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New Zealand billfish and gamefish tagging, 2019–20 to 2021–22

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J.C. Holdsworth

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EXECUTIVE SUMMARY

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Release and recapture data for 2019–20 to 2021–22 sport fishing years (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 3917 gamefish tagged and released in the New Zealand fisheries waters over the three years of this project. A further 45 fish were tagged with Gamefish Tagging Programme tags outside New Zealand. Both these totals are lower than in previous three-year periods due to fishing and travel restrictions in response to the Covid-19 pandemic.

The seasonality and regional distribution of fish tagged are 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 records. The combination of data from these sources provides a reasonably complete record of annual recreational catch of striped marlin, blue marlin, broadbill swordfish, and mako and blue sharks. It is indicative of recreational catch, but less complete, for albacore, southern bluefin tuna, yellowfin tuna, and other large shark species.

Yellowtail kingfish make up 70% of all recaptures in New Zealand waters. Marlin, tuna, and sharks have been recaptured around the Southwest Pacific Ocean by various fleets, mainly surface longliners. Seven striped marlin and two swordfish recaptures were reported for the period 2019–20 to 2021–22 in New Zealand waters. The number of blue sharks and mako sharks tagged has declined over recent years and the number of bronze whaler sharks tagged has increased. There were no blue shark recaptures, but one mako shark and five bronze whaler recaptures for the three-year period.

Two southern bluefin tuna tagged by other research programmes were recaptured by recreational anglers off Cape Runaway in the western Bay of Plenty. One measured 120 cm when tagged with an electronic data recording archival tag northeast of North Cape in 2008. The tag provided depth, light level, water temperature, and internal body temperature for four years until the battery power died. Over that time, the fish remained in the Tasman Sea or east of New Zealand between 32° S and 48° S latitude. The fish was recaptured in 2019 and weighed 82.6 kg and measured 167 cm. The second southern bluefin tuna recapture was 86 cm when double tagged off Francis Island, South Australia, in January 2007. This measured 175 cm and weighed 93.4 kg when recaptured off Cape Runaway in the Easten Bay of Plenty in June 2022 after 15 years and 5 months at liberty.

[1] Blue Water Marine Research, New Zealand.

1. INTRODUCTION

1.1 Overview

The New Zealand Gamefish Tagging Programme (NZGTP) is a cooperative project between Fisheries New Zealand, 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.

This gamefish tagging programme 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, Holdsworth et al. 2016). Tagging meaningful numbers of large oceanic pelagic species without constituent participation would be difficult if not impossible to accomplish at a reasonable cost (Prince et al. 2002). 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 has supported the programme since its inception and has purchased and distributed all tags through gamefish clubs since 1992. This report summarises the results 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. Blue marlin (*Makaira nigricans*), small numbers of black marlin (*Istiompax indica*), shortbill spearfish (*Tetrapturus angustirostris*), and increasing numbers of broadbill swordfish (*Xiphias gladius*) are also caught. Yellowfin tuna (*Thunnus albacares*) and yellowtail kingfish (*Seriola lalandi*) have historically been caught in large numbers. However, several poor yellowfin tuna seasons have seen an increase in the targeting of striped marlin, blue marlin, and, more recently, southern bluefin tuna (*Thunnus maccoyii*).

Game fishing has developed off the North Island's west coast 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 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 southern bluefin tuna. There was 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 bycatch of the commercial surface longline fishery that primarily 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 can be landed and brought to port for scientific study (Holdsworth & Saul 2017).

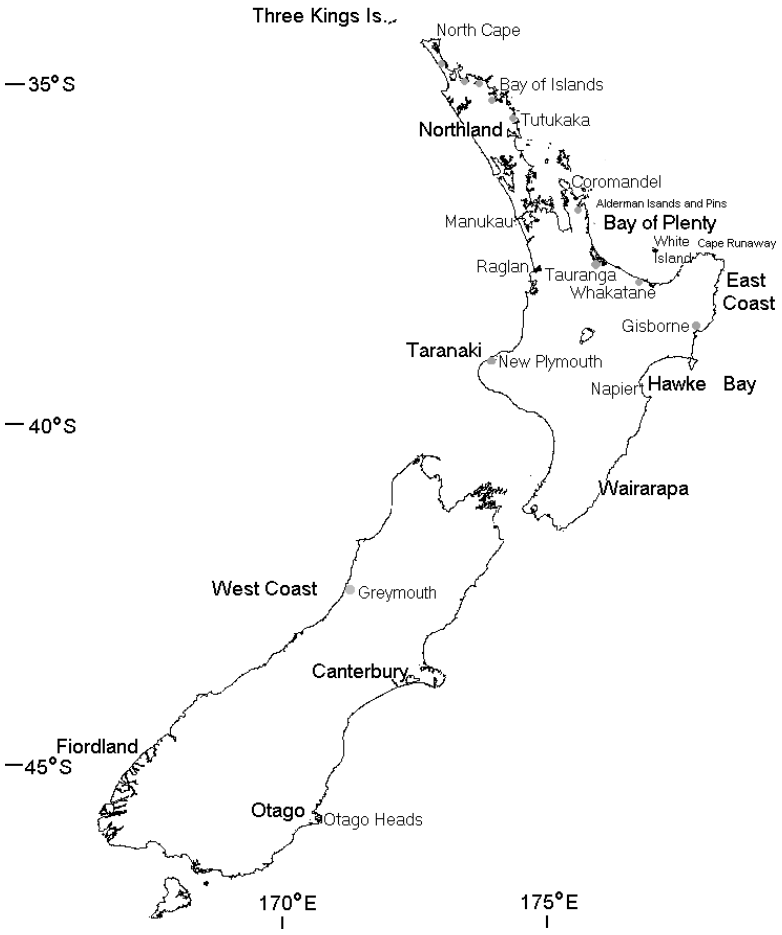

Figure 1: Location of the main areas of gamefish tagging around the North Island and South Island in New Zealand.

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—Hallpint type PIMA-W—are widely used by international billfish tagging programmes, with higher recapture rates than the stainless steel anchors in blue marlin and white marlin (*Kajikia albidus*) (Ortiz et al. 2003). The PIMA tags require a different applicator tip from that used with the stainless steel dart tags but are unsuitable for tagging sharks with tough skin. Both tag types are currently in use, and several leading charter skippers have been double-tagging billfish with both tag types.

The gamefish tagging database records tag release and recapture events from two other New Zealand tagging programmes to assist in providing these data to Fisheries New Zealand and reporting results. In 2016 flyfishing guides and enthusiasts purchased single-barb plastic-tipped dart tags—Hallprint type

PDAT—for use on kingfish caught and released on sand flats and in harbours. These fish tended to be too small for tagging with the larger gamefish tags. In 2019 the Deepwater Group purchased a smaller version of the plastic head intra-muscular tags—Hallpint type PIMS-W—and distributed these to vessels in the trawl fishery for jack mackerel (*Trachurus* spp.) operating off the west coasts of the North Island and South Island that were catching increasing numbers of kingfish (KIN). The quota in KIN 7 and KIN 8 is limited, and large numbers of kingfish were being released alive.

For many years the primary way of collecting tag-and-release information was on printed and numbered tag report cards issued with each tag. They request information on the species, date, location, length, and weight of the fish tagged. More recent tag cards include a space for the latitude and longitude of release, the skipper's phone number, tick boxes for the fishing method, the style of hook used, 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 who reported 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).

A webpage was established in 2018 to help fly fishers record tag-and-release and recapture events as part of the gamefish tagging programme. This enabled data to be incorporated into the Fisheries New Zealand gamefish tagging database and was a pilot for providing the option of online reporting for all gamefish catch and release. Gamefish tags and tag cards purchased since 2019 are printed with the new postal address for the Auckland Fisheries New Zealand office and the fishtagnz.co.nz web address.

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

Historical records for individual fish, including fish weight, vessel, and capture date, were collected from long-established fishing clubs, including Bay of Islands Swordfish Club, Whangaroa Sport Fishing Club, Whangārei Deep Sea Anglers Club, Tauranga Game Fishing Club, Mercury Bay Ocean Sports Club, and Whakatāne Sportfishing Club. Detailed catch records are updated annually from these and ten other fishing clubs. These records include tagged fish for club members and some captures from non-members who choose to get their fish weighed.

3. RESULTS

3.1 Overview

The multi-species NZGTP was initiated in 1975 to study the seasonal and short-term movements of gamefish important to New Zealand fisheries. Billfish tags supplied by the United States National Marine Fisheries Service introduced the concept of tag and release to anglers who were landing primarily billfish at the time (Saul & Holdsworth 1992). For the first 14 years, mako sharks (*Isurus oxyrinchus*) and kingfish were the main species tagged. The number of striped marlin tagged increased significantly after the introduction of the Billfish Moratorium on the commercial landing of marlin by the government and a voluntary minimum weight of 90 kg initiated by the NZSFC to help lift the proportion of marlin catch tagged and released by recreational fishers to over 50%.

The NZGTP data base contains records of 81 838 fish tagged in the New Zealand EEZ, including 28 358 striped marlin, 25 060 kingfish, and 16 592 mako shark (Appendix 1, Table A1 & A2). Of the total, there were 37% billfish species, 30% shark species, 30% kingfish, and 2% tuna, mainly yellowfin tuna. New Zealand fishers travelling overseas have also tagged fish outside the EEZ, totalling 2972 to date, mostly striped marlin (1676) and blue marlin (863) in the southwest Pacific Ocean (Table A3).

There have been 2400 tag recaptures reported across all areas, with 1682 kingfish (the main species) followed by 374 mako shark, 111 striped marlin, and 90 blue shark (Appendix 2, Table A4).

3.2 Billfish

Striped marlin is the main billfish species caught and tagged in this fishery. The number tagged peaked at 1658 in 2015–16 and was below the ten-year average for the following three years (Table 1). Recreational fishing from boats was prohibited for much of March and April 2020, which reduced the catch and number of gamefish tagged in 2019–20. The number tagged in 2020–21 and 2021–2022 has been at or above the ten-year average (Table 1). The number of blue marlin tagged is variable, with an average of 37 per year. The number of swordfish tagged has been relatively consistent, with a ten-year average of 32. There was a peak of 62 in 2017–18 and a low of 18 in 2021–22. The number of shortbill spearfish tagged is variable over the last ten years with, a ten-year average of 17 fish tagged per year. Striped marlin recaptures are often short-term and were highest in number (7) in 2015–16. Over the last ten years 29 striped marlin, and 6 swordfish recaptures have been reported (Table 1).

Table 1: The number of billfish tagged in New Zealand waters in the last ten fishing years and combined billfish recaptures in the NZGTP database, 2012–13 to 2021–22.

	Fishing year										
Species	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	Annual average
Striped marlin	819	492	967	1653	517	752	652	469	806	891	802
Blue marlin	15	9	33	36	35	72	62	38	30	39	37
Black marlin	2	4	7	5	4	5	3	1	3	1	4
Shortbill spearfish		6	12	26	12	24	35	12	10	15	17
Swordfish	40	34	25	29	31	62	22	20	39	18	32
Billfish recaptures	4	4	2	7	3	4	3	0	5	3	4

The New Zealand striped marlin season usually extends from January to May. Occasionally striped marlin are caught in early December, but the fishing effort is low until January. February is consistently the peak month for striped marlin caught and tagged (Figure 2). The proportion of fish tagged in January increased in 2019–20 to 2021–22 to 29% of all striped marlin tagged, up from 14% in the previous nine years, while

the proportion tagged in March fell to 14% in 2019–20 to 2021–22, down from 25% (Figure 2). 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.

