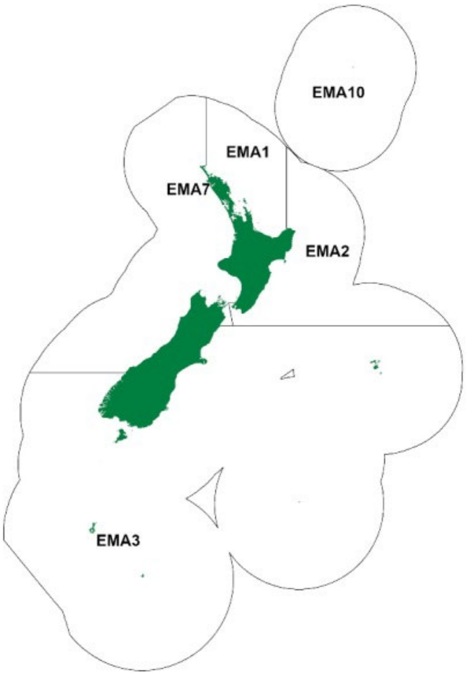
BLUE MACKEREL (EMA)

(*Scomber australasicus*)
Tawatawa



1. FISHERY SUMMARY

Blue mackerel were introduced into the QMS on 1 October 2002. Since then allowances, TACCs, and TACs (Table 1) have not changed.

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

Fishstock	Recreational allowance	Customary non-commercial allowance	TACC	TAC
EMA 1	40	20	7 630	7 690
EMA 2	5	2	180	187
EMA 3	1	1	390	392
EMA 7	1	1	3 350	3 352
EMA 10	0	0	0	0
Total	47	24	11 550	11 621

1.1 Commercial fisheries

Blue mackerel are taken by a variety of methods but for most of these methods the catches are very low. The largest and most consistent catches have been from the target purse seine fishery in EMA 1, 2, and 7, and as both target and non-target catch in the midwater trawl fishery in EMA 7, which primarily targets jack mackerel. Most catch is taken north of latitude 43° S (Kaikōura). Historical estimated and recent reported blue mackerel landings and TACCs are shown in Tables 2 and 3, and Figure 1 shows the historical landings and TACC values for these three main stocks. Since 1983–84 the catch of blue mackerel in New Zealand waters has grown substantially (Table 3), primarily in the purse seine fishery in EMA 1, and catches have averaged about 10 000 t annually since 1990–91.

Most blue mackerel purse seine catch comes from the Bay of Plenty (BoP) and East Northland, where it is primarily taken between July and December. Purse seine fishing effort on blue mackerel has been strongly influenced by the availability and market value of other pelagic species, particularly skipjack tuna and kahawai, with effort increasing as limits have been placed on the purse seine catch of kahawai. The purse seine fishery has accounted for more than 97% of annual EMA 1 landings since at least 1990, and about 90% of this was targeted (Ballara 2016).

Total blue mackerel landings peaked in 1991–92 at more than 15 000 t, of which 60–70% was taken by purse seine. EMA 1 landings exceeded the TACC in 2004–05, 2006–07, 2009–10, 2011–12, 2014–15, 2017–18, 2018–19, 2020–21, and 2021–22. EMA 7 landings fluctuated around the TACC from 2001–02 to 2009–10 but were substantially lower from 2010–11 to 2016–17. However, in 2017–18 EMA 7 landings increased to near the TACC and have remained at a similar level with the TACC exceeded in 2021–22 for the first time since the late 2000s. Landings from EMA 2 and 3 have been below the TACCs since the early to mid-1990s; they are mainly bycatch from purse seine vessels (EMA 2) and trawlers (EMA 3).

Table 2: Reported landings (t) for the main QMAs from 1931 to 1982.

Year	EMA 1	EMA 2	EMA 3	EMA 7	Year	EMA 1	EMA 2	EMA 3	EMA 7
1931–32	0	0	0	0	1957	0	0	0	0
1932–33	0	0	0	0	1958	0	0	0	0
1933–34	0	0	0	0	1959	0	0	0	0
1934–35	0	0	0	0	1960	0	0	0	0
1935–36	0	0	0	0	1961	0	0	0	0
1936–37	0	0	0	0	1962	0	0	0	0
1937–38	0	0	0	0	1963	0	0	0	0
1938–39	0	0	0	0	1964	0	0	0	0
1939–40	0	0	0	0	1965	0	0	0	0
1940–41	0	0	0	0	1966	0	0	0	0
1941–42	0	0	0	0	1967	0	0	0	0
1942–43	0	0	0	0	1968	0	0	0	0
1943–44	0	0	0	0	1969	0	0	0	0
1944	0	0	0	0	1970	0	0	0	0
1945	0	0	0	0	1971	0	0	0	0
1946	0	0	0	0	1972	0	0	0	0
1947	0	0	0	0	1973	0	0	0	0
1948	0	0	0	0	1974	38	8	0	6
1949	0	0	0	0	1975	10	0	0	2
1950	0	0	0	0	1976	50	49	0	0
1951	0	0	0	0	1977	34	135	0	0
1952	0	0	0	0	1978	14	55	0	128
1953	0	0	0	0	1979	185	31	0	317
1954	0	0	0	0	1980	752	32	0	407
1955	0	0	0	0	1981	459	49	0	1 363
1956	0	0	0	0	1982	305	0	0	791

Notes:
1. The 1931–1943 years are April–March, but from 1944 onwards are calendar years.
2. Data up to 1985 are from fishing returns; data from 1986 to 1990 are from Quota Management Reports.
3. Data for the period 1931 to 1982 are based on reported landings by harbour and are likely to be underestimated as a result of under-reporting and discarding practices. Data include both foreign and domestic landings.

