KINGFISH (KIN)

(*Seriola lalandi*)
Haku

1. FISHERY SUMMARY

Kingfish were introduced into the QMS on 1 October 2003. Current allowances, TACCs, and TACs are given in Table 1.

Table 1: Recreational and customary non-commercial allowances, TACCs, and TACs by Fishstock (t), as at 1 October 2022.

Fishstock	Recreational allowance	Customary non-commercial allowance	Other sources of fishing related mortality	TACC	TAC
KIN 1	459	76	47	91	673
KIN 2	79	18	19	69	185
KIN 3	6	4	2	11	23
KIN 4	1	1	0	1	3
KIN 7	40	6	8	44	98
KIN 8	55	19	13	80	167
KIN 10	1	0	0	1	2

1.1 Commercial fisheries

Historical estimated and recent reported kingfish landings and TACCs are shown in Tables 2 and 3, and Figure 1 shows the historical and recent landings and TACC values for the main kingfish stocks. Commercial landings of kingfish have been reported since the 1930s, with landings peaking at 144 t in 1940–41 before dropping to 11–41 t per annum between the mid-1940s and mid-1960s (Figure 1, Table 2). Landings increased from the late-1960s, exceeding 200 t per annum from the early 1970s, and reaching 532 t in 1992–93. Walsh et al (2003) note that landings for 1985 to 1988 are likely to be underestimated because of the change from the FSU to QMS reporting systems.

In the mid-1980s the commercial targeting of kingfish was restricted to certain methods and only fishers with ‘kingfish’ designated on their fishing permits could target the species (Walsh et al 2003). In the Auckland Fishery Management Area (FMAs 1 and 9), kingfish could be targeted by pole, troll, longline, and set net. After 1988, no new targeting permits were issued for kingfish. Although kingfish could be taken as bycatch, only fishers who had been granted targeting rights before 1988 could continue to target kingfish. In 1992 a moratorium was imposed on the targeting of all non-QMS species. Fishers could only continue to target a non-QMS species if they held a target authorisation for that species as at September 1992 and they had taken the species at least once in the previous two years.

A minimum legal size (MLS) of 65 cm was established for kingfish in October 1993. This restriction applied to kingfish taken by all methods except trawling between 1993 and 2000. In December 2000, the Minister of Fisheries revoked the trawl MLS exemption (Walsh et al 2003).

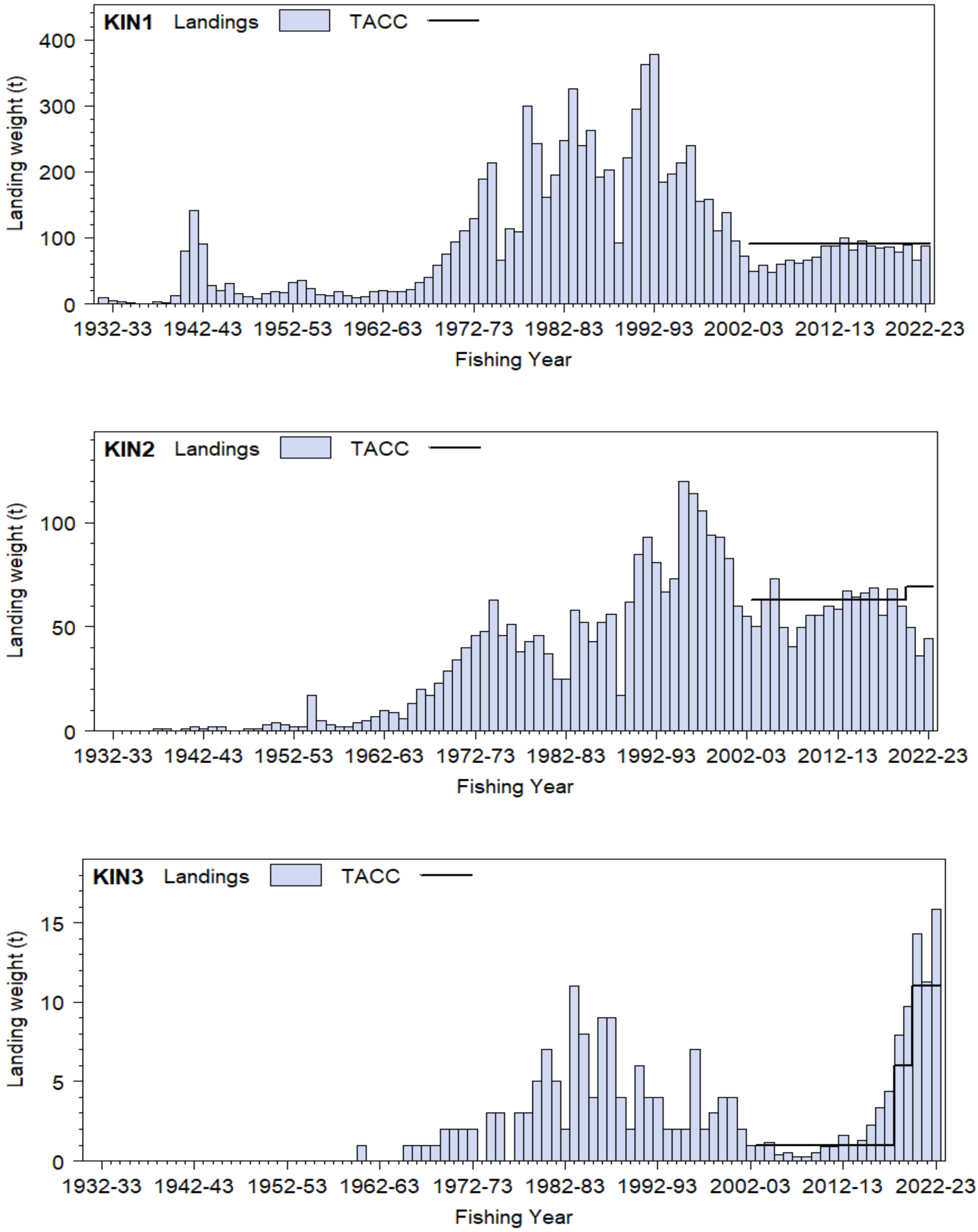
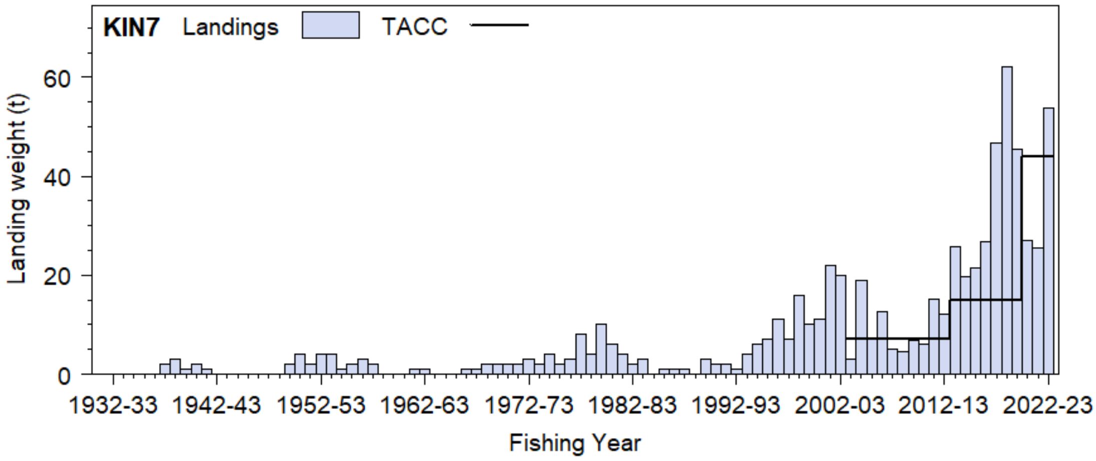


Figure 1: Reported commercial landings and TACC for the five largest KIN fisheries. From top to bottom: KIN 1 (Auckland East), KIN 2 (Central East), and KIN 3 (East Coast South Island & Southland). [Continued on next page]



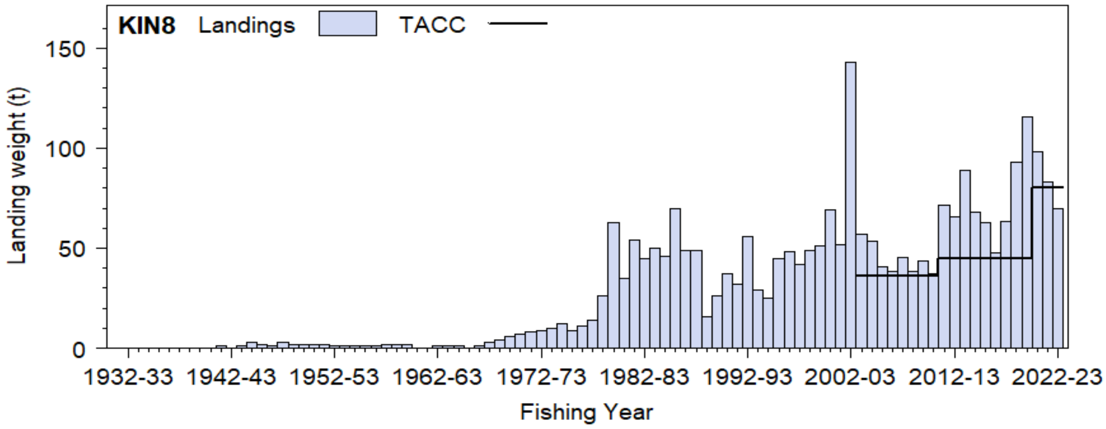


Figure 1 [Continued]: Reported commercial landings and TACC for the five largest KIN fisheries. KIN 7 (Challenger) and KIN 8 (Central Egmont and Auckland West).

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

Year	KIN 1	KIN 2	KIN 8	Year	KIN 1	KIN 2	KIN 8
1931–32	10	0	0	1957	18	2	2
1932–33	5	0	0	1958	13	2	2
1933–34	3	0	0	1959	10	4	2
1934–35	1	0	0	1960	11	5	0
1935–36	0	0	0	1961	18	7	0
1936–37	0	0	0	1962	20	10	1
1937–38	3	1	0	1963	18	9	1
1938–39	1	1	0	1964	18	6	1
1939–40	13	0	0	1965	21	13	0
1940–41	80	1	0	1966	32	20	1
1941–42	141	2	1	1967	40	17	3
1942–43	90	1	0	1968	58	23	4
1943–44	28	2	1	1969	75	29	6
1944	20	2	3	1970	93	34	7
1945	31	0	2	1971	111	40	8
1946	16	0	1	1972	129	46	9
1947	11	1	3	1973	189	48	10
1948	8	1	2	1974	214	63	12
1949	16	3	2	1975	66	46	9
1950	19	4	2	1976	114	51	11
1951	17	3	2	1977	109	38	14
1952	33	2	1	1978	299	43	26
1953	35	2	1	1979	242	46	63
1954	23	17	1	1980	161	37	35
1955	14	5	1	1981	195	25	54
1956	12	3	1	1982	247	25	45

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.

The main fishing areas for kingfish have traditionally been the east (KIN 1 and KIN 2) and west coast (KIN 8) of the North Island of New Zealand (Table 2). Of the peak landings in 1992–93 of 532 t, 71% was from KIN 1. From 1993–94 to 2002–03 the reported landings of kingfish decreased substantially in both KIN 1 and KIN 2. Possible reasons for this decrease include: the effect of the October 1993 introduction of a MLS of 65 cm on all methods other than trawl, changes in fishing patterns in the snapper and trevally target set net, trawl, and bottom longline fisheries (that were responsible for most of the non-target catch of kingfish), decreased target fishing for kingfish, and set net area closures in FMA 1 from October 1993.

The TACs set for kingfish stocks from 1 October 2003 were based on a 20% reduction in average landings in KIN 1, KIN 2, and KIN 8. Commercial catches in KIN 1 were substantially below the TACC from 2003–04 to 2010–11 and have been around the TACC since then (Table 3). Except for 2005–06, landings in KIN 2 remained at or below the TACC until 2013–14 then fluctuated around the TACC until 2019–20, dropping to 36 t in 2021–22. In KIN 3 landings had generally been very low, but have increased since 2015–16, and exceeded the 6 t TACC in 2018–19 and 2019–20. The TACC was increased to 11 t from 2020–21. Landings in KIN 7 increased substantially from 2011–12, consistently exceeding the TACC until this was increased from 15 t to 44 t in 2020–21. In KIN 8 landings dropped to just above the TACC from 2005–06 to 2010–11 but were substantially above the TACC in the following years, reaching a peak of 115 t (TACC 45 t) in 2019–20. The TACC was increased from 45 t to 80 t in 2020–21 but catches continued to exceed the TACC to 2021–22.

