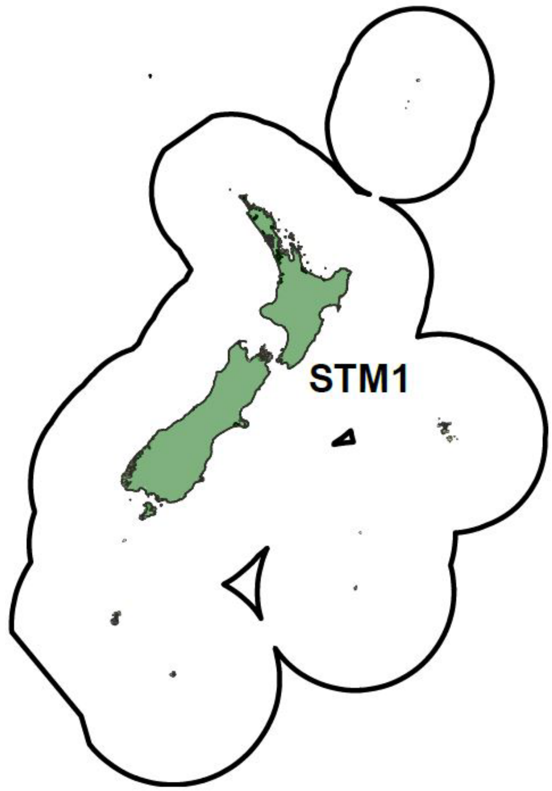
# STRIPED MARLIN (STM)

(*Kajikia audax*)




## 1. FISHERY SUMMARY

All marlin species are currently managed outside the Quota Management System.

Management of the striped marlin and other highly migratory pelagic species throughout the western and central Pacific Ocean (WCPO) is the responsibility of the Western and Central Pacific Fisheries Commission (WCPFC). Under this regional convention, New Zealand is responsible for ensuring that the fisheries management measures applied within New Zealand fisheries waters are compatible with those of the Commission.

At its third annual meeting (2006) the WCPFC passed a Conservation and Management Measure (CMM) (this is a binding measure that all parties must abide by) relating to conservation and management of striped marlin in the south-west Pacific Ocean (CMM 2006-04). This measure restricts the number of vessels a state can have targeting striped marlin on the high seas. However, this does not apply to those coastal states (including New Zealand) south of 15° S in the Convention Area who have already taken, and continue to take, significant steps to address concerns over the status of striped marlin in the south-western Pacific region, through the establishment of a commercial moratorium on the landing of striped marlin caught within waters under their national jurisdiction.

### 1.1 Commercial fisheries

Most of the commercial striped marlin catch in the south-west Pacific is caught in the tuna surface longline fishery, which started in 1952, and in the New Zealand region from 1956. Since 1980 foreign fishing vessels had to obtain a licence to fish in New Zealand's EEZ and were required to provide records of catch and effort. New Zealand domestic vessels commenced fishing with surface longlines in 1989 and the number of vessels and the fishing effort expanded rapidly during the 1990s. Also in 1989, licences were issued to charter up to five Japanese surface longline vessels to fish on behalf of New Zealand companies. The Japanese charter vessels ceased fishing from May 2016 due to changes in New Zealand government legislation. Very few striped marlin are caught by other commercial methods, although there are occasional reports of striped marlin caught in purse seine nets.

A three-year billfish moratorium was introduced in October 1987 in response to concerns over the decline in availability of striped marlin to recreational fishers. The moratorium prohibited access to the Auckland Fisheries Management Area (AFMA: Tirua Point to Cape Runaway) by foreign licensed and chartered tuna longline vessels between 1 October and 31 May each year. Licence restrictions required that all billfish, including broadbill swordfish, caught in the AFMA be released. In 1990, the moratorium was renewed for a further three years with some amended conditions and it was reviewed and extended in 1993 for a further year.

Regulations have prohibited domestic commercial fishing vessels from retaining billfish caught within the AFMA since 1988. In 1991 these regulations were amended to allow the retention of broadbill swordfish and prohibited the retention of marlin species (striped, blue, and black marlin) by commercial fishers in New Zealand fishery waters. These regulations, and government policy changes on the access rights of foreign licensed surface longline vessels, have replaced the billfish moratorium. A billfish memorandum of understanding (MOU) between representatives of commercial fishers and recreational interests provided a framework for discussion and agreement on billfish management measures. This MOU was reviewed annually between 1990 and 1997 and was last signed in 1996.

A review of marlin regulations and management was identified as an issue during the development of the National Fisheries Plan for Highly Migratory Species. The main focus was on the relative benefits of alternative management options for striped marlin that might either allow for some limited commercial utilisation, or further consolidate the current status of marlin as a non-commercial species. At review meetings in 2013 there was no agreement between sector representatives on alternative management measures for marlin. The Minister decided to reintroduce the moratorium on commercial landings of marlin caught in New Zealand waters. The National Fisheries Plan for Highly Migratory Species was updated in 2019, with Objective 2 focussing on maintaining and enhancing world class game fisheries in New Zealand fisheries waters.

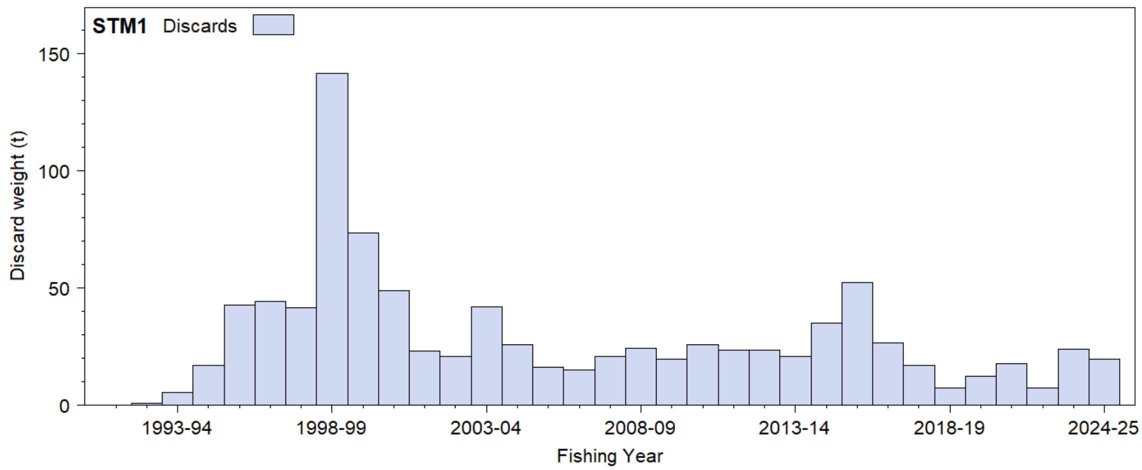
Estimates of total landings (commercial and recreational) for New Zealand are given in Table 1. Commercial catch of striped marlin were previously reported on Catch Effort Landing Returns (CELRs) and Tuna Longline Catch and Effort Returns (TLCERs). The catch and effort monitoring system was replaced with Electronic Reporting (ER) in 2019. The ER system serves the same purpose as the previous paper-based system, but with improvements to the amount of data collected and the timeliness of data collection. Commercial catch data and recreational catches from New Zealand Sport Fishing Council records are given in Table 1. Figure 1 shows historical landings from outside the New Zealand EEZ and discards from inside the New Zealand EEZ for the striped marlin stocks.

Following the introduction of the billfish regulations, striped marlin caught by commercial vessels were required to be returned to the sea and few of these fish were recorded on catch and effort returns. In 1995 the Ministry of Fisheries instructed that commercially caught marlin be recorded on TLCERs. However, compliance with this requirement was inconsistent and estimated catches in the tuna longline fishery (calculated by scaling-up observed catches to the entire fleet) are considerably higher than reported catches in fishing years for which these estimates are available. However, the estimates are probably imprecise because observer coverage of the domestic fleet has been low and has not adequately covered the spatial and temporal distribution of the fishery over summer. Observer coverage averaged 12% of hooks observed in 2017–2021 but declined to 5.4% in 2022 and 3.2% in 2023. No observer data was available for 2024. The surface longline fleet switched from on-board observers to camera monitoring of 100% of the fleet in January 2024. Camera monitoring is now the primary verification method for the fleet (Ministry for Primary Industries, 2025).

A significant number of catch records from domestic commercial vessels provide the number of fish caught but not the estimated catch weight. The total weight of striped marlin caught per season was therefore calculated using fisher estimates from TLCER and CELR records, and more recently ER data, plus the number of fish with no weights multiplied by the mean recreational striped marlin weight for that season. Reported total landings and discards (commercial and recreational) and commercial landings from outside the EEZ are shown in Table 2.

**Table 1: Commercial landings and discards (number of fish) of striped marlin in the New Zealand EEZ reported by fishing nation (CELRs and TLCERs), electronic reporting (ER), and recreational landings and number of fish tagged, by fishing year.**

| Fishing | Japan | | Korea | Philippines | Australia | Domestic | NZ recreational | | Total |
|---|---|---|---|---|---|---|---|---|---|
| year | Landed | Discarded | Landed | Discarded | Discarded | Discarded | Landed | Tagged | |
| 1979–80 | 659 | | | | | | 692 | 17 | 1 368 |
| 1980–81 | 1 663 | | 46 | | | | 792 | 2 | 2 503 |
| 1981–82 | 2 796 | | 44 | | | | 704 | 11 | 3 555 |
| 1982–83 | 973 | | 32 | | | | 702 | 6 | 1 713 |
| 1983–84 | 1 172 | | 199 | | | | 543 | 9 | 1 923 |
| 1984–85 | 548 | | 160 | | | | 262 | | 970 |
| 1985–86 | 1 503 | | 19 | | | | 395 | 2 | 1 919 |
| 1986–87 | 1 925 | | 26 | | | | 226 | 2 | 2 179 |
| 1987–88 | 197 | | 100 | | | | 281 | 97 | 675 |
| 1988–89 | 23 | | 30 | | | 5 | 647 | 371 | 1 076 |
| 1989–90 | 138 | | | | | 1 | 463 | 365 | 967 |
| 1990–91 | | 1 | | | | 6 | 532 | 229 | 768 |
| 1991–92 | | 17 | | | | 1 | 519 | 239 | 776 |
| 1992–93 | | | | | | 7 | 608 | 383 | 998 |
| 1993–94 | | | | | | 59 | 663 | 928 | 1 650 |
| 1994–95 | | | | | | 182 | 910 | 1 202 | 2 294 |
| 1995–96 | | | | | | 456 | 705 | 1 102 | 2 263 |
| 1996–97 | | | | | | 441 | 619 | 1 301 | 2 361 |
| 1997–98 | | | | | | 445 | 543 | 895 | 1 883 |
| 1998–99 | | | | | | 1 642 | 823 | 1 541 | 4 006 |
| 1999–00 | | 2 | | | | 798 | 398 | 787 | 1 985 |
| 2000–01 | | | | | | 527 | 422 | 851 | 1 800 |
| 2001–02 | | | | | | 225 | 430 | 771 | 1 426 |
| 2002–03 | | 3 | | 7 | | 205 | 495 | 671 | 1 381 |
| 2003–04 | | 1 | | | | 423 | 592 | 1 051 | 2 067 |
| 2004–05 | | | | | | 258 | 834 | 1 348 | 2 440 |
| 2005–06 | | | | | | 168 | 630 | 923 | 1 721 |
| 2006–07 | | | | | 9 | 154 | 688 | 965 | 1 816 |
| 2007–08 | | 1 | | | | 208 | 485 | 806 | 1 500 |
| 2008–09 | | | | | | 241 | 731 | 1 058 | 2 030 |
| 2009–10 | | | | | | 195 | 607 | 859 | 1 661 |
| 2010–11 | | | | | | 269 | 607 | 733 | 1 609 |
| 2011–12 | | | | | | 241 | 635 | 663 | 1 539 |
| 2012–13 | | 1 | | | | 216 | 744 | 858 | 1 819 |
| 2013–14 | | | | | | 202 | 620 | 520 | 1 342 |
| 2014–15 | | | | | | 371 | 696 | 1 088 | 2 155 |
| 2015–16 | | | | | | 550 | 900 | 1 658 | 3 108 |
| 2016–17 | | | | | | 261 | 542 | 517 | 1 320 |
| 2017–18 | | | | | | 168 | 618 | 730 | 1 516 |
| 2018–19 | | | | | | 74 | 446 | 649 | 1 169 |
| 2019–20 | | | | | | 129 | 333 | 424 | 886 |
| 2020–21 | | | | | | 195 | 627 | 805 | 1 627 |
| 2021–22 | | | | | | 82 | 377 | 891 | 1 350 |
| 2022–23 | | | | | | 267 | 277 | 974 | 1 518 |
| 2023–24 | | | | | | 228 | 376 | 1 632 | 2 236 |



