SCIENTIFIC COMMITTEE
SECOND REGULAR SESSION

7-18 August 2006
Manila, Philippines

CHARACTERIZATION OF SEA TURTLE BYCATCH IN NEW ZEALAND'S TUNA FISHERIES

WCPFC-SC2-2006/EB-WP-03

Paper prepared by

S. J. Harley[1] and T. Kendrick[2]

[1] New Zealand Ministry of Fisheries
[2] Trophia Ltd.

Characterization of sea turtle bycatch in New Zealand's tuna fisheries

S. J. Harley[3] and T. Kendrick[4]

[3] New Zealand Ministry of Fisheries
[4] Trophia Ltd.

Introduction

Sea turtles are considered to be one of the most sensitive groups among bycatch species taken in tuna fisheries, with most sea turtles being allocated a high risk status (e.g. IUCN). Accordingly, at its second meeting the WCPF Commission made several requests for its members, cooperating non-members and its subsidiary bodies to provide further information on sea turtle bycatch.

The purpose of this paper is to summarise available data for sea turtle interactions from tuna fisheries operating within New Zealand fisheries waters. First we summarise information on observed and reported sea turtle interactions. Second we report on data relating to fisheries operations, in particular the types of hooks and bait types used in the surface longline fishery. Third we examine the impact of hook and bait type on the catch rates of bycatch and target species and give examples of the type of analyses that may be required by decision makers. Finally we present further work New Zealand could do and how that may fit into the "turtle programme" requested by the Commission.

Sea turtle interactions in New Zealand's tuna fisheries

Estimates of sea turtle interactions come from two sources. Firstly, fishers are required to report accidental deaths or injuries to marine mammals or marine wildlife (including turtles) that occur in the act of fishing under a variety of New Zealand legislation (e.g. New Zealand Wildlife Act (1953) and the Marine Mammal Protection Act (1978)). Secondly, New Zealand places scientific observers on fishing vessels to collect a range of data, including information on non-fish bycatch.

Each data source has its potential problems. The level of reporting by fishers on sea turtle interactions is unknown, but this process has recently been reviewed with new regulations and reporting system soon to be put in place. An observer programme provides the best source of information on sea turtle interactions, but observer coverage is both expensive, and in the New Zealand situation, was difficult to coordinate on the large fleet of small (and dispersed) vessels that operated in the early 2000s. Observer coverage of the effort in the longline fishery has ranged from 10-20%.

No interactions with turtles have been reported or observed in the purse-seine and troll fisheries that operate within New Zealand's fishery waters over the past five years, but some sea turtle interactions have been reported in the longline fishery. Over the period 2001 to 2005, 11 turtles have been reported from the longline fishery from these two data sources (Table 1).

Table 1. Sea turtle interactions for surface longline vessels based on fisher and observer records. All turtles, except the one green turtle caught in 2001 were alive on capture and released.

Species	Scientific name	2001	2002	2003	2004	2005
Green turtle	*Chelonia mydas*	1				1
Leatherback turtle	*Dermochelys coriacea*	3	1		1	2
Loggerhead turtle	*Caretta caretta*		1			
Unidentified		1				

Seven of the turtles were leatherbacks, whilst the remainder were reported as green turtles (two), loggerhead (one), and one was unidentified. When an observer is onboard, a photograph is usually taken which makes it easier to confirm the species of turtle caught. All turtles were alive when caught and released alive except for one green turtle caught in 2001 which was dead when it came onboard.

All but two of the sea turtle interactions occurred during the period of highest sea surface temperatures in New Zealand (February – May), with the other two caught in November and June. Based on these records, it is hypothesized that turtles are predominantly found within New Zealand waters during the Austral summer. Confirmation of this assumption will be important when attempting to scale up these observations to provide an overall estimate of sea turtle interactions for the fleet.

Most sea turtle interactions occurred in the north of New Zealand, though one leatherback turtle interaction occurred off the southwestern tip of New Zealand (Figure 1). While most longline fishing effort during the first half of the year occurs off the east coast of the North Island (Figure 2), most sea turtle interactions occurred in the Bay of Plenty region slightly north.

Fishery operations

Considerable research has been undertaken to understand factors that lead to increased probability of sea turtle interactions and the outcome of these interactions (e.g. does the turtle survive or die from injuries sustained in the interaction). Due to the low number of interactions, it is not possible to undertake statistical analyses to determine factors that may lead to the interactions. Further, mitigation studies in New Zealand fisheries are unlikely to be useful as the low probability of interactions will result in very low statistical power to detect any effects.

