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Striped marlin catch and CPUE in the New Zealand sport fishery, 2022–23 to 2024–25

New Zealand Fisheries Assessment Report 2026/03

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PLAIN LANGUAGE SUMMARY

This report describes the annual recreational catch of striped marlin in New Zealand and the data collected by the Logbook Programme for the 2022–23 to 2024–25 fishing years. Information on the annual catch and fishing effort help track trends in the fishery and the wider striped marlin population.

This report adds to a long record of recreational striped marlin catch in New Zealand including:

- 100 years of weigh station records of individual fish from some sportfishing clubs.
- 50 years of charter boat average catch per day fished for marlin.
- 50 years of tag and release information from the Gamefish Tagging Programme.
- 47 years of the number of billfish, sharks, and tuna weighed by sport fishing clubs.
- 19 years of daily catch and effort data from the Billfish Logbook Programme.

Overall, the records show striped marlin catch per day fished was relatively high in the late 1970s and early 1980s with three years of low CPUE in the mid-1980s. Catch rates were high again in the mid-1990s and there has been a declining trend since then. The 2024–25 fishing year was notable for a shift in the distribution of striped marlin with poor catches in the traditional fishing regions of northern and eastern New Zealand and high catch rates in the central and southern west coast of the North Island.

EXECUTIVE SUMMARY

Holdsworth, J.C.[1]; Gaskell, S.G.[1]; Curtis, S.[2] (2026). Striped marlin catch and CPUE in the New Zealand sport fishery, 2022–23 to 2024–25.

***New Zealand Fisheries Assessment Report* 2026/03. 34 p.**

Striped marlin (*Kajikia audax*) is the dominant billfish species available to sport fishers in New Zealand over the austral summer months, with a long-established international reputation for large fish. Two Northland fishing clubs have near continuous records of landed fish weights since 1925. An annual postal survey of charter boat operators started collecting striped marlin catch and effort information from the East Northland target fishery in 1975, providing a useful index of annual availability and abundance of adult striped marlin in New Zealand.

The New Zealand Billfish Logbook Programme replaced the postal survey in 2006–07 by collecting daily catch and effort data from cooperating charter operators and private skippers that fish for marlin more than 10 days per year. It was extended to other regions where marlin are caught and is a voluntary programme aimed at fishers willing to keep a complete and accurate fishing record while targeting billfish. Striped marlin catch per unit effort (CPUE) is calculated as the number caught (landed or tagged) per vessel day gamefishing. Fishing effort is measured as vessel days or vessel hours, because the number of lines set or the number of anglers on board does not effectively increase fishing power.

Billfish catch records from sport fishing clubs and striped marlin CPUE are updated and summarised in this report. Over the fishing years 2022–23 to 2024–25, 139 striped marlin were reported in logbooks from 644 days fished. Fishing clubs affiliated with the New Zealand Sport Fishing Council (NZSFC) reported 4424 striped marlin caught, with 76% tagged and released. Commercial fishers have been required to release all marlin caught for the last 33 years; there is little overlap between the summer sport fishery and the surface longline fishery.

This report also summarises the combined catch from 55 sport fishing clubs affiliated with the NZSFC. This includes striped marlin landed at club weigh stations and fish tagged and released. Fishers who are not members of clubs may choose to weigh their fish at a weigh station (where they can also arrange for it to be processed and smoked). Clubs also record catch details for these fish.

Annual striped marlin catch and effort data are standardised using a negative binomial model that includes zero catches for the annual East Northland charter boat series and the daily billfish logbook series. Overall, CPUE was relatively high in the late 1970s and early 1980s. There were three years of low CPUE in the mid-1980s, followed by an increasing trend to the mid-1990s There is a declining trend in charter and logbook standardised CPUE since 2006–07 in both indices. The similarity is in part due to the charter catch and effort being a subset of the logbook data. There has also been a reduction in the gamefish charter fleet over this period. The 2024–25 fishing year was notable for a shift in the distribution of striped marlin with very few available or caught from northern and eastern New Zealand and high catch rates in the central and southern west coast of the North Island. For many logbook participants that could not access the west coast, striped marlin catch and CPUE were very low.

For many years, when charter fishing was how most fishers went gamefishing, club catch records were a reasonably complete record of billfish and large pelagic shark landings in the sport fishery. Since 1990 there has been a shift toward marlin fishing from private launches and trailer boats by club members and in the last 15 years an increase in offshore capable trailer boats. Fishers are mobile and travel to various launch sites to target marlin or tuna. Small boat fishing competitions are well supported

[1] Blue Water Marine Research, New Zealand Ltd.
[2] Marinus Ltd.

and club membership is required for all entrants. However, there has been an increase in billfish landed or released that are not included in club records, particularly in years when catch rates are high. Fishers whose billfish are not included in club records or the New Zealand gamefish tagging programme database are encouraged to enter catch details on the web page at fishcatch.co.nz. There have been 570 gamefish recorded in the fishcatch and fishtag online forms from 2022–23 to 2024–25.

1 INTRODUCTION

The first marlin caught on rod and reel in New Zealand was by a tourist from Scotland in February 1915. He was fishing at Cape Brett with a custom-made rod and reel from the vessel Waiomo. The 223 pound (101 kg) striped marlin was weighed at Russell. After the end of the First World War there were five charter vessels operating from the Bay of Islands (Illingworth 1961). Game fishing in New Zealand was made famous after the first trip to New Zealand by the best-selling author Zane Grey in 1926. He brought with him a secretary who took notes as he fished and a cinephotographer to record his exploits for a film that was later shown around the world (Illingworth 1961). The book Grey wrote "Tales of the Angler's Eldorado, New Zealand" also went worldwide (Grey 1926).

Recreational sport fishing clubs have kept catch records for pelagic gamefish for many years. The Bay of Islands Swordfish Club (BOISC) and Whangaroa Sport Fishing Club have published yearbooks with detailed catch records since 1925. These contain the date, weight, and vessel name for each fish recorded. For many years these records contained an almost complete record of billfish caught by charter boats and skippers with specialist knowledge and fishing tackle to target marlin. Northern New Zealand has one of the few recreational gamefish fisheries in the world where striped marlin (STM, *Kajikia audax*) is clearly the main target species and all but one of the current IGFA world records for line weights 4 kg and above are held by striped marlin caught in this area (IGFA 2025).

Of the five billfish species reported from New Zealand waters, striped marlin are the most abundant and main species of the recreational gamefish fishery in northern New Zealand. Recreational fishers increasingly target broadbill swordfish (*Xiphias gladius*) using deep-set baits during the day, and commercial vessels fish with night-set surface longlines. Other billfish occasionally caught by recreational and commercial fishers are blue marlin (*Makaira nigricans*), black marlin (*Istiompax indica*), and shortbilled spearfish (*Tetrapturus angustirostris*). The marlins and spearfish are most abundant in summer and autumn around northern New Zealand. Swordfish are caught year-round in New Zealand, with the primary season for recreational fishers being between March and July (Holdsworth et al. 2016).

Regulations in New Zealand have prohibited commercial vessels from retaining marlins and spearfish caught in New Zealand fisheries waters. Although there are requirements in place for commercial fishers to report marlin caught and released, not all commercial operators have kept complete records of marlin species that they cannot land (Francis et al. 2000). Since November 2010 there have been reporting requirements for amateur fishing charter vessels (AFCV) operators which require reporting of fishing effort by target species on charter trips, but marlin are not on the list of required species for catch reporting. Voluntary reporting of some gamefish species occurs, and these are included in the AFCV reporting system. Since 1990 there has been a significant decline in the number of charter vessels targeting marlin and an increase in private launches and trailer boats marlin fishing (Holdsworth & Kopf 2005). Many sport fishers are willing to report their catch and fishing effort to help monitor trends in abundance and availability of billfish in New Zealand.

The New Zealand Gamefish Tagging Programme has operated since 1975. This project is supported by Fisheries New Zealand and the New Zealand Sport Fishing Council (NZSFC) and encourages anglers to tag and release billfish, tuna, and sharks to aid research and conservation. The tagging database contains a good record of where and when these fish were caught but only estimated fish weights are available.

A 51-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. Initially it was a simple annual postal survey.

However, it only provided catch and effort on a coarse scale (the number of marlin and targeted fishing days per vessel per year) from East Northland (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 & Saul 2017).

This report summarises the results for Fisheries New Zealand project STM2022-01 to monitor recreational fisheries for billfish within New Zealand fisheries waters and specific objectives:

1. To undertake a logbook programme for striped marlin for the recreational fishery for the 2019–20, 2022–23, 2023–24 and 2024–25 fishing years
2. To update time series of catches, landings, and size composition data collected from recreational sources for the 2022–23, 2023–24 and 2024–25 fishing years.

2 METHODS

2.1 Catches, landings, and size composition

The number of billfish, sharks, and tuna landed by recreational fishers and weighed by fishing clubs is collated annually by the New Zealand Sport Fishing Council (NZSFC) since 1977–78 and published in their yearbooks (see Appendix 1). The New Zealand Gamefish Tagging Programme collects tag and release details from clubs and individuals (Holdsworth & Gaskell in press). The number of gamefish recorded are summarised and plotted by species. The austral fishing year (1 July to 30 June) is used by NZSFC and in this report.

Catch records from club weigh stations are requested at the end of each year from the main North Island clubs. Data from within the New Zealand EEZ were separated into landed fish and released fish and summarised by species, fishing year, and club.

Average annual weights of striped marlin are plotted with data from the three Northland clubs as this was where most of the catch was taken prior to 1980 and they have the longest time series.

Amateur fishing charter vessels (AFCV) have been required to register and record fishing effort and target species since 2010–11, although reporting of billfish is not mandatory. An extract of the Fisheries New Zealand AFCV database was obtained (replog 16964) with all fishing events targeting or catching billfish. Some charter operators have been reporting billfish total catch and retained catch. This is summarised by October fishing year, but marlin catch is very rare from July to September, so the data is effectively the same as the austral fishing year used by clubs.

2.2 Catch and effort data collection

An annual postal survey of Northland gamefish charter skippers was started in 1977 and some skippers provided catch and effort data for two previous seasons. Respondents reported the number of days fished per vessel where marlin was the target species (whether under charter or fishing with friends) and the catch of billfish by species for the season in the area from North Cape to Cape Rodney. The survey was administered by the Ministry of Agriculture and Fisheries until 1996 and was continued with support from the New Zealand Marine Research Foundation (Holdsworth & Kopf 2005). The average catch of striped marlin per target fishing day per vessel, home port and year from East Northland was available for use in a CPUE analysis.

The Fisheries New Zealand project STM2005-01 completed the postal surveys for 2003–04 and 2004–05 and designed a billfish logbook programme to collect the number of days fished and catch. Project

STM2006-01 ran the final postal survey of East Northland charter skippers for 2005–06 and the first year of the national logbook programme in 2006–07. The main objective of the logbook programme was to collect data on striped marlin, however, data on other New Zealand gamefish species are also recorded. These are blue marlin, black marlin, shortbill spearfish, swordfish, yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), southern bluefin tuna (*Thunnus maccoyii*), and shortfin mako shark (*Isurus oxyrinchus*). The logbook forms were designed with input from charter boat organisations and experienced private skippers as part of project STM2005/01 (Holdsworth et al. 2007) and reviewed by the Highly Migratory Species Working Group. Data collected includes target species; hours fished per day; fishing method; location at noon; primary target species; water temperature at noon; a record of billfish strikes; wind speed and direction; and precise locations for fish caught. Distribution of logbooks has focused on charter vessels and private boats that target billfish more than ten days per season. Fishing effort is measured as vessel days or vessel hours targeting gamefish, because the number of lines set or the number of anglers on board does not effectively increase fishing power.

Initially, many skippers or owners were recruited to the logbook programme in December and January 2006–07, but new volunteers have been actively sought and accepted in subsequent seasons. Regular contact with participants is maintained, including in-season newsletters. Free Hallprint billfish tags are provided to logbook participants during the year, and a free logbook shirt is provided to each skipper if they return their logbook at the end of the season.

A database with a 3-tier architecture built in Microsoft .NET Framework 2.0 is used to store the information. The first tier is the front-end or presentation layer which uses Windows Forms originally created in Microsoft Visual Studio 2008 and later reconstructed in Access. The database adopts some of the table and field names of the Fisheries New Zealand **rec_data** database with the addition of several tables and fields required to record environmental variables and support functionality. Summary tables were exported into Microsoft Excel for analysis and plotting.

The gamefish logbook scheme has been running for 19 years (2006–07 to 2024–25) and collects data on striped marlin catch and targeted fishing effort from charter and private vessels from four regions (Figure 1).

Standardisation of CPUE was undertaken on core vessels in the fleet using a negative binomial model fitted to all data, including zero catches, in GLM runs undertaken using R software (Bentley et al. 2012). Alternative core vessel selection criteria were investigated by considering the reduction in the percentage of catch with the number of vessels in the core set. The most appropriate combination of criteria was defined as those vessels that had fished for a minimum of ten trips in at least five of the selected number of years.

The set of model terms offered was fishing year, month, region, vessel, fleet (charter or private), target species, hours fished, and sea surface temperature at noon each day.

A subset of logbook data was selected to match the previous East Northland postal survey (1974–75 to 2005–06) so that the East Northland charter boat CPUE time series now extends for 51 years. For trends in CPUE to be comparable across the whole time series, it is important to standardise the fishing area and methods where possible. Effectively the survey area is covered by Fisheries New Zealand General Statistical Areas 002, 003, and 004 from North Cape to the northern point of Great Barrier Island. It excludes catch and effort from the productive fishery in the Three Kings Islands area, which started in the early 1990s north of New Zealand.

A similar approach to CPUE standardisation was used on the 51 year time series including core vessel selection and with a negative binomial model fitted to all data, including zero catches, in GLM runs undertaken using R software (Bentley et al. 2012).

3 RESULTS

3.1 Catch trends from fishing club records

Striped marlin has been among the main large pelagic species caught in the New Zealand gamefish fishery over the last 48 years (Figure 2). Details of landed catch comes from all fishing clubs affiliated to the New Zealand Sport Fishing Council and tagged fish from the gamefish tagging database. For many years these data have been a reasonably complete record of recreational catch of billfish and large pelagic sharks. Clubs also record fish taken by non-members who may choose to weigh their fish at a club and have it processed or smoked. Striped marlin numbers vary by season but show a significant increase during the early 1990s and have been maintained at over 1000 per year since 1995 apart from 2020 which was affected by Government Covid-19 restrictions (Figure 2). A record number of striped marlin (2558) were landed or tagged by sport fishers in the 2015–16 fishing year, and this was followed by four relatively poor years, but striped marlin catch was above average in 2021–22 and 2023–24 (Figure 2).

The 2022–23 striped marlin season had a late start with few fish caught in January and severe storms in late January and early February. There were still a few marlin available in May and June as has been known to occur in some years. The 2023–24 season was the opposite. There were large numbers of small striped marlin caught in January. The weather was reasonably settled but the fish disappeared from northern New Zealand during the main part of the season. There were record catches in Hawke Bay, with fish also caught off the Wairarapa coast and even the east coast of the South Island, indicating that most of the marlin may have moved south. The 2024–25 season was described by some of the most experienced skippers as the worst marlin season they had experienced in East Northland and Bay of Plenty. There were a few fish caught in early January, but most of the marlin catch was on the west coast of the North Island with high catch rates for the boats that could travel there. The fish also moved south to Kawhia, New Plymouth and beyond during the season (Holdsworth &Gaskell in press).