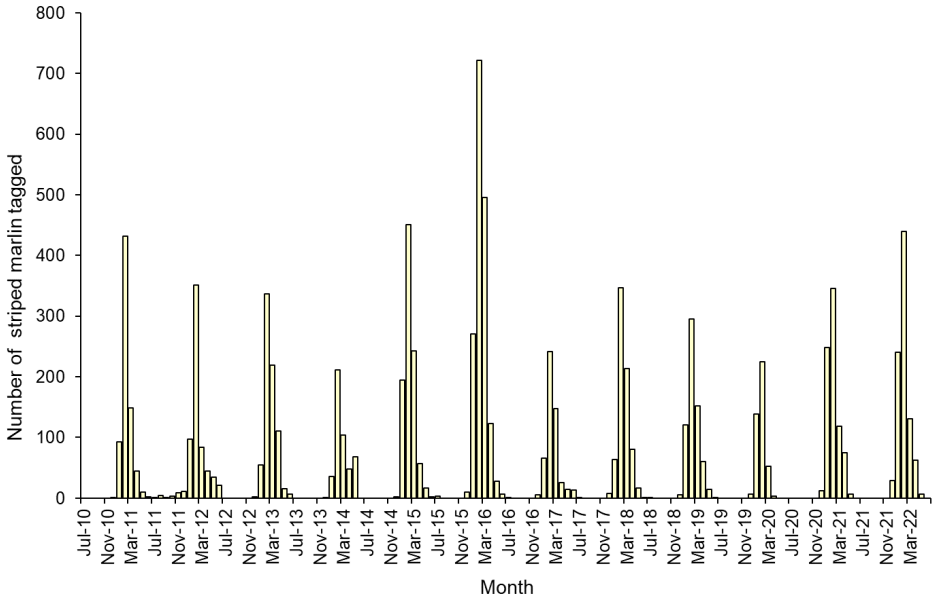

Figure 2: The number of striped marlin tagged by month in New Zealand waters since 2010–11.

The proportion of striped marlin tagged off the North Island west coast has increased since 2006–07, while the proportion tagged off East Northland and the Far North has declined (Figure 3). The Three Kings Islands area has been a productive area for marlin fishers since 1990, but the number of striped marlin tagged on the King Bank and Middlesex Bank has declined following the reduction in the number of long-range charter vessels in the fishery.

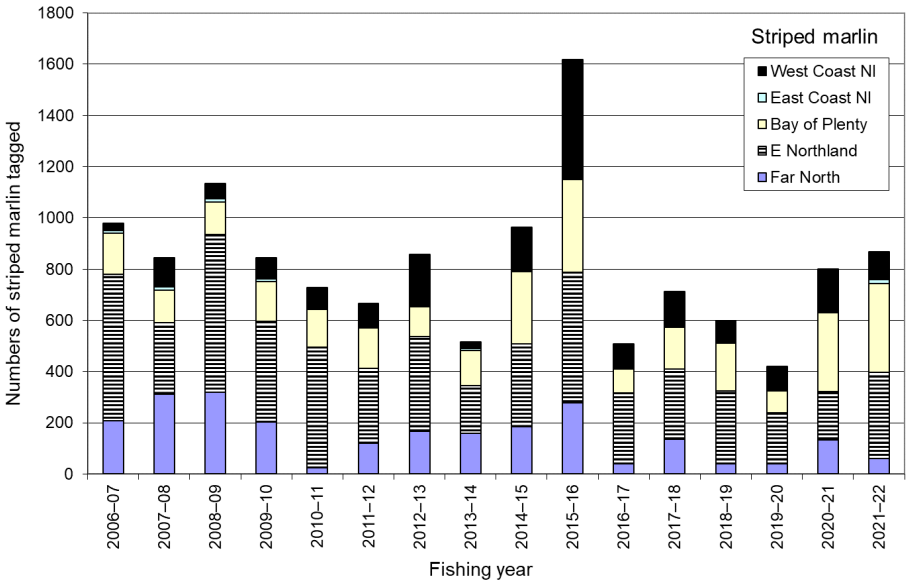

Figure 3: The number of striped marlin tagged by region and fishing year, 2006–07 to 2021–22.

The distribution of tagged striped marlin weight estimates are similar for 2019–20 and 2021–22. In 2019–20, fewer fish were in the 60 and 70 kg size classes. Generally, there was a mode in the 80 kg bin, over 20% in the 90 kg size class, and few fish tagged over 130 kg (Figure 4).

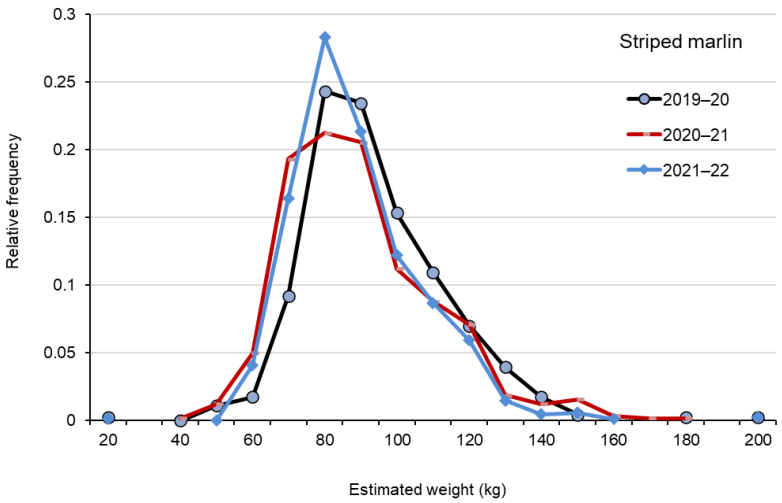

Figure 4: Comparison of the proportion by estimated weight of striped marlin tagged and released, for 2019–20 to 2021–22.

Some billfish were also tagged outside the New Zealand EEZ by NZGTP participants. For the three years since 2019–20, there were 16 blue marlin, 15 sailfish (*Istiophorus platypterus*), and 13 striped marlin tagged with New Zealand tags outside the EEZ (Appendix 1, Table A2). Due to Covid-19 border closures, travel restrictions resulted in reduced fishing effort and the number of fish tagged.

Blue marlin prefer the warmest months of February and March around northern New Zealand, whereas around 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 2019–20 was above average with blue marlin being caught in late March, just before recreational fishing was restricted.

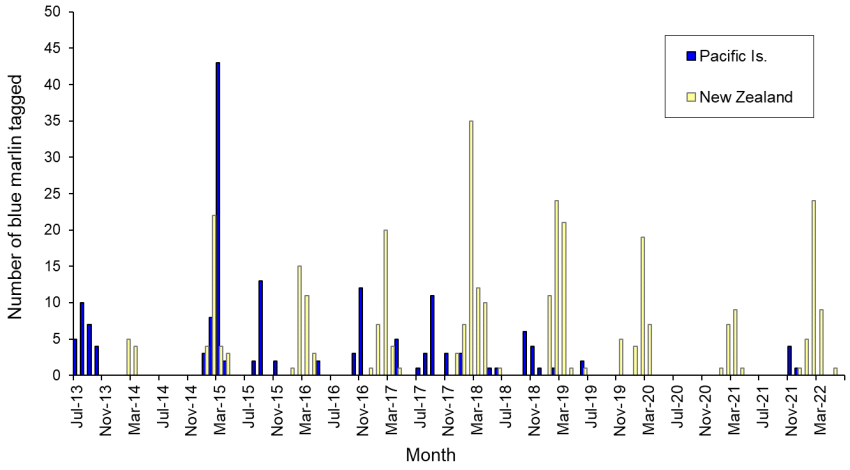

Figure 5: The number of blue marlin tagged by month around New Zealand and the Pacific Islands since July 2013.

Estimated release weights for blue marlin tagged in the three years since 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 around Tonga and Samoa are frequently less than 100 kg (Figure 6).

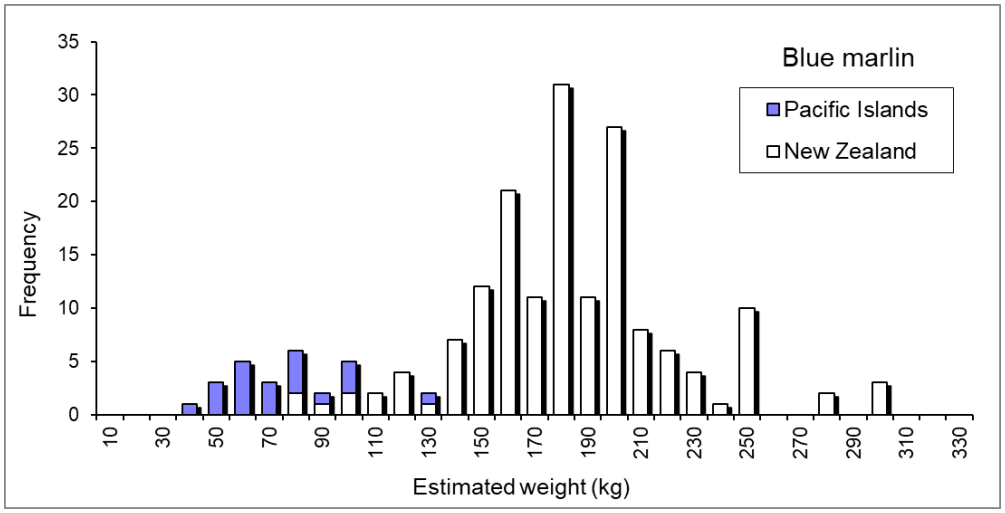

Figure 6: Weight frequency distribution of blue marlin estimated on release, 2019–20 to 2021–22.

Billfish recaptures

Seven striped marlin and two swordfish recaptures were reported for the three years from 2019–20 to 2021–22 (Figure 7). Six of the striped marlin were recaptured by New Zealand recreational anglers. One of these was the first Australian-tagged marlin recaptured in the New Zealand EEZ from the New South Wales Game Fish Tagging Program, which has been operating for 48 years. This fish was tagged off the Gold Coast and was recaptured west of Auckland after 521 days at liberty. A striped marlin tagged in the Bay of Plenty was recaptured off Fraser Island, Queensland, by a surface longline vessel after 70 days at liberty with an average displacement rate of about 20 nautical miles per day. Four striped marlin were released and recaptured in the same season after 7, 27, 28, and 79 days at liberty, respectively. Notably, one of these in-season recaptures moved from the west coast off Hokianga to the east coast off the Bay of Islands. A striped marlin caught after two years at liberty (732 days) was recaptured off the Northland west coast after being tagged off the Poor Knights Islands on the east coast (Figure 7). Both swordfish recaptures were reported by recreational anglers close to their release locations, one after 36 days and the other in the Bay of Plenty three years (1093 days) later.

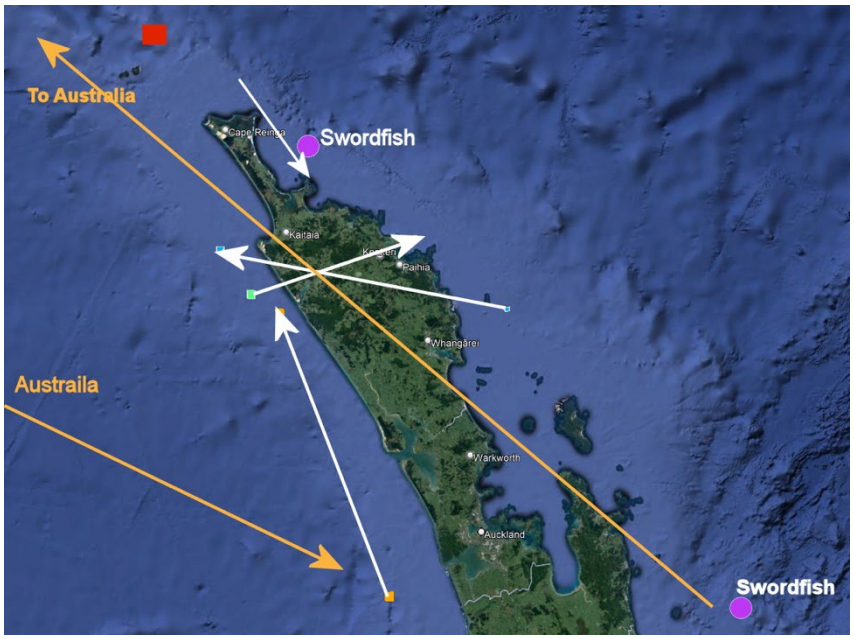

Figure 7: All billfish recaptures from 1 July 2019 to 30 June 2022 in New Zealand waters, seven striped marlin and two swordfish (purple circles) caught close to their release locations.