Set net, bottom trawl, and bottom longline accounted for 36%, 33%, and 15% respectively, of the kingfish commercial catch on average from 1983–84 to 1999–2000 (Walsh et al 2003). Targeting of kingfish has been largely restricted to the set net fishery. Set netting was responsible for most of the commercial catch of kingfish in the 1990s, but set net catches decreased substantially from 2000. Bottom longline catches have been largely restricted to KIN 1, primarily as a bycatch of the snapper target fishery. Bycatch of kingfish in trawl fisheries targeting other species currently accounts for the majority of the commercial catch in all QMAs.

Table 3: Reported landings (t) of kingfish by area (QMA) from 1983–84 to present. From 1986–87 to 2000–01, total landings are from LFRRs and landings by QMA are from CLRs prorated to the LFRR total. Totals include landings not attributed to the listed QMAs. MHR data from 2001-02 to present. [Continued on next page]

Year	KIN 1		KIN		KIN 3		KIN 4	
	Landing	TACC	Landing	TACC	Landing	TACC	Landing	TACC
1983–84*	326	–	58	–	11	–	0	–
1984–85*	239	–	52	–	8	–	0	–
1985–86*	262	–	43	–	4	–	0	–
1986–87	192	–	52	–	9	–	0	–
1987–88	202	–	56	–	9	–	0	–
1988–89	92	–	17	–	4	–	0	–
1989–90	221	–	62	–	2	–	0	–
1990–91	295	–	85	–	6	–	< 1	–
1991–92	362	–	93	–	4	–	< 1	–
1992–93	378	–	81	–	4	–	0	–
1993–94	184	–	67	–	2	–	< 1	–
1994–95	196	–	73	–	2	–	0	–
1995–96	214	–	120	–	2	–	< 1	–
1996–97	240	–	114	–	7	–	< 1	–
1997–98	155	–	106	–	2	–	< 1	–
1998–99	159	–	94	–	3	–	< 1	–
1999–00	111	–	93	–	4	–	< 1	–
2000–01	138	–	83	–	4	–	< 1	–
2001–02	95	–	60	–	2	–	< 1	–
2002–03	73	–	55	–	1	–	0	–
2003–04	49	91	50	63	1	1	< 1	1
2004–05	58	91	63	63	1	1	0	1
2005–06	48	91	73	63	< 1	1	0	1
2006–07	60	91	50	63	1	1	0	1
2007–08	66	91	40	63	< 1	1	< 1	1
2008–09	61	91	50	63	< 1	1	< 1	1
2009–10	66	91	56	63	< 1	1	< 1	1
2010–11	71	91	55	63	< 1	1	< 1	1
2011–12	87	91	60	63	< 1	1	< 1	1
2012–13	88	91	59	63	2	1	< 1	1
2013–14	100	91	67	63	1	1	< 1	1

Table 3 [Continued]:

Year	KIN 1 Landing	KIN 1 TACC	KIN 2 Landing	KIN 2 TACC	KIN 3 Landing	KIN 3 TACC	KIN 4 Landing	KIN 4 TACC
2014–15	81	91	64	63	1	1	< 1	1
2015–16	95	91	67	63	2	1	< 1	1
2016–17	88	91	69	63	3	1	< 1	1
2017–18	85	91	55	63	4	1	< 1	1
2018–19	86	91	68	63	8	6	< 1	1
2019–20	78	91	60	63	10	6	< 1	1
2020–21	89	91	50	69	14	11	< 1	1
2021–22	66	91	36	69	11	11	< 1	1
2022–23	88	91	44	69	16	11	< 1	1

Year	KIN 7 Landings	KIN 7 TACC	KIN 8 Landings	KIN 8 TACC	KIN 10 Landings	KIN 10 TACC	Total Landings	Total TACC
1983–84*	3	–	50	–	0	–	448	–
1984–85*	< 1	–	46	–	0	–	345	–
1985–86*	1	–	70	–	0	–	380	–
1986–87	1	–	49	–	0	–	356	–
1987–88	1	–	49	–	0	–	373	–
1988–89	< 1	–	16	–	0	–	460	–
1989–90	3	–	§26	–	< 1	–	428	–
1990–91	2	–	§37	–	< 1	–	448	–
1991–92	2	–	§32	–	9	–	512	–
1992–93	1	–	§56	–	< 1	–	532	–
1993–94	4	–	29	–	< 1	–	288	–
1994–95	6	–	25	–	< 1	–	302	–
1995–96	7	–	45	–	< 1	–	380	–
1996–97	11	–	48	–	6	–	427	–
1997–98	7	–	42	–	1	–	326	–
1998–99	16	–	49	–	< 1	–	323	–
1999–00	10	–	51	–	0	–	270	–
2000–01	11	–	69	–	< 1	–	304	–
2001–02	22	–	52	–	0	–	231	–
2002–03	20	–	143	–	0	–	292	–
2003–04	3	7	57	36	0	1	160	200
2004–05	19	7	53	36	0	1	195	200
2005–06	7	7	40	36	< 1	1	169	200
2006–07	13	7	39	36	0	1	161	200
2007–08	5	7	45	36	0	1	157	200
2008–09	5	7	38	36	0	1	154	200
2009–10	7	7	43	36	0	1	172	200
2010–11	6	7	37	36	0	1	171	200
2011–12	15	7	72	45	0	1	235	209
2012–13	12	7	66	45	0	1	226	209
2013–14	26	15	89	45	0	1	283	217
2014–15	20	15	68	45	0	1	235	217
2015–16	21	15	63	45	0	1	248	217
2016–17	27	15	48	45	0	1	235	217
2017–18	47	15	63	45	0	1	255	217
2018–19	62	15	93	45	0	1	317	222
2019–20	46	15	115	45	0	1	309	222
2020–21	27	44	98	80	0	1	279	297
2021–22	25	44	83	80	0	1	222	297
2022–23	54	44	70	80	0	1	272	297

* FSU data (Area unknown data prorated in proportion to recorded catch).
§ Some data included in FMA 1.

Kingfish were added to Schedule 6 of the Fisheries Act (1996) in October 2005 for all fishing methods except set net and in all areas. A special reporting code for Schedule 6 releases was introduced on 1 October 2006 to allow monitoring of releases. Kingfish that were released in accordance with Schedule 6 conditions and reported against this code were not counted against ACE. Schedule 6 was repealed as of 1 November 2022, but the Fisheries (Landing and Discard Exceptions) Notice allows the return to the sea of legal size kingfish until 30 September 2026, with identical requirements and restrictions to the previous Schedule 6 regime. Use of Schedule 6 provisions to release kingfish alive was adopted from 2008 in KIN 8 and has been used in KIN 7 since 2012 as catches increased; Schedule 6 returns in KIN 7 have equalled or exceeded the retained catch since 2016 (Figure 2, Table 4). Use of Schedule 6 provisions is more recent in KIN 1 and is associated with a decision in parts of the bottom longline fishery to only retain fish that exceed the recreational MLS of 75 cm. There was reduced use of the Schedule 6 provisions in KIN 1 and KIN 2 in 2020–21 and 2021–22.

When kingfish stocks were introduced into the QMS an annual deemed value rate of $8.90 per kg was set for all stocks. Differential deemed value rates were also set, the maximum of which was double the annual rate (i.e., $17.80). The rate of $8.90 was chosen because this was the maximum port price of any kingfish stock reported by any licensed fish receiver prior to 2003. Deemed value rates were set high to discourage fishers from landing catch in excess of ACE holdings.

When landings began to increase and exceed available ACE, significant deemed values began to be incurred by fishers, particularly those who took kingfish in KIN 7 and KIN 8. Deemed values peaked in 2018–19 when around $1.5m was incurred for KIN 7 and KIN 8 combined. The low value of kingfish packed and frozen at sea meant that catching kingfish that was unable to be balanced with ACE represented a significant financial loss to industry. To reduce the quantity of deemed values incurred, fishers have been attempting to avoid catching kingfish in the first place, as well as implementing operational changes designed to ensure that any live kingfish can be returned to the sea.

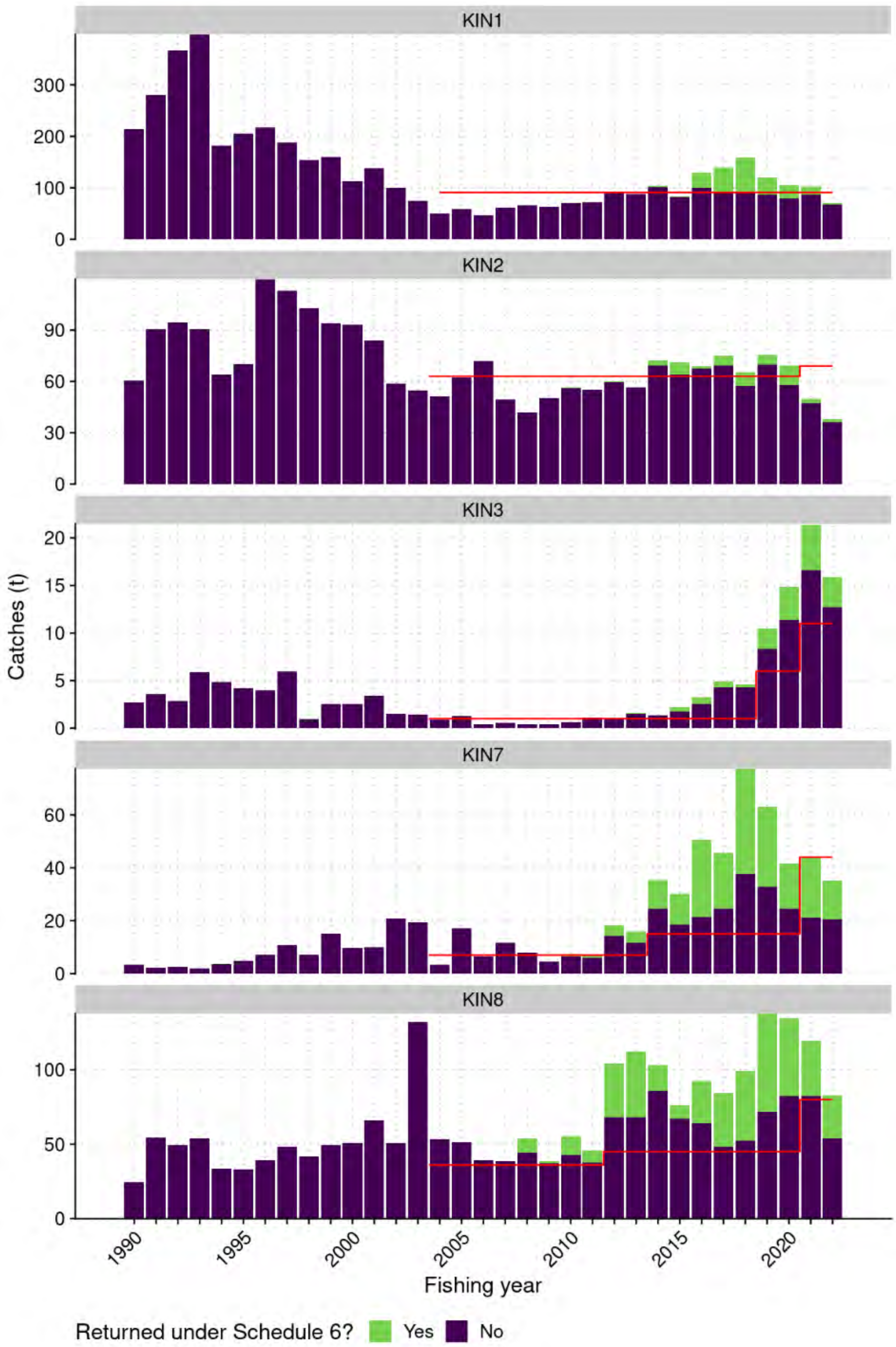


Figure 2: Bars: reported commercial landings of kingfish, and returns under Schedule 6 provisions; line: TACC.

Table 4: Groomed landings (t) of kingfish by area (QMA) from 2006–07 to 2021–22 by destination code. Landing code 'L' represents normal landings to a licensed fish receiver, code 'X' indicates returns to the sea under Schedule 6, 'Y' indicates returns under the minimum landing size (only from electronic reporting, which was not fully implemented until early in 2019–20), and 'Other' includes all other non-intermediate landing codes of fish above the minimum landing size.

