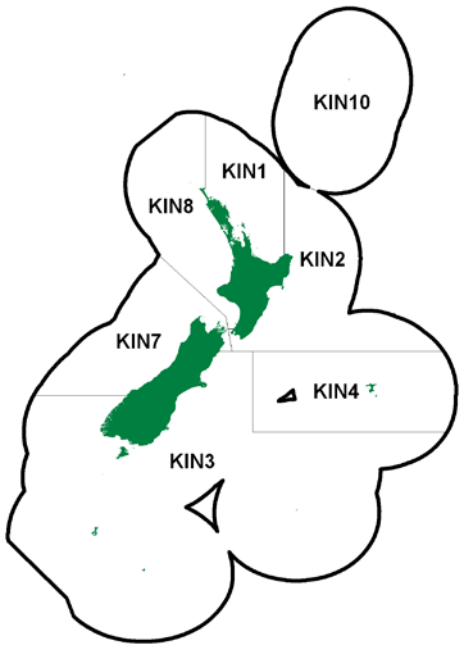
KINGFISH (KIN)

(*Seriola lalandi*)
Haku



1. FISHERY SUMMARY

Kingfish were introduced into the QMS on 1 October 2003, with allowances, TACCs and TACs in Table 1 except that he TACC for KIN 8 was increased from 36 to 45 t in October 2012.

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

Fishstock	Recreational Allowance	Customary non-commercial Allowance	Other sources of fishing related mortality	TACC	TAC
KIN 1	459	76	47	91	673
KIN 2	65	18	24	63	170
KIN 3	1	1	0	1	3
KIN 4	1	1	0	1	3
KIN 7	10	2	2	7	21
KIN 8	31	9	7	45	92
KIN 10	1	0	0	1	2

An increased minimum legal size (MLS) to 75 cm (from 65 cm) for recreationally caught kingfish was introduced on 15 January 2004. Kingfish were added to the 6th Schedule of the Fisheries Act (1996) in October 2005 for all fishing methods except setnet and in all areas. A special reporting code for 6th Schedule releases was introduced on 1 October 2006 to allow monitoring of releases. Kingfish released in accordance with 6th Schedule conditions and reported against this code are not counted against ACE.

