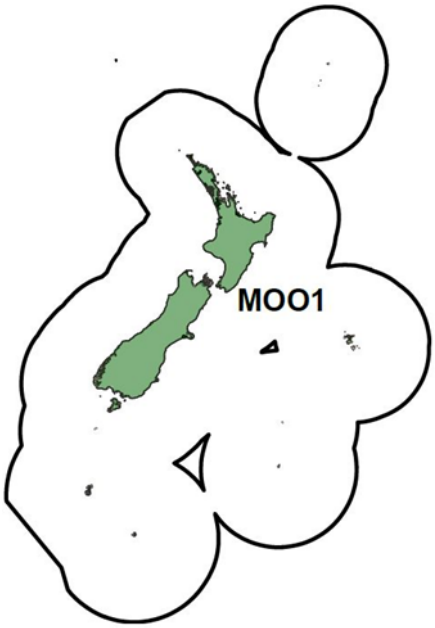
MOONFISH (MOO)

(Lampris guttatus)



1. FISHERY SUMMARY

Moonfish were introduced into the Quota Management System on 1 October 2004 under a single Quota Management Area, MOO 1, with the Total Allowable Catch (TAC) equal to the Total Allowable Commercial Catch (TACC) (Table 1).

Table 1: Recreational and customary non-commercial allowances, TACCs, and TACs (all in t) of moonfish.

Fishstock	Recreational allowance	Customary non-commercial allowance	Other mortality	TACC	TAC
MOO 1	0	0	0	527	527

Moonfish were added to the Third Schedule of the 1996 Fisheries Act with a TAC set under s14.

1.1 Commercial fisheries

Most moonfish (70%) are caught as bycatch in surface longline fisheries (in the top seven most common bycatch species in the surface longline fishery; see Table 5). The main fisheries that catch moonfish by surface longlining target bigeye tuna (*Thunnus obesus*) and, to a lesser extent, southern bluefin tuna (*T. maccoyii*), albacore (*T. alalunga*), and yellowfin tuna (*T. albacares*). Midwater trawling accounts for 18% of the catch, bottom trawling 8%, and bottom longlining 1%. The main target fisheries are for southern blue whiting (*Micromesistius australis*) and hoki (*Macruronus novaezelandiae*) when midwater trawling and hoki and gemfish (*Rexea solandri*) when bottom trawling.

When caught on tuna longlines most moonfish are alive (79.8%). Most moonfish catch is kept and landed, as there is a market demand. It is likely that landing data for moonfish reasonably represent actual catches, although they may include small amounts (less than 1%) of the less common *Lampris* spp. and the more southerly occurring species (*Lampris immaculatus*) because of misidentification. Most of the catch taken by the tuna longline fishery is aged 2 to 14 years, and most (71%) of the commercial catch appears to be of adult fish. Figure 1 shows the historical landings for moonfish inside and outside the New Zealand EEZ.

