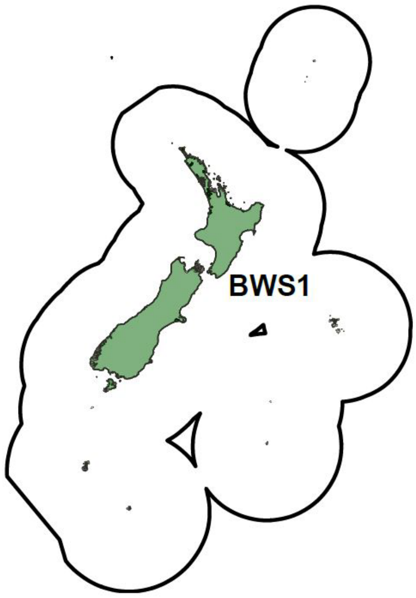
BLUE SHARK (BWS)

(*Prionace glauca*)



1. FISHERY SUMMARY

Blue shark was introduced into the Quota Management System (QMS) on 1 October 2004 under a single Quota Management Area, BWS 1, and the allowances, Total Allowable Commercial Catch (TACC), and Total Allowable Catch (TAC) are given in Table 1..

Table 1: Recreational and customary non-commercial allowances, other mortalities, TACC, and TAC (all in t) for blue shark.

Fishstock	Recreational allowance	Customary non-commercial allowance	Other mortality	TACC	TAC
BWS 1	20	10	190	1 860	2 080

Blue shark was added to the Third Schedule of the 1996 Fisheries Act with a TAC set under s14 because blue shark 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.

Blue shark was also added to the Sixth Schedule of the 1996 Fisheries Act with the provision that:

> "A commercial fisher may return any blue shark to the waters from which it was taken if –
> (a) that blue shark is likely to survive on return; and
> (b) the return takes place as soon as practicable after the blue shark is taken."

The conditions of Schedule 6 releases have been amended for mako, porbeagle, and blue sharks. On 1 October 2014 a ban on shark finning was introduced; after this time any blue sharks for which the fins are retained are required to be landed with the fins attached (artificial attachment such as tying or securing the fins to the trunk is permitted). From 1 October 2014, fishers have been allowed to return these three species to the sea both alive and dead, although the status must be reported accurately. Those returned to the sea dead are counted against a fisher's Annual Catch Entitlement and the total allowable catch limit for that species.

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

1.1 Commercial fisheries

Most of the blue shark catch in the New Zealand EEZ is caught in the tuna surface longline fishery. Relatively few blue sharks are caught by other methods. Data collected by Fisheries New Zealand Fishery Observer Services from the tuna longline fishery suggest that most of the blue shark catch has been processed (72% of the observed catch), although prior to 1 October 2014 usually only the fins were retained and the rest of the carcass was dumped (over 99% of the processed, observed catch). Greenweight (total weight) was obtained by applying species specific conversion factors to the weight of the fins landed. On 1 October 2014 a ban on shark finning was introduced; after this time any blue sharks for which the fins are retained are required to be landed with the fins attached (artificial attachment such as tying or securing the fins to the trunk is permitted). However, since the ban on shark finning in 2015, almost all blue shark catches are now discarded or actively released (Moore and Finucci 2024). The annual mean total catch (i.e., including landings and disposals) of blue shark in the three-year period from 2019–02 to 2021–22 was 588.0 t. Annual average disposals were 587.6 t, representing 99.9% of the total annual commercial catch by weight. In the last three fishing years, 84.5% of disposals of blue shark from surface longline have been attributed to disposal code X (i.e., alive and likely to survive), with the remaining 15.5% of disposals reported to disposal code Z (i.e., returned to the water dead or near-dead). Figure 1 shows historical landings and fishing effort for BWS 1 and BWS ET.

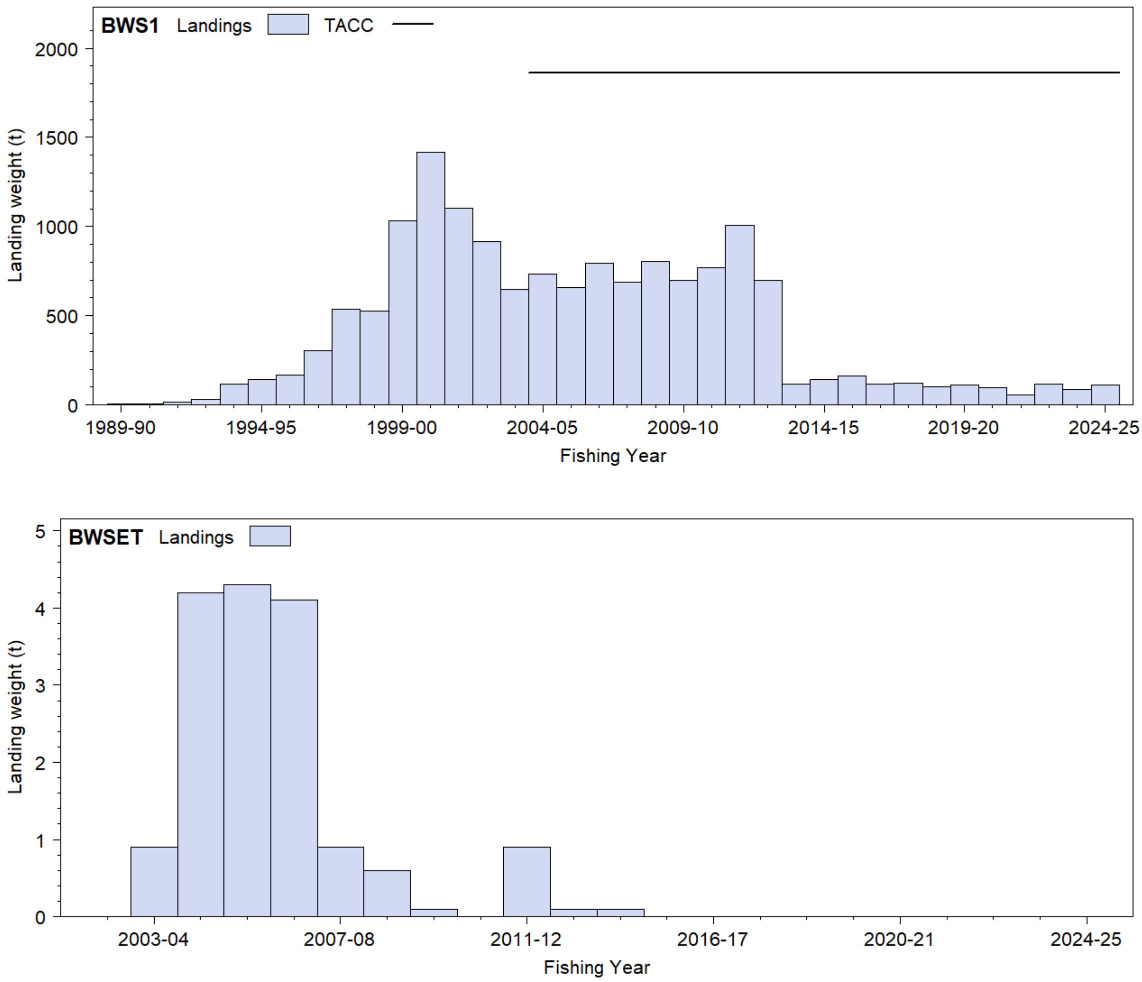


Figure 1: [Top] Blue shark catch from 1989–90 to present within New Zealand waters (BWS 1), and [bottom] 2002–03 to present on the high seas (BWS ET).

Landings of blue sharks reported by fishers on CELRs, CLRs, or TLCERs and by processors on LFRRs and MHRs are given in Table 2. Total weights reported by fishers were 551–1167 t per annum during 1997–98 to 2007–08. Processors (LFRRs) reported 525–1415 t per annum during 1997–98 to 2012–13, and 55–163 t per annum during 2013–14 to 2023–24. In addition to catches within New Zealand fisheries waters, small catches are taken by New Zealand vessels operating on the high seas (Figure 1).

Table 2: New Zealand estimated commercial landings of blue sharks (t) reported by fishers on CELRs, CLRs, or TLCERs and processors (LFRRs or MHRs) by fishing year[1].

Year	Fishers	Processors
1989–90	12	5
1990–91	2	3
1991–92	18	13
1992–93	39	33
1993–94	371	118
1994–95	254	140
1995–96	152	166
1996–97	161	303
1997–98	551	537
1998–99	576	525
1999–00	641	1 031
2000–01	1 167	1 415
2001–02	1 076	1 105
2002–03*	968	914
2003–04*	649	649
2004–05*	734	734
2005–06*	656	656
2006–07*	790	794
2007–08*	681	687
2008–09*		804
2009–10*		696
2010–11*		770
2011–12*		1 011
2012–13*		691
2013–14*		117
2014–15*		142
2015–16*		163
2016–17*		116
2017–18*		121
2018–19*		101
2019–20*		112
2020–21*		94
2021–22*		56
2022–23		117
2023–24		86
2024–25		111

[1] Note that there may be some misreporting of blue shark catches (Species code 'BWS') as bluenose (*Hyperoglyphe antarctica*; species code 'BNS') and vice versa.
*MHR rather than LFRR data.

