INTER-AMERICAN TROPICAL TUNA COMMISSION
COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

78TH MEETING

PANAMA
24-27 JUNE 2008

DOCUMENT IATTC-78-06b

CONSERVATION RECOMMENDATIONS (REVISED 2)

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 a conservation program for these two species during 2008-2010, and for an annual limit on the catch of swordfish in the southeastern Pacific Ocean. It also makes recommendations for clarifying Resolution C-05-02 on northern albacore tuna, for addressing the growing capacity of the purse-seine fleet, and for establishing a system for marking and identifying fish-aggregating devices (FADs).

Summaries of the situation of the fishery and of the stock assessments for all species are provided in Document IATTC-78-05, *Tunas and billfishes in the eastern Pacific Ocean in 2007*.

1. FLEET CAPACITY

The principal issue that needs to be addressed with respect to the conservation of the stocks of yellowfin and bigeye tunas and the economic viability of the fisheries is the capacity of the purse-seine fleet. On 18 May 2008, the carrying capacity of the purse-seine fleet fishing or expected to fish in the EPO was 228,246 m^3, essentially unchanged since May 2007. While Resolution C-02-03 on capacity has limited entry to the fishery, there is still room for some additional vessels to enter the fishery within the limits 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 more optimistic than that of 2007: the base case assessment indicates that the size of the spawning stock is about 4% above the level corresponding to the maximum sustainable yield (MSY), and that the recent fishing mortality (2005-2007 average) has fallen to about 12% below that level.

Figure 1 illustrates the status of the stock since 1977 in relation to management objectives. The green area represents the target zone for management; when the estimates are in the red area, the stock is considered overfished and overfishing is occuring. Each dot represents a three-year average of the exploitation rate, and the large red dot at the end corresponds to the average fishing mortality for 2005-2007 and the 2007 spawning stock size. Although the current estimates for yellowfin lie in the green area, the low catch rates of fish associated with dolphins and other factors give cause to doubt an optimistic assessment. The larger catches of smaller fish that result from the decline in the number of dolphin sets and the increase in the number of floating-object and unassociated sets (Figure 2) can make the stock appear to be in better condition than it really is.

The base case assessment assumes that the increase in recruitment and stock size after 1985 was due to a regime change that led to greater spawning biomasses, rather than to a stock-recruitment relationship. If such a relationship is assumed, recruitment is dependent on the size of the spawning stock, and moderate reductions in stock size can cause recruitment to decline. In the staff's alternative assessment, which does include this relationship, the fishing mortality corresponding to the MSY is 77% of the average fishing mortality rate during 2005-2007; this result is more pessimistic, and indicates that the stock is currently

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 both the MSY and the biomass.

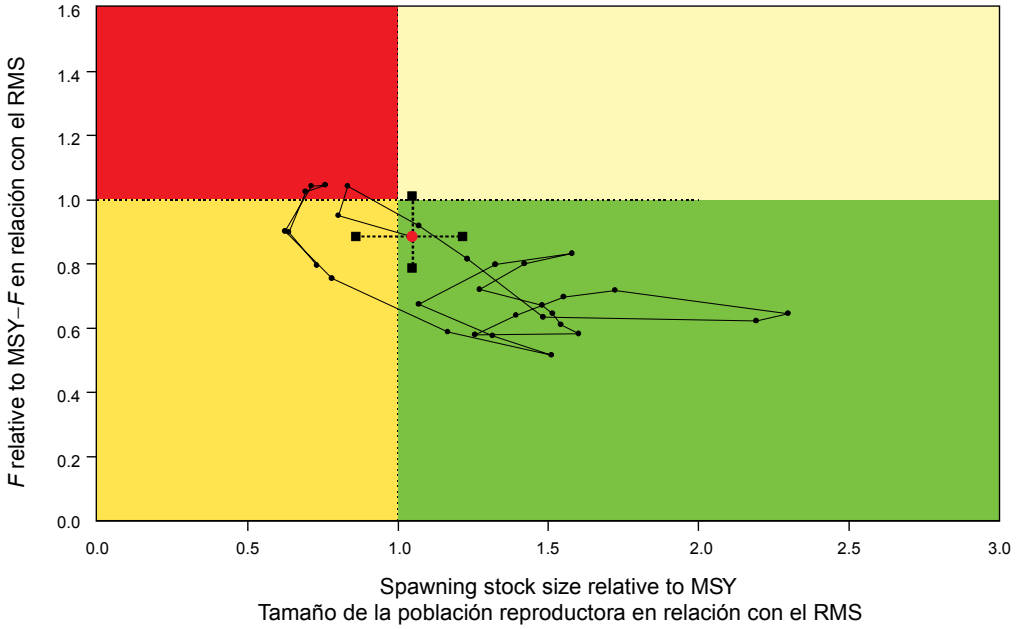


FIGURE 1. Phase plot of the time series of estimates for spawning stock size and fishing mortality of yellowfin tuna relative to their MSY reference points, 1977-2007 (see text). Each dot is based on the average exploitation rate over three years; the large dot indicates the most recent estimate. The squares represent approximate 95% confidence intervals.