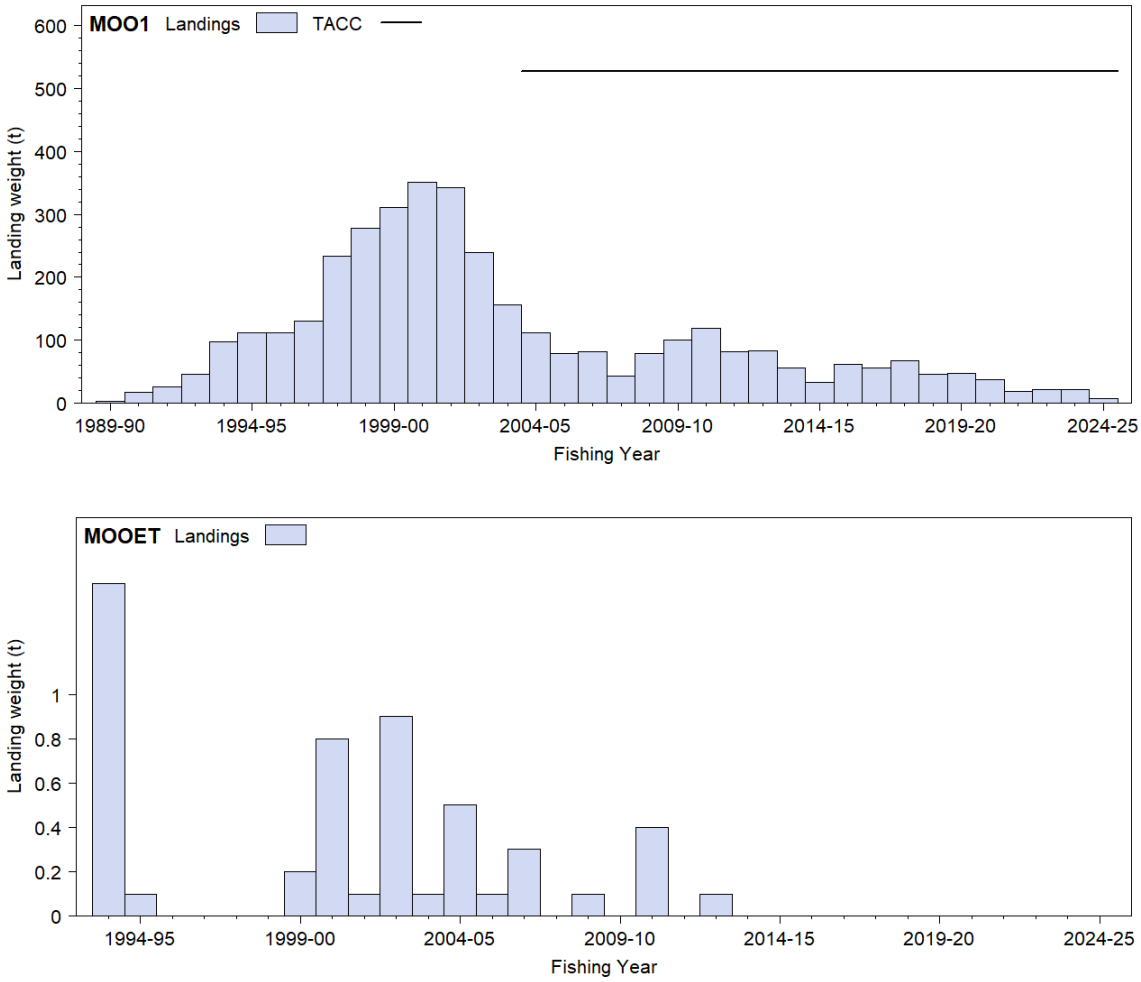


Figure 1: [Top] Moonfish catch from 1989–90 to present within New Zealand waters (MOO 1) and [Bottom] from 1993–94 to present on the high seas (MOO ET).

Reported landings in New Zealand increased each year from 3 t in 1989–90 to a maximum of 351 t in 2000–01 but have declined since then as a result of decreasing effort in the surface longline fishery (Table 2). From 2005–06 to 2024–25 landings averaged around 57 t. New Zealand landings of moonfish appear to represent about 70% of the reported catch of moonfish in the wider South Pacific area based on Food and Agriculture Organisation of the United Nations statistics. However, this may reflect general non-reporting of bycatch.

Table 2: Reported landings (t) of moonfish (CELR, CLR, and LFRR data from 1989–90 to 2000–01, MHR data from 2001–02 onwards).

Fishing year	MOO 1 (all FMAs)	Fishing year	MOO 1 (all FMAs)	Fishing year	MOO 1 (all FMAs)
1989–90	3	2001–02	342	2013–14	56
1990–91	18	2002–03	239	2014–15	32
1991–92	26	2003–04	156	2015–16	61
1992–93	46	2004–05	112	2016–17	57
1993–94	97	2005–06	80	2017–18	67
1994–95	112	2006–07	82	2018–19	45
1995–96	112	2007–08	43	2019–20	47
1996–97	130	2008–09	80	2020–21	38
1997–98	234	2009–10	100	2021–22	19
1998–99	278	2010–11	118	2022–23	22
1999–00	311	2011–12	84	2023–24	22
2000–01	351	2012–13	85	2024–25	7

In 2024–25, across all surface longline fisheries moonfish comprised about 1% of the total catch (Figure 2). Surface longline fishing effort is distributed along the east coast of the North Island and the south-west coast of the South Island. The west coast South Island fishery predominantly targets southern bluefin tuna, whereas the east coast of the North Island fishery targets a range of species including bigeye tuna, swordfish (*Xiphias gladius*), and southern bluefin tuna. Moonfish generally have higher catch rates in the north of New Zealand (Griggs et al. 2024).