Although there are no directed blue shark fisheries, blue sharks made up around 8% of the catch for all surface longline fisheries in 2024–25 (Figure 2). Longline fishing effort is distributed along the east coast of the North Island and the south-west coast of the South Island.

Across all fleets in the surface longline fishery most of the blue sharks were alive when brought to the side of the vessel during 2006–07 to 2017–18 (Table 3). The percentage of blue shark catches retained has varied over time, becoming relatively low in 2014–15 (Table 4).

Most blue shark catches and disposals by surface longline between the 2019–20 and 2021–22 fishing years were taken when targeting southern bluefin tuna in autumn and winter off the east coast of the North Island and the east and west coasts of the South Island (Figure 3) (Moore and Finucci 2024).

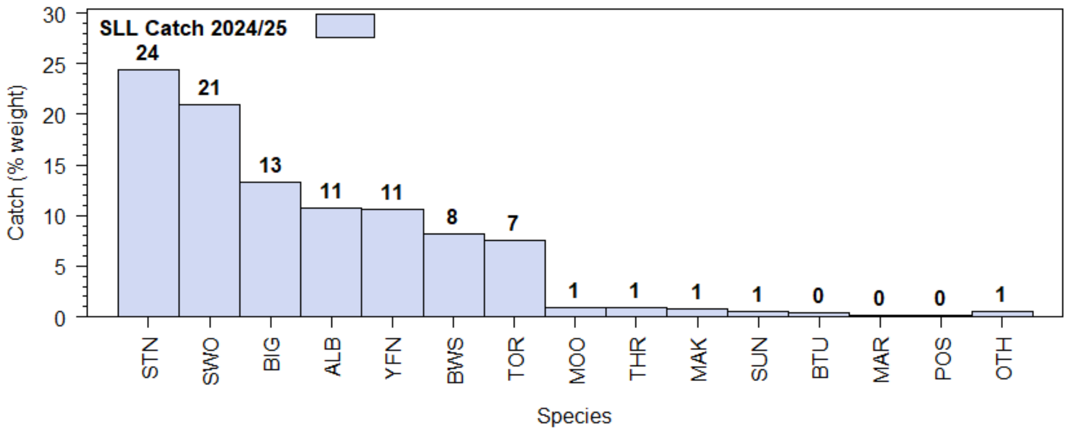


Figure 2: A summary of species composition of the surface longline estimated catch for the most recent fishing year. The percentage by weight of each species is calculated for all surface longline trips.

Table 3: Percentage of blue sharks (including discards) that were alive or dead when hauled to the longline vessel and observed during 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). Only the New Zealand domestic fleet operated after 2014–15 [continued on next page].

Year	Fleet	Area	% alive	% dead	Number
2006–07	Australia	North	95.4	4.6	131
	Charter	North	89.8	10.2	2 155
		South	93.4	6.6	5 025
	Domestic	North	87.9	12.1	3 991
	Total		**90.8**	**9.2**	**11 302**
2007–08	Charter	South	89.2	10.8	2 560
	Domestic	North	88.6	11.4	5 599
	Total		**88.8**	**11.2**	**8 159**
2008–09	Charter	North	94.5	5.5	1 317
		South	95.1	4.9	4 313
	Domestic	North	92.0	8.0	3 935
		South	94.9	5.1	98
	Total		**93.7**	**6.3**	**9 663**
2009–10	Charter	South	95.6	4.4	2 004
	Domestic	North	85.7	14.3	2 853
		South	94.0	6.0	882
2010–11	Charter	North	100.0	0.0	25
		South	95.9	4.1	2 650
	Domestic	North	92.8	7.2	3 553
	Total		**94.1**	**5.9**	**6 228**
2011–12		South	93.0	7.0	5 394
	Domestic	North	93.5	6.5	5 672
		South	93.2	6.8	1 592
	Total		**93.2**	**6.8**	**12 668**
2012–13	Charter	North	96.1	3.9	256
		South	89.3	10.7	5 087
	Domestic	North	95.5	4.5	4 831
		South	95.6	4.4	180
	Total		**92.5**	**7.5**	**10 354**
2013–14	Charter	South	89.5	10.5	7 752
	Domestic	North	91.9	8.1	3 719
		South	93.8	6.2	2 146
	Total		**90.8**	**9.2**	**13 617**
2014–15	Charter	South	93.3	6.7	5 961
	Domestic	North	85.5	14.5	3 127
		South	92.2	7.8	922
	Total		**90.8**	**9.2**	**10 010**
2015–16	Domestic	North	84.9	15.1	5 850
		South	92.8	7.2	3 762
	Total		**88.0**	**12.0**	**9 612**
2016–17	Domestic	North	86.6	13.4	5 239
		South	93.9	6.1	3 722
	Total		**89.6**	**10.4**	**8 961**
2017–18	Domestic	North	88.5	11.5	5 406
		South	94.8	5.2	3 953
	Total		**91.2**	**8.8**	**9 359**
2018–19	Domestic	North	83.8	16.2	2 553
		South	87.7	12.3	4 901
	Total		**86.4**	**13.6**	**7 454**

Table 3 [Continued]:

Year	Fleet	Area	% alive	% dead	Number
2019–20	Domestic	North	88.3	11.7	1 937
		South	86.6	13.4	1 602
	Total		**87.5**	**12.5**	**3 539**
2020–21	Domestic	North	89.7	10.3	1 544
		South	91.3	8.7	2 517
	Total		**90.7**	**9.3**	**4 061**

Table 4: Percentage of blue sharks that were retained, or discarded or lost, when observed on a longline vessel during 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). Only the New Zealand domestic fleet operated after 2014–15.

Year	Fleet	% retained or finned	% discarded or lost	Number
2006–07	Australia	3.0	97.0	132
	Charter	85.1	14.9	8 272
	Domestic	33.2	66.8	3 994
	Total	67.5	32.5	12 398
2007–08	Charter	91.8	8.2	2 638
	Domestic	59.5	40.5	5 650
	Total	69.8	30.2	8 288
2008–09	Charter	87.5	12.5	5 723
	Domestic	54.0	46.0	4 049
	Total	73.6	26.4	9 772
2009–10	Charter	91.7	8.3	2 023
	Domestic	37.6	62.4	5 531
	Total	52.1	47.9	7 554
2010–11	Charter	89.0	11.0	2 675
	Domestic	43.0	57.0	3 736
	Total	62.2	37.8	6 411
2011–12	Charter	86.1	13.9	5 404
	Domestic	53.1	46.9	7 947
	Total	66.4	33.6	13 351
2012–13	Charter	76.8	23.2	5 344
	Domestic	12.7	87.3	5 233
	Total	45.1	54.9	10 577
2013–14	Charter	25.9	74.1	7 755
	Domestic	1.2	98.8	6 535
	Total	14.6	85.4	14 290
2014–15	Charter	0.4	99.6	6 218
	Domestic	0.1	99.9	4 163
	Total	0.3	99.7	10 381
2015–16	Domestic	0.1	99.9	9 994
	Total	0.1	99.9	9 994
2016–17	Domestic	0.2	99.8	8 977
	Total	0.2	99.8	8 977
2017–18	Domestic	0.0	100.0	9 395
	Total	0.0	100.0	9 395
2018–19	Domestic	0.1	99.9	7 476
	Total	0.1	99.9	7 476
2019–20	Domestic	0.1	99.9	3 631
	Total	0.1	99.9	3 631
2020–21	Domestic	0.0	100.0	4 087
	Total	0.0	100.0	4 087

