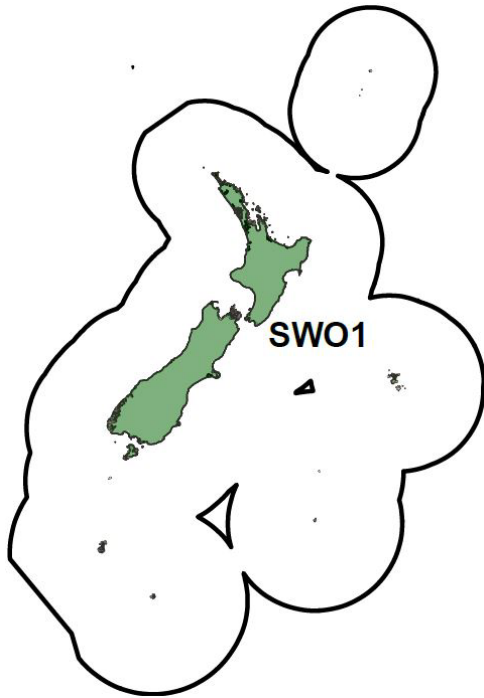


**SWORDFISH (SWO)**

*(Xiphias gladius)*



**1. FISHERY SUMMARY**

Swordfish were introduced into the Quota Management System (QMS) on 1 October 2004 under a single Quota Management Area, SWO 1, with allowances, Total Allowable Commercial Catch (TACC), and Total Allowable Catch (TAC) given in Table 1.

**Table 1: Recreational and customary non-commercial allowances, TACC and TAC (all in t) for swordfish.**

Fishstock	Recreational allowance	Customary non-commercial allowance	Other mortality	TACC	TAC
SWO 1	20	10	4	885	919

Swordfish were added to the Third Schedule of the 1996 Fisheries Act with a TAC set under s14 because swordfish is a highly migratory species and it is not possible to estimate *MSY* for the part of the stock that is found within New Zealand fisheries waters.

Swordfish were added to the Sixth Schedule of the 1996 Fisheries Act, but this was repealed from the Fisheries Act on 1 November 2022. The ability for commercial fishers to return swordfish to the sea is now provided for in the Fisheries (Landing and Discard Exceptions) Notice but the provision must be reviewed by 1 September 2026 to determine whether it should continue.

**13.3 Swordfish may be returned or abandoned**

(1) This clause applies to a swordfish taken from New Zealand fisheries waters that has a lower jaw to fork length of less than 1.25 metres.

(2) A commercial fisher may return a swordfish to the waters from which it was taken if:

- a) it is likely to survive on return; and
- b) the return takes place as soon as practicable after it is taken.

Lower jaw to fork length in subclause (1) means the projected straight line distance from the foremost point of the lower jaw to the rear centre edge of the tail (caudal fin).

Management of swordfish throughout the western and central Pacific Ocean (WCPO) is the responsibility of the Western and Central Pacific Fisheries Commission (WCPFC). At its sixth annual meeting (2009) 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 swordfish in the southwest Pacific Ocean ([www.wcpfc.int/](http://www.wcpfc.int/)). This measure restricts the number of vessels fishing for swordfish and sets catch limits in the convention area south of 20° S.

### 1.1 Commercial fisheries

In New Zealand, swordfish are caught throughout the year in oceanic waters, primarily by pelagic longlines in areas where the bottom depth exceeds 1000 m. Swordfish are either targeted or caught in the tuna longline fishery as a bycatch when targeting bigeye tuna and to a lesser extent when targeting southern bluefin tuna. Swordfish can be caught in most Fishery Management Areas (FMAs) and adjacent high seas areas although most catches are from waters north of 40° S. Swordfish catch by domestic vessels increased rapidly from 1994–95 to peak at 1100 t in 2000–01. After 2000–01, swordfish catches declined each year coinciding with the decline in effort in the surface longline fishery, until 2005–06 when catches increased again (Table 2). This increase was attributed to the development of a target fishery, which was, in part, initiated by the arrival of several surface longline vessels from Australia. Since 2005, almost 9000 swordfish captures have been observed by fisheries observers on surface longline vessels. The vast majority of swordfish observed has been landed, with only small swordfish being disposed (Moore & Finucci 2024). Catches have been steadily declining since 2015–16. Most of the catch is from FMAs 1, 2, and 9. Figure 1 shows historical landings and TACCs and longline effort for SWO stocks.

Swordfish are processed at sea and the processed weight of the catch is converted to greenweight using approved conversion factors. TLCER, CELR, and LFRR data are provided for comparative purposes in Table 2 for the domestic fleet (New Zealand owned and operated vessels and chartered longline vessels).

Before the start of the domestic longline fishery in 1990–91, distant water longline fleets were granted foreign licence access to fish for southern bluefin (*Thunnus maccoyii*) and bigeye tuna (*Thunnus obesus*) (Japan), and albacore (*Thunnus alalunga*) (Korea). Swordfish catches for the Japanese fleet are given in Table 2. The swordfish bycatch by the Japanese foreign licensed fishery averaged 388 t per year between 1979–80 and 1992–93 with a maximum catch of 761 t in 1980–81. Most of the Japanese swordfish catch (85%) was from FMAs 2 and 9. Korean catches were only small (0 to 7 t per year) and were mostly (79%) from FMAs 9 and 10.

In 2024–25, for all longline fisheries, swordfish made up 21% of the catch by weight, and 41% of the catch in the SWO target fishery (Figure 2). Longline fishing effort is distributed off the east coast of the North Island and the southwest coast of the South Island. The southwest coast South Island fishery predominantly targets southern bluefin tuna, whereas the east coast North Island fishery targets a range of species including bigeye tuna, swordfish, and southern bluefin tuna. Most of the swordfish catch and disposals by trawl in the 2019–20 to 2021–22 fishing years was taken off the west coast of the South Island (Figure 3), when jack mackerel (*Trachurus* spp.; JMA) and hoki (*Macruronus novaezelandiae*) were targeted (Figure 4) (Moore & Finucci 2024).

## SWORDFISH (SWO) – Nov 2025

Across all fleets in the longline fishery from 2006–07 to 2017–18, 20–40% of the swordfish were alive when brought to the side of the vessel (Table 3). More than 90% of swordfish catches have been retained by all fleets (Table 4).

**Table 2: Reported catches (t) of swordfish by fishing year (from TLCER and CELR data) for the New Zealand domestic and chartered vessel fleet 1990–91 to present and Japanese foreign licensed fleet 1979–80 to 1992–93; annual totals from Licensed Fish Receiver Return (LFRR) and Monthly Harvest Return (MHR) data from 1990–91 to present.**

Year	SWO 1 (all FMAs)				
	Japan	NZ/MHR	Total	LFRR	NZ ET
1979–80	386		386		
1980–81	756.1		756.1		
1981–82	734.6		734.6		
1982–83	436.1		436.1		
1983–84	384.8		384.8		
1984–85	316.1		316.1		
1985–86	673.6		673.6		
1986–87	575.5		575.5		
1987–88	286.2		286.2		
1988–89	181.1		181.1		
1989–90	194.3		194.3		
1990–91	211.9	21.9	233.8	41	0.5
1991–92	194.5	33.5	228	32	0.6
1992–93	31.1	46.8	77.9	79	0.6
1993–94		88.2	88.2	102	2.6
1994–95		91.4	91.4	102	0.8
1995–96		148.6	148.6	187	2.5
1996–97		223.3	223.3	283	0.2
1997–98		379.7	379.7	534	2.8
1998–99		679.1	679.1	965	2.9
1999–00		778	778	976	4.6
2000–01		901.4	901.4	1 022	25.4
2001–02		945	783.9	958.8	
2002–03		673	622.0	670.1	0.5
2003–04		545	519.4	555.2	0.5
2004–05		344	320.7	344.7	22.7
2005–06		560.9	548.3	558.9	9.7
2006–07		412.7	412.7	425.8	3.3
2007–08		350.1	350.1	351.4	0.7
2008–09		398.7	398.7	393.9	0.6
2009–10		536.5	536.5	533.4	0.1
2010–11		729.6	729.6	739	5.1
2011–12		688.1	688.1	686.4	0.9
2012–13		796.8	796.8	788.4	2.8
2013–14		577.0	577.0	562.7	0.2
2014–15		726.2	730.3	716.1	0.2
2015–16		758.8	758.8	749.5	0.
2016–17		500.5	500.5	494.8	0.5
2017–18		475.0	475.0	468.5	0.1
2018–19		262.4	262.4	257.6	2.8
2019–20		216.0	216.0	211.0	0
2020–21		308.6	308.6	300.6	0
2021–22		141.2	141.2	127.5	0
2022–23		258.2	258.2		0
2023–24		199.0	199.0		0
2024–25		140.2	140.2		0

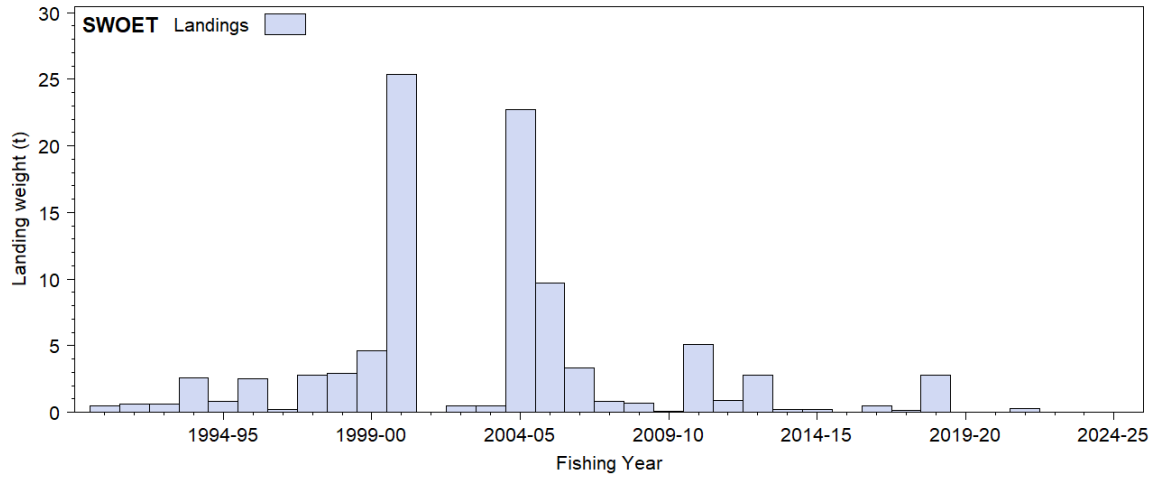
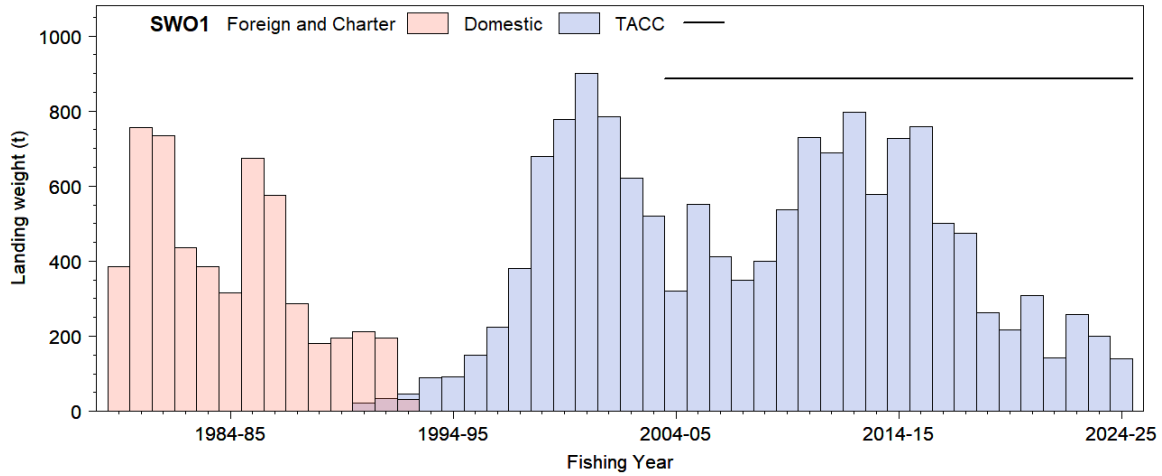


Figure 1: [Top] Swordfish catch by foreign licensed and New Zealand vessels from 1979–80 to present in New Zealand fishery waters (SWO 1). [Bottom] Swordfish catch from 1990–91 to present on the high seas (SWO ET).

