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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.

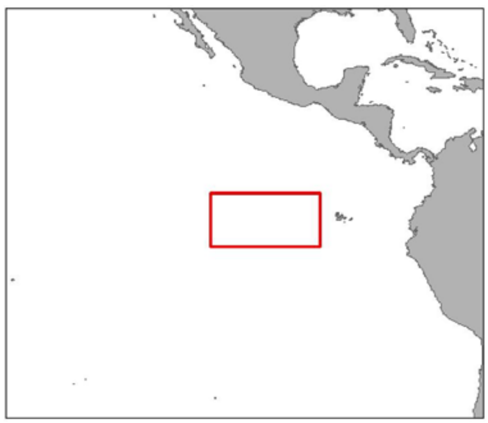

FIGURE 1. Proposed closure area between 94° and 110°W and from 3°N to 5°S.

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

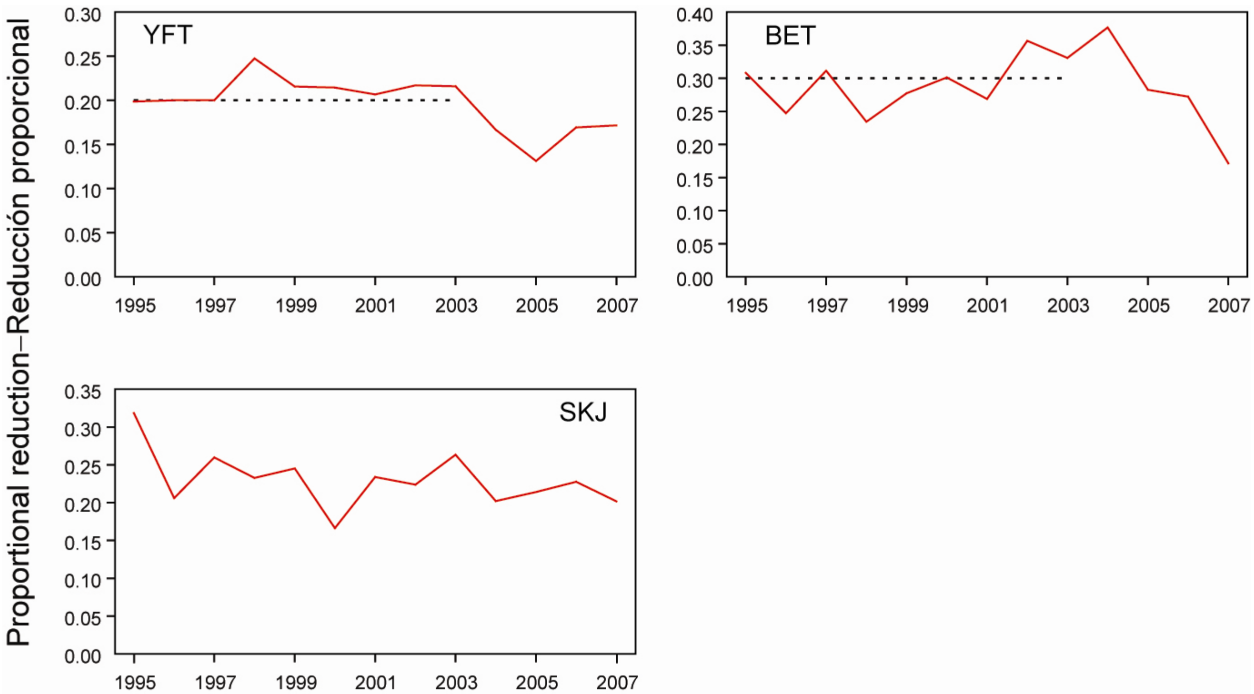

FIGURE 2. Proportional reduction in catch of yellowfin (YFT), bigeye (BET) and skipjack (SKJ) resulting from implementation of the conservation proposal. The dashed lines represent the target reference points for conservation purposes.

