COMMISSION

NINTH REGULAR SESSION

Manila, Philippines
2-6 December 2012

Preliminary analysis of the potential impacts of wire traces on shark catches in WCPO tuna longline fisheries

WCPFC9-2012-IP14

19 November 2012

Oceanic Fisheries Programme,

Secretariat for the Pacific Community

Preliminary analysis of the potential impacts of wire traces on shark catches in WCPO tuna longline fisheries

Oceanic Fisheries Programme, SPC *November 2012*

In reviewing the stock assessments conducted in 2012 for silky and oceanic whitetip sharks, SC8 noted both the a) concerns over the status of the stocks, and b) the large impact that non-target longline fisheries are estimated to have. For these reasons, SC8 recommended consideration of mitigation measures as providing the best opportunity to improve stock status.

With respect to oceanic whitetip shark SC8 concluded:

> ***Management Advice and Implications***
>
> 50. Despite the data limitations going into the assessment, and the wide range of uncertainties considered, all of the accepted model runs indicate that the WCPO oceanic whitetip shark stock is currently overfished and overfishing is occurring relative to commonly used MSY-based reference points and depletion-based reference points. Management measures to reduce fishing mortality and to rebuild spawning biomass have been agreed to under CMM 2011-04, but mitigation to avoid capture is recommended.
>
> 51. Given the bycatch nature of most of the fishery impacts, mitigation measures provide the best opportunity to improve the status of the WCPO oceanic whitetip shark stock.

Further, for silky shark SC8 concluded:

> ***Management Advice and Implications***
>
> 57. Noting SC8s concerns over the data conflict and potential biases in the silky shark assessment, it is not possible to provide management advice based on the assessment at this time. However, noting that some basic fishery indicators (e.g. mean lengths and some CPUE series) are showing declines in recent years, the SC recommends no increase in fishing mortality on silky sharks.
>
> 58. Further, recognizing that the major fishery impacts relate to non-target fisheries, the SC recommends that the Commission consider mitigation measures to reduce the impact of these non-target fisheries as a precautionary measure. SC8 recommends that the silky shark assessment be updated to incorporate all potentially important data series.

As an immediate step towards further examination of mitigation measures, a preliminary analysis of the impact of wire traces on shark catch rates was undertaken to build on that described in Clarke (2011[1]). Importantly, the preliminary analysis described here does not provide information on total fishing-related mortality. To do so would require consideration of the fate and condition of sharks including the fate of shark 'bite-offs'. Such an analysis is planned for SC9.

Wire traces are not necessarily an indication of shark targeting. However, the analyses described in this brief report, and those of other researchers (Ward et al. 2008[2]; Afonso et al. 2012[3]) show that the number of sharks that are on the line when it comes to the side of the boat is higher when wire traces are used[4].

[1] Clarke, S. 2011. A Status Snapshot of Key Shark Species in the Western and Central Pacific and Potential Management Options. WCPFC-SC7-2011/EB-WP-04.

[2] Ward, P., Lawrence, E., Darbyshire, R., Hindmarsh, S., 2008. Large-scale experiment shows that nylon leaders reduce shark bycatch and benefit pelagic longline fishers. Fish. Res. 90, 100–108.

[3] Afonso, A.S., Santiago, R., Hazin, H., and Hazin, F.H.V. 2012. Shark bycatch and mortality and hook bite-offs in pelagic longlines: Interactions between hook types and leader materials. Fish. Res. 131-133: 9-14.

[4] These studies included Japanese-style and J-style hooks, so these conclusions may not apply to circle hooks.

Our analysis included all longline observer data held by OFP for which there was a record from the observer as to whether wire traces were present or not, at the trip level. For only 22% of the observed trips is information on trace material currently available. The number of records is updated from that available in the analyses described in Clarke (2011; repeated in Table 1 below), but it is clear that the number of records is very low for some years and some critical fleets (e.g. distant water fleets) and this paucity of data is reflected in the uncertainty in the estimates of overall wire trace use in WCPO tuna longline fisheries (Clarke 2011; repeated in Figure 1 below).