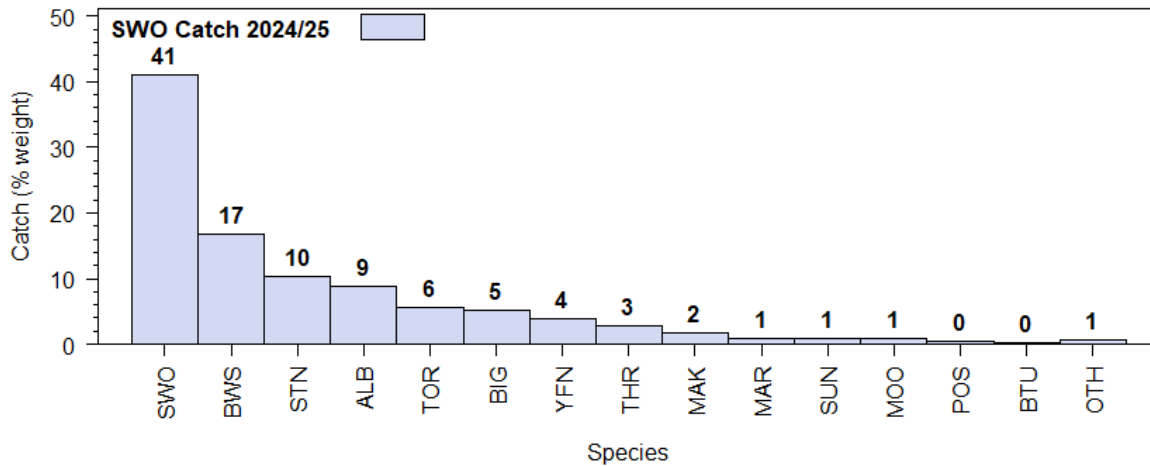
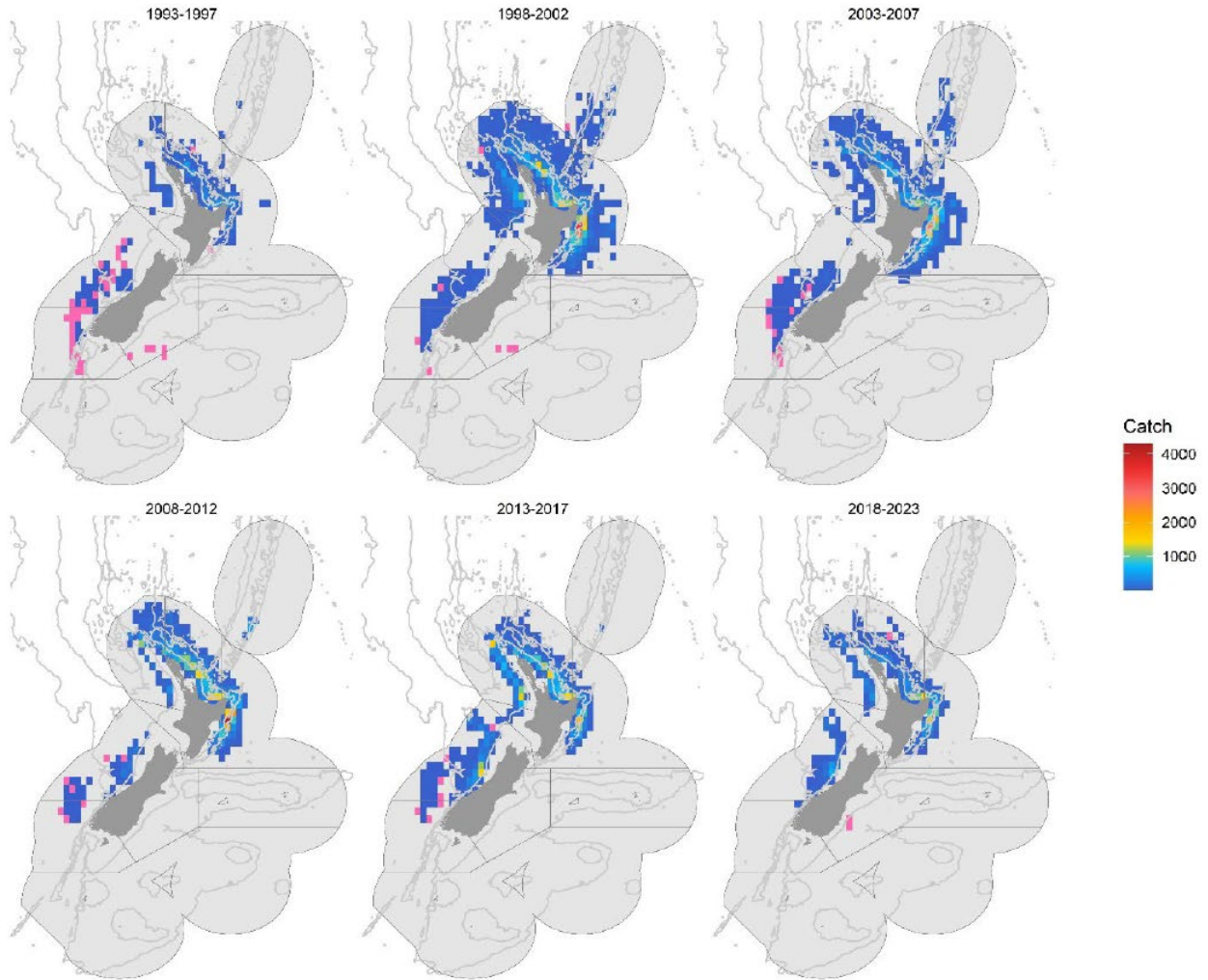


Figure 2: A summary of species composition of the reported swordfish target surface longline estimated catch for the most recent fishing year. The percentage by weight of each species is calculated for all surface longline trips targeting swordfish.

## SWORDFISH (SWO) – Nov 2025



**Figure 3: Swordfish catch (number of fish) from the surface longline fishery in the New Zealand Exclusive Economic Zone between 1993 and 2023, aggregated in five-year bins at 0.5° resolution. Pink represents locations where fishing occurs, but swordfish catch has never been reported. Each cell contains data from at least three permit holders (Finnuci & Moore 2025).**

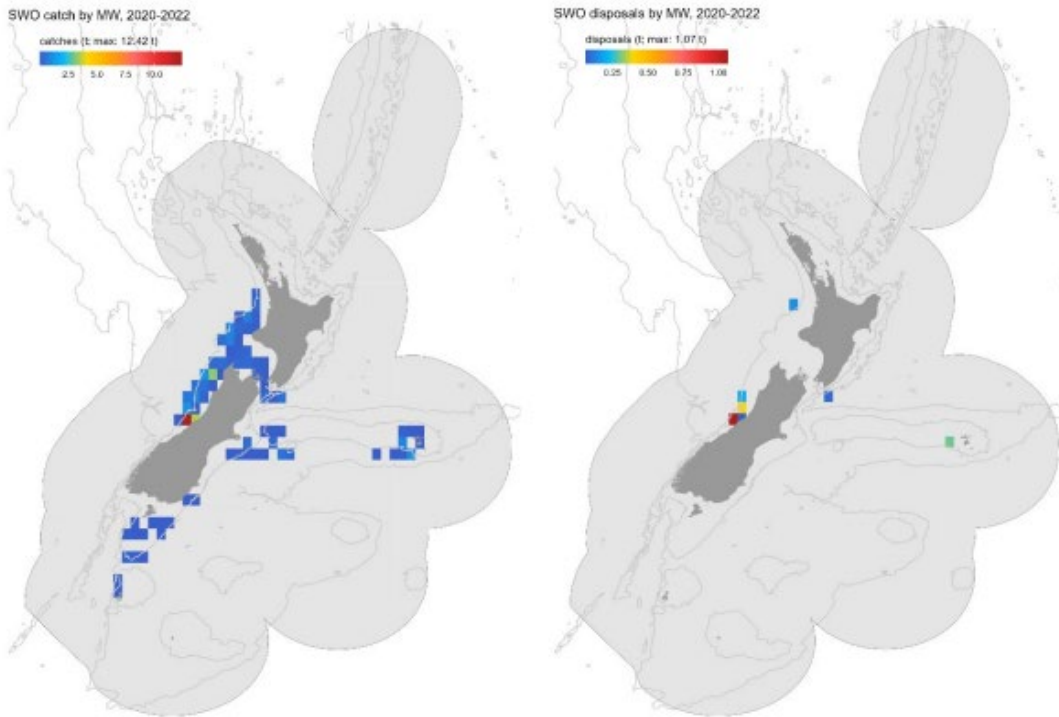


Figure 4: Total Catches (including disposals: left) and disposals (right) of swordfish (SWO) by mid-water trawl (MW) in New Zealand’s Exclusive Economic Zone, aggregated at the 0.5° resolution for 2019–20 to 2021–22 (Moore & Finucci 2024).

Table 3: Percentage of swordfish (including discards) that were alive or dead when arriving at the longline vessel and observed 2006–07 to 2020–21, by fishing year, fleet, and region. Small sample sizes (number observed < 20) were omitted (Griggs & Baird 2013, Griggs et al. 2018, 2021, 2024). [Continued on next page]

Year	Fleet	Area	% alive	% dead	Number
2006–07	Australia	North	42.8	57.2	325
		Charter	58.9	41.1	90
	Domestic	South	61.9	38.1	21
		North	27.3	72.7	355
	<b>Total</b>		<b>38.2</b>	<b>61.8</b>	<b>791</b>
2007–08	Domestic	North	25.1	74.9	495
2008–09	Charter	North	97.0	3.0	33
		Domestic	26.0	74.0	416
	<b>Total</b>		<b>31.6</b>	<b>68.4</b>	<b>455</b>
2009–10	Domestic	North	23.2	76.8	448
		<b>Total</b>	<b>23.7</b>	<b>76.3</b>	<b>452</b>
2010–11	Domestic	North	23.1	76.9	904
		<b>Total</b>	<b>23.9</b>	<b>76.1</b>	<b>918</b>
2011–12	Charter	South	66.7	33.3	24
		Domestic	27.5	72.5	494
	Domestic	North	27.8	72.2	90
		<b>Total</b>	<b>29.2</b>	<b>70.8</b>	<b>610</b>
	2012–13	Charter	North	39.4	60.6
South			63.9	36.1	36
Domestic		North	27.4	72.6	223
<b>Total</b>		<b>33.1</b>	<b>66.9</b>	<b>293</b>	
2013–14	Charter	South	70.8	29.2	24
		Domestic	23.1	76.9	451
	Domestic	South	34.5	65.5	139
		<b>Total</b>	<b>27.5</b>	<b>72.5</b>	<b>614</b>

SWORDFISH (SWO) – Nov 2025

Table 3: [Continued]

Year	Fleet	Area	% alive	% dead	Number
2014–15	Charter Domestic	South	70.6	29.4	34
		North	31.6	68.4	263
		South	26.0	74.0	96
		<b>Total</b>	<b>33.6</b>	<b>66.4</b>	<b>393</b>
2015–16		North	26	74	715
		South	35.2	64.8	193
		<b>Total</b>	<b>28</b>	<b>72</b>	<b>908</b>
2016–17		North	24.8	75.2	705
		South	44.2	55.8	113
		<b>Total</b>	<b>27.5</b>	<b>72.5</b>	<b>818</b>
2017–18		North	24.3	75.7	605
		South	39.1	60.9	192
		<b>Total</b>	<b>27.9</b>	<b>72.1</b>	<b>797</b>
2018–19		North	33.3	66.7	123
		South	46.5	53.5	43
		<b>Total</b>	<b>36.7</b>	<b>63.3</b>	<b>166</b>
2019–20		North	23.2	76.8	397
		<b>Total</b>	<b>23.4</b>	<b>76.6</b>	<b>401</b>
2020–21		North	22.4	77.6	589
		South	71.8	28.2	39
		<b>Total</b>	<b>25.5</b>	<b>74.5</b>	<b>628</b>

Table 4: Percentage of swordfish that were retained, or discarded or lost, when observed on a longline vessel 2006–07 to 2020–21, by fishing year and fleet. Small sample sizes (number observed < 20) omitted (Griggs & Baird 2013, Griggs et al. 2018, 2021, 2024).

Year	Fleet	% retained	% discarded or lost	Number
2006–07	Australia	94.8	5.2	326
	Charter	99.1	0.9	115
	Domestic	93.2	6.8	355
	<b>Total</b>	<b>94.7</b>	<b>5.3</b>	<b>796</b>
2007–08	Charter	100.0	0.0	3
	Domestic	91.5	8.5	496
	<b>Total</b>	<b>91.6</b>	<b>8.4</b>	<b>499</b>
2008–09	Charter	100.0	0.0	43
	Domestic	97.1	2.9	418
	<b>Total</b>	<b>97.4</b>	<b>2.6</b>	<b>461</b>
2009–10	Charter	100.0	0.0	3
	Domestic	94.3	5.7	454
	<b>Total</b>	<b>94.3</b>	<b>5.7</b>	<b>457</b>
2010–11	Domestic	94.5	5.5	917
	<b>Total</b>	<b>94.6</b>	<b>5.4</b>	<b>932</b>
	Charter	100.0	0.0	29
2011–12	Domestic	96.8	3.2	590
	<b>Total</b>	<b>96.9</b>	<b>3.1</b>	<b>619</b>
	Charter	98.6	1.4	69
2012–13	Domestic	92.9	7.1	225
	<b>Total</b>	<b>94.2</b>	<b>5.8</b>	<b>294</b>
	Charter	96.4	3.6	28
2013–14	Domestic	95.8	4.2	590
	<b>Total</b>	<b>95.8</b>	<b>4.2</b>	<b>618</b>
	Charter	100.0	0.0	35
2014–15	Domestic	96.2	3.8	365
	<b>Total</b>	<b>96.5</b>	<b>3.5</b>	<b>400</b>
	<b>Total</b>	<b>97.4</b>	<b>2.6</b>	<b>912</b>
2016–17	<b>Total</b>	<b>96.8</b>	<b>3.2</b>	<b>824</b>
2017–18	<b>Total</b>	<b>94.0</b>	<b>6.0</b>	<b>798</b>
2018–19	<b>Total</b>	<b>96.4</b>	<b>3.6</b>	<b>166</b>
2019–20	<b>Total</b>	<b>95.3</b>	<b>4.8</b>	<b>400</b>
2020–21	<b>Total</b>	<b>94.6</b>	<b>5.4</b>	<b>628</b>

## 1.2 Recreational fisheries

Swordfish are targeted by recreational sport fishers with the annual recreational landed catch in fishing club records increasing since 2011 to 97 in 2020–21, 84 in 2021–22, 45 in 2022–23, and 86 in 2023–24. The 10-year average annual landed catch is 76 fish weighed by New Zealand Sport Fishing Council affiliated clubs. There is renewed recreational interest in swordfish, using deep drifted baits during the day rather than drifting or slow trolling at night. Consequently, the number of swordfish tagged increased in 2022–23 and 2023–24 (69 and 74 fish respectively); the 10-year average is 40 fish tagged annually. Over the last ten years, 7 swordfish recaptures have been reported (Holdsworth & Curtis 2025).

### 1.2.1 Estimates of recreational harvest

No estimates of recreational harvest of swordfish were generated from the telephone-diary surveys conducted in 1994, 1996, and 2000 because so few were reported. A national panel survey was conducted for the first time throughout the 2011–12 fishing year (Wynne-Jones et al. 2014) and was repeated during the 2017–18 and 2022–23 fishing years using very similar methods to produce directly comparable results (Wynne-Jones et al. 2019, Heinemann & Gray 2024). The national panel survey results do not include estimates for swordfish because the surveys did not reflect the number of fishers and fishing activity for the large gamefish species.

## 1.3 Customary non-commercial fisheries

An estimate of the current customary catch is not available, but it is considered to be low.

## 1.4 Unreported catch

Prior to QMS introduction in 2004 there were no reports of swordfish targeted fishing, but analyses of CPUE data suggest targeting did occur. These catches were generally still reported (although as bycatch), so estimates of total annual catch were not affected.

## 1.5 Other sources of mortality

Swordfish have occasionally been observed as a bycatch in the skipjack tuna (*Katsuwonus pelamis*) purse seine fishery and in trawl fisheries for jack mackerel (*Trachurus* spp.) and hoki (*Macruronus novaezelandiae*).

## 2. BIOLOGY

Swordfish (*Xiphias gladius*) are an epi- and meso-pelagic highly migratory species found in all tropical and temperate oceans and large seas. Based on longline catches, swordfish range from 50° N to 45° S in the western Pacific Ocean and from 45° N to 35° S in the eastern Pacific Ocean.

In the New Zealand EEZ, swordfish size varies markedly with latitude, with larger swordfish (and hence fewer males) caught south of 40° S. Since 2020, average annual size of swordfish was smallest in FMA 1 (36–47 kg), followed by FMA 2 (44–55 kg), and FMA 9 (55–63 kg). Average annual size of swordfish was between 80 and 99 kg in FMA 7 since 2020. Across all areas, average annual swordfish size showed a declining trend from 1993 to the late 2010s and was lowest in 2010 and 2011 (41 kg). Since then, average size increased to around 60 kg by 2019 and has remained between 57 and 63 kg since (Finucci & Moore 2025).