Movement

Based on tagging data, slight genetic differences, and spawning areas, current thinking is that the southwest Pacific striped marlin constitutes a single stock (Davies et al. 2012, Ducharme-Barth et al. 2019). Spawning occurs in the Coral Sea, the Fiji Basin, and French Polynesia (Kopf et al. 2012). Recaptures of tagged striped marlin from the NZGTP have occurred in all three areas.

Long-distance recaptures for striped marlin show a wide spread of locations across the southwest Pacific Ocean and the Tasman Sea (Figure 8). 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 ten months of release. Tag shedding is a problem with this species, which 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 had left New Zealand and were recaptured in subtropical waters during the second quarter, and many of the other recaptures in the subtropics are in the third and fourth quarters (Figure 8).

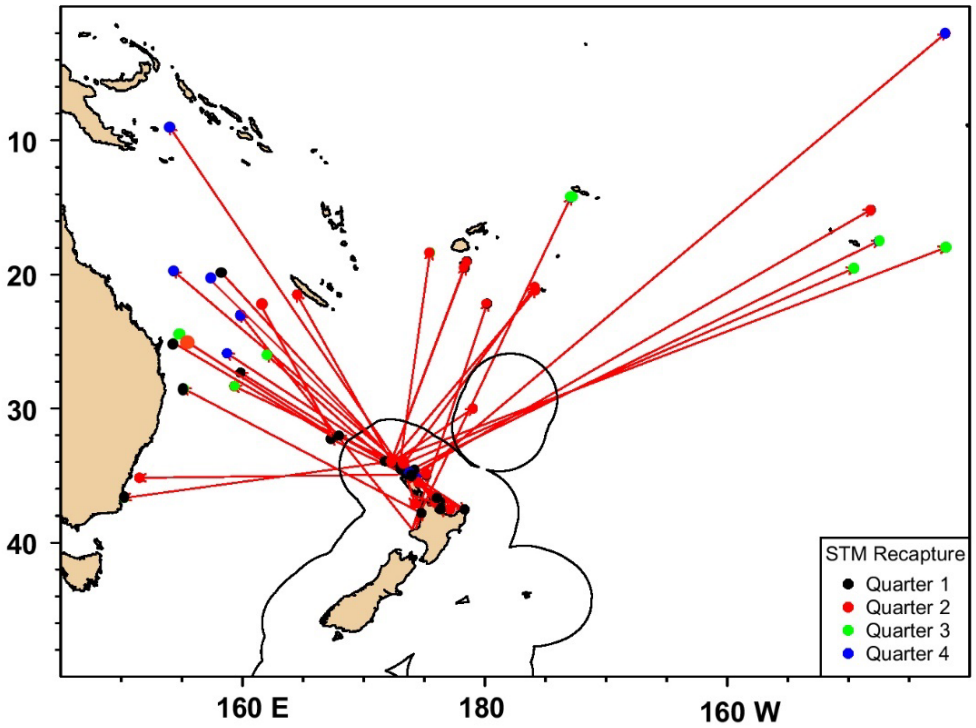

Figure 8: Long-distance movements of striped marlin (STM) in the NZGTP for all years, with recapture location colour coded by quarter (Quarter 1 = Jan-Mar).

The seasonality of recaptures by latitude has most recaptures between 34° S and 37° S from mid-January to mid-May which is week 20 in Figure 9. These fish have been recaptured around New Zealand, with two fish also in this cluster from southern New South Wales. Striped marlin have also been recaptured in subtropical waters from early May to mid-January (Figure 9). Some fish must leave New Zealand in March or April to reach these latitudes (15° S to 25° S) by May.

The displacement distance by recapture weight shows no trend for striped marlin recaptures within 1500 n.miles (Figure 10). This is not surprising because adult fish aggregate in spawning grounds in spring to early summer in subtropical waters within this range (Nakamura 1985). Most fish recaptured more than 1500 nautical miles from their release location are estimated to be 80 kg or lighter.

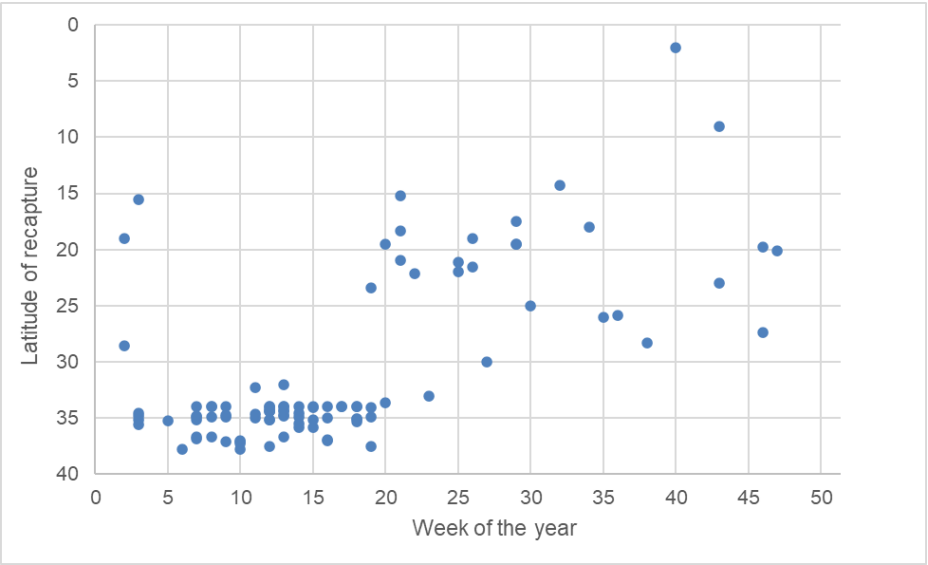

Figure 9: Striped marlin latitude of recapture by week of the calendar year.

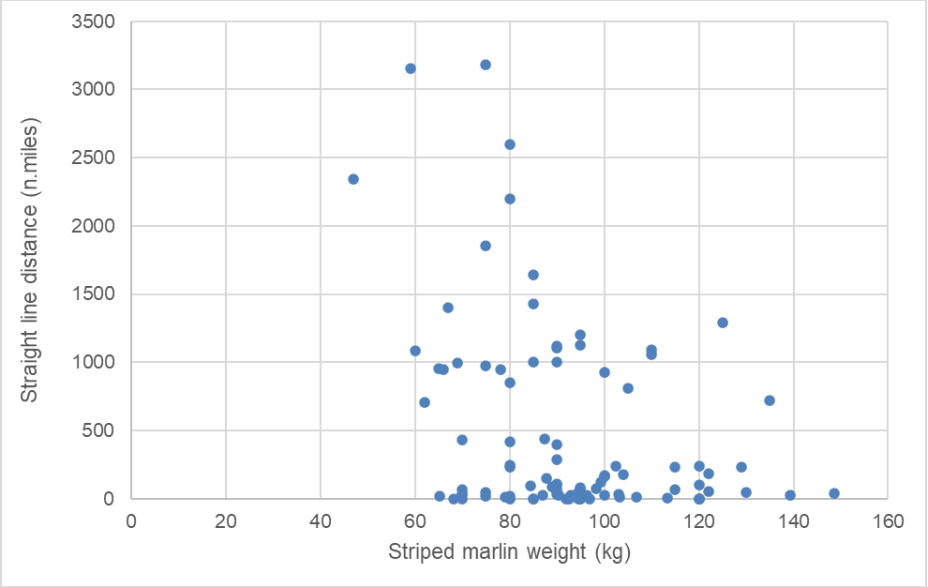

Figure 10: Striped marlin displacement distance by weight at recapture.

Blue marlin have been released with NZGTP tags from several Pacific Island countries. 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 of the release location after 158 days at liberty (Figure 11).

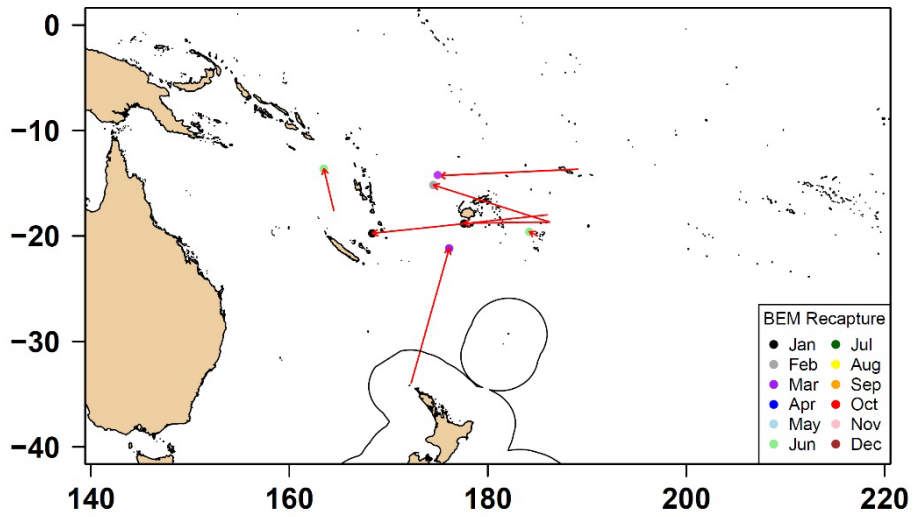

Figure 11: Long-distance movements of blue marlin (BEM) in the NZGTP for all years, with recapture location colour coded by month.

Landed catch

The 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 ten years is given in Table 2. The landed catch of striped marlin has been relatively constant, around the 10-year average of 620 fish. The exceptions are 2015–16, with 900 fish landed, and 2019–20, with 333 fish landed in a short season due to Covid-19 restrictions on marine fishing. 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 ten years. Shortbill spearfish numbers are also variable, with between 11 and 95 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. The unaccounted catch is likely to be a higher proportion of overall catch in seasons when catch rates are high and finding striped marlin is easier for less experienced fishers.

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

Table 2: The number of billfish landed from New Zealand waters and recorded by NZSFC clubs in the last ten fishing years by species, 2012–13 to 2021–22.

	Fishing year										
Species	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	Annual average
Striped marlin	744	620	696	900	516	618	507	333	627	377	594
Blue marlin	54	64	102	99	120	159	155	95	68	100	102
Shortbill spearfish	11	25	58	69	46	91	95	42	54	51	54
Swordfish	55	80	87	85	87	72	76	39	97	84	76
Black marlin	2	4	5	4	7	5	6	5	6	5	5

Of the landed billfish (other than striped marlin) in NZSFC club records since 1993–94, blue marlin has dominated the landed catch in some years, shortbill spearfish numbers have increased since 2013–14, and swordfish have been relatively consistent since 2013–14 (Figure 12).

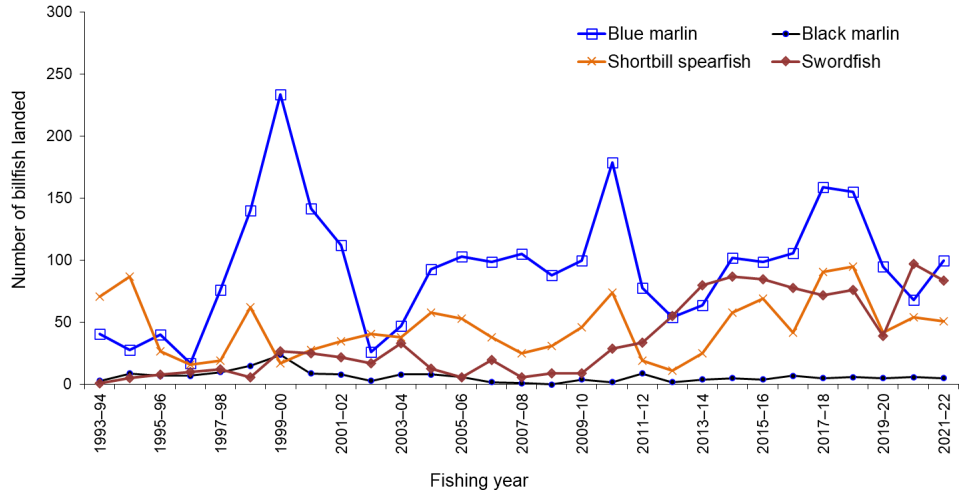

Figure 12: The number of billfish landed (excluding striped marlin) by year since 1993–94 from NZSFC records.

