Seabird/fisheries interactions
Final report of advisory officer

Crispin Keith
Biodiversity Recovery Unit
Department of Conservation
Wellington

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Abstract

In November 1998 participants of a tuna longline stakeholders meeting recommended that a technical officer be appointed to the domestic tuna fleet in order to meet with fishermen and provide assistance, advice and information on how to minimise seabird bycatch in the pelagic longline industry. This position initially commenced in March 1999, and continued until September 1999. During the course of the project, 41 fishers were successfully contacted, and productive conversations held. Tori lines were constructed for those vessels that required them. Five sea trips were undertaken during which time seabird observations were made, tori lines were tested and modified, and TDRs were deployed to study the sink rate patterns of the longline. An informal information folder was created to provide fishers with a basic reference guide to seabird bycatch mitigation.

1. Introduction

1.1 BACKGROUND TO THE FISHERY

The history of pelagic longlining in New Zealand is a relatively short one. Japanese longliners have been fishing in the area that is now the New Zealand Exclusive Economic Zone (EEZ) since the 1950s (Duckworth 1995), but it has only been in the last 10 years that there has been a significant increase in the number of domestic vessels fishing using this method.

The domestic fleet is made up of predominantly small vessels varying between 12 and 25 m in length. There are some 60-70 vessels based in ports all over the country, but generally these vessels are concentrated in ports on the east coast of the North Island from Gisborne up to Mangonui, and on the west coast of Auckland.

The pelagic longlining operation in the New Zealand domestic fleet is based on setting a single line ranging from 15 to 40 nautical miles (nm) in length. Most vessels set one line every 24 hours, though some will set 2-3 smaller lines in the same time period. Most fishers in the New Zealand domestic fleet try to set their lines at night, with general setting times dictated largely by the rest of the fleet. Because lines can be set as close as 2 nm apart, fishers must set in unison to avoid gear crosses due to strong tide or current. As a result, vessels fishing as a part of the main fleet will generally commence setting within an hour of each other, and will set parallel to a set of marks provided by the other vessels in the area. (Marks are positions given in latitude and longitude to describe where a given vessel will begin and end the setting of their longline.)

Setting of the longline takes 3-6 hours, dependent on vessel speed, longline length and the number of hooks set. Hooks are baited with either imported squid or a pilchard-like fish known by the fishers as Sanmar. Snoods may also have a luminous light-stick placed approximately 3m from the hook. (A snood is an 8-14 m length of 1.8-2.0 mm monofilament that is clipped to the backbone at one end and has the baited hook at the other.)

The longline is left to soak for 8-15 hours before it is hauled. Retrieval of the longline takes 5-10 hours dependent on the length of the line and the number of fish caught (the more fish there are the longer the line takes to haul due to the processing requirements of the fish).

The mainline, or backbone of the longline is made of a heavy gauge (3.0-4.0 mm) nylon monofilament. The backbone is suspended between plastic floats at intervals chosen by the vessel master. Between floats, 10-25 snoods are suspended from the backbone, according to preferred fishing depth. Depths targeted are generally between 40 and 200 m, dependent on target species.

Until recently the fishery was concentrated over the summer months, with a slow period over winter when many vessels switched to other fisheries, such as bottom longlining for bluenose or ling. However, as knowledge of tuna movement and behaviour through winter has improved, the fishery has become a year-round operation, with vessel masters and fishing companies becoming much more willing to move their vessels between ports and frequently travelling long distances in order to reach suitable fishing grounds. This has resulted in a fishery where water temperatures dictate a northward trend for the fleet over the winter months.

The domestic tuna fleet targets several species of tuna, but generally the target species will vary by season, water temperature, geographical area, and perceived market value.