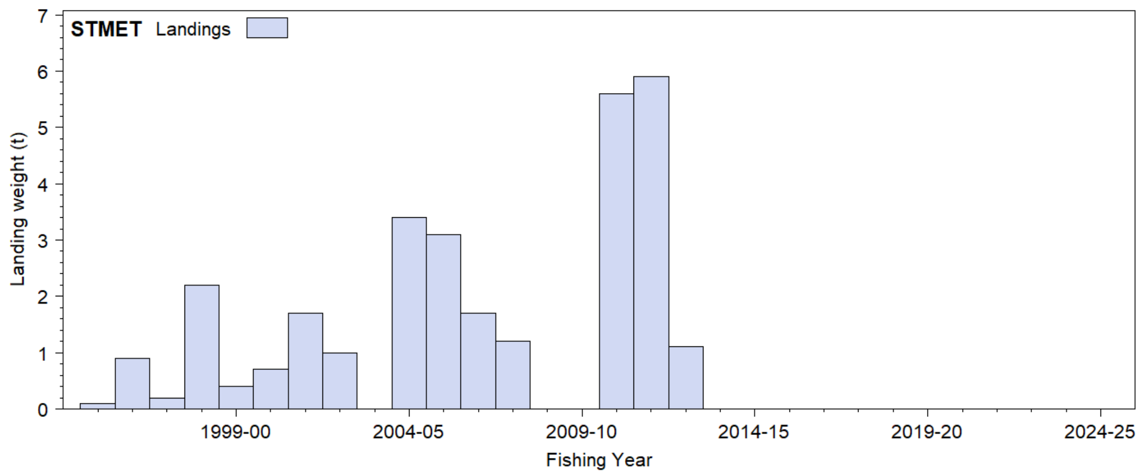




**Figure 1: [Top] Striped marlin catch (commercial discards) between 1991–92 and present within New Zealand waters (STM 1). [Bottom] Striped marlin catch between 1995–96 and present on the high seas (STMET).**

Combined landings from within New Zealand fisheries waters are relatively small compared with commercial landings from the greater stock in the south-west Pacific Ocean. In New Zealand, striped marlin are landed almost exclusively by the recreational sector, but there are no current estimates of recreational catch from elsewhere in the south-west Pacific.

Tremblay-Boyer (2021) assessed bycatch of striped marlin by commercial surface longliners in New Zealand waters and found that the three key surface-longline target species with striped marlin bycatch are bigeye tuna (*Thunnus obesus*), swordfish (*Xiphias gladius*), and southern bluefin tuna (*Thunnus maccoyii*). Trends in striped marlin bycatch were found to mirror changes in the surface-longline fishery during the assessment period 2003–04 to 2018–19, when the available data was considered to be the most reliable. Early in the reporting period, striped marlin bycatch mostly occurred in surface-longline sets targeting bigeye tuna. However, when fishing effort targeting swordfish increased, striped marlin bycatch rates were high compared with other target species; about half of striped marlin bycatch was found to be in sets targeting swordfish. In contrast, although fishing effort targeting southern bluefin tuna also steadily increased after 2003–04, this did not result in increased striped marlin bycatch levels, as striped marlin capture rates for this fleet were consistently low.

**Table 2: Reported total New Zealand landings and discards (commercial and recreational, t) and commercial landings from the western and central Pacific Ocean (WCPO) (t) of striped marlin from 1991 to present.**

| | Commercial | | Recreational | | EEZ | NZ commercial | WCPO all |
|---|---|---|---|---|---|---|---|
| | Landed | Discarded | Landed | Tagged | Total | Outside the EEZ | gears |
| 1991 | 0.1 | 0.6 | 52.0 | 20.1 | 73 | | 7 076 |
| 1992 | 0.8 | 0.1 | 58.0 | 22.2 | 81 | | 6 878 |
| 1993 | 0 | 0.7 | 62.2 | 36.4 | 99 | | 11 867 |
| 1994 | | 5.4 | 65.7 | 81.6 | 153 | | 8 013 |
| 1995 | | 17.1 | 92.7 | 106.5 | 216 | 0.1 | 8 437 |
| 1996 | | 42.6 | 68.8 | 100.4 | 212 | 0.9 | 6 746 |
| 1997 | | 44.2 | 65.5 | 127.7 | 237 | 0.2 | 6 027 |
| 1998 | | 41.6 | 55.2 | 79.8 | 177 | 2.2 | 8 501 |
| 1999 | | 141.4 | 72.8 | 131.0 | 345 | 0.4 | 7 222 |
| 2000 | | 73.3 | 39.5 | 69.9 | 183 | 0.7 | 5 649 |
| 2001 | | 48.9 | 42.7 | 76.1 | 168 | 1.7 | 6 151 |
| 2002 | | 23.2 | 45.6 | 78.6 | 147 | 0.9 | 5 962 |
| 2003 | | 20.8 | 54.1 | 65.3 | 140 | | 6 625 |
| 2004 | | 41.9 | 60.1 | 103.2 | 205 | | 6 421 |
| 2005 | | 25.7 | 85.4 | 131.8 | 243 | 3.5 | 5 873 |
| 2006 | 0.4 | 16.1 | 60.5 | 88.4 | 165 | 3.2 | 5 526 |
| 2007 | 1.2 | 14.9 | 67.0 | 92.6 | 176 | 1.9 | 4 502 |
| 2008 | | 20.6 | 47.4 | 80.4 | 148 | 1.1 | 5 091 |
| 2009 | | 24.1 | 73.2 | 106.0 | 203 | | 3 804 |
| 2010 | | 19.6 | 62.8 | 84.2 | 167 | 5.6 | 4 067 |
| 2011 | | 25.8 | 59.5 | 68.5 | 154 | 5.9 | 4 184 |
| 2012 | | 23.3 | 63.5 | 61.8 | 149 | 1.8 | 4 507 |
| 2013 | | 23.5 | 77.9 | 75.4 | 177 | 1.1 | 3 912 |
| 2014 | | 20.8 | 66.3 | 46.9 | 134 | 0 | 3 975 |
| 2015 | | 34.9 | 68.8 | 97.1 | 201 | | 4 469 |
| 2016 | | 52.4 | 92.3 | 148.5 | 293 | | 3 538 |
| 2017 | | 26.4 | 55.3 | 49.2 | 131 | | 3 118 |
| 2018 | | 17.0 | 66.7 | 65.5 | 149 | | 3 022 |
| 2019 | | 7.3 | 53.2 | 69.0 | 129 | | 3 460 |
| 2020 | | 12.3 | 34.0 | 39.7 | 86 | | 3 225 |
| 2021 | | 17.7 | 60.8 | 92.9 | 171 | | 2 973 |
| 2022 | | 7.4 | 36.2 | 79.3 | 123 | | 2 586 |
| 2023 | | 23.9 | 26.3 | 85.8 | 136 | | 3 942 |
| 2024 | | 19.8 | 36.0 | 137.8 | 194 | | 4 266 |

Source: TLCER and CELRs, ER data, New Zealand Sport Fishing Council, Holdsworth & Saul (2008), Holdsworth & Saul (2017b), J Holdsworth (pers. comm.).

Most striped marlin bycatch events occurred in North Island waters, from Bay of Plenty to Northland, and there were few captures (and low catch-per-unit-effort, CPUE) on the east coast south of Hawke Bay. This pattern appeared to correspond with patterns of spatial occupancy and not catchability given that similar fishing fleets were active in both of these areas and over the same seasons. In parallel, increases in sea surface temperatures may have impacted the distribution of striped marlin in New Zealand waters as the boundary of striped marlin bycatch has expanded southward along the South Island west coast (Tremblay-Boyer, 2021).

Striped marlin's preference for warm waters was reflected in seasonal trends in the bycatch records. Capture rates were particularly high in warm months between January and March. This period coincided with the fishing season for swordfish, as well as bigeye tuna to some extent. For these two target species, striped marlin captures were highest in February and March. In contrast, for southern bluefin tuna, striped marlin bycatch was highest in the winter months between June and August, when effort targeting this species shifted from the North Island southern east coast towards Bay of Plenty and Northland (Tremblay-Boyer, 2021).

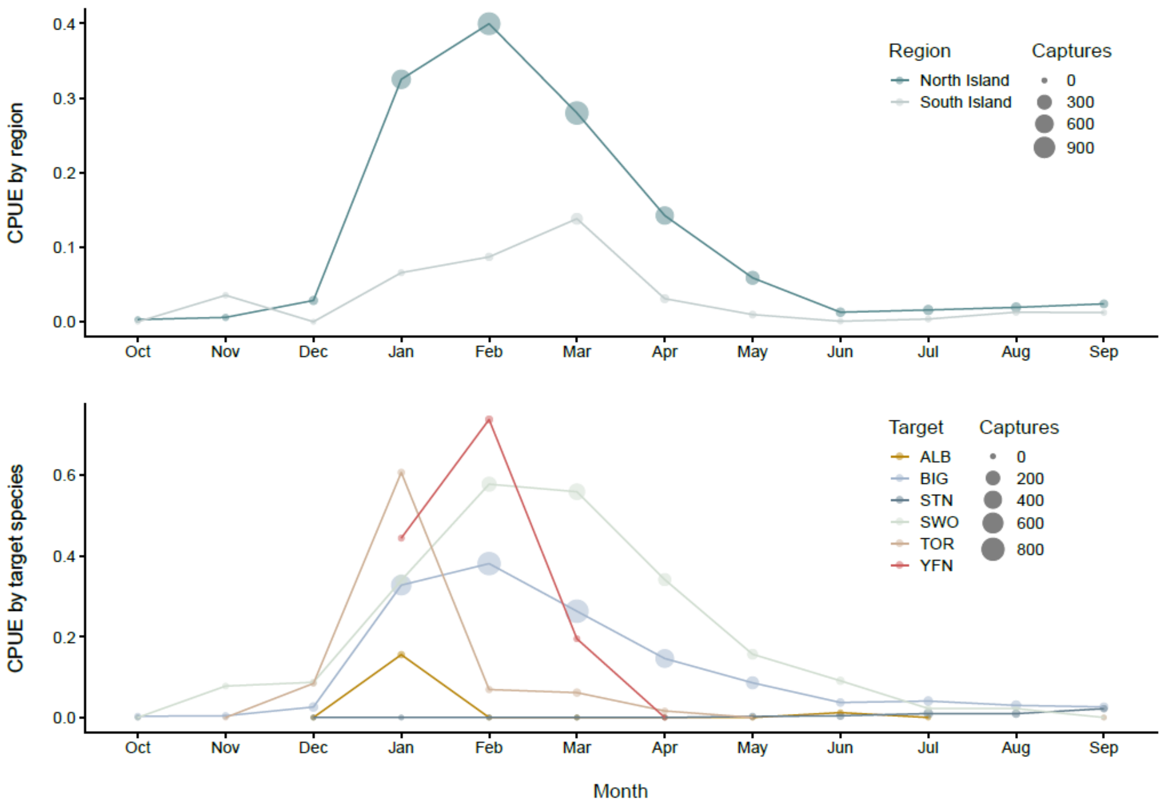



**Figure 2: Nominal catch-per-unit-effort (CPUE) per month for striped marlin in surface-longline fisheries by region. CPUE aggregated for the period from 2003–04 to 2018–19 (top), and by month and key target species, for the North Island only (bottom). Circle size scales with the total number of captures for the month over the time period; records are only included if there were at least 5000 hooks of effort for a target species during the month. Target species were: ALB, albacore tuna; BIG, bigeye tuna; STN, southern bluefin tuna; SWO, swordfish; TOR, Pacific bluefin tuna; YFN, yellowfin tuna. Months are ordered from October to September, following the definition for the fishing year (Tremblay-Boyer 2021).**

## 1.2 Recreational fisheries

### 1.2.1 Estimates of recreational harvest

A 48-year time series of striped marlin catch per unit effort (CPUE) data has been collected from gamefish charter skippers fishing the northeast coast of New Zealand. It started as a simple, low-cost, annual postal survey which provided catch and effort on a coarse scale (fish and vessel days per vessel per season) and in a limited area (North Cape to Cape Rodney). The postal survey was last used to collect striped marlin CPUE in the East Northland area for the 2005–06 season (Holdsworth et al 2007). Since then, the Billfish Logbook Programme has collected daily information on billfish catch, hours fished, and environmental variables from private and charter skippers in fished areas (Holdsworth 2023).

