New Zealand Fisheries
Assessment Report
2009/6
February 2009
ISSN 1175-1584

Characterisation of pelagic fisheries using observer data

S. J. Baird

Characterisation of pelagic fisheries using observer data

S. J. Baird

NIWA
Private Bag 14901
Wellington 6241

New Zealand Fisheries Assessment Report 2009/6
February 2009

Published by Ministry of Fisheries
Wellington
2009

ISSN 1175-1584

Baird, S.J. (2009).
Characterisation of pelagic fisheries using observer data.
New Zealand Fisheries Assessment Report 2009/6. 58 p.

This series continues the informal
New Zealand Fisheries Assessment Research Document series
which ceased at the end of 1999.

EXECUTIVE SUMMARY

Baird, S.J. (2009). Characterisation of pelagic fisheries using observer data.

***New Zealand Fisheries Assessment Report 2009/6.* 58 p.**

During 2004–05 and 2005–06, Ministry of Fisheries observers were placed on vessels in various fisheries targeting pelagic species: purse seine fisheries for blue mackerel (*Scomber australasicus*), jack mackerels (*Trachurus* spp.), pilchard (*Sardinops neopilchardus*), and skipjack tuna (*Katsuwonus pelamis*) data collection; inshore trawl fisheries for data collection on trevally (*Pseudocaranx dentex*) catch and kingfish (*Seriola lalandi*) bycatch; tuna longline for target and non-target catch, and incidental catch of protected species. The overall objectives were to *describe pelagic fisheries and significant changes in pelagic fisheries through time utilising observer data* and to *inform future observer data collection needs and utility of observer data in stock assessment.*

This report presents the work completed to address the seven objectives from data available up to 30 April 2006. The objectives related to observed purse seine fishing, inshore trawling, and shark handling practices of the tuna longline fleets. Data for six purse seine trips on small- to medium-sized vessels are described. Vessels worked with spotter planes to detect and target schools. Much of each day in a fishing trip was spent searching for schools, steaming to fishing grounds, and in port or at anchor. Gear difficulties limited the efficiency of some operations and resulted in large losses on some sets. Few non-target fish were caught and fishing appeared to pose no danger to seabirds or marine mammals. Observers were new to purse seine fisheries and developed routines around each vessel's activities. Over the duration of the trips, the development of the data collection forms evolved through feedback from observers to Ministry of Fisheries officials. Some recommendations are provided with the aim to increase the consistency of the data collection and the value and effectiveness of the data.

Three observer trips were focussed on inshore fisheries to collect data on kingfish bycatch (one trip) and trevally target fishing (two trips) off the northern west coast of the North Island. Kingfish were between 50 and 130 cm long and similar numbers of males and females were caught. The length frequency distributions of the trevally catch were different between trips: most fish on one vessel fishing in December were 33–38 cm long compared with 38–43 cm for fish caught on the second vessel during January.

Shark finning practices in the tuna longline fisheries are broadly described. At least 26 shark species were caught on observed surface longlines, and blue sharks (*Prionace glauca*), mako sharks (*Isurus oxyrinchus*), porbeagle sharks (*Lamna nasus*), school sharks (*Galeorhinus galeus*), and various deepwater dogfish accounted for most of the captures. Over 80% of all observed sharks were landed alive. Blue sharks were usually finned by Japanese fishers, but not retained for further processing, whereas there were no real trends in the domestic blue shark handling data. There was a decreasing trend in the proportion of alive sharks, other than blue sharks, that were finned (mainly mako and porbeagle sharks). Lack of completion of some data fields limited the description of the fate of sharks that were finned and/or retained.

1. INTRODUCTION

Observer data have been used in New Zealand commercial fisheries, principally in midwater and deepwater trawl and longline fisheries operated by larger vessels, to describe various characteristics of the catch and effort. These descriptions have covered fishing methods, environmental factors, target and nontarget catch information, and biological parameters of the catch. Little such information has been collected from fisheries that target coastal fish species and operate in more inshore waters.

Observer projects OBS2004/05 and OBS2005/06 (Table 1) were set up by the Ministry of Fisheries (MFish) to specifically target data collection from:

- purse seine fisheries for tuna (primarily skipjack *Katsuwonus pelamis*, but also *Thunnus* spp.), kahawai (*Arripis trutta*), blue mackerel (*Scomber australasicus*), and pilchard (*Sardinops sagax*), and
- inshore trawl fisheries for trevally (*Pseudocaranx dentex*) and where kingfish (*Seriola lalandi*) is caught as bycatch.

These projects should provide data to describe the non-target catch and fishery operations for the specified fisheries; aid in the determination of future research programmes to underpin stock assessments and assessment of stock status in pelagic fisheries; and assess the usefulness of the data collected and the method of collection.

Table 1: Number of observer days planned and achieved (Alan Martin, MFish, pers. comm.) for 2004–05 (July–June) and 2005–06, for species in PEL2005/01 and with relevance to the project objectives, based on specifications given in OBS2004/05 and OBS2005/06.

Target species	Fishing method	Fishing year	No. days planned	No. days achieved
Blue mackerel (EMA)	Purse seine	2004–05	20	13
	Purse seine	2005–06	18	17
Pilchard (PIL)	Purse seine	2004–05	10	0
	Purse seine	2005–06	9	9
Kingfish (KIN)	Trawl (bycatch)	2004–05	20	7
	Trawl (bycatch)	2005–06	18	15
Domestic tuna	Longline	2004–05	600	260
		2005–06	604	227
Charter tuna	Longline	2004–05	320	225
		2005–06	266	212
Trevally (TRE)	Trawl	2005–06	20	17
Kahawai (KAH)	Purse seine	2005–06	20	11
Skipjack tuna (SKJ)	Purse seine	2005–06	63	66

The specific objectives of this work were to describe:

1. the blue mackerel purse seine fishery based on observer data collected during 2004/05,
2. the kingfish trawl bycatch fishery based on observer data collected during 2004/05,
3. the pilchard purse seine fishery based on observer data collected during 2004/05,
4. the kahawai purse seine fishery based on observer data collected during 2005/06,
5. the trevally trawl fishery based on observer data collected during 2005/06,
6. the tuna purse seine fishery based on observer data collected during 2004/05 and 2005/06, and to review
7. shark conversion factor data collected by observers and the shark finning practices as observed in the tuna longline fishery.

The report is collated in three sections: the first discusses observer data collection for the purse seine fisheries; the second summarises observed trawl data relating to kingfish bycatch and trevally catch; and lastly, discusses shark finning practices based on observed surface tuna longline data.

2. OBSERVER DATA COLLECTION FROM PURSE SEINE VESSELS, 2004–05 AND 2005–06

The collection of observer data from purse seine fisheries in New Zealand waters resulted from a request from the Pelagic Stock Assessment Working Group convened by MFish. The rationale for this request was the need for independent data collection that allowed detailed quantification of the catch on a set-by-set basis, and the provision of associated effort and biological data.

Documentation provided by the Data Management Group of MFish stated that the main requirement of this data collection is to provide basic biological information for JMA, EMA, PIL, and tuna (SKJ) stock assessment and purse seine fishery characterisation. The project OBS2004/05 was established to collect specified data to *describe the catch (including discards/bycatch) in the JMA, EMA, and tuna fisheries; to characterise the SKJ, PIL, and EMA fisheries; and to collect biological data about JMA, EMA, tuna, and other species as directed, from their respective fisheries. The directive is to provide "exploratory coverage of fishery characterisation", and the data is "not intended to provide a statistical sample".*

Under OBS2004/05, about 60 days of observer coverage were requested for domestic purse seine effort in 2004–05 (July–June), 75 days in 2005–06, 115 days in 2006–07, and 150 days in 2007–08. Seventy-five percent of the planned observer days for blue mackerel during 2004–05 and 2005–06 were achieved (see Table 1). No days were achieved for pilchard in 2004–05, but 90% were achieved in 2005–06. Just over 50% of the planned 20 days for kahawai in 2005–06 were achieved, though the data show that the target for the "kahawai" trip was actually jack mackerel and that 7 days were achieved. It appears that, due to the amount of available kahawai quota of the vessel or the market demand for kahawai, the vessel was not able to target kahawai. The data available from skipjack observer coverage at 31 March 2006 cover 40 days fishing and thus exceed that planned. An unknown number of days were completed on a superseiner (MFish Observer Programme), but these data were not available at the time of analysis. These data probably are included in the achieved total given in Table 1.

Based on the available data, this report presents a summary of observer data collection for the observed purse seine effort for blue mackerel and pilchard in 2004–05, jack mackerel in 2005–06, and skipjack tuna in 2004–05 and 2005–06; inshore trawl observer data, including the bycatch of kingfish; and shark capture practices used in the tuna surface longline fisheries. The year ranges of 2004–05 and 2005–06 refer to the July–June years used by the MFish observer programme. The report also assesses the usefulness of the data and the collection method by identifying any problems with the data collection.

2.1 Purse seine data collection

Observers are required to fill out forms that relate to the fishing activity: a purse seine catch effort logbook and an activity log (Appendix A). These forms were developed specifically for New Zealand purse seine fisheries, with the current observer forms for other fisheries and those used by observers on purse seine vessels in waters governed by the South Pacific Community. The forms were designed with consideration of other relevant data sources: commercial data collected on Catch Effort Landing Return (CELR) forms, aerial sightings database (*aer_sight*) that contains records of aerial search effort and sightings of pelagic schooling species, and shed sampling (including catch from purse seiners operating out of Tauranga) data stored in the *market* database.

Initial data collection from trials for purse seine observers

The initial data forms developed by MFish Research Data Management were first trialled by one experienced observer on a relatively large domestic purse seine vessel (36 m in length) during a blue mackerel trip; this observed trip is included in the trips discussed below in the results section. A second observed trip to trial forms ended prematurely when fishing was not successful. A third trip was undertaken on a similar sized vessel (33 m in length) targeting skipjack (see trip information below). Feedback from this observer, and others from subsequent trips, resulted in ongoing refinements to produce the forms presented in Appendix A. Changes included:

- data collection on net rolling and thus all aspects of the fishing process,
- further development of the "loss" codes to include fish loss over the top of the net,
- additions to the activity log codes to clarify ambiguous wording or codes,
- space for comment when the observer was not present, and
- amendments to allow direct linkage to *aer_sight* or *market* fields.

Other feedback from observers noted the difficulty in getting a catch sample for biological data collection due to the nature of the fishing activity (for example, during brailing) and lack of deck space. The use of different sized vessels in these trials provided some insight into vessel-specific aspects of the fishing activity that may affect the successful completion of observer duties.

Details of purse seine data collection

Data collection for the set catch and effort included the date, position, target, spotter plane details, environmental data (sea state and temperature), time of all aspects of the fishing operation, and catch details (including losses). Codes were provided to describe the method of assessing catch (and loss). The activity log collected data on specific activities and their duration. These forms were supplemented with diary entries which described aspects of the fishing that were not readily captured in observer logbooks (see Appendix A for detailed description of data collection, including the most recent version of the main forms). The final summary document produced from each trip is the trip report. The observer forms were linked to the MFish catch and effort forms with the provision on the *Purse seine catch effort set details* form for recording the Catch Effort Landing Return form number.

Data for all sets observed were recorded, regardless of the outcome. The start of a seining operation was determined by the time the skiff and the net were deployed. The start time for each of the following activities was recorded:

- Set start — when skiff was unloaded.
- Pursing — beginning (winch on) and end (rings up).
- Net rolling — when the net was gathered to confine the catch to the bunt end.
- Net sacking — when the catch was concentrated next to the hull.
- Brailing — beginning and end of loading the catch onto the vessel.
- Set end — when the skiff was on board.

Note that "net sacking" was not included as an activity separate from "net rolling" on the forms summarised in this report. If the vessel was unable to secure any catch, the set was reported as *skunked* and the observer noted the parts of the process that were not achieved.

The catch details required to be completed by the observer included the following.

- Total greenweight at the surface — estimated before pursing (for a skunked set this estimate was put in the *Losses* column and the event was documented in a *Comments* section). A three-part method code described how the estimate was determined.
- Total greenweight on board — estimated weight of all fish brailed onto the vessel (the transfer of any part of the catch to another vessel was recorded).
- Result of the set — the proportion of the catch lost.
- Type of brail used.
- Losses — including the estimated amount (and how that estimate was determined), and the (loss) event, the cause, and the time it occurred.
- Species codes and names of all quota (and if known, all non-quota) species.
- Processed state of each species (though most are landed *green*).
- Calculated greenweight of each species — including a record of the location of the catch and the method used to calculate this weight.
- Incidental captures of marine mammals, marine reptiles, or seabirds.

The following gear details were recorded in the trip report.

- Vessel specifications, crew details, and spotter plane details.
- Pursing gear specifications.
- Type and description of the brailer.
- Net details, such as length, depth, mesh sizes, floatation devices (buoys or corks), sinkers and their weights.
- Electronic gear, such as fish finders.

The observer was also required to record the capacity and details of all holds and wells (on deck and below) and the total fish storage capacity. Other information recorded by the observer related to the voluntary code of practice followed by purse seine vessels. This stated that vessels should not set/target schools when dolphins are in the vicinity or are feeding on the target school, or when within 3 miles of shore (including islands).

The activity log was completed for a trip (see Appendix A). On these forms, the observer records the time an activity started and ended, such that every minute of the day during an observed trip should be recorded against an activity, whether the vessel is in port or actively fishing.

Methods for summarising observed purse seine data

The methods used to describe and summarise the observer activity and the observed fishing operations are given firstly for the project objectives that relate to the purse seine observed effort targeted at EMA, PIL, JMA, and SKJ. On request, the MFish Data Management Group provided a background document that (a) outlined the history and rationale for data collection by observers on purse seine vessels and (b) summarised the development of the forms during the first observed purse seine trips. This group also provided copies of the forms and associated documentation. The MFish observer programme provided trip reports and observer diaries to supplement the database extracts.

All available data were extracted from the MFish *obs_lfs* database as the basis for the characterisation of the purse seine trips. Data from the activity logs were summarised at a slightly broader scale than they were recorded at. Thus, they are presented under headings such as “transit”, “port”, “no fishing”, “at anchor”, et cetera, with added descriptions for each trip to provide extra information for each of the broader headings. The data described were subjected to very little grooming to illustrate where there were difficulties or inconsistencies with the data collection or discrepancies that result from interpretation of the required fields on the data forms.

2.2 Observed purse seine trips

The forms were first trialled on a blue mackerel trip in EMA 1 during December 2004 (see Figure 1 for location of fishing effort). Three subsequent trips that targeted skipjack tuna in February and March 2005 completed the observed effort for 2004–05 (July–June). In 2005–06, one observer trip took place in September–October on a vessel that targeted jack mackerel and another was completed on a vessel targeting pilchard during September–November (Table 2).

Four vessels were observed, with two trips on two vessels and one on each of the remaining two vessels. Four observers were placed on these vessels, with one observer completing three trips (Observer A) and the other three completing one trip each. Observer A was placed on Vessel W for another trip in January 2005, but this was abandoned when the vessel was unsuccessful on the first day; thus no further comment on is made in this report.

Several versions of the forms described above were used on these trips, as amendments were incorporated to increase the accessibility of the data. The observer data were loaded into newly developed tables stored within the MFish database *obs_lfs*. This work was completed in February

2006 by NIWA under contract to MFish. The developments in the forms are reflected in the attributes.

Some slight changes in definition mean that data stored in some fields may not be strictly comparable; for example, the definition for "searching for school" meant "looking for a school already sighted by a spotter plane" in the first three versions of the activity log, whereas in the subsequent (latest) version (1.4), the definition is "the vessel is searching for a school to target (e.g., using sonar or crow's-nest watch", see Appendix A). Steaming to find a spotter plane-located school was already catered for under another code.

For clarity, a general description of purse seining (in New Zealand waters) is given before each of the observed trips is described and summarised. For some trips there was more information available due to the more in-depth reporting by observers.

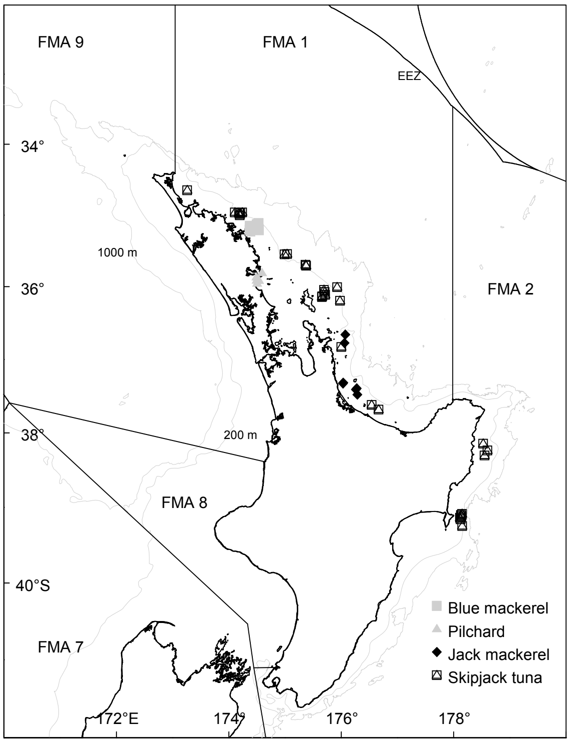

Figure 1: Start position of observed purse seine sets that targeted blue mackerel, pilchard, jack mackerel, and skipjack tuna during 2004–05 and 2005–06. Note that fishstock areas EMA 1 and PIL 1 are equivalent to FMA 1, whereas JMA 1 includes FMA 1 and FMA 2 combined. SKJ 1 and SKJ 2 are equivalent to FMAs 1 and 2.

Table 2: Details of observed purse seine trips during 2004–05 and 2005–06*.

Trip	Date	Fishery Management Area	Vessel (length)	Observer	No. sets	No. days fished
EMA_1	3–17 Dec 2004	FMA 1	W (36 m)	A	15	6
SKJ_1	9–13 Feb 2005	FMA 1 south of 36° S	X (33 m)	A	7	4
SKJ_2	4–10 Mar 2005	FMA 1 north of 36° S	W (36 m)	B	10	5
SKJ_3	9–23 Mar 2005	FMA 1, 2 south of 36°	X (33 m)	C	13	7
JMA_1	22 Sep–18 Oct 2005	FMA 1	Y (35 m)	A	7	5
PIL_1	22 Sep–1 Nov 2005	FMA 1	Z (18 m)	D	6	5

* The species codes that identify the trips are given in Table B1 in Appendix B. SKJ_1 is the first SKJ trip. See Figure 1 for areas and distribution of observed purse seine sets.

2.3 General description of purse seine fishing gear and activity

Vessels used spotter planes to search for schools of fish or searched independently using sonar or the crow's-nest watch when in known fishing grounds. When the spotter plane located a school of fish, the pilot radioed the vessel skippers the following: the position of the school, the species, and the estimated tonnage. The vessels then proceeded to the school, and the first vessel that arrived at the school had priority in setting the net. Vessels operated under a code of practice that amongst other things gave guidance on procedure should two vessels arrive at a school at the same time, mitigation of dolphin capture (no fishing when dolphins are associated with a school), and areas closed to purse seining (for example, within a stated distance from shore).

Purse seine nets used on observed domestic purse seine vessels were similar in style to that shown in Figure 2. Descriptions of specific net designs and mesh sizes in the main part of the net and the bunt (where the catch is concentrated) are given in the following sections on individual observer trips.

Several factors determined the success of a purse seine set: environmental aspects such as wind and sea state; fish school behaviour such as speed, direction, depth, and size of the target school; and vessel operating characteristics, particularly the condition of the fishing gear and the speed and accuracy of the fishing procedure for all aspects described below.

The fishing procedure used by the observed domestic purse seine vessels generally followed that shown in Figure 3. On arrival at the school, the vessel dropped off a skiff to which one end of the net was attached. The vessel then steamed away from the skiff in a broad arc whilst paying out the net until the school was encircled and the vessel was back at the skiff. The skiff purse and net lines were taken on board the vessel and pursing began as both ends of the purse line were winched on board.

Once pursing was complete, the net was rolled to concentrate the fish in the bunt and effectively close off the net so fish could not escape over the top. Next the net was sacked, and this process involved the crew hauling the bunt closer to the vessel and manoeuvring it to the side from which the fish were harvested. Finally the net was close to the vessel and ready to be emptied.

A purpose-built brailer (scoop) was sometimes used for fish that could not be pumped because of size or shape (for example, skipjack tuna). Otherwise the fish were pumped out (as were kahawai, blue mackerel, jack mackerel, and pilchards) into the holds. If the set was unsuccessful and the fish lost (due to the fish school sinking below the net or being lost over the top of the net), the set was said to be "skunked". Note that the activity that results in getting the catch on board was generally described as "brailing" whether a brail or a pump was used.

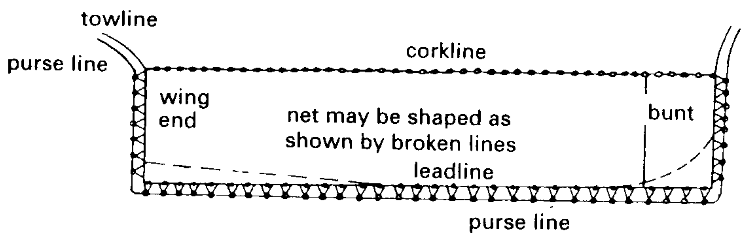

Figure 2: Purse seine net similar in design to that used by domestic purse seine vessels (after Sainsbury 1996).