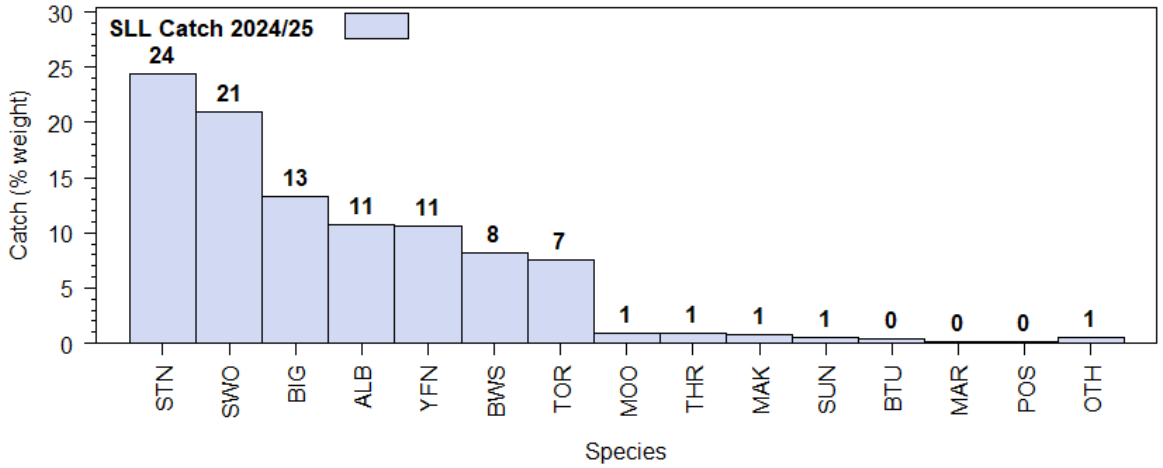


Figure 2: A summary of species composition of the surface longline estimated catch for the most recent fishing year. The percentage by weight of each species is calculated for all surface longline trips.

By far the majority of moonfish have been alive when brought to the side of the vessel (Table 3). From 2006–07 to 2020-21, most of the moonfish catch was retained (Table 4).

Table 3: Percentage of moonfish (including discards) that were alive or dead when arriving at 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	80.0	20.0	20
	Charter	North	85.2	14.8	472
		South	84.2	15.8	114
	Domestic	North	65.6	34.4	180
	Total		**80.4**	**19.6**	**786**
2007–08	Charter	South	100.0	0.0	41
	Domestic	North	78.4	21.6	97
	Total		**84.8**	**15.2**	**138**
2008–09	Charter	North	100.0	0.0	60
		South	100.0	0.0	30
	Domestic	North	72.6	27.4	201
	Total		**81.1**	**18.9**	**291**
2009–10	Charter	South	98.6	1.4	69
	Domestic	North	71.5	28.5	333
	Total		**76.0**	**24.0**	**408**
2010–11	Charter	South	90.5	9.5	21
	Domestic	North	76.5	23.5	341
	Total		**77.3**	**22.7**	**362**
2011–12	Charter	South	91.7	8.3	24
	Domestic	North	63.0	37.0	127
	Total		**67.7**	**32.3**	**155**
2012–13	Charter	North	85.7	14.3	42
		South	90.5	9.5	42
	Domestic	North	67.8	32.2	87
	Total		**77.8**	**22.2**	**171**
2013–14	Charter	South	93.8	6.3	96
	Domestic	North	67.4	32.6	132
	Total		**76.2**	**23.8**	**244**

Table 3: [continued]

Year	Fleet	Area	% alive	% dead	Number
2014–15	Charter	South	95.8	4.2	48
	Domestic	North	60.5	39.5	38
	Total		**76.8**	**23.2**	**95**
2015–16	Domestic	North	60.3	39.7	315
		South	86.0	14.0	57
	Total		**64.2**	**35.8**	**372**
2016–17	Domestic	North	55.8	44.2	283
		South	55.4	44.6	56
	Total		**55.8**	**44.2**	**339**
2017–18	Domestic	North	61.7	38.3	316
		South	74.4	25.6	43
	Total		**63.2**	**36.8**	**359**
2018–19	Domestic	North	68.5	31.5	127
		South	89.7	10.3	39
	Total		**73.5**	**26.5**	**166**
2019–20	Domestic	North	70.0	30.0	150.0
		South	90.3	9.7	31
	Total		**73.5**	**26.5**	**181**
2020–21	Domestic	North	**75.3**	**24.7**	**92**
		South	-	-	-
	Total		**77.2**	**22.8**	**92**