The number of striped marlin caught by sport fishers in New Zealand has increased significantly since the early 1970s, with a peak in 2015–16 (2471; Figure 3). The majority of striped marlin caught in the first half of the time series came from the East Northland charter fleet. In 2021–22 the number of striped marlin reported from the recreational fishery dropped to 802 as a result of the fishing season ending in March 2020 due to Covid-19 restrictions. The historical club landed weight and catch data were important inputs to the 2019 stock assessment for striped marlin in the southwest Pacific (Ducharme-Barth et al 2019). In 2024, 175 t of striped marlin were caught by recreational fishers, with 81% of these tagged and released (Ministry for Primary Industries 2025).

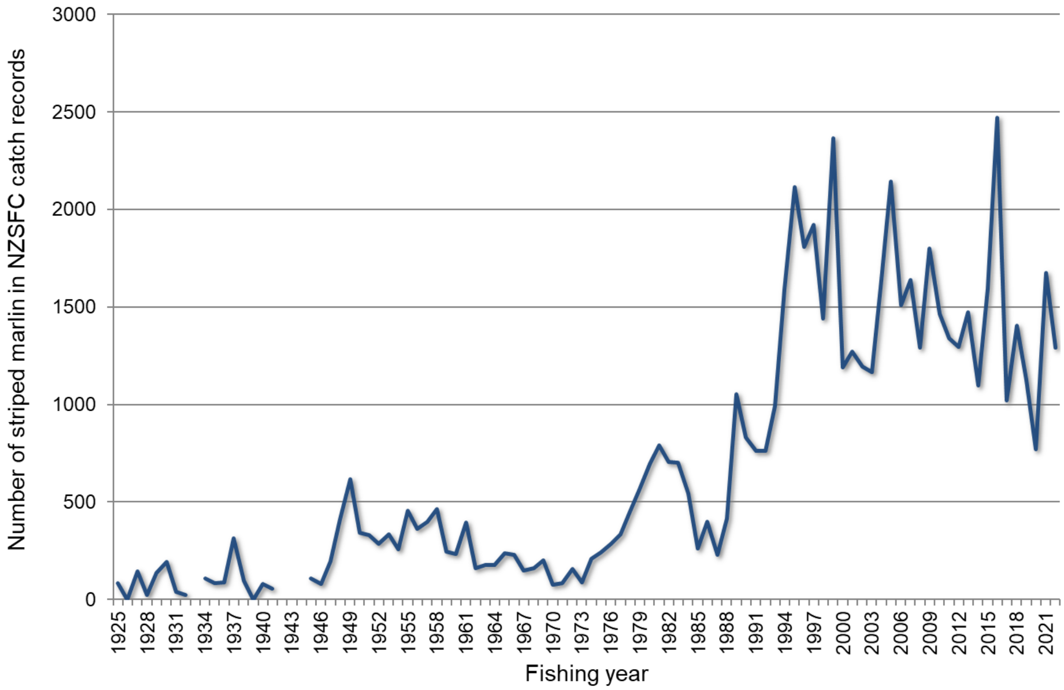



**Figure 3: The number of striped marlin landed or tagged in NZSFC club records by fishing year. Fishing years are labelled by the later calendar year, e.g., 2018 is 2017–18 (Holdsworth 2023).**

### 1.2.2 Gamefish Tagging Programme

The multi-species New Zealand Gamefish Tagging Programme (NZGTP) was initiated in 1975 to study the seasonal and short-term movements of gamefish important to New Zealand fisheries. Striped marlin is the main billfish species tagged in the recreational game fish fishery (Holdsworth & Curtis 2025) and the number of striped marlin tagged increased significantly after the introduction, in 1987–88 of the Billfish Moratorium restricting the commercial landing of marlin; and the introduction of a voluntary minimum weight of 90 kg initiated by the NZSFC. This helped lift the proportion of marlin catch tagged and released by recreational fishers to over 50%.

As of September 2024, the NZGTP database contains records of 86 241 fish tagged in the New Zealand EEZ, including 30 731 striped marlin, 26 373 kingfish, and 16 678 mako shark (Holdsworth & Curtis 2025). Of the total, 38% were billfish species, 28% shark species, 31% kingfish, and 2% tuna, mainly yellowfin tuna. New Zealand fishers travelling overseas have also tagged fish outside the EEZ, totalling 3008 to date, mostly striped marlin (1681) and blue marlin (889) in the southwest Pacific Ocean. There have been 2457 tag recaptures reported across all areas, with 1682 kingfish (the main species) followed by 374 mako shark, 111 striped marlin, and 90 blue shark.

There is an almost complete historical database of recreational catch for individual striped marlin caught by the Bay of Islands Swordfish Club and the Whangaroa Sport Fishing Club going back to the 1920s, when this fishery started.

## 1.3 Customary non-commercial fisheries

Māori traditionally ate a wide variety of seafood, however, no record of specific marlin fishing methods has been found to date. An estimate of the current customary catch is not available.

## 1.4 Unreported catch

There is no known unreported catch of striped marlin.

### 1.5 Other sources of mortality

Some fish that break free from commercial or recreational fishing gear may die due to hook damage or entanglement in trailing line. A high proportion of fish that are caught are released alive by both commercial and recreational fishers. Data collected by government observers from the tuna longline fishery suggest that most striped marlin are alive on retrieval (76.8% of the observed catch, Griggs et al 2024). The proportion of striped marlin brought to the boat alive was similar on domestic longliners and foreign and charter vessels. However, post-release survival rates are unknown.

Recreational anglers tagged and released 81% of their striped marlin catch in 2024 (Ministry for Primary Industries, 2025). Reported results from 6 pop-up satellite archival tags (PSATs) deployed on lure-caught striped marlin in New Zealand in 2003 showed a high survival rate following catch and release. The PSATs are programmed to release from the fish following death. One tag failed to transmit but the duration of deployment of the remaining tags was between 20 and 60 days, indicating that the fish survived capture and release on standard recreational fishing gear (Sippel 2005).

## 2. BIOLOGY

Striped marlin is one of eight species of billfish in the family Istiophoridae. They are epipelagic predators in the tropical, sub-tropical, and temperate pelagic ecosystem of the Pacific Ocean and Indian Ocean. Juveniles generally stay in warmer waters, whereas adults move into higher latitudes and temperate water feeding grounds in summer (i.e., the first quarter of the calendar year in the southern hemisphere; the third quarter in the northern hemisphere). The latitudinal range estimated from longline data extends from 45° N to 40° S in the Pacific Ocean and from continental Asia to 45° S in the Indian Ocean. Striped marlin are not uniformly distributed, having a number of areas of high abundance. Fish tagged in New Zealand have undergone extensive seasonal migrations within the south-west Pacific Ocean but not beyond.

Samples from recreationally caught striped marlin in New Zealand indicate that the most frequent prey items are saury and arrow squid, followed by jack mackerel. However, 28 fish species and 4 cephalopod species have been identified from stomach contents indicating that they are opportunistic predators.

Although striped marlin have been caught in New Zealand fisheries waters in every month, abundance is highest during austral summer months (January to March), when large, mature individuals move from spawning grounds to feed in New Zealand and neighbouring waters (Tremblay-Boyer 2021).

Striped marlin are oviparous and are known to spawn in the Coral Sea between Australia and New Caledonia. Their ovaries start to mature in this region during late September or early October. Spawning peaks in November and December and 60–70% of fish captured at this time are in spawning condition. The minimum size of mature fish in the Coral Sea is recorded at approximately 170 cm lower jaw-fork length (LJFL) and 36 kg. Striped marlin captured in New Zealand are rarely less than 200 cm (LJFL) suggesting that these fish are all mature. Female striped marlin are larger than males on average, but sexual dimorphism is not as marked as that seen in blue and black marlin. The sex ratio of striped marlin sampled from the recreational fishery in Northland (n = 61) was 1:1 prior to the introduction of the voluntary minimum size restriction (90 kg). There is no clear evidence of striped marlin reproductive activity in New Zealand waters. The northern edge of the EEZ around the Kermadec Islands extends into sub-tropical waters. According to historical longline records, in some years there are moderate numbers of striped marlin in this area from October to December. Therefore, striped marlin spawning could occur in this area.

Estimated growth and validated age estimates of striped marlin were derived from fin spine and otolith age estimates from 425 striped marlin collected between 2006 and 2009. Samples came from the Australian commercial longline and recreational fisheries, longline fisheries in Pacific Island countries, and 133 samples from the New Zealand recreational fishery. Ages ranged from 130 days to 8 years, in striped marlin ranging in length from 990 mm (about 4 kg) to 2871 mm (about 168 kg) LJFL (Kopf et al 2010). Estimated ages of striped marlin from New Zealand ranged from 2 to 8 years in fish ranging in length from 2000 mm to 2871 mm LJFL. The median age of striped marlin landed in the New Zealand recreational fishery was 4.4 years for females and 3.8 years for males.

Growth for striped marlin in the south-west Pacific is broadly comparable with that reported in overseas studies. Melo-Barrera et al (2003) identified between 2 and 11 growth bands from fish sampled in Mexico, and Skillman & Yong (1976) classified up to 12 age groups from length frequency analysis of striped marlin in Hawaii. Recreational catch records kept by the International Game Fish Association (IGFA) list the heaviest striped marlin as 224.1 kg caught in New Zealand in 1975.

Estimates of biological parameters for striped marlin in New Zealand waters are given in Table 3.