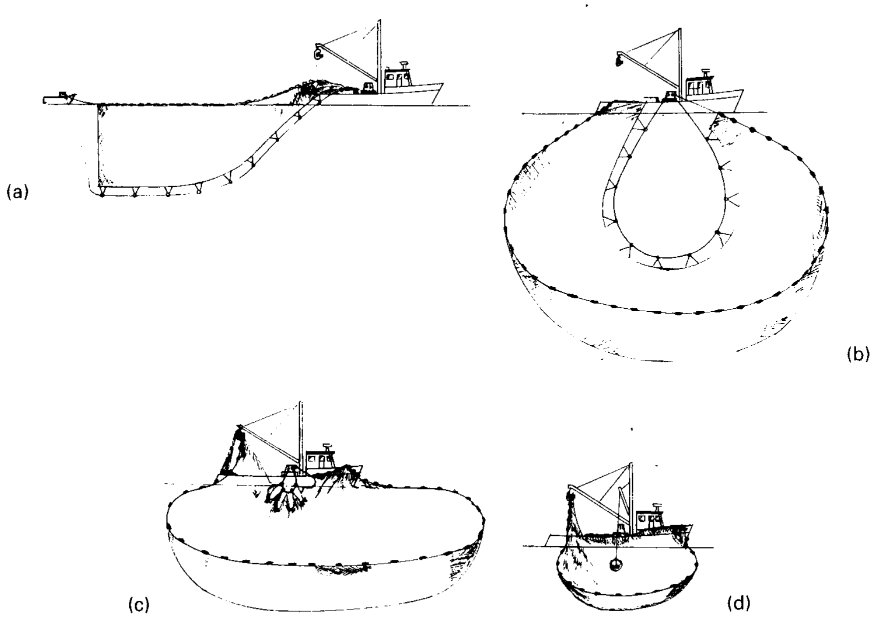

Figure 3: The purse seine operation. (a) Setting the net: the net is attached to the skiff, and the vessel drops the skiff and steams a circular path away from the skiff whilst paying out the net. (b) Pursing the net: the float lines and purse lines are back on board and each end of the purse line is taken to the winch and both ends are pulled to draw together the bottom of the net. (c) Pursing is complete, the rings are on board, the net secured to the vessel and the net is rolled to concentrate the fish in the bunt and ensure it is close to the side of the vessel where brailing takes place. (d) Brailing or pumping: the fish are then brailed (by scoop) or pumped into the vessel holds (after Sainsbury 1996).

2.4 Blue mackerel purse seine fishery in FMA 1

Since 1983–84, the blue mackerel commercial catch has grown, mainly through purse seine activity in FMA 1 [EMA 1]; 80% of purse seine catches landed between 1989–90 and 1999–2000 were from target fisheries in FMA 1, with lesser catches from FMAs 2, 3, 7, 8, and 9 (Taylor 2002). This effort has been influenced by market demands and values and the availability of other species; for example, effort increased as limits were placed on the capture of kahawai (Morrison et al. 2001, Taylor 2002). Landings from FMA 1 declined after the peak years in the early 1990s (over 10 000 t during 1991–92 and 1992–93) to a low of under 4000 t in 1999–2000. A second peak was reported in 2000–01 (9738 t), and since then FMA 1 landings have stabilised at between about 6500 t and 7500 t (Sullivan et al. 2005). Catches are seasonal, with a build up from August to September to a peak in November before declining to a low in June (Taylor 2002). During fishing years 2000–01 to 2003–04, most effort has been in Statistical Areas 002, 003, 008, and 009, with 5 of the 7 or 8 vessels in the fishery completing between 210 and 350 sets a year (MFish unpublished data). Blue mackerel has been included in the Quota Management System since 1 October 2002.

2.4.1 Observed blue mackerel trip, 2004–05

Blue mackerel was the target species for one observed purse seine trip during 2004–05, in December 2004. This was the first trip using the newly developed forms. The observed trip included one 2-day fishing trip of six sets and one 4-day fishing trip of nine sets. The vessel was a 36 m purse seine vessel from Tauranga that worked north of 36° S with a Cessna spotter plane. Fishing took place in EMA 1 (see Figure 3). All fishing was conducted during daylight hours, from first light to dusk. Fishing took place in waters with sea surface temperatures of 16 °C and 17 °C and depths of 83–182 m, with the net extending from the surface to about 75–95 m below the surface. Weather conditions during the observed trip ranged between 2 and 6 on the Beaufort scale.

The vessel and a spotter plane worked together on blue mackerel schools of 30–100+ t. Initially the vessel would target the larger schools and as the hold capacity was filled, the size of school targeted reflected the remaining hold capacity.

The specifications of the purse seine net used by the vessel are given in Table 3. The vessel had three holds on each side of the vessel, each with a capacity of 60–68.5 t. The two aft-most holds were never used because of stability concerns, and the vessel's hold capacity was filled where possible to about 300 t. Six of the eight crew members were involved in this operation, and once the net was pursed and the rings were up, the crew lifted the net in "bites" until the fish were at the surface. During the brailing operation, the suction pump was lodged into the bunt, below the surface, to pump the fish directly to the hold chutes. Hold-ups in this process occurred on some sets when the net was not sitting correctly. Usually the vessel pumped about 3 t of blue mackerel per minute. The observer noted that brailing was usually faster when the sea was choppier.

None of the schools fished were associated with baitfish or birds. Successful sets took about 3 h from when the skiff was dropped off to when the skiff was retrieved once the catch was landed. Pursing the net (including net rolling and sacking) took about 10 to 30 minutes. There was no relationship between the school size and the time taken to purse the net (Figure 4). However, larger catches took longer to pump than smaller catches.

On several sets, fish escaped when the tide and the weight of the fish caused the net to sink. This was more likely to occur during rolling the net, but also happened during pursing in association with large numbers of jellyfish. Other circumstances of fish (or school) loss occurred when the school sank below the net before it could be pursed or when fish escaped between the net and the vessel before the net was rolled completely. Two of the 4 schools detected by the vessel were skunked sets and 4 of the 11 schools detected by the spotter plane were also nil catches.

Table 3: Purse seine gear dimensions as recorded by the observer (in the observer trip report) during December 2004 on observed Vessel W that targeted blue mackerel (see Figure 2).

Gear	Description
Floatline	800 m long by 80 m deep
Leadline	850 m long
Purse sinkers	Chain
Purse buoys	7 per 2 m; 30 cm diameter, Type:DL10s
Mesh size	Shoulder (3 x 16 mm); Bunt (16 x 16 mm); wing (8 x 16 mm); sling (16 x 16 mm)
Brailer	Suction pump; pumps 2500 kg per minute

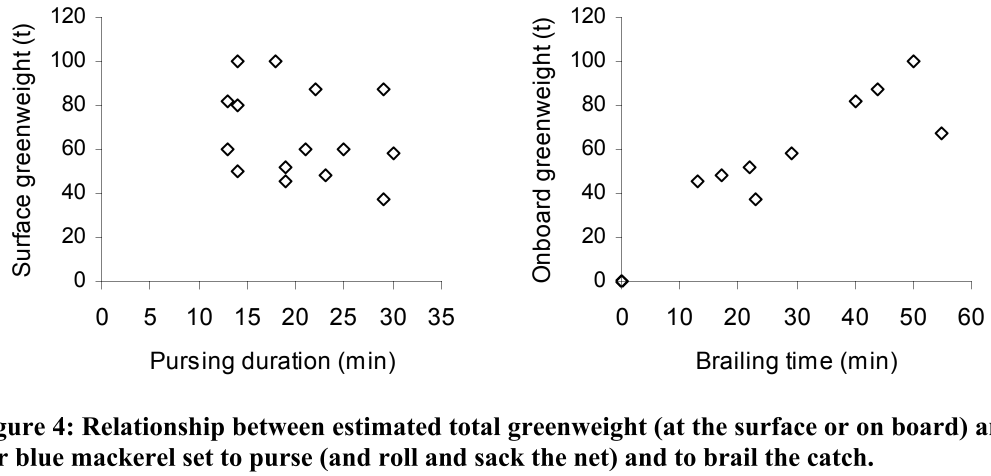

Figure 4: Relationship between estimated total greenweight (at the surface or on board) and time taken per blue mackerel set to purse (and roll and sack the net) and to brail the catch.

2.4.2 Observer data collection

According to the observer, the following information was used to quantify the catch: that gained from viewing the hauls, the estimation of the spotter plane pilot, and the engineer who controlled the filling of the holds. The final figure for each set was the estimate (by eye) of the hold volumes. After unloading, the catch was pumped into uniform-sized bins at the onshore processing plant, and these were counted and multiplied by the average weight to give the total catch weight for the trip.

The observer could not estimate easily the hold dimensions because they were full of brine and noted that this resulted in inaccuracies in the assessment of species greenweights per set. Timed samples of fish being pumped into the holds were carried out regularly, but there were problems with this method because the pump worked faster in swells than in calm conditions.

Length frequency measurements (LF) were conducted daily on the target species. Once familiar with the vessel operations, the observer carried out fork length measurements on each set. The crew assisted with the collection of fish and a random sample of five bins was tested per sample. However, because the top of a hold was used for this work, LFs were not able to be measured if the vessel set immediately after the previous haul. Otolith collection was weather-dependent and occurred only on calm days.

The observer noted that during the rolling and hauling of the net, it was too dangerous to be on deck, and at this time suitable viewing was attained from a position beside the winch operator on the upper level. The observer returned to the deck once hauling was complete to sample fish during the brailing operation.

2.4.3 Activity log data

During this initial purse seine observer trip, the observer was familiarising himself with the fishing activity and the emphasis was on finding the best ways to achieve certain required activities (as noted above). Thus, though many activities were recorded with start times, end times were rarely recorded and it was difficult to ascertain the time taken for some activities.

The activity fields used by the observer are given in Table A1, along with the type of comment the observer made with each activity code entry. Data presented in Table 4 show the percent of a 24-h day that is occupied by a certain activity. Sets occurred on 6 of the 11 trip days. The days with no fishing activity were spent steaming to fishing grounds, searching, at anchor, or in port for various breakdowns (engine and freezer problems).

2.4.4 Greenweight and length frequency data

Estimated greenweights of the catch when at the surface ranged from 37 to 100 t per set (mean 67.1 t, median 60 t). Nine of the 15 sets were successful; 8 sets retrieved the entire estimated catch, though one lost fish that accounted for 23% of the estimated surface weight during net rolling because of the tide and the presence of jellyfish. The location of catches is shown in Figure 5 (see Figure 4 for catch sizes). The total greenweights for the trip were estimated by the observer (and the vessel) as 551 t (550 t) for blue mackerel and 25.5 t (26 t) for jack mackerel (Table 5).

Of the nine successful sets in the trip, five were sampled for blue mackerel length frequency data. Of the 615 fish sampled, two-thirds were females (all recorded as gonad stage 3). Most fish were between 40 and 50 cm, and males and females peaked at 44–47 cm (Figure 6), slightly higher than the 40–45 cm reported by Manning et al. (2007). Morrison et al. (2001) and Manning et al. (2007) found that catch-at-length was strongly unimodal, with no evidence of length modes entering the catch that may correspond to recruitment pulses. This was considered to be a result of the selectivity effect of the gear and size-selective fishing effort.

Table 4: Percentage of 24 h recorded for each activity, by day for the EMA observed trip. Note that end times were not consistently recorded on the activity log for this trip; thus these data are limited in their use. Time recorded against "no fishing" was due to net repairs and awaiting sightings from spotter plane pilot. "Examine" means the vessel went to investigate the sighted school. "Port" refers to the percent of the day when the observer was in port awaiting departure. Table A1 of Appendix A gives further explanation of the comments.

										Activity
Trip day	Transit	Port	Search	Steam to school	Examine	Set	Retrieval	Breakdown	No fishing	Day %
1	71	5	–	–	–	–	–	–	–	75
2*	–	–	–	8	–	13	< 1	–	–	21
3*	–	–	–	–	–	–	–	–	–	0
4	–	–	–	–	–	–	–	–	–	0
5	9	4	–	–	–	–	–	9	–	22
6	20	3	–	–	–	–	–	–	12	35
7	15	19	5	11	–	–	–	10	–	60
8*	52	–	21	1	–	–	–	–	–	73
9*	–	–	24	–	5	–	–	–	–	29
10*	–	–	4	3	–	–	–	–	7	15
11*	–	–	18	–	–	–	–	–	–	18

* Three sets were made on Days 2 and 3, 2 on Days 8 and 10, 4 on Day 9, and 1 set on Day 11.

Table 5: Catch weight (kg) data by processed state from the EMA purse seine trip during December 2004. Species codes are given in Table B1 of Appendix B.

Weight (kg)	SUN	EMA	JMA	JMD	POP	All
Discarded weight	40	–	–	–	–	40
Greenweight	–	551 000	500	25 000	20	576 520
Total	40	551 000	500	25 000	20	576 560

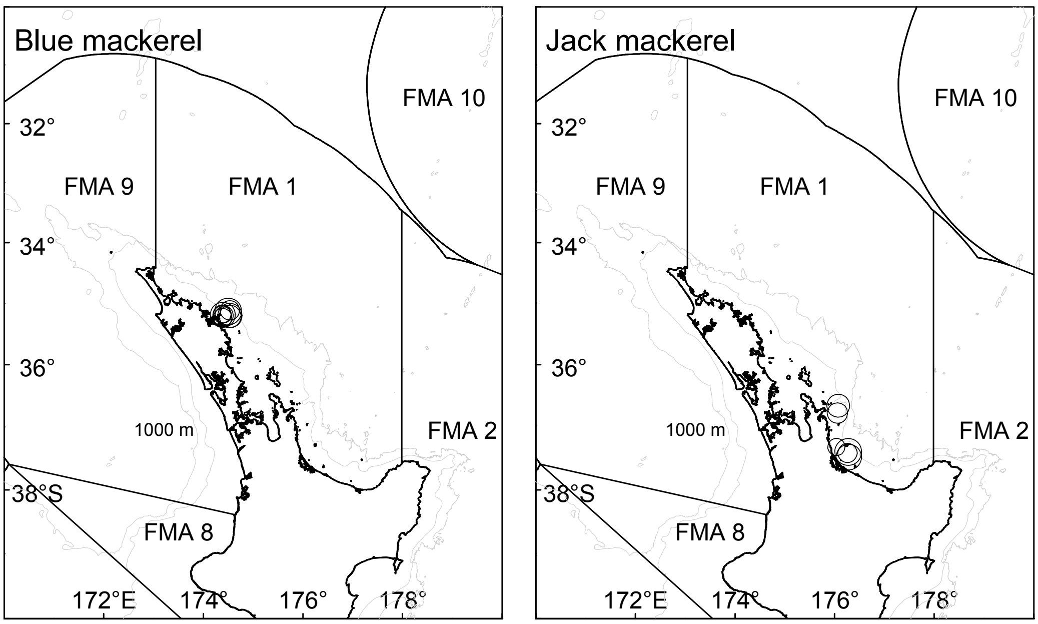

Figure 5: Location of catches represented by total on-board greenweight for purse seine sets during EMA_1 that targeted blue mackerel (left), where the largest circle represents 100 t and during JMA_1 for jack mackerel (right), where the largest circle represents 78 t.

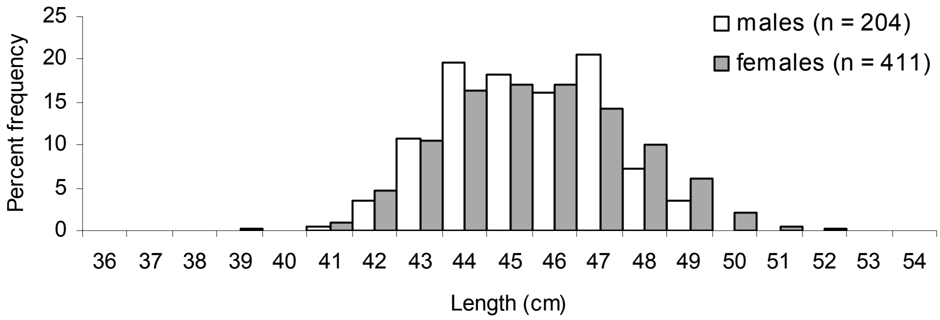

Figure 6: Length frequency distribution of blue mackerel sampled from five sets in December 2004 (*n* = 615 fish).

2.4.5 Observations of seabirds and marine mammals

Flocks of birds usually indicated a school of fish. The observer noted bird numbers for those species associated with the schools being targeted by the vessel: up to 1000 Buller's shearwaters (*Puffinus bulleri*), 500 black petrels (*Procellaria parkinsoni*), and 500 fairy prions (*Pachyptila turtur*). Seabirds sitting on the water were feeding on krill forced up by the fish school and flew off once the net was hauled. Some interest was shown during brailing, but the birds were not close to the fishing operation.

No marine mammals were seen during fishing activity.

2.5 Jack mackerel purse seine fishery

The purse seine fishery contributes the greatest proportion to the total jack mackerel catch in JMA 1 (equivalent to FMA 1 and 2). Fishing is concentrated in the Bay of Plenty and east Northland coast. In recent years, 95% of the catch consisted of *Trachurus novaezelandiae* due to poor prices and less targeting of the larger species *T. symmetricus murphyi* that had been an increasing proportion of the catch during the early to mid 1990s (Sullivan et al. 2005). *T. novaezelandiae* prefers waters north of 42° S that are shallower than 150 m and at least 13 °C.

The same vessels that target blue mackerel target jack mackerels, kahawai, and skipjack tuna. Fishing is governed by the availability of skipjack tuna during December to May, and the other species are targeted outside this season, on an 'on-demand' basis to fill export orders. Jack mackerels and kahawai school together sometimes and depending on the market demand and quota allocations fishers will choose which school to set on. Further, kahawai is subject to a voluntary moratorium in the Bay of Plenty from 1 December of a year to the Tuesday after Easter of the following year (Sullivan et al. 2005).

2.5.1 Jack mackerel observed trip, 2005–06

This trip was initially designated as a kahawai trip, but the lack of kahawai schools resulted in a switch of target to jack mackerel (*T. novaezelandiae*). The observed trip took place during September and October 2005 on a 35 m vessel that was based in Tauranga and was operated by a crew of seven. The dimensions of the vessel's purse seine gear are given in Table 6. The vessel worked with a spotter plane, but also relied on school sightings by the vessel. The observer had previous experience on the blue mackerel trip, and the observed trip consisted of three fishing trips: one day with no sets, a 4-day trip with 4 sets, and a 2-day trip of 3 sets to give a total of 7 sets over 7 days.

All fishing was conducted in FMA 1 (see Figure 1) in waters of 14.5–17 °C SST in depths of about 50–145 m. Although completed in daylight hours, fishing generally took place in the afternoon or evening, with set start times between 1152 h and 1758 h. Sets were made during conditions recorded as 3 and 4 on the Beaufort Scale.

This vessel worked in association with a spotter plane on some sets to target jack mackerel feeding on the surface. School sightings were made also by the skipper from the crow's-nest. The decision to set was determined by the size of the school (estimated by eye) with consideration of the species composition. If no spotter plane was in the vicinity or no schools were observed on the surface, the vessel used sonar to locate a school and the species was confirmed by use of a fishing rod, line, and fly. The fishing was completed on known grounds, usually with at least three other vessels of similar size. Quota concerns governed the target fishing and many of the sighted schools were either all kahawai or mixed schools of kahawai and jack mackerel. It appeared that the vessel held little available kahawai quota.

For five of the seven sets, the observer recorded that the schooling fish were associated with baitfish. Two of these schools were sighted from the vessel (57 t and 78 t schools) and three were sighted by the spotter plane (40 t, 45 t, and 110 t schools). The remaining two schools were detected using sonar (32.4 t and one of unknown size).

The observer noted that after net rolling the bunt was pulled up by a choker and a winch during net sacking. Once the bunt was up sufficiently in the water for the pump to work, brailing began. This net sacking process usually took about 15–20 minutes and was included in the net rolling time reported on the form. Sets took between 1.5 and about 4 h to be completed and the last set was completed at 2040 h. Pursing took between 12 and 16 minutes, net rolling (and sacking) took between 1 and 2 hours, and the catch took between 25 and 100 minutes to be pumped on board (Figure 7). The school size appeared to have little effect on the time taken to complete any of these activities. However, it could be expected that the larger the catch the longer it took to brail, as was apparent for some of the sets, but vessel and gear problems resulted in longer brailing times taken for two sets with catches of 35 and 40 t. On one set there was a 45-minute hold-up when pumping the fish because of concerns with the list of the vessel. On another set there were problems with the pump.

The vessel processed the catch by pumping whole fish directly into the four starboard and four port holds. Each hold had a capacity of 10–31 t to give a total hold capacity of 187 t when the target species was either jack mackerel or kahawai. When targeting blue mackerel or skipjack tuna, the skipper added a tonne to each well capacity. Near the end of the observed trip, the vessel caught 40 t more jack mackerel than it could hold, and the extra catch was transferred to another vessel.

Table 6: Purse seine gear dimensions as recorded by the observer during September–October 2005 on observed vessel Y that targeted jack mackerel.