Since 1999–2000, the blue mackerel catch from EMA 7 has been principally taken in the jack mackerel midwater trawl fishery, with the proportion of catch taken when blue mackerel was the target species increasing from the early 2000s. However, targeting of blue mackerel did not occur during the 2013–14 to 2016–17 period when catches were particularly low. Purse seine catches in EMA 7 have been relatively minor in comparison to midwater trawl methods since around 2000 but were larger in 2019–20 and 2021–22. The temporal and spatial distribution of catches in EMA 7 reflects the operation of the jack mackerel fishery. Prior to the mid-2000s the highest catches were taken during June and July in Statistical Areas 034 and 035 off the west coast South Island (WCSI). Since 2004, catches have become less seasonal and have primarily been taken in Statistical Areas 041 and 801 (North Taranaki Bight).

A number of factors have been identified that can influence landing volumes in the blue mackerel fisheries. In the purse seine fishery, blue mackerel has become the second most preferred species because of decreased TACCs on kahawai. Skipjack tuna is the preferred species and blue mackerel will not be targeted once the skipjack season has begun in late-spring, early summer. Thus, early arrival of skipjack can result in reduced volumes of blue mackerel being landed.

Management of company quota is complicated by the relative timing of the fishing season and the fishing year and this, along with the timing of the main market, may influence whether the blue mackerel TACC can all be taken in a particular year. The fishing season usually begins in about July–August, runs through to the end-beginning of subsequent fishing years, and finishes in about November. The main market for blue mackerel purse seine catches takes up to 80% of the catch and requires premium fish to be available from early spring. To meet the demands of this market and to minimise the costs of storing fish from the previous season, fishing companies must carry over some proportion of their quota for a given year until fish become available the following season. If availability is delayed until after October 1, only 10% of the total quota can then be carried over into the new fishing year.

Because blue mackerel is taken principally as bycatch in the jack mackerel target fishery in JMA 7, factors influencing the targeting of jack mackerel also affect blue mackerel landings.

Table 3: Reported landings (t) of blue mackerel by QMA, and where area was unspecified (Unsp.), from 1983–84 to present. CELR data from 1986–87 to 2000–01. MHR data from 2001–02 to present.

Fishing year	EMA 1	EMA 2	EMA 3	EMA 7	EMA 10†	Unsp.	Total
1983–84*	480	259	44	245	0	1	1 028
1984–85*	565	222	18	865	0	73	1 743
1985–86*	618	30	190	408	0	51	1 296
1986–87	1 431	7	424	489	0	49	2 399
1987–88	2 641	168	864	1 896	0	58	5 625
1988–89	1 580	< 1	1 141	1 021	0	469	4 211
1989–90	2 158	76	518	1 492	0	< 1	4 245
1990–91	5 783	94	478	3 004	0	0	9 358
1991–92	10 926	530	65	3 607	0	0	15 128
1992–93	10 684	309	133	1 880	0	0	13 006
1993–94	4 178	218	223	1 402	5	0	6 025
1994–95	6 734	94	154	1 804	10	149	8 944
1995–96	4 170	119	173	1 218	0	1	5 680
1996–97	6 754	78	340	2 537	0	< 1	9 708
1997–98	4 595	122	78	2 310	0	< 1	7 104
1998–99	4 505	186	62	8 756	0	4	13 519
1999–00	3 602	73	3	3 169	0	0	6 847
2000–01	9 738	113	6	3 278	0	< 1	13 134
2001–02	6 368	177	49	5 101	0	0	11 694
2002–03	7 609	115	88	3 563	0	0	11 375
2003–04	6 523	149	1	2 701	0	0	9 373
2004–05	7 920	9	< 1	4 817	0	0	12 746
2005–06	6 713	13	133	3 784	0	0	10 643
2006–07	7 815	133	42	2 698	0	0	10 688
2007–08	5 926	6	122	2 929	0	0	8 982
2008–09	3 147	2	88	3 503	0	0	6 740
2009–10	8 539	3	14	3 260	0	0	11 816
2010–11	6 630	2	9	1 996	0	0	8 638
2011–12	8 080	2	28	2 707	0	0	10 817
2012–13	7 213	3	100	2 401	0	0	9 716
2013–14	6 860	4	29	1 200	0	0	8 092
2014–15	8 134	16	87	892	0	0	9 129
2015–16	7 226	18	27	761	0	0	8 033
2016–17	7 551	83	126	625	0	0	8 385
2017–18	7 988	112	46	3 254	0	0	11 400
2018–19	7 630	12	32	2 626	0	0	10 300
2019–20	7 169	7	13	2 409	0	0	9 597
2020–21	8 002	129	3	2 832	0	0	10 966
2021–22	7 768	67	10	3 766	0	0	11 612
2022–23	7 306	40	4	3 282	0	0	10 631

* FSU data.
† Landings reported from QMA 10 are probably attributable to Statistical Area 010 in the Bay of Plenty (i.e., EMA 1).