**Table 3: Estimates of biological parameters.**

| Parameter | Estimate | | | | Source |
|---|---|---|---|---|---|
| 1. Natural mortality (M) | | | | | |
| STM | 0.49–1.33 | | | | Boggs (1989) |
| STM | 0.389–0.818 | | | | Hinton & Bayliff (2002) |
| | | | | | |
| 2. Weight = $a$ (length)$^b$ (weight in kg, length in mm LJFL) | | | | | |
| | $a$ | $b$ | | | |
| STM | $1.012 \times 10^{-10}$ | 3.55 | | South West Pacific | Kopf et al (2010) |
| STM males | $4.171 \times 10^{-11}$ | 3.67 | | South West Pacific | Kopf et al (2010) |
| STM females | $1.902 \times 10^{-9}$ | 3.16 | | South West Pacific | Kopf et al (2010) |
| STM males | $2.0 \times 10^{-8}$ | 2.88 | | New Zealand | Kopf et al (2005) |
| STM females | $2.0 \times 10^{-8}$ | 2.90 | | New Zealand | Kopf et al (2005) |
| | | | | | |
| 3. von Bertalanffy model parameter estimates | | | | | |
| | $k$ | $t_0$ | $L_\infty$ | | |
| STM | 0.44 | -1.07 | 2 636 | South West Pacific | Kopf et al (2010) |
| STM | 0.22 | -0.04 | 3 010 | New Zealand | Kopf et al (2005) |
| STM | 0.23 | -1.6 | 2 210 | Mexico | Melo-Barrera et al (2003) |
| STM male | 0.315–0.417 | -0.521 | 2 774–3 144 | Hawaii | Skillman & Yong (1976) |
| STM female | 0.686–0.709 | 0.136 | 2 887–3 262 | Hawaii | Skillman & Yong (1976) |

## 3. STOCKS AND AREAS

Striped marlin are a highly migratory species, and fish caught in the New Zealand fisheries waters are part of a wider stock. The stock structure of striped marlin in the Pacific Ocean is not well understood and resolving stock structure uncertainties is the focus of current research activities. The two most frequently considered hypotheses are: (1) a single-unit stock in the Pacific, which is supported by the continuous 'horseshoe-shaped' distribution of striped marlin; and (2) a two-stock structure, with the stocks separated roughly at the Equator, albeit with some intermixing in the eastern Pacific.

Recent genetic work indicates potentially three genetically distinct spawning populations: two in the western central Pacific (in the north and south) and the third in the eastern Pacific (Mamoozadeh et al 2020). However research based on genetics and popup satellite archival tags around the Hawaii archipelago indicates regional connectivity, particularly for the northern and southern striped marlin populations (Martinez 2021, Lam et al 2022). In comparison with the rest of the Pacific, there are much larger fish at higher latitudes in the south Pacific, with a progressive increase in mean size with latitude, but there is no such trend observed in the northern hemisphere (Ijima & Kanaiwa 2019). The cause of this pattern in striped marlin has not been determined but hypotheses include spatially varying growth, discard patterns, and ontogenetic movement in the Southwest Pacific stock.

Long-distance recaptures for striped marlin in the NZGTP show a wide spread of locations across the southwest Pacific Ocean and the Tasman Sea (Figure ). 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. Striped marlin tagged in the south Pacific are not normally recaptured beyond the south Pacific, however most striped marlin with spaghetti tags have been recaptured within ten months of release. Tag shedding is a problem with this species, which may explain the short duration of most recaptures (Ortiz et al 2003). Most striped marlin are tagged 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 occurred in the third and fourth quarters (Figure ).

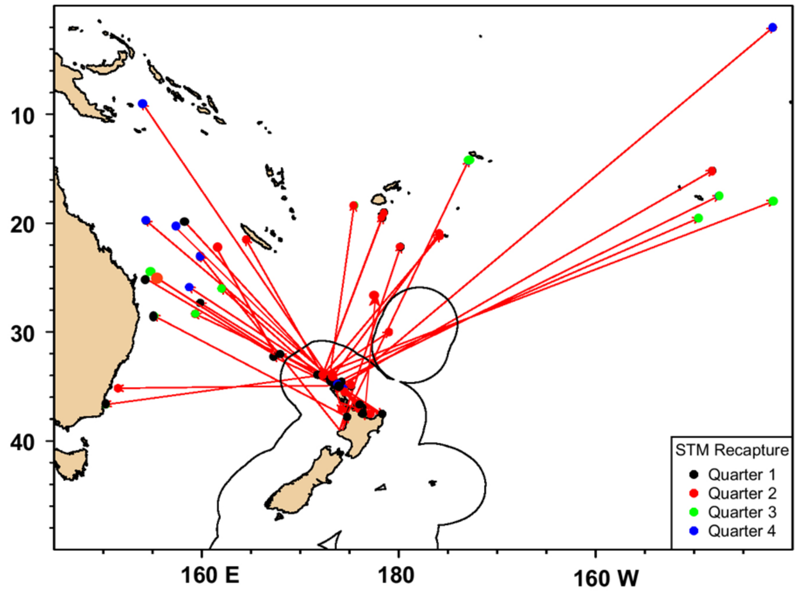



**Figure 4: Long-distance movements of striped marlin (STM) in the NZGTP for all years, with recapture location colour coded by quarter (Quarter 1 = Jan-Mar) (Holdsworth & Curtis 2025).**

Recently an eight-month track was obtained from a pop off archival tag deployed in January 2024 on a 90 kg striped marlin which transmitted 4739 nautical miles from its release location off Northland (Figure ). This is the first record of a striped marlin leaving the southwest Pacific Ocean after 50 years of conventional tagging in New Zealand and Australia.

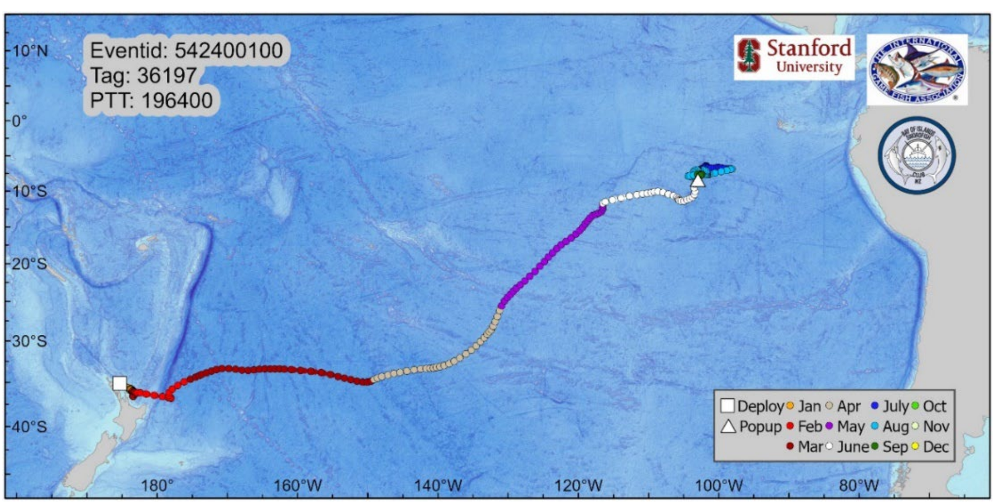



**Figure 5: Striped marlin track from a pop off archival tag deployed in January 2024 showing daily positions colour coded by month (Holdsworth & Curtis 2025).**

# 4. ENVIRONMENTAL AND ECOSYSTEM CONSIDERATIONS

This summary is from the perspective of striped marlin but there is no directed fishery for this species. The incidental catch sections below reflect the New Zealand surface longline fishery as a whole and are not specific to this species; a more detailed summary from an issue-by-issue perspective is available in the Aquatic Environment and Biodiversity Annual Review where the consequences are also discussed (Aquatic environment and biodiversity annual review (AEBAR) | NZ Government (mpi.govt.nz)).

## 4.1 Role in the ecosystem

Striped marlin (*Kajikia audax*) are large pelagic predators, so they are likely to have a 'top down' effect on the squid, fish, and crustaceans they feed on.

## 4.2 Non-target fish catch

Most of the commercial striped marlin catch in the south-west Pacific is caught in the tuna surface longline fishery.

Observer records indicate that a wide range of species are landed by the longline fleets in the New Zealand fishery. Blue sharks are the most commonly caught species (by number), followed by lancetfish and porbeagle shark (Table 4).

**Table 4: Total estimated catch (numbers of fish) of common bycatch species in the New Zealand surface longline fishery as estimated from observer data from 2017 to 2022. Observer data is too limited to raise to the fleet for 2023 and no observer data is available for 2024. Also provided is the percentage of these species retained (2022 data only) and the percentage of fish that were alive when discarded, N/A (none discarded). Striped marlin is highlighted in grey.**

| Species | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | % retained (2022) | discards % alive (2022) |
|---|---|---|---|---|---|---|---|---|
| Blue shark | 49 924 | 63 618 | 89 377 | 37 093 | 39 524 | 65 277 | 0 | 91.9 |
| Porbeagle shark | 3 101 | 2 594 | 2 883 | 1 320 | 2 248 | 2 810 | 0 | 29.2 |
| Lancetfish | 13 274 | 13 163 | 18 747 | 11 457 | 4 211 | 2 212 | 0 | 2.1 |
| Butterfly tuna | 406 | 419 | 348 | 120 | 388 | 663 | 96.0 | 0 |
| Moonfish | 2 022 | 2 698 | 1 975 | 1 834 | 1 033 | 526 | 100.0 | N/A |
| Oilfish | 227 | 602 | 417 | 1 149 | 504 | 510 | 0 | 74.3 |
| Pelagic stingray | 1 798 | 2 949 | 526 | 1721 | 3 182 | 508 | 0 | 97.1 |
| Ray's bream | 2 421 | 1 579 | 1 949 | 3 211 | 2 514 | 494 | 90.0 | 10.0 |
| Mako shark | 1 391 | 2 721 | 1 138 | 859 | 933 | 310 | 0 | 72.2 |
| Striped marlin | 290 | 247 | 157 | 279 | 426 | 175 | 0 | 66.7 |
| Escolar | 300 | 594 | 488 | 808 | 388 | 146 | 0 | 30.0 |
| Skipjack tuna | 57 | 184 | 8 | 134 | 110 | 117 | 100.0 | N/A |
| Rudderfish | 680 | 253 | 186 | 164 | 221 | 80 | 66.7 | 33.3 |
| Dealfish | 72 | 25 | 23 | 69 | 18 | 80 | 0 | 33.3 |
| Sunfish | 1 648 | 3 648 | 1 982 | 1 618 | 1 537 | 56 | 0 | 100.0 |
| Big scale pomfret | 17 | 34 | 0 | 52 | 17 | 53 | 0 | 50.0 |
| School shark | 59 | 187 | 116 | 29 | 64 | 27 | 100.0 | N/A |
| Deepwater dogfish | 32 | 6 | 90 | 29 | 42 | 27 | 0 | 100.0 |
| Thresher shark | 260 | 253 | 193 | 269 | 161 | 15 | 0 | 0 |

## 4.3 Benthic interactions

There are no known benthic interactions for this fishery.

# 5. STOCK ASSESSMENT

An updatated stock assessment for Southwest Pacific Ocean (SWPO) striped marlin was attempted in 2024, however the review during SC20 revealed several serious concerns with the technical aspects of the assessment. SC20 therefore recommended further work, including in particular resolving the conflict between the size composition data and the CPUE indices. An important part of this revision involved moving the assessment from MFCL to Stock Synthesis (SS3). Along with the change in software, numerous other changes and data modifications were implemented in the 2025 revision of the integrated assessment (Castillo-Jordan et al 2025).

Some of the more important changes included.

- Switch from MFCL to SS3.
- Start the model in 1952, and include early catch uncertainty.
- Implement size-based selectivity and modifications to selectivity functions.
- Major revision of size data inputs and refined size data filtering, resulting in a significant reduction in size data inputs.
- Separate New Caledonia and French Polynesia longline fleets from the mixed flag fisheries and create separate fisheries due to their different length data distributions.
- Use of ad hoc size data weighting to downweight the influential size data.
- Use condition-age-at-length data to estimate growth internally for the diagnostic model.
- Explored sensitivity to alternative CPUE indices, including Australian longline, New Zealand recreational, and newly developed observer-based longline indices for PICT fleets (SC21-SA-IP-13).