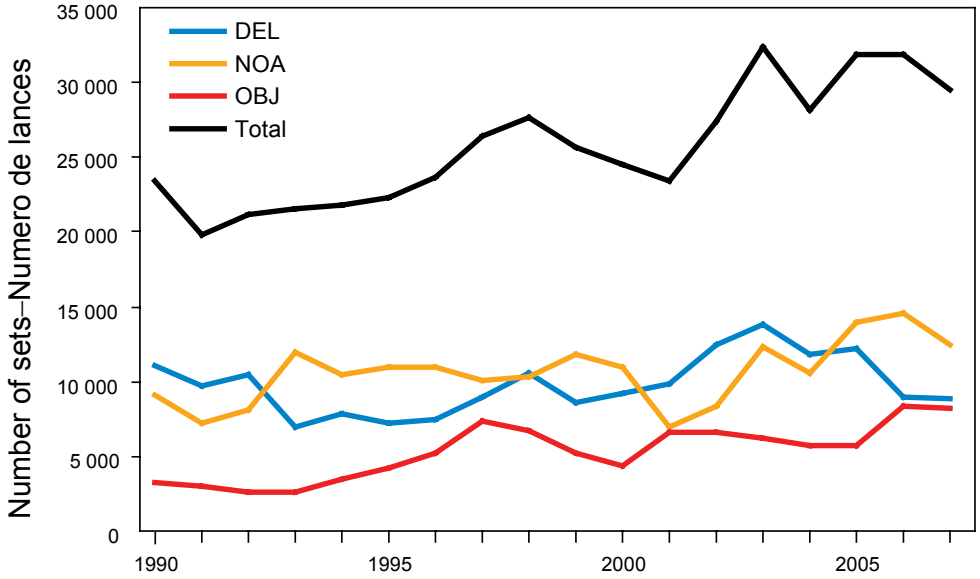


FIGURE 2. Purse-seine effort, in number of sets, by set type, 1990-2007. OBJ: floating object; NOA: unassociated; DEL: dolphin.

3. BIGEYE TUNA

The results of the stock assessment are generally similar to those of previous assessments. The base case assessment indicates that the spawning biomass is about 10% below the MSY level, but recent above-average recruitments have caused the total biomass, including juveniles, to reach a level about 15% above the MSY level. The base case assessment indicates that the fishing mortality corresponding to the MSY is 82% of the average fishing mortality rate during 2005-2007. 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 dot at the end corresponds to the average fishing mortality for 2005-2007 and the 2007 spawning stock size.

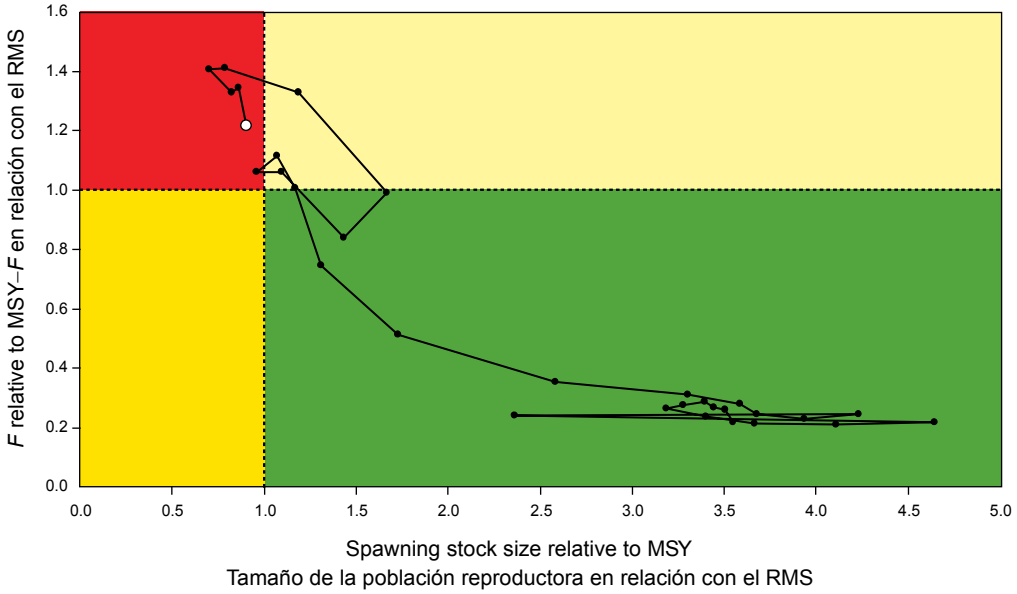


FIGURE 3. Phase plot of the time series of estimates of spawning stock size and fishing mortality of bigeye tuna relative to their MSY reference points, 1977-2007 (see text). Each dot is based on the average exploitation rate over three years. The large dot indicates the most recent estimate.

The base case assessment did not include a stock-recruitment relationship; if that were incorporated (the alternative assessment) then the fishing mortality corresponding to the MSY is 59% of the average fishing mortality rate during 2005-2007. Longline catches have declined to below the levels allowed in Resolution C-06-02, so the impact of this fishery is less than is 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 (t)		
	Purse-seine	Longline
2004	67,592	43,478
2005	69,826	41,720
2006	83,978	35,363
2007	61,434	25,560

Further measures are necessary to allow the stock of bigeye to be maintained at or above the MSY level. The base case assessment indicates that the combined fishing effort (longline and purse-seine) should be reduced to 82% of the level of 2005-2007. This reduction is nearly identical to that calculated for the conservation proposal presented at the Commission meeting in March 2008 in Document IATTC-77-04 (Appendix A).

Regardless of the recruitment, the total catch and stock size could be increased if the average size of the bigeye in the catch were increased. The longline fishery catches the largest fish, but currently takes a

reduced share of the total catch as compared to historical catches.

The MSY 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, the primary target of the FAD fishery, 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.

At the request of some member countries, the staff analyzed the effect of excluding purse-seine vessels of less than 363 metric tons (t) carrying capacity from the proposed closures (Appendix B). The results indicate that, during each of the past nine years, the catches by vessels of size classes 1-4 (<272 t) or 5 (273-363 t) during the proposed 12-week closure period made up less than 2% of the total catches.

Another request was made to examine an option of individual vessel quotas (IVQ) for vessels fishing on floating objects. The purpose of this approach would be to establish limits on the amount of bigeye that could be taken in a defined offshore area by an individual vessel; any vessel that reached its limit would have to stop setting on floating objects in that area. Obviously, if a vessel were able to avoid setting on bigeye, which appears to be likely, then it would not reach its IVQ.

