



**Fisheries New Zealand**

Tini a Tangaroa

# New Zealand billfish and gamefish tagging, up to 2019–20

New Zealand Fisheries Assessment Report 2021/19

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## EXECUTIVE SUMMARY

**Holdsworth, J.C. (2021). New Zealand billfish and gamefish tagging, up to 2019–20.**

***New Zealand Fisheries Assessment Report 2021/19. 26 p.***

Release and recapture data for the 2019–20 sport fishing year (July to June) are summarised in this report and compared with those from previous seasons. Recaptures that provide growth or movement information of significance or interest are described.

There were 822 fish tagged and released in the New Zealand Gamefish Tagging Programme (NZGTP) in 2019–20. A further 23 billfish were tagged with NZGTP tags outside New Zealand fisheries waters. The number of gamefish landed or tagged and released in 2019–20 is lower than previous years due New Zealand Government Covid-19 restrictions from 23 March 2020 to 12 May 2020 which prohibited recreational fishing from boats, under Covid-19 Alert Levels 3 and 4.

The seasonality and regional distribution of fish tagged is summarised for the main species from the tagging database and the number of gamefish landed by recreational fishers is updated from New Zealand Sport Fishing Council (NZSFC) records. The combination of data from these sources provides a reasonably complete record of annual recreational catch of billfish, southern bluefin tuna, and mako and blue sharks. It is indicative of recreational catch, but less complete, for albacore and yellowfin tuna and other large shark species.

Over all years, yellowtail kingfish make up 70% of all recaptures, mostly from New Zealand waters. Marlin, tuna, and sharks have been recaptured in New Zealand and around the Southwest Pacific Ocean by various fleets, mainly surface longliners. A record time at liberty was established with a kingfish caught near Mayor Island on 29 November 2019. It had been tagged and released 19 years and 10 months (7247 days) prior at Rangatira Reef also in the Bay of Plenty. When initially tagged and released, the fish measured 98 cm fork length and weighed 16 kg; on recapture, the fish measured 148 cm fork length and was sling weighed on board at 41 kg before being released in good condition with the tag intact.

# 1. INTRODUCTION

## 1.1 Overview

This gamefish tagging programme is a cooperative project between Fisheries New Zealand (previously the Ministry for Primary Industries), 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 long-distance 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. This report is an annual update for Fisheries New Zealand project TAG2019/01, which had the following objectives:

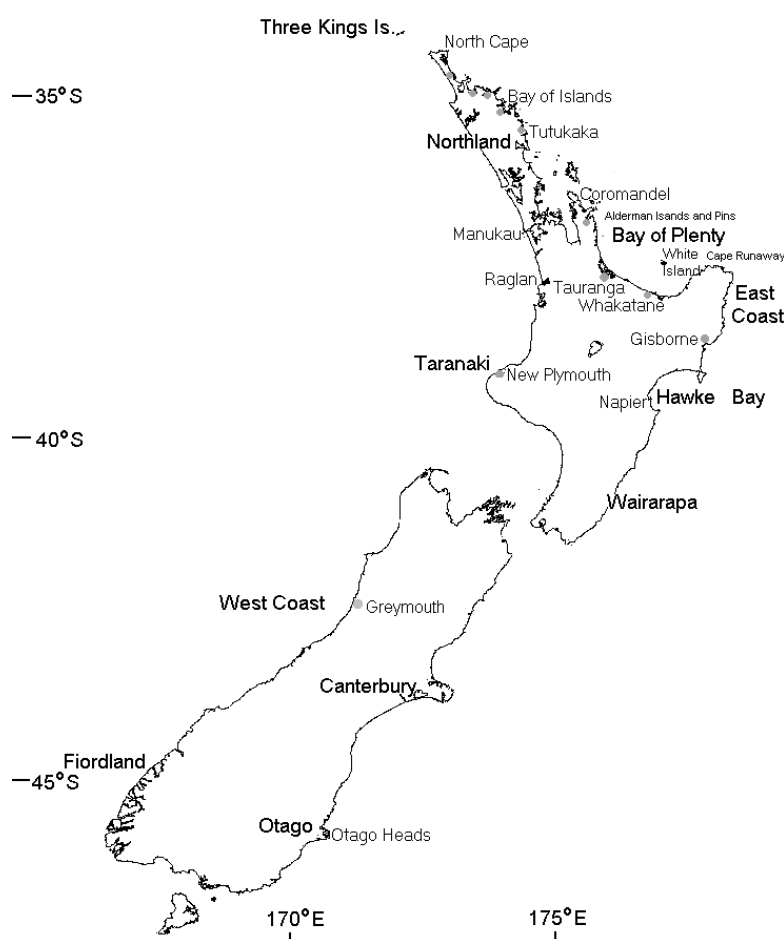
1. To characterise the New Zealand recreational gamefish fishery.
2. To collect and key punch tagging and recapture data for gamefish species in the 2019–20, 2020–21 and 2021–22 fishing years.
3. To compile annual summaries of the results of the tag recapture programme for 2019–20, 2020–21 and 2021–22 fishing years.
4. To develop graphical descriptions of linear displacements for each species tagged, released and recaptured by the programme; review displacements in terms of time-at-liberty, fish size, season and area.

## 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 game fishery off the Northland east coast, with blue marlin (*Makaira nigricans*), small numbers of black marlin (*Makaira indica*), shortbill spearfish (*Tetrapturus angustirostris*), and increasing numbers of broadbill 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, blue marlin, and more recently southern bluefin tuna (*Thunnus maccoyii*).

Game fishing has developed off the west coast of the North Island over the last 25 years with, at times, a very productive marlin and tuna fishery accessed from the west coast harbours and beaches as far south as Taranaki (Figure 1). 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. 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*), broadbill 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 (Holdsworth & Saul 2017).



**Figure 1:** Location of the main areas of gamefish tagging in New Zealand.

## 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, 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 was 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 (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 Fisheries New Zealand and the words “Please measure – Reward”. 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 (Holdsworth & Saul 2017).

The New Zealand Sport Fishing Council compiles annual sport fish tallies for the main species from 54 game fishing clubs around New Zealand. These records are used to provide an estimate of the national landed recreational catch of billfish, tuna, and shark species in New Zealand waters.

Catch records for individual fish including fish weight, vessel, and capture date will be sourced from six long established gamefish clubs. These are Bay of Islands Swordfish Club, Whangaroa Sport Fishing Club, Whangarei Deep Sea Anglers Club, Tauranga Game Fishing Club, Mercury Bay Ocean Sports Club, and Whakatane Sportfishing Club. These records include tagged fish for club members and captures from non-members who choose to get their fish weighed. New Zealand sport fishing clubs have used the July to June austral fishing year since the 1920s.

### 3. RESULTS

#### 3.1 Billfish

Striped marlin are the main billfish species caught and tagged in this fishery. The number tagged peaked at 1658 in 2015–16 and has been below the ten year average for the last four years (Table 1, Appendix A, Table A1). Recreational fishing from boats was prohibited for much of March and April 2020 which reduced catch and number of gamefish tagged. The number of blue marlin tagged is variable, with an average of 42 per year. Swordfish numbers were lower in 2018–19 and 2019–20. The number of shortbill spearfish tagged is variable over the last 10 years with a high of 32 in 2018–19 (Table 1). Striped marlin recaptures are often made within the first year after release, and were highest in number (7) in 2015–16. Over the last ten years there have been 24 striped marlin, five swordfish, and one blue marlin recaptures reported (Appendix A, Table A3).

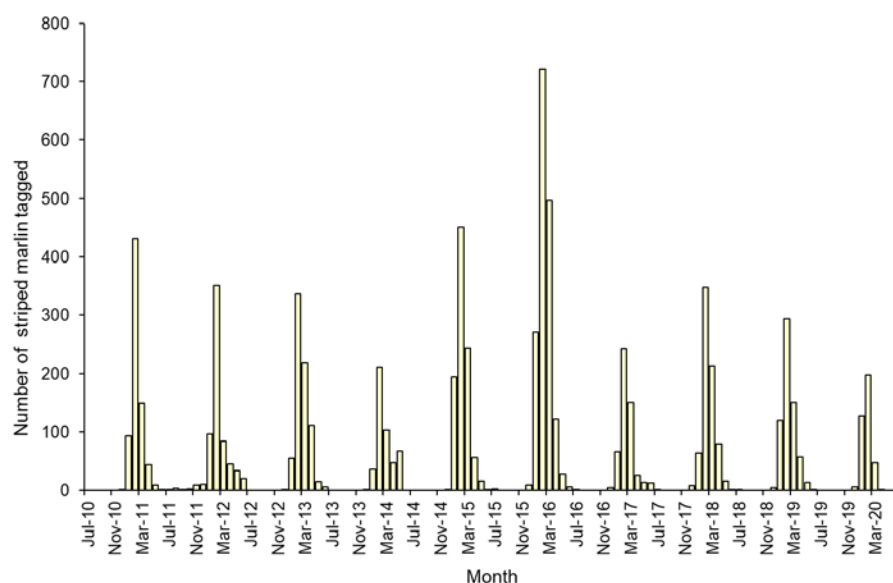
**Table 1: The number of billfish tagged in New Zealand waters in the last ten fishing years (July to June) and combined billfish recaptures in the NZGTP database.**

| Species             | Year    |         |         |         |         |         |         |         |         |         | Average            |
|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------------|
|                     | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 | 2019–20 | 2010–11 to 2019–20 |
| Striped marlin      | 733     | 663     | 858     | 520     | 1 088   | 1658    | 517     | 742     | 649     | 437     | 753                |
| Blue marlin         | 78      | 50      | 18      | 9       | 37      | 35      | 35      | 74      | 60      | 34      | 43                 |
| Shortbill spearfish | 21      | 5       | 0       | 6       | 12      | 26      | 12      | 24      | 35      | 12      | 15                 |
| Swordfish           | 37      | 51      | 47      | 38      | 34      | 29      | 31      | 51      | 20      | 14      | 35                 |
| Black marlin        | 1       | 3       | 3       | 4       | 7       | 5       | 4       | 7       | 3       | 0       | 4                  |
| Billfish recaptures | 1       | 1       | 4       | 4       | 2       | 7       | 3       | 4       | 3       | 0       | 3                  |

Some billfish were also tagged outside the New Zealand EEZ by NZGTP participants. In 2019–20, there were 7 blue marlin, 9 sailfish (*Istiophorus platypterus*), and 7 striped marlin tagged with New Zealand tags outside the EEZ (Appendix A, Table A2).

