Ministry for Primary Industries
Manatū Ahu Matua

New Zealand Billfish and Gamefish Tagging, 2012–13

New Zealand Fisheries Assessment Report 2014/11

J.C. Holdsworth
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ISSN 1179-5352 (online)
ISBN 978-0-478-42364-8 (online)

February 2014

New Zealand Government

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Release and recapture data for the 2012–13 season (July to June fishing year) are summarised in this report and compared with those from previous seasons. Particular recaptures that provide growth or movement information of significance or interest are described.

The number of fish tagged and released in New Zealand this season (2263) was less than the ten year mean. A further 172 fish were tagged outside New Zealand fisheries waters. The number of striped marlin and blue marlin tagged and released was below average, especially in East Northland and Bay of Plenty. Fewer kingfish were also tagged compared to the ten year mean. The number of mako and blue sharks tagged was higher than recorded in recent years. Thirty three swordfish were tagged and released, not as many as last year but still well above the ten year mean. For the third year running no yellowfin tuna were tagged. According to New Zealand Sport Fishing Council club catch records, very high percentages of the total recreational catch of mako (94%) and blue sharks (92%) were tagged and released rather than landed.

A total of 58 recaptures were reported in the 2012–13 fishing season. These comprised 38 (66%) yellowtail kingfish, 11 (19%) mako sharks, 3 (5%) blue sharks, and 4 (7%) striped marlin. Three striped marlin were recaptured in northern New Zealand waters, 25 to 104 days after release. It is possible that when conditions are favourable, marlin will spend longer over the New Zealand continental shelf and will be accessible to the recreational fishery.

The other striped marlin recapture was from the Coral Sea in January 2013, a known spawning ground for striped marlin at that time of year. This fish was tagged in February 2012 at the King Bank in the Three Kings area. This is the first striped marlin recapture with the new generation billfish tag equipped with the surgical grade nylon anchor. However, they have been in use for six years now with over 1100 used on striped marlin so more recaptures are expected in the future.

There were two long term kingfish recaptures, of 11 and 14 years, from fish that are not close to maximum size (16.1 and 19 kg respectively). It was noted however that the smaller fish looked old and in poor condition on recapture. This fish was heavier on release, estimated at over 20 kg. Both fish were recaptured in the Three Kings area, which is remote and lightly fished so is believed to support a relatively large kingfish population.

Landed catch as reported by New Zealand Sport Fishing Council clubs is included to help characterise the fishery as a whole. The number of striped marlin landed has remained relatively constant, varying without trend around 600 fish per year for the last 25 years, while the number of striped marlin tagged peaked in 1995 to 1999 at around 1200 per year and has declined since then.

The catch of sharks landed by anglers declined significantly from the 1990s to the mid-2000s and continues to decline as attitudes of clubs and anglers toward killing sharks change.

1 INTRODUCTION

1.1 Overview

This gamefish tagging programme is a cooperative project between the Ministry for Primary Industries (MPI), the New Zealand Sport Fishing Council (NZSFC), its affiliated clubs, and anglers. Cooperative tagging programmes provide information on the size and distribution of fish released by recreational fishers. Recaptures provide information on fish growth, distance and direction of movement, time at liberty, and in some circumstances the average migration rate (displacement rate) of the fish involved (Ortiz et al. 2003). Recaptures are obtained from recreational and commercial fishers. Commercial fishers around the South Pacific often provide some of the most interesting tag returns.

The New Zealand Gamefish Tagging Programme (NZGTP) was initiated by the Ministry of Agriculture and Fisheries in 1975 following requests from gamefish clubs. Although the tags supplied in New Zealand were initially intended for billfish, it was accepted that a variety of gamefish species would be tagged (Saul & Holdsworth 1992). These programmes have gained widespread support from recreational anglers and provide the only logistically and economically feasible way to tag large numbers of billfish (Pepperell 1990).

The New Zealand Sport Fishing Council (formerly New Zealand Big Game Fishing Council) has supported the programme since its inception and has purchased and distributed all tags through gamefish clubs since 1992. Administration of the data was put out to competitive tender by the Ministry of Fisheries in 2000. This report is the annual gamefish tagging report for the 2011–12 season prepared by Blue Water Marine Research as a reporting requirement for the Ministry for Primary Industries (MPI), project TAG2012/01.

1.2 Description of the fishery

The recreational fishery for large pelagic species is very important for many New Zealanders and attracts tourist fishers from around the world. The fishery operates mainly over the warm summer and autumn months. Striped marlin (*Kajikia audax*) is the mainstay of the gamefishery on the Northland east coast, with blue marlin (*Makaira nigricans*), small numbers of black marlin (*Makaira indica*), shortbill spearfish (*Tetrapturus angustirostris*), and increasing numbers of swordfish (*Xiphias gladius*) also caught. Yellowfin tuna (*Thunnus albacares*) and yellowtail kingfish (*Seriola lalandi*) have historically been caught in large numbers, although several poor yellowfin seasons have seen an increase in targeting of striped marlin and blue marlin.

Game fishing has developed on the west coast of the North Island over the last 20 years with, at times, a very productive marlin and tuna fishery accessed from the west coast harbours and beaches as far south as Taranaki. Shark species are important as a recreational target species in the southern regions. In the South Island, the game fishery is centred off Canterbury, Otago, and Fiordland, with blue shark (*Prionace glauca*) abundant and therefore the primary target species, along with porbeagle shark (*Lamna nasus*), albacore (*Thunnus alalunga*) and occasionally southern bluefin tuna (*Thunnus maccoyii*). There is a seasonal (winter) fishery for Pacific bluefin tuna (*Thunnus orientalis)* off the central west coast of the South Island, accessed from the ports of Greymouth and Westport between July and September.

Marlin species are also a bycatch of the commercial surface longline fishery that mainly targets bigeye tuna (*Thunnus obesus*), swordfish and southern bluefin tuna. Within the New Zealand Exclusive Economic Zone (EEZ), commercial fishers are obliged by regulation to release all billfish, except swordfish, whether the fish is alive or dead upon capture. This regulation includes a provision that live billfish should be tagged if possible, and tagged marlin recaptured by commercial fishers are allowed to be landed and brought to port for scientific study.

2. METHODS

The tags used in the gamefish tagging programme up to 2005 all had printed yellow streamers with a stainless steel dart anchor. In 2005, 1000 tags with nylon double-barbed anchors were purchased for billfish. These plastic head intra-muscular tags – type PIMA – require a different applicator tip from that used with the stainless steel tag anchors. Both tag types are currently in use.

The process of tagging gamefish has been described by Saul & Holdsworth (1992). Numbered tag report cards are issued with each tag. They request information on the species, date, location, length, and weight of the fish tagged. More recent tag cards have included a space for latitude and longitude of release, the skipper's phone number, and tick boxes for capture method and whether the hook was removed before release (Figure 1) (Holdsworth & Saul 2003). Recording latitude and longitude is encouraged for all release and recapture events.

The individually numbered tags are printed with the address of the Auckland office of the Ministry for Primary Industries and the words "Please measure and sex – Reward". The sex of shark species can be readily determined by the presence of claspers on males and this information is mostly relevant for shark species which may segregate by sex for part of the year.

Tag cards and recapture reports are passed on to the contractor for entry into the database. The fisher reporting a recaptured fish is sent a printed polo shirt as a reward along with a letter describing the release date, location, growth, movement, and time at liberty of the fish. A copy of the recapture letter and a reward T-shirt is also sent to the angler who tagged the fish.

There is a $1000 lucky draw every year for a fisher returning all the required recapture information from a tagged fish.


Billfish Tag Report
New Zealand Cooperative Tagging Programme
Please Complete and Return
Tag No. N 121395
Date: Locality Name:
Species:
Latitude: South Longitude: East/West
Length: cm Est/Measured Weight: kg Est/Weighed
Method: Lure☐ Livebait ☐ Deadbait ☐ Hook removed Yes/No
Remarks: Fighting Time:
Anglers' Name:
Address:
Skipper: Boat:
Address: Ph:

Figure 1: Copy of a tag card used with the nylon head N series tags used for billfish.

3. RESULTS

3.1 Billfish

There were 798 billfish tagged and released inside New Zealand fisheries waters in 2012–13, comprising 745 striped marlin, 33 swordfish, 17 blue marlin, and 3 black marlin. There were no shortbill spearfish tagged this year (Table A1). Blue marlin releases are lower than previous seasons, with an average of 30 per year in the 10 previous seasons. In addition 35 blue marlin, 5 sailfish and 132 striped marlin were tagged outside New Zealand fisheries waters by NZGTP members in 2012–13. There were four striped marlin recaptured in 2012–13; the most since 2004–05.

A further 744 striped marlin were recorded as kept by gamefish club members. The number of swordfish landed (53) was higher than recent years, with blue marlin (55) and shortbilled spearfish (13) numbers lower in 2012–13 than in recent years (Roz Nelson, N.Z. Sport Fishing Council, pers. comm.). Using NZSFC tagged and landed records only, it is estimated that 52% of recreationally caught striped marlin were recorded as tagged and released by clubs in 2012–13. Some fish were tagged outside the New Zealand EEZ by NZGTP participants in 2012–13. These were 35 blue marlin, 5 sailfish and 132 striped marlin (Appendix A, Table A2). One boat had two trips to the Wanganella Bank, 200 nautical miles northwest of New Zealand, and tagged all the out of zone striped marlin.

Billfish highlights 2012–13

The summer and autumn in 2012–13 provided enough calm weather and relatively warm water to encourage fishers to target billfish (Holdsworth & Saul 2013). Striped marlin catch rates in East Northland were about average with more fish caught on the west coast as far south as Taranaki (Holdsworth & Saul 2013).

The number of swordfish tagged and released over the last two years is a result of increased fishing effort and reasonable catch rates. The development of daylight fishing for swordfish, where baits are dropped to depths of 500 – 600 metres during the day with breakaway weights has greatly increased the popularity of target fishing for swordfish amongst anglers as it has become more widely known and practiced. Nine swordfish were tagged at the beginning of the fishing year, July and August 2012, and the peak month with 11 swordfish tagged was April 2013.

There were four striped marlin recaptured in 2012–13, the most in a season for eight years. The only one from outside New Zealand waters was recaptured by a surface longliner in the Coral Sea west of New Caledonia on 12 January 2013. This fish was tagged by Jeff Bawden at the King Bank on 19 February 2012, with an estimated weight of 85 kg. This is the first striped marlin in the NZGTP recaptured with the nylon tag anchor (Hallprint PIMA tag) and has the fourth longest time at liberty of 328 days.

The three other recaptures were all made in the Far North of the North Island. On 17 February 2013 a striped marlin was recaptured by Pete Rowsell off Parengarenga Harbour 25 days after being tagged off Cape Brett. This fish had travelled 70 nautical miles and was retagged and released.

On 15 March a 103 kg fish was recaptured off Ahipara by Ian Stevens and weighed at Houhora. It had been tagged off New Plymouth just eight days earlier with an estimated weight of 130 kg. This fish travelled about 240 nautical miles at a rate of 30 nautical miles per day.

John Gregory on the vessel *Primetime* reported getting several tagged marlin to the boat in 2013. Only one tag was retrieved by angler Jim Gigger on 7 June at the King Bank from a fish estimated at 95 kg. It had been tagged off Ahipara on 23 February, one of a treble strike which were all caught with just two crew on board. This fish moved 80 nautical miles in 104 days and was retagged and released.

Trends

Striped marlin, as always, dominated the billfish catch statistics. Striped marlin were available in good numbers at times and more were tagged than in 2011–12. February was once again the peak month for striped marlin, but the proportion of catch taken in March and April (44%) was higher than in recent years (Figure 2). Data reported by recreational fishers in billfish logbooks show that the water remained relatively warm in the areas fished for marlin in March through to June 2013 (Holdsworth & Saul 2013).