The most commonly targeted species in the fishery are southern bluefin tuna, *Thunnus maccoyii,* and bigeye tuna, *Thunnus obesus.* During autumn and early winter months there is a concentration on southern bluefin tuna in more southerly latitudes, while bigeye tuna is caught year round, but moves north with the retreat of warmer water during winter. Lines set to catch one of these species of tuna will often catch the other species, and will often also catch yellowfin tuna, *Thunnus albacares,* northern bluefin tuna, *Thunnus thunnus,* and albacore tuna, *Thunnus alalunga.*

Other species commonly caught as bycatch include swordfish *Xiphias gladius,* moonfish *Lampris guttatus,* oilfish *Ruvettus pretiosis,* and rudderfish *Centralophis niger.* Although swordfish are not directly targeted, as there is a prohibition on the targeting of swordfish by longliners, these fish can make up a substantial proportion of the catch.

1.2 SEABIRD/FISHERY INTERACTIONS IN THE DOMESTIC PELAGIC LONGLINE FLEET

Demersal and pelagic longline fisheries overlap with the foraging zones of a number of seabird species. Seabirds have learnt that fishing boats provide a consistent and predictable supply of food in the form of squid or fish used to bait hooks, discarded offal from processed fish, used bait returned on the haul, and unwanted bycatch fish species.

The consistent supply of food means that fishing vessels are seldom without the company of seabirds during the fishing operation. Brothers (1991) reports an average of 10.8 albatrosses closely following Japanese longliners during setting off Tasmania, and Duckworth (1995) comments that there can be hundreds of smaller birds such as petrels and shearwaters following vessels in the New Zealand domestic fleet.

Seabirds can potentially become hooked or entangled in the longline during setting; the baited hook can be swallowed by the larger seabirds, such as albatrosses, while smaller seabirds tend to be caught by either becoming foul-hooked or entangled in the line.

While all seabirds are predominantly visual feeders, some species are better adapted to foraging behind fishing vessels than others. Larger seabirds such as albatross generally only conduct food searches from the air or at the surface, so only scraps or baits seen from above the water are likely to be taken, but many of the smaller seabirds search for scraps by swimming on the surface with heads dipped under the water. If a bait or scrap is located, then some of these seabirds are capable of diving very deep to retrieve them. Some smaller species of petrel, such as the sooty shearwater *Puffinus griseus,* have been recorded diving to a maximum depth of 67 metres while foraging for food, though more commonly these seabirds dive to maximum depths between 16 and 40 m (Weimerskirch & Sagar 1996).

Because they are much more proficient at retrieving baits than the larger albatrosses, smaller seabirds may bring the baits that would otherwise be unavailable to the larger species back to the surface. Often when the bait has been retrieved, the larger, more aggressive species, such as black-browed mollymawks and wandering albatross, will chase the smaller species away, and eat the scrap or bait themselves (Brothers 1991).

1.3 BACKGROUND TO THE TECHNICAL OFFICER POSITION

In a stakeholders meeting in November 1998 it was suggested that a technical officer be appointed to the domestic tuna fleet in order to meet with fishermen and provide assistance, advice and information on how to minimise seabird bycatch. It was agreed that the appointee would visit each port used by the northern tuna longline fleet and visit with the skippers on each vessel, providing advice on ways to improve the effectiveness of any seabird streamer (tori) lines in use. Where no tori line existed, the advisory officer would assist in the design and construction of one for that vessel.

The person would also discuss other ways to prevent seabirds from accessing baited hooks during the setting and hauling of the line, explain why the capture of seabirds was a concern, and provide the vessel with other information relevant to the fishery. Fishing trips would be undertaken on some vessels, if required, in order to provide the best vessel-specific advice on seabird bycatch mitigation.

It was hoped that the position would also provide a means of collecting feedback and gaining information from vessel masters and other fishers by listening to their opinions and experience on how to prevent or reduce the problem of seabird bycatch.

