(FLA)

(*Colistium nudipinnis*, *Peltorhamphus novaezelandiae*, *Colistium guntheri*, *Rhombosolea retiaria*, *Rhombosolea plebeia*, *Rhombosolea leporina*, *Rhombosolea tapirina*, *Pelotretis flavilatus*)
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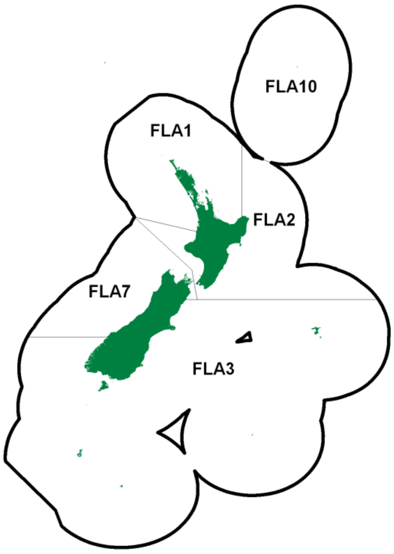
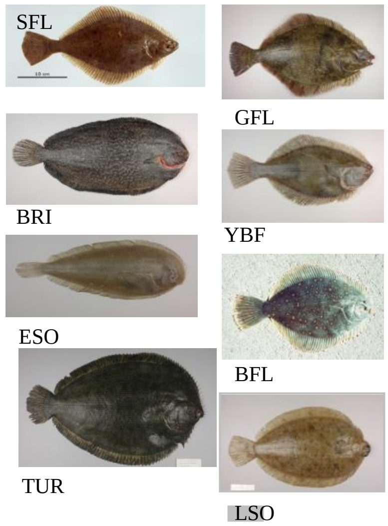




1. FISHERY SUMMARY

1.1 Commercial fisheries

Flatfish Individual Transferable Quota (ITQ) provides for the landing of eight species of flatfish. These are: the yellow-belly flounder, *Rhombosolea leporine* (YBF); sand flounder, *Rhombosolea plebeian* (SFL); black flounder, *Rhombosolea retiaria* (BFL); greenback flounder, *Rhombosolea tapirina* (GFL); lemon sole, *Pelotretis flavilatus* (LSO); New Zealand sole, *Peltorhamphus novaezeelandiae* (ESO); brill, *Colistium guntheri* (BRI); and turbot, *Colistium nudipinnis* (TUR). For management purposes landings of these species are combined.

Flatfish are shallow water species, taken mainly by target inshore trawl and Danish seine fleets around the South Island. Set and drag net fishing are important in the northern harbours and the Firth of Thames. Important fishing areas are:

Yellow-belly flounder	-	Firth of Thames, Kaipara and Manukau harbours;
Sand flounder	-	Hauraki Gulf, Tasman/Golden Bay, Bay of Plenty, Canterbury Bight and Te Wae Wae Bay;
Greenback flounder	-	Canterbury Bight, Southland;
Black flounder	-	Canterbury Bight;
Lemon sole	-	west coast South Island, Otago and Southland;
New Zealand sole	-	west coast South Island, Otago, Southland and Canterbury Bight;
Brill and turbot	-	west coast South Island.

TACCs were originally set at the level of the sum of the provisional ITQs for each fishery. Between 1983–84 and 1992–93 total flatfish landings fluctuated between 5160 t and 2750 t; from 1992–93 to 1997–98, landings were relatively consistent, between about 4500 t and 5000 t per year. Landings declined to 2963 t in 1999–00, the lowest recorded since 1986–87, and subsequently increased to a peak of 4051 t for the 2006–07 fishing year and have declined since to 2792 and 2672 t in 2012–13 and 2013–14 respectively. Historical estimated and recent reported flatfish landings and TACCs are shown in Tables 1 and 2, while Figure 1 shows the historical landings and TACC values for the main FLA stocks. From 1 October 2007 a TAC and allowances were set for the first time in FLA 3. The FLA 3 TACC was reduced by 47% to 1430 t as well as implementing a management procedure that recommends an in-season increase in the TACC if supported by early CPUE data (see Section 4.3 for a description of this procedure). All FLA fisheries have been put on to Schedule 2 of the Fisheries Act 1996. Schedule 2 allows that for certain "highly variable" stocks, the Total Annual Catch (TAC) can be increased within a fishing season. The base TAC is not changed by this process and the "in-season" TAC reverts to the original level at the end of each season. The FLA 3 management procedure (Section 4.3) is an implementation of this form of management.