The results in Appendix C indicate that an adequate conservation measure for bigeye would be to establish IVQs of 0.5 t per cubic meter (m^3) of vessel capacity on the total catch (retained catch plus discards) of bigeye and yellowfin combined, for vessels that captured at least 50 t of bigeye during 2004-2006. The 0.5 t/m^3 rate corresponds to an analysis based on restriction of maximum potential total catch; it could be set higher, at 1.0 t/m^3, if it were based on 2004-2006 average vessel performance. Yellowfin was included in the IVQ rates for several reasons, including: (1) distinguishing small yellowfin from bigeye can be difficult at sea; (2) conservation of yellowfin of the small sizes generally caught in floating-object sets is an appropriate management goal.

4. STAFF RECOMMENDATIONS TO THE COMMISSION

A. Conservation of yellowfin and bigeye tuna: The staff recommends implementation during 2008-2010 of a conservation proposal similar to that proposed in Document IATTC-77-04:

1. **For the purse-seine fishery**, a 12-week closure in the entire EPO from 20 June through 11 September, and a closure of the offshore area (Figure A) from 12 September through 31 December. For 2008, due to the timing of the IATTC meeting, the recommended 12-week closure would be delayed by 25 days, and the offshore closure, which would begin at the end of the 12-week closure and terminate at the end of 2008, would be shortened.

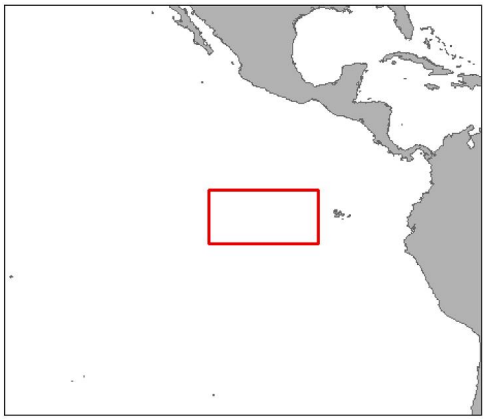


FIGURE A. Offshore closure area between 94° and 110°W and from 3°N to 5°S.

2. **For the longline fishery**:

   a. China, Japan, Korea, and Chinese Taipei shall take the measures necessary to ensure that their total annual longline catches of bigeye tuna in the EPO during 2008, 2009, and 2010 do not exceed the following levels:

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

   b. Other CPCs shall take the measures necessary to ensure that their total annual longline catches of bigeye tuna in the EPO during 2008, 2009, and 2010 do not exceed the greater of 83% of 2001 catches or 500 t.

B. Marking and identification of FADs: The staff recommends that vessels that use FADs be required to mark the FADs in accordance with a program developed by the Commission, to include, *inter alia*, maintaining a record of the numbers of FADs on board each vessel at the beginning and end of each fishing trip, and recording the date, time, and position of deployment of each FAD. The information collected shall be held by the Commission staff, and shall be made available to CPCs, subject to any confidentiality rules or policies that the Commission may establish.

C. Conservation of swordfish: The stock assessment for swordfish in the southern EPO (south of 5ºS) indicates that the stock is currently above the level corresponding to the MSY, but that the recent annual catches of about 11,000-12,000 t are at about the MSY level. **The staff recommends that**, as a precautionary measure, annual catches be limited to 13,000 t.

D. Conservation of Northern Pacific albacore: The most recent assessment of northern albacore, by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean in 2006, uses fishing mortality averaged for 2002-2004 as the "current" fishing mortality. **The staff recommends that** this definition be applied to paragraph 1 of Resolution C-05-02. Also, paragraph 3 calls upon all CPCs to report all catches of North Pacific albacore tuna every six months; however, since the limit in the resolution is in terms of effort, **the staff recommends that** the six-monthly reports include information on effort as well as catch, in terms of the most relevant measures for a given gear type. The technical aspects of the effort data to be supplied could be established by the Director, in collaboration with scientists of the interested member countries.

Also, **the staff recommends that** the resolution be clarified to indicate that data provided should be for the EPO only, since that is the area covered by the IATTC. Currently, at least one country reports catches for the entire Pacific only. Finally, **the staff recommends that** the resolution contain a paragraph encouraging all CPCs to report annually to the IATTC all catches of albacore north of the equator and all fishing effort north of the equator in fisheries directed at albacore.

Appendix A.

INTER-AMERICAN TROPICAL TUNA COMMISSION
COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

77TH MEETING

LA JOLLA, CALIFORNIA (USA)
5-7 MARCH 2008

DOCUMENT IATTC-77-04 REV

PROPOSAL FOR CONSERVATION OF YELLOWFIN AND BIGEYE TUNA IN THE EASTERN PACIFIC OCEAN

This paper evaluates the effect of a proposal for the conservation of bigeye and yellowfin tuna in the eastern Pacific Ocean (EPO).

For the purse-seine fishery in the EPO during 2008, 2009, and 2010, the proposal consists of two components: a 12-week closure in the entire EPO from 20 June through 11 September, and a closure of the offshore area (Figure 1; proposal D2A in Document IATTC-76-04) during 12 September through 31 December.

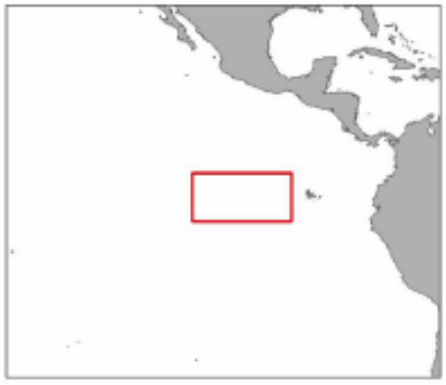


FIGURE 1. Proposed closure area between 94° and 110°W and from 3°N to 5°S.

For the longline fishery:

1. China, Japan, Korea, and Chinese Taipei shall take the measures necessary to ensure that their total annual longline catches of bigeye tuna in the EPO during 2008, 2009, and 2010 do not exceed the following levels:

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

2. Other CPCs shall take the measures necessary to ensure that their total annual longline catches of bigeye tuna in the EPO during 2008, 2009, and 2010 do not exceed the greater of 83% of 2001 catches or 500 t.