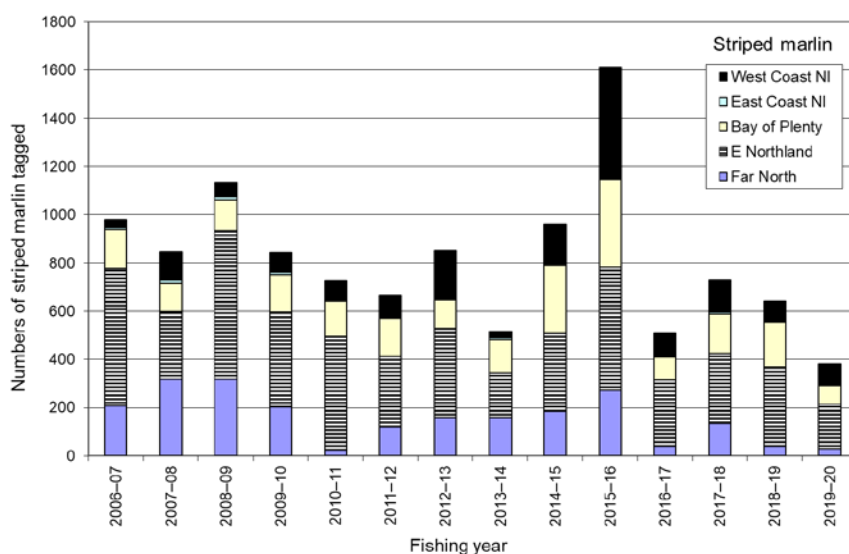
The New Zealand striped marlin season usually extends from January to May. Occasionally striped marlin are caught in early December but fishing effort is low until January. February is consistently the peak month

for striped marlin caught and tagged (Figure 2). There were 130 striped marlin tagged in January 2020, the third highest number in the last 16 years. The number tagged in February 2020 was below average and the fishing season was cut short by government Covid-19 restrictions from 23 March to 12 May 2020.



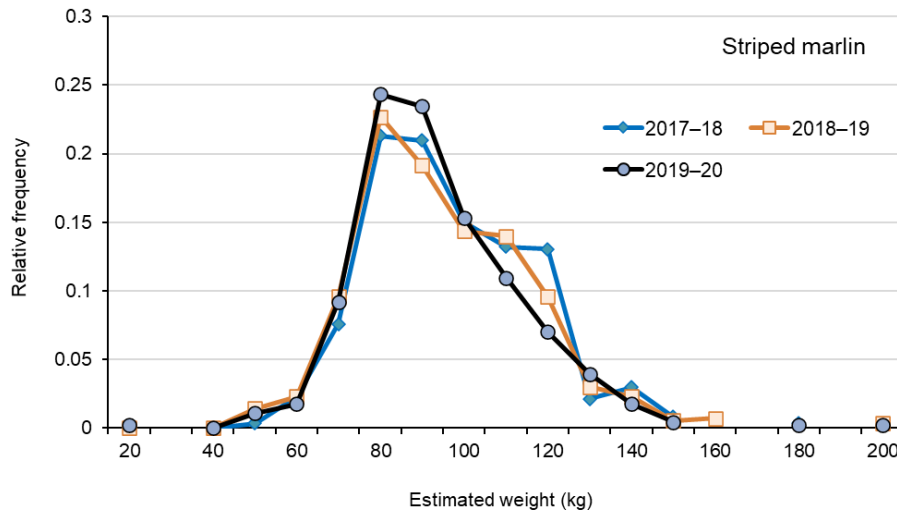
**Figure 2: The number of striped marlin tagged by month in New Zealand waters since 2010–11.**

More striped marlin were tagged off the west coast of the North Island in 2015–16 (421) than for any year to date with good numbers from Cape Reinga to Taranaki. The Three Kings area has been a productive area for marlin fishers in most years since 1990 but the number of striped marlin tagged in this area has been low over the last four years (Figure 3).



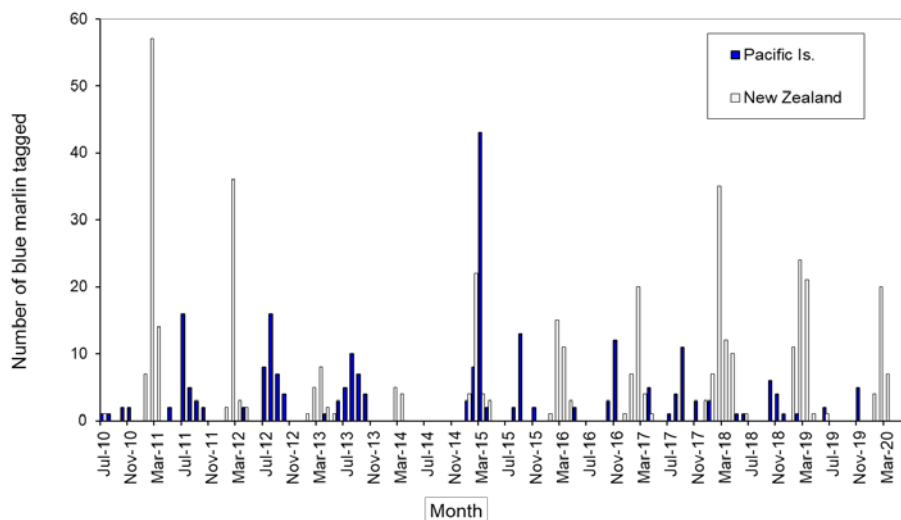
**Figure 3: The number of striped marlin tagged by region and fishing year, 2006–07 to 2019–20.**

Striped marlin estimated weights are similar over the last 3 years. In 2020 there were fewer fish in the 110 kg and 120 kg size classes (Figure 4). In 2017–18, the mode was at the 80 kg weight bin and 33% of tagged fish were estimated at 110 kg or more, whereas in 2019–20 24% were 110 kg or more (Figure 4).



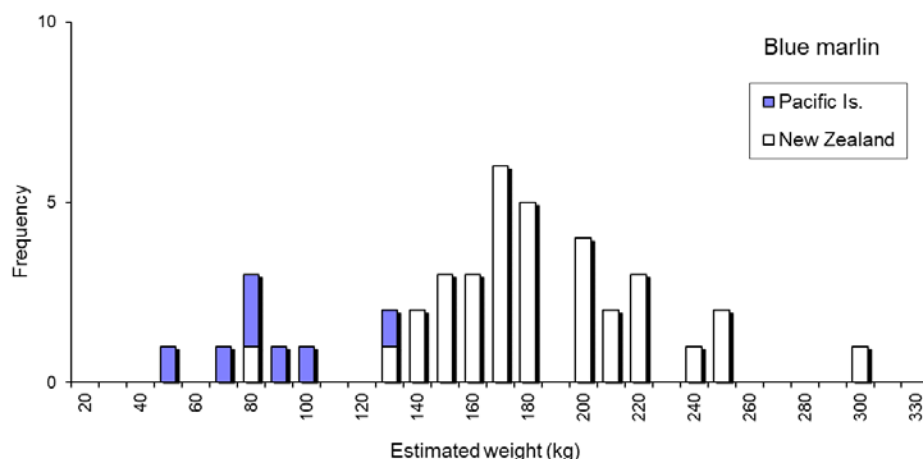
**Figure 4:** Comparison of the proportion by estimated weight of striped marlin tagged and released, for 2016–17 to 2018–19.

Blue marlin prefer the warmest months of February and March in northern New Zealand, whereas in the Pacific Islands most blue marlin have been tagged in Tongan waters from July to October (Figure 5). The number of blue marlin tagged in 2020 was above average and there were blue marlin being caught in late March just before recreational fishing was restricted.



**Figure 5:** The number of blue marlin tagged by month in New Zealand and the Pacific Islands since 2009–10.

Estimated release weights for blue marlin tagged in 2019–20 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 in Tonga and Samoa are frequently less than 100 kg (Figure 6).



**Figure 6: Weight frequency distribution of blue marlin from estimated weight on release, 2019–20.**

### Billfish recaptures

There were eight striped marlin and two swordfish recaptures reported for the three years from 2016–17 to 2018–19 (Holdsworth & Saul 2019). Five of the striped marlin were recaptured by New Zealand recreational anglers, two were reported from the Coral Sea by surface longline fishers from New Caledonia, and one was reported from the Melbourne fish market with no recapture information. Both swordfish were reported by surface longliners in New Zealand. No billfish recaptures were reported in 2019–20.

### 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, Ducharme-Barth et al. 2019). 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. Although no striped marlin tagged in the south Pacific have so far been recaptured beyond the south Pacific, most striped marlin have been recaptured within 10 months of release. Tag shedding is a problem with this species, and this may be the reason for the short duration of most recaptures (Ortiz et al. 2003). Most striped marlin are tagged in New Zealand during the first and second quarters (January to June). Some striped marlin have left New Zealand and been recaptured in subtropical waters during the second quarter and many of the other recaptures in the subtropics are in the third and fourth quarter (Figure 7).

