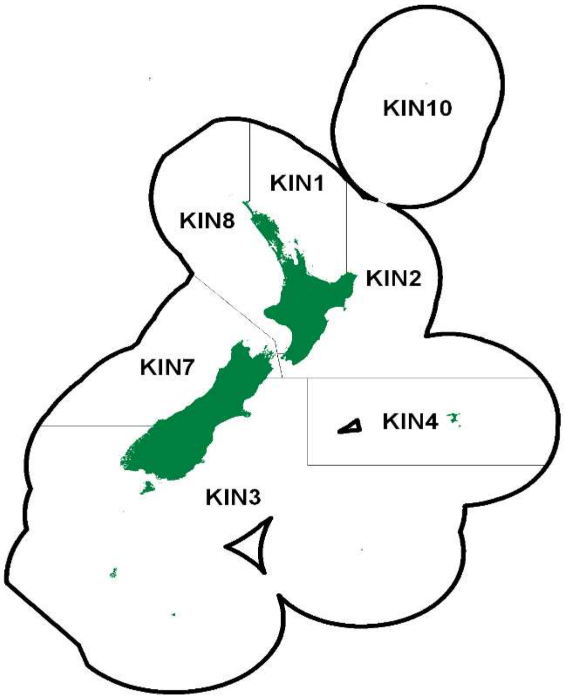
KINGFISH (KIN)

(*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 2021.

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 catching 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).

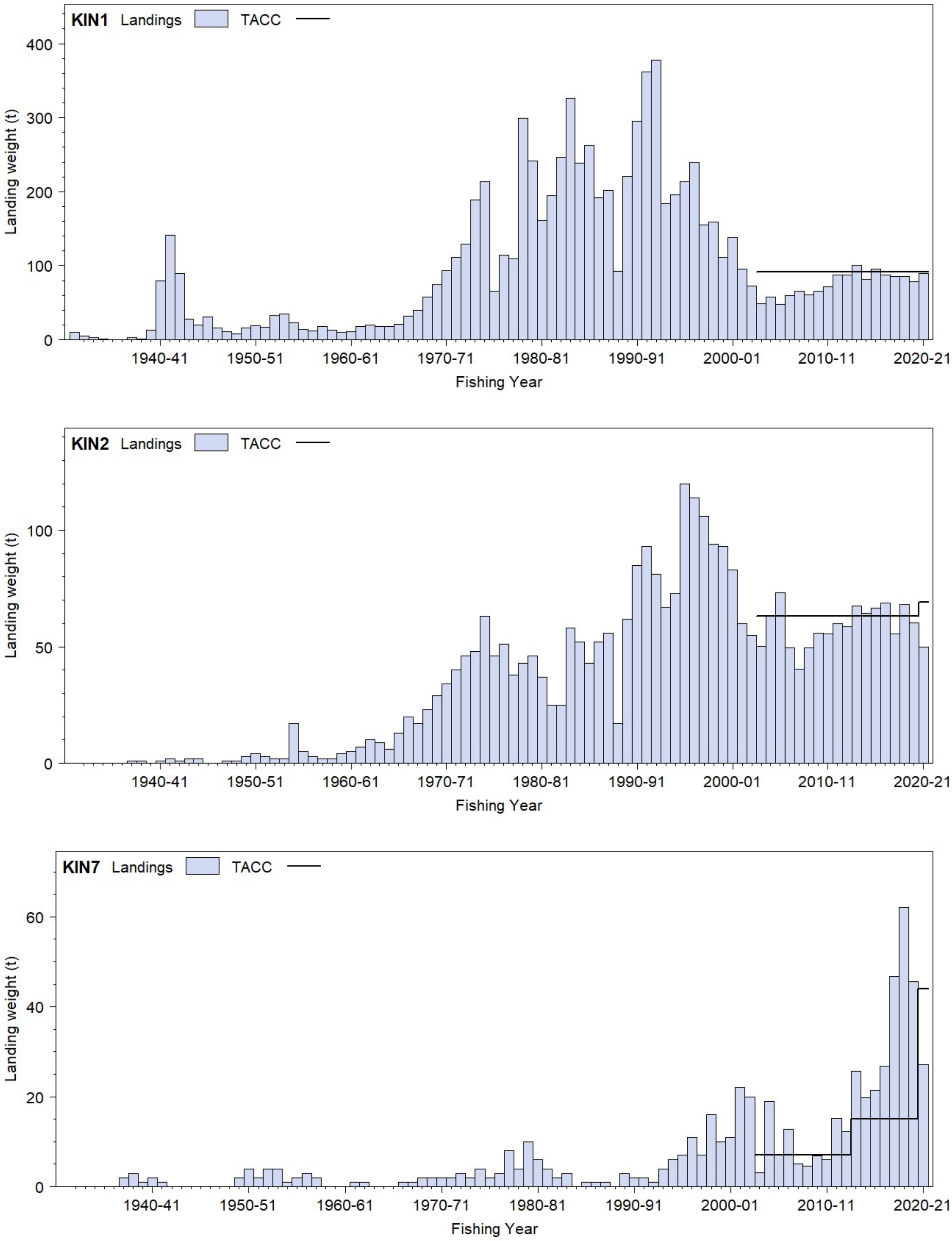


Figure 1: Reported commercial landings and TACC for the four largest KIN stocks. From top to bottom: KIN 1 (Auckland East), KIN 2 (Central East), and KIN 7 (Challenger). **[Continued on next page]**