Method

The method employed to evaluate the proposed conservation measure is focused upon the change expected from the purse-seine fishery. The longline measures are the same as those proposed at the 2007 annual meeting (Document IATTC 75-07b). The evaluation was made by estimating the reduction in catch due to the closures and comparing this with the desired reduction in fishing mortality (*F*). The advantage of this approach is that we have fine-scale temporal and spatial information on catch and effort

that can be used to provide estimates that are more exact than those based on forward projections, such as were presented in Document IATTC-76-04.

Reference points for conservation

The target reference point for conservation purposes is the *F* multiplier obtained in the previous stock assessment for yellowfin and bigeye (IATTC, 2007), which corresponds to the effort reduction necessary to attain F_{MSY}, the fishing mortality that will produce the maximum sustainable yield (MSY). The *F* multiplier is then adjusted to account for the increase in fishing capacity in 2007. The percentage reduction in fishing mortality needed to achieve the conservation targets were 9% and 21% for yellowfin and bigeye tunas, respectively. When evaluating years prior to the implementation of the six-week closures (1995-2003), an adjustment is needed to produce comparable expected catch reductions in those years. The expected catch reductions were increased to reflect the absence of closures, so that in years prior to 2003 the conservation targets were 20% and 30% for yellowfin and bigeye tunas, respectively.

Results

Table 1 presents the estimated annual proportional reduction in catch of yellowfin, skipjack and bigeye tuna if the proposal is implemented. These values are also plotted in Figure 2. The threshold values to attain for conservation purposes are 20% and 30% for yellowfin and bigeye tunas, respectively. These values should be applied only to the 1995-2003 period.

For yellowfin, the proposal would achieve the conservation goals (reduction in catch ≥20%) in all years of the the 1995-2003 period. With respect to bigeye, it would achieve the conservation goals (reduction in catch ≥30%) on average; however, there is inter-annual variability, and in four out of nine years the reduction in catch would be insufficient. The effect of the proposal on skipjack catch would be an average reduction in catch of 23%.

The effect of temporal closures is related to the temporal distribution of catch and effort. Effort is constant throughout most of the year, except for a major reduction around the start and end of the year (Figure 3). There is more variation in catch per day fished (CPDF; Figure 4). Yellowfin catch rates decline gradually thoughout the year, while the CPDF of skipjack peaks around the end of the first quarter. The CPDF of both skipjack and bigeye increase at the start and end of the year. This indicates that the reduction in effort seen at the start and the end of the year (Figure 3) is predominantly a reduction in effort targeting yellowfin. The impact of 12- and 6-week temporal closures at different times of the year is shown in Figure 5. In general, temporal closures in the first half of the year are more effective for yellowfin and skipjack, and closures in the middle of the year are more effective for bigeye.

The spatial distribution of the catches of bigeye, yellowfin and skipjack in the EPO during the offshore closure period (12 September–31 December) are shown in Appendix 2.

TABLE 1. Proportional reduction in catch of yellowfin (YFT), bigeye (BET) and skipjack (SKJ) resulting from implementation of the conservation proposal.

	YFT	SKJ	BET
1995	0.20	0.32	0.31
1996	0.20	0.21	0.25
1997	0.20	0.26	0.31
1998	0.25	0.23	0.23
1999	0.22	0.25	0.28
2000	0.21	0.17	0.30
2001	0.21	0.23	0.27
2002	0.22	0.22	0.36
2003	0.22	0.26	0.33
2004	0.17	0.20	0.38
2005	0.13	0.21	0.28
2006	0.17	0.23	0.27
2007	0.17	0.20	0.17
1995-2003 average	0.20	0.23	0.29

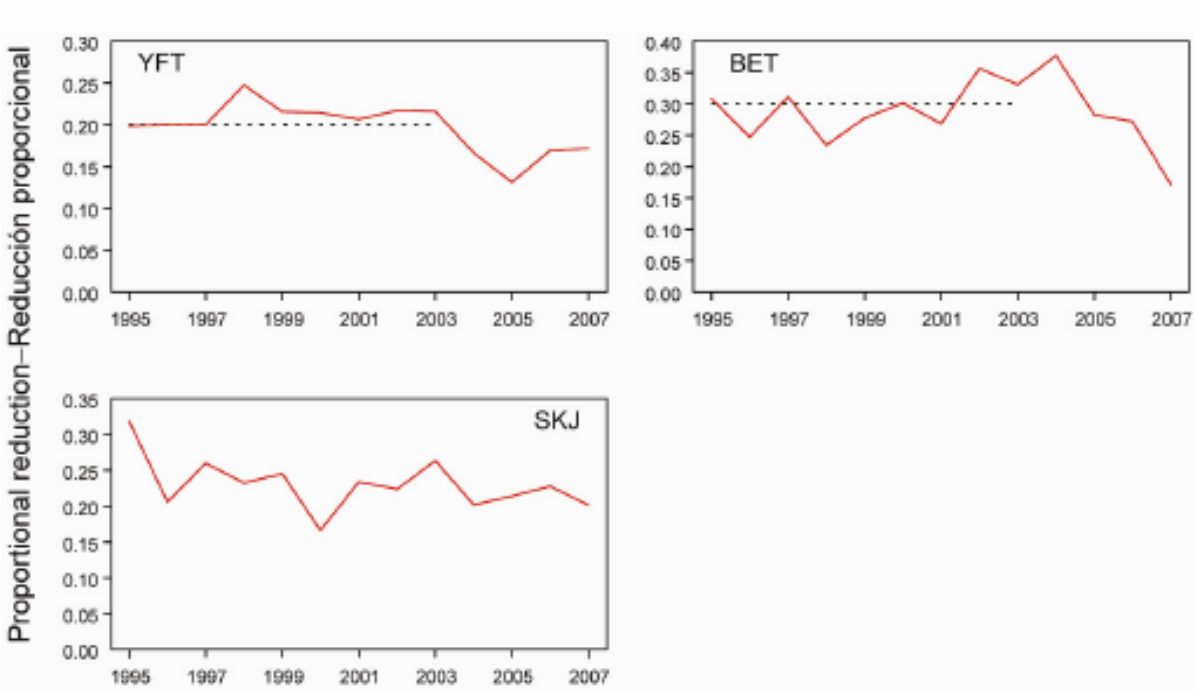


FIGURE 2. Proportional reduction in catch of yellowfin (YFT), bigeye (BET) and skipjack (SKJ) resulting from implementation of the conservation proposal. The dashed lines represent the target reference points for conservation purposes.