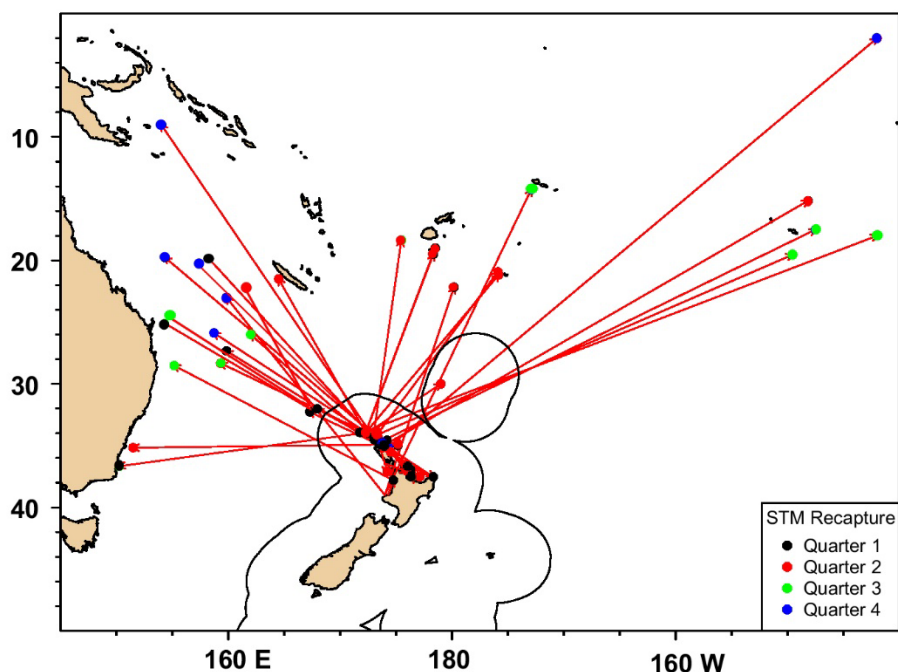


Figure 7: Long-distance movements of striped marlin in the gamefish tagging programme for all years, with recapture location colour coded by quarter (Quarter 1 = Jan-Mar).

Blue marlin have been released with NZGTP tags from various countries in the Southwest Pacific and there is some international evidence of better tag retention rates (Ortiz et al. 2003). Two blue marlin tagged in Tongan waters were recaptured three years later around Fiji and a blue marlin recaptured west of Vanuatu had been at liberty for two years. Only one of these recaptures was for a fish tagged in New Zealand waters, which was recaptured 700 nautical miles north after 158 days at liberty (Figure 8).

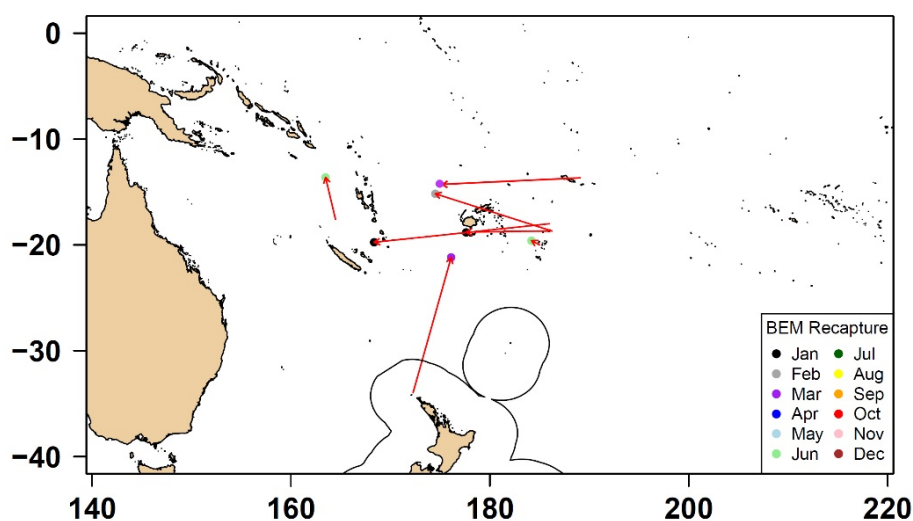


Figure 8: Long-distance movements of blue marlin in the gamefish tagging programme for all years, with recapture location colour coded by month.

### Landed catch

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

because most billfish caught by club members and non-members are weighed and recorded at club weigh stations.

The number of billfish recorded as landed by NZSFC affiliated clubs over the last 10 years is given in Table 2. The number of swordfish landed has increased since 2010–11 and now exceeds the number tagged for this species. Blue marlin numbers have been variable over the last 10 years. Shortbill spearfish numbers are also variable with between 11 and 91 landed per year (Helen Pastor, New Zealand Sport Fishing Council, pers. comm.).

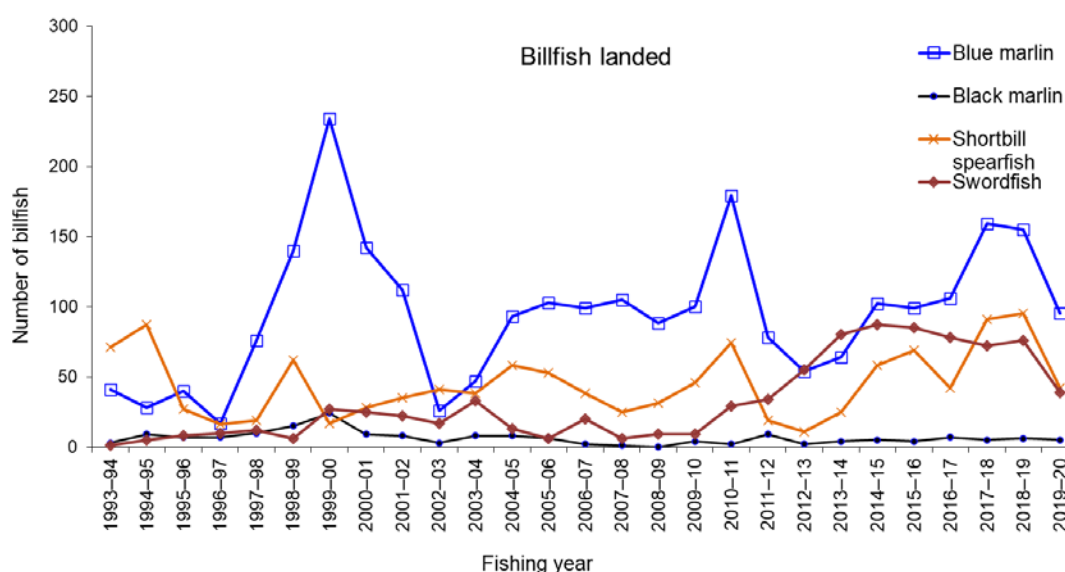
The sport fishing fleet is changing, with an increase in the number of trailer boats travelling to various launch sites to target marlin. This has probably resulted in a higher proportion of landed billfish which are not reported in club records. Unaccounted catch is likely to be higher in seasons with high catch rates and when fishing is good off the west coast of the North Island, away from the main fishing ports.

There are also tagged billfish that are reported directly to Fisheries New Zealand and not recorded in NZSFC club records. Tag cards that are not presented to the club until the following season will also not be included in the annual club tallies published in the NZSFC yearbook.

Of the landed billfish (other than striped marlin) in NZSFC club records, blue marlin has dominated the landed catch in some years, whereas shortbill spearfish numbers have increased and swordfish has started to decline in recent years (Figure 9).

**Table 2: The number of billfish landed from New Zealand waters and recorded by NZSFC clubs in the last ten fishing years by species.**

| Species                | Year        |             |             |             |             |             |             |             |             |             | Average<br>2010–11 to<br>2019–20 |
|------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|----------------------------------|
|                        | 2010–<br>11 | 2011–<br>12 | 2012–<br>13 | 2013–<br>14 | 2014–<br>15 | 2015–<br>16 | 2016–<br>17 | 2017–<br>18 | 2018–<br>19 | 2019–<br>20 |                                  |
| Striped marlin         | 607         | 635         | 744         | 620         | 696         | 900         | 516         | 618         | 507         | 333         | 620                              |
| Blue marlin            | 179         | 78          | 54          | 64          | 102         | 99          | 120         | 159         | 155         | 95          | 110                              |
| Shortbill<br>spearfish | 74          | 19          | 11          | 25          | 58          | 69          | 46          | 91          | 95          | 42          | 53                               |
| Swordfish              | 29          | 34          | 55          | 80          | 87          | 85          | 87          | 72          | 76          | 39          | 64                               |
| Black marlin           | 2           | 9           | 2           | 4           | 5           | 4           | 7           | 5           | 6           | 5           | 5                                |



**Figure 9: The number of billfish landed (excluding striped marlin) by year since 1993–94 from NZSFC records. 2019–20 catch provisional.**

## 3.2 Yellowtail kingfish

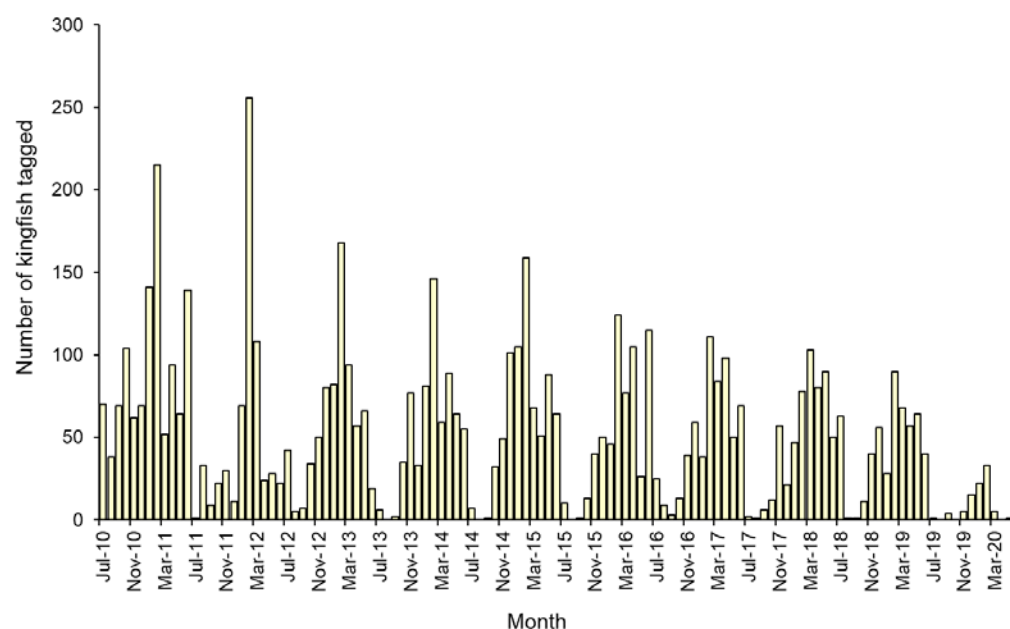
Yellowtail kingfish have been an important component of the NZGTP since its inception; not only are they available year round in New Zealand waters, but they tolerate handling and retain tags well. Although they come second behind striped marlin as the most tagged species in the programme, they make up over 69% of all recaptures.