From 1 October 2008, a suite of regulations intended to protect Maui's and Hector's dolphins was implemented for all of New Zealand by the Minister of Fisheries. Commercial and recreational set netting was banned in most areas to 4 nautical miles offshore of the east coast of the South Island, extending from Cape Jackson in the Marlborough Sounds to Slope Point in the Catlins. Some exceptions were allowed, including an exemption for commercial and recreational set netting to only one nautical mile offshore around the Kaikoura Canyon, and permitting setnetting in most harbours, estuaries, river mouths, lagoons and inlets except for the Avon-Heathcote Estuary, Lyttelton Harbour, Akaroa Harbour and Timaru Harbour. In addition, trawl gear within 2 nautical miles of shore was restricted to flatfish nets with defined low headline heights. The commercial minimum legal size for sand flounder is 23 cm, and for all other flatfish species is 25 cm.

Table 1: Reported landings (t) for the main QMAs from 1931 to 1982.

Year	FLA 1	FLA 2	FLA 3	FLA 7	Year	FLA 1	FLA 2	FLA 3	FLA 7
1931-32	767	290	219	265	1957	308	64	529	183
1932-33	958	219	61	276	1958	362	59	989	321
1933-34	698	277	181	346	1959	362	48	971	382
1934-35	708	203	83	195	1960	410	58	1257	361
1935-36	686	118	57	209	1961	386	102	665	273
1936-37	438	127	139	139	1962	383	156	584	228
1937-38	570	125	380	123	1963	352	106	627	228
1938-39	717	83	639	94	1964	499	134	879	350
1939-40	721	128	448	83	1965	599	109	917	518
1940-41	1004	180	494	101	1966	547	222	1141	496
1941-42	943	139	622	139	1967	646	231	1273	493
1942-43	591	192	594	154	1968	541	139	973	311
1943-44	669	89	606	172	1969	686	193	936	269
1944	441	104	783	78	1970	557	262	1027	471
1945	435	104	984	83	1971	407	149	1028	276
1946	392	168	1264	146	1972	475	114	548	166
1947	551	99	1685	198	1973	438	149	717	442
1948	433	93	1494	214	1974	503	147	637	748
1949	412	76	1473	202	1975	431	156	598	476
1950	284	31	1446	176	1976	548	132	802	929
1951	308	62	1178	135	1977	764	255	916	1165
1952	349	94	1117	166	1978	706	202	1730	1225
1953	349	149	1510	197	1979	742	287	1962	899
1954	376	112	1184	213	1980	906	219	1562	459
1955	377	125	913	248	1981	1082	760	1369	399
1956	308	106	772	190	1982	934	650	1214	468

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.

Table 2: Reported landings (t) of flatfish by Fishstock from 1983–84 to present and actual TACCs (t) from 1986–87 to present. QMS data from 1986–present. [Continued on next page.]

