



## New Zealand Billfish and Gamefish Tagging, 2011–12

New Zealand Fisheries Assessment Report 2013/26

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## EXECUTIVE SUMMARY

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Release and recapture data for the 2011–12 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 overall this season (1945) was the lowest since 2002–03. Bad weather, with consistent strong south-east (onshore) winds disrupted much of the fishing season on the important east coast fishing grounds. The numbers of striped marlin fell compared to the previous season, 33% below the ten year mean. Kingfish were also well down on the previous year with 600 tagged, representing a drop of 25% on the ten year mean. Although the number of mako sharks tagged was down on the 2010–11 season, it remained well above the ten year mean. Forty nine swordfish were tagged, the best total for any year to date but for the second 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 (92%) and blue sharks (90%) were tagged and released rather than landed.

The number of striped marlin reported as tagged and released inside New Zealand fisheries waters in the 2011–12 year (603) was the lowest for 19 years. The number of blue marlin tagged (43), was well above the ten year mean for the second consecutive year. The number of yellowtail kingfish tagged (600) in 2011–12 was substantially down on the previous year (1123). Usually late returns of tag cards adds about 10% to these totals.

A total of 58 recaptures was reported in the 2011–12 fishing season. These comprised 44 (76%) yellowtail kingfish, 8 (14%) mako sharks, 4 (7%) blue sharks, 1 swordfish, and 1 Pacific bluefin tuna.

This season we recorded the longest-term kingfish and Pacific bluefin recaptures for this programme. Two kingfish recaptured by set net off Otago (the furthest recorded movement south for this species) and a mako shark off Victoria, Australia (the furthest west for this species) were notable recaptures. A tagged swordfish was recaptured by the same angler on the same boat in the same place after 8 months, retagged and re-released. The first recapture of a kingfish tagged in the Marlborough Sounds was made in January 2012. This fish had moved 360 n. miles south upon recapture. In May 2012 a kingfish tagged in the Bay of Islands was recaptured at the King Bank. This is the first kingfish tagged in coastal waters to be recaptured in the Three Kings area.

We use information recorded on tag cards describing bait type, hook removed or not and capture time with estimates of striped marlin mortality from satellite tagging studies to estimate a release mortality rate for striped marlin in New Zealand. Applying the calculated release mortality rate of 14.5% to the average number of striped marlin tagged in New Zealand over the last seven years (880) gives an estimated annual release mortality of 127 fish or about 12.5 tonnes for the New Zealand recreational fishery.

Over the last seven years 43% of striped marlin were recorded as landed in the New Zealand Sport Fishing Council records. There is a culture in this fishery to land fish that are damaged, tail wrapped or unlikely to survive to avoid wasting the fish. Therefore the release mortality estimated for New Zealand may be lower than in countries where almost all striped marlin are tagged.

## 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, project TAG2009/01.

### 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.

**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 708 billfish tagged and released inside New Zealand fisheries waters in the 2011–12 season, comprising 603 striped marlin, 49 swordfish, 48 blue marlin, 5 shortbill spearfish and 3 black marlin. Striped marlin numbers were the lowest since 2002–03 and shortbill spearfish releases were also well below the previous two seasons (Table 1). However, a record number of swordfish (49) were tagged and released. Blue marlin releases (48) fell in comparison to the previous record season, but still represented the third best season to date for that species. A further 646 striped marlin were recorded as kept by gamefish club members (Roz Nelson, N.Z. Sport Fishing Council, pers. comm.). Using NZSFC tagged and landed records only, it is estimated that 49% of recreationally caught striped marlin were recorded as tagged and released by clubs in 2011–12. Also, 28 blue marlin, 2 sailfish and 2 shortbill spearfish were tagged outside New Zealand fisheries waters by NZGTP members in 2011–12 (Appendix A, Table A2).

#### **Billfish highlights 2011–12**

Despite the easterly (onshore) conditions throughout most of the summer, water temperatures were unusually cold in early 2012. The prevailing easterly wind had a limiting effect on fishing effort, with a reduction of 30% recorded in the billfish logbook project for the season, and many clubs had difficulty in staging or rescheduling their fishing competitions (Roz Nelson, NZSFC, pers. comm.). This is the likely reason for much of the reduction in tag and release totals reported.

The increase in swordfish tagged and released was due to increased fishing effort between North Cape and East Cape in April, May and June, after most of the effort targeting marlin had ceased. The development of daylight fishing for swordfish, where baits are dropped to depths of 500 – 600 metres during the day, was well reported in the recreational fishing media during 2012. This technique has greatly increased the popularity of target fishing for swordfish amongst anglers as it has become more widely known and practiced.

Striped marlin, as always, dominated the catch statistics. Striped marlin were available in good numbers at times when the weather was favourable. February was once again the peak month for striped marlin, with 60 % of the striped marlin catch reported then (Figure 2). For the second year running there were no New Zealand striped marlin recaptures.

A broadbill swordfish was recaptured by Jim Gigger on the charter vessel Primetime off Great Exhibition Bay on 20 February 2012. Remarkably this fish was tagged by the same angler on the same boat and in the same area in mid June 2011. The fish had been at liberty for 8 ½ months (251 days) and was estimated to be 130 to 140 kg on recapture. This fish had been double tagged with the standard stainless steel headed tag and a nylon headed billfish tag. Just the nylon tag was in the fish on recapture and it was double tagged again and released.

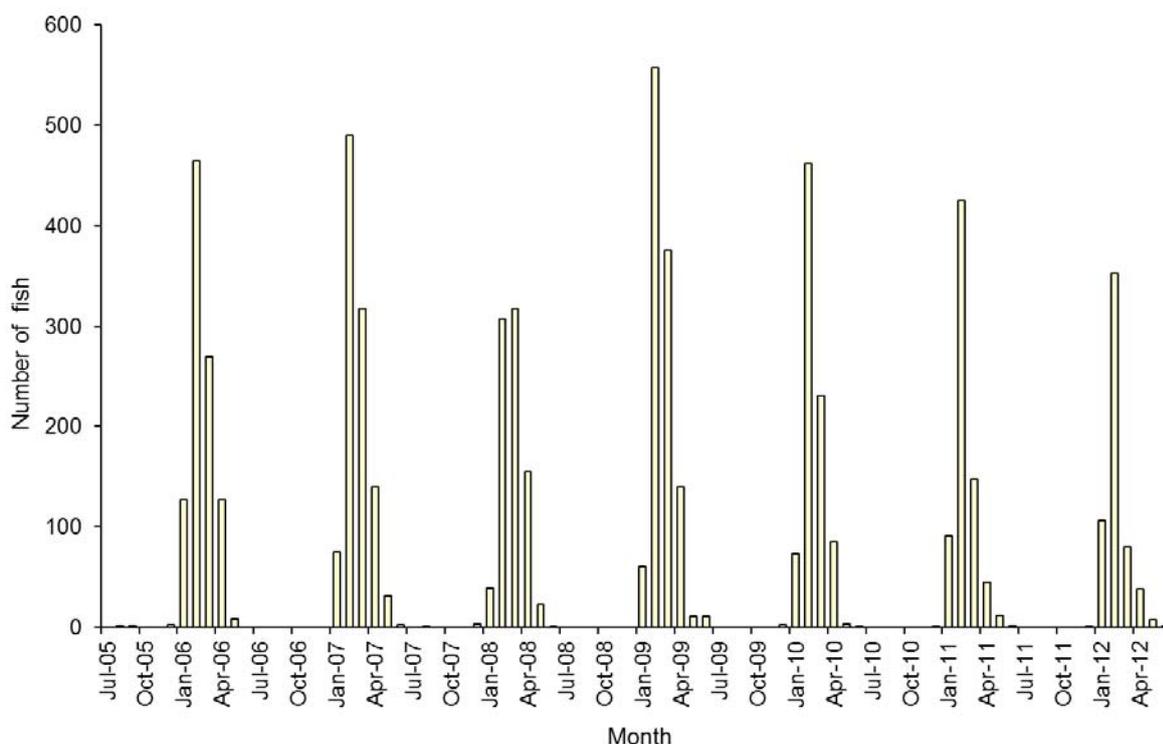
This is the third swordfish recapture in this program. The other two were small fish released by commercial fishers and at liberty for many years. The first was a 12 kg fish tagged from a Japanese longline in June 1991. It was recaptured in February 2002 just to the west of Wanganella Bank and was estimated to be 160 kg whole weight and 205 cm long upon recapture. It was caught 250 nautical miles to the west of its release location after 10 years 8 months at liberty. The second swordfish was tagged off eastern New Zealand in February 1996 and was estimated at 20 kg. It was recaptured 8 years 4 months later 113 nautical miles south of its release point. It was estimated to have grown 70 kg during this time.

## Trends

The number of striped marlin tagged in the 2011–12 season was lower than the previous season and significantly below the average number tagged in the 10 previous seasons (Table 1).

**Table 1: The number of billfish tagged in New Zealand waters in the last ten years and the combined billfish recaptures by season.**

	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	Average 2003 to 2012
Striped marlin	671	1051	1348	923	965	806	1058	858	725	603	901
Blue marlin	6	8	29	17	26	29	24	32	78	48	30
Shortbill spearfish	14	8	7	11	14	8	5	15	21	5	11
Swordfish	3	2	6	5	16	25	24	18	37	49	19
Billfish recaptures	4	5	4	2	1	4	3	2	1	1	3



**Figure 2: The number of striped marlin tagged by month in New Zealand fisheries waters (2005–06 to 2011–12).**

Most striped marlin are tagged in February which is generally our warmest month. More striped marlin were tagged in January than for the previous five years but all other months were down in comparison to recent years (Figure 2).