The number of kingfish tagged and released has declined in the last four years (Table 3). The retirement of some leading charter skippers who have long supported kingfish tagging has reduced releases and recaptures. A kingfish ageing study in 2010 encouraged fishers to measure all kingfish catch at sea and boosted the number of fish tagged. The use of smaller dart tags has been an initiative by fly fishers targeting smaller kingfish in harbours and on sand flats. They have deployed a useful number of tags (370) with an overall recapture rate of 10.1%.

**Table 3: The number of yellowtail kingfish tagged and the number recaptured by tag type over the last ten fishing years.**

|                         | Year        |             |             |             |             |             |             |             |             |             |                   |
|-------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------------|
|                         | 2010<br>–11 | 2011<br>–12 | 2012<br>–13 | 2013<br>–14 | 2014<br>–15 | 2015<br>–16 | 2016<br>–17 | 2017<br>–18 | 2018<br>–19 | 2019<br>–20 | Annual<br>Average |
| Gamefish tag releases   | 1123        | 613         | 761         | 649         | 723         | 607         | 598         | 547         | 534         | 100         | 626               |
| Gamefish tag recaptures | 54          | 44          | 38          | 31          | 30          | 28          | 31          | 23          | 32          | 20          | 33                |
| Dart tag releases       |             |             |             |             |             | 12          | 231         | 66          | 62          | 15          | 77                |
| Dart tag recaptures     |             |             |             |             |             |             | 3           | 14          | 12          | 10          | 10                |

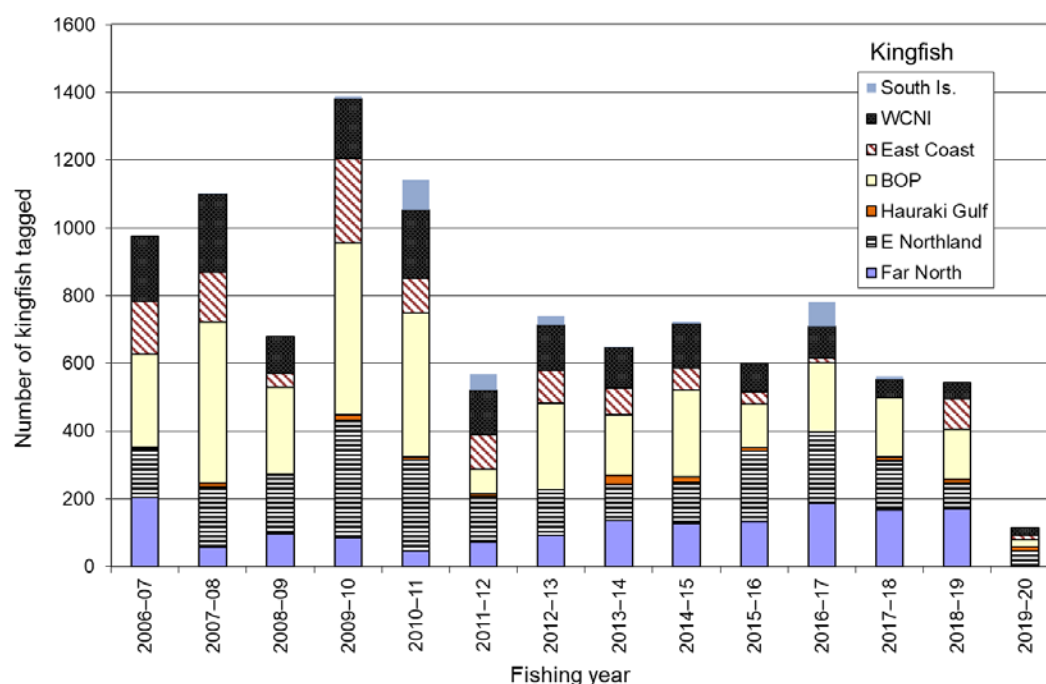
Generally, most kingfish are tagged between October and June of the following year. February is the peak month, as with other species in the NZGTP, but the number tagged in February has become less prominent since 2015 (Figure 10).



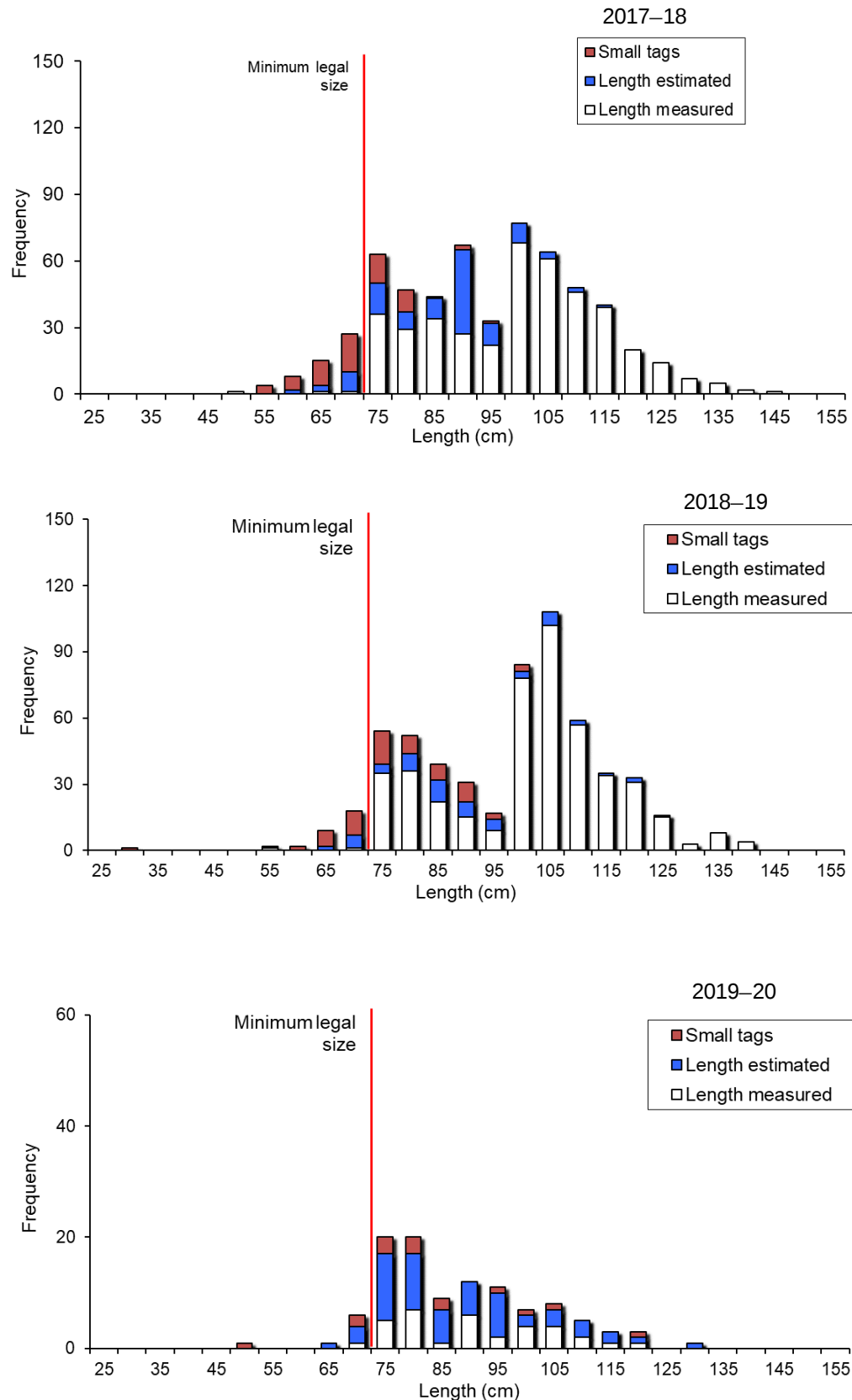
**Figure 10: The number of yellowtail kingfish released with gamefish tags by month since 2010–11.**

Trends in the proportion of annual kingfish releases by region over the last 14 years show a decrease in numbers tagged overall and across all regions, in 2019–20 in particular (Figure 11).

The length frequency distribution of tagged kingfish has been bimodal for the last three years (Figure 12). The modes at 75 and 80 cm size classes are mainly from inshore fisheries whereas the modes for larger fish are mainly from fish tagged in offshore locations. Many of the kingfish tagged with the small Hallprint PDAT tags have also been measured on release (Figure 12).



**Figure 11: The number of yellowtail kingfish tagged by region and fishing year, 2006–07 to 2019–20.**

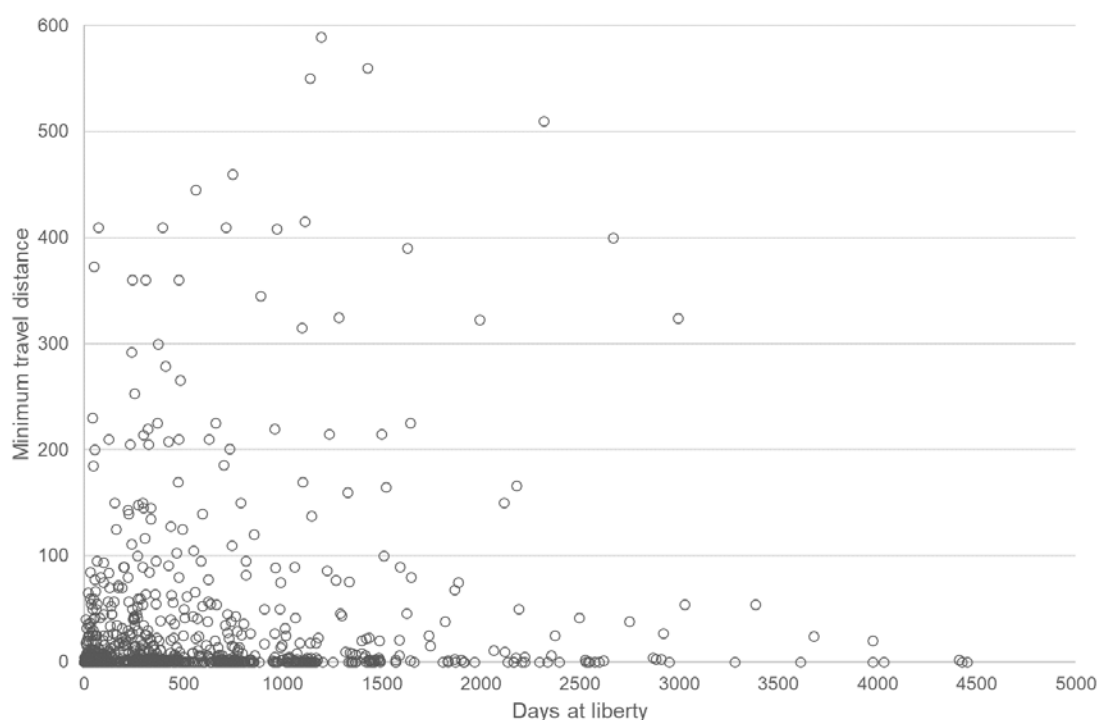


**Figure 12: Yellowtail kingfish length frequency for released fish, fish measured (white bars), and those with estimated lengths (blue bars), for 2017–18 to 2019–20.**

## Movement

Most kingfish are recaptured close to their release location even after many years (Figure 13). Ninety four percent of recaptures at liberty for 30 days or more were within 100 nautical miles of the release point. Movements between east and west coasts have been recorded, in both directions, and from North Island to the South Island.