Fishstock	FLA 1		FLA 2		FLA 3		FLA 7		FLA 10			
FMA (s)	1 & 9		2 & 8		3, 4, 5 & 6		7		10		Total	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1983–84*	1 215	-	378	-	1 564	-	1 486	-	0	-	5 160	-
1984–85*	1 050	-	285	-	1 803	-	951	-	0	-	4 467	-
1985–86*	722	-	261	-	1 537	-	385	-	0	-	‡3 215	-
1986–87	629	1 100	323	670	1 235	2 430	563	1 840	0	10	‡2 750	6 050
1987–88	688	1 145	374	677	2 010	2 535	1 000	1 899	0	10	‡4 072	6 266
1988–89	787	1 153	297	717	2 458	2 552	757	2 045	0	10	4 299	6 477
1989–90	791	1 184	308	723	1 637	2 585	745	2 066	0	10	3 482	6 568
1990–91	849	1 187	292	726	1 340	2 681	502	2 066	0	10	2 983	6 670
1991–92	940	1 187	288	726	1 229	2 681	745	2 066	0	10	3 202	6 670
1992–93	1 106	1 187	460	726	1 954	2 681	1 566	2 066	0	10	5 086	6 670
1993–94	1 136	1 187	435	726	1 926	2 681	1 108	2 066	0	10	4 605	6 670
1994–95	964	1 187	543	726	1 966	2 681	1 107	2 066	0	10	4 580	6 670

Table 2 [Continued]

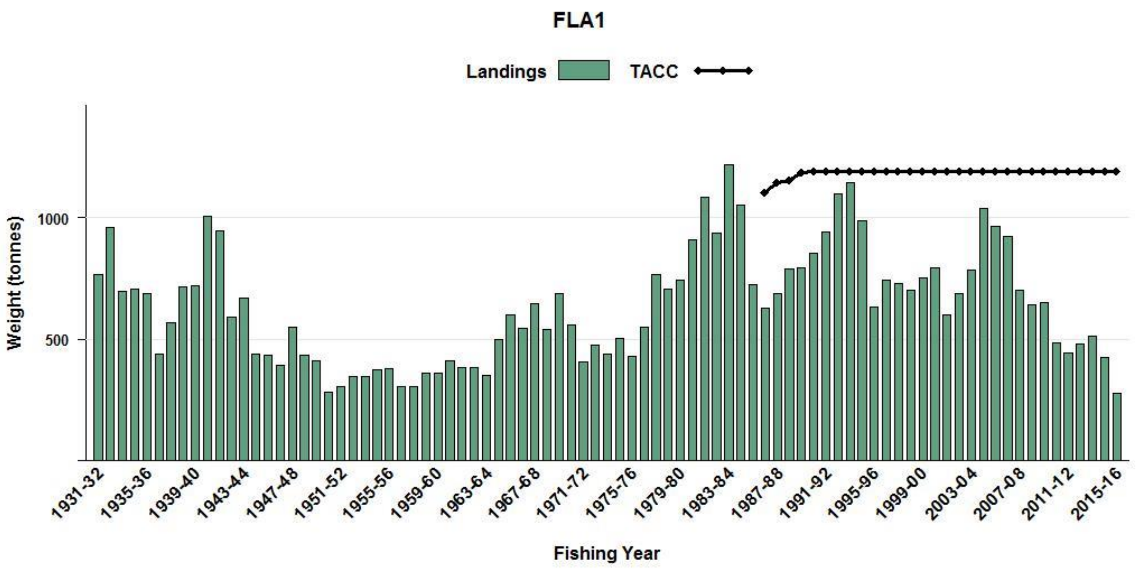
1995–96	628	1 187	481	726	2 298	2 681	1 163	2 066	1	10	4 571	6 670
1996–97	741	1 187	363	726	2 573	2 681	1 117	2 066	0	10	4 794	6 670
1997–98	728	1 187	559	726	2 351	2 681	1 020	2 066	0	10	4 657	6 670
1998–99	690	1 187	274	726	1 882	2 681	868	2 066	0	10	3 714	6 670
1999–00	751	1 187	212	726	1 583	2 681	417	2 066	0	10	2 963	6 670
2000–01	792	1 187	186	726	1 702	2 681	447	2 066	0	10	3 127	6 670
2001–02	596	1 187	177	726	1 693	2 681	614	2 066	0	10	3 080	6 670
2002–03	686	1 187	144	726	1 650	2 681	819	2 066	0	10	3 299	6 670
2003–04	784	1 187	218	726	1 286	2 681	918	2 066	0	10	3 206	6 670
2004–05	1 038	1 187	254	726	1 353	2 681	1 231	2 066	0	10	3 876	6 670
2005–06	964	1 187	296	726	1 177	2 681	1 283	2 066	0	10	3 720	6 670
2006–07	922	1 187	296	726	1 429	2 681	1 419	2 066	0	10	4 066	6 670
2007–08	703	1 187	243	726	1 365	1 430	1 313	2 066	0	10	3 624	5 409
2008–09	639	1 187	214	726	1 544	1 430	1 020	2 066	0	10	3 417	5 409
2009–10	652	1 187	212	726	1 525	**1 846	884	2 066	0	10	3 273	5 409
2010–11	486	1 187	296	726	1 027	**1 520	659	2 066	0	10	2 467	5 419
2011–12	445	1 187	262	726	1 507	1 430	646	2 066	0	10	2 861	5 419
2012–13	480	1 187	274	726	1 512	**1 727	526	2 066	0	10	2 792	5 419
2013–14	511	1 187	216	726	1 377	1 430	568	2 066	0	10	2 672	5 419
2014–15	426	1 187	166	726	1 231	1 430	640	2 066	0	10	2 464	5 419
2015–16	277	1 187	238	726	1 622	**1 650	656	2 066	0	10	2 792	5 638