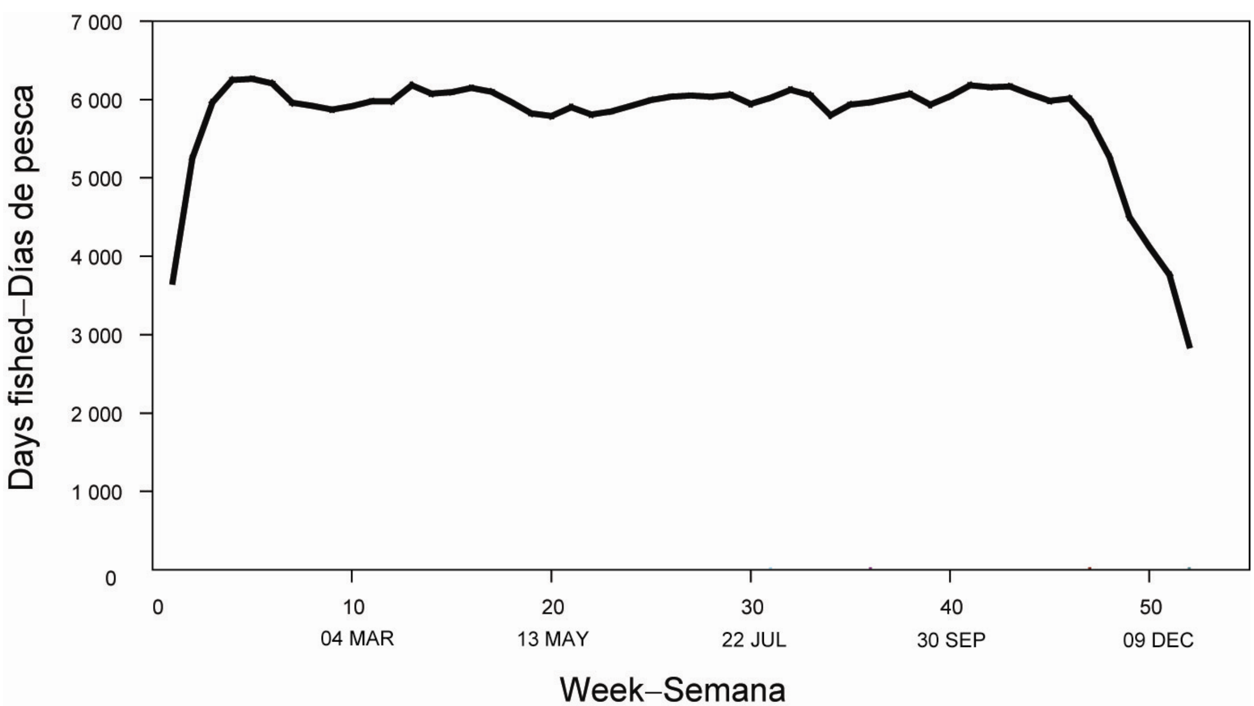

FIGURE 3. Effort, in days fished, in the EPO, summed over the 1995-2003 period. The data used for this figure are not raised to the total effort; therefore, the figure illustrates the trend in effort, not the total effort.

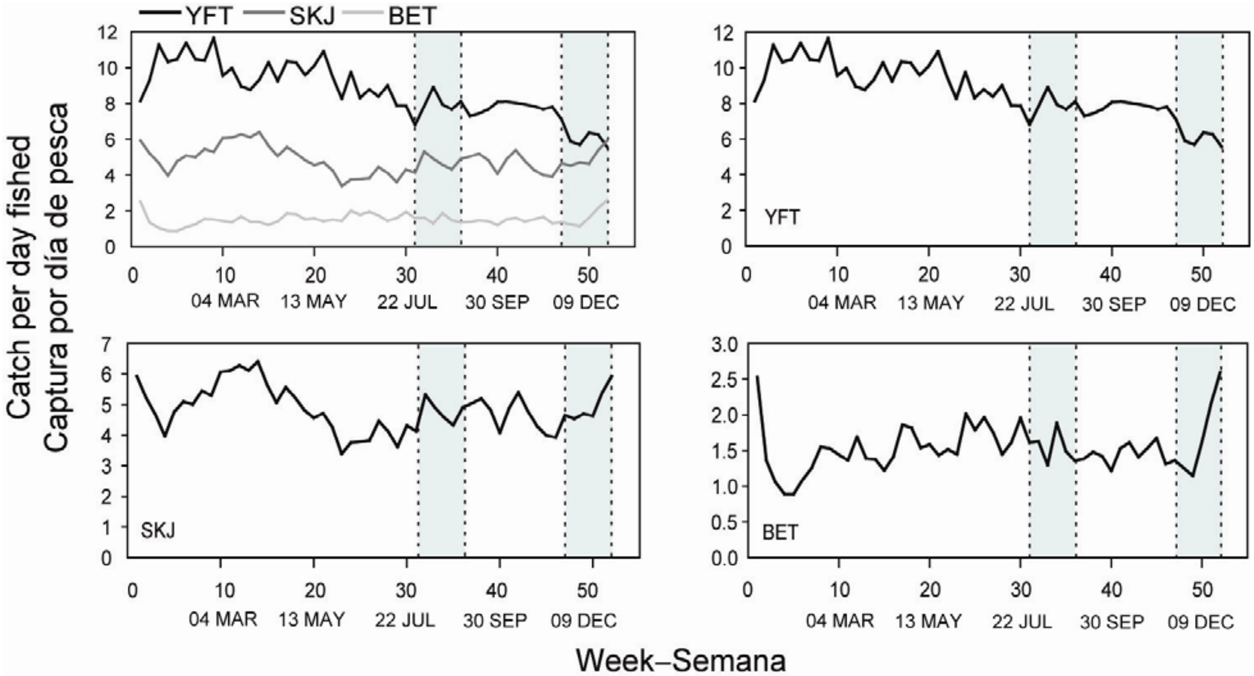

FIGURE 4. Catch per day fished for yellowfin, skipjack, and bigeye in the EPO, calculated using data for 1995-2003. The vertical dashed lines represent the two existing closures.