Gear	Description
Net	930 m long by 80 m deep and constructed of 12 panels
Purse buoys	4000 corks; 25 by 15 cm
Mesh size	Main section (2 inches); Bunt (2 inches)
Brailer	Pump with 3 t per minute pumping capacity

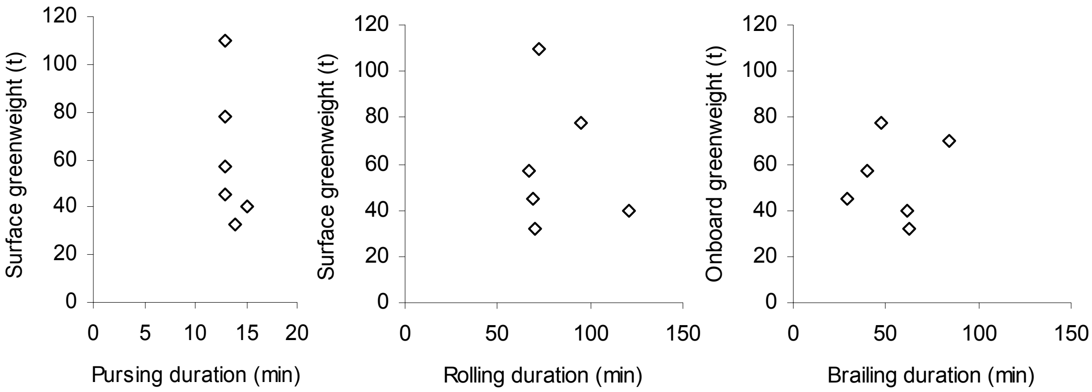

Figure 7: Relationship between estimated total greenweight (at the surface or on board) and time taken per jack mackerel set to purse and roll the net and to brail the catch.

2.5.2 Observer data collection

The observer quantified the catch by calculating the volume of each hold based on the given hold specifications, with a series of time samples to indicate the volume of fish pumped per minute. The greenweights of bycatch species were estimated by eye. Biological sampling took place for jack mackerel and kahawai when time allowed and when the observer would not interrupt normal fishing procedures. The most convenient time (in terms of the fishing procedure) was after the last set of the day when there was minimal disruption; however, sometimes it was difficult to determine which set was the last for the day. Otherwise, the observer noted that this sampling could be done during brailing, but that at that time the observer was also busy estimating the catch.

2.5.3 Activity log data

The fishing activity of this vessel was often frustrated by the lack of clean schools of jack mackerel. The activity fields used by the observer are given in Table A1, along with the type of comment made with each activity code entry. Much of the at-sea time was spent steaming, either in transit or to a sighted school (Table 7). Sets occurred on five of the seven trip days, with one or two sets completed on fishing days. The days with no fishing activity were spent steaming to fishing grounds, searching, or at anchorage.

Table 7: Percentage of 24 h recorded for each activity, by day for the JMA observed trip. Time recorded against "no fishing" included time spent waiting for sightings from the spotter plane pilot and time when darkness prevented fishing. For days with less than 100% assigned to the day's activities, generally the overnight hours were not included in the completion of the activity log.

									Activity
Trip Day	Transit	Search	Steam to school	Examine	Set	Anchor	No fish	Port land	Day %
1	7	–	7	2	–	–	–	1	18
2*	8	13	10	–	11	9	–	3	55
3*	13	7	2	2	10	50	16	–	99
4	15	–	–	–	–	61	24	–	100
5*	29	–	–	2	21	34	–	–	100
6*	18	–	–	10	14	17	–	4	63
7*	13	3	4	1	30	39	7	–	96

* Sets were made on these days: 1 set each on Days 2, 3, 6, and 2 sets each on Days 5 and 7.

2.5.4 Greenweight and length frequency data

Catch data were available for six of the seven sets. One school was lost during the set of the net and the fish were seen (on the sonar screen) escaping under the vessel. Estimated greenweights of the catch when at the surface ranged from 32.4 t to 110 t per set (mean 60.5 t, median 51 t). Forty tonnes of the last set of 110 t was transferred to another vessel. The locations of catches are shown in Figure 5, and the largest catches were from around Mayor Island during mid October (see Figure 7 for the estimated greenweights).

The total greenweights for the trip were estimated by the observer (and the skipper) as 309.9 t (310 t) for jack mackerel and 11 t (11 t) for kahawai. Estimated greenweights of the bycatch species are given in Table 8.

Two sets were sampled for jack mackerel (n = 200 *T. novaezelandiae*) and another set was sampled for kahawai (n = 84 fish). The jack mackerel distribution was unimodal for each sex; females peaked at 32 cm and males at 33 cm (Figure 8). All fish were mature; the range at which fish are considered mature is 26–30 cm (Sullivan et al. 2005). There are few kahawai data; males appeared to peak at 54 cm and females at 55 cm. All the female kahawai were recorded as Stage 1.

2.5.5 Observations of seabirds and marine mammals

Large flocks of seabirds feeding on krill on the surface indicated schools of feeding fish. The bird species most often seen were fluttering shearwaters (*Puffinus gavial*), Buller's shearwaters, diving petrels, and Australasian gannets (*Sula bassana serrator*). Although the net is set surrounding the fish and the birds associated with the school, the birds fly away as the net is rolled in. The observer considers that this fishing method poses no danger to the birds.

No marine mammals were seen in the vicinity of the fishing activity.

Table 8: Estimated greenweight (kg) from the JMA purse seine trip during September–October 2005. Species codes are given in Table B1 of Appendix B. Species were not processed further.

Weight (kg)	BAR	EMA	FRO	JMA	KAH	KIN	POP	STU	Total
Greenweight	20	1 200	4	309 860	11 000	10	2	360	322 456

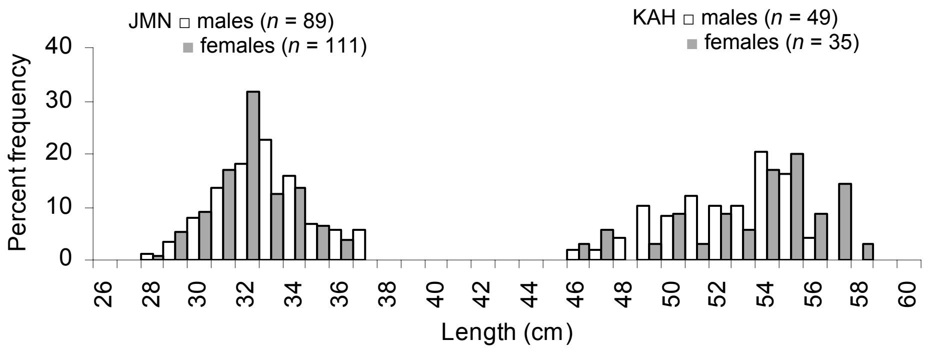

Figure 8: Length frequency distributions for jack mackerel (*T. novaezelandiae*) (JMN) sampled during two purse seine sets and kahawai (KAH) sampled from one set. Numbers of fish are given in parentheses.

2.6 Pilchard purse seine fishery

Paul et al. (2001) provided a thorough summary of the development and main characteristics of pilchard fishing in New Zealand waters. In the early 1990s there was rapid development of a pilchard fishery, primarily using purse seine nets in the Hauraki Gulf and East Northland, with the main fishing area since 1994 being in Statistical Area 3. There is a lack of real knowledge on the size of pilchard schools, but Paul et al. (2001) suggested that most schools are in the 5–30 t range, with an appreciable number of schools in the 25–50 t range. Pilchard populations can vary greatly in biomass and sometimes in distribution; recent work suggests that weather conditions caused by the El Niño Southern Oscillation may affect the northeastern New Zealand population (Paul et al. 2005).

Purse seine net sizes vary, but can be about 600 m in length and 70 m depth. Since 1 October 1994, the regulated mesh size has been 20 mm (¾ inch), a reduction from 25 mm to minimise waste from enmeshment of smaller fish. During spring–summer when the fish are spawning, schools are located and targeted during daylight hours, whereas at other times of the year vessels search in the late afternoon or evening for an aggregation and use lights to raise the aggregation to the surface (Paul et al. 2001).

Up to three vessels make significant landings in a year, with market diversification leading to more consistent and increasing landings in the late 1990s, when it appeared that landings were higher in the second half of the year (Paul et al. 2001). In October 2000, a target commercial catch limit of 2000 t was set for PIL 1, and this became the Total Allowable Commercial Catch for PIL 1 in October 2002. Catches in recent years have not reached this limit (Sullivan et al. 2005).

2.6.1 Pilchard observed trip 2005–06

The observed trip that targeted pilchard consisted of three fishing trips made between 22 September and 16 November 2005 on a small vessel (18.3 m) based in Whangarei and operated by a crew of four. Six sets were made during 9 days at sea in waters of 16–19 °C and depths of 7–36 m [as recorded by the observer] in Bream Bay in FMA 1, generally about a 1.5 h steam from port (see Figure 1). Sets were made during daylight hours, generally in relatively calm conditions (1–3 on the Beaufort scale).

This vessel was the smallest purse seine vessel with observer coverage. The net used (Table 9) was just over half the length of the nets on the larger domestic purse seiners, though the net depth was comparable. The vessel capacity was 20 t overall, each of the four holds having a capacity of 5 t. The two portside holds contained ice slurry and the two starboard holds held refrigerated brine.

The vessel used sonar to detect fish schools, and bird activity, surface feeding activity, and local knowledge were also important in the search for schools. However, the observer recorded in the logbook that none of the schools the vessel set on were associated with seabirds.

Each set took between 1 h and 3 h 40 minutes to complete. On successful sets, the net was set in 4–8 minutes, pursing 12–14 minutes, rolling and sacking took 45–55 minutes, and pumping took 15–17 minutes (Figure 9). The vessel had problems with the net ripping, mainly during rolling, and consequently lost fish.

2.6.2 Observer data collection

The observer and the skipper estimated the catch on board (by eye) during pumping and when the catch was in the ice slurry holds. These estimates were later compared against the catch weights during unloading. The observer noted that the clear view of the catch on the pump chute allowed him to identify and count the bycatch species.

Table 9: Purse seine gear dimensions as recorded by the observer during September–November 2005 on observed vessel Z that targeted pilchard.

Gear	Dimensions
Net	480/420 m long by 80 m deep
Leadline	Line with 8 oz (227 g) sinkers with one per metre
Purse buoys	1200 plastic floats
Mesh size	Main section (20 mm); Bunt (20 mm)
Brailer	Suction pump with ~ 100 kg per minute pumping capacity

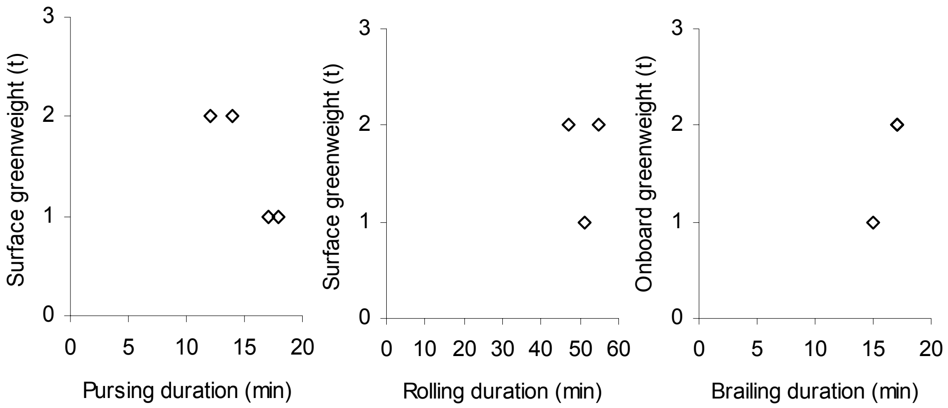

Figure 9: Relationship between estimated total greenweight (at the surface or on board) and time taken per pilchard set to purse and roll the net and to pump the catch.

Length frequency measurements of pilchards were carried out on two of the three successful sets, with the measurements recorded in millimetres. Samples were collected during the pumping process: the observer placed a fish bin under the pump chute, weighed the sample, and then measured the fish before emptying them into the hold. Measurements were carried out on the top of a hold hatch after activity on the deck had finished so there was no disruption to normal fishing procedures. No other biological sampling was carried out because the catch of bycatch species was small.

Records of SSTs were reported for three of the six sets; two records in September (at about 16 °C) were from the vessel, but the 19 °C reported from the last set in November was from another vessel operating nearby. The observer made no comment on how SST data were obtained.

2.6.3 Activity log data

The observer stated in the trip report that about 70% of the time the vessel was at sea was spent searching for and locating schools, 10% on purse seine sets, and 20% on net and other repairs. This summary does not directly tally with the data reported on the activity log (Table 10, see also Table A1 in Appendix A), particularly the time taken to do net repairs. It may be that net repairs were also carried out when the vessel was anchored. The activity log did not cover all the hours of a day for all days, particularly on the first and last days of a trip. For example, the first fishing trip finished on Day 2 at just after midday.

2.6.4 Greenweight and length frequency data

The observer reported varying degrees of fishing success during this trip. Fish were retrieved from three of the six sets, and on these successful sets, fish were lost, either during the setting of the net or through holes where the net had ripped. This generally happened during the rolling of the net from the pressure of the catch. All fish targeted during two sets were lost during setting. The observer noted that the vessel probably missed most of the target school on other ‘successful’ sets. Estimated greenweights were between 1 and 2 t (see Figure 9).

The observer noted in the comments section of the forms that where the estimated greenweight was reported at 2 t (both surface and total on board), the landed weight (by bin) during offloading was actually 1.5 t, and that the 2 t catch from the last set weighed in at 1.7 t during offloading. About 3–5 kg of pilchard were picked from the net meshes after the catch of each set had been pumped into the holds.

The summary of catch data by processed state is given in Table 11, with a total of just over 5 t greenweight of pilchard. The remainder of the catch consisted of small individuals of seven other species: barracouta, red gurnard, John dory, jack mackerel, leatherjacket, purple rock crab, and yellow-eyed mullet.

Two of the three successful sets were sampled for length frequencies and the observer was not required to determine the sex of sampled fish, though he noted that the samples were about 50:50. Measurements were made in millimetres rather than centimetres (Figure 10), and fish ranged from 181 to 216 mm long, with a peak at about 194 mm. When measurements were rounded to the nearest centimetre, 4% of fish were 18 cm long, 39% were 19 cm, 41% were 20 cm, 14% were 21 cm, 1% measured 22 cm, and 1% measured 23 cm.

Table 10: Percentage of 24 h recorded for each activity, by day for the pilchard observed trip. Time recorded against “repairs” was spent repairing the net. Time spent at anchor included sheltering against rough weather. Fishing trips within the observed trip finished on Day 2, Day 4, Day 6 and Day 9. Hours on an observer day which was the first or last day of a fishing trip were not reported for the full 24 hour period.

						Activity
Trip Day	Transit	Search	Set	Anchor	Repairs	Day %
1*	5	26	6	42	6	85
2*	8	17	7	17	–	49
3	6	41	–	–	–	47
4*	8	25	25	18	2	79
5*	8	33	4	–	–	45
6*	6	37	7	17	8	75
7	34	–	–	50	–	85
8	–	58	–	25	–	83
9	31	17	–	–	–	48

* One set per day was made on Days 1, 2, 5, and 6. Two sets were made on Day 4.

Table 11: Processed state and weights (kg) from the PIL purse seine trip during September–November 2005, by species. Species codes are given in Appendix B.

Weight (kg)	BAR	GUR	JDO	JMN	LEA	PCR	PIL	YEM	Total
Discarded weight	2	2	–	–	–	2	–	–	6
Galley	–	–	3	–	–	–	–	–	3
Greenweight	–	–	–	1	2	–	5 005	1	5 009
Total	2	2	3	1	2	2	5 005	1	5 018

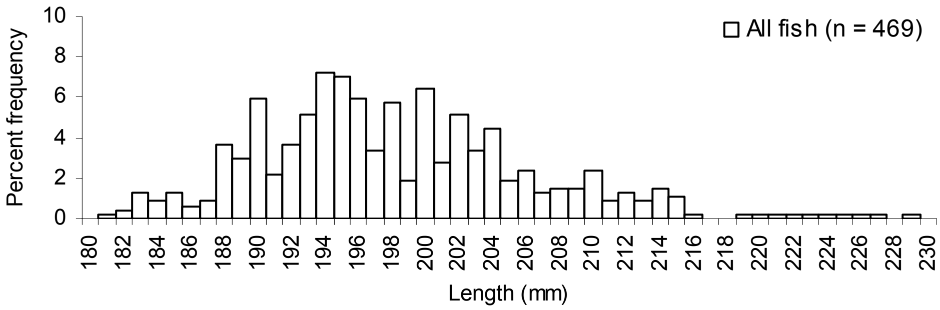

Figure 10: Length frequency distribution of pilchards measured from two observed purse seine sets. Note fork length measurements were made in millimetres.

Hundreds of Australasian gannets and flesh-footed shearwaters (*Puffinus carneipes*) and tens of fluttering shearwaters and Buller's shearwaters were in the areas fished. These birds were either sitting on the water in groups or individually or in large flocks during "work-ups". Between 10 and 20 seagulls constantly followed the vessel. The birds kept away from the vessel until after the net was set and the catch was concentrated in the pursed net against the vessel and ready for pumping. Gannets and flesh-footed shearwaters would then feed and dive around the outside of the net on any escaping fish. None were caught during the observed trips. The observer noted that on the last set, when there was once again a large hole in the net, about 30 gannets, 2 Buller's albatrosses (*Thalassarche bulleri*), and 1 fluttering shearwater were feeding on lost fish. The fluttering shearwaters often stayed with the vessel, but gannets and the Buller's albatross moved away.

When the vessel steamed to grounds off Great Barrier Island during November, the observer recorded about 200 gannets, 300 sooty shearwaters (*Puffinus griseus*), 100 flesh-footed shearwaters, and 50 Buller's shearwaters in the area.

Large pods of common dolphins (*Delphinus delphis*) were also seen around Great Barrier Island. There were no interactions with the vessel and no fishing took place when the dolphins were feeding on schooling fish.

2.7 Skipjack tuna purse seine fishery

Schools of juvenile and adult (fish over 40 cm fork length) skipjack tuna at or near the surface are found to at least 40° S in New Zealand waters and prefer waters warmer than 20 °C (Sullivan et al. 2005). The domestic skipjack tuna purse seine fishery is conducted during summer months by four or five medium-sized vessels working with spotter planes, primarily in FMA 1 and FMA 2, and occasionally in FMA 9 (Sullivan et al. 2005). Since 2001, four superseiners have been operated by New Zealand companies, both within and outside the EEZ. Most effort is during December to April, and during 2002–03, most catches were landed in February (Kendrick 2004). Landed catches (mostly from purse seine fishing) in 2003–04 were more than double those in the previous three fishing years (Sullivan et al. 2005).

2.7.1 Skipjack tuna observed trips 2004–05 and 2005–06

There were three observed trips on two purse seine vessels that targeted skipjack tuna during February and March 2005. Hereafter these trips are referred to as SKJ_1, SKJ_2, and SKJ_3 (see Table 2). All sets were made during daylight hours. [Note that there were no data available for any trips in 2005–06 at the time of writing (March 2006).] Both vessels were observed in the earlier blue mackerel observer trips. The SKJ_1 observed trip targeted schools identified by the spotter plane pilots in FMA 1 off Great Barrier Island and the Aldermen Islands (see Figure 1 for location of sets). Fishing took place during February 2005 in depths of 108–210 m (mean 132 m), with SST of 22 °C. Wind conditions were recorded as 3 or 4 on the Beaufort scale.

Trip SKJ_2 was undertaken on Vessel W, a 36 m vessel (the same one used for the first observed purse seine trip that targeted blue mackerel). Fishing took place in March 2005 in FMA 1 generally close to the 200 m contour north of 36° S (see Figure 1) during calm weather in 21–22 °C waters between 117 and 290 m deep. The observer noted that vessel crowding affected catch rates.

The second trip on Vessel X (SKJ_3) was during March 2005 and effort was split between FMA 2 (9 sets) in 21–22 °C waters 114–135 m deep (mean 124 m) between Mahia Peninsula and East Cape and FMA 1 east of Coromandel Peninsula in 23 °C waters in 85–240 m (mean 136 m) (four sets).

Both the observed vessels worked closely with two spotter pilots. Information on the location, size, and activity (for example, feeding on the surface) of each school sighted by the pilots, and its suitability to target, was radioed through to the skipper. Both vessels followed the voluntary code of practice.

The vessel used for SKJ_1 and SKJ_3 appeared to use different net depths on each trip, according to the measurements recorded by the observers, with one net half the depth of the other (Table 12). This information was obtained from the observer trip reports. The vessel had three holds on the port side and three on the starboard side; the front two could hold 30 t, whereas the capacity of the other four holds was 23 t per hold (total capacity of 152 t). The observer on the second trip reported the hold capacity as 28 t for each of the front port and starboard holds, and 23 t for each of the other four holds, to give a total capacity of 148 t, He commented that the capacities vary depending on species and fish size.

During SKJ_1, once the pilot had radioed through the sighting details, the skipper would then investigate the school, sometimes for up to 2 hours, from the crow's-nest and would call for the skiff to be released once he had established the school would be worth targeting. School size was important. All six successful sets targeted schools associated with baitfish, and all except one were spotted from the air. This vessel's sonar was not working.

The vessel set between one and three nets per day, depending on the size of the schools fished. Sets were made on four of the eight observer trip days and six of the seven sets were successful. Sets were usually 2–3 h long, from skiff off to skiff on board; the net was set in 4–6 minutes, pursed in 12–15 minutes, rolled and sacked in 60–90 minutes, and brailed in 7–55 minutes (Figure 11). Larger catches took longer to brail.