1.4 OBJECTIVES FOR PROJECT

The key objectives for the project were based around a liaison/education role within the tuna longline fleet. Key tasks for the project included:

- Meeting with the skippers of as many vessels in the North Island tuna longline fleet as possible.
- Providing vessel-specific advice on how best to address the problem of seabird bycatch.
- Explaining to the skippers why seabird conservation issues are of concern, from both a conservation and fisheries perspective.

Further to these key objectives were the aims of developing good working relationships with as many skippers in the fleet as possible and obtaining a high degree of knowledge of the tuna fishery in order to relate better to the fishers, and to provide the best possible advice.

2. Results

During the course of the contract, 41 vessels in ten ports were visited, and constructive conversations were had with the fishers on most of those vessels. Nine other vessels were approached on one or more occasion, but were unoccupied, unwilling, or unavailable to talk.

The majority of fishers were either approached at the vessel berth, met through other fishers or company representatives, or contacted the advisory officer directly themselves. Fishers were given a brief summary of what the project was about and what the project was trying to achieve. Although conversations were free-flowing and often covered a broad range of topics, a key range of questions was covered in any given meeting. These essentially covered the length of time the skipper had been longline fishing, whether or not the vessel held and employed a tori line during the normal fishing operation, and general fishing strategy (set times, haul times, regions most commonly fished). This information was used to gain a better understanding of the fishery as a whole. Other means of seabird bycatch mitigation that the skipper used or had previously used were recorded, as were any opinions or observations that the fishers had made on the behavioural patterns or species presence of seabirds that were commonly encountered. A Vessel Questionnaire form was used to ensure a degree of consistency for the more salient topics that were covered.

In conversations, the development of the fishery itself was often discussed, as were fishers opinions on subjects such as the Conservation Services Levy (CSL) and the respective roles of the Department of Conversation and the Ministry of Fisheries in the tuna longline industry. Concerns raised by fishers on various issues related to these roles (departmental research priorities, quota and compliance issues, and the growth of the industry without appropriate control mechanisms) were discussed, and referred to more appropriate sources for information if it was required.

The advisory officer was also contacted several times regarding the identification of unusual species of fish that were caught and brought back to port. These were sent to the Museum of New Zealand for identification. On one occasion, the advisory officer was given a tag recovered from a blue shark, and asked to send it to the appropriate place on behalf of the vessel.

2.1 FISHER RESPONSE TO THE PROJECT

There has been a range of responses to the advisory officer project and position, though generally, and for the large majority of fishers, response to the project has been very positive. Fishers were often pleased to receive information on seabirds, and showed a great deal of interest in being able to learn more about the species that they encountered every day. Some described the behaviour of some species in great detail, and were genuinely concerned with the public and political perceptions that surrounded their industry. Many pointed to the historical and superstitious relationship between people in the maritime professions and albatrosses as a reason to be concerned with preventing seabird bycatch.

Many fishers conveyed that, although they considered that there was no "seabird problem", they appreciated the provision of a personal approach by the department in the form of an advisory officer. The idea of having a single, approachable and available person who has a working knowledge of the industry and the people involved was well received. Skippers often commented that it was good to be able to talk directly with a representative from the department, rather than receiving correspondence from an anonymous representative somewhere inside the department.

As an extension of this, it was felt that the position of advisory officer has provided fishers with someone whom they can approach to talk about their concerns. This is extremely important to many fishers, who can give their opinions as individuals without having to feel they represent the whole tuna longline fleet.

Fishers who had taken the advisory officer on sea-trips found the information gained from time-depth recorders (TDRs) extremely valuable, as it provided them with knowledge of the behaviour of the longline over the course of a set. It also provided confirmation on depths fished by hooks in different positions of the longline, and how tide, weather, or gear configuration can affect the depths that the longline will fish. One fisher approached the advisory officer some months after the sea-trip and commented that since he was given the information provided by the TDRs, he had caught more southern bluefin tuna than ever before.