Yellowfin tuna was a major component of catch from 1977–78 to 2000–01, but by 2008–09 they had disappeared from the gamefish fishery (Figure 2). In 2014–15 some, mainly small, yellowfin were caught and the warm 2015–16 fishing year was also a relatively productive year with similar catches of yellowfin tuna in 2019–20 and 2020–21 of about 550 landed or tagged. Catches were low from 2021–22 to 2023–24 but then increased to 1930 recorded in 2024–25. There were a large number of yellowfin of less than 20 kg and many of these may not be included in the catch records, but some yellowfin of up to 80 kg were weighed.

The number of mako sharks recorded has declined since the mid-1990s (Figure 2), in part because of a shift in fisher attitudes. Fishing tournaments now do not allow landing of sharks and almost all mako caught are tagged and/or released. The NZSFC clubs introduced minimum weights for landed pelagic sharks in the 1990s of 40 kg and some clubs have increased this to 70 kg or no longer accept sharks at their weigh stations. Mako will take trolled lures or baits set for marlin, but there has been a significant decline in by-catch and sightings in the last 5 years.

Blue marlin is, at times, a dominant component of the catch of other billfish species caught in New Zealand waters, with over 200 blue marlin landed or tagged and released in the fishing years 1999–00, 2011–12, 2018–19 and 2019–20. Over the last four fishing years blue marlin catch has declined from 157 in 2021–22 to just 13 in 2024–25 (Figure 3).

Swordfish catch increased over the last 20 years to 150 per year after 2013–14, but the numbers have fluctuated over the last three fishing years with an average of 154 caught (72 landed and 82 tagged and released) per year. The number of shortbill spearfish that have been landed and tagged and released reached peak numbers in 2017–18 and 2018–19 with over 120 caught per year and apart from low catches in in 2023–24 have returned to average numbers of around 60 per year since. Black marlin are caught in low numbers, generally between 5 and 15 each year (Figure 3).

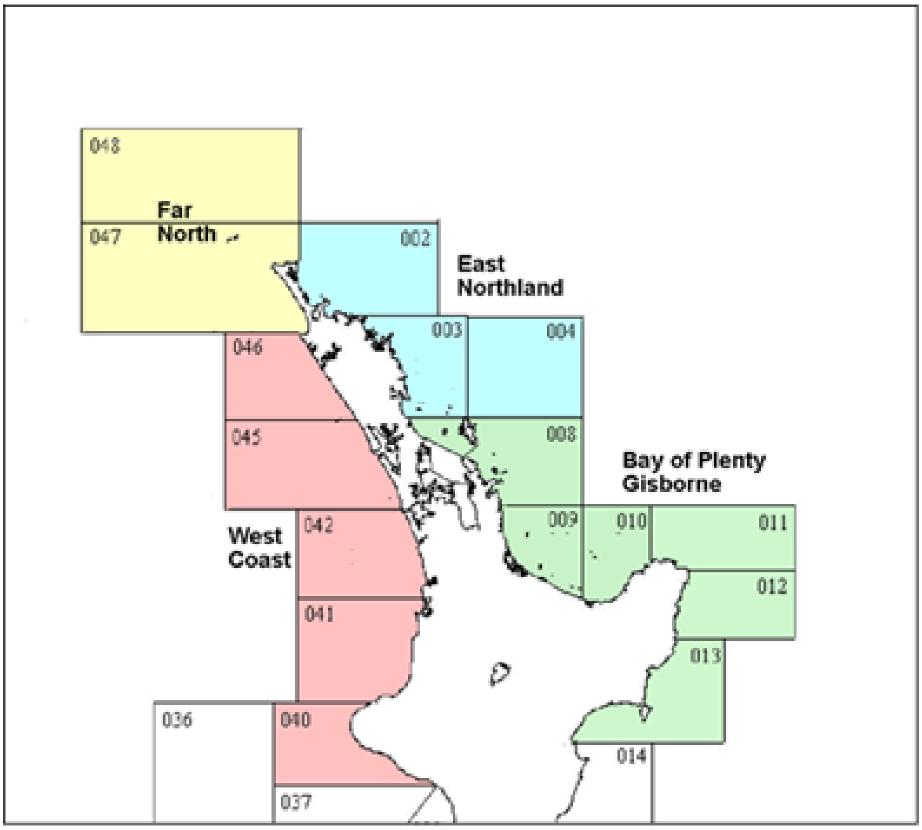

Figure 1. General Statistical Areas and the regional boundaries used in this report.

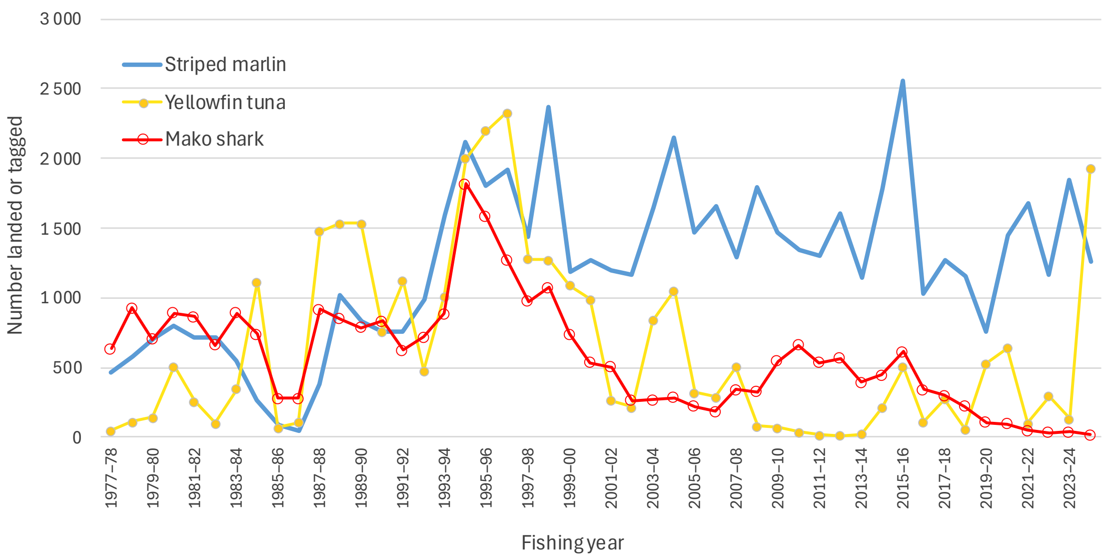

Figure 2. The total of landed or tagged fish by year for the main billfish, tuna, and shark species in New Zealand from New Zealand Sport Fishing Council records.

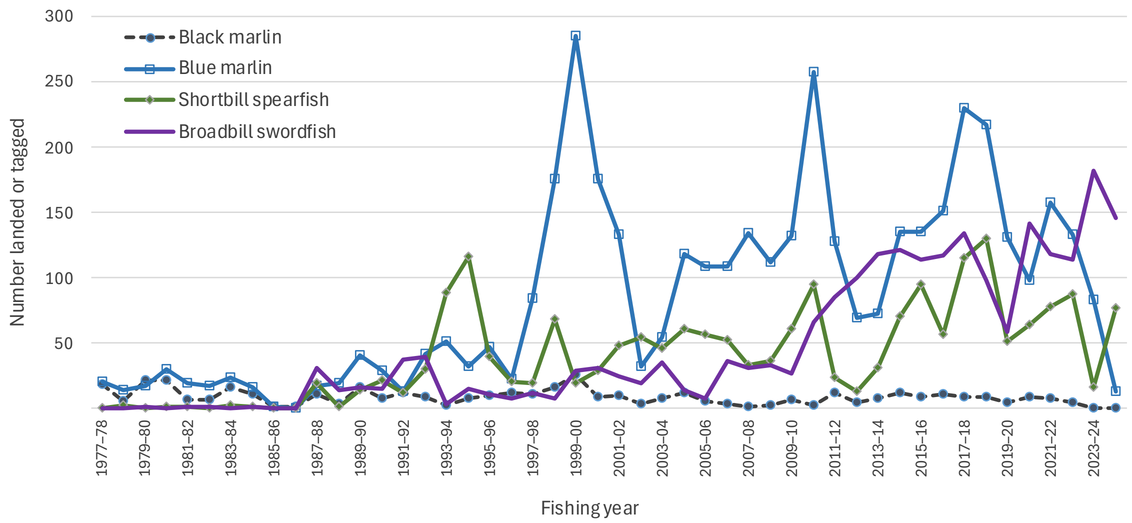

Figure 3. Total number of billfish, other than striped marlin, landed or tagged by year in New Zealand from New Zealand Sport Fishing Council records.

The NZSFC introduced a voluntary minimum weight of 90 kg for striped marlin in 1988 to encourage fishers to tag and release 50% of the recreational catch. Consequently, more small marlin are tagged, and the average weight of landed fish is generally higher than that of tagged marlin (Figure 4). A notable exception is in 2024–25 when the average landed weight was lower than the average estimated weight of tagged fish. The proportion of marlin tagged has increased over the last eight years and the average weight of landed and tagged fish has declined (Figure 4). This trend is also seen in the number of marlin landed over the last eight years (Figure 5).

The median weight of striped marlin reported for fishing club weigh stations also reflect changes in the size structure of fish caught in New Zealand waters. These shows a decline from about 115 kg average prior to 1950 to about 100 kg since the mid-1980s. Over the last 35 years, annual median weight has cycled, with occasional years with median weights below 90 kg, which usually coincide with warmer years, often associated with La Niña events (Figure 6). The four years from 2021–22 to 2024–25 have a cluster of low median weights below 93 kg which is has not occurred before.

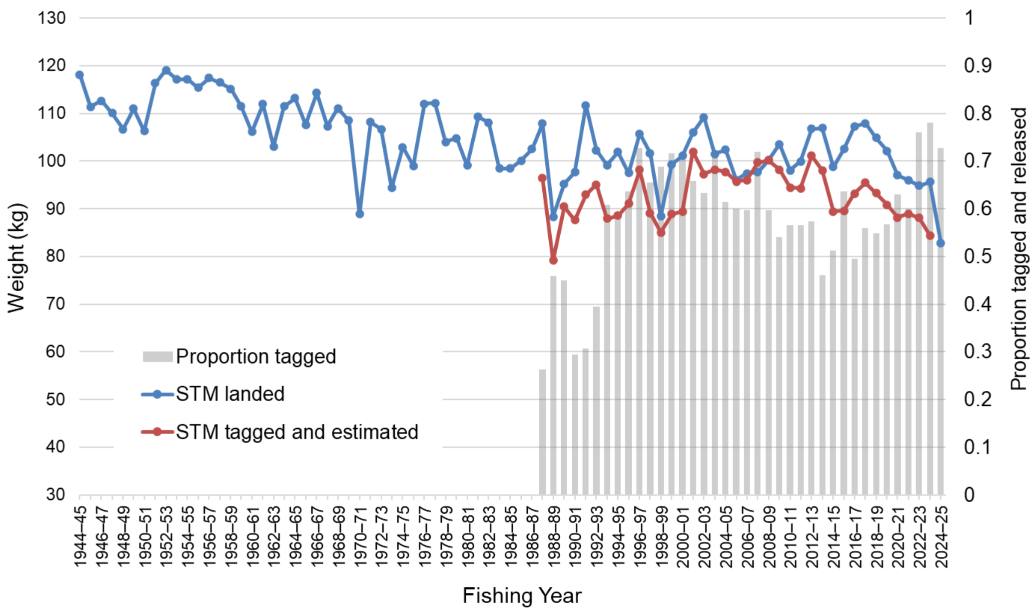

Figure 4. Average weight of landed striped marlin and tagged striped marlin from NZSFC clubs and the proportion tagged and released by fishing year.

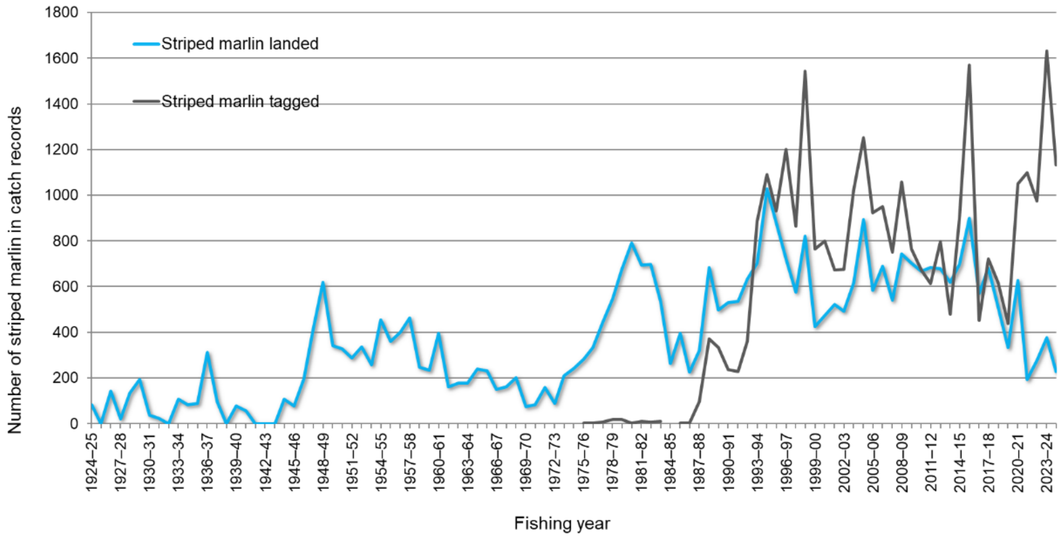

Figure 5. The number of striped marlin landed in NZSFC club records and tagged in the gamefish tagging database by fishing year. Fishing years are labelled by the later calendar year, e.g., 2018 is 2017–18.

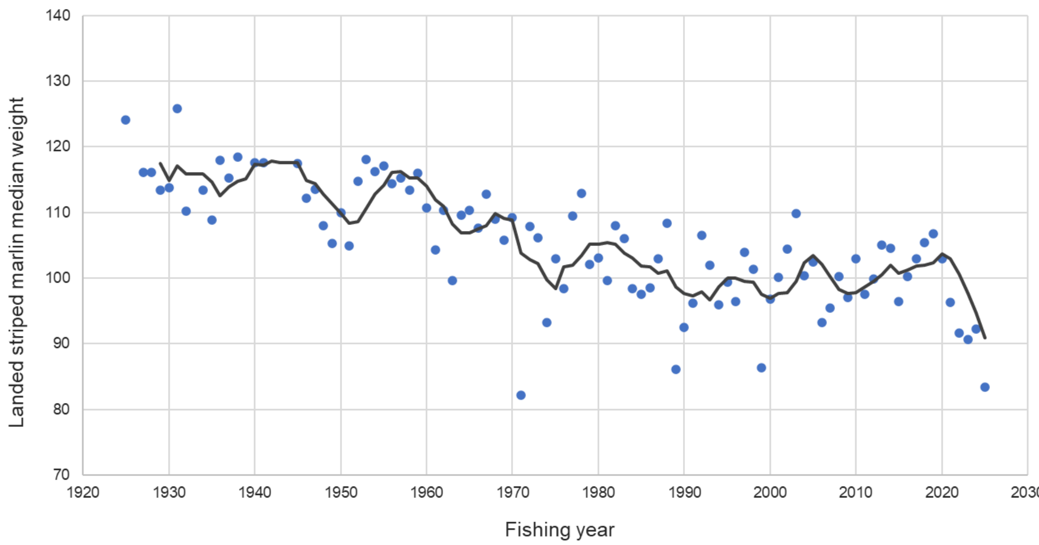

Figure 6. The median weight of landed striped marlin (blue dots) from NZSFC records and the five-year rolling average (black line) by fishing year.