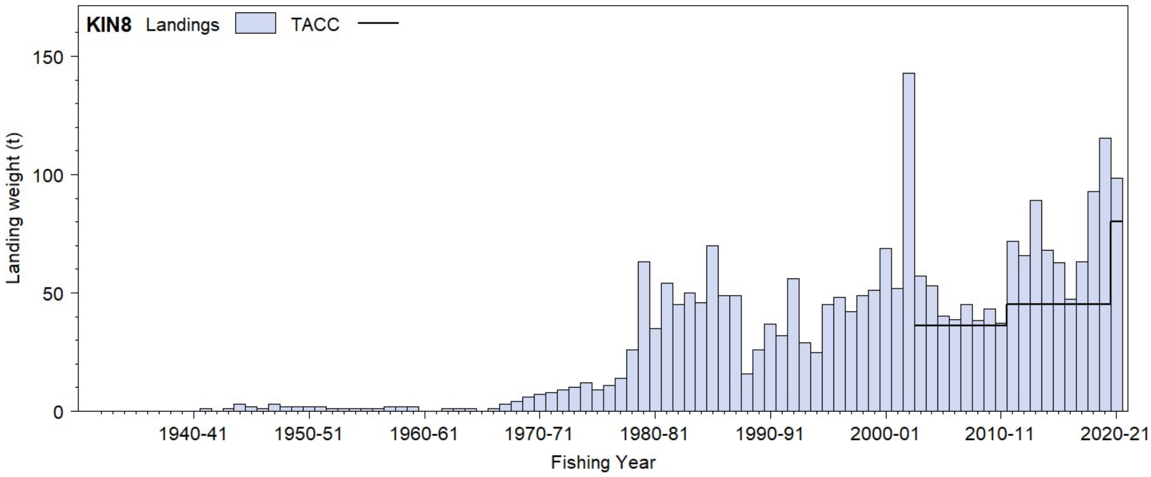


Figure 1: [Continued] Reported commercial landings and TACC for the four largest KIN stocks. KIN 8 (Central Egmont).

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 includes both foreign and domestic landings.

The main fishing areas for kingfish are the east (KIN 1 and KIN 2) and west coast (KIN 8) of the North Island of New Zealand (Table 2). In recent years an increasing amount of landings have been taken off the west coast of the South Island (KIN 7). 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 also remained at or below the TACC until 2012–13 but have fluctuated around the TACC since then. In KIN 3 landings have generally been very low, but have increased since 2015–16, and exceeded the 6 t TACC in 2018–19 and 2019–20. Landings in KIN 7 have increased substantially since 2011–12, consistently exceeding the TACC of 15 t (by 47 t in 2018–19). In KIN 8 landings dropped to just above the TACC from 2005–06 to 2010–11 but have typically been substantially above the TACC since then, reaching a peak of 115 t (TACC 45 t) in 2019–20.

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.

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 2		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
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

Table 3 [Continued]

Year	KIN 7		KIN 8		KIN 10		Total	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	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

* 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 released in accordance with Schedule 6 conditions and reported against this code are not counted against ACE. 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 exceeded the retained catch since 2016 (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.

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. An increased MLS to 75 cm (from 65 cm) for recreationally caught kingfish was introduced 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)

Table 4: Groomed landings (t) of kingfish by area (QMA) from 2006–07 to 2018–19 by destination. Landing code 'L' represents normal landings to a licensed fish receiver, code 'X' indicates returns to the sea under Schedule 6, and 'Other' includes all other non-intermediate landing codes.

Fishing	KIN 1			KIN 2			KIN 3			KIN 7			KIN 8		
year	L	X	Other	L	X	Other	L	X	Other	L	X	Other	L	X	Other
2006–07	62	0	1	50	0	0	1	0	0	12	0	1	37	0	3
2007–08	67	0	2	43	0	0	0	0	0	8	0	1	44	10	2
2008–09	62	0	2	52	0	0	0	0	0	4	0	1	36	1	3
2009–10	68	0	2	56	0	0	1	0	0	5	1	1	39	13	5
2010–11	70	0	2	55	0	0	1	0	0	5	1	1	34	8	4
2011–12	90	0	2	59	1	0	1	0	0	13	4	3	64	36	7
2012–13	87	0	2	56	0	0	1	0	0	8	4	4	63	44	8
2013–14	99	0	2	69	3	0	1	0	0	22	11	5	83	17	7
2014–15	80	1	2	64	7	0	1	1	1	15	12	5	63	9	6
2015–16	95	30	4	67	1	0	2	1	1	16	29	6	58	29	6
2016–17	87	50	4	69	6	0	3	1	2	21	21	4	42	36	7
2017–18	84	70	5	55	8	3	3	0	1	41	100	8	55	61	7
2018–19	82	34	5	66	6	3	6	2	2	59	103	4	88	103	7
2019–20	77	30	3	60	15	1	8	4	3	41	34	4	103	103	9

1.2.2 Tag and release

A voluntary recreational tagging programme has released 23 684 kingfish in New Zealand (1975 to 2019). Anglers feel they are contributing to research and conservation of stocks, while still getting recognition of their catch. The research objectives are to collect detailed information on released fish to help characterise the fishery and collect growth and movement information from recaptured fish. There have been 1608 tagged kingfish recaptured in New Zealand (1977 to 2019), with an average of 36 recaptures (and 679 releases) per year over the last 10 years (Table 5) (Holdsworth & Saul 2019).

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 2). The proportion of recaptured kingfish at distances (over 100 nautical miles) increases after 3 years. Although kingfish are also capable of extensive movements, with three trans-Tasman recaptures recorded, 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.