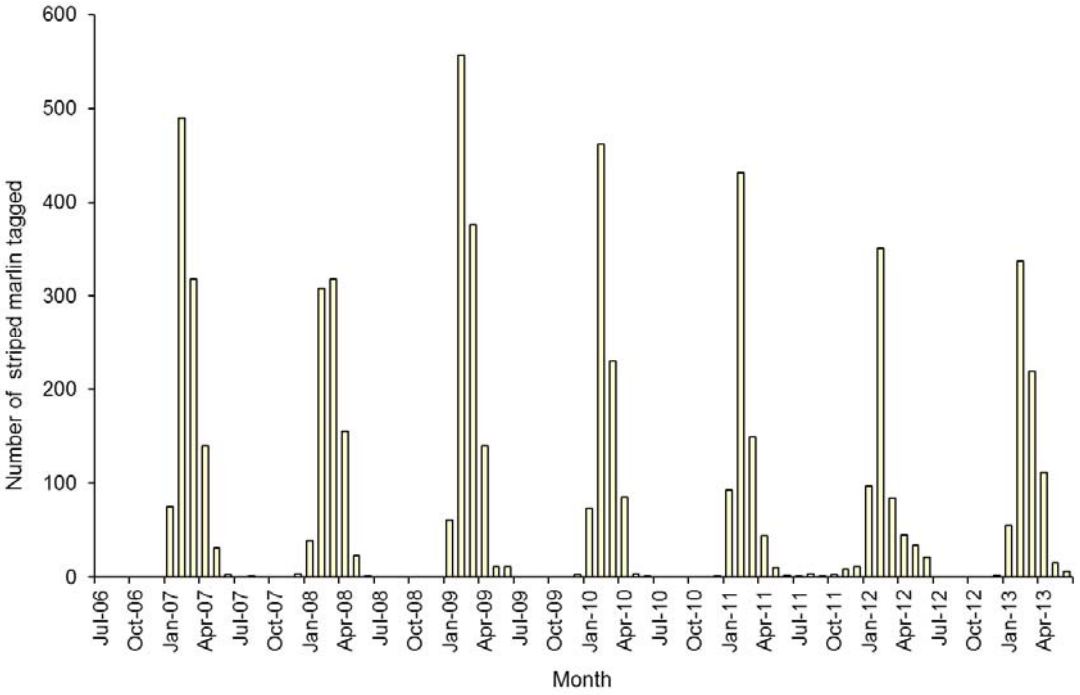


Figure 2: The number of striped marlin tagged by month in New Zealand waters (2006–07 to 2012–13).

There were fewer blue marlin tagged in New Zealand during 2012–13 than in recent years, while in the Pacific Islands more blue marlin were tagged than usual, mainly from July to October (Figure 3). In New Zealand blue marlin are generally found in warm, oceanic waters beyond the continental shelf and the number caught and tagged per year can be quite variable (Appendix, Table A1).

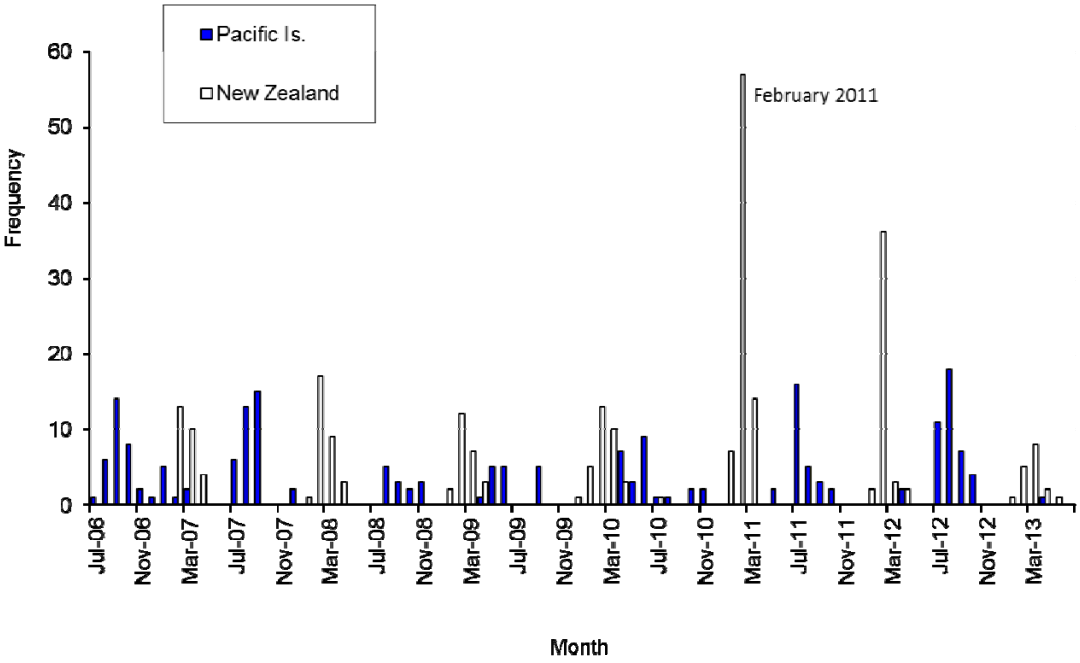


Figure 3: The number of blue marlin tagged by month in New Zealand and Pacific Island waters (2006–07 to 2012–13).

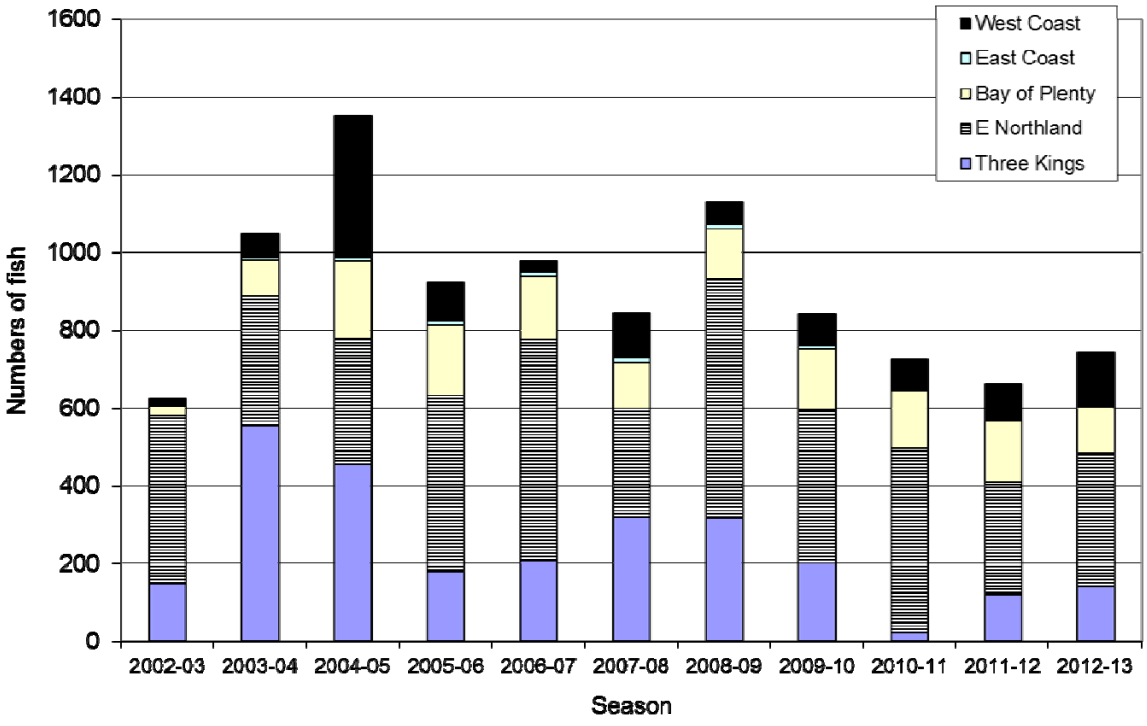


Figure 4: The number of striped marlin tagged by region and fishing season (2002–03 to 2012–13).

More striped marlin were tagged in the west coast region in 2012–13 than in recent seasons while there were fewer from the Bay of Plenty (Appendix B). The number tagged in the Three Kings area has been relatively low for the last three years (Figure 4). The highest proportion of striped marlin is tagged in the East Northland region (64% in 2010–11, 43% in 2011–12 and 46% in 2012–13).

In 2012–13 the 90 kg size class had most striped marlin with relatively equal numbers tagged in the other size classes between 80 and 120 kg (Figure 5). There were more large fish tagged and landed in 2012–13 than in recent years with a combined average weight of 104 kg (Holdsworth & Saul 2013).

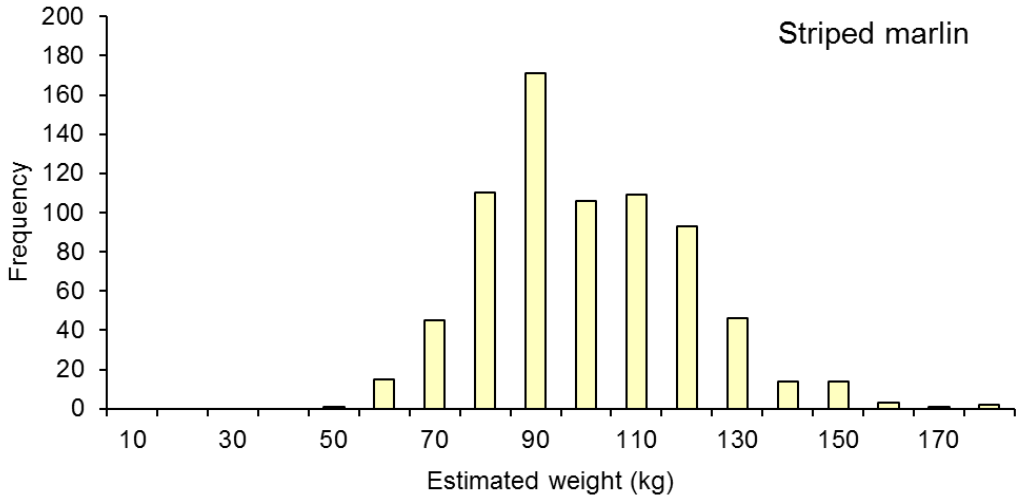


Figure 5: Weight frequency distribution of striped marlin from estimated weights on tag and release in the NZGTP in 2012–13.

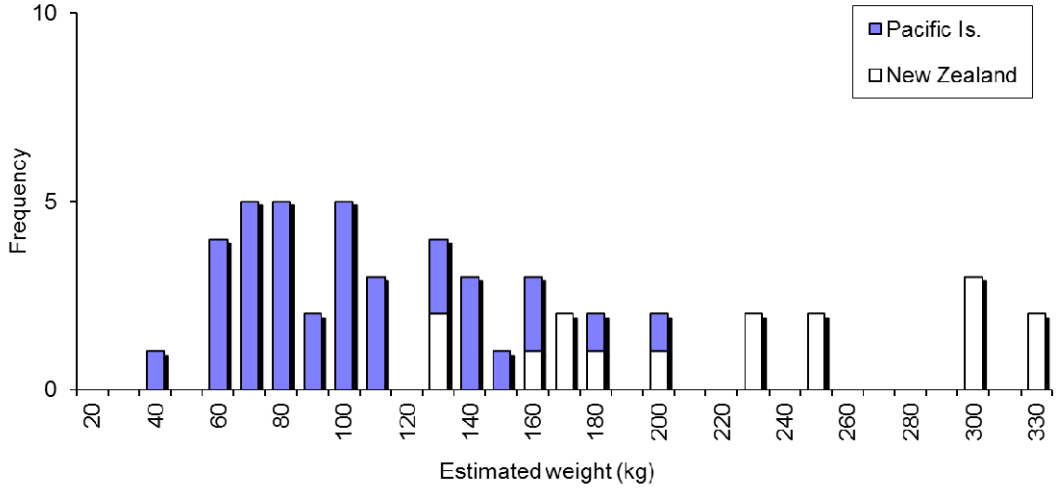


Figure 6: Weight frequency distribution of blue marlin from estimated weight on release in NZGTP 2012–13.

