Estimates of the Catch Reductions that might have been achieved historically through the application of the Time/Area Closures proposed in IOTC Resolution 10/01

IOTC Management Resolution 10/01 (FOR THE CONSERVATION AND MANAGEMENT OF TROPICAL TUNAS STOCKS IN THE IOTC AREA OF COMPETENCE) defines a closed area for fishing from 0 ° - 10° North and 40° - 60° East for the month of November for purse seine (PS) and February for longline (LL) fisheries. It is difficult to estimate the effect of this sort of time/area closure because there is currently a poor understanding of: i) the dynamics of the fleet (i.e. why do the vessels operate where they do, and what would they do differently if there was a closed area?), and ii) the dynamics of the fish population (i.e. given that tuna species migrate long distances very quickly, how large of a time/area closure is actually required to create a spatial refuge?). In the following, we present two possible estimates of the impact of the proposed management unit on historical annual catches for YFT, BET and SKJ from 1990-2009.

Table 1 represents the sum of the catch observed in the management unit as a percentage of the total annual Indian Ocean catch. This value can be interpreted as the maximum catch reduction that might have been realized if this resolution had been applied historically. It is unrealistic in that it assumes that all effort from within the closure disappeared, when it would have been redistributed.

Table 1	Percentage of Annual Catch (in mass) in the Management Time/Area/Fleet Unit:				
	(Assuming that effort from the closure vanishes)				
Species	2008 (%)	2009 (%)	Mean (%) (1990-2009)	Min (%) (1990-2009)	Max (%) (1990-2009)
YFT	0.70	0.50	1.4	0.38	3.9
BET	1.10	0.40	1.3	0.40	3.2
SKJ	1.42	0.71	1.9	0.64	3.6

Table 2 provides similar figures, assuming that the effort from within the closure was redistributed to outside of the closed area, and attained mean catch rates equal to the part of the fleet that was outside of the closed area during the closure period. Negative values indicate that catches would have actually increased because mean catch rates were higher outside the closure than inside.

Table 2	Percentage of Annual Catch (in mass) in the Management Time/Area/Fleet Unit:				
	(Assuming that effort from the closed area relocates outside of the closure)				
Species	2008 (%)	2009 (%)	Mean (%) (1990-2009)	Min (%) (1990-2009)	Max (%) (1990-2009)
YFT	-0.10	0.21	0.21	-0.61	1.7
BET	0.37	0.11	0.10	-0.57	0.68
SKJ	0.63	0.40	0.63	-0.18	2.4

The maximum catch reductions are plotted by year in Figure 1. For comparison, the equivalent plots are shown assuming that the closure was applied for a whole quarter (Oct-Dec for PS, and Jan-Mar for LL) in Figure 2, and for the whole year in Figure 3.

To develop a general tool for more accurately evaluating the effect of time/area closures would require an improved understanding of the fleet and fish dynamics. The movement rates of the fish would become increasingly important if larger times and areas were considered. Fleet behaviour and oceanographic effects on the fish distribution will probably not be easy to predict accurately, even if historical observations can be explained.

Calculation Notes

- This summary is based on the catch and effort tables produced by the Secretariat for stock assessment in 2010. The EU PS data subsequently been revised and resubmitted to the Secretariat, but is not expected to have changed dramatically.
- Catch reductions are calculated relative to the aggregate from the whole Indian Ocean catch, not just the industrial fleets subject to the management measure.
- For scenarios in which effort is redistributed outside of the management area, it is assumed that the mean nominal CPUE from the fleets operating outside of the closure in the same time period would be realized by the relocated effort. Fleets are defined by gear type, aggregated across nations. For the quarterly and annual closure scenarios, the nominal CPUE was calculated across the whole time period of the closure.
- PS Effort recorded in days was converted to hours assuming 13 h per day.