	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19
Releases	1 381	1 123	613	761	649	723	607	598	546	509
Recaptures	46	54	44	38	31	30	28	31	23	32

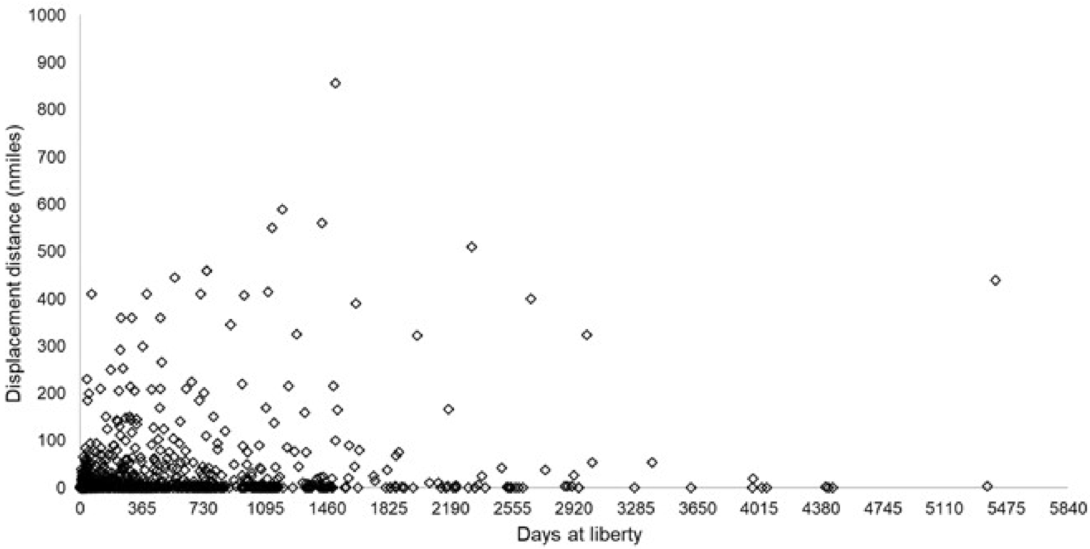


Figure 2: Kingfish straight line distance (nautical miles) from release location by days at liberty 1977 to 2018.

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 2002) 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 and repeated in 2017–18 (Wynne-Jones et al 2014, 2019). 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 the national panel survey estimate does not include recreational harvest taken under s111 general approvals on commercial vessels. 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 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 2002, Boyd et al 2004, Wynne-Jones et al 2014).

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	52 056	535	0.13
	2018	Panel survey	69 473	571	0.16
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	4 025	41	0.24
	2018	Panel survey	9 602	79	0.28
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	3 289	27	0.25
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	6 252	63	0.25
	2018	Panel survey	6 672	55	0.22

#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 has increased in commercial fisheries since 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.

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 in Table 7.

Table 7: Estimates of biological parameters.

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

Fishstock	Estimate: Both sexes a	Estimate: Both sexes b	Source
KIN 1	0.03651	2.762	Walsh et al (2003)

2. von Bertalanffy growth parameters

Fishstock	Females L_∞	Females k	Females t_0	Males L_∞	Males k	Males t_0	Combined L_∞	Combined k	Combined t_0	Source
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 (2010)	124.48	0.232	-0.890	113.69	0.279	-0.790				Holdsworth et al (2013)
Bay of Plenty (2010)	125.63	0.211	-0.987	119.32	0.226	-0.976				Holdsworth et al (2013)

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.

Tagging results suggest that most adult kingfish do not move outside local areas, with many tag returns close to the release site (Figure 2). 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.

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. 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, and the offshore midwater trawl fishery that targets jack mackerels in KIN 7 and KIN 8 off the western North Island and north-western South Island (from trips where an observer was present on the vessel). Additional indices were developed for the midwater fishery in KIN 7 and 8 from trips where an observer was present on the vessel, and 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 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 SNA mostly caught small kingfish.

In KIN 2, 7, and 8, and the bottom trawl fisheries in KIN 1, the proportion of the trip-level landed catches represented in aggregated event-level catch estimates can be low, especially where 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 and, for the midwater fishery in KIN 7 and 8, the proportion of jack mackerel target tows. 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. For the midwater fishery in KIN 7 and 8 there were few trips without kingfish landings and a lognormal model of positive catches was fitted. Analyses were restricted to the period after kingfish was introduced to the QMS and, for the midwater trawl fishery, data were only used from trips where an observer was present on the vessel.

For the East Northland bottom longline fishery, the working group noted that kingfish was a valuable bycatch of the snapper longline fishery and that they appeared to have been consistently reported in estimated catches and landings since the QMS catch-effort data systems were introduced in the 1990 fishing year. As a result, 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.

For the observed trips from the midwater trawl fishery in KIN 7 and 8, modelling used tow-level data and a delta-lognormal model was fitted using tow-level covariates.

Negative-binomial GLMMs were fitted to the number of fish caught during recreational bait-fishing trips recorded in the ramp survey data. 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. 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.

A key consideration in the working group's evaluation of the resulting series and indices of relative abundance was the size composition of the kingfish catch in each fishery. Aggregated observer data (Figure 3) indicated that the bottom trawl fisheries primarily catch immature kingfish, whereas the midwater trawl fishery catches both juvenile and adult fish. 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 4). This indicates that the bottom longline fishery also catches 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.