Estimated release weights for blue marlin are shown in Figure 6. Even in particularly warm years, it is rare for New Zealand anglers to catch blue marlin less than 100 kg in green weight. Blue marlin tagged in Pacific Island fisheries such as Tonga and Samoa are frequently less than 100 kg, but also show some larger fish caught in 2012–13.

Movement

Current thinking, based on tagging data, slight genetic differences, and spawning areas, is that southwest Pacific striped marlin constitutes a single stock (Davies et al. 2012). Spawning is known to occur in the Coral Sea, in the Fiji Basin and in French Polynesia (Kopf et al. 2012). Recaptures of tagged striped marlin from the NZGTP have occurred in all three of these areas.

Long-distance recaptures for striped marlin show a wide spread of locations across the southwest Pacific Ocean and Tasman Sea (Figure 7). Fish tagged in the same season, even in the same month and area, have been observed to travel to completely different regions of the southwest Pacific, but no striped marlin tagged in the south Pacific have been recaptured beyond the south Pacific. Most striped marlin were recaptured within 10 months of release; however, tag shedding is common for this species and this may be the reason for the short duration of most recaptures.

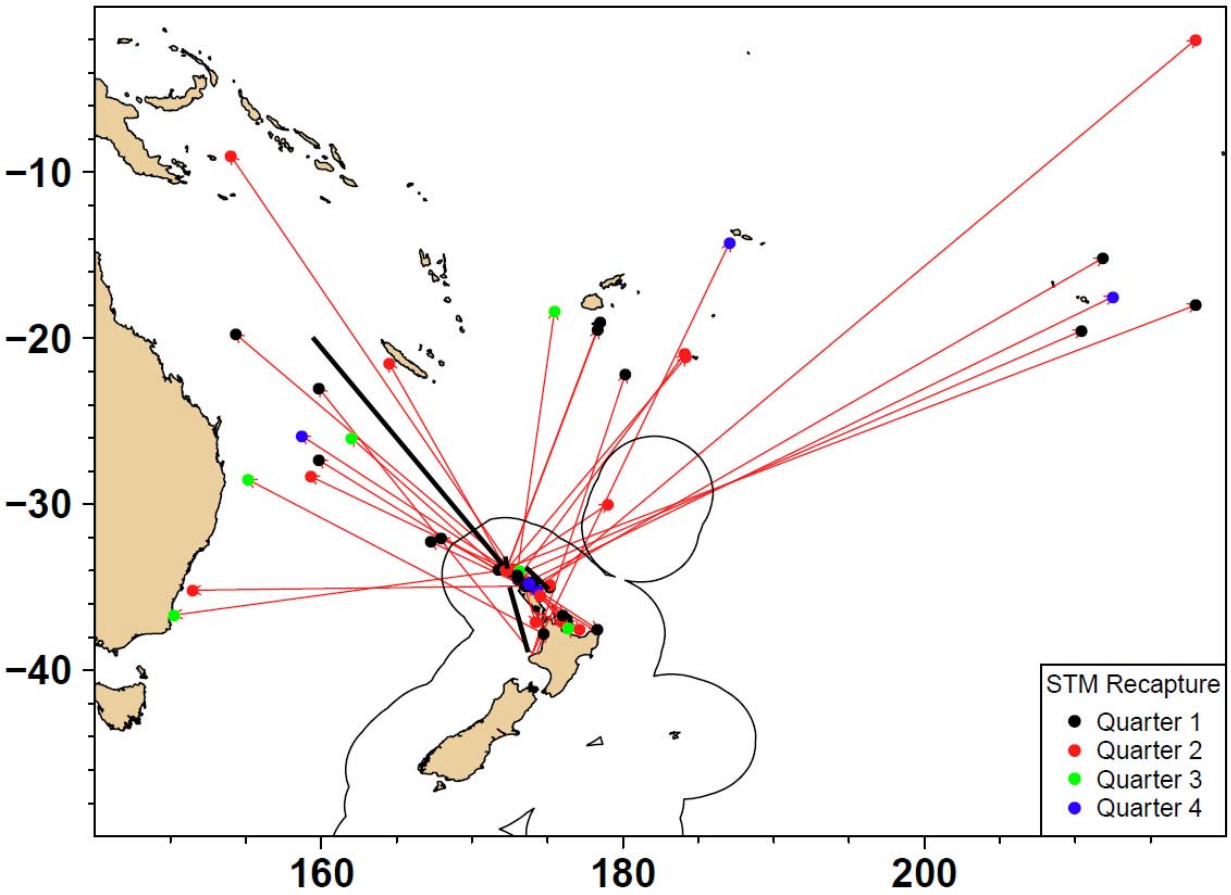


Figure 7: Long distance movements of striped marlin in the gamefish tagging programme, 1988–2013 with recapture location colour coded by quarter and recaptures from 2012–13 black lines.

New Zealand Sport Fishing Council collects annual catch tallies of fish landed and fish tagged from affiliated clubs. The collective catch is a reasonably complete record of billfish catch in New Zealand as most billfish caught by club members and non-members pass over a club weigh station and are recorded. However, the number of trailer boats launching from remote locations and targeting marlin has been increasing in recent years. This has probably resulted in a higher proportion of landed billfish which are not captured in club records. We estimate that this amounted to 15 to 20% of landed striped marlin in 2012–13. The proportion of billfish by species that are tagged each year is shown in Table 1. Over the last 10 years 58% of striped marlin, 41% of swordfish and 33% of black marlin caught by NZSFC clubs have been tagged and released.

Trends in landed catch are also useful to characterise the sport fishery. The number of striped marlin landed by NZSFC clubs has been around 600 per year for the last 25 years while the number of striped marlin tagged peaked in 1995 to 1999 at around 1200 per year and has declined since then (Figure 8).

Table 1: The proportion of billfish tagged in New Zealand waters in the last ten years by species from NZSFC records.

Fishing Year	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	Overall
Striped marlin	0.63	0.61	0.59	0.58	0.61	0.59	0.56	0.53	0.49	0.52	0.58
Blue marlin	0.11	0.27	0.16	0.19	0.19	0.22	0.21	0.30	0.36	0.21	0.24
Shortbill spearfish	0.10	0.11	0.16	0.31	0.24	0.14	0.18	0.20	0.14	0.00	0.17
Swordfish	0.08	0.32	0.45	0.13	0.60	0.18	0.47	0.48	0.60	0.40	0.41
Black marlin	0.00	0.43	0.33	0.33	0.00	1.00	0.43	0.33	0.25	0.40	0.33

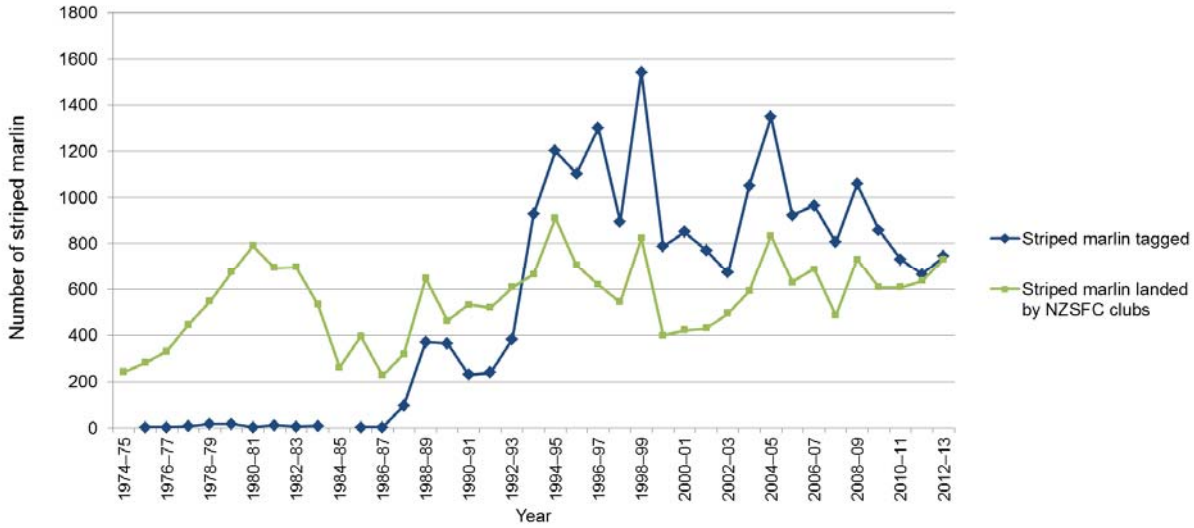


Figure 8: The number of striped marlin landed by year (1975 to 2013) from NZSFC records and the number tagged and released from the tagging database.

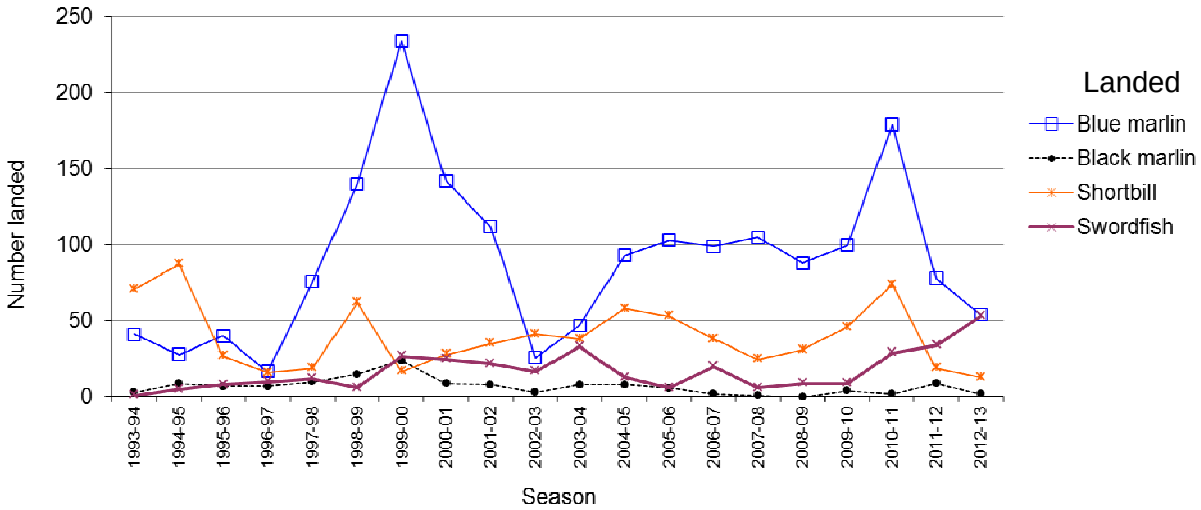


Figure 9: The number of billfish landed by year (1994 to 2013) from NZSFC records.

The number of blue marlin landed by NZSFC clubs is around 100 per year over the last 10 years but was down to 54 in 2012–13 (Figure 9). The number of shortbill spearfish landed was also down in the last couple of years while the number of swordfish increased.

3.2 Yellowtail kingfish

Yellowtail kingfish highlights 2012–13

Seven hundred yellowtail kingfish were tagged and released in New Zealand fisheries waters during 2012–13, more than in the previous season (Table 2). The 10 year average is 808 kingfish per year.
In 2012–13 most kingfish were tagged between October and June. February was the peak month again but the number tagged (168) was down on previous years (Figure 10).