A relationship between lower jaw-fork length and weight has been estimated for swordfish from observer records (n = 2835):

$$\text{weight (kg)} = (3.8787 \times 10^{-6}) \text{ length}^{3.24}$$

There have been a number of studies of swordfish growth rates and maturity in the Pacific (summarised in Day et al. 2025) providing a range of estimates for these key biological parameters that have contributed to

stock assessment uncertainty. WCPFC SC recommended that additional work on age, growth, age validation, and reproductive biology be undertaken for the southwest Pacific swordfish stock (WCPFC Project 71). That research and its results are described in Farley et al. (2016), which indicated that swordfish lived longer and grew more slowly than previously estimated. The conditional age-at-length dataset from the Farley et al. (2016) study is used in this assessment, and there has been no addition of conditional age-at-length data since then. The key findings of Farley et al. (2016) include:

- southwest Pacific swordfish can live for at least 21 years;
- male and female growth is similar until about age 3 years after which females reach larger sizes than males for the same age;
- the size at 50% maturity for females is estimated to be around 160 cm eye orbital fork length, which is around 175 cm lower jaw-fork length; and
- age at 50% maturity occurs at around 4–5 years.

The spawning period in the southwest Pacific is from August to May with a peak in December–January. Spawning takes place in the tropical waters of the western Pacific Ocean and to a lesser extent the equatorial waters of the central Pacific Ocean. Larval distributions suggest that key spawning areas are located in the Coral Sea, and around Tonga and French Polynesia (Ijima & Jusup 2023). Swordfish are serial batch spawners, perhaps spawning as frequently as every few days over several months. Eggs are spawned in the upper layers of the tropical ocean and, like the protracted larval phase, are pelagic. Depending on fish size, swordfish egg production is estimated to range from 1 to 29 million eggs per year (for 68–272 kg females, respectively).

Little information on mortality rate is available, but natural mortality  $M$  has been estimated elsewhere in the Pacific to range from 0.22–0.48 yr<sup>-1</sup> depending on age and sex (Moore 2020). This is consistent with the maximum estimated ages for swordfish in Australia and New Zealand.

### 3. STOCKS AND AREAS

Swordfish found in the New Zealand EEZ are part of a much larger stock that spawns in the tropical central to western Pacific Ocean. They are highly migratory and their residence time in the EEZ and adjacent waters is unknown. In the Pacific Ocean, swordfish occur from 50° N to 45° S in the western Pacific Ocean and from 45° N to 35° S in the eastern Pacific Ocean. Swordfish are visual predators with a wide temperature tolerance. Extensive diel vertical migrations have been observed for swordfish in the Atlantic Ocean and Pacific Ocean from waters deeper than 600 m to the surface and across large temperature gradients (e.g., 8–27 °C) in a few hours. Swordfish are found at, or near, the surface at night. This vertical migration is related to feeding behaviour as swordfish follow the diurnal migrations of prey, primarily squid (which are feeding on vertically migrating fish), to the surface at night (Day et al. 2025). Within the EEZ most swordfish are caught in FMAs 1, 2, and 9 when sea surface temperatures are 17–19 °C.

Swordfish stock structure remains poorly understood for swordfish (Day et al. 2025). The New Zealand Gamefish Tagging Programme provides spaghetti tags for large pelagic species (Holdsworth & Curtis 2025). There have been 903 swordfish tagged and released over the last 40 years with 81% tagged by recreational fishers and 19% by commercial surface longliners. Of the 15 recaptures of tagged fish 13 have been reported from inside the New Zealand EEZ. Four swordfish were recaptured during the 2024–25 fishing austral year (July to June). Three of these were re-caught within 20 nautical miles of their original tagging locations, with times at liberty ranging from 75 days to just over six years. The fourth swordfish, tagged off east Northland in March 2024, was recaptured 421 days later, on the southern end of the Colville Ridge.

Longline catch rate distributions suggest three large, relatively high-density areas, the North-West, South-West and Eastern Pacific. However, spawning distributions inferred from larval surveys, (Nishikawa et al. 1985; Ijima & Jusup 2023) as well as studies of spawning and reproduction (Young & Drake, 2004; Mejuto et al. 2008) suggest that spawning occurs in more localized regions - predominantly in tropical and subtropical areas in the southwest Pacific.

Tagging studies provide some confirmation that swordfish undergo directed seasonal migrations between temperate foraging grounds and tropical spawning grounds, with more limited longitudinal movement (Moore 2020). Evans et al. (2014) and Patterson et al. (2021) analysed movement data from swordfish tagged with pop-up satellite tags (PSATs) in the waters off eastern Australia, Cook Islands, and northeast of New Zealand between Fiji and French Polynesia, as well as northern New Zealand (Holdsworth et al. 2007), and northern Chile (Abascal et al. 2010). The analysis suggested a lack of movement between the southern and northern regions of the WCPO, and between the WCPO and the far eastern EPO. This study led to the recommendation of the two model regions east and west of 165°E that have been adopted by WCPFC since the 2013 assessment (Davies et al. 2013). More recent pop-off satellite tagging (PSAT) of larger swordfish off the east coast of Tasmania however showed that some fish do move large distances from west to east across the 165°E regional boundary (Tracey & Pepperell 2018). The difference between the observed movements in the two studies may relate to the size of tagged fish, with the smaller fish in the Evans et al. (2014) study showing more restricted movements.

Moore et al. (2020) reviewed other approaches to studying stock structure, including genetics, otolith chemistry, parasites and tissue stable isotopes. Most studies applying these approaches have had limitations in either the method and or the sample coverage, although there is now strong evidence from genetics that populations in the Indian and Pacific Oceans are separated (Grewe et al. 2020). For the Pacific Ocean, Reeb et al. (2000) suggest that the southwest and northwest Pacific populations are the most genetically distinct from each other, with central and eastern populations intermediate between the two. Alvarado Bremer et al. (2006) suggested that the southeast Pacific population was also genetically distinct from the northeast and southwest populations, and there was additional evidence to suggest that the south-central Pacific may represent a population intermediate between the southwest and southeast, but this was inconclusive due to the low sample sizes. More recent genetic studies have, however, found less evidence for population structure across the Pacific (Lu et al. 2016).

Overall, the stock structure remains poorly understood for swordfish, movement behaviour appears to be complex, extensive, and to cross management boundaries, and most likely differs by sex and size, but there is evidence of fidelity to particular areas (Sepulveda & Aalbers, 2025). As such there is likely to be sub-structure and migratory contingents within a more broadly resolved stock structure (Day et al. 2025). Despite some degree of regional connectivity, swordfish are susceptible to local depletion and data from tagged individuals suggest foraging site fidelity in New Zealand waters (Finucci & Moore 2025).

#### 4. ENVIRONMENTAL AND ECOSYSTEM CONSIDERATIONS

The figures and tables in this section were updated and additional text included for the November 2024 Fishery Assessment Plenary. This summary is from the perspective of the swordfish longline fishery; 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

Swordfish (*Xiphias gladius*) are large pelagic predators, so they are likely to have a ‘top down’ effect on the squid, fish, and crustaceans they feed on.

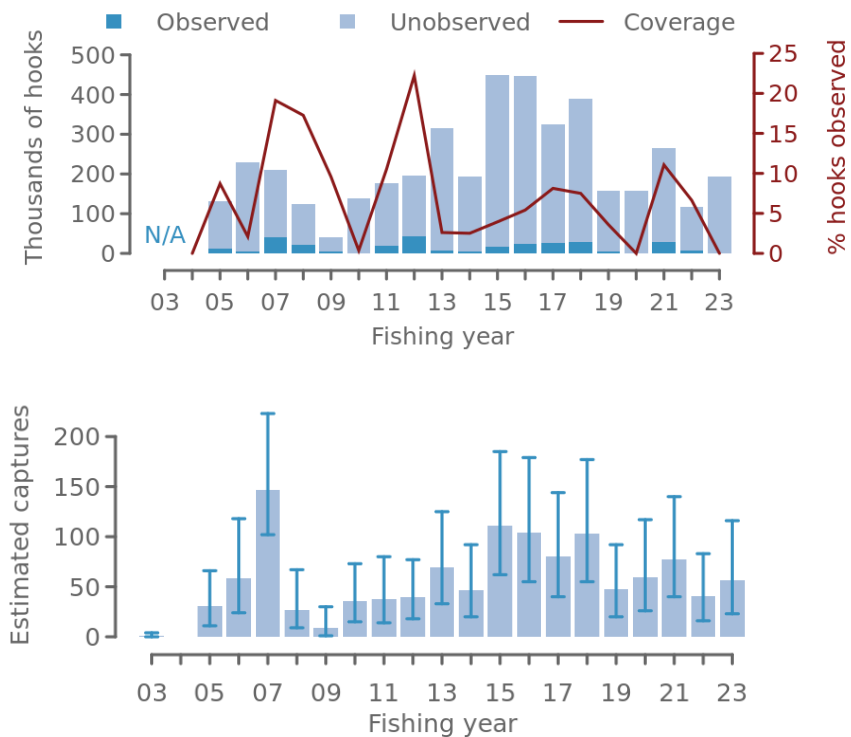
**4.2 Incidental catch of seabirds, sea turtles and mammals**

These capture estimates relate to the swordfish target longline fishery only, from the New Zealand EEZ. The capture estimates presented here include all animals recovered onto the deck (alive, injured, or dead) of fishing vessels but do not include any cryptic mortality (e.g., seabirds caught on a hook but not brought onboard the vessel).

**4.2.1 Seabird bycatch**

Between 2002–03 and 2022–23, there were 109 observed captures of seabirds in swordfish longline fisheries. Seabird capture rates since 2003 are presented in Figure 5. Peaks in the observed capture rate were seen in 2006–07 and 2009–10. The seabird capture locations are predominantly within the northern area of New Zealand’s EEZ Table 5 and Figure 6). The high number of captures in 2006–07 (2007) (Figure 5) are anomalous and are the result of a new entrant vessel fishing in the EEZ with inappropriate mitigation gear; this issue has since been resolved. A recent decrease in observer coverage due to Health and Safety concerns has increased uncertainty. Observed and estimated seabird captures in swordfish longline fisheries are provided in Table 6.

Through the 1990s the minimum seabird mitigation requirement for surface longline vessels was the use of a bird scaring device (tori line), but common practice was that vessels set surface longlines primarily at night. In 2007, a notice was implemented under s11 of the Fisheries Act 1996 to formalise the requirement that surface longline vessels only set during the hours of darkness and use a tori line when setting. This notice was amended in 2008 to add the option of line weighting and tori line use if setting during the day. In 2011 the notices were combined and re-promulgated under a new regulation (Regulation 58A of the Fisheries (Commercial Fishing) Regulations 2001), which provides a more flexible regulatory environment under which to set seabird mitigation requirements. Trials have been undertaken to assess the operational functionality of an underwater bait setter during production fishing and the work is ongoing. The aim of this work was to assess the device without the use of other existing mitigation measures in the New Zealand surface longline fleet.

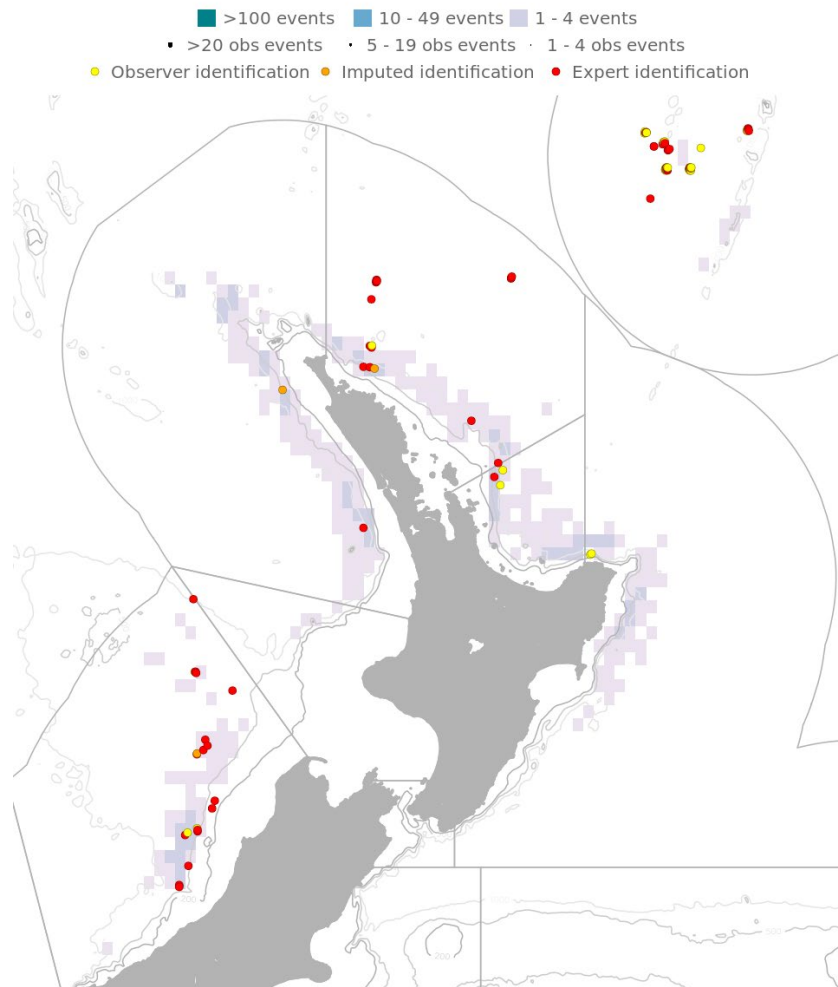


**Figure 5: Fishing effort and observations (top) and estimated seabird captures (bottom) in swordfish longline fisheries from 2002–03 to 2022–23.**

**Table 5: Number of observed seabird captures in swordfish longline fisheries, 2002–03 to 2022–23, by taxon and area. The risk category is an estimate of aggregate potential fatalities across trawl and longline fisheries relative to the Population Sustainability Threshold, PST (an analogue of PBR approach) (Edwards et al. 2023). The current version of the risk assessment does not include recovery factor.**

Taxon	Risk category	Bay of Plenty	East Coast North Island	Kermadec Islands	Northland and Hauraki	West coast North Island	West coast South Island	Total
Albatrosses	NA			33				33
Antipodean albatross	Medium			12	3			15
Gibson's albatross	Medium			4	5		3	12
New Zealand white-capped albatross	High					1	11	12
Antipodean and Gibson's albatrosses	NA			5			1	6
Campbell black-browed albatross	Low				2		1	3
Black-browed albatrosses	NA			2				2
Southern Buller's albatross	Very high		1					1
Wandering albatross	NA				2			2
<b>Total albatrosses</b>			<b>1</b>	<b>56</b>	<b>12</b>	<b>1</b>	<b>16</b>	<b>86</b>
Black petrel	High	3			3	1		7
White-chinned petrel	Low			2			5	7
Flesh-footed shearwater	Medium		1		1			2
Grey petrel	Negligible			2				2
Grey-faced petrel	Negligible			1	1			2
Fulmars, petrels, prions and shearwaters	NA			1				1
Sooty shearwater	Negligible			1				1
Westland petrel	High						1	1
<b>Total other seabirds</b>		<b>3</b>	<b>1</b>	<b>7</b>	<b>5</b>	<b>1</b>	<b>6</b>	<b>23</b>

Current results for the risk posed by commercial fishing to seabirds have been assessed via a spatially explicit fisheries risk assessment (SEFRA), supported under the NPOA-Seabirds 2020 risk assessment framework (Fisheries New Zealand & Department of Conservation 2020). The method used in the risk assessment arose initially from an expert workshop hosted by the Ministry of Fisheries in 2008. The overall framework is described in [3 - SEFRA - Aquatic Environment and Biodiversity Annual Review 2021 \(mpi.govt.nz\)](#) and has been variously applied and improved in multiple iterations (most recently Edwards et al. 2023). The method applies an ‘exposure-effects’ approach where exposure refers to the number of fatalities and is calculated from the overlap of seabirds with fishing effort compared with observed captures to estimate the species vulnerability (capture rates per encounter) to each fishery group. This is then compared with the population’s productivity, based on population estimates and biological characteristics, to yield estimates of population-level risk.