3.2 Striped marlin catch and effort data

The Billfish Logbook Programme has collected 19 years of data with an average of 169 (sd = 101.1) striped marlin recorded yearly. The annual catch of striped marlin by sport fishers in New Zealand has been variable in recent years. It ranged from 1163 in 2022–23 to 1842 in 2023–24. The striped marlin recorded catch was 1448 in 2024–25. (Table 1). The average annual reported total catch is 1454 (sd = 392.8) over the last 19 years. For many years the charter boat skippers were the main participants in the billfish postal surveys that make up much of this time series. The number of charter boats engaged in the billfish fishery and the number of days fished per year have declined in recent years (Figure 7). A structural change in the fleet has contributed to this, with a shift away from long-range charter boats tagging large numbers of marlin on multi-day trips. Some of the skippers from high performing charter boats have retired as charter vessels but are still running their boats and remain in the logbook programme. In this analysis, data from these ex charter skippers fishing in East Northland have been included in the charter vessel CPUE extended series (Figure 7).

Table 1: Number of New Zealand landed striped marlin (STM) recorded in club records and number tagged from the gamefish tagging programme. Also totals from two catch effort surveys of skippers, the East Northland charter boat survey and the Billfish Logbook Programme.

Fishing	Recreational striped marlin numbers			East Northland	Billfish	Proportion of
year	Landed	Tagged	Total	charter survey STM	logbook STM	catch surveyed
1974–75	242	0	242	4		0.02
1975–76	281	3	284	11		0.04
1976–77	332	2	334	140		0.42
1977–78	445	7	452	70		0.15
1978–79	547	18	565	150		0.27
1979–80	692	17	709	136		0.19
1980–81	792	2	794	84		0.11
1981–82	704	11	715	127		0.18
1982–83	702	6	708	126		0.18
1983–84	543	9	552	149		0.27
1984–85	262		262	66		0.25
1985–86	395	2	397	67		0.17
1986–87	226	2	228	51		0.22
1987–88	281	136	417	165		0.4
1988–89	647	408	1 055	407		0.39
1989–90	463	367	830	308		0.37
1990–91	532	232	764	181		0.24
1991–92	519	242	761	197		0.26
1992–93	608	386	994	226		0.23
1993–94	663	929	1 592	438		0.28
1994–95	910	1 206	2 116	510		0.24
1995–96	705	1 104	1 809	489		0.27
1996–97	619	1 302	1 921	116		0.06
1997–98	543	898	1 441	116		0.08
1998–99	823	1 541	2 364	451		0.19
1999–00	398	791	1 189	206		0.17
2000–01	422	851	1 273	267		0.21
2001–02	430	771	1 201	96		0.08
2002–03	495	671	1 166	142		0.12
2003–04	592	1 051	1 643	206		0.13
2004–05	834	1 348	2 182	181		0.08
2005–06	630	923	1 553	134		0.09
2006–07	675	965	1 640		270	0.16
2007–08	485	806	1 291		316	0.24
2008–09	741	1 058	1 799		384	0.21
2009–10	607	858	1 465		276	0.19
2010–11	607	731	1 338		185	0.14
2011–12	635	663	1 298		176	0.14
2012–13	744	858	1 602		243	0.15
2013–14	620	520	1 140		206	0.18
2014–15	696	1 088	1 784		209	0.12
2015–16	900	1 653	2 553		207	0.09
2016–17	516	517	1 033		66	0.07
2017–18	618	752	1 370		163	0.14
2018–19	507	652	1 159		78	0.08
2019–20	333	469	802		56	0.07
2020–21	627	806	1 433		95	0.07
2021–22	377	891	1 268		145	0.11
2022–23	277	886	1 163		64	0.06
2023–24	376	1 466	1 842		59	0.03
2024–25	429	1 019	1 448		16	0.01
Total	27 483	32 252	58 716	6 017	3 230	

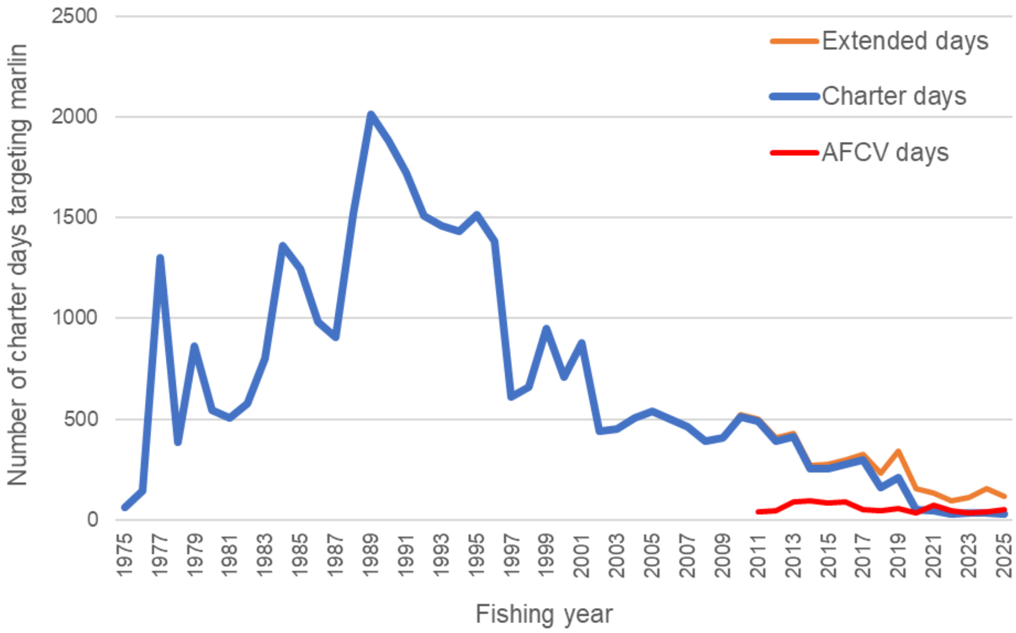

Figure 7. **The number of days targeting marlin by charter vessels in the postal survey (blue), the logbook survey with extended charter series (orange), and the AFCV Activity Catch Return forms (red) by year since 1975.**

The distribution of logbook days targeting marlin across all logbook years shows a strong mode in February with a declining trend to June. Occasionally there are days fished in December and July (Figure 8).

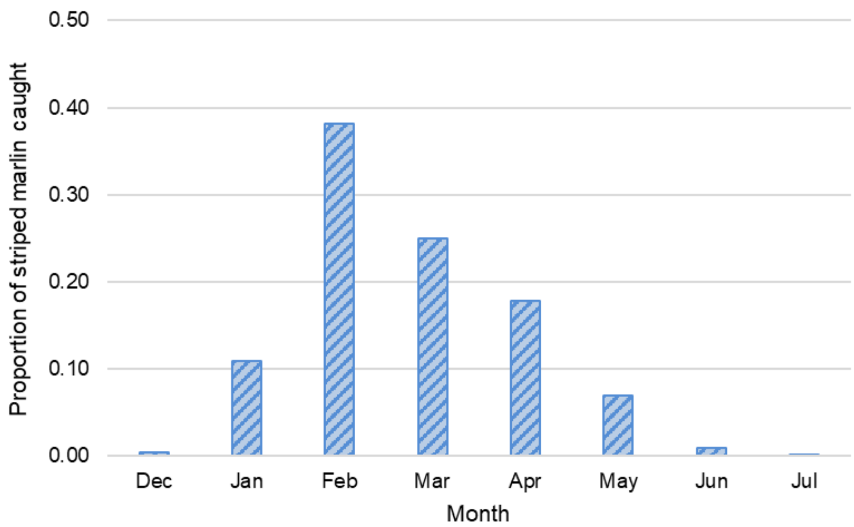

Figure 8. **Proportion of striped marlin caught by month from all logbooks, 2006–07 to 2024–25.**

Billfish logbook striped marlin catch by month and region for 2022–23 to 2024–25 show a decline in the proportion of catch from the Far North region and an increase in the East Northland region. Catch in January was variable with no striped marlin in 2022–23 but 24% of the year's catch in 2023–24. The catch in 2024–25 was very low across all months as the fish were mainly on the west coast (Figure 9).

The overall distribution of logbook days fished shows the usual strong mode in February 2024 but weaker modes in February 2023 affected by tropical cyclones and in February 2025 due to overall poor catch rates (Figure 9).

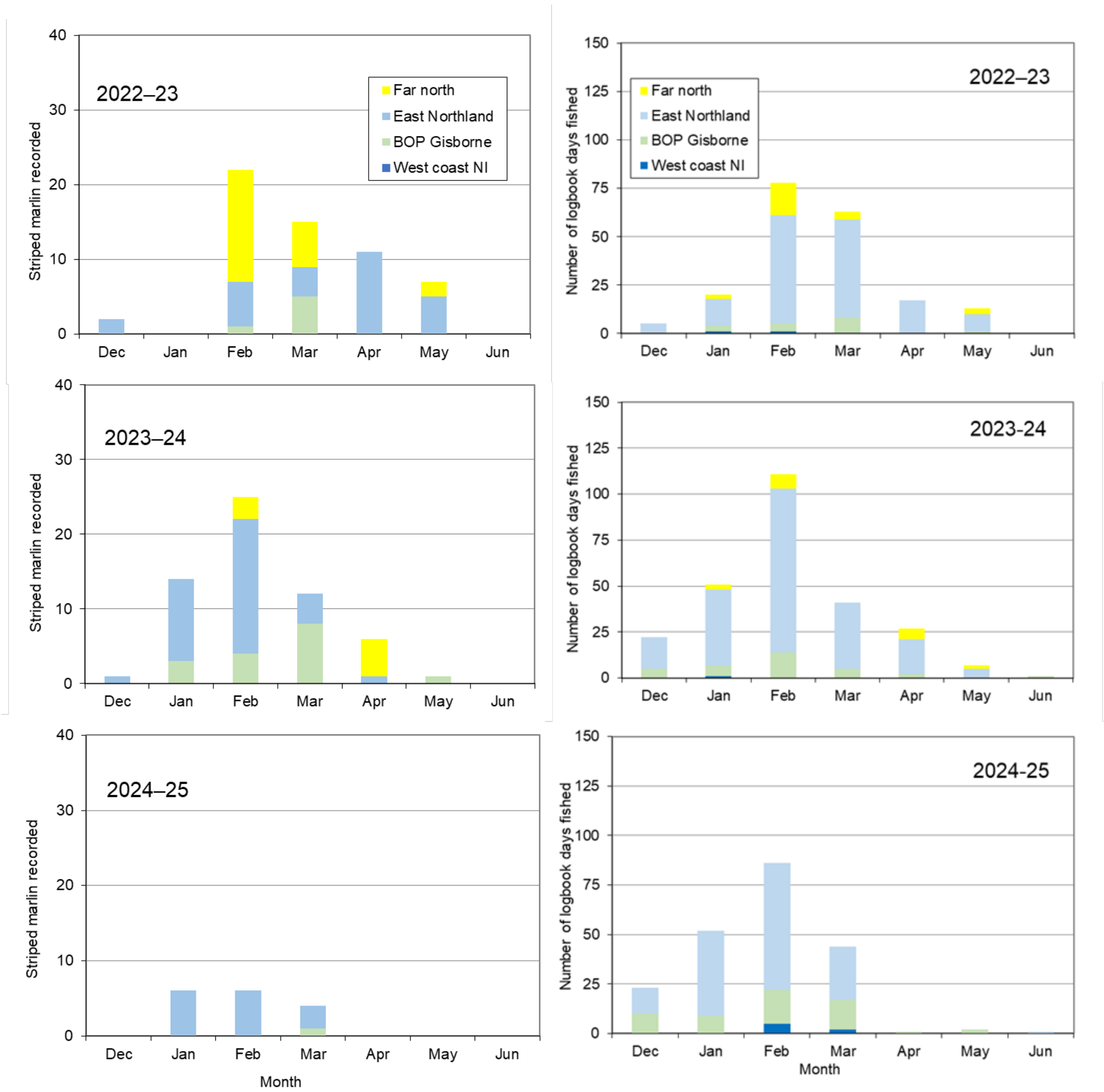

Figure 9. Logbook reported number of striped marlin caught by region and month (left) and total logbook days fished targeting billfish by month (right) for 2022–23 to 2024–25.

There is no consistent patten in catch rates by region or across years for 2022–23 to 2024–25 (Figure 10). Catch per day is high in the Far North in some months, which has also been a patten in the past in the Three Kings area. The Bay of Plenty had the best catch rate in March 2023–24, with 1.6 striped marlin per day. Late season (April, May) catch rates can be high but need to be interpreted with caution since they are based on limited data from a few days fishing. In 2024–25 catch rates were consistently low across the main fishing areas.

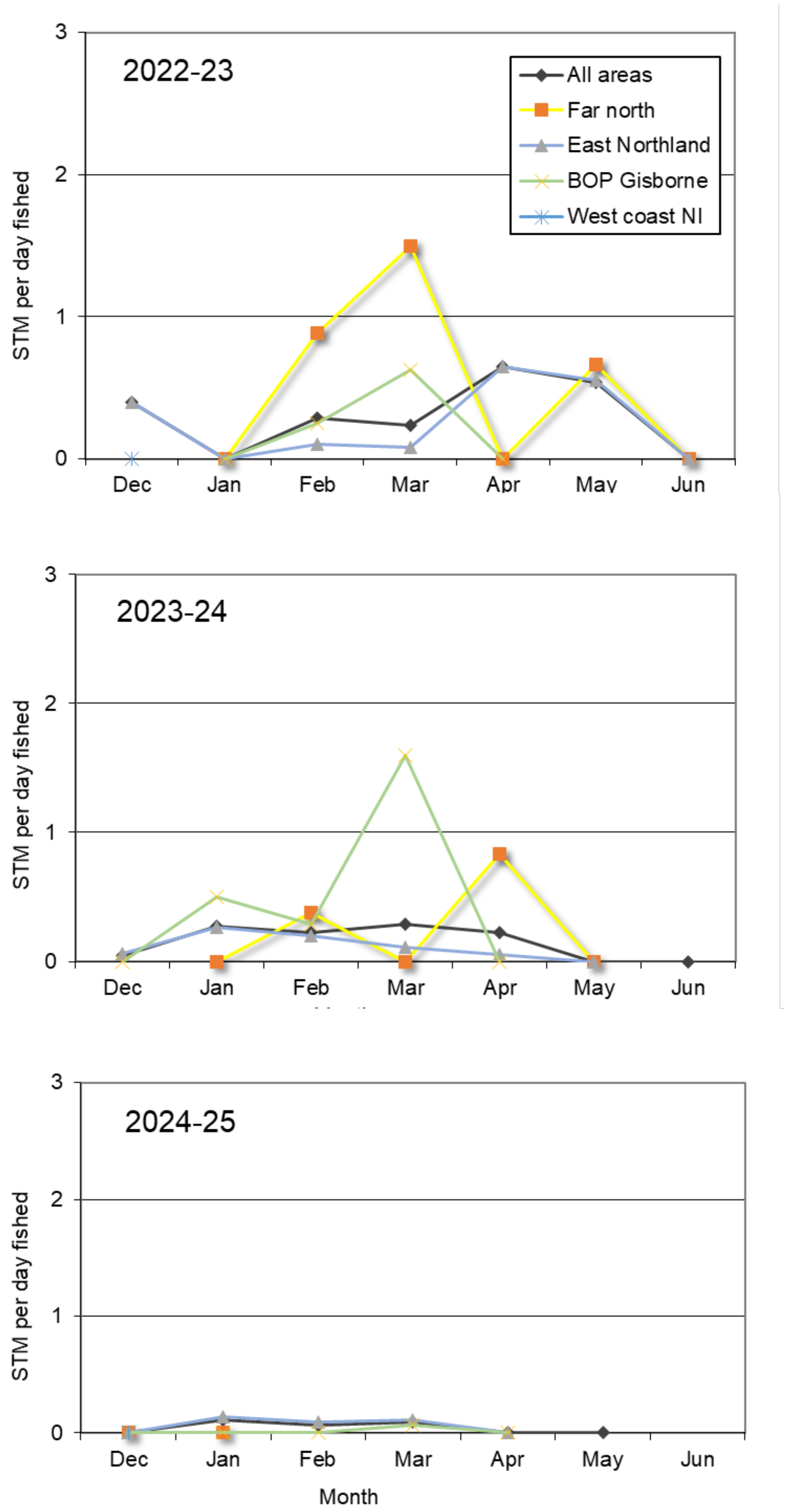

Figure 10. Striped marlin catch per vessel day by area and month from logbook data for 2022–23 to 2024–25.

