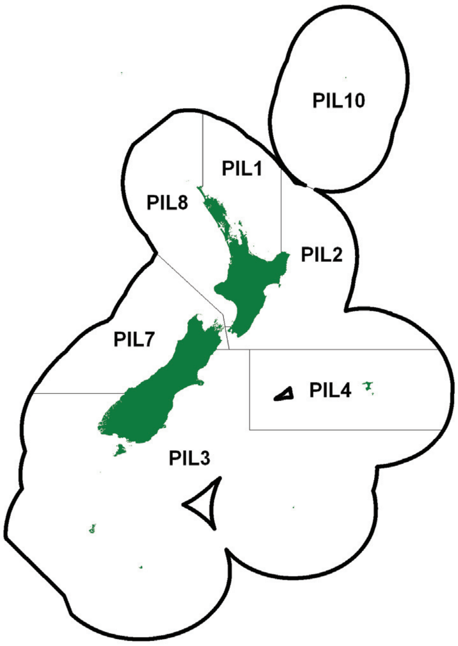
PILCHARD (PIL)

(*Sardinops sagax*)
Mohimohi



1. FISHERY SUMMARY

Pilchards were introduced into the QMS in October 2002 with allowances, TACCs and TACs as shown in Table 1.

Table 1: Recreational and Customary non-commercial allowances, TACCs and TACs by Fishstock.

Fishstock	Recreational Allowance	Customary Non-commercial Allowance	TACC	TAC
PIL 1	20	10	2 000	2 030
PIL 2	10	5	200	215
PIL 3	5	2	60	67
PIL 4	3	2	10	15
PIL 7	10	5	150	165
PIL 8	10	5	65	80
PIL 10	0	0	0	0

1.1 Commercial fisheries

Pilchards occur around most of New Zealand, however, commercial fisheries have only developed in north-eastern waters (east Northland to Bay of Plenty), and in Tasman Bay and Marlborough Sounds at the north of the South Island.

The first recorded commercial landings of pilchards were in 1931 (Table 2), but a minor fishery existed before this. Informal sales, mainly as bait, or as food for zoos and public aquariums, were unreported. A fishery for pilchard developed in the Marlborough Sounds in 1939 and operated through the war years providing canned fish for the armed forces. Landings reached over 400 t in 1942, but the fishery was unsuccessful for a variety of reasons and ceased in 1950. Between 1950 and 1990 landings were generally less than 20 t, intermittently reaching 70–80 t.

From 1990–91 the northeastern fishery was developed by vessels using both lampara nets and purse seines (Table 3). Lampara netting was the main method in the first couple of years, and continued at a low level through the 1990s. From 1993–94 onwards, purse seining became the dominant method. A diminishing catch (less than 10 t annually) was caught by beach seine. Almost all the pilchard catch (particularly in the northeastern fishery) is targeted. A small catch (less than 10 t annually), has been recorded as a bycatch of jack mackerel. Total annual landings increased steadily from1990 as the fishery developed in northeastern waters, reaching over 1200 t in 1999–00, and almost 1500 t in 2000–01. Since that time landings have fluctuated between 670 t (2008-09) and 1 320 t (2003–04), generally directly linked to the amount of targeted effort in PIL 1. Landings in PIL 8 have fluctuated between 34 t and 153 t since this stock was introduced to the QMS, exceeding the TACC (65 t) in four of the last six years. The recent increase in catches in PIL 8 since 1999-2000 is thought to be in part the result of previously unreported catches now being reported due to the species being introduced to the QMS. Figure 1 depicts the historical landings and TACC values for the main PIL stocks.

Table 2: Reported total New Zealand landings (t) of pilchard from 1931 to 1990.

Year	Landings	Year	Landings	Year	Landings	Year	Landings	Year	Landing	Year	Landing
1931	5	1941	168	1951	0	1961	17	1971	1	1981	17
1932	4	1942	418	1952	9	1962	2	1972	8	1982	32
1933	2	1943	219	1953	0	1963	0	1973	70	1983	–
1934	0	1944	218	1954	0	1964	1	1974	19	1984	–
1935	0	1945	74	1955	0	1965	3	1975	2	1975	49
1936	0	1946	61	1956	4	1966	3	1976	6	1986	29
1937	0	1947	5	1957	2	1967	9	1977	20	1987	70
1938	0	1948	46	1958	8	1968	10	1978	6	1988	6
1939	10	1949	11	1959	7	1969	15	1979	4	1989	1
1940	93	1950	0	1960	8	1970	83	1980	41	1990	2

Source: Annual reports on fisheries and subsequent MAF data.