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.



**Figure 13: Kingfish displacement distance by days at liberty, all years truncated at 600 nautical miles and 5000 days.**

A kingfish fish caught by an Italian angler on a charter boat on 29 November 2019 has set a new time at liberty record for the NZGTP. This fish was tagged at Rangatira Reef on 26 January 2000 when it measured 98 cm and weighed 16 kg. It was recaptured 27 nautical miles west near Mayor Island after 19 years and 10 months at liberty. It was measured at 148 cm fork length and was sling weighed on board at 41 kg before being released in good condition. This fish would be nearing the maximum age recorded for kingfish in New Zealand of 29 years old (Holdsworth et al. 2016a).

### 3.3 Mako and blue shark

The number of mako sharks tagged and released inside New Zealand fisheries waters has decreased over the last four years (Table 4). The number of blue sharks tagged has dropped below the 10 year average to the lowest recorded for the period (22) in 2018–19. This is largely due to the reduction of targeted fishing effort for blue sharks off Otago.

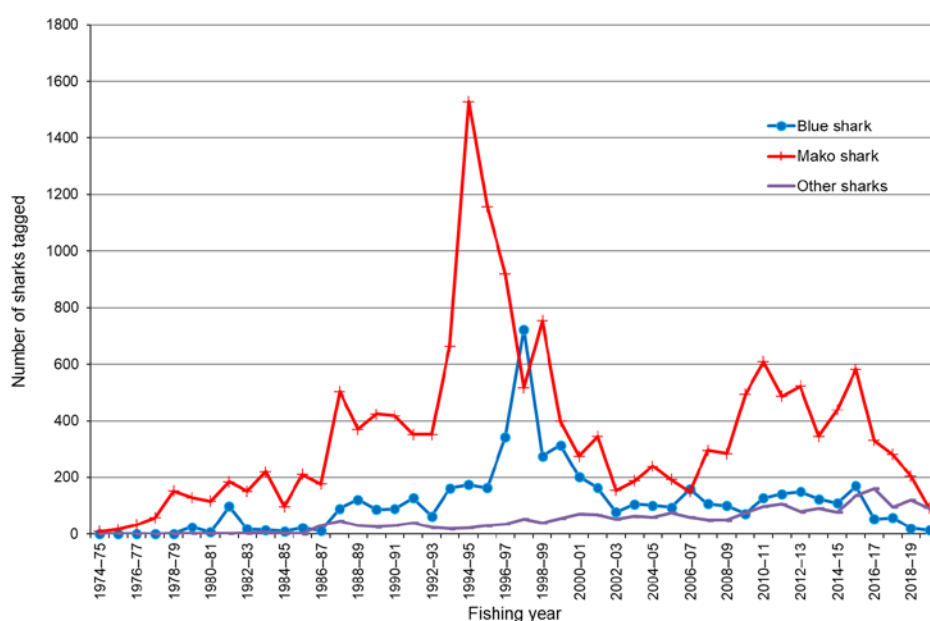
There have been no mako or blue sharks tagged for this programme outside New Zealand fisheries waters in the last five years. The overall recapture rate is 2.3% for tagged mako sharks and 1.7% for blue sharks (Appendix A, Table A3).

**Table 4: The number of mako and blue sharks tagged in New Zealand fisheries waters and the number recaptured by fishing year.**

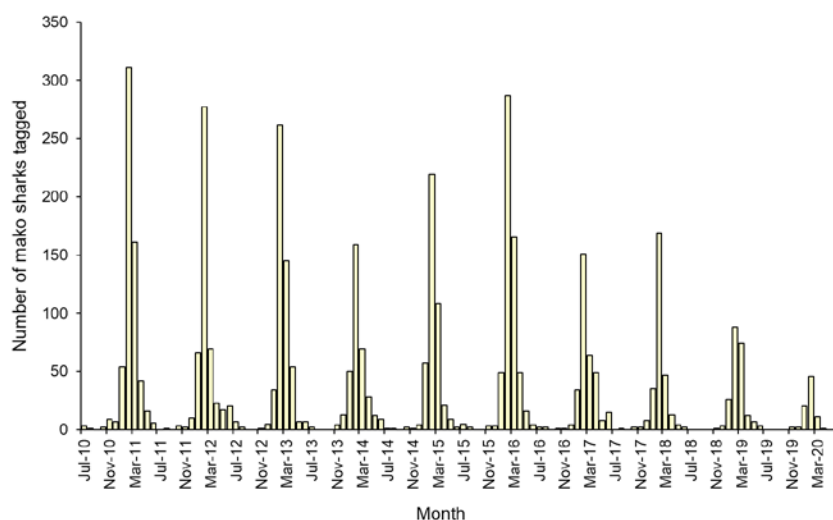
| Species               | Year    |         |         |         |         |         |         |         |         |         | Annual average |
|-----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
|                       | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 | 2019–20 |                |
| Mako tagged           | 609     | 488     | 524     | 367     | 439     | 583     | 331     | 216     | 82      | 92      | 216            |
| Blue shark tagged     | 128     | 142     | 150     | 124     | 110     | 170     | 54      | 24      | 14      | 97      | 24             |
| Mako recaptures       | 7       | 8       | 11      | 6       | 0       | 2       | 3       | 4       | 0       | 0       | 4              |
| Blue shark recaptures | 3       | 4       | 3       | 3       | 0       | 0       | 1       | 1       | 0       | 0       | 2              |

The number of tagged mako and blue sharks peaked during the mid-1990s, then declined to a low level in the mid 2000s, and has increased and decreased over the last 13 years (Figure 14). Generally, mako sharks are caught as a bycatch of other sport fisheries, particularly off the North Island.

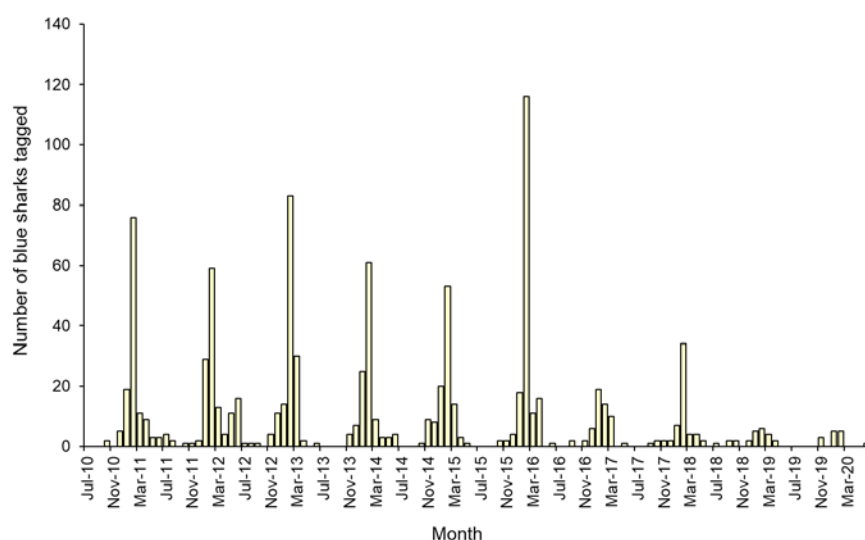
Most mako sharks were tagged between January and April with a strong mode in February (Figure 15). This peak is associated with the New Zealand Sport Fishing Council Nationals Contest which encourages the tag and release of various species. A stronger peak in tag and release during the Nationals is seen for blue sharks up to 2016 (Figure 16).