More blue marlin had been landed and tagged in the 2010–11 year than in any other season, but 2011–12 was also a relatively good year for this species. In 2011–12 February was a productive month in New Zealand while in the Pacific Islands blue marlin were mainly tagged from July to October (Figure 3).

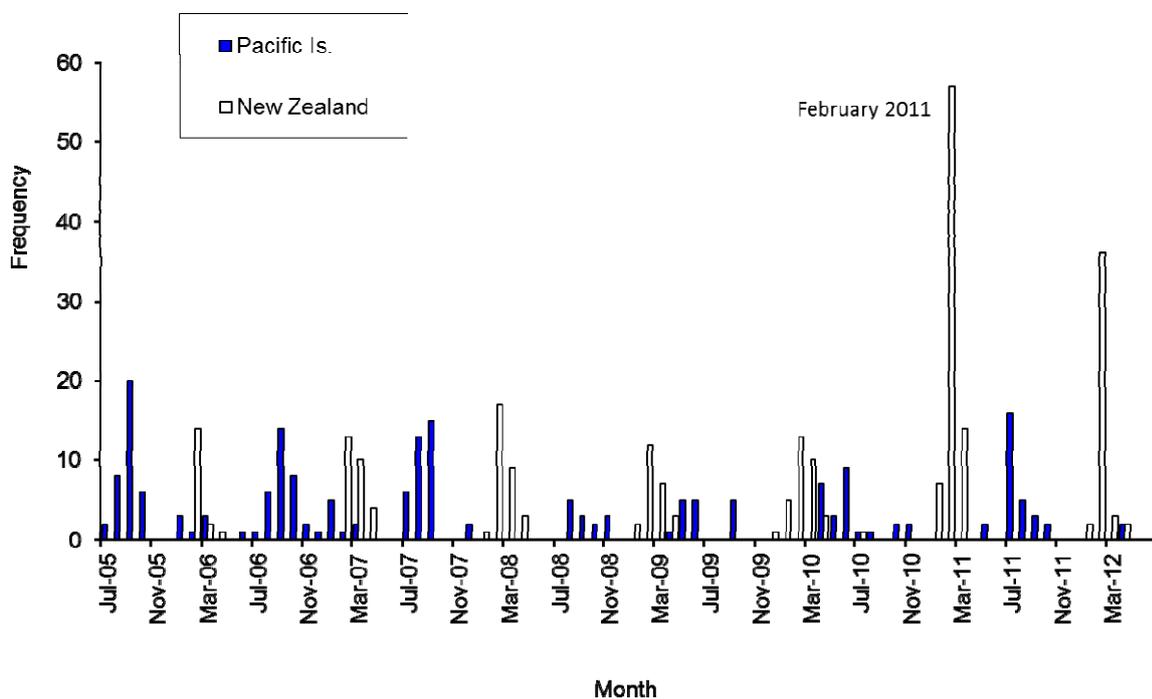


Figure 3: The number of blue marlin tagged by month in New Zealand and Pacific Island waters (2005–06 to 2011–12).

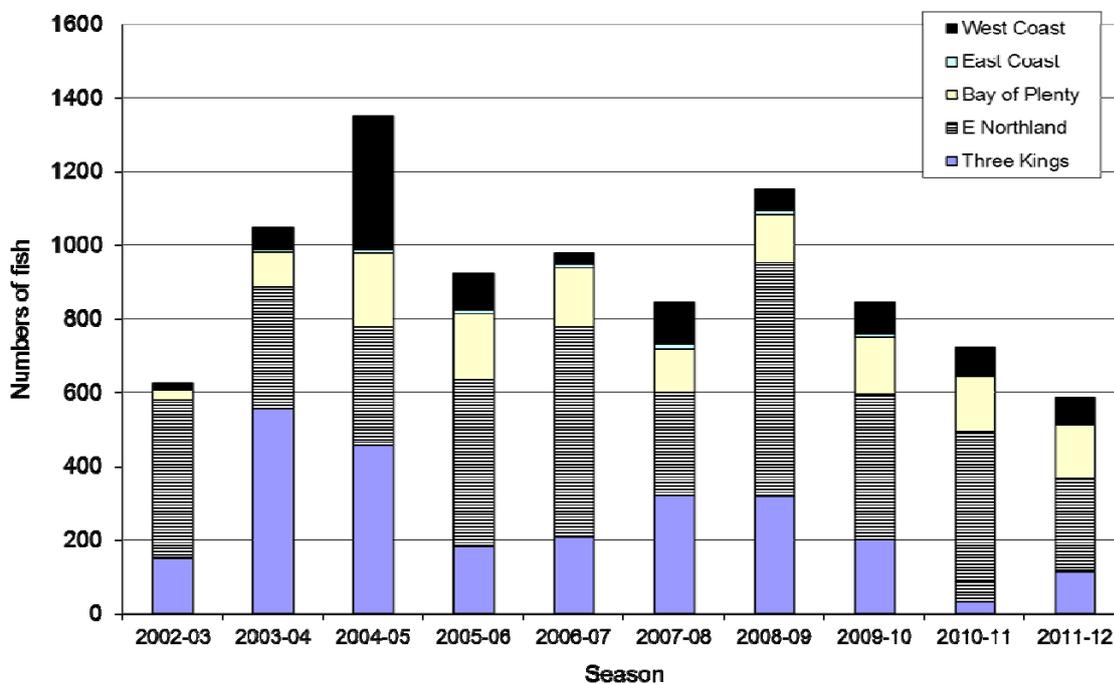
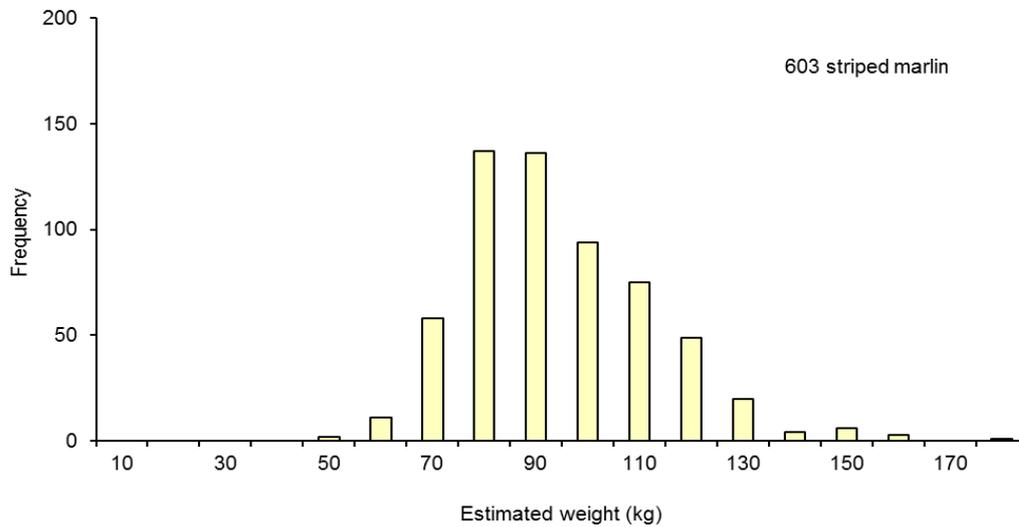


Figure 4: The number of striped marlin tagged by region and fishing season (2002–03 to 2011–12).

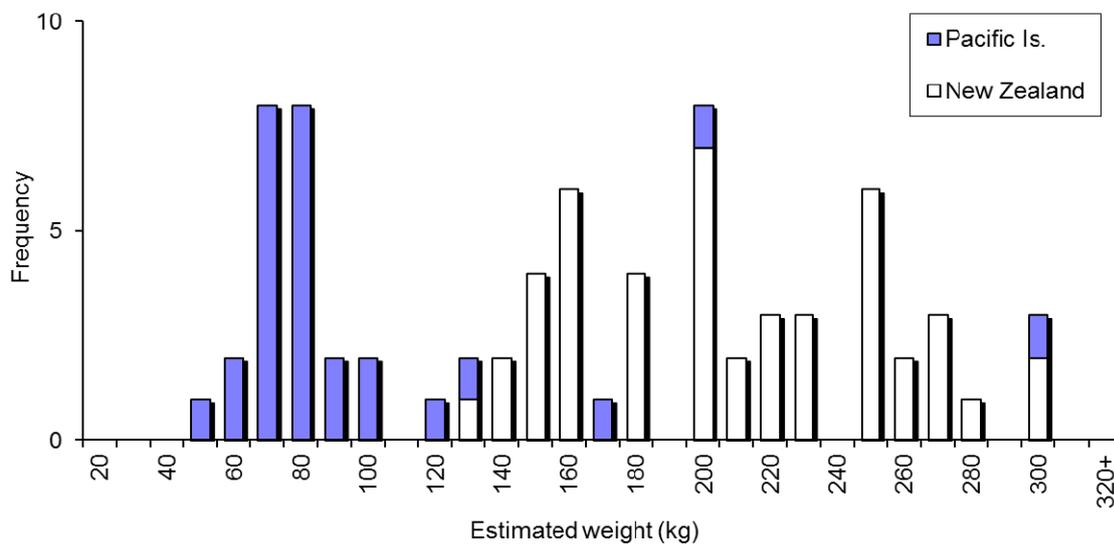
The major change in the number of striped marlin tagged by region in 2011–12 was that there were fewer striped marlin tagged in East Northland. The number tagged in the Three Kings area has been low for the

last two years (Figure 4). Most fish were tagged off East Northland (64% in 2010–11 and 43% in 2011–12).