**Figure 6: Distribution of fishing effort targeting swordfish and observed seabird captures, 2002–03 to 2022–23. Fishing effort is mapped into 0.2-degree cells, with the colour of each cell being related to the amount of effort. Observed fishing events are indicated by black dots, and observed captures are indicated by red, yellow, or orange dots. Fishing is only shown if the effort could be assigned a latitude and longitude, and if there were three or more vessels fishing within a cell. Data grooming methods are described by Abraham & Berkenbusch (2019).**

The risk ratio is an estimate of potential deaths from interactions with trawl and bottom-longline and surface longline fisheries relative to the Population Sustainability Threshold (PST) for each species assessed. PST provides a reference point of anthropogenic deaths that can be sustained by the population relative to its size and reproductive rate and still meet long term recovery goals. A risk ratio above 1 indicates that domestic fishing related deaths alone exceed PST and the population is at risk of not obtaining long term recovery goals.

Edwards et al. (2023) assessed the domestic tuna and swordfish surface longline fishery contribution to the total risk posed by New Zealand commercial fishing to seabirds (Table 7). This fishery (which includes swordfish targeting) contributes 0.313 of risk to Southern Buller’s albatross (26.8% of the total risk posed by New Zealand commercial fishing included in the risk assessment), the only species categorised as Very high risk (Edwards et al. 2023), and 0.115, 0.089 and 0.042 of risk to Black petrel, Westland petrel and New Zealand white-capped albatross, respectively; these were assessed to be at high risk from New Zealand commercial fishing. The wider surface longline fishery contributes most of the risk to species in

the wandering albatross family: Gibson’s albatross and Antipodean albatross, contributing 87% and 94% of their total risk respectively.

**Table 6: Effort, observed, and estimated seabird captures by fishing year for the swordfish fishery within the EEZ. For each fishing year, the table gives the total number of hooks; the number of observed hooks; observer coverage (the percentage of hooks that were observed); the number of observed captures (both dead and alive); the capture rate (captures per thousand hooks); and the mean number of estimated total captures (with 95% confidence interval). Estimates are based on methods described by Abraham & Richard (2019).**

Fishing year	Fishing effort			Observed captures		Estimated captures	
	All hooks	Observed hooks	% observed	Number	Rate	Mean	95% c.i.
2002–03	NA	0	NA	0		1	0–4
2003–04	0	0		0			–
2004–05	132 503	11 553	8.7	2	0.17	30	11–66
2005–06	228 305	4 800	2.1	2	0.42	58	24–118
2006–07	210 175	40 174	19.1	71	1.77	146	102–223
2007–08	125 330	21 630	17.3	1	0.05	27	9–67
2008–09	41 700	3 990	9.6	0	0.00	9	1–30
2009–10	137 840	500	0.4	3	6.00	36	15–73
2010–11	177 248	18 638	10.5	0	0.00	38	14–80
2011–12	195 400	43 450	22.2	7	0.16	40	18–77
2012–13	316 390	8 250	2.6	1	0.12	69	33–125
2013–14	192 963	4 850	2.5	0	0.00	47	20–92
2014–15	447 962	17 650	3.9	6	0.34	111	62–185
2015–16	447 220	24 230	5.4	3	0.12	104	55–179
2016–17	324 040	26 340	8.1	0	0.00	80	40–144
2017–18	390 220	29 260	7.5	3	0.10	104	55–177
2018–19	158 011	5 670	3.6	0	0.00	47	20–92
2019–20	157 365	0	0.0	0		59	26–117
2020–21	266 296	29 470	11.1	9	0.31	77	40–140
2021–22	118 239	7 850	6.6	1	0.13	41	16–83
2022–23	193 147	0	0.0	0		56	23–116

**Table 7: Risk ratio of seabirds predicted by the SEFRA for the domestic tuna and swordfish surface longline fishery and all fisheries included in the SEFRA, 2006–07 to 2019–20, with a risk posed by the domestic tuna and swordfish SLL fishery. The risk ratio is an estimate of aggregate potential fatalities across trawl and longline fisheries relative to the Population Sustainability Threshold, PST (an analogue of the PBR approach) (Edwards et al. 2023). The current version of the risk assessment does not include a recovery factor. The New Zealand threat classifications are shown (Robertson et al. 2021).**

Species name	Domestic SLL	Risk ratio		Risk category	NZ Threat Classification
		Total risk from NZ commercial fishing	% of total risk from NZ commercial fishing		
Southern Buller’s albatross	0.313	1.19	26.8	Very high	At Risk: Declining
Antipodean albatross	0.141	0.16	94.4	Medium	Threatened: Nationally Critical
Gibson’s albatross	0.137	0.16	89.7	Medium	Threatened: Nationally Critical
Black petrel	0.115	0.49	24.5	High	Threatened: Nationally Vulnerable
Westland petrel	0.089	0.38	25.9	High	At Risk: Naturally Uncommon
New Zealand white-capped albatross	0.042	0.5	8.7	High	At Risk: Declining
Northern Buller’s albatross	0.038	0.19	20.6	Medium	At Risk: Naturally Uncommon
Southern royal albatross	0.018	0.08	24.4	Low	Threatened: Nationally Vulnerable
Campbell black-browed albatross	0.016	0.05	30.2	Low	At Risk: Naturally Uncommon
Flesh-footed shearwater	0.015	0.22	7.3	Medium	At Risk: Relict

#### 4.2.2 Sea turtle bycatch

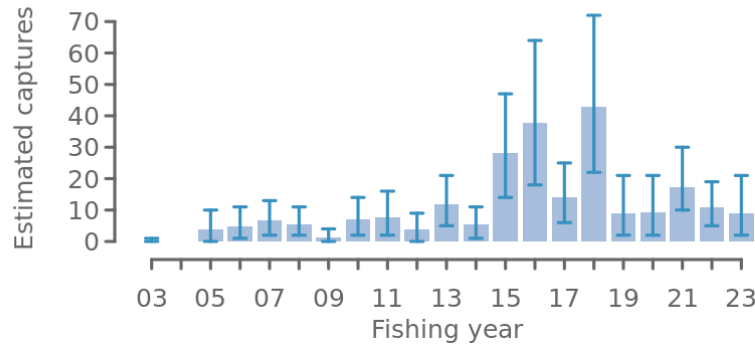
Between 2002–03 and 2022–23, there were 18 observed captures of sea turtles in swordfish longline fisheries (Table 8 and Figure 7). Observer recordings documented all sea turtles as captured and released alive. Sea turtle captures for this fishery have been observed in the Bay of Plenty, east coast North Island, Kermadec Islands, Northland and Hauraki, and the west coast South Island fishing areas (Table 8 and Figure

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8). Fishing effort and sea turtle captures in swordfish longline fisheries between 2002–03 and 2022–23 are shown in Table 9.

**Table 8: Number of observed sea turtle captures in swordfish longline fisheries, 2002–03 to 2022–23, by species and area. Data grooming methods are described by Abraham & Berkenbusch (2019).**

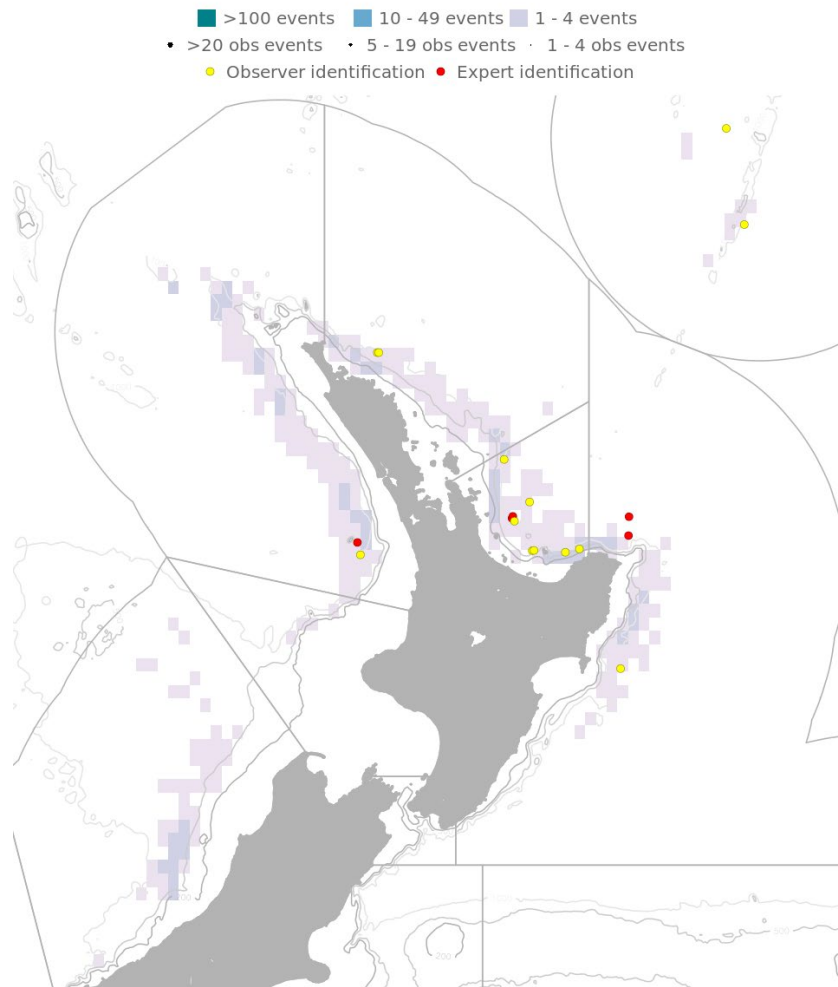
Species	East Coast North Island	Bay of Plenty	Kermadec Islands	Northland and Hauraki	West coast North Island	Total
Leatherback turtle	2	9	2	2	2	18



**Figure 7: Estimated captures of sea turtles in swordfish longline fisheries from 2002–03 to 2022–23.**

**Table 9: Fishing effort and sea turtle captures by fishing year for the swordfish fishery within the EEZ. For each fishing year, the table gives the total number of hooks; the number of observed hooks; observer coverage (the percentage of hooks that were observed); the number of observed captures (both dead and alive); the capture rate (captures per thousand hooks); and the mean number of estimated total captures (with 95% confidence interval). Estimates are based on methods described by Abraham & Richard (2019).**

Fishing year	Fishing effort			Observed captures		Estimated captures	
	All hooks	Observed hooks	% observed	Number	Rate	Mean	95% c.i.
2002–03	NA	0	NA	0		0	0–1
2003–04	0	0		0			–
2004–05	132 503	11 553	8.7	0	0.000	4	0–10
2005–06	228 305	4 800	2.1	0	0.000	5	1–11
2006–07	210 175	40 174	19.1	1	0.025	7	2–13
2007–08	125 330	21 630	17.3	1	0.046	5	2–11
2008–09	41 700	3 990	9.6	0	0.000	1	0–4
2009–10	137 840	500	0.4	0	0.000	7	2–14
2010–11	177 248	18 638	10.5	0	0.000	8	2–16
2011–12	195 400	43 450	22.2	0	0.000	4	0–9
2012–13	316 390	8 250	2.6	0	0.000	12	5–21
2013–14	192 963	4 850	2.5	0	0.000	5	1–11
2014–15	447 962	17 650	3.9	0	0.000	28	14–47
2015–16	447 220	24 230	5.4	2	0.083	38	18–64
2016–17	324 040	26 340	8.1	2	0.076	14	6–25
2017–18	390 220	29 260	7.5	1	0.034	43	22–72
2018–19	158 011	5 670	3.6	0	0.000	9	2–21
2019–20	157 365	0	0.0	0		9	2–21
2020–21	266 296	29 470	11.1	7	0.238	17	10–30
2021–22	118 239	7 850	6.6	4	0.510	11	5–19
2022–23	193 147	0	0.0	0		9	2–21



**Figure 8: Distribution of fishing effort targeting swordfish and observed sea turtle captures, 2002–03 to 2022–23.** Fishing effort is mapped into 0.2-degree cells, with the colour of each cell being related to the amount of effort. Observed fishing events are indicated by black dots, and observed captures are indicated by red or yellow dots. Fishing is only shown if the effort could be assigned a latitude and longitude, and if there were three or more vessels fishing within a cell. Estimates are based on methods described by Abraham & Richard (2019).

### 4.2.3 Incidental catch of marine mammals

#### 4.2.3.1 Cetaceans

Between 2002–03 and 2022–23, there was one observed capture of a beaked whale in swordfish longline fisheries, off the west coast of the South Island in 2016–17.

#### 4.2.3.2 New Zealand fur seals

Currently, New Zealand fur seals are dispersed throughout New Zealand waters but are more common in waters south of about 40° S to Macquarie Island. The spatial and temporal overlap of commercial fishing grounds and New Zealand fur seal foraging areas has resulted in New Zealand fur seal captures in fishing gear (Mattlin 1987, Rowe 2009). Most fisheries with observed captures occur in waters over or close to the continental shelf, which slopes steeply to deeper waters relatively close to shore, and thus rookeries and haulouts, around much of the South Island and offshore islands. Captures on longlines occur when the fur

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seals attempt to feed on the bait and fish catch during hauling. Most New Zealand fur seals are released alive, typically with a hook and short snood or trace still attached.

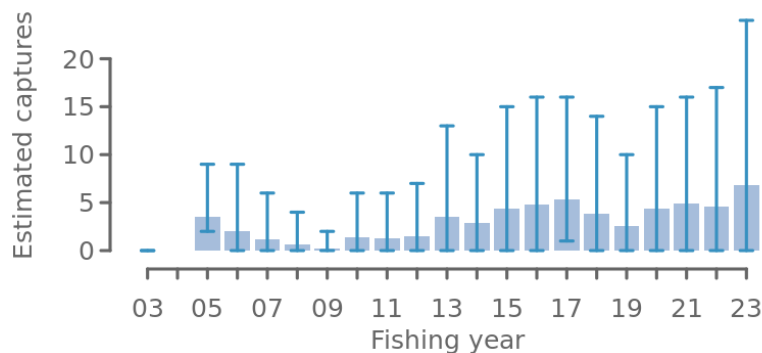
Between 2002–03 and 2022–23, there were three observed captures of New Zealand fur seals in swordfish longline fisheries (Table 10 and Table 11, Figure 9 and Figure 10). These captures include animals that are released alive (Thompson et al. 2013).