**Figure 14: The number of mako and blue sharks tagged, 1974–75 to 2019–20.**



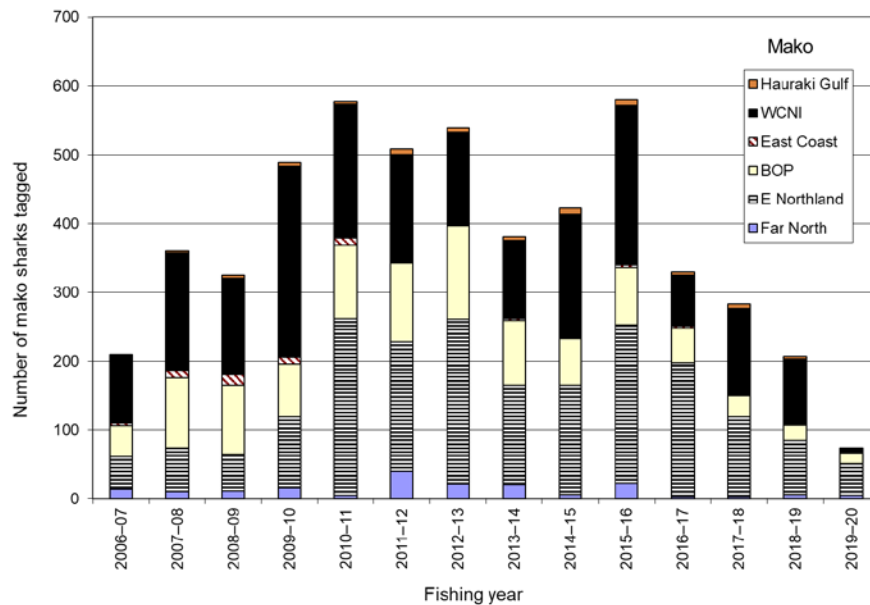
**Figure 15: Number of mako sharks tagged by month since 2010–11.**



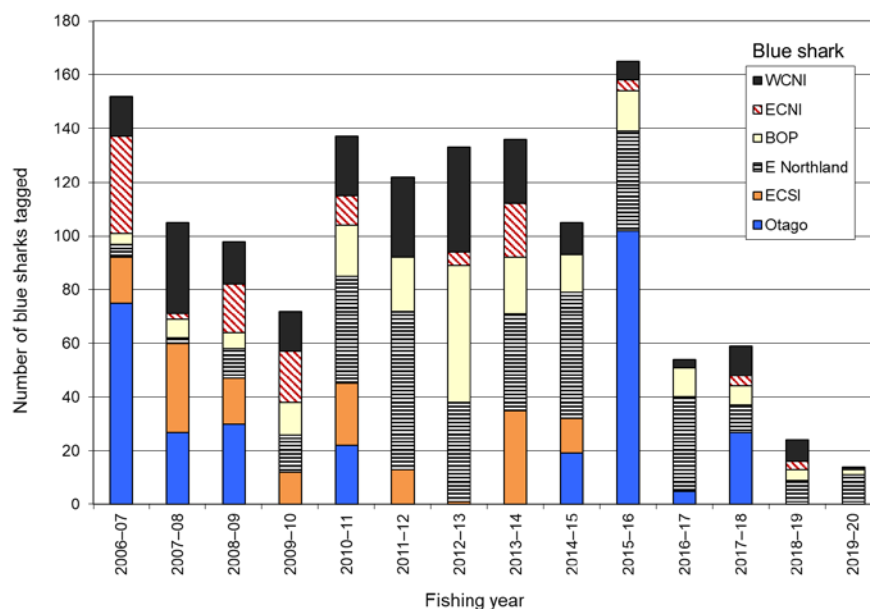
**Figure 16: Number of blue sharks tagged by month since 2010–11.**

The number of mako sharks tagged from East Northland and off the west coast of the North Island has increased in the last 10 years with fewer tagged in Bay of Plenty and East Coast regions. Few mako were tagged in the 2019–20 fishing year in any region (Figure 17).

Although mako sharks take lures, blue sharks form a bycatch when fishing with baits, but very seldom take the artificial lures intended for billfish or tuna. Most blue sharks have been tagged in target fisheries off Otago and Canterbury or as incidental catch in East Northland and Bay of Plenty (Figure 18).



**Figure 17: The number of mako sharks tagged by region and fishing year, 2006–07 to 2019–20.**



**Figure 18: The number of blue sharks tagged by region and fishing year, 2006–07 to 2019–20.**

### Mako and blue shark recaptures

There were seven mako and two blue sharks with release and recapture details over the three years from 2016–17 to 2018–19 (Holdsworth and Saul 2019) and no recaptures in 2019–20.

### Movement

Mako sharks tagged in New Zealand seldom stray into equatorial waters to the north, or past French Polynesia to the east or Australia to the west. A high proportion of recaptures have been reported from the Fijian region, New Caledonia, and New South Wales (Figure 19). The distribution of long-distance recaptures can be affected by non-reporting by some commercial longline sectors. For a number of species, the proportions of tag recoveries reported by commercial longline fleets do not match the proportions of landings reported in the region (Ortiz et al. 2003).

To date there have been five mako sharks recaptured after 5 years or more at liberty, with the longest confirmed recapture at 9 years and 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 sharks 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.

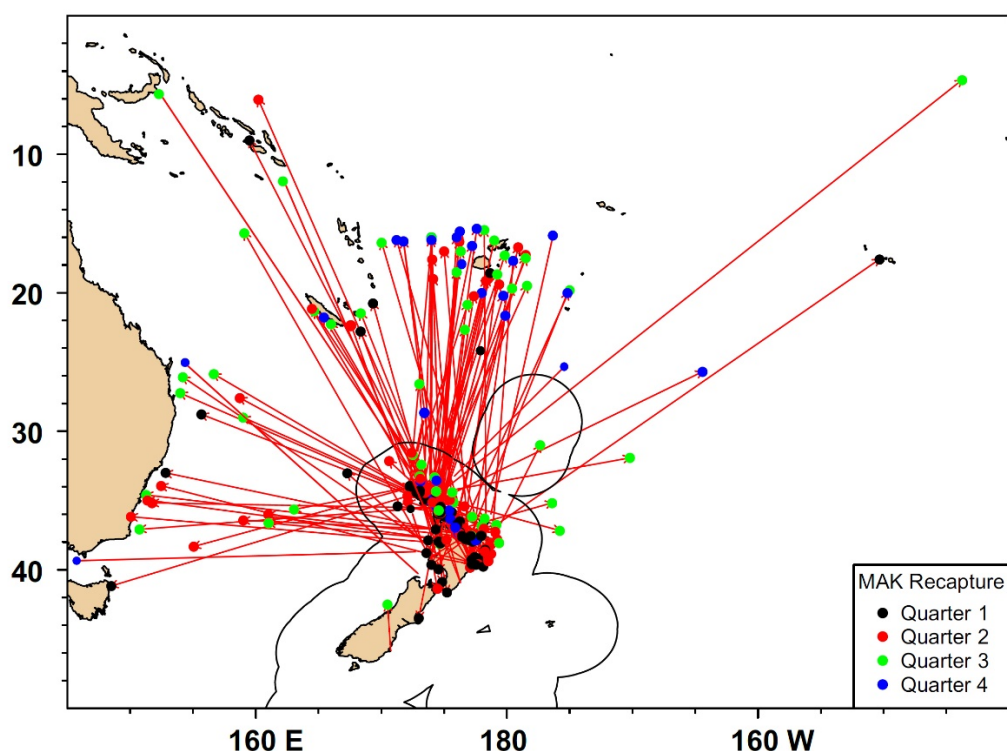


Figure 19: All release and recapture locations of mako sharks in the gamefish tagging programme, with recapture location colour coded by quarter (Quarter 1 = Jan-Mar).

Blue sharks also appear to disperse across the Southwest Pacific, with recaptures from Australia, New Caledonia, Vanuatu, Fiji, Tonga, Cook Islands, and French Polynesia (Figure 20). 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.

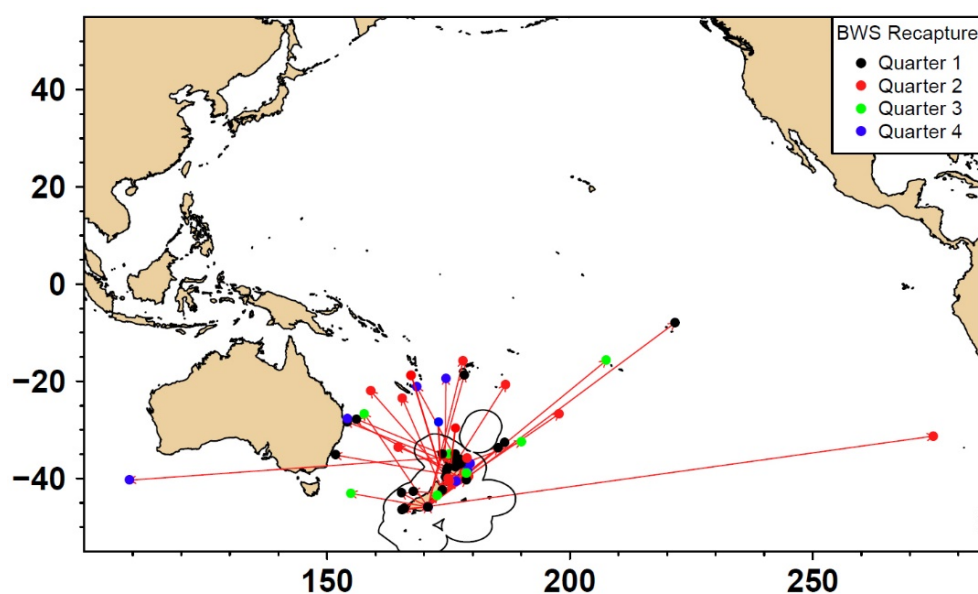
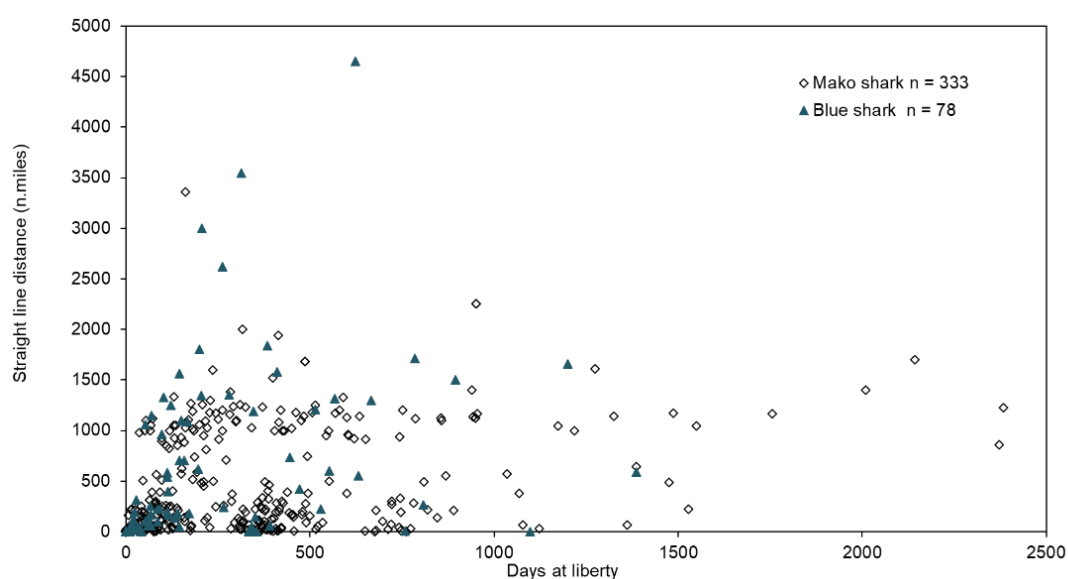


Figure 20: All release and recapture locations of blue sharks in the gamefish tagging programme, with recapture location colour coded by quarter (Quarter 1 = Jan-Mar).

