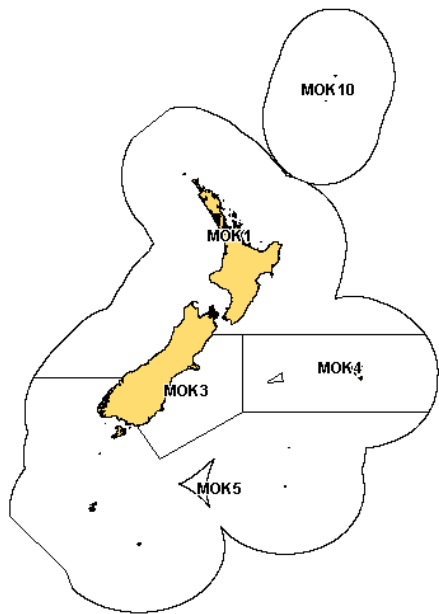# BLUE MOKI (MOK)

(*Latridopsis ciliaris*)
Moki

1. FISHERY SUMMARY

1.1 Commercial fisheries

Most blue moki landings are taken by setnet or trawl on the east coast between the Bay of Plenty and Kaikoura, although small quantities are taken in most New Zealand coastal waters. While the proportions of the total commercial landings taken by setnet and trawl have varied over time, setnetting has been the predominant method (60%) since 1979.

Blue moki stocks appeared to be seriously depleted by fishing prior to 1975 and this resulted in the sum of allocated ITQs being markedly less than the sum of the catch histories. Landings of blue moki peaked in 1970 and 1979 at about 960 t. Since 1993–94, total landings have been around 500 t. Landings in 1999–00 (443 t) were the lowest recorded since 1992–93. While there was a slight increase in landings in 2000–01 (499 t), they dropped to 451 t in 2001–02 and have remained below 500 t, except in the 2004–05 and 2006–07 fishing years. Reported landings and TACCs are given in Tables 1 and 2.

Table 1: Total reported landings (t) of blue moki from 1979 to 1985–86.

Year	1979*	1980*	1981*	1982*	1983†	1983–84†	1984–85†	1985–86†
Landings	957	919	812	502	602	766	642	636

*MAF data.
†FSU data.

Total annual landings of blue moki were substantially constrained when it was introduced into QMS. In MOK 1, landings have increased as the TACC has been progressively increased; and overcatch has declined since 1995–96, when the TACC was set at 400 t.

Table 2: Reported landings (t) and actual TACCs (t) of blue moki by Fishstock from 1986–87 to 2006–07. Source – QMS data.

Fishstock	MOK 1		MOK 3		MOK 4		MOK 5	
FMA (s)	1,2,7,8,9		3		4		5 & 6	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1986–87	109	130	52	60	0	20	3	40
1987–88	183	142	95	62	0	20	2	40
1988–89	134	151	121	64	0	20	3	40
1989–90	202	156	89	65	11	25	1	43
1990–91	264	157	93	71	1	25	2	43
1991–92	285	157	66	71	2	25	2	43
1992–93	289	157	94	122	1	25	4	43
1993–94	374	200	102	126	4	25	5	43
1994–95	418	200	90	126	<1	25	3	43
1995–96	435	400	91	126	1	25	3	43
1996–97	408	400	66	126	2	25	3	43
1997–98	416	400	78	126	3	25	2	43
1998–99	468	400	78	126	<1	25	4	43
1999–00	381	400	56	126	1	25	5	43
2000–01	420	400	67	126	5	25	6	43
2001–02	365	403	77	127	8	25	2	44
2002–03	380	403	87	127	2	25	6	44
2003–04	372	403	60	127	2	25	6	44
2004–05	418	403	70	127	3	25	11	44
2005–06	408	403	69	127	1	25	5	44
2006–07	402	403	90	127	< 1	25	11	44

Fishstock	MOK 10			
FMA (s)	10		Total	
	Landings	TACC	Landings	TACC
1986–87	0	10	164	260
1987–88	0	10	280	274
1988–89	0	10	258	285
1989–90	0	10	303	299
1990–91	0	10	360	306
1991–92	0	10	355	306
1992–93	0	10	388	358
1993–94	0	10	485	404
1994–95	0	10	511	404
1995–96	0	10	530	604
1996–97	0	10	479	604
1997–98	0	10	500	604
1998–99	0	10	551	604
1999–00	0	10	443	604
2000–01	0	10	499	604
2001–02	0	10	451	608
2002–03	0	10	475	608
2003–04	0	10	440	608
2004–05	0	10	502	608
2005–06	0	10	483	608
2006–07	0	10	504	608

1.2 Recreational fisheries

Popular with recreational fishers, blue moki are taken by beach anglers, setnetting and spearfishing. Annual estimates of recreational harvest were obtained from diary surveys in 1991–94, 1996 and 1999–00 (Tables 3 and 4).

