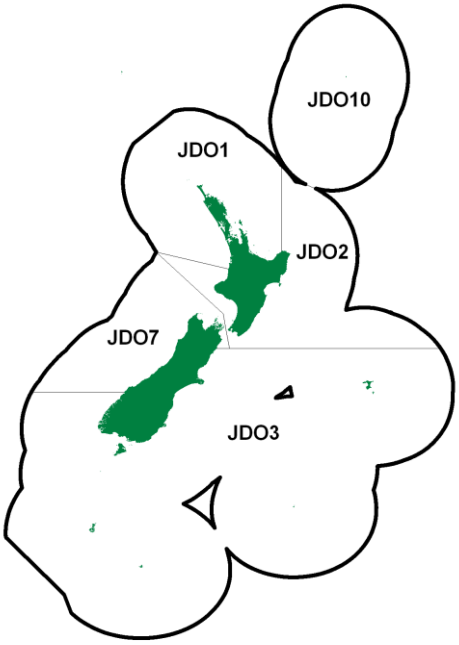
JOHN DORY (JDO)

(*Zeus faber*)
Kuparu



1. FISHERY SUMMARY

John Dory was introduced into the QMS on 1 October 1986 with allowances, TACCs, and TACs in Table 1, except that the TACC for JDO 7 was increased from 131 to 150 t in October 2012.

Table 1: TACs. TACCs and allowances for John Dory

Fishstock	Recreational Allowance	Customary non-commercial allowance	Other mortality	TACC	TAC
JDO 1	-	-	-	-	704
JDO 2	-	-	-	-	269.5
JDO 3	-	-	-	-	31.9
JDO 7	2	1	8	161	150
JDO 10	-	-	-	-	10

1.1 Commercial fisheries

John dory are taken mainly as a bycatch of the trawl and Danish seine fisheries. In recent years, around 50–65% of the total reported catch has been taken in JDO 1, and around 20% taken in JDO 2. Recent reported landings by Fishstock are shown in Table 3, while the historical landings and TACC values for the three main JDO stocks are depicted in Figure 1.

The increase in JDO 1 landings after 1986–87 is largely attributed to increased targeting of John dory by trawl and Danish seine. The TACC in JDO 1 was exceeded (slightly) in 1994–95, but in the following years landings steadily decreased, reaching a low of 440 t in 2002–03. Landings increased to 549 t in 2005–06 but have since declined to 349 t. It is estimated that during the 1990s about 10–20% of the annual JDO 1 landings were taken in FMA 9, mainly as bycatch in fisheries targeting snapper and trevally. Landings from the eastern part of JDO 1 (FMA 1) are taken primarily in target fisheries for John dory and snapper.

Annual landings in JDO 2 have never exceeded the TACC and in the mid 90s, were around 50% of the TACC in each year (Figure 1). From 1999–00 to 2002–03 landings were above 200 t, but in recent years landings have decreased, being below 150 t since 2005–06. Landings from JDO 2 are considered to be approximately equally split between FMAs 2 and 8. Substantial proportions of John dory landings are taken as bycatch in target trawl fisheries for jack mackerels in FMA 8, and as tarakihi and red

gurnard bycatch in FMA 2. Landings from JDO 7 increased markedly after 1999–2000, as a result of increasing abundance. JDO 7 is taken largely as a bycatch by FMA 7 trawl fisheries. The JDO 7 TACC has been increased three times since 2003–04 and is currently 150 t (Table 3).

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

Year	JDO 1	JDO 2	JDO 3	JDO 7	Year	JDO 1	JDO 2	JDO 3	JDO 7
1931–32	70	0	0	0	1957	110	37	0	20
1932–33	60	0	0	0	1958	132	54	0	40
1933–34	57	0	0	0	1959	157	64	0	50
1934–35	42	0	0	0	1960	158	81	0	53
1935–36	92	0	0	0	1961	156	76	0	52
1936–37	105	4	0	1	1962	150	87	0	38
1937–38	80	3	0	0	1963	114	96	0	44
1938–39	78	3	1	0	1964	112	85	1	30
1939–40	40	5	0	0	1965	111	101	0	32
1940–41	0	2	1	1	1966	148	110	0	37
1941–42	0	7	1	3	1967	162	102	0	41
1942–43	3	4	3	3	1968	203	83	0	36
1943–44	12	4	3	3	1969	189	96	0	19
1944	11	7	2	5	1970	259	137	0	24
1945	12	6	0	1	1971	234	141	1	38
1946	27	7	0	3	1972	213	122	0	34
1947	23	12	2	12	1973	259	99	0	30
1948	21	20	1	1	1974	340	101	0	28
1949	22	79	0	4	1975	261	92	0	22
1950	17	65	0	6	1976	362	135	0	55
1951	5	38	0	2	1977	315	141	0	73
1952	34	50	0	5	1978	392	119	0	24
1953	163	62	0	7	1979	503	121	0	29
1954	181	52	0	25	1980	563	173	0	26
1955	162	50	0	24	1981	646	186	0	38
1956	175	46	0	24	1982	577	162	0	28

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. Data were aggregated to FMA using methods and assumptions described by Francis & Paul (2013).

Table 3: Reported landings (t) of John dory by Fishstock from 1983–84 to 2013–14 and actual TACCs (t) for 1986–87 to 2014–15. QMS data from 1986–present.

Fishstock	JDO 1		JDO 2		JDO 3		JDO 7	
FMA (s)	1 & 9		2 & 8		3, 4, 5 & 6		7	
	Landings	TACC	Landings	TAC	Landings	TACC	Landings	TACC
1983–84*	659	-	131	-	1	-	35	-
1984–85*	620	-	110	-	0	-	36	-
1985–86*	531	-	158	-	1	-	45	-
1986–87	409	510	168	240	3	30	57	70
1987–88	476	633	192	246	1	30	89	75
1988–89	480	662	151	253	6	30	47	82
1989–90	494	704	152	262	1	30	54	88
1990–91	505	704	171	269	1	31	53	88
1991–92	562	704	214	269	1	31	60	88
1992–93	578	704	217	269	8	31	50	91
1993–94	640	704	186	269	2	32	37	91
1994–95	721	704	140	270	3	32	30	91
1995–96	696	704	139	270	< 1	32	42	91
1996–97	689	704	140	270	< 1	32	35	91
1997–98	651	704	134	270	< 1	32	26	91
1998–99	672	704	182	270	< 1	32	34	91
1999–00	519	704	235	270	< 1	32	71	91
2000–01	497	704	217	270	1	32	104	91
2001–02	453	704	240	270	4	32	124	91
2002–03	440	704	239	270	2	32	114	91
2003–04	492	704	184	270	< 1	32	155	91
2004–05	561	704	182	270	1	32	133	114
2005–06	549	704	159	270	1	32	124	114
2006–07	544	704	143	270	1	32	127	114
2007–08	482	704	133	270	< 1	32	110	114

Table 3 [continued]

Fishstock	JDO 1		JDO 2		JDO 3		JDO 7	
FMA (s)	1 & 9		2 & 8		3, 4, 5 & 6		7	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
2008–09	411	704	136	270	< 1	32	116	114
2009–10	359	704	152	270	< 1	32	109	125
2010–11	386	704	138	270	< 1	32	112	125
2011–12	351	704	131	270	< 1	32	126	125
2012–13	365	704	138	270	< 1	32	128	150
2013–14	349	704	142	270	<1	32	151	151
2014–15	354	704	147	270	<1	32	150	150

Fishstock	JDO 10			
FMA (s)	10		Total	
	Landings	TACC	Landings	TACC
1983–84*	0	-	826	-
1984–85*	0	-	766	-
1985–86*	0	-	735	-
1986–87	< 1	10	638	860
1987–88	0	10	758	994
1988–89	0	10	684	1 037
1989–90	0	10	701	1 094
1990–91	0	10	730	1 102
1991–92	0	10	837	1 102
1992–93	0	10	853	1 105
1993–94	0	10	865	1 106
1994–95	0	10	894	1 107
1995–96	0	10	877	1 107
1996–97	0	10	864	1 107
1997–98	0	10	811	1 107
1998–99	0	10	889	1 107
1999–00	0	10	826	1 107
2000–01	0	10	819	1 107
2001–02	0	10	819	1 107
2002–03	0	10	795	1 107
2003–04	0	10	832	1 107
2004–05	0	10	877	1 129
2005–06	0	10	833	1 129
2006–07	0	10	815	1 129
2007–08	0	10	725	1 129
2008–09	0	10	663	1 129
2009–10	0	10	620	1 140
2010–11	0	10	637	1 140
2011–12	0	10	609	1 140
2012–13	0	10	633	1 165
2013–14	0	10	642	1 165
2014–15	0	10	652	1 165

* FSU data.

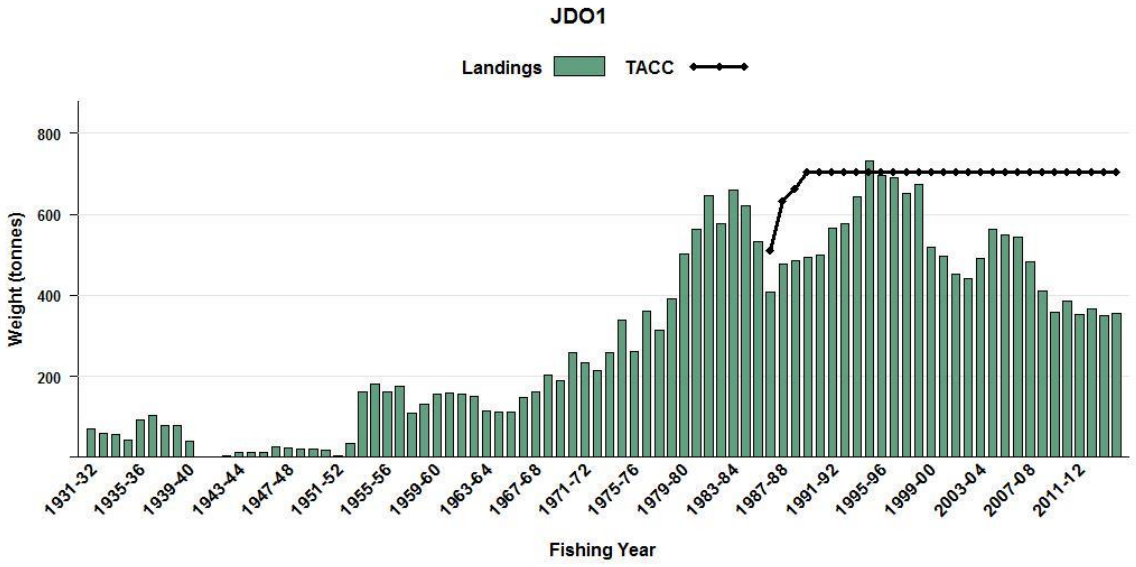


Figure 1: Reported commercial landings and TACC for the three main JDO stocks. JDO 1 (Auckland East). (Continued on next page).