3.3 Amateur fishing charter vessel records

Registered amateur fishing charter vessel skippers are not required to report billfish, but there has been some voluntary reporting of billfish total catch and retained catch by species. An extract of the Fisheries New Zealand AFCV database was obtained with all fishing events targeting or catching billfish. A total of 560 striped marlin have been caught and 175 (31%) retained since 2010–11. The number of striped marlin reported was highest in 2013–14, then declined after 2015–16 before increasing again in 2020–21 and 2021–22 which were years where more fish were caught in the Three Kings and far north area (Holdsworth 2023) (Figure 11). In 2024–25 38 striped marlin were caught with 30 of these from long range vessels fishing the Three Kings and far north area out of port Mangonui. The seasonality of catch by month of AFCV striped marlin across all years (Figure 12) is similar to the seasonal distribution of catch in the logbook programme (Figure 8).

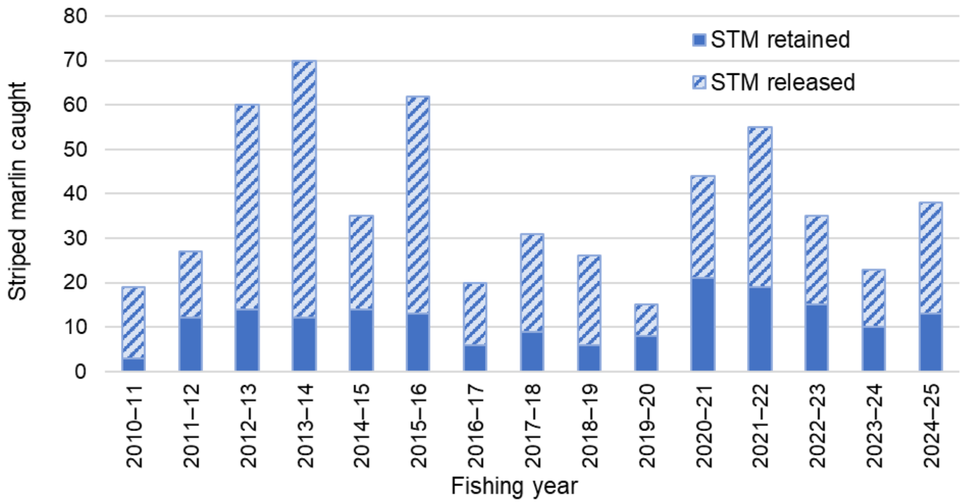

Figure 11. The number of striped marlin reported in AFCV logbooks, by October fishing year.

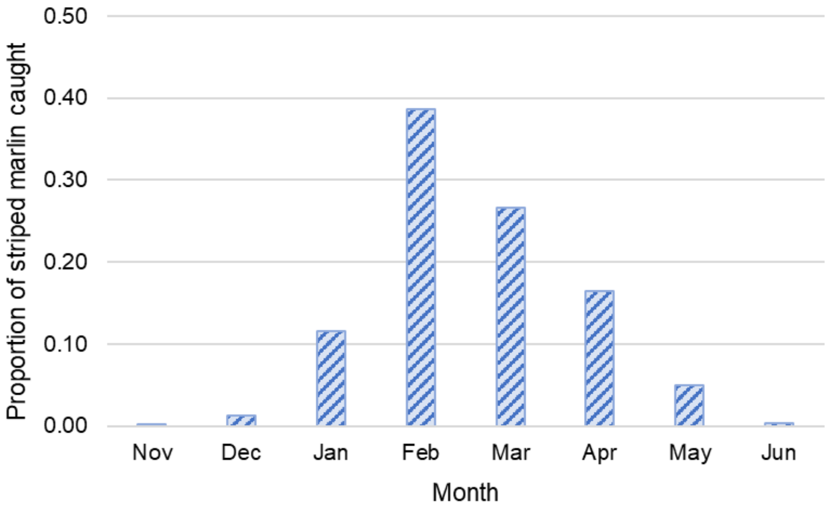

Figure 12. Proportion of striped marlin caught by month from AFCV logbooks, 2010–11 to 2024–25.

There were 15 charter vessels that voluntarily reported catching striped marlin from the 2022–23 to 2024–25 fishing seasons (Figure 13). Five vessels caught more than two marlin per season in some years. Only two vessels reported striped marlin catch in all three years and 23 of the 45 vessel years had no reported catch of striped marlin.

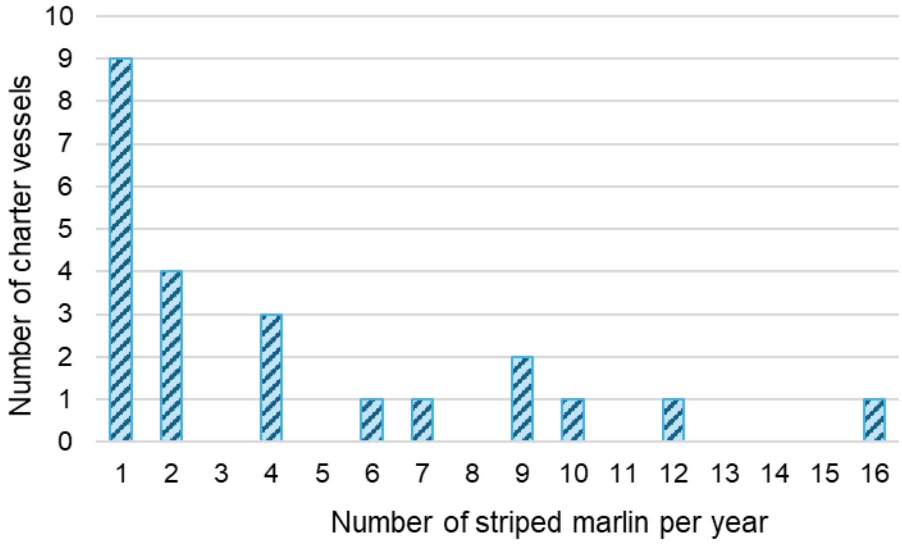

Figure 13. The number of striped marlin caught per charter vessel year from 2022–23 to 2024–25.

3.4 East Northland charter CPUE time series

The CPUE data from 1974–75 to 2005–06 are available from the annual postal survey of charter skippers. A subset of logbook data from the gamefish logbook scheme has been used to extend the postal survey time series from 2006–07 to 2024–25. The data were restricted to recreational charter vessels fishing in East Northland (General Statistical Areas 002, 003, and 004; Figure 1). The core fleet was restricted to vessels that had fished for at least five years, including years with zero catch. This resulted in a core fleet size of 54 vessels which took 86% of the catch from this dataset. A plot of the degree of overlap of core vessel fishing years is provided (Figure 14).

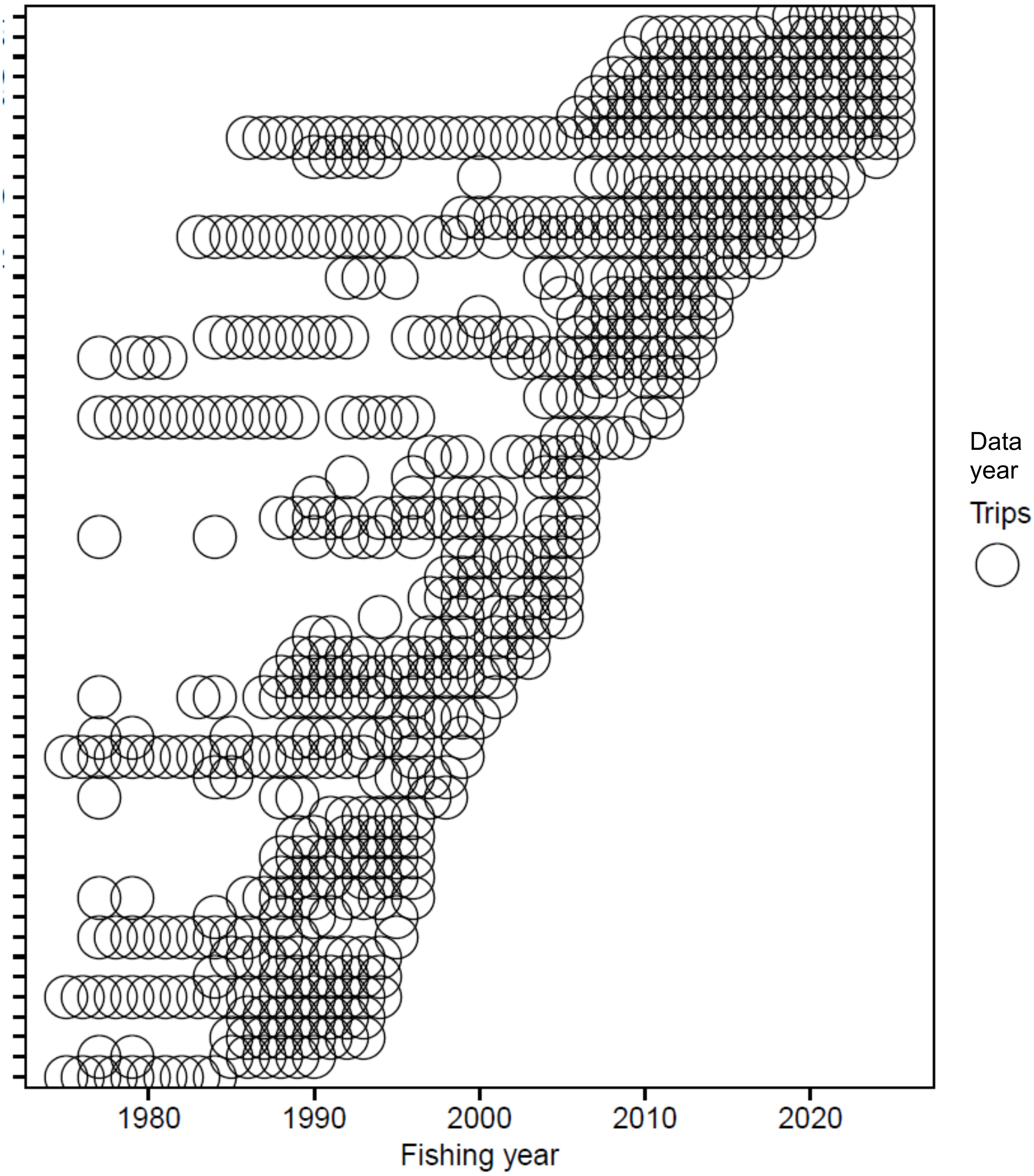

Figure 14: Participation of the core charter vessels used. Each observation summarises one year of fishing, whether or not successful with respect to striped marlin. Fishing years are labelled by the later calendar year, e.g., 1990 = 1989–90.

A negative binomial model was fitted to all data including zero catches, with a forward stepwise selection of model terms made on the basis of the Akaike Information Criterion (AIC). The maximal set of model terms offered to the stepwise selection algorithm was:

~ . fyear + area + vessel + poly(log(days), 3)

with the term *fyear* forced into the model. *Area* denotes the home port of the vessel. Terms were only added to the model if they increased the percent deviance explained by at least 1%. Table 2 provides a summary of the changes in the deviance explained and in AIC as each term was added to the model. The final model formula was:

~ fyear + poly(log(days), 3) + vessel

Table 2: Summary of stepwise selection for the East Northland charter vessel model. Model terms are listed in the order of acceptance to the model. AIC: Akaike Information Criterion; *: Term included in final model.

Term	DF	Log likelihood	AIC	Deviance pseudo-R2 (%)	Nagelkerke pseudo-R2 (%)	
fyear	51	-1 811	3 725	40.04	42.76	*
poly(log(days), 3)	54	-1 666	3 441	61.98	63.79	*
vessel	107	-1 519	3 252	75.99	77.27	*

Standardised and unstandardised CPUE indices by year are presented in Appendix 3. The standardisation effect of the model was a tendency to reduce the index in the early years and lift the index since the late 1990s (Figure 15). The main driver for this was the effort term which shows a large and consistent trend toward fewer days fished by charter boats in East Northland between 1982 and 2009. The vessel effect pushed the index back down as a number of new high performing vessels entered the fishery in the mid-2000s (Figure 16). Distribution and influence plots are provided in Appendix 4.

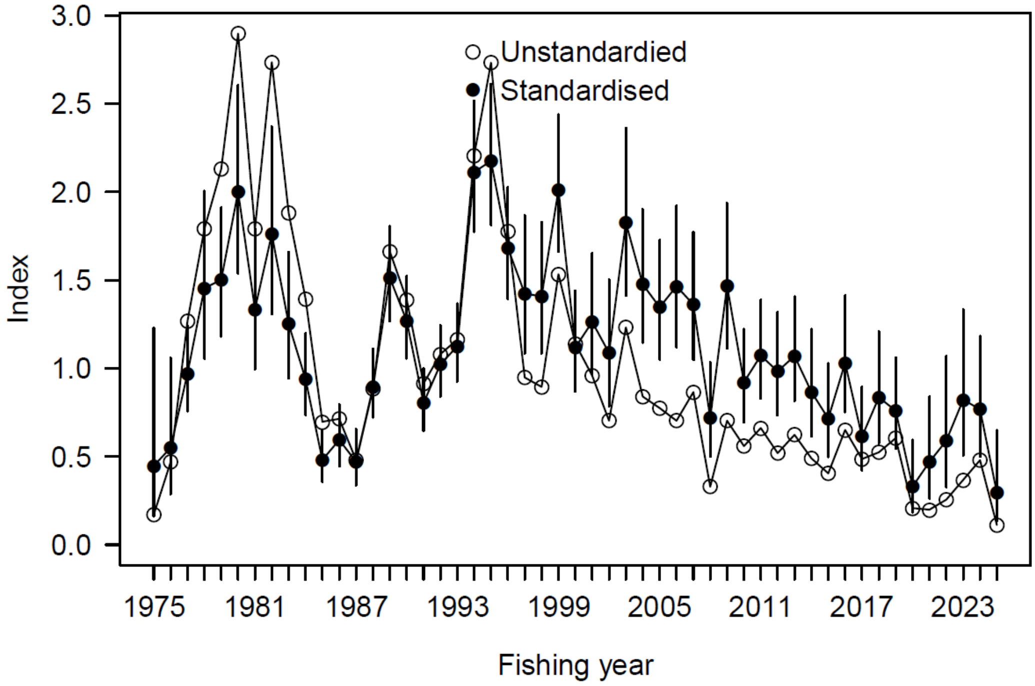

Figure 15: The effect of standardisation on East Northland charter boat striped marlin catch. The unstandardised index is based on the geometric mean of the catch only and is not adjusted for effort. The standardised index is adjusted for fishing effort and vessel.