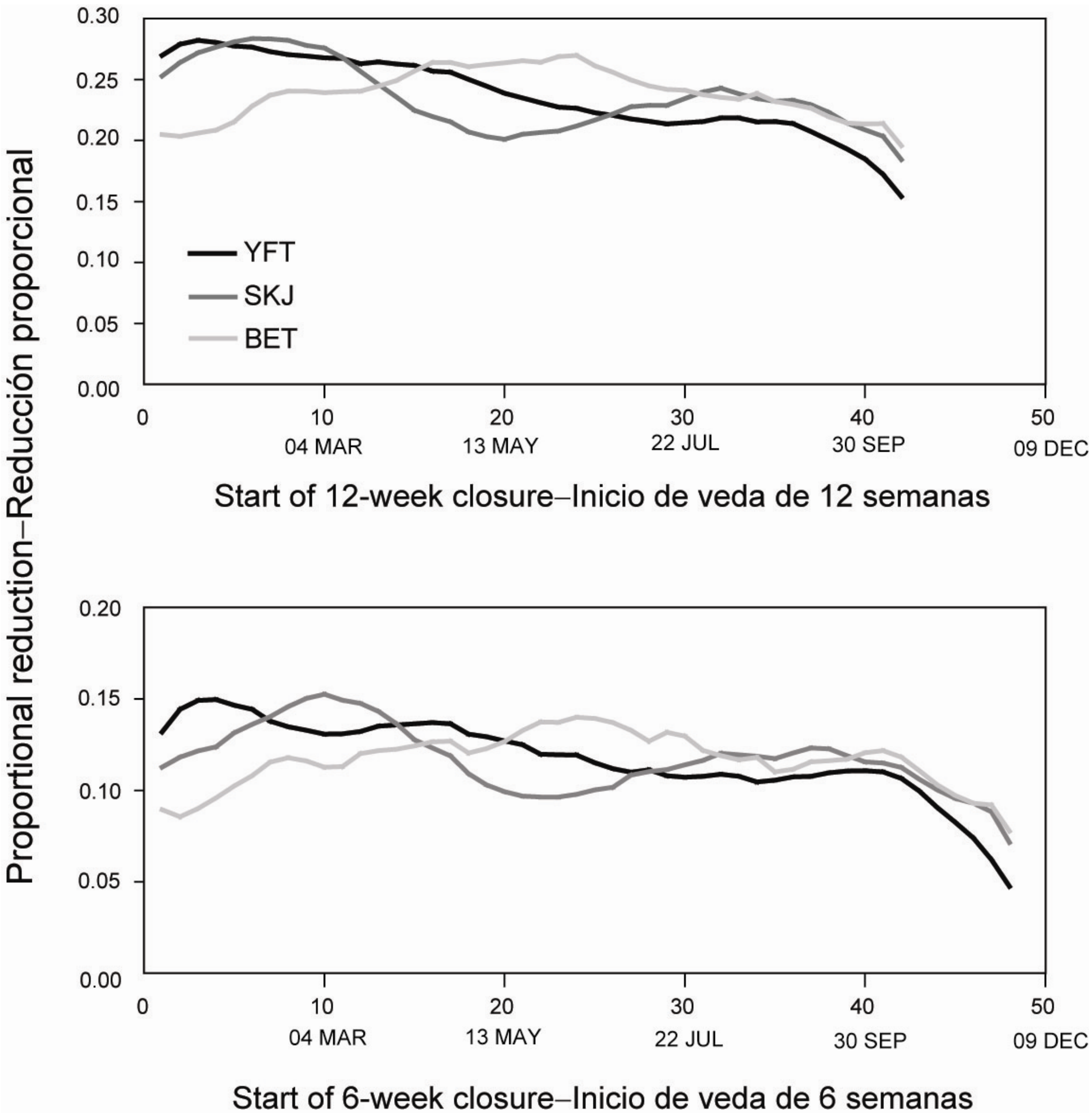

FIGURE 5. Reduction in catch as a proportion of the total catch for 12-week (top) and 6-week (bottom) closures starting at different times of the year. The reductions, based on data from 1995-2003, are calculated independently for each species.

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 10ºN. The restriction to south of 10ºN 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 10ºN.

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.