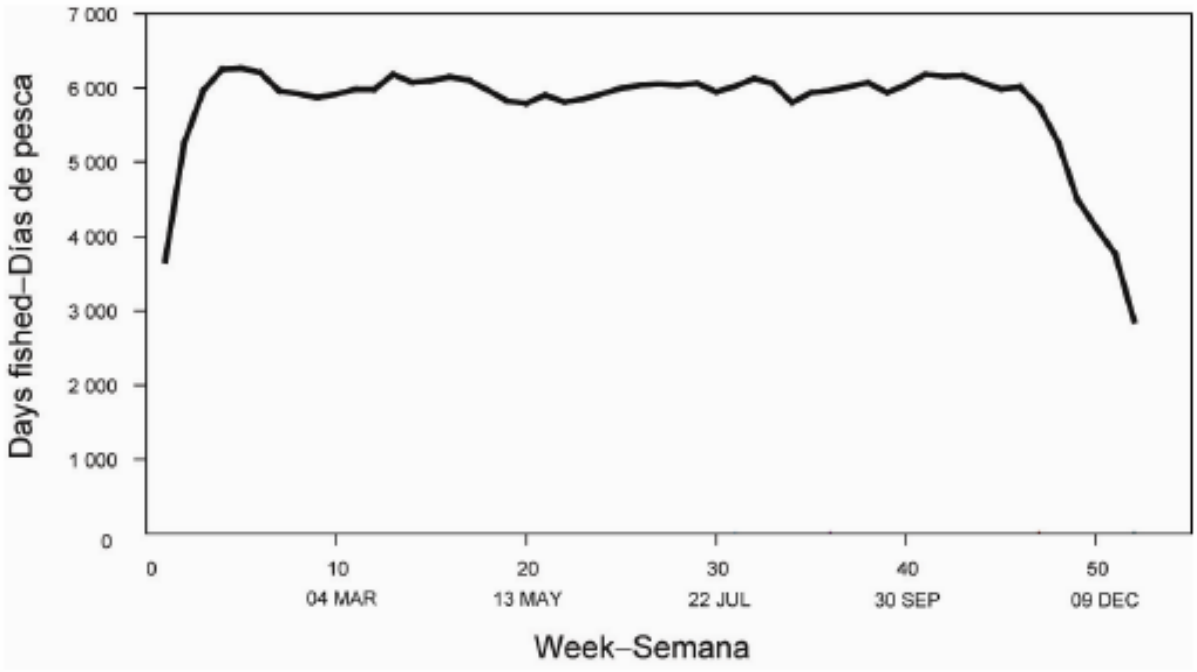


FIGURE 3. Effort, in days fished, in the EPO, summed over the 1995-2003 period. The data used for this figure are not raised to the total effort; therefore, the figure illustrates the trend in effort, not the total effort.

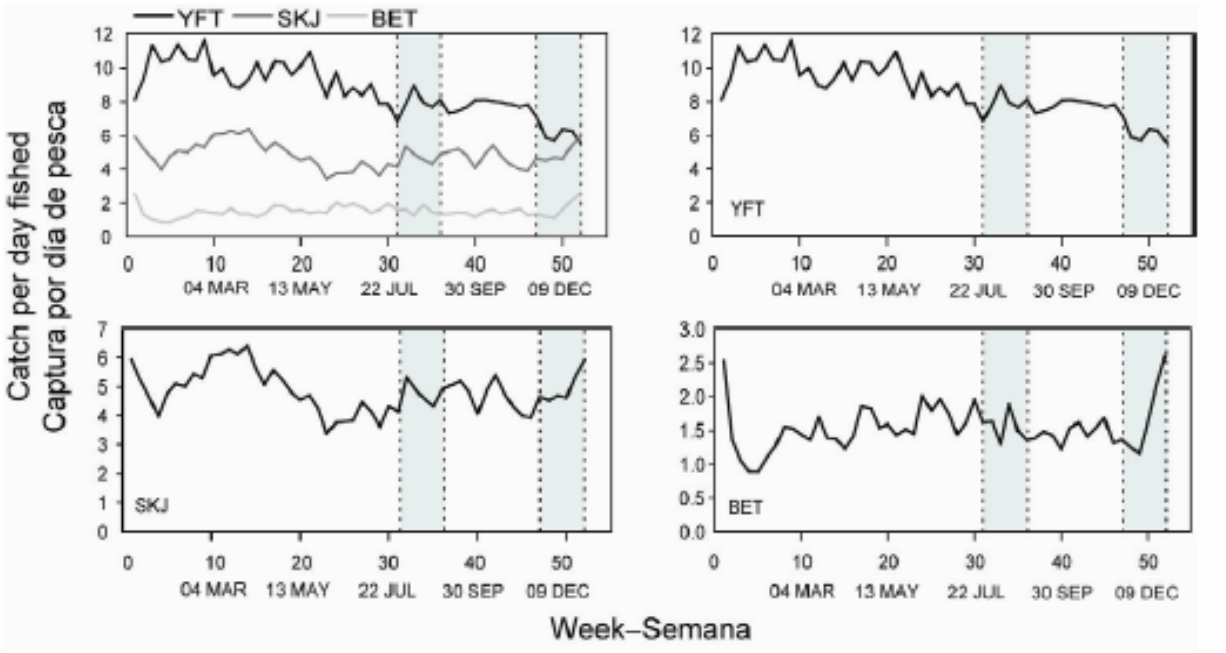


FIGURE 4. Catch per day fished for yellowfin, skipjack, and bigeye in the EPO, calculated using data for 1995-2003. The vertical dashed lines represent the two existing closures.