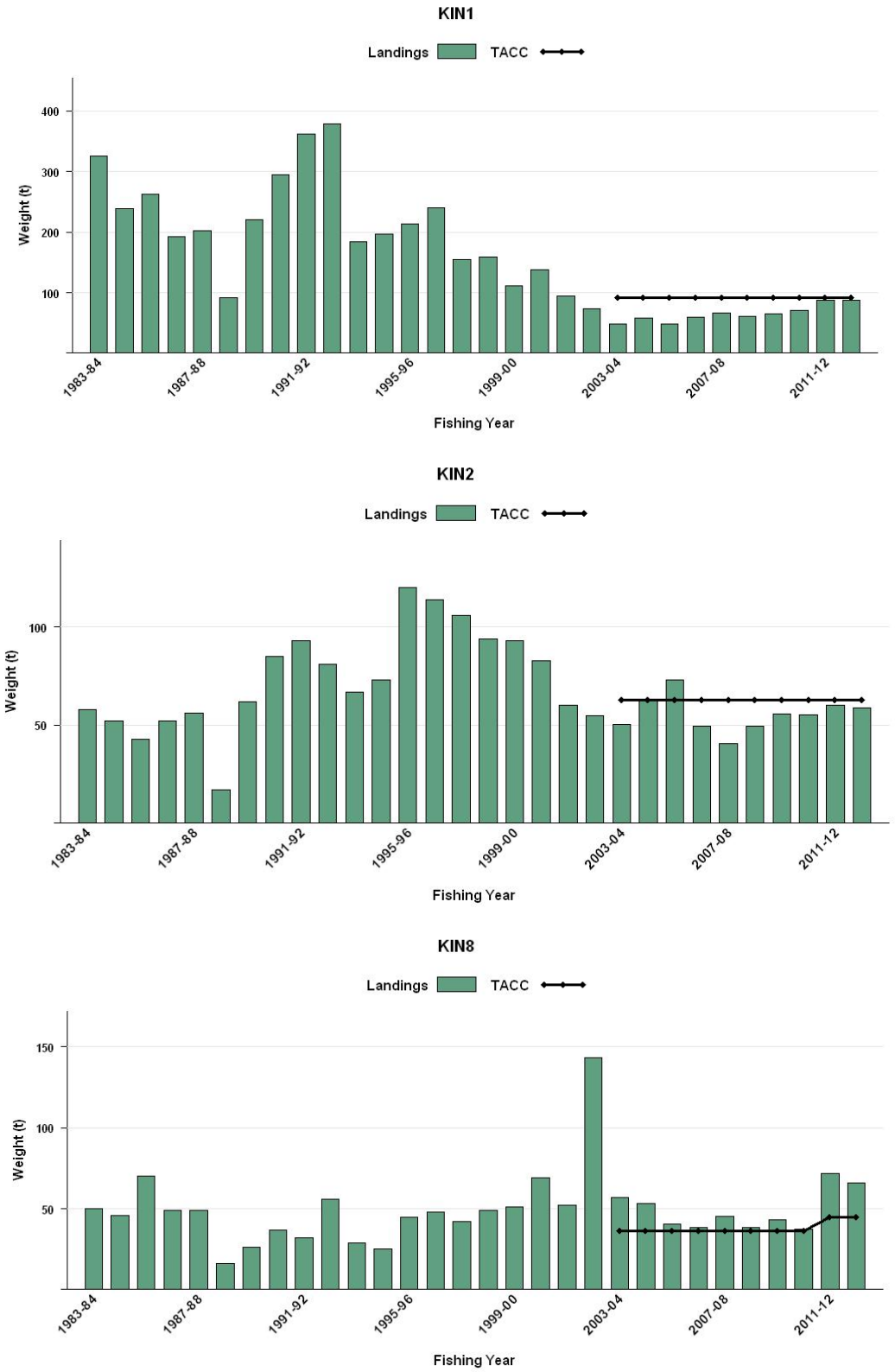


Figure 1: Historical landings and TACC for the three largest KIN stocks. From top left: KIN 1 (Auckland East), KIN 2 (Central East) and KIN 8 (Central Egmont).

1.1 Commercial fisheries

Kingfish commercial landings are reported largely as bycatch of inshore setnet, trawl and longline fisheries. From 1991 to late 2003, targeting of kingfish (as a non-QMS species) was prohibited unless the species was identified on a fisher's permit. A few permit holders were authorized to target kingfish and most of their catch was taken using setnets.

Commercially, kingfish is a moderately high value species and is usually sold as fillets or whole chilled.
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). The largest commercial catches generally come from KIN 1. Landings were relatively large in 1983–84, especially in KIN 1, and were probably due to the greater number of vessels in the fishery prior to the introduction of the QMS in 1986. In addition, there was increased effort and better reporting as fishers sought to establish a catch history for the main species in anticipation of the introduction of the QMS. By 1988–89, reported catches of kingfish had reduced to their lowest levels across most areas. This was most likely due to the under-reporting of less common species in the catch (which includes kingfish) and the introduction of non-QMS restrictions. An increase in kingfish landings in FMA 1 between 1988–89 and 1992–93 and in FMA 2 between 1988–89 and 1991–92 may be due to a number of factors. These include: better reporting of catches; changes in fishing patterns with increased catch by setnet; increased numbers of vessels reporting kingfish catch; and increased targeting of kingfish.

The total reported catch across all FMAs peaked in 1992–93 at 532 t, with 73% of the catch from KIN 1. By 1993–94, the reported catch of kingfish over all QMAs decreased considerably, mainly because of the reduced catch from KIN 1. 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 setnet, trawl, and bottom longline fisheries (that were responsible for most of the non-target catch of kingfish); decreased target fishing for kingfish; and setnet area closures in FMA 1 from October 1993. The trawl exemption with respect to MLS was removed in December 2000.

The annual catch of kingfish from KIN 1 fluctuated between 100 and 250 t from 1993–94 through to 2000–01 and has remained below 100 t since 2001–02. The kingfish annual catch from KIN 2 declined from the high of 120 t in 1995–96 to 50 t in 2003–04, and has mostly been below 60 t since then. Landings from KIN 8 have averaged approximately 35 t for the last 19 years, with catches ranging from 19–70 t. In 2002–03 landings nearly triple the 2001–02 level were reported in KIN 8, the highest ever landing in this area. Landings returned to near average in 2003–04 and 2004–05, but were still above the TACC. Annual catches in KIN 8 have remained below 50 t since 2005–06, but were often above the 36 t TACC Although the TACC was increased to 45 t in October 2011 to accommodate previous levels of by-catch, the 2011–12 commercial catch increased substantially to 92 t. In addition to annual catches reported for kingfish QMAs, about 5 t of kingfish has been taken by New Zealand flagged vessels fishing outside NZ fishing waters.