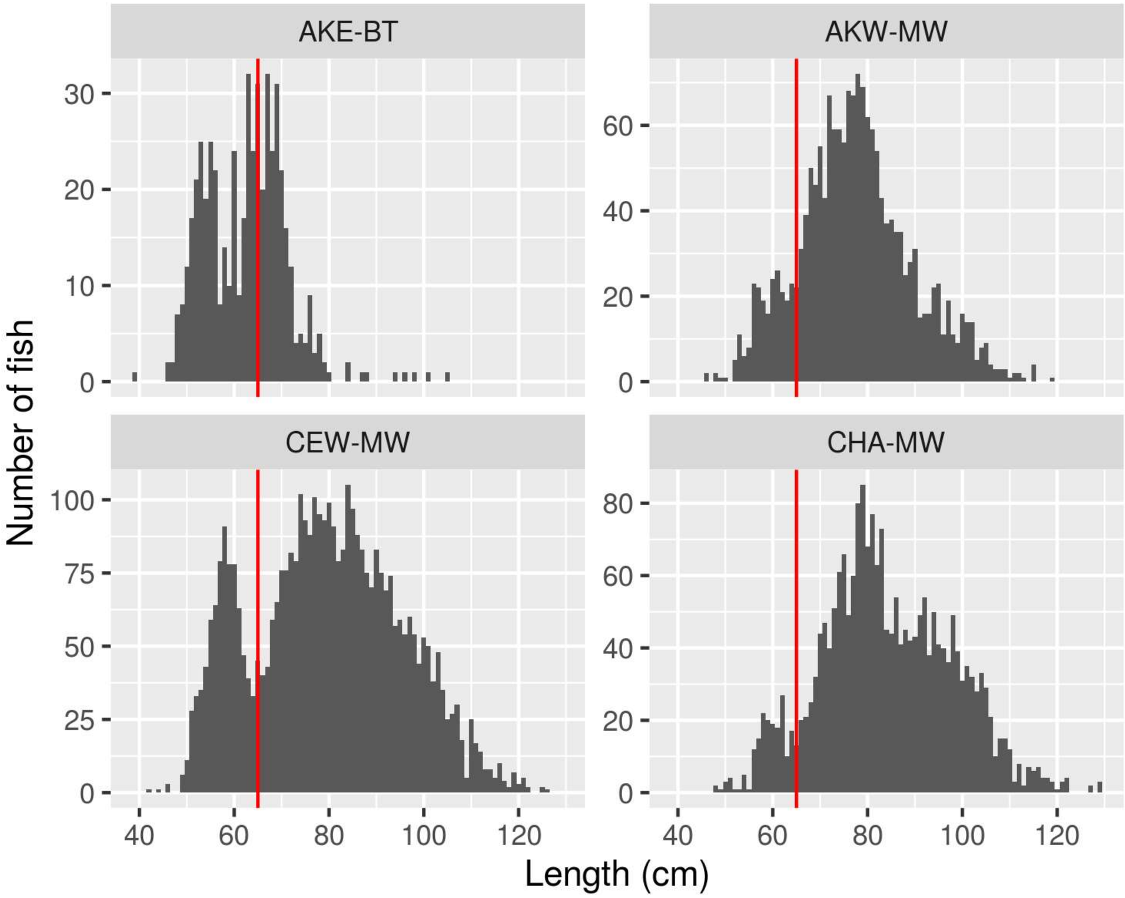


Figure 3: Raw aggregate length-frequency distributions for kingfish by area and method for kingfish using observer data collected from 2000–01 onwards, for strata where at least 200 fish were sampled. The red vertical line indicates the minimum legal size of kingfish for the commercial fishery.

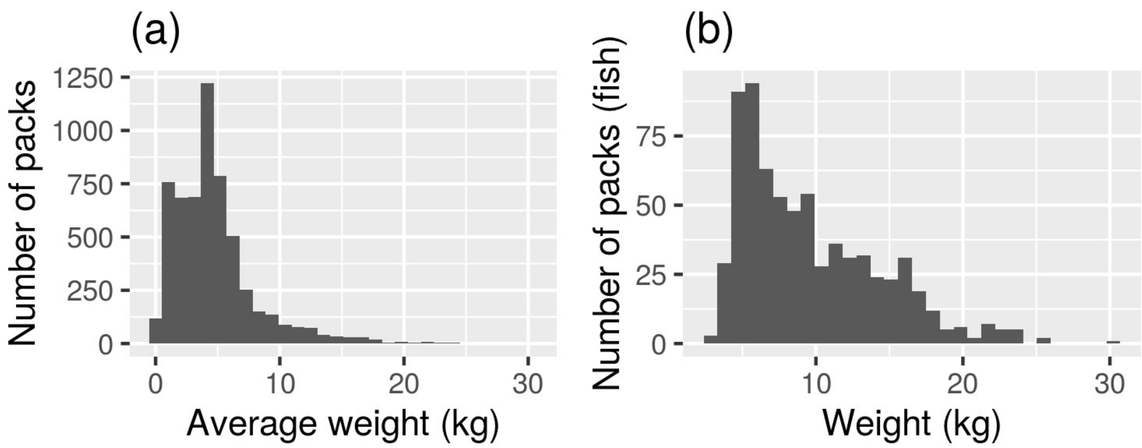


Figure 4: Weight frequency of (a) all kingfish and (b) single kingfish packed from the East Northland bottom longline fishery by Leigh Fisheries Limited between 2010 and 2016.

The different treatments of data from the East Northland bottom longline fishery result in similar indices (Figure 5), and indices from all three East Northland fisheries show a significant increase since 2010 (Figure 6) despite significant inter-annual variability in the longline index in this period. In the Bay of Plenty, the bottom trawl index increases consistently from 2004 to 2016 before declining somewhat to 2019 (Figure 7), whereas the recreational bait fishing index shows an increasing trend, but considerable year to year variation.

The trip based index from the statutory catch and effort data for the midwater trawl fishery in KIN 7 and 8 and the tow based observer index showed similar trends. 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 2020 (Figure 8). The index from the KIN 8 bottom trawl fishery demonstrated a more cyclic pattern around a steadily increasing trend from 2009 to 2020.