3.3 Pelagic sharks

The number of mako and blue sharks tagged and released inside New Zealand fisheries waters has decreased significantly since 2015–16 (Table 3). In 2020–21 just two blue sharks were tagged and released, and, in 2021–22, 29 mako sharks were tagged; these are the lowest numbers recorded for 40 years. There has been a reduction of targeted shark fishing effort off Otago but also reduced shark bycatch in inshore commercial fisheries (Peter Saul, Records Officer for NZSFC, pers. comm.). The number of bronze whaler sharks (*Carcharhinus brachyurus*) tagged has increased in recent years.

There has been one mako shark and no blue sharks tagged for this programme outside New Zealand fisheries waters between 2018–19 and 2021–22 (Appendix 2, Table A4). The recapture rate is 2.3% for tagged mako sharks and 1.8% for blue sharks.

Table 3: The number of pelagic sharks tagged in New Zealand fisheries waters and the number recaptured by fishing year since 2012–13.

	Fishing year										
Species	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	Annual average
Bronze	40	43	44	63	106	58	88	81	82	43	65
Blue	150	120	121	158	54	59	24	14	2	3	71
Hammerhead	19	27	17	52	34	27	24	17	18	9	24
Mako	536	367	424	587	331	289	217	96	92	29	297
Porbeagle	1			1		1					
Sevengill				1		1	1				
Thresher	16	11	8	17	13	6	7	3	7	12	10
Recaptures	10	8	0	4	5	5	2	0	2	4	4

The number of tagged mako and blue sharks peaked during the mid to late 1990s, then declined to a low level in the mid-2000s. Between 400 and 600 mako sharks were tagged per year from 2009–10 to 2015–16 and the number has decreased since then (Figure 13). Generally, mako sharks are caught as a bycatch of other sport fisheries, particularly off the North Island.

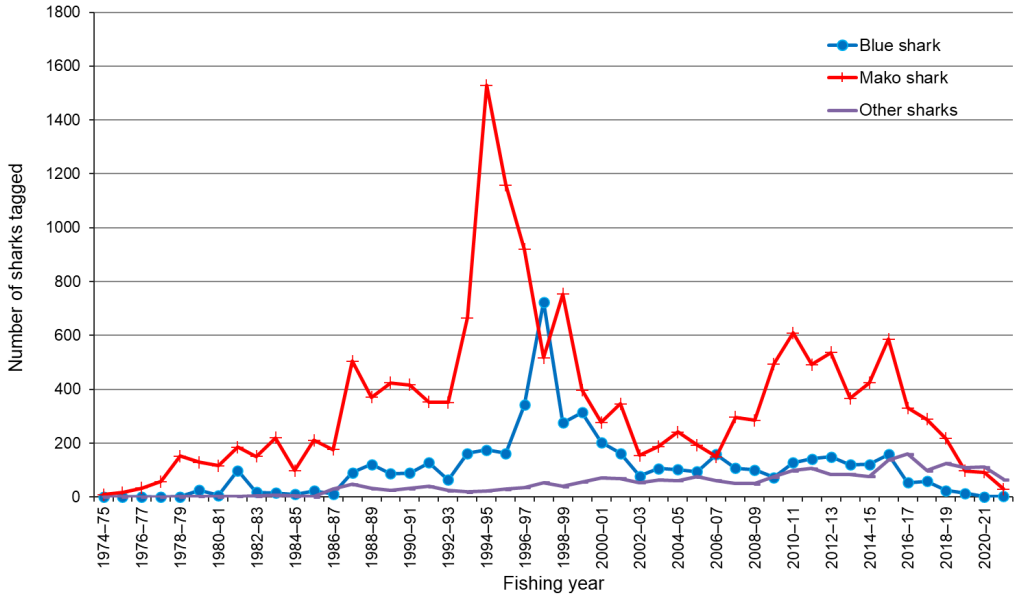

Figure 13: The number of mako and blue sharks and other shark species tagged, 1974–75 to 2021–22.

Mako sharks have been tagged in most months of the year, with the highest numbers between January and April, with a strong mode in February (Figure 14). This peak is associated with the New Zealand Sport Fishing Council Nationals Contest, which encourages the tag and release of various species. Bronze whaler sharks are mainly tagged between November and April (Figure 15).

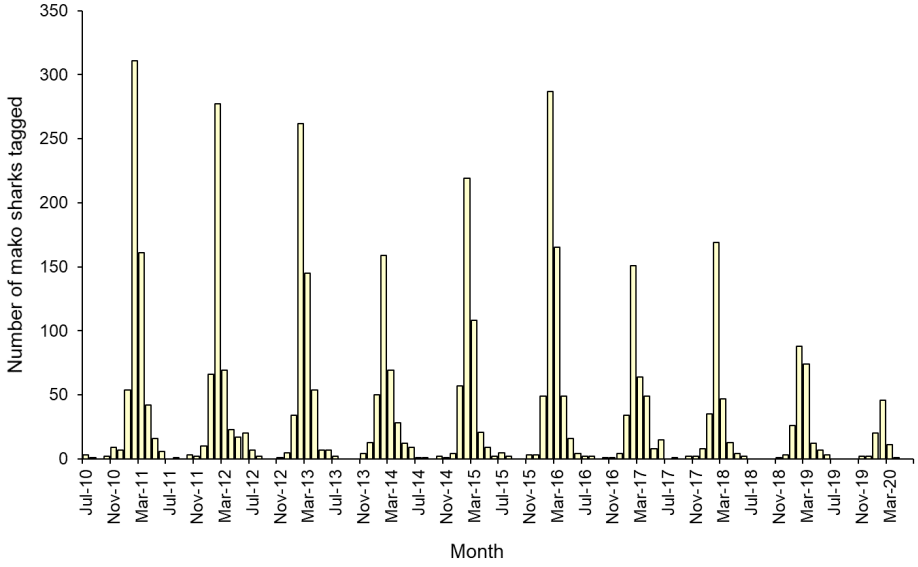

Figure 14: Number of mako sharks tagged by month since 2010–11.

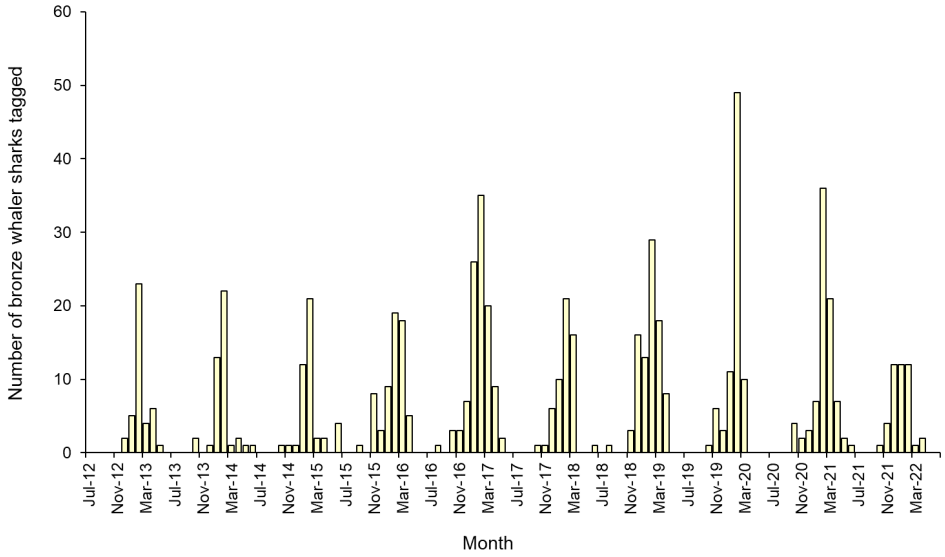

Figure 15: Number of bronze whaler sharks tagged by month since July 2012.

The number of mako sharks tagged from East Northland and off the North Island's west coast has increased in the last ten years, with fewer tagged in the Bay of Plenty and other east coast regions. Few mako sharks were tagged in any region in the 2021–22 fishing year (Figure 16).

Although mako sharks take lures when fishers target billfish and tuna, blue sharks are usually caught when fishing with baits and very seldom take artificial lures. Blue sharks were mainly caught and tagged in target fisheries off Otago and Canterbury, but those fisheries no longer operate (Figure 17). The number of bronze whaler sharks tagged and released has increased since 2014–15, particularly in the Bay of Plenty (Figure 18). Many of these were caught in Tauranga Harbour and tagged as part of a University of Waikato Master of Science project by Melissa Kellett (Kellett 2021).

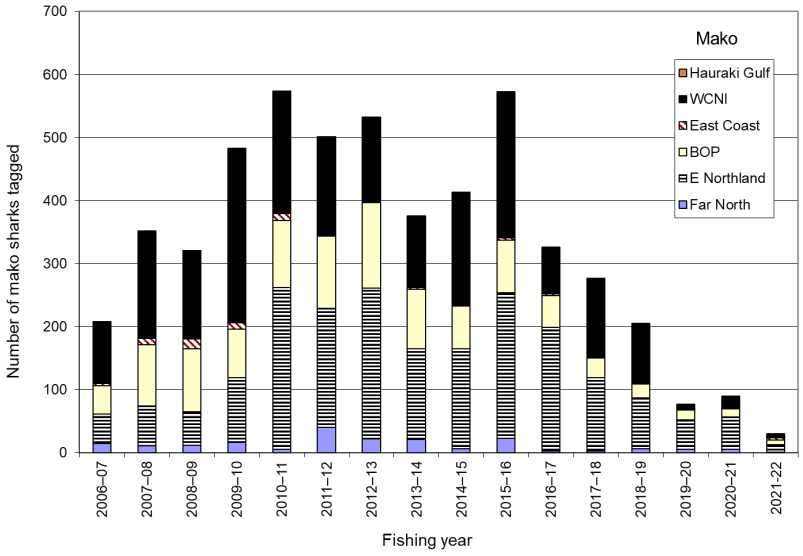

Figure 16: The number of mako sharks tagged by region and fishing year, 2006–07 to 2021–22.

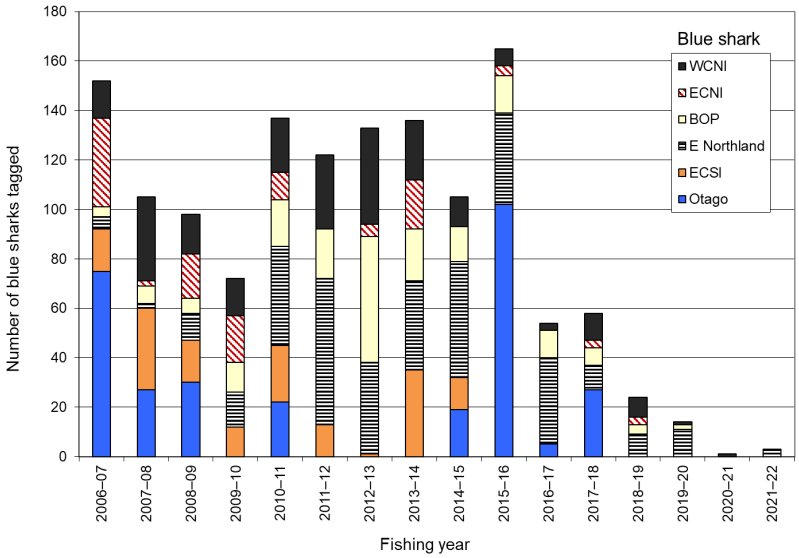

Figure 17: The number of blue sharks tagged by region and fishing year, 2006–07 to 2021–22.