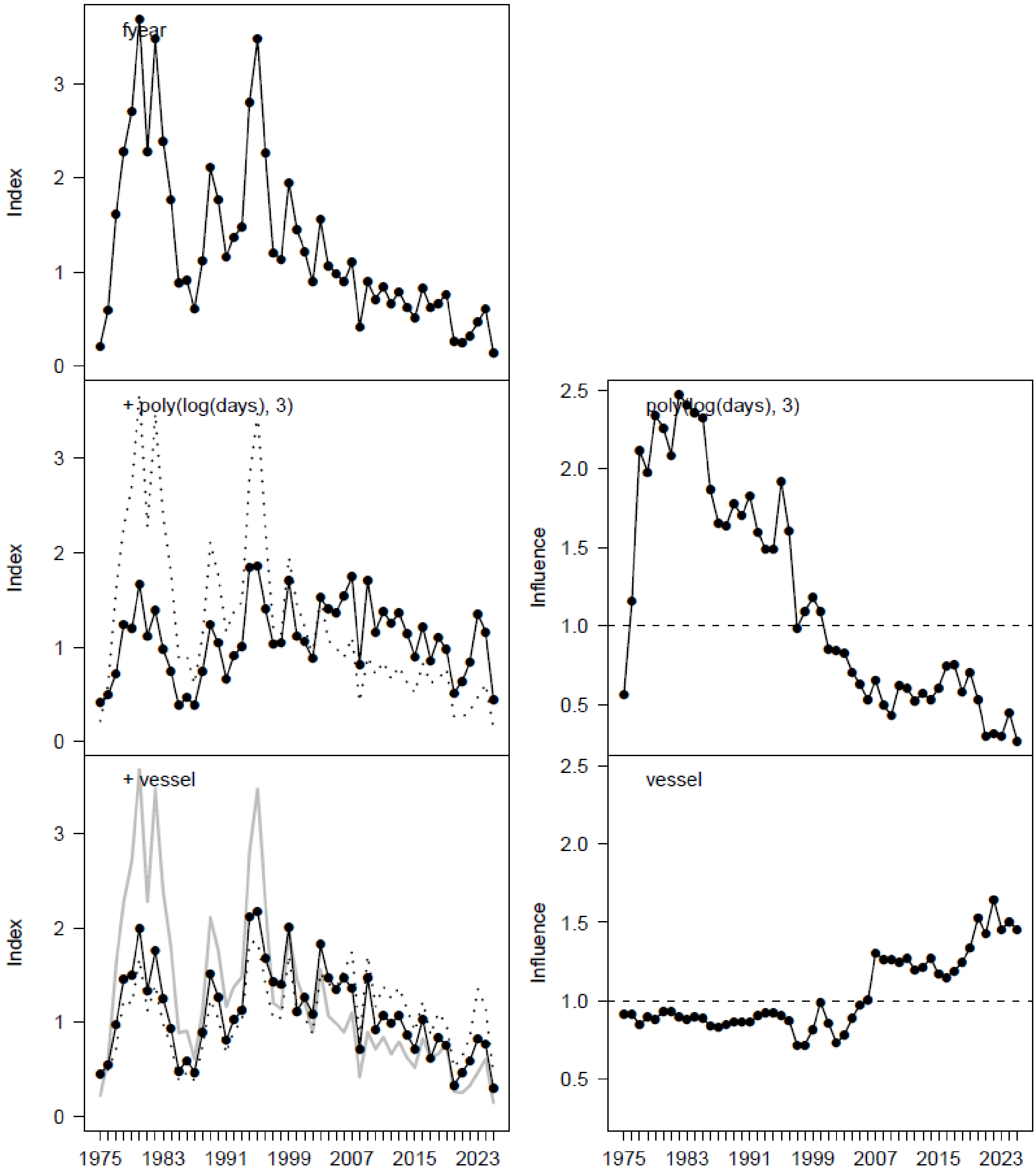

Figure 16: Step plot (left) and influence plots (right) with fishing year at the top, adding polynomial of days fished in the middle, and adding vessel at the bottom.

The diagnostic plots of the residuals from the fit of this model to the data show an adequate fit to the negative binomial assumption (Figure 17).

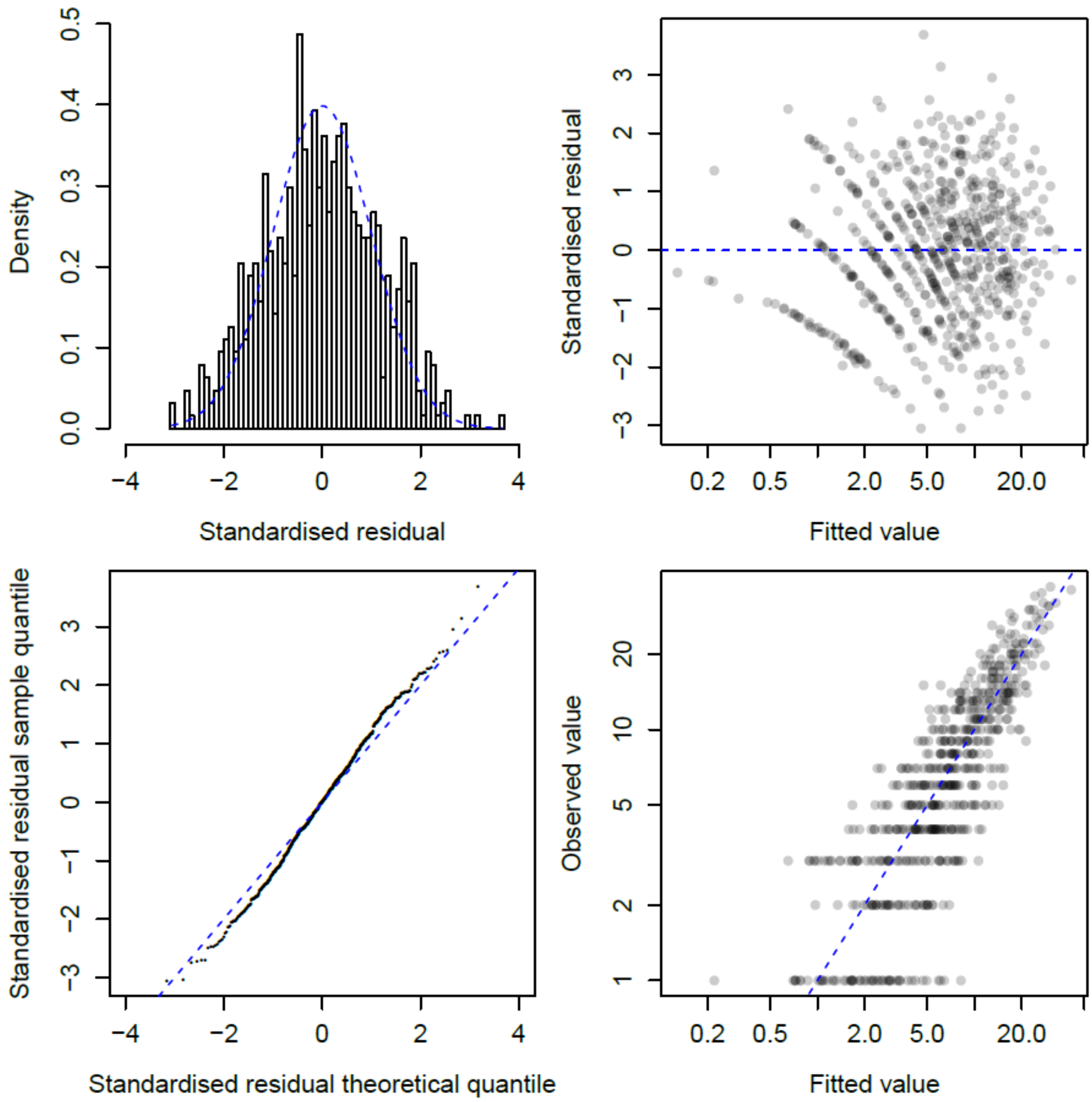

Figure 17: Residual diagnostics for the charter vessel model. Top left: histogram of standardised residuals compared to standard normal distribution. Bottom left: quantile-quantile plot of standardised residuals. Top right: fitted values versus standardised residuals. Bottom right: observed values versus fitted values.

3.5 Billfish logbook CPUE time series

The Billfish Logbook Programme has been collecting daily catch effort and environmental data from participating fishers since 2006–07. Over these 19 years, 96 boats have participated and reported 11 489 days targeting billfish for a catch of 3230 striped marlin and 221 blue marlin.

For the GLM the core fleet was defined as those vessels that had fished for at least 10 trips in each of at least five years. This resulted in a core fleet size of 37 vessels which took 78% of the catch (Figure 18).

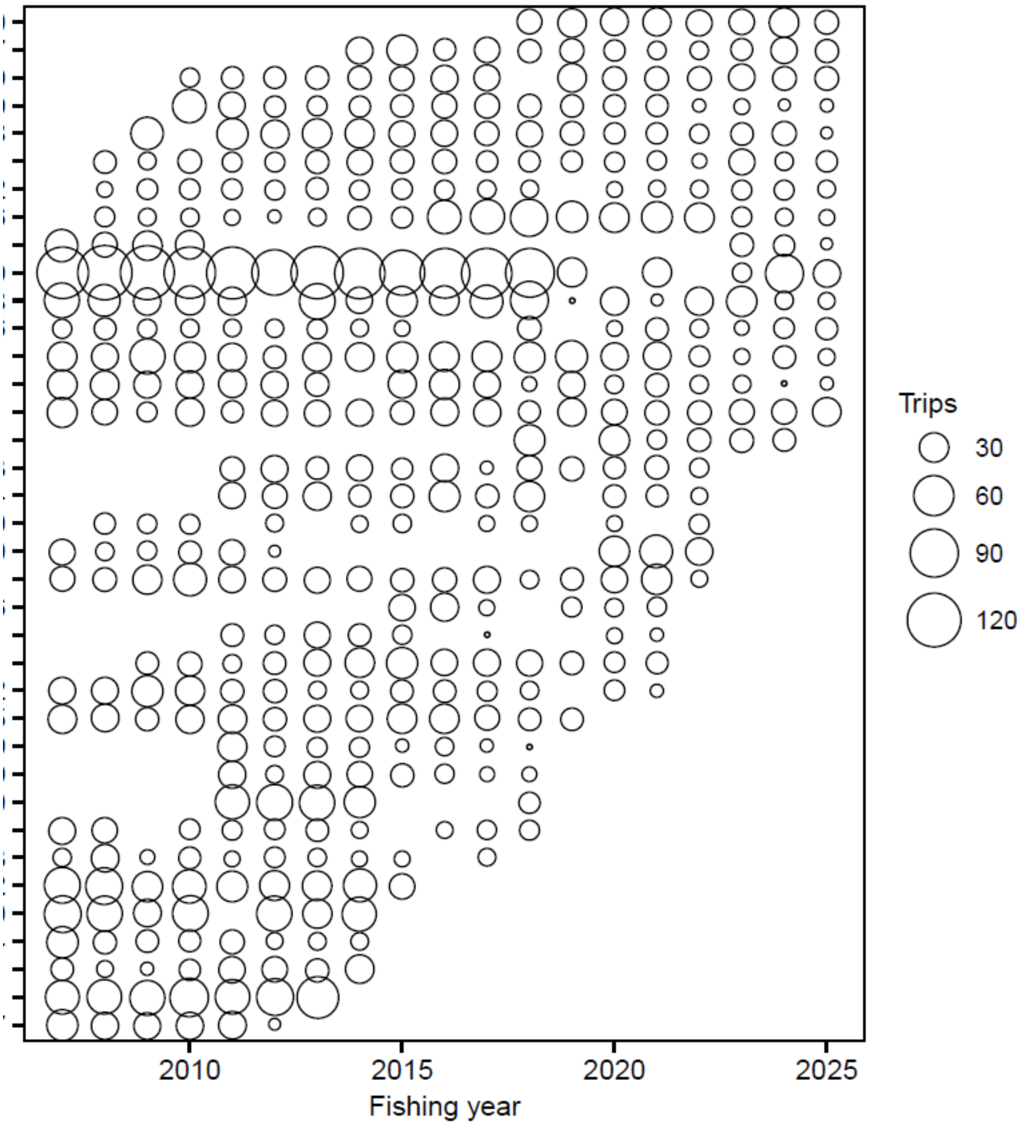

Figure 18: Participation of core vessels providing billfish logbook data by fishing year. The area of circles is proportional to the number of trips for a vessel in a fishing year.

A negative binomial model was fitted to all data including zero catches, with a forward stepwise selection of model terms made on the basis of the Akaike Information Criterion (AIC). The maximal set of model terms offered to the stepwise selection algorithm was:

~ . fyear + month + zone + vessel + fleet + target + poly(log(duration), 3) + poly(temp, 3)

with the term *fyear* forced into the model, *zone* splits the North Island into four fishing areas (Figure 1), *fleet* separates charter from private vessels, *target* is the main target species, *duration* is hours fished per day, and *temp* is the sea surface temperature (SST) at noon. Terms were only added to the model if they increased the percent deviance explained by 1%. Table 3 provides a summary of the changes in the deviance explained and in AIC as each term was added to the model.

The final model formula was

~ fyear + vessel + zone + poly(log(duration), 3)

Table 3: Summary of stepwise selection for the daily billfish logbook vessel model. Model terms are listed in the order of acceptance to the model. AIC: Akaike Information Criterion; *: Term included in final model.

Term	DF	Log likelihood	AIC	Deviance pseudo-R2 (%)	Nagelkerke pseudo-R2 (%)	
fyear	19	-5 376	10 789	3.50	2.64	*
vessel	55	-4 770	9 650	25.96	20.74	*
zone	58	-4 637	9 390	30.13	24.37	*
poly(log(duration), 3)	61	-4 598	9 319	31.29	25.40	*
target	68	-4 581	9 297	31.82	25.88	
poly(temp, 3)	71	-4 571	9 283	32.13	26.14	

The CPUE index based on daily billfish logbook data shows a flat or slightly declining trend with a lower CPUE in 2017 and 2020 (Figure 19). Explaining most variance was the vessel effect which pushed the standardised index down in the first two years and in 2022. The hours fished per day (duration) had a strong correlation with catch (see distribution and influence plots in Appendix 3) but did not show much of a trend over time to influence the CPUE index (Figure 20). Sea surface temperature and month did not explain more than 1% of the deviance after vessel and zone were included in the model.

Residual diagnostics for the billfish logbook model show a bimodal distribution of standardised residuals due to the high proportion of zero catch days (Figure 21).

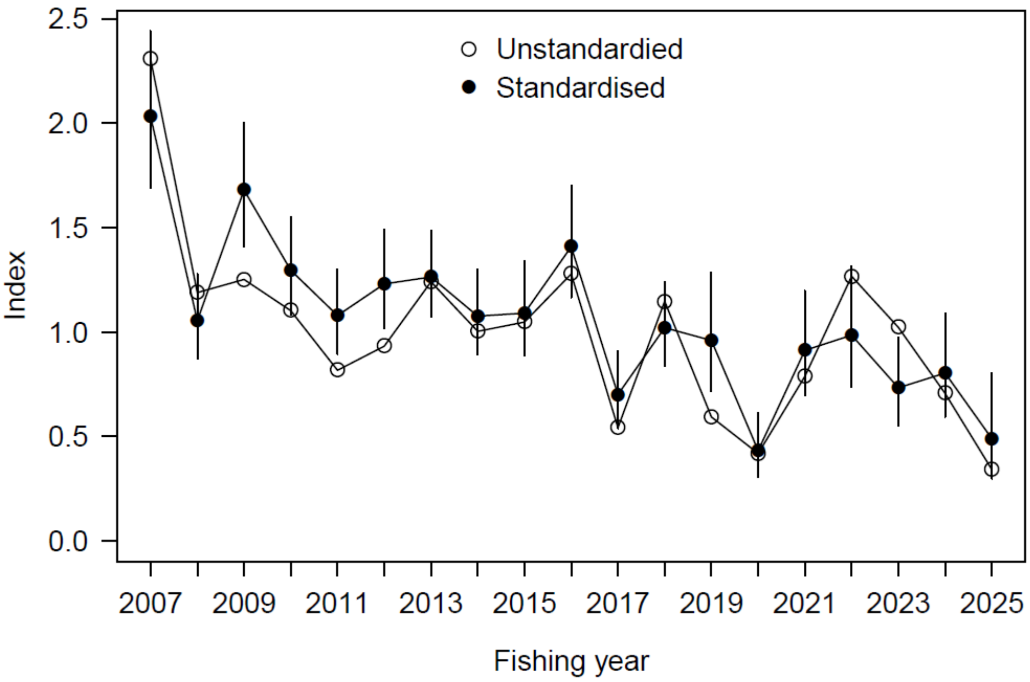

Figure 19: Overall standardisation effect from the billfish logbook model of striped marlin CPUE. The unstandardised index is based on the geometric mean of the catch per year and is not adjusted for effort. Fishing years are labelled by the later calendar year, e.g., 2007 = 2006–07.