Assuming that kingfish targeting effectively ceased during the mid 1990s, catches since the early 2000s possibly reflect ‘true’ bycatch levels.

Table 2: Reported landings (t) of kingfish by area (QMA) from 1983–84 to 2012–13. 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–present. [Continued next page].

Year	KIN 1		KIN 2		KIN 3		KIN 4	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	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	-

Table 2 [Continued].

Year	KIN 1		KIN 2		KIN 3		KIN 4	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
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

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

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

1.2 Recreational fisheries

Kingfish is highly regarded by recreational fishers in New Zealand for its sporting attributes and large size. 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 are recognized internationally as a sport fish, and kingfish caught in New Zealand waters hold 20 of the 22 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 (MLS), method restrictions and daily bag limits. Fishers can take up to three kingfish as part their daily bag limit and the MLS is 75 cm.

Recreational fishers have voiced concerns over a perceived marked decline in the size of kingfish available to them in recent years. Many clubs, competitions and charter boats have implemented a voluntary one kingfish

per person per day limit in response. A number of gamefish clubs have also adopted a minimum size limit of 100 cm for kingfish.

1.2.2 Estimates of recreational harvest

Recreational catch estimates are given in Table 3. 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 2005) and a rolling replacement of diarists in 2001 (Boyd & Reilly 2004 allowed estimates for a further year (population scaling ratios and mean weights 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 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 indicated that the kingfish estimate should be considered with considerable caution due to the limited overlap between this methods sampling technique and the fisheries for kingfish, e.g., the target fisheries for kingfish are usually 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. The panel survey 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 harvest taken on recreational charter vessels, or recreational harvest taken under s111 general approvals.

Table 3: 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 survey ran through the October to September fishing year but is 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, MPI unpublished data).

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	449 000	434	0.19
	2012	Panel survey	47 463	488	0.14
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	107 000	124	0.21
	2012	Panel survey	3 681	37	0.25
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	32 000	33.9	0.23
	2012	Panel survey	2 081	21	0.38
KIN 8	1992	Telephone/diary	6 000	7.6#	-
	1994	Telephone/diary	-	-	-
	1996	Telephone/diary	2 000	2.5#	-
	2000	Telephone/diary	1 000	7	0.63
	2001	Telephone/diary	2 000	1.7	0.46
	2012	Panel survey	5 257	53	0.26

#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.

All indications are that the recreational catch is in the range of 500–700 t in KIN 1. The earlier telephone/diary surveys and the recent national panel survey also indicate that over 85% of the recreational kingfish catch is taken in the northern QMAs (1 & 8).

It was assumed that the introduction of the higher MLS of 75 cm on 15 January 2004 for kingfish would reduce recreational catches.

1.3 Customary non-commercial fisheries

Kingfish is an important traditional food fish for Maori, but no quantitative information on the level of Maori 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 Maori 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.

2. BIOLOGY

In New Zealand, kingfish are predominantly found in 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 kingfish von Bertalanffy growth parameters 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 4). 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.

The recent research has provided estimates of M ranging from 0.20–0.25, however, these estimates are thought to represent an upper bound as the samples were taken from an exploited population.

Available biological parameters relevant to stock assessment are shown in Table 4.

Table 4: Estimates of biological parameters.

Fishstock	Estimate									Source
2. 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)
3. 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 (in press)
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

A study based on meristic characters and parasite loads suggests two stocks of kingfish off the west and east coasts. These stocks are contained within the Tasman current on the west coast and the east Auckland current and east Cape current on the east coast, with little mixing between them. The east coast stock may be further subdivided into northeast and Hawkes 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. 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.

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

Total mortality (Z) was estimated for kingfish stocks in East Northland and in the Bay of Plenty based on the age structure of the recreational catches in 2010 (Holdsworth and Saul 2010). In the Bay of

Plenty estimates of *Z* for offshore (i.e., White Island) and inshore samples were 0.3 and 0.38, respectively; assuming an age of full recruitment of 5 yrs. Assuming an instantaneous rate of natural mortality (*M*) of 0.2, the target reference point of $F_{40\%}$ for kingfish in KIN 1 was calculated to be 0.1. This suggests that overfishing of kingfish in the Bay of Plenty is not occurring.

Total mortality for East Northland was estimated to be 0.77. However, fishing pressure is expected to be lower in East Northland than in the Bay of Plenty and since no samples were obtained from offshore areas known to be inhabited by large kingfish – i.e. Three Kings Islands and Ranfurly Bank – the Northern Inshore Working Group concluded that the recreational catch sampled in 2010 was unlikely to reflect the age structure of the entire East Northland population. As the 2010 estimate of *Z* for East Northland may well have been biased (high) by emigration to offshore areas, this estimate is considered to be unreliable.