In this section we describe operational aspects of the New Zealand longline fishery focussing on variables which have been shown to be important in relation to sea turtle interactions in other studies.

Basic gear configuration is reported on catch effort forms and is available for all vessels, this includes the number of hooks and the number of floats for each longline set, and the percent of hooks baited with 1) fish, 2) squid, 3) artificial baits/lures, and 4) other. The distribution of hooks per float at set-by-set resolution is shown in Figure 3 for the domestic and charter fleets. These data are not rigorously groomed and may contain some errors, but for the domestic vessels this statistic ranges between 5 to 25 hooks per float, while for the charter fleet, its varies little from the mode at 10 hooks per float. Bait strategies also vary by fleet, with domestic vessels characteristically using 50% fish and 50% squid on each set, but with a tendency to use more squid than fish when they deviate from that strategy (Figure 4). The charter fleet generally uses more fish than squid bait per set.

Hook types used are typically recorded by observers, though the level of reporting is variable. Observed hooks in 2004 and 2005 were all described as silver circle or Japanese hooks, and the few observations of hook size suggest that size 16/0 and 17/0 may be the norm.

Impacts of bait and hooks on catch rates of target and bycatch species

Many mitigation measures proposed for sea turtles have focussed on hook and bait types with large circle hooks and fish bait thought to reduce the probability of interactions and reduce the severity of the impacts for turtles that take baited hooks. As most of our interactions are with leatherback turtles, factors such as hook type and bait are probably less important and others such as “hooks per basket” may be more important.

In order to successfully implement such measures it is important that the potential impacts on target and bycatch species is assessed. New Zealand has very little contrast in hook sizes used to allow quantitative analysis of the affect of hook size / type on catch rates. Data are bait types is also limited as it is not possible to determine the bait taken by an individual fish meaning that inferences are restricted to the set level, e.g. we can assess the set level catch rates of a given species associated with a given bait mix (% fish bait used).

We analysed the catch effort data for 2004 and 2005 where bait data are more complete. Logistic (presence/absence) and lognormal (positive catch rates) analyses were undertaken to assess the impact of "percentage fish bait used" on the catch rates of important target and bycatch species in the New Zealand longline fishery. Species considered were albacore, bigeye, and southern bluefin tunas, and porbeagle, mako, and blue sharks. In the standardization we considered the effects of latitude, longitude, month, and target species (plus interactions) to reduce the possibility of incorrectly estimating a significant "fish bait" effect when it was due to other factors.

These analyses are preliminary and were undertaken to provide examples of the types of analysis that might be useful to inform decision makers.

Fish bait was estimated to have a significant affect on catch rates for only three species: albacore tuna, swordfish, and mako shark (Figure 5). Over the range of fish bait percentages used in the domestic fleet (Figure 4), there is a strong increase in catch rates of albacore and slightly weaker decrease in the catch rates of swordfish. The estimated effect for mako sharks is very weak with some suggestion of an increase in mako shark catch rates with increased use of fish bait.

Future work

This work represents a first analysis of turtle interactions in New Zealand's tuna fisheries, in particular the tuna longline fishery. This examination has pinpointed other analyses and associated work to be done in this area. These are as follows:

- review observers diaries for further details of individual sea turtle interactions;
- provide special briefings on sea turtles issues to observers to allow better identification of turtles, descriptions of turtle interactions, and recording of operational data known to be important in turtle interactions (e.g. hook and bait types);
- provide better information to fishers to allow better identification of turtles; and
- estimate the total number of sea turtle interactions from observer reports.

While work on addressing the first three bullet points is already underway, in order for us to undertake this work effectively the following information is necessary and would hopefully form part of the turtle programme:

- which details of fishery operations are most important for sea turtle issues and should be recorded by fisher and observers (e.g. bait, hooks, light-sticks, float lines);
- what are the spatial and temporal distributions of the different sea turtle species;
- What are the diving abilities of the various species?
- How deep are the longlines set?
- what are the best mitigation measures for sea turtles, and do the measures differ by species; and
- what are the effect of these mitigation measures on the catches of target (e.g. tunas and swordfish) and bycatch (e.g. sharks and other fish and non-fish species) species.

Acknowledgements

Thanks to Lynda Griggs (NIWA), Guy Pasco (MFish), and the fishers and observers who collect the data necessary for such analyses.