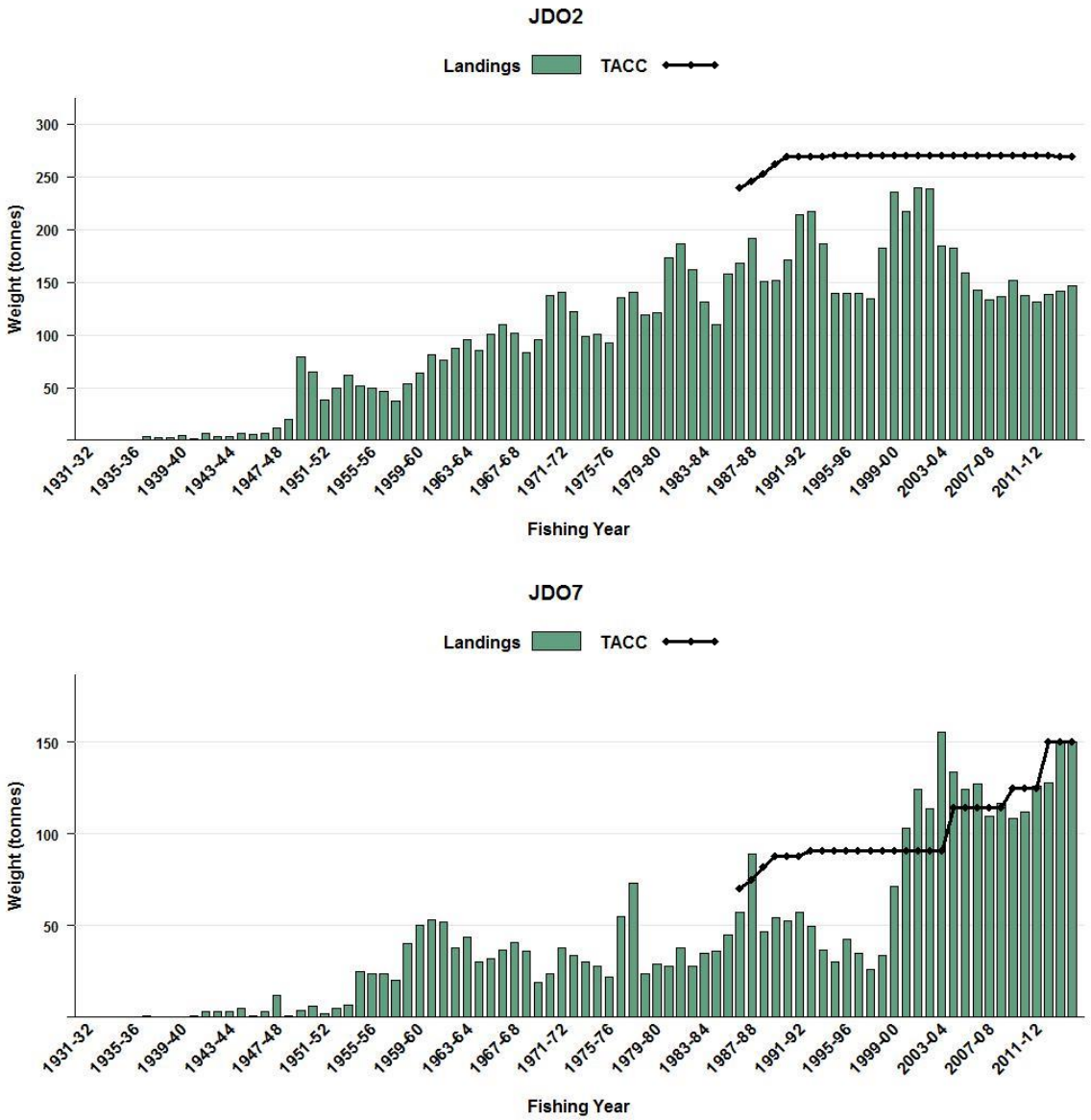


Figure 1: [Continued] Reported commercial landings and TACC for the three main JDO stocks. From top: JDO 2 (Central East), and JDO 7 (Challenger).

Overall the majority of John dory catch is reported in the snapper bottom trawl fishery (16%), followed by the John dory bottom trawl (14%) and the tarakihi bottom trawl fisheries (14%). Danish seine accounts for the second largest John dory catch across fishing methods (Figure 2).

Catches of John dory in JDO 1 are predominantly taken through bottom trawl in the snapper (23%), John dory (19%) and trevally (10%) target fisheries. Danish seine, bottom pair trawl and bottom longline comprise the remaining John dory catch by fishing method (Figure 3). John dory catch in JDO 2 are taken predominantly by bottom trawl targeting tarakihi (30%) and gurnard (25%), with mid-water and setnet fishing methods comprising the remainder of catch (Figure 4). John dory in JDO 7 is predominantly caught by bottom trawl targeting flatfish (25%), barracouta (23%) and tarakihi (18%) (Figure 5). Throughout the North Island, the trawl and Danish seine fisheries targeting John dory take the majority of their catch targeting snapper (33%) followed by the John dory target fishery (23%) (Figure 6). No data were available for JDO setnet fisheries in the South Island.

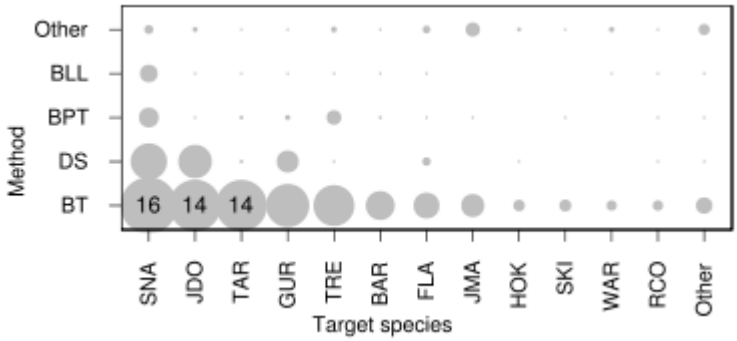


Figure 2: A summary of the proportion of landings of John dory (all QMAs) taken by each target fishery and fishing method. The area of each circle is proportional to the percentage of landings taken using each combination of fishing method and target species. The number in the bubble is the percentage. BT = bottom trawl, DS = Danish seine, BPT = bottom pair trawl, BLL = bottom longline (Bentley et al 2012).

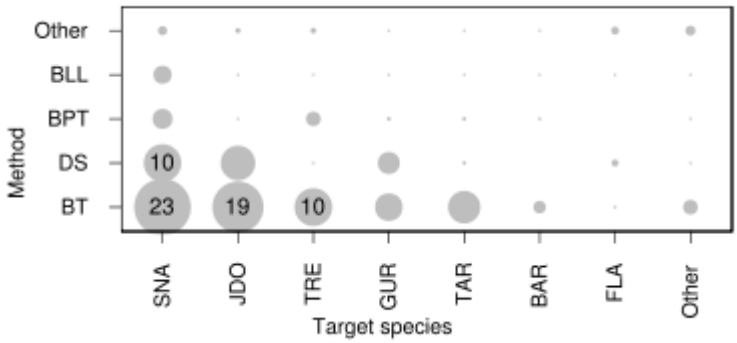


Figure 3: A summary of the proportion of landings of JDO 1 taken by each target fishery and fishing method. The area of each circle is proportional to the percentage of landings taken using each combination of fishing method and target species. The number in the bubble is the percentage. BT = bottom trawl, DS = Danish seine, BPT = bottom pair trawl, BLL = bottom longline (Bentley et al 2012).

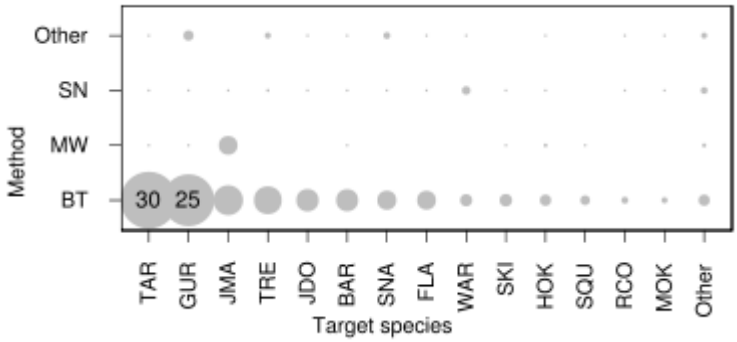


Figure 4: A summary of the proportion of landings of JDO 2 taken by each target fishery and fishing method. The area of each circle is proportional to the percentage of landings taken using each combination of fishing method and target species. The number in the bubble is the percentage. BT = bottom trawl, MW = mid-water, SN = setnet (Bentley et al 2012).

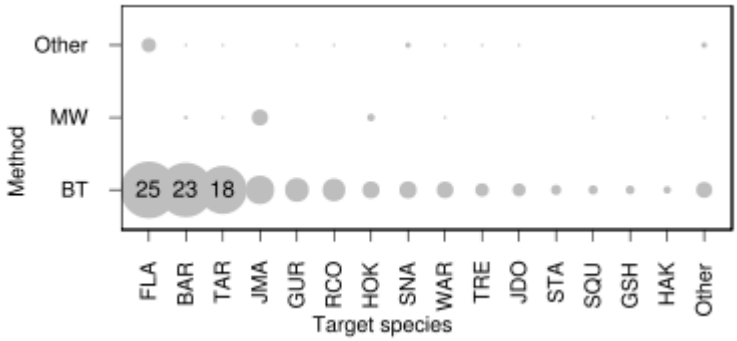


Figure 5: A summary of the proportion of landings of JDO 7 taken by each target fishery and fishing method. The area of each circle is proportional to the percentage of landings taken using each combination of fishing method and target species. The number in the bubble is the percentage. BT = bottom trawl, MW = mid-water (Bentley et al 2012).