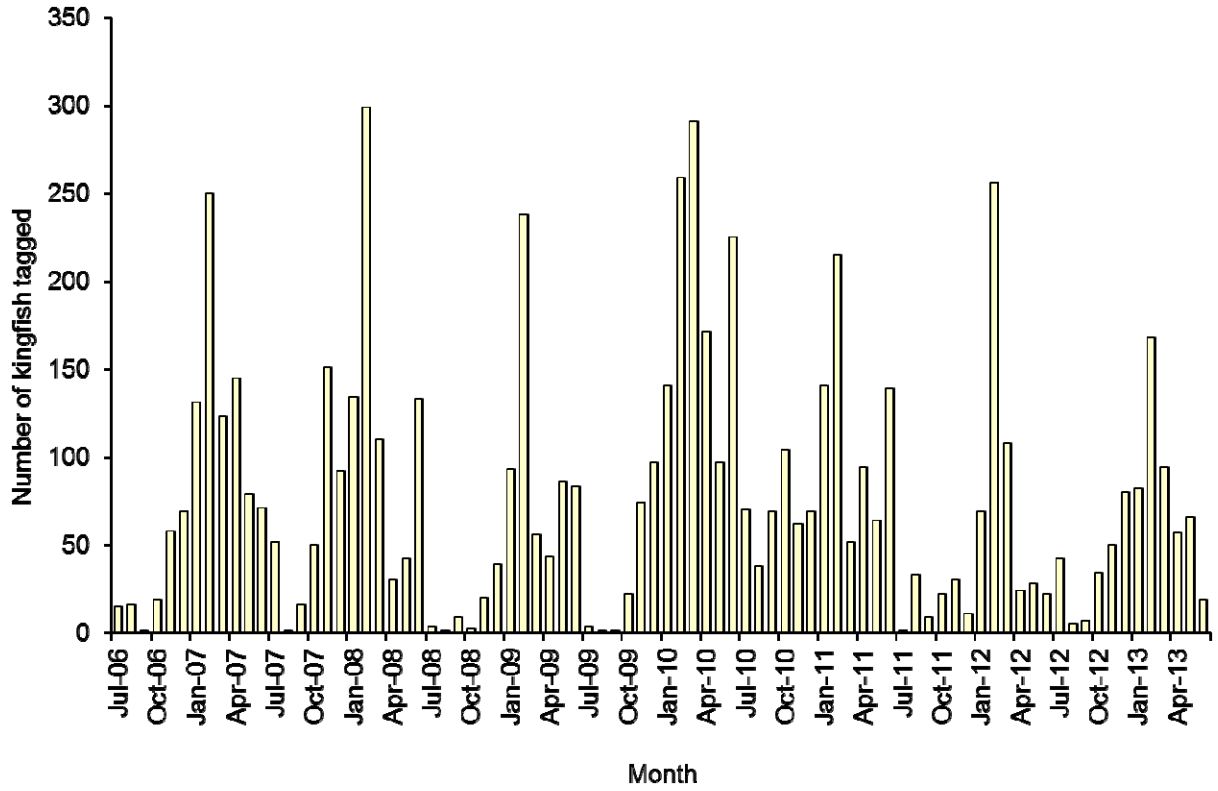


Figure 10: The number of yellowtail kingfish tagged by month since the 2006–07 season.

There were 38 kingfish recaptures reported, two of which were long-term. The first was tagged at the Princes Group, Three Kings Islands on 4 April 2002 and recaptured nearby by Robert Lynds on 17 April 2013, 11 years later. This fish was estimated to weigh over 20 kg on release but measured just 122 cm and weighed 16.1 kg on recapture. It was described as looking old and in poor condition with pale gills.

The second was tagged off Tolaga Bay on 9 May 1998 and was recaptured at the Middlesex Bank, north of the Three Kings Islands on 4 March 2013 by Shane Cluitt. This is nearly 14 years 10 months at liberty and a distance by sea of 440 nautical miles. It measured 78.5 cm on release and was estimated to weigh 19 kg on recapture. The fish was released again.

Eighteen recaptures came from the White Island area in 2012–13 (Appendix B). They were at liberty between 4 and 773 days and all were tagged in that area.

Five fish tagged in the White Island area were recaptured elsewhere, an unusually high number. One 13 kg kingfish tagged at Volkner Rocks, in the White Island area, was recaptured in the Bay of Islands, travelling 200 nautical miles in 53 days. Of the six kingfish recaptured in other areas of the Bay of Plenty four had been tagged in the White Island area and had travelled 27 nautical miles on average.

Fishers from Nelson and Marlborough have tagged kingfish in the outer Marlborough Sounds for about three years. The first recapture came from a commercial set net off Otago Heads in late January 2012.

In 2012–13 two more recaptures have been recorded from fish tagged in Stephens Passage. A 14 kg fish tagged by Barry McFall in May 2012 was recaptured by a commercial set net fisher on 17 December 2012 outside Bushetts Shoals on the southern Kaikoura Coast. It had been at liberty for 219 days and travelled 143 nautical miles. A 15kg fish tagged by Dan Govier in March 2012 was speared in Pelorus Sound on 1 February 2013. It was about 30 nautical miles from the release location after 321 days.

Table 2: The number of yellowtail kingfish tagged and recaptured by season since 2003–04.

	2003–04	2004–05	2005-06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2003 to 2013
NZ EEZ	771	806	1 016	977	1 120	661	1 381	1123	613	704	808
Recaptures	32	38	53	38	55	43	46	54	44	38	44

Trends in the proportion of annual kingfish releases by region over the last 11 years are shown in Figure 13. The number tagged in 2012–13 in the Bay of Plenty increased over an historic low the previous year, but fewer kingfish were tagged in East Northland (Figure 11).

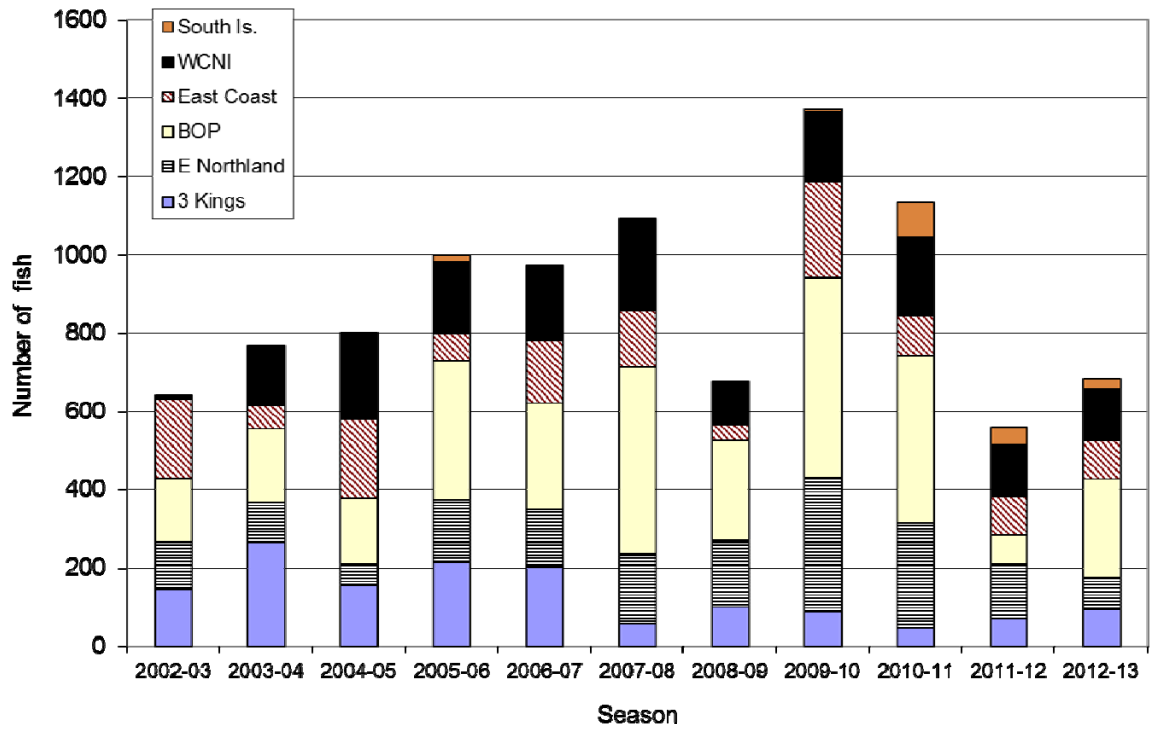


Figure 11: The proportion of yellowtail kingfish tagged and released by region and season since 2002–03.

The great majority of tagged kingfish in 2012–13 were measured (fork length), before release (Figure 12). There were a few small kingfish tagged in 2012–13 but most were larger than the 75 cm MLS and there was a mode in the 105 cm size bin (105 to 109.9 cm). Many of the fish over 100 cm were tagged in offshore locations such as White Island and Ranfurly Banks.

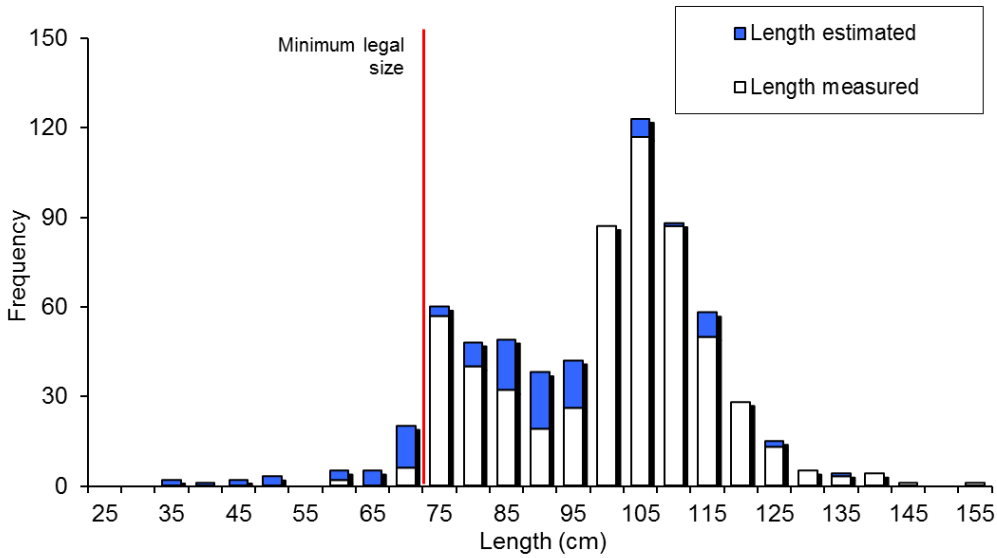


Figure 12: Yellowtail kingfish length frequency for released fish, fish measured (white bars) and those with estimated lengths (blue bars) in 2012–13.

Movement

Most kingfish are caught close to their release location even after many years. Ninety four percent of recaptures at liberty for 30 days were within 100 nautical miles of the release point (Figure 13). The proportion of recaptured kingfish at distance (over 100 miles) increases after 3 years. However, about half of all recaptures have come from White Island fish which generally appear to be resident in that area.

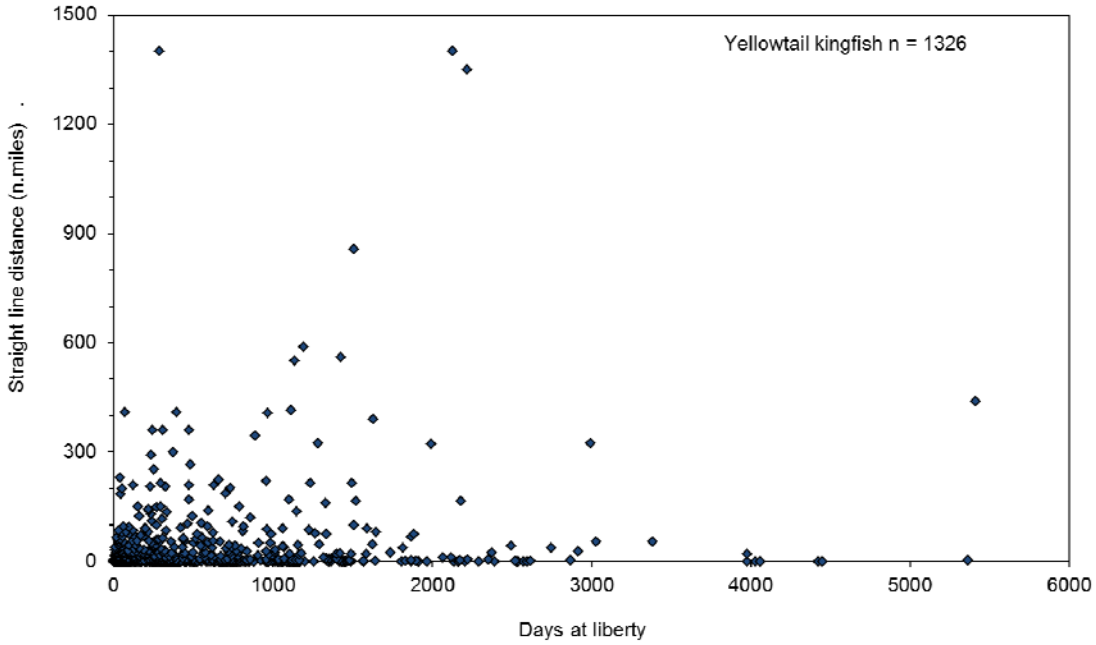


Figure 13: Yellowtail kingfish straight line distance from release location by days at liberty for all years.

