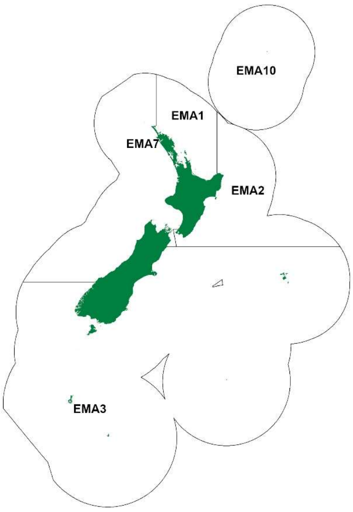
BLUE MACKEREL (EMA)

(*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 non-target catch in the jack mackerel midwater trawl fishery in EMA 7. 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. More recently, commercial landings of over 12 500 t were taken in 2000–01 (13 100 t) and 2004–05 (12 750 t), with the highest landings recorded in EMA 1 and EMA 7 (MacGibbon 2021). EMA 1 landings exceeded the TACC in 2004–05, 2006–07, 2009–10, 2011–12, 2014–15, and 2017–18. The 2004–05, 2005–06, and 2008–09 EMA 7 landings also exceeded the TACC. EMA 7 landings have fluctuated in recent years, with the lowest landings since the mid-1980s recorded in 2016–17 (625 t) and landings increasing to just below the TACC in 2017–18 (3254 t). Landings from EMA 2 and 3 have been below the TACCs since the early to mid-1990s; they are mainly bycatch from purse seines (EMA 2) and trawlers (EMA 3).

The blue mackerel catch from EMA 7 is now principally non-target catch from the jack mackerel midwater trawl fishery. Purse seine catches are relatively minor in comparison to midwater trawl methods and have been declining since around 2000 (MacGibbon 2021). Highest catches are taken during June, July, and October in Statistical Areas 034 and 035 off the west coast South Island (WCSI)and Statistical Areas 041 and 801 further north (west coast North Island, WCNI). Fishing has shifted from south to north in the last decade. Since the late 1990s, a fleet of Ukrainian vessels has taken most of the catch in the JMA 7 target fishery and these vessels have taken the EMA as bycatch. Purse seine accounted for 17% of the EMA 7 catch between 1990 and 2018 (MacGibbon 2021).

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.

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.

Because blue mackerel is taken principally as bycatch in the jack mackerel TCEPR target fishery in JMA 7, factors influencing the targeting of jack mackerel also affect blue mackerel landings. Other bycatch species taken in this fishery include barracouta, gurnard, John dory, kingfish, and snapper, and, although non-availability of ACE is unlikely to be constraining in the first three of these, the same is not true of kingfish and snapper. Fishing company spokespersons have stated that known hotspots of snapper are avoided. Other factors in this fishery include strategies to avoid the catch of marine mammals, and a code of practice operates in which gear is not deployed between 2 a.m. and 4 a.m. It is unknown whether this affects total landing volumes.

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.

	QMA						
Fishing year	**1**	**2**	**3**	**7**	**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