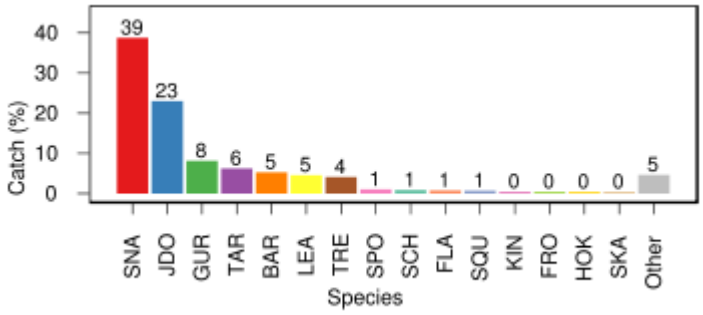


Figure 6: A summary of species composition of the reported trawl and Danish seine catch in trips targeting John dory off the North Island. Catch is expressed as the percentage by weight of each species calculated for all trawl and Danish seine trips (Bentley et al 2012).

1.2 Recreational fisheries

John dory is an important recreational species in the north of New Zealand. They are caught using line fishing methods, predominantly on rod and reel with some longline catch.

1.2.1 Management controls

The main method used to manage recreational harvests of John dory is daily bag limits. Fishers can take up to 20 John dory as part of their combined daily bag limit in the Auckland and Kermadec, Central, and Challenger Fishery Management Areas.

1.2.2 Estimates of recreational harvest

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 John dory 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). The harvest estimates provided by these telephone diary surveys (Table 4) are no longer considered reliable.

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. Recreational catch estimates from the national panel survey are given in Table 4 (Wynne-Jones et al 2014).

Table 4: Recreational harvest estimates for John dory 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).

Stock	Year	Method	Number of fish	Total weight (t)	CV
JDO 1	1996	Telephone/diary	49 000	87	0.09
	2000	Telephone/diary	129 000	227	0.23
	2012	Panel survey	28 863	36	0.13
JDO 2	2000	Telephone/diary	9 000	16	0.43
	2012	Panel survey	2 000	3	0.33

1.3 Customary non-commercial fisheries

No quantitative information is available on the current level of Maori customary non-commercial catch.

1.4 Illegal catch

No quantitative information is available.

1.5 Other sources of mortality

No quantitative information is available.

2. BIOLOGY

John dory are widespread, being found in the eastern Atlantic Ocean, the Mediterranean Sea and around New Zealand, Australia and Japan. They are common in the inshore coastal waters of northern New Zealand, and to a lesser extent in Tasman Bay, to depths of 50 m. In the Hauraki Gulf, adults move to deeper waters during summer, and occasional feeding aggregations occur during winter.

John dory are serial spawners (spawning more than once in a season). There appears to be substantial variation in the time of spawning in New Zealand, with spawning occurring between December and April on the northeast coast. The eggs are large and pelagic, taking 12–14 days to hatch. Initially John dory grow rapidly with both males and females reaching 12 to 18 cm standard length (SL) after the first year. From the second year onwards females grow faster than males and reach a greater maximum length. Females mature at a size of 29 to 35 cm SL and in general, larger females mature earlier in the season and are more fecund. Males mature at 23 to 29 cm SL.

M was estimated using the equation $M = \log_e 100/\text{maximum age}$, where maximum age is the age to which 1% of the population survives in an unexploited stock. Using a maximum observed age of 12 years, M was estimated to equal 0.38. Biological parameters relevant to the stock assessment are shown in Table 5.

Table 5: Estimates of biological parameters of John dory.

Fishstock							Estimate		Source
1.Weight = a (length)^b (Weight in g, length in cm total length)									
Combined sexes							a	b	
JDO 1							0.048	2.7	from *Ikatere* 2003
2. von Bertalanffy growth parameters									
			Females					Males	
	K		t_0	$L\infty$	*K*		t_0	$L\infty$	
JDO 1	0.425		-0.223	41.13	0.48		-0.251	36.4	Hore (1982)

3. STOCKS AND AREAS

In 2012 the stock structure of John dory was reviewed (Dunn & Jones 2013). The approach evaluated patterns in the distribution of catch and CPUE, research survey biomass trends, location of spawning and nursery grounds, size and age compositions, and anecdotal information from the fishery.

John dory have been caught around most of the North Island and the northern South Island, indicating that the QMA boundaries are not biologically appropriate. The analysis suggested five stocks around New Zealand: (1) Hauraki Gulf and east Northland; (2) Bay of Plenty; (3) west coast North Island; (4) southeast North Island; and (5) northern South Island.

Spawning fish and nursery grounds are found in all five stocks. In addition, on the east coast North Island, CPUE analyses support the separation of the Hauraki Gulf, Bay of Plenty, and Hawkes Bay fisheries, and research trawl survey biomass estimates had different trends in Hauraki Gulf and the Bay of Plenty. Very few John dory are found south of Hawkes Bay on the southeast North Island, providing a gap between the east and west coast components of JDO 2. There is relatively strong evidence to separate the northeast and northwest coasts of JDO 1, including fishery CPUE analyses, length and age compositions, and research trawl survey biomass trends. The distribution of John dory on the west coast North Island is continuous between JDO 1 and the northern part of the west coast JDO 2, and the combination of these areas is also supported by CPUE analyses. There is evidence to separate the northern South Island from stocks to the north including the occurrence of unusually large fish on the northern South Island, and CPUE analyses. John dory appear to reach the southern limit of their range off the north and northwest coasts of the South Island.

4. STOCK ASSESSMENT

The yield estimates are based on commercial landings data only and have not changed since the 1992 Plenary Report.

4.1 Estimates of fishery parameters and abundance

An investigation into the stock structure of New Zealand John dory (Dunn & Jones 2013) supported five biological stocks: (1) Hauraki Gulf and east Northland, (2) Bay of Plenty, (3) West coast North Island, (4) Southeast North Island, and (5) Northern South Island. The first three stocks are found within JDO 1, the fourth consists of the east coast portion of JDO 2 and the fifth of JDO 7 and the portion of JDO 2 located on the south and east coast of the North Island.

JDO 1

Relative abundance indices have been obtained from trawl surveys of the Bay of Plenty, west coast North Island, and Hauraki Gulf within the JDO 1 Fishstock (Table 6). However, there was a change in the configuration of the trawl gear following the 1988 trawl survey. Modifications to the trawl gear

may have resulted in a change in the catchability of John dory part way through the time series. Therefore, surveys conducted between 1982 and 1988 and from 1989 onwards should be considered separately for comparisons of biomass indices to be valid.

In 2015, the CPUE indices for the three sub-areas within JDO 1 (Hauraki Gulf and east Northland, Bay of Plenty, and west coast North Island) were updated and refined. The catch and effort data set included individual bottom trawl records from trawl targeting a range of inshore finfish species (BAR, TAR, TRE, GUR, SNA and JDO). The landed catch of John dory from a trip was allocated to the individual trawl records in proportion to the estimated catch. The analyses used a delta-lognormal CPUE model incorporating positive catch (lognormal) and presence/absence (binomial) components. For a number of analyses, different trends were apparent between the lognormal and binomial CPUE models. Further investigation indicated that the differences may have been attributable to changes in the recording of smaller John dory catches over the time period. Potential biases introduced by changes in catch reporting are likely to be adequately accounted for by applying the delta-lognormal approach.

Hauraki Gulf and east Northland (part of JDO 1)

In Hauraki Gulf and east Northland, the standardised CPUE indices fluctuated during the 1990s and 2000s and then steadily declined from 2004–05 to 2012–13 (Figure 7).

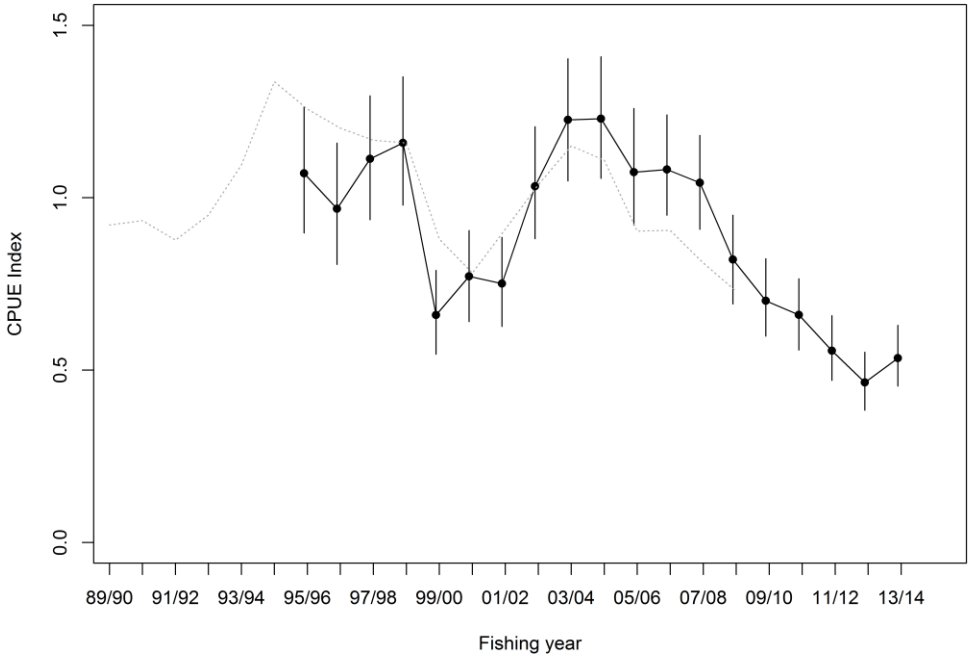


Figure 7: CPUE indices of abundance for Hauraki Gulf and east Northland (part of JDO 1): solid points and line, combined model of catch rates in mixed species bottom trawl tows; dotted line, a lognormal model of positive catches in mixed species bottom trawl tows (Kendrick & Bentley 2011). Indices are scaled to have the same geometric mean over the overlapping years. Vertical lines show the 95% confidence intervals.

Bay of Plenty (part of JDO 1)

The standardised CPUE series declined during the late 1990s, remained relatively stable during the 2000s and then declined from 2010–11 to 2013–14 (Figure 8).