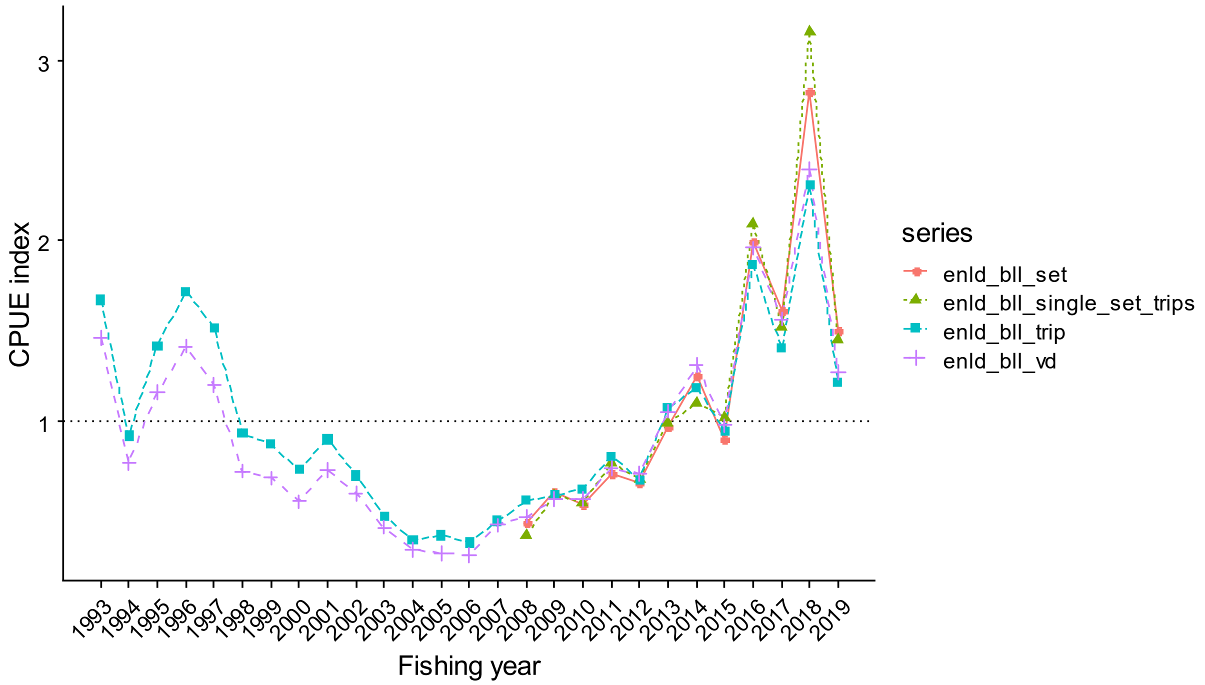


Figure 5: CPUE indices for the East Northland bottom longline fishery.

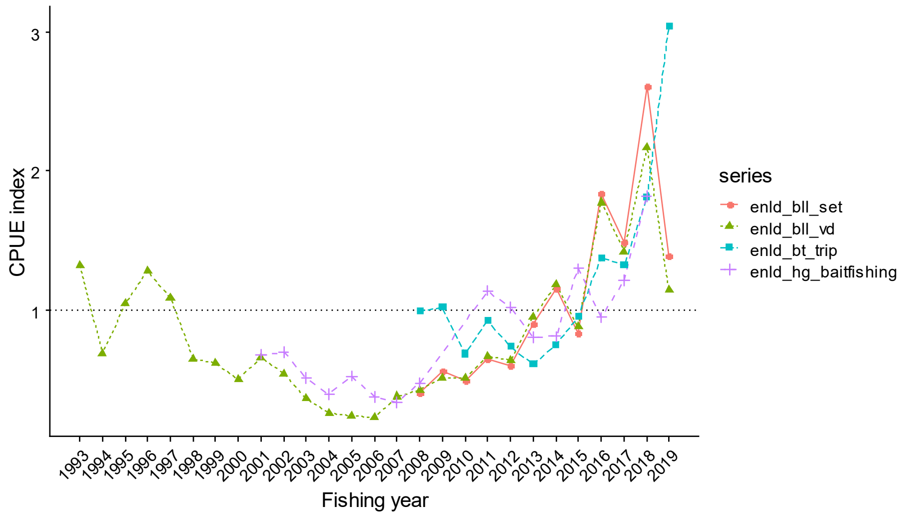


Figure 6: CPUE indices for the different East Northland fisheries.

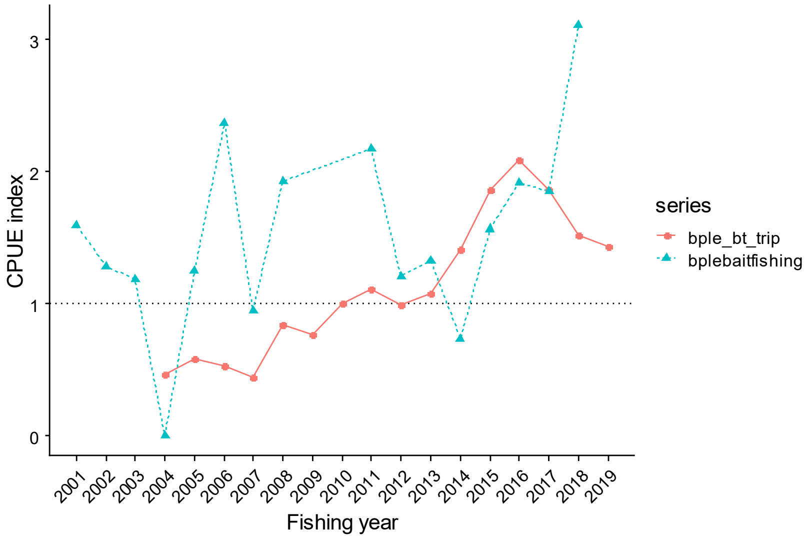


Figure 7: CPUE indices for the two Bay of Plenty fisheries.