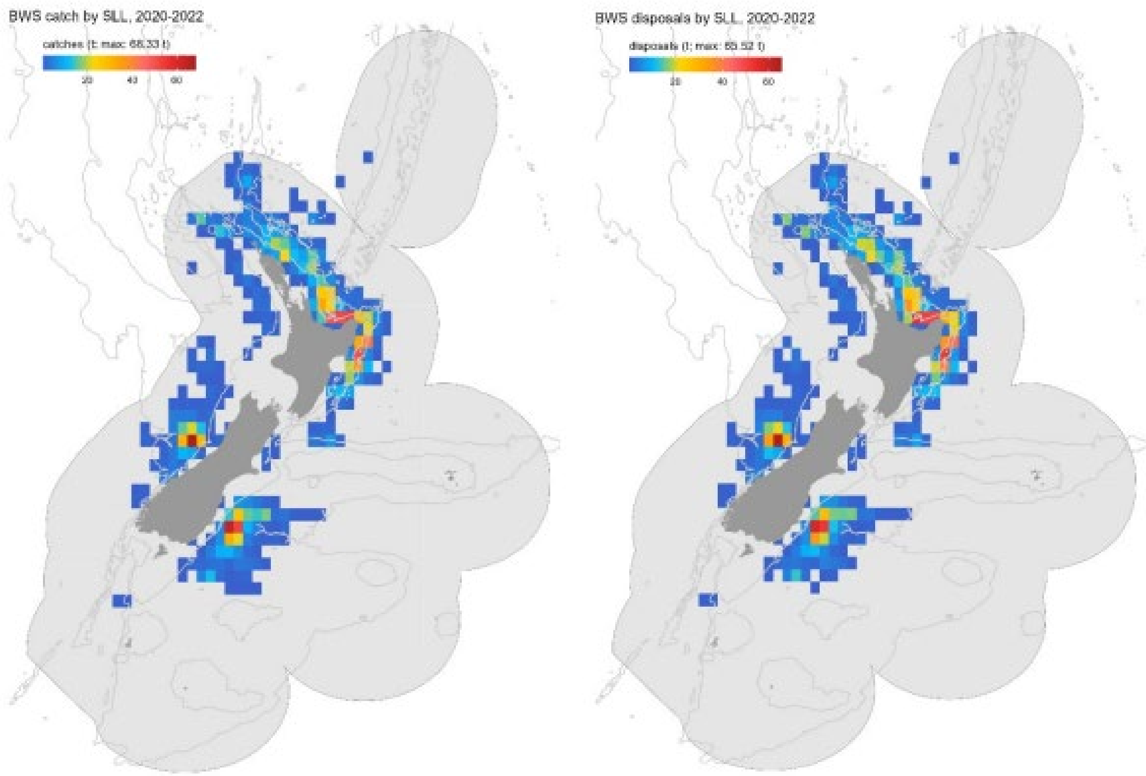


Figure 3: Total catches (including disposals; left) and disposals (right) of blue shark (BWS) by surface longline (SLL) in New Zealand's Exclusive Economic Zone, aggregated at the 0.5° resolution for 2019–20 to 2021–22 (Moore and Finucci 2024).

1.2 Recreational fisheries

Blue sharks are caught in relatively large numbers by recreational fishers in the New Zealand EEZ. Although not as highly regarded as other large pelagic sharks such as mako in northern New Zealand, blue sharks were the primary target gamefish in southern New Zealand in past years. Several hundred blue sharks were tagged and released each year by recreational fishers off Otago Heads in the late 1990s as part of the New Zealand Gamefish Tagging Programme. However, the number of blue sharks released inside New Zealand fisheries waters has significantly decreased with just two blue sharks tagged and released from 2023–24 and no blue sharks recaptured in 2022–23 and 2023–24 (Holdsworth & Curtis 2025).

The total recreational catch is unknown, but most are released. There were ten blue sharks weighed by New Zealand Sport Fishing Council clubs in 2017–18, five in 2021–22, but none in the intervening years.

1.2.2 Estimates of recreational harvest

No estimates of recreational harvest of blue sharks 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. The panel survey used face-to-face interviews of a random sample of 30 390 New Zealand households to recruit a panel of fishers and non-fishers for a full year (Wynne-Jones et al. 2014). The panel members were contacted regularly about their fishing activities and harvest information was collected in standardised phone interviews. The national panel survey 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). Note that national panel survey estimates do not include recreational harvest taken on charter vessel trips or under s111 general approvals. The national panel survey results do not include estimates for blue sharks because the surveys did not reflect the numbers of fishers and fishing activity for the large gamefish species.

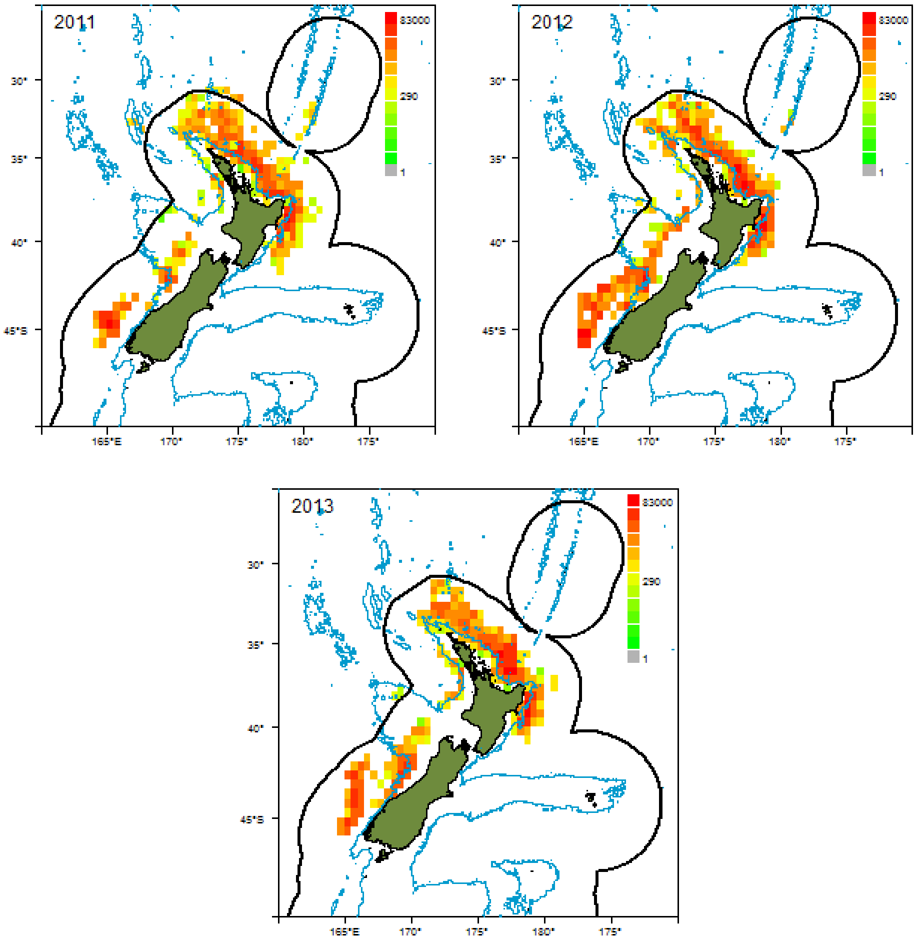


Figure 4: Blue shark catches (kg) by the surface longline fishery in 0.5 degree cells by fishing year. Note the log scale used for the colour palette. Depth contour = 1000 m. Source: TLCER data (Francis et al. 2014).

1.3 Customary non-commercial fisheries

Prior to European settlement, Māori caught large numbers of cartilaginous fishes, including blue sharks. However, there are no estimates of current Māori customary catch.

1.4 Unreported catch

There is no known unreported catch of blue sharks.

1.5 Other sources of mortality

About 91% of all observed blue sharks caught in the tuna longline fishery are retrieved alive. Nearly 100% of all observed blue sharks are discarded. The proportion of sharks discarded dead is unknown. Mortality rates of blue sharks tagged and released by the New Zealand Gamefish Tagging Programme are also unknown.

2. BIOLOGY

Blue sharks (*Prionace glauca*) are large, highly migratory, pelagic carcharhinids found throughout the world's oceans in all tropical and temperate waters from about 50° N to 50° S. They are slender in build, rarely exceeding 3 m in total length and 200 kg in weight. They feed opportunistically on a range of living and dead prey, including bony fishes, smaller sharks, squid, and carrion (Horn et al. 2013).

In New Zealand waters, male blue sharks are sexually mature at about 190–195 cm fork length (FL) and females at about 170–190 cm FL. Gestation in female blue sharks lasts between 9–12 months and between 4 and 135 pups (averaging 26–56) are born alive per hatching event, probably during the spring. Pups are probably born at about 50 cm FL. The few embryos from New Zealand fisheries waters examined to date consisted of mid-term pups 21–37 cm FL collected in July and a full-term pup 54 cm FL collected in February. Blue sharks 50–70 cm FL are caught year-round in New Zealand fisheries waters but only in small numbers, and mostly in FMAs 1 and 10.

Age and growth estimates are available for blue sharks in New Zealand waters (Manning & Francis 2005). These estimates were derived from counts of opaque growth zones in X-radiographs of sectioned vertebrae with the assumption that one opaque zone is formed per year. This assumption is untested. Female blue sharks appear to approach a lower mean asymptotic maximum length and grow at a faster rate than males. This is thought to result from the presence of relatively few large (over 250 cm FL), old female blue sharks in the length-at-age dataset.

The observer data suggest that large (over 250 cm FL) female blue sharks are missing from the catch, despite reliable personal observations to the contrary from commercial and recreational fishers. There is evidence of size and sex segregation in the distributions of blue sharks in the North Pacific, with large pregnant females tending to be found nearer the equator than males or smaller females. It is possible that large female blue sharks occur in New Zealand but have not been adequately sampled by observers.

Growth rates estimated for New Zealand blue sharks are broadly comparable with those from overseas studies (Manning & Francis 2005). Males and females appear to grow at similar rates until about seven years of age, when their growth appears to diverge. Age-at-maturity is estimated at 8 years for males and 7–9 years for females. The maximum recorded ages of male and female blue sharks in New Zealand waters are 22 and 19 years, respectively. However, there is considerable uncertainty about the accuracy of blue shark age estimates, because a recent study recorded different vertebral readings between readers and was unable to generate agreed ages (Francis & Ó Maolagáin 2016). Ageing validation is therefore required. Blue sharks appear to be fully recruited to the commercial longline fishery by the end of their second year. The commercial catch sampled by observers consists of both immature and mature fish.