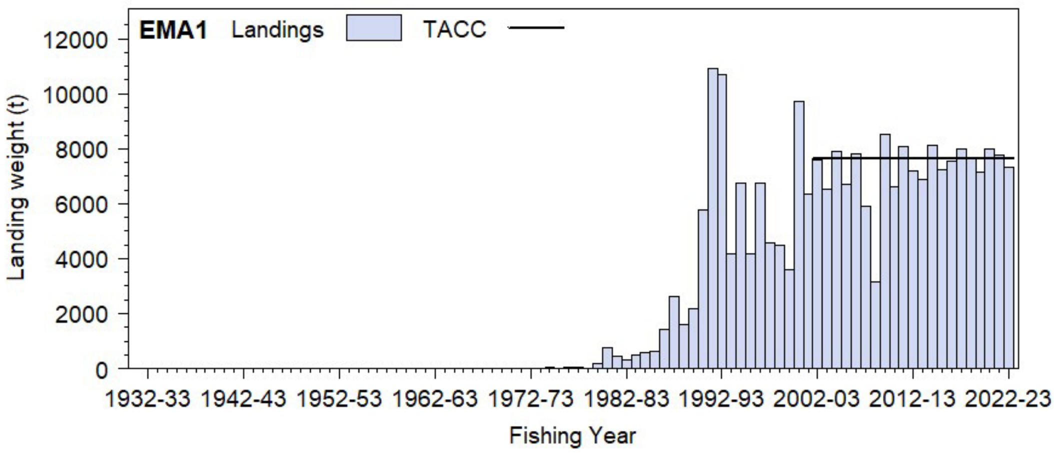
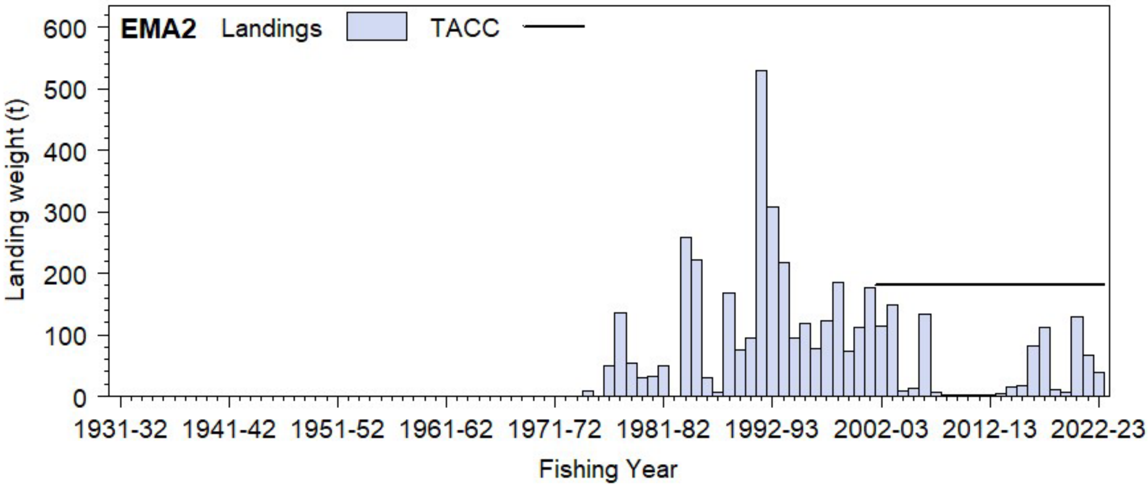


Figure 1: Reported commercial landings and TACC for the three main EMA stocks. EMA 1 (Auckland East). [Continued on next page]



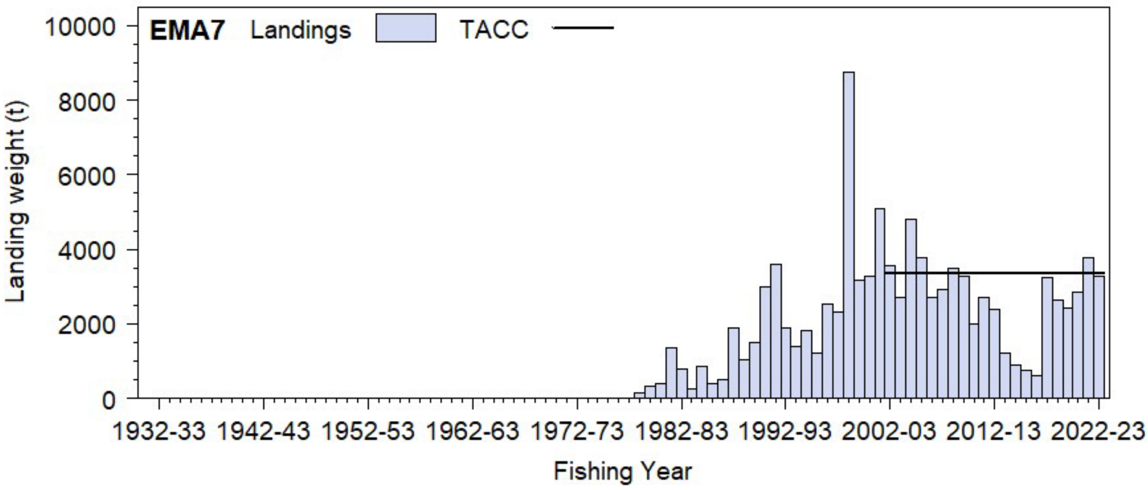


Figure 1 [Continued]: Reported commercial landings and TACC for the three main EMA stocks. From top: EMA 2 (Central East) and EMA 7 (Challenger to Auckland West).