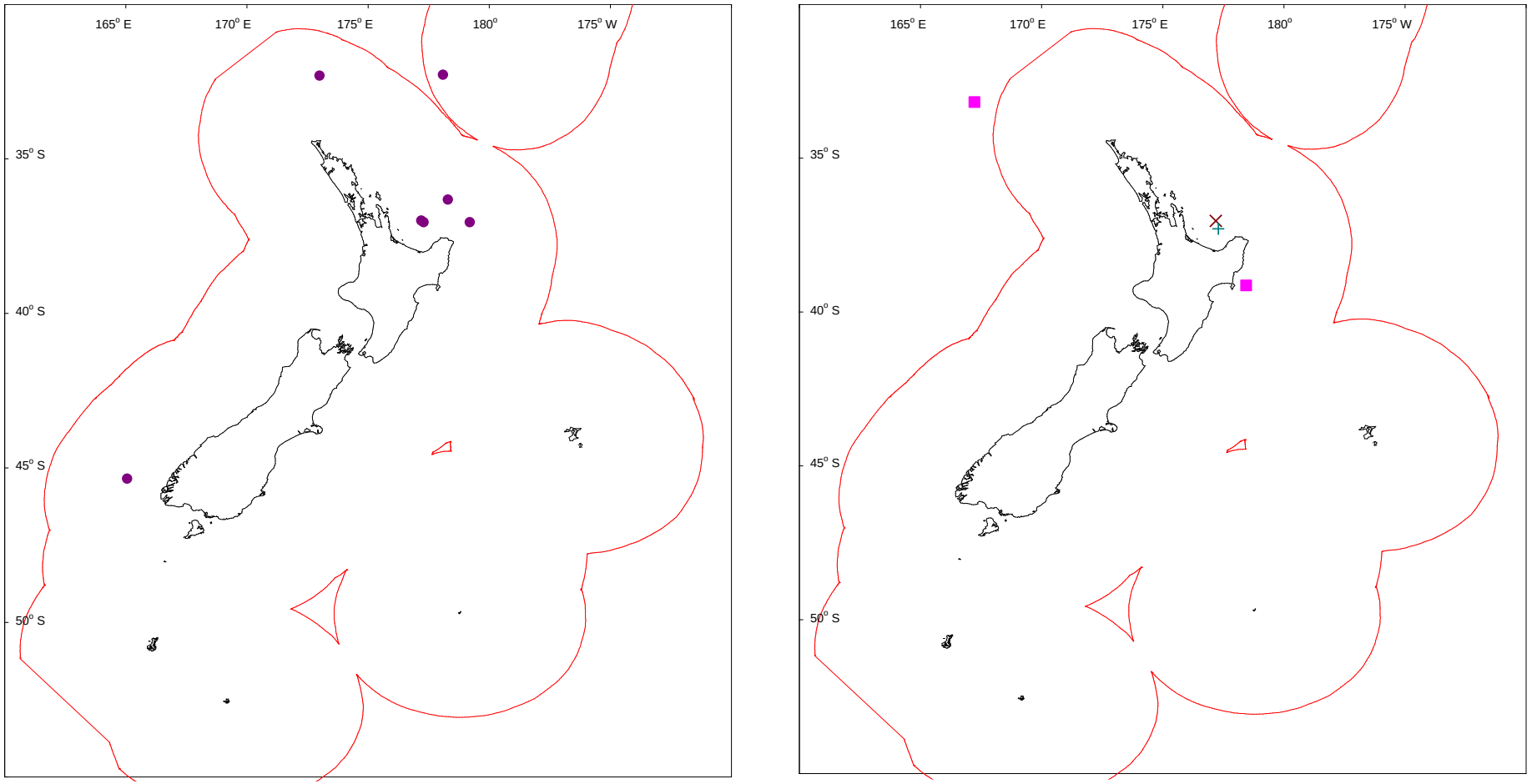

Figure 1. Locations of sea turtle interactions for tuna longline vessels based on fisher and observer records. Leatherback turtles are provided in the left-hand panel and all others are provided in the right. For the right-hand panel: green turtle (box), loggerhead (x) and unidentified (+).