Estimates of biological parameters for blue sharks in New Zealand waters are given in Table 5.

Table 5: Estimates of biological parameters.

Fishstock		**Estimate**				**Source**
Natural mortality (M)		0.19–0.21				Manning & Francis (2005)
BWS 1						
Weight = a (length)^b (Weight in kg, length in cm fork length)						
	a	b				
BWS 1 males	1.578×10^{-6}	3.282				Ayers et al. (2004)
BWS 1 females	6.368×10^{-7}	3.485				
von Bertalanffy model parameter estimates						
	k	t_0	L_∞			
BWS 1 males	0.0668	-1.7185	390.92			Manning & Francis (2005)
BWS 1 females	0.1106	-1.2427	282.76			
Schnute model (case 1) parameter estimates (are provided for comparison with the von Bertalanffy estimates above)						
	L_1	L_2	κ	γ	L_∞	Manning & Francis (2005)
BWS 1 males	65.21	217.48	0.1650	0.1632	297.18	
BWS 1 females	63.50	200.60	0.2297	0.0775	235.05	

3. STOCKS AND AREAS

The New Zealand Gamefish Tagging Programme tagged and released 5116 blue sharks between May 1979 and June 2022 in the New Zealand EEZ (Holdsworth and Curtis, 2025). Most tagged sharks were captured and released off the east coast of the South Island. A total of 89 tagged blue sharks have been recaptured since the start of the tagging programme. The recapture data show dispersal of tagged sharks away from their release point, although the relationship between time at liberty and dispersal is unclear. Whereas some tagged sharks have been recaptured with little apparent net movement away from their release point, others have been recaptured off Australia, New Caledonia, Vanuatu, Fiji, Tonga, Cook Islands, and French Polynesia (Figure 5). The longest displacement distance for any fish recaptured in the New Zealand Gamefish Tagging Programme (4600 nautical miles) was from a blue shark recaptured off Chile. A Chilean-tagged blue shark was recaptured by a New Zealand fisher in 2017, indicating two-way movements across the South Pacific.

Although the data are relatively sparse, an overview of tagging data from Australia, New Zealand, the Central Pacific, and California suggests that population exchange exists between not only the eastern and western South Pacific, but also between the South Pacific, South Indian, and even South Atlantic oceans. This suggests that blue sharks in the South Pacific constitute a single biological stock, although whether this is part of a single larger Southern Hemisphere stock is unclear. Bailleul et al. (2018) found nearly complete genetic homogeneity from specimens from the Pacific and Atlantic oceans (including some from New Zealand) and multiple markers (mtDNA and nine microsatellites), indicating widespread mixing of blue sharks and the need to use higher resolution genetic markers (e.g., whole genomes) to identify any meaningful stock boundaries. Contrastingly, Nikolic et al. (2023) completed genomic sequencing of blue shark tissue samples collected globally and found that two significantly differentiated populations of blue shark, a Northern Population (with samples from the Mediterranean Sea and North Atlantic) and a Southern Population (with samples from the Indo-west Pacific). They also found further genetic differentiation within the Northern Population both within the Atlantic Ocean and between the Atlantic Ocean and the Mediterranean Sea.

No other data are available on blue shark stock structure in the South Pacific.

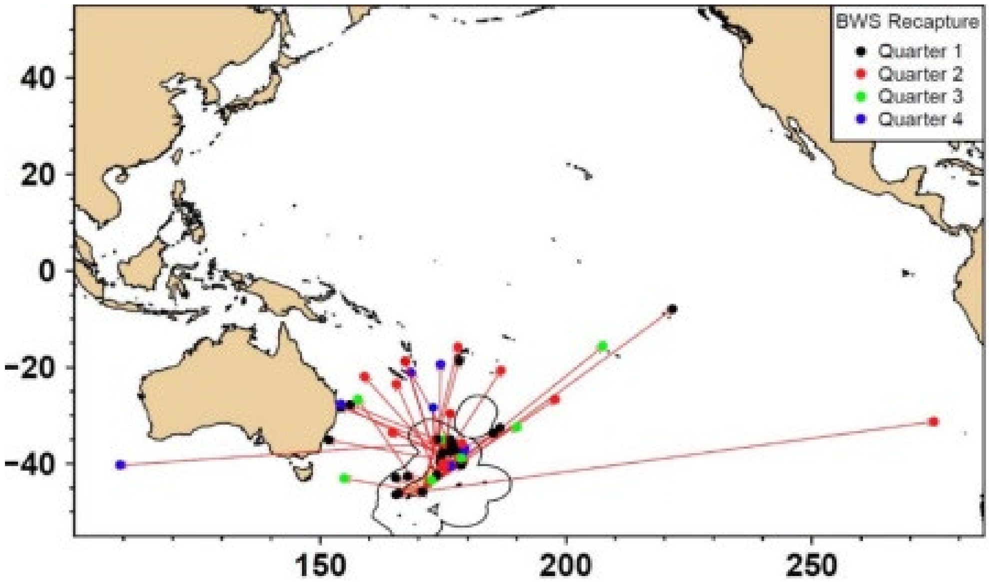


Figure 5: All release and recapture locations of blue sharks in the gamefish tagging programme, 1982–2024.

4. ENVIRONMENTAL AND ECOSYSTEM CONSIDERATIONS

Most of the blue shark catch in the New Zealand EEZ is caught in the tuna and swordfish surface longline fishery, please refer to those species for environmental and ecosystem considerations.

5. STOCK ASSESSMENT

Since the establishment of the WCPFC in 2004, stock assessments of the western and central Pacific Ocean stock of blue sharks have been reviewed by the WCPFC.

Southwest Pacific Ocean

In 2021 document SC17-SA-WP-03 (Neubauer et al. 2021) described the stock assessment of Southwest Pacific blue shark. Blue sharks are caught in large numbers in a range of fisheries in the Southwest Pacific (Figure 6).

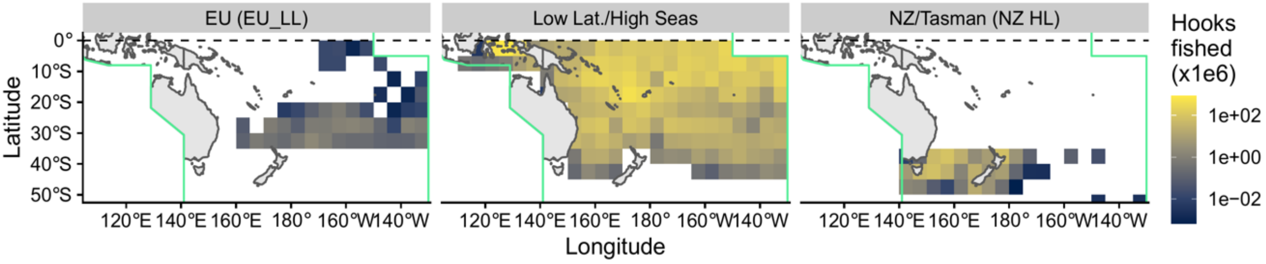


Figure 6: Spatial structure used in the 2022 stock assessment model.

An initial attempt at assessing this stock in 2016 was not successful. In 2021 a range of CPUE indices, length frequencies, and predicted catch scenarios were used to infer stock status and trends of blue shark in this region.

To adequately reflect uncertainties, an extensive sensitivity grid with nine grid axes covering catch, discard, CPUE, and biological assumptions totalling over 3500 models was run. Across the sensitivity grid, a large majority of stock trajectories showed a decline from relatively high stock levels in 1995, reflecting increasing effort during that time, followed by a steady increase in biomass as effort plateaued and discard rates increased, especially in lower latitude fisheries. The mean outcome suggested a current stock status near SB_0, with a range of outcomes between 0.58 to 1.49 SB_0.

SC17 agreed that the assessment was an improvement on the 2016 assessment; in particular, the catch reconstruction, CPUE time series, and re-parametrisation of biological parameters using combined information from South and North Pacific assessments. However, the model grid was not adopted by SC17 due to the views of some CCMs that a more thorough investigation of diagnostics across the grid of models was required. These CCMs recommended that residual pattern and retrospective analysis, among other approaches, would be informative, and a deeper investigation into the grid model selection and uncertainty was advised.

In 2022 SC18-SA-WP-03 (Neubauer et al. 2022) provided a response to SC17 recommendations to assess performance of each model and evaluate the plausibility of the uncertainty grid before approving the results for providing management advice using several diagnostic tests. These tests include model convergence (the final gradient), stability (Hessian matrix and jitter procedure), goodness-of-fit (residuals patterns of the CPUE and length frequency distributions), model consistency (retrospective pattern), and prediction skill (hindcasting analysis). The weighting of axes of the grid was also investigated. After applying these tests, the number of models consisting of the uncertainty grid decreased from 3888 to 228. SC18 noted the improvement of the structural uncertainty grid and the reduced grid complexity compared with the 2021 version.