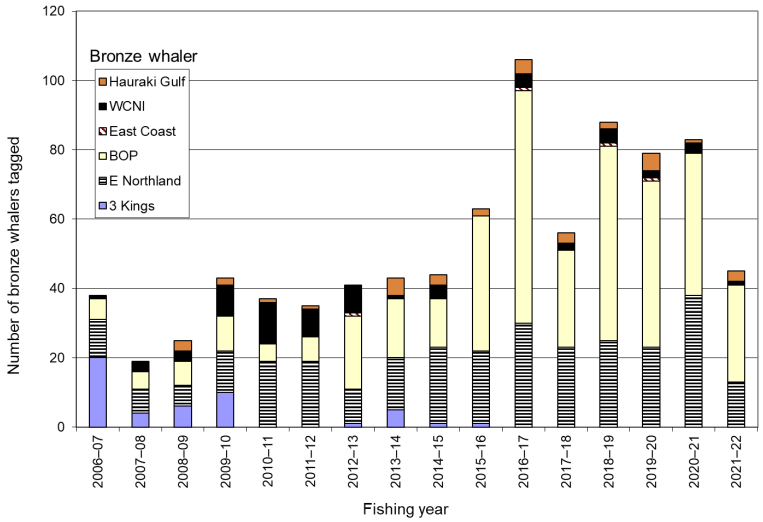

Figure 18: The number of bronze whaler sharks tagged by region and fishing year, 2006–07 to 2021–22.

Shark recaptures

There were seven mako sharks and two blue sharks with release and recapture details over the three years from 2016–17 to 2018–19, with four of the mako sharks recaptured around the Pacific Islands and one in the Bass Strait, Australia (Holdsworth & Saul 2019). There were no blue shark recaptures reported for 2019–20 to 2021–22, and one mako shark recapture was reported to CSIRO Australia without a date or location. Twenty-three bronze whaler sharks have complete release and recapture details since 1991–92. Twelve of these were recaptured close to their release locations after 32 days to three years at liberty.

Movement

Mako sharks tagged in New Zealand seldom stray into equatorial waters to the north or past French Polynesia to the east or past 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 proportion of tag recoveries reported by commercial longline fleets does not match the proportions of landings reported in the region (Ortiz et al. 2003).

To date, there have been five mako sharks recaptured after five 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 eight pups.

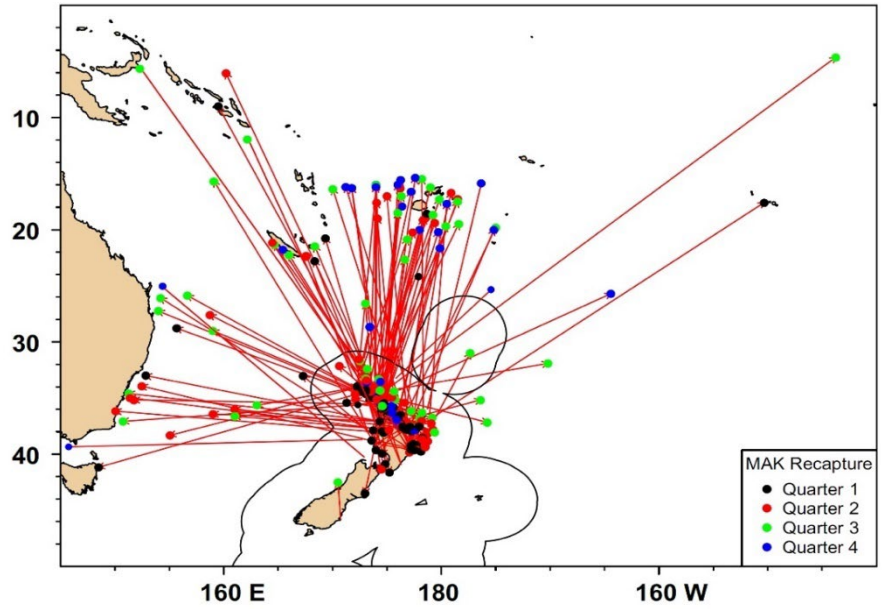

Figure 19: All release and recapture locations of mako sharks (MAK) in the NZGTP, with recapture location colour coded by quarter (Quarter 1 = Jan-Mar).

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. Mako and blue sharks are mostly tagged in summer months and recaptures have been recorded close to their release locations in following summer seasons up to three years later (Figure 21). The number of recaptures declines each year after release with 5% of mako recaptures and 4% of blue shark recaptures after 3 years (1095 days) at liberty.

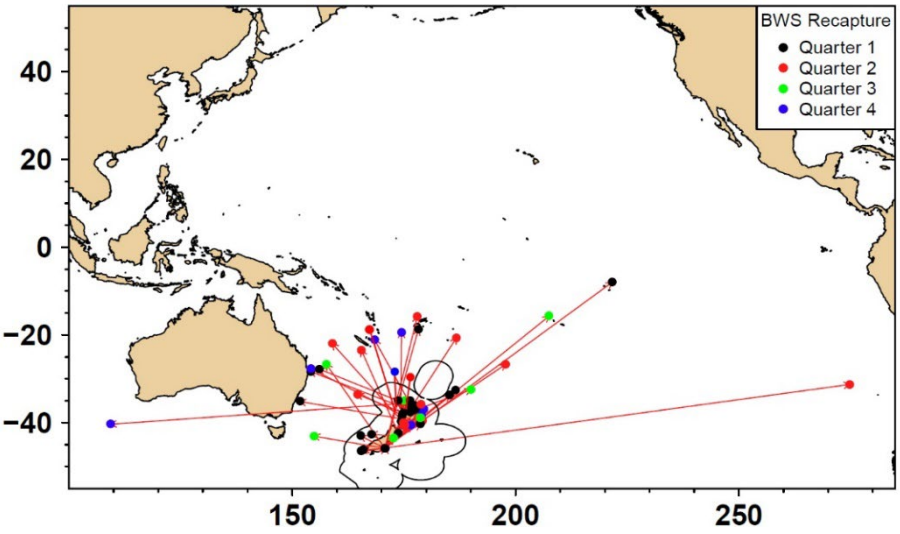

Figure 20: All release and recapture locations of blue sharks (BWS) in the NZGTP, with recapture location colour coded by quarter (Quarter 1 = Jan-Mar).

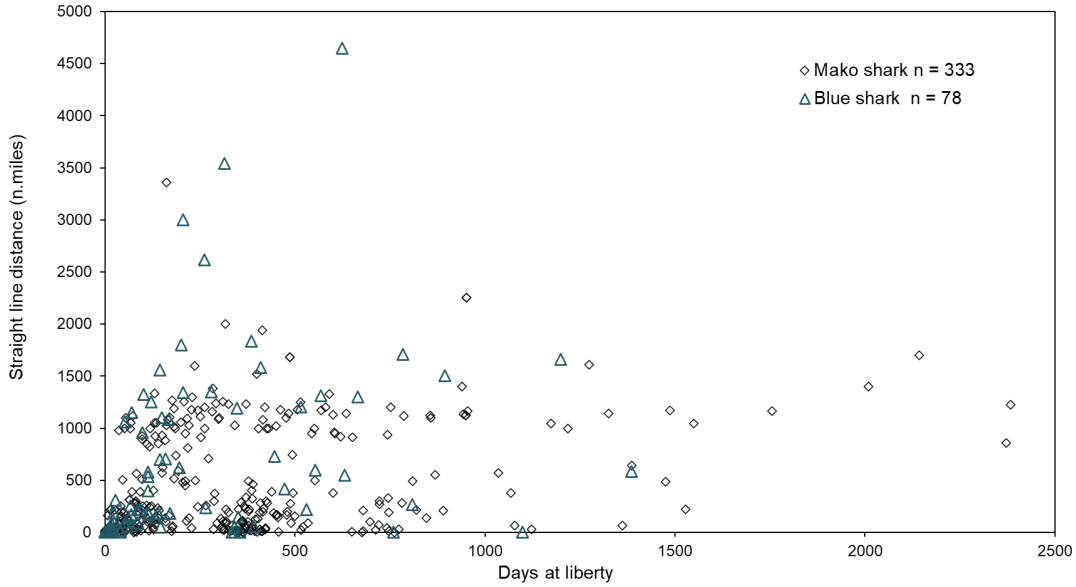

Figure 21: Mako shark and blue shark displacement distance by days at liberty.

Most bronze whaler sharks are tagged in the northern region of New Zealand, and recapture locations are mainly in coastal areas (Figure 22), though one was recaptured in Australia, one in the Coral Sea, and one in the EEZ of Tuvalu. There were eight bronze whaler sharks recaptured close to their release locations after one or two years, and, although three of four bronze whaler sharks with displacement distances between 100 and 250 nautical miles were 200 kg or heavier (Figure 23), the longest distance movements were for sharks of 50 and 100 kg (not plotted).

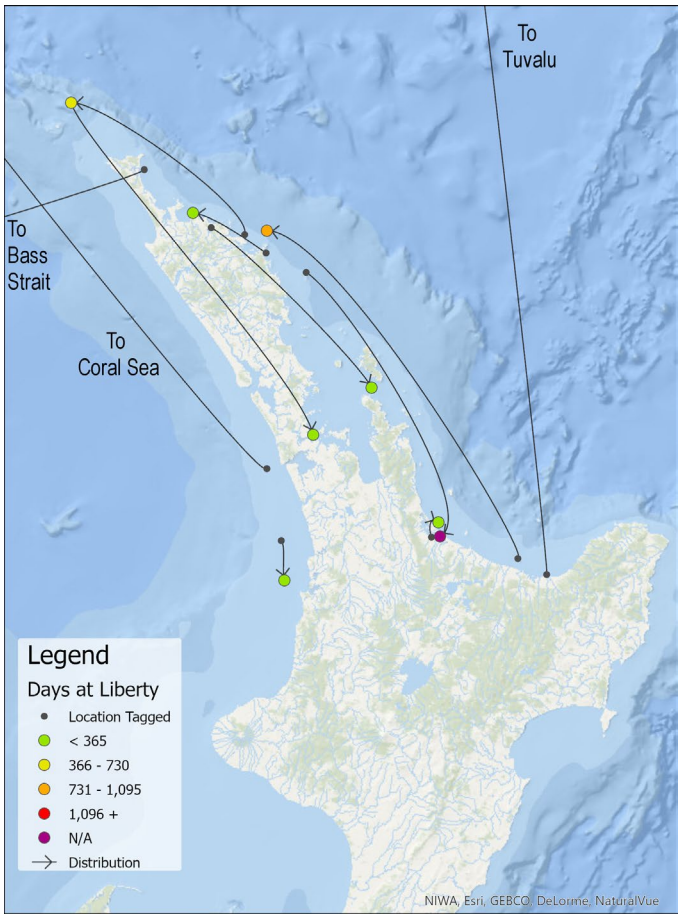

Figure 22: Bronze whaler shark release and recapture locations with displacement more than 10 nautical miles.

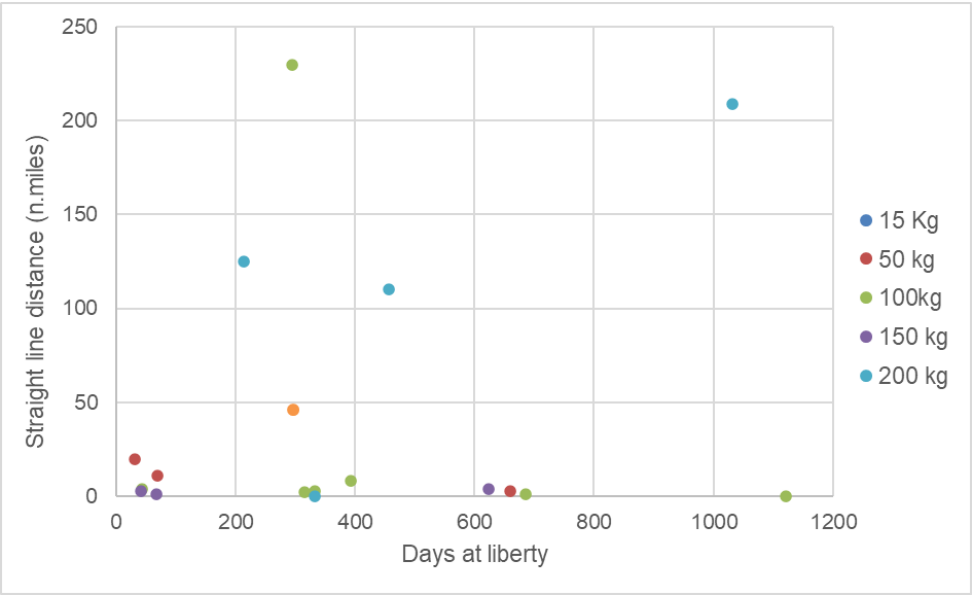

Figure 23: Bronze whaler shark displacement distance by days at liberty and weight on release, all years truncated at 250 nautical miles (n.miles). Not shown are a 50 kg bronze whaler recaptured in Bass Strait after 671 days and a 100 kg bronze whaler recaptured off Tuvalu—a distance of 1800 nautical miles after 2445 days at liberty.