Striped marlin estimated release weights for 2011–12 are plotted in Figure 5 and show a mode in the 80 to 90 kg size class. In 2011–12, 35% were estimated at less than 90 kg, and 42% estimated at over 100 kg.



**Figure 5: Weight frequency distribution of striped marlin from estimated weights on tag and release in the NZGTP 2011–12.**



**Figure 6: Weight frequency distribution of blue marlin from estimated weight on release in NZGTP 2011–12.**

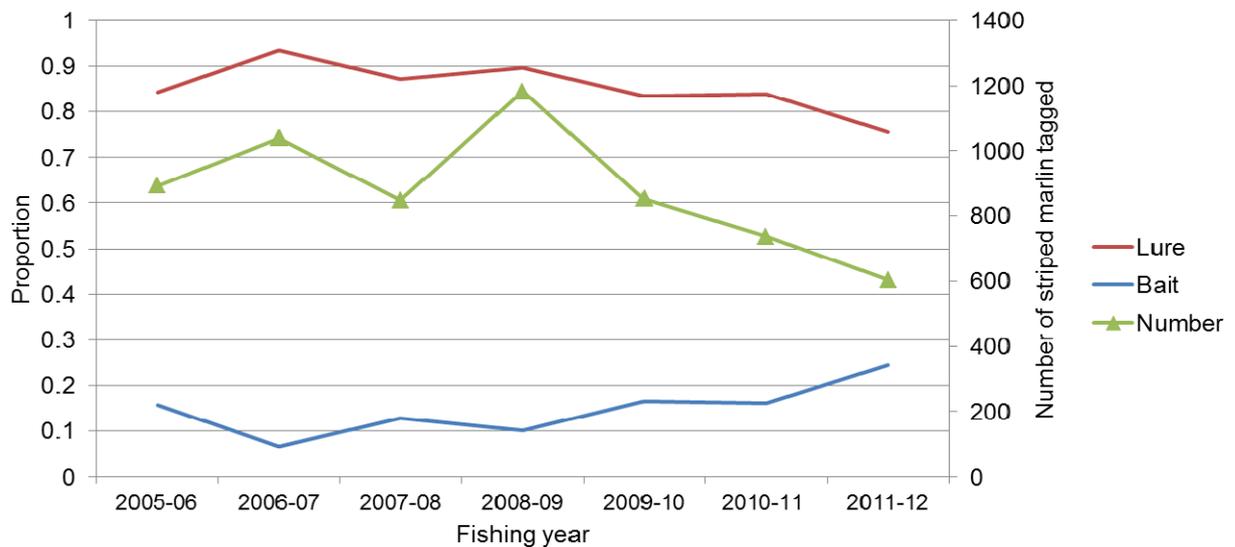
Estimated release weights for blue marlin are shown in Figure 6. Even in particularly warm years, it is rare for New Zealand anglers to catch blue marlin less than 100 kg in green weight. Blue marlin tagged in Pacific Island fisheries such as Tonga and Samoa are frequently less than 100 kg, and these represent the great majority of the small blue marlin reported in 2011–12.

Caution must be used in accepting angler estimated weights of marlin and other large fish. In 2010 two recaptured striped marlin that were weighed were about 15 kg under the estimated release weight.

Generally it is believed that fishers are quite good at estimating fish weights close to the 90 kg voluntary minimum size which applies to most fishing tournaments (John Chibnall, IGFA, pers.com.).

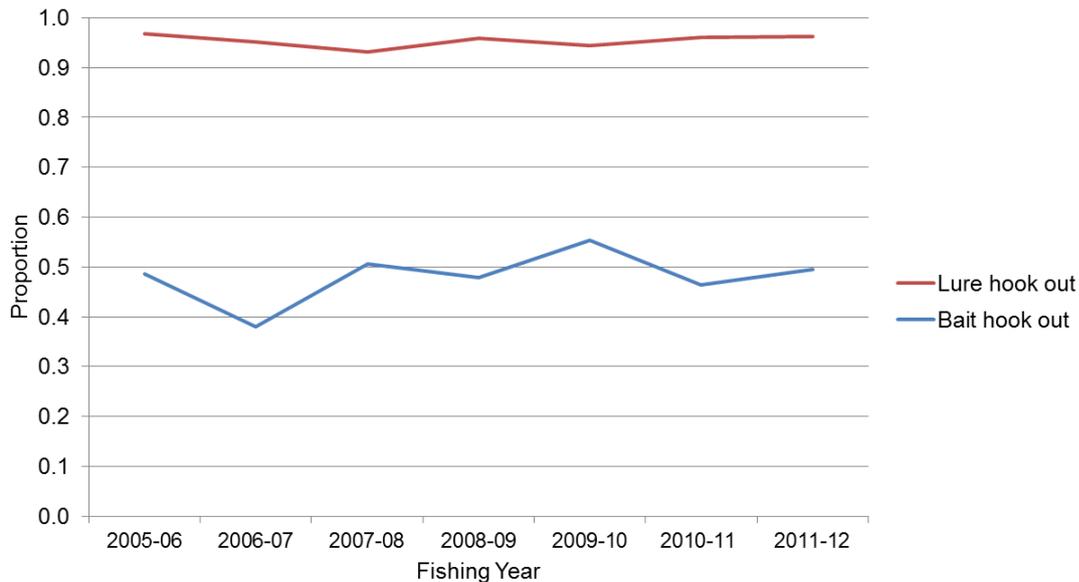
### Method and hook removal

Many fishers (69%) record where tagged striped marlin were hooked (in the mouth, deep hooked, or outside the mouth on the body) and whether the hooks were removed or left in the fish. There has been a gradual decline in the proportion of fish recorded as lure caught from around 90% in the mid-2000s to 76% in 2011–12 and a corresponding increase in the proportion of striped marlin caught on baits (Figure 7).



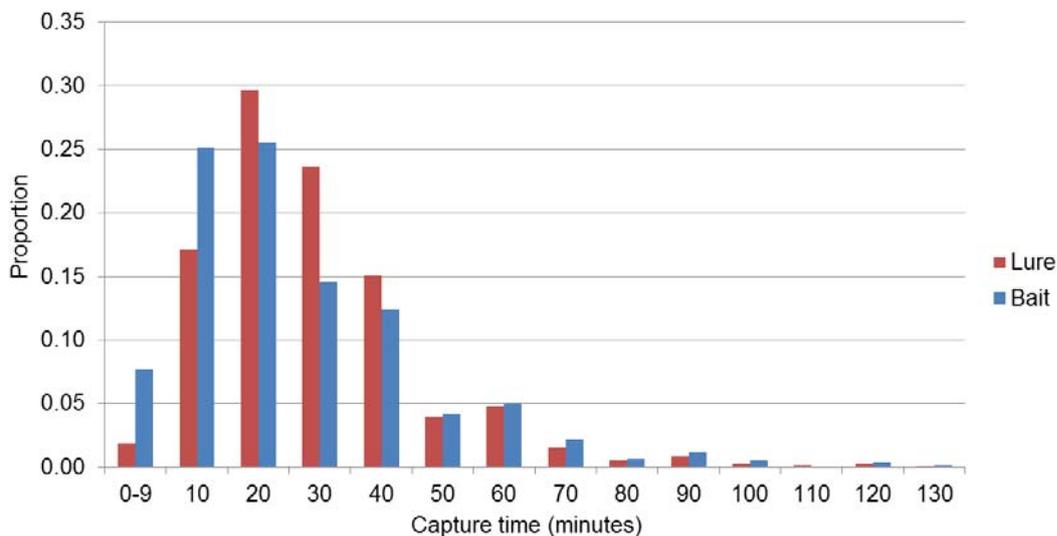
**Figure 7: Proportion of striped marlin recorded as caught on lure or bait by year and the total number tagged since 2005–06 (right hand axis).**

Lure caught fish are usually caught in the jaw or mouth, although some are foul hooked. Fish caught on baits can be deep hooked or caught by the jaw. Circle hooks are more likely to lodge in the corner of the jaw. Fishers generally indicate whether the hook is removed or left in, but not where it is located. Half the fish caught on baits have the hook removed prior to release (Figure 8). This indicates that the hook is in the jaw or other accessible location. Circle hooks can be difficult to remove from the corner of the mouth where they usually lodge, and some skippers prefer to cut the trace close to the hook rather than remove it. They believe it is better to release the fish without bringing it close to the boat, to avoid possible injury to the fish and crew. It is therefore probable that in many of the cases where the hook was not removed, the hook was still in the mouth area rather than swallowed. Hooks have been removed from 95% of lure caught fish over the last seven years.