4.2 Biomass estimates

Few kingfish are encountered in trawl surveys, 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 is inadequate to estimate stock biomass.

4.5 Yield estimates and projections

No information is available.

4.6 Other factors

Kingfish in New Zealand can be regarded as a high value species from customary, commercial and recreational perspectives. Although fluctuating, catches of kingfish have shown very little trend over the last 20 years and there is no direct evidence to suggest that the current catch levels are not sustainable. However, recreational fishers are concerned about a perceived decline in the quality of the fishery.

5. STATUS OF THE STOCKS

Stock Structure Assumptions

The movement of New Zealand kingfish has been extensively studied through mark-recapture programmes. Although some kingfish moved considerable distances (e.g., from New Zealand to Australia) most kingfish were recaptured close to the site of release, regardless of time at liberty. It is therefore assumed that New Zealand kingfish are comprised of several biological stocks. In addition to the results from tagging studies, the age structure of recreational catches suggests that kingfish off East Northland and in the Bay of Plenty in KIN 1 comprise separate stocks.

- **KIN 1 – Bay of Plenty**

Stock Status	
Year of Most Recent Assessment	2013
Assessment Runs Presented	Base case model only
Reference Points	Target: $F_{40\%}$ Soft Limit: $20\%B_0$ Hard Limit: $10\%B_0$ Overfishing threshold: $F_{40\%B0}$
Status in relation to Target	*F* is About as Likely as Not (40–60%) to be at or below the target
Status in relation to Limits	Soft Limit: Unknown Hard Limit: Unknown Overfishing is Unlikely (< 40%) to be occurring

Historical Stock Status Trajectory and Current Status
-

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	-
Recent Trend in Fishing Mortality or Proxy	Low estimates of fishing mortality for 2010 and low and stable catches over the previous 10 years, suggest that fishing mortality has been low for a decade.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-
Projections and Prognosis	
Stock Projections or Prognosis	Catch curve analysis from recent catch sampling (2010) indicates that total mortality is low, with fishing mortality below natural mortality and close to the target. Given the low TACC for KIN 1, inclusion on Schedule 6, increased MLS, and practice of catch and release by recreational anglers, stock size is unlikely to decline in the medium-term.
Probability of Current Catch or TACC causing decline below Limits	Soft Limit: Unknown Hard Limit: Unknown Overfishing: Unlikely (< 40%)

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: 2013	Next assessment: 2017
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	-Age structure of recreational catch in 2010 -Instantaneous rate of natural mortality (*M*) of 0.20 based on a maximum age of 23 years. - Age at 50% maturity (6 yrs) -Age at MLS (4 yrs) -Growth rate	1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality
Data not used (rank)	-	-
Assessment dates	Latest assessment: 2013	Next assessment: 2017
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	Uncertainty in the estimate of *M*	

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

Research Needs
Future kingfish catch at age sampling in KIN 1 needs to include samples from offshore fishing grounds. CPUE based on charterboat catch and effort forms should be investigated once there are sufficient data.

- **KIN 1 – East Northland**

A status of the stock summary table is not included for the East Northland substock as the 2010 estimates of mortality (*Z*) for this area are not reliable.

Yields, TACCs and reported landings for the 2012–13 fishing year are summarised in Table 5.

Table 5: Summary of yields (t) from the commercial fishery, and reported commercial landings (t) for the most recent fishing year.

Fishstock		FMAs	*MCY*	2012–13 Actual TACC	2012–13 Reported landings
KIN 1	Auckland (East)	1	195	91	88
KIN 2	Central	2	40	63	59
KIN 3	South-east (Coast), Southland, Sub-Antarctic	3, 5 & 6	-	1	2
KIN 4	South-east (Chatham)	4	-	1	< 1
KIN 7	Challenger	7	-	7	12
KIN 8	Central (West) and Auckland (West)	8 & 9	20	45	66
KIN 10	Kermadec	10	-	1	0
Total			260*****	209	226

*****5 ton *MCY* estimate for FMAs 3,4,5,6 & 7 combined included in total.

6. FOR FURTHER INFORMATION

Bradford, E (1997) Estimated recreational catches from Ministry of Fisheries North region marine recreational fishing surveys, 1993–94. New Zealand Fisheries Assessment Research Document 1997/7. 16 p. (Unpublished report held by NIWA library, Wellington.)