Using generalised linear models[5] we estimated the effect of wire traces on shark catch rates for several of the key shark species, plus all other sharks combined. We then combined these estimates of the effect of wire traces with the estimated prevalence of use of wire traces (including the uncertainty in each of those estimates) to predict the reduction in shark catches that could occur if wire traces were not used (Figure 2).

The largest median reductions (Table 2) were predicted for mako sharks (55%), followed closely by silky sharks (50%), and then oceanic whitetips (24%). The estimated reduction in catch for blue and thresher sharks was much less (6-7%).

The major caveats of this work are as follows:

- Our confidence in the direction of the effects is more reliable than in their magnitude due to poor coverage of the observer records that include leader material across time, space, and vessel flag. Ignoring these factors may have reduced the uncertainty in our estimates of the wire trace effect (Table 2). Only improved observer coverage (including recording by observers) can address this issue.
- Our analysis cannot make predictions about how overall fishing-induced mortality could change. This requires further examination of the life status of sharks at the side of the boat when different trace materials are used, plus some assumptions regarding the fate of sharks that successfully bite through monofilament traces. Clarke (2011) and Afonso et al. (2012) draw particular attention to this issue.
- There are other important factors such as hook type (see Afonso et al. (2012) and Yokota et al. (2006[6])) that have a known impact on catch rates and likely fishing related mortality that are not included in the current analysis. Neither of the studies that gave positive results on the use of monofilament traces considered circle hooks, so it is not known if the same reductions in catch rates would apply in fisheries that used circle hooks. At this time there are simply insufficient data to include these factors at this time. Future data collection is critical.

Further work will be undertaken for consideration by SC9. This will include any new data available through the increased longline observer coverage, information on the life status and fate of sharks (as presented in Clarke (2011)), an update on the estimates of wire trace use, and the impact of trace material on catches of target species. Interestingly with respect to the final point, both Ward et al. (2008) and Afonso et al. (2012) found that monofilament leaders increased catch rates of bigeye tuna, an important target species in longline fisheries.

Critical to any future analyses will be increased observer coverage and recording by observers of important operational characteristics such as leader material, hook types, and bait.

[5] We included factors of location, hooks between floats, and time of the day. Unfortunately it was not possible to include both location and flag so we included only location.

[6] Yokata, K., Kiyota, M., and Minami, H. 2006. Shark catch in a pelagic longline fishery: comparison of circle and tuna hooks. Fish. Res. 81:337-341.

Table 1. The number of observer trips for which the presence or absence of wire trace was recorded, 1996-2009 (from Clarke (2011)).

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
CK													6		6
CN									11	17	49	48	8	11	144
FJ								5	9	29	22	19	25	20	129
FM								1	4	5	11	6	2		29
JP			1						1	3	3	1			9
KI													4		4
KR			1							1	3				5
MH													1	1	2
NC	1		2	2					4	2	5	6	11	8	41
NZ										1		1			2
PF								1	1	12	18	12	15	47	106
PG								4	6	16	10	3	9		48
SB			2	1			1	2	12						18
TO					2				2	1	18	6	12	7	48
TW	1		4	2					7		3	2	14	9	42
VU														2	2
WS										1	1				2
Total	2	0	10	5	2	0	1	13	57	88	143	104	107	105	637

Table 2. Median predicted reduction in shark catches associated with switching from wire to monofilament traces, with the associated uncertainty estimates. The ratio between catch rates of each species where wire trace or monofilament is also presented.

	Predicted % change in longline catch			**Relative catch rate of wire to mono**	
Species	**2.5% quantile**	**Median**	**97.5% quantile**	**Ratio**	**CV**
Blue shark	-8.7	-6.6	-4.6	1.11	0.06
Mako sharks	-71	-55.3	-38.7	1.90	0.10
Oceanic whitetip shark	-30.9	-24	-16.6	1.39	0.09
Silky shark	-64.4	-50.4	-35.4	1.82	0.09
Thresher shark	-8.2	-5.6	-3.3	1.09	0.13
Other sharks	-10.3	-7.2	-4.6	1.12	0.14