**Figure 8: Proportion of striped marlin recorded as having the hook removed before release for fish caught on lure or bait by year since 2005–06.**

The distribution of capture times by bait type shows some consistent differences, with baits tending to have a higher proportion (33%) less than 20 minutes compared to fish caught on lures (19%) (Figure 9). Conversely a higher proportion of lure caught fish had capture times between 20 and 49 minutes (68%) than fish on baits (52%). This difference is not explained by larger fish being caught on lures. In fact a higher proportion of fish less than 100 kg and a lower proportion of fish 110 kg are taken on lures compared with baits.

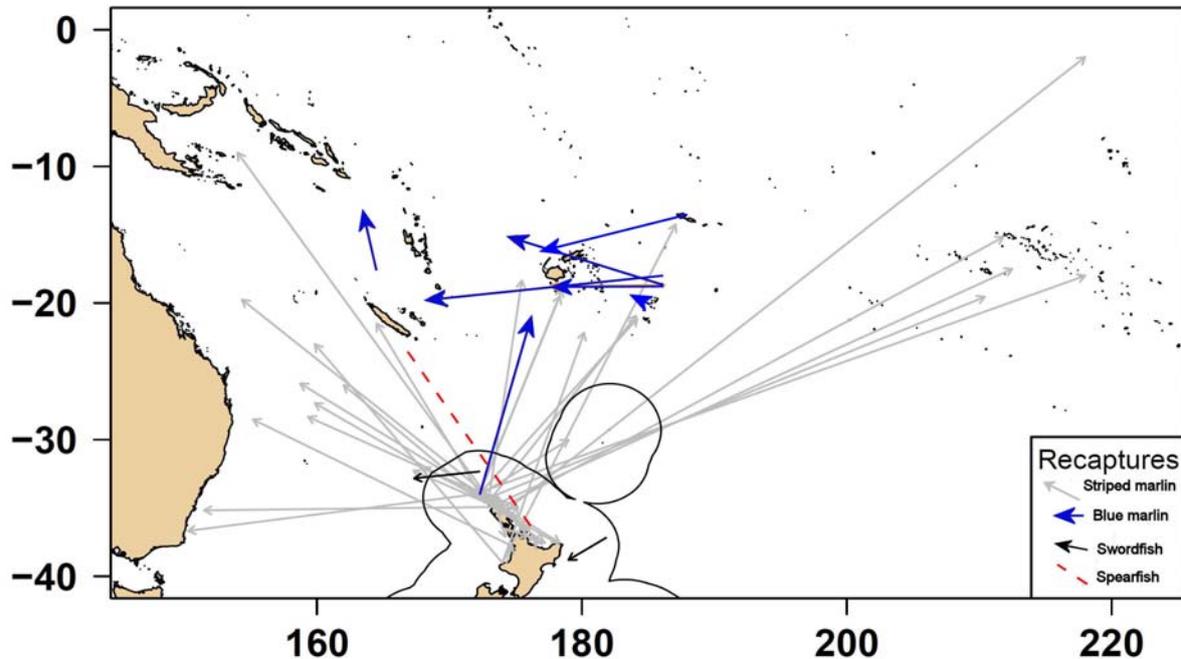


**Figure 9: Distribution of capture time for striped marlin caught on lures or bait, 2004–05 to 2011–12 combined.**

### Movement

Current thinking, based on tagging data, slight genetic differences, and spawning areas, is that southwest Pacific striped marlin constitutes a single stock. 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 10). 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 10: Long distance movements of billfish in the gamefish tagging programme, 1988–2012 (release and recapture location for the shortbill spearfish are approximate).**

Blue marlin in the NZGTP have mainly been recaptured at latitudes between 15° and 20° S with most recoveries coming from fish tagged in Pacific Island waters (Figure 10). Tag retention is better in blue marlin than striped marlin, with three of seven recaptures made after two years at liberty.

### Growth

The problems inherent in measuring the size of large active fish while they are still in the water mean that tag and recapture data for this species is of limited use for studies on striped marlin growth. Samples taken from fish weighed at New Zealand sport fishing clubs have contributed to a southwest Pacific study on age, growth, and reproduction of striped marlin. This study (Kopf et al. 2010) validated annual growth rings in the dorsal fin spines. Samples of small striped marlin were obtained from New Caledonia, Fiji, and Tahiti.

Small striped marlin grow incredibly fast. Kopf et al. (2010) estimated the age of the youngest fish, which weighed 4 kg and measured 1120 mm Lower Jaw–Fork Length (LJFL), to be just 130 days old. The oldest striped marlin sampled was a 168 kg fish from New Zealand (2871 mm LJFL) that was over 8 years old (Kopf and Davie 2009). Females grew to a larger maximum length, weight, and age compared to males, but there were no significant differences in growth curve parameters. Growth remained rapid during the first two years of life, during which time both sexes achieved 75–80% of maximum body length (Kopf et al. 2010). Male are mature at this size and age while most females are not (Kopf et al. 2012).

### 3.2 Yellowtail kingfish

#### Yellowtail kingfish highlights 2011–12

Six hundred yellowtail kingfish were tagged and released in New Zealand fisheries waters during 2011–12, 46% below the previous season (Table 2). The decline in numbers tagged is likely to be due to the completion of a targeted piece of work on kingfish. A kingfish monitoring project (MPI project KIN2009/01) undertaken from North Cape to Cape Runaway during 2010 resulted in high numbers of fish being tagged in the previous two seasons. Fishers were encouraged to measure kingfish prior to tag and rerelease or to measure fish and collect heads for otolith removal and ageing. In 2011–12, few fish were tagged in winter months and 42% were tagged in January and February (Figure 11).

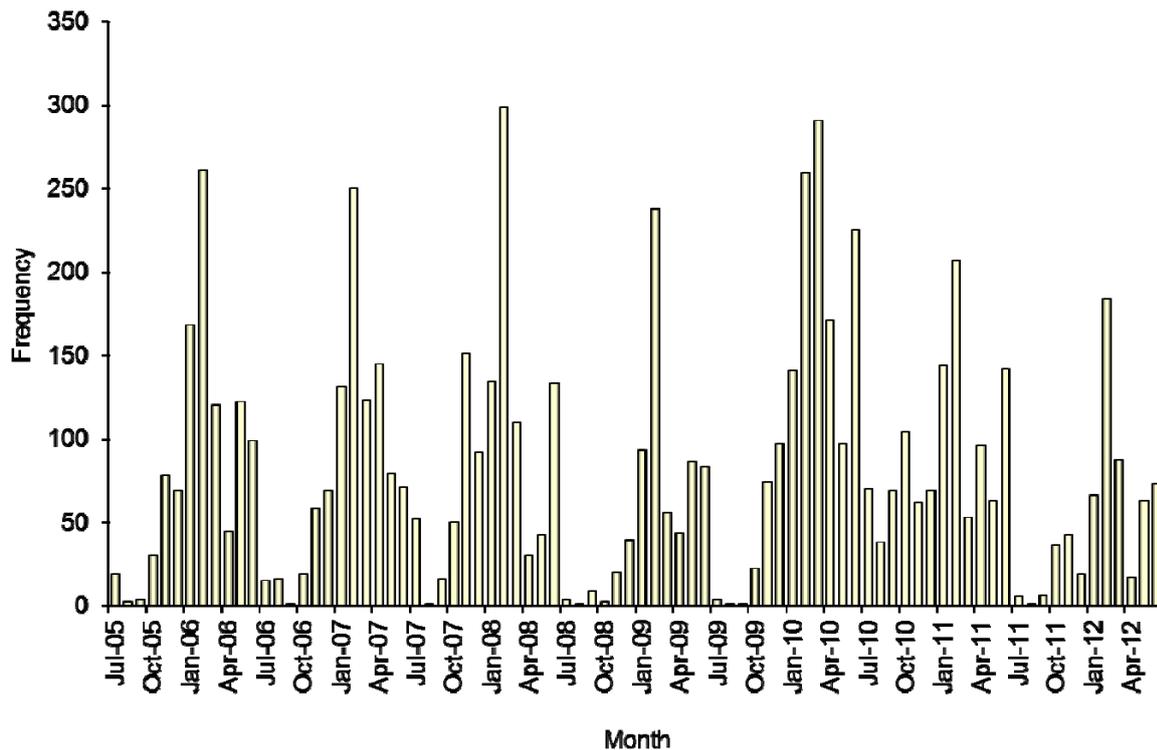


Figure 11: The number of kingfish tagged by month since the 2005–06 season.

There were 44 kingfish recaptures reported, one of which was free for over 12 years. Recaptures made by recreational fishers tend to be during the summer or autumn, when most recreational fishers are active, while recaptures made by commercial fishers are spread throughout the year.

A 35 kg kingfish tagged and released at Rangatira Knoll in February 2000 was recaptured at the same location after 12 years 2 ½ months (4450 days) at liberty. The fish was 126 cm when tagged by Richard Hart and was recaptured by Aaron Jones weighing 45 kg and measuring 141 cm (Figure 12). It had grown 15 cm and an estimated 10 kg. This is the longest time at liberty for a kingfish with a single tag and one of the heaviest recaptured kingfish on record. A fast growing kingfish could reach 126 cm at 11 or 12 years old so this fish is probably 23 years old or older. The oldest fish sampled in the kingfish monitoring project was 24 years old.

A kingfish tagged at the Three Kings Islands was recaptured after 7 ½ years at liberty by John Bare fishing from the rocks at Spirits Bay 38 n. miles away from the release point. It weighed 21 kg on release and was estimated to be 32 to 33 kg on recapture. The tag was removed and the fish released again.