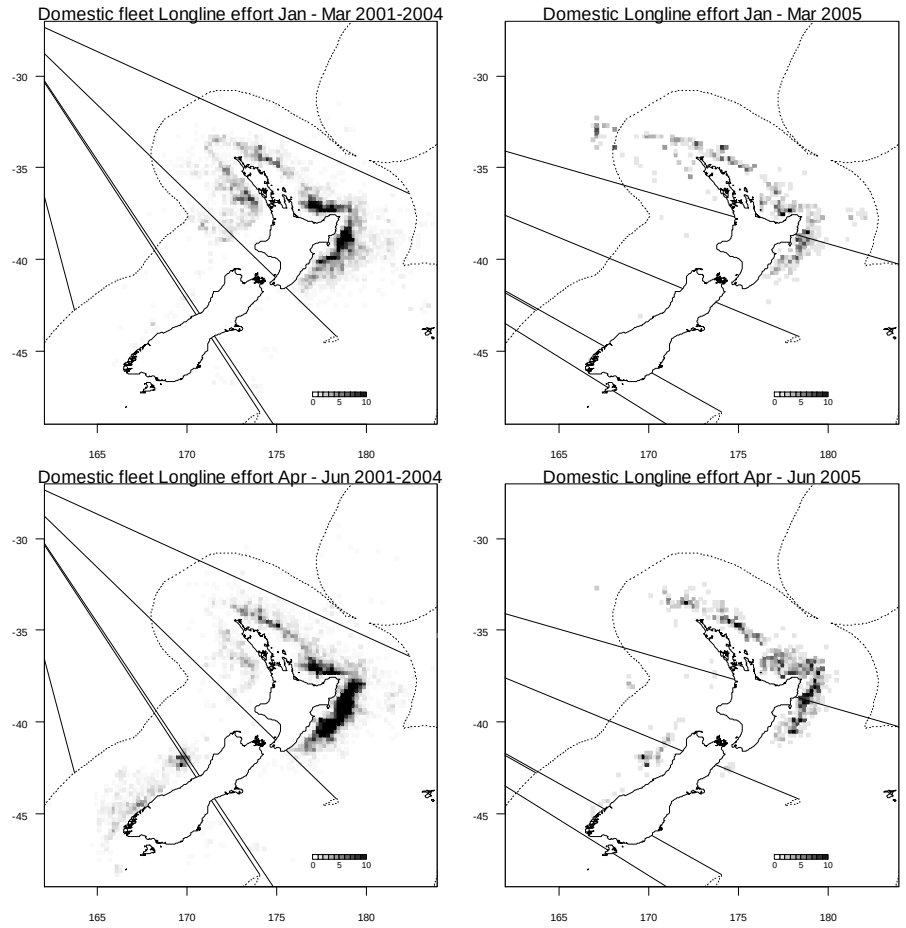

Figure 2. Distribution of tuna longline effort during the first two quarters of the year (the period where most of the sea turtle interaction occurred).

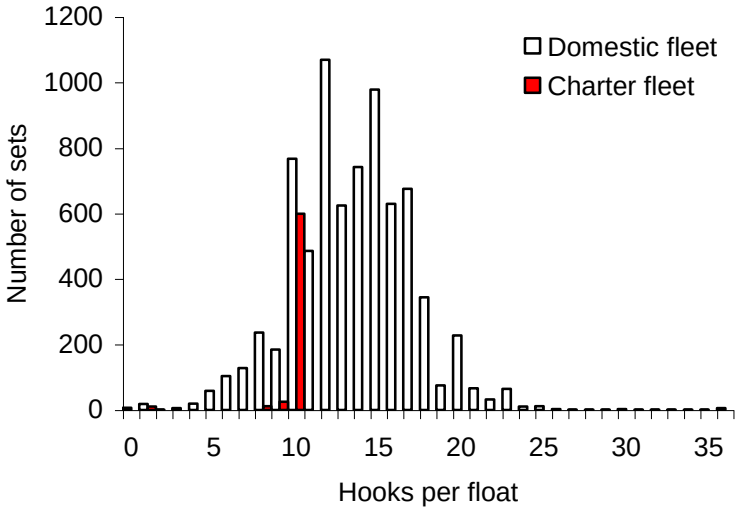

Figure 3: Frequency of hook per float strategies used on tuna longlines in New Zealand fisheries waters in 2004 and 2005 years combined, by fleet. Data from catch-effort logbooks.