These fishers also greatly appreciated having someone from the Department of Conservation on board who could not only provide information on seabird-fishery interactions, but was knowledgeable about the fishery, and could also function as a part of a working crew. This meant that disruptions to the fishing operation were kept at a minimal level.

Fishers also commented that they appreciated having an advisory officer who was willing to go to sea on the small domestic vessels to observe and learn first-hand the level of seabird-fishery interaction. They also appreciated that the advisory officer was willing to listen to the fishers themselves rather than relying on very high (and possibly inaccurate or inapplicable for New Zealand) figures of seabird mortality used by some Non-Governmental Organisations (NGOs) and the media.

Those fishers who were opposed to the project largely objected because they believed that CSL money should be spent on projects that benefit them directly, and that the position of advisory officer provided them with no visible benefit. As an extension of this, a number of fishers objected to the levy as a whole on the basis that they believed that moneys gathered were being used to fund research in non-longline related issues, and that the levy was simply another method of "revenue gathering" for the government.

Some fishers stated that, although they felt that the advisory officer position was beneficial to the fishery and the relationship between the industry and the Department of Conservation, the likelihood of long-term change as a result of the project was not great. Reasons for this were largely based on the fact that the position of advisory officer was a temporary one, and that, once the project was finished, any impetus created by the person in the position would be lost. Any personal or professional relationship, or indeed, knowledge of the domestic tuna fleet, that is established over the course of a contract period between the advisory officer and tuna fishers would likewise be lost on completion of contract.

A small number of fishers felt that the advisory officer's position was only a token one, and that there would be little chance that, even if they gave them their suggestions, opinions or feedback to the department through the advisory officer would actually get through to anyone who "mattered". The end result would be that public and political perceptions of the fishers and the fishery as a whole would not be changed by the position.

2.2 PERCEPTION OF THE PROBLEM

By far the majority of fishers interviewed (98%) did not believe that they had a "seabird problem". When the number of birds caught in the past was asked for or volunteered, most of the fishers said that they had caught 5 or fewer seabirds in the past year, most of which were "muttonbirds", and many of which were caught on the haul and subsequently released alive.

Fisher perceptions were largely based around the belief that the domestic tuna longliners did not have a seabird bycatch problem as is perceived by the public and that this perception is a result of media and departmental speculation.

2.3 SKIPPER OPINION ON FACTORS INFLUENCING SEABIRD CAPTURE

Fishers often offered their opinion on what the major causes of seabird capture were. These can mostly be grouped into generalised categories. These categories are listed by the number of times that each issue was expressed. Percentages indicate the number of mentions, unprompted, by fishers, but these figures may not necessarily accurately reflect the attitudes of all longline fishers. Those categories without percentages given were mentioned less often, but still frequently enough to be included here.

1. Most seabird bycatch problems are associated with setting lines during the day. Most fishers believed that, because they set their lines at night when there are fewer birds present, they had no problem with the bycatch of seabirds, though many did concede that there were more birds active at certain times of the month and in certain conditions. (92%)

2. Other domestic fisheries kill more seabirds than domestic tuna longliners, but are not levied to pay for any related research. Many tuna fishers had experience in other fisheries where they had encountered what they perceived as a much higher rate of seabird capture. Fisheries that were pointed out as having high seabird capture rates (in order of mention) were snapper longliners, other bottom line fisheries, and factory trawlers. (61%)

3. Foreign licensed or joint venture longline vessels catch more seabirds than domestic longline vessels. (56%)

4. The area being fished can affect the rate of seabird catch. In particular, areas mentioned were East Cape, and the fishery on the south-western coast of the South Island.

5. Most seabirds are caught around the full moon when seabird activity is higher.

Many of the factors that are expressed here are the same as or similar to those noted in Nelson (1998) and Duckworth (1998), which would indicate that there have been very few changes in the overall perception of the problem of seabird bycatch in the past few years. Three of the factors identified here (daylight setting, geographical area, and moon phase) have been previously recognised by researchers, but the fact that there has been little movement to improve the situation, or further research on reducing the impacts of these factors, is indicative of the stasis that is surrounding the matter of seabird bycatch.