Most (87%) of the 228 (weighted) model runs show that the biomass is above SB/SB_{MSY}. The stock biomass was low throughout the region through the early 2000s following the expansion of longline fishing effort in the region. But the estimates across the uncertainty grid of 228 models largely indicated that the stock has been recovering since then. These results were qualitatively similar to the 2021 assessment grid outcomes.

A description of the structural uncertainty grid with associated weighting that was used to define stock status and characterise uncertainty in the Southwest Pacific blue shark (SBSH) assessment is included in Table 6.

SC18 noted that the fishing mortality has declined over the last decade (Figure 7 and Figure 8) and is currently relatively low with the median $F_{2017\text{-}2020}/F_{MSY} = 0.65$ (90th percentiles 0.43 and 0.86; Table 7). SC18 noted that there was a 1% likelihood (according to the 228 weighted models) that the recent fishing mortality ($F_{2017\text{-}2020}$) was above F_{MSY}.

Table 6: Description of the seven axes for the updated 2022 structural uncertainty grid. Base settings used under the diagnostic case are highlighted in bold. Weights used for alternative values in the weighting of the grid axes are given in parentheses.

Axis	Description
Catch scenario	**Base (0.9)**, high (0.1)
Discard scenario	Low (0.25), **base (0.5)**, high (0.25)
Initial F	**base (0.9)**, high (0.1)
High latitude CPUE	**New Zealand (1),** low weight (0.5), remove (RM) early New Zealand (0.5)
Low latitude CPUE	**Japan (1)**, Australia (0.5), remove EU CPUE
Survival fraction	**Base**, low, high
Growth	**Manning & Francis (2005)**, Joung et al. (2018)

Table 7: Summary of reference points and stock status for the subset of 228 grid model in the structural uncertainty grid, after sub-setting the grid for model runs that showed acceptable retrospective patterns and estimates for natural mortality. Grid axes are weighted by prior input weights. The symbols used in the yield and stock status are described in table 3 of SC18-SA-WP03.

	Mean	Median	Min	10%	90%	Max
C_{latest}	5 965	5 671	3 707	3 978	7 593	9 601
C_{recent}	6 912	6 744	4 322	4 596	8 926	9 577
MSY	11 413	9 993	8 968	9 313	16 333	25 629
SB_0	22 772	20 603	15 686	18 524	32 263	53 503
$SB_{F=0}$	25 894	22 658	17 559	20 161	38 033	66 434
SB_{MSY}	11 104	9 985	7 564	9 008	15 854	26 684
SB_{latest}	18 420	17 904	12 973	15 902	20 424	38 004
SB_{recent}	16 344	15 907	11 320	14 000	17 670	33 654
SB_{latest}/SB_0	0.85	0.90	0.42	0.49	1.01	1.19
SB_{recent}/SB_0	0.76	0.80	0.37	0.43	0.90	1.05
$SB_{latest}/SB_{F=0}$	0.76	0.79	0.32	0.43	0.93	1.29
$SB_{recent}/SB_{F=0}$	0.67	0.71	0.29	0.37	0.82	1.15
SB_{latest}/SB_{MSY}	1.75	1.84	0.85	1.00	2.10	2.47
SB_{recent}/SB_{MSY}	1.55	1.64	0.76	0.88	1.87	2.19
F_{MSY}	0.144	0.142	0.134	0.136	0.158	0.181
$F_{lim,AS}$	0.228	0.225	0.211	0.214	0.248	0.291
$F_{crash,AS}$	0.325	0.320	0.299	0.304	0.351	0.419
F_{latest}	0.073	0.072	0.039	0.051	0.093	0.120
F_{recent}	0.094	0.094	0.048	0.065	0.117	0.160
F_{latest}/F_{MSY}	0.51	0.52	0.24	0.35	0.67	0.78
F_{recent}/F_{MSY}	0.65	0.65	0.30	0.43	0.86	1.06
$F_{latest}/F_{lim,AS}$	0.32	0.33	0.15	0.22	0.43	0.50
$F_{recent}/F_{lim,AS}$	0.41	0.41	0.19	0.27	0.55	0.68
$F_{latest}/F_{crash,AS}$	0.23	0.23	0.11	0.15	0.30	0.35
$F_{recent}/F_{crash,AS}$	0.29	0.29	0.13	0.19	0.39	0.48

Estimated annual recruitment (age-0 recruits) for the diagnostic case model is shown in Figure 9, and the estimated annual spawning potential for diagnostic case model is shown in Figure 10.

SC18 noted the stock biomass was low throughout the region through the early 2000s following the expansion of longline fishing effort in the region, but the estimates across the uncertainty grid of 228 models largely indicated that the stock has been recovering since then (Figure 11).

SC18 noted that the median value of relative recent dynamic spawning biomass depletion for Southwest Pacific blue shark ($SB_{2017\text{-}2020}/SB_{F=0}$) was 0.71 (90th percentiles 0.37 and 0.82). Alternatively, relative recent equilibrium spawning biomass depletion for South Pacific blue shark ($SB_{2017\text{-}2020}/SB_0$) was = 0.80 (90th percentiles 0.43 and 0.90). The Majuro plot summarising the results for each of the models in the structural uncertainty grid is shown in Figure 12.

SC18 noted that the median value of $SB_{2017\text{-}2020}/SB_{MSY}$ was 1.64 (90th percentiles 0.88 and 1.87; Table 7) with 87% likelihood (according to the 228 weighted models) that the biomass is above SB_{MSY}. The Kobe plot summarising the results for each of the models in the structural uncertainty grid is shown in Figure 13.

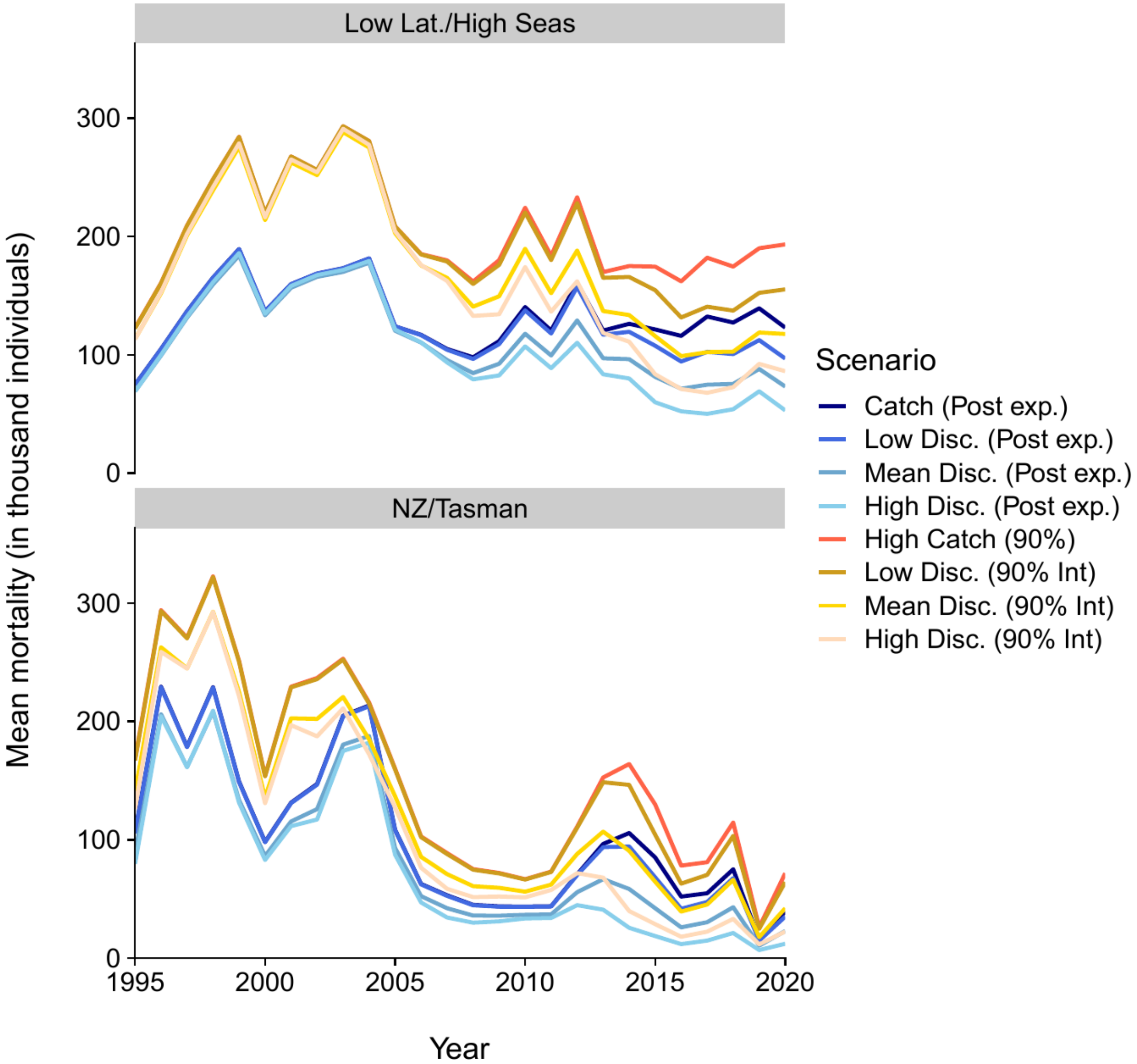


Figure 7: Predicted total fishing related mortality by latitudinal stratum (high [≥ 35 degree South] and low latitude [< 35 degree South]), including 17% post release mortality for live-discarded blue sharks. Interactions refer to the posterior median (50%) and 90th percentile (90%) of the predicted catch from the observer catch rate model. Low, median, and high discard scenarios refer to the 25%, 50% (median), and 75% discard estimates. All discard estimates were applied at flag and latitudinal stratum level to overall interactions.