These changes addressed the core concerns raised at SC20. However, despite the improvements, the model results remained very similar to those from the previous 2024 MFCL assessment, and MFCL assessments in 2019 and 2012. In the course of the revision, other issues were raised, most notably, concerns around the low population/biomass size (scale) that was estimated since the 1970s. Despite a range of modelling investigations, including one-off sensitivities on biological parameters, alternative CPUE and a factorial grid on biological parameters, the model estimates would not deviate substantially from the low population size. The SS3 model, as configured, estimated the stock as being very small and highly productive, with the dynamics being driven by recruitment variability. Various diagnostic analyses pointed to issues the model was having in estimating a well-determined production function. It was problematic to reconcile the small population scale in the context of the recent observed catches and the assessment spatial scale, and calculations indicated that the population scale being estimated was implausibly low. The development of the BSPM assessment was motivated to investigate these issues and see if a simplified, more flexible Bayesian modelling approach could allow for the identification of a production function, and more effectively characterize uncertainty in estimates of population scale. Since issues with the integrated age-structured assessment using Stock Synthesis 3 could not be satisfactorily resolved, the assessment was ultimately shifted to a data-moderate Bayesian surplus production model (BSPM) (Ducharme-Barth et al 2025). The results of the BSPM assessment are described in more detail below.

## 5.1. Stock status and trends

The Bayesian surplus production model implemented a Fletcher-Schaefer production model framework in Stan using a state-space formulation, where population depletion evolves according to surplus production and fishing mortality dynamics linked to effort data. This approach condenses biological and fishery assumptions, which provides a robust framework for estimating stock status and efficiently exploring uncertainties in productivity and scale. The model assumes a single, well-mixed stock (Figure 6) with no population age structure and fished by a single aggregate fishery in 1952–2022 (Table 5).

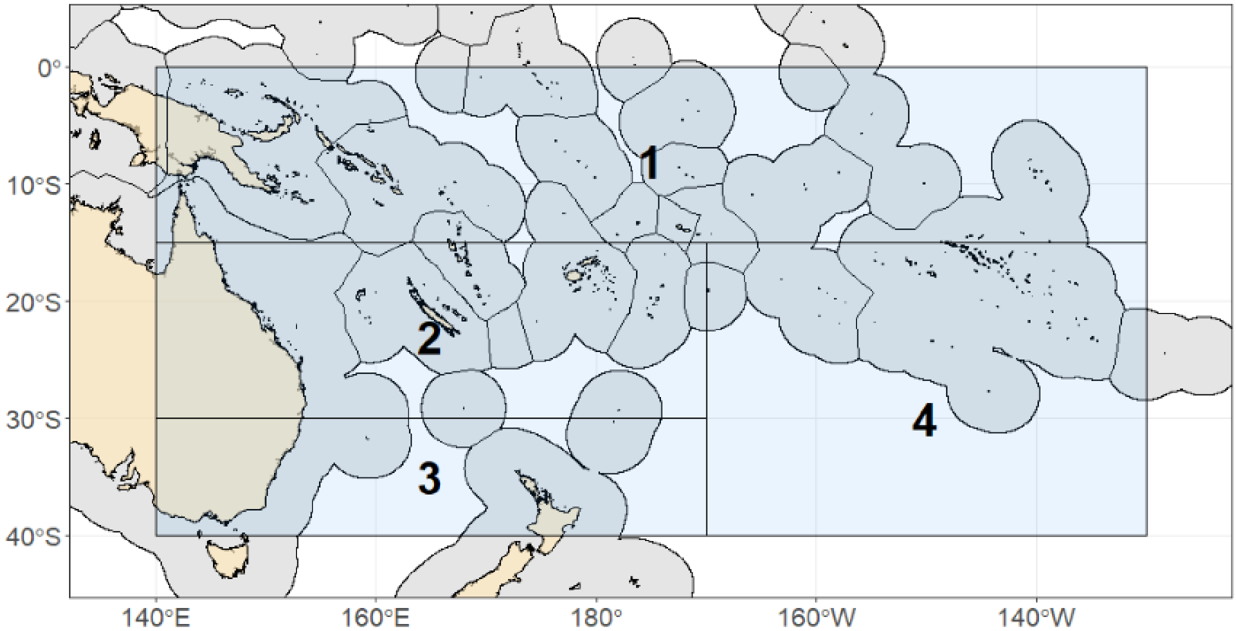



**Figure 6: Assessment model spatial domain, noting that no sub-fleets or regions were used.**

**Table 5: Stock assessment model structure for the 2025 Southwest Pacific striped marlin assessment.**

| | **Number** | **Description** |
|---|---|---|
| Spatial structure | 1 | Assumes single, well-mixed stock |
| Age structure | 1 | Assumes a single age class |
| Fishery structure | 1 | Assumes a single fishery with knife-edge asymptotic selectivity |

The assessment incorporated multiple sources of uncertainty through both model structure and parameter estimation approaches (Table 6). Key uncertainties included substantial uncertainty in absolute population scale, biological parameter uncertainty in growth, maturity, natural mortality, and steepness that contributed to broad priors for maximum intrinsic rate of increase, and population scale. The model ensemble explicitly incorporated uncertainty in population trend by considering the distant water fishing nation (DWFN) and New Zealand recreational sportfish index. Alternative priors for the shape parameter, which informs the location of MSY, were also considered in the ensemble.

Annual catches are provided from 1952 to 2022 (Figure 7). The annual catch series showed initially low removals in 1952–1953, followed by a high but potentially legitimate peak of ~80 000 individuals in 1954, then generally stable catches of between 20 000 and 40 000 individuals with a slight decline since 2000.

**Table 6: Key sources of uncertainty considered in the 2025 Southwest Pacific striped marlin stock assessment.**

| Rationale | Uncertainty | Impact | Confidence |
|---|---|---|---|
| **Data** | | | |
| CPUE | Best available long-term indices (DWFN & New Zealand recreational) | Changes in the fleet composition and or fishing location in the DWFN index can be interpreted by the model as population level changes. For the New Zealand index, if the stock distribution has shifted, this may impact representativeness | Medium |
| Catch | Situationally targeted species, so catch reporting may be inconsistent | Reported catches are highly influential on the estimated population scale | Medium |
| **Model** | | | |
| Parsimonious and robust model | Over-simplifies population and spatial dynamics | Unknown | Medium |
| Static models | The value of key parameters is constant | Changes in the fleet composition would influence the age structure of the population and lead to time-varying population dynamics. | Low |
| **Spatial Assumptions** | | | |
| Little tagging data to understand the structure | Unclear | Potentially important, not quantified, impact unknown | Low |
| **Key Parameter Uncertainty** | | | |
| Productivity ($R_{MAX}$) | Uncertainty in key biological processes | Wide prior contributes to high uncertainty within model runs | High |
| Population scale (log(K) & $q_{eff}$) | Scale prior dependent on the maximum observed catch being representative of MSY | Broad prior contributes to high uncertainty within model runs | High |
| Shape n | Alternative priors used to capture the shape of the production function | Uncertainty in where MSY occurs as a fraction of the unfished condition | Medium |
| **Structural Uncertainty** | | | |
| Fixed $\sigma_C$ = 0.2 | Choice of $\sigma_C$ and observation model impacts estimated removals | Removal estimates may not exactly match observations | Medium |
| **Estimation Uncertainty** | | | |
| Full Bayesian estimation integrating uncertainty over key parameters | Estimated | Basis for model ensemble | High |
| **Other Sources of Uncertainty** | | | |
| Genetic sampling of catch in North Pacific indicates the presence of Southwest Pacific Ocean fish | Not considered | Actual population removals may be under-counted, impacting scale and stock status | Low |

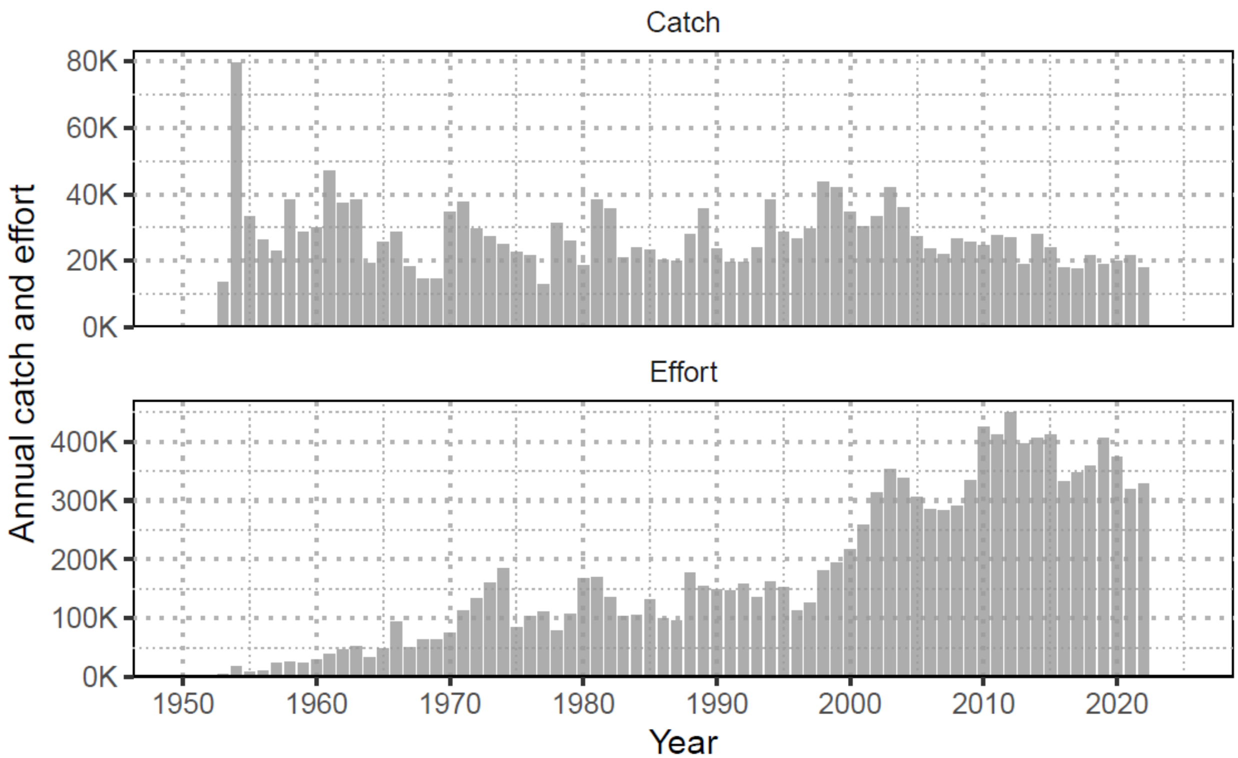



**Figure 7: Annual catch (numbers; individuals) of striped marlin and nominal longline effort (hooks fished; thousands) in the Southwest Pacific Ocean (1952–2022).**

The standardized DWFN CPUE index (1988–2022) and New Zealand recreational index (Figure 8) were the only indices with sufficient length and contrast to inform population-scale estimates, both exhibiting declining trends that constrain population size. The DWFN index showed high variability with a general decline most pronounced after 2000, though stabilizing somewhat before showing slight recent increases. The New Zealand index showed a more continual decline from the mid-1990s, although observation error was larger in the terminal years. The shorter observer indices were largely flat from 2000 to 2022. The Australian longline index was also short and showed an initial decline before being largely stable with a larger observation in the terminal year.

The ensemble estimated total population trajectories (Figure 9) showing a pronounced decline from unfished conditions during the 1950s–1960s, relatively stable population levels around from the 1970s through to the early 2000s, and recovery since approximately 2015. Fishing mortality ($F$) estimates (Figure 9) generally increased through the model period until the early 2000s, followed by generally declining trends in recent decades consistent with population recovery patterns. The models demonstrated evidence of a well-determined production function through successful model-free hindcast validation, where models fitted to progressively truncated datasets successfully predicted future population dynamics based solely on estimated production parameters and catch data. Model validation through retrospective analysis showed acceptable bias within recommended ranges, and all models showed good convergence according to conventional Bayesian diagnostics.