A 2000 t annual Commercial Catch Limit (CCL) was introduced for FMA 1 from 01 October 2000. The CCL was subject to a logbook programme, a catch spreading arrangement and the avoidance of areas of particular importance to non-commercial fishers. The CCL was superseded when the PIL 1 stock was introduced to the QMS with a TACC of 2000 t on 1st October 2002.

Table 3: Reported landings (t) of pilchard by Fishstock from 1990–91 to 2008–09.

Fishstock	PIL 1	PIL 2	PIL 3	PIL 7	PIL 8	PIL 10	Total
1990–91	15	0	0	9	< 1	0	25
1991–92	59	0	0	< 1	0	0	59
1992–93	163	2	0	0	0	0	164
1993–94	258	0	0	0	1	0	259
1994–95	317	0	0	< 1	< 1	0	317
1995–96	168	< 1	0	2	0	0	170
1996–97	419	0	0	2	< 1	0	421
1997–98	440	0	0	1	0	0	447
1998–99	785	0	< 1	2	1	0	788
1999–00	1 227	0	0	4	< 1	0	1 231
2000–01	1 290	0	0	12	188	0	1 491
2001–02	574	0	0	93	129	0	796
2002–03	792	0	0	8	153	0	953
2003–04	1 284	0	< 1	1	34	0	1 320
2004–05	853	0	< 1	< 1	106	0	959
2005–06	892	< 1	< 1	2	116	0	1 010
2006–07	808	0	0	11	45	0	864
2007–08	635	0	0	10	71	0	716
2008–09	644	< 1	0	3	23	0	670

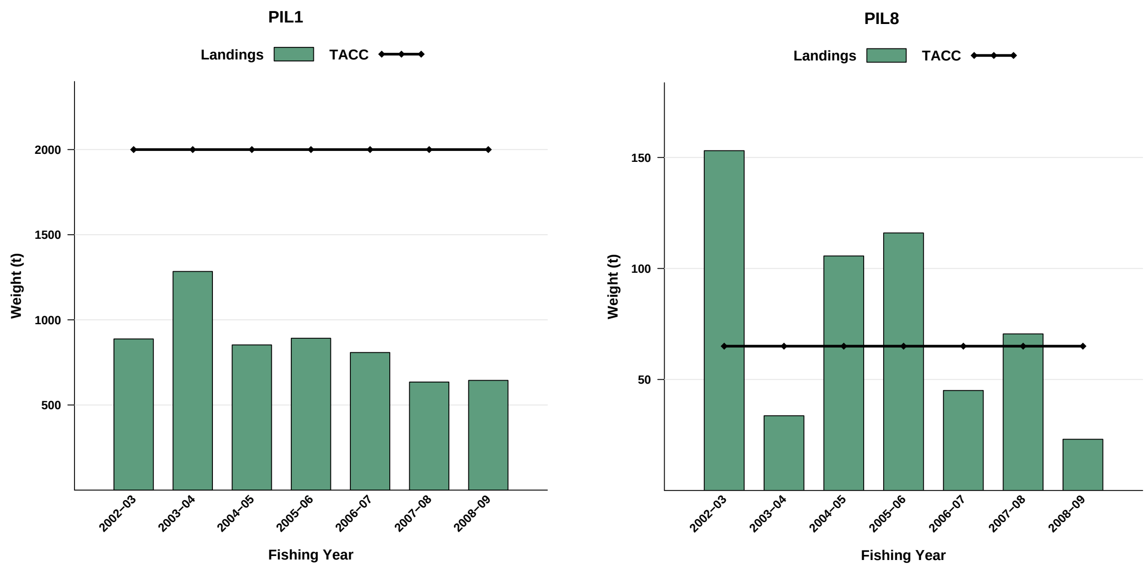


Figure 1: Historical landings and TACC for the two main PIL stocks. Left to right: PIL1 (Auckland East), and PIL8 (Central Egmont, Auckland West). Note that these figures do not show data prior to entry into the QMS.