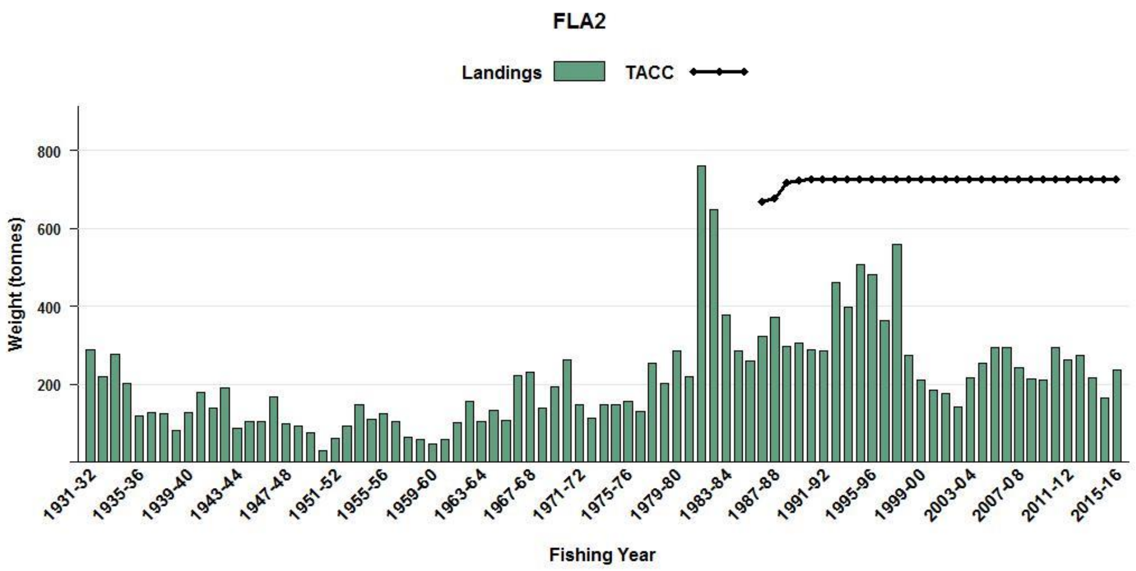
* FSU data.
‡ Includes 11 t Turbot, area unknown but allocated to QMA 7.
§ Includes landings from unknown areas before 1986–87.
** The TACC was increased in-season under Schedule 2 of the Fisheries Act (1996).