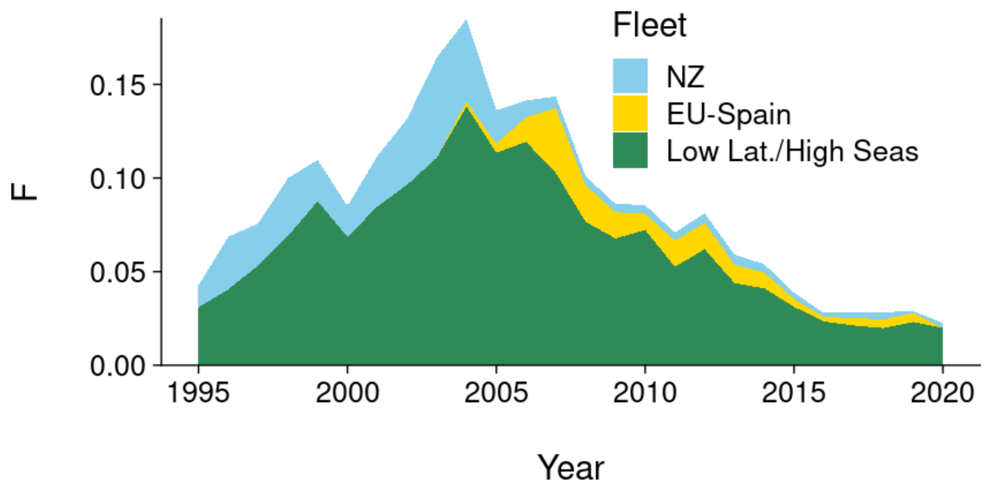


Figure 8: Estimated annual fishing mortality for the diagnostic case model.

Figure 9: Estimated annual recruitment for the diagnostic case model.

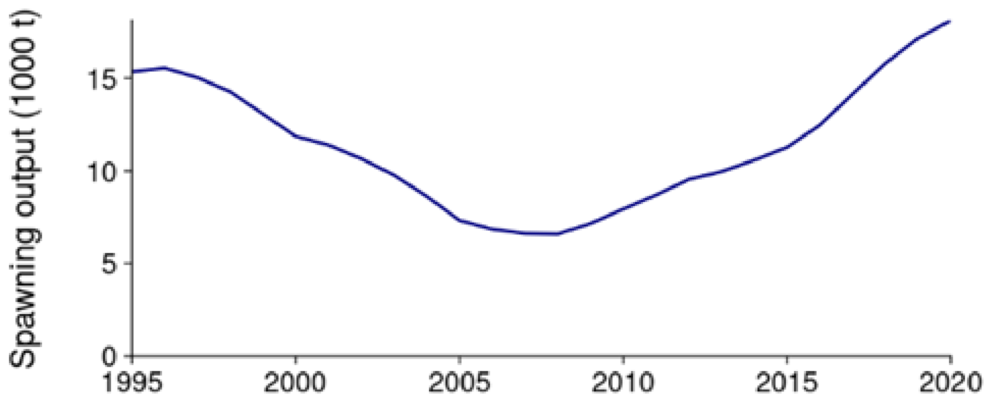


Figure 10: Estimated annual spawning potential for diagnostic case model.

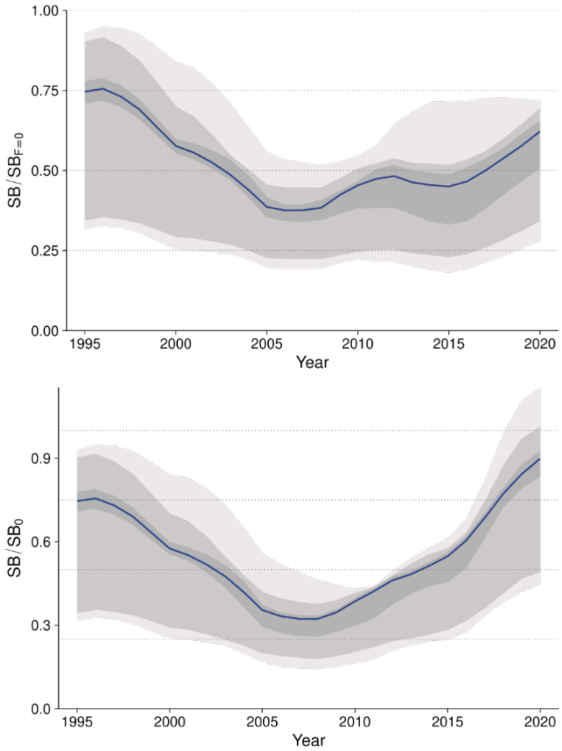


Figure 11: Plot showing the quantiles of trajectories of fishing depletion (of spawning potential) for the 228 model runs included in the structural uncertainty grid.

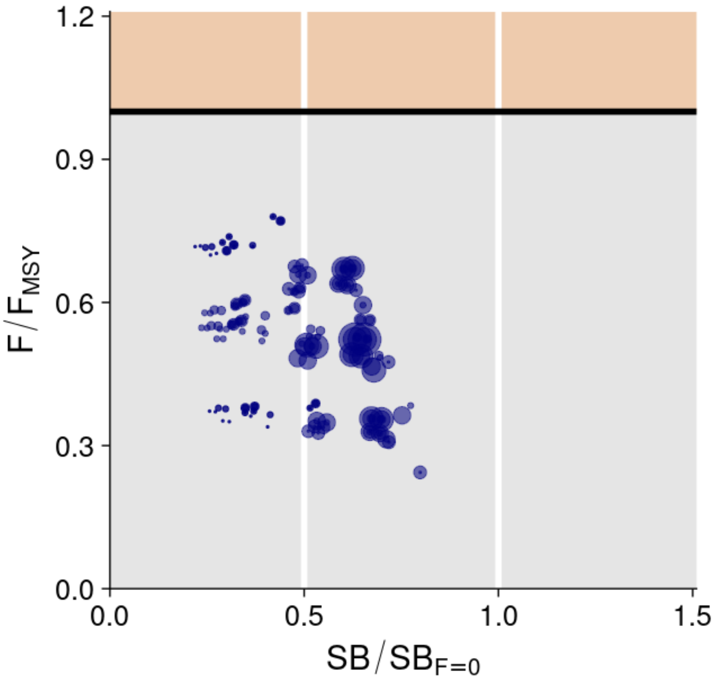


Figure 12: Majuro plot summarising the results for each of the models in the structural uncertainty grid. Size indicates weight of each model in the grid, darker shading indicates multiple models with similar outcomes.

SC18 welcomed the reduction and refinement of the grid of models for Southwest Pacific blue shark as well as the approach to the weighting of the model.

Based on the above information, SC18 advised the Commission that the Southwest Pacific blue shark is unlikely to be overfished and it is unlikely that overfishing is occurring when considered against MSY and depletion-based reference points.

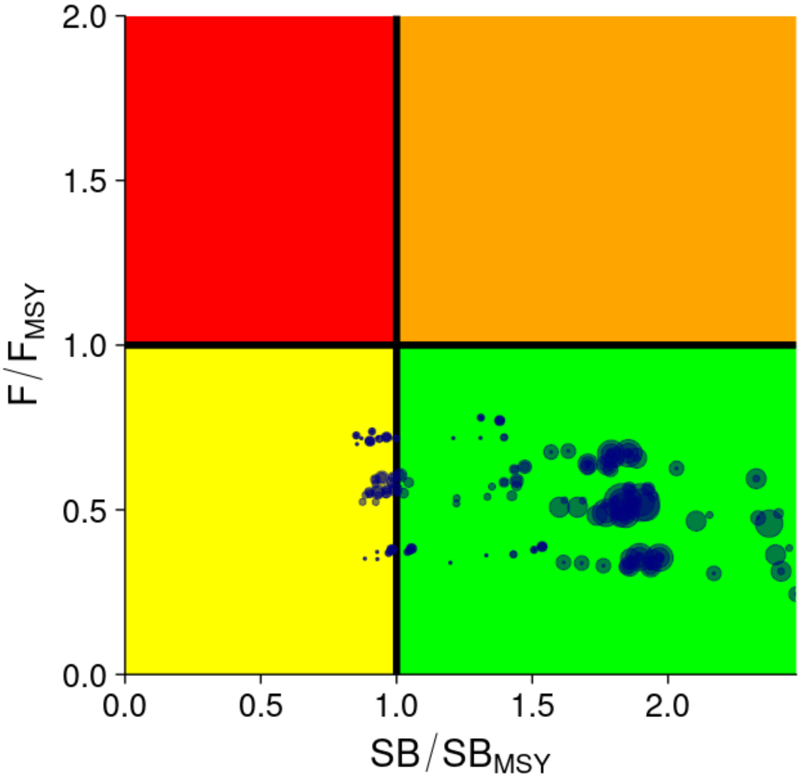


Figure 13: Kobe plot summarising the results for each of the models in the structural uncertainty grid. Size indicates weight of each model in the grid, darker shading indicates multiple models with similar outcomes.