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

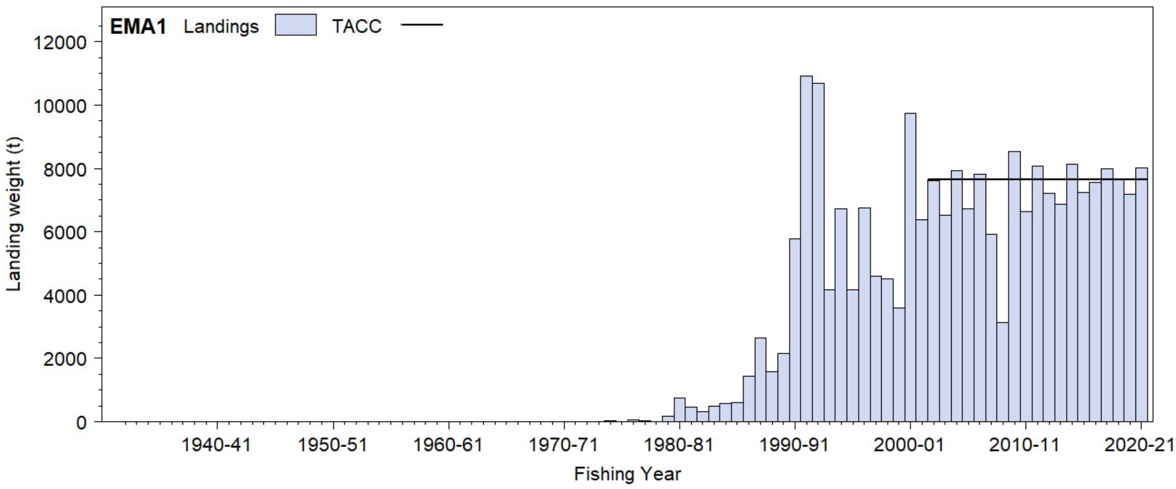


Figure 1: Reported commercial landings and TACC for the three main EMA stocks. EMA 1 (Auckland East).
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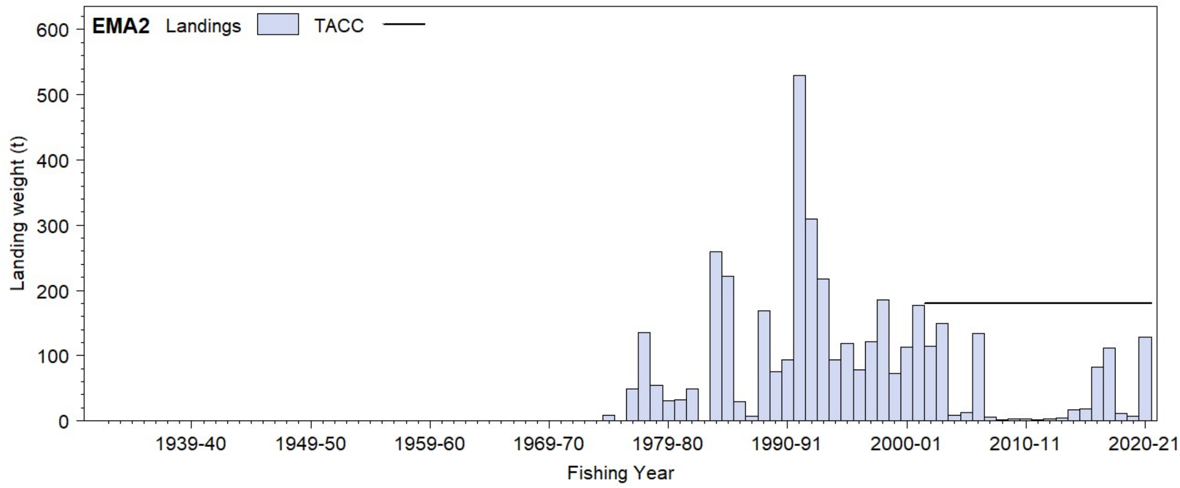