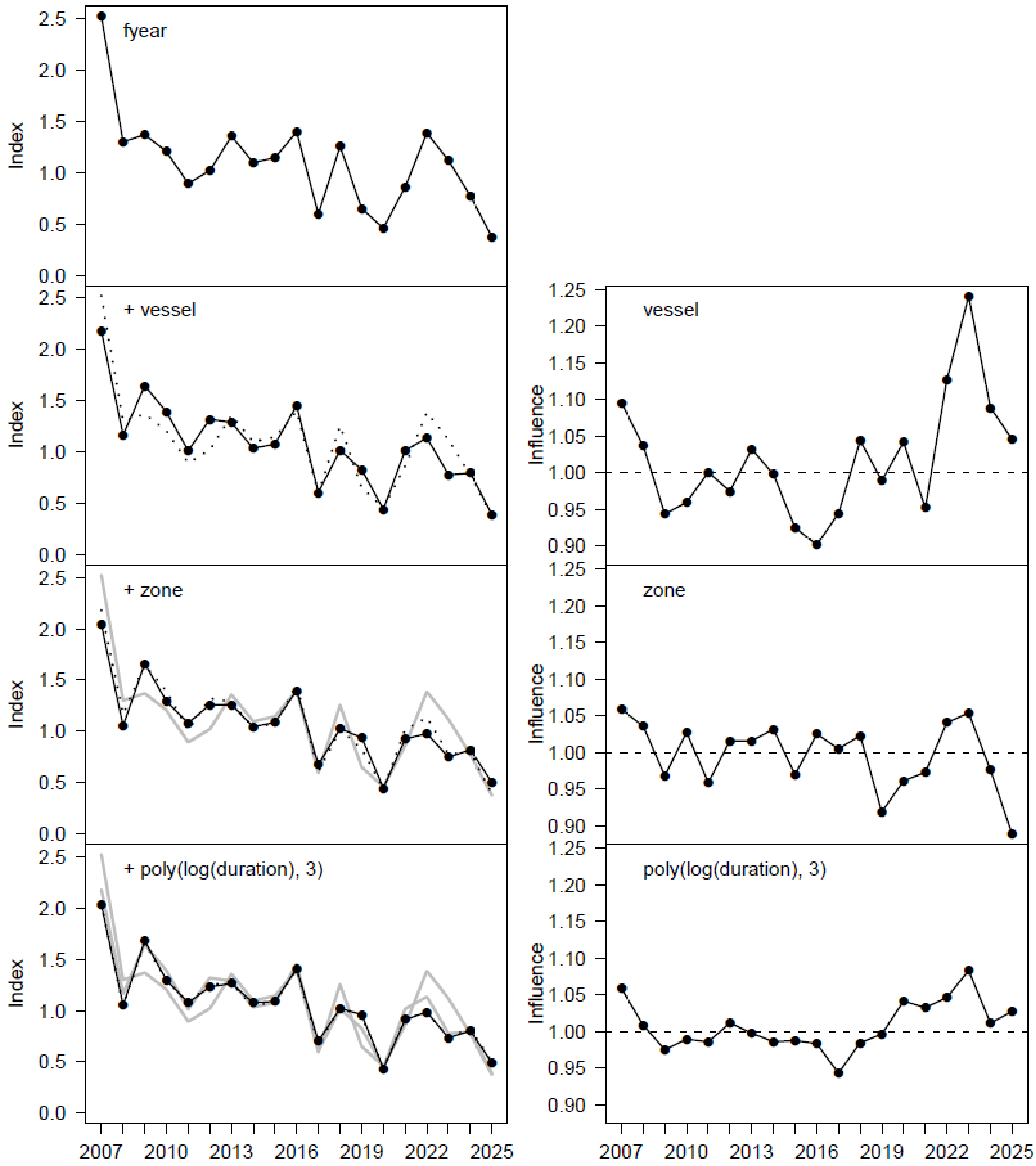

Figure 20: Step and influence plot from the billfish logbook model.

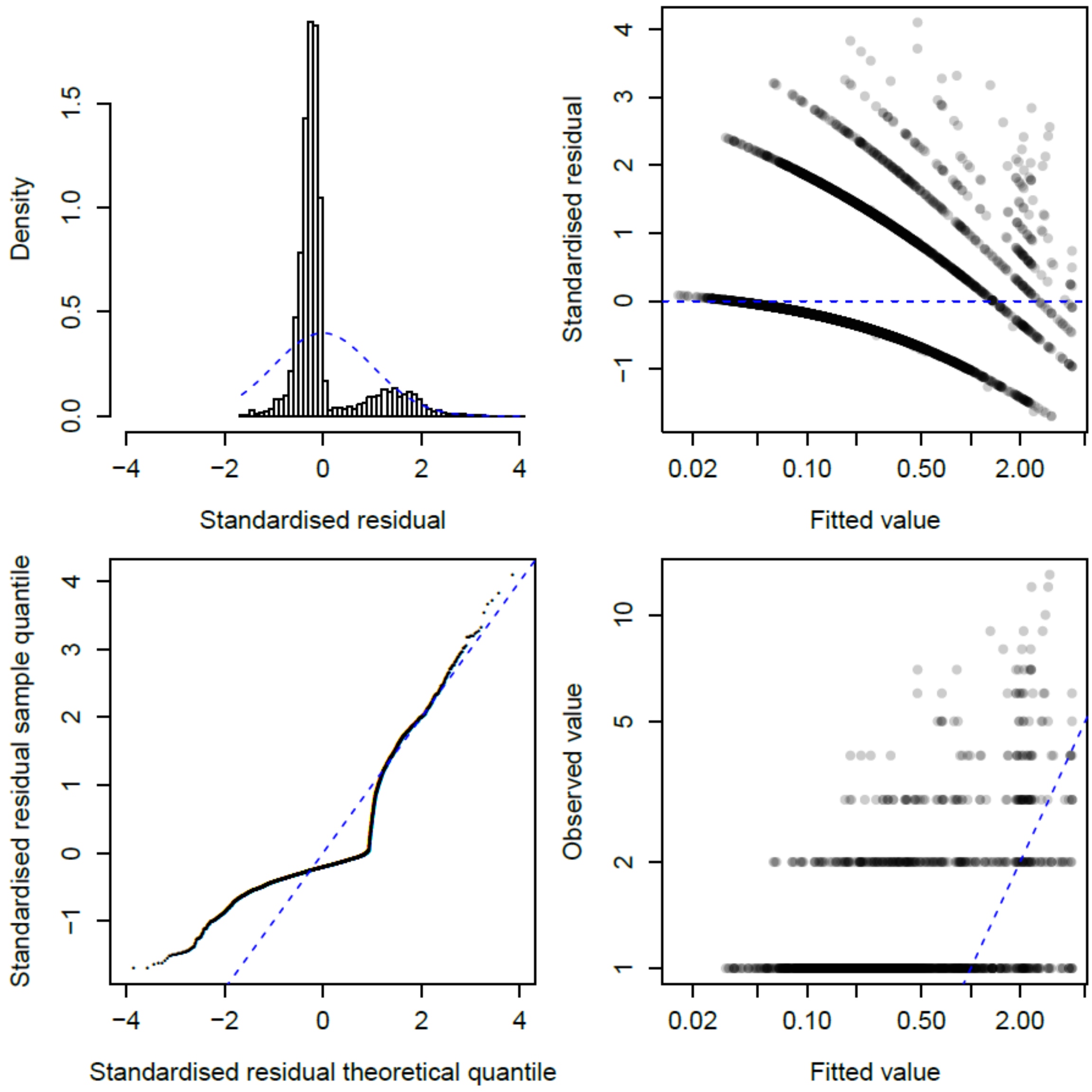

Figure 21: Residual diagnostics for the billfish logbook model. Top left: histogram of standardised residuals compared with the standard normal distribution. Bottom left: quantile-quantile plot of standardised residuals. Top right: fitted values versus standardised residuals. Bottom right: observed values versus fitted values from the billfish logbook model.

The logbook and East Northland charter standardised CPUE indices for a subset of the New Zealand recreational stiped marlin catch have been extended for the 2022–23 to 2024–25 fishing years. Traditionally the core recreational gamefish fishery was located off the northeast coast of the North Island. Over the three years of the project there has been a shift in marlin distribution which has affected the availability of gamefish in the core areas which has influenced catch and fishing effort.

Overall, striped marlin CPUE was relatively high in the late 1970s and early 1980s. There was an increasing trend in the CPUE index from the lows in the mid-1980s to highs in the mid-1990s. There is a declining trend in charter and logbook standardised CPUE since 2006–07 in both indices (Figure 22). The similarity is in part due to the charter catch and effort being a subset of the logbook data. There has also been a reduction in the gamefish charter fleet over this period. The 2024–25 fishing year was notable for a shift in the distribution of striped marlin with very few available or caught from northern and eastern New Zealand and high catch rates in the central and southern west coast of the North Island. For many logbook participants that could not access the west coast striped marlin catch CPUE was very low (Figure 22).

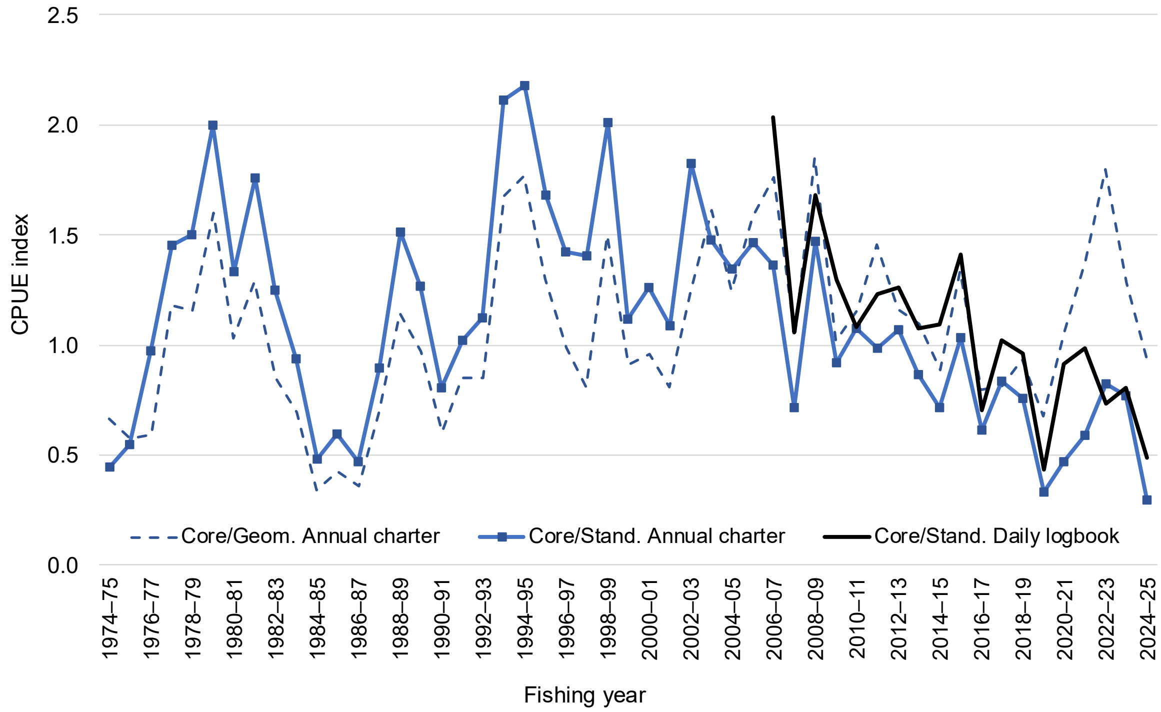

Figure 22: Comparison between the negative binomial model of the East Northland recreational charter boat annual CPUE since 1975 (1974–75 fishing year) and billfish logbook daily CPUE 2007 to 2025. The unstandardised geometric mean of the catch per year is not adjusted for effort.

4 DISCUSSION

The striped marlin is truly an oceanic pelagic species, distributed widely in subtropical and warm temperate waters of the Pacific and Indian Oceans. They do not appear to be common in the warmest tropical waters. Striped marlin in the southwest Pacific grow rapidly and enter the New Zealand recreational fishery as 3 or 4 year olds when they are sexually mature. Adults migrate seasonally into higher latitudes and cooler water foraging grounds after spawning in late spring (November and December in the southern hemisphere) (Kopf et al. 2011, Kopf et al. 2012).

In New Zealand striped marlin is the main target species in the northern gamefish fishery. Fishing clubs have published details of individual catches, in some cases since the 1920s. The recreational catch has increased significantly from a few hundred fish per season prior to the 1980s, mostly caught from recreational charter vessels, to around 1500 per season since the mid late 1990s. The New Zealand Gamefish Tagging Programme is well supported with 60% of recorded catch tagged and released over the last 20 years (Holdsworth & Gaskell in press).

A characterisation of striped marlin bycatch in New Zealand commercial surface longline fisheries found that bycatch levels were stable from 2003–04 to 2018–19. The most catch was recorded in waters 20 °C and warmer from the Bay of Plenty to the Northland region. The ocean around Aotearoa New Zealand has been warming, and marine heatwaves have become more prevalent and more intense (Behrens et al. 2025). SST anomalies are projected to increase by between 1–1.5°C relative to 1982–2022 by the middle of the century. Most of the warming which New Zealand encounters originates from the Tasman Sea, consequently regions west of New Zealand show more coherent and slightly more positive anomalies than regions east of New Zealand. There is not much difference between low and high emissions scenarios for mid-century, which suggests that New Zealand will very likely experience SST anomalies in that range (Behrens et al. 2025). 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 North Island's and South Island's west coast in recent years (Tremblay-Boyer 2021). Striped marlin abundance off the west coast of the North Island varies from year to year from very low to very high catch rates, relative to the core areas of East Northland and Bay of Plenty which have been more consistent. The 2024–25 season was exceptional, with very high striped marlin abundance off the west coast and very low catch rates off the North Island east coast.

The Billfish Logbook Programme is intended to have national coverage. Fishers have been recruited who regularly fish the west coast, but their participation seldom lasts. The most influential model term used in the CPUE standardisation is the vessel, and this requires several years of CPUE data to reliably estimate the relative vessel effect (Table 3). Currently the GLM uses vessels that had fished for at least 10 trips in each of at least 5 years. Recruiting fishers from new regions that are having regular striped marlin catches will take time to feed into the CPUE index even if criteria for inclusion in the GLM are changed.