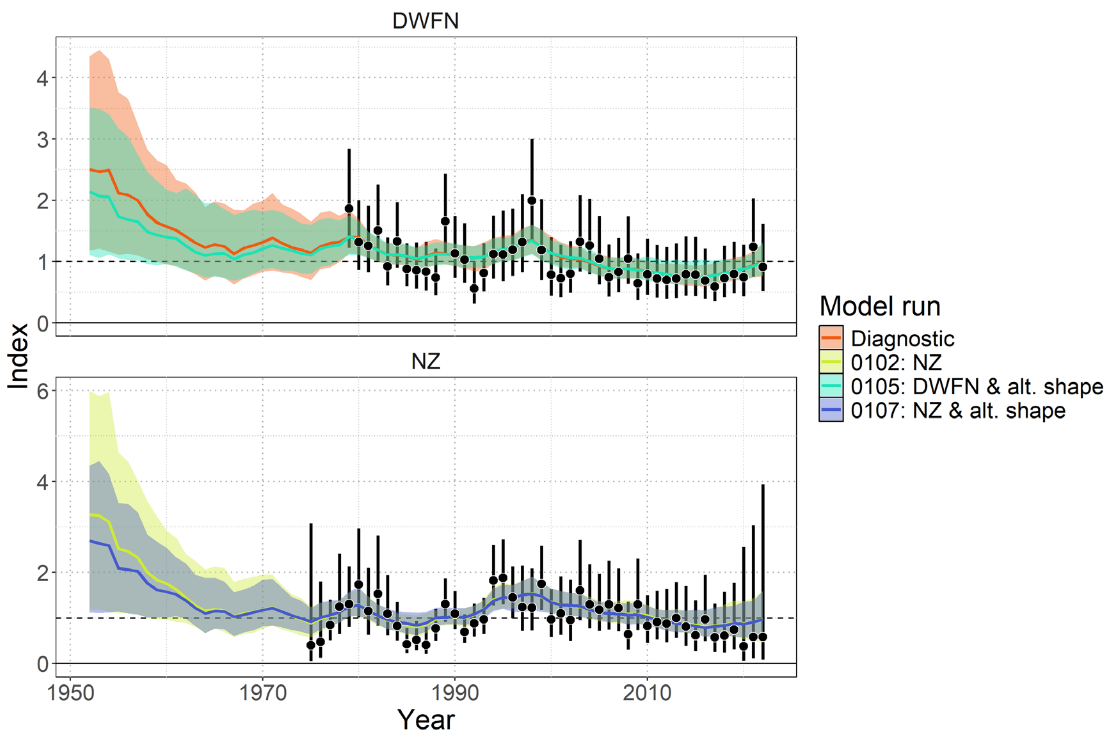



**Figure 8: Model fit to standardized index data showing observations (black points with 95% error bars) and model-predictions (colored lines and shaded ribbons representing 95% credible intervals). The diagnostic model (0100) is shown in orange.**

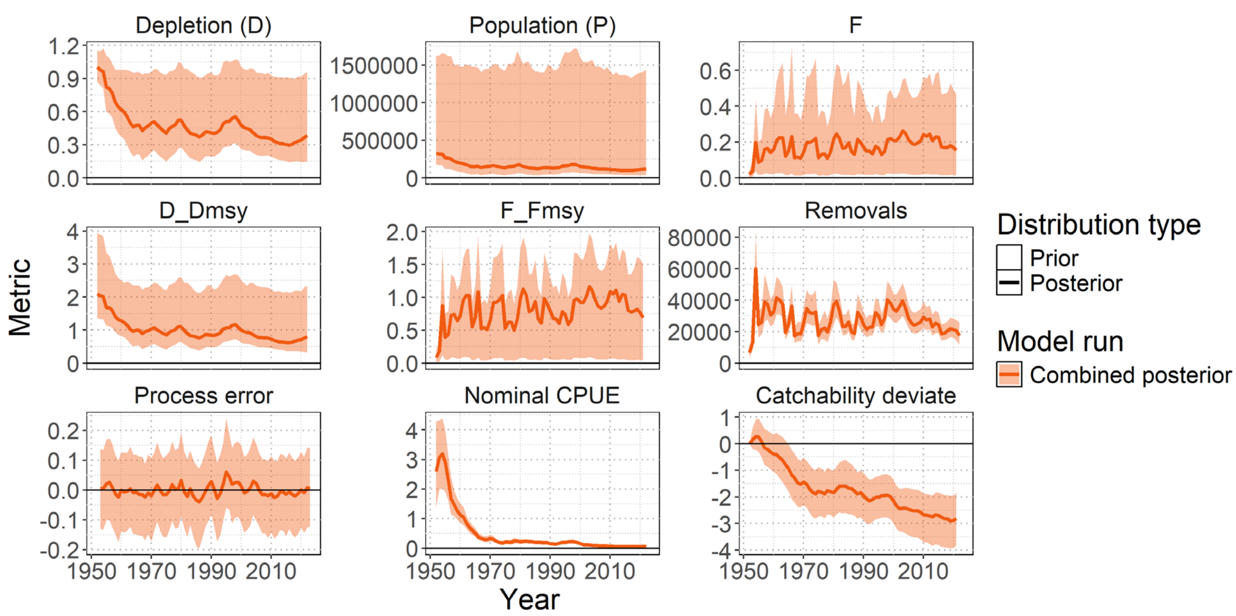



**Figure 9: Posterior time series distributions for key derived quantities over time (line = median, shading = 95% credible interval): depletion (D), absolute population size in numbers (P), fishing mortality (F), stock status relative to MSY reference points ($D/D_{MSY}$, $F/F_{MSY}$), total removals in numbers, process error, nominal CPUE (numbers caught per 1000 hooks), and catchability deviates. The model ensemble is shown in orange.**

Total depletion ($D$), defined as the static depletion of total numbers relative to the initial total unfished numbers, largely followed the same patterns as the total population trajectory (Figure 9). Uncertainty in total depletion was large and asymmetrical, with more uncertainty to the high side. This is driven by the large uncertainty in population scale. The lower bound of uncertainty was constrained by requiring a large enough population to support the 70-year catch history. However, the existing data do not support a large population but rather indicate a small, highly productive stock capable of sustaining observed catch levels, which is a conclusion consistent with the Stock Synthesis assessment and previous assessments of this stock. Though population scale estimates were driven by different productivity assumptions, larger catches or a flatter CPUE index would all support a larger population.

As noted, this BSPM approach showed similar results to the Stock Synthesis integrated model but provided greater confidence in the results by identifying a well-determined production function and more appropriately integrating over uncertainty in population scale and productivity. Previous integrated assessments encountered challenges fitting size composition data, conflicts between data sources, and difficulties in determining a stock production function. Key strengths of the BSPM included explicit parameter uncertainty incorporation through simulation-based priors, prior pushforward analysis ensuring biological realism, comprehensive sensitivity analysis, and a well-determined production function.

Striped marlin lacks formal, agreed-upon reference points, so stock status was summarized using MSY-based reference points and total depletion relative to the generalized limit reference point of 20% total depletion from the unfished state ($D/D_{0.2,F=0}$) (Table 7).

The stock is very unlikely to be below 20% of the unfished state (Figure 10). The probability of the stock being below $D_{0.2,F=0}$ is 9.2% for the recent period, with a median ratio of 1.84 (95% CI: 0.73 – 4.7295). Noting that this depletion is relative to the 20% total depletion from the equilibrium unfished population level and is not equivalent to the conventional $SB/SB_{20\%,F=0}$.

Median recent fishing mortality was below $F_{MSY}$ ($F_{recent}/F_{MSY}$ = 0.77 with a 95% range of 0.05–1.51 and a 22.9% probability of *Frecent* exceeding $F_{MSY}$ (Figure 11) indicating the stock was unlikely to be subject to overfishing.

Median recent stock abundance was below $D_{MSY}$ ($D_{recent}/D_{MSY}$ = 0.77 with a 95% range of 0.33–2.3 and a 74% probability that the stock abundance was below $D_{MSY}$ (Figure 11) indicating the stock was likely to be overfished. The depletion value at which MSY occurs is 0.48 (the 95% credible interval is 0.26–0.7).

SC21 recommended that future work investigate the estimated long-term decline in catchability and evaluate the assumption of stationary productivity, in order to reduce uncertainty and improve confidence in future stock assessments. In addition, it encouraged using the prior information and results from the BSP approach to improve the Stock Synthesis model and to continue using both models in parallel to improve understanding of the status of the SWPO striped marlin stock.

**Table 7: Estimates of management quantities (stock status as depletion $D_{recent}$ relative to MSY), and fishing mortality (F) relative to indicators ($F_{MSY}$). P(>RP) refers to the probability that the metric (status, fishing mortality) is above the respective indicator.**

| **Summary** | | | | |
|---|---|---|---|---|
| **Year of assessment:** 2025 | **Depletion ($D_{recent}$)** | Likely (74%) to be below $D_{MSY}$ | | The stock is overfished |
| **Last year of data:** 2022 | **Fishing mortality ($F_{recent}$)** | Unlikely (23%) to be above $F_{MSY}$ | | Overfishing is not occurring |
| | **Projection** | $F$ about as likely as not (33–66%) to decline further by 2027 | | The stock is unlikely (<33%) to be undergoing overfishing in the near term under recent average catch levels. |
| | | $D$ likely (>66%) to increase further by 2027 | | The stock is about as likely as not (33–66%) to be overfished in the near term under recent average catch levels. |
| **Reference points** | **Metric** | **Median [2.5%-97.5% CI]** | **Likelihood** | **Recent trend / projection** |
| Depletion | $D_{MSY}$ | 0.48 [0.26 – 0.7] | | |
| Abundance | $P_{MSY}$ | 155 183 n [63 037 – 808 861] | | |
| Abundance | $0.2 \times log(K)$ | 65 041 n [36 198 – 327 844] | | |
| Catch | $MSY$ | 29 962 n [25 828 – 184 069] | | |
| Fishing mortality | $F_{MSY}$ | 0.23 [0.08 – 0.69] | | |
| **Estimates** | **Metric** | **Median [2.5%-97.5% CI]** | **Likelihood** | **Recent trend / projection** |
| Depletion | $D_{latest}$ | 0.38 [0.14 – 0.96] | | Increasing |
| Depletion | $D_{recent}$ | 0.37 [0.15 – 0.94] | | Increasing |
| Abundance | $P_{latest}$ | 121 943 n [34 067 – 1 479 253] | | Increasing |
| Abundance | $P_{recent}$ | 117 967 n [34 199 – 1 442 511] | | Increasing |
| Catch | $C_{latest}$ | 17 488 n [11 545 – 25 988] | | Stable, decreasing |
| Catch | $C_{recent}$ | 20 570 n [13 357 – 28 058] | | Stable, decreasing |
| Fishing mortality | $F_{latest}$ | 0.15 [0.01 – 0.47] | | Decreasing |
| Fishing mortality | $F_{recent}$ | 0.17 [0.01 – 0.49] | | Decreasing |
| **Status** | **Metric** | **Median [2.5%-97.5% CI]** | **Likelihood** | **Recent trend / projection** |
| Depletion | $D_{latest}/D_{MSY}$ | 0.81 [0.32 – 2.36] | Likely (>66%) to be below $D_{MSY}$ | |
| Depletion | $D_{recent}/D_{MSY}$ | 0.77 [0.33 – 2.3] | Likely (>66%) to be below $D_{MSY}$ | |
| Fishing mortality | $F_{latest}/F_{MSY}$ | 0.69 [0.05 – 1.51] | Unlikely (<33%) to be above $F_{MSY}$ | |
| Fishing mortality | $F_{recent}/F_{MSY}$ | 0.77 [0.05 – 1.51] | Unlikely (<33%) to be above $F_{MSY}$ | |
| **Projections** | **Metric** | **Median [2.5%-97.5% CI]** | **Likelihood** | **Recent trend / projection** |
| Depletion | $D_{proj}^{2027}/D_{MSY}$ | 1.1 [0.13 – 2.47] | About as Likely as Not (33-66%) to be below $D_{MSY}$ | $D_{proj}$ increasing |
| Fishing mortality | $F_{proj}^{2027}/F_{MSY}$ | 0.6 [0.04 – 19.3] | Unlikely (<33%) to be above $F_{MSY}$ | $F_{proj}$ decreasing |

