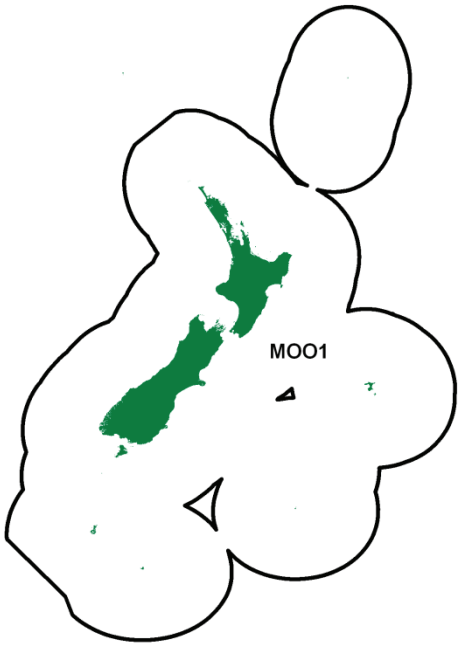
MOONFISH (MOO)

(Lampris guttatus)



1. FISHERY SUMMARY

Moonfish were introduced into the QMS on 1 October 2004 under a single QMA, MOO 1, with the TAC equal to the TACC (Table 1).

Table 1: Recreational and Customary non-commercial allowances, TACCs and TACs of moonfish.

Fishstock	Recreational Allowance (t)	Customary non-commercial Allowance (t)	Other mortality (t)	TACC (t)	TAC (t)
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 longlines fisheries (the 7th most common bycatch species in the surface longline fishery). The main fisheries catching moonfish by surface longlining are targeting bigeye tuna (*Thunnus obesus*) and, to a lesser extent, southern bluefin tuna (*T. maccoyii*), albacore (*T. alalunga*) and yellowfin tuna (*T. albacares*). Mid-water trawling accounts for 18% of the catch, bottom trawling 8% and bottom longlining 1%. The main target fisheries using mid-water trawling are for southern blue whiting (*Micromesistius australis*) and hoki (*Macruronus novaezelandiae*), and bottom trawling for hoki and gemfish (*Rexea solandri*).

When caught on tuna longlines most moonfish are alive (72.4%). Most moonfish catch is kept and landed, as there is a market demand. It is likely that landing data for moonfish reasonably represents actual catches, although it may include small amounts (< 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 was aged 2 to 14 years, and most (71%) of the commercial catch appears to be of adult fish. Figure 1 shows the historic landings and longline fishing effort of the two moonfish stocks.