Over 5000 kingfish have been tagged at White Island resulting in 631 recaptures. Most of those recaptures have come from White Island or the Rangatira Knoll or Ranfurly Banks, with similar

offshore habitat. A few have been recaptured from Whangaroa in the North to southeast of the North Island (Figure 14). One was recaptured at Kapiti Island on the west coast of the North Island.

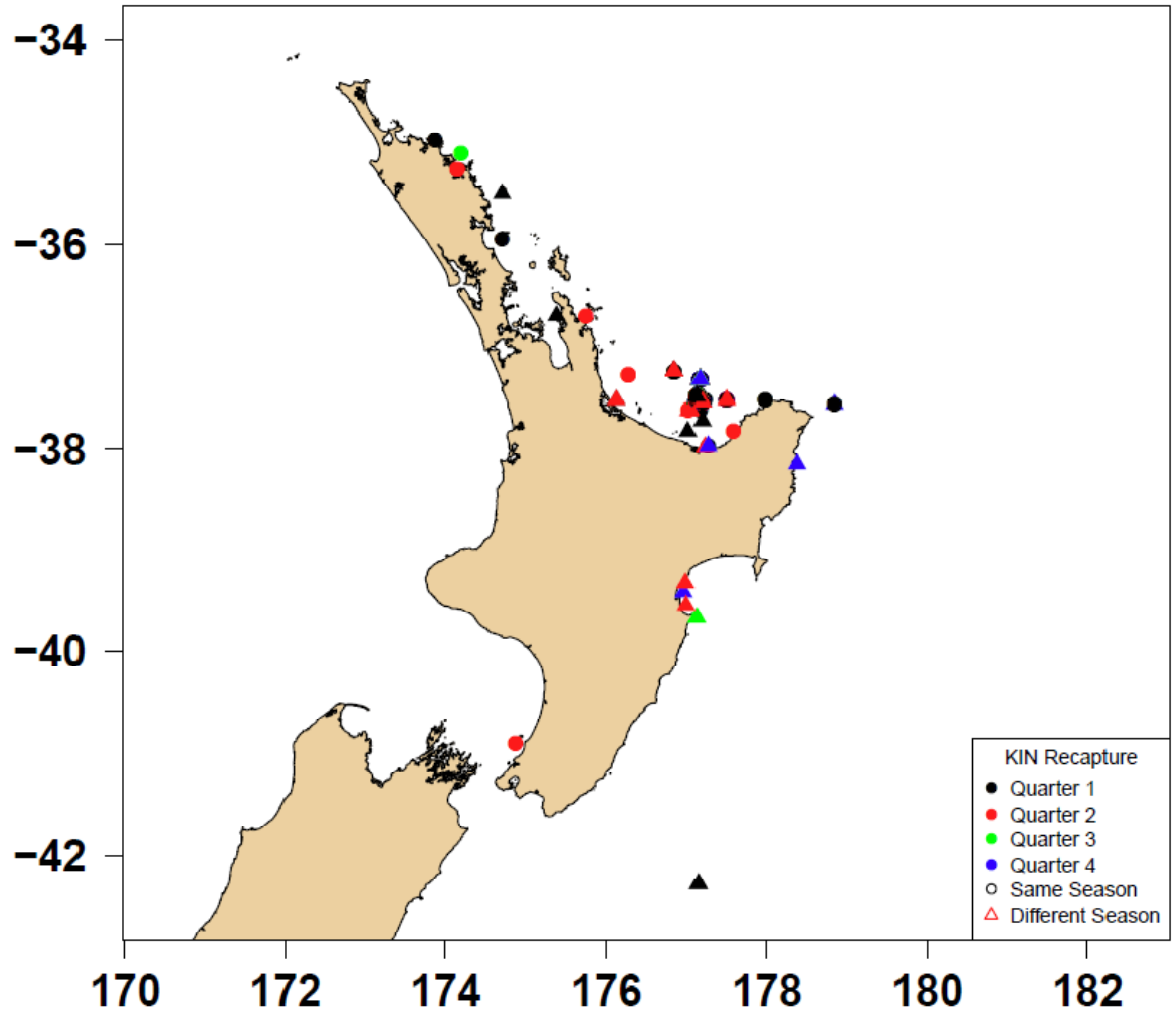
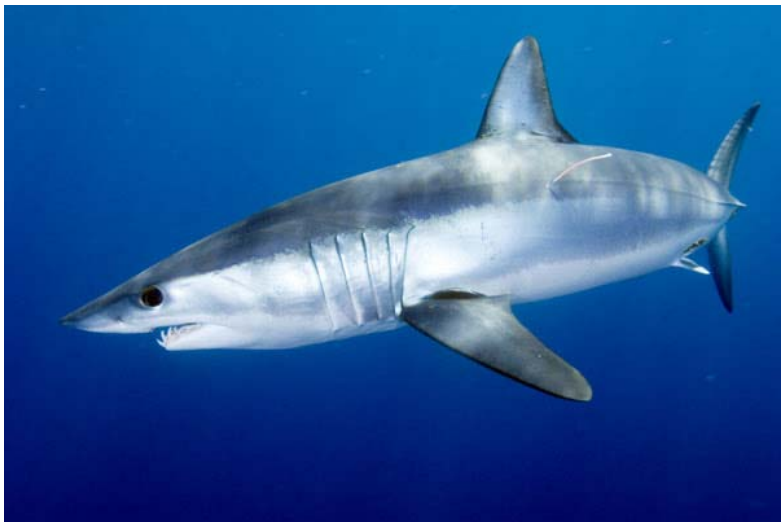


Figure 14: Recapture locations of yellowtail kingfish tagged and released at White Island by recapture quarter (colour at recapture location) for all years.

Yellowtail kingfish are also capable of long distance movement with three fish tagged in New Zealand recaptured in New South Wales, Australia. Recaptures have also been reported from Lord Howe Island and Wanganella Banks.

A Marlborough Sounds kingfish was recaptured off Otago Heads in a commercial set net in late January 2012. It was 107 cm long and had travelled 360 nautical miles south and is the southernmost recapture of a tagged kingfish in New Zealand waters.

3.3 Mako and blue shark



There were 524 mako sharks reported as tagged and released inside New Zealand fisheries waters in the 2012–13 fishing year, which is well above the ten year mean of 347. There has also been a rise in the number of blue sharks tagged and released over recent seasons, with the total of 148 tagged in 2012–13 compared to the ten year mean of 116 (Table 3).

There were 31 mako and 13 blue sharks reported as landed in gamefish club records this season (Roz Nelson, N.Z. Sport Fishing Council, pers. comm.). Using NZSFC records only, it is estimated that 94% of mako and 92% of blue sharks caught by recreational fishers associated with sport fishing clubs were tagged and released. There were no mako and blue sharks tagged for this programme outside New Zealand fisheries waters in 2012–13. The overall recapture rate is 2.5% for mako sharks and 1.8% for blue sharks (Appendix, Table A3).

Mako and blue shark highlights, 2011–12

There were 11 mako shark recaptures reported in 2012–13 (Table 3). Four were caught by commercial tuna longline vessels outside New Zealand fishers waters, four by domestic commercial vessels and three by recreational fishers.

Two mako sharks were caught off Fiji by commercial fishers. Both had travelled over 1000 nautical miles north, the first was 178 cm when recaptured in September 2012 after 222 days, the other was reported as 200 cm and 65 kg in May 2013 after 477 days at liberty. A 40 kg mako shark tagged off Waihau Bay was recaptured by a Spanish longliner 280 nautical miles east of East Cape after 280 days at liberty. It was a 175 cm long male. In March 2013 a 158 cm mako was recaptured in Tongan waters. No tag card with release details is on file.

The mako sharks recaptured in New Zealand waters were at liberty between 2 and 810 days and had recorded movements between 5 and 490 nautical miles. Two sharks estimated at 60 kg on release were recaptured by recreational fishers after 2 and 5 days and both were estimated at 40 kg before being released again. A 55 kg mako tagged at Alderman Islands was recaptured by a trawler in the Chatham Rise (measured 173 cm), 490 nautical miles south in 490 days. A 35 kg mako tagged off New Plymouth was recaptured by a commercial fisher 21 nautical miles away after two years at liberty (712 days). This fish was a 155 cm male.

There were three blue shark recaptures in 2011–12. All were reported by commercial fishers in New Zealand waters. There was no report card for one of these recaptures from off Mahia Peninsular in July 2012. The other two recaptures were both relatively short-term. One was tagged off Parengarenga Harbour and recaptured north of New Zealand (100 n. miles in 53 days) while the other was tagged off Castle Point and recaptured in Hawke Bay 135 nautical miles in 62 days.

Trends

The number of mako and blue sharks tagged peaked during the mid-1990s then declined to a low in 2002–03, followed by an increasing trend (Figure 15). Generally mako sharks are caught as a bycatch of other sport fisheries, particularly off the North Island. The decline in 2011–12 may well be a result of reduced gamefishing effort that season.

While mako sharks take lures, blue sharks form a bycatch when live or dead baits are being used but very seldom take the artificial lures intended for billfish or tuna. Between 1993–94 and 2001–02 the great majority of blue sharks were tagged by fishers in a small target fishery off Otago. Although the number of blue sharks tagged off Otago has declined in recent seasons there has been a modest increase in the annual totals tagged (Figure 15). This is possibly due to an increasing use of bait (as opposed to artificial lures), as well as more effort targeting swordfish, when baits are generally used.

Table 3: The number of mako and blue sharks tagged in New Zealand fisheries waters, the percentage tagged according to NZSFC records, and the number recaptured by season.

Mako	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	Average 2003 to 2013
NZ EEZ	188	241	193	150	297	285	494	609	488	524	347
% tagged	70	80	81	82	87	87	90	92	92	94	86
Recaptures	9	6	3		2	5	7	7	8	11	6

Blue shark	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2003 to 2013
NZ EEZ	106	102	95	157	108	101	73	128	142	148	116
% tagged	85	80	76	91	90	89	92	91	90	92	88
Recaptures	2	2	1	2	3	4	3	3	4	3	3

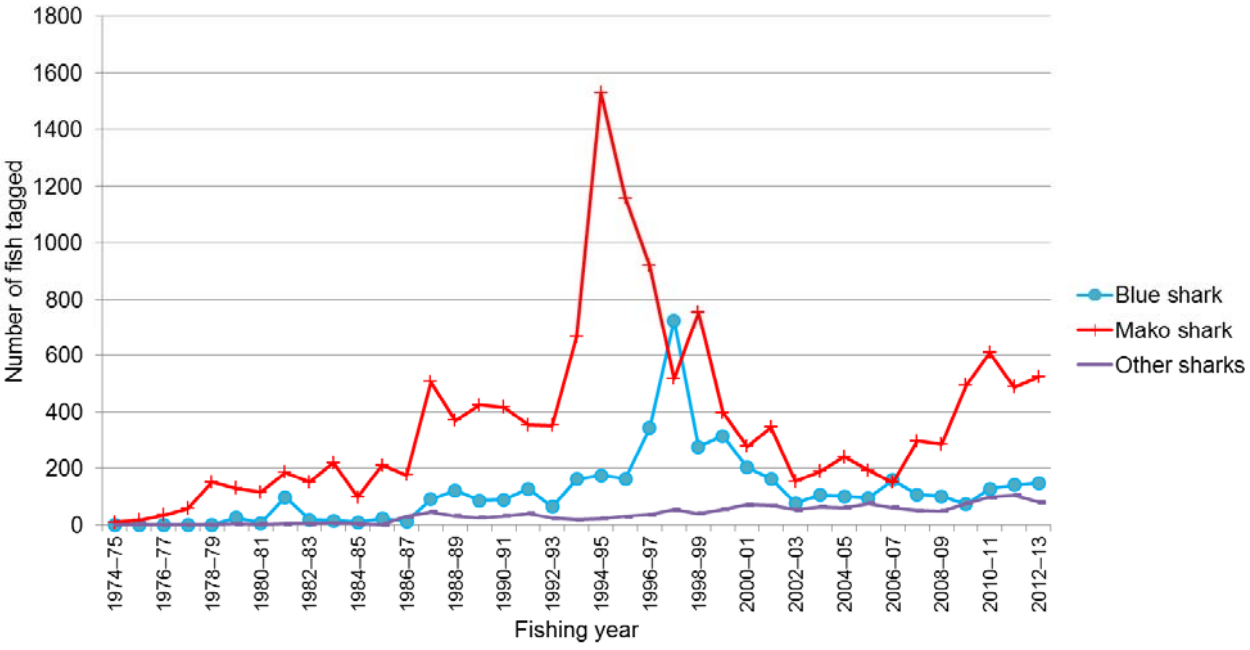


Figure 15: The number of mako and blue sharks tagged by region since 1975.