1.2 Recreational fisheries
Recreational fishers seldom target pilchards, except perhaps for bait. Bait is generally bought in commercially frozen packs (the main product of the commercial fishery). Pilchard may be caught accidentally in small mesh nets that are set or dragged to catch mullet, or on small hooks fished from wharves. They are rarely reported as a catch in recreational fishing activities. An estimate of the recreational harvest is not available.

1.3 Customary non-commercial catch
Pilchards were known by the early Maori as mohimohi, and could have been taken in fine mesh nets, but there are very few accounts of pilchard capture and use. An estimate of the current customary non-commercial catch is not available.

1.4 Illegal catch
There is no known illegal catch of pilchards.

1.5 Other sources of mortality
Some accidental captures by vessels purse seining for jack mackerel or kahawai may be discarded if no market is available. Pilchard mortality is known to be high in some places as a result of scale loss resulting from net contact.

2. BIOLOGY

The taxonomy of *Sardinops* is complex. The New Zealand pilchard was previously identified as *Sardinops neopilchardus*, but there is now considered to be a single species, *S. sagax*, with several regional subspecies or populations.

Pilchard are generally found inshore, particularly in gulfs, bays, and harbours. They display seasonal changes in abundance (e.g. locally abundant in Wellington Harbour during spring), reflecting schooling and dispersal behaviour, localised movement, and actual changes in population size. The geographical extent of their movements in New Zealand is unknown.

Their vertical distribution in the water column varies, but on the inner shelf they move between the surface and the seafloor. Pilchards form compact schools (know as ‘meatballs’), particularly during summer, and these are heavily preyed upon by larger fishes, seabirds, and marine mammals and are thought to form an important part of the diet for many species. There have been no biological studies that are directly relevant to the recognition of separate stocks.

Spawning is recorded from many coastal regions over the shelf during spring and summer. The pelagic eggs are at times extremely abundant.

Otolith readings suggest pilchard are relatively fast growing and short-lived. They reach a maximum length of about 25 cm, and perhaps 9 years, but the main size range is of 10–20 cm fish, 2 to 6 years old. Maturity is probably at age 2.

A study on the feeding of Northland pilchards found that phytoplankton was probably the dominant food, but organic detritus was also important, and small zooplankton – mainly copepods – were taken and at times were the main component. Feeding by females diminished during the spawning season.

Although they generally comprise single-species schools, pilchards associate with other small pelagic fishes, particularly anchovy. In northern waters they also occur with juvenile jack mackerel, and in southern waters with sprats.

During the 1990s pilchard populations were severely impacted by natural mass mortalities, generally attributed to a herpes virus. The first outbreak occurred in Australia and New Zealand in 1995 and Australia experienced another outbreak in 1998.

Biological parameters relevant to stock assessment are shown in Table 4.

Table 4: Estimates of biological parameters.

'Fishstock'	Estimate		Source
1. Natural mortality (*M*)			
PIL 1	*M* = 0.66		NIWA, unpublished estimate[1]
PIL 1	*M* = 0.46		NIWA, unpublished estimate[2]
2. Weight = a (length)^b			
	Both sexes combined		
PIL 1	a = 2.2	b = 3.3	Paul *et al.* (2001)[3]
PIL 7	a = 3.7	b = 3.3	Baker (1972)[4]

Notes:
1. Hoenig's rule-of-thumb estimate, maximum age = 7 years.
2. Hoenig's rule-of-thumb estimate, maximum age = 10 years.
3. Fork length in mm, weight in g, n = 493.
4. Standard length in mm, weight in g, n = 660.

3. STOCKS AND AREAS

No biological information is available on which to make an assessment on whether separate pilchard biological stocks exist in New Zealand (in Australia there is evidence of small differences between some populations off the southwest coast).

Pilchard and anchovy are often caught together. Pilchard Fishstock boundaries are fully aligned with those for anchovy.

4. STOCK ASSESSMENT

There have been no stock assessments of New Zealand pilchard.