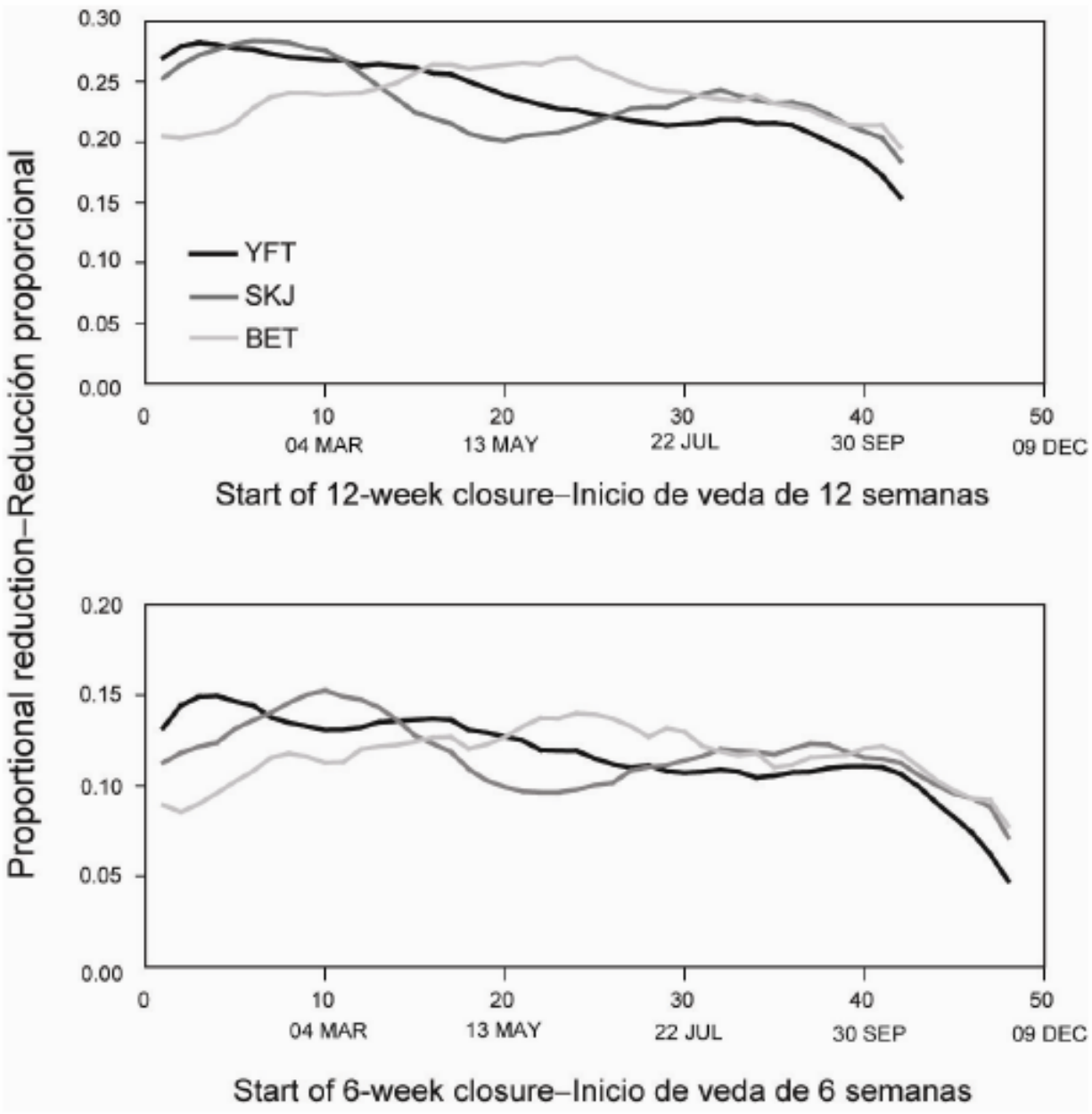


FIGURE 5. Reduction in catch as a proportion of the total catch for 12-week (top) and 6-week (bottom) closures starting at different times of the year. The reductions, based on data from 1995-2003, are calculated independently for each species.

APPENDIX 1

Methods

The closures of the entire EPO are implemented in the analysis by assuming that there will be no purse-seine effort during the closures.

The fishing effort within the offshore closure area (Figure 1) is reallocated to the area outside this area, but south of 10°N. The restriction to south of 10°N corresponds roughly to the assumption that those vessels will not switch to dolphin-associated fishing in the north.

The reduced total annual catch in the EPO after implementation of the the proposal is:

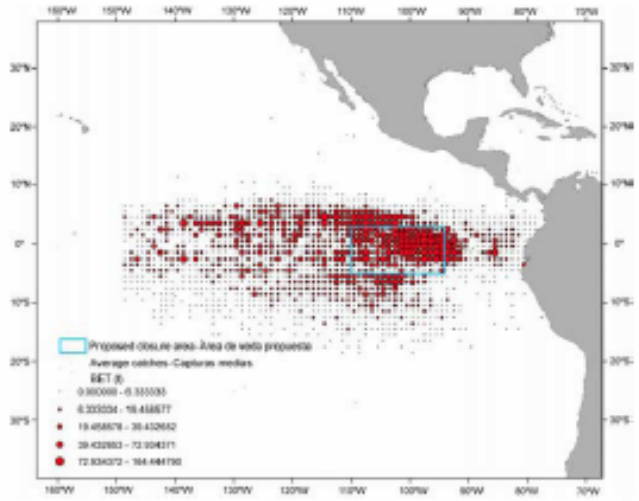
$$C_R = C_T - \sum_{i=1 \text{ to } 3} C_i + CPUE_{outside3} E_3 ,$$