New Zealand waters

There have been several attempts to assess the status of blue sharks in New Zealand waters, all of which have however been inconclusive:

- 2014 – indicator analysis (Francis & Large 2017)
- 2019 – updated indicator analysis (Francis & Finucci 2019)
- 2017 – qualitative risk assessment (Ford et al. 2018)
- 2025 – spatial risk assessment (Edwards et al., 2025)

Indicator analyses

Results of the New Zealand indicator analyses (Figure 14 and 15) suggest that blue shark populations in the New Zealand EEZ have not been declining under recent fishing pressure and may have been increasing since 2005 (Table 8, Francis et al. 2014). These changes are presumably in response to a decline in SLL fishing effort since 2003 and a decline in annual landings (Figure 1) since a peak in 2001 for blue sharks. Observer data from 1995 suggest that blue sharks may have undergone a down-then-up trajectory. The quality of observer data and model fits means these interpretations are uncertain. The stock status of blue sharks may be recovering. Conclusive determination of stock status will require a regional (i.e., South Pacific) stock assessment.

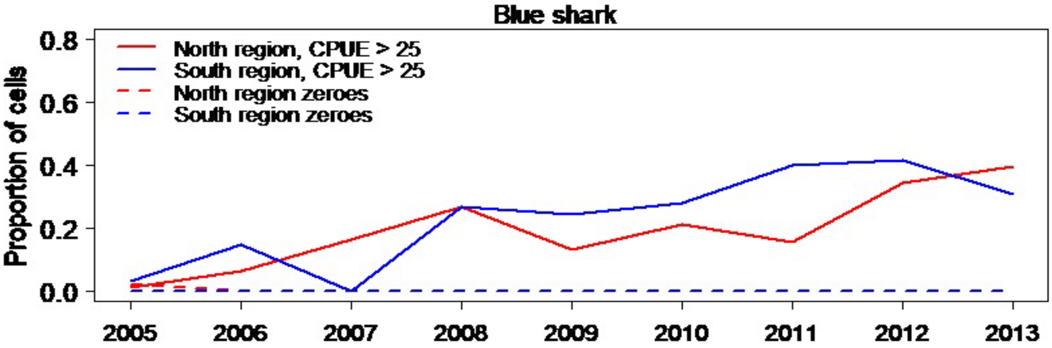


Figure 14: Blue shark distribution indicators in New Zealand waters. Proportions of 0.5 degree cells with CPUE greater than 25 per 1000 hooks, and proportions of cells with zero catches, for North and South regions by fishing year, based on estimated catches (processed and discarded combined) reported on TLCERs. North region comprises Fisheries Management Areas (FMAs) 1, 2, 8, and 9, and South region comprises FMAs 5 and 7.

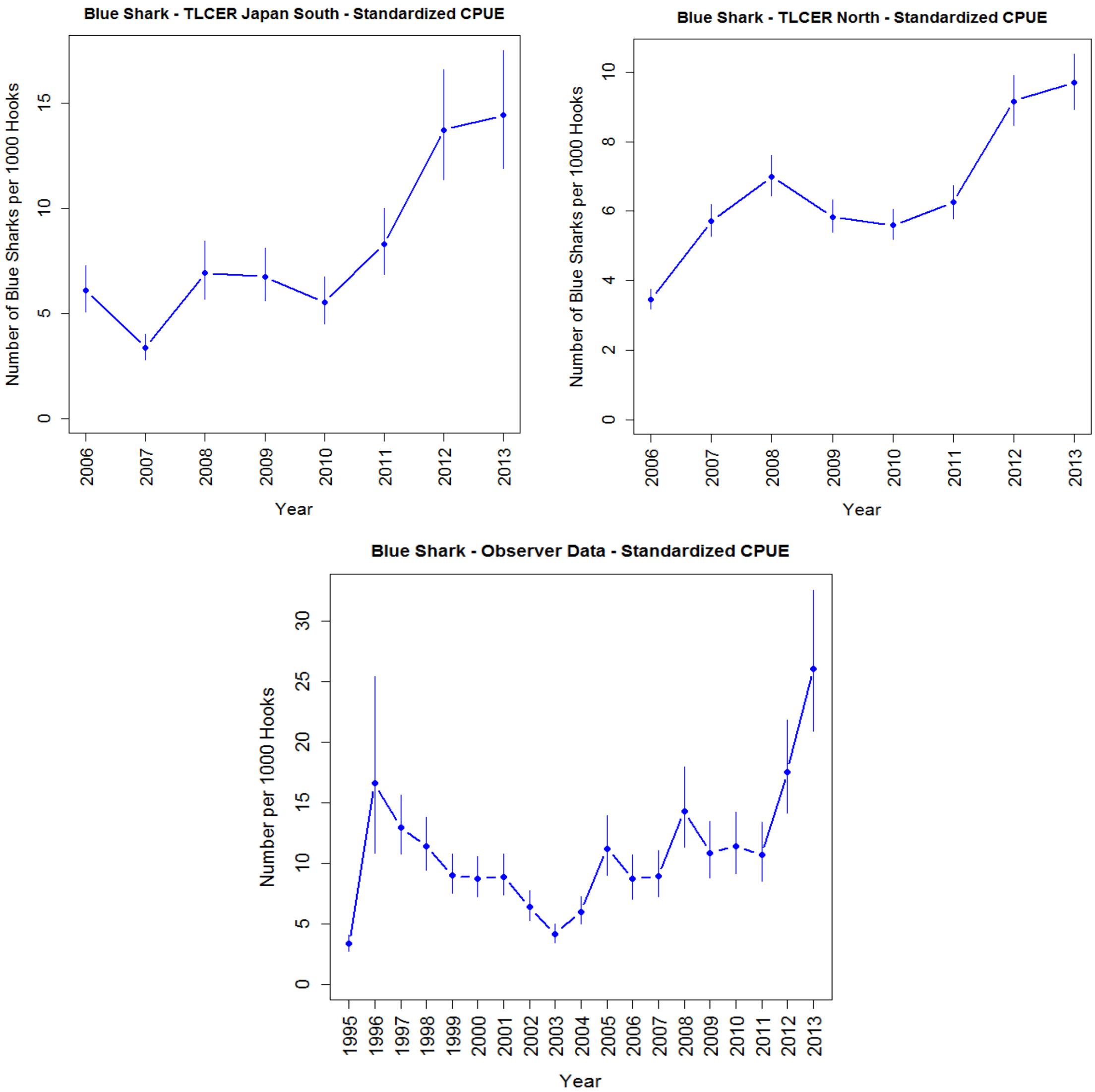


Figure 15: Standardised CPUE indices for commercial TLCER (Japan South and North) and observer datasets (all New Zealand).

Table 8: Summary of trends identified in abundance indicators since the 2005 fishing year based on both TLCER and observer data sets. The CPUE - Obs indicator was calculated for both North and South regions combined. North region comprises Fisheries Management Areas (FMAs) 1, 2, 8, and 9, and South region comprises FMAs 5 and 7. For the CPUE - TLCER indicator in South region, only the Japan dataset indicator is shown (the TLCER Domestic South dataset was small and probably unrepresentative). Green cells show indicators that suggest positive trends in stock size. Note that a downward trend in 'proportion-zeroes' is considered a positive stock trend. NA = indicator not applicable because of small sample size (Francis et al. 2014).

		North region			South region		
Indicator class	Indicator	Blue	Porbeagle	Mako	Blue	Porbeagle	Mako
Distribution	High-CPUE	Up	Up	Up	Up	Up	NA
Distribution	Proportion-zeroes	Nil	Down	Down	Nil	Nil	Down
Catch composition	GM index total catch - TLCER	Up (all species)			Up (all species)		
Catch composition	GM index total catch - Obs	Up (all species)			Nil (all species)		
Catch composition	GM index HMS shark catch - TLCER	Up (all species)			Up (all species)		
Catch composition	GM index HMS shark catch - Obs	Up (all species)			Nil (all species)		
Standardised CPUE	CPUE - TLCER	Up	Nil	Up	Up	Nil	Nil
Standardised CPUE	CPUE - Obs	Up	Nil	Nil	Up	Nil	Nil
Sex ratio	Proportion males	Nil	Nil	Nil	Nil	Nil	NA
Size composition	Median length - Males	Nil	Nil	Nil	Nil	Nil	NA
Size composition	Median length - Females	Nil	Nil	Nil	Nil	Nil	NA

The indicator analyses were updated in 2019 (Francis & Finucci 2019). The authors updated the same indicators with five more years of data (to 2018), during which time there were major changes in the SLL fishery, which takes most of the New Zealand catch of these species. Most of the abundance indicator series presented showed declining trends in recent years, particularly in North region in 2017–18, suggesting a reversal of the previous increasing trends. Taken at face value, these changes suggest there has been a decline in the abundance of pelagic sharks in New Zealand's EEZ. However, the authors described a number of reasons why the indicators may not accurately index shark abundance. The abundance indicators have been compromised by changes in the fisheries they monitor, under-reporting by commercial fishers, and reduced collection of data by observers. They may also have been invalidated by avoidance of sharks by SLL fishers and changes in shark availability resulting from shark movement. These factors combine to make interpretation of the stock status of the three species problematic.