**Table 10: Number of observed New Zealand fur seal captures in swordfish longline fisheries, 2002–03 to 2022–23, by species and area. Data grooming methods are described by Abraham & Berkenbusch (2019).**

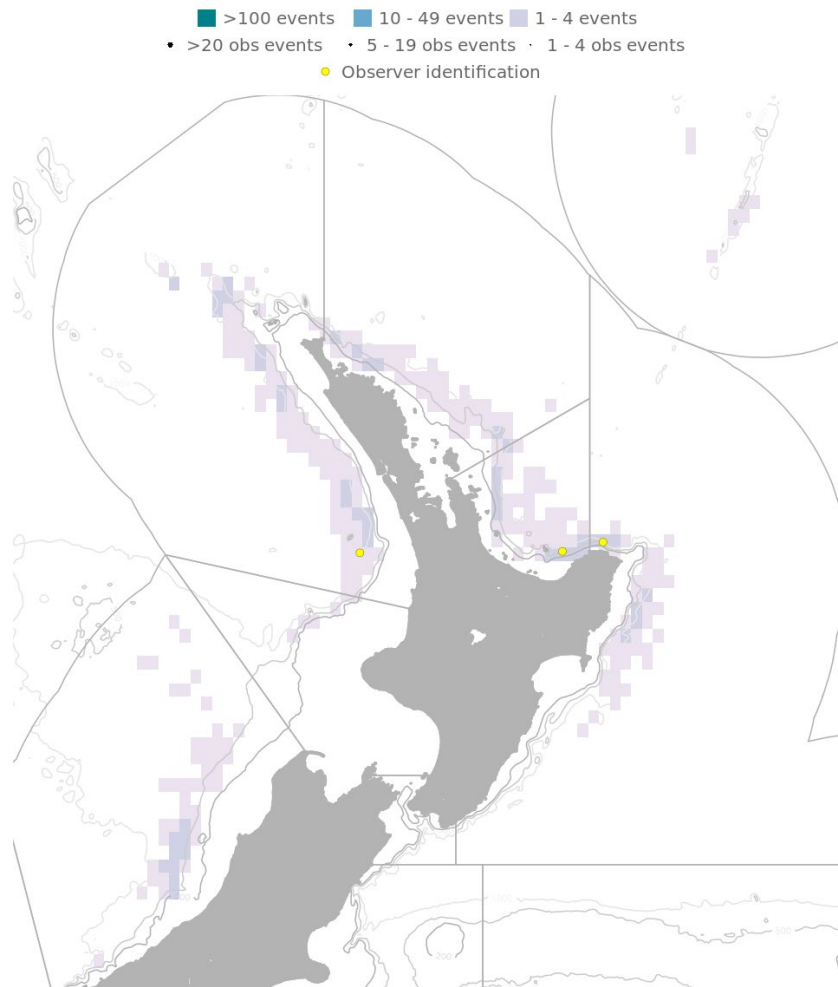
	Bay of Plenty	East coast North Island	West coast North Island	Total
New Zealand fur seal	1	1	1	3

**Table 11: Effort and captures of New Zealand fur seals in swordfish longline fisheries by fishing year. For each fishing year, the table gives the total number of hooks; the number of observed hooks; observer coverage (the percentage of hooks that were observed); the number of observed captures (both dead and alive); and the capture rate (captures per thousand hooks). Estimates are based on methods described by Abraham & Richard (2019).**

Fishing year	Fishing effort			Observed captures		Estimated captures	
	All hooks	Observed hooks	% observed	Number	Rate	Mean	95% c.i.
2002–03	NA	0	NA	0		0	0–0
2003–04	0	0		0			–
2004–05	132 503	11 553	8.7	2	0.173	3	2–9
2005–06	228 305	4 800	2.1	0	0.000	2	0–9
2006–07	210 175	40 174	19.1	0	0.000	1	0–6
2007–08	125 330	21 630	17.3	0	0.000	1	0–4
2008–09	41 700	3 990	9.6	0	0.000	0	0–2
2009–10	137 840	500	0.4	0	0.000	1	0–6
2010–11	177 248	18 638	10.5	0	0.000	1	0–6
2011–12	195 400	43 450	22.2	0	0.000	1	0–7
2012–13	316 390	8 250	2.6	0	0.000	3	0–13
2013–14	192 963	4 850	2.5	0	0.000	3	0–10
2014–15	447 962	17 650	3.9	0	0.000	4	0–15
2015–16	447 220	24 230	5.4	0	0.000	5	0–16
2016–17	324 040	26 340	8.1	1	0.038	5	1–16
2017–18	390 220	29 260	7.5	0	0.000	4	0–14
2018–19	158 011	5 670	3.6	0	0.000	3	0–10
2019–20	157 365	0	0.0	0		4	0–15
2020–21	266 296	29 470	11.1	0	0.000		0–16
2021–22	118 239	7 850	6.6	0	0.000		0–17
2022–23	193 147	0	0.0	0			0–24



**Figure 9: Estimated captures of New Zealand fur seals in swordfish longline fisheries from 2002–03 to 2022–23.**



**Figure 10: Distribution of fishing effort targeting swordfish and observed New Zealand fur seal captures, 2002–03 to 2022–23. Fishing effort is mapped into 0.2-degree cells, with the colour of each cell being related to the amount of effort. Observed fishing events are indicated by black dots, and observed captures are indicated by yellow dots. Fishing is only shown if the effort could be assigned a latitude and longitude, and if there were three or more vessels fishing within a cell. Estimates are based on methods described by Abraham & Richard (2019).**

### 4.3 Non-target fish catch

Observer records indicate that a wide range of species are landed by the longline fleets in New Zealand fishery waters. Blue sharks (*Prionace glauca*) are the most commonly landed species (by number), followed by lancetfish (*Alepisaurus* spp.) and Ray’s bream (*Brama brama*) (Table 12).

### 4.4 Benthic interactions

There are no known interactions with benthic habitats in this fishery.

### 4.5 Key environmental and ecosystem information gaps

Cryptic mortality is unknown at present but developing a better understanding of this in future may be useful for reducing uncertainty in the seabird risk assessment and could be a useful input into risk assessments for other species groups.

The survival rates of released target and bycatch species is currently unknown.

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Observer coverage of the New Zealand fleet is not spatially and temporally representative of the fishing effort.

**Table 12: 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. 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).**

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	1 721	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

## 5. STOCK ASSESSMENT

The most recent stock assessment of Southwest Pacific Ocean swordfish was carried out in 2025 (Day et al. 2025). An additional four years of data were incorporated into this assessment, from 2020–2023, including new catch, CPUE and size composition data. It represents the seventh assessment of swordfish in the southwest Pacific since 2006, with all previous assessments being conducted in MULTIFAN-CL, except for one in CASAL.

The 2025 assessments transitioned from MULTIFAN-CL to Stock Synthesis. While the 2025 Stock Synthesis assessment used aspects of the previous MULTIFAN-CL assessment to guide the initial assessment model set-up, the objective was to develop a new benchmark assessment in Stock Synthesis, utilising features of the Stock Synthesis software, rather than try to replicate the previous MULTIFAN-CL assessment.

The 2025 assessment makes a fundamental structural change to develop a two-sex assessment, and various other changes and alternative approaches are applied in the quest to improve the assessment. The key changes include:

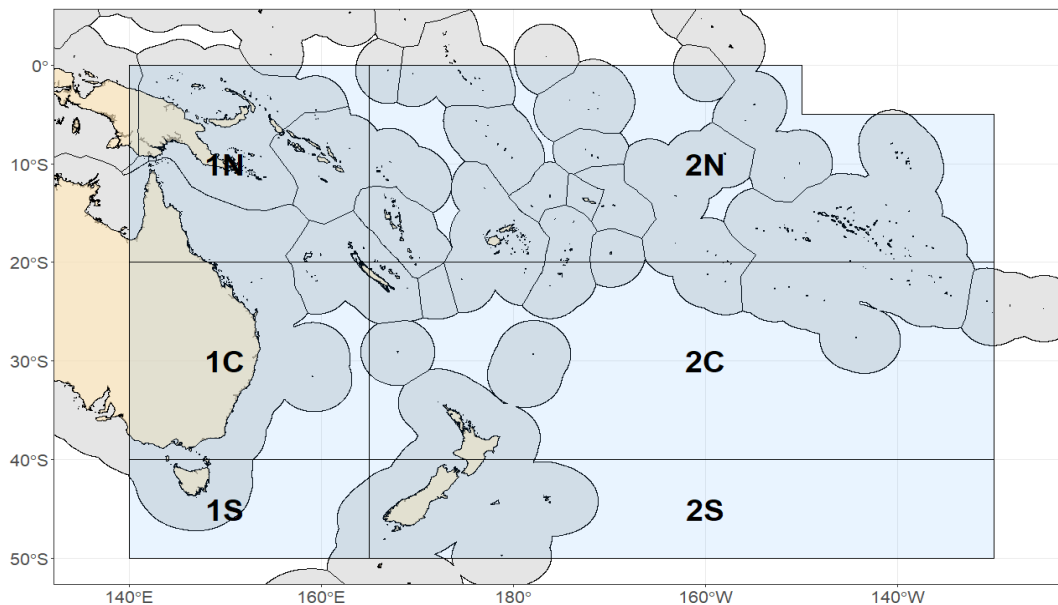
- Change of stock assessment platform from MULTIFAN-CL to Stock Synthesis.
- Conversion from a 1-sex model to a 2-sex model.
- Major revision of the size data inputs (both length and weight), stronger filtering methods and additional down weighting of unreliable size data.
- Separation of all fisheries into distinct fisheries in each model subregion.
- Changing from age-based selectivity to length-based selectivity.
- Constraining selectivity options to logistic or double normal, rather than complex spline-based selectivities.

- Inclusion of sex-specific conditional age-at-length data within the assessment and using these data to contribute to internal growth estimation.
- Estimating the scale of the Lorenzen mortality form, using more recent published approaches of Hamel & Cope (2022); Hoyle (2022).
- Switching to an updated length-weight relationship based on a new dataset and with more careful filtering of the old data (Macdonald et al. 2025).
- The use of a quarterly model time step, rather than an annual time step, to allow greater resolution in modelling the growth curve.
- The adoption of variable bin widths for the weight composition data, using a feature in Stock Synthesis that is not available in MFCL.

Due to the time spent focusing on these substantial structural changes, a standard grid approach was used to characterise uncertainty in management quantities. This contrasts with the more sophisticated approach of creating a model ensemble based on joint prior distributions to characterise uncertainty pioneered in 2021. The ensemble approach appears to be a more suitable approach and could be reinstated for the next swordfish assessment.

### 5.1. Stock status and trends

The 2025 stock assessment of the southwest Pacific Ocean swordfish adopts a two-region spatial structure with three subregions within each region (**Error! Reference source not found. 11**). The model assumes a fixed quarterly movement between these two regions and a single reproductive stock, with 19 extraction fisheries (Table 13), each operating in one of the 6 sub-regions.



**Figure 11: The geographical area covered by the stock assessment and the boundaries of the two model regions (1, 2) and six subregions (N, C, S) used for the 2025 southwest Pacific swordfish assessment.**

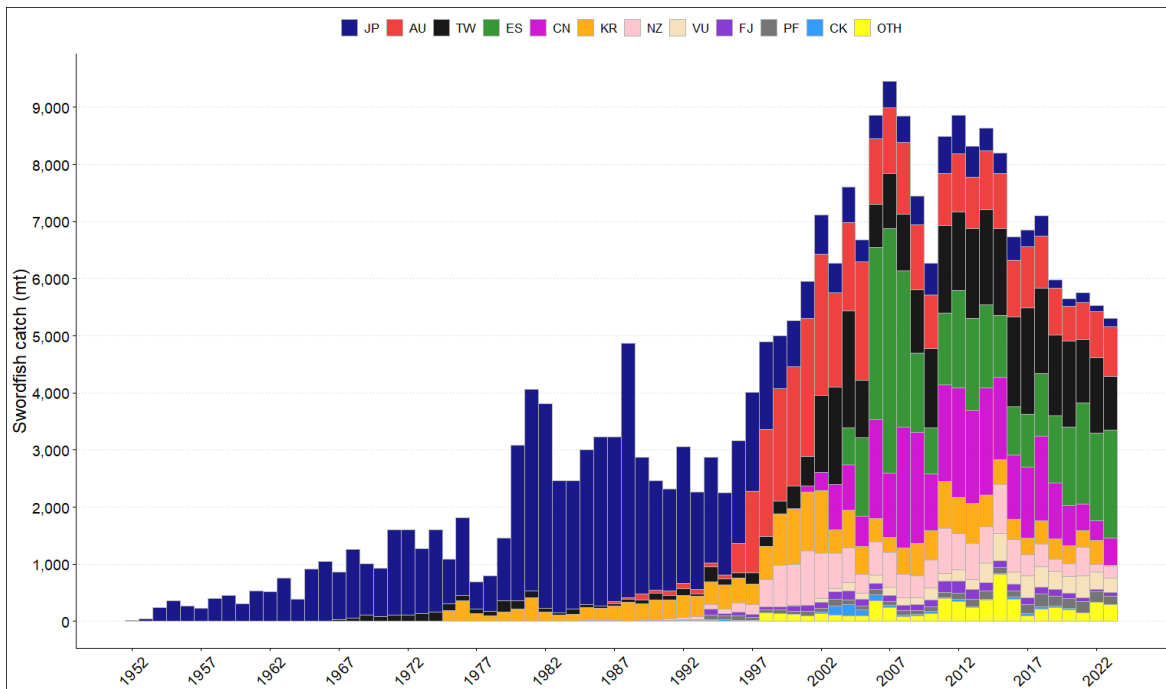
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**Table 13: Definition of fisheries by model regions (1, 2), fleet areas (N, C, S), and flags. Extraction fisheries: 1-19 and CPUE indices: 20-21), and indication of whether catch data is in tonnes (t) or numbers of fish (nos).**

Fishery	Catch	Fishery	Catch	Fishery	Catch
01.DW.1N	nos	09.PICT.1C	nos	17.EU.2S	t
02.DW.1C	nos	10.DW.2N	nos	18.PICT.2N	nos
03.DW.1S	nos	11.DW.2C	nos	19.PICT.2C	nos
04.AU.1N	nos	12.DW.2S	nos		
05.AU.1C	nos	13.NZ.2C	nos	<b>Index fisheries</b>	<b>Catch</b>
06.AU.1S	nos	14.NZ.2S	nos	20.AU.IDX.1	nos
07.EU.1C	t	15.EU.2N	t	21.NZ.IDX.2	nos
08.PICT.1N	nos	16.EU.2C	t		

The major structural uncertainties considered include incorporating: two alternative CPUE indices for region 2; three fixed values for steepness; two options for the proportion of recruitment in each region; three movement rate options between the two regions; five data weighting options for the length and weight composition data; and two options for natural mortality (Table 14). These axes of structural uncertainty were incorporated into the estimates of reference point values listed in Table 15.