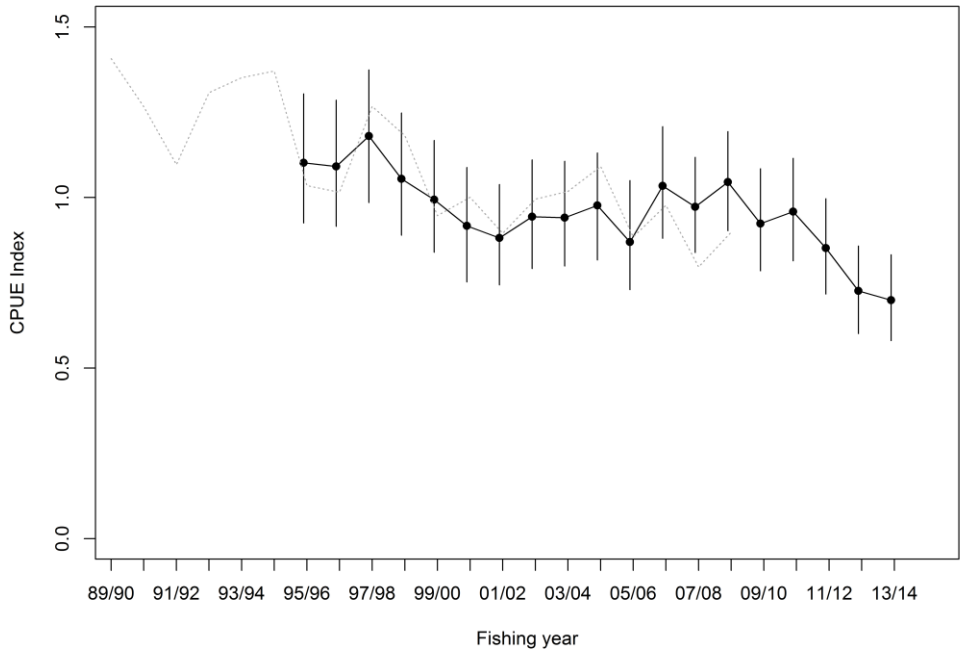


Figure 8: CPUE indices of abundance for the Bay of Plenty (part of JDO 1): solid points and line, combined model of catch rates in mixed species bottom trawl tows (Langley 2015)); dotted line, a lognormal model of positive catches in mixed species bottom trawl tows (Kendrick & Bentley 2011). Indices are scaled to have the same geometric mean over the overlapping years. Vertical lines show the 95% confidence intervals.

West Coast North Island (parts of JDO 1 and JDO 2)

The standardised CPUE series suggests that biomass has fluctuated about the average level since the late 1990s (Figure 9).

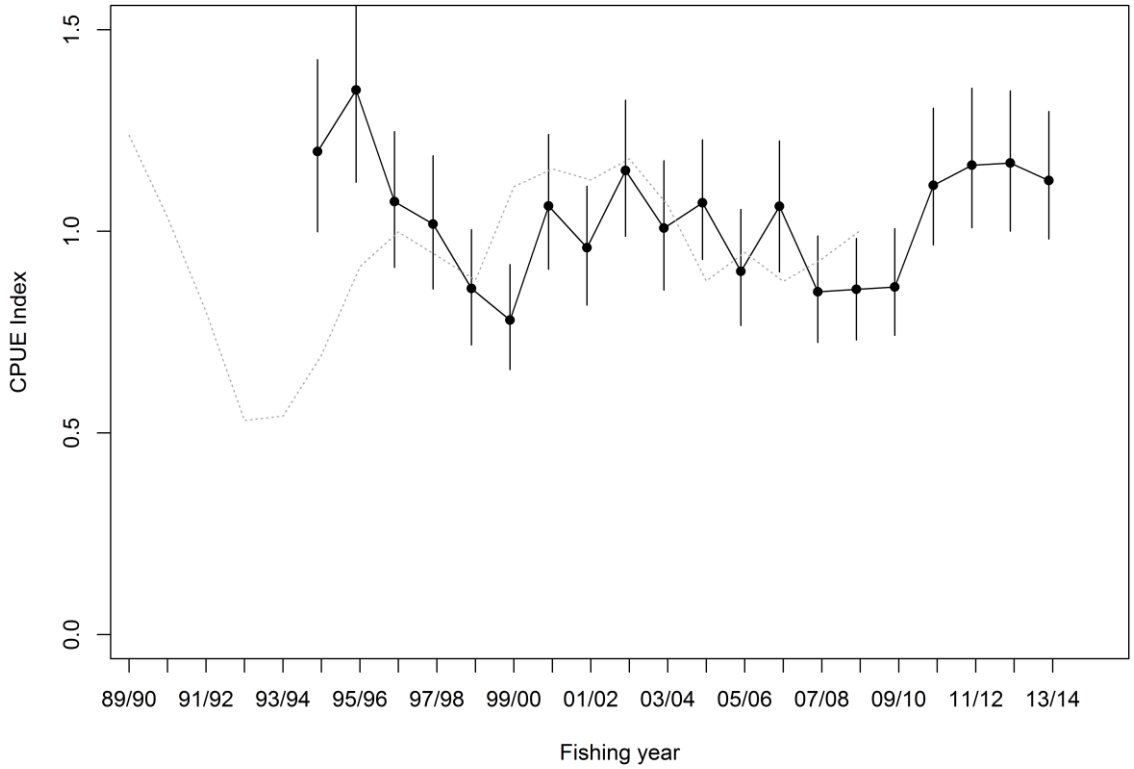


Figure 9: CPUE indices of abundance for the West Coast North Island (part of JDO 1 and part of JDO 2): solid points and line, combined model of catch rates in mixed species bottom trawl tows; dotted line, a lognormal model of positive catches in mixed species bottom trawl tows for the west coast North Island (JDO 1 only) (Kendrick & Bentley 2011). Indices are scaled to have the same geometric mean over the overlapping years. Vertical lines show 95% credible intervals.

Southeast North Island (part of JDO 2)

The standardised CPUE series suggests an increase in abundance from a low in the mid-1990s to a peak in 2000–01, followed by a steady decline to a series low in 2010–11 (Figure 10).

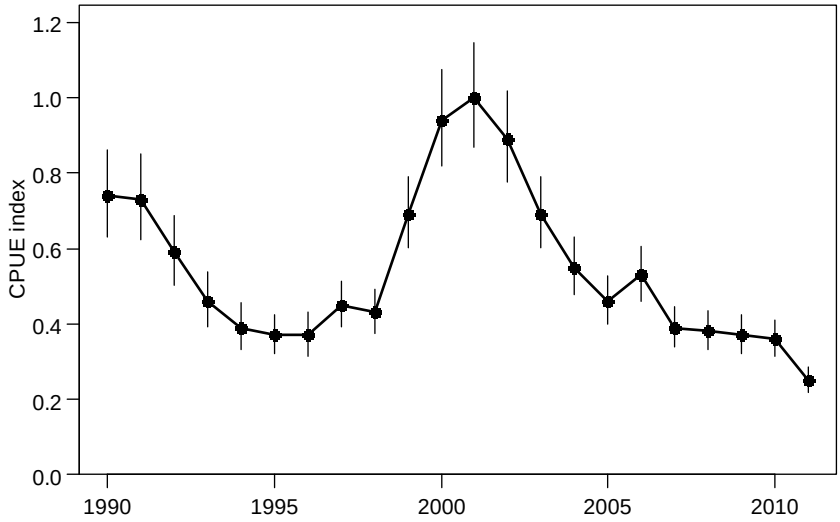


Figure 10: CPUE indices of abundance for the Southeast North Island (part of JDO 2), combined model of catch rates in mixed species bottom trawl tows (Dunn & Jones 2013). Vertical lines show the 95% credible intervals. Years labeled as year-ending (i.e., 1990 is 1989–90).

Northern South Island (JDO 7, and part of JDO 2)

In 2014, the CPUE indices for the Northern South Island zone (JDO 7, and part of JDO 2) were revised and updated to include data to 2012–13 (Langley 2014). The CPUE index was based on JDO bycatch from the following bottom trawl targets: BAR, FLA, GUR, JDO, JMA, RCO and TAR, in Statistical Areas: 033–039.

The Southern Inshore Working Group noted that the West Coast South Island trawl survey series appears to be monitoring trends in abundance of the John dory, particularly recruited biomass (defined as fish of at least 25 cm TL) (Figure 11). Length frequency trends for the John dory survey catch from the West Coast South Island and Tasman Bay/Golden Bay are presented in Figure 12. Smaller (20–35cm) fish tend to be caught in the latter survey region. The 1+ cohort centred on 20–30 cm is almost as strong in 2015 as the record in 2009. Biomass levels were low before 2003, with recruited biomass increasing two to three fold since then.

The last four trawl surveys (2009, 2011, 2013 and 2015) have estimated the recruited biomass of John Dory in the WCSI area to be at the highest level of the entire time series (Figure 11). For the survey area as a whole, the 2015 estimate is the highest in the time series and the strong 1+ cohort visible in length frequencies suggests the biomass will remain high, at least in the short term.