**Figure 12: A 35 kg kingfish tagged and released by Richard Hart (left) was recaptured 12 years later by Aaron Jones at the same location (right).**

Data from this tagging programme shows that most kingfish tagged at offshore locations, like the Three Kings Islands or White Island; tend to get recaptured in the same area. In 2011–12 it was noticeable that kingfish tagged at the Alderman Pins were usually caught at the same pin or nearby. The Alderman Islands are 10 n. miles off the coast in the Bay of Plenty (Appendix B Figure 1). They rise out of 60 m of water. There are several Pins a few miles further out which rise from 120 m water depth. Of the seven fish recaptured in the area in 2011–12 four were tagged at the Pins and recaptured there. Time at liberty ranged from 690 to 1353 days with an average of just under 3 years (1076 days s.d. 284 days). One fish moved 12 n. miles west to Castle Island and two fish moved each way between the Alderman Islands and the Pins, about 6 n. miles.

The pattern of movements recorded by fish tagged in the more coastal areas of the Bay of Islands and Cavalli Islands in 2011–12 is quite different. Nine fish were at liberty for between 31 and 2164 days (average 584 days s.d. 735 days). Six fish moved between 15 and 160 n. miles (average of 63 n. miles s.d. 61 n. miles). These fish moved north and south, between the King Bank and Whangamata in the Bay of Plenty. One 6 kg fish was released at Nine Pin and recaptured in the same location after 6 years weighing 19 kg at the time of recapture. The other two kingfish had not moved far but had been at liberty for less than 50 days. The fish from the Bay of Islands recaptured at the Three Kings is the first record of a fish moving from the coast offshore to those islands. This fish was about 17 kg and was at liberty for 2 years and 4 months. It was re-released with the tag intact.

Fishers from Nelson and Marlborough have recently started targeting kingfish in the outer Marlborough Sounds and have returned 133 tag cards over the last two years. One of these kingfish was recaptured off Otago Heads in a commercial setnet in late January 2012. It was 107 cm long and had travelled 360 n. miles south in 242 days at liberty. This is the first recapture of a Marlborough Sounds kingfish in the tagging programme and the southernmost recapture of a tagged kingfish in New Zealand waters.

There was also a kingfish tagged at the Ranfurly Bank that was recaptured off Oamaru in the South Island travelling 560 n. miles south in 4 years at liberty. This fish was also caught in a setnet in January 2012. It measured 78 cm on release and 91 cm (10.6 kg) on recapture.

**Table 2: The number of yellowtail kingfish tagged and recaptured by season since 2002–03.**

	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	Average 2003 to 2012
NZ EEZ	646	771	806	1 016	977	1 120	661	1 381	1 123	600	798
Recaptures	27	32	38	53	38	55	43	46	54	44	43

Trends in the proportion of annual kingfish releases by region are shown in Figure 13. The number tagged in the Bay of Plenty and East Northland is significantly lower in 2011–12.

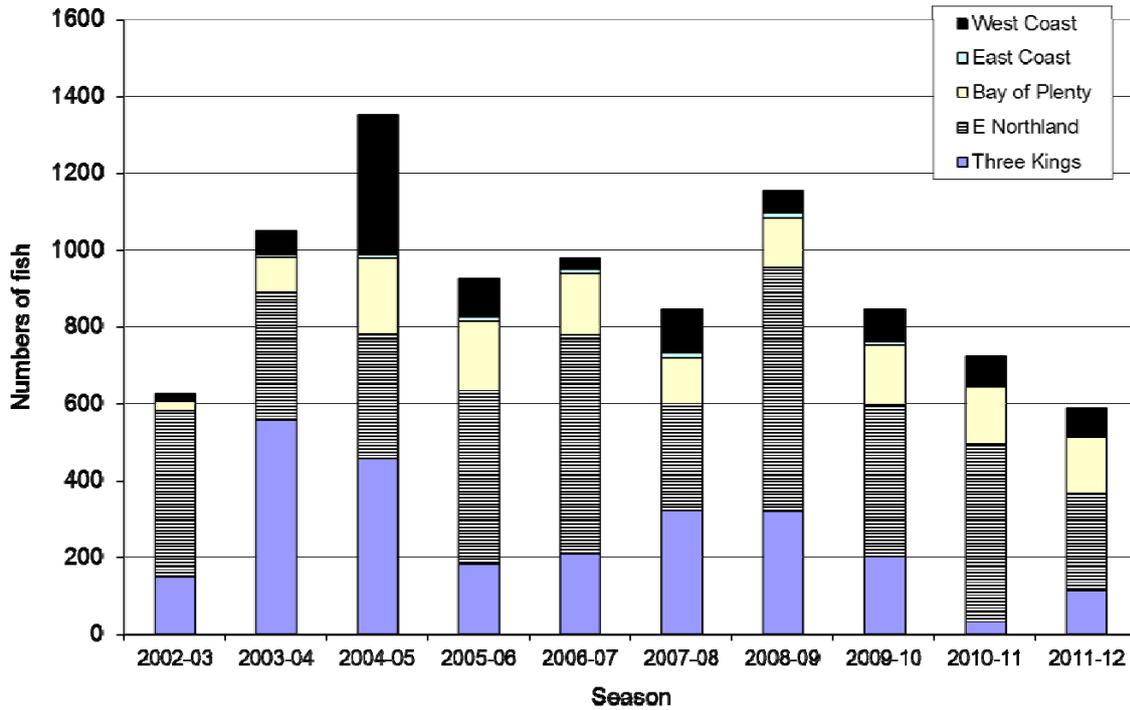


Figure 13: The proportion of yellowtail kingfish tagged and released by region and season since 2001–02.

The great majority of tagged kingfish in 2011–12 were measured (fork length), before release (Figure 14). The length of kingfish tagged in 2011–12 ranged from 60 to 140 cm.

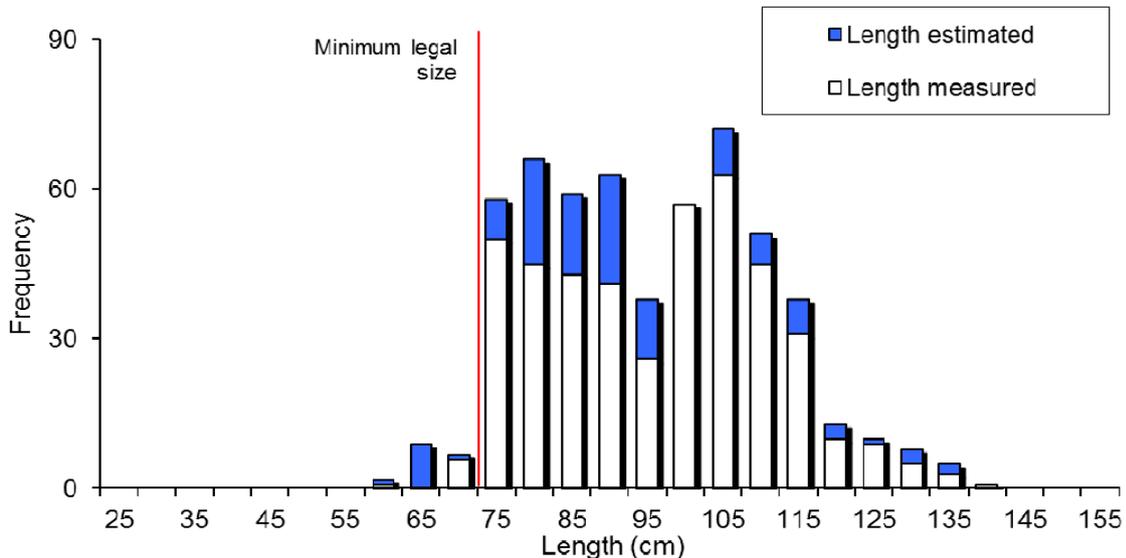


Figure 14: Yellowtail kingfish length frequency for released fish, fish measured (white bars) and those with estimated lengths (blue bars) in 2011–12.

## Movement

Kingfish release and recapture locations have been plotted by the quarter of the year in which they were released. More fish are tagged in the first quarter (January to March) when recreational fishing activity is high (Figure 15). Some kingfish have moved considerable distances including three that have crossed the Tasman Sea from New Zealand. Recaptures have also been reported from Lord Howe Island and Wanganella Banks. Movement in the second and fourth quarter appear similar. There is less movement for fish released in the third quarter but much of this may be due to lower fishing effort and fewer fish tagged. Many of the fish recaptured in the lower North Island and South Island were in the first quarter (black dots, Figure 15), suggesting that these fish may penetrate further south in summer than winter.