The long running catch and effort data collected from East Northland charter boats has been useful for striped marlin management and monitoring fishery performance. It quantified the poor state of the fishery in the mid-1980s and the increase in catch rates following the introduction of the Billfish Moratorium and subsequent regulations prohibiting the commercial landing of marlin caught in New Zealand. The switch to the Billfish Logbook Programme which includes daily records from private and charter fishers from Northland and other regions increased the number of model terms that could be used in deriving a standardised CPUE index. While this is potentially an index of adult striped marlin abundance, the last five years have shown that other factors can also affect catch rates.

Several of the most active gamefish charter vessels were sold to private owners, Covid 19 restrictions disrupted the 2020 fishing season and international visitor numbers, and several powerful ex-cyclones in early 2023 disrupted fishing and land-based infrastructure in the North Island. In 2024 there were patches of striped marlin abundance with some record catches for Northland clubs in January, but the fish moved on and there were few logbook days that month. Marlin catch rates were very low for all of 2024–25 on the east coast, while fishing clubs in the central and lower North Island all had record catches. There were a high proportion of small striped marlin caught in 2023–24 and 2024–25. Most were tagged and released but the average weight of landed fish was below 85 kg in 2024–25.

The international Western and Central Pacific Fisheries Commission (WCPFC) funds stock assessments for highly migratory species and sets conservation and management measures for fisheries in the convention area. Data from the New Zealand recreational and commercial fisheries is provided for use in the Southwest Pacific striped marlin stock assessments. In the 2019 integrated age-structured stock assessment the recreational club catch records for landed striped marlin were one of the most influential data components in the stock assessment, because they provided a continuous record of catch-at-weight data since 1952 (Ducharme-Barth et al. 2019, Holdsworth et al. 2019). The WCPFC Science Committee reviewed the integrated age-structured assessments presented in 2024 and again in 2025 but there was concern about data conflicts and productivity estimates (Castillo-Jordan et al. 2024, Castillo-Jordan et al. 2025).

The alternative was a simpler Bayesian surplus production model (BSP) for estimating stock status and exploring uncertainties in productivity assuming a single and well-mixed stock with no population age structure (Ducharme-Barth et al. 2025). 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 ($D/D_{(0.2,F=0)}$). The BSP model primarily used catch per unit effort from surface longline data for the distant water fishing nations (DWFN) and the New Zealand recreational sportfish index. The standardized DWFN CPUE index (1988 to 2022) and New Zealand recreational index (1975 to 2022) were the only indices with sufficient length and contrast to inform population-scale estimates, both exhibiting declining trends since the mid-1990s which constrained population size. The Scientific Committee recommended that stock status and management advice be based upon the BSP model which indicated that the stock was likely to be overfished (likely (74%) to be below D_{MSY}), but the stock was currently unlikely to be subject to overfishing (unlikely (23%) to be above F_{MSY}) (WCPFC 2025).

5 FULFILMENT OF BROADER OUTCOMES

Regional development

- Blue Water Marine Research Ltd is based in rural Northland.
- Billfish Logbook project helps monitor the performance the marlin fishery that attracts fishers and tourist to regional ports. Gamefishing contests are major social and economic events in Northland ports such as Hohoura, Hokianga, Whangaroa, Bay of Islands, Tutukaka and Bay of Plenty ports from Whitianga to Waihau Bay and west coast ports such as Raglan Kawhia and New Plymouth.

Building capacity and capability in the research sector

- Over the course of STM2022-01 we have implemented a succession plan for a young scientist to work on and lead research projects including the Billfish Logbook Programme.
- Blue Water Marine Research has been approached and has provided striped marlin catch and CPUE data, with Fisheries New Zealand approval, to Australasian research and Masters projects for the University of Tasmania.

Transition to zero emissions

- Blue Water Marine Research engages in fisheries assessment science working groups and fisheries management meetings online. We have significantly reduced travel by car and plane from Tutukaka to attend HMS related meetings in Auckland and Wellington.

Making efficient use of existing data

- This project encourages citizen volunteers to contribute to research and conservation by recording catch and effort information while targeting marlin and other pelagic species. It builds on an annual charter vessel catch and effort survey for billfish that started in 1975 that was influential in many of the marlin management decisions in the 1980s and 1990s.
- Sport fishing clubs record weigh station records for individual billfish, some of which started in 1925. This project uses these data sources to extend the time series of fish weights and lengths that have been used in the striped stock assessment for the wider southwest Pacific.

6 ACKNOWLEDGEMENTS

Thanks to all those who participated in this programme and completed and returned billfish logbooks. The New Zealand Sport Fishing Council and all affiliated clubs are thanked for their cooperation and for providing detailed catch records. Thanks to Terese Kendrick for running the striped marlin CPUE analysis. Many thanks to Dr Leyla Knittweis for Fisheries New Zealand for guiding the project and reviewing this document. The project design and results were reviewed by the Highly Migratory Species Working Group. Fisheries New Zealand provided funding for this project STM2022-01, “Multi-year stock monitoring of striped marlin including logbook programme implementation”.

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8 APPENDIX 1 Catch from New Zealand sport fishing clubs

Table A1.1: Landed catch by species from New Zealand Sport Fishing Council yearbooks since 1977–78.

Fishing year	Striped marlin	Blue marlin	Black marlin	Shortbill spearfish	Broadbill swordfish	Southern bluefin	Yellowfin tuna	Mako shark	Blue shark	Hammerhead shark	Bronze whaler	Thresher shark
1977–78	452	21	18			18	42	577		120		18
1978–79	565	14	6	2		36	113	776		147		8
1979–80	692	17	22		1	18	134	572		113		7
1980–81	792	30	21	1		8	491	775	328	113	13	17
1981–82	704	19	7	1	1	8	244	680	170	89	4	8
1982–83	705	17	7		1		90	511	188	104	3	17
1983–84	543	24	16	2		1	342	668	206	76		9
1984–85	262	16	11	1	1		1 112	638	284	119	13	3
1985–86	82	1	1				53	65	16	26	2	6
1986–87	47		1				22	99	6	43		
1987–88	281	16	10	19	25		1 358	413	313	51	5	12
1988–89	647	18	4	1	10		1 436	476	305	84	14	21
1989–90	463	40	14	12	12		1 480	364	227	68	12	18
1990–91	532	29	8	15	10		719	414	127	57	10	28
1991–92	519	12	11	11	17		1 043	270	143	42	9	5
1992–93	608	41	9	22	4		440	364	214	70	19	10
1993–94	663	41	2	71	1		986	220	96	57	30	6
1994–95	910	28	8	87	5		1 995	288	235	49	20	14
1995–96	705	40	7	27	8		2 187	424	198	44	22	5
1996–97	619	17	7	16	4		2 325	352	114	44	26	8
1997–98	543	76	10	19	12		1 268	455	177	47	29	13
1998–99	823	140	15	62	6		1 230	320	70	36	7	11
1999–00	398	234	24	17	27		1 085	338	79	50	24	11
2000–01	422	142	9	28	25	1	988	255	54	40	29	18
2001–02	430	112	8	35	22	1	262	155	100	39	20	14
2002–03	495	26	3	41	17		211	109	30	24	32	9
2003–04	592	47	8	38	33		838	82	18	12	20	4
2004–05	796	89	7	54	8		1 050	40	10	9	22	3
2005–06	550	92	4	46	3		313	28	28	6	13	1
2006–07	688	83	2	38	20		283	34	15	6	18	1
2007–08	484	105	1	25	6		496	45	12	7	12	2
2008–09	731	88		31	9		69	41	12	4	9	1
2009–10	607	100	4	46	9		59	51	13	4	20	
2010–11	607	179	2	74	29	1	21	58	18	6	13	2
2011–12	635	79	9	19	34	2	10	40	15	4	10	2
2012–13	745	54	2	13	53		10	31	13	2	9	3
2013–14	620	64	4	25	80	2	8	24	6	11	8	1
2014–15	696	102	5	58	87	1	198	21	12	1	6	1
2015–16	900	99	4	69	85	7	492	24	8	9	2	1
2016–17	516	116	7	45	86	228	96	9	3	3	2	
2017–18	538	158	4	91	72	109	272	8	10	2	1	1
2018–19	507	155	6	95	76	188	51	6			2	
2019–20	333	93	4	42	39	15	494	6		5	5	
2020–21	627	68	6	54	97	401	556	2		1	2	1
2021–22	372	100	5	51	84	505	72	2	5			
2022–23	277	78	1	61	45	125	241	1			7	1
2023–24	376	56		14	86	297	130	4		1	8	
2024–25	429	13		39	90	173	743				10	
Total	26 528	3 189	344	1 518	1 340	2 145	28 158	11 135	3 878	1 845	542	321

9 APPENDIX 2. Striped marlin average weights

Table A2.1: Striped marlin catch numbers and average weights by year from three long established East Northland sportfishing clubs.

	Number		Average weight	
Year	landed	tagged	landed	tagged (kg)
1945	108		118.17	
1946	78		111.41	
1947	196		112.64	
1948	410		110.02	
1949	618		106.71	
1950	341		111.02	
1951	329		106.26	
1952	287		116.34	
1953	335		119.06	
1954	259		117.09	
1955	298		117.20	
1956	276		115.39	
1957	278		117.46	
1958	402		116.46	
1959	186		115.13	
1960	164		111.46	
1961	319		106.12	
1962	105		111.93	
1963	122		103.08	
1964	122		111.47	
1965	145		113.23	
1966	124		107.63	
1967	74		114.32	
1968	96		107.35	
1969	140		111.10	
1970	46		108.52	
1971	47		88.84	
1972	119		108.19	
1973	76		106.65	
1974	184		94.38	
1975	211		102.91	
1976	254		99.03	
1977	284		112.01	
1978	305		112.20	
1979	515		103.99	
1980	647		104.78	
1981	597		99.09	
1982	668		109.25	
1983	657		108.11	
1984	501		98.44	
1985	217		98.48	
1986	325		100.08	
1987	209		102.50	
1988	255	91	107.88	96.40
1989	379	321	88.31	79.15
1990	400	327	95.25	90.43
1991	385	161	97.69	87.64
1992	392	174	111.67	92.98
1993	428	279	102.27	95.10
1994	460	715	99.12	87.97
1995	601	871	101.90	88.57
1996	412	721	97.54	91.10
1997	256	685	105.78	98.13
1998	298	565	101.69	89.12
1999	329	726	88.47	85.03
2000	170	429	99.28	88.87
2001	203	493	101.09	89.44
2002	256	493	105.97	101.95
2003	279	481	109.22	97.31
2004	269	684	101.48	98.23
2005	375	599	102.35	97.77
2006	315	472	96.05	95.73
2007	414	614	97.42	96.01
2008	166	424	97.67	99.69
2009	454	674	100.18	100.16
2010	340	399	103.54	98.19
2011	297	386	98.07	94.42
2012	219	285	99.93	94.33
2013	284	382	106.74	101.15
2014	215	183	106.95	98.08
2015	274	288	98.79	89.43
2016	398	508	102.54	89.58
2017	242	176	107.25	93.12
2018	231	259	107.96	95.43
2019	156	225	104.92	93.31
2020	127	193	102.11	90.81
2021	140	377	97.03	88.58
2022	165	504	96.03	89.00
2023	94	355	94.82	88.06
2024	181	735	95.63	84.43
2025	82	223	82.72	84.16

10 APPENDIX 3. Tables of CPUE indices

Table A3.1: Standardised and unstandardised CPUE indices for the daily billfish logbook model. Fishing year labelled by later calendar year e.g. 1990=1989–90. All: all vessels, Core: core vessels, Geom.: geometric mean, Arith: arithmetic mean, Stand.: standardised using GLM, SE: standard error.

Fishing year	All/Arith.	Core/Arith.	Core/Geom.	Core/Stand.	Core/Stand. SE
2007	1.3659	1.595	1.0532	2.032	0.09158
2008	1.2046	1.1391	1.0425	1.0551	0.09576
2009	1.6175	1.4163	1.1167	1.68	0.08791
2010	1.2249	1.2504	1.0208	1.2957	0.08953
2011	0.9395	0.9386	0.9622	1.0794	0.0936
2012	1.1112	1.0439	0.9056	1.2306	0.09521
2013	1.335	1.3561	1.0419	1.2638	0.08145
2014	1.0989	1.149	1.1055	1.0763	0.09433
2015	1.3957	1.1453	1.1035	1.0909	0.10285
2016	1.3386	1.396	1.1069	1.4085	0.09497
2017	0.5695	0.608	0.9104	0.7011	0.13092
2018	1.166	1.1436	1.0765	1.0209	0.09794
2019	0.7581	0.7805	1.0893	0.96	0.14566
2020	0.4761	0.4348	0.9244	0.4326	0.17277
2021	0.834	0.798	1.0109	0.9125	0.13571
2022	1.2166	1.2646	1.1007	0.9853	0.14498
2023	1.0999	1.1324	0.7578	0.7333	0.14113
2024	0.8294	0.8738	0.8189	0.8039	0.15195
2025	0.4832	0.5405	0.9564	0.4898	0.24809

Table A3.2: Standardised and unstandardised CPUE indices for the East Northland charter vessel model. Geom.: geometric mean, Arith: arithmetic mean, Stand.: standardised using GLM, SE: standard error.

Fishing year	All/Arith.	Core/Arith.	Core/Geom.	Core/Stand.	Core/Stand. SE
1975	0.5999	0.6100	0.6658	0.4470	0.50479
1976	0.3849	0.3914	0.5761	0.5505	0.32784
1977	0.6363	0.6471	0.5947	0.9707	0.12421
1978	1.1454	1.1647	1.1805	1.4544	0.16049
1979	1.1061	1.1248	1.1583	1.5023	0.12025
1980	1.5251	1.5509	1.5976	2.0008	0.13157
1981	1.0397	1.0572	1.0296	1.3354	0.14683
1982	1.3687	1.2935	1.2895	1.7610	0.14885
1983	1.0092	0.9261	0.8505	1.2516	0.14081
1984	0.6825	0.6952	0.6976	0.9393	0.12223
1985	0.3216	0.3482	0.3429	0.4814	0.15241
1986	0.4011	0.4079	0.4239	0.5945	0.14566
1987	0.3913	0.3960	0.3613	0.4705	0.16568
1988	0.6972	0.7116	0.6866	0.8953	0.10800
1989	1.2431	1.1740	1.1450	1.5134	0.08845
1990	0.9824	0.9814	0.9688	1.2692	0.09160
1991	0.7286	0.6552	0.6042	0.8038	0.10804
1992	0.7979	0.8768	0.8523	1.0234	0.09766
1993	0.9248	0.9800	0.8487	1.1249	0.09751
1994	1.4961	1.7033	1.6788	2.1129	0.08737
1995	1.5553	1.7408	1.7657	2.1759	0.09129
1996	1.2816	1.3573	1.3029	1.6817	0.09386
1997	1.0120	0.8861	0.9889	1.4240	0.13534
1998	1.0195	0.9621	0.8095	1.4079	0.13071
1999	1.6734	1.6604	1.4966	2.0135	0.09595
2000	0.9741	0.9223	0.9134	1.1183	0.12664
2001	0.9320	0.8089	0.9560	1.2633	0.13454
2002	0.9239	0.7359	0.8074	1.0875	0.16191
2003	1.3755	1.3987	1.2415	1.8261	0.12878
2004	1.7109	1.5007	1.6102	1.4763	0.12670
2005	1.6381	1.5892	1.2450	1.3466	0.12457
2006	2.0366	1.8986	1.5808	1.4654	0.13525
2007	1.7729	1.9712	1.7591	1.3621	0.13132
2008	1.1164	1.2127	1.0452	0.7188	0.18185
2009	1.8063	1.8763	1.8501	1.4688	0.13825
2010	1.2749	1.2973	1.0191	0.9219	0.14151
2011	1.3242	1.3635	1.1541	1.0727	0.12940
2012	1.2576	1.3255	1.4544	0.9832	0.14667
2013	1.3438	1.3597	1.1640	1.0700	0.13665
2014	1.3077	1.3298	1.0964	0.8668	0.17216
2015	0.9440	0.9599	0.8887	0.7156	0.18159
2016	1.2580	1.2793	1.3380	1.0310	0.15799
2017	0.8508	0.8652	0.7963	0.6129	0.18886
2018	1.0963	1.1148	0.8155	0.8352	0.18523
2019	0.9247	0.9403	0.9358	0.7603	0.16680
2020	0.6099	0.6202	0.6786	0.3298	0.29517
2021	0.6722	0.6836	1.0589	0.4693	0.29082
2022	0.7965	0.8100	1.3851	0.5900	0.29675
2023	1.4452	1.5350	1.7956	0.8219	0.24290
2024	1.1506	1.1701	1.2812	0.7684	0.21539
2025	0.6183	0.5384	0.9246	0.2950	0.39435

