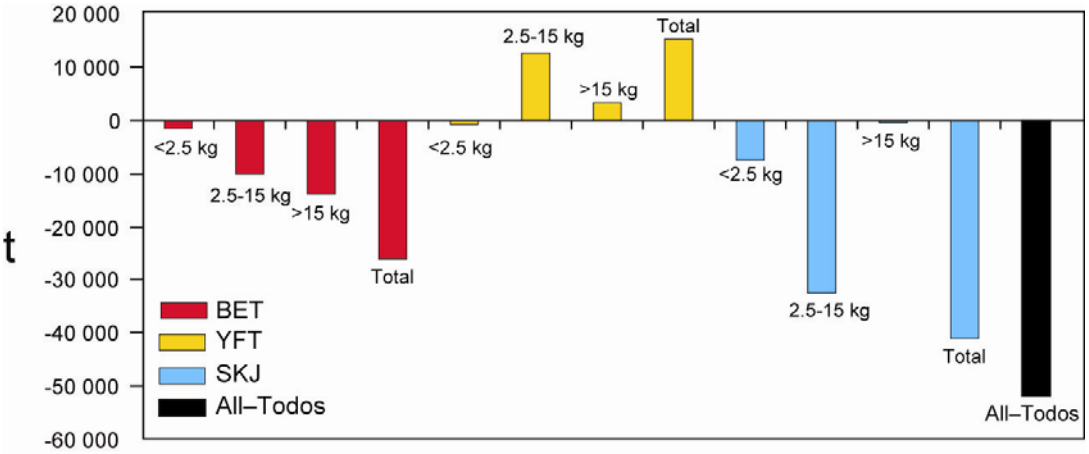

FIGURE A-4. Average change in annual catch, by species, with closure of offshore area

TABLE A-1. Average annual purse-seine catches, including discards, of tunas, by size category, inside and outside the coastal closure area (Figure 2), 1994-2006.

		Inside	Outside	% inside
Bigeye	<2.5 kg	105	4,375	2
	2.5-15 kg	305	23,782	1
	>15 kg	537	23,046	2
	Total	946	51,203	2
Yellowfin	<2.5 kg	1,354	5,158	21
	2.5-15 kg	32,795	39,947	45
	>15 kg	24,896	80,515	24
	Total	59,045	125,620	32
Skipjack	<2.5 kg	6,300	41,088	13
	2.5-15 kg	15,371	93,777	14
	>15 kg	68	1,209	5
	Total	21,739	136,075	14
Grand total		**81,730**	**312,897**	**21**

TABLE A-2. Average annual purse-seine catches, including discards, of tunas, by size category, in the four areas illustrated in Figure A-2, 1994-2006.

	Northern Coastal				Southern Coastal			
	Bigeye	**Skipjack**	**Yellowfin**	**Total**	**Bigeye**	**Skipjack**	**Yellowfin**	**Total**
<2.5 kg	0	496	207	703	105	5,804	1,147	7,056
2.5-15 kg	0	2,257	11,315	13,571	305	13,114	21,481	34,899
> 15 kg	0	0	5,297	5,297	537	68	19,598	20,203
All	0	2,753	16,819	19,572	946	18,986	42,226	62,158
	Northern Offshore				**Southern Offshore**			
	Bigeye	**Skipjack**	**Yellowfin**	**Total**	**Bigeye**	**Skipjack**	**Yellowfin**	**Total**
<2.5 kg	1,311	10,193	1,666	13,170	2,912	29,098	3,388	35,398
2.5-15 kg	6,073	22,139	21,781	49,993	16,900	69,805	17,870	104,574
> 15 kg	3,428	290	33,381	37,099	19,293	918	46,643	66,853
All	10,812	32,621	56,829	100,261	39,105	99,820	67,900	206,825

TABLE A-3. Catches of tunas, by species and quarter, inside and outside the coastal closure area (Figure 2).

	Quarter	Inside	Outside	% inside
Bigeye	1	189	10,622	2
	2	384	12,846	3
	3	250	13,114	2
	4	124	14,620	1
	Total	946	51,203	2
Yellowfin	1	19,048	37,327	34
	2	17,863	32,705	35
	3	12,539	30,161	29
	4	9,595	25,426	27
	Total	59,045	125,620	32
Skipjack	1	8,071	35,830	18
	2	7,088	31,711	18
	3	4,018	32,562	11
	4	2,562	35,973	7
	Total	21,739	136,075	14
Grand total		**81,730**	**312,897**	**21**

TABLE A-4. Average annual purse-seine catches of tunas, by species and size category, inside and outside the offshore closure area (Figure 4), 1994-2006.

		Inside	Outside	% inside
Bigeye	>2.5 kg	2,274	2,203	51
	2.5 kg–12.5 kg	13,603	10,481	56
	>15 kg	16,251	7,328	69
	Total	32,435	20,176	62
Yellowfin	>2.5 kg	2,317	4,189	36
	2.5 kg–15 kg	7,806	64,929	11
	>15 kg	22,890	82,513	22
	Total	33,212	153,045	18
Skipjack	>2.5 kg	17,014	30,368	36
	2.5 kg–15 kg	50,953	58,188	47
	>15 kg	770	504	60
	Total	69,258	89,860	44
Grand total		**134,907**	**263,089**	**34**