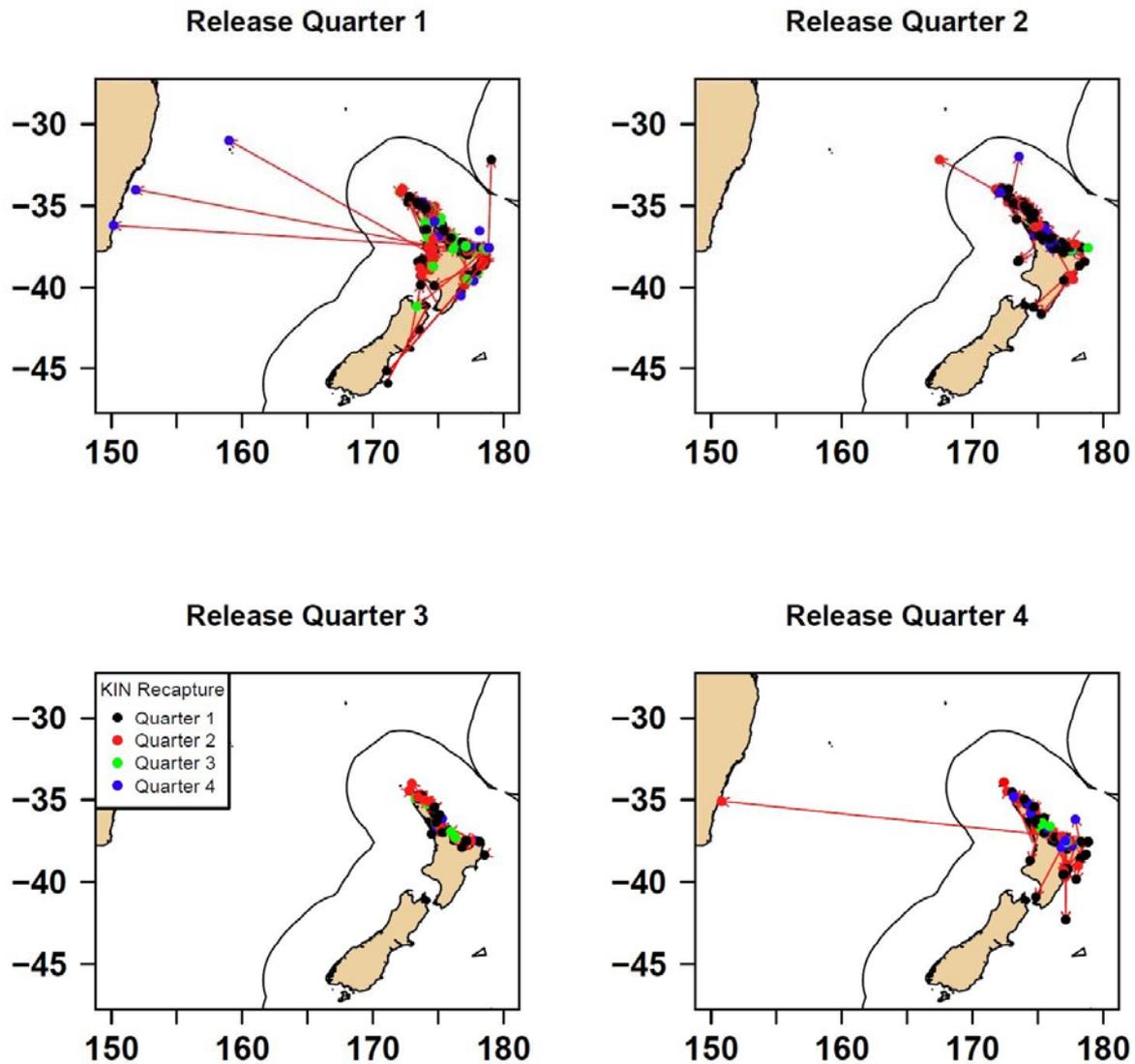


Figure 15: All kingfish movements recorded in the gamefish tagging programme by release quarter (frames) and recapture quarter (colour at recapture location).

### 3.3 Mako and blue shark

There were 395 mako sharks reported as tagged and released inside New Zealand fisheries waters in the 2011–12 season. Although well down on the previous year (609), the total was still well above the ten year mean of 289. There has also been a rise in the number of blue sharks tagged and released over recent seasons, with the total of 129 tagged in 2011–12 similar to the previous year and slightly better than the average of the last ten seasons (Table 3).



There were few mako and 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 over 92% of mako and 90% 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 2011–12. The overall recapture rate is 2.5 % for mako sharks and 1.8% for blue sharks.

#### **Mako and blue shark highlights, 2011–12**

There were eight mako shark recaptures reported in 2011–12 (Table 3). Four were caught by commercial tuna longline vessels and four by recreational fishers. There was no release card information for one of the commercial recaptures made off Napier in June, 2012, and also none for a recreational recapture, made off east Northland in March 2012.

Three makos were recaptured outside of the EEZ. Two were caught off Fiji by commercial fishers. One had travelled 950 n. miles north in 544 days, while the second one was recaptured after 1550 days, 1045 n. miles from its release location. A mako shark tagged off New Plymouth was recaptured by a recreational fisher off Portland, Victoria Australia after 399 days at liberty. This was the westernmost recapture of a mako shark from this tagging programme, with the recapture being 1520 n. miles west of the tagging location. The shark had apparently passed through Bass Strait and was caught just short of the border between Victoria and South Australia.

The mako shark recaptures in New Zealand waters were at liberty between 7 and 399 days and had recorded movements between 5 and 220 n. miles. The makos recaptured outside of New Zealand waters were at liberty for between 399 and 1550 days, and had recorded movement of between 950 and 1520 n. miles.

There were four blue shark recaptures in 2011–12. All were reported by commercial tuna longline fishers. Only one of these was outside the EEZ; a shark tagged off Kawhia and recaptured 1250 nautical miles away near Vanuatu after 399 days. There was no report card for one of the New Zealand recaptures, which was made off Napier in June, 2012. The other two recaptures were both relatively short-term. One was tagged off Whangamata and recaptured off Cape Brett (138 n. miles in 132 days) while the other was tagged off eastern Northland and recaptured 60 n. miles north after 68 days.

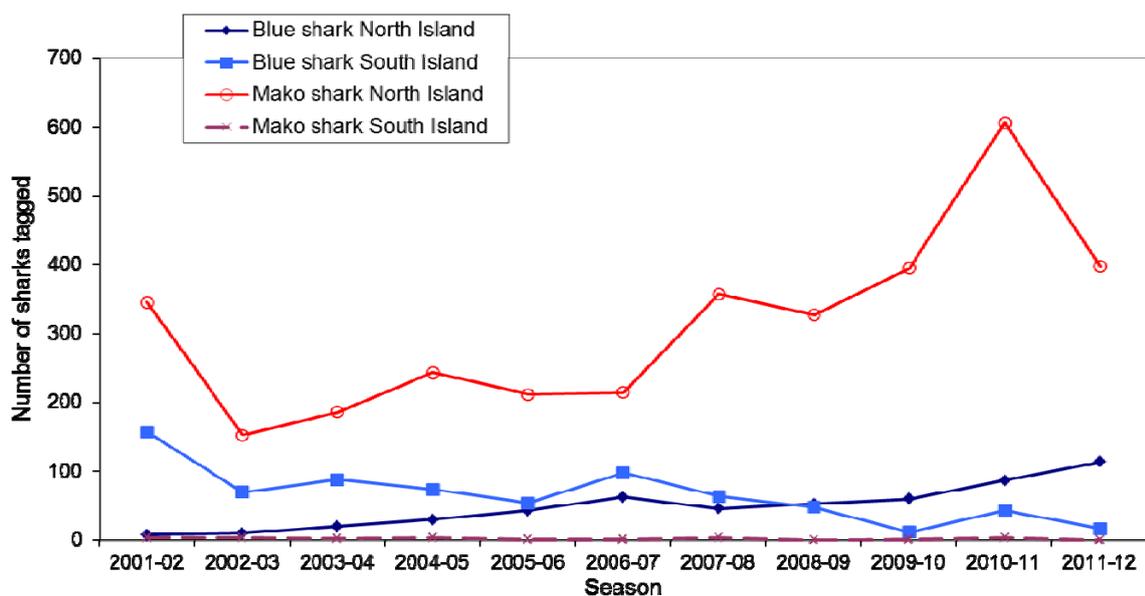
## Trends

The number of mako sharks tagged has shown an increasing trend since 2002–03 (Figure 16). Generally mako sharks are caught as a bycatch of other sport fisheries, particularly off the North Island. The decline in 2011–12 may well indicate reduced gamefishing effort this 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 tagging off the North Island (Figure 16). 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 New Zealand Sport Fishing Council Records, and the number recaptured by season.**

	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	Average 2003 to 2012
Mako											
NZ EEZ	155	188	241	193	150	297	285	494	609	395	301
% tagged	59	70	80	81	82	87	87	90	92	92	82
Recaptures	9	9	6	3		2	5	7	7	8	6
Blue shark											
NZ EEZ	78	106	102	95	157	108	101	73	127	129	108
% tagged	72	85	80	76	91	90	89	92	91	90	86
Recaptures		2	2	1	2	3	4	3	3	4	3



**Figure 16: The number of mako and blue sharks tagged by region for the last 11 seasons.**

Most mako sharks were tagged between January and April 2012 with a very strong mode in February, when 60% of the annual tally was recorded (Figure 17). This peak is associated with the New Zealand Sport Fishing Council National Contest which encourages the tag and release of various species.