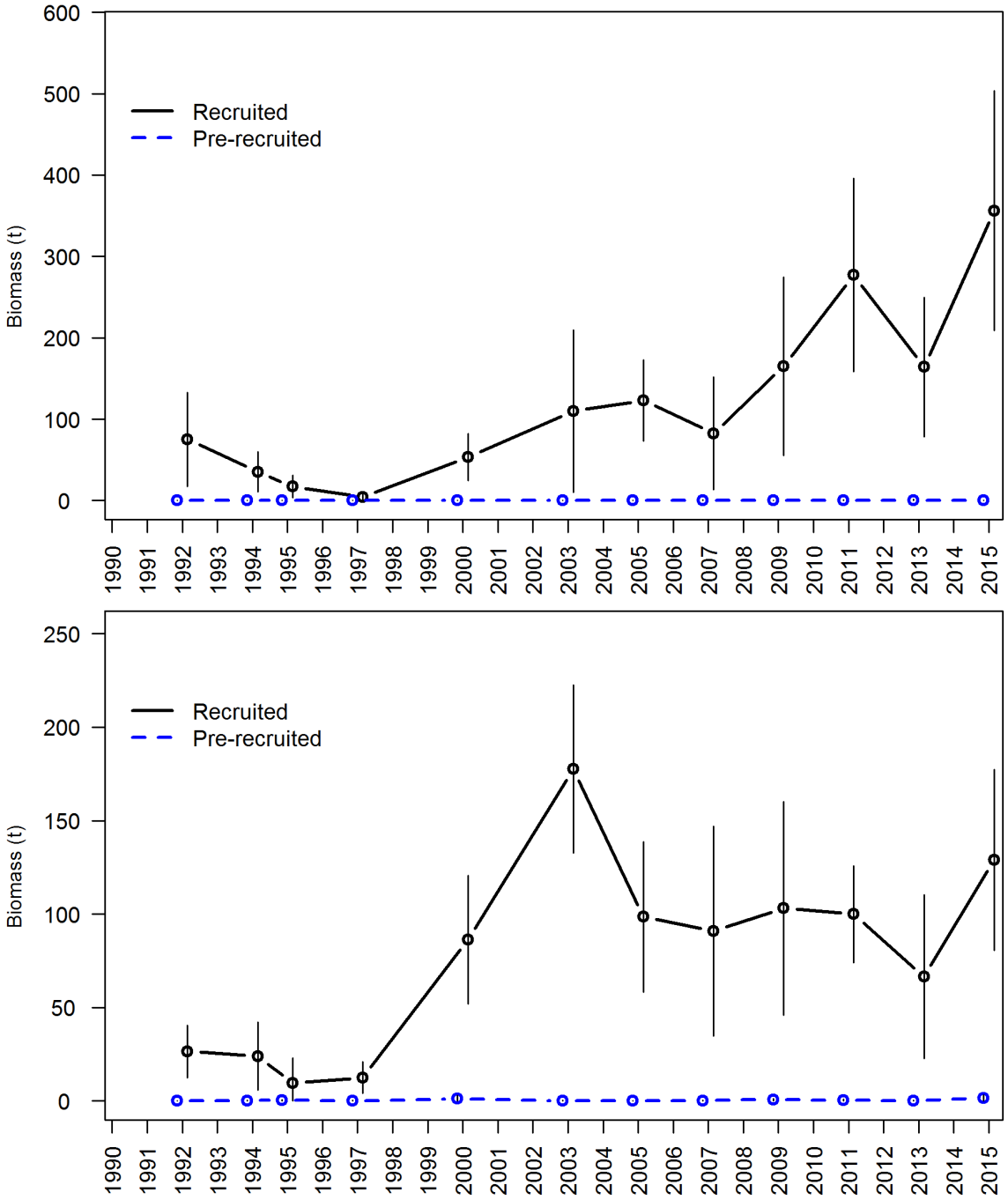


Figure 11: WCSI trawl survey Biomass estimates of recruited and pre-recruit John dory for the west coast South Island strata (top plot) and Tasman Bay/Golden Bay (bottom plot). Error bars are ± two standard deviations. John dory are assumed to recruit to the commercial fishery at 25 cm TL.

The standardised CPUE series shows a similar trend to the trawl survey biomass index, with a large increase in biomass between the late 1990s and early 2000s, which has persisted to the present (2013) (Figure 13).

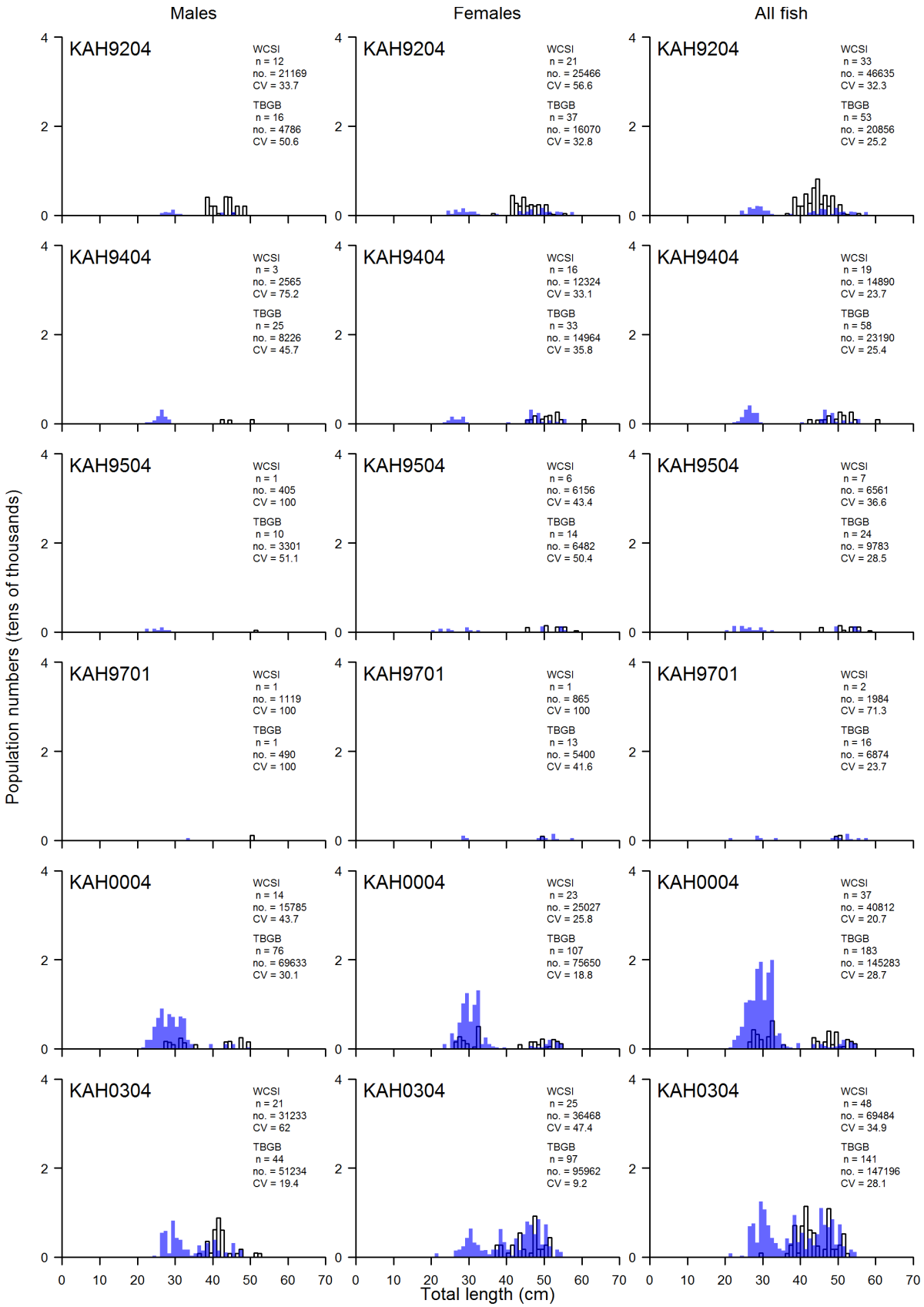


Figure 12: Scaled population length frequency distributions for John dory in 30–400 m for West Coast (white bars) and Tasman Bay/Golden Bay (blue bars), from WCSI surveys. n = number of fish measured, no. = scaled population number, CV = coefficient of variation (%). [Continued on next page].

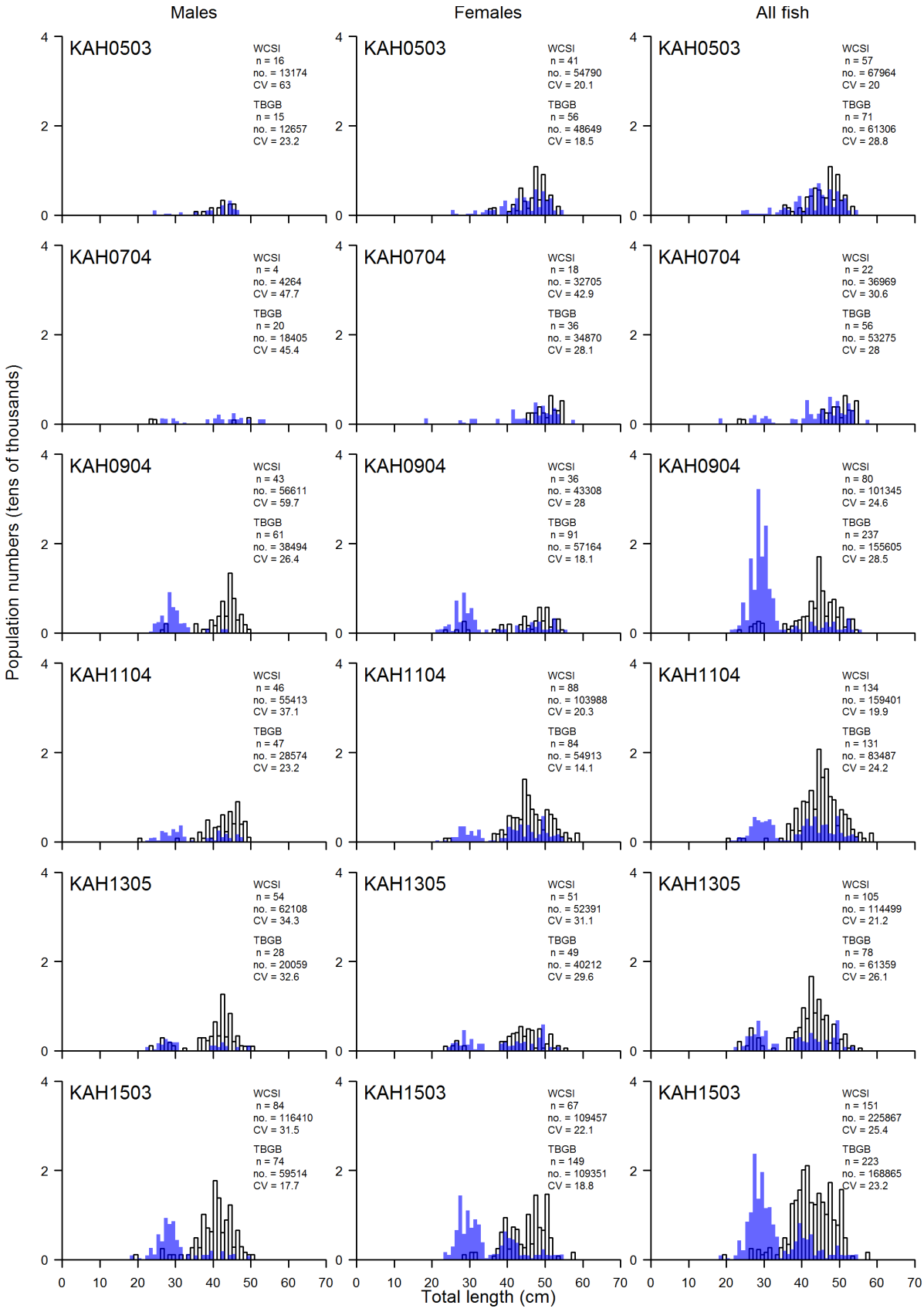


Figure 12 [Continued].