Table 12: Skipjack tuna purse seine gear dimensions, for February and March 2005 trips.

Skipjack tuna observed trips (SKJ_1 and SKJ_3) on vessel X south of 36° S

8-panel net	1000 m long by 45 m deep (SKJ_1); 938 m long by 89 m deep (SKJ_3)
Leadline	8 t chain
Purse buoys	~ 3000 D10 corks
Mesh size	Main section (63 mm); bunt (63 mm)
Brailer	1000 kg scoop with a brailing capacity of 555 kg per minute

Skipjack tuna observed trip (SKJ_2) on vessel W north of 36° S

Net	995 m long by 107 m deep constructed of 14 panels
Leadline	1000 m of 12 mm chain
Purse buoys	~ 3000 corks 18 cm diameter
Mesh size	Main section (75 mm); bunt (75 mm)
Brailer	1000 kg brail

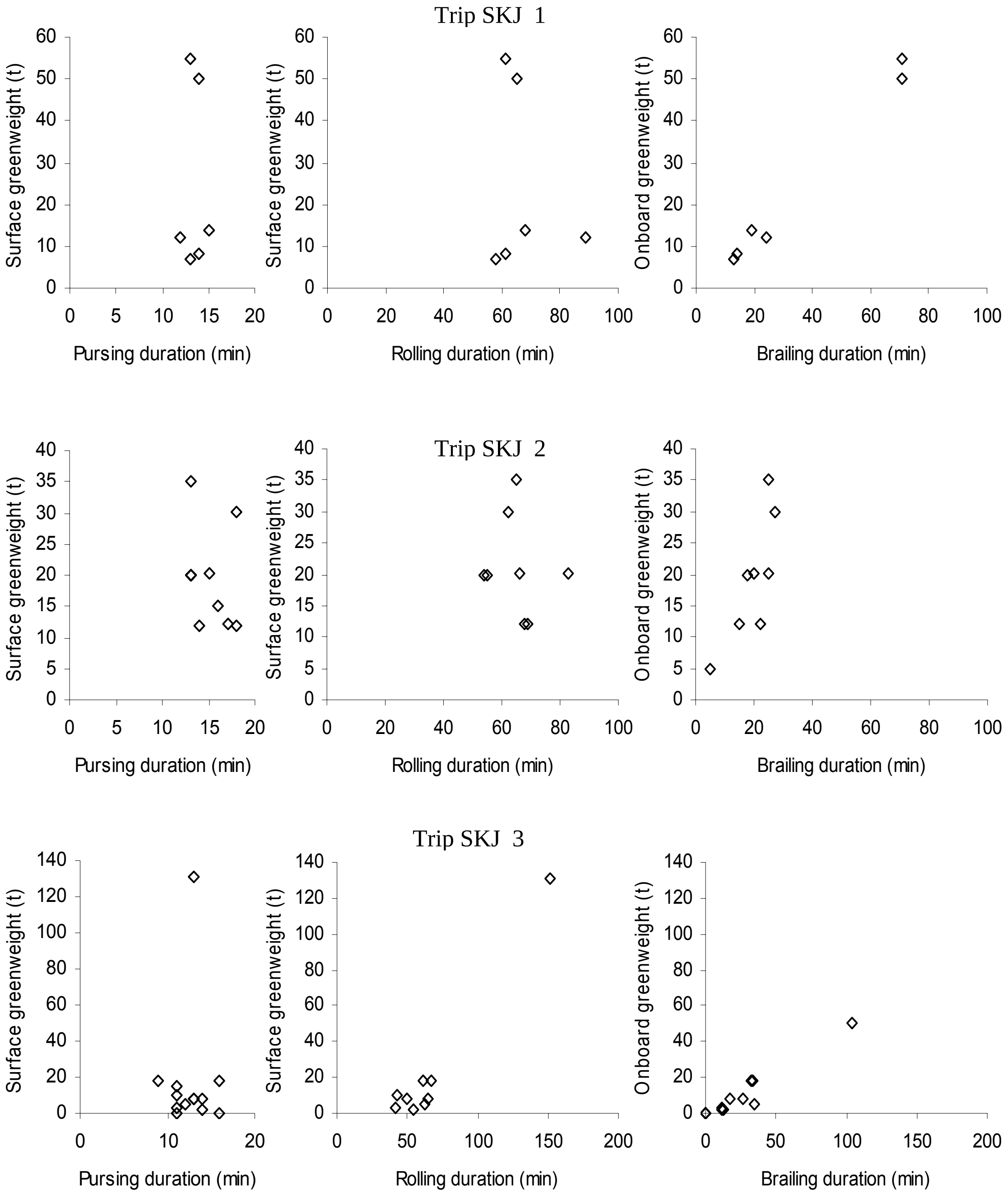

Figure 11: Relationship between estimated total greenweight (at the surface or on board) and time taken per skipjack set to purse, roll the net, and brail the catch.

Sets were made on 4 of the 19 days on the second trip on this vessel (SKJ_3), with a total of 13 sets made. Ten sets were made on schools associated with baitfish, and eight schools were detected by the pilot, with the remainder detected by the vessel. The times for the fishing operation were similar to those above, other than for the set that targeted the 130 t school (with a 50 t result). [Note: the catch lost from this set was caught by another vessel nearby.] Although most successful sets took between 1.5 and 2.5 hours for the whole operation (for on board catches of 2.3 to 18 t), the set of 50 t took almost 6 hours to brail. This trip was less successful in catching and landing the entire school. Two sets were skunked and two suffered significant losses resulting in less than 1 t on board; no brail times were recorded for these sets.

Vessel W during SKJ_2 used a deeper and slightly longer net with larger mesh (see Table 12). This larger vessel had hold capacities of 56 t in the bow port and starboard holds, 57 t in the middle two holds, and 50 t in the two aft holds, to give a total of 326 t. School size was an important determinant for fishing. Eight of the 10 targeted schools were detected by spotter planes and two by the vessel; none of the schools were associated with baitfish or birds. During SKJ_2, the whole fishing operation took between 1 and 2.5 h per set, with 13–18 min to purse the net, 54–83 min to roll and sack the net, and 5–27 min to brail the catch (see Figure 11).

2.7.2 Observer data collection

The observer for SKJ_1 observed all sets and hauls and noted bird observations on the first set of each day. The initial catch volume was the estimate from the spotter plane pilot, and the on-board estimate was by eye, based on the known volume of each hold. Quantities of bycatch species were estimated by eye.

Four sets on the first observed trip were sampled for length frequency measurements. Fish were collected by emptying the scoop on the deck and transferring fish into bins which were then weighed. Brailing time was the safest and most efficient time to carry out length frequency measurements.

On SKJ_3, the observer used the vessel estimates initially while trying to estimate an average weight per scoop. However, too much variability in the load of each scoop hindered this approach and instead the observer estimated the weight of each scoop and tallied the scoop weight estimates when the catches were less than 10 t. The proportion that each hold was filled was used to estimate larger catches. On the occasion that fish were discarded, the observer made an 'inexact count' and multiplied this by the estimated average weight to determine the amount discarded. Weights of fish sent to the galley were precise.

The vessel estimates of total greenweight initially used the spotter plane pilots' estimates combined with the skipper's observations from the crow's-nest. This would include the spread of the school, the colour of the 'patch', and the movement of the school. A second vessel estimate was obtained when the net had been rolled and the school was concentrated in the bunt section of the net between the skiff and the vessel. A third estimate was made when the fish were in the holds and percentage volumes were used to estimate the size of the catch. The recorded numbers of fish sent to the galley (yellowfin tuna) and discarded fish (skipjack tuna and manta ray) were based on the numbers of fish loose on the deck. The vessel did not record catches of nontarget, non-quota discard species such as flying fish, sunfish, porcupine fish, and jellyfish.

On this second trip, LF measurements were made on five of the seven days (five sets); fishing on one day resulted in zero catch of skipjack and on another day, too few skipjack were caught. These measurements were taken from a sample of 100 skipjack tuna from the first set of each day. Fewer fish were sampled on two occasions when larger fish filled the bins. Fish were collected from the deck once the scoop had been emptied and the observer used a purpose-built workbench beside the first starboard hold to make these measurements. Bycatch species (few in numbers of fish) were not sampled.

Bird observations were made during brailing of the first set of each day on the second observed trip, and dolphin observations were recorded on the two occasions dolphins were present.

On SKJ_2, 100% of sets and hauls were observed. A length frequency sample of 100 skipjack tuna was taken each day (from five sets). The observer quantified all species caught, but noted difficulty in achieving independence and accuracy in estimates because of the brailing speed and the on-board storage methods. Bird and marine mammal abundance and activity were recorded by the observer on the first set of each day.

2.7.3 Activity log data

Summaries of the activity log data for skipjack tuna fishing are given by trip in Tables 13–15. A substantial part of each day was spent steaming to and from grounds, searching for schools, or at anchor. Bad weather had a large impact on the fishing activity during SKJ_2 and gear repairs similarly affected SKJ_3. The completion of activity logs varied depending on the observer.

Table 13: Percentage of 24 h recorded for each activity, by day for the SKJ_1 observed trip. Time recorded against "no fishing" was due to dolphins in the vicinity, net mending, searching for schools, and awaiting sightings from spotter plane pilot. Time recorded as "port land" is time spent in port when unloading, and "examine" means the vessel was investigating the school. Table A1 of Appendix A gives a description of data fields collected by observers. Hours on an observer day which was the first or last day of a fishing trip were not reported for the full 24 hour period. On some days, the time spent anchored overnight was not recorded.

									Activity
Trip Day	Transit	Pilot radio	Search	Steam to school	Examine	Set	No fishing	Port land	Day %
1	69	< 1	7	4	–	–	2	2	84
2	21	–	–	–	–	–	–	–	21
3	48	–	–	5	–	–	–	4	57
4*	6	–	12	2	–	26	18	–	64
5*	17	–	11	1	3	29	3	–	64
6*	19	–	5	1	–	9	12	–	46
7	21	–	–	–	–	–	18	–	38
8*	50	–	2	1	–	14	4	–	72

* One set was made per day for Days 4, 6, and 8 and three sets were made on Day 5.

Table 14: Percentage of 24 h recorded for each activity, by day for the SKJ_2 observed trip. Time recorded against "no catch" was due to the small size of fish in the school or disappearance of the school. Table A1 of Appendix A gives a description of data fields collected by observers. Hours on an observer day which was the first or last day of a fishing trip were not reported for the full 24 hour period.

												Activity
Trip day	Transit	Bad weather	Port	Steam to anchor	At anchor	Search	Steam to school	Examine	Set	No catch	Port land	Day %
1	51	–	2	–	–	–	–	–	–	–	7	60
2*	1	–	–	–	–	14	5	1	15	63	–	99
3*	12	–	–	–	13	13	10	3	17	30	–	98
4	21	–	–	–	44	34	–	–	–	–	–	100
5	43	–	–	–	57	–	–	–	–	–	–	100
6*	–	–	–	17	33	25	3	5	9	6	–	98
7*	8	–	–	–	46	11	2	4	27	–	–	98
8*	31	–	1	–	24	27	2	5	9	–	–	100
9	37	–	–	4	25	33	–	–	–	–	–	100
10	21	52	–	–	25	–	–	2	–	–	–	100
11	–	100	–	–	–	–	–	–	–	–	–	100
12	31	26	–	–	–	43	–	–	–	–	–	100
13	–	–	–	29	–	–	–	–	–	–	–	29

* One set was made per day for Days 6 and 8; two sets per day for Days 2 and 3; and 4 sets on Day 7.

Table 15: Percentage of 24 h recorded for each activity, by day for the SKJ_3 observed trip. Time recorded against "Port" included time spent waiting for departure and for skiff repairs to be completed. "At anchor repairs" was time spent repairing gear. "Plane" includes spotter plane takeoff, school sighting, and return to base. Table A1 of Appendix A gives a description of data fields collected by observers. Note that where day % is greater than 100%, time included activity by vessel whilst observer asleep (as reported later to the observer by the crew).

	Activity										
Trip day	Transit	Port	Steam to search	Search	Steam to school	Examine	Set	At anchor	At anchor repairs	Plane	Day %
1	18	4	–	5	6	–	–	–	43	1	76
2	–	–	–	–	–	–	–	–	100	–	100
3	3	31	–	–	64	1	–	–	–	1	99
4	–	–	–	20	21	15	16	51	–	< 1	124
5	–	–	2	29	3	–	6	59	–	< 1	100
6	21	–	1	19	–	–	–	–	30	–	71
7	12	–	–	10	–	20	10	55	21	< 1	129
8	–	–	5	10	–	6	23	55	0	< 1	99
9	–	–	–	27	–	–	–	–	45	–	72
10	6	40	–	21	–	–	–	–	33	< 1	99
11	–	100	–	–	–	–	–	–	–	–	100
12	–	100	–	–	–	–	–	–	–	–	100
13	–	100	–	–	–	–	–	–	–	–	100
14	–	100	–	–	–	–	–	–	–	–	100
15	–	100	–	–	–	–	–	–	–	–	100
16	7	34	–	8	31	–	18	–	1	< 1	100
17	–	–	23	13	10	–	24	27	2	< 1	99
18	–	–	–	15	–	–	7	65	13	–	99
19	42	29	–	–	–	–	–	29	–	–	100

* One set was made a day for Days 5, 17, and 18; two sets a day for Days 4, 7, and 16; and 4 sets on Day 8.

2.7.4 Greenweight and length frequency data

Of the 30 observed purse seine sets that targeted skipjack tuna, 70% were estimated to be 0–20 t (greenweight at the surface), 20% were 20–40 t, and 10% over 50 t, with the maximum reported as 130.7 t. The on-board percentages were similar, with 73%, 17%, and 10% respectively, though the maximum catch on board was estimated at 55 t. Of the 30 sets, 20 had no fish loss (Figure 12) and 7 experienced losses of between 7.2 and 80.6 t; losses represented between 62 and 100% of the estimated catch at surface. The remaining three sets were skunked.

The locations of catches (on-board greenweight estimates) are shown in Figure 13. The smaller catches were made in FMA 2 and in the Bay of Plenty. Catches of 50 t (including the school estimated at 130 t) were made east of Great Barrier Island and the Coromandel Peninsula, and catches up to 30 t were made off Cape Brett.

From SKJ_1, in February 2005, Vessel X unloaded 147 t of fish from all six holds after six successful sets; the observer estimate of the total greenweight was less than 1% greater than that reported by the vessel. The catch from one unsuccessful set was lost when the bag burst from the weight of the fish. The observer recorded this quantity as 69 t of skipjack tuna (estimated by eye). The catch was very clean, with only 25 kg of bycatch (Table 16).

On the second observed trip on this vessel (SKJ_3), 11 of the 13 sets brailed either all the estimated surface weight of fish (7 sets) or various proportions (4 sets) (see Figure 11). The observer noted a set-by-set difference of 10% in the total greenweight estimated by himself and the vessel skipper, compared with an overall difference of 4.2%. A total of 114.15 t of skipjack was estimated by the observer compared with 118.93 t estimated by the vessel. Just over a tonne of bycatch was reported, and this consisted primarily of manta ray and some yellowfin tuna (Table 16).

Seven of the 10 sets were successfully brailed during SKJ_2, with on-board catches estimated at between 12 and 35 t; the remaining three sets lost between 75 and 100% of the estimated surface weight (see Figure 11). The catch of several manta rays contributed to most of the bycatch (Table 16).

Over the three trips, 1363 skipjack tuna were sampled for length frequencies. Lengths ranged between 36 and 68 cm, and females were generally larger than males. There appear to be two modes; one at around 47 cm and the other at about 51–52 cm (Figure 14). However, length frequencies showed marked differences between the vessels. The smaller fish caught during SKJ_2 represent the lower mode, whereas the larger fish caught on the two other trips contribute to the second mode. The latter trips were on the same vessel and fished in FMAs 1 and 2, south of 36° S, whereas the other vessel fished in slightly deeper waters north of 36° S. The net used by this latter vessel (W) had larger depth and mesh dimensions than that used by vessel X (see Table 12).

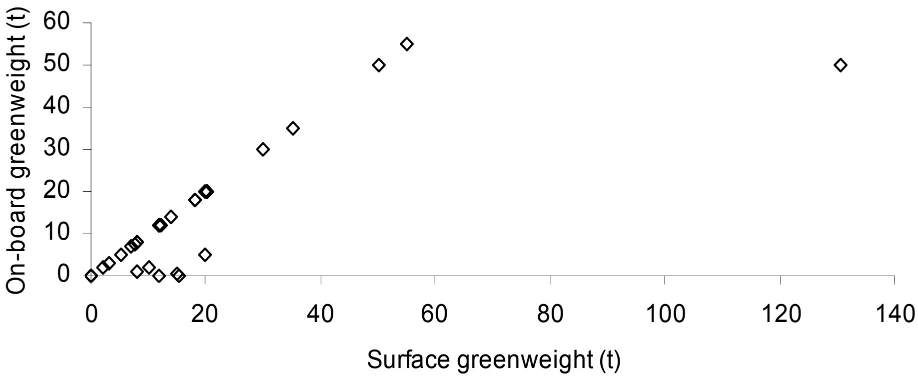

Figure 12: Relationship between estimated total greenweights for skipjack purse seine sets during February–March 2005.

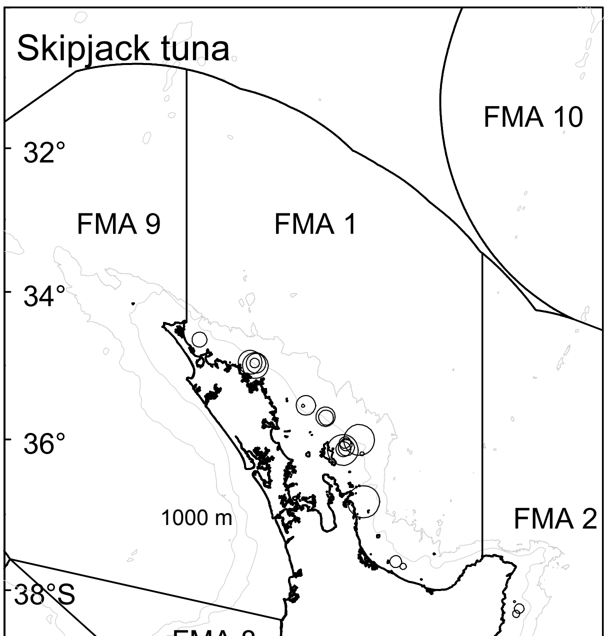

Figure 13: Location of catches represented by total on-board greenweight for purse seine sets that targeted skipjack tuna during all three SKJ trips, where the largest circle represents 55 t.

Table 16: Catch weight (kg) data from observed purse seine trips that targeted SKJ during 2004–05 and 2005–06. Species codes are given in Table B1 in Appendix B.

Target_trip	Species code	Discarded weight	Galley	Greenweight	Retained weight	Total
SKJ_1	FLY	6	–	–	–	6
	POP	–	–	4	–	4
	SKJ	–	–	147 000	–	147 000
	STR	15	–	–	–	15
	Total	21	–	147 004	–	147 025
SKJ_2	SUN	100	–	–	–	100
	FLY	1	–	20	–	21
	FTU	–	–	150	–	150
	MJA	700	–	–	–	700
	POP	–	–	60	6	66
	SKJ	4	–	148 700	–	148 704
	SQU	–	2	–	–	2
	STM	75	–	–	–	75
	STU	–	–	150	–	150
	Total	880	2	149 080	6	149 968
SKJ_3	SUN	50	–	15	–	65
	FLY	15	–	10	–	25
	JFI	14	–	–	–	14
	MJA	750	–	–	–	750
	POP	–	–	–	1	1
	SKJ	80	–	114 070	–	114 150
	YFN	–	12	330	–	342
	Total	909	12	114 425	1	115 347

2.7.5 Observations of seabirds and marine mammals

The Vessel X observer on the SKJ_1 noted that Buller's shearwaters, black petrels, and flesh-footed shearwaters were always present around the fish schools. There were no incidents of injury or capture of seabirds. On SKJ_3, the observer on Vessel X sighted flesh-footed shearwaters, Westland petrels, and black petrels. About 20–40 black petrels were seen in FMA 1, and several unidentified black-browed albatrosses were sighted in FMA 2, where there were never more than 10 birds around the vessel. The birds were not interested in the fishing operation and were at least 20 m away from the vessel. No birds were captured on this trip.

Dolphins were seen on two occasions in FMA 2, in pods of about 200 animals that briefly visited the vessel. No mammals were captured and the observer noted that the crew were not aware of a voluntary code of practice, but that they did not set when dolphins were around.

Vessel W had relatively few birds around the vessel during the purse seine set, with 2–10 birds in the vicinity (mean of 5). A petrel, thought by the observer to be black petrel, was the predominant species, with a few fluttering shearwaters, gannets, and prions completing the composition. As with previous sets, there was no interaction between birds and the net setting and pursing operations. Some birds fed on small fish discharged from the seine during net rolling and brailing, but the birds were well away from the fishing activity. The vessel did not set in the vicinity of dolphins. A pod of 10 bottlenose dolphins was seen during one set and on two occasions pods of about 6 common dolphins were bow-riding.