2.4 MITIGATION MEASURES SUGGESTED BY FISHERS IN THE DOMESTIC TUNA FLEET

Although there has been little change in overall perceptions of the problem, many fishers had given the situation some thought, and gave suggestions on how they had previously prevented or reduced seabird bycatch on their vessels. Some suggestions were not likely to be effective as mitigation measures, but other ideas were often well thought out and were likely to help reduce seabird bycatch. Many of the fishers had employed these methods, not because of seabird bycatch issues, but because seabirds were thought to be removing a significant number of baits from hooks, thereby reducing the efficiency of the fishing operation. The ideas are listed below with an explanation or comment on their effectiveness.

1. Night setting. This was by far the most common mitigation measure used by the domestic tuna fleet. Night setting has been shown to significantly reduce capture of seabirds (Duckworth 1995) although its effectiveness around the full moon period is reduced (FAO 1999).

2. Bait thawing. Thawed baits sink faster than frozen baits (Brothers et al. 1995), meaning that the baited hook is available to seabirds for a shorter time.

3. Reduction of deck lighting during setting. This measure reduces the amount of light on the water thereby making it more difficult for seabirds to see baits that would otherwise be hidden by darkness.

4. Dropping baited hooks into the wash of the vessel. Essentially the idea is that a baited hook dropped into the down-cycle of the propeller wash will be rapidly pulled down to a depth that will be safe from foraging seabirds. There is some evidence to suggest a "sweet-spot" in the propeller wash of longline vessels (Okazaki 1998), but information gathered from TDRs on domestic tuna longliners during this project suggests that, while baited hooks may initially sink very rapidly in the propeller wash, they will almost always be caught in the turbulence created by the wash, and very quickly be spun back up to within 1-2 m of the surface. Baited hooks have been recorded at these very shallow depths more than 60 seconds after leaving the vessel. Results of these trials will be described in a separate report (Keith in prep (a)). This method is not recommended as a means of reducing seabird bycatch.

5. Line guides. These work on the opposite principle of the previous method. Essentially a length of monofilament is run from the stern quarter, then the baited hooks are cast over this line, which holds the hooks outside of the propeller wash, ensuring they are not caught in turbulence. Although there have been no tests done on the effectiveness of

this method, it is likely to have a positive effect on the sink rate of baited hooks.

6. The stern quarter water spray. This idea has been trialed by a number of skippers in an attempt to prevent seabird capture during the hauling of the longline. A deck-hose is set up to spray water out from the stern quarter on the side of the vessel on which the gear is being hauled. The most common approach used by seabirds during the haul of the vessel is generally from the stern quarter (pers. obs.), so a strong spray of water may discourage seabirds from pursuing baited hooks that trail at the side of the vessel during the haul.

2.5 TORI LINES CONSTRUCTED FOR THE PROJECT

A high proportion of fishers visited during the course of the project were not interested in the tori lines being offered by the department. Reasons for this included the belief that, because they set at night, there was no need for a tori line, or the fact that they already had a tori line on board.

Many had used tori lines in the past, but had experienced difficulties in the use of them. The risk of entanglement in fishing gear was often given as a major reason for discontinuing their use in the past, or hesitance in employing one now. Tori lines were also refused because fishers had found that those they had used previously were too complicated to use easily as a part of the normal fishing operation, particularly on retrieval. A small proportion of fishers believed that tori lines simply did not work, and that there were other more effective ways of preventing seabird bycatch (predominantly night setting).

Most were aware that tori lines were compulsory, but not all were aware that the use of tori lines was compulsory for every set, instead thinking that it was compulsory only to carry a tori line on the vessel.