As in previous years, in 2013 most mako sharks were tagged between January and April with a strong mode in February, when 51% of the annual tally was recorded (Figure 16). This peak is associated with the New Zealand Sport Fishing Council National Contest which encourages the tag and release of various species. There were 16 mako sharks landed and 165 tagged and release in the eight day Nationals in 2013.

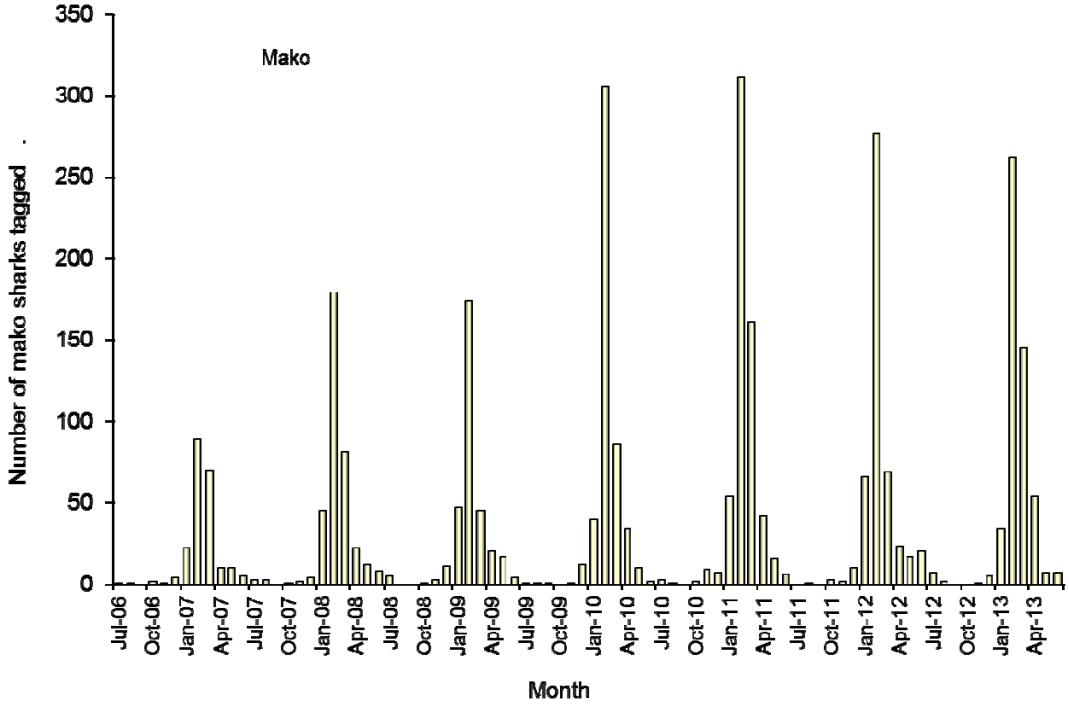


Figure 16: Number of mako sharks tagged by month since 2005–06.

Movement

The gamefish tags hold well on sharks and, as noted above, some long-term recaptures have been made. Rather than getting increased dispersal for longer times at liberty, as would be the case if movement was unstructured or random, we see some fish recaptured close to their release points in following seasons (Holdsworth & Saul 2006).

In many ways the distribution of recaptures of mako sharks tagged in New Zealand is similar to that for striped marlin. They seldom stray into equatorial waters to the north, or past French Polynesia to the east or Australia to the west. Mako sharks have tended to be recaptured in Fiji and New South Wales more often than striped marlin, but this may be due to the methods of fishing in those areas (Figure 17).

Blue sharks also appear to disperse into the subtropical South Pacific, with recaptures from Australia, New Caledonia, Vanuatu, Fiji, Tonga, Cook Islands and French Polynesia (Figure 18). However, they have strayed further afield with single recaptures from this programme coming from the south-eastern Pacific off Chile and the Indian Ocean, southwest of Perth (not plotted).

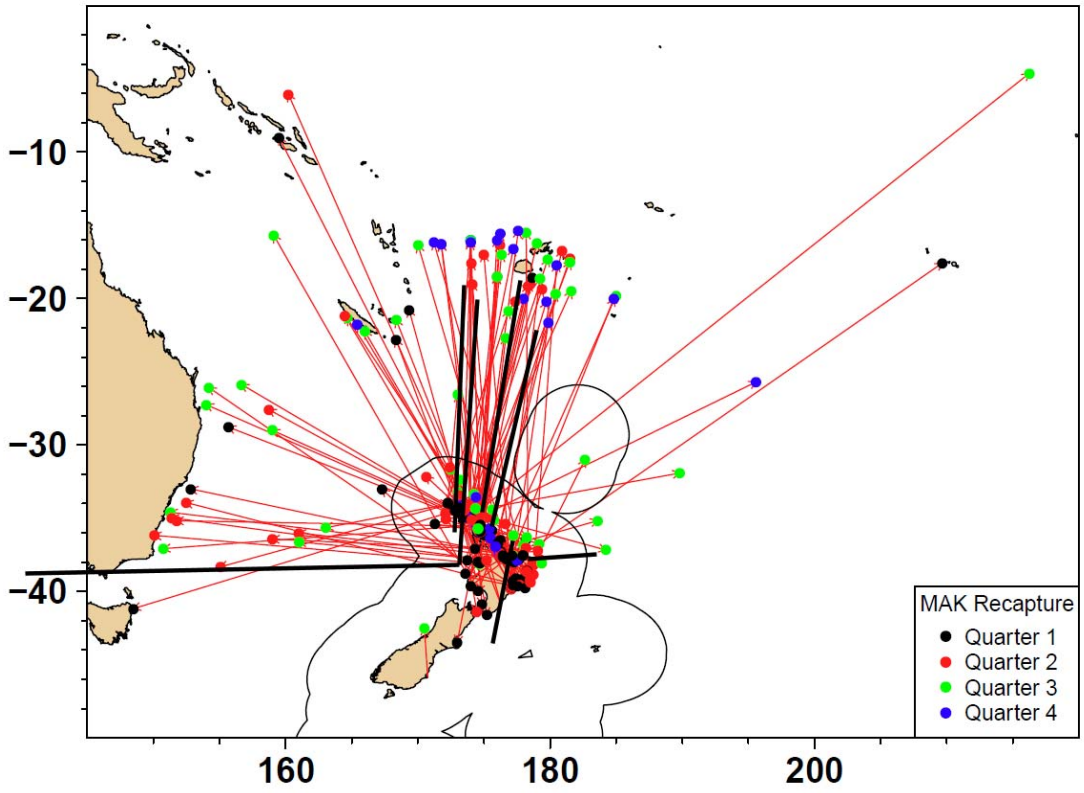


Figure 17: All release and recapture locations of mako sharks in the gamefish tagging programme, with recapture location colour coded by quarter. Long distance recaptures from 2011–12 and 2012–13 black lines.

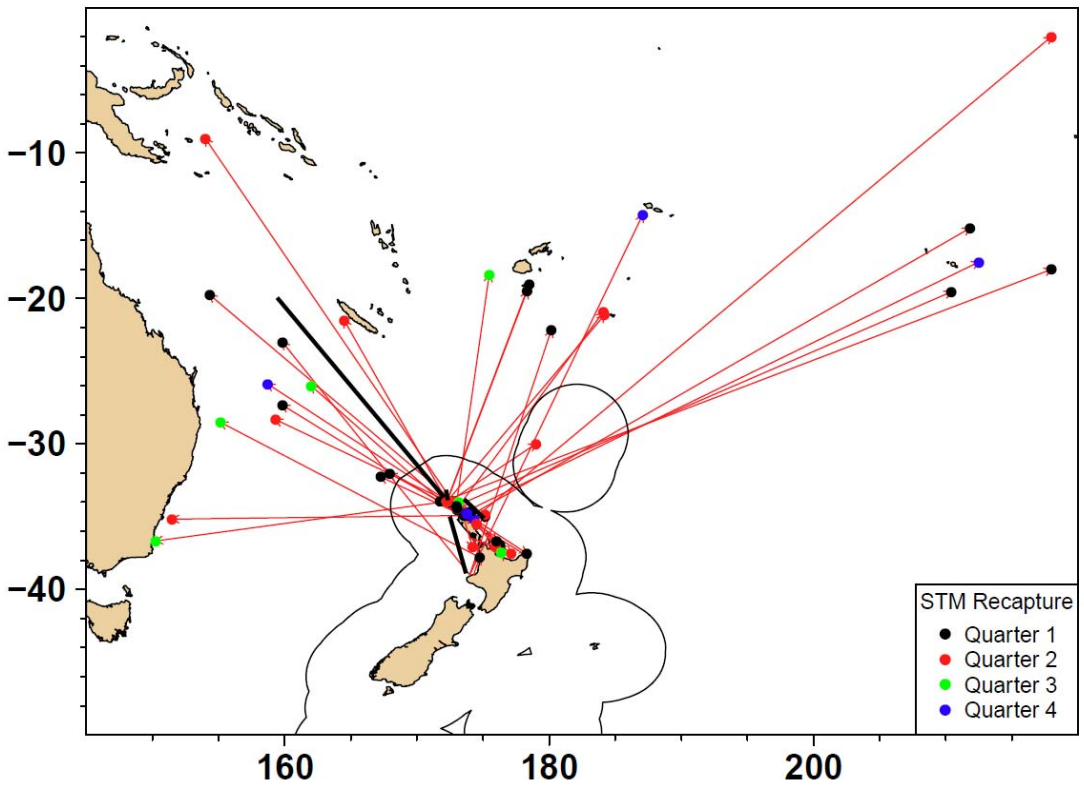


Figure 18: All release and recapture locations of blue sharks in the gamefish tagging programme, with recapture location colour coded by quarter. Long distance recaptures from 2011–12 and 2012–13 black lines.