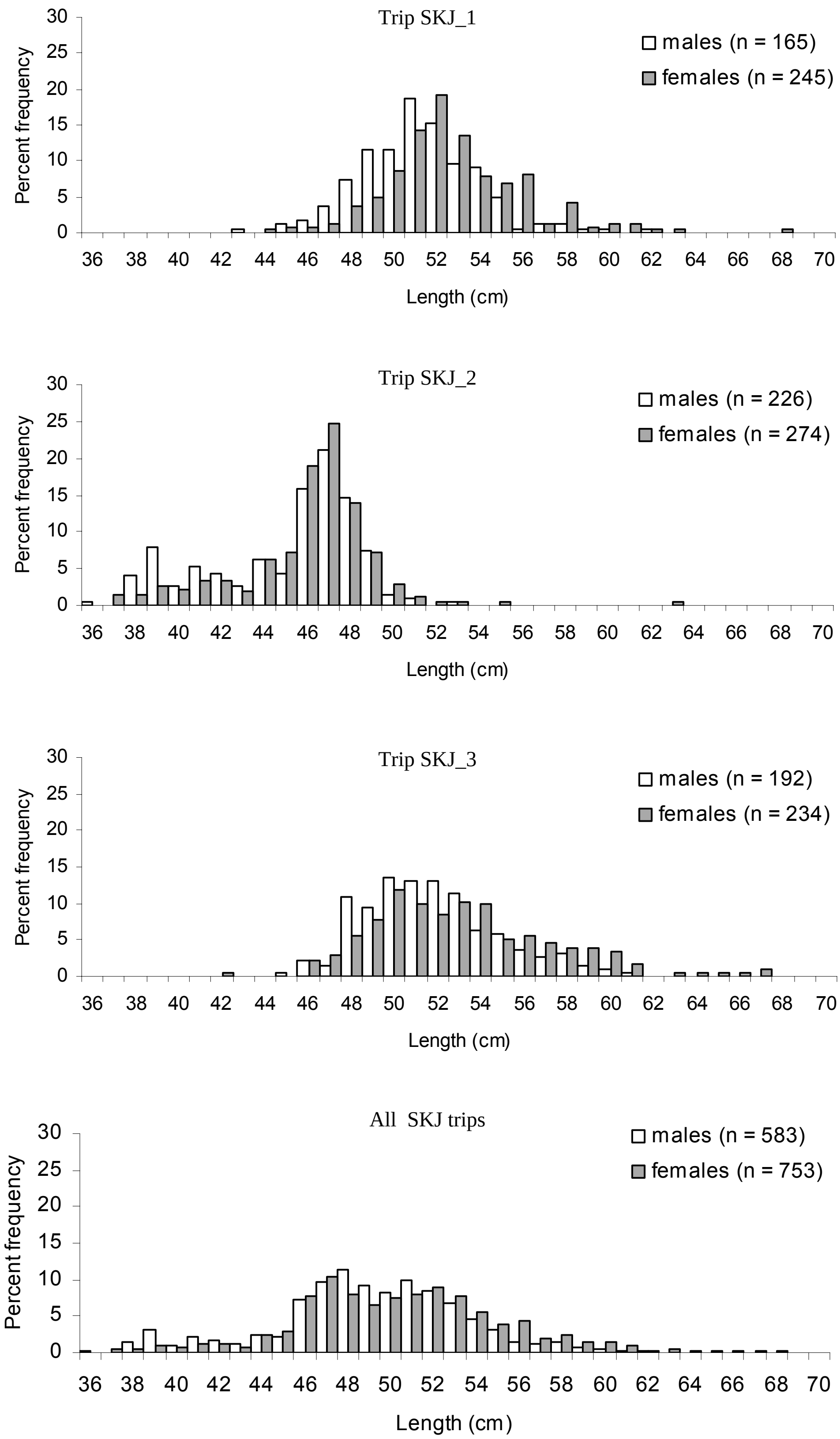

Figure 14: Length frequency distribution of skipjack tuna sampled during observed purse seine trips that targeted skipjack tuna schools during February-March 2005.

2.8 Factors that affected observer purse seine data collection

The number of sets made in a day and per observed trip on a purse seine vessel can vary widely from one observed trip to another (Table 17). Many reasons for a lack of sets were identified in the individual trip summaries above, particularly in some of the comments given by observers in their activity logs. Thus for all the fisheries, there are a variety of factors that potentially determine the success of the fishing trip and the observed trip. These can be divided into several categories: the factors that determine a fishing trip takes place; the success of the fishing once the vessel is at sea; and the required duties of the observer;

2.8.1 The likelihood of a fishing trip

One of the largest problems was the uncertainty around when fishing would take place. The reasons for the skipper going fishing were related to crew availability, weather conditions, likely presence of schools of an appropriate target species (one for which the skipper had quota), and condition of the gear (that is, whether anything needed repairing).

2.8.2 Fishing success

Once the vessel was underway, the factors determining successful fishing could be vessel-specific. The amount of quota available to a skipper would determine the schools targeted. For example, on the jack mackerel trip (that the observer programme had originally hoped would target kahawai) it is assumed that the skipper had little kahawai quota (either left or in total) because the skipper targeted schools that were primarily jack mackerel. Unfortunately, some schools sighted by the spotter planes were kahawai or a mix of both species and thus this restricted the number of schools the vessel could attempt to purse. Another skipper would steam to a school, for which the target species wasn't fully identified and would drop a line into the school to catch a fish to establish the target.

Table 17: Number of purse seine sets made per observed trip day for each observed trip (identified by target species) in 2004–05 and 2005–06. Species codes are given in Table B1 in Appendix B.

Observed	Observer trip					
trip day	EMA	JMA	PIL	SKJ_1	SKJ_2	SKJ_3
1	0	0	1	0	0	0
2	3	1	1	0	2	0
3	3	1	0	0	2	0
4	0	0	2	1	0	2
5	0	2	1	3	0	1
6	0	1	1	1	1	0
7	0	2	0	0	4	2
8	2	–	0	1	1	4
9	4	–	0	–	0	0
10	2	–	–	–	0	0
11	1	–	–	–	0	0
12	–	–	–	–	0	0
13	–	–	–	–	0	0
14	–	–	–	–	–	0
15	–	–	–	–	–	0
16	–	–	–	–	–	2
17	–	–	–	–	–	1
18	–	–	–	–	–	1
19	–	–	–	–	–	0

This is not a problem when targeting skipjack because it is not a quota species. However, concerns relayed to observers on these vessels related to the presence of superseiners that appear to access spotter plane radio reports and because of their superior speed may get to the target school first and thus recover the catch.

The number of vessels fishing on known grounds can have other costs and benefits. As mentioned above, spotter plane sightings are often relayed to several vessels; it seems there may be at least five domestic vessels fishing in an area at one time. Thus, there can sometimes be a race to get to the school first. One of the skipjack vessels moved away from an area that was being fished simultaneously by similar-sized vessels as well as the three superseiners. However, close proximity of other vessels may allow a vessel to target a school that it may not have feasibly targeted because of fears of over-catching its hold capacity. Any extra catch could be transferred and brailed by a sister vessel.

Thus, the capacity of a vessel determines what size of school a vessel will target. Larger schools will be targeted by a vessel at the start of a trip. If the holds are getting full, the vessel skipper needs to be selective on school size as well as target species. It also appears that for some skippers a small school is not worth targeting, as reported by an observer on a skipjack tuna trip.

Gear breakdowns seemed to be one of the predominant reasons provided on the activity log for some vessels either to heave to or to return to port. The type of gear problems encountered were related to rips in the net (when the catch was concentrated in the bunt end of the net and as the net was being rolled and sacked); breakdown of the skiff; and a malfunctioning freezer.

Bad weather was a factor in time spent not fishing or actively searching. Vessels sought shelter in bays or off islands until the bad weather receded. The larger vessels steamed some distances from their home ports (mainly Tauranga) to get to fishing grounds and thus for short periods of rough weather, they were likely to stay at sea. The small vessel that operated from Whangarei also remained on the pilchard fishing grounds during extensive net repairs.

All of the above assume that the fish were schooling and sighted either by spotter planes or by the vessel skipper or sonar. Many hours on most trips were spent searching for schools or waiting for sightings from the spotter planes. The behaviour of some schools caused a certain amount of frustration and difficulty in snaring the school. The main problem identified was the fish going down in the water column and therefore escaping before the net either encircled the school or was pursed.

2.8.3 Success in data collection

As noted previously, comments from the first observer placed on purse seine vessels during his familiarisation with the fishing procedure on several different vessels were used to amend the data forms. One of the major concerns was the area in which the observer would be expected to carry out his/her duties; this needed to be out of the way so that it did not disrupt normal fishing procedure. At the same time it needed to be somewhere stable to allow the observer to work efficiently. All observers commented on the good cooperation they got from the vessel crews, which made their job easier. Thus, fulfilment of various aspects of the observer’s duties would be reliant on vessel activity. For example, if the vessel had needed to set the gear while the observer was working, the biological sampling would be aborted. Some observers sampled the first set of the day; others sampled the last set of the day. The latter situation sometimes caused a problem because the observer could never be sure which set was going to be the last.

For some observers, there were some major concerns about the estimation of scoop weights and hold capacities. Often the depth of fish in the holds was used as a percentage of the maximum hold capacities to estimate the on-board weight.

2.9 Recommendations for data collection

There are several aspects of the recorded data that would benefit from having a more defined structure to the data collection.

- Standard information that describes the net and vessel specifications on the trip report — although there are specific fields for the observer to complete, the data were provided at different levels of completeness.
- The collection of bycatch data would be improved if the two codes for manta rays and the four codes for stingrays were available for use by the observer, presuming the observer has the identification information available.
- It is not clear how temperatures (SST) are measured and concern was expressed as to the level of accuracy (Paul Taylor, NIWA, pers. comm.). It is suggested that the onboard thermometer is calibrated at the start of each trip and adjustments be made if necessary.
- Observers would benefit from feedback and perhaps tighter instruction with respect to completing the activity logs to enable a seamless summary of each 24-h period. This would help to characterise the fisheries further and also increase the ease with which the data could be summarised from the database.
- Some of the comments made by observers in their diaries were extremely useful in describing the strategies used by fishers (for example, fishing to the vessel's capacity), the difficulties in certain aspects of the fishing operation (for example, the influence of weather or the effect of changing holds on the brailing or pumping time), and gear problems. Many of these aspects directly affect the success of the fishing, which evidently varies between trips as well as during trips. It is important to be able to consider this kind of information when discussing the 'hard' data. Thus, it would be useful to provide the observers with a list of information needs, so they have some direction in their diary notes. Observers new to the fishery could be provided with summaries of the history of the fishery and the fishing technology or methodology, if they are not already.
- It would also be useful to provide clear instructions on the use of the *Comments* field, so that comments directly supplement the data fields.
- The estimation of greenweight (both at the surface and on board) was a task that each observer attempted to find the best way for himself. A general discussion between the observers could be useful for all.

3. OBSERVED TRAWL FISHERIES, 2004–05

During 2004–05, 20 observer days were allocated to collecting data on kingfish bycatch from inshore vessels, and 7 days were achieved. Another 20 days were allocated in 2005–06 and 15 were achieved. Another 20 days were allocated to trevally target fishing and 17 of these were observed.

3.1 Trawl fisheries with kingfish bycatch 2004–05

Ten observed trips during 2004–05 reported kingfish as bycatch during trawl fishing targeted at barracouta, blue mackerel, red gurnard, hoki, jack mackerel, moki, tarakihi, and common warehou (Table 18). However, only one of these trips was on an inshore trawler (Trip 6 in Table 18). This vessel operated a winged bottom trawl net with a wingspread of 15 m and a headline height of 5 m and fished in 27–167 m. The remainder of the observed tows with kingfish bycatch were on large Ukrainian trawlers that used large midwater nets and predominantly targeted jack mackerels off the Taranaki Bight in 100–150 m. For interest, the catch of kingfish from these vessels is described here. The distribution of the observed effort and that which caught kingfish is shown in Figure 15.

Table 18: Details for observed trips on trawlers that caught kingfish (KIN) during 2004–05*.

					Total tows		KIN
Trip	Month	Area	Target	Gear	No.	% with KIN	(kg)
1	Nov	FMA 9, 8	JMA	MW	56	27	316
2	Nov	FMA 9, 8	JMA	MW	52	29	268
3	Nov–Dec	FMA 9, 8	JMA	MW	111	14	498
4	Nov–Dec	FMA 9, 8	JMA/HOK	MW	68	22	702
5	Mar–May	FMA 3, 5–8	SQU/JMA/BAR	MW	94	16	220
6	Apr–May	FMA 2	TAR/GUR/MOK/ WAR/ORH	BT	22	68	655
7	May–Jun	FMA 7-9	JMA/BAR/EMA/ HOK/HAK	MW	83	18	1 004
8	Jun–Jul	FMA 7-9	JMA	MW	112	13	1 558
9	Jun–Jul	FMA 7, 8	HOK/JMA/BAR	MW	153	10	8 434
10	Jul–Sep	FMA 7, 8	HOK/BAR/JMA/ EMA/RBT	MW	203	7	7 305

* See Figure 15 for Fishery Management Area (FMA) areas and Table 22 for species codes. MW is the code for midwater trawl gear and BT for bottom trawl gear.

3.1.1 Catch and biological data

Kingfish were observed caught during tows that targeted red gurnard, moki, tarakihi, and warehou in FMA 2, barracouta, blue mackerel, and jack mackerel in FMAs 7 and 8, and hoki and jack mackerel in FMA 9 (Table 19, Figure 15). The largest catches per tow were made in July off the Taranaki Bight in tows that targeted JMA, BAR, and EMA. The catch by the one inshore vessel is evident as trip 6 in Table 19.

Of the 10 observed trips with kingfish catches recorded, kingfish contributed less than 1% of the catch on 82% of 156 observed tows with at least one kingfish record. Almost 50% of catches were of less than 25 kg per observed tow, and 75% were less than 50 kg (Figure 16). Thus few tows caught even moderate quantities of kingfish. Three percent of observed tows with kingfish catches contributed to over 10% of the total greenweight of all species per tow; generally the total greenweight recorded for these tows was less than 25 000 kg (Figure 17).

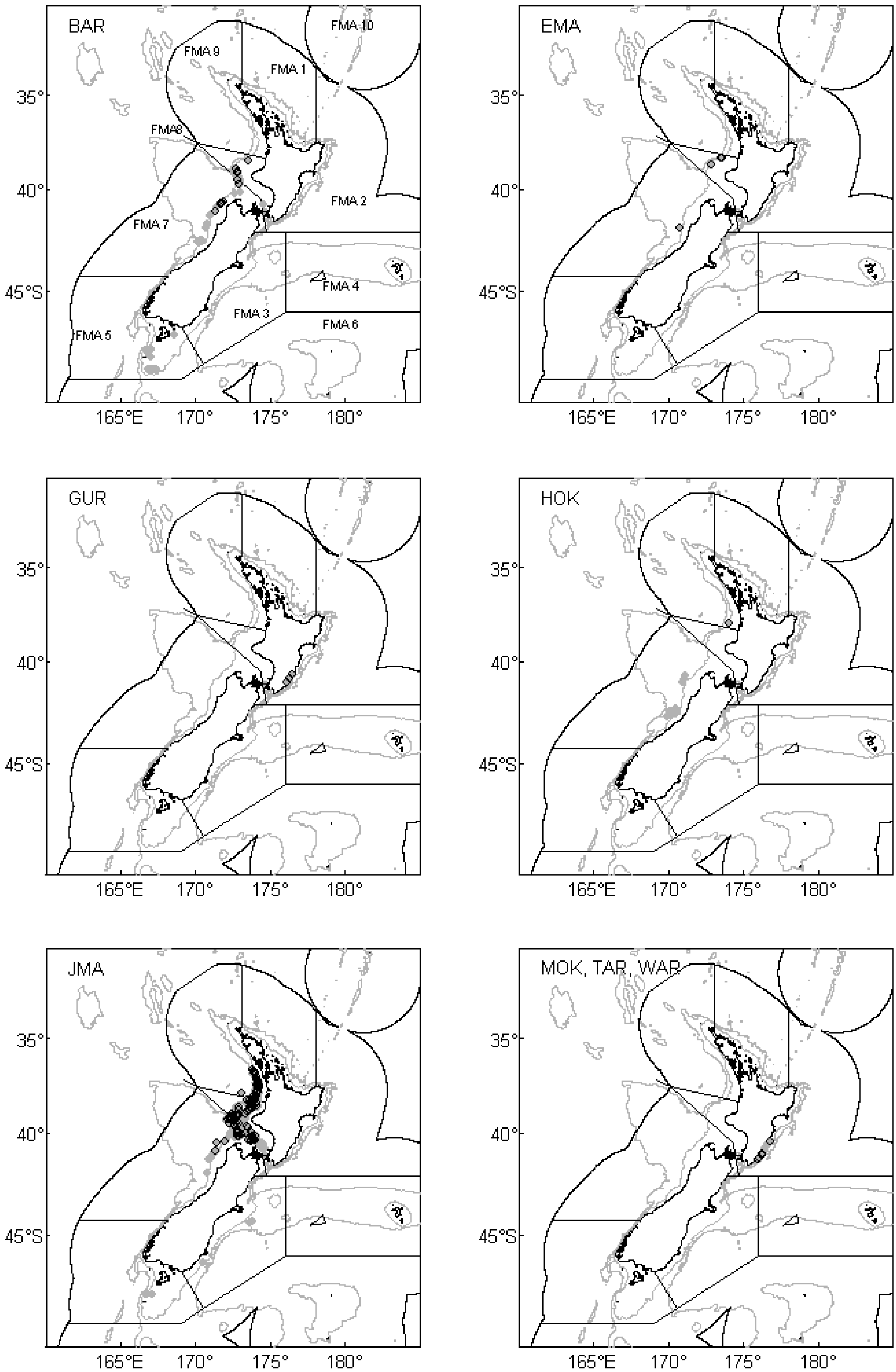

Figure 15: Start positions of observed tows (◆), including those with kingfish bycatch (◇), for those observed trips that reported kingfish bycatch during 2004–05. The target species of the observed effort is given on each plot, where BAR is barracouta, EMA is English mackerel, GUR is red gurnard, HOK is hoki, JMA is jack mackerels, MOK is moki, TAR is tarakihi, and WAR is blue warehou.

Table 19: Total greenweight (kg) of kingfish caught by observed trips summarised in Table 18, by target species and Fishery Management Area (FMA) (upper) and by trip (lower), 2004–05.

									Target species
FMA	BAR	EMA	GUR	HOK	JMA	MOK	TAR	WAR	total
1	0	0	0	0	0	0	0	0	0
2	0	0	101	0	0	69	479	6	655
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	2 752	189	0	0	9 315	0	0	0	12 256
8	514	766	0	0	4 885	0	0	0	6 165
9	0	0	0	127	1 757	0	0	0	1 884
10	0	0	0	0	0	0	0	0	0
Total	3 266	955	101	127	15 957	69	479	6	20 960

									Target species
Trip	BAR	EMA	GUR	HOK	JMA	MOK	TAR	WAR	total
1	0	0	0	0	316	0	0	0	316
2	0	0	0	0	268	0	0	0	268
3	0	0	0	0	498	0	0	0	498
4	0	0	0	127	575	0	0	0	702
5	0	0	0	0	220	0	0	0	220
6	0	0	101	0	0	69	479	6	655
7	60	189	0	0	755	0	0	0	1 004
8	0	0	0	0	1 558	0	0	0	1 558
9	0	0	0	0	8 434	0	0	0	8 434
10	3206	766	0	0	3 333	0	0	0	7 305
Total	3 266	955	101	127	15 957	69	479	6	20 960

3.1.2 Length frequency recorded by observers for kingfish bycatch

Most (86%) of the observed kingfish measurements came from the inshore observed trip (Figure 18). This trip was the only one in which the observer was required to undertake biological sampling. All the fish on this trip were sampled except for a few undersized fish that were weighed in full and returned to the sea. Similar numbers of males and females were measured in the total of 98 fish. All fish were between 50 and 130 cm long.

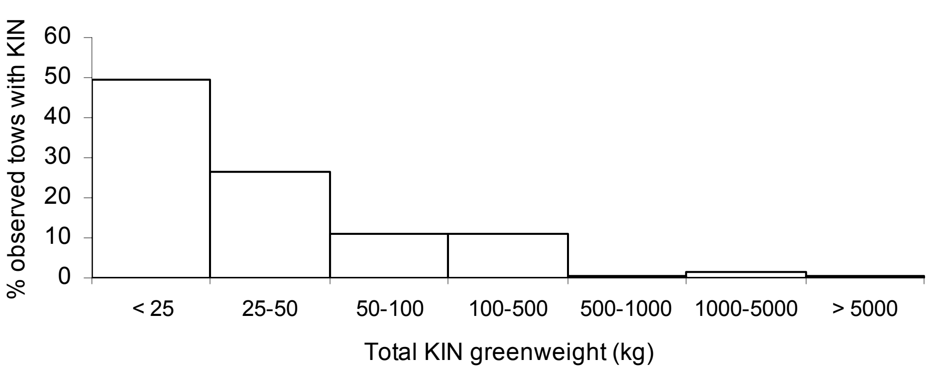

Figure 16: Percentage of observed tows with kingfish catches, by total kingfish (KIN) greenweight per tow. A total of 156 observed tows caught kingfish in 2004–05.