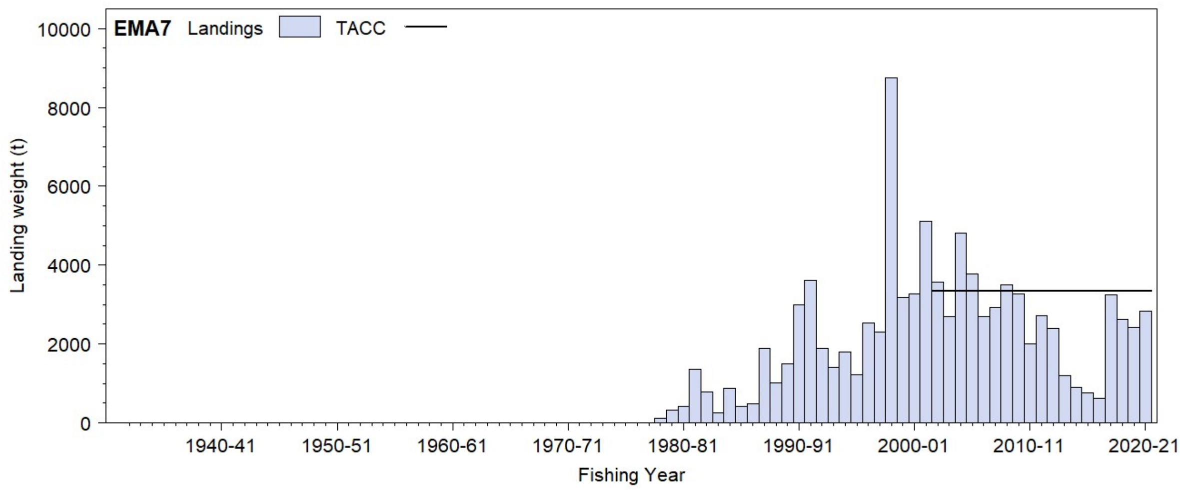


Figure 1: [Continued] Reported commercial landings and TACC for the three main EMA stocks. From top: EMA 2 (Central East) and EMA 7 (Challenger to Auckland West).

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 2002), 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 was collected in standardised phone interviews. The national panel survey was repeated during the 2017–18 fishing year using very similar methods to produce directly comparable results (Wynne-Jones et al 2019).

Recreational catch estimates from the two national panel surveys are given in Table 4. Note that national panel survey estimates do not include recreational harvest taken under s111 general approvals.

Table 4: Recreational harvest estimates for blue mackerel stocks (Wynne-Jones et al 2014, 2019). Mean fish weights were obtained from boat ramp surveys (Hartill & Davey 2015, Davey et al 2019).

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	15 036	17.3	0.50
EMA 2	2011–12	Panel survey	3 346	3.5	–
	2017–18	Panel survey	1 209	1.3	0.69
EMA 7	2011–12	Panel survey	11 194	11.6	0.42
	2017–18	Panel survey	4 375	4.5	0.45

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 in press). 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 in press).

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 in press).

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 et al 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.

4.2. EMA 7

4.2.1 Estimates of fishery parameters and abundance

A standardised CPUE analysis for EMA 7 was carried out using TCEPR tow-by-tow data from the midwater trawl jack mackerel target fishery up to 2017–18 (Ballara 2016, Kienzle in press). The initial dataset comprised tows that targeted jack mackerel with blue mackerel caught as bycatch. Tows that targeted blue mackerel were not considered because they constituted a small amount of catch and effort (about 30 tows each year for the last 10 years by all vessels) and they were confined to a few areas in the fishery and were directed at large sub-surface schools of blue mackerel. Tows that targeted jack mackerel but did not report any blue mackerel catch were also excluded. The data used for the CPUE analyses consisted of catch and effort by core vessels that targeted jack mackerel; core vessels were those participating in the fishery for five or more years, and reporting at least 20 tows per vessel-year. Estimates of relative year effects were obtained using a forward stepwise multiple regression method, where the data were fitted using binomial-lognormal model structure.

Separate standardisations were carried out for two subgroups of core vessels corresponding to an early and late period of the data series, respectively. CPUE indices were developed for the early time series from 1989–90 to 1997–98 using catch and effort by 12 core vessels (Fu & Taylor 2011) and the later time series from 1996–97 to 2017–18 using catch and effort by 7 core vessels (Table 7, Kienzle in press). The residual deviance explained was 33% for the early time series and 22% for the late time series. For both data series, the main terms selected by the models were statistical area, vessel, and month.

The early time series increased from 1990 to 1992 and was then relatively constant to 1998. The late time series showed a 70% decline in abundance from 1996–97 to 2004–05, followed by a period of stable abundance to 2017–18 (Figure 2).

The WG concluded that standardised CPUE series based on the blue mackerel bycatch in the WCNI and WCSI jack mackerel trawl fishery appears to provide a reliable index of abundance.