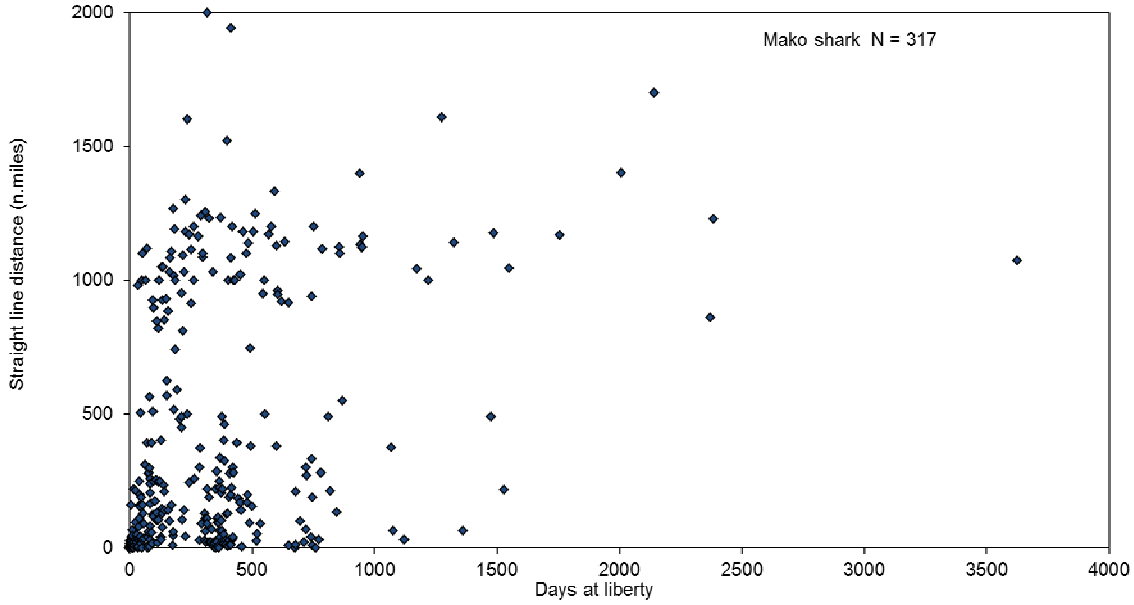


Figure 19: Recaptured mako shark straight line distance from release location by days at liberty for all years.

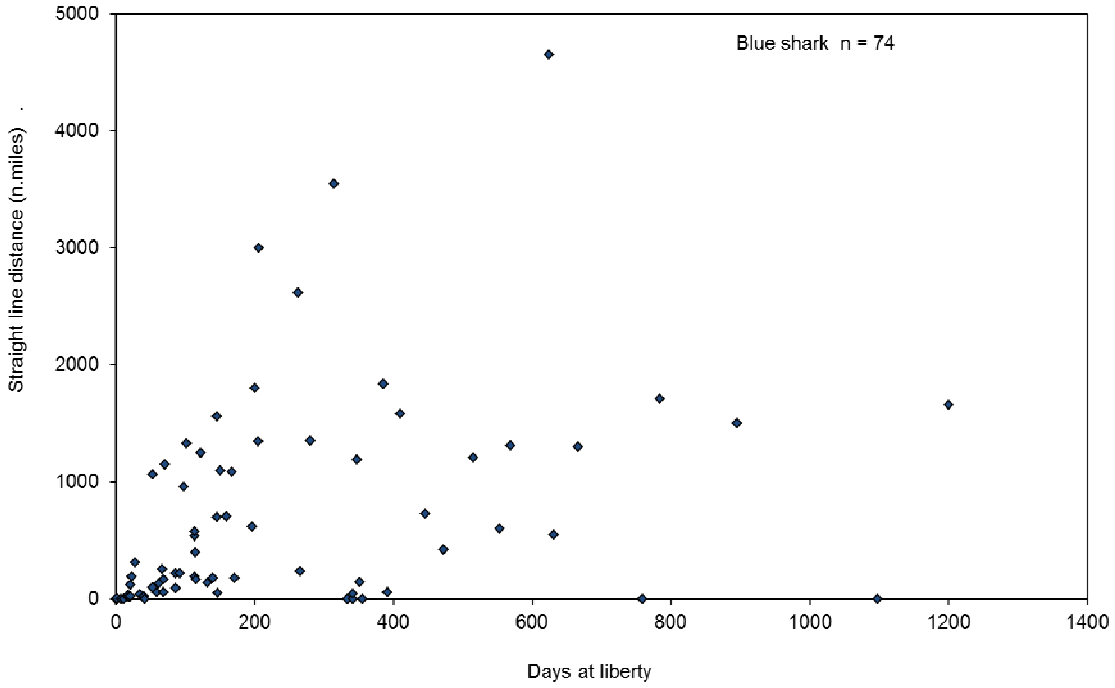


Figure 20: Recaptured blue shark straight line distance from release location by days at liberty for all years.

To date there have been five mako sharks recaptured after 5 years or more at liberty, with the longest confirmed recapture at 9 years 11 months (3624 days). This fish was caught between New Caledonia and Vanuatu in January 2009 and was reported as a pregnant female with 8 pups. Mako recaptures in New Zealand tend to be during the first 4 months at liberty or in the summer of following years (Figure 19). They are also capable of relatively rapid disbursement of 15 to 20 nautical miles a day. One fish tagged in March off Whangaroa moved to Fiji in 36 days, a displacement rate of 27.2 nautical miles per day.

Blue sharks have also been recaptured close to their release point after one year and individual fish have been recaptured at their release location off Otago Heads after two and three years at liberty (Figure 20). Blue sharks have been recaptured further away than any other species in the NZGTP to date though their maximum displacement rate is not as high as mako or striped marlin. A blue shark tagged off Tutukaka was recaptured after 53 days off Queensland giving the maximum recorded displacement rate to date of 20 nautical miles per day.

Landed sharks

Mako, blue shark and to a lesser extent hammerhead sharks were regularly caught and landed by sport fishers in New Zealand. The number landed declined for all species in the early 2000s (Figure 21). A similar trend is seen in the number tagged (Figure 15). Most sharks were landed during fishing tournaments or for club trophies. For over 20 years sharks were required to exceed a minimum weight of 40 kg set by the New Zealand Sport Fishing Council. Some clubs set higher minimum weights, up to 70 kg, for qualifying sharks. Over the last 10 years many clubs have removed prizes for landed sharks altogether, as the attitude toward sharks has changed.

The total number of bronze whalers land by club members over the last 5 years is 60 (12 per year), while just 20 hammerhead, 8 thresher, and 1 porbeagle shark have been landed over the last 5 years.

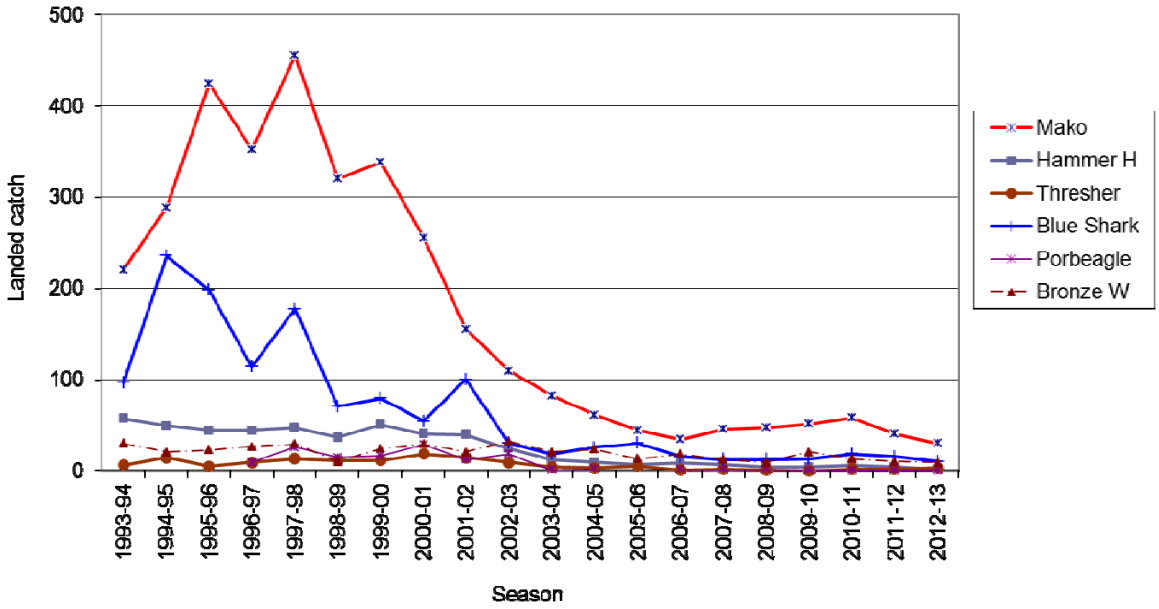


Figure 21: Number of sharks landed and recorded by New Zealand Sport Fishing Council clubs by species since 1993–94.

3.4 Other species

Each year, anglers tag and release a number of species that are not considered to be mainstream parts of the programme. Most of these are sharks, in particular hammerhead shark and bronze whaler. The number of "other sharks" tagged in 2012–13 was 80, less than the two previous seasons (Appendix, Table A1).

For the third consecutive year no yellowfin tuna were tagged and released in the NZGTP. Sport fishing clubs recorded weighing just 10 yellowfin in 2011–12 and 2012–13, the lowest number on record.

4. DISCUSSION

In recreational fisheries for large pelagic species capture and release has become the norm in many countries. Anglers are encouraged to record information on the fish they catch to aid research on the species concerned and the fishery. Cooperative tagging programmes are an effective way of collecting information on large pelagic species, their seasonal distribution and the recreational fisheries that catch them. This is especially true for striped marlin and some pelagic sharks in New Zealand, which have a high proportion of the catch tagged and released. The date, location, vessel name, fish size, fight time and release condition have been recorded for most of the 66 000 fish in the database. Recapture and reporting of highly migratory fish is a relatively rare event, but over the years a picture of where these fish go and who catches them has built up.

Anglers feel they are contributing to research and conservation of stocks, while still getting recognition of their catch. The New Zealand Sport Fishing Council and clubs support the tagging programme by setting minimum sizes for qualifying fish and offering good prizes and trophies for tagged fish. The Council and clubs also purchase and distribute all the tags, and act as a collection point for tag cards with release information. Projects for Ministry for Primary Industries ensure that the information is used. They fund data management, recapture rewards, analysis and inclusion of this information in Working Group Reports, reports to the Western and Central Pacific Fisheries Commission and Fisheries Assessment Reports such as this.

The summer of 2012–13 year provided relatively good fishing conditions on the east and west coast of the North Island. The numbers of striped marlin and blue marlin tagged and released was below average however, especially in East Northland and Bay of Plenty. Fewer kingfish were also tagged compared to the ten year mean. The number of mako and blue sharks tagged was higher than recorded in recent years. Thirty three swordfish were tagged and released, not as many as last year but still well above the ten year mean. For the third year running no yellowfin tuna were tagged.

The trends in landed catch of billfish are similar to trends in the number tagged. In addition there is a notable decline in the number of shortbilled spearfish landed. These are an occasional catch spread throughout the gamefish season and areas when trolling lures. There were 13 shortbilled spearfish landed in 2012–13, which is down from the ten year mean of 40.

The catch of sharks by anglers declined significantly from the 1990s to the mid-2000s and has increased over the last 5 years. Most of these sharks are now tagged and released and the landed catch continues to decline as attitudes of clubs and anglers change.

To get four striped marlin recaptures in a season is a highlight. Three were in northern New Zealand waters 25 to 104 days after release. It is possible that when conditions are favourable marlin will spend longer within range of the recreational fishery.

The other striped marlin recapture was from the Coral Sea in January 2013, a known spawning ground for striped marlin at that time of year (Kopf et al. 2012). The new generation billfish tag with the surgical grade nylon anchor lasted 328 days. These are more expensive than tags with the stainless steel anchor and are widely used for billfish around the world. Some charter skippers are double tagging billfish with both types of tags.

Kingfish recaptures continue to surprise. This year it was two long term recaptures, of 11 and 14 years, from fish that are not close to maximum size (16.1 and 19 kg respectively). It was noted however that the smaller fish looked old and in poor condition. This fish was less that its estimated release weight of over 20 kg. Both fish were recaptured in the Three Kings area, prime kingfish habitat we assume, with a relatively lightly fished population. If anglers catch a kingfish with an old worn tag it would be useful to measure the length, determine the sex, and keep the head in the freezer. John Holdsworth can arrange collection and removal of otoliths for ageing. Contact details below.

Release information collected on tag cards on where and how fish are caught and released can be a useful component of tagging programme data. Anglers are encouraged to complete all the details on the card including approximate latitude and longitude.