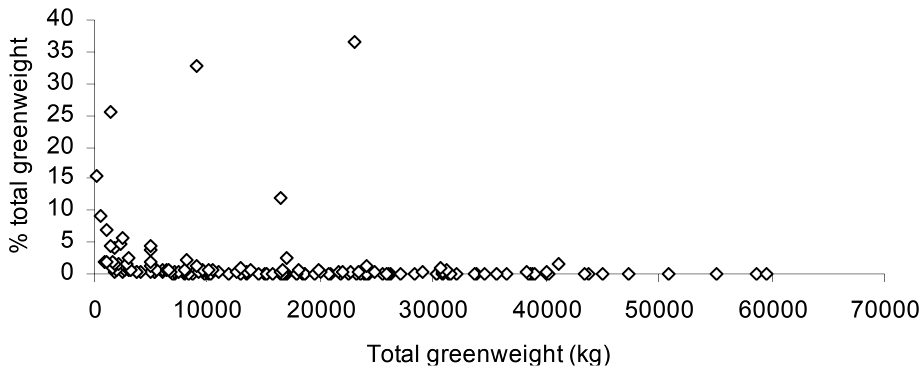

Figure 17: Proportion that kingfish represents in the total greenweight (kg) of all species caught per observed tow.

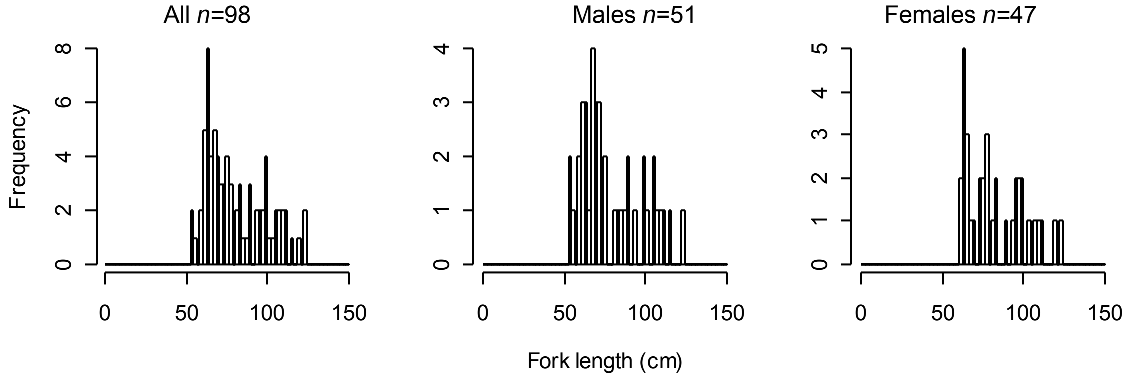

Figure 18: Length frequency distributions of kingfish caught during observed trips in 2004–05, where 86% of fish came from the inshore trip.

3.1.3 Processed state of the kingfish catch

Other than the trip on the inshore vessel, 89% of the weight of kingfish was processed to dressed state (Table 20), with most of the rest being consumed in the galley. The inshore vessel discarded a small proportion and head and gutted most of the catch. Usually kingfish are left as "green" but because otoliths were being collected, the fish were generally headed and gutted.

Table 20: Processed state* and weights (kg) for kingfish caught during observed trawl trips in 2004–05. Trip details are given in Table 18.

Observed					Processed state
trip	DRE	EAT	GRE	HGU	Total
1	0	316	0	0	316
2	0	221	0	0	221
3	139.2	233	0	0	372.2
4	349.5	32	0	0	404.5
5	0	220	0	0	220
6	0	0	18	378.6	396.6
7	465	172	0	0	637
8	742	105	0	0	847
9	4674	20	0	0	4694
10	3 911.5	264	0	0	4 175.5
Total	10 281.2	1 583	18	378.6	12 283.8

* Processed states are: DRE for dressed, EAT for galley, GRE for green (whole), HGU for headed and gutted. Note that the totals for trip 4 (and all trips combined) include 23 kg of kingfish that had no record for processed state.

3.2 Observed trevally trawl fisheries, 2005–06

Two observed trips off the west coast of the North Island targeted trevally with bottom trawl gear in waters 18–160 m deep, though most were in the 40–80 m (Table 21, Figure 19).

Table 21: Details for observed trevally trips during 2005–06.

					Number of tows	
Trip	Month	Area	Target	Gear	All	% target TRE
1	8–15 Dec	TRE 7	TRE, SNA	BT	23	20
2	14–17 Dec to 3–16 Jan	TRE 7, TRE 1	TRE, SNA, TAR	BT	54	48

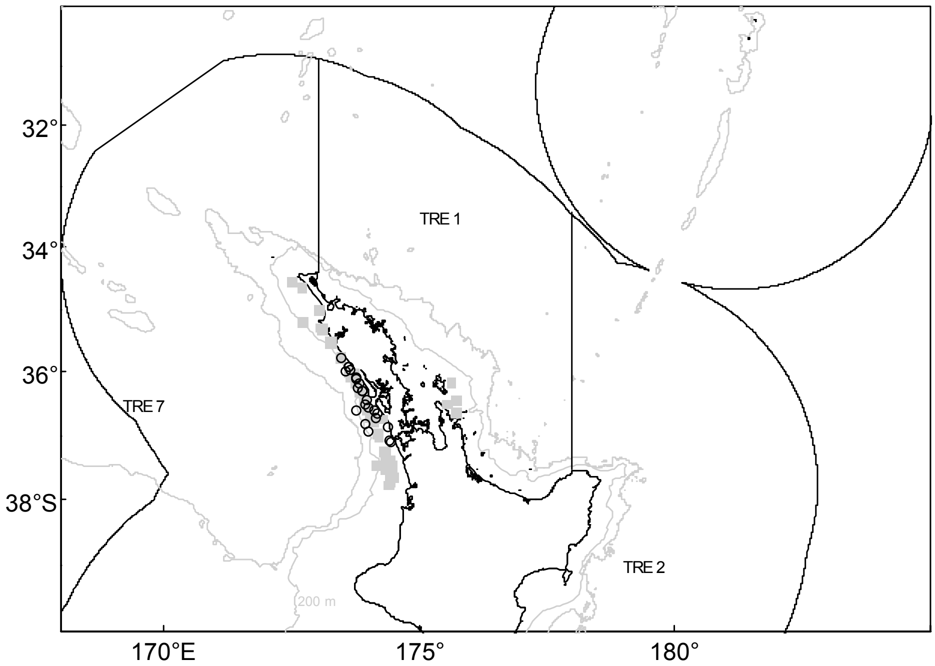

Figure 19: Start positions of observed tows on two observed trips that mainly targeted trevally during December–January 2005–06. The symbols represent Trip 1 (■) and Trip 2 (○).

3.2.1 Catch and biological data

Trevally catches were recorded on all but one tow in Trip 1 and all but two tows on Trip 2. From a total of 68 observed tows that targeted trevally during December 2005 and January 2006, the catch of trevally represented 59% of the total calculated greenweight of over 220 t (Table 21), with another 11% being snapper, and barracouta, red gurnard, kahawai, jack mackerel, school shark, John dory, and tarakihi accounting for most of the rest of the catch. Trip 2 accounted for 90% of the calculated greenweight. All the above species were kept whole, other than the school shark which was dressed (Table 22).

3.2.2 Length frequency distribution for trevally

Observers measured 2896 trevally, with 62% measured during Trip 2. No fish were sexed. Lengths ranged from 27 to 65 cm, with a peak at 38 cm (Figure 20). However, Trip 1 caught smaller fish, with a peak at about 35–37 cm, compared with a peak of around 39–43 cm for Trip 2 fish (Figure 21).

Table 22: Processed state* and weights (kg) for species caught during observed trevally tows, 2005–06.

Species			DIS	DRE	FIL	GRE	unk	Total
TRE	Trevally	*Pseudocaranx dentex*	–	–	–	131020	–	131 020
SNA	Snapper	*Pagrus auratus*	4	–	–	24626	–	24 630
BAR	Barracouta	*Thyrsites atun*	–	–	–	15831	–	15 831
GUR	Red gurnard	*Chelidonichthys kumu*	–	–	–	14098	–	14 098
KAH	Kahawai	*Arripis trutta*	–	–	–	10585	–	10 585
JMA	Jack mackerel	*Trachurus* spp.	–	–	–	5710	–	5 710
SCH	School shark	*Galeorhinus galeus*	–	5679	–	–	–	5 679
JDO	John dory	*Zeus faber*	–	–	–	4344	–	4 344
TAR	Tarakihi	*Nematodactylus macropterus*	–	–	–	3283	–	3 283
PUF	Pufferfish	*Sphoeroides pachygaster*	1566	–	–	–	–	1 566
SPD	Spiny dogfish	*Squalus acanthias*	829	–	–		–	829
KIN	Kingfish	*Seriola lalandi*	172	–	–	454	–	626
SPO	Rig	*Mustelus*	–	478	–	16	–	494
CAR	Carpet shark	*Cephaloscyllium isabellum*	413	–	–	–	–	413
FRO	Frostfish	*Lepidopus caudatus*	–	–	–	286	–	286
LEA	Leatherjacket	*Parika scaber*	–	–	–	157	120	277
EGR	Eagle ray	*Myliobatis tenuicaudatus*	263	–	–	–	–	263
SSK	Smooth skate	*Dipturus innominatus*	1	40	202	10	–	253
SUN	Sunfish	*Mola mola*	230	–	–	–	–	230
FLA	Flatfish		–	–	–	212	–	212
BWH	Bronze whaler shark	*Carcharhinus brachyurus*	–	200	–	–	–	200
POP	Porcupine fish	*Allomycterus jaculiferus*	180	–	–	–	–	180
STR	Stingray		173	–	–	–	–	173
BER	Blind electric eel	*Typhlonarche* sp.	165	–	–	–	–	165
STA	Giant stargazer	*Kathetostoma giganteum*	3	–	–	157	–	160
SQU	Arrow squid	*Nototodarus* sp.	–	–	–	78	30	108
LSK	Softnose skate	*Arhynchobatis asperrimus*	105	–	–	–	–	105
SWA	Silver warehou	*Seriolella*	–	–	–	68	–	68
EMA	English mackerel	*Scomber australasicus*	–	–	–	35	30	65
UNI	Unidentified		62	–	–	–	–	62
ERA	Electric ray	*Torpedo fairchildi*	45	–	–	–	–	45
BRZ	Brown stargazer	*Xenocephalus armatus*	–	–	–	36	1	37
GSH	Ghost shark	*Hydrolagus novaezealandiae*	–	–	–	37	–	37
THR	Thresher shark	*Alopias vulpinus*	27	7	–	–	–	34
LIN	Ling	*Genypterus blacodes*	–	18	–	15	–	33
WRA	Longtailed stingray	*Dasyatis thetidis*	30	–	–		–	30
GAS	Gastropods	Gastropoda	25	–	–	–	–	25
MAC	Mackerels		–	–	–	20	–	20
HOK	Hoki	*Macruronus novaezelandiae*	–	–	–	15	–	15
NSD	Northern spiny dogfish	*Squalus griffini*	15	–	–	–	–	15
JFI	Jellyfish		12	–	–	–	–	12
TAM	Urchin	Echinothuriidae	–	–	–	10	–	10
BCO	Blue cod	*Parapercis colias*	–	–	–	4	–	4
CRB	Crab		4	–	–	–	–	4
MUU	Mullet		–	–	–	4	–	4
PHC	Packhorse rock lobster	*Jasus verreauxi*	3	–	–	–	–	3
WOD	Wood		3	–	–		–	3
OCT	Octopus		2	–	–	–	–	2
SEO	Seaweed		2	–	–	–	–	2
WAR	Blue warehou	*Seriolella brama*	–	–	–	2	–	2
RCO	Red cod	*Pseudophycis bachus*	–	–	–	1	–	1
SFI	Starfish		1	–	–	–	–	1
All			4 335	6 422	202	211 114	181	222 254

* Processed states are: DIS for discarded, DRE for dressed, FIL for filleted, and GRE for green (whole).

3.2.3 Dolphin incidental capture on observed trevally tows

Two common dolphins (*Delphinus delphis* — as identified by the observer) were landed dead from one tow south of the entrance to Kaipara Harbour.

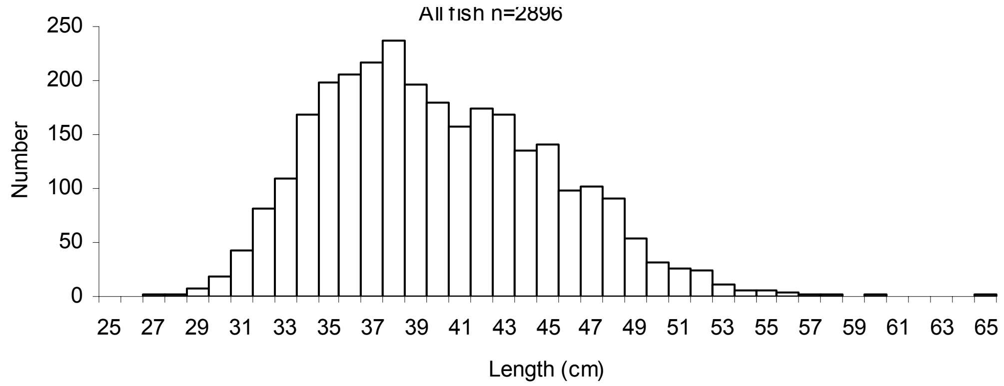

Figure 20: Length frequency distribution for trevally caught off the west coast North Island in TRE 7 during two observed trips, 2005–06.

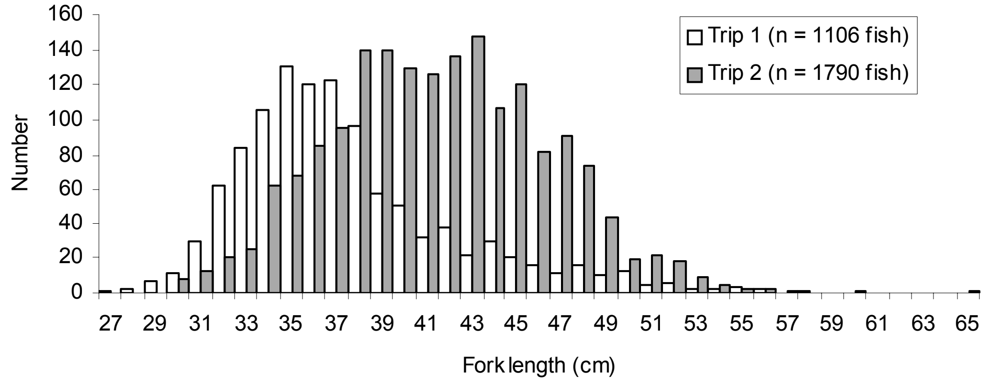

Figure 21: Length frequency distribution for trevally caught off the west coast North Island in TRE 7, by trip, 2005–06.

4. SHARK CONVERSION FACTORS AND FINNING PRACTICES AS REPORTED IN THE OBSERVED TUNA LONGLINE DATA

The increase in domestic fishing effort in the surface longline fisheries since the late 1990s, and perhaps the better reporting of shark species, has led to higher levels of reported catches of shark species such as blue sharks (*Prionace glauca*), porbeagle (*Lamna nasus*), mako (*Isurus oxyrinchus*), and school shark (*Galeorhinus galeus*) (Francis et al. 2004, Ayers et al. 2004, Griggs et al. 2007). These authors also presented summaries of observed fishing effort and catch data for foreign-licensed, chartered, and domestic surface longline fleets that primarily targeted tuna (*Thunnus* spp.) species. In all years except 1996, most of the observed hooks were reported from Japanese longlines during effort targeted mainly at *T. maccoyii*. These observer data indicate that most sharks were processed in some way, with some species finned before being discarded and others being processed for their flesh.

The data presented here are used to describe any changes in finning practices, rather than trends in observed numbers of captures, summaries of which were reported by Francis et al. (2000, 2004), Ayers et al. (2004), and Griggs et al. (2007) along with further discussion of handling and life status relative to the catch of the target species.

4.1 Shark conversion factors

There is no formal data collection by MFish observers on shark conversion factors (A. Martin, MFish Observer Programme, pers. comm.), largely because it is impractical for observers to use electronic scales on small vessels. Thus, there is no further comment on conversion factors in this report, other than to note that observers have started to provide diagrammatic information showing fin cuts (exclusive of length and weight details) and that observers do record fin weight from the charter vessels, but this cannot be easily linked back to the shark greenweight. However, one diary note by an observer noted results from his attempt at a conversion factor for blue sharks. He calculated a conversion factor of 14.53 based on 139 blue sharks (total weight of 2680 kg).

4.2 Shark finning practices, based on observer data

When observers complete the tuna longline deck log, they measure and weigh a representative sample of each shark species and the number measured depends on various factors including the numbers caught, vessel size, shark size, or the weather (L. Griggs, NIWA, pers. comm.). The form requires observers to code the life status as 'alive', 'dead', 'killed by crew', or 'unknown' and the handling status as 'discarded', 'finned', 'retained for further processing', 'lost', or 'unknown'. In the summary tables presented here, sharks killed by the crew are included in the landed alive totals and sharks retained for processing are included in the numbers finned.

Observers record whether the shark was finned or not for individuals reported on the deck log, and in recent years, observers also noted these details for those shark species tallied at the bottom of the form. Thus, over the time series, there is an increasing amount of data for individual sharks, particularly blue sharks. It was evident that there were some problems with the recording of various codes in the handling and life status fields of the shark catch data, particularly with respect to the processed state field. This field was not consistently completed and, in some records, codes that related to fish processing rather than shark processing were used. The use of some codes, such as 'OT' (the code for "other") appears to be observer dependent. The completion of the processed state field would provide more data on the product from those sharks that are finned and retained.

From the full dataset from 1992 to 2005 fishing years, at least 26 shark species (Tables C1 & C2 in Appendix C) were reported caught. Blue sharks were the most abundant, accounting for at least 75% of all shark captures by each fleet (Table 23). Sharks were more likely to be landed alive than dead (see also Tables C3–C6), and this may depend on the species, for example, mako sharks appear to be more likely to be landed alive than were porbeagle sharks (Tables C7 & C8). Francis et al. (2000) noted that porbeagle sharks caught in more northern waters were more likely to be dead on landing than those caught in more southern waters. Note that these numbers are presented in isolation from the observed effort data and any trends in numbers caught may reflect the coverage of the fleet rather than an increase or decrease in sharks captures.

The handling practices for blue sharks landed alive on Japanese vessels have changed over the years, and the changes appear to reflect the fleet make-up. Before 1996 (the year in which there was no Japanese effort), both chartered and foreign-licensed Japanese vessels were present in the fishery and were observed. After 1996, only chartered vessels fished New Zealand waters, and in 2005 only two of the usual four or five chartered vessels were present. The Japanese were more likely than the domestic fishers to fin blue sharks, and in the early 1990s, 30–60% of blue sharks landed alive on observed Japanese vessels were finned (Figure 22, Table C3). After 1996, between 72 and 86% of blue sharks landed alive were finned each year, and in most years a very small proportion of these finned sharks was retained for further processing.

Less than 50% of other sharks landed alive by Japanese vessels were finned in the early years. In 1996, about 70% were finned, but in subsequent years there was a steady downward trend to less than 30% in 2004. However, in 2005, when the number of vessels in the fishery halved to two, about 70% of other sharks were finned. This coincided with a higher percentage of live sharks being retained (Table C4).

If not kept for finning, alive blue sharks were reported by observers as discarded or lost. Of those discarded, between 24 and 64% were killed by the crew between 1992 and 2002. In subsequent years, this percentage dropped, to zero in 2004–05. This also occurred with the other shark species; however, unlike for blue sharks, there is no trend in the numbers discarded relative to the numbers finned (see Tables C3 & C4). All sharks landed dead were more likely to be finned than discarded after 1996. No quota species such as school shark (and blue, mako, and porbeagle sharks since October 2004) should be discarded.

There were no real trends in the handling practices of sharks landed alive on observed domestic longlines (Tables C5 & C6), though in recent years more were discarded than finned, except blue sharks in 2004–05. The percentage of blue sharks that was finned after being landed alive fluctuated from year to year, with less than about 60% in most years. Overall, the percentage finning of other sharks has decreased with less than 40% of other sharks landed alive being finned each year in recent years. Of sharks landed alive and discarded, up to 12% were killed by the crew in a year.

The most commonly finned species other than blue shark were porbeagle shark, mako shark, and school shark (Table C9). Almost all the observed deepwater dogfish were discarded. There were no real patterns with the domestic practices for these species, though most school sharks were finned and retained, and porbeagle sharks were more likely to be discarded, as were live mako sharks (Table C7). Mako and school sharks were usually finned and retained by Japanese fishers after 1998, whereas less than about 25% of porbeagle sharks that were finned each year were retained for further processing (Table C8). Data related to the processing of retained sharks were inconsistently recorded, if at all, and were not used in this summary. Improvements to the processed state data collection would greatly increase the understanding of the fate of finned and retained sharks.

Several factors may affect these data. Firstly, on the vessel, finning practice may be influenced by the size of the shark (for example, most finned blue sharks were between 100 and 200 cm fork length); the size of the catch of the target species (a large catch may limit time and space); the weather; and the attitude of the skipper to finning as a practice (L. Griggs, NIWA, pers. comm.). Secondly, Schedule 6 of the Fisheries Act 1996, applied from 1 October 2004 when mako, porbeagle, and blue sharks became quota species, allowed fishers to return any live individuals to the water if they were likely to survive and were returned as soon as possible (www.fish.govt.nz). It would be interesting to review these data in several years to measure changes in practices.