YFT - One Month Closure

BET - One Month Closure

SKJ - One Month Closure

Annual Catch Reduction (%)
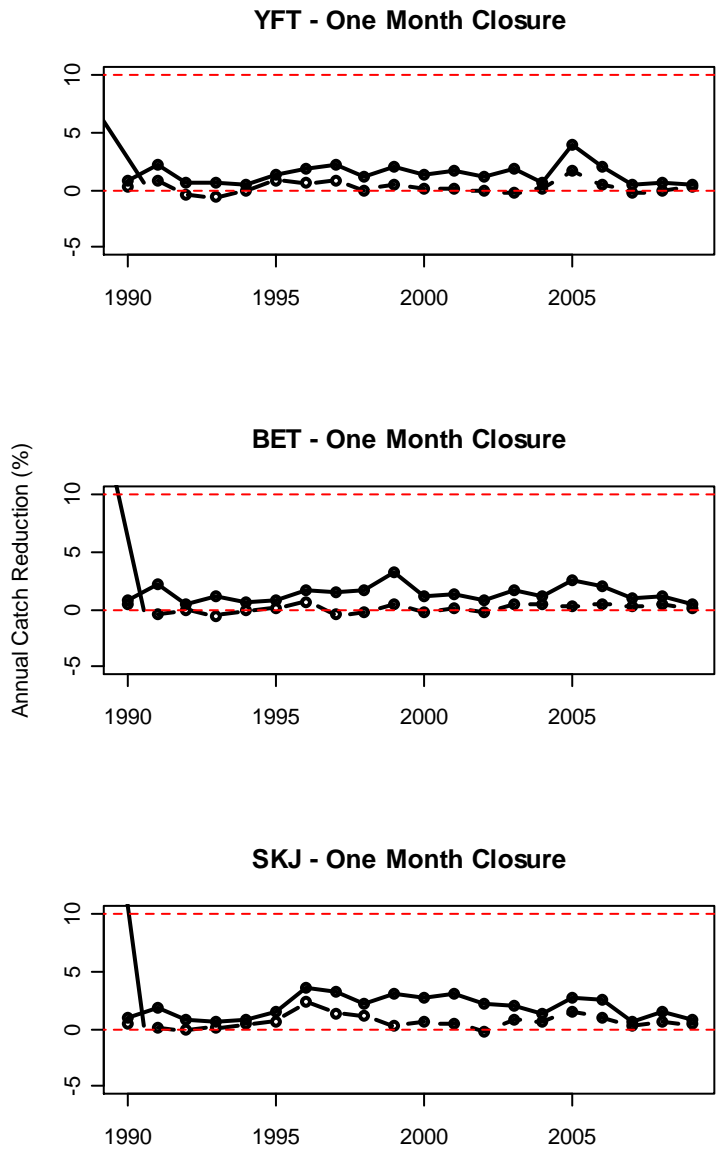
Figure 1. Estimates of the historical catch reduction that might have been realized if IOTC Resolution 10/01 had been applied historically. Solid lines indicates the results if the effort from the closed area had vanished, broken lines indicate the results if the effort from within the closed area had redistributed to the outside. Red broken lines indicate reference levels of 0 and 10%. Values below zero indicate catches that would have increased if the closure had been in place.

YFT - One Quarter Closure

BET - One Quarter Closure

SKJ - One Quarter Closure
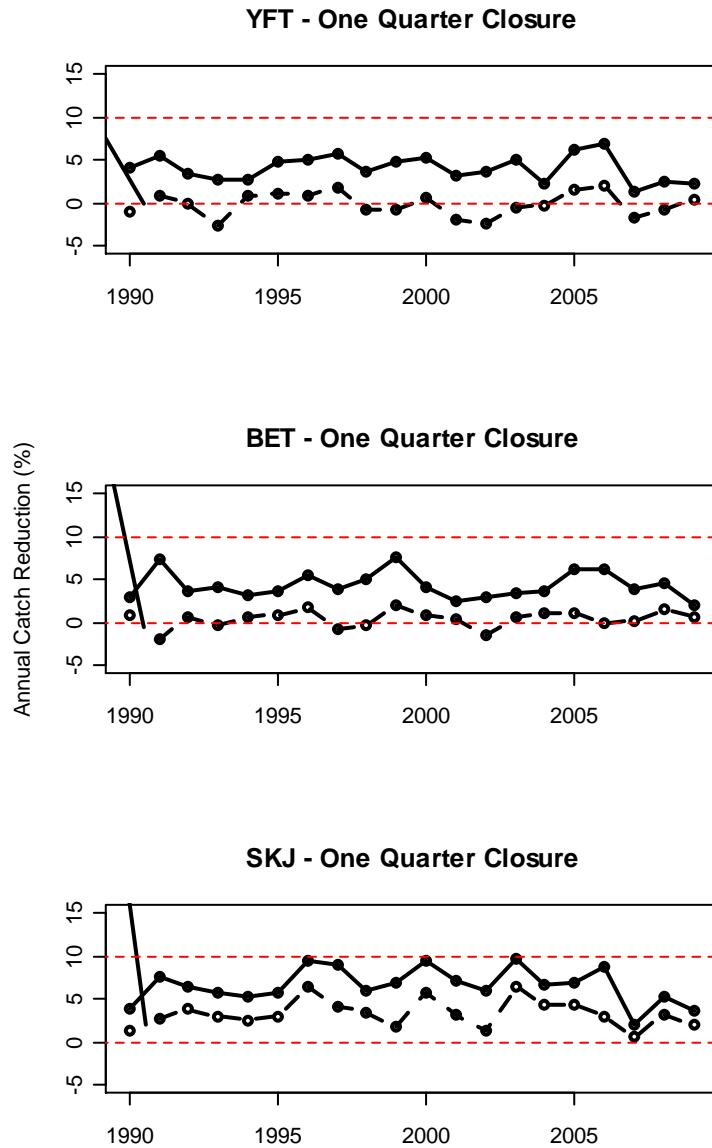
Figure 2. Estimates of the historical catch reduction that might have been realized if IOTC Resolution 10/01 had been applied historically for a whole quarter (Oct-Dec for PS, Jan-Mar for LL). Solid lines indicates the results if the effort from the closed area had vanished, broken lines indicate the results if the effort from within the closed area had redistributed to the outside. Red broken lines indicate reference levels of 0 and 10%. Values below zero indicate catches that would have increased if the closure had been in place.