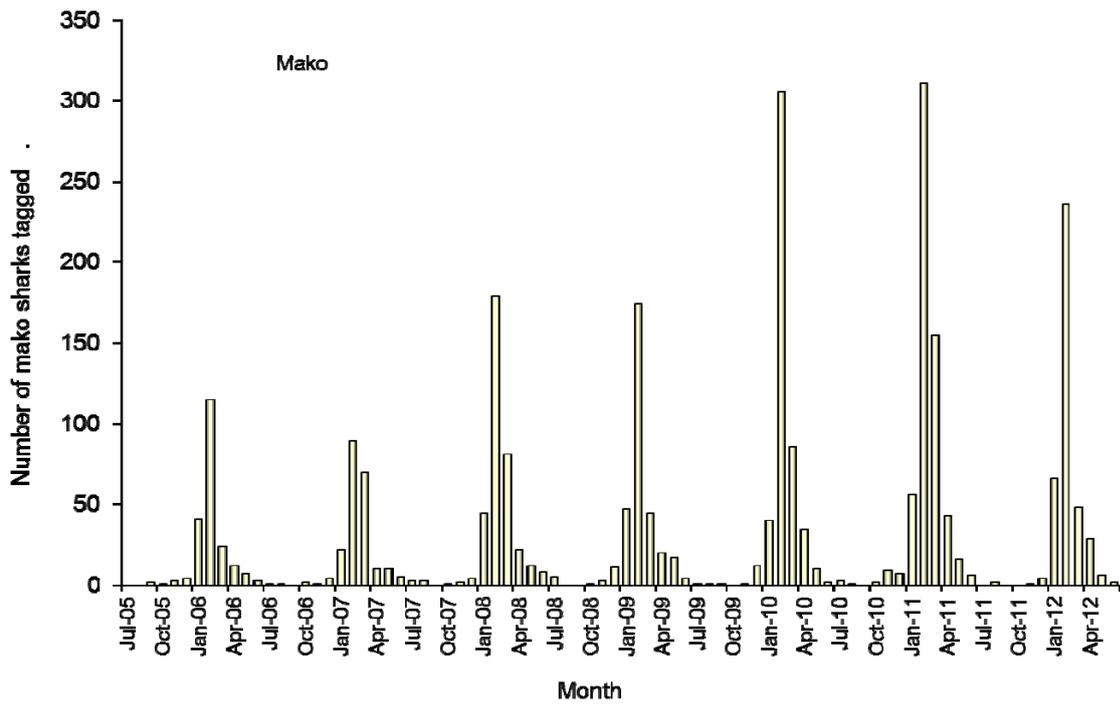


Figure 17: Number of mako sharks tagged by month since 2005–06.

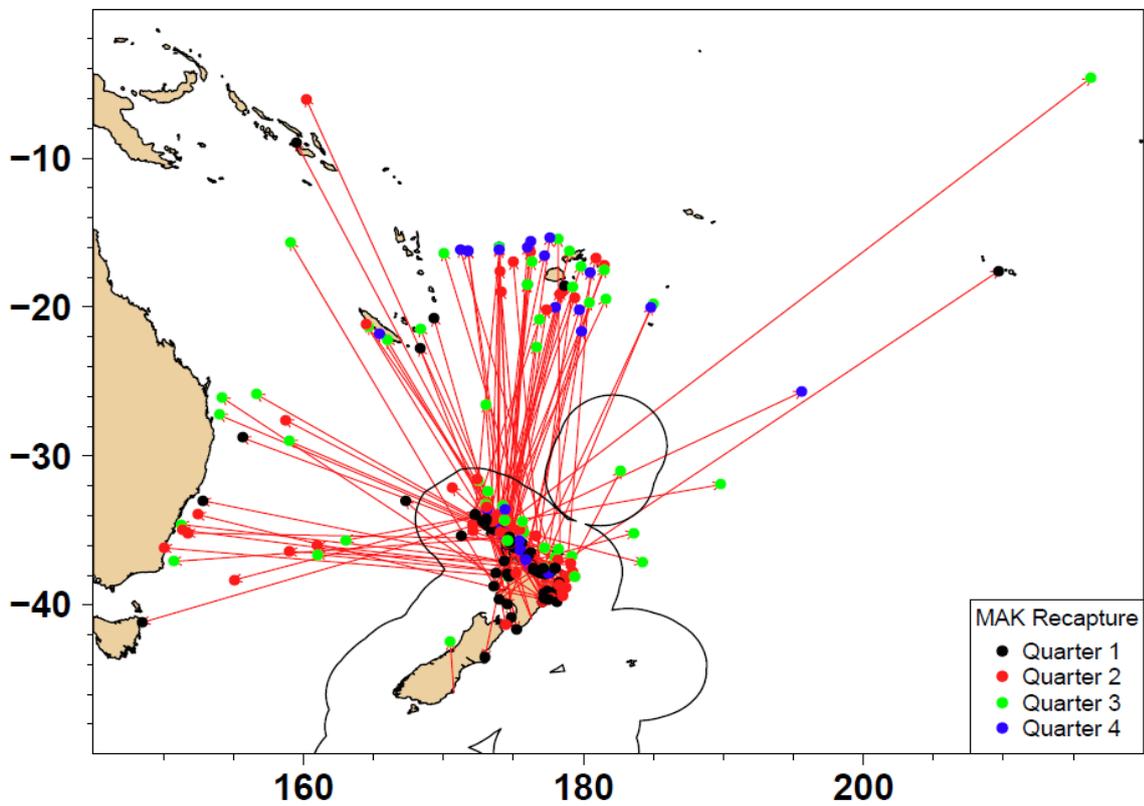


Figure 18: All release and recapture locations of mako sharks in the gamefish tagging programme, 1982–2012.

## Growth

There have been a number of long-term recaptures of mako sharks in the gamefish tagging programme. Five were at liberty for five years or more. They were between 80 and 140 cm (7 to 30 kg) when tagged and released and between 177 and 297 cm on recapture. Some lengths had to be calculated from estimated weight. On average these fish grew 13.8 cm per year over 6.9 years.

Blue sharks tend to grow faster than mako sharks. There have been fewer tagged and released and consequently fewer recaptures than for mako sharks. There have been five blue shark recaptures between 2 and 3.3 years at liberty. These fish were all less than 45 kg on release and grew on average 16.4 cm per year. Care is needed when calculating shark growth rates as it is not possible to measure fish on release and sometimes only estimates are also supplied on recapture.

## 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 18).

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. 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 (Figure 19).

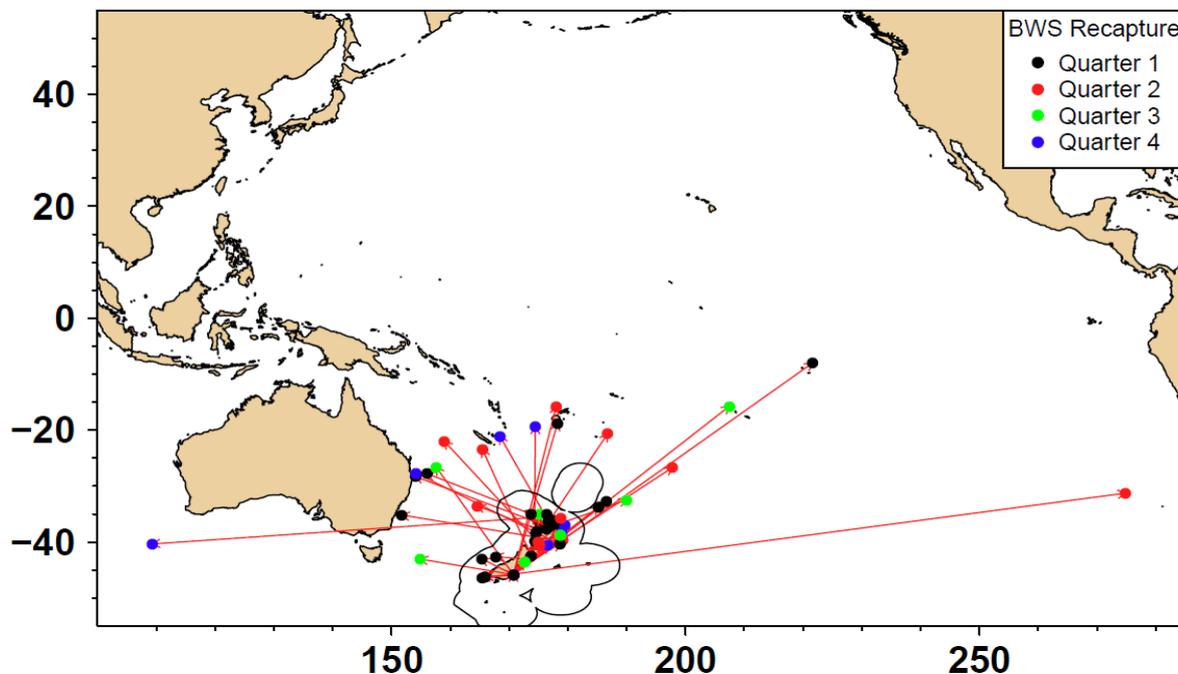


Figure 19: All release and recapture locations of blue sharks in the gamefish tagging programme, 1982–2012.

### 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 2011–12 was 97, the highest total to date (see Appendix A).

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

A Pacific bluefin tuna was recaptured after 4 years at liberty 60 n. miles south from where it was tagged off West Coast, South Island. This fish carried a satellite tag for 57 days before it prematurely released leaving a coded tether in the fish. This was one of 7 Pacific bluefin tagged on 18 August 2007 from the charter boat *Cerveza 2*. It was estimated to be 260 kg on release and was recaptured on 26 August 2011 by the crew on *Cova Rose* and weighed 303 kg. This follows another satellite tagged fish recaptured on 19 August 2010 exactly two years after being tagged 22 n. miles to the northwest, also off Westport.