Table 4: Percentage of moonfish that were retained, or discarded or lost, when observed on a longline vessel during 2006–07 to 2017–18, 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	% discarded or lost	Number
2006–07	Australia	100.0	0.0	20
	Charter	91.6	8.4	616
	Domestic	97.2	2.8	180
	Total	**93.0**	**7.0**	**816**
2007–08	Charter	100.0	0.0	41
	Domestic	100.0	0.0	96
	Total	**100.0**	**0.0**	**137**
2008–09	Charter	100.0	0.0	107
	Domestic	98.5	1.5	201
	Total	**99.0**	**1.0**	**308**
2009–10	Charter	100.0	0.0	76
	Domestic	96.5	3.5	345
	Total	**97.1**	**2.9**	**421**
2010–11	Charter	100.0	0.0	22
	Domestic	97.1	2.9	343
	Total	**97.3**	**2.7**	**365**
2011–12	Charter	100.0	0.0	26
	Domestic	96.3	3.7	134
	Total	**96.9**	**3.1**	**160**
2012–13	Charter	97.6	2.4	84
	Domestic	97.7	2.3	87
	Total	**97.7**	**2.3**	**171**
2013–14	Charter	96.5	3.5	114
	Domestic	90.8	9.2	153
	Total	**93.3**	**6.7**	**267**
2014–15	Charter	94.0	6.0	50
	Domestic	87.2	12.8	47
	Total	**90.7**	**9.3**	**97**
2015–16	Domestic	95.5	4.5	377
	Total	**95.5**	**4.5**	**377**
2016–17	Domestic	96.2	3.8	341
	Total	**96.2**	**3.8**	**341**
2017–18	Domestic	95.6	4.4	361
	Total	**95.6**	**4.4**	**361**
2018-19	North	94.5	5.5	127
	South	92.7	7.3	41
	Total	**94.0**	**6.0**	**168**
2019-20	North	97.4	2.6	151
	South	90.3	9.7	31
	Total	**96.2**	**3.8**	**182**
2020-21	North	88.9	11.1	81
	South	89.1	10.9	92
	Total	**93.9**	**6.1**	**442**

1.2 Recreational fisheries

There is no information on recreational catch levels of moonfish. Moonfish has not been recorded from any of the recreational surveys.

1.3 Customary non-commercial fisheries

There is no information on customary catch, although customary fishers consider moonfish good eating and may have used moonfish in the past.

1.4 Unreported catch

There is no known unreported catch of moonfish.

1.5 Other sources of mortality

There is no information on other sources of mortality although moonfish are occasional prey of blue and mako sharks in New Zealand waters, suggesting that there may be some unobserved shark depredation of longline-caught moonfish.

2. BIOLOGY

Until recently, little was known about the biology of moonfish in New Zealand waters. Studies have examined growth rates, natural mortality, and maturity for moonfish.

Age and growth of moonfish (*Lampris guttatus*) in New Zealand waters was assessed using counts of growth bands on cross sections of the second dorsal fin ray. Fisheries New Zealand observers working on tuna longline vessels collected fin samples. Observers also collected maturity data, and length frequency data were obtained from the longline observer database.

Thin sections were cut from fin rays 3.5–4 times the condyle width above the fin base. Sections were read blind (without knowing the fish length) by two readers. Readability scores were poor and the four readers who examined the fin rays came to two different interpretations.

Length-at-age data did not show any marked differences between males and females. Von Bertalanffy growth curves were fitted to the age estimates of both readers individually, and also to the mean age estimates of the two readers. The mean age provides the best available age estimate for moonfish samples. However, because of differences between readers, and the unvalidated nature of the estimates, the growth curves must be interpreted with caution, especially for younger fish.

The growth curves suggest rapid early growth. The maximum age estimated in this study was 13 or 14 years depending on the reader, but this is probably an underestimate of true longevity. Using a maximum age of 14 years, Hoenig's method provides an M estimate of 0.30. If moonfish live to 20 years, this estimate would reduce to 0.21. The Chapman-Robson estimate of Z is 0.13–0.14 for ages at recruitment of 2–4 years. However, the sample was not randomly selected and so this is probably unreliable. The best estimate of M may be around 0.20–0.25.

Length- and age-at-maturity could not be accurately determined due to insufficient data, but it appears that fish longer than about 80 cm fork length are mature. The corresponding age-at-maturity would be 4.3 years. Sexual maturity may therefore be attained at about 4–5 years. A few spawning females were collected in the Kermadec region, and at East Cape, suggesting that moonfish spawn in northern New Zealand. Identification of the location and timing of spawning is an important area of further research and a prerequisite for obtaining good estimates of length- and age-at-maturity.