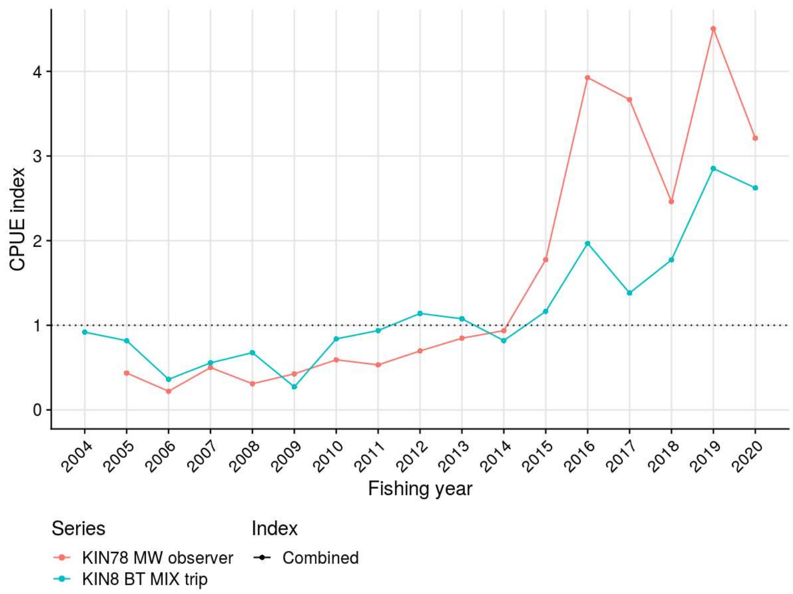


Figure 8: CPUE indices for the west coast North Island fisheries.

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 only defensible approach to determining reference points was to choose stable periods of low abundance early in the series as representing soft limits.

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.

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 9).

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	

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.

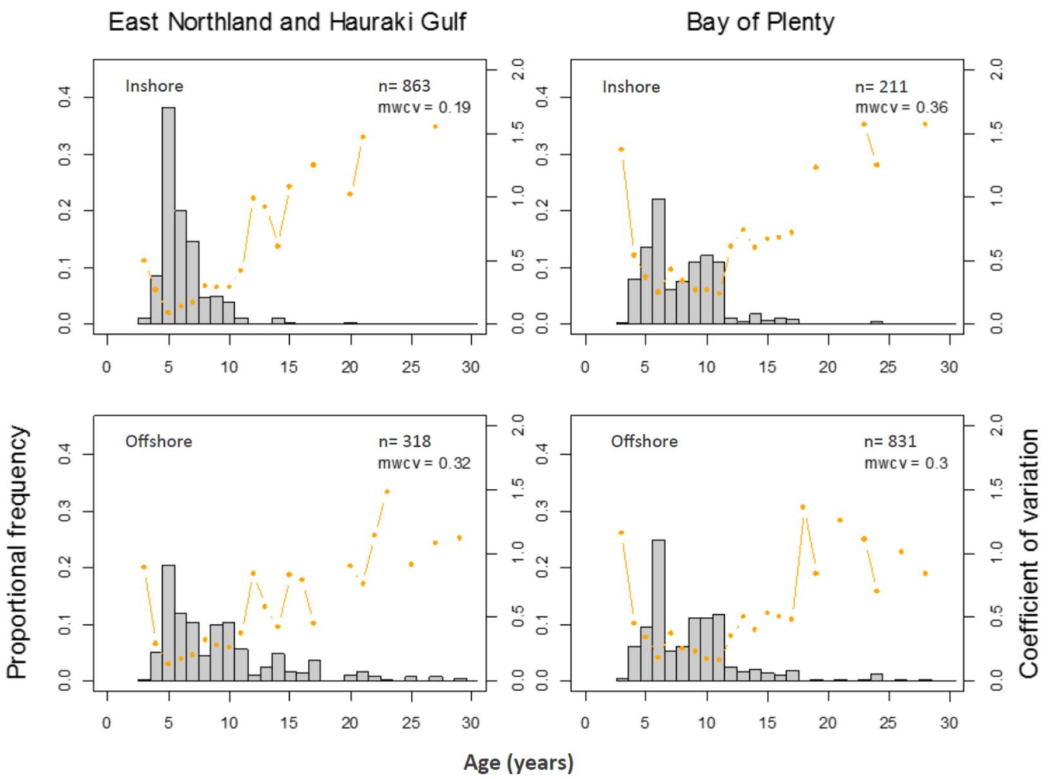


Figure 9: Kingfish age composition by region for inshore and offshore samples in 2014–15.

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 because they are capable of swimming faster the nets, suggesting that trawling is 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 investigation of the implications of modelling catch-effort data aggregated to trip levels vs finer scale data is needed, along 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.
- Further consider the benefits/pitfalls of smoothing CPUE indices (and alternative smoothing methods) when generating reference points from partial quantitative stock assessments. Consider the period where smoothing is the most needed or appropriate, which will generally be the recent period, because this enables better interpretations of current stock status relative to reference periods when recent CPUE indices are fluctuating, and it may be more appropriate to calculate simple moving averages over recent years.
- Revisit the bottom longline CPUE for the Bay of Plenty; although the spatial extent of this fishery may be limited, it may be the best option for an index that monitors immature and adult fish in this area.
- Full catch histories by area (recreational and commercial) are required to estimate the relative exploitation rate.
- Consider finer scale information (particularly spatial information) on fishing effort patterns in the East Northland commercial longline fishery; however such information is only available from 2004–05.