Fishing	KIN 1				KIN 2				KIN 3				KIN 7				KIN 8			
year	L	X	Y	Other	L	X	Y	Other	L	X	Y	Other	L	X	Y	Other	L	X	Y	Other
2006–07	61	0		1	49	0		0	1	0		0	10	0		1	35	0		3
2007–08	65	0		2	42	0		0	0	0		0	7	0		1	42	10		2
2008–09	60	0		2	50	0		0	0	0		0	4	0		1	34	1		3
2009–10	67	0		2	56	0		0	1	0		0	5	1		1	38	12		5
2010–11	70	0		2	55	0		0	1	0		0	5	1		1	33	8		4
2011–12	90	0		2	59	1		0	1	0		0	12	4		3	61	36		7
2012–13	86	0		2	56	0		0	1	0		0	8	4		4	60	44		8
2013–14	99	2		2	69	3		0	1	0		0	20	11		5	78	17		7
2014–15	80	1		2	64	7		0	1	1		1	14	12		5	61	9		6
2015–16	95	30		4	67	1		0	2	1		1	16	29		6	58	29		6
2016–17	87	49		4	69	6		0	3	1		2	21	21		4	42	36		7
2017–18	84	69	2	5	55	8		3	3	0	0	1	35	54	2	8	51	55	13	6
2018–19	81	34	6	5	66	6	1	3	6	2	0	2	41	48	0	3	85	82	17	6
2019–20	76	27	24	3	57	12	2	1	8	4	0	3	31	24	1	4	84	62	18	7
2020–21	82	15	32	5	47	3	2	0	11	5	0	6	22	33	0	2	87	49	16	6
2021–22	64	3	27	3	36	2	1	0	9	3	0	4	21	19	0	3	53	39	24	5

1.2 Recreational fisheries

Kingfish is highly regarded by recreational fishers in New Zealand for its sporting attributes and as a table fish. Kingfish are most often caught by recreational fishers from private boats and from charter boats but are also a prized catch for spearfishers and shore-based game fishers. Kingfish (defined as southern yellowtail kingfish) are recognised internationally as a sport fish, and kingfish caught in New Zealand waters hold 34 of the 36 International Gamefish Association World Records.

1.2.1 Management controls

The main methods used to manage recreational harvests of kingfish are minimum legal size limits, method restrictions, and daily bag limits. Fishers can retain and land up to three kingfish as part their daily bag limit. The MLS was increased to 75 cm (from 65 cm) for recreationally caught kingfish on 15 January 2004.

Many clubs, competitions, and charter boats have implemented a voluntary limit of one kingfish retained per person per day, and a number of gamefish clubs have also adopted a minimum size limit of 100 cm for kingfish. A high proportion of private and charter recreational catch is released (Holdsworth et al 2016b)

1.2.2 Tag and release

A voluntary tagging programme (the 'Gamefish Tagging Programme') with participation by some recreational fishers, and more recently some commercial fishers, has released 25 499 kingfish in New Zealand (1975 to 2022). Anglers feel they are contributing to research and conservation of stocks, while still getting recognition of their catch. Tagging of fish released by the JMA 7 trawl fishery was initiated in 2019 with over 465 tagged to date and five recaptured (three by recreational fishers and two by commercial trawl). The research objectives are to collect detailed information on released fish to help characterise the fishery and collect coarse growth, and movement information from recaptured fish. There have been 1682 tagged kingfish recaptured in New Zealand (1977 to 2022), with an average of 25 recaptures (and 569 releases) per year over the last 10 years (Table 5) (Holdsworth 2023).

Most kingfish are caught close to their release location, even after many years. Ninety four percent of recaptures for fish at liberty for 30 days or more were within 100 nautical miles of the release point (Figure 3). The proportion of recaptured kingfish at distances over 100 nautical miles increases after 3 years. Although kingfish are also capable of extensive movements, with four fish tagged in New Zealand recaptured in New South Wales, Australia, few recaptures are made outside the QMAs in which the fish were released.

Table 5: The number of kingfish tagged and recaptured by fishing year for the last 10 years.

	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22
Releases	760	654	720	620	827	615	624	156	372	337
Recaptures	41	34	28	23	33	36	45	30	13	13

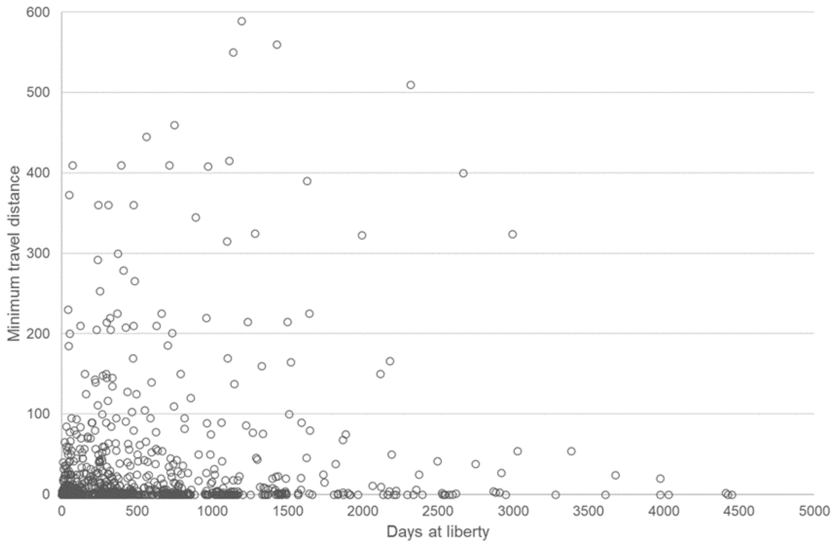


Figure 3: Kingfish straight line distance (nautical miles) from release location by days at liberty 1977 to 2022, truncated at 600 nm and 5000 days.

1.2.3 Estimates of recreational harvest

Recreational catch estimates are given in Table 6. There are two broad approaches to estimating recreational fisheries harvest: the use of onsite or access point methods where fishers are surveyed or counted at the point of fishing or access to their fishing activity; and offsite methods where some form of post-event interview and/or diary are used to collect data from fishers.

The first estimates of recreational harvest for kingfish were calculated using an offsite approach, the offsite regional telephone and diary survey approach. Estimates for 1996 came from a national telephone and diary survey (Bradford 1998). Another national telephone and diary survey was carried out in 2000 (Boyd & Reilly 2004) and a rolling replacement of diarists in 2001 (Boyd et al 2004) allowed estimates for a further year (population scaling ratios and mean weights from 2000 were not re-estimated in 2001).

The harvest estimates provided by these telephone/diary surveys are no longer considered reliable for various reasons. With the early telephone/diary method, fishers were recruited to fill in diaries by way of a telephone survey that also estimates the proportion of the population that is eligible (likely to fish). A ‘soft refusal’ bias in the eligibility proportion arises if interviewees who do not wish to co-operate falsely state that they never fish. The proportion of eligible fishers in the population (and, hence, the harvest) is thereby under-estimated. Pilot studies for the 2000 telephone/diary survey suggested that this effect could occur when recreational fishing was established as the subject of the interview at the outset. Another equally serious cause of bias in telephone/diary surveys was that diarists who did not immediately record their day’s catch after a trip sometimes overstated their catch or the number of trips made. There is some indirect evidence that this may have occurred in all the telephone/diary surveys (Wright et al 2004).

The recreational harvest estimates provided by the 2000 and 2001 telephone diary surveys are thought to be implausibly high for many species, which led to the development of an alternative maximum count aerial-access onsite method that provides a more direct means of estimating recreational harvests for suitable fisheries. The maximum count aerial-access approach combines data collected concurrently from two sources: a creel survey of recreational fishers returning to a subsample of boat ramps throughout the day; and an aerial survey count of vessels observed to be fishing at the approximate time of peak fishing effort on the same day. The ratio of the aerial count in a particular area to the number of interviewed parties who claimed to have fished in that area at the time of the overflight was used to scale up harvests observed at surveyed ramps, to estimate harvest taken by all fishers returning to all ramps. The methodology is further described by Hartill et al (2007).

This aerial-access method was first employed and optimised to estimate snapper harvests in the Hauraki Gulf in 2003–04. It was then extended to survey the wider SNA 1 fishery in 2004–05 and to provide estimates for other species, including kingfish. The PELWG (Pelagic Working Group) indicated that the kingfish estimate should be considered with considerable caution due to the limited overlap between this method's sampling technique and the fisheries for kingfish, e.g., the target fisheries for kingfish are often in offshore areas from launches which were not sampled by the boat ramp survey. For this reason, the results from this survey have not been accepted or included in the working group report at this time.

In response to the cost and scale challenges associated with onsite methods, in particular the difficulties in sampling other than trailer boat fisheries, offsite approaches to estimating recreational fisheries harvest have been revisited. This led to the development and implementation of a national panel survey for the 2011–12 fishing year, repeated in 2017–18 and 2022–23 (Wynne-Jones et al 2014, 2019; Heinemann & Gray, in prep). The panel surveys used face-to-face interviews of a random sample of 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 catch information collected in standardised phone interviews. Note that national panel survey estimates do not include recreational harvest taken on charter vessel trips or under s111 general approvals.The estimates of harvest from the 2011–12 panel survey were compared with direct estimates (using onsite surveys) for key stocks in FMA 1 (Edwards & Hartill 2015) and are considered reliable.

The increase in the minimum legal size to 75 cm in 2004 increased the average size of kingfish landed by recreational fishers. Average weights from boat ramp data collected during the survey year are not available for all QMAs and a national average weight is used to estimate toptal harvest weight. The point estimates of recreational harvest for KIN 1, KIN 7, and KIN 8 in 2012 and 2018 were above the allowances; recreational harvests in KIN 2 increased from 2012 to 2018 and exceeded the allowance in 2018.

Table 6: Recreational harvest estimates for kingfish stocks. The telephone/diary surveys ran from December to November but are denoted by the January calendar year. The national panel surveys ran throughout the October to September fishing year but are denoted by the January calendar year. Mean fish weights were obtained from boat ramp surveys (for the telephone/diary and panel survey harvest estimates). (Source: Tierney et al 1997, Bradford 1997, Bradford 1998, Boyd & Reilly 2004, Boyd et al 2004, Wynne-Jones et al 2014, 2019, Heinemann & Gray, in prep). Harvest estimates from telephone/diary and panel surveys and not considered comparable.

Stock	Year	Method	Number of fish	Total weight (t)	CV
KIN 1	1992	Telephone/diary	186 000	260	–
	1994	Telephone/diary	180 000	228*	0.09
	1996	Telephone/diary	194 000	234	0.07
	2000	Telephone/diary	127 000	800	0.18
	2001	Telephone/diary	109 000	683	0.17
	2012	Panel survey	47 460	488	0.14
	2018	Panel survey	62 434	513	0.18
	2023	Panel survey	22 623	225	0.18
KIN 2	1992	Telephone/diary	68 000	92	–
	1994	Telephone/diary	62 000	78	0.18
	1996	Telephone/diary	67 000	70	0.11
	2000	Telephone/diary	25 000	138	0.38
	2001	Telephone/diary	21 000	113	0.33
	2012	Panel survey	3 682	37	0.25
	2018	Panel survey	9 373	77	0.28
	2023	Panel survey	4 495	50	0.39
KIN 7	1992	Telephone/diary	10 000	20	–
	1994	Telephone/diary	–	–	–
	1996	Telephone/diary	9 000	13	0.19
	2000	Telephone/diary	2 000	11	0.55
	2001	Telephone/diary	1 000	9	0.86
	2012	Panel survey	2 079	21	0.38
	2018	Panel survey	3 037	25	0.27
	2023	Panel survey	1 236	13	0.38
KIN 8	1992	Telephone/diary	6 000	#8	–
	1994	Telephone/diary	–	–	–
	1996	Telephone/diary	2 000	#3	–
	2000	Telephone/diary	9 000	65	0.45
	2001	Telephone/diary	14 000	108	0.46
	2012	Panel survey	5 259	53	0.26
	2018	Panel survey	5 175	43	0.24
	2023	Panel survey	4 445	46	0.42

* No harvest estimate available in the survey report; estimate presented is calculated as average fish weight for all years and areas by the number of fish estimated caught.

1.3 Customary non-commercial fisheries

Kingfish is an important traditional food fish for Māori, but no quantitative information on the level of Māori customary non-commercial catch is available. The extent of the traditional fisheries for kingfish in the past is described by the Muriwhenua Fishing Report (Waitangi Tribunal 1988). Because of the coastal distribution of the species and its inclination to strike lures, it is likely that historically Māori caught considerable numbers of kingfish.

1.4 Illegal catch

There is no known illegal catch of kingfish.

1.5 Other sources of mortality

The extent of any other sources of mortality is unknown, however, handling mortality for sub-MLS size fish is likely to occur in both the recreational (sub 75 cm) and commercial (sub 65 cm) fisheries. Recreational fishers also release a large proportion of legal-size kingfish, and the use of Schedule 6 provisions to return legal-size kingfish to the sea if they are likely to survive increased in commercial fisheries after 2010.