The gamefish tags hold well on mako sharks and 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, some fish are recaptured close to their release points during summer in following years (Figure 21).

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 21). Blue sharks have been recaptured further away than any other species in the NZGTP to date but the maximum time at liberty is just 3 years and 9 months. A blue shark tagged off Tutukaka was recaptured after 53 days off Queensland, a minimum travel distance by sea of 1060 nautical miles giving a displacement rate to date of 20 nautical miles per day, the maximum recorded for a blue shark in the NZGTP.



**Figure 21: Mako and blue shark displacement distance by days at liberty, all years.**

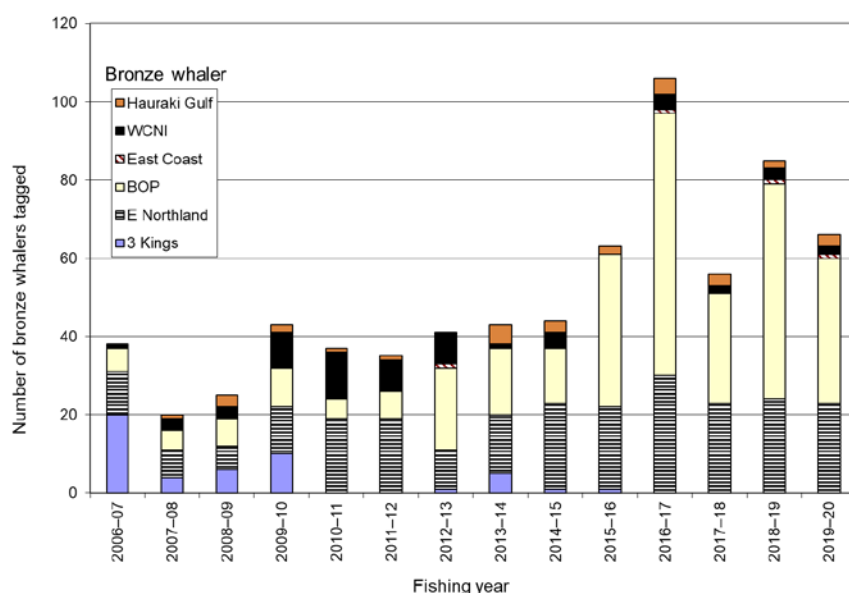
### 3.4 Other shark species

Each year, anglers tag and release a number of species that are not considered to be mainstream parts of the NZGTP. Most of these are sharks, in particular smooth hammerhead sharks *Sphyrna zygaena* and bronze whaler *Carcharhinus brachyurus*. The number of tagged sharks by species over the past 10 years is provided in Table 5. Most bronze whaler, hammerhead, and thresher sharks are tagged over summer, January to April, by recreational fishers (Holdsworth et al. 2016b).

The number of bronze whalers tagged in New Zealand waters has increased over the last 10 years, primarily in the Bay of Plenty (Figure 22) where a research project undertaken by Melissa Kellett has sparked ongoing interest.

**Table 5: The number of sharks other than mako and blue sharks tagged in New Zealand waters by sport fishing year (July to June).**

| Species         | Year    |         |         |         |         |         |         |         |         |         | Annual average |
|-----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
|                 | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 | 2019–20 |                |
| Bronze whaler   | 37      | 34      | 40      | 43      | 44      | 63      | 106     | 56      | 85      | 67      | 57             |
| Hammerhead      | 43      | 38      | 19      | 27      | 17      | 51      | 34      | 26      | 24      | 14      | 29             |
| Porbeagle       | 1       |         | 1       |         |         | 1       |         | 1       |         |         | 1              |
| School shark    | 4       | 14      | 5       | 3       | 1       | 1       | 3       | 3       | 4       | 6       | 4              |
| Sevengill Shark | 6       |         |         |         |         | 1       |         | 1       | 1       |         | 2              |
| unidentified    | 3       | 4       | 4       | 1       | 7       | 3       | 4       | 3       | 2       | 1       | 3              |
| Thresher        | 8       | 16      | 16      | 11      | 9       | 17      | 13      | 5       | 7       | 3       | 11             |
| White shark     | 1       |         |         |         |         |         | 1       | 1       |         |         | 1              |
| Total           | 840     | 736     | 759     | 576     | 627     | 890     | 546     | 436     | 348     | 181     | 594            |



**Figure 22: The number of bronze whalers tagged by region and fishing year, 2006–07 to 2019–20.**

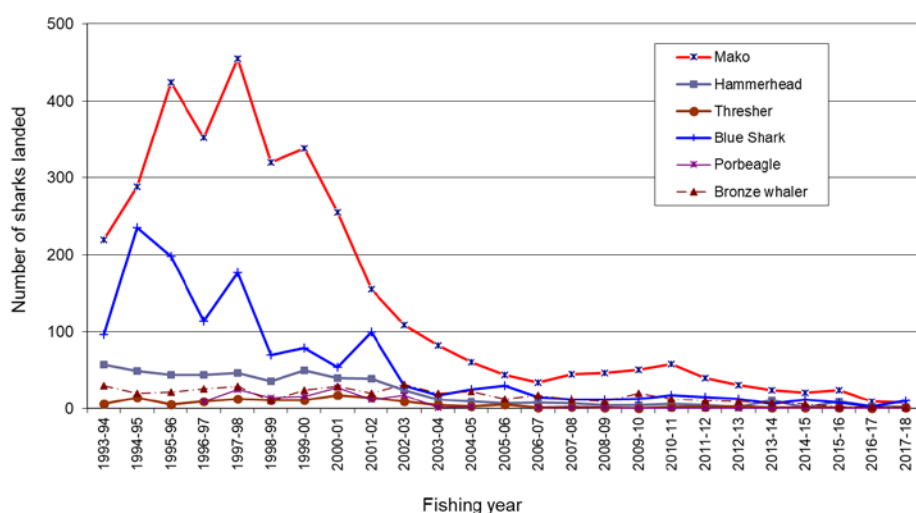
## Recaptures

A number of shark recaptures have been within 50 nautical miles of the release location and relatively short term. In addition, bronze whalers tagged off northern New Zealand have been recaptured off north western Tasmania in January, in the Coral Sea in July, and west of Tuvalu in October. A bronzer whaler tagged in Tauranga Harbour in April 2017 was recaptured in the same area nearly two years (686 days) later. A hammerhead shark tagged off Coromandel in April was recaptured 884 days later in September by a longliner in the Fiji Basin, a minimum distance of 1060 nautical miles. A small sevengill shark tagged off Cape Brett was recaptured two years later by a commercial setnet fisher off Waverly, 712 days at liberty and a minimum distance of 410 nautical miles.

## Landed sharks

In the 1990s, mako, blue shark, and to a lesser extent hammerhead sharks were regularly caught and landed in New Zealand fishing competitions. The number landed declined for all species in the early 2000s (Figure 23).

The NZSFC introduced minimum weights for sharks to qualify to be weighed. Over the last 10 years many clubs have removed prizes for landed sharks altogether, as attitudes toward sharks have changed.



**Figure 23: Number of sharks landed and recorded by New Zealand Sport Fishing Council clubs by species since 1993–94.**

### 3.4 Tuna

For several years during the 2000s few yellowfin tuna were caught by recreational fishers in New Zealand and none were tagged and released. In 2015–16, there were 63 yellowfin tagged with estimated release weights between 10 kg and 65 kg (mean = 32 kg). Since then annual numbers tagged have been below 30 (Table 6).

The number of Pacific bluefin tuna caught and tagged in the winter target recreational fishery off the West Coast has declined significantly since 2012 (Table 6). Although most of the tuna in this fishery were released, not many were tagged. A satellite tagging programme sponsored by Stanford University, University of Auckland, Ministry for Primary Industries, and the New Zealand Marine Research Foundation deployed 46 PSAT tags on Pacific bluefin tuna between 2006 and 2008. These fish survived capture and release well but achieving deployments longer than 6 months was problematic due to attachment failures.

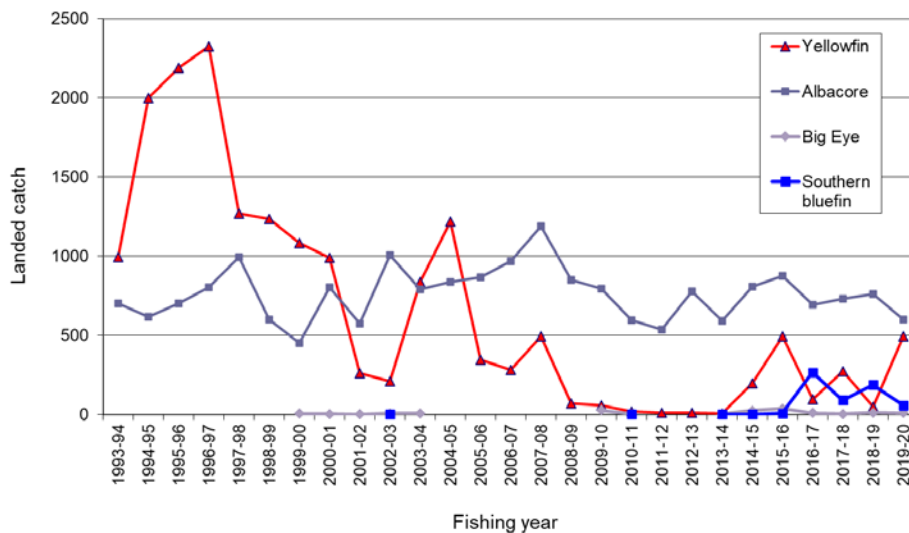
A few southern bluefin tuna have been tagged over the last 10 years (Table 6). Some of these have been small fish released by commercial fishers from surface longline vessels.