1.2 Recreational fisheries

Blue mackerel does not rate highly as a recreational target species although it is popular as bait. There is some uncertainty with all recreational harvest estimates for blue mackerel and there is some confusion between blue and jack mackerels in the recreational data.

Recreational catch in the northern region (EMA 1) was estimated at 114 000 fish by a diary survey in 1993–94 (Bradford 1996), 47 000 fish in a national recreational survey in 1996 (Bradford 1998), 84 000 fish (CV 42%) in the 2000 survey (Boyd & Reilly 2004), and 58 000 fish (CV 27%) in the 2001 survey (Boyd et al 2004). The surveys suggest a harvest of 35–90 t per year for EMA 1, insignificant in the context of the commercial catch. Estimates from other areas are very low (between 500 and 3000 fish) and are likely to be insignificant in the context of the commercial catch.

The harvest estimates provided by telephone-diary surveys between 1993 and 2001 are no longer considered reliable for various reasons. A Recreational Technical Working Group concluded that these harvest estimates should be used only with the following qualifications: a) they may be very inaccurate; b) the 1996 and earlier surveys contain a methodological error; and c) the 2000 and 2001 estimates are implausibly high for many important fisheries. In response to these problems and the cost and scale challenges associated with onsite methods, 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. The panel members were contacted regularly about their fishing activities and harvest information 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, in prep). Recreational catch estimates from the three national panel surveys are given in Table 4. Note that national panel survey estimates do not include recreational harvest taken on charter vessel trips or under s111 general approvals.

Table 4: Recreational harvest estimates for blue mackerel stocks (Wynne-Jones et al 2014, 2019, Heinemann & Gray, in prep). Mean weights from boat ramp surveys (Hartill & Davey 2015, Davey et al 2019; Davey et al in prep).

Stock	Year	Method	Number of fish	Total weight (t)	CV
EMA 1	2011–12	Panel survey	18 438	19.2	0.36
	2017–18	Panel survey	14 686	16.9	0.51
	2022–23	Panel survey	7 940	9.0	0.48
EMA 2	2011–12	Panel survey	3 346	3.5	0.54
	2017–18	Panel survey	1 209	1.3	0.69
	2022–23	Panel survey	6 333	7.1	0.94
EMA 7	2011–12	Panel survey	11 193	11.6	0.43
	2017–18	Panel survey	4 230	4.4	0.46
	2022–23	Panel survey	1 357	1.5	0.63

1.3 Customary non-commercial fisheries
Quantitative information on the current level of customary non-commercial catch is not available.

1.4 Illegal catch
There is no known illegal catch of blue mackerel.

1.5 Other sources of mortality
There is no information on other sources of mortality.

2. BIOLOGY

The geographical distribution and habitat of blue mackerel vary with life history stage. Juvenile and immature blue mackerel are northerly in their distribution, with records from commercial and research catches around the North Island and into Golden Bay and Tasman Bay at the top of the South Island.

By contrast, adults have been recorded around both the North Island and South Island to Stewart Island and across the Chatham Rise almost to the Chatham Islands. Sporadic catches of small numbers of yearling blue mackerel have been made by bottom trawl in shallow waters.

The distribution of blue mackerel at the surface is seasonal and differs from its known geographical range. During summer, surface schools are found in Northland, BoP, South Taranaki Bight, and Kaikōura, but they disappear during winter, when only occasional individuals are found in Northland and the BoP. A possible corollary to this winter disappearance comes from the peak in bycatch of blue mackerel in the winter jack mackerel midwater trawl fishery in EMA 7. This suggests an increased partitioning of the population in deeper water at this time of the year, reflecting an observed behavioural characteristic of the related Atlantic species, *Scomber scombrus*. Summaries from aerial sightings data show that blue mackerel can be found in mixed schools with jack mackerel (*Trachurus* spp.), kahawai (*Arripis trutta*), skipjack tuna (*Katsuwonus pelamis*), and trevally (*Pseudocaranx dentex*), and that its appearance in mixed schools varies seasonally.

Observer data collected in EMA 7 between 1993 and 2019 suggest that blue mackerel spawn from spring into summer (Nov–Feb) (Kienzle 2022). Observer data indicate that sexual maturity is reached at 33 cm fork length and 4.1 years for females (Table 5) and at a smaller size (about 28 cm) and presumably younger age for males (Kienzle 2022).

Eggs are pelagic and development rate is dependent on temperature. In plankton surveys, blue mackerel eggs have been found from North Cape to East Cape, with highest concentrations from Northland, the Hauraki Gulf, and the western BoP. Eggs have been described throughout the Hauraki Gulf from November to the end of January, at surface temperatures in the range 15–23 °C. Individuals in spent or spawning condition have been taken in a few tows off Tasman Bay and Taranaki in EMA 7 and in the BoP in EMA 1.