2. BIOLOGY

In New Zealand, kingfish are predominantly found around the northern half of the North Island but also occur from 29° to 46° S, Kermadec Islands to Foveaux Strait (Francis 1988) and to depths of 200 m. Kingfish are large predatory fish with adults exceeding one and a half metres in length. They usually occur in schools ranging from a few fish to well over a hundred fish. Kingfish tend to occupy a semi-pelagic existence and occur mainly in open coastal waters, preferring areas of high current and or tidal flow adjacent to rocky outcrops, reefs, and pinnacles. However, kingfish are not restricted to these habitats and are sometimes caught or observed in open sandy bottom areas and within shallow enclosed bays. Juvenile kingfish are pelagic, often found in association with floating rafts of kelp and other debris. These can occur quite far offshore.

Estimates of age have been derived from opaque-zone counts in sagittal otolith thin sections. Estimates of von Bertalanffy growth parameters for kingfish were also derived from recreational tagging data and otoliths collected from the eastern Bay of Plenty. Estimates of K and L_∞ were similar, being 0.128 and 130 cm from the otolith age data and 0.130 and 142 cm from the tagging increment data, respectively (Table 7). The hard-structure ageing techniques have yet to be validated for New Zealand kingfish, although the position of the first annulus has been validated using regular samples of 0+ year old fish from a fish aggregating device (Holdsworth et al 2013, Francis et al 2005).

A Bayesian analysis of length and maturity data suggests that the length of 50% maturity is 97 cm in females and 83 cm in males (McKenzie et al 2014).

Estimates of M ranged from 0.20 to 0.25, however, these estimates are thought to represent an upper bound because the samples were taken from an exploited population.

Available biological parameters relevant to stock assessment are given on the following page in Table 7.

Table 7: Estimates of biological parameters.

Fishstock									**Estimate**	**Source**
1. Weight = a(length)^b (Weight in g, length in cm fork length).										
						Both sexes				
						a			b	
KIN 1						0.03651			2.762	Walsh et al (2003)
2. von Bertalanffy growth parameters										
Females			Males			Combined				
L_∞	k	t_0	L_∞	k	t_0	L_∞	k	t_0		
Bay of Plenty (2002)										
135.79	0.119	-0.976	123.81	0.137	-0.911	130.14	0.128	-0.919		McKenzie et al (2014)
East Northland (2015)										
131.06	0.173	-1.257	116.44	0.247	-0.708					Holdsworth et al (2016)
Bay of Plenty (2015)										
129.67	0.173	-1.074	120.27	0.184	-1.314					Holdsworth et al (2016)

3. STOCKS AND AREAS

Kingfish are widespread, occurring in temperate waters around South Australia, Japan, South Africa, and the western coast of the Americas (British Columbia to Chile) (Walsh et al 2003). Although previously considered a single species, Martinez-Takeshita et al (2015) suggest that southern hemisphere kingfish should be considered a separate species, and that "a combination of dynamics in the sub-tropical and temperate regions permits a low-level of connectivity among *S. lalandi* sampled in South Africa, New Zealand, and Chile".

Within New Zealand, a study based on meristic characters and parasite loads suggests two stocks of kingfish off the west and east coasts (Smith et al 2004). These stocks are contained within the Tasman Current off the west coast and the East Auckland Current and East Cape Current off the east coast, with little mixing between them. The east coast stock may be further subdivided into northeast and Hawke's Bay stocks based on limited exchange from tagging studies and parasite marker prevalence. Young juvenile kingfish are pelagic, often found in association with floating rafts of kelp and other debris.

Tagging results suggest that most adult kingfish do not move outside local areas, with many tag returns close to the release site (Figure 3). However, some tagged kingfish have been found to move very long distances; there are validated reports of New Zealand tagged kingfish being caught in Australian waters and Australian tagged kingfish being recaptured in New Zealand waters. Fish tagged off Taranaki were recaptured off North Cape and Coromandel (Holdsworth 2023).

In addition to the results from tagging studies, the age structure of recreational catches (Holdsworth et al 2016a) suggests that kingfish off the East Northland/Hauraki Gulf region and in the Bay of Plenty/East Cape region may comprise separate stocks.

4. STOCK ASSESSMENT

4.1 CPUE analyses

Standardised CPUE analyses were developed for KIN 1, 2, 7, and 8 during 2019 and 2020, and the key indices for KIN 7 and 8 were updated in 2021. Indices for all areas were updated in 2023, with the addition of a CPUE index for KIN 3, where landings have increased from previously low levels.

Statutory catch, effort, and landings data from the commercial fisheries were used to develop indices for the mixed-target inshore bottom trawl fisheries in the Bay of Plenty and East Northland sub-areas of KIN 1, and for KIN 2 and KIN 8. Indices were also developed for the snapper-target bottom longline fishery in East Northland, the mixed-target midwater and bottom trawl fisheries in KIN 3, and the offshore midwater gear trawl fishery that targets jack mackerels in KIN 7 and KIN 8 off the western North Island and north-western South Island.

Additional indices were developed for the recreational fisheries in the KIN 1 sub-areas using ramp survey data. Indices using data from kingfish catches reported from amateur charter vessels were also considered in 2020 but were rejected by the Working Group because (i) the recorded catches included fish returned to the sea without distinguishing returns of fish above and below the MLS, (ii) kingfish were targeted on features, where they aggregated, and CPUE was likely to be hyperstable, and (iii) charter boats targeting snapper mostly caught small kingfish.

In KIN 2, 7, and 8, and the bottom trawl gear fisheries in KIN 1, the proportion of the trip-level landed catches represented in event-level catch estimates can be low, especially when reporting used the CELR or TCEPR forms where estimated catches are limited to the top five species by weight per event. As a result, the CPUE analyses for the trawl fisheries used trip-level data where kingfish landings were modelled using covariates that were trip-level summaries of the effort data. These included number of tows, modal statistical area, mean hours per tow, mean bottom depth, and mean headline height. Delta-lognormal models were fitted to the trip-level catch and effort data from bottom trawl fishers operating in East Northland, the Bay of Plenty, KIN 2, and KIN 8. Analyses were restricted to the period after kingfish was introduced to the QMS.
A trip level index for the midwater fishery in KIN 7 and 8 was also developed in 2020; this used data from trips where an observer was present on the vessel and offered the proportion of jack mackerel tows as a covariate. However, the preferred CPUE index for KIN 7 and 8 uses observer catch and effort data at the fishing event level in a combined (binomial/lognormal) index, starting in the 2005 fishing year when observer coverage increased in this fishery.

For the East Northland bottom longline fishery, the working group noted that kingfish was a valuable bycatch of the snapper longline fishery and appeared to have been consistently reported in estimated catches and landings since the QMS catch and effort data systems were introduced in the 1990 fishing year. In 2020, four indices were prepared for this fishery: (i) a daily-level index with the fine scale data available since 2008 aggregated to match the previous CELR-resolution data, and landings allocated to events using the approach of Starr (2007); (ii) a trip-level index using landings data and aggregated effort data; (iii) an event-level index using data from the LTCER form from 2008 onwards and landings allocated to events; and (iv) an index that was restricted to trips with a single set. The trip level index was adopted as the primary index for this substock.

Negative-binomial GLMMs were fitted to the number of fish caught during recreational bait-fishing trips recorded in the ramp survey data, separately for fishing locations in East Northland and the Bay of Plenty. These indices were updated in 2023, with data to 2021. Data were aggregated to location-month-target strata and the covariates offered to the models were: location, month, target species (KIN or SNA), number of events, mean number of fishers per event, and mean event duration. Location was included as a random effect. In 2020, separate trip-level models fitted to recreational fishing trips where the fishing method was reported as jigging and trolling were also presented to the working group. The indices derived from jigging and trolling models were more variable than the bait-fishing index because of lower numbers of surveyed events. Jigging and trolling are usually used to target kingfish aggregations on features, and there is believed to be a degree of learned hook avoidance associated with these catch methods.

4.1.1 Size composition

A key consideration in the working group's evaluation of the indices of relative abundance was the size composition of the kingfish catch in each fishery. Aggregated observer data (Figure 4) indicated that the bottom trawl fisheries primarily catch immature kingfish, whereas the midwater trawl fishery catches both juvenile and adult fish. The working group concluded that the bottom trawl indices were best regarded as indices of immature kingfish, whereas the midwater trawl and bottom longline indices included adult fish and were the better indices for the kingfish populations in the areas for which these indices are available.

No observer data were available from the bottom longline fishery, but packing data were used to examine the weight composition of kingfish landed from this fishery (Figure 5). These indicated that the bottom longline fishery also catches adult fish (based on the length-weight relationship in Table 7, and the sizes at 50% maturity reported by McKenzie et al 2014, the weight at 50% maturity is approximately 7.3 kg for males and 11.2 kg for females).

Cumulative weight distributions from the annual Bay of Islands Yellowtail Tournament suggests this catches fewer small fish than the bottom longline fishery, but similar proportions of larger fish (e.g., greater than 15kg; Figure 5). Between year variation in catch at weight distributions is evident in both fisheries. Comparisons between cumulative length distributions from recreational catch at age sampling in 2015 (Holdsworth et al 2016) and other recreational fishing length frequency information indicates that the fish sampled from bait-fishing in ramp surveys typically resemble the "inshore" fishery while fish encountered in the Bay of Islands Yellowtail Tournament are generally larger (Figure 6a). However, the "offshore" fishery has a much higher proportion of large fish.

By way of comparison, the cumulative length frequency distributions from the KIN 7 and 8 midwater trawl fisheries most closely resemble those of the East Northland inshore fisheries (including the Bay of Islands Tournament) (Figure 6b).

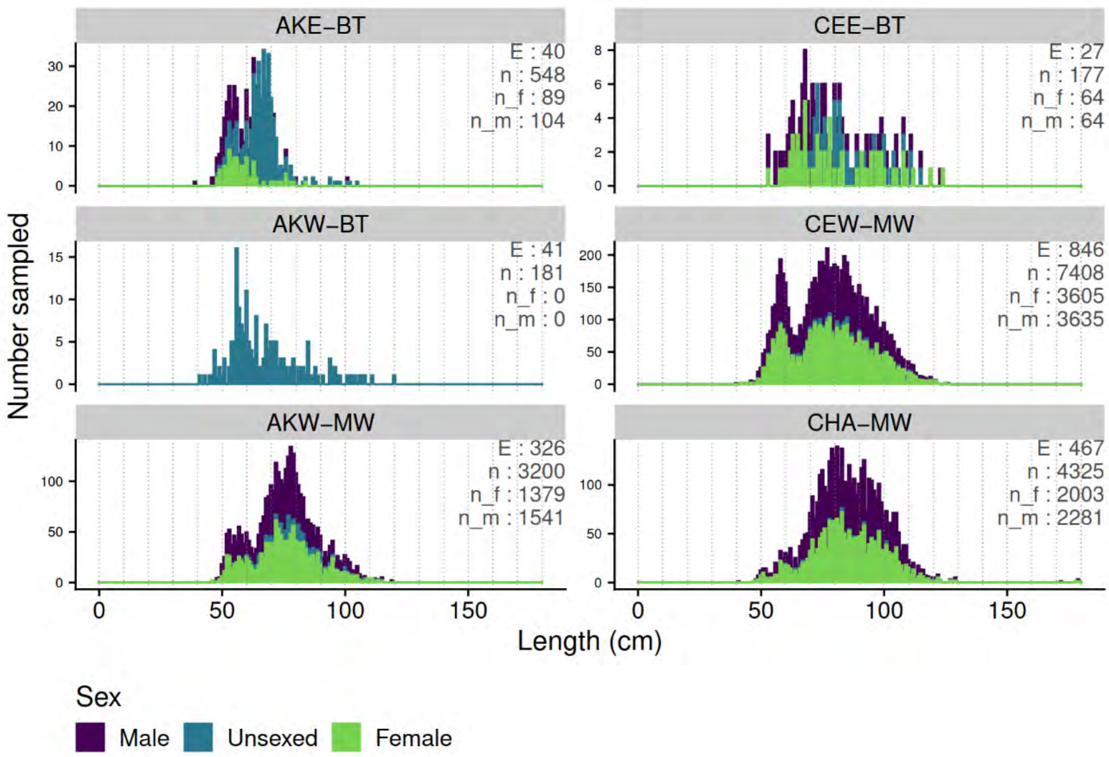


Figure 4: Unscaled length frequency distributions for kingfish by area and method, aggregated over all available samples, using observer data collected from 2000–01 onwards. (E: number of events sampled, n: number of fish sampled, MW: midwater, BT: bottom trawl). Area codes are Observer Fisheries Management Areas: AKE = Auckland East (FMA 1); AKW = Auckland West (FMA 9); CEE = Central East (FMA 2) ; CEW = Central Egmont (FMA 8); ; CHA = Challenger (FMA 7).