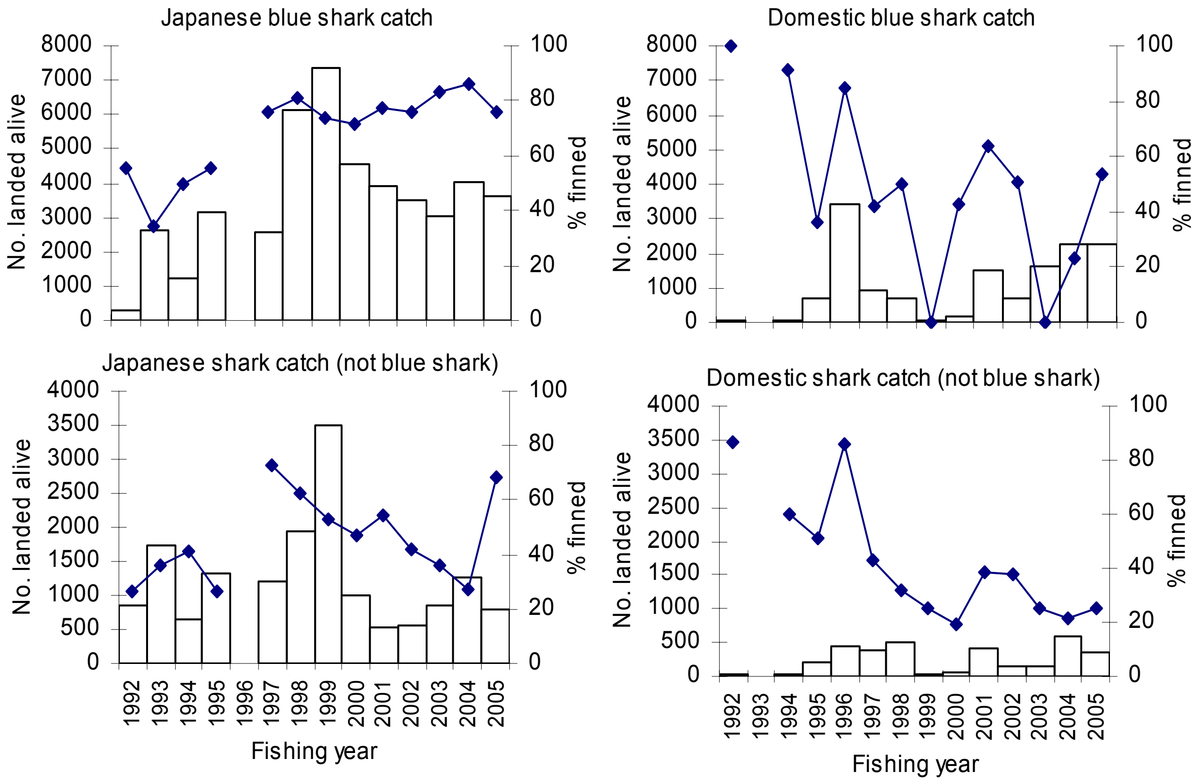

Figure 22: Observed numbers of sharks landed alive (histogram) and percentage of alive sharks that were finned, for Japanese (left) and domestic (right) vessels, 1992–2005. There was no effort by Japanese vessels in 1996 and no observer coverage of the domestic fleet in 1993.

Thirdly, the observed domestic effort has been on a variety of vessels and fishing practices tend to be vessel dependant (L. Griggs, NIWA, pers. comm.). In some years most observer coverage was on a large vessel that fished differently from the rest of the domestic fleet. Thus, a small component of a diverse fleet is covered by observers, and the practices summarised for domestic vessels are unlikely to describe the fleet's finning practices very well. Lastly, a new version of the Tuna Longlining Catch Effort Return, introduced during 2003, required improved reporting of discards and may affect the data since 2003.

Table 23: Numbers of sharks observed caught, and percentage released alive*, by the three fleets that operated in New Zealand waters, 1992–2005. Note the Philippine-flagged vessels fished in 2003 only.

	No. blue sharks		No. other sharks		Total	
Fleet	No.	% alive	No.	% alive	No.	% alive
Domestic	17 084	90	4 755	70	21 839	85
Japanese	77 824	86	24 695	69	102 519	81
Philippine-flagged	772	95	263	82	1 035	96
All	95 680	87	29 713	70	125 393	82

* Life status percentages are based on data for which the life status records were not null: 75% of Japanese shark captures (69% of blue sharks and 95% of others); 95% of domestic captures (94% of blue sharks and 99% others); and 96% of captures by the two Philippine-flagged vessels (95% of blue sharks and 100% of others).

5. ACKNOWLEDGMENTS

Grateful thanks to the MFish Observer Programme, particularly Alan Martin, for very useful discussions and access to observer diaries and to Paul Taylor, Larry Paul, Lynda Griggs, and Malcolm Francis (NIWA) for helpful comments on the first draft. This work was completed for the Ministry of Fisheries under project PEL2005/01.

6. REFERENCES

Ayers, D.; Francis, M.P.; Griggs, L.H.; Baird, S.J. (2004). Fish bycatch in New Zealand tuna longline fisheries, 2000–01 and 2001–02. *New Zealand Fisheries Assessment Report 2004/46*. 47 p.

Francis, M. P.; Griggs, L. H.; Baird, S. J.; Murray, T.E.; Dean, H.D. (2000). Fish bycatch in New Zealand tuna longline fisheries, 1988–89 to 1997–1998. *NIWA Technical Report 76*. 79 p.

Francis, M. P.; Griggs, L. H.; Baird, S. J. (2004). Fish bycatch in New Zealand tuna longline fisheries, 1998–99 to 1999–2000. *New Zealand Fisheries Assessment Report 2004/22*. 62 p.

Griggs, L.H.; Baird, S.J.; Francis, M.P. (2007). Fish bycatch in New Zealand tuna longline fisheries 2002–03 to 2004–05. *New Zealand Fisheries Assessment Report 2007/18*. 58 p.

Kendrick, T. (2004). Characterisation of the New Zealand tuna fisheries in 2002–03. Draft report to the Pelagic Fisheries Stock Assessment Working group (PELWG) PELWG04/61. (Unpublished report held by MFish, Wellington.)

Manning, M. J.; Marriot, P. M.; Taylor, P. R. (2007). The length and age composition of the commercial catch of blue mackerel (*Scomber australasicus*) in EMA 1 & 7 during the 2003–04 fishing year. *2007/13*. 41 p.

Morrison, M.; Taylor, P.; Marriott, P.; Sutton, C. (2001). An assessment of information on blue mackerel (*Scomber australasicus*) stocks. *New Zealand Fisheries Assessment Report 2001/44*. 26 p.

Paul, L.J.; Taylor, P.R.; Parkinson, D.M. (2001). Pilchard (*Sardinops neopilchardus*) biology and fisheries in New Zealand, and a review of pilchard (*Sardinops*, *Sardina*) biology, fisheries, and research in the main world fisheries. *New Zealand Fisheries Assessment Report 2001/37*. 44 p.

Paul, L.J.; Bradford-Grieve, J.M.; Tasker, R.A.; Chang, F.H.; Manning, M.J. (2005). Guts, gill rakers, and ENSO oceanography: a preliminary study on feeding patterns in the New Zealand pilchard, *Sardinops sagax*. Final Research Report prepared for the Ministry of Fisheries, Wellington. 30 p. (Unpublished report held by MFish, Wellington.)

Sainsbury, J.C. (1996). Commercial fishing methods: An introduction to vessels and gears. Third Edition. Fishing News Books. 359 p.

Sullivan, K.J.; Mace, P.M.; Smith, N.W.McL.; Griffiths, M.H.; Todd, P.R.; Livingston, M.E.; Harley, S.J.; Key, J.M. and Connell, A.M. (Comps.) 2005: Report from the Fishery Assessment Plenary, May 2005: stock assessments and yield estimates. 792 p. (Unpublished report held in NIWA library, Wellington.)

Taylor, P.R. (2002). A summary of information on blue mackerel (*Scomber australasicus*), characterisation of its fishery in QMAs 7, 8, and 9, and recommendations on appropriate methods to monitor the status of this stock. *New Zealand Fisheries Assessment Report 2002/50*. 68 p.

APPENDIX A: CATCH EFFORT FORM USED BY OBSERVERS DURING PURSE SEINE TRIPS — VERSION 1.4.

PURSE SEINE CATCH EFFORT SET DETAILS

CELR No. ______

Date Day Month Year v1.4

Set Detail: Set No. | Method | Target Species | FMA | Spotter Call sign | **Target School** Assoc Detect | Latitude (vessel position) Deg Min S | Longitude (vessel position) Deg 1 Min E/W | **Sea surface** Temp. °C | **Seabed** Depth m | Sea State

Time NZST: **Start of Set** (skiff off) TIME CODE | **Begin Pursing** (winch on) TIME CODE | **End Pursing** (rings up) TIME CODE | **Net Rolling** TIME CODE | **Net Sacking** TIME CODE | **Begin Brailing** TIME CODE | **End Brailing** TIME CODE | **End of Set** (skiff on board) TIME CODE

Total Catch: Total GW at surface (kg) Method | Total GW on board (kg) Method | **Result code** | **Brail type**

Losses: Total losses (kg) Method | Loss code | event stage | Time catch lost TIME CODE

Other sampling this set Y N: **MDBD** | **l-f** | **bird obs** | **NFB**

Non-fish Bycatch: mammal | seabird | turtle

Losses: Total losses (kg) Method | Loss code | event stage | Time catch lost TIME CODE

Catch Details

SPECIES name	code	Processed State	Hold No.	Greenweight (kg)	Tag

SPECIES name	code	Processed State	Hold No.	Greenweight (kg)	Tag

COMMENTS ______

SPECIES CODES (target and common bycatch)

ALB	Albacore tuna	FTU	Frigate tuna	PIL	Pilchard	STM	Striped marlin
ANC	Anchovy	JMA	Jack mackerel	POP	Porcupine fish	STN	Sth bluefin tuna
BAR	Barracouta	KAH	Kahawai	RBM	Ray's bream	STR	Stingray
EMA	Blue (English) mackerel	KIN	Kingfish	SKJ	Skipjack tuna	STU	Slender tuna
FLY	Flying fish	MAK	Mako shark	SNA	Snapper	SUN	Sunfish
FRO	Frostfish	MJA	Manta ray	SQU	Arrow squid	TRE	Trevally

Processed States

GRE	Green (whole) *(specify hold destination)*
EAT	Galley (eaten)
DIS	Discarded
RET	Retained (specimen)
FIN	Fins (sharks)

Result Codes

1	Entire school caught (on board)
2	Some caught / some lost
3	Skunked (entire school lost)
5	Caught unknown amount
6	Catch let go
8	Transferred/transhipped

APPENDIX A: — *continued*

VESSEL ACTIVITY LOG

DRAFT v1.3 MFISH, MAR 2005

OBSERVER NAME

VESSEL NAME

OBSERVER TRIP NUMBER

PAGE ____ OF ____

TRIP DAY	DATE	ACTIVITY CODE	SET NO.	START TIME (nzst)	END TIME (nzst)	LATITUDE (dd°mm.m') S	LONGITUDE (ddd°mm.m')	E W	PORT	BEAUF. SCALE	SCHOOL ASSOC.	SCHOOL DETECT	Target Sp.	FMA	Aircraft callsign	COMMENTS

ACTIVITY CODES

1 Set (fishing activity)
2 Searching for school
2a Steaming to school
3 Transit (to/from port or fishing destination)
4 No fishing - Breakdown
5 No fishing - Bad weather
6a In port - awaiting departure
6 In port - landing / offloading catch
7 Net cleaning set
8 Investigate free school (not radioed in)
11 No fishing - Drifting / anchored at day's end

No fishing - other (specify)
13a No fishing -..............................
13b No fishing -..............................

S1 Spotter plane takes off to search
S1a Spotter plane radios in sighting
S2 Spotter plane returned from search

H1 Helicopter takes off to search
H2 Helicopter returned from search

16 O Other:......................................

NOTE: If for any reason the activity was unobserved (ie. details relayed to you from a crew member), please prefix the code with an "X".

SCHOOL ASSOCIATION

A 1 Unassociated
A 2 Feeding (on baitfish / krill)
A 3 Drifting log, debris, dead animal
A 4 Drifting raft, FAD or payao
A 5 Anchored raft, FAD or payao
A 8 Other:..............................
A 9 Bird associated

SCHOOL DETECTED

D 1 Seen from vessel
D 2 Seen from spotter aircraft
D 3 Marked with beacon
D 4 Bird radar
D 5 Sonar / depth sounder
D 6 Info. from other vessel
D 8 Other:..............................

APPENDIX A: — *continued*

Table A1: Activity log comments

Code	Description	Comments
EMA	Observer A	
1	Set	Start time
2	Searching	Search location; search success; desired school size of search
2a	Steaming to school	Steaming to grounds; position of school in water column
3	Transit	Steaming to fishing grounds or to port
4	No fishing: breakdown	Engine problems (steaming to port)
6	In port: awaiting departure	Engine problems (steaming to port)
6A	In port: landing or offloading catch	
8	Investigate free school	Weather conditions (fog) and school location (within restricted zone)
10R	Retrieve: raft, FAD, Payao	Set end time; skunked set
11	No fishing: anchored at day's end	Anchorage location
13A	No fishing	Port (freezer breakdown); anchorage (bad weather/plane refuel)
S1	Spotter plane takes off to search	[no comment]
S1a	Spotter plane radioes in sighting	Target of school
S2	Spotter plane returned from search	[no comment]
JMA	Observer A	
1	Set	Start of set
2	Searching	Steam to "boil-up"
2a	Steaming to school	Time when left port and steamed to school
3	Transit	Time left for port or to anchorage; port arrival or departure time
6A	In port: landing or offloading catch	Time vessel arrived at port
8	Investigate free school	Target and non-target mix of school
11	No fishing: anchored at day's end	Anchorage location
13A	No fishing	Anchorage while wait for sightings of target school; vessel transfer of catch
16O	Other	Darkness prevented fishing; vessel sonar use
S1	Spotter plane takes off to search	[no comment]
S1a	Spotter plane radioes in sighting	Location of plane in relation to school
S2	Spotter plane returned from search	Name of port/home base

APPENDIX A: — *continued*

Table A1 continued

Code	Description	Comments
PIL trip undertaken by Observer D		
1	Set	Success of fishing: missed school, tonnage of catch
2	Searching	Position of fish in water column; location of vessel; record of photographs
3	Transit	Steaming to anchorage; name of port or anchorage; start or end of fishing trip
11	No fishing: anchored at day’s end	Anchorage location
13	No fishing: other	Anchorage location; reason for seeking shelter
13A	No fishing	Net mending
SKJ_1 trip undertaken by Observer A		
1	Set	Set start time
2	Searching	Size of school; school behaviour; whereabouts of school (water column)
2a	Steaming to school	Size of school; whereabouts of school (disappearance)
3	Transit	Steaming to port, anchorage, or fishing grounds
6	In port: awaiting departure	Port arrival time
6A	In port: landing or offloading catch	Time of arrival of observer and wait for departure
8	Investigate free school	Whereabouts of school (disappearance)
11	No fishing: anchored at day’s end	Anchorage location
13A	No fishing	Net mending; dolphins in vicinity; waiting for sightings; searching (skipper and pilot)
S1	Spotter plane takes off to search	Time pilot departs
S1a	Spotter plane radioes in sighting	Size of school; name of pilot

APPENDIX A: — *continued*

Table A1 continued

Code	Description	Comments
SKJ_2 trip undertaken by Observer B [included times for when observer was asleep and vessel informed observer of activities later]		
1	Set	Size of school (including whether school was skunked)
2	Searching	Searching location of vessel and plane
2a	Steaming to school	Size of school; whereabouts of school; behaviour of school; size of fish; vessel spotting
3	Transit	Time left to steam to port (supplies), anchorage, or fishing grounds
5	No fishing: bad weather	Awaiting better forecast and pilot sightings
6	In port: awaiting departure	[no comment]
6A	In port: landing or offloading catch	Time of arrival of observer; time of unloading of vessel and wait for better weather
8	Investigate free school	School size and behaviour; school whereabouts; loss of school (catch); loss (second vessel to school)
11	No fishing: anchored at day's end	Anchorage location
13	No fishing: other	Anchored
S1	Spotter plane takes off to search	Pilot name
S1a	Spotter plane radios in sighting	Size and number of schools; other vessel set on school
SKJ_3 trip undertaken by Observer C [included times for when observer was asleep and vessel informed observer of activities later]		
1	Set	Size of school (including whether school was skunked)
2	Searching	Searching by vessel and pilot
2a	Steaming to school	Steaming destination (including school size)
3	Transit	Time of steam to port, anchorage, or fishing grounds; comment re lack of schools
5	No fishing: bad weather	Weather and pilot activity
6	In port: awaiting departure	Unloading and skiff repairs
6A	In port: landing or offloading catch	Time of scheduled departure
8	Investigate free school	School size and behaviour
11	No fishing: anchored at day's end	Anchorage location
13a	No fishing:	Reason for wait (sightings); steaming; docked (port and reason such as skiff repairs)
S1	Spotter plane takes off to search	Pilot name and departure port
S1a	Spotter plane radios in sighting	Size, number, and behaviour of schools; distance of school relative to vessel
S2	Spotter plane returns from search	Pilot name and port destination (and pilot's planned activity such as lunch)

APPENDIX B: Fish species recorded during observed purse seine trips

Table B1: Species observed caught during purse seine fishing operations, 2004–05 and 2005–06

Code	Scientific name	Common name	Code	Scientific name	Common name
BAR	*Thyrsites atun*	Barracouta	LEA	*Parika scaber*	Leatherjacket
EMA	*Scomber australasicus*	Blue mackerel	MJA	*Mobula japanica*	Manta ray
FLY	Not specified	Flying fish	PCR	*Leptograpsus variegatus*	Purple rock crab
FRO	*Lepidopus caudatus*	Frostfish	PIL	*Sardinops neopilchardus*	Pilchard
FTU	*Auxis thazard*	Frigate tuna	POP	*Allomycterus jaculiferus*	Porcupine fish
GUR	*Chelidonichthys kumu*	Red gurnard	SKJ	*Katsuwonus pelamis*	Skipjack tuna
JDO	*Zeus faber*	John dory	SQU	Not specified	Squid
JFI	Not specified	Jellyfish	STM	*Tetrapturus audax*	Striped marlin
JMD	*Trachurus declivis*	Jack mackerel	STR	Not specified	Stingray
JMN	*Trachurus novaezelandiae*	Jack mackerel	STU	*Allothunnus fallai*	Slender tuna
JMA	*T. declivis, T. murphyi T. novaezelandiae*	Jack mackerels	SUN	*Mola mola*	Sunfish
KAH	*Arripis trutta*	Kahawai	YEM	*Aldrichetta forsteri*	Yellow-eyed mullet
KIN	*Seriola lalandi*	Kingfish	YFN	*Thunnus albacares*	Yellowfin tuna

APPENDIX C: Shark bycatch in the tuna longline fisheries

Table C1: Shark species observed caught during tuna longline fishing

Code	Common name	Scientific name
BET	Bigeye thresher	*Alopias superciliosus*
BSH	Seal shark	*Dalatias licha*
BWH	Bronze whaler shark	*Carcharhinus brachyurus*
BWS	Blue shark	*Prionace glauca*
CAR	Carpet shark	*Cephaloscyllium isabellum*
CSQ	Leafscale gulper shark	*Centrophorus squamosus*
CYL	Portuguese dogfish	*Centroscymnus coelolepis*
CYO	Owston's dogfish	*Centroscymnus owstoni*
CYP	Longnose velvet dogfish	*Centroscymnus crepidater*
DWD	Deepwater dogfish	Squaliformes
ETB	Baxter’s dogfish	*Etmopterus baxteri*
HEP	Sharpnose seven gill shark	*Heptranchias perlo*
HHS	Hammerhead shark	*Sphyrna zygaena*
IBR	Cookie-cutter shark	*Isistius brasiliensis*
MAK	Mako shark	*Isurus oxyrinchus*
OWS	Oceanic whitetip shark	*Carcharhinus longimanus*
PLS	Plunket's shark	*Centroscymnus plunketi*
POS	Porbeagle shark	*Lamna nasus*
SCH	School shark	*Galeorhinus galeus*
SCM	Largespine velvet dogfish	*Centroscymnus macracanthus*
SEV	Broadnose seven gill shark	*Notorynchus cepedianus*
SLB	White tail dogfish	*Scymnodalatias albicauda*
SND	Shovelnose dogfish	*Deania calcea*
SPD	Spiny dogfish	*Squalus acanthias*
THR	Thresher shark	*Alopias vulpinus*
TIS	Tiger shark	*Galeocerdo cuvier*
ZAS	Velvet dogfish	*Zameus squamulosus*

APPENDIX C: — *continued*

Table C2: Number of sharks (other than blue sharks) observed caught, by nation (Japan, New Zealand, Philippine) and fishing year*.