Table 5: Proportion of female blue mackerel mature at age from South Taranaki Bight (EMA 7) (Kienzle 2022).

Sex	Age group (y)	Age (y)	Fraction mature
female	1	0.50	0.01
female	2	1.50	0.03
female	3	2.50	0.10
female	4	3.50	0.29
female	5	4.50	0.61
female	6	5.50	0.86
female	7	6.50	0.96
female	8	7.50	0.99
female	9	8.50	1.00

Age and growth studies suggest a difference in the age structures of catches taken in the BoP (New Zealand, EMA 1) and New South Wales (Australia). For fish from the New South Wales study (Stewart & Ferrell 2001), a peak was found at 1 year that accounted for more than 55% of the fish sampled, with a maximum age of 7 years. The BoP results show a much broader distribution, with a maximum age of 24 years, and a mode in the data at around 8 to 10 years. Growth parameters estimated in the BoP study are given in Table 6. Following a quantitative test of competing growth models in the BoP study, no evidence was found of statistically significant differences in growth between the sexes in BoP blue mackerel.

Table 6: von Bertalanffy growth parameters for Bay of Plenty (EMA 1) blue mackerel (Manning et al 2006).

	Males	Females	Both sexes
L_∞	52.49	53.10	52.79
K	0.15	0.15	0.15
t_0	-3.29	-3.18	-3.19
Age range	1.8–21.9	1.8–21.9	1.8–21.9
N	240	269	509

Australian studies may underestimate the ages of larger, older blue mackerel in their catch. The Australian method for estimating blue mackerel ages is based on reading otoliths whole in oil, whereas the New Zealand method is based on otolith thin-sections (Marriott & Manning 2011). Results from the New South Wales study referred to above, suggest that blue mackerel 25–40 cm fork length may be 3–7 years old. Using the New Zealand method, fish in this length range could be as old as 16 years. Australian scientists, reading whole otoliths, may be missing opaque zones near the margin, which are visible in sectioned otoliths.

Although Australian scientists have validated the timing of the first opaque zone in blue mackerel otoliths, their results do not cover the complete life history defined using either the Australian or New Zealand method. A study attempting to validate the New Zealand age estimation method using lead-radium dating indicated that blue mackerel in New Zealand are a relatively long-lived, small pelagic species, living to at least 17 to 49 years, with the real age most likely nearer the lower value (Marriott et al 2010). Although this range of age estimates is less than desirable for the validation of the growth zone counting method for this species, the findings are consistent with the New Zealand method where otolith ageing studies from commercial catches describe blue mackerel living to at least 24 years.

Instantaneous natural mortality (*M*) for male and female fish was estimated using Hoenig's method (Morrison et al 2001). Based on age estimates from otoliths collected during the mid-1980s, when fishing pressure was presumably light, natural mortality estimates of 0.22 yr^{-1} for males and 0.20 yr^{-1} for females were derived.

In New Zealand, the diet of blue mackerel has been described as zooplankton, which consists mainly of copepods, but also includes larval crustaceans and molluscs, fish eggs, and fish larvae. Feeding involves both filtering of the water and active pursuit of prey, with blue mackerel able to take much smaller animals than, for example, kahawai can.

3. STOCKS AND AREAS

Sampling of eggs, larvae, and spawning blue mackerel indicate at least three spawning centres for this species: Northland-Hauraki Gulf; western BoP; and south Taranaki Bight. Nothing is known of migratory patterns or the fidelity of fish to a particular spawning area. Examination of mitochondrial DNA shows no geographical structuring between New Zealand and Australian fish. Meristic characters show significant regional differentiation within New Zealand fisheries waters and, combined with parasite marker information, Smith et al (2005) sub-divided blue mackerel into at least three stocks in New Zealand fisheries waters: EMA 1, EMA 2, and EMA 7. No information is currently available on the stock affinity of fish in EMA 3.

4. STOCK ASSESSMENT

4.1 EMA 1

4.1.1 Estimates of fishery parameters and abundance

Analysis of aerial sightings data for east Northland (part of EMA 1) from 1985–86 to 2002–03 found no apparent trends in abundance, apart from a peak off east Northland in 1991–92 for both the number of schools and the estimated tonnage, and a further strong signal for the number of schools and the estimated tonnage from 2000–01 to 2002–03.

Using market and catch sampling data collected from 2002 to 2005, estimated numbers-at-length and numbers-at-age were calculated based on all available groomed length and length-at-age data (Manning et al 2007). These were done separately by sex and scaled to estimates of the total catch from the purse seine fishery. Results showed that the EMA 1 purse seine fishery was composed of fish between 2 and 21 years of age, although most were between 5 and 15 years.

The EMA 1 is primarily a purse seine fishery and, as such, CPUE is not considered as an abundance index.

4.2. EMA 7

Standardised CPUE analyses have provided indices of abundance for blue mackerel in EMA 7 since 2010 (Fu & Taylor 2011), with periodic updates to 2017–18 (Kienzle 2022). A fully quantitative stock assessment attempted in 2020 was rejected by the Working Group (Kienzle 2022). The most recent standardised CPUE analysis (up to the 2021–22 fishing year) was accepted by the Working Group, and is described below.