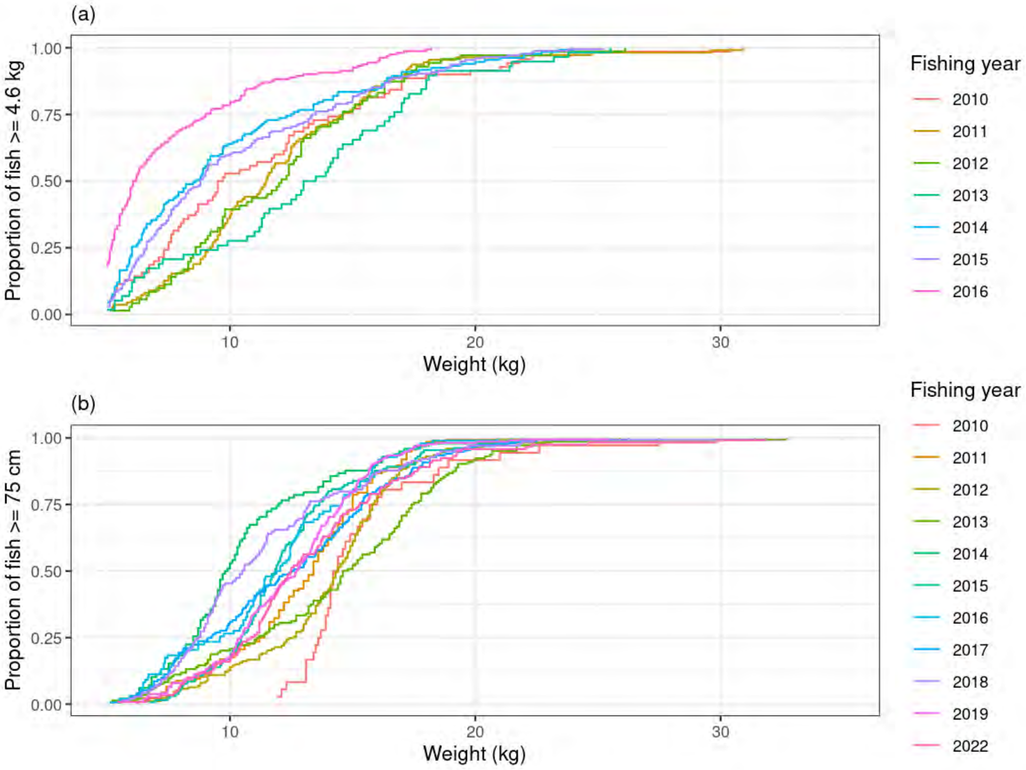


Figure 5: Annual cumulative weight frequency of (a) single kingfish packed from the East Northland bottom longline fishery by Leigh Fisheries Limited between 2010 and 2016, and (b) kingfish caught in the Bay of Islands Yellowtail Tournament which takes place in June each year. The weights included from the packing data are restricted to fish greater than 4.6 kg, the minimum weight recorded in the Yellowtail Tournament data which were restricted to fish greater than 75 cm.

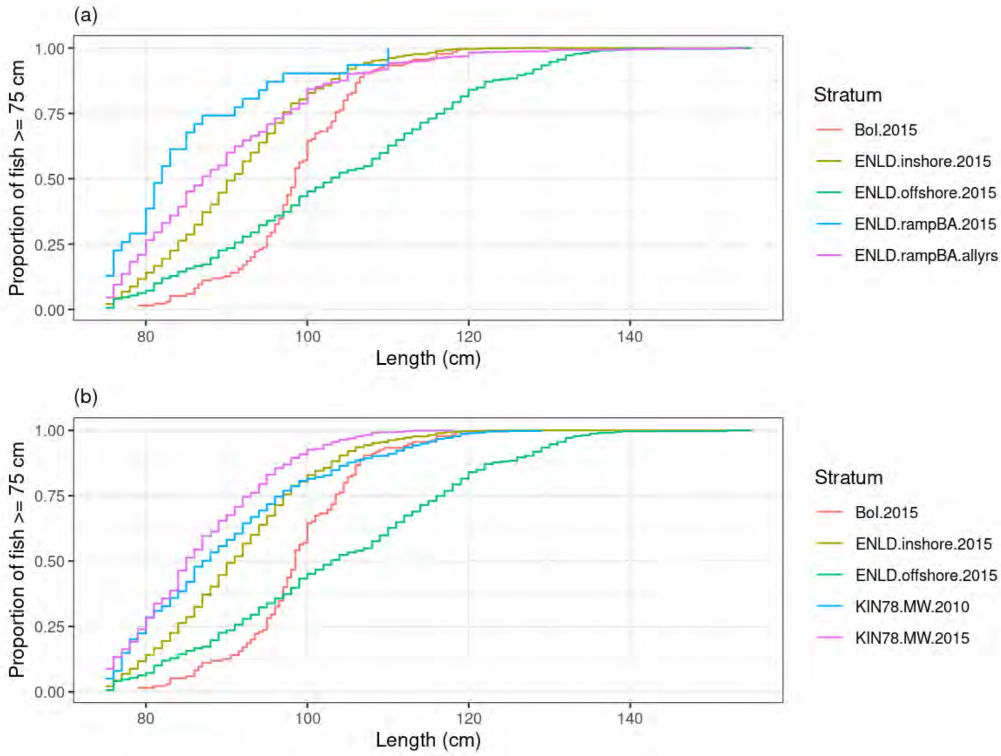


Figure 6: Cumulative length distributions of fish ≥ 75 cm from the inshore and offshore East Northland (ENLD) recreational length frequency data in 2015 (Holdsworth et al 2016) and other recreational fishery length frequency information: the Bay of Islands Yellowtail Tournament in 2015 (BoI.2015), plotted with (a) recreational bait-fishing samples from ramp surveys in 2015 (ENLD.rampBA.2015) and overall from 1991 to 2021 (ENLD.rampBA.allyrs), noting that Yellowtail Tournament fish were included in the wider East Northland samples collected in 2015; (b) length frequency information from the KIN 7 and 8 midwater trawl fishery.

4.1.2 Trends in CPUE indices

All three East Northland fisheries CPUE indices increased between 2010 and 2018 (Figure 7) with high inter-annual variability in the longline index in this period. Since 2018, the longline index has declined to levels about the long-term average, and a similar decline is evident in the recreational bait-fishing index. In contrast, the bottom trawl index continued to increase until 2021, with a drop in 2022.

The bottom longline index in the Bay of Plenty shows a similar pattern to East Northland, increasing to a peak in 2018 and then declining. The bottom trawl index increased consistently from 2004 to 2021 before declining in the most recent year (Figure 8). The recreational bait-fishing index for the Bay of Plenty showed an increasing trend over this period, but with considerable year to year variation.

The main index from observer data in the KIN 7 and 8 midwater trawl fishery showed a gradual increase from 2008 to 2014, before increasing rapidly. The index has fluctuated at this increased level from 2016 to 2022 (Figure 9). The index from the KIN 8 bottom trawl fishery demonstrated a more cyclic pattern around a steadily increasing trend from 2009 to 2021, and a decline in the final year that is common between both the the KIN 7 and 8 observer trip index and the bottom trawl index in KIN 8.

Series from the bottom trawl fisheries (and the bottom/midwater fishery in KIN 3) are based on catches of primarily juvenile kingfish. The index for KIN 3 shows a substantial increase from 2018 to 2021 (Figure 10, left plot), coincident with the increase of catch in this area. The bottom trawl indices all showed a similar increase from 2004 to 2017, but recent trends have differed, In KIN 1, both the ENLD and BPLE series had an increasing trend to 2021, but dropped towards the series mean in 2022. In KIN 2 and KIN 8 the series have fluctuated without trend since 2017.

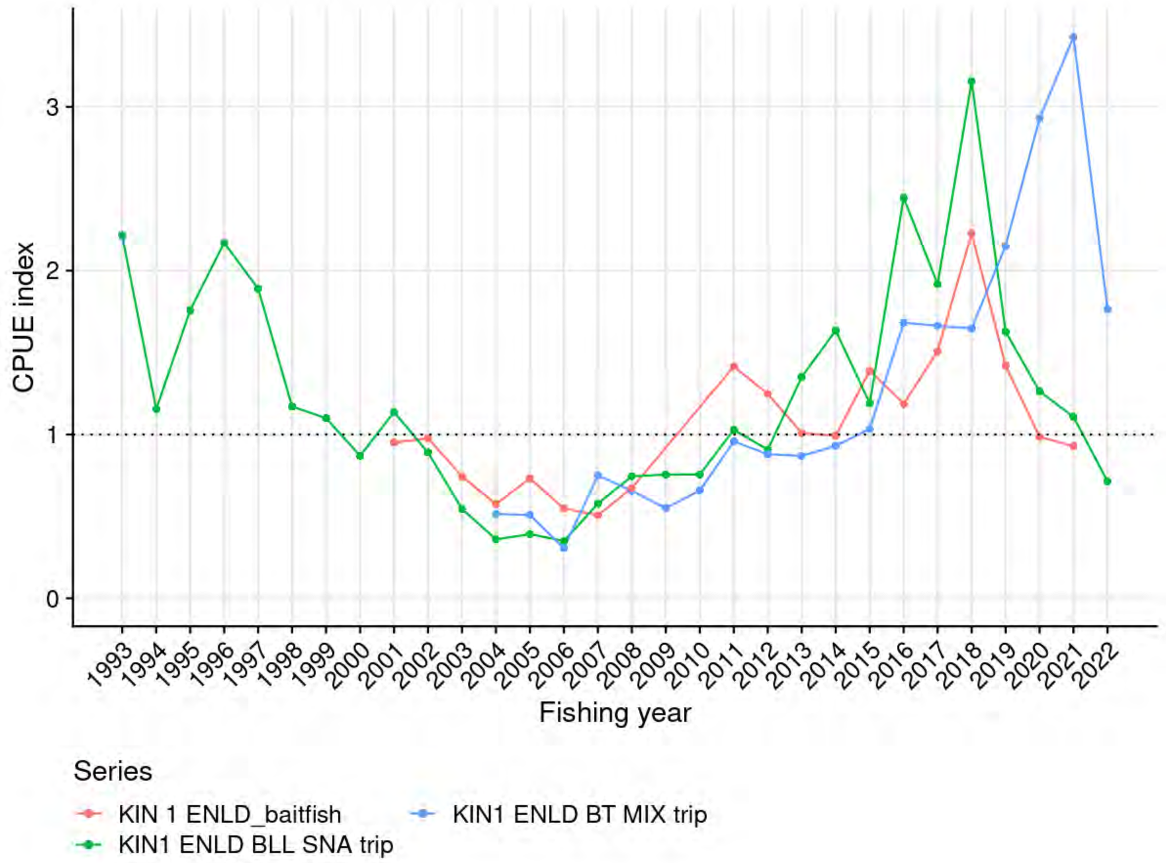


Figure 7: CPUE indices for the different fisheries (BT: bottom trawl, BLL bottom longline) in KIN 1 (ENLD: East Northland) scaled to a geometric mean of one for the years in common.

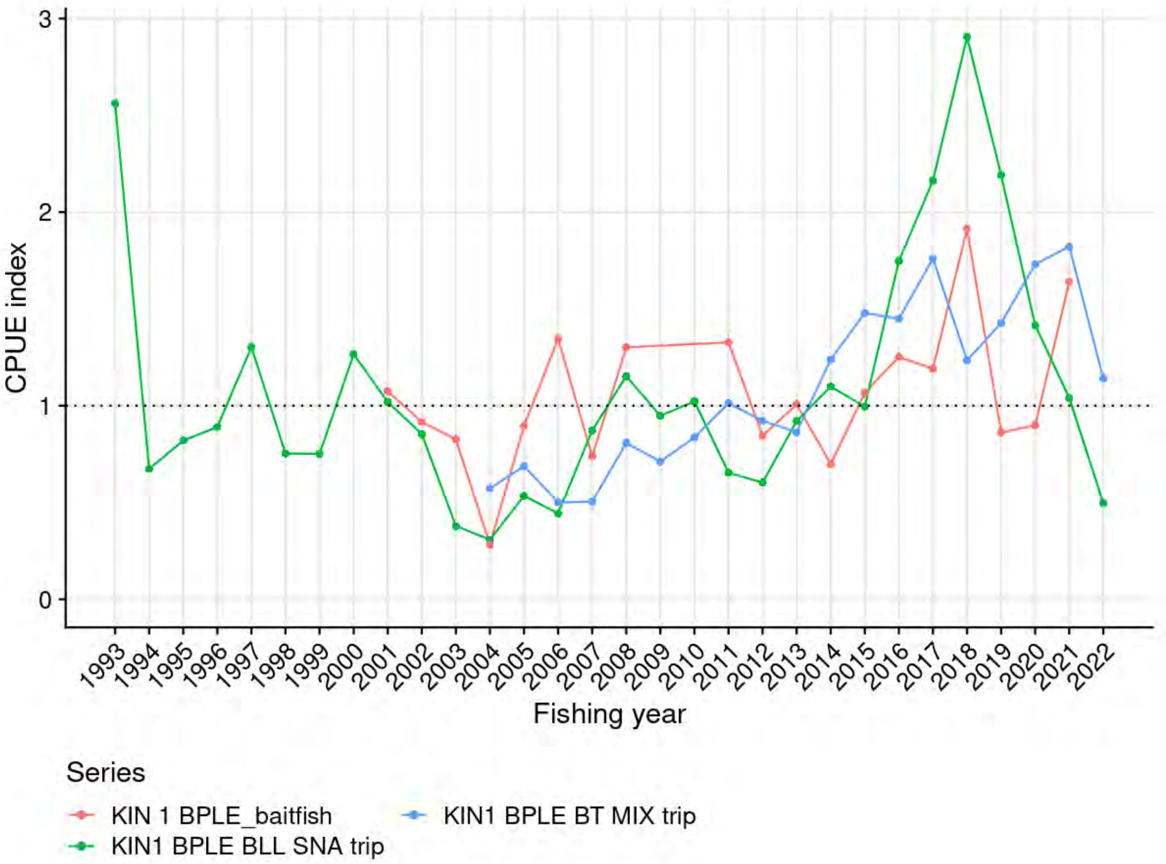


Figure 8: CPUE indices for the different fisheries (BT: bottom trawl, BLL: botton long line) in KIN 1 (BPLE: Bay of Plenty) scaled to a geometric mean of one for the years in common.