**Table 6: The number of tuna tagged in New Zealand waters by fishing year.**

| Tuna species     | Year    |         |         |         |         |         |         |         |         |         | Average 2010–11 to 2019–20 |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------------------|
|                  | 2010–11 | 2011–12 | 2012–13 | 2013–14 | 2014–15 | 2015–16 | 2016–17 | 2017–18 | 2018–19 | 2019–20 |                            |
| Pacific bluefin  | 15      | 16      | 5       | 4       | 0       | 0       | 0       | 0       | 0       | 0       | 4                          |
| Yellowfin        | 0       | 0       | 0       | 1       | 14      | 63      | 2       | 7       | 6       | 23      | 12                         |
| Southern bluefin | 7       | 15      | 1       | 2       | 7       | 4       | 5       | 13      | 4       | 4       | 6                          |

#### Landed Tuna

The total landed catch of yellowfin from NZSFC clubs and NZGTP records shows the decline in recreational catch since the mid-1990s (Figure 24). The large target fishery in the Bay of Plenty no longer operates and Whakatane Sport Fishing Club tournaments target marlin and other gamefish. The number of albacore landed and weighed by clubs shows no obvious trend (Figure 24). Most of the albacore catch is reported from clubs from the Bay of Plenty south, off east and west coasts.



**Figure 24: The number of landed tuna recorded by NZSFC clubs since 1993–94.**

A small recreational fishery for southern bluefin tuna developed off the west coast of the South Island in the 1970s. The Fiordland Game Fishing Club was formed and was a member of the New Zealand Sport Fishing Council until the late 1980s. Most of the southern bluefin tuna were caught in February and weighed less than 30 kg (Marquand 1978). A North Island recreational fishery for southern bluefin tuna rapidly emerged in June and July 2017. Good catch rates and favourable weather attracted hundreds of anglers to the eastern Bay of Plenty at short notice. Most fishers towed trailer boats and launched at Waihou Bay. Fish were caught by trolling lures using the same tackle as the summer billfish fishery. The NZSFC fishing year ends on 30 June, in the middle of the North Island southern bluefin tuna season. The numbers of landed southern bluefin tuna plotted in Figure 24 do not include NZSFC catch from July to August 2020.

A recreational fishery for Pacific bluefin tuna developed in 2005 off the west coast of the South Island with charter boats fishing from Greymouth and Hokitika but these fish are not reported in club records and the fishery has declined in recent years. Bigeye tuna have occasionally been caught by recreational fishers and weighed at fishing clubs.

#### 4. DISCUSSION

The recreational fishery for most of highly migratory species included in the NZGTP occurs in the months with the warmest sea surface temperatures from January to May. In 2020, the season started well with striped marlin and yellowfin tuna caught in reasonable numbers. There was a marked slowdown in March. Club fishers from New Plymouth and Bay of Islands had pop-off satellite archival tags to deploy on striped marlin. Despite good efforts only two of the 12 PSATs were deployed, both in February and programmed for 240 day deployments that were due to end in October 2020.

On 23 March 2020 the New Zealand government introduced level 3 Covid-19 restrictions, followed by level 4 (stay at home) restrictions on 25 March. Recreational fishers were not allowed on the water under level 4 which ended on 27 April, nor under level 3 which ended on 12 May. By then, the extended spell of calm weather during April in northern New Zealand had ended and the summer gamefish season had ended.

The number of fish tagged in 2019–20 was 822, less than half of the previous tally in the previous 3 years. Contributing to the lower tag tally was the cancellation of yellowtail kingfish tournaments in June which have attracted overseas anglers for many years. The number of recaptures was also lower with 20 reported in 2019–20, all kingfish. This is about 45% down on the previous three years.

Anglers who tag and release 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 and released fish. The Council and clubs also purchase and distribute the tags, and act as a collection point for tag cards with release information. This Fisheries New Zealand project ensures that the information is used. It funds data management, recapture rewards, analysis, and inclusion of this information in New Zealand annual fisheries plenary reports, reports to the Western and Central Pacific Fisheries Commission, and Fisheries Assessment Reports such as this.

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.

Your feedback on the NZGTP and this report is encouraged. The programme aims to continue providing good value for all those involved: fishers, New Zealand Sport Fishing Council, scientists and government. You can email [John@bluewatermarine.co.nz](mailto:John@bluewatermarine.co.nz) or [info@fish.govt.nz](mailto:info@fish.govt.nz). Release or recapture information can be entered on the website [fishtagnz.co.nz](http://fishtagnz.co.nz) or posted to:

Gamefish Tagging  
Fisheries New Zealand  
PO Box 53030  
Auckland 2150

## 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. Peter Saul is acknowledged for his extensive contribution to gamefish tagging in New Zealand for many years. Particular thanks to Helen Pastor, from 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. This project was reviewed by the Highly Migratory Species Working Group and by Dr John Annala from Fisheries New Zealand. Fisheries New Zealand provided funding under the project TAG2019/01, “Management of data from the gamefish tag recapture programme”.

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## APPENDIX A

**Table A1: Number of fish tagged and released by species and season for fish tagged by recreational and commercial fishers inside the New Zealand EEZ only. Species codes are defined on the next page.**

| 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    | 1 390  | 494    | 76    | 15  | 859    | 18  | 15  | 30    | 9   | 3 014  |
| 2010–11 | 78  | 1   | 128   | 1 145  | 609    | 103   | 21  | 733    | 37  | 15  |       | 14  | 2 884  |
| 2011–12 | 50  | 3   | 142   | 575    | 488    | 106   | 5   | 663    | 51  | 16  |       |     | 2 099  |
| 2012–13 | 18  | 3   | 150   | 761    | 524    | 86    |     | 858    | 47  | 5   |       | 4   | 2 456  |
| 2013–14 | 9   | 4   | 124   | 649    | 347    | 85    | 6   | 520    | 38  | 4   | 1     |     | 1 787  |
| 2014–15 | 37  | 7   | 110   | 723    | 439    | 78    | 12  | 1 088  | 34  |     | 14    |     | 2 542  |
| 2015–16 | 35  | 5   | 170   | 607    | 583    | 137   | 26  | 1 658  | 29  |     | 63    | 10  | 3 323  |
| 2016–17 | 35  | 4   | 54    | 598    | 331    | 161   | 12  | 517    | 31  |     | 2     | 7   | 1 752  |
| 2017–18 | 74  | 7   | 58    | 547    | 283    | 96    | 24  | 730    | 51  |     | 7     | 11  | 1 888  |
| 2018–19 | 60  | 3   | 24    | 534    | 216    | 121   | 35  | 649    | 20  |     | 6     | 1   | 1 669  |
| 2019–20 | 34  |     | 14    | 100    | 92     | 91    | 12  | 437    | 14  |     | 23    | 5   | 822    |
| Total   | 783 | 71  | 5 114 | 24 319 | 16 459 | 2 215 | 340 | 26 675 | 559 | 142 | 1 360 | 765 | 78 802 |

|     |              |     |              |     |                     |     |                   |
|-----|--------------|-----|--------------|-----|---------------------|-----|-------------------|
| 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 sharks | SWO | broadbill swordfish | OSP | all other species |
| SAI | sailfish     |     |              |     |                     |     |                   |

**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. Species codes are defined above.**

| Season  | BEM | BKM | BWS | KIN | MAK | SHA | SAI | SSF | STM   | SWO | YFN | OSP | Total |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|-----|-----|-------|
| 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   | 40    |     |     |     | 110   |
| 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 | 9   |     |     |     |     | 3   | 10  |     | 1     |     |     |     | 23    |
| 2011–12 | 28  |     |     |     |     |     | 2   | 2   |       | 1   |     |     | 33    |
| 2012–13 | 36  |     |     |     |     |     | 5   |     | 133   | 1   |     |     | 175   |
| 2013–14 | 26  |     |     |     |     |     | 2   | 2   | 267   |     |     | 2   | 299   |
| 2014–15 | 56  | 1   |     |     | 2   |     | 4   | 1   | 233   |     |     |     | 297   |
| 2015–16 | 23  | 18  |     |     |     | 1   | 2   | 2   | 134   |     |     | 1   | 181   |
| 2016–17 | 20  | 2   |     |     |     |     | 8   |     | 52    |     |     |     | 82    |
| 2017–18 | 23  |     |     |     |     |     | 11  | 5   | 91    |     |     |     | 130   |
| 2018–19 | 17  |     |     |     |     |     | 11  |     | 97    |     |     | 2   | 127   |
| 2019–20 | 7   |     |     |     |     |     | 9   |     | 7     |     |     |     | 23    |
| Total   | 845 | 68  |     | 3   | 7   | 4   | 201 | 33  | 1 553 | 5   | 53  | 47  | 2 819 |

**Table A3: Number of fish recaptured by species and season by species. Species codes are defined above.**

| 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    | 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   | 3   |     |     |     | 1   |     |     | 70    |
| 2011–12 |     |     | 4   | 44    | 9   |     |     |     | 1   | 1   |     |     | 59    |
| 2012–13 |     |     | 3   | 40    | 12  | 2   |     | 4   |     |     |     |     | 61    |
| 2013–14 |     |     | 3   | 34    | 6   | 2   |     | 3   | 1   |     |     | 1   | 50    |
| 2014–15 |     |     |     | 30    |     |     |     | 2   |     |     |     |     | 32    |
| 2015–16 |     |     |     | 28    | 2   | 4   |     | 7   | 1   |     |     |     | 42    |
| 2016–17 |     |     | 1   | 31    | 3   | 2   |     | 2   | 1   |     |     |     | 40    |
| 2017–18 |     |     | 1   | 23    | 4   | 2   |     | 3   | 1   |     |     |     | 34    |
| 2018–19 |     |     |     | 32    |     | 4   |     | 2   |     |     |     |     | 38    |
| 2019–20 |     |     |     | 20    |     |     |     |     |     |     |     |     | 20    |
| Total   | 8   | 1   | 89  | 1 628 | 377 | 75  | 1   | 106 | 7   | 4   | 15  | 25  | 2 316 |