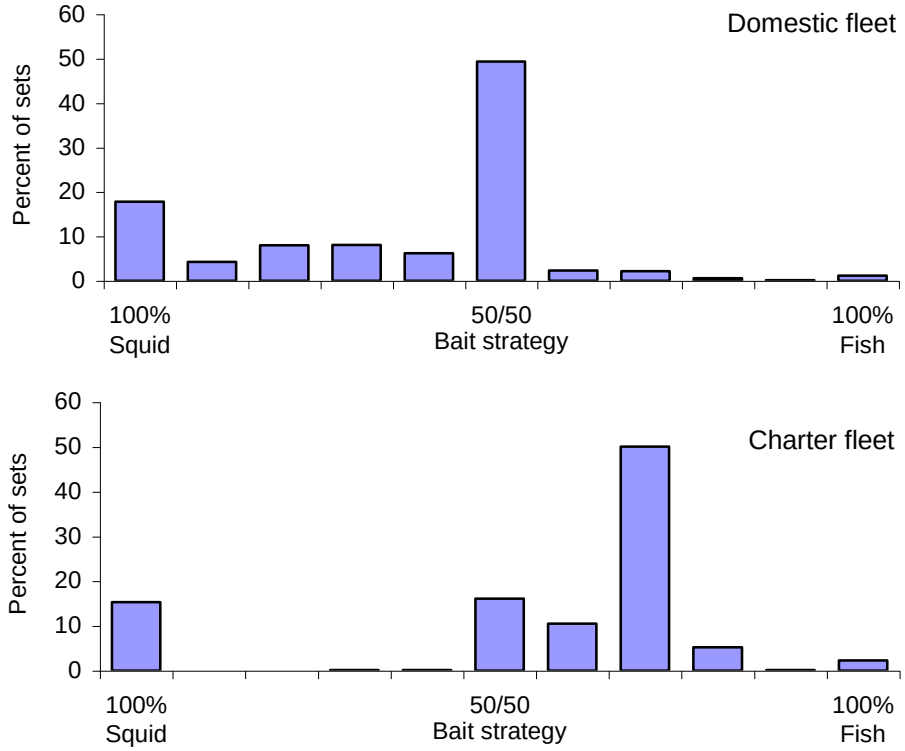

Figure 4: Frequency of bait strategies used on domestic (top) and charter (bottom) tuna longlines in New Zealand fisheries waters in 2004 and 2005 years combined. Data from catch-effort logbooks.

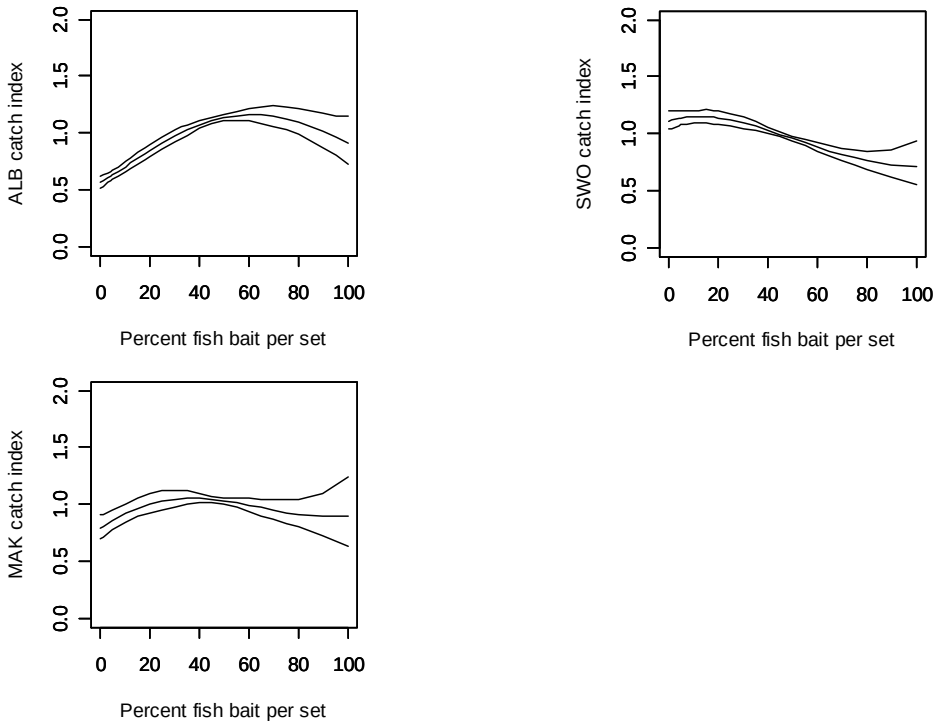

Figure 5: Estimated "fish bait" effects for albacore tuna (ALB – top left), swordfish (SWO – top right), and mako shark (MAK – bottom left).