4.1 Estimates of fishery parameters and abundance
No fishery parameters are available.

4.2 Biomass estimates
No estimates of biomass are available.

4.3 Estimation of Maximum Constant Yield (MCY)

(i) Northeast North Island (PIL 1)

MCY has been estimated using the equation MCY = cY_{AV} (Method 4). The most appropriate Y_{AV} was considered the average of landings for the three years 1998–99 to 2000–01. Although a brief period, three years represents at least half the exploited life span for this species. The mean of these landings is 1101 t. With provisional values of *M* about 0.4 or 0.6, the value of c becomes 0.6 (i.e. high natural variability).

1998–99 to 2000–01 MCY = 0.6 * 1101 t = 661 t (rounded to 660 t)

However, the MCY approach is considered to be of limited value for pilchards, because this fishery has been developing rapidly, was historically infrequently targeted, and since 2000 has been subject to a CCL and more recently a TACC. The level of risk to the stock by harvesting the northeast North Island population at the estimated MCY value cannot be determined.

(ii) Tasman Bay/Marlborough Sounds (PIL 7)

MCY cannot be estimated for this region because the fishery has been largely unexploited since the 1940s, and no appropriate biological parameters exist.

(iii) Other regions

MCY cannot be estimated because of insufficient information, and absence of fisheries.

4.4 Estimation of Current Annual Yield (CAY)

Current biomass cannot be estimated, so CAY cannot be determined.

4.5 Other yield estimates and stock assessment results

No information is available.

4.6 Other factors

It is likely that pilchard, although not strongly migratory, will vary considerably in their regional abundance over time. The larger vessels in the fleet that targets them are capable of travelling moderate distances to the best grounds. Thus, while the resource may have a relatively localised distribution, the catching sector of the fishery does not. Should the pilchard fishery continue to develop, it is likely to become one component of a set of fisheries for small pelagic species (anchovy, sprats, and small jack mackerels). Mixed catches will be inevitable.

Pilchard is abundant in some New Zealand regions. However, it is unlikely that the biomass is comparable to the very large stocks of pilchard (sardine) in some world oceans where strong upwelling promotes high productivity. It is more likely that the New Zealand pilchard comprises abundant but localised coastal populations, comparable to those of southern Australia. They appear to be adaptable feeders, able to utilise food items from organic detritus through phytoplankton to zooplankton. East Northland is a region where under neutral to El Niño conditions moderately productive upwelling predominates, but in La Niña years downwelling and oceanic water incursion will limit recruitment and may affect adult condition and survival.

In those regions of the world where small pelagic fishes are particularly abundant and have been well studied, there is often a reciprocal relationship between the stock size of pilchard and anchovy, as well as great variability in their overall abundance. Many pilchard/anchovy fisheries have undergone boom-and-bust cycles.

In both Australia and New Zealand, pilchard have been affected by mass mortality events, the two in Australia are estimated to have each killed over 70% of the adult fish. The mortality rate of the 1995 event in New Zealand is not known, but was high. In combination, these features of the pilchard's biology suggest that the yield from the New Zealand stock will be variable, both short-term (annual) and long-term (decadal).

5. STATUS OF THE STOCKS

No estimates of current biomass are available. Recent catches from northeast North Island, and the TACC for PIL 1 are higher than the 660 t MCY estimate (apart from the 2001–02 landings of 498 t). However the MCY estimate is considered unreliable. It is not known if the current catches or TACCs are sustainable.

Yield estimates, TACCs and reported landings by Fishstock are summarised in Table 5.

Table 5: Summary of yield estimates (t), TACCs (t), and reported landings (t) of pilchards for the most recent fishing year.

Fishstock		FMA	MCY Estimates	2008–09 Actual TACC	2008–09 Reported landings
PIL 1	Auckland (East)	1	660	2 000	644
PIL 2	Central (East)	2	–	200	< 1
PIL 3	South-east (Coast)/Southland & Sub-Antarctic	3, 5 & 6	–	60	0
PIL 4	South-east (Chatham)	4	–	10	0
PIL 7	Challenger	7	–	150	3
PIL 8	Central (West)/Auckland (West)	8, 9	–	65	23
PIL 10	Kermadec	10	–	0	0
Total				2 485	670

6. FOR FURTHER INFORMATION

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