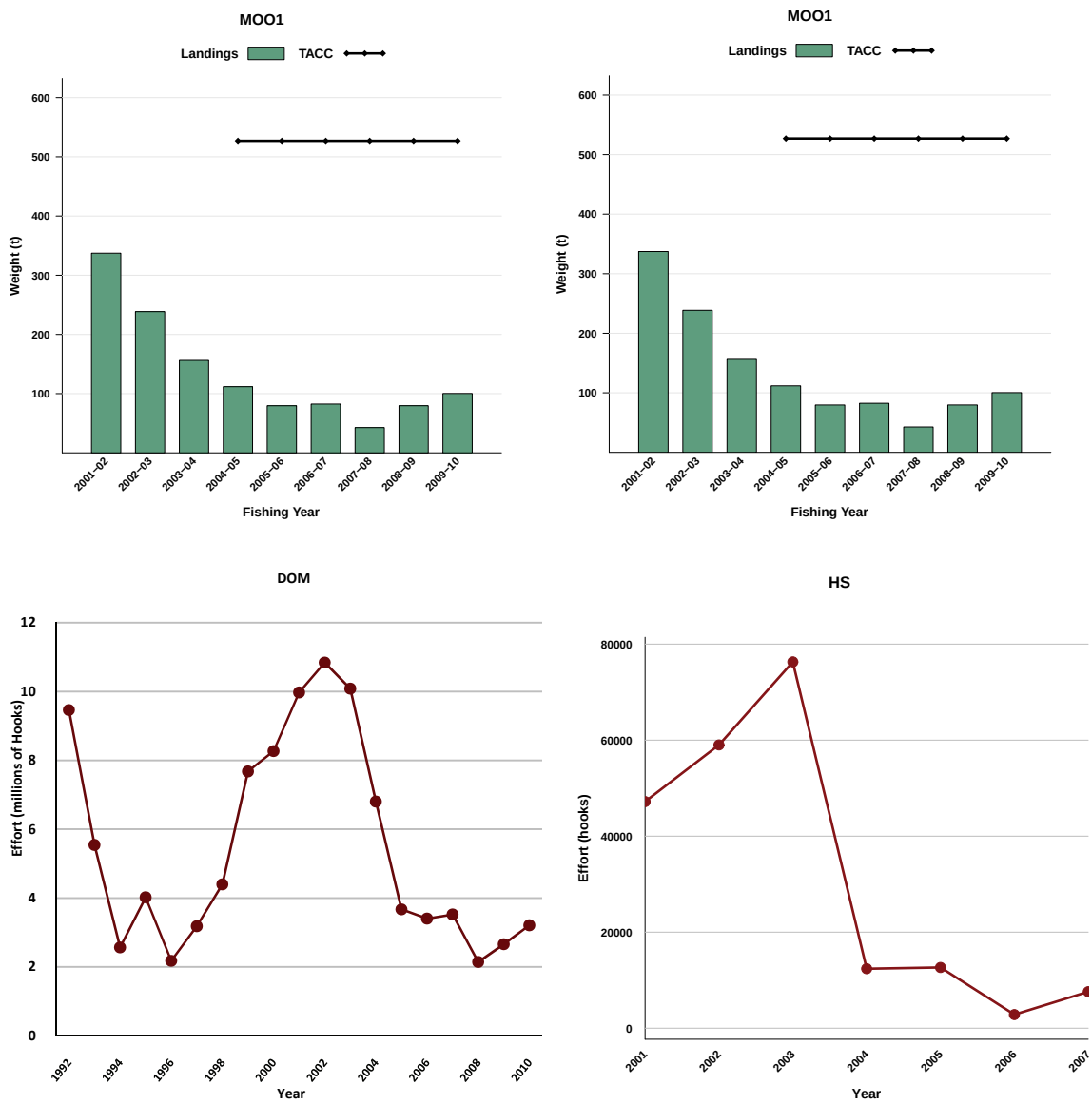


Figure 1: [Top] Moonfish catch from 2001-02 to 2009-10 within NZ waters (MOO1) and on the high seas (MOOET). [Bottom] Fishing effort (number of hooks set) for all domestic (including effort by foreign vessels chartered by NZ fishing companies) and high seas New Zealand flagged surface longline vessels, from 1992 to 2010 and 2001 to 2007, respectively.

Between 1989/90 and 1998/99, reported landings in New Zealand increased each year from 2 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). Over the last three fishing years, landings have averaged around 115 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. Alternately, this may reflect non-reporting of bycatch by others.

1.2 Recreational fisheries

There is no information on recreational catch levels of moonfish. Moonfish has not been recorded from recreational surveys conducted by MFish.

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 Illegal catch

There is no known illegal catch of moonfish.

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

Fishing year	MOO 1 (all FMAs)
1989/90	3
1990/91	18
1991/92	26
1992/93	46
1993/94	97
1994/95	112
1995/96	112
1996/97	130
1997/98	234
1998/99	278
1999/00	311
2000/01	351
2001/02	342
2002/03	239
2003/04	156
2004/05	112
2005/06	79
2006/07	82
2007/08	43
2008/09	80
2009/10	100

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 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. Recent 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. Ministry of Fisheries 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 ages of the two readers. The mean age provides the best available age estimate for moonfish samples. However, because of differences between readers, and the un-validated 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 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 are important areas of further research and are a pre-requisite 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. STOCK ASSESSMENT

There is insufficient information on which to do a stock assessment of moonfish.

4.1 Estimates of fishery parameters and abundance

There are no estimates of relevant fisheries parameters or abundance indices for moonfish.

4.2 Biomass estimates

There are no biomass estimates for moonfish.

4.3 Estimation of Maximum Constant Yield (MCY)

There are no estimates of biomass on which to base an estimate of MCY. Similarly most of the moonfish caught is a bycatch in the tuna longline fishery targeting bigeye tuna. This fishery is relatively new and has not undergone a stable period where the average catch of moonfish can be used as a proxy for abundance or standing stock. It is therefore not appropriate to estimate MCY.

4.4 Estimation of Current Annual Yield (CAY)

There is insufficient information to estimate CAY.

4.5 Other yield estimates and stock assessment results

There are no other yield estimates or stock assessment results.

4.6 Other factors

While there is no information on stock status, available data suggests 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 there are any sustainability concerns for moonfish at this time.

5. STATUS OF THE STOCKS

Stock structure assumptions

MOO1 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	
Year of Most Recent Assessment	No assessment
Reference Points	Target: Not established 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.
Status in relation to Target	Unknown
Status in relation to Limits	Unknown

Fishery and Stock Trends	
Recent trend in Biomass or Proxy	Unknown
Recent trend in Fishing Mortality 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 have declined from 351t in 2000/01 to 43t in 2007/08.

Projections and Prognosis	
Stock Projections or Prognosis	Unknown
Probability of Current Catch causing decline below limits	Soft Limit: Unknown Hard Limit: Unknown

Assessment Methodology		
Assessment Type	Level 4: Low information evaluation - There are only data on catch and TACC, with no other fishery indicators.	
Assessment Method		
Main data inputs		
Period of Assessment	Latest assessment:	Next assessment:
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 big-eye moonfish.

Fishery Interactions
Interactions with protected species are known to occur in the longline fisheries of the South Pacific, particularly south of 30°S. Seabird bycatch mitigation measures are required in the New Zealand, Australian EEZ's and through the WCPFC Conservation and Management Measure (CMM2007-04). Sea turtles also get incidentally captured in longline gear; the WCPFC is attempting to reduce sea turtle interactions through Conservation and Management Measure (CMM2008-03). Shark bycatch is common in longline fisheries and largely unavoidable; this is being managed through New Zealand domestic legislation and to some extent through Conservation and Management Measure (CMM2008-06).

6. FOR FURTHER INFORMATION

Anon. 2003. Information summaries and indicative areas for species proposed to be introduced to the QMS in October 2004. NIWA Report on MFish Project MOF2002/03F.

Anon. 2004. Setting of Sustainability and Other Management Controls for Stocks to be introduced into the QMS on 1 October 2004: Final Advice Paper. Ministry of Fisheries.

Anon. 2004. www.fishbase.org.

Ayers, D.; Francis, M.P.; Griggs, L.H.; Baird, S.J. (2004). Fish bycatch in New Zealand tuna longline fisheries, 2000-01 and 2001-02. *New Zealand Fisheries Assessment Report 2004/46*. 47 p.

Francis, M.P.; Griggs, L.H.; Baird, S.J. 2004. Fish bycatch in New Zealand tuna longline fisheries, 1998–99 to 1999–2000. New Zealand Fisheries Assessment Report 2004/22.

Francis, M. P., Griggs, L., Ó Maolagáin, C.. 2005. Growth rate, age at maturity, longevity and natural mortality rate of moonfish (*Lampris guttatus*). Final Research Report for Ministry of Fisheries Research Project TUN2003-01, Objective 1.