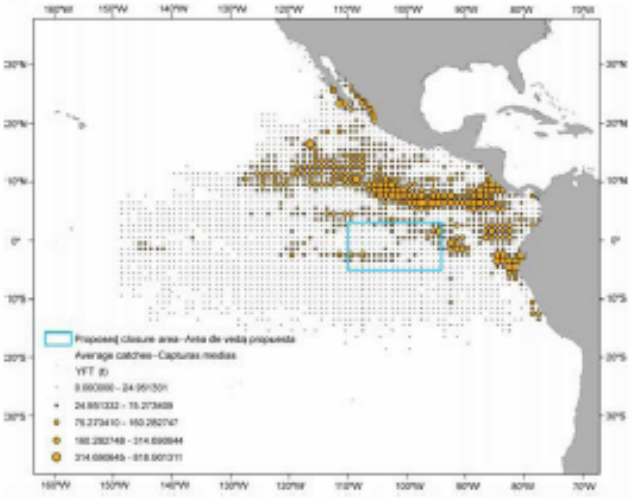
in which:

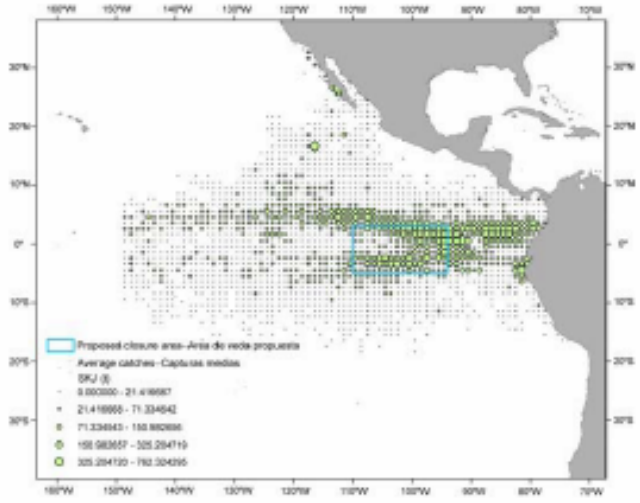
C_R is the reduced total catch in the EPO after implementation of the proposal;
C_T is the total catch in the EPO before implementation of the proposal;
C_I is the catch inside the closed area during closure i;
E_3 is the effort inside the offshore area during the offshore closure;
$CPUE_{outside3}$ is the catch per unit of effort outside the offshore closure area during the closure period, excluding data from north of 10°N.

APPENDIX 2.

Distribution of the catches of bigeye, yellowfin and skipjack in the EPO during the offshore closure period (12 September–31 December), 1995-2006.







Appendix B.

EVALUATION OF CATCHES BY PURSE-SEINE VESSELS OF < 363 T CAPACITY DURING THE PROPOSED 12-WEEK CLOSURE

The following tables summarize the annual catches of yellowfin (YFT), skipjack (SKJ), and bigeye (BET) tunas by purse-seine vessels in three capacity groups (0-272 t, 273-363 t, and > 363 t) during the proposed 12-week closure period (20 June-11 September) during 1999-2007. The catches of bigeye by vessels in the first two categories during that period were much lower than during other times of the year. In the last two years the intermediate-size vessels (273-363 t) show a marked increase in bigeye catch. Yellowfin catches during the proposed closure period are greater than those of bigeye, but for both of the smaller-capacity groups still make up less than 3% of the annual purse-seine catch of yellowfin.

TABLE B.1. Catches by purse-seine vessels, by capacity category, during the 12-week period from 20 June to 11 September, for vessels from which logbook data were obtained.

t	0-272 t (Class 1-4)			273-363 t (Class 5)			> 363 t (Class 6)		
	YFT	SKJ	BET	YFT	SKJ	BET	YFT	SKJ	BET
1999	6,423	2,750	301	3,475	2,121	172	53,797	51,231	14,696
2000	2,999	3,096	50	1,493	1,894	255	54,504	26,249	23,536
2001	3,552	2,251	71	3,132	2,624	5	78,303	23,255	13,153
2002	2,339	3,088	51	4,375	2,716	124	84,673	27,420	12,613
2003	2,480	4,847	48	6,299	2,053	261	80,749	48,716	11,901
2004	1,866	993	20	2,060	1,969	4	51,180	23,942	11,540
2005	1,888	4,190	30	3,372	6,319	1	38,967	42,009	9,806
2006	606	2,627	115	3,422	3,685	350	33,999	48,170	13,234
2007	1,084	2,233	213	932	1,908	73	22,763	26,956	10,407

TABLE B.2. Annual catches by purse-seine vessels, by capacity category, from which logbook data were obtained, 1999-2007.

t	0-272 t (Class 1-4)			273-363 t (Class 5)			> 363 t (Class 6)		
	YFT	SKJ	BET	YFT	SKJ	BET	YFT	SKJ	BET
1999	27,312	19,017	1,191	12,985	10,898	231	243,071	223,202	49,904
2000	17,383	24,575	890	8,748	12,080	345	246,945	167,502	81,443
2001	22,142	9,881	625	17,734	6,446	177	350,948	125,050	53,630
2002	13,021	13,877	541	23,248	10,564	388	380,947	135,883	43,887
2003	12,100	27,277	547	25,926	15,676	261	361,907	211,434	49,044
2004	9,440	15,654	416	13,373	15,349	289	256,925	167,964	55,055
2005	9,524	26,540	133	15,933	23,713	234	240,797	218,722	52,105
2006	6,617	23,310	488	10,276	21,054	1,488	163,943	256,965	64,242
2007	5,418	18,274	586	7,092	16,891	1,340	142,388	148,464	48,055

TABLE B.3. Catches by purse-seine vessels, by capacity category, during the 12-week period from 20 June to 11 September, for vessels from which logbook data were obtained, as a percentage of the total purse-seine catch during that period.