Bradford, E (1998) Harvest estimates from the 1996 national recreational fishing surveys. New Zealand Fisheries Assessment Research Document. 1998/16. 27 p. (Unpublished report held by NIWA library, Wellington.)

Boyd, R O; Gowing, L; Reilly, J L (2004) 2000/2001 National marine recreational fishing survey: diary results and harvest estimates. Draft New Zealand Fisheries Research Report. (Unpublished report held by Ministry for Primary Industries, Wellington.)

Boyd, R. O.; Reilly, J. L. (2002). 1999/2000 National Marine Recreational Fishing Survey: recreational harvest estimates. Draft New Zealand Fisheries Assessment Report 2002/XX

Hartill, B; Bian, R; Armiger, H; Vaughan, M; Rush, N (2007) Recreational marine harvest estimates of snapper, kahawai, and kingfish in QMA 1 in 2004–05. *New Zealand Fisheries Assessment Report. 2007/26*. 44p

Hartill, B; Davies, N M (1999) New Zealand billfish and gamefish tagging, 1997–98. *NIWA Technical Report No. 57*. 39 p.

Francis, M; McKenzie, J; Ó Maolagáin, C (2005) Attempted validation of the first annual growth zone in kingfish (*Seriola lalandi*) otoliths. Final Research Report for Ministry of Fisheries research project SAP2004-04, Objective 1. 22 p. (Unpublished report held by Ministry for Primary Industries, Wellington.)

Francis, R I C C (1988) Maximum likelihood estimation of growth and growth variability from tagging data. *New Zealand Journal of Marine and Freshwater Research* 22: 42–51.

Holdsworth, J C; McKenzie, J R; Walsh, C; van der Straten, K M; Ó Maolagáin, C (2013) Catch-at-age of yellowtail kingfish (*Seriola lalandi*) caught by recreational fishers in KIN 1, New Zealand. *New Zealand Fisheries Assessment Report 2013/3.* 31 p.

Holdsworth, J; Saul, P (2003) New Zealand: billfish and game tagging 2001–02. *New Zealand Fisheries Assessment Report 2003/15*. 39 p.

Holdsworth, J; Saul, P (2004) New Zealand billfish and gamefish tagging, 2002–2003. *New Zealand Fisheries Assessment Report 2004/50*. 27 p.

Holdsworth, J; Saul, P (2005) New Zealand billfish and gamefish tagging, 2003–2004. *New Zealand Fisheries Assessment Report 2005/36.* 30 p.

Holdsworth, J; Saul, P (2006) New Zealand billfish and gamefish tagging, 2004–05. *New Zealand Fisheries Assessment Report 2006/18*. 28 p.

Holdsworth, J; Saul, P (2007) New Zealand billfish and gamefish tagging, 2005–06. *New Zealand Fisheries Assessment Report 2007/02*. 29 p.

Holdsworth, J. C., & Saul, P. J. (2010). New Zealand billfish and gamefish tagging, 2008–09. *New Zealand Fisheries Assessment Report, 12*, 34

Holdsworth, J.C.; McKenzie, J.R.; Walsh, C.; van der Straten, K.M.; Ó Maolagáin, C. (2013). Catch-at-age of yellowtail kingfish (*Seriol lalandi*) caught by recreational fishers in KIN 1, New Zealand. *New Zealand Fisheries Assessment Report 2013/3*. 31 p.

McKenzie, J. R. (2014). Review of productivity parameters and stock assessment options for kingfish (Seriola lalandi lalandi). *New Zealand Fisheries Assessment Report*, 04.

McKenzie, J.; Smith, M.; Watson, T.; Francis, M.; Ó Maolagáin, C.; Poortenaar, C.; Holdsworth, J. (2014). Age, growth, maturity and natural mortality of New Zealand kingfish (Seriola lalandi lalandi). New Zealand Fisheries Assessment Report 2014/03. 36 p.

Teirney, L D; Kilner, A R; Millar, R E; Bradford, E; Bell, J D (1997) Estimation of recreational catch from 1991/92 to 1993/94. New Zealand Fisheries Assessment Research Document 1997/15. 43 p. (Unpublished report held by NIWA library, Wellington.)

Waitangi Tribunal. (1988). Muriwhenua fishing report. Department of Justice, Wellington.

Walsh, C; McKenzie, J; McGregor, G; Poortenaar, C; Hartill, B; Smith, M (2003) Information available for the management of New Zealand kingfish (*Seriola lalandi lalandi*) stocks. *New Zealand Fisheries Assessment Report 2003/25*. 57 p.