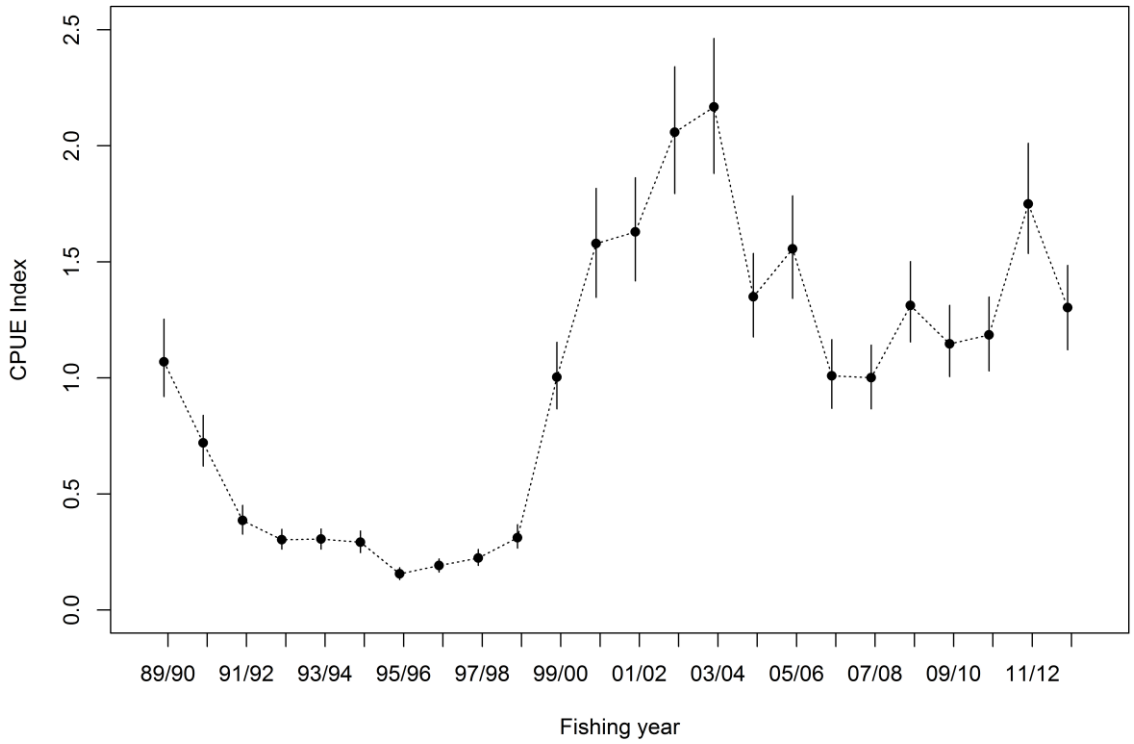


Figure 13: CPUE indices of abundance for the northern South Island (JDO 7 and part of JDO 2), combined model of catch rates in mixed species bottom trawl tows (Langley 2014). Vertical lines show the 95% credible intervals.

4.2 Biomass estimates

Estimates of absolute reference and current biomass are not available.

Table 6: Estimates of John dory biomass (t) from *Kaharoa* trawl surveys. [Continued on next page].

Year	Trip Code	Biomass	CV (%)
Bay of Plenty			
1983	KAH8303	113	24
1985	KAH8506	128	12
1987	KAH8711	155	38
1990	KAH9004	157	16
1992	KAH9202	236	12
1996	KAH9601	193	44
1999	KAH9902	176	14
North Island west coast (FMA 8)			
1989	KAH8918	68	25
1991	KAH9111	142	62
1994	KAH9410	33	47
1996	KAH9615	19	38
North Island west coast (FMA 9)			
1986	KAH8612	155	35
1987	KAH8715	160	16
1989	KAH8918	148	16
1991	KAH9111	216	37
1994	KAH9410	102	47
1996	KAH9615	147	15
1999	KAH9915 (FMAs 8 & 9 combined)	374	9

Table 6 [Continued].

Year	Trip Code	Biomass	CV (%)
Hauraki Gulf			
1984	KAH8421	292	22
1985	KAH8517	245	20
1986	KAH8613	211	25
1987	KAH8716	181	12
1988	KAH8810	477	32
1989	KAH8917	250	22
1990	KAH9016	322	13
1992	KAH9212	227	35
1993	KAH9311	374	24
1994	KAH9411	288	17
1997	KAH9720	387	18
2000	KAH0012	260	26
North Island east coast			
1993	KAH9304	265	17
1994	KAH9402	268	31
1995	KAH9502	170	18
1996	KAH9605	172	48
West Coast South Island			
1992	KAH9204	102	29
1994	KAH9404	59	26
1995	KAH9504	27	36
1997	KAH9701	17	31
2000	KAH0004	141	16
2003	KAH0304	288	19
2005	KAH0503	222	14
2007	KAH0704	174	26
2009	KAH0904	269	23
2011	KAH1104	378	18
2013	KAH1305	231	21
2015	KAH1503	486	16

4.3 Yield estimates and projections

The level of risk to the stock by harvesting the population at the estimated MCY value cannot be determined.

No estimates of current biomass are available which would permit the estimation of *CAY*

4.4 Other yield estimates and stock assessment results

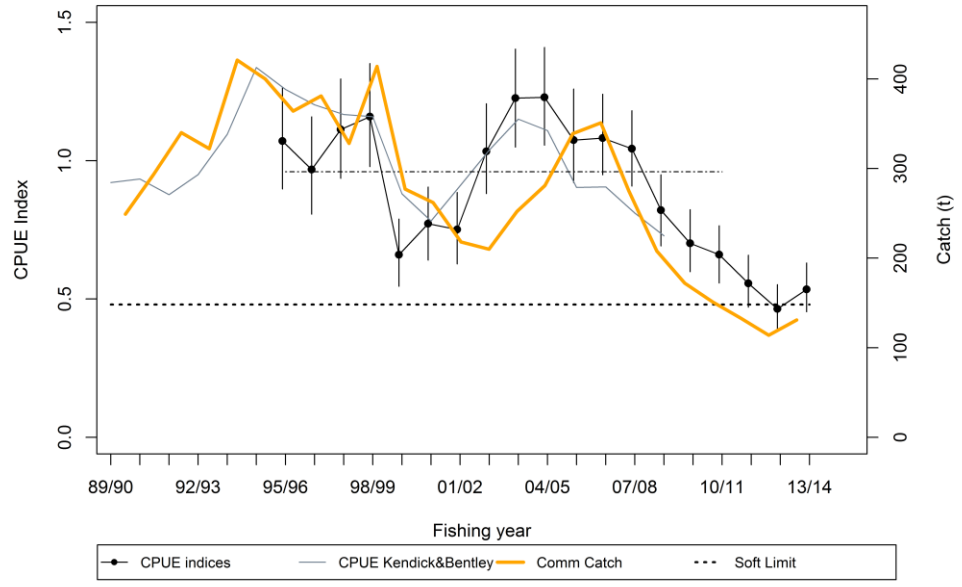
Current estimates of yield are based upon commercial landings only and are assumed to be independent of the non-commercial catch. There was no indication that John dory were overfished at the time of the introduction of the QMS.

5.0 STATUS OF THE STOCKS

- **JDO 1 (Hauraki Gulf and east Northland)**

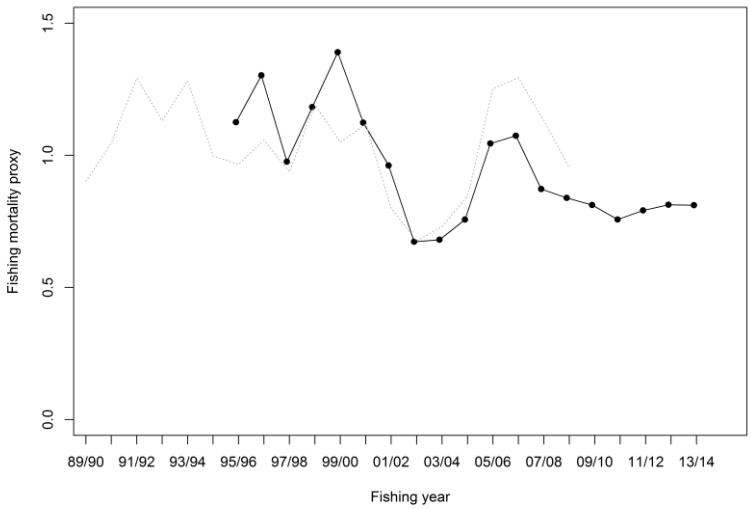
Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	Standardised CPUE
Reference Points	Interim Target: Mean of the CPUE indices for John dory in Hauraki Gulf and east Northland from combined binomial and lognormal models from 1995–96 to 2010–11 Soft Limit: 50% of target Hard Limit: 25% of target Overfishing threshold: F_{MSY}
Status in relation to Target	Very Unlikely (< 10%) to be at or above the target
Status in relation to Limits	Soft Limit: About as Likely as Not (40–60%) to be below Hard Limit: Unlikely (< 40%) to be below
Status in relation to Overfishing	Unlikely (< 40%) that overfishing is occurring

Historical Stock Status Trajectory and Current Status



Standardised CPUE indices for John dory in Hauraki Gulf and east Northland from combined binomial and lognormal models of catch rate in bottom trawl tows in a mixed target fishery (Langley 2015). Broken horizontal lines indicate the target and soft limit. The grey line represents a lognormal model of positive catches in mixed species bottom trawl tows, including data recorded on earlier (i.e., CELR) form types (Kendrick & Bentley 2011). Indices are scaled to have the same geometric mean over the overlapping years. The commercial catch from the area is also presented. Vertical lines show the 95% confidence intervals.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The CPUE series has steadily declined from the mid-2000s. The 2013–14 index is 56% of the target CPUE.