4.2.1 Estimates of fishery parameters and abundance

Previous CPUE analyses modelled the catch of blue mackerel in jack mackerel target fishing, using estimated catches of EMA and a positive catch standardisation only. A core fleet of vessels with at least three trips in the fishery for a minimum of five years was selected. Data were included from the west coast of the South Island, Taranaki Bight, and west coast of the North Island. Separate analyses were undertaken for 1990 to 1998 and 1997 onwards, presumably due to the significant change in the JMA 7 fleet which saw a transition from vessels using bottom trawls to the current fleet that uses midwater trawls.

In 2023, an updated CPUE analysis was completed using data to the 2021–22 fishing year. The series was based on tow by tow (TCEPR and ERS) records of midwater effort targeting either jack or blue mackerels during 1991–92. Estimated catches were scaled to landings on a trip by trip basis. A binomial model was fitted for the occurrence of blue mackerel catch and combined with a model for the magnitude of positive catches to provide the final indices.

A secondary index was calculated based on observer data from the midwater trawl fishery; data selection was similar to the index based on statutory data, but the core fleet selection criteria were reduced to require only one observed trip in a minimum of five years. Nevertheless, because observer coverage of this fishery was lower before the mid-2000s, this index could only be estimated from 2000–01 onwards.

The CPUE series using fisher-reported (EMA7 MW MACK event) and observer (EMA7 MW MACK observer) catch and effort data from the midwater trawl fisheries in EMA 7 show similar trends from the late 2000s; there are larger differences in the early 2000s, a period with lower levels of observer coverage (Figure 2). The main (EMA7 MW MACK event) series suggests higher abundance in the period prior to 2002, dropping substantially between 2001–02 and 2002–03. The observer data series also shows a substantial decrease, but over a longer period and with a slightly later timing (Figure 2).

The Deepwater Working Group accepted the mackerel target, midwater trawl standardised CPUE series using fisher-reported event data (EMA7 MW MACK event) as an index of abundance for blue mackerel in EMA 7 after introduction to the QMS in 2002, but had concerns about the comparability of the index in the pre-QMS period. Reported levels of catch were inconsistent with a ‘fish down’ period resulting in the substantial drop in the index between 2001–02 and 2002–03.

For the period since 2002, the accepted index suggests reduced abundance in the period from 2012 to 2017, which coincides with the period of reduced catches (Figure 2).

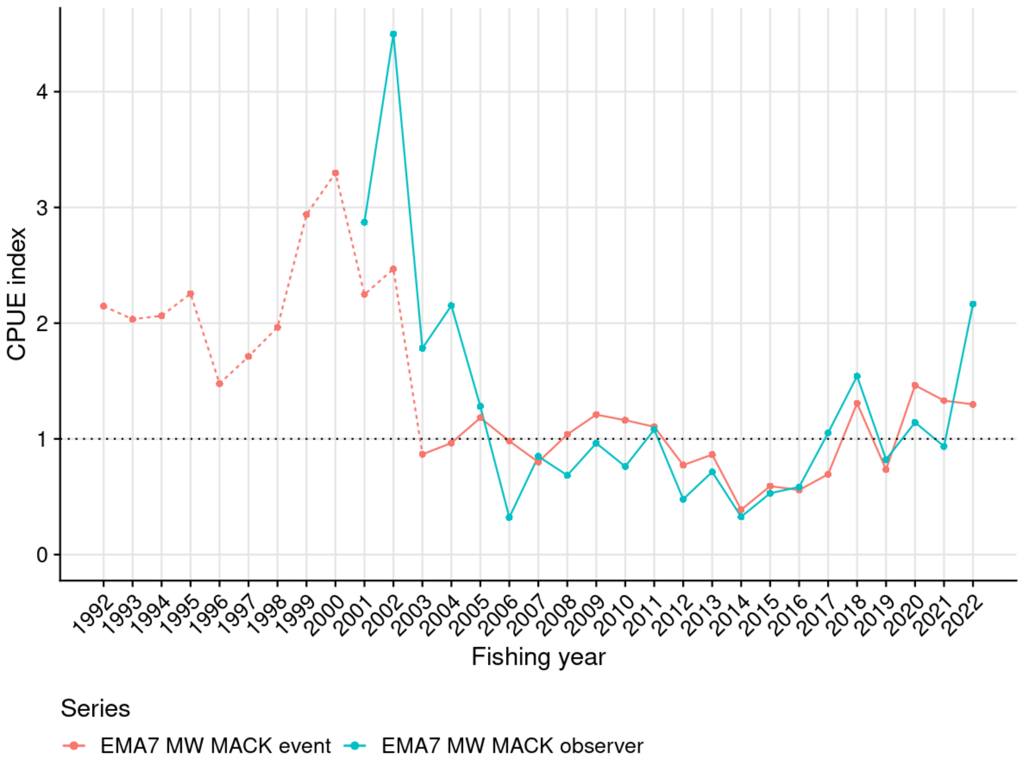


Figure 2: Blue mackerel CPUE during 1992–2022 in EMA 7, using fisher-reported event and observer data (combined binomial/positive indices). Indices have been standardised to have the same geometric mean for the overlapping years. The EMA7 MW MACK event index was accepted as an index of abundance after QMS introduction in 2002 (solid line); the pre-2002 analusis is shown for context (dashed line). Fishing years: 1992 is 1991–92, 1993 is 1992–93, etc.