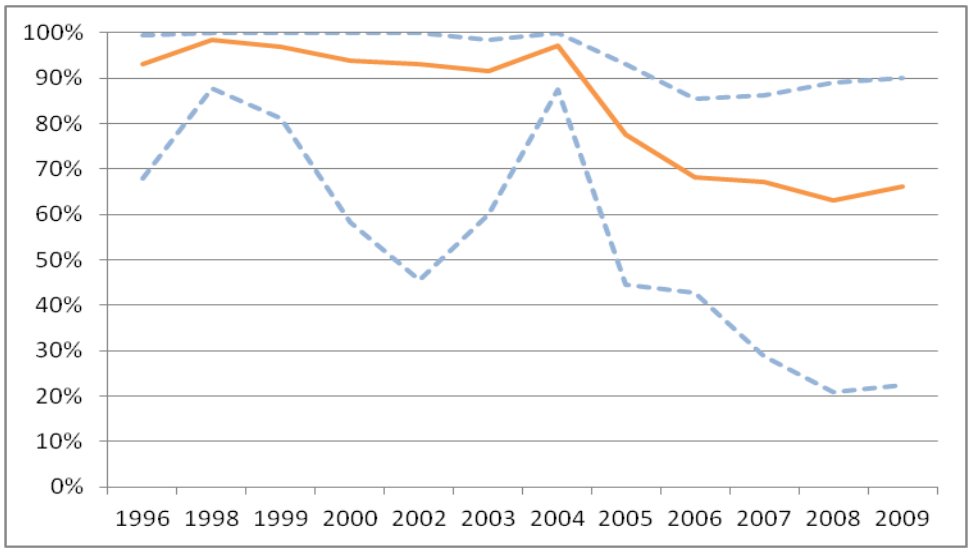

Figure 1 . An extrapolated estimate of the proportion of longline effort in the WCPFC Statistical Area that employed wire traces for 1996, 1998-2000, and 2002-2009 (estimation for other years is not supported by the available data) (from Clarke (2011)).

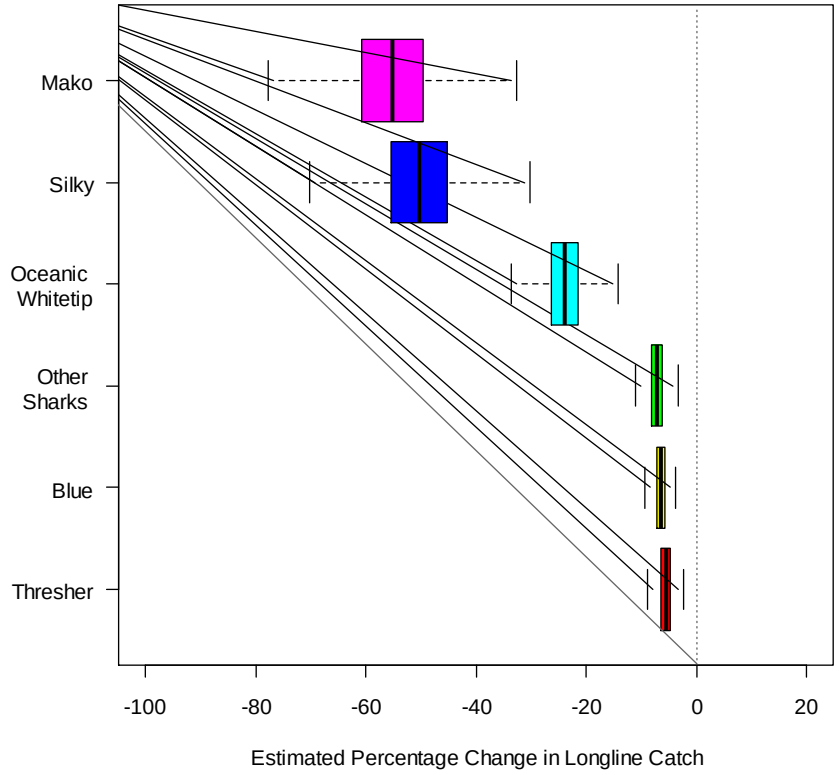

Figure 2. Estimated percent change in longline catch of sharks in WCPO fisheries based on the switching from wire to monofilament traces based on the estimated impact on catch rates of wire leaders (Table 2) and the estimated extent of wire trace use (Figure 1).