Code	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
Japanese															
BET	–	–	1	1	–	–	1	–	1	–	–	–	–	1	5
BSH	–	–	18	1	–	7	–	–	–	–	1	7	–	–	34
BWH	1	3	3	–	–	–	–	2	1	1	1	–	–	3	15
CAR	–	1	–	–	–	1	–	–	–	–	–	–	–	–	2
CSQ	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
CYL	2	–	–	–	–	–	1	–	–	–	–	73	–	–	76
CYO	37	68	44	135	–	14	672	1356	456	126	234	364	876	202	4584
CYP	4	–	–	–	–	–	–	–	–	–	–	–	–	–	4
DWD	47	384	72	225	–	170	–	–	–	–	1	2	–	3	904
ETB	–	–	–	1	–	–	–	–	–	–	–	–	–	–	1
HHS	1	1	1	–	–	–	–	–	1	–	–	–	–	–	4
IBR	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1
MAK	350	224	115	134	–	211	224	214	82	63	67	87	85	147	2003
PLS	3				–			1							4
POS	587	2207	825	709	–	1457	1930	2771	954	512	243	305	340	251	13091
SCH	124	162	288	383	–	273	184	379	119	87	93	82	188	269	2631
SCM	78	–	–	–	–	–	–	–	–	–	–	–	–	–	78
SEV	–	–	–	–	–	–	1	–	–	–	–	1	–	1	3
SPD	–	1	12	29	–	9	7	6	1	6	5	–	2	–	78
THR	18	48	83	22	–	47	77	110	72	77	100	114	95	55	918
TIS	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
ZAS	–	–	–	230	–	–	–	–	–	–	–	27	–	–	257
All	1252	3100	1462	1870	–	2189	3098	4839	1687	872	746	1062	1586	932	24695

Code	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
New Zealand															
BET	–	–	–	2	1	–	2	–	–	5	–	–	–	12	22
BSH	1	–	1	–	7	–	–	–	–	6	–	–	15	–	30
BWH	–	–	–	2	6	3	10	–	1	8	2	–	8	57	97
CSQ	–	–	–	–	2	–	–	–	–	1	–	–	–	–	3
CYO	–	–	1	1	9	–	26	–	–	–	11	–	121	–	169
DWD	–	–	–	33	–	94	–	–	–	–	7	1	32	–	167
HEP	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1
HHS	–	–	–	–	1	1	1	–	–	1	1	–	–	4	9
IBR	–	–	–	–	–	–	1	1	–	–	–	–	–	–	2
MAK	29	–	8	71	139	127	104	38	41	332	97	22	204	276	1488
OWS	–	–	–	–	3	–	3	–	1	2	–	–	1	1	11
PLS	–	–	–	–	–	–	–	–	–	–	–	37	–	–	37
POS	10	–	15	93	493	146	478	27	11	154	41	99	366	108	2041
SCH	1	–	2	26	113	91	12	–	10	30	31	31	69	5	421
SLB	–	–	–	–	–	–	2	–	–	–	–	–	–	–	2
SPD	–	–	4	7	–	2	4	–	1	1	–	4	–	–	23
THR	1	–	1	4	5	18	11	1	3	64	25	39	25	17	214
ZAS	–	–	–	–	18	–	–	–	–	–	–	–	–	–	18
All	42	–	32	239	798	482	654	67	68	604	215	233	841	480	4755

Code	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
Philippine-flagged															
BET	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
BWH	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
IBR	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
MAK	–	–	–	–	–	–	–	–	–	–	–	225	–	–	225
OWS	–	–	–	–	–	–	–	–	–	–	–	5	–	–	5
POS	–	–	–	–	–	–	–	–	–	–	–	18	–	–	18
THR	–	–	–	–	–	–	–	–	–	–	–	11	–	–	11
All	–	–	–	–	–	–	–	–	–	–	–	263	–	–	263
Total	1294	3100	1494	2109	798	2671	3752	4906	1755	1476	961	1558	2427	1412	29713

* Codes are defined in Table C1. Note that MAK and POS were often misidentified before the late 1990s and CYO was usually coded as DWD before 1998.

APPENDIX C: — *continued*

Table C3: Number of blue sharks* caught on observed Japanese tuna longlines, by life status and handling status, 1992–2005. There was no observer coverage of these vessels in 1996.

			Finned			
Life status	Year	Discarded	Total	% retained	Lost†	Total
Alive	1992	130 (44)	164	56.7	0	294
	1993	1 747 (55)	899	7.8	0	2 646
	1994	632 (28)	615	0.7	0	1 247
	1995	1 396 (64)	1 750	0.2	2	3 148
	1997	276 (41)	1 950	0.4	344	2 570
	1998	207 (24)	4 948	0.4	970	6 125
	1999	609 (28)	5 469	0.3	1 308	7 386
	2000	317 (49)	3 245	0.3	968	4 530
	2001	222 (42)	3 002	0.4	665	3 889
	2002	202 (51)	2 669	0.1	632	3 503
	2003	182 (5)	2 542	0.1	341	3 065
	2004	127 (5)	3 460	0.0	432	4 019
	2005	673 (0)	2 753	0.6	199	3 625
	All	6 720 (41)	33 466	0.8	5 861	46 047
Dead	1992	49	14	28.6	0	63
	1993	818	193	5.7	0	1 011
	1994	174	57	0.0	0	231
	1995	286	211	0.0	0	497
	1997	14	309	1.0	8	331
	1998	55	938	0.4	21	1 014
	1999	184	630	1.0	12	826
	2000	155	559	0.4	18	732
	2001	138	524	1.0	10	672
	2002	44	252	0.0	4	300
	2003	32	228	0.0	5	265
	2004	10	267	0.0	9	286
	2005	2	184	0.0	0	186
	All	1 961	4 366	0.8	87	6 414
Unknown		35	417	–	276	858
Total		8 716	38 249		6 203	53 319

* Data are for where the life status and handling codes were not null and represent 69% Japanese blue shark captures. The numbers in parentheses represent the percentage of sharks landed alive and subsequently killed by the crew.

† This column includes a few sharks for which the handling status was recorded as ‘unknown’.

APPENDIX C: — *continued*

Table C4: Number of sharks* (other than blue sharks) caught on observed Japanese tuna longlines, by life status and handling status, 1992–2005. There was no observer coverage of these vessels in 1996.

			Finned			
Life status	Year	Discarded	Total	% retained	Lost†	Total
Alive	1992	625 (45)	221	79.6	0	846
	1993	1 107 (30)	614	58.1	0	1 721
	1994	378 (16)	263	30.8	0	641
	1995	972 (27)	353	39.4	0	1 325
	1997	268 (22)	881	37.5	64	1 213
	1998	643 (40)	1 211	33.7	95	1 949
	1999	1 447 (35)	1 845	36.0	201	3 493
	2000	465 (46)	463	23.8	59	987
	2001	201 (21)	290	34.5	40	531
	2002	289 (36)	227	53.7	30	546
	2003	497 (4)	309	46.9	53	859
	2004	914 (15)	342	53.2	15	1 271
	2005	231 (<1)	533	73.5	17	781
Total alive		8 037 (28)	7 552	42.5	574	16 163
Dead	1992	114	102	92.2	0	216
	1993	534	251	39.8	0	785
	1994	201	104	36.5	0	305
	1995	162	294	29.9	1	457
	1997	74	842	17.9	16	932
	1998	228	881	28.5	15	1 124
	1999	135	1 113	47.5	23	1 271
	2000	100	557	23.5	11	668
	2001	44	267	31.1	6	317
	2002	49	145	46.2	0	194
	2003	25	133	38.3	6	164
	2004	41	220	55.5	1	262
	2005	30	54	81.5	0	84
Total dead		1 737	4963	35.2	79	6 779
Unobserved	All	95	228	61.8	83	406
Total		9 869	12 743	40.0	736	23 348

* Data are for where the life status and handling codes were not null and represent 95% Japanese shark captures. Foreign-licensed and charter vessels fished during 1992–95 and only charter vessels fished from 1997. The numbers in parentheses represent the percentage of sharks landed alive and subsequently killed by the crew.

† This column includes a few sharks for which the handling status was recorded as ‘unknown’.

APPENDIX C: — *continued*

Table C5: Number of blue sharks* caught on observed domestic tuna longlines, by life status and handling status, 1992–2005. There was no observer coverage of these vessels in 1993.

Life status	Year	Discarded	Finned Total	Finned % retained	Lost†	Total
Alive	1992	0	53	67.9	0	53
	1994	4 (0)	42	0.0	0	46
	1995	435 (2)	245	2.9	0	680
	1996	516 (0)	2 891	0.9	2	3 409
	1997	505 (2)	398	3.8	42	945
	1998	284 (2)	348	1.7	61	693
	1999	79 (4)	0	–	0	79
	2000	71 (7)	70	0.0	24	165
	2001	371 (6)	951	0.2	169	1 491
	2002	306 (5)	366	0.5	46	718
	2003	1 592 (9)	0	–	26	1 618
	2004	1 700 (5)	522	6.5	50	2 272
	2005	1 006 (1)	1 220	1.3	38	2 264
	All	6 869 (4)	7 106	0.8	458	14 433
Dead	1992	0	8	12.5	0	8
	1994	1	1	0.0	0	2
	1995	22	3	0.0	0	25
	1996	30	391	3.3	0	421
	1997	3	32	3.1	0	35
	1998	8	36	2.8	2	46
	1999	3	0	–	0	3
	2000	22	7	0.0	3	32
	2001	49	104	0.0	0	153
	2002	68	57	5.3	3	128
	2003	66	0	–	1	67
	2004	166	151	3.3	2	319
	2005	111	123	0.0	0	234
	All	549	913	0.9	11	1473
Unknown		100	14		34	148
Total		7518	8033	1.6	503	16054

* Data are for where the life status and handling codes were not null and represent 94% of domestic blue shark captures. The numbers in parentheses represent the percentage of sharks landed alive and subsequently killed by the crew.

† This column includes a few sharks for which the handling status was recorded as ‘unknown’.

APPENDIX C: — *continued*

Table C6: Numbers of sharks* (other than blue sharks) caught on observed domestic tuna longlines, by life status and handling status, 1992–2005. There was no observer coverage of these vessels in 1996.

			Finned			
Life status	Year	Discarded	Total	% retained	Lost†	Total
Alive	1992	3 (0)	20	95.0	0	23
	1994	10 (50)	15	20.0	0	25
	1995	97 (3)	100	10.0	0	197
	1996	62 (3)	375	25.9	0	437
	1997	206 (3)	163	48.5	11	380
	1998	328 (4)	159	6.9	11	498
	1999	22 (0)	8	87.5	2	32
	2000	29 (10)	9	0.0	8	46
	2001	213 (7)	156	55.8	36	405
	2002	82 (5)	55	58.2	10	147
	2003	112 (12)	39	100.0	6	157
	2004	458 (3)	129	62.8	8	595
	2005	248 (<1)	91	28.6	18	357
Total alive		1 870 (4)	1 319	37.2	110	3 299
Dead	1992	2	17	94.1	0	19
	1994	1	5	20.0	0	6
	1995	14	28	3.6	0	42
	1996	24	304	9.9	0	328
	1997	34	64	25.0	1	99
	1998	74	64	3.1	4	142
	1999	16	14	100.0	3	33
	2000	11	11	0.0	0	22
	2001	73	120	37.5	6	199
	2002	23	24	45.8	1	48
	2003	52	4	100.0	0	56
	2004	131	52	17.3	1	184
	2005	57	64	29.7	1	122
Total dead		512	771	21.8	17	1 300
Unobserved	All	34	9	55.6	62	105
Total		2 416	2 099	31.6	189	4 704

* Data are for where the life status and handling codes were not null and represent 99% of domestic shark captures. The numbers in parentheses represent the percentage of sharks landed alive and subsequently killed by the crew.

† This column includes a few sharks for which the handling status was recorded as ‘unknown’.

Table C7: Numbers of mako, porbeagle, and school sharks* observed caught on domestic surface longlines by handling category and year, 1992–2005 (except 1993 when there was no observer coverage.)

Status*	Handling	1992	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
Mako sharks															
Alive	Discarded	1	3	11	8	35	51	20	14	81	37	1	92	134	488
	Finned	0	0	3	54	0	4	0	5	7	9	0	26	37	145
	Retained	13	0	3	3	11	3	1	0	24	2	7	19	25	111
	Unknown	0	0	0	0	2	4	2	5	31	8	4	6	13	75
	Total	14	3	17	65	48	62	23	24	143	56	12	143	209	819
Dead	Discarded	0	0	1	0	4	5	13	6	22	12	1	26	25	115
	Finned	0	0	5	24	20	13	0	7	49	8	0	11	25	162
	Retained	15	1	0	6	4	2	0	0	36	9	3	6	16	98
	Unknown	0	0	0	0	0	1	2	0	3	1	0	1	0	8
	Total	15	1	6	30	28	21	15	13	110	30	4	44	66	383
Killed	Discarded	0	1	1	2	3	6	0	3	9	0	2	4	1	32
	Finned	0	0	44	27	38	15	0	1	31	9	0	8	0	173
	Retained	0	2	3	3	6	0	0	0	38	1	4	2	0	59
	Unknown	0	0	0	0	3	0	0	0	1	0	0	0	0	4
	Total	0	3	48	32	50	21	0	4	79	10	6	14	1	268
All		29	8	71	139	127	104	38	41	332	97	22	204	276	1488
Porbeagle sharks															
Alive	Discarded	2	0	30	22	57	222	2	2	54	18	27	217	54	707
	Finned	1	0	5	142	4	121	1	2	3	0	0	10	13	302
	Retained	4	0	4	5	0	0	6	0	0	3	0	2	0	24
	Unknown	0	0	0	0	2	3	0	0	0	0	1	0	0	6
	Total	7	0	39	169	63	346	9	4	57	21	28	229	67	1039
Dead	Discarded	1	0	8	11	5	59	2	2	34	1	45	83	19	270
	Finned	1	4	14	246	25	49	0	4	26	5	0	30	19	423
	Retained	1	0	0	5	4	0	14	0	5	1	0	1	3	34
	Unknown	0	0	0	0	1	3	0	0	0	0	0	0	0	4
	Total	3	4	22	262	35	111	16	6	65	7	45	114	41	731
Killed	Discarded	0	1	0	0	3	6	0	0	5	1	12	5	0	33
	Finned	0	10	32	44	40	2	0	1	25	3	0	2	0	159
	Retained	0	0	0	2	4	0	0	0	2	0	0	0	0	8
	Total	0	11	32	46	47	8	0	1	32	4	12	7	0	200
All		10	15	93	493	146	478	27	11	154	41	99	366	108	2041
School sharks															
Alive	Discarded	0	0	14	0	19	6	0	6	3	1	2	4	4	59
	Finned	0	0	0	7	0	0	0	0	0	0	0	0	0	7
	Retained	1	0	0	32	57	6	0	0	0	26	23	56	1	202
	Unknown	0	0	0	0	4	0	0	1	1	1	0	2	0	9
	Total	1	0	14	39	80	12	0	7	4	28	25	62	5	277
Dead	Discarded	0	0	2	2	2	0	0	3	1	0	0	2	0	12
	Finned	0	0	7	3	1	0	0	0	0	0	0	0	0	11
	Retained	0	0	0	19	7	0	0	0	3	1	1	2	0	33
	Total	0	0	9	24	10	0	0	3	4	1	1	4	0	56
Killed	Finned	0	1	3	0	0	0	0	0	0	0	0	0	0	4
	Retained	0	1	0	50	1	0	0	0	22	0	4	2	0	80
	Total	0	2	3	50	1	0	0	0	22	0	4	2	0	84
All		1	2	26	113	91	12	0	10	30	31	31	69	5	421

* Totals include 18 mako sharks, 71 porbeagle sharks, and 4 school sharks reported with unknown life code.

APPENDIX C: — *continued*

Table C8: Numbers of mako, porbeagle, and school sharks* observed caught on Japanese surface longlines by handling category and year, 1992–2005 (except 1996 when there was no Japanese effort).

Status	Handling	1992	1993	1994	1995	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
Mako sharks															
Alive	Discarded	38	27	7	45	2	1	3	1	1	2	0	4	23	154
	Finned	0	0	3	0	37	6	1	1	0	0	0	1	0	49
	Retained	0	52	26	0	93	23	93	18	19	11	33	46	34	448
	Unknown	0	0	0	0	17	20	29	12	4	9	5	3	7	106
	Total	38	79	36	45	149	50	126	32	24	22	38	54	64	757
Dead	Discarded	22	3	1	14	1	2	2	0	0	0	0	0	0	45
	Finned	8	0	0	14	12	10	0	0	0	0	0	1	0	45
	Retained	28	18	22	11	35	53	34	23	15	15	10	5	5	274
	Unknown	0	0	0	0	5	0	0	0	1	0	0	0	0	6
	Total	58	21	23	39	53	65	36	23	16	15	10	6	5	370
Killed	Discarded	84	7		11	1	1	1	1	0	0	0	0	0	106
	Finned	42	3	11	13	2	11	2	1	1	1	0	0	4	91
	Retained	124	106	36	16	5	95	40	22	21	28	33	15	61	602
	Total	250	116	47	40	8	107	43	24	22	29	33	15	65	799
All		350	224	115	134	211	224	214	82	63	67	87	85	147	2003
Porbeagle sharks															
Alive	Discarded	134	433	141	183	58	67	58	34	22	3	15	40	58	1246
	Finned	0	22	26	1	244	264	814	107	9	1	49	90	1	1628
	Retained	2	12	2	0	85	29	89	28	46	20	46	9	29	397
	Unknown	0	0	0	0	34	56	98	19	13	8	5	0	1	234
	Total	136	467	169	184	421	416	1059	188	90	32	115	139	89	3505
Dead	Discarded	68	313	113	52	10	44	42	10	6	3	1	11	2	675
	Finned	0	137	52	192	678	619	584	423	183	77	78	97	10	3130
	Retained	60	68	4	5	38	158	410	56	34	23	8	7	21	891
	Unknown	0	0	0	0	9	15	19	7	4	0	4	0	0	58
	Total	128	518	169	250	726	821	1037	488	223	103	87	115	33	4698
Killed	Discarded	182	308	31	35	10	26	1	17	7	1	0	0	0	618
	Finned	1	209	106	197	260	519	358	241	180	102	89	69	122	2453
	Retained	33	167	2	6	0	128	273	5	1	0	0	0	0	615
	Unknown	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	Total	216	684	139	238	270	673	633	263	188	103	89	69	122	3687
All		587	2207	825	709	1457	1930	2771	954	512	243	305	340	251	13091
School sharks															
Alive	Discarded	93	80	74	158	20	4	61	0	11	17	4	0	0	522
	Finned	0	1	32	0	7	1	0	0	0	0	1	0	1	43
	Retained	0	0	0	1	128	25	114	18	10	10	22	86	11	425
	Unknown	0	0	0	0	8	3	43	21	21	4	5	2	1	108
	Total	93	81	106	159	163	33	218	39	42	31	32	88	13	1098
Dead	Discarded	14	30	55	30	4	1	1	0	2	2	0	0	0	139
	Finned	0	14	13	0	1	1	0	1	1	1	0	0	0	32
	Retained	2	0	0	70	87	46	101	57	36	27	36	82	17	561
	Unknown	0	0	0	0	2	0	0	2	1	0	0	0	0	5
	Total	16	44	68	100	94	48	102	60	40	30	36	82	17	737
Killed	Discarded	10	9	18	1	0	1	0	0	0	0	0	0	0	39
	Finned	0	22	1	1	1	2	0	1	0	0	0	0	1	29
	Retained	4	2	0	113	15	99	53	13	2	32	10	7	233	583
	Total	14	33	19	115	16	102	53	14	2	32	10	7	234	651
All		124	162	288	383	273	184	379	119	87	93	82	188	269	2631

* Totals include 77mako, 1201 porbeagle, and 145 school sharks reported with unknown life code, most before 1998.

APPENDIX C: — *continued*

Table C9: Number of observed sharks* (other than blue sharks), by species and handling type, for Japanese and domestic longlines, 1992–2005.

Code	Discarded	Finned	Lost	Unknown	Total
Japanese					
BET	2	3	0	0	5
BSH	16	0	0	18	34
BWH	2	13	0	0	15
CAR	2	0	0	0	2
CSQ	1	0	0	0	1
CYL	72	0	2	2	76
CYO	4 531	7	19	27	4 584
CYP	4	0	0	0	4
DWD	829	1	5	69	904
ETB	1	0	0	0	1
HHS	3	1	0	0	4
IBR	1	0	0	0	1
MAK	305	1 557	114	27	2 003
PLS	4	0	0	0	4
POS	2 557	9 197	294	1 043	13 091
SCH	702	1 704	113	112	2 631
SCM	0	0	0	78	78
SEV	2	1	0	0	3
SPD	70	1	0	7	78
THR	510	256	111	41	918
TIS	1	0	0	0	1
ZAS	254	2	1	0	257
All	9 869	12 743	659	1 424	24 695
Domestic					
BET	20	2	0	0	22
BSH	22	2	0	6	30
BWH	56	34	7	0	97
CSQ	3	0	0	0	3
CYO	166	1	1	1	169
DWD	133	2	0	32	167
HEP	0	1	0	0	1
HHS	7	1	1	0	9
IBR	1	1	0	0	2
MAK	635	750	85	18	1 488
OWS	8	3	0	0	11
PLS	37	0	0	0	37
POS	1 032	955	10	44	2 041
SCH	71	339	9	2	421
SLB	2	0	0	0	2
SPD	23	0	0	0	23
THR	186	8	12	8	214
ZAS	14	0	0	4	18
All	2 416	2 099	125	115	4 755

* Codes are defined in Table C1. Note that MAK and POS were often misidentified before the late 1990s and CYO was usually coded as DWD before 1998.