Establishing B_{MSY}-compatible reference points

In 2022, the Plenary agreed to adopt the period from 2005 to 2010 as a reference period for EMA 7. While discounting the pre-QMS CPUE as comparable with the post-QMS index, the Working Group considered that the potential that abundance was higher in this period provided useful context for the selection of the reference period as a proxy for B_{MSY} (assumed to be 35% B_0 as a medium-productivity species). Catches and abundance were relatively stable over the period 2003 to 2010, but the Working Group proposed, and Plenary agreed, to start the reference period in 2005 to mitigate any impacts associated with the introduction of the TACC from 2002. The soft limit (20% B_0) was set at 4/7 of the mean value for each period and the hard limit (10% B_0) was set at 2/7 of the mean value by period.

Catch-at-age

Biological samples of blue mackerel were most recently collected by observers on board trawlers targeting jack mackerel to estimate an age-length key for 2017–18 (Horn & Ó Maolagáin 2019). This age-length key, and other annual keys estimated in previous years were applied to length frequency distributions to provide estimated age compositions for 2003–04 to 2005–06, 2013–14, and 2017–18 (Horn & Ó Maolagáin 2019). Blue mackerel had ages of between 1 and 25 years. The catch-at-age distributions showed no clear cohort progression and were not consistent from year to year, with 2017–18 being considerably different from earlier years (Figure 3).

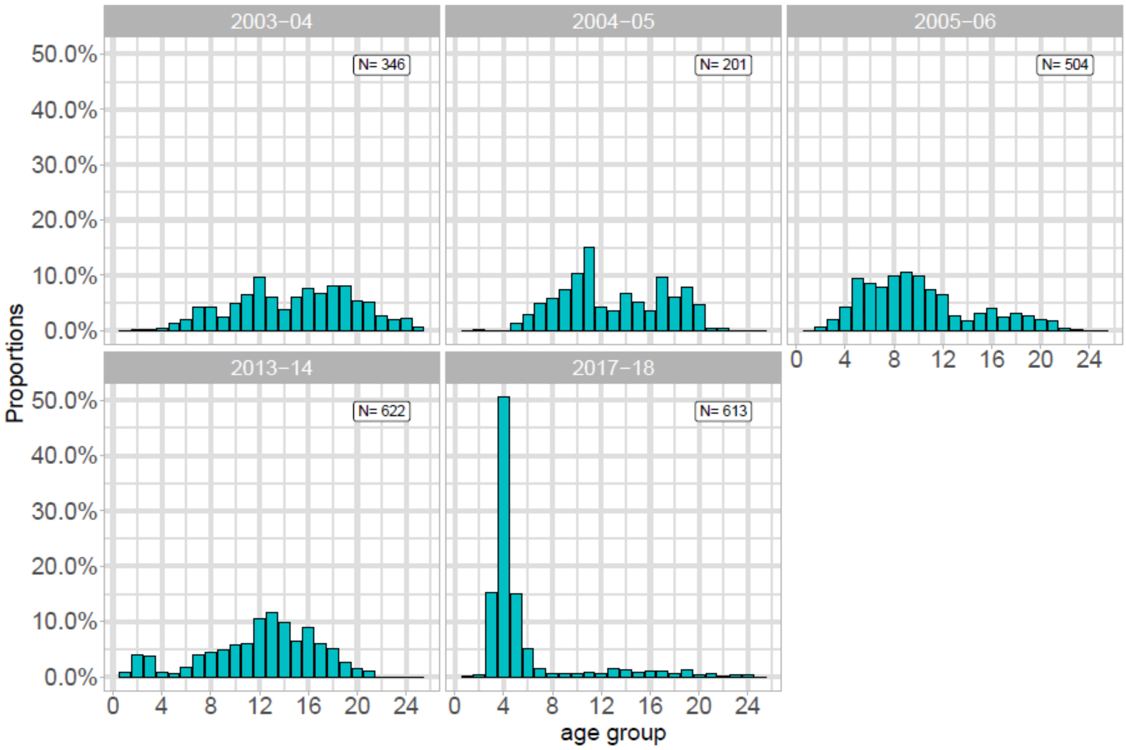


Figure 3: Blue mackerel scaled catch-at-age distributions. The number of age measurements (N) for each year is given in the top right-hand corner of each panel.

Future Research Considerations

- Explore CPUE series starting in the 2002–03 fishing year in future analyses, given concerns over the impact of entry into the QMS on data reporting.
- Further explore the CPUE index based on observer data.
- Consider starting the model in 2002–03, if a fully quantitative stock assessment for EMA 7 is attempted in future.
- Undertake comprehensive analysis of the length and age data to determine sampling representativeness and the spatial and temporal patterns in length and age composition. This might include determining the appropriate sample size for annual otolith collection from the fishery.

- Investigate environmental drivers of distribution for EMA, and how these might influence availability to the JMA fishery. Dunn (2022) identified latitudinal shifts potentially related to temperature that should be explored further. There may be merit in conducting an analysis for JMAs and EMA at the same time.

4.3 Biomass estimates

No estimates of biomass are available for any blue mackerel stocks.