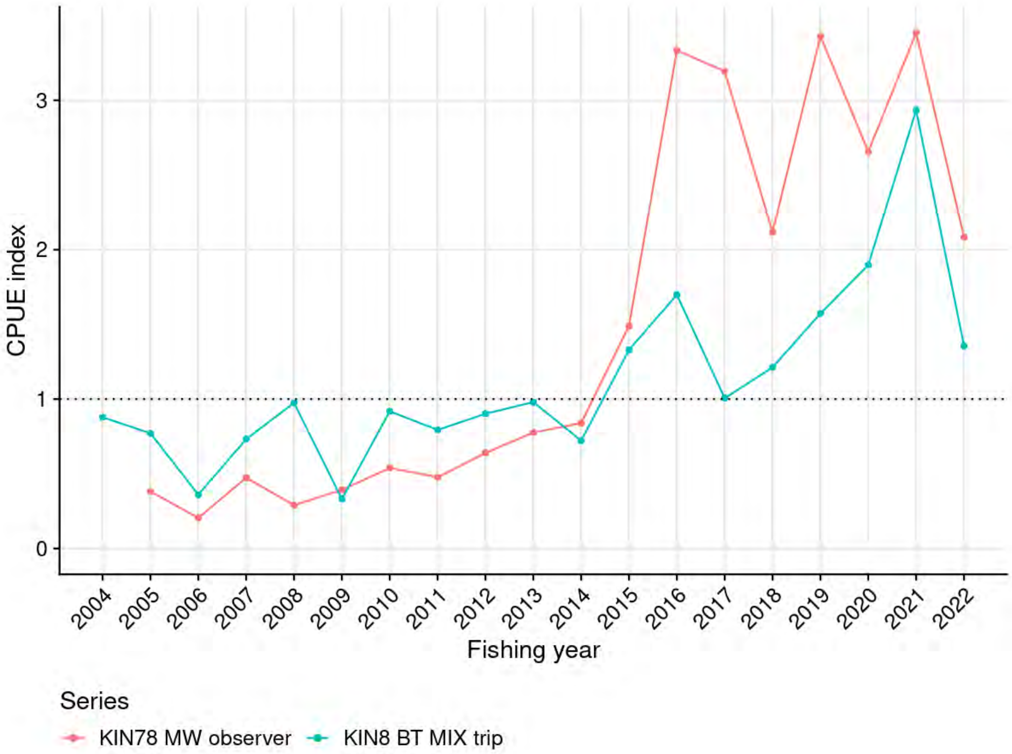


Figure 9: CPUE indices for the west coast North Island fisheries (MW: midwater trawl, BT: Bottom trawl) scaled to a geometric mean of one for the years in common.

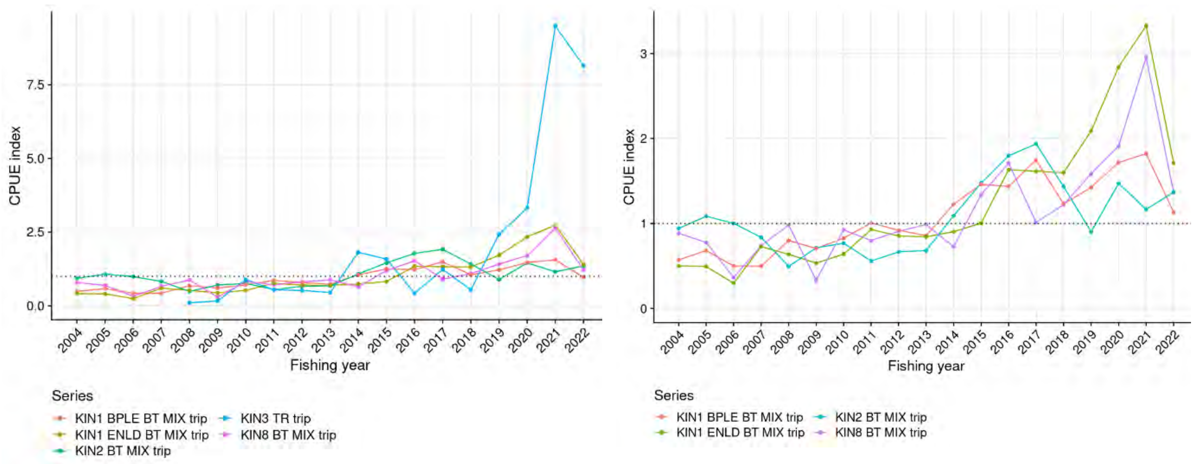


Figure 10: CPUE indices for bottom trawl fisheries (combined bottom and midwater fishing in KIN 3) scaled to a geometric mean of one for the years in common. Left: all series; Right: excluding the KIN 3 series.

4.1.3 Catch at length information

Length frequency distributions for kingfish caught at the annual Bay of Islands Yellowtail Tournament (Figure 11) show progression of length modes associated with fish estimated to be 4 to 6 years of age with some evidence that the 2009 and 2013 year classes (i.e, fish around 93 cm and aged 5 in 2014 and 2018) were above average.

Observer sampling in the JMA midwater trawl fishery in KIN 7 and 8 allows the progression of year classes entering the west coast Nort Island fishery to be followed (Figure 12). For example, based on the size at age estimated from the East Northland von Bertalanffy curve (Table 7), the small mode of fish observed in the Challenger (CHA) FMA around 50 cm in 2015 is likely to be age 1 fish, that are subsequently evident as a 60 cm mode in 2016. There was no sampling in 2017, but a 70 cm mode in 2018, and an 85 cm mode in 2019, dominate the fishery potentially indicating a large cohort with slower-than-expected growth. Sampling is more limited in the Central West (CEW) and Auckland West (AKW) FMAs, but the same modes are evident in 2015 and 2016 sampling in these areas.

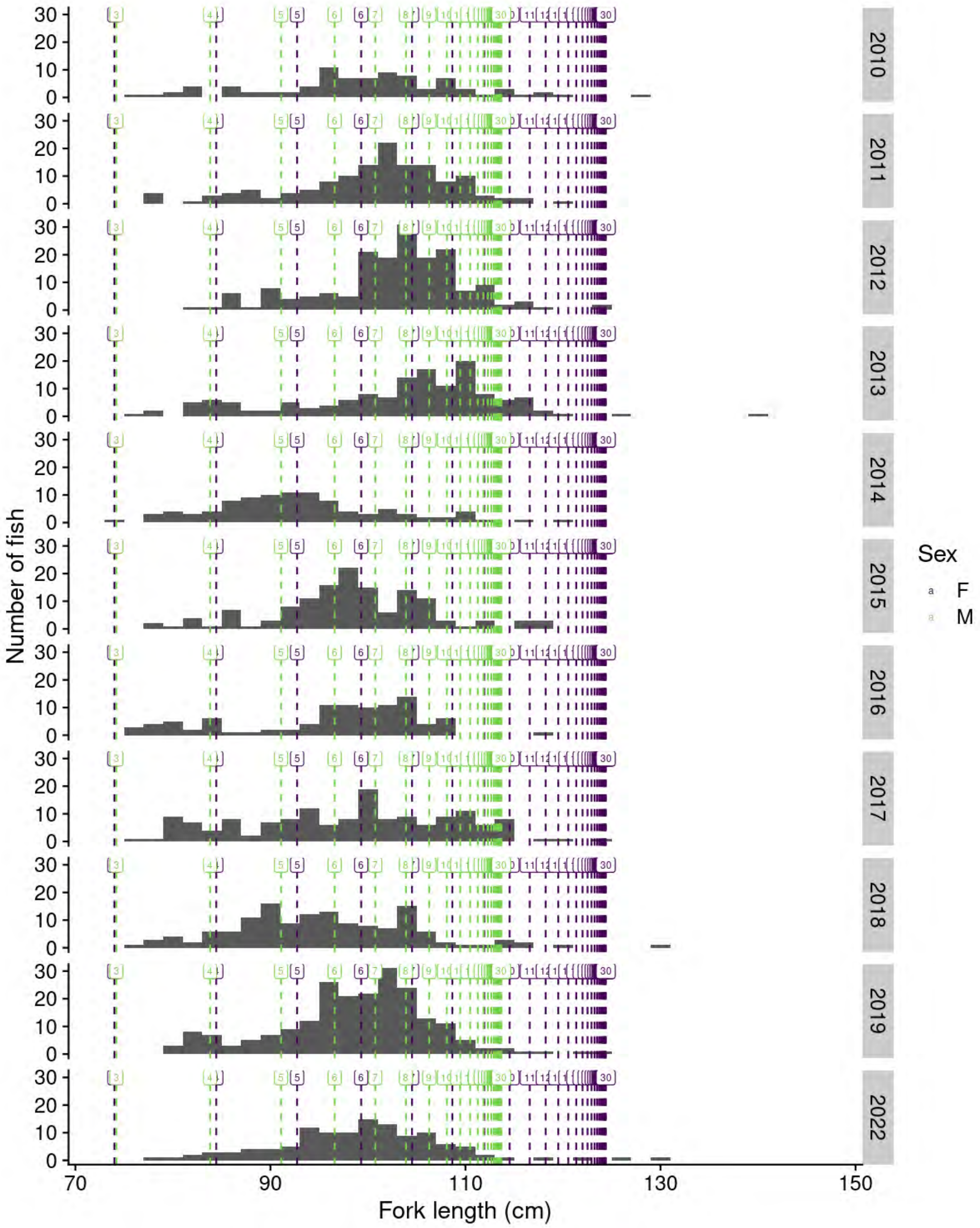


Figure 11: Length frequency distributions for kingfish measured from the Bay of Islands Yellowtail Tournament by Bluewater Marine Research, with estimated mean length at age for male and female kingfish in East Northland (Table 7). Note that the Tournament was not held in 2020 and 2021 due to Covid pandemic restrictions.