Table 7: Standardised lognormal CPUE catch/hr indices for the core west coast TCEPR tow-by-tow target JMA data indices for fishing years 1990–2018. The standardised CPUE indices for the early series were estimated for 1990 to 1998 (Fu & Taylor 2011), and a later series from 1997 to 2018 (Kienzle in press).

	u & Taylor (2011)		Kienzle (in press)	
Year	Indices	CV	Indices	CV
1989–90	0.67	0.20	–	–
1990–91	0.87	0.10	–	–
1991–92	1.24	0.11	–	–
1992–93	1.01	0.13	–	–
1993–94	0.99	0.09	–	–
1994–95	1.05	0.07	–	–
1995–96	0.87	0.11	–	–
1996–97	1.34	0.08	2.43	0.09
1997–98	1.13	0.08	2.06	0.07
1998–99	–	–	2.29	0.05
1999–00	–	–	1.99	0.05
2000–01	–	–	1.65	0.05
2001–02	–	–	1.75	0.04
2002–03	–	–	1.18	0.05
2003–04	–	–	0.80	0.04
2004–05	–	–	0.70	0.04
2005–06	–	–	0.91	0.04
2006–07	–	–	0.66	0.04
2007–08	–	–	0.75	0.04
2008–09	–	–	0.92	0.04
2009–10	–	–	0.75	0.04
2010–11	–	–	0.86	0.04
2011–12	–	–	0.63	0.05
2012–13	–	–	0.63	0.05
2013–14	–	–	0.57	0.06
2014–15	–	–	0.68	0.08
2015–16	–	–	0.82	0.08
2016–17	–	–	0.81	0.08
2017–18	–	–	0.84	0.05

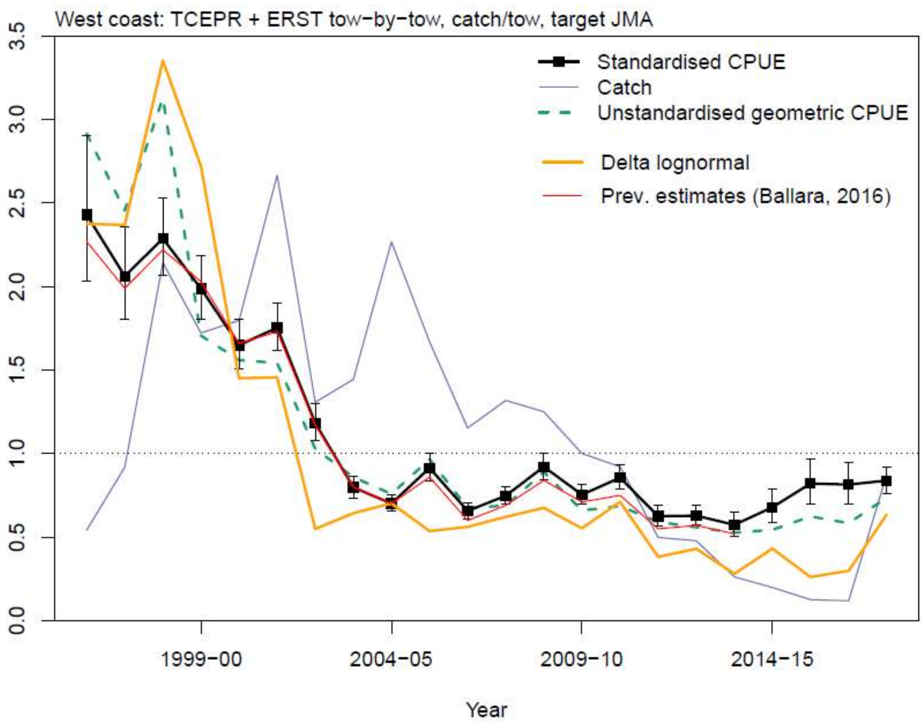


Figure 2: Blue mackerel CPUE for 1997–2018 fishing years for west coast areas WCSI and WCNI combined (EMA 7). Indices have been standardised to have the same geometric mean (Kienzle in press). The standardised CPUE index, accepted as an index of stock abundance by the WG, used only non-zero catch data (lognormal model).

Biological samples of blue mackerel collected by observers on board trawlers targeting jack mackerel were used to estimate an age-length key for 2017–18 (Horn & Ó Maolagáin 2019). This age-length key was 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).