The annual catches show a general moderate increase through to the late 1990s, when there was a notable increase to a peak in annual catches in 2007, followed by a general decrease in catches through to 2023. However, recent catches remain twice as large as the catches during the early 1990s (Figure 12). Catches in the Western and Central Pacific Convention Area (WCPFC-CA) south of the equator but north of 20°S, and therefore not managed by CMM 2009-03, have accounted for 42% of the catch in the most recent period (2021–24; Figure 13). Both the Australian CPUE index and the New Zealand CPUE index (Figure 14) peak in the 2010s, but with no obvious longer-term trends that would indicate a general increase or decrease in the population size. The CPUE indices start much later (1998 for the Australian index and 2004 for the New Zealand index) than the catch series (1953).



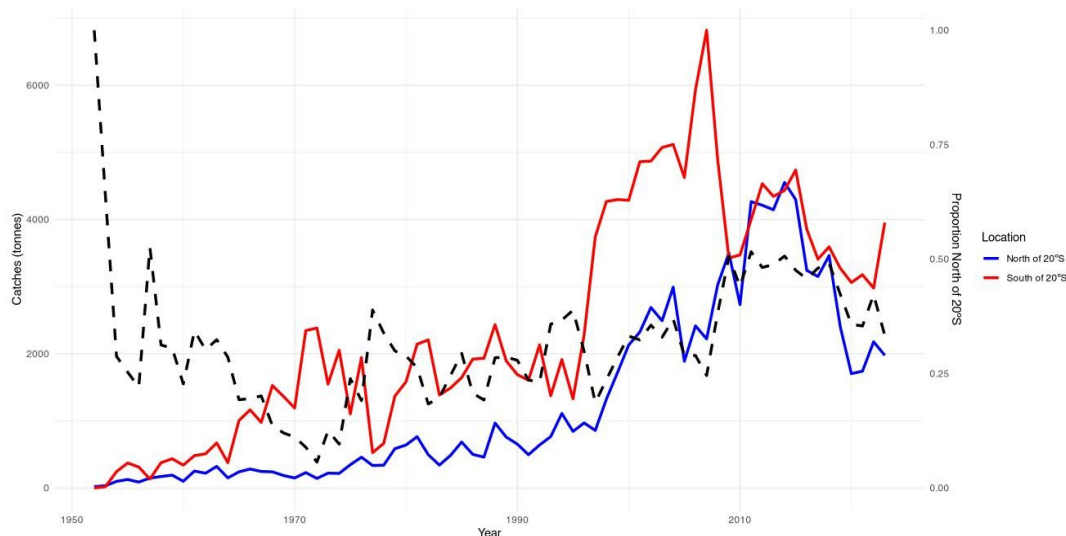
**Figure 12: Annual catches of southwest Pacific swordfish by flag in the area covered by the assessment.**

Table 14: Key sources of uncertainty in the 2025 Southwest Pacific swordfish stock assessment.

TYPE	RATIONALE	UNCERTAINTY	IMPACT	CONFIDENCE
<b>DATA</b>				
CPUE	Best available standardised indices, incorporating operational data, multiple indices.	Not a spatio-temporal index, limited spatial range for index fisheries compared to fishery range, mostly bycatch fisheries	May not be representative of the full stock	Medium
Catch	Best available information	Good certainty, mandatory catch reporting	Minor	High
Length	Representative sampling	Considerable uncertainty in some data sources. Conversion factors, patchy sampling, and likely selective sampling issues.	May have temporal variation, but due to filtering and data weighting, the impact of unreliable data will be low.	Medium
Weight	Representative sampling	Conversion factors have some uncertainty. Weight sampling programmes have high coverage from some fisheries, but restricted spatial coverage.	Medium	High (but spatial coverage is low)
Age	Representative sampling	Very limited temporal and spatial sampling of age composition data.	Influences estimated growth	Low
<b>MODEL</b>				
Stock Synthesis	Widely used platform	Low, well-tested	Single model framework used for inference	High
<b>SPATIAL ASSUMPTIONS</b>				
2 regions	Based on the movement of satellite tags	High uncertainty in spatial structure, only one spatial structure considered.	Potentially important, but uncertainty not quantified, impact unknown	Low
<b>KEY PARAMETER UNCERTAINTY</b>				
M	Estimable	Estimated and fixed (in grid)	Influential in the grid	Medium
Steepness	Not estimable in the current model	Grid (0.7, 0.8, 0.9)	Influential in the grid	High
Growth	Estimable	Estimated variance of length-at-age fixed	Not included in the grid	Medium
Recruitment proportion	Not estimable in the current model	Grid (1:3,1:4)	Some influence on the grid	Medium
Movement	External estimates	Grid (halving each of the 2 movement rates successively)	Limited influence on the grid	Low
<b>STRUCTURAL UNCERTAINTIES</b>				
CPUE options	PICT observer index in region 2	Limited time series	Potentially important	Medium
<b>Estimation uncertainty</b>				
Hessian	Variance-covariance estimates	Calculated	Important	High
<b>Other source of uncertainty</b>				
Climate	Possible recruitment impacts	Not considered	Changes to productivity parameters	Low
Stock structure		Not considered	Unknown	Low
Spatial variation on growth		Not considered	Unknown	Low

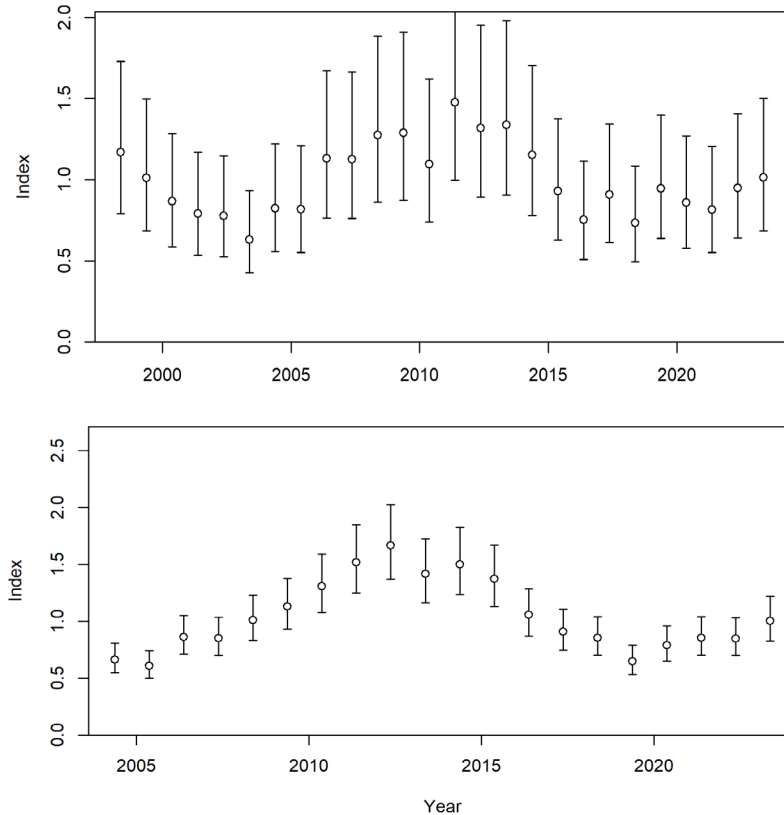
**Table 15: Summary of reference points over the uncertainty grid, along with results incorporating estimation uncertainty. Note that these values do not include estimation uncertainty, unless otherwise indicated.**

Metric	Mean	Median	Min	10%ile	90%ile	Max
$C_{latest}$	5 922	5 926	5 758	5 846	5 994	6 071
$SB_{latest}$	47 080	43 738	26 110	35 742	62 301	96 686
$SB_{recent}$	48 523	44 994	27 255	36 729	64 013	99 654
$TB_{latest}$	118 832	110 466	65 944	91 676	155 510	234 896
$TB_{recent}$	118 023	109 628	65 577	90 625	154 507	234 147
$F_{latest}$	0.06	0.06	0.03	0.04	0.07	0.10
$F_{recent}$	0.06	0.06	0.03	0.04	0.07	0.10
$SB_{MSY}$	20 039	19 502	11 521	13 580	26 557	38 811
MSY	12 078	11 560	8 189	9 708	15 339	22 310
$F_{MSY}$	0.21	0.20	0.15	0.16	0.27	0.27
$F_{recent}/F_{MSY}$	0.28	0.28	0.11	0.18	0.38	0.53
$F_{latest}/F_{MSY}$	0.28	0.27	0.11	0.18	0.38	0.53
$SB_{recent}/SB_{MSY}$	2.48	2.33	1.54	1.88	3.34	4.10
$SB_{latest}/SB_{MSY}$	2.41	2.27	1.47	1.82	3.24	3.98
$SB_{recent}/SB_{F=0}$	0.52	0.50	0.37	0.46	0.58	0.67
$SB_{latest}/SB_{F=0}$	0.50	0.49	0.36	0.45	0.57	0.65
Including estimation uncertainty						
$F_{recent}/F_{MSY}$	0.28	0.27	0.00	0.16	0.41	0.93
$SB_{recent}/SB_{MSY}$	2.48	2.37	0.48	1.80	3.37	5.37



**Figure 13: Plot of the total Southwest Pacific swordfish catch (primary axis) south of 20S (red line), between the equator and 20S (blue line), and proportion of catch between the equator and 20S (dashed black line, secondary axis) by year in the WCPFC-CA.**

The estimated absolute recruitment and recruitment deviations (Figure 15) suggest some autocorrelation, and they appear to be partly driven by the pattern in the CPUE indices. The estimated time series of spawning biomass by region (Figure 16) also reflects the pattern seen in the CPUE, but with a declining trend since the late 1990s, to match the increase in catches in this period. Fishing mortality started to increase in the late 1990s (Figures 17) and has been relatively stable, fluctuating around a higher historical average mortality level, since around 2005.



**Figure 14: Standardised CPUE with initial input 95% confidence interval (CI) for (top) the Australian longline CPUE index fishery in region 1 and (bottom) the New Zealand longline CPUE index fishery in region 2. Additional variance was estimated within the model, which effectively reduced these confidence intervals for the Australian index and increased them for the New Zealand index.**

The model convergence is very good, as seen from the jitter analysis. However, likelihood profiles indicate some conflict in the data. The retrospective analysis indicates sensitivity to recent data, and the age-structured production model indicates that the population scale is not well determined by the CPUE.

The spawning biomass trajectory is relatively stable into the mid-1990s (Figure 18), followed by a period of decline and then a period of some recovery, from 2008–2015, followed by a further decline. The spawning biomass relative to  $SB_{MSY}$ , the default WCPFC reference point, shows a similar pattern (Figure 18).

The 2025 stock assessment results are generally similar to the previous assessment, indicating that the stock is unlikely to be experiencing overfishing or to be overfished, albeit with tighter uncertainty bounds, which are likely to be underestimated due to the simplified model structure and the limited range of options explored in the uncertainty grid.

A number of key concerns are highlighted by Day et al. (2025). Firstly, growth continues to be a major uncertainty for this assessment, and no suitable resolution was found to problems discovered when applying fixed external growth, as was used successfully in the 2021 diagnostic model. As a result, growth uncertainty is not incorporated in the uncertainty grid. Von Bertalanffy growth parameters were estimated internally for females, with sex specific conditional age-at-length data as the major source of information for these growth estimates, and with fixed offsets used for male growth parameters. Secondly, model outputs and diagnostics indicated that the uncertainty in population scale is large. This key output,

population scale, required an appropriate contribution from the weight composition data to counter the tendency of the CPUE data to support unrealistically high estimates of population scale. The conflict in these data sources is problematic and independent validation of the population size is important to increase confidence in the management advice for this integrated assessment. Any bias in estimated population scale will bias key management metrics. Thirdly, we note the influence of weight composition data, which has cyclic variation and recent decreases, most notably for Australian longline weight composition data. A better understanding of the processes (biological, sampling or fishing practices) influencing the variation in the weight composition time series is important to ensure that these data are treated appropriately in the model. Finally, spatial structure remains a key uncertainty, the current spatial structure may be mis-specified and the treatment of the large catch area in the northeast of the model region, and adjacent waters outside the model region, needs review with regards to appropriate spatial extent and structure of the assessment region.

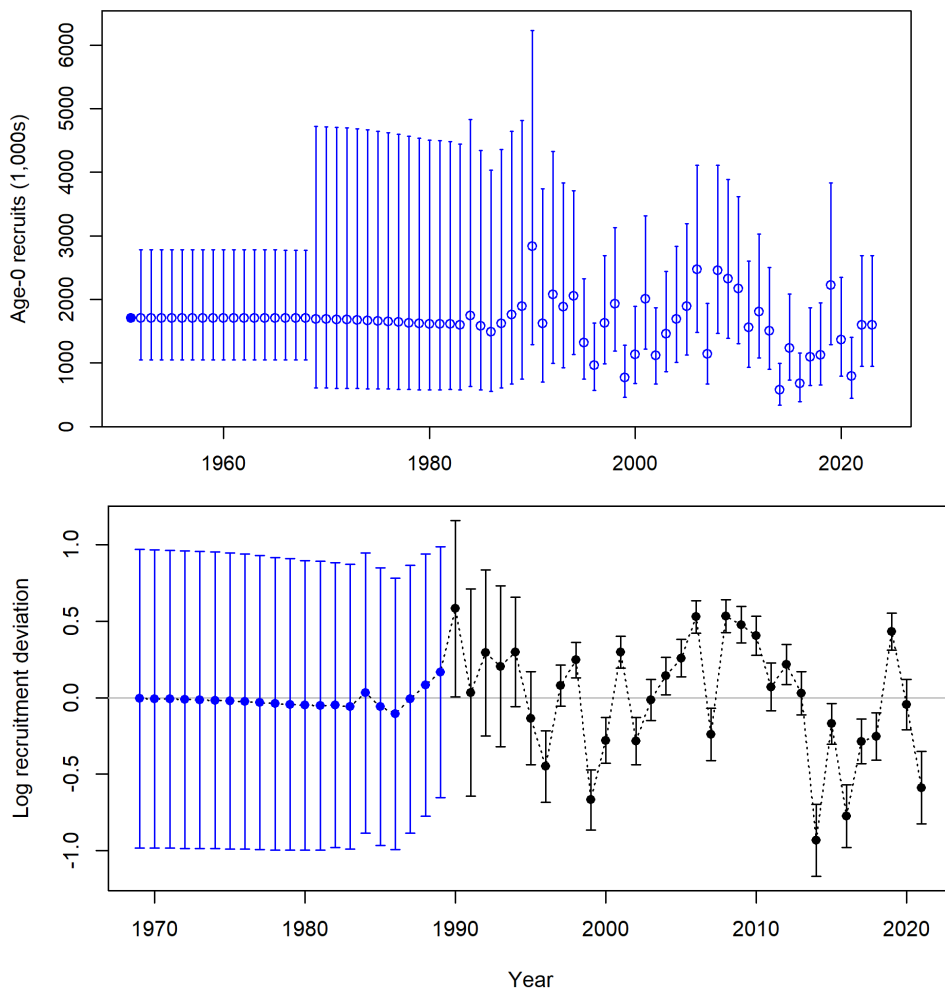


Figure 15: Annual time series of estimated absolute annual recruitment in numbers (top) and annual time series of estimated log annual recruitment deviations (bottom), including estimation uncertainty with 95% confidence interval for the diagnostic model.