Landed sharks

In the 1990s, mako and blue sharks 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 and was in single digits for 2019–20 to 2021–22 (Figure 24). The NZSFC introduced a minimum weight of 40 kg in 1993 for sharks to qualify to be weighed in their contests and encouraged clubs to apply their own minimum weights for landed sharks. Over the last 15 years, many clubs have removed prizes for landed sharks altogether as attitudes toward sharks have changed.

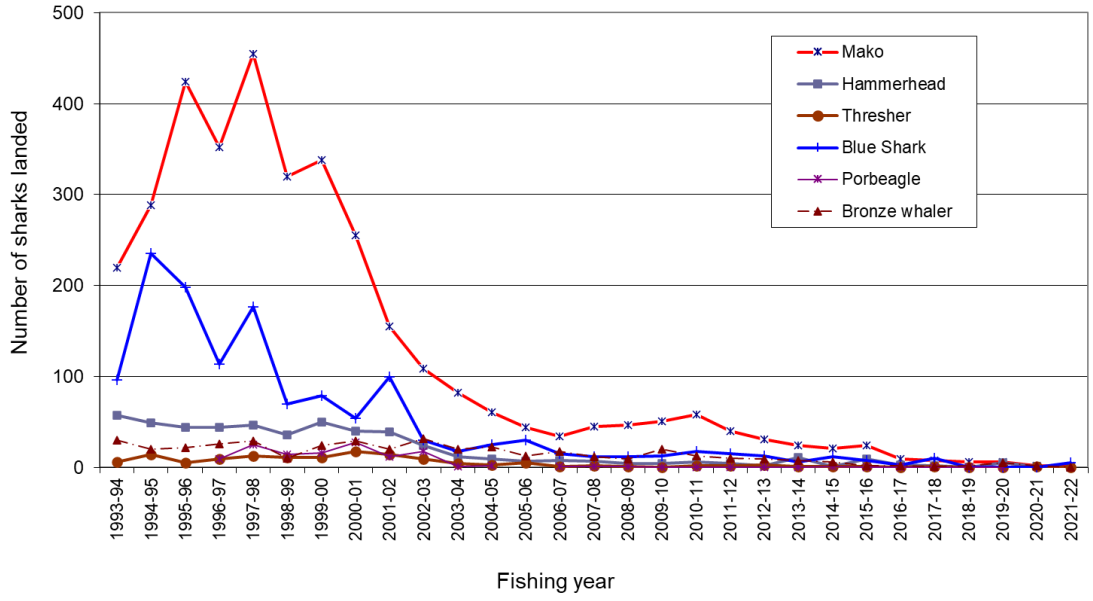

Figure 24: Number of sharks landed and recorded by New Zealand Sport Fishing Council clubs, by species since 1993–94.

3.4 Yellowtail kingfish

Yellowtail kingfish have been an important component of the NZGTP since its inception; they are available year-round in New Zealand waters and tolerate handling and retain tags well. Although they come second behind striped marlin as the most tagged species in the programme, they make up 70% of all recaptures.

The number of kingfish tagged with gamefish tags has declined since 2016–19 (Table 4). The retirement of some leading charter skippers who have long supported kingfish tagging has reduced the number of releases and recaptures. A kingfish ageing study in 2015 encouraged selected 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 sand flats. They have deployed 465 dart tags (PDAT) with an overall recapture rate of 9.5%. The Deepwater Group have supplied PIMA tags to observers and crews for kingfish they release from trawl vessels targeting jack mackerel. Over the three years to 30 June 2022, they have tagged 413 kingfish off the west coast of the North and South Islands.

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 25).

Table 4: The number of yellowtail kingfish tagged and the number recaptured by tag type over the last ten fishing years.

	Fishing year										
	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	Annual average
Gamefish tag releases	760	654	720	608	598	549	561	130	127	100	481
Dart & PIMA tag releases				12	229	66	63	26	245	237	125
Total releases	760	654	720	620	827	615	624	156	372	337	569
Gamefish tag recaptures	41	34	28	23	30	22	33	19	11	9	25
Dart & PIMA tag recaptures					3	14	12	11	2	4	8
Total recaptures	41	34	28	23	33	36	45	30	13	13	30

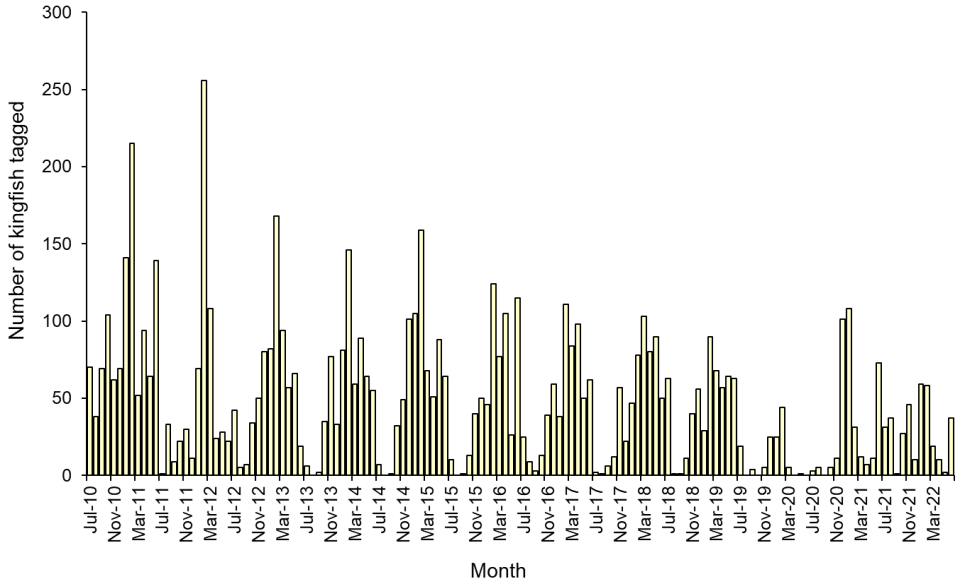

Figure 25: The number of yellowtail kingfish released with gamefish tags by month since 2010–11.

The number of kingfish tagged and released across all regions has decreased since 2009–10. Covid-19 restrictions reduced fishing efforts in 2019–20, and the increase in the number tagged off the North Island's west coast (WCNI) since 2020–21 is from fish released by the jack mackerel trawl vessels (Figure 26).

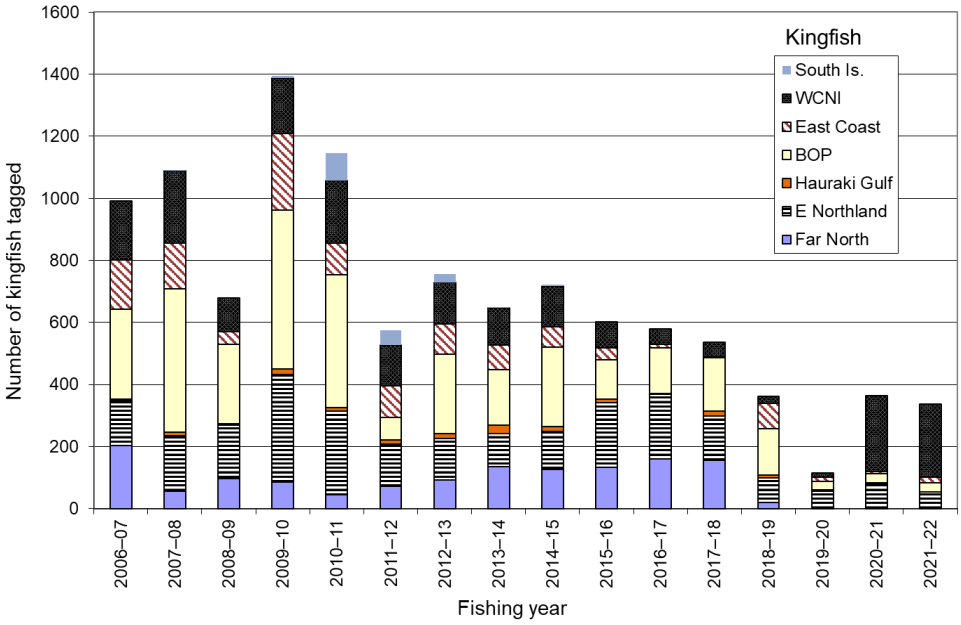

Figure 26: The number of yellowtail kingfish tagged by region and fishing year, 2006–07 to 2021–22.

The length frequency distribution of tagged kingfish since 2019–20 shows a high proportion of tagged fish were 80 to 94 cm, mainly released with the PIMA or dart tags. Most of the kingfish over 110 cm were tagged with the larger gamefish tags (Figure 27). Fishers have been discouraged from tagging kingfish under the recreational minimum legal size of 75 cm with gamefish tags. The use of the smaller dart and PIMA kingfish tags has increased the number of fish under 75 cm tagged and released (Figure 27).

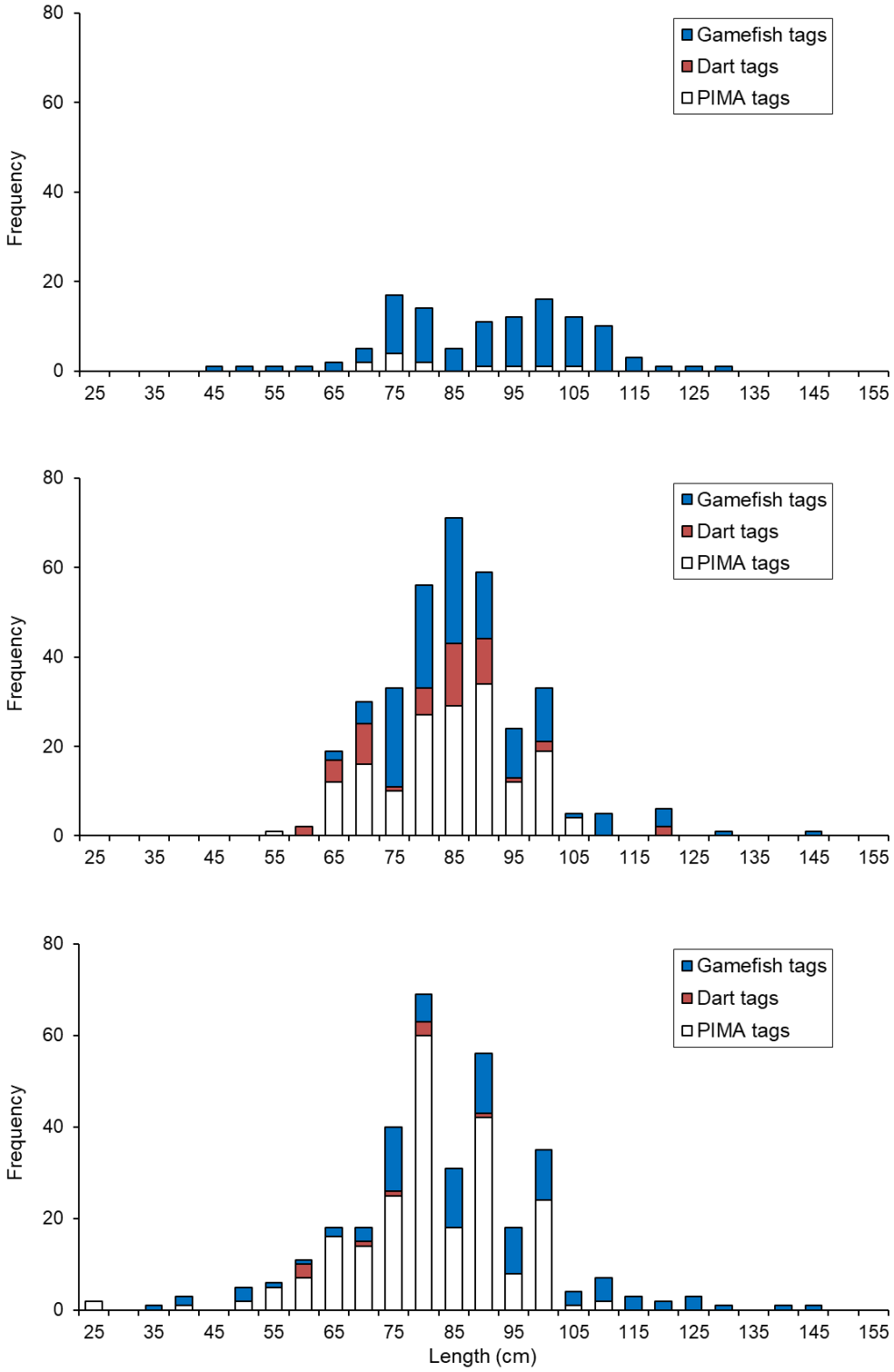

Figure 27: Yellowtail kingfish length frequency distributions for released fish, fish measured (white bars), and those with estimated lengths (blue bars), for 2019–20 (top), 2020–21 (middle), and 2021–22 (bottom).