YFT - Permanent Closure

BET - Permanent Closure

SKJ - Permanent Closure

Annual Catch Reduction (%)
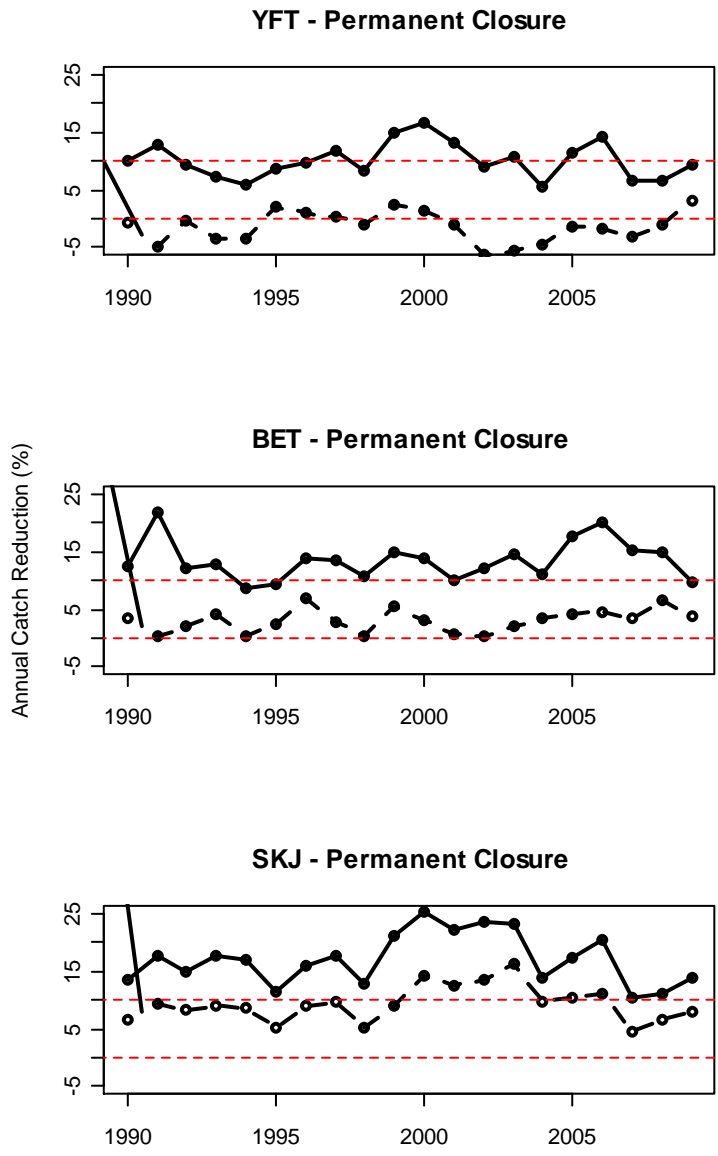
Figure 3. Estimates of the historical catch reduction that might have been realized if IOTC Resolution 10/01 had been applied historically for the whole year. Solid lines indicates the results if the effort from the closed area had vanished, broken lines indicate the results if the effort from within the closed area had redistributed to the outside. Red broken lines indicate reference levels of 0 and 10%. Values below zero indicate catches that would have increased if the closure had been in place.