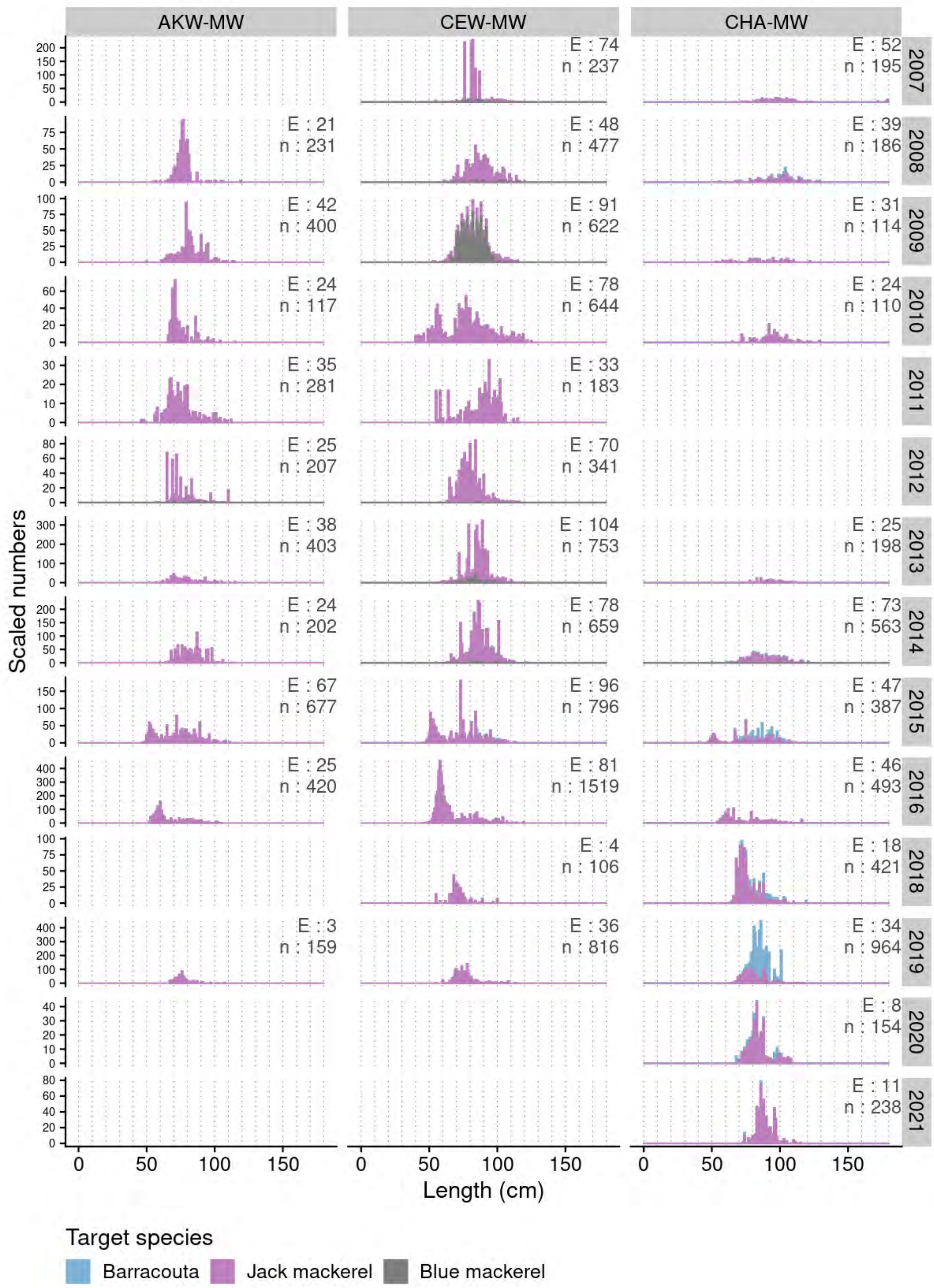


Figure 12: Length-frequency distributions for kingfish caught in the midwater trawl fishery, by area, fishing year, and target species. Annotations indicate the number of unique sampling events (E) and sampled number of fish (n) for each area, target and year. Sampled numbers are scaled to the catch weight in each sampled event. Column headers refer to Observer Fisheries Management Area codes: AKW – Auckland West (FMA 9), CEW – Central Egmont (FMA 8), CHA – Challenger (FMA 7). All midwater trawl.

Establishing B_{MSY}-compatible reference points

The working group accepted the trip-level bottom longline index as the primary index of abundance for KIN 1 (East Northland) and the observer data based tow-level model for KIN 7 and KIN 8. Most of the available CPUE series start in the early 2000s and show steeply increasing trends in abundance for all areas. With the lack of stable periods of high catch and abundance, the working group concluded that the most reasonable approach to determining reference points was to choose stable periods of low abundance early in the series as representing soft limits. The KIN 1 longline series monitors the portion of the population vulnerable to longline gear used to target snapper. Because the selectivity of this gear excludes larger adults found on offshore features, the offshore populations are monitored separately for EN and BoP using *Z* estimates derived from the age composition of recreational and charterboat catches from these features. The target mortality rate is $F_{SB40\%} = 0.1$.

4.2 Catch at age sampling (KIN 1)

The age composition of the KIN 1 target recreational charter boat fleet catch was sampled in 2010–11 and in 2014–15 for the purpose of estimating total mortality (*Z*). Sampling was stratified into two regions, East Northland and Bay of Plenty, and two strata based on distance from the shore: inshore on the North Island continental shelf (shallower than 200 m) and around four offshore islands and pinnacles. Representative samples of kingfish over the MLS were obtained from the offshore Bay of Plenty and inshore East Northland with 831 and 863 kingfish measured over 75 cm in these two strata in 2014–15 (Table 8). Sampling was less successful in the inshore Bay of Plenty and the offshore East Northland but deemed usable by the Inshore Working Group.

Table 8: Number of kingfish lengths and otolith sets collected in 2014–15 from the recreational fishery.

	KIN measured > 75 cm	Otoliths collected	Otoliths used in the age-length key
Inshore Bay of Plenty	211	57	212
Offshore Bay of Plenty	831	156	
Inshore EN/HGU	863	217	271
Offshore East Northland	318	55	

All kingfish were measured and recorded per trip on participating vessels. Age-length keys were developed using otoliths from retained fish. Bay of Plenty offshore samples in 2010–11 included more old fish than those from inshore (Holdsworth et al 2013). The Bay of Plenty offshore age distribution in 2014–15 was similar to that observed from the Bay of Plenty in 2010–11, although more older fish were evident in the 2014–15 sample. In 2014–15 there was a mode at age 5 in East Northland and age 6 in Bay of Plenty (Figure 13).

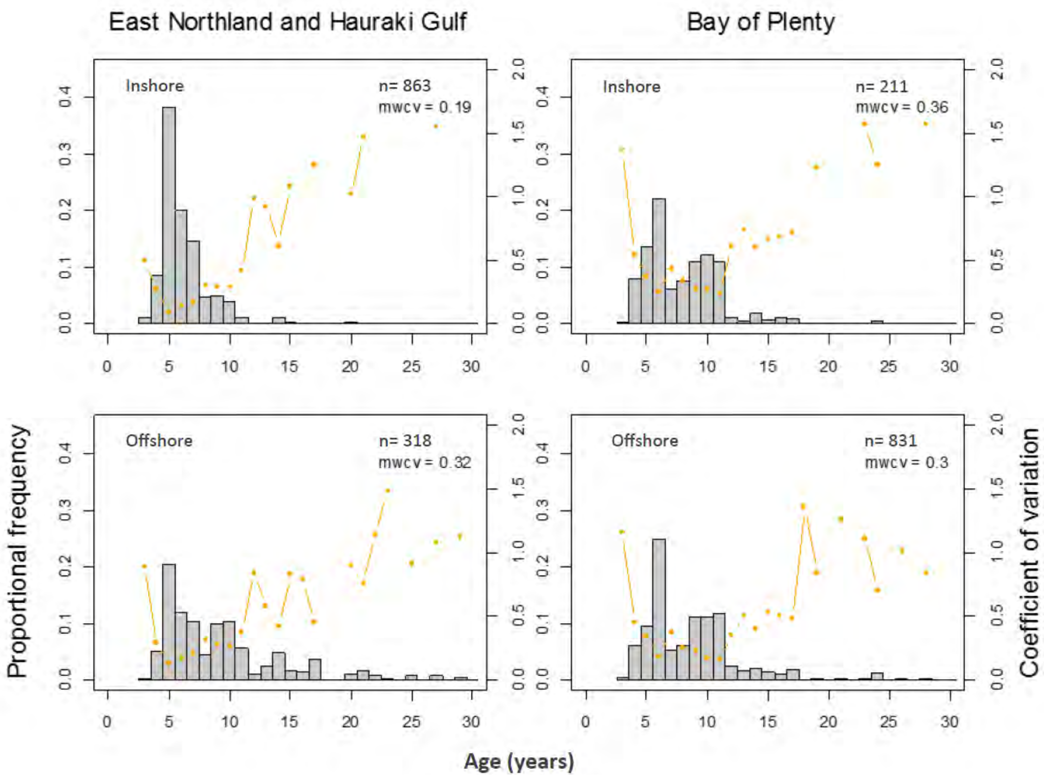


Figure 13: Kingfish age composition by region for inshore and offshore samples in 2014–15.

The Inshore Working Group agreed there was no valid method for combining inshore and offshore age frequencies by region for the purpose of estimating regional total mortality (Z), recommending instead that total mortality estimates be derived solely from the offshore age frequencies.

Total mortality estimates for offshore areas ranged from 0.19 to 0.25 for 2014–15 (Table 9). The $F_{SB40\%}$ target reference point for kingfish is 0.1, as derived by *SSB*/*R* methods (Holdsworth et al 2013). Assuming an instantaneous natural mortality rate (*M*) of 0.2, the target total mortality (*Z*) rate for kingfish is 0.3. None of the 2014–15 derived *Z* estimates given in Table 9 are higher than 0.3, suggesting that overfishing of kingfish in offshore areas of the Bay of Plenty and East Northland was unlikely. Although movement has been recorded between inshore and offshore areas, the relationship between these areas is unknown.

Table 9: Total mortality (*Z*) estimates for KIN 1 sub-regions as derived from catch-curve analysis (Chapman & Robson) of recreational charter boat catch-at-age data by fishing year, assuming 6 years is the age at full recruitment. The offshore estimate for the Bay of Plenty in 2009–10 was for the White Island area only and the offshore estimate for Northland in 2014–15 was for the Three Kings area only. Bootstrap CVs are shown in parentheses. EN/HG is East Northland/Hauraki Gulf, BoP is Bay of Plenty.

	EN/HG		BoP	
Sub-Region	2009–10	2014–15	2009–10	2014–15
Inshore	0.87 (0.12)	0.49 (0.08)	0.50 (0.14)	0.29 (0.09)
Offshore	–	0.19 (0.08)	0.30 (0.14)	0.25 (0.07)

4.3 Biomass estimates

Few kingfish are encountered in trawl surveys likely because their swimming speed and endurance makes them capable of escaping during the tow or while hauling (this exacerbated by the relatively low tow speed and duration of survey tows, suggesting that trawl surveys are not a suitable method for monitoring changes in kingfish abundance). Kingfish are amenable to mark-recapture studies. However, up to now, tagging studies have been conducted solely to describe kingfish movement patterns and to estimate growth. Data from these programmes are inadequate to estimate stock biomass because tag releases and recoveries are voluntary, not systematic.

4.4 Other factors

It was recognised that if the increases in abundance represented a regime shift, or a significant change in productivity levels, with an associated increase in B_0, then the use of historical levels of relative abundance to establish a soft limit may not be appropriate.

4.5 Future research considerations

<u>CPUE analyses</u>

- Further investigate the implications of modelling catch and effort data aggregated to trip levels vs. finer scale data, with consideration of the range of descriptors that can be constructed for trip models (including weighting by catch). Consideration should also be given to the choice of modal values for area and month, and investigation of alternatives such as where fisheries spend the most time vs. where the influence is greatest.

<u>Catch curve analysis</u>

- Improve data collection to better understand inshore–offshore movements.
- Continue to monitor age structure in the offshore population

<u>General</u>

- Revisit estimates of biological parameters (maturity, natural mortality, growth rates, and length-weight).
- Develop full catch (removals) histories, including those for recreational fisheries. This is required to estimate the relative exploitation rate in partial quantitative assessments.
- Improve data collection from the charter boat catch and effort by requiring that released kingfish less than the MLS are reported separately from larger released kingfish.
- For KIN 7&8, there are observer length frequency and maturity data, and some otoliths have been collected, in addition to an accepted CPUE index. The length frequency, maturity and ageing data should be fully analysed with a view toward evaluating the feasibility of conducting a fully quantitative stock assessment in the future. Investigate how representative observer

sampling is of the full catch, given they only sample retained fish, and explore the potential of using observer data to generate a mature biomass index.
- Undertake an investigation of stock structure for kingfish.

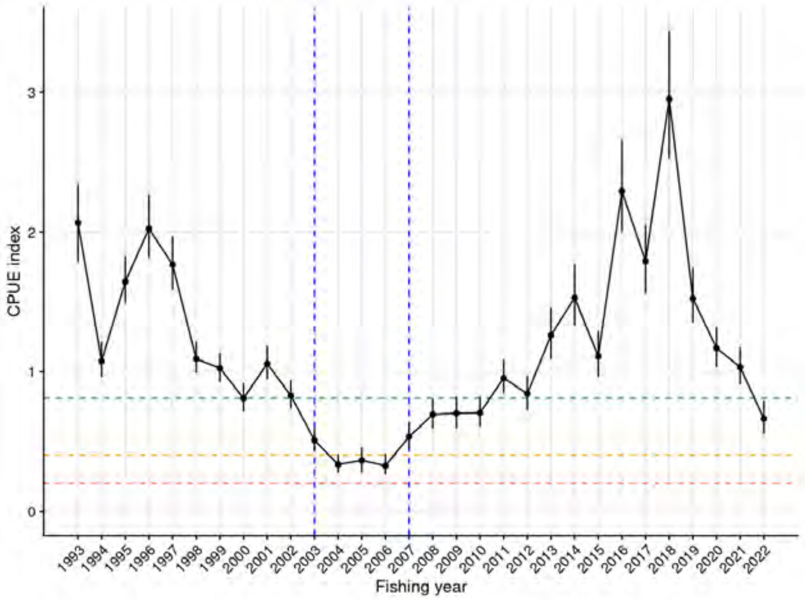
5. STATUS OF THE STOCKS

Stock Structure Assumptions
Meristic characteristics and parasite loads suggest that there are two stocks of kingfish off the west and east coasts. Opportunistic mark-recapture programmes indicate that most kingfish are recaptured close to the site of release, regardless of time at liberty. However, there some movement between the east and west coasts of the North Island, and more widely including trans-Tasman. The age structure of recreational catches suggests that kingfish off East Northland/Hauraki Gulf and in the Bay of Plenty/East Cape regions may comprise separate stocks.