Recent Trend in Fishing Intensity or Proxy	 **Relative fishing mortality proxy derived from total area catch divided by CPUE indices from the recent CPUE analysis (Black points) and the CPUE analysis of Kendrick & Bentley 2011 (grey line).** The fishing mortality proxy indicates that fishing mortality has been lower in the recent period as total catch from the fishery has declined more than the decline in CPUE. The level of fishing mortality that corresponds to the target biomass level is unknown.
Other Abundance Indices	The trend in Danish seine CPUE indices from the Hauraki Gulf fishery is comparable to the BT CPUE index.
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	Annual catches and fishing mortality have been relatively low over the last five years, although there is no indication that the stock is recovering. It is likely that recruitment has been low over the recent period (5–10 years). The rebuilding of the stock to the target biomass level will depend on an increase in the level of recruitment (from recent levels).
Probability of Current Catch or TAC causing Biomass to remain below or to decline below Limits	Soft Limit: About as Likely as Not (40–60%) at current catch Hard Limit: Unknown
Probability of Current Catch or TAC causing Overfishing to continue or to commence	Current catch is Unlikely (< 40%) to cause overfishing

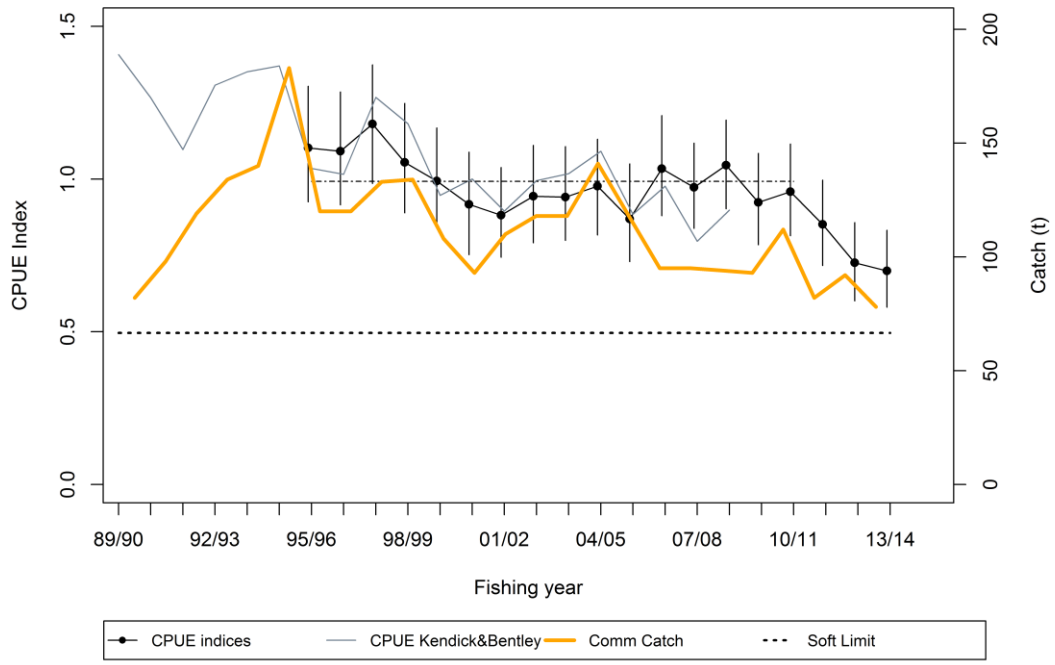
Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Standardised CPUE	
Assessment Dates	Latest assessment: 2015	Next assessment: 2017
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Catch and effort data	1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	Lack of information on incoming recruitment	

Qualifying Comments
As both catch and CPUE are declining there is some concern over the status of this stock and the analysis should be updated in 2017.
Fishery Interactions
John dory is taken on the east coast by bottom trawl and Danish seine targeted at John dory and snapper. Incidental captures of seabirds and dolphins occur; there is a risk of incidental capture of New Zealand fur seal.

- **JDO 1 (Bay of Plenty)**

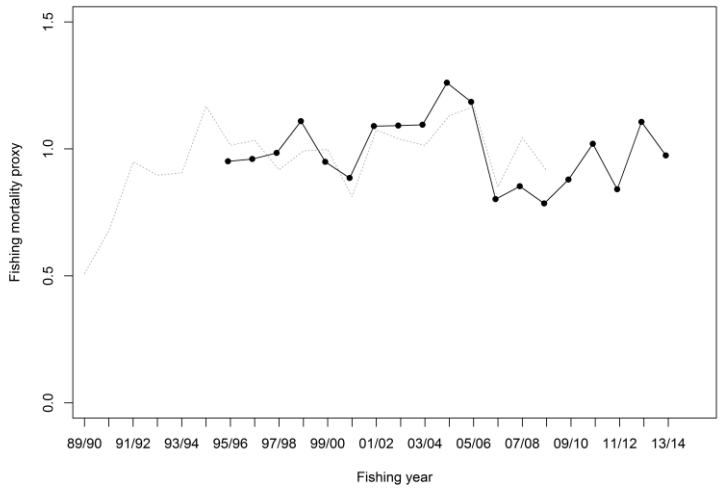
Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	Standardised CPUE
Reference Points	Interim Target: Mean of the CPUE indices for John dory in Bay of Plenty from combined binomial and lognormal models from 1994–95 to 2010–11 Soft Limit: 50% of target Hard Limit: 25% of target Overfishing threshold F_{MSY}
Status in relation to Target	Very Unlikely (< 10%) to be at or above the target
Status in relation to Limits	Soft Limit: Unlikely (< 40%) to be below Hard Limit: Very Unlikely (< 10%) to be below
Status in relation to Overfishing	About as Likely as Not (40–60%) that overfishing is occurring

Historical Stock Status Trajectory and Current Status



Standardised CPUE indices for John dory in Bay of Plenty from combined binomial and lognormal models of catch rate in bottom trawl tows in a mixed target fishery (Langley 2015). Broken horizontal lines indicate the target and soft limit. The grey line represents a lognormal model of positive catches in mixed species bottom trawl tows, including data recorded on earlier (i.e., CELR) form types (Kendrick & Bentley 2011). Indices are scaled to have the same geometric mean over the overlapping years. The total catch from the area is also presented. Vertical lines show the 95% confidence intervals.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The CPUE series declined from 2010–11 and the 2013–14 index is at 70% of the target biomass level.

Recent Trend in Fishing Mortality or Proxy	 **Relative fishing mortality proxy derived from total area catch divided by CPUE indices from the recent CPUE analysis (Black points) and the CPUE analysis of Kendrick & Bentley 2011 (grey line).** The fishing mortality proxy has increased since 2008–09 and in 2013–14 was close to the average for the series.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-
Projections and Prognosis	
Stock Projections or Prognosis	Annual catches and fishing mortality were relatively low during the last 5–7 years. The recent decline in stock biomass may be attributable to low recruitment over the recent period (5 years). The rebuilding of the stock to the target biomass level will be dependent on an increase in the level of recruitment (from recent levels).
Probability of Current Catch or TAC causing Biomass to remain below or to decline below Limits	Soft Limit: About as Likely as Not (40–60%) at current catch levels Hard Limit: Unlikely (< 40%) at current catch levels
Probability of Current Catch or TACC causing Overfishing to continue or to commence	About as Likely as Not (40–60%)

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Fishery characterisation and standardised CPUE	
Assessment Dates	Latest assessment: 2015	Next assessment: 2017
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- 2015 CPUE analysis - 2010 CPUE analysis	1 – High Quality 1 – High Quality
Data not used (rank)	-	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

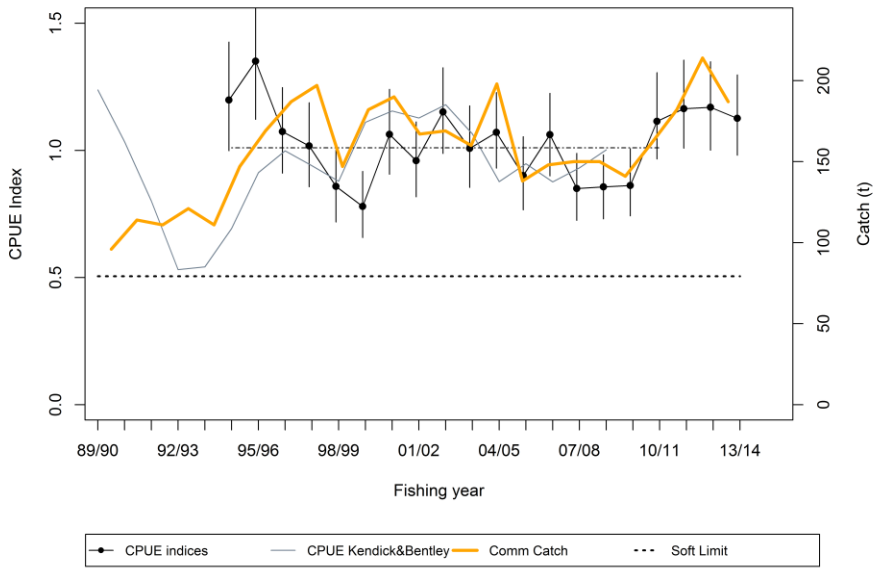
Qualifying Comments
Stock biomass is variable, probably in response to recruitment variation, and the current trend is downward. This makes it difficult to predict future trends without recruitment information.

Fishery Interactions
John dory is taken in the Bay of Plenty by bottom trawl targeted at John dory, snapper, trevally, tarakihi and gurnard; and by Danish seine targeted at snapper and gurnard. Incidental captures of seabirds and dolphins occur; there is a risk of incidental capture of New Zealand fur seal.

- **JDO 1 (West Coast North Island)**

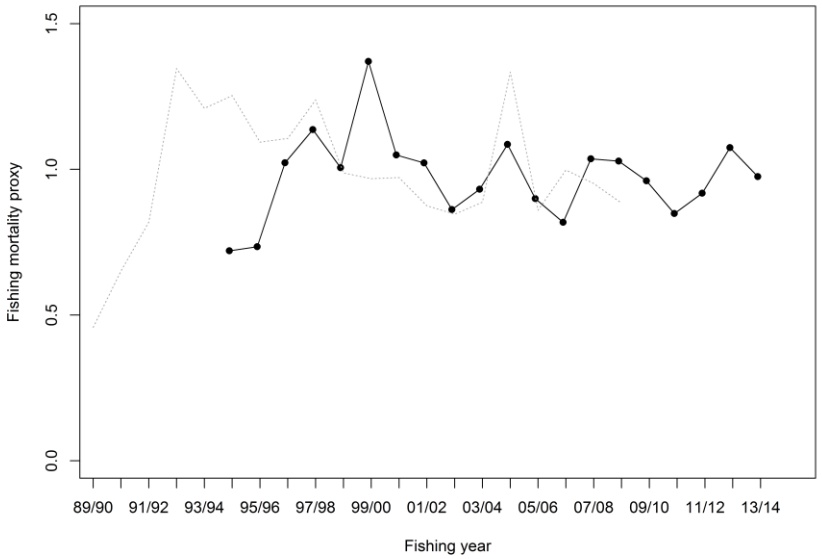
Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	Standardised CPUE
Reference Points	Interim Target: Mean of the CPUE indices for John dory in West Coast North Island from combined binomial and lognormal models from 1994–95 to 2010–11 Soft Limit: 50% of target Hard Limit: 25% of target Overfishing threshold: F_{MSY}
Status in relation to Target	Likely (> 60%) to be above the target
Status in relation to Limits	Soft Limit: Very Unlikely (< 10%) to be below Hard Limit: Very Unlikely (< 10%) to be below
Status in relation to Overfishing	Unlikely (< 40%) to be occurring

Historical Stock Status Trajectory and Current Status



Standardised CPUE indices for John dory in West Coast North Island from combined binomial and lognormal models of catch rate in bottom trawl tows in a mixed target fishery (Langley 2015). Broken horizontal lines indicate the target and soft limit. The grey line represents a lognormal model of positive catches in mixed species bottom trawl tows, including data recorded on earlier (i.e., CELR) form types (Kendrick & Bentley 2011). Indices are scaled to have the same geometric mean over the overlapping years. Vertical lines show the 95% credible intervals. Commercial catch represents the catch from this area.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Both CPUE series have fluctuated without trend.