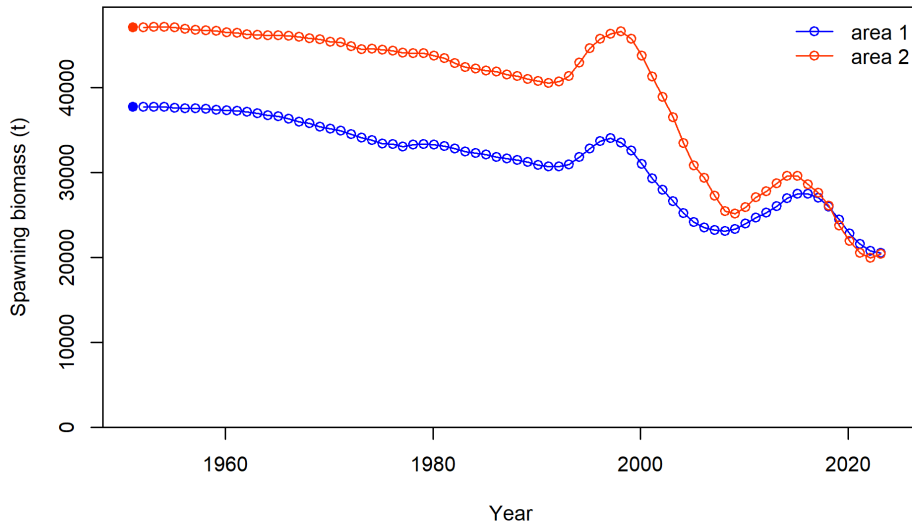


Figure 16: Time series of estimated annual female spawning biomass (without estimation uncertainty) by region for the diagnostic model.

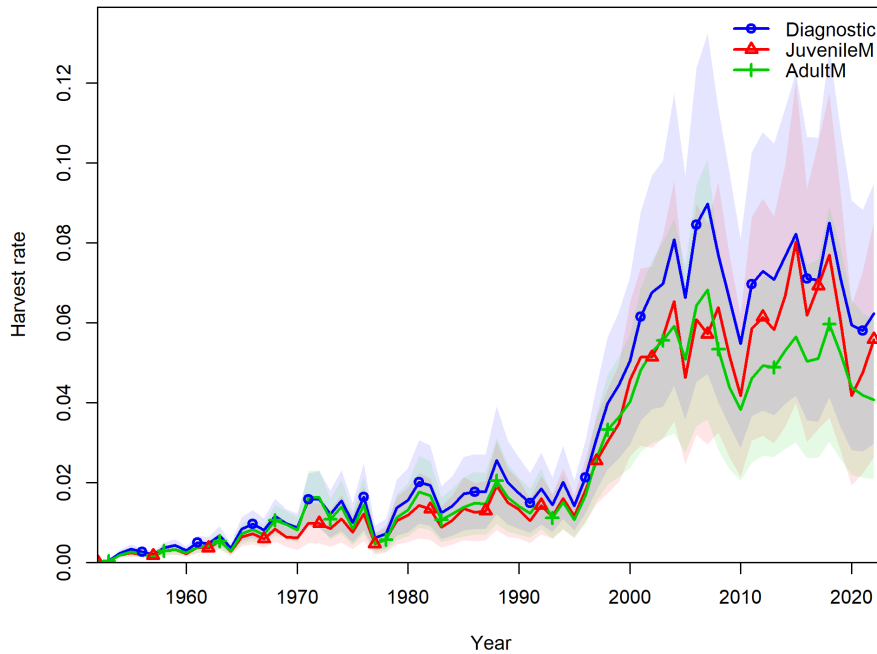
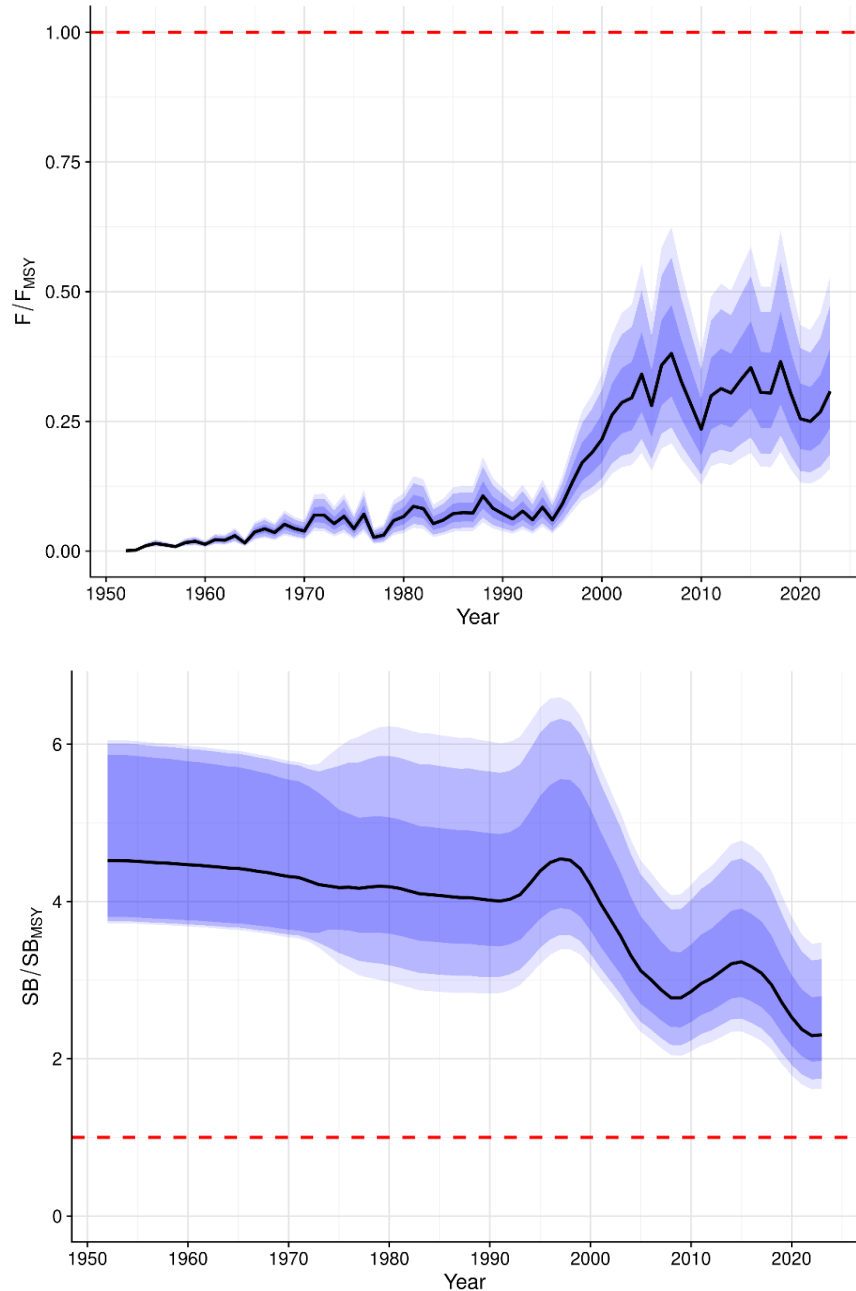


Figure 17: Time series of annual estimated mean fishing mortality for age range 3-12 years for the diagnostic model (blue); for juvenile swordfish (age 1-3, red); and for adult swordfish (age 8-15, green).

There are no agreed reference points for Southwest Pacific swordfish. Stock status is therefore assessed in relation to the default WCPFC  $SB/SB_{MSY}$  and  $F/F_{MSY}$  reference points, with information also provided for the depletion relative to the  $20\%SB_{F=0}$  LRP that is applied to key tunas. The 2025 stock assessment indicates that the stock status is positive with respect to the MSY-based reference points, and although the stock biomass trend and depletion decline, the last few years of the model indicate some stability in female spawning biomass.

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**Figure 18: Annual estimated  $F/F_{MSY}$  (top) and annual  $SB/SB_{MSY}$  (bottom) from the uncertainty grid. The black line indicates the median of all trajectories, along with 50%, 80% and 90% quantile ranges.**

Median recent fishing mortality was below  $F_{MSY}$  ( $F_{recent}/F_{MSY}$  is 0.28 with 80% quantile range from 0.18 – 0.38, and the probability of  $F_{recent}/F_{MSY} > 1$  is  $<1\%$ , Tables 15 and 16). Median recent female spawning biomass was well above  $SB_{MSY}$  ( $SB_{recent}/SB_{MSY}$  biomass reference point is 2.33 with 80% quantile range 1.88 – 3.34, and the probability of  $SB_{recent}/SB_{MSY} < 1$  is  $<1\%$ , Table 15 and 16). Median recent spawning biomass was also well above the 20%SBF=0 LRP applied to tunas ( $SB_{recent}/SB_{F=0} = 0.50$  with 80% quantile range 0.46–0.58, without estimation uncertainty, Tables 15 and Table 16). Depletion with respect to unfished female biomass ( $SB_{recent}/SB_{F=0}$ ) is 0.50 with an 80% quantile range of 0.46 – 0.58 (Tables 15 and 16), without estimation uncertainty.

Based upon these results, the stock is exceptionally unlikely to be experiencing overfishing (<1% probability) and to be overfished (<1% probability) relative to MSY-based reference points (Figures 19–22).

**Table 16: Estimates of management quantities (stock status as abundance  $SB_{recent}$  relative to  $SB_{MSY}$ , and unfished spawning biomass ( $SB_{F=0}$ ), and recent fishing mortality ( $F_{recent}/F_{MSY}$ ). P(>RP) refers to the probability that the metric (status, fishing mortality) is above the respective indicator.**

Year: 2025 (final data year = 2023)	Spawning Potential	Exceptionally unlikely (<1%) to be below $SB_{MSY}$	Stock is not overfished
	Fishing mortality	Exceptionally unlikely (<1%) to be above fishing mortality upper limit of $F_{MSY}$	Overfishing is not occurring
	Projections	Not conducted	Not conducted
	Recommendation	The stock has a generally declining female spawning biomass since the late 1990s, with some periodic oscillations, but with a steadier and a gentler decline in $\frac{SB_{recent}}{SB_{F=0}}$ , with a generally stable fishing mortality since 2004. No action required to reach target biomass.	
<b>Reference points</b>		<b>Median [10%--90%]</b>	<b>Comment</b>
Ratio of $SB_{recent}$ to $SB_{MSY}$	$\frac{SB_{recent}}{SB_{MSY}}$	2.33 [1.88–3.34]	Spawning biomass is well above $SB_{MSY}$ , the default WCPFC limit reference point (LRP) for billfish stocks
Ratio of $F_{recent}$ to $F_{MSY}$	$\frac{F_{recent}}{F_{MSY}}$	0.28 [0.18 – 0.38]	Fishing mortality well below the default $F_{MSY}$ WCPFC LRP for fishing mortality.
<b>Recent estimates</b>			<b>Recent trend / projection</b>
Fishing mortality	$F_{recent}$	0.06 [0.04 – 0.07]	$F_{recent}$ shows a stable trend, with short-term variation over the last 15 years, and a slight increase over the last 3 years of the assessment, which is most likely variability rather than indicative of any recent trend.
SB relative to SB to produce MSY	$\frac{SB_{recent}}{SB_{MSY}}$	2.33 [1.88–3.34]	The spawning biomass relative to biomass at MSY has a trend of becoming more depleted, especially since the 1990s, but with some signs or stability in the very recent years.
SB depletion relative to SB without fishing (w/o estimation uncertainty)	$\frac{SB_{recent}}{SB_{F=0}}$	0.50 [0.46 – 0.58]	The spawning biomass relative to unfished spawning biomass has a trend of becoming more depleted, especially since the 1990s, but with some signs of stability in the very recent years.
<b>Status</b>			<b>Likelihood</b>
SB depletion	$\frac{SB_{recent}}{SB_{MSY}}$	0.50 [0.46 – 0.58]	<1% probability < $SB_{MSY}$ (Exceptionally unlikely)
Fishing mortality	$\frac{F_{recent}}{F_{MSY}}$	0.28 [0.18 – 0.38]	<1% probability > $F_{MSY}$ (Exceptionally unlikely)

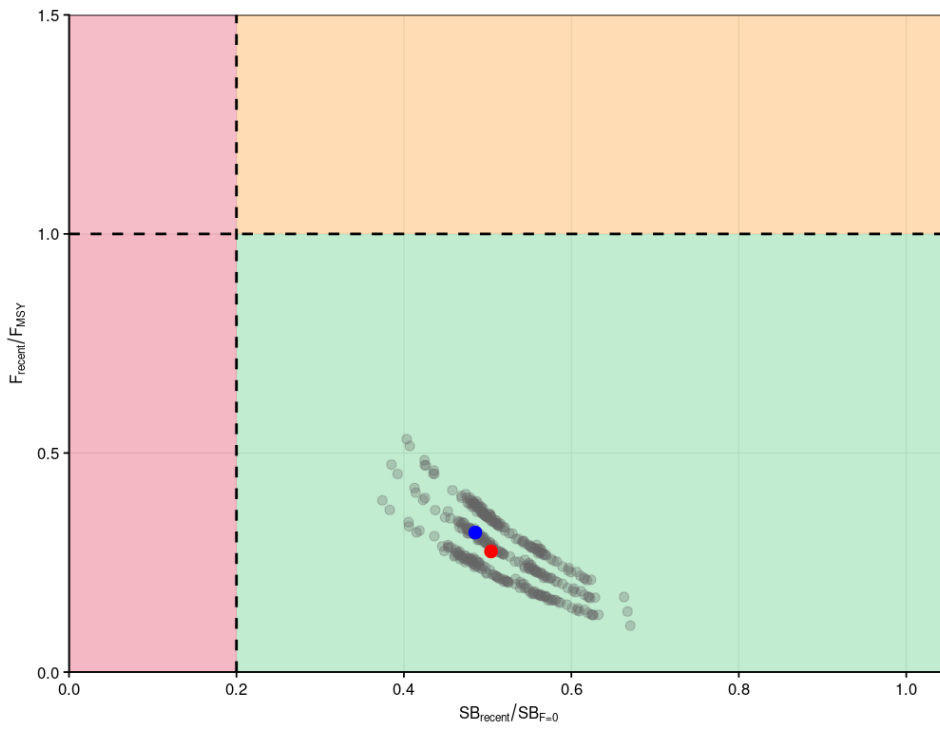


Figure 19: Majuro plot summarising the results for the uncertainty grid (without estimation error) for the relevant recent periods, 2020–2023 for  $SB_{\text{recent}}/SB_{F=0}$  and 2019–2022 for  $F_{\text{recent}}/F_{\text{MSY}}$ , respectively. The red dot indicates the median, and the blue dot the diagnostic model.