## 4. DISCUSSION

The gamefish tagging programme has been an integral part of the New Zealand marine sports fishery since the mid 1970s. Worldwide there has been a growing trend toward the capture and release of large pelagic species targeted by recreational fishers. Cooperative tagging programmes are a cost-effective way of collecting information on large pelagic species that are difficult to study by other means.

The 2011–12 year was a relatively poor fishing season, with consistent strong south-east (onshore) winds disrupting much of the fishing season on the important east coast fishing grounds. The numbers of striped marlin tagged and released fell compared to the previous season, 33% below the ten year mean. Fewer kingfish were also tagged when compared to the previous year with 600 tagged, representing a drop of 25% on the ten year mean. Although the number of mako sharks tagged was down on the 2010–11 year, it remained well above the ten year mean. The number of blue sharks, other sharks and Pacific bluefin tuna tagged and released were about the same as the previous year. Forty nine swordfish were tagged, the best total for any year to date. For the second year running no yellowfin tuna were tagged. Overall 1945 fish were reported tagged and released and 58 fish were recaptured. Although the fishing year finishes on 30 June some individuals and clubs do not hand all their tag cards in until the following season. This means that totals reported here for the 2011–12 season may increase in next year’s report.

The Scientific Committee of the Western and Central Pacific Fisheries Commission recommended in August 2012 that tagging mortality be estimated for striped marlin (WCPFC 2012). There is information in the tagging database on method of capture and hook removal rates that may assist in estimating release mortality.

There is also information recorded from marlin tagged with electronic tags which shows that fish that are deep hooked are less likely to survive capture and release (Domeier et al. 2003). In a New Zealand study, 26 lure caught fish taken on 37 kg line within 40 minutes of hook up were tracked with electronic tags. Two of these fish (8%) died within 24 hours of release, with one being eaten, tag and all, by a shark 14 hours after release (Holdsworth et al. 2009). All these fish had additional handling and burden from the attachment of a small electronic SPOT tag to their tail.

Over the last seven years 66% of striped marlin were caught on lures with a fight time of 40 minutes or less and had the hook removed. Applying the mortality rate from the New Zealand satellite tagging (Holdsworth et al. 2009) the release mortality for these fish would be 8%. This is relatively low but

plausible as there is a culture in this fishery to land fish that are damaged, tail wrapped or unlikely to survive to avoid wasting the fish. This includes fish under the 90 kg voluntary size limit which may not count under club or contest rules.

A further 26% of the striped marlin tagged and released in New Zealand were caught on a lure with a fight time in excess of 40 minutes or without the hook being removed. For the purpose of this estimate we assume release mortality of 16%, double that above.

Furthermore, as a conservative assumption, we could assume that all fish caught on baits with the hook left in were “deep hooked” and apply the release mortality rate of 63% reported for these fish by Domeier et al. (2003). Over the last seven years 8 % of fish in the New Zealand sport fishery would fall into this category.

Using the proportions above we estimate a weighted overall release mortality rate of 14.5%. Applying this to the mean number of striped marlin tagged in New Zealand over the last seven years (880 per year) we estimate an annual release mortality of 127 fish or about 12.5 tonnes for the New Zealand recreational fishery. The mortality rate estimated for the New Zealand fishery may be lower than in countries where almost all striped marlin are tagged, because damaged fish are landed to avoid waste.

Information on where and how fish are caught and released can be a useful component of tagging programme data. 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. 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, more information sharing across programmes will be encouraged.

Your feedback on the GFTP and this report is encouraged. The programme will need to change to provide good value for all those involved: fishers, NZ Sport Fishing Council, scientists and government. You can email or post to [John@bluewatermarine.co.nz](mailto:John@bluewatermarine.co.nz) or [info@fish.govt.nz](mailto:info@fish.govt.nz)

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## Appendix A: 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 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	157	977	150	61	14	965	16	14	8	6	2 396
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	127	1 123	609	98	21	725	37	15		14	2 848
2011–12	48	3	129	600	395	97	5	603	49	16			1 945
Total	479	38	4 394	19 794	13 551	1 346	213	20 149	293	133	1 244	727	62 361
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						10		1				19
2011–12	28						2	2					32
Total	636	47		3	5		149	23	505	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 and overall recapture rate by species.**

Season	BEM	BKM	BWS	KIN	MAK	SHA	SSF	STM	SWO	TOR	YFN	OSP	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	2	2	1	3			1		67
2008-09			4	43	5	2		3		2		2	61
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
Total	8	1	81	1 390	345	58	1	83	3	4	15	24	2 013
Releases A	1 110	85	4 394	19 798	13 556	1 346	316	20 654	296	133	1 297	918	63 903
Recapture rate (%)	0.7	1.2	1.8	7.0	2.5	4.3	0.3	0.4	1.0	3.0	1.2	2.6	

**Table A4: Reported recaptures by fishing nation for highly migratory species by season (commercial methods only).**

Season	Main species BWS, MAK, STM											Other BEM, STN, SWO, THR, YFN					Total		
	Aus	China	Fiji	Japan	New Cal	NZ	Vanuatu	Spain	Tahiti	Taiwan	Tonga	Unknown	Aus	Fiji	Japan	NZ		Tonga	Unknown
1999–00	5	1	1	2		6						11						1	27
2000–01	1		1			8				1		2		1	1	1			16
2001–02	1		1	2		5			1			1	1						13
2002–03	1	2	1		1	2					1			1				1	10
2003–04	1	1	1	1	1	5			1						1	2			14
2004–05						2					1			1	1				5
2005–06			1					1					1	1		1			5
2006–07													1			1	1		3
2007–08	1			1				2				2				1		1	8
2008–09	1	1			2	1		5				1			1				10
2009–10			2	1	1	2		2					3						9
2010–11			3											1					4
2011–12			2			5	1												
Total	11	5	13	7	5	36	1	10	2	1	2	17	6	5	3	7	1	3	128

## Appendix B: Map of tagging locations

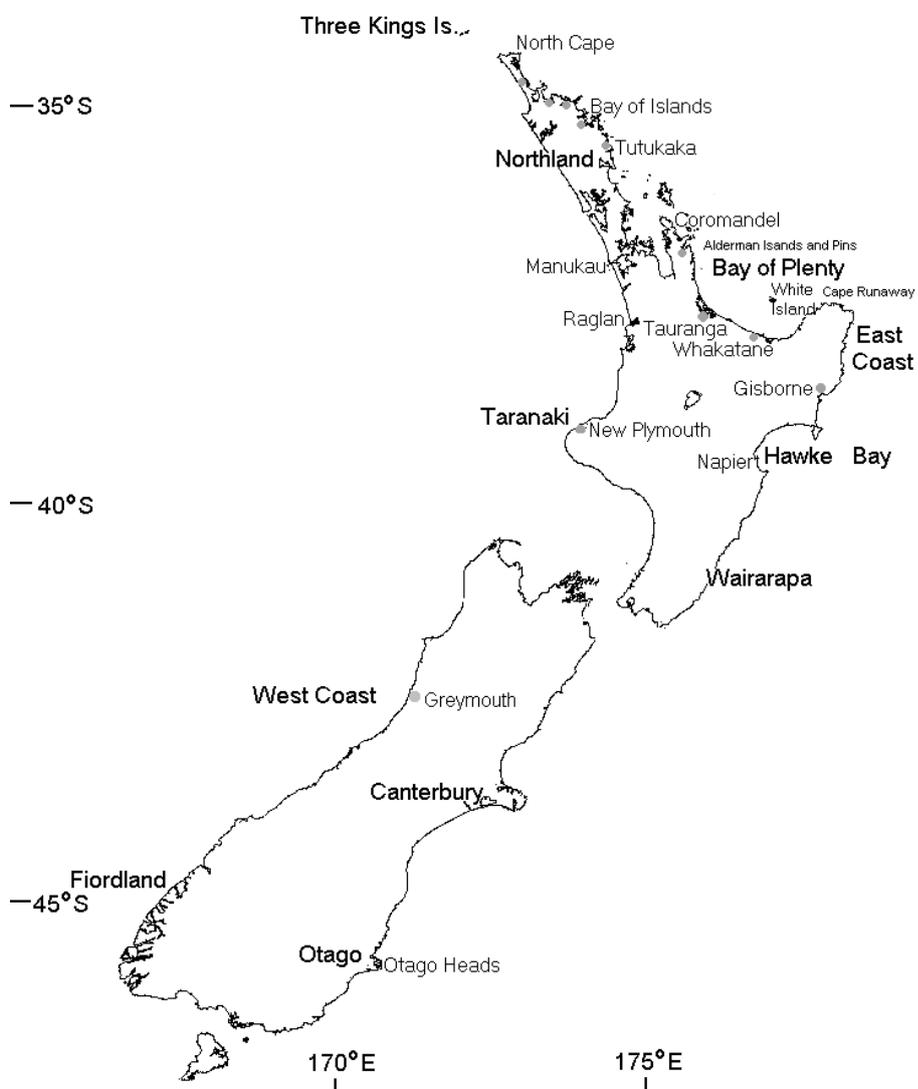


Figure B1: Location of the main areas of gamefish tagging in New Zealand.