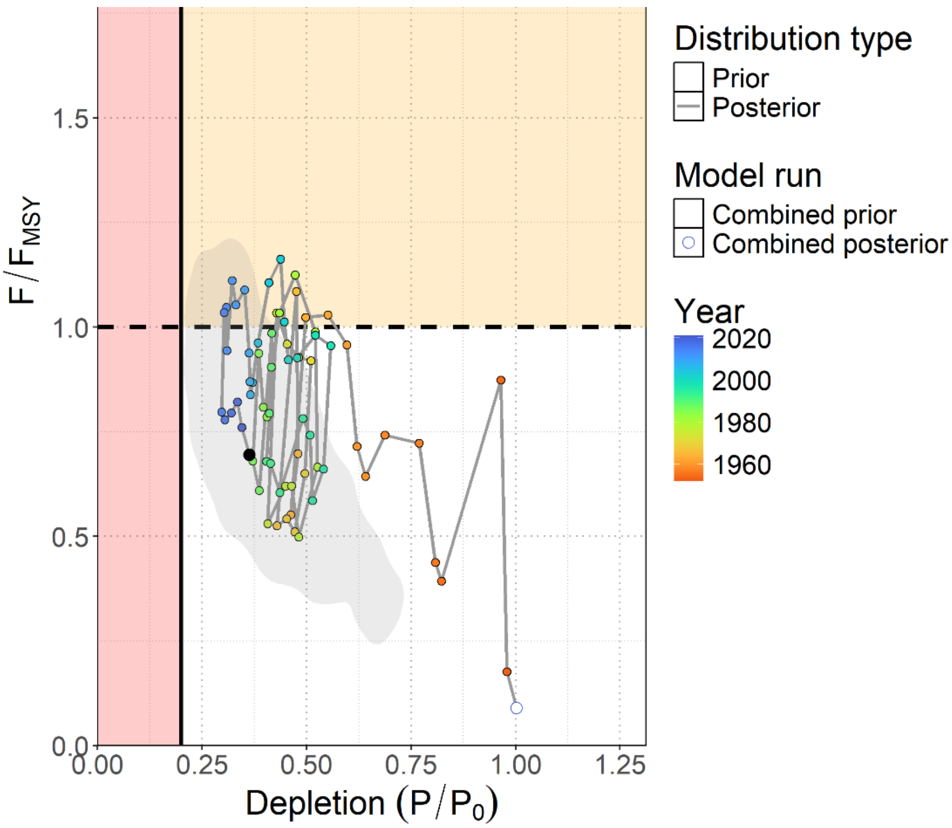



**Figure 10: Majuro plot showing the median posterior estimate of the latest stock depletion ($D_{latest} = P_{latest}/P_0$) and fishing mortality relative to MSY ($F_{latest}/F_{MSY}$). Points represent model estimates colored by year (blue ~ 2020, green ~ 1985, orange ~ 1950), with a connecting line showing the trajectory over time. The gray shaded contour is the bi-variate 95% credible distribution around the terminal year estimate $D_{2022}$ and $F_{2021}/F_{MSY}$.**

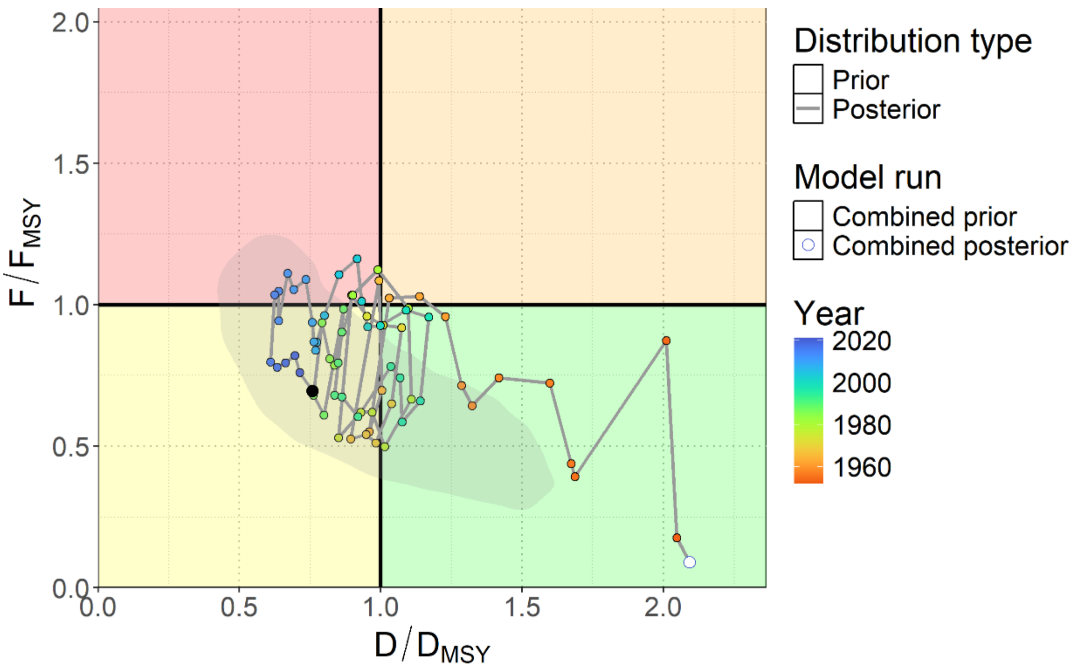



**Figure 11: Kobe plot showing the median posterior estimate of the latest stock depletion relative to depletion at MSY ($D_{latest}/D_{MSY}$) and fishing mortality relative to MSY ($F_{latest}/F_{MSY}$). Points represent model estimates colored by year (blue ~ 2020, green ~ 1985, orange ~ 1950), with a connecting line showing the trajectory over time. The gray shaded contour is the bi-variate 95% credible distribution around the terminal year estimate $D_{2022}/D_{MSY}$ and $F_{2021}/F_{MSY}$.**

## 5.2 Projections

Ten-year stochastic projections (Figure 12) assuming recent average catch levels (2018–2022) indicated continued population recovery through 2032, with median $D/D_{MSY}$ projected to reach 1.32 by 2032 and only a 26% chance of remaining overfished. Projections to 2025 showed a median $D/D_{MSY}$ of 0.99 with only a 51% chance of being overfished, improving to less than 50% probability by 2026. Fishing mortality was projected to continue declining through the projection period, with a median $F/F_{MSY}$ reaching 0.49 by 2032 and only a 15% chance of overfishing occurring. While continued recovery was expected under status quo catch scenarios, the substantial uncertainty in model inputs was carried forward into projections, and, for example, there remained a very small risk (5%) of the stock declining to less than 5% depletion under recent average catch levels by 2032. This risk would be expected to increase if catches rose above recent average levels.

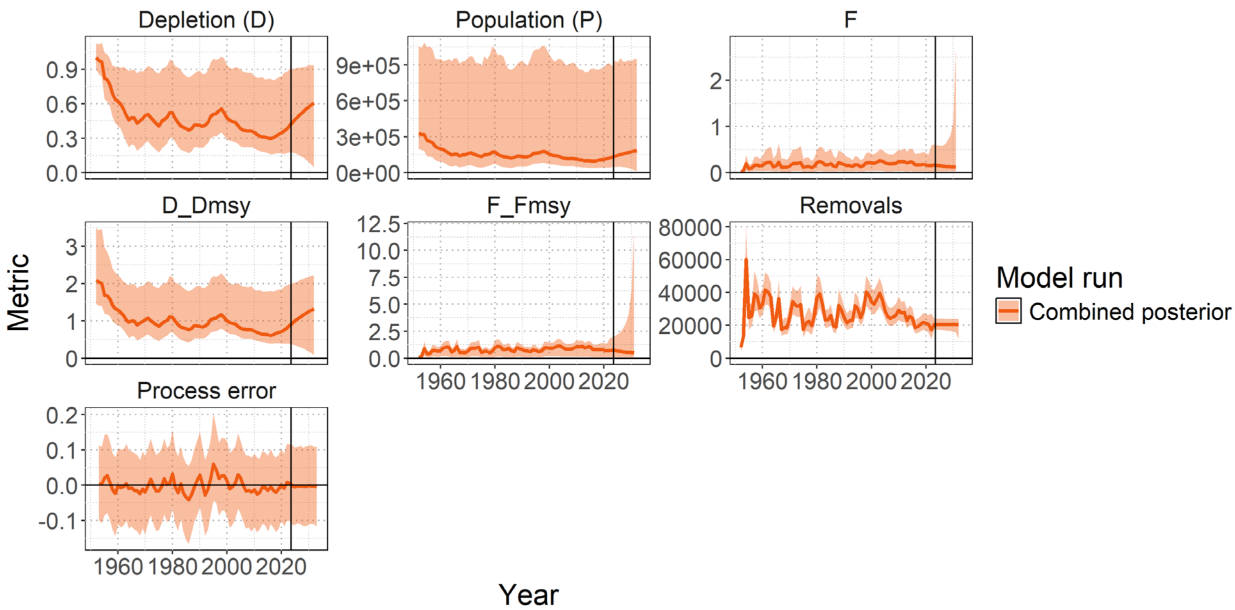



**Figure 12: Posterior time series distributions for key derived quantities over time during the forecast period 2023-2032 (line = median, shading = 90% credible interval): depletion (D), absolute population size in numbers (P), fishing mortality (F), stock status relative to MSY reference points ($D/D_{MSY}$ , $F/F_{MSY}$), total removals in numbers, and process error. The model ensemble is shown in orange. A 90% credible interval is shown to restrict the y-axis of the fishing mortality F panel, which shows high values of F in the projection period, as a very small percentage of populations are estimated to go to zero under recent average catch levels.**

## 5.3 Management advice and implications

The general conclusions of this assessment are as follows:

- **Population trajectory:** The SWPO striped marlin stock declined substantially from the assumed unfished state in 1952, reaching minimum levels around the mid-2010s, with strong evidence of recovery since approximately 2015.
- **Current stock status:** The stock is estimated to be overfished but not undergoing overfishing, with recent depletion relative to $D_{MSY}$ at 0.77 (95% CI: 0.33 – 2.3) and recent fishing mortality relative to $F_{MSY}$ at 0.77 (95% CI: 0.05 – 1.51).
- **Stock status probabilities:** There is a 74% probability that the stock is below $D_{MSY}$ and only a 22.9% probability that overfishing is occurring.
- **Future projections:** Ten-year projections assuming recent average catch levels indicate continued recovery, with median $D/D_{MSY}$ projected to reach 1.32 by 2032 and only a 26.05% chance of remaining overfished. SC21 noted that under projections using recent average catch, the stock had a 55% probability of recovering to greater than MSY levels by 2026 (Table 8), and recommended not increasing catch above recent average levels.

**Table 8: Table of the probability of Southwest Pacific striped marlin reaching $D_{MSY}$ from status quo projections.**

| Year | Probability |
|---|---|
| 2023 | 38% |
| 2024 | 44% |
| 2025 | 49% |
| 2026 | 55% |
| 2027 | 59% |
| 2028 | 62% |
| 2029 | 66% |
| 2030 | 69% |
| 2031 | 71% |
| 2032 | 74% |

SC21 noted that the current BSPM may not reflect population dynamics associated with the changing population age structure, and encouraged the SSP to include non-stationary population processes in model parameters to improve understanding of the population dynamics in future assessments.