<u>Catch curve analysis</u>

- Sensitivity analyses to determine the effect of progressively increasing the age of full recruitment on the estimates should be conducted.
- Improved data to better understand inshore–offshore movements should be collected.

<u>General</u>

- Develop full catch (removals) histories, including those for recreational fisheries.
- The CPUE based on charter boat catch and effort forms should be improved by reporting released kingfish less than the MLS separately from larger released kingfish.
- For KIN 7&8, there are observer length-frequency data, and some otoliths have been collected, in addition to an accepted CPUE index. The length-frequency and ageing data should be fully analysed with a view toward evaluating the feasibility of conducting a fully quantitative stock assessment in the future.
- Scaled observer length-frequency data, and confirmation of sampling representativeness, would also be informative.

5. STATUS OF THE STOCKS

Stock Structure Assumptions

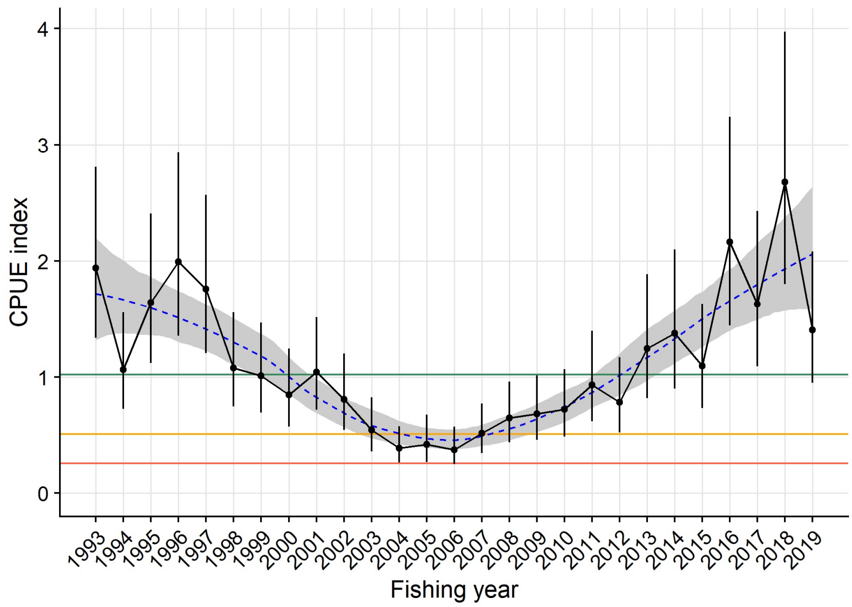
Meristic characteristics and parasite loads suggest that there are two stocks of kingfish off the west and east coasts. Extensive, opportunistic mark-recapture programmes indicate that most kingfish are recaptured close to the site of release, regardless of time at liberty, and there is little movement between the east and west coasts of the North Island. 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, consistent with movement patterns recorded from tagging studies. There is broad similarity in CPUE trends for East Northland and the west coast (KIN 7 and 8). Recruitment indices have shown similar trends for East Northland and the west coast, and the Bay of Plenty and FMA 2 since 2012.

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

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

Stock Status	
Year of Most Recent Assessment	2020
Assessment Runs Presented	Standardised CPUE from the East Northland bottom longline fishery (trip index)
Reference Points	Target: 40% B_0, interpreted as twice the smoothed mean CPUE for the period 2003–2007 Soft Limit: Mean smoothed CPUE from 2003–2007 Hard Limit: 50% of the soft limit Overfishing threshold: Twice the relative exploitation rate in 2003–2007
Status in relation to Target	Likely (> 60%) to be 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 1 ENLD from bottom longlining targeting snapper, relative to the agreed reference points, and a loess smooth curve—the values from which were used to define the reference period.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	CPUE decreased from 1993 to 2006 and then increased to 2018. The index has shown greater year to year variation since 2015 and it decreased in 2019.
Recent Trend in Fishing Mortality or Proxy	In 2016, total mortality estimates from catch curve analyses indicated that *F* was unlikely to be at or below $F_{SB40\%}$ in inshore areas but likely to be at or below $F_{SB40\%}$ in offshore areas
Other Abundance Indices	The bait fishing (fishing with bait) index for the recreational fishery shows a similar long-term trend to the bottom longline index.
Trends in Other Relevant Indicators or Variables	An index for immature fish using data from the bottom trawl fishery declined from 2008 to 2014 before increasing.

Projections and Prognosis	
Stock Projections or Prognosis	Because the index for immature kingfish shows a substantial increase in the last three years, it is anticipated that the recruited stock will continue to increase at current catch levels.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Very unlikely (< 10%) Hard Limit: Very unlikely (< 10%)
Probability of Current Catch or TACC causing Overfishing to continue or commence	Unlikely (< 40%)

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	
Assessment dates	Latest assessment: 2020	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	2 – Medium or Mixed Quality: spatial coverage is an issue
	Observer length frequency data used to interpret indices of abundance	2 – Medium or Mixed Quality: data is not fully representative
	Packing data used to interpret indices of abundance	2 – Medium or Mixed Quality: a detailed analysis of these data has not been completed
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	CPUE analyses were performed rather than catch curve analysis	
Major Sources of Uncertainty	It is unknown if all fish above the MLS returned to the sea are reported using the destination code X; such returns may be higher than reported	

Qualifying Comments
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. The method of smoothing the CPUE trajectory may need further development and should be interpreted with caution. The bottom longline fishery catches immature and adult fish and so is not an index solely of the spawning stock biomass.