Table 3: Estimated number and weight of blue moki harvested by recreational fishers by Fishstock and survey. Surveys were carried out in different years in the Ministry of Fisheries regions: South in 1991–92, Central in 1992–93 and North in 1993–94 (Teirney *et al*. 1997).

Fishstock	Survey	Total Number	CV(%)	Survey harvest (t)
MOK 1	North	6 000	–	5–15
MOK 1	Central	38 000	28	40–80
MOK 1	South	2 000	–	0–5
MOK 3	South	31 000	33	40–70
MOK 5	South	7000	33	5–15

Table 4: **Estimates of annual number and weight of blue moki harvested by recreational fishers from national diary surveys in 1996 (Bradford 1998) and Dec1999-Nov 2000 (Boyd and Reilly 2002). The mean weights used to convert numbers to catch weight are considered the best available estimates. Estimated harvest is also presented as a range to reflect the uncertainty in the point estimates.**

Fishstock	Number caught	CV	Estimated harvest range (t)	Point estimate (t)
				1996
MOK 1	63 000	14	80–110	93
MOK 3	16 000	18	20–30	24
MOK 5	9000	–	–	–
				1999–00
MOK 1	81 000	37	82–180	130
MOK 3	36 000	32	36–70	53
MOK 5	38 000	89	7–115	61

A key component of the estimating recreational harvest from diary surveys is determining the proportion of the population that fish. The Recreational Working Group has concluded that the methodological framework used for telephone interviews produced incorrect eligibility figures for the 1996 and previous surveys. Consequently the harvest estimates derived from these surveys are considered to be considerably underestimated and not reliable. However relative comparisons can be made between stocks within these surveys. The Recreational Working Group considered that the 2000 survey using face-to-face interviews better estimated eligibility and that the derived recreational harvest estimates are believed to be more accurate. FMA2 catches are nevertheless considered to be over-estimated, probably because of an unrepresentative diarist sample. The 1999–00 Harvest estimates for each Fishstock should be evaluated with reference to the coefficient of variation.

The MOK 1 recreational harvest estimated during the 1999–00 survey was almost half (44%) of the commercial catch over that period.

1.3   Customary non-commercial fisheries

A traditional Maori fishery exists in some areas, particularly the eastern Bay of Plenty and East Cape regions. No quantitative information is available on the level of customary non-commercial catch.

Iwi in the Cape Runaway area have a strong view that blue moki are of special significance in the history and life of the community. They believe that blue moki come to spawn in the waters around Cape Runaway and there are traditional fishing grounds, where in earlier years fishing took place in accordance with customary practices. In addition, these local Iwi consider the taking of blue moki by nets in this area to be culturally offensive.

Since September 1996, fishing by the methods of trawling, Danish seining and setnetting has been prohibited at all times within a two nautical-mile wide coastal band beginning at the high water mark and extending from Cape Runaway to a stream tributary at Oruiti Beach. (Note this is not a legal description, for full details please refer to the Fisheries Act (Auckland and Kermadec Areas Commercial Fishing Regulations 1986, Amendment No. 13).

1.4   Illegal catch

No quantitative estimates are available

1.5   Other sources of mortality

Some blue moki caught for use as rock lobster bait have not been reported. While little information is available, this practice appears to have been most common in Stewart Island and the Chatham Islands, and may have accounted for about 45 t and 60 t in Stewart and Chatham respectively in the past. The use of blue moki as bait has not been considered in the determination of MCY.

2. BIOLOGY

Blue moki grow rapidly at first, attaining sexual maturity at 40 cm fork length (FL) at 5–6 years of age. Growth then slows, and fish of 60 cm FL are 10–20 years old. Fish over 80 cm FL and 33 years old have been recorded.

Many adults take part in an annual migration between Kaikoura and East Cape. The migration begins off Kaikoura in late April/May as fish move northwards. Spawning takes place in August/September in the Mahia Peninsula to East Cape region (the only known spawning ground), with the fish then returning south towards Kaikoura. The larval phase for blue moki lasts about 6 months.

Juvenile blue moki are found inshore, usually around rocky reefs, while most adults school offshore over mainly open bottom. Some adults do not join the adult schools but remain around reefs.

Natural mortality is not known precisely but is likely to be between 0.1–0.2 based on the longevity of the species. M was estimated using the equation $M = \log_e 100/\text{maximum age}$, where maximum age is the age to which 1% of the population survives in an unexploited stock. Based on the maximum observed age of 33 years, M equalled 0.14.

Catch sampling in 2004–05 and 2005–06 in MOK 1 found fish up to 44 years old, suggesting that it may be necessary to revisit the assumption about natural mortality.

Biological parameters relevant to the stock assessment are shown in Table 5.

Table 5: Estimates of biological parameters for blue moki.

Fishstock				Estimate	Source
1. Natural mortality (M)					
All areas				0.14	Francis (1981b)
For maximum observed age of 33 yr.					