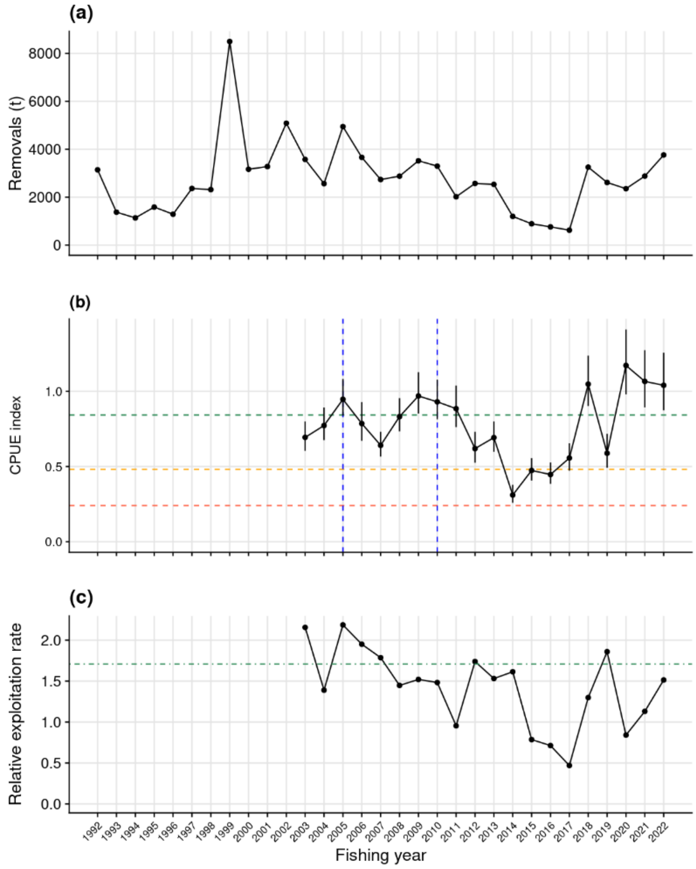
5. STATUS OF THE STOCKS

Based on studies of stock structure within New Zealand waters, blue mackerel may be sub-divided into at least three stocks: EMA 1, EMA 2, and EMA 7. No information is currently available on the stock affinity of fish in EMA 3.

- **EMA 7**

Stock Status		
Most Recent Assessment Plenary Publication Year	2023	
Catch in most recent year of assessment	Year: 2021–22	Catch: 3 766 t
Assessment Runs Presented	Event resolution CPUE index from mackerel target midwater trawls (EMA7 MW MACK event)	
Reference Points	Management Target: 35% B_0; the geometric mean CPUE for the period 2005–2010 (a conceptual proxy for B_{MSY}) Soft Limit: 20% B_0; scaled from management target Hard Limit: 10% B_0; scaled from management target Overfishing threshold: The mean relative exploitation rate in 2005–2010	
Status in relation to Target	Likely (> 60%) to be at or above the target	
Status in relation to Limits	Very Unlikely (< 10%) to be be below both the soft and hard limits	
Status in relation to Overfishing	Overfishing is Unlikely (< 40%) to be occurring	

Historical Stock Status Trajectory and Current Status



(a) Annual removals for EMA 7; (b) the standardised catch per unit effort (CPUE) index with 95% CI, relative to the agreed reference points, for EMA 7 from midwater trawling targeting mackerels; (c) annual relative exploitation rate (catch/CPUE) for blue mackerel in EMA 7. The green, orange, and red dashed lines in (b) represent the interim target, soft limit, and hard limit, respectively. The green dashed line in (c) represents the overfishing threshold.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	CPUE declined from 2010–11 and reached a low point in 2013–14 before increasing in the period to 2017–18. Biomass has fluctuated without trend about the interim target since 2017–18.
Recent Trend in Fishing Intensity or Proxy	Relative exploitation rates have fluctuated, but have generally been below the overfishing threshold since 2007–08.
Other Abundance Indices	A CPUE index calculated using observer data shows similar trends to the main index since the late 2000s.
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	Unknown
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Unknown
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown

Assessment Methodology and Evaluation	
Assessment Type	Level 2 - Partial Quantitative Stock Assessment
Assessment Method	Standardised CPUE from the mackerel target midwater trawl fishery

Assessment Dates	Latest assessment Plenary publication year: 2023	Next assessment: 2026
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Fisher-reported catch, effort and landings data - Observer catch records (used as corroborating index)	1 – High Quality 1 – High Quality
Data not used (rank)	Proportions at age data from the commercial trawl fishery	2 – Medium of Mixed Quality: lack of year-class tracking
Changes to Model Structure and Assumptions	- Combined (binomial/positive catch) model replaced positive catch only model - Use of estimated catches scaled to trip landings rather than raw estimated catches - EMA and JMA target effort included - Series not split in 1998, but new series prior to 2002 not considered comparable to post 2002 series	
Major sources of Uncertainty	- The CPUE index is not considered to be comparable before and after QMS introduction (2002); the reasons for this change in the index are unknown	

Qualifying Comments
Environmental changes may alter the distribution of EMA such that the CPUE index monitors local abundance rather than stock abundance.

Fishery Interactions
There is a small target trawl fishery for blue mackerel off the WCNI but much of the catch is taken as bycatch in the jack mackerel target fishery on the WCSI and WCNI, which has a bycatch of kingfish and snapper. Incidental interactions and associated mortality of common dolphins occur in the jack mackerel fishery but have reduced considerably in recent years (see JMA chapter).

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