Kingfish recaptures

There were 34 records for tagged kingfish with release and recapture details for 2019–20 to 2021–22. Most recaptures were made close to release locations, and 12 fish moved more than 40 nautical miles. Two kingfish from the Three Kings Islands area and two from off the lower west coast of the North Island were recaptured in the Bay of Plenty and Hauraki Gulf, respectively. A kingfish tagged off Raglan on the west

coast of the North Island in February 2018 was recaptured off Yamba, northern New South Wales, in September 2021. This fish measured 97 cm on release and 108.7 cm on recapture after 1296 days at liberty.

A kingfish 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 Rangitira Reef, Bay of Plenty, in January 2000 when it measured 98 cm. It was recaptured 27 nautical miles away in November 2019 after 19 years and ten months (7247 days) 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.

Over the last ten years 234 tagged kingfish with release and recapture details have been reported, with 35 (15%) of these recaptured more than 40 nautical miles from their release location. Most kingfish have been tagged and recaptured off the east coast of the North Island and an increase in the number of kingfish tagged off the west coast of the North Island in the last five years has resulted in more recaptures there (Figure 28). There have been six kingfish that moved from the east coast to the west coast and five from the west coast to the east coast in the last 10 years.

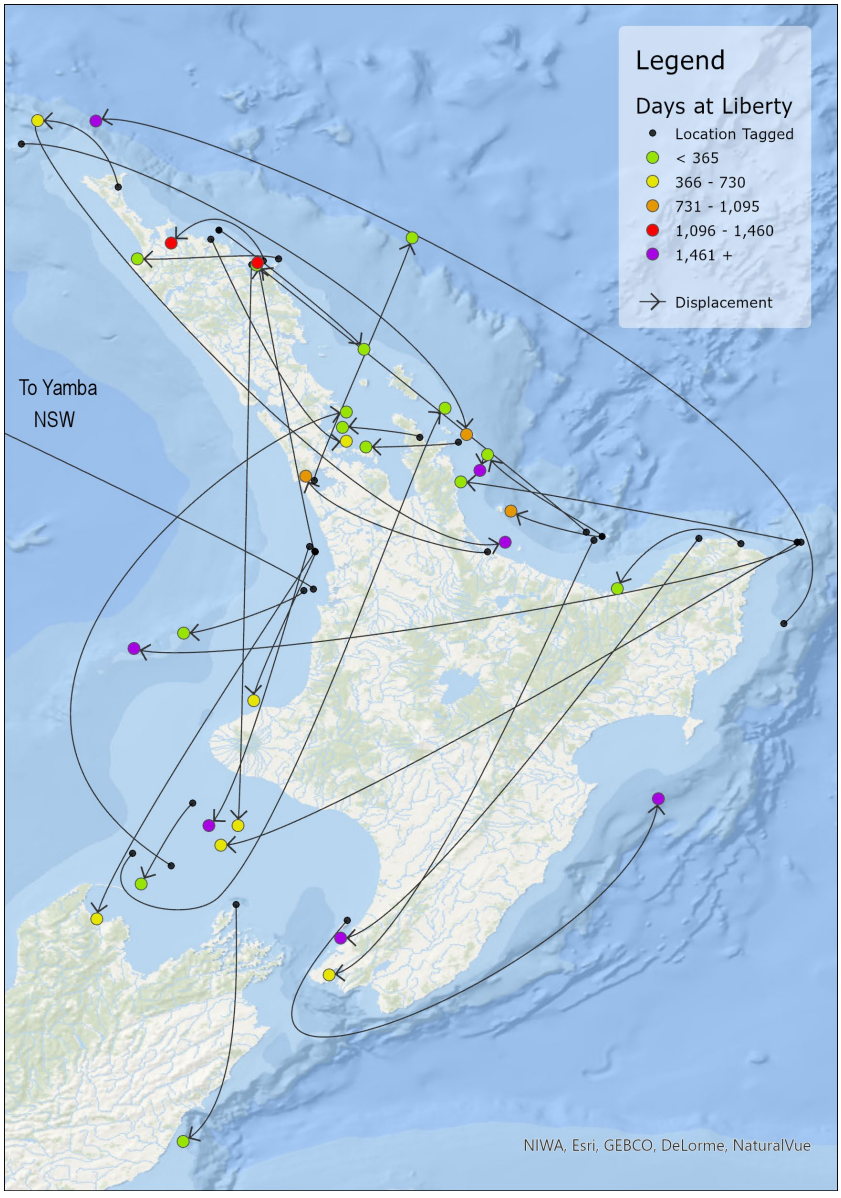

Figure 28: Yellowtail kingfish release and recapture locations with displacement more than 40 nautical miles for the period 2012–13 to 2021–22.

Movement

Most kingfish are recaptured close to their release location even after many years (Figure 29). Ninety-four percent of recaptures at liberty for 30 days or more were within 100 nautical miles of the release point. Movements between the 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 four fish tagged in New Zealand and recaptured in New South Wales, Australia. Recaptures have also been reported from Lord Howe Island and Wanganella Bank northwest of the North Island.

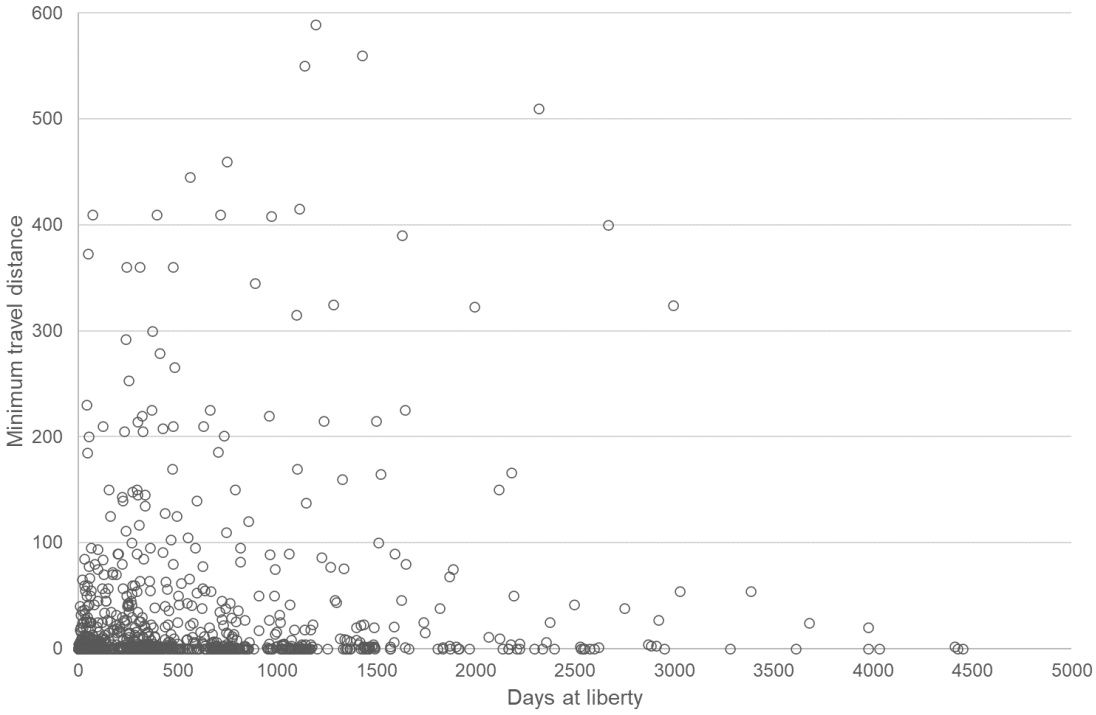

Figure 29: Kingfish displacement distance by days at liberty, all years truncated at 600 nautical miles and 5000 days.

3.5 Tuna

The availability of yellowfin tuna to recreational and commercial fishers in New Zealand has been variable over the last 30 years. 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 5).

The number of Pacific bluefin tagged in the winter target recreational fishery off the South Island west coast has declined significantly from a peak of 41 in 2007–08. A satellite tagging programme sponsored by Stanford University, University of Auckland, Ministry of Fisheries (now Fisheries New Zealand), 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 six months was problematic due to attachment failures.

The number of southern bluefin tuna released by recreational fishers and the number tagged is increasing as interest and catch increase. In 2021–22, 71 southern bluefin tuna were tagged, but the ten-year annual average is just 14 (Table 5).

Table 5: The number of tuna tagged and released over the last ten fishing years.

Species	Fishing year 2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	Annual average
Bigeye			2	1						4	
Pacific bluefin	5	4	2								1
Southern bluefin	1	1	7	4	5	13	2	4	31	71	14
Yellowfin		1	13	63	2	7	6	24	21	10	15

Tuna recaptures

There were no yellowfin or Pacific bluefin tuna recaptures for 2019–20 to 2021–22. In previous years there have been twelve recaptures reported from New Zealand waters, the Tasman Sea, and near Fiji (Figure 30).

One southern bluefin tuna with an NZGTP tag was recaptured in the Bay of Plenty on a surface longline in June 2021, but no tag release information was reported. Recreational fishers from the eastern Bay of Plenty reported two long-term recaptures with Australian tags. The first was a data recording archival tag from a southern bluefin tuna recaptured in 2019. This 120 cm fish was caught by a surface longline vessel northeast of North Cape in August 2008, and the tag was inserted into the gut cavity with a sensor stalk sampling external light levels and water temperature. One or more of the sensors often fail within the first year or two. In this fish, all the tag sensors (depth, light level, water temperature, internal body temperature) remained intact throughout the four-year duration of battery power. Over that time, the fish remained in the Tasman Sea or east of New Zealand between 32° S and 48° S latitude. In 2019 this fish weighed 82.6 kg and measured 167 cm.

An 86 cm southern bluefin tuna was double tagged off Francis Island, South Australia, in January 2007. This fish was two years old when tagged and weighed 93.4 kg, and it measured 175 cm when recaptured 15 years and 5 months later in June 2022 off Cape Runaway. The otoliths were collected from this fish for ageing.