Moonfish in New Zealand waters may be a species complex of *L. guttatus* and a new species, large-eye moonfish. This needs clarification in New Zealand.

3. STOCKS AND AREAS

There is no information on the stock structure of moonfish.

4. ENVIRONMENTAL AND ECOSYSTEM CONSIDERATIONS

This summary is from the perspective of moonfish but there is no directed fishery for them.

4.1 Role in the ecosystem

Moonfish (*Lampris guttatus*) are a midwater pelagic fish, found between 50 and 400 m depth. They often exhibit vertical behaviour like many other large pelagic visual predators, including swordfish and bigeye tuna, with deeper day and shallower night depth distributions (Polovina et al. 2008). While no published data exist on the diet of *L. guttatus* in the South Pacific, a study on the diet of southern moonfish (*Lampris immaculatus*) along the Patagonian Shelf showed that they had a narrow range of prey items with the most common being the deepwater onychoteuthid squid (*Moroteuthis ingens*) (Jackson et al. 2000, Polovina et al. 2008). Large pelagic sharks such as great white and mako are thought to prey on moonfish.

4.2 Non-target fish catch

Moonfish is a non-target catch in the tuna and swordfish surface longline fishery in the New Zealand EEZ. Observer records indicate that a wide range of species are landed by surface longline fleets in New Zealand waters. Blue sharks are the most commonly caught species (by number), followed by lancetfish and porbeagle shark (Table 5).

Table 5: 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 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). Moonfish are highlighted in grey.

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

4.3 Benthic interactions

There are no known benthic interactions for this fishery.

5. STOCK ASSESSMENT

There is insufficient information to conduct a stock assessment of moonfish.

5.1 Estimates of fishery parameters and abundance
There are no estimates of relevant fisheries parameters or abundance indices for moonfish.

5.2 Biomass estimates
There are no biomass estimates for moonfish.

5.3 Other yield estimates and stock assessment results
There are no other yield estimates or stock assessment results.

5.4 Other factors
While there is little information on stock status, available data suggest that moonfish are moderately productive and that most (71%) of New Zealand's catches are of mature fish. Provided that juvenile moonfish are not experiencing high fishing mortality elsewhere in their range, it is unlikely that the stock is currently depleted.

6. STATUS OF THE STOCKS

Stock structure assumptions
MOO 1 is assumed to be part of the wider south-western Pacific Ocean stock but the text below relates only to the New Zealand component of that stock.

Stock Status		
Most Recent Assessment Plenary Publication Year	No assessment	
Intrinsic productivity level		
Catch in most recent year of assessment	Year:	Catch:
Assessment Runs Presented	-	
Reference Points	Target: Not established Soft Limit: Not established by WCPFC; but HSS default of 20% SB_0 assumed Hard Limit: Not established by WCPFC; but HSS default of 10% SB_0 assumed Overfishing threshold: Unknown	
Status in relation to Target	Unknown	
Status in relation to Limits	Unknown	
Status in relation to Overfishing	Unknown	

Fishery and Stock Trends	
Recent trend in Biomass or Proxy	Unknown
Recent trend in Fishing Intensity or Proxy	Unknown
Other Abundance Indices	Unknown
Trends in Other Relevant Indicators or Variables	Catches in New Zealand increased from the late 1980s to 2000 but declined from 351 t in 2000–01 to 43 t in 2007–08 and have remained low since. This decline in catch coincides with a decline in longline fishing effort.

Projections and Prognosis	
Stock Projections or Prognosis	Unknown
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unknown Hard Limit: Unknown

Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown

Assessment Methodology and Evaluation		
Assessment Type	Level 4: Low information evaluation – there are only data on catch and TACC, with no other fishery indicators	
Assessment Method	2 – Medium or Mixed Quality: information has been subjected to peer review and has been found to have some shortcomings.	
Assessment Dates	Latest assessment Plenary publication year: None	Next assessment:
Overall assessment quality rank	N/A	
Main data inputs (rank)	- Commercial reported catch and effort	1 – High Quality for the charter fleet but low for all the other fleets
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

Qualifying Comments
This fishery is largely a bycatch fishery. There are some issues associated with species identification with a new species recently described as the large-eye moonfish.

7. FOR FURTHER INFORMATION

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