%	0-272 t (Class 1-4)			273-363 t (Class 5)			> 363 t (Class 6)		
	YFT	SKJ	BET	YFT	SKJ	BET	YFT	SKJ	BET
1999	2	1	1	1	1	0	19	23	29
2000	1	2	0	1	1	0	20	16	29
2001	1	2	0	1	2	0	20	19	25
2002	1	2	0	1	2	0	20	20	29
2003	1	2	0	2	1	1	20	23	24
2004	1	0	0	1	1	0	18	14	21
2005	1	2	0	1	2	0	15	19	19
2006	0	1	0	2	1	1	19	19	21
2007	1	1	0	1	1	0	15	18	22

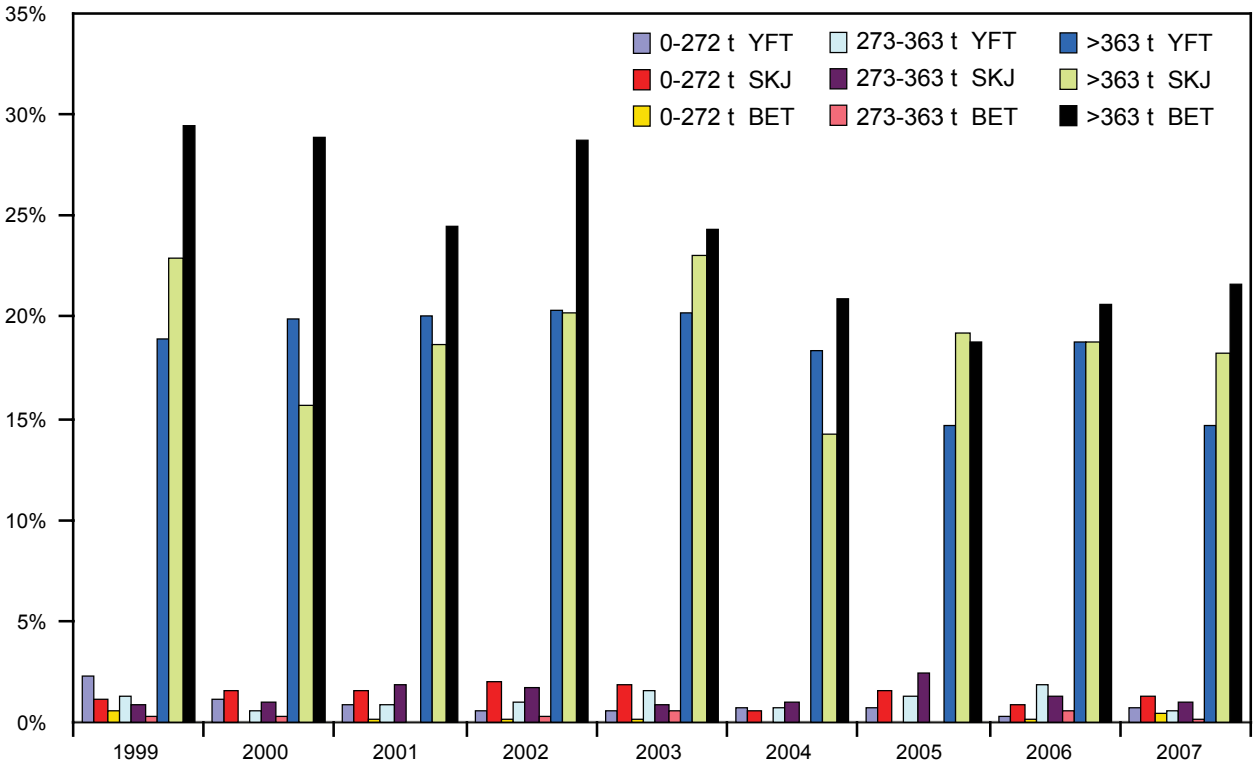


FIGURE B.1. Percentage of total annual purse-seine catches of the three principal tuna species (yellowfin, skipjack, and bigeye) taken during the 20 June-11 September period by vessels from which logbooks information was obtained, by capacity category, 1999-2007.

Appendix C.

INDIVIDUAL VESSEL QUOTAS FOR PURSE-SEINE VESSELS THAT FISH ON FADs

Two analyses of IVQ limits on the total catch (retained catch plus discards) of bigeye and yellowfin combined were carried out. On the basis of observer estimates of total catch of these two species, 101 purse-seine vessels were identified that caught a minimum of 50 t of bigeye during 2004-2006. During that period, the annual total catch by these vessels averaged 57,237 t and 25,820 t of bigeye and yellowfin tuna, respectively. Yellowfin was included in the IVQ analysis for several reasons, including: (1) distinguishing small yellowfin from bigeye can be difficult at sea; (2) conservation of yellowfin of the small sizes generally caught in floating-object sets is an appropriate management goal.

The objective of the analyses was to determine the IVQ that would have resulted in a 20% reduction in the annual total catch of yellowfin and bigeye combined during 2004-2006. The 20% target reduction is based on the current base case assessment for bigeye tuna, and takes into account the annual six-week closures of the purse-seine fishery during 2004-2007.

The first analysis is based on the maximum potential total catch by these 101 vessels, using the formula *Maximum Potential Total Catch = IVQ_rate*(vessel capacity)*. The IVQ rate of 0.5 t per m^3 of capacity corresponds to a maximum potential annual total catch of yellowfin and bigeye combined which is 20% below the level of annual total catch during 2004-2006.

The second analysis is based on the actual performance of these vessels during 2004-2006, in terms of each vessel's annual total catch of bigeye and yellowfin combined in the years in which it was active in the FAD fishery. This analysis recognizes that some vessels catch far less bigeye and yellowfin than their capacity would indicate. The IVQ in this analysis is based on the formula *IVQ =minimum of IVQ_rate*(vessel capacity) and total catch of bigeye and yellowfin combined*. The IVQ rate of 1.0 t per m^3 of capacity corresponds to an annual total catch of yellowfin and bigeye combined which is 20% below the level of annual total catch in the years during 2004-2006 in which the vessel was active in the FAD fishery.