2. Weight = a(length)^b (Weight in g, length in cm fork length).

	a	Both sexes b			
All areas	0.055	2.713			Francis (1979)

3. von Bertalanffy growth parameters

	L_∞	Both sexes k	t_0		
All areas	66.95	0.208	-0.029		Francis (*pers. comm.*)

3. STOCKS AND AREAS

There are no new data which would alter the stock boundaries given in previous assessment documents.

Blue moki forms one stock around the North Island and the South Island north of Banks Peninsula. No information is available to indicate stock affiliations of blue moki in other areas (southern South Island and Chatham Rise) so these fish are currently divided into three Fishstocks.

4. STOCK ASSESSMENT

There are no new data which would alter the yield estimates given in the 1996 Plenary Report. The yield estimates are based on commercial landings data only and have not changed since the 1992 Plenary Report.

4.1 Estimates of fishery parameters and abundance

Standardized CPUE analyses (using both loglinear indices of none zero catches and negative binomial indices or the proportion of zero catches) were undertaken for blue moki caught in four separate fisheries operating between Banks Peninsula and East Cape: blue moki setnet fishery, blue warehou setnet fishery, tarakihi setnet fishery and tarakihi bottom trawl fishery (Langley and Walker 2004). Setnet CPUE trends, particularly those for the target component, proved to be the most promising

candidates for future monitoring of the fishery. On account of the poor quality of the data collected up to 2002, however, the current trends were not thought to track abundance. The recently implemented setnet data-form requires higher spatial resolution of catch and effort data, thus promising to provide data of sufficient quality to monitor the fishery in the future.

Estimates of total mortality (Z) for MOK 1 were obtained from catch curve analysis of catch sampling data collected during 2004-05 and 2005-06. Samples were taken from both the target setnet fishery and from bycatch from the TAR 2 trawl fishery. Z estimates ranged from 0.13 – 0.23 across both fishing years and fisheries. Assuming a value of natural mortality of 0.10 (based on a maximum age of 44 years), this suggests that recent fishing mortality is likely to be in the range of about 0.03 to 0.13 (across both fishing years and fisheries). These estimates are at or below the current assumed value of natural mortality.

4.2   Biomass estimates
Estimates of current and reference biomass are not available.

4.3   Estimation of Maximum Constant Yield (MCY)
MCY for all Fishstocks combined was estimated using the equation, MCY = cY_{AV} (Method 4). The national catch, and probably effort, over the period 1961–86 varied considerably (annual landings ranged from 450 to 957 t with an average value of 705 t). However, no clear trend in landings over that period is apparent. The value of c was set equal to 0.9 based on the estimate of $M = 0.14$.

$$MCY = 0.9 * 705\ t = 635\ t$$

The level of risk to the stock by harvesting the population at the estimated MCY value cannot be determined.

Yield estimates for blue moki have been made using reported commercial landings data only and therefore apply specifically to the commercial fishery. Blue moki have been caught and used as bait and not reported. Therefore, the MCY estimates are likely to be conservative.

4.3   Estimation of Current Annual Yield (CAY)
No estimate of CAY is available for blue moki stocks.

4.4   Other yield estimates and stock assessment results
None available.

4.5   Other factors
CPUE data from the 1970s for the main northern blue moki stock indicated that the stock had declined to a level low enough to make recruitment failure a real concern. The 1986–87 TAC was set at a level considered low enough to enable some stock rebuilding. An analysis of MOK 1 CPUE data indicates that annual catch rates remained relatively constant between 1989–90 and 1993–94, despite an increase in the total commercial catch during the same period.

Blue moki forms one stock around the North Island and the east coast of the South Island north of Banks Peninsula. As other stock boundaries are unknown, any interdependence is uncertain. If only one stock exists, then blue moki from the southern waters may be moving north and rebuilding the heavily exploited northern population.

5.   STATUS OF THE STOCKS

No estimates of current and reference biomass are available. The current TACCs and recent catch levels are below the estimated MCY, are considered sustainable, and are probably at levels which will allow the stock to move towards a size that will support the MSY. TACs were originally set at low levels to promote stock rebuilding.

Catch curve analysis from recent catch sampling (2004–05 and 2005–06) indicates that total mortality (Z) is low and the fishery is comprised of fish across a broad range of ages across both sexes. This observation supports the conclusion that current catches are sustainable in the short to medium term.

Yields and reported landings are summarised in Table 6.

Table 6: Summary of yields (t), TACCs (t), and reported landings (t) for blue moki for the most recent fishing year.

Fishstock	QMA	MCY	2006–07 Actual TACC	2006–07 Reported landings
MOK 1	Auckland (East) (West), Central (East) (West), Challenger 1, 2, 7, 8 & 9	–	403	402
MOK 3	South East (Coast) 3	–	127	90
MOK 4	South East (Chatham) 4	–	25	0
MOK 5	Southland, Sub-Antarctic 5 & 6	–	44	11
MOK 10	Kermadec 10	–	10	0
Total		635	608	504

6.   FOR FURTHER INFORMATION

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