As a result, tori lines were made up for only 6 vessels during the project, with additional requests for 2 lines received at the end of the project. Some vessels had their own tori lines that appeared to be acceptable, or would be with a few minor or moderate changes. The appropriate suggestions were made to the skippers of these vessels.

It is hoped that with the continued relationship between an advisory officer and the domestic tuna fishers, a greater awareness of the legal requirements for the use of tori lines will be promoted. In addition, the introduction of tori lines that are increasingly easy to use and safe from the potential for entanglement should reduce the opposition that many fishers hold against using tori lines. From this point, education will be the key to promoting a more widespread use of tori lines.

Tori line design

The tori lines constructed for each vessel differed according to the requirements of the skipper, or the limitations of the individual vessel, such as the availability of a superstructure that provides a suitable attachment point for the line. Despite these differences, the make-up of the tori lines remained relatively consistent between vessels. The design used was based on a tori line developed in Keith (1999), though with the benefit of on-vessel trials, it was possible to further refine and develop the design.

A description of key issues in the development, design and construction of tori lines is given in Keith (1999):

In designing a tori line there are some basic conditions that [have] to be met in order for the line to be both useful and utilised by the fisher. Firstly there has to be minimal opportunity for entanglement with the fishing gear. If a fisher considers that there is a risk of losing expensive fishing gear and valuable fishing time due to entanglement problems with the tori line, there is an immediate disincentive to deploy the tori line. The tori line must also be simple to construct and repair.... An extension of this concept is that the construction materials need to be readily available to the fisher. Streamers must be constructed so that they move freely and unpredictably and do not wrap around the backbone of the tori line, rendering themselves useless for their purpose of scaring birds.

The tori line must also comply with legislative requirements. An essential facet of the legislative requirement is the attachment point at the stern of the vessel. By law this shall be approximately 4.5 m above the water at the stern. This height is critical because it essentially dictates the length of the aerial section of the tori line which is the part of the tori line that provides the bird scaring effect over the longline. Any attachment point lower than this restricts aerial coverage over baited hooks and thus substantially reduces the effectiveness of the tori line. A high attachment point has the further advantage that it also lessens the risk of entanglement with wayward branchlines as they are thrown out of the boat after baiting. The tori line must be attached at a point that suspends the tori line directly above where the baited hooks enter the water.

Construction materials

A number of different tori line designs were constructed and tested over the course of the project. The greatest difference in construction materials was the use of alternative backbone material. Tori lines were constructed and trialed using 4.0 mm orange twine, 4.0 mm nylon green danline, and white 3.5mm monofilament. Red monofilament was trialed for visibility in low light conditions, but was not as visible as white. Final tori line designs were constructed using white 3.5 mm nylon monofilament, predominantly as this appeared to be the most visible material in low light conditions. Also a monofilament backbone reduces the chances of becoming caught or entangled with a stray hook or float. Lastly, replacement or repair of tori lines constructed using a monofilament backbone can be done using materials that are largely already on the vessel.

The lines were constructed to be between 150 and 220 m in length, dependent on the requirements of the vessel, and, as previously stated, were coloured white for better visibility in low light conditions. (If the skipper did not approve of other methods as a means of increasing drag to create a longer aerial section, a longer line was provided, as increasing the length of the line in the water provides a greater degree of drag.) Between 8 and 12 streamers of varying length were attached to the backbone at 5 m intervals. Streamers were constructed using lengths of 3 mm luminous rubber tubing with a small (30 cm) section of 2.02 mm monofilament crimped inside the trailing end of each streamer to increase rigidity and reduce the chance of them wrapping around or tangling with fishing gear. Each tori line used 12-30 rubber washers to improve drag while providing little opportunity for tangling with a hook.

Each tori line was provided to vessels pre-wound on to a plastic hose reel for easy deployment, retrieval and storage. Including the hose reel, the cost of a constructing a tori line using new materials was approximately $110; a more detailed breakdown of costs is provided in Appendix 1. More details on the design and at-sea testing of tori lines developed during this project are provided in a further paper (Keith, in prep (b)).