Blue, porbeagle, and mako sharks are generally regarded as wide-ranging, mobile oceanic species. Although this may be true of blue sharks, recent electronic tagging of porbeagle and mako sharks in New Zealand waters has shown that juveniles (which make up a high proportion of the catch of each species) are partly residential in the New Zealand EEZ. Thus, abundance indices for the New Zealand EEZ may not index the entire southwest Pacific populations of those species. To understand trends in the wider pelagic shark stocks of the South Pacific, and to quantify their status in relation to management reference points, quantitative regional stock assessments are now required.

Blue sharks are the most heavily fished of the three large pelagic shark species (blue, mako, and porbeagle sharks) commonly caught in the tuna longline fishery. Compared with mako and porbeagle sharks, however, blue sharks are relatively fecund, fast growing, and widely distributed.

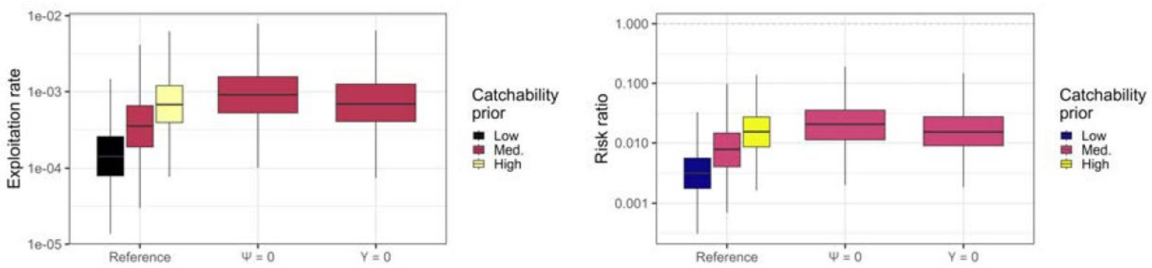
Risk assessments

A data-informed qualitative risk assessment was completed on all chondrichthyans (sharks, skates, rays, and chimaeras) at the New Zealand scale in 2017 (Ford et al. 2018). Blue sharks had a risk score of 12 and were ranked lowest risk of the 11 QMS chondrichthyan species. Data were described as "exist and sound" for the purposes of the assessment and consensus over this risk score was achieved by the expert panel, but with low confidence. This low confidence was due to the fact that no data were available on adult stock size.

In 2025 a spatial risk assessment for selected shark species in New Zealand, including blue sharks, was completed (Edwards et al., 2025). Catch and effort data were obtained for all methods that caught each of these species. From these data, the catchability per fishing gear type was co-estimated with the species spatial density distribution (in numbers) using Bayesian methods. The estimation model had a hierarchical structure, first predicting the density and spatial limit of the population as a function of environmental covariates, and then predicting the catch as the product of the density and catchability.

Exploitation rate was estimated from model parameters as the weighted sum of catchabilities across all fishing events, with weights provided by the spatial distribution of the population relative to each event. This was compared to an exploitation rate reference point (the impact sustainability threshold or IST), which is a function of the maximum intrinsic growth rate (rmax). Comparison of the exploitation rate with the IST yielded the risk ratio. Risk for a particular species was calculated as the posterior probability that the risk ratio was greater than one. Since the IST is a measure of the equilibrium exploitation rate at a desirable population status, the risk is the probability that this management objective will not be reached under current levels of fishing pressure.

The model was shown to provide a good fit to the catch data and produce well-defined posterior estimates of the risk for each species. However, risk estimates were highly sensitive to assumptions of post-capture survivorship (Ψ_l), and the proportion of the population outside of the spatial assessment domain (Υ) at any given time. Neither of these could be estimated, and sensitivity testing was therefore needed to explore the credibility of the results. Whilst a higher prior catchability for surface longlines equated to a higher estimated blue shark exploitation rate, there was no noticeable effect on the risk estimate (Figure 10).



(a) Exploitation rate. **(b) Risk ratio.**

Figure 10. Posterior estimates of the recent (2021 to 2023 inclusive) total exploitation rate (as a proportion of the exploitable population, summed across all fishing methods) and the associated risk ratio, for blue shark (BWS). The reference case, and sensitivity to $\Psi_l = 0$ and $\Upsilon = 0$ are shown (Edwards et al., 2025).

Sensitivity runs showed that if the total population were inside the New Zealand Exclusive Economic Zone (EEZ), then the risk would be close to one for all species (i.e., eventual depletion of the population would be almost certain). The reference case assumed that most of the population was outside of the EEZ and not exposed to any fishing pressure. Under this scenario blue shark was estimated to have a low risk. Despite high catches for this species, it is also highly productive.

6. STATUS OF THE STOCK

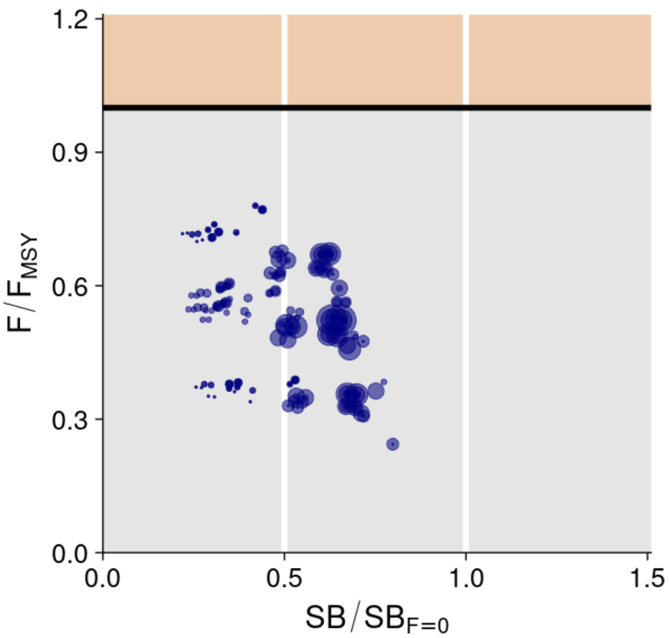
Stock structure assumptions

BWS 1 is assumed to be part of the wider Southwest Pacific Ocean stock.

Stock Status		
Most Recent Assessment Plenary Publication Year	2022	
Intrinsic productivity level	Medium	
Catch in most recent year of assessment	Year: 2020	Catch: 5 671 t

Assessment Runs Presented	Southwest Pacific Ocean: Stock Synthesis model with structural uncertainty grid approach
Reference Points	Target: Not established by WCPFC or IATTC; evaluated against HSS default of B_{MSY} = 40% SB_0 (further proxied by 40% $SB_{F=0}$) Soft Limit: Not established by WCPFC or IATTC; but evaluated using HSS default of 20% SB_0 (further proxied by 20% $SB_{F=0}$) Hard Limit: Not established by WCPFC or IATTC; but evaluated using HSS default of 10% SB_0 (further proxied by 10% $SB_{F=0}$) Overfishing threshold: F_{MSY}
Status in relation to Target	Very Likely (> 90%) to be at or above the target
Status in relation to Limits	Soft Limit: Very Unlikely (< 10%) to be below Hard Limit: Very Unlikely (< 10%) to be below
Status in relation to Overfishing	Overfishing is Very Unlikely (< 10%) to be occurring

Historical Stock Status Trajectory and Current Status



Majuro plot summarising the results for each of the models in the structural uncertainty grid. Size indicates weight of each model in the grid, darker shading indicates multiple models with similar outcomes.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Stock biomass is likely to be increasing.
Recent Trend in Fishing Intensity or Proxy	Fishing mortality has likely declined over the last decade.
Other Abundance Indices	-
Trends in Other Relevant Indicator or Variables	Catches in New Zealand increased from the early 1990s to a peak in the early 2000s with a second peak in 2011–12 but then declined to low levels in the late-2010s and have remained low since that time.

Projections and Prognosis	
Stock Projections or Prognosis	The stock is likely to increase if effort remains at current levels.

Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Very Unlikely (< 10%) Hard Limit: Very Unlikely (< 10%)
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Very Unlikely (< 10%)

Assessment Methodology and Evaluation		
Assessment Type	Level 1 – Full Quantitative Stock Assessment	
Assessment Dates	Latest assessment Plenary publication year: 2022	Next assessment: 2026–27 (two-year assessment)
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Catch reconstruction - CPUE time series - Re-parametrisation of biological parameters	1 – High quality 1 – High quality 1 – High quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	- Historical catch estimates - Movements and stock structure - Age and growth	

Qualifying Comments
-

7. FOR FURTHER INFORMATION

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