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

- **KIN 1 – Bay of Plenty and KIN 2**

Stock Status	
Year of Most Recent Assessment	2016 with recruitment indices added in 2020
Assessment Runs Presented	Total mortality estimates from catch curve analysis for Inshore BPLE and Offshore BPLE Recruitment index of abundance based on bottom trawl CPUE
Reference Points	Target: $F_{SB40\%}$ (current estimate is $F_{SB40\%} = 0.1$) Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: $F_{SB40\%}$
Status in relation to Target	Inshore BPLE: *F* in 2016 was Likely (> 60%) to be at or below the target Offshore BPLE: *F* in 2016 was Likely (> 60%) to be at or below the target
Status in relation to Limits	Soft Limit: Unknown for both Inshore BPLE and Offshore BPLE Hard Limit: Unknown for both Inshore BPLE and Offshore BPLE
Status in relation to Overfishing	Inshore BPLE: Overfishing is Unlikely (< 40%) to be occurring Offshore BPLE: Overfishing is Unlikely (< 40%) to be occurring

Historical Stock Status Trajectory and Current Status-

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Unknown
Recent Trend in Fishing Intensity or Proxy	*F* appeared to have declined between 2010 and 2016 for Inshore BPLE and 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	The bait fishing index for the recreational fishery in the Bay of Plenty shows significant inter-annual fluctuations but has a generally increasing trend from 2001 to 2019.
Trends in Other Relevant Indicators or Variables	The CPUE indices for immature fish from the bottom trawl fisheries in the Bay of Plenty and KIN 2 show a steady increase from 2004 to 2016, before declining to 2019.

Projections and Prognosis	
Stock Projections or Prognosis	Catch curve analysis from catch sampling in 2014–15 indicated that total mortality was low for both the inshore and offshore regions, with fishing mortality below natural mortality and close to the target. The indices for immature fish are above average from 2013 to 2019 so the stock is expected to increase in the short term.

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	Unlikely (< 40%) for both inshore and offshore areas

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Estimates of total mortality using Chapman-Robson estimator	
Assessment dates	Latest assessment: 2016 (the 2020 update added recruit series for BoP and KIN 2)	Next assessment: 2021
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; available data do not support much movement of inshore fish to offshore areas. Information from KIN 2 recreational catch at age is limited to the northern part of the QMA	

Qualifying Comments
The *Z* estimates are unweighted by relative catch by method (bait, jig) and area. The selectivity of the two capture methods differs substantially. The indices from the bottom trawl fisheries do not provide indices of abundance for the whole population

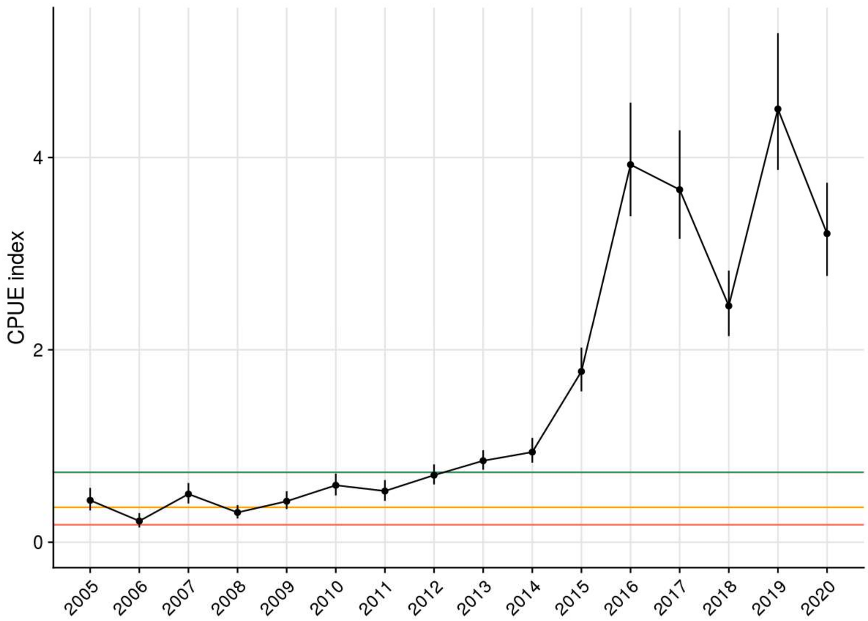
Fishery Interactions
Commercial kingfish catch is almost all bycatch in fisheries for other species.

- **KIN 7 and KIN 8**

Stock Status	
Year of Most Recent Assessment	2021
Assessment Runs Presented	Standardised CPUE from observer tow data in the jack mackerel target mid-water trawl fishery
Reference Points	Target: 40% B_0, interpreted as twice the mean CPUE in the period 2005–2009 Soft Limit: Mean CPUE from 2005–2009 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.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	CPUE increased considerably from 2006/2007 to 2016 and has been relatively stable at a high level since.
Recent Trend in Fishing Mortality or Proxy	-
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	An index for immature fish using data from the bottom trawl fishery shows an increasing trend from 2009 to 2020. Unscaled observer length-frequency data are indicative of strong recruitment in 2015.

Projections and Prognosis	
Stock Projections or Prognosis	Because there are indications of recent high recruitment, it is anticipated that the spawning stock will remain high at current catch levels, and the vulnerable biomass is expected to remain above the target level.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Very unlikely (< 10%) Hard Limit: Very unlikely (< 10%)
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: 2021	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Observer catch and effort data Commercial catch and effort data Observer length-frequency data	1 – High Quality 1 – High Quality 2 – Medium or Mixed Quality: data were unscaled
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

Qualifying Comments
It was recognised that if the increases in abundance represented a regime shift or a temporary or permanent increase in productivity, 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.

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

6. FOR FURTHER INFORMATION

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