Recent Trend in Fishing Intensity or Proxy	 **Relative fishing mortality proxy derived from total area catch divided by CPUE indices from the recent CPUE analysis (Black points) and the CPUE analysis of Kendrick & Bentley 2011 (grey line).** Fishing mortality has fluctuated without trend over the time-series corresponding to the CPUE indices.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	Stock biomass is expected to continue to fluctuate about the target biomass level.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unlikely (< 40%) at current catch levels Hard Limit: Very Unlikely (< 10%) at current catch levels
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unlikely (< 40%) at current catch levels

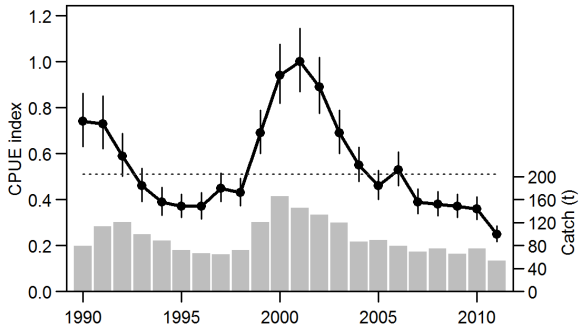
Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Fishery characterisation and standardised CPUE	
Assessment Dates	Latest assessment: 2015	Next assessment: 2017
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	2015 CPUE analysis 2010 CPUE analysis	1 – High Quality 1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	- The stock relationship between JDO 1 and JDO 2	
Qualifying Comments		
-		

Fishery Interactions
John dory is taken on the west coast by bottom trawl targeted at snapper trevally, gurnard and tarakihi. Incidental captures of seabirds and dolphins occur; there is a risk of incidental capture of New Zealand fur seal and Maui's dolphins.

- **JDO 2 (Southeast North Island)**

Stock Status	
Year of Most Recent Assessment	2013
Assessment Runs Presented	Standardised CPUE
Reference Points	Interim Target: Mean of the CPUE indices for John dory in South East coast of the North Island from combined binomial and lognormal models from 1989–90 to 2010–11 Soft Limit: 50% of target Hard Limit: 25%of target Overfishing threshold F_{MSY}
Status in relation to Target	Unlikely (< 40%) to be at or above the target
Status in relation to Limits	Soft Limit: About as Likely as Not (40–60%) to be below Hard Limit: Unlikely (< 10%) to be below
Status in relation to Overfishing	Unknown

Historical Stock Status Trajectory and Current Status



Standardised CPUE indices for John dory in Southeast North Island from combined binomial and lognormal models of catch rate in bottom trawl trips in a mixed target fishery (Dunn & Jones 2013). Broken horizontal line indicates the mean from 1989–90 to 2010–11; Bars represent catch from this area.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The CPUE series has fluctuated with a cyclical trend. The data points since 2006–07 have been below the long-term mean. 2010–11 is the lowest in the series.
Recent Trend in Fishing Intensity or Proxy	Unknown
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	Without information on recruitment, it is not possible to predict how the stock will respond in the next few years.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Likely (> 60%) Hard Limit: About as Likely as Not (40–60%)
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown

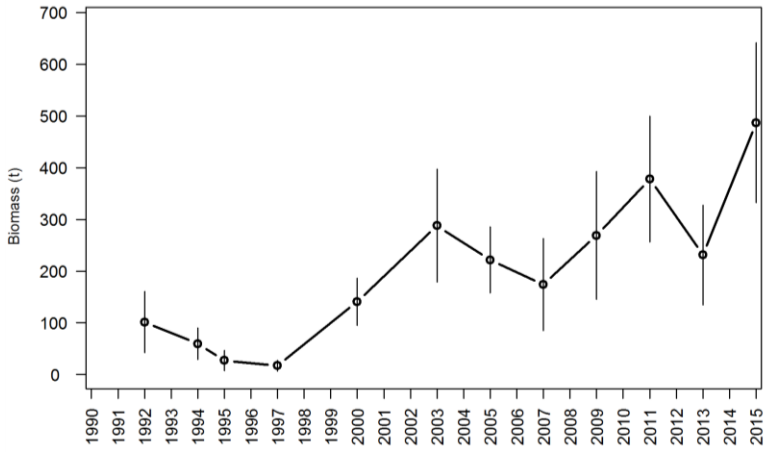
Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Fishery characterisation and standardised CPUE	
Assessment Dates	Latest assessment: 2013	Next assessment: Unknown

Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Catch and effort data	1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	- The stock relationship between JDO 1 and JDO 2 - Lack of information on incoming recruitment	
Qualifying Comments		
As the John dory fishery in FMAs 1 and 9 has a long history, it is not possible to infer stock status from abundance trends from only the last 22 years. This sub-stock appears to be cyclical, probably in response to recruitment variation. This makes it difficult to predict future trends without recruitment information.		
Fishery Interactions		
John dory is taken on the east coast by bottom trawl targeted primarily at tarakihi and red gurnard.		

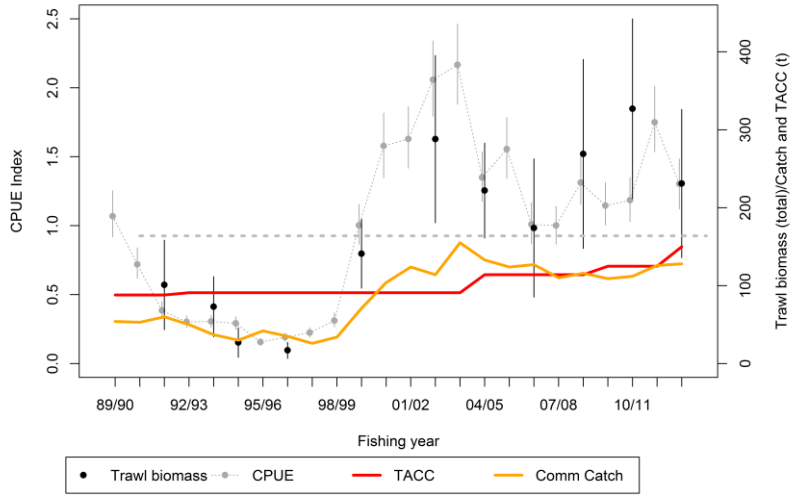
JDO 7 (Northern South island)

Stock Status	
Year of Most Recent Assessment	2016
Assessment Runs Presented	Trawl survey biomass index (2015) and standardised CPUE (2014)
Reference Points	Interim Target: Mean total biomass from the West Coast South Island trawl survey (WCSI and TBGB) from 1992 to 2011 Soft Limit: 50% of target Hard Limit: 25% of target Overfishing threshold F_{MSY}
Status in relation to Target	Likely (> 60%) to be above the target
Status in relation to Limits	Soft Limit: Very Unlikely (< 10%) to be below Hard Limit: Very Unlikely (< 10%) to be below
Status in relation to Overfishing	Overfishing is Unlikely (< 40%) to be occurring

Historical Stock Status Trajectory and Current Status



Biomass trends from the west coast South Island inshore trawl survey time series. Error bars are ± two standard deviations.



A comparison of trends in trawl survey biomass estimates (total biomass, WCSI), CPUE indices and the commercial catch relative to the TACC. The dashed line represents the interim target biomass level relative to the trawl survey biomass indices.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The trawl survey series declined through the 1990s then increased between 1997–98 and 2003–04. The 2015 estimate is the highest in the time series and continues an overall increasing trend since 1997. The series has been above the long term mean since 2000–01. Trends in CPUE are comparable to trawl survey biomass trends.
Recent Trend in Fishing Intensity or Proxy	The commercial catch trends generally followed those of the trawl survey biomass estimates up to 2006–07. Since then, the annual catch has been maintained at about the annual TACC level, while trawl survey biomass has increased.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	Length frequency analysis from the West Coast South Island trawl survey showed very good recruitment in 2000, 2003 and 2009 and these are probably supporting the high biomass at this time. Recruitment from the 2011 and 2013 surveys was more modest but was again high in 2015, similar to the record in 2009.

Projections and Prognosis	
Stock Projections or Prognosis	The stock is currently at a relatively high level, above the interim target biomass level, and previous high catches appear to have been sustained by intermittent high recruitment. The strong 1+ year class seen in 2015 is likely to sustain biomass levels, at least in the short term.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unlikely (< 40%) Hard Limit: Unlikely (< 40%)
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unlikely (< 40%). Non target species so that even if abundance declines considerably the exploitation rates are unlikely to substantially increase.

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Evaluation of survey biomass and length frequencies. Standardised CPUE	
Assessment Dates	Latest assessment: 2015 (Survey) 2014 (CPUE)	Next assessment: 2017 (survey) 2016 (CPUE)
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- West Coast South Island trawl survey - Survey length frequency - CPUE	1 – High Quality 1 – High Quality 1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	- More complete data set obtained for CPUE analysis	
Major Sources of Uncertainty	- The stock relationship between JDO 7 and JDO 2	
Qualifying Comments		
-		
Fishery Interactions		
John dory are primarily taken in conjunction with the following QMS species: barracouta, red cod, stargazer, red gurnard and tarakihi in the Northern South Island bottom trawl fishery.		

6. FOR FURTHER INFORMATION

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