3. The tuna fishers folder

Because not all the necessary information can always be passed on effectively in the course of one of two meetings, a folder was prepared for distribution amongst the domestic tuna fleet. The folder includes a wide range of subject matter on issues and subjects that affect the domestic tuna fleet and perhaps provides a more full description of the advisory officer's role in that fleet.

Information covered in the folder included a basic identification guide for the most common seabirds that are likely to be seen around fishing vessels in the domestic tuna fleet, the research that the department is doing in the area of seabird bycatch mitigation, and suggestions and instructions for tori line construction and regulations. Some information on the fishery itself was included, as was a basic description of the use of archival tags on longline gear as a method of understanding its behaviour over the course of a set.

The response to the folder to date has been extremely positive, with fishers finding it informative and useful. The seabird identification sections have been found useful for those fishers interested in improving their knowledge of seabirds that are often encountered.

4. Sea trips

During the course of the contract, five sea trips were undertaken on four small domestic tuna vessels. Trips averaged six days in length and included the setting and retrieval of, on average, four longlines. Several primary reasons existed for these sea trips:

1. To gain a comprehensive understanding of the operation of a small domestic longliner in the North Island tuna fleet.

2. To gain a better knowledge of seabird/fisheries interactions in this fishery, and to develop a better understanding of what the potential is for seabird capture in different situations.

3. To provide, manufacture, prepare and test tori lines for the vessel. If the vessel already had a tori line, advice was given on how it could be improved.

4. To provide the fishers with a description of the depth of their longlines over the course of the whole soak period, and to gain information for the Department of Conservation on the sink rate of baited hooks using information gathered from timed-depth recorders (TDRs) attached to snoods.

In order to understand the fishery more completely, one trip was taken in every main region fished by the North Island tuna fleet. Fishing trips were carried out from the western coast of Auckland up to Cape Reinga, with two trips corresponding to the same latitudes on the eastern coast, one based from Auckland, one from Tauranga. In the more southerly latitudes on the east coast, one trip was spent fishing between East Cape and Gisborne, and another was undertaken in the Bay of Plenty.

Twenty sets were observed in full or in part, with five sets containing a part or full daylight component. It should be noted that this is not a normal proportion of sets done during daylight hours. The skippers of these vessels were kind enough to shoot their gear during daylight hours so that the advisory officer could make observations on seabird behaviour, abundance, and seabird interaction with the fishing vessel and the tori line.

These observations are discussed more fully in a further paper (Keith, in prep (c)).

5. Timed-depth recorder results

Initial TDR results indicate that there is wide variation in the sink rate of baited hooks, but that these variations are relatively consistent between vessels. According to data collected from TDRs, a baited hook may sink at a rate that results in the hook reaching a depth of 5 m by the end of the aerial section of the tori line. This translates to approximately 50 m, or 15 seconds after the baited hook is thrown clear of the vessel. In other situations, such as if the bait is not cast clear of the vessel wake, the bait may be as shallow as 1 m at a distance of 200 m, or approximately 1 minute after the snood has been thrown clear of the vessel.

Preliminary results, however, show that a typical baited hook (on a 14 m snood using 2.02 mm nylon monofilament and a 17/0 Eagle claw hook baited with approximately 150 g squid) attached to a backbone being spooled directly off the longline reel (no line shooter) will sink at a rate of 0.092 m/s (n=22), which puts the baited hook at a depth of approximately 1.4 m by the end of the aerial section of the tori line (50 m). Aerial section of tori lines varies from vessel; if the minimum height of attachment as set in legislation is adhered to (4.5 m), an aerial section of around 35 m is achieved. This figure is markedly increased on vessels with the scope for higher attachment of the tori line. Again, it needs to be stressed that there is a very high degree of variation in these results, as a direct result of a large number of factors. Much of this variation can be attributed to such factors as weather effect, and particularly crew performance while casting the baits outside the vessel wake. Sometimes a mistimed casting of the snood can result in the baited hook being dragged back into the propeller wash. These factors and the general variation expressed in these results are discussed more in depth in Keith (in prep (a)).