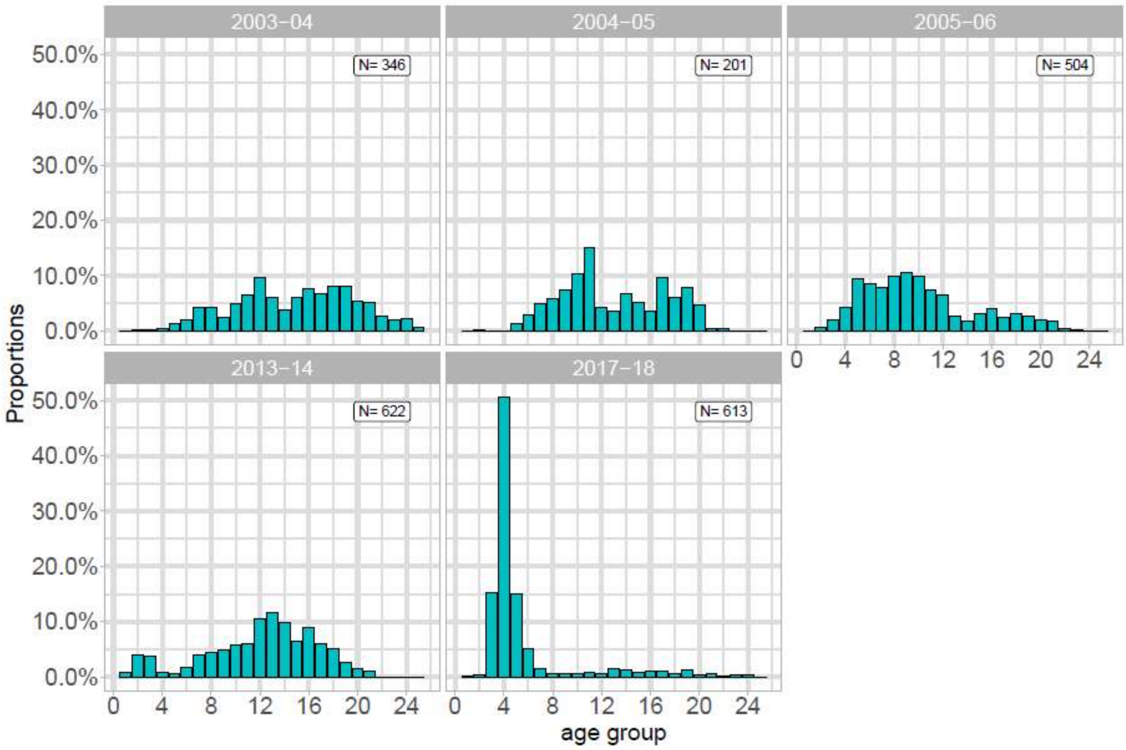


Figure 3: Blue mackerel scaled catch-at-age distributions. The number of age measurements (N) for each year is given in the top right-hand corner of each panel.

A stock assessment attempted in 2020 was rejected by the Working Group (Kienzle in press). This was because (a) there were sufficient concerns about the representativeness of the age data to preclude their usage in an age-structured model, and (b) the proposed model failed to adequately fit the observed data. Options to improve the assessment include:

- A more 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.

- Explore whether a change in selectivity between 2013–14 and 2017–18 might have taken place.

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

4.4 Other factors
Catch sampling in the period from 2002 to 2005 indicated that catch-at-length and catch-at-age is relatively stable between years in EMA 1. Although total mortality in EMA 1 is poorly understood, the relatively stable age-length composition between years and the number of year-classes that compose the catch-at-age within fishing years, suggested that blue mackerel may have been capable of sustaining the catch levels at that time in EMA 1.

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.