11 APPENDIX 4. GLM coefficient, distribution, and influence plots

East Northland charter vessels

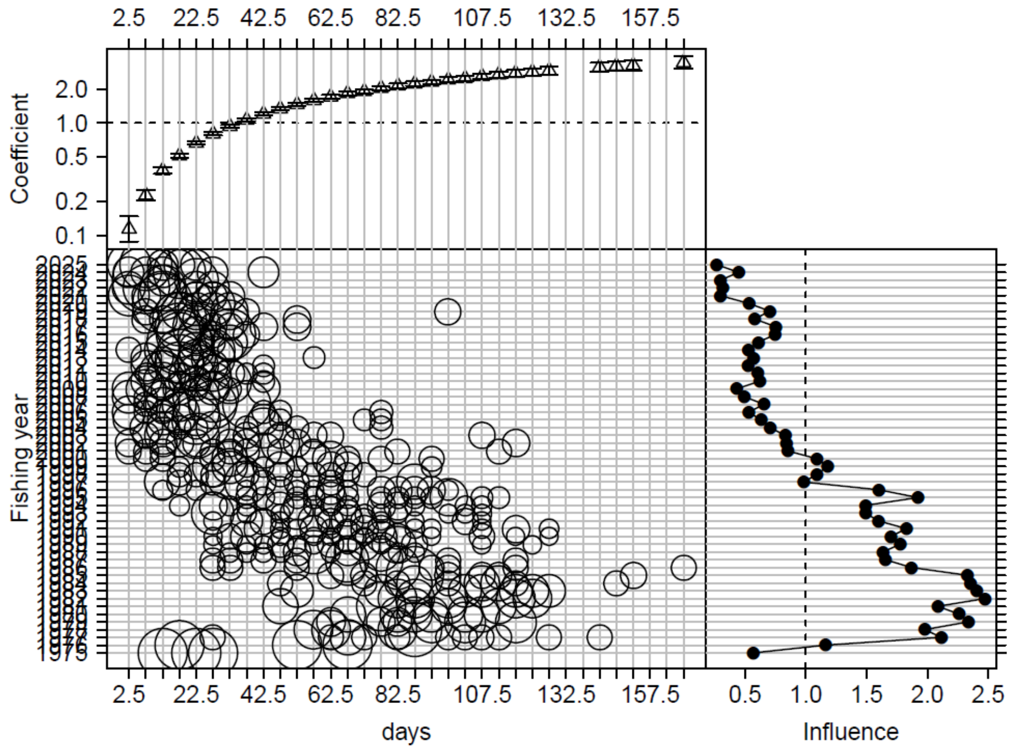

Figure A4.1: Coefficient-distribution-influence plot for *poly(log(days), 3)* for the East Northland charter vessel model.

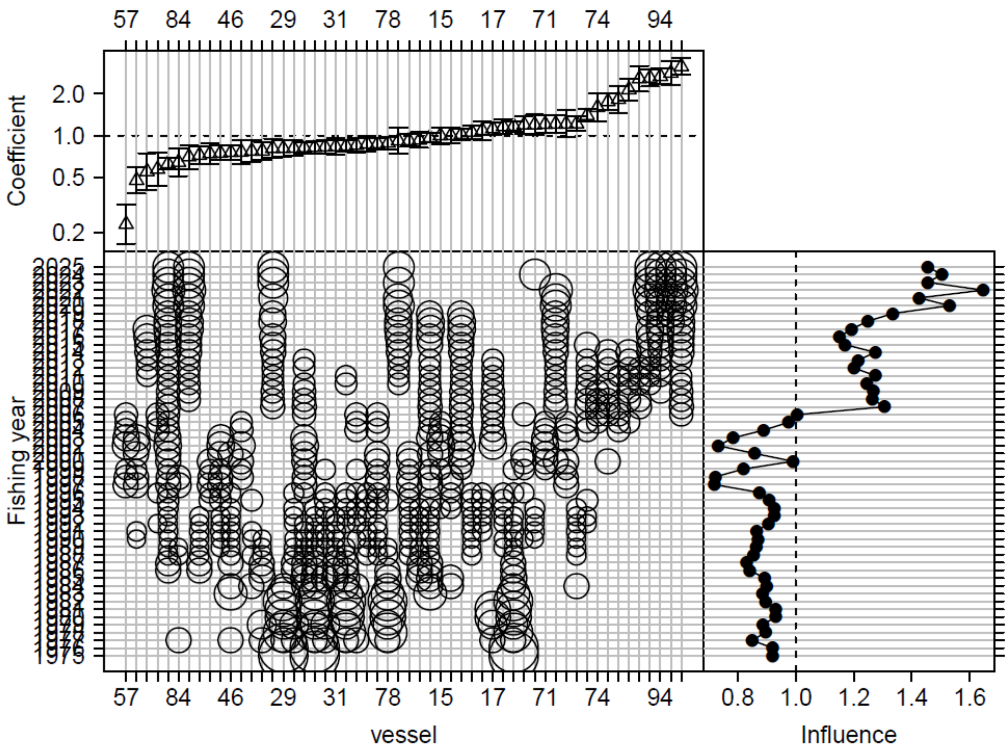

Figure A4.2: Coefficient-distribution-influence plot for *vessel* in the East Northland charter vessel model.

Billfish logbook vessels

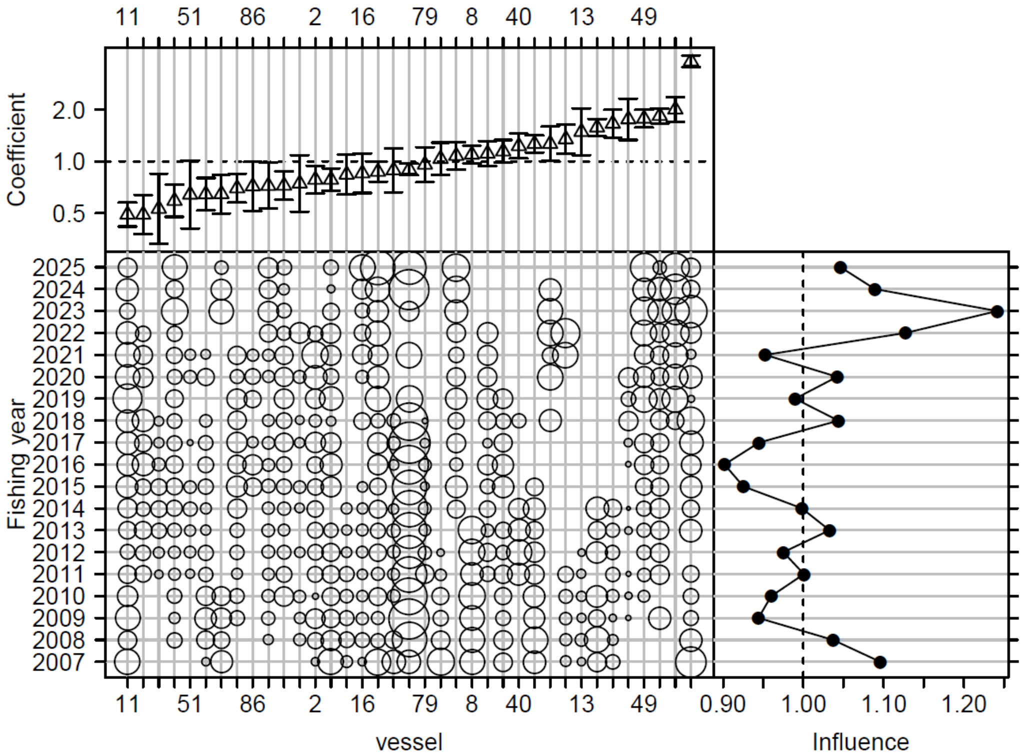

Figure A4.3: Coefficient-distribution-influence plot for *vessel* from the billfish logbook model.

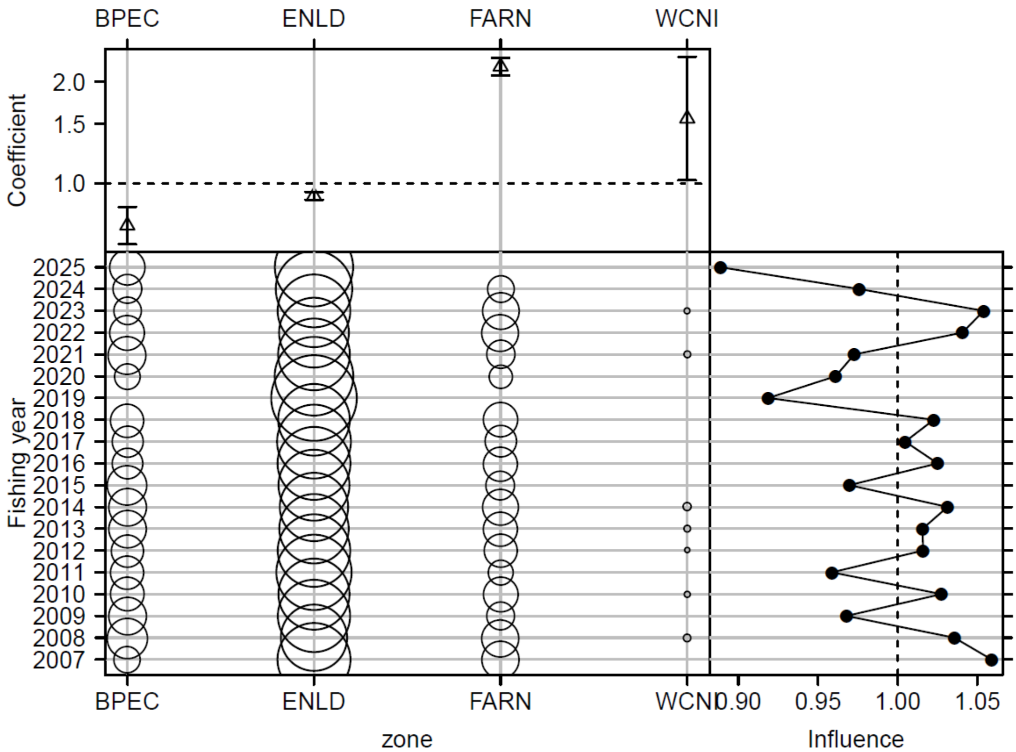

Figure A4.4: Coefficient-distribution-influence plot for *zone* from the billfish logbook model.

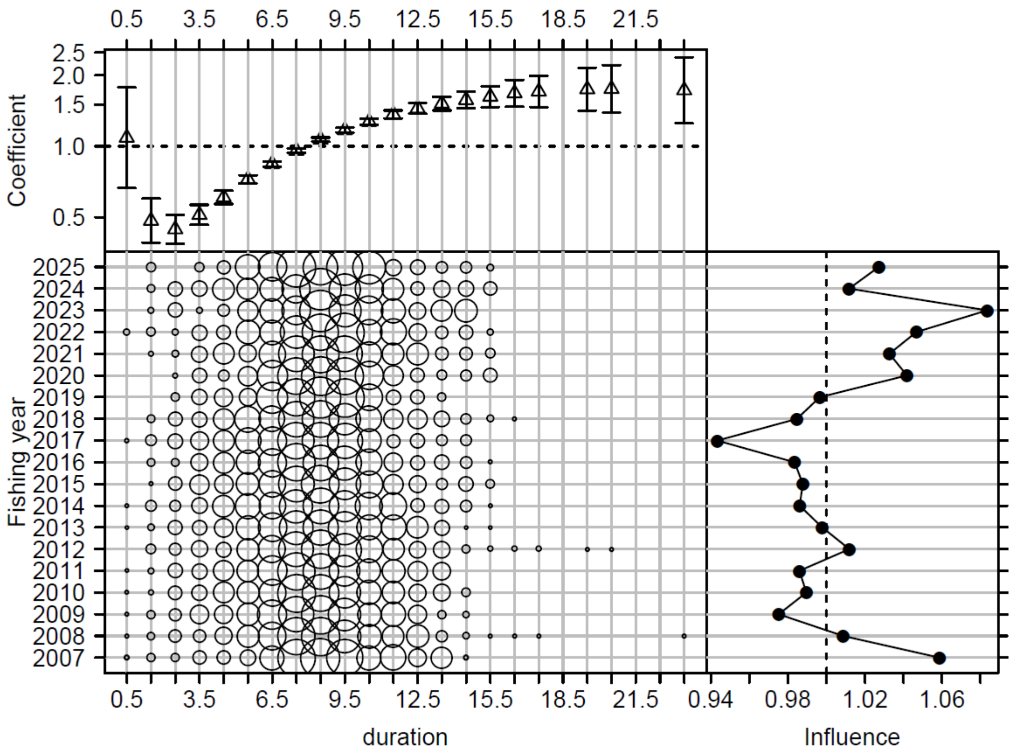

Figure A4.5: Coefficient-distribution-influence plot for *poly(log(duration), 3)* from the billfish logbook model.

12 APPENDIX 5. Data tables and fields used in the billfish logbook database.

t_person
Person_AutoID person_type title first_name last_name address1 address2
address3 city postcode home_phone work_phone mobile boat_phone
email diarist_yn diarist_next_year DateCreated

t_respondent
Respondent_AutoID Person_FKID respondent_id respondent_varchar_id year_s month_s
day_s year_f response survey active_response DateCreated

t_boat_codes
BoatCode_AutoID boat_id boat_name boat length construction boat_type
boat_year GPS temp_gauge radar sonar depth_sound auto_pilot
live_bait_tank_tubes number_main_motors combined_horsepower_hp
combined_horsepower_kw vhf_radio ssb_radio home_port DateCreated

t_effort
Effort_AutoID Respondent_FKID Person_FKID BoatCode_FKID effort_guid
effort_type trip_no resp_status fish_date respondent_guid fish_loc
person_guid time_start time_stopped minutes_fishing trip_date
main_target_sp locality survey area_stat qma lat_noon long_noon
lat_noon_min long_noon_min fish_meth wind_noon dir_noon meth_type
boat_guid strike0500 strike0530 strike0600 strike0630 strike0700
strike0730 strike0800 strike0830 strike0900 strike0930 strike1000
strike1030 strike1100 strike1130 strike1200 strike1230 strike1300
strike1330 strike1400 strike1430 strike1500 strike1530 strike1600
strike1630 strike1700 strike1730 strike1800 strike1830 strike1900
strike1930 strike2000 strike2030 strike2100 strike2130 DateCreated
effort_comments

t_catch
Catch_AutoID Effort_FKID survey_pageid species_caught species_target weight survey
fish_no time_hk ft_time sst depth lat_hk n_rods long_hk lat_hk_min
long_hk_min kpt_rel bait_type weight_est lat_dir weight_act DateCreated
long_dir CreatedBy DateLastModified LastModifiedBy
UpdateStamp