6. Discussion

The advisory officer project has provided a good base for a better understanding and better relationship between the domestic tuna longline fleet and the Department of Conservation. Longline fishers have long felt that they were being unfairly targeted by the department with the CSL, without contributing much to the problem itself. Of particular concern are a small number of fishers who state (whether in jest or otherwise) that the amount paid in conservation levies not only justifies the capture of seabirds, but in some situations may promote it.

It needs to be stated that this opinion represents a very small minority of fishers in the industry, and that the great majority of fishers are concerned with accidental seabird capture and take at least some steps to avoid it. Certainly, from observations made and discussions held during the course of this project, it does not appear that there is any single vessel among the domestic fleet that could be considered as a "problem" vessel. It is true, however, that there is a relatively consistent low level of seabird capture within and between domestic vessels, which means that seabird bycatch is still an issue for the fleet as a whole.

Fishers mostly accept this explanation, but still feel that they pay too much for the number of seabirds that they personally catch. They also understand that other fisheries, such as the driftnet fishery, have closed because they could not find a satisfactory solution for their problem, and do not want the same to happen to their fishery.

A large factor in the success of this position is the development of trust through familiarity, which by definition cannot exist within the framework of an ephemeral or temporary position that is passed around from contractor to contractor. The development of trust means that a greater understanding of the industry can be gained on a personal level with fishers who might not otherwise be involved in negotiations or meetings with other parties, or with the department.

Often, during organised or more formal gatherings, fishers do not feel that they can express their opinions freely and without opening themselves to criticism or condemnation by their peers. They do not want to be seen as saying something that may be taken as anti-industry, or pro-department, or taking a stand that may be considered as representative of the industry as a whole.

7. Conclusions

The need for the development of a better relationship between fishers and the department has been highlighted several times in this report. As a function of this, there needs to be a degree of consistency in maintaining the relationships that have been developed as a part of this project. A good working relationship is the key to better understanding the needs of the industry when it comes to conservation issues, and this can only be developed if there is consistency and continuity with the people that are developing the relationships.

A very high proportion of fishers expressed a desire to have more feedback on research being done in relation to their CSL moneys. Fishers are genuinely interested in what is going on with issues related to their industry, and have a real desire to understand more of what is going on around them. It was expressed that perhaps an advisory officer was a good means of providing this feedback.

The position of advisory officer, seabird/fisheries interactions was essentially created to provide the domestic tuna longline fleet with someone who could act in an education/liaison capacity for the Department of Conservation. The position allowed the development of a good working relationship with a number of fishers in the fleet, and has provided others with an understanding of the issues that the department is trying to address. Overall response to the project from fishers has been very positive, and in order for the progress that was achieved in the project to be maintained, there needs to be continuity. This can be achieved by contact on a regular basis so that relationships and contacts that have been developed are maintained.

8. Acknowledgements

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Appendix 1 Cost approximation for tori line design

Materials	Units	Unit price	Total
3.5 mm monofilament	Approx. 150 m	$0.185/m	$27.75
Plassay garden hose reel	1	approx	$40.00
4.2 mm Sleeve w. 5/0 crane swivel	10	$0.50	$5.00
4.5 mm aluminium double sleeve	2	$0.18	$0.36
3.9 mm aluminium stopper	26	$0.16	$4.16
3.0 mm luminous rubber tubing	approx. 20 m	$1.08	$21.60
2.02 mm nylon monofilament	approx 3.0 m	$0.92	$2.76
20 mm rubber tap washers	12	$0.60	$7.20
Total ($NZ)			$108.83