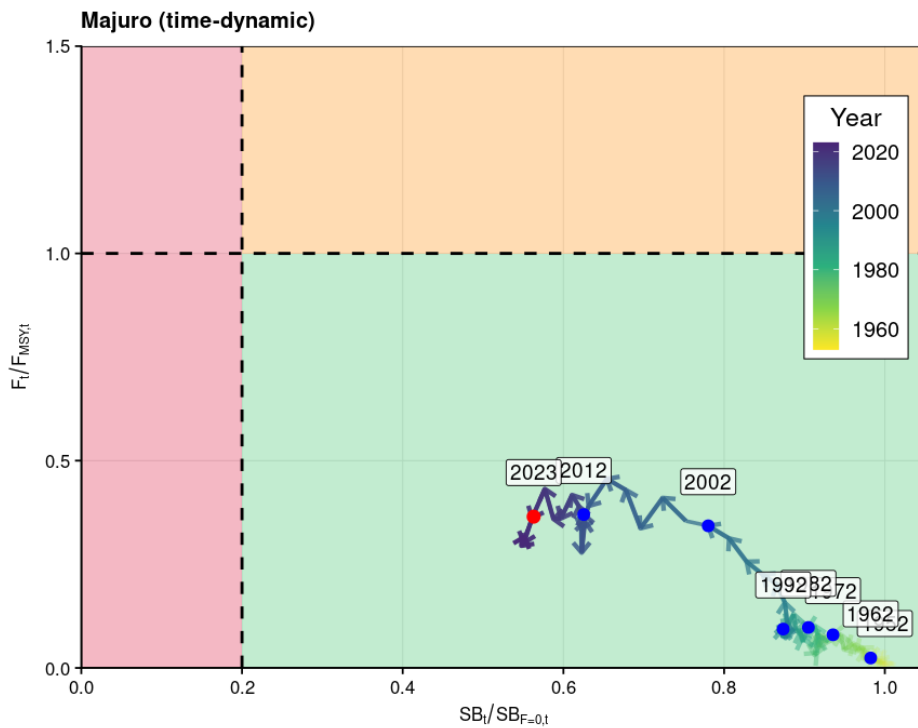
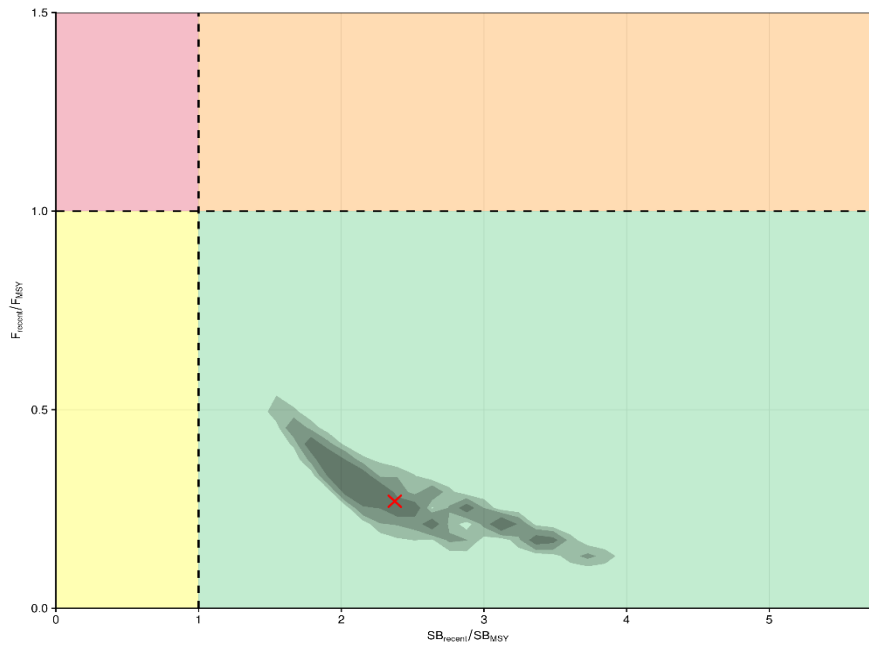
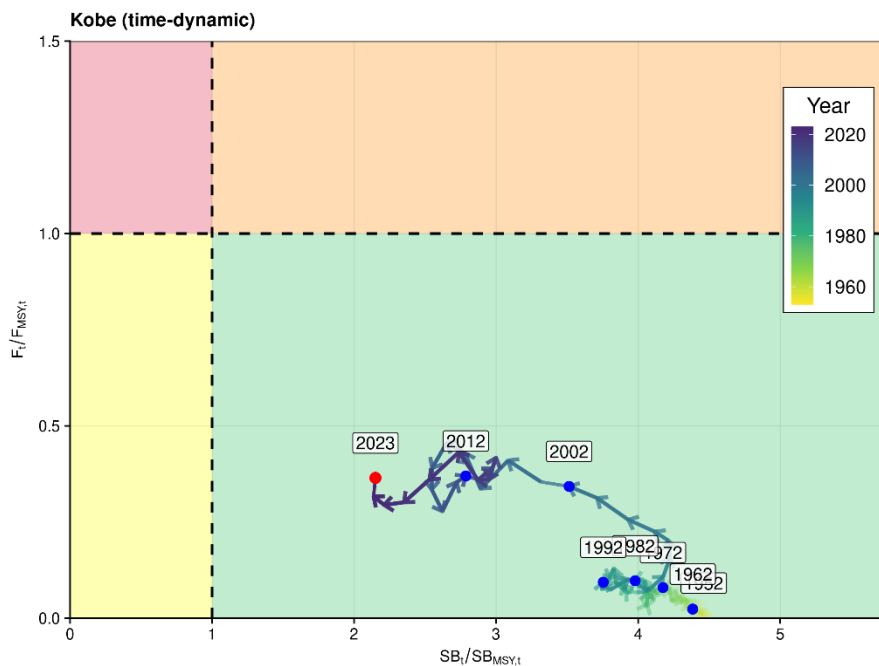


Figure 20: Time dynamic Majuro plot from the diagnostic model for swordfish for the period 1952 to 2023 (red dot).



**Figure 21:** Kobe plot for the relevant recent periods, 2020–2023 for  $SB_{recent}/SB_{MSY}$  and 2019–2022 for  $F_{recent}/F_{MSY}$ , respectively, using contour plots to summarise the full uncertainty grid, including structural and estimation uncertainty, with 50%, 80% and 90% quantile ranges. The red cross shows the median.



**Figure 22:** Time dynamic Kobe plot from the diagnostic model for swordfish for the period 1952–2023 (red dot).

## 5.2 Management advice and implications

SC21 advised that it is exceptionally unlikely that Southwest Pacific swordfish is overfished or subject to overfishing. SC21 noted that the estimated spawning biomass relative to unfished levels has continued to decline over the last decade, despite a brief recovery in 2015. This declining trend highlights the ongoing need for management. To this end, SC21 noted the Commission’s intention to develop a management strategy evaluation framework for Southwest Pacific swordfish and to design and evaluate a candidate management procedure. SC21 agreed to use this year’s stock assessment model as a starting point for developing an operating model reference set to evaluate the candidate management procedures, noting that better addressing the issue of model mis-specification is necessary to improve the reliability of the operating model reference set.

### 5.3 Projections

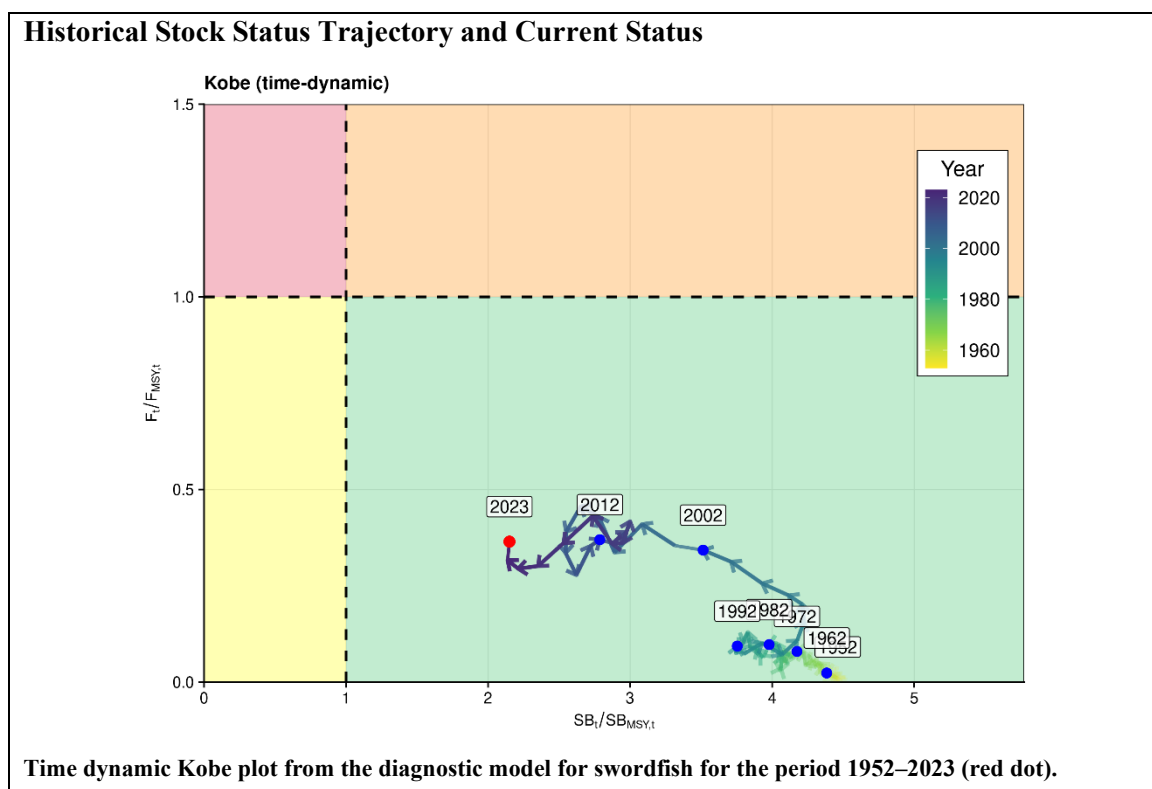
SC21 noted that due to challenges and associated time constraints in fitting the stock assessment model, no projections were provided to the SC and recommended that projections be included in future assessment reports.

## 6. STATUS OF THE STOCKS

### Stock structure assumptions

Swordfish taken in New Zealand are part of larger southwest and south-central Pacific stocks; the evaluation below refers to the assessment of the southwest portion of that stock.

Stock Status	
Most Recent Assessment Plenary Publication Year	2025
Intrinsic productivity level	Medium
Catch in most recent year of assessment	Year: 2023      Catch: 250 t
Assessment Runs Presented	Diagnostic case and structural uncertainty grid
Reference Points	Target: $SB > SB_{MSY}$ Soft Limit: Not established by WCPFC but evaluated using HSS default of 20% $SB_0$ Hard Limit: Not established by WCPFC but evaluated using HSS default of 10% $SB_0$ Overfishing threshold: $F_{MSY}$
Status in relation to Target	Virtually Certain (> 99%) that $SB$ is at or above $SB_{MSY}$
Status in relation to Limits	Soft Limit: Very Unlikely (< 10%) to be below Hard Limit: Exceptionally Unlikely (< 1%) to be below
Status in relation to Overfishing	Overfishing is Exceptionally Unlikely (< 1%) to be occurring



<b>Fishery and Stock Trends</b>	
Recent Trend in Biomass or Proxy	The spawning biomass showed some recovery, from 2008–2015, followed by decline. The spawning biomass relative to $SB_{MSY}$ shows a similar pattern.
Recent Trend in Fishing Intensity or Proxy	Fishing mortality has been consistently low, stabilising around 0.06, with some annual variation.
Other Abundance Indices	-
Trends in Other Relevant Indicator or Variables	Recruitment has fluctuated without trend from the 1980s to the present.

<b>Projections and Prognosis</b>	
Stock Projections or Prognosis	No projections were undertaken for the 2025 stock assessments.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	-
Probability of Current Catch or TACC causing Overfishing to continue or commence	-

<b>Assessment Methodology and Evaluation</b>		
Assessment Type	Level 1 – Full Quantitative Stock Assessment	
Assessment Method	Integrated age- and size-structured model in Stock Synthesis	
Assessment Dates	Latest assessment Plenary publication year: 2025	Next assessment: unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Commercial catch and effort data, CPUE, size composition data (weight and length), conditional catch-at-age	1 – High Quality (all)
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	<p>Major changes from the 2021 assessment include:</p> <ul style="list-style-type: none"> <li>- Change of stock assessment platform from MULTIFAN-CL to Stock Synthesis</li> <li>- Conversion from a 1-sex model to a 2-sex model</li> <li>- Major revision of the size data inputs (both length and weight), stronger filtering methods and additional down weighting of unreliable size data</li> <li>- Separation of all fisheries into distinct fisheries in each model subregion</li> <li>- Changing from age-based selectivity to length-based selectivity</li> <li>- Constraining selectivity options to logistic or double normal, rather than complex spline-based selectivities</li> <li>- Inclusion of sex-specific conditional age-at-length data within the assessment and using these data to contribute to internal growth estimation</li> <li>- Estimating the scale of the Lorenzen mortality form, using more recent published approaches of Hamel &amp; Cope (2022); Hoyle (2022)</li> <li>- Switching to an updated length-weight relationship based on a new dataset and with more careful filtering of the old data (Macdonald et al. 2025)</li> </ul>	

	<ul style="list-style-type: none"> <li>- The use of a quarterly model time step, rather than an annual time step, to allow greater resolution in modelling the growth curve</li> <li>- The adoption of variable bin widths for the weight composition data, using a feature in Stock Synthesis that is not available in MFCL</li> </ul>
Major Sources of Uncertainty	<ul style="list-style-type: none"> <li>- growth uncertainty (not incorporated in the uncertainty grid)</li> <li>- unknown absolute population scale</li> <li>- limited conditional age-at length data</li> <li>- uncertain weight composition data time series</li> <li>- appropriate spatial extent and structure of the assessment region uncertain</li> </ul>

**Qualifying Comments**

WCPFC SC21 noted that the model shows some lack of fit to the CPUE index, and diagnostics suggest some model misspecification.

**7. FOR FURTHER INFORMATION**

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