## 5.4 New Zealand recreational catch and effort

### East Northland charter vessel CPUE standardisation

A general linear model (GLM) was used to standardise annual striped marlin CPUE from East Northland charter boats using the postal survey data and a matching subset of data from the Billfish Logbook Programme (Holdsworth et al 2019). The core fleet was defined as those vessels that had fished at least once in at least five years.

### National billfish logbook CPUE standardisation

For the GLM, the core fleet was defined as those vessels that had fished for at least 10 trips in each of at least 5 years (Holdsworth 2023). This resulted in a core fleet size of 31 vessels which took 72% of the catch

### Comparison of indices

The annual East Northland charter index showed an increasing trend in standardised CPUE following the introduction of the billfish moratorium in 1987 to the mid-1990s and then a decreasing trend back toward the long-term average (Figure 13). There have been several relatively poor years since 2013–14. A number of long-term East Northland charter operators are leaving the industry and new entrants and more private vessels have been recruited to the logbook scheme. Over the time series since 1975 there has been a strong decline in the number of days of fishing for marlin per season across the fleet of East Northland charter boats. The CPUE index based on daily billfish logbook data shows similar trends to the charter index (Figure 13).

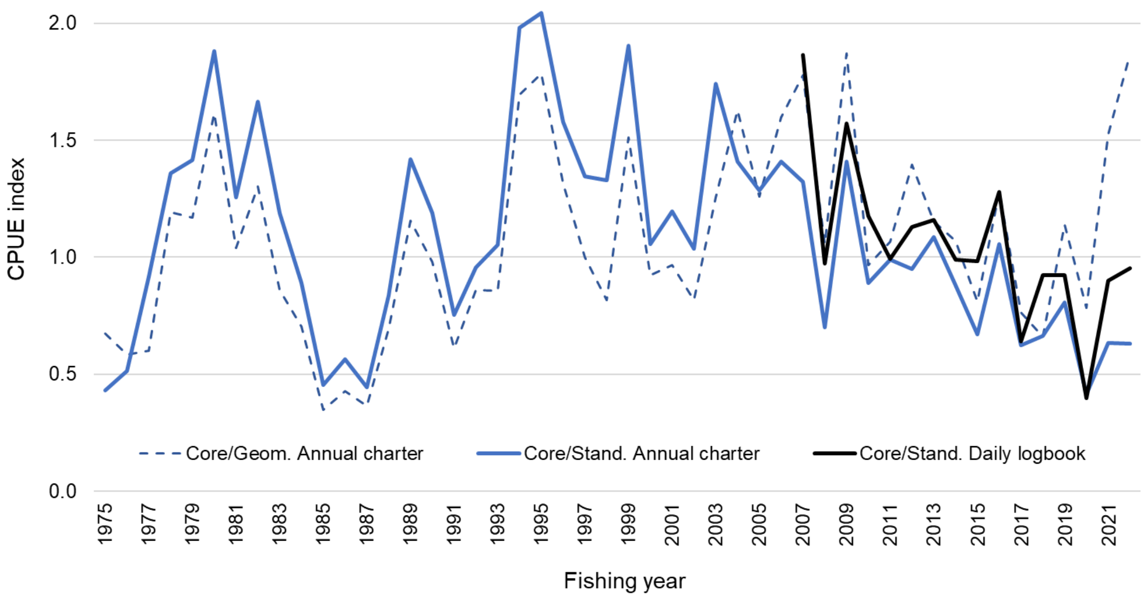



**Figure 13: CPUE trends in New Zealand recreational catch and effort.**

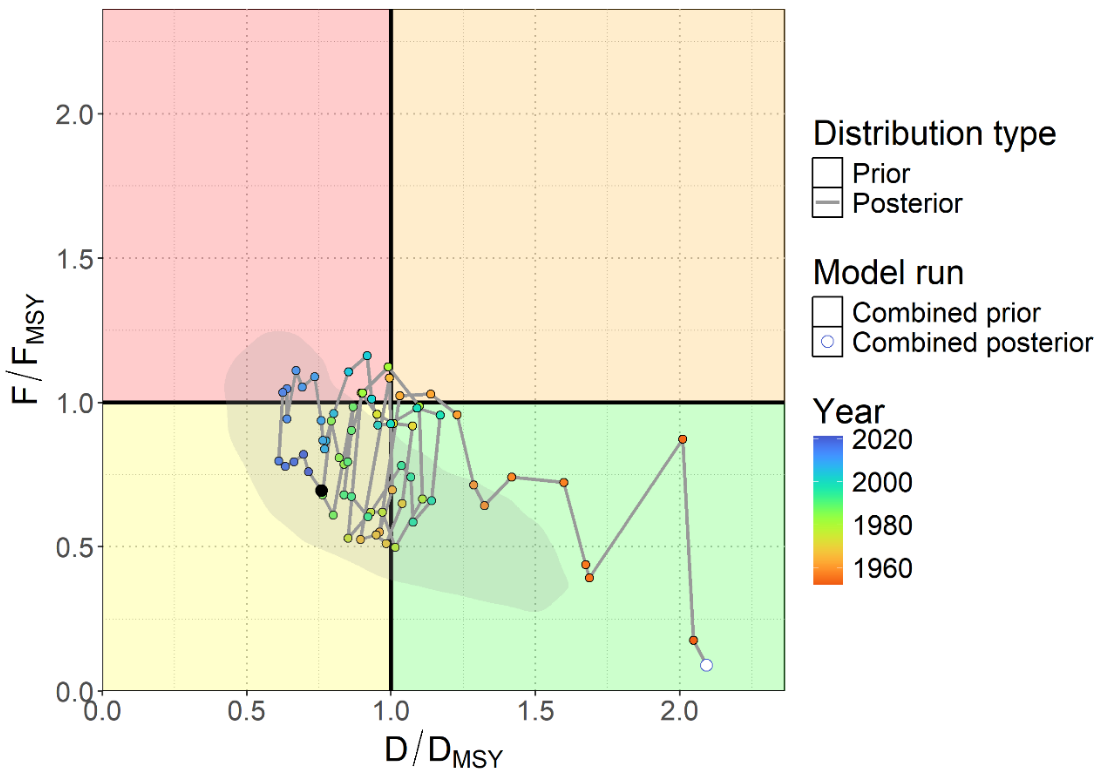
## 6. STATUS OF THE STOCK

The 2025 revision of the Southwest Pacific Ocean (SWPO) striped marlin stock assessment employed a multi-model approach in an effort to provide a robust basis for the provision of management advice on stock status. During the revision work, issues with the integrated age-structured assessment using Stock Synthesis 3 (Castillo-Jordan et al 2025), that could not be satisfactorily resolved led to a strategic shift to a data-moderate Bayesian surplus production model (BSPM) (Ducharme-Barth et al 2025).

**Stock structure assumptions**

Striped marlin taken in New Zealand are part of a larger SWPO stock, although stock structure is not well understood.

| **Stock Status** | | |
|---|---|---|
| Most Recent Assessment Plenary Publication Year | 2025 | |
| Intrinsic productivity level | Medium | |
| Catch in most recent year of assessment | Year: 2022 | Commercial Discards: 7.4 t<br>Recreational Catch: 36.2 t |
| Assessment Runs Presented | Diagnostic case and model ensemble based on results of sensitivity analyses | |
| Reference Points | Target: $B_{MSY}$<br>Soft Limit: Not established by WCPFC but evaluated using HSS default of 20% $SB_0$<br>Hard Limit: Not established by WCPFC but evaluated using HSS default of 10% $SB_0$<br>Overfishing threshold: $F_{MSY}$ | |
| Status in relation to Target | Unlikely (< 40%) to be at or above the target | |
| Status in relation to Limits | Soft Limit: Unlikely (< 40%) to be below<br>Hard Limit: Very Unlikely (< 10%) to be below | |
| Status in relation to Overfishing | Overfishing is Unlikely (< 40%) to be occurring | |

| Historical Stock Status Trajectory and Current Status |
| --- |
| <br>**Kobe plot showing the median posterior estimate of the latest stock depletion relative to depletion at MSY ($D_{latest}/D_{MSY}$) and fishing mortality relative to MSY ($F_{latest}/F_{MSY}$). Points represent model estimates colored by year (blue ~ 2020, green ~ 1985, orange ~ 1950), with a connecting line showing the trajectory over time. The gray shaded contour is the bi-variate 95% credible distribution around the terminal year estimate $D_{2022}/D_{MSY}$ and $F_{2021}/F_{MSY}$.** |

| **Fishery and Stock Trends** | |
| --- | --- |
| Recent Trend in Biomass or Proxy | The SWPO striped marlin stock shows evidence of recovery from low levels since approximately 2015. |
| Recent Trend in Fishing Intensity or Proxy | Fishing mortality appears highly variable, with substantial uncertainty, it trends upwards to a peak (~ 0.275) in the early 2000s before declining. |
| Other Abundance Indices | In the earliest years of the fishery, nominal CPUE approached 3 fish per 1000 hooks before declining to ~ 0.45 fish per 1000 hooks in 1970, and ~ 0.05 fish per 1000 hooks at the end of the model period. |
| Trends in Other Relevant Indicator or Variables | The stock has been estimated to be recovering from the mid-2010s. |

| **Projections and Prognosis** | |
| --- | --- |
| Stock Projections or Prognosis | Ten-year stochastic projections assuming recent average catch levels (2018–2022) indicated continued population recovery through to 2032. SC21 recommended not increasing catch above recent average levels. |
| Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits | Soft Limit: Unknown<br>Hard Limit: Unknown |

| | |
|---|---|
| Probability of Current Catch or TACC causing Overfishing to continue or commence | Unlikely (< 40%) with current catch levels |

<table>
<tr><th colspan="4">Assessment Methodology and Evaluation</th></tr>
<tr><td>Assessment Type</td><td colspan="3">Level 1 – Fully Quantitative Stock Assessment</td></tr>
<tr><td>Assessment Method</td><td colspan="3">Data-moderate Bayesian surplus production model</td></tr>
<tr><td>Assessment Dates</td><td colspan="2">Latest assessment Plenary publication year: 2025</td><td>Next assessment: unknown</td></tr>
<tr><td>Overall assessment quality rank</td><td colspan="3">1 – High Quality</td></tr>
<tr><td>Main data inputs (rank)</td><td>- Annual catch data (in numbers of individuals) spanning 1952–2022<br>- Annual longline effort (in numbers of hooks)<br>- CPUE indices (one-off sensitivies or included in grid): composite DWFN longline, Australian longline index, New Zealand recreational index, observer based indices</td><td colspan="2">1 – High Quality (all)</td></tr>
<tr><td>Data not used (rank)</td><td>N/A</td><td colspan="2"></td></tr>
<tr><td>Changes to Model Structure and Assumptions</td><td colspan="3">Issues with the updated 2019 integrated age-structured assessment that could not be resolved led to a strategic shift to a data-moderate Bayesian surplus production model (BSPM) in 2025.</td></tr>
<tr><td>Major Sources of Uncertainty</td><td colspan="3">• Population scale: Substantial uncertainty in absolute population scale, though minimum scale is well-constrained by the 70-year catch history<br>• Stock structure: Potential stock connectivity issues given genetic evidence of SWPO fish in North Pacific catches.<br>• Data representativeness: Uncertainty in how well available abundance indices represent true stock trends and whether catch reporting has been complete over the assessment period<br>• Model structure: The BSPM approach inherently simplifies complex age-structured population dynamics, assuming a single well-mixed population with knife-edged selectivity<br>• Biological parameters: Uncertainty in key biological parameters (e.g., natural mortality, steepness, and growth) propagates through prior distributions and contributes to wide credible intervals around stock status estimates</td></tr>
</table>

| Qualifying Comments |
|---|
| None |

# 7. FOR FURTHER INFORMATION

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