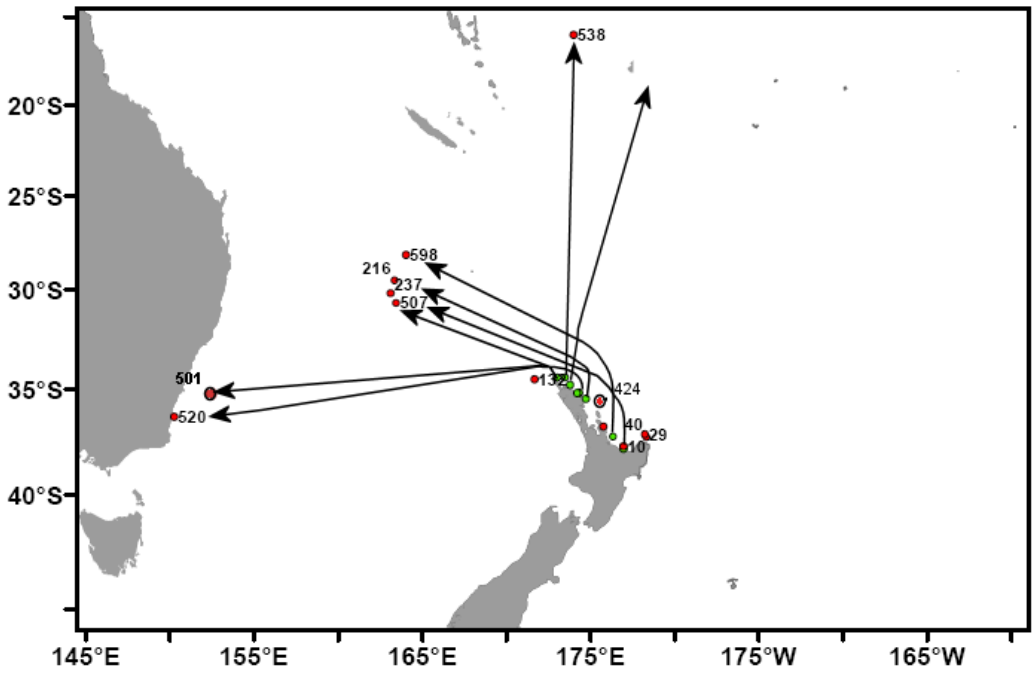

Figure 30: Yellowfin tuna release and recapture locations with days at liberty by recapture location.

Landed Tuna

The total landed catch of yellowfin from NZSFC clubs and NZGTP records show the decline in recreational catch since the mid-1990s, with six years of very low catches from 2008–09 (Figure 31). The large target fishery that was a feature of the sport fishery in the Bay of Plenty has switched to target marlin and other gamefish. The number of albacore landed and weighed by clubs shows no obvious trend with an average around 740 fish per year (Figure 31). Most of the albacore catch is reported from clubs from the Bay of Plenty south on the east and west coasts. The number of southern bluefin tuna weighed by clubs has increased since the North Island winter fishery developed in 2017.

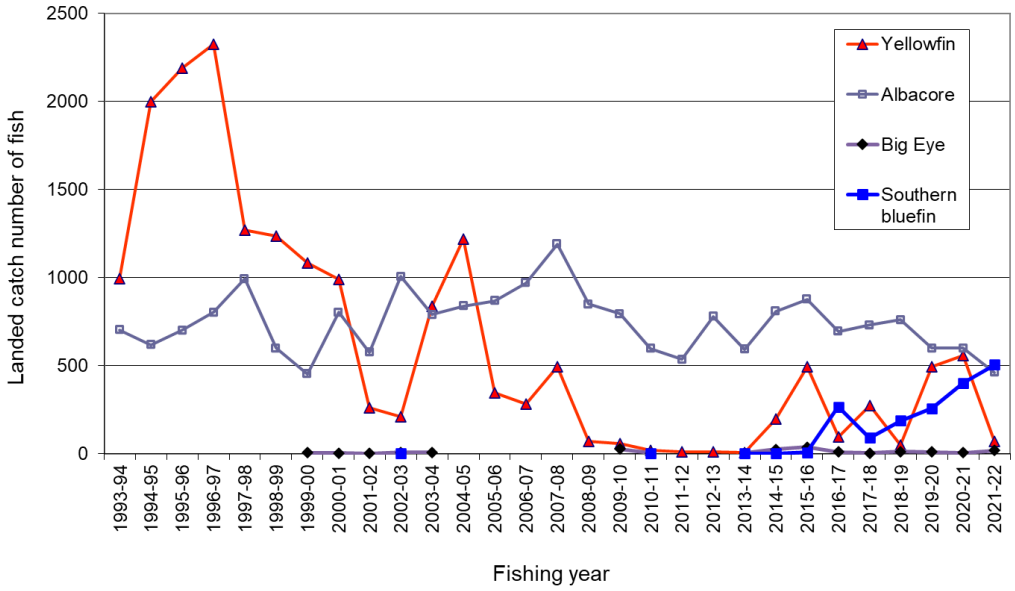

Figure 31: The number of landed tuna recorded by NZSFC clubs since 1993–94.

4. DISCUSSION

The recreational fishery for most highly migratory species included in the NZGTP occurs in the months with the warmest sea surface temperatures from January to May. On 23 March 2020, the New Zealand government introduced Covid-19 restrictions. Recreational fishers were not allowed on the water under level 4 restrictions, which ended on 27 April, nor under level 3, which ended on 12 May. By then, the extended spell of calm weather had ended, and the summer gamefish season was effectively over. The number of gamefish caught was reduced for many species in 2020.

Billfish tag and release has been a focus of the NZGTP since the introduction of the billfish moratorium in 1987 and the Minister's challenge to recreational fishers to tag 50% of the striped marlin catch. The ten-year average tally of striped marlin tagged and released for the NZGTP is 802, and the landed catch is 620 fish based on NZSFC records. Although a high proportion of marlin catch by club members and non-members are weighed and recorded, there has been a trend for fishers to not weigh their fish and to process it themselves. At the same time discussion on social media reveals that, for some fishers, recognition of catch is not important, and marlin are being released without tags. Fishers can now report gamefish catch, landed or released, on the www.fishcatch.co.nz web form to help collect data not reported through fishing clubs.

There is a bycatch of striped marlin (required to be released) from surface longline vessels in New Zealand. The reported average annual catch between 2015–16 and 2020–21 was 230 per year. Striped marlin longline catch is mainly caught when fishers are off the north coast of the North Island targeting swordfish and bigeye tuna (Tremblay-Boyer 2021). In the warmer months, the longline bycatch has extended down the west coast of the South Island and increasing sea surface temperatures may have impacted the

distribution of striped marlin captures. Fisheries observers reported an average of 61.4% of striped marlin were released alive from observed sets from 2003–04 to 2018–19. The proportion released alive is higher (between 52.9% and 85.7%) for domestic vessels over recent years (Tremblay-Boyer 2021).

An analysis of electronic tagging data found the majority of istiophorid billfish (marlins) survive when released from recreational and longline fishing gear, implying catch and release is a viable management option that permits fishing activity while protecting parental biomass and the fishery (Musyl et al. 2015). For striped marlin, post-release mortality was estimated at 14.5% for recreational and commercial catches on circle hooks.

Most tagged striped marlin have been recaptured within 10 months of release in the NZGTP and other conventional tagging programmes. 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). Many of the long-term striped marlin tag recaptures have been from broken tags with just the tag anchor and short end tag number remaining.

Striped marlin spawning in the southwestern Pacific region 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. There have been 32 790 striped marlin tagged and released in the New South Wales Department for Primary Industries Game Fish Tagging Program from 1974 to 2021. This programme has recorded 283 striped marlin recaptures with just nine recaptured more than one year after release. Movement records are predominantly north and south in the western Tasman Sea and Coral Sea (Anon. 2022). The first recapture of an Australian tagged striped marlin in New Zealand waters was made in February 2021.

Yellowtail kingfish have made up a significant proportion of the fish released (31%) and recaptured (70%) in the NZGTP. They are available year-round and have been a major target species for amateur charter boat operators, particularly around offshore islands and reef systems. While some kingfish move large distances there is also a high degree of residency at the targeted offshore areas which is reflected in a high recapture rate of 6.6%. There has been an increase in the number of private boats targeting gamefish and fewer long-range amateur charter vessels over the last 10 years. The number of large kingfish tagged at offshore locations has declined and data on kingfish tagged by fly fishers in harbours and sand flats have been integrated into the NZGTP. The largest numbers of kingfish tagged and released in 2020–21 and 2021–22 were from observers and crew members on the jack mackerel trawl vessels fishing west off central New Zealand. We have not recorded any recaptures on those trawl vessels, but, surprisingly, of the three recaptures by recreational fishers one was in the Hauraki Gulf and another just east of there, at Cuvier Island.

There has been increased tagging and recaptures of whaler sharks (genus *Carcharhinus*) in the last 10 years. Given the tagging locations of most of these in harbours and inshore waters, most of these sharks will be bronze whalers. These are a widespread amphitemperate species which has yet to have confirmed identification from tropical regions, where a number of similar species are common. A whaler shark tagged in January off Opotiki that was recaptured in the open ocean west of Tuvalu (8° S latitude) is an interesting record but may have been a dusky shark (*Carcharhinus obscurus*) which has been recorded in Northland and Bay of Plenty (Roberts et al. 2015).

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. 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. This Fisheries New Zealand project ensures that the information is documented and used. It funds data management, recapture rewards, analysis, and inclusion of this information in New Zealand's annual fisheries plenary reports, reports to the Western and Central Pacific Fisheries Commission, and Fisheries Assessment Reports such as this.

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 or info@fish.govt.nz. Gamefish catch information, whether landed, released, or recaptured can be entered on the website fishtagnz.co.nz or posted to:

Gamefish Tagging
Fisheries New Zealand
PO Box 53030
Auckland 2150

5. ACKNOWLEDGEMENTS

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APPENDIX 1

Table A1: Number of fish tagged and released by species and season in the New Zealand EEZ. Species codes are given in Table A2.

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	1115	602	103	21	733	37	15		10	2 843
2011–12	49	3	142	617	492	105	5	663	51	18		19	2 164
2012–13	15	3	150	760	537	85		858	47	5		4	2 464
2013–14	9	4	120	654	367	85	6	520	38	4	1	2	1 810
2014–15	33	7	122	720	424	77	12	1 088	34	2	13	13	2 545
2015–16	36	5	158	620	587	138	26	1 658	29		63	10	3 330
2016–17	35	4	54	827	331	161	12	517	31		2	10	1 984
2017–18	72	5	59	615	289	100	24	730	62		7	14	1 977
2018–19	62	3	24	624	217	126	35	649	22		6	2	1 770
2019–20	38	1	14	156	97	109	9	424	20		26	5	899
2020–21	30	3	2	374	92	112	10	805	39		21	33	1 521
2021–22	39	1	3	337	30	67	15	891	18		10	87	1 498
Total	849	74	5 116	25 499	16 612	2 419	362	28 358	635	146	1 393	922	82 385

Table A2: Fisheries New Zealand species codes used in Tables A1, A3, and A4.

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 A3: 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
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						6		133	1			176
2013–14	29						4	2	267			2	304
2014–15	59	1			2		5	1	234				302
2015–16	23	18				1	2	2	134			1	181
2016–17	20	2					8		168				198
2017–18	27						11	5	92				135
2018–19	16					1	11		96			2	126
2019–20	6						9		2				17
2020–21	5						5	1	10				21
2021–22	5						1		1				7
Total	863	68		3	7	5	211	34	1 676	5	53	47	2 972

APPENDIX 2

Table A4: Number of fish recaptured by species and season by species for all areas.

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	41	3	2		3					51
1993–94			1	53	10	5		4			1		74
1994–95			2	83	16			6				1	108
1995–96		1	1	74	32	1		6			3	1	119
1996–97			4	46	35	2		5			1	1	94
1997–98	1		9	27	17	2		12			1	1	70
1998–99			11	21	15	4		14					65
1999–00	1		11	54	24	5		5				2	102
2000–01	1		5	30	16	4		2			1	2	61
2001–02			2	47	14	1		2	1				67
2002–03	2			27	9	2		1				1	42
2003–04			2	32	9	2		4	1		2		52
2004–05			3	39	6			4			2		54
2005–06	1			51	2	2		1			1		58
2006–07	1		2	39		1					1	1	45
2007–08			3	54	3	2	1	3			1		67
2008–09			4	45	8	2		3		2			64
2009–10			3	49	6	1		2				2	63
2010–11	1		4	54	6	2		1		1			69
2011–12			4	45	10				1	1			61
2012–13			3	41	10	2		4					60
2013–14			3	34	6	2		3	1			1	50
2014–15				28				2					30
2015–16				23	2	4		6	1				36
2016–17			1	33	3	2		2	1				42
2017–18			1	37	4	2		3	1				48
2018–19				45		4		3					52
2019–20				30								1	31
2020–21				13	1	1		4	1			1	21
2021–22				13		5		2	1			1	22
Total	8	1	90	1 682	374	78	1	111	9	4	15	27	2 400