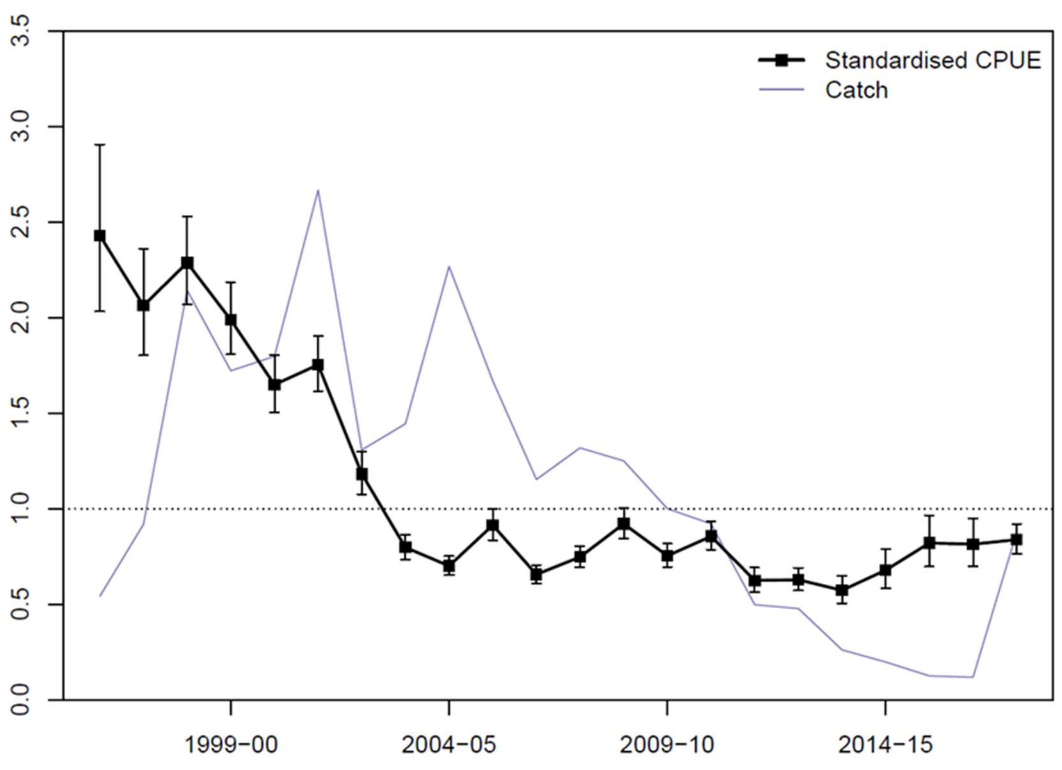
Little is known about the status of blue mackerel stocks and no estimates of current and reference biomass, or yield, are available for any blue mackerel area.

- **EMA 1**

  For EMA 1, the stability of the age composition data and the large number of age classes that comprise the catches suggests that blue mackerel may be capable of sustaining current commercial fishing mortality, at least in the short-term.

- **EMA 7**

Stock Status	
Year of Most Recent Assessment	2020
Assessment Runs Presented	Standardised trawl CPUE
Reference Points	Target: 40% B_0 Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: $F_{40\%B0}$
Status in relation to Target	Unknown
Status in relation to Limits	Unknown
Status in relation to Overfishing	Unknown
Historical Stock Status Trajectory and Current Status	



West coast blue mackerel CPUE: Comparison of indices for the TCEPR tow-by-tow datasets for fishing years 1997 to 2018; CPUE indices from Ballara (2016) and Kienzle (in press). Standardised CPUE was the accepted biomass index. Indices have been standardised to have a mean of one.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	CPUE has shown a modest increase in recent years and remains roughly constant from 2015–16 to 2017–18.
Recent Trend in Fishing Intensity or Proxy	
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	Broad age structure of the trawl catch between 2003–04 and 2013–14 does not support a large decrease in biomass as suggested by the CPUE series

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 jack mackerel target fishery WCSI and WCNI	
Assessment Dates	Latest assessment: 2020	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Standardised CPUE - Proportions at age data from the commercial trawl fishery	1 – High Quality 1 – High Quality
Data not used (rank)		
Changes to Model Structure and Assumptions	-	
Major sources of Uncertainty	-	

Qualifying Comments

Fishery Interactions
There is a small target fishery for blue mackerel on the WCNI but the bulk of the catch is taken as bycatch in the jack mackerel mid-water trawl 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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