There are a number of other cooperative tagging programmes operating in the southwest Pacific, run from Australia, Tonga, and USA. In addition, a number of projects have used electronic tags on fish caught on recreational vessels, providing more detail of survival and behaviour after release (Domeier et al. 2003; Holdsworth et al. 2009 Sippel et al. 2011). Researchers can also draw on current and historical data collected by remote sensing satellites. The full value of the time series of gamefish release and recapture information may be yet to be realised. In future a wider spread of tagging locations for billfish, in Pacific Island nations where tourist fisheries are becoming important, may increase our knowledge of spawning and post spawning migrations which are important for determining stock structure in the Pacific Ocean.

Your feedback on the NZGTP and this report is encouraged. The programme aims to continue providing good value for all those involved: fishers, NZ Sport Fishing Council, scientists and government. You can email John@bluewatermarine.co.nz or info@fish.govt.nz or post to

Ministry for Primary Industries
PO Box 19747
Avondale
Auckland

5. ACKNOWLEDGMENTS

Thanks to all those who participated in this programme by releasing or reporting tagged fish. The New Zealand Sport Fishing Council and all affiliated clubs are thanked for their cooperation and the purchase and distribution of tags. Particular thanks to Roz Nelson, secretary of the NZSFC, for compiling catch information and keeping track of clubs and tags and Sandra Gaskell of Blue Water Marine Research for managing the data and processing recaptures. Many thanks to Dr Tim Sippel for plotting fish movements. Thanks to Dr Stephen Brouwer (MPI) for his review and comments on this report. The Ministry for Primary Industries provided funding for this project, "Management of data from the gamefish tag recapture programme" TAG2012/01.

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Appendix Tables for all years

Table A1: Number of fish tagged and released by species and season, and the mean number of releases for the 10 seasons previous to 2011–12, for fish tagged by recreational and commercial fishers inside the New Zealand EEZ only.

Season	BEM	BKM	BWS	KIN	MAK	SHA	SSF	STM	SWO	TOR	YFN	OSP	Total
1974–75			1		9								10
1975–76				1	17	2		3			1		24
1976–77			1	1	34			2					38
1977–78				15	58			7					80
1978–79			1	107	152	1		18				5	284
1979–80			26	22	129	3		17					197
1980–81		1	7	7	116	2		2				7	142
1981–82			99	30	185	3		11				17	345
1982–83			18	55	151	4		6			2	11	247
1983–84			15	54	220	7		9			6	9	320
1984–85			10	143	98	4					25	2	282
1985–86			23	318	211	1		2			6	4	565
1986–87			12	365	177	31		2			5	18	610
1987–88	1	1	91	689	505	47		97	6		13	82	1 532
1988–89	1		122	371	370	32		371	4		63	116	1 450
1989–90	1	2	87	427	424	26	2	365	4		139	100	1 577
1990–91			90	528	417	32	7	229	5		24	51	1 383
1991–92	1	1	128	389	353	40	1	239	20		39	38	1 249
1992–93	1		64	692	352	24	8	383	36		10	75	1 645
1993–94	10		162	1 100	666	19	17	928	3		92	38	3 035
1994–95	4		175	1 443	1 529	23	29	1 202	10		200	24	4 639
1995–96	7	3	163	643	1 158	30	13	1 102	3		110	5	3 237
1996–97	6	5	343	416	920	36	5	1 301	4		33	9	3 078
1997–98	8	1	724	364	518	54	1	895			3	4	2 572
1998–99	36	1	276	311	754	40	6	1 541	2		17	8	2 992
1999–00	51	2	314	818	398	56	2	787	2		27	40	2 497
2000–01	34		203	606	277	72	1	851	6		17	4	2 071
2001–02	21	2	163	778	346	69	13	771	3		7	3	2 176
2002–03	6	1	78	646	155	54	14	671	3		76	2	1 706
2003–04	8		106	771	188	64	8	1 051	2		184	6	2 388
2004–05	29	5	102	806	241	61	7	1 348	6		81		2 686
2005–06	17	2	95	1 016	193	76	11	923	5	7	5	4	2 354
2006–07	26	2	159	977	150	61	14	965	16	14	8	6	2 398
2007–08	29		108	1 120	297	51	8	806	25	31	21	7	2 503
2008–09	24	2	101	661	285	50	5	1 058	24	35		9	2 254
2009–10	32	3	73	1 381	494	76	15	858	18	15	30	9	3 004
2010–11	78	1	128	1 123	609	99	21	731	37	15		14	2 856
2011–12	50	3	142	613	488	106	5	663	50	16			2 136
2012–13	17	3	148	704	524	80		745	33	5		4	2 263
Total	498	41	4 558	20511	14168	1436	213	20960	327	138	1244	731	64 825
Previous 10 year Mean	30	2	109	911	310	70	11	907	19	19	58	6	2 429

BEM	blue marlin	KIN	kingfish	SSF	shortbill spearfish	TOR	Pacific bluefin
BKM	black marlin	MAK	mako shark	STM	striped marlin	YFN	yellowfin tuna
BWS	blue shark	SHA	other shark species	SWO	broadbill swordfish	OSP	all other species

Table A2: Number of fish tagged and released by species and season, in the New Zealand gamefish tagging database, for fish caught outside the New Zealand EEZ.

Season	BEM	BKM	BWS	KIN	MAK	SHA	SAI	SSF	STM	SWO	YFN	OSP	Total
1974–75													
1975–76													
1976–77													
1977–78													
1978–79													
1979–80													
1980–81													
1981–82													
1982–83													
1983–84													
1984–85													
1985–86											2	2	4
1986–87											2	4	6
1987–88													
1988–89													
1989–90	6	2						1			1		10
1990–91		2					4						6
1991–92	4	1							2				7
1992–93	10	1		1			5	1	3		3	5	29
1993–94	10	2			1		5		1		12	3	34
1994–95	25	4		1	2		9		4		15	4	64
1995–96	39	3					4	2	2			7	57
1996–97	20						4		1				25
1997–98	16	4					6		3				29
1998–99	7	1					2				2		12
1999–00	13	1					11	1	4				30
2000–01	37	1					8						46
2001–02	48	1					11		1				61
2002–03	53						15	2	6				76
2003–04	78	18		1	1		15	4	308		12	1	438
2004–05	69	3			1		6	3	9		4		95
2005–06	45						7	1	69			6	128
2006–07	45						12	4	62	1		2	126
2007–08	39	2					5					8	54
2008–09	12	1					1		29	2			45
2009–10	24						7	2					33
2010–11	8					3	10		1				19
2011–12	28						2	2					32
2012–13	35						5		132				172
Total	671	47		3	5	3	154	23	637	3	53	42	1 466

BEM	blue marlin	KIN	kingfish	SAI	sailfish	TOR	Pacific bluefin
BKM	black marlin	MAK	mako shark	STM	striped marlin	YFN	yellowfin tuna
BWS	blue shark	SHA	other shark species	SWO	broadbill swordfish	OSP	all other species

Table A3: Number of fish recaptured by species and season by species.

Season	BEM	BKM	BWS	KIN	MAK	SHA	SSF	STM	SWO	TOR	YFN	0SP	Total
1976–77				1	2								3
1977–78					3								3
1978–79				7	6								13
1979–80				3	3							1	7
1980–81				2	3								5
1981–82				2	8								10
1982–83			1	11	5								17
1983–84				9	1								10
1984–85				10	7								17
1985–86				56	10								66
1986–87				92	9	4							105
1987–88				77	8	1						3	89
1988–89			2	91	13	1		1				3	111
1989–90				45	10	6		2					63
1990–91			3	37	7	3		1			1	1	53
1991–92			3	31	12	1						3	50
1992–93			2	43	3	2		3					53
1993–94			1	54	10	5		4			1		75
1994–95			2	86	16			6				1	111
1995–96		1	1	71	32	1		6			3	1	116
1996–97			4	52	35	2		5			1	1	100
1997–98	1		9	26	17	2		12			1	1	69
1998–99			10	20	15	4		14					63
1999–00	1		11	57	23	5		5				2	104
2000–01	1		4	29	15	3		2			1	1	56
2001–02			3	48	16	1		2	1				71
2002–03	2			27	9	2		2				1	43
2003–04			2	32	9	2		5	1		2		53
2004–05			2	38	6	1		4			2		53
2005–06	1		1	53	3	3		1			1	1	64
2006–07	1		2	38		1					1		43
2007–08			3	55	3	2	1	3			1		68
2008–09			4	43	8	2		3		2		2	64
2009–10			3	46	7	2		2				2	62
2010–11	1		4	54	7	2				1			69
2011–12			4	44	8				1	1			58
2012–13			3	38	11	2		4					58
Total	8	1	84	1 428	360	60	1	87	3	4	15	24	2 075
Recapture rate (%)	0.7	1.1	1.8	7.0	2.5	4.2	0.4	0.4	0.9	2.9	1.2	3.1	

Appendix B: Map of tagging locations

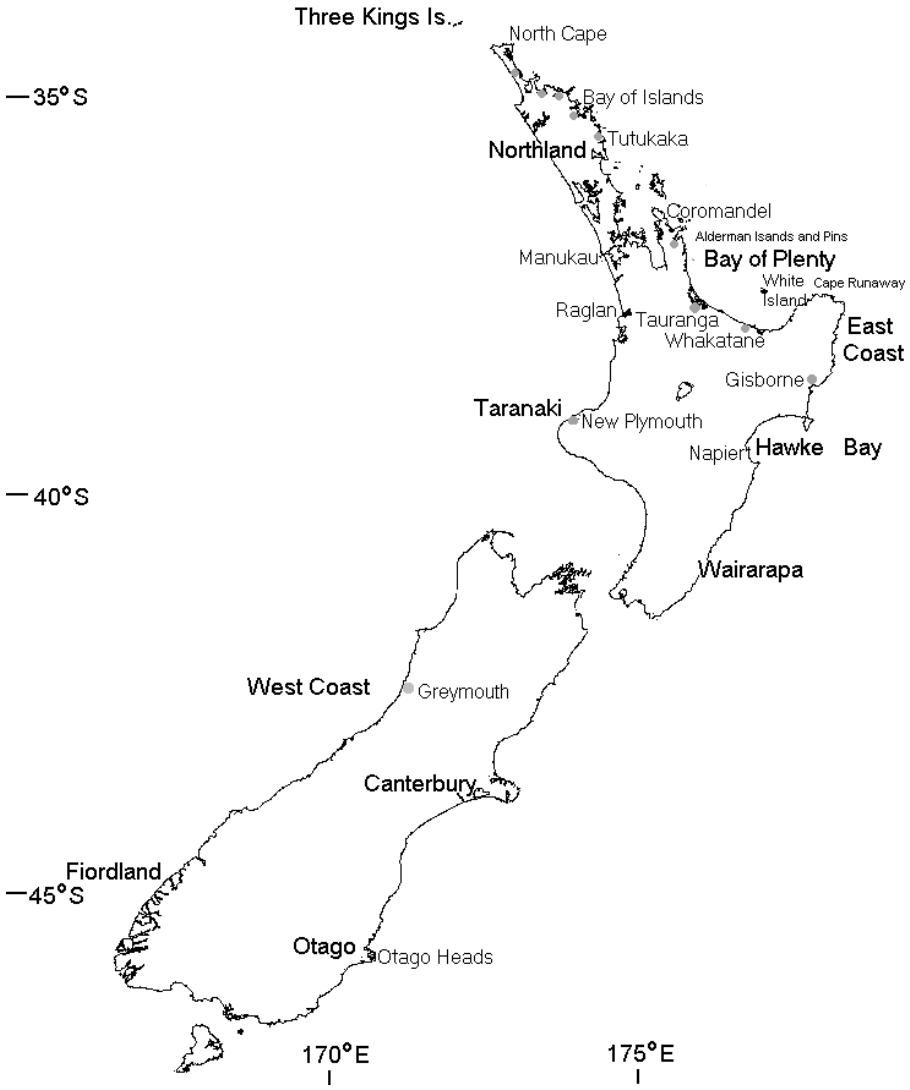

Figure B1: Location of the main areas of gamefish tagging in New Zealand.