For assessment purposes it is assumed that New Zealand kingfish comprise several biological stocks: East Northland, Bay of Plenty & KIN 2; KIN 3; KIN 7 & KIN 8. KIN 4 is not considered here.

- **KIN 1 – East Northland/Hauraki Gulf**

Stock Status		
Most Recent Assessment Plenary Publication Year	Inshore 2023; Offshore 2016	
Catch in most recent year of assessment	Year: 2021–22	Catch: 29 t (commercial)
Assessment Runs Presented	Standardised CPUE from the East Northland bottom longline fishery (trip index) (considered an index of inshore fish) Total mortality estimates from catch curve analysis for Offshore ENLD	
Reference Points	Inshore interim target: B_{MSY} proxy, interpreted as twice the mean CPUE for the period 2003–2007; Offshore interim target: $F_{SB40\%}$ (current estimate is $F_{SB40\%}$ = 0.1) Inshore Soft Limit: Mean CPUE from 2003–2007 Inshore Hard Limit: 50% of the soft limit Offshore Soft Limit: 20% B_0 Offshore Hard Limit: 10% B_0 Inshore overfishing threshold: Twice the relative exploitation rate from 2003–2007 Offshore overfishing threshold: $F_{SB40\%}$	
Status in relation to Target	Inshore: About as Likely as Not (40–60%) to be at or above the target Offshore: F_{2015} was Likely (> 60%) to be at or below the overfishing threshold	
Status in relation to Limits	<u>Inshore</u> Unlikely (< 40%) to be below the soft limit Very Unlikely (< 10%) to be below the hard limit <u>Offshore</u> Unknown for both the soft and hard limits	
Status in relation to Overfishing	Inshore: Unknown Offshore: Overfishing is Unlikely (< 40%) to be occurring	

Historical Stock Status Trajectory and Current Status-

Standardised catch per unit effort (CPUE) index for KIN 1 ENLD from bottom longlining targeting snapper, relative to the agreed reference points, the values from which were used to define the reference period.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The inshore index has shown a strong decline since 2018.
Recent Trend in Fishing Mortality or Proxy	In 2016, total mortality estimates from catch curve analyses indicated that *F* was likely to be at or below $F_{SB40\%}$ in offshore areas.
Other Abundance Indices	The recreational bait fishing index shows similar trends to the bottom longline inshore index. The BLL and inshore recreational bait fishery catch similar sized fish.
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 commence	Unknown

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Inshore: Standardised CPUE based on a delta-lognormal index from bottom longline Offshore: Estimates of total mortality using Chapman-Robson estimator	
Assessment dates	Latest assessment Plenary publication year: 2023 (CPUE); 2016 (Chapman-Robson)	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Commercial catch and effort data	1 – High Quality

	Ramp survey data used to generate a secondary index of abundance Recreational length frequency data used to interpret indices of abundance Packing data used to interpret indices of abundance Age structure of recreational catch in 2014–15 Instantaneous rate of natural mortality (*M*) of 0.20 based on a maximum age of 23 years. Age at 50% maturity (6 yr) Age at MLS (4 yr) Growth rate	2 – Medium or Mixed Quality: spatial coverage is an issue 1 – High Quality 2 – Medium or Mixed Quality: a detailed analysis of these data has not been completed 1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	The smoother fitted to the CPUE index was removed	
Major Sources of Uncertainty	- Uncertainty in the estimate of *M* - Uncertain relationship between inshore and offshore areas	

Qualifying Comments
Selectivity of the bottom longline fishery (and recreational bait fishery) is considered to be domed and the full adult population is unlikely to be indexed. The CPUE series does not apply to the offshore population that is fished on features by amateur charter vessels. Offshore fisheries occur on features (pinnacles or islands) found beyond the mainland 200 m depth contour.

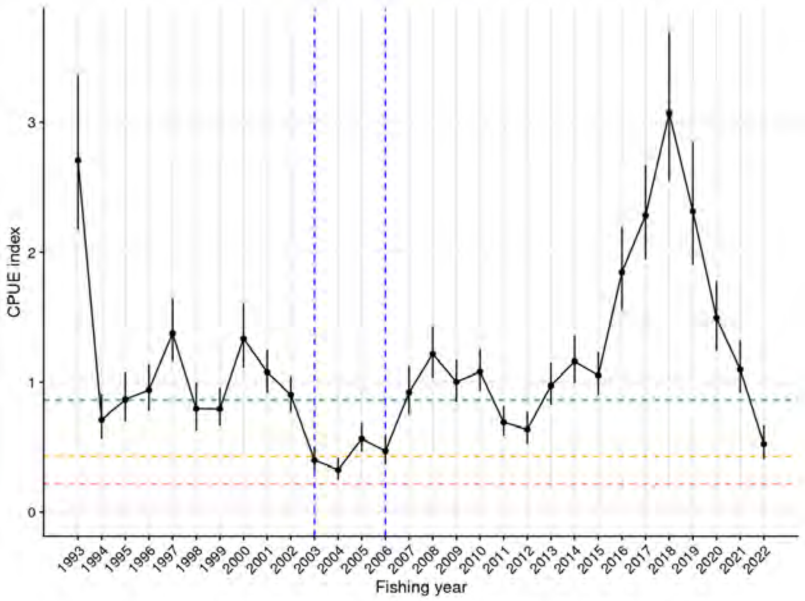
Fishery Interactions
Commercial kingfish catch is almost all bycatch in fisheries for other species.

- **KIN 1 – Bay of Plenty and KIN 2**

Stock Status		
Most Recent Assessment Plenary Publication Year	Inshore 2023; Offshore 2016	
Catch in most recent year of assessment	Year: 2021–22	Catch: 73 t (commercial)
Assessment Runs Presented	Standardised CPUE from the Bay of Plenty bottom longline fishery (trip index) (considered an index of inshore fish) Total mortality estimates from catch curve analysis for Offshore Bay of Plenty	
Reference Points	Inshore interim target: B_{MSY} proxy, interpreted as twice the mean CPUE for the period 2003–2006; Offshore interim target: $F_{SB40\%}$ (current estimate is $F_{SB40\%}$ = 0.1) Inshore Soft Limit: Mean CPUE from 2003–2007 Inshore Hard Limit: 50% of the soft limit Offshore Soft Limit: 20% B_0 Offshore Hard Limit: 10% B_0 Inshore overfishing threshold: $F_{SB40\%}$ Offshore overfishing threshold: $F_{SB40\%}$	

Status in relation to Target	Inshore: Unlikely (< 40%) to be at or above the target Offshore: F_{2015} was Likely (> 60%) to be at or below the overfishing threshold
Status in relation to Limits	Inshore Soft Limit: Unlikely (< 40%) to be below Hard Limit: Unlikely (< 40%) to be below Offshore Unknown for both the soft and hard limits
Status in relation to Overfishing	Inshore: Unknown Offshore: Overfishing is Unlikely (< 40%) to be occurring

Historical Stock Status Trajectory and Current Status-



Standardised catch per unit effort (CPUE) index for KIN 1 BPLE from bottom longlining targeting snapper, relative to the agreed reference points, the values from which were used to define the reference period.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The inshore biomass has declined since 2018
Recent Trend in Fishing Intensity or Proxy	*F* appeared to have declined between 2010 and 2016 for Offshore BPLE (although White Island was the only BPLE area assessed in 2010); likely to have been low for the decade to 2016 in all BPLE areas
Other Abundance Indices	-
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	Soft Limit: Unknown for both inshore and offshore areas Hard Limit: Unknown for both inshore and offshore areas
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown for both the inshore and offshore areas

Assessment Methodology and Evaluation	
Assessment Type	Level 2 - Partial Quantitative Stock Assessment
Assessment Method	Standardised CPUE based on a delta-lognormal index from bottom longline (inshore)

	Estimates of total mortality using Chapman-Robson estimator (offshore)	
Assessment dates	Latest assessment Plenary publication year: 2023 (CPUE); 2016 (Chapman-Robson)	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Commercial catch and effort data Age structure of recreational catch in 2014–15 Instantaneous rate of natural mortality (*M*) of 0.20 based on a maximum age of 23 years. Age at 50% maturity (6 yr) Age at MLS (4 yr) Growth rate	1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	- Uncertainty in the estimate of *M* - Uncertain relationship between inshore and offshore areas	

Qualifying Comments
Selectivity of the bottom longline fishery (and the recreational bait fishery) is considered to be domed and the full adult population is unlikely to be indexed The CPUE series does not apply to the offshore population that is fished on features by amateur charter vessels Offshore fisheries occur on features (pinnacles or islands) found beyond the mainland 200 m depth contour.

Fishery Interactions
Commercial kingfish catch is almost all bycatch in fisheries for other species.

- **KIN 3**

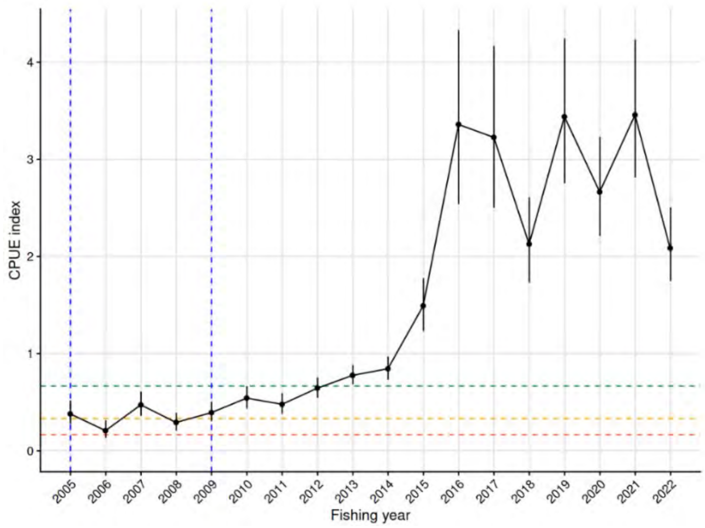
There is insufficient information to estimate current stock status. However, recent increases in catches are considered to be driven by increases in abundance.

- **KIN 7 and KIN 8**

Stock Status		
Most Recent Assessment Plenary Publication Year	2023	
Catch in most recent year of assessment	Year: 2021–22	Catch: 108 t (commercial)
Assessment Runs Presented	Standardised CPUE from observer tow data in the jack mackerel target midwater trawl fishery	
Reference Points	Interim Target: B_{MSY} proxy, interpreted as twice the mean CPUE in the period 2005–2009 Soft Limit: Mean CPUE from 2005 to 2009 Hard Limit: 50% of the soft limit Overfishing threshold: Twice the relative exploitation rate in 2005–2009	

Status in relation to Target	Very Likely (> 90%) to be at or above the target
Status in relation to Limits	Very Unlikely (< 10%) to be below both the soft and hard limits
Status in relation to Overfishing	Unknown

Historical Stock Status Trajectory and Current Status-



Standardised catch per unit effort (CPUE) index for KIN 7 and KIN 8 from midwater trawling targeting jack mackerel (observer tow-level index), relative to the agreed reference points, defined by the period indicated between dashed blue vertical lines.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	CPUE increased considerably from 2006–07 to 2016 and has fluctuated without trend since then, remaining well above the interim target
Recent Trend in Fishing Mortality or Proxy	-
Other Abundance Indices	-
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	Soft Limit: Very Unlikely (< 10%) for current retained catch Hard Limit: Very Unlikely (< 10%) for current retained catch
Probability of Current Catch or TACC causing Overfishing to continue or commence	Unknown

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Standardised CPUE based on a lognormal index from observed midwater trawl tows targeting jack mackerel	
Assessment dates	Latest assessment Plenary publication year: 2023	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Observer catch and effort data Observer length frequency data	1 – High Quality 1 – High Quality

Data not used (rank)	N/A
Changes to Model Structure and Assumptions	-
Major Sources of Uncertainty	- Avoidance of kingfish by the JMA fleet may impact this index
Qualifying Comments	
The vulnerable biomass index for the BATM fleet is largely sub-adults, and we are not monitoring adults well. Length observations are from the retained fish, and it is unclear how representative these are of total catch due to no measurements of fish released alive. The CPUE series may not be long enough to encompass the natural fluctuations in stock productivity.	

Fishery Interactions
Commercial kingfish catch is almost all bycatch in fisheries for other species.

6. FOR FURTHER INFORMATION

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