Fishers and processors are required to use a generic flatfish (FLA) code in the monthly harvest returns to report landed catches of flatfish species as well as in the landings section of the catch and effort forms. Although fishers are now instructed to use specific species codes when reporting estimated catches, they often use the generic FLA code. Beentjes (2003) showed that, for all QMAs combined between 1989–90 and 2001–02, about half of the estimated catch of flatfish was recorded using the generic species code FLA, and the remainder was reported using a combination of 12 other species codes (Table 3). Flatfish species that comprised a large proportion of the total estimated catch over the 13 year period included ESO (16%), LSO (12%), SFL (12%) and YBF (6%). Species that are important contributors to catch in each QMA are FLA 1: YBF, SFL, GFL; FLA 2: ESO, SFL; FLA 3: ESO, LSO, SFL, BFL, BRI; FLA 7: GFL, SFL, TUR (Table 4; codes provided in the caption to Table 3). Starr & Kendrick (in prep) have recently shown that trips which report catches in FLA 3 by species rather than using the generic FLA code accounted for greater than 80% of the estimated catches in 2012–13 and 2013–14.

Table 3: Percent estimated flatfish catch by species and fishing year in FLA 3 for "splitter" trips, which are trips which landed FLA 3 but which did not use the FLA code in the estimated catch section of the catch/effort form. Codes are arranged in descending order of total estimated catch: lemon sole (LSO), New Zealand sole (ESO), sand flounder (SFL), black flounder (BFL), brill (BRI), yellow belly flounder (YBF), Turbot (TUR), greenback flounder (GFL) (Starr & Kendrick in prep). Also shown is the proportion by weight of estimated catch defined in the "splitter" category.

Year	LSO	ESO	SFL	BFL	BRI	YBF	FLO	TUR	GFL	Other	"Splitters"
1990–91	14.7	32.1	22.2	18.1	5.2	4.5	0.0	1.3	1.9	0.0	44.9
1991–92	23.9	41.7	15.3	1.7	3.5	8.5	0.0	1.3	4.0	0.0	42.6
1992–93	23.6	42.9	20.3	0.4	3.2	4.5	0.0	0.4	4.8	0.0	44.1
1993–94	32.9	43.2	14.4	0.3	2.3	2.3	0.0	0.7	3.9	0.0	58.8
1994–95	34.8	35.4	16.3	3.5	2.0	2.8	0.0	1.1	3.6	0.5	60.9
1995–96	40.6	34.0	11.9	6.1	2.3	2.4	0.7	0.7	0.9	0.4	67.5
1996–97	38.2	36.8	14.6	2.4	2.0	1.2	2.4	0.7	1.6	0.1	61.5
1997–98	54.5	26.1	10.8	0.7	1.6	1.3	2.3	0.7	1.8	0.1	62.2
1998–99	57.2	22.4	8.9	1.3	2.7	2.0	2.4	1.6	1.4	0.1	67.0
1999–00	42.0	31.8	9.7	6.4	4.2	2.9	0.7	2.0	0.4	0.1	65.8
2000–01	36.4	37.3	9.7	3.5	3.2	2.9	1.1	1.9	0.2	3.8	67.8
2001–02	26.3	44.5	10.8	8.6	2.6	2.0	1.0	1.4	0.3	2.5	67.2
2002–03	33.0	40.2	11.2	2.2	4.1	4.3	1.3	1.8	0.2	1.7	59.0
2003–04	39.1	30.1	9.6	1.7	2.8	10.8	0.8	0.7	0.1	4.3	59.6
2004–05	33.9	27.0	12.7	13.4	2.9	3.6	1.1	1.2	0.3	3.9	59.3
2005–06	46.3	25.0	12.1	5.3	2.9	3.0	2.1	0.9	1.1	1.3	61.1
2006–07	52.0	20.6	15.9	0.1	2.5	4.6	1.8	1.2	0.5	0.8	65.3
2007–08	65.4	18.2	7.3	0.0	3.3	0.7	1.3	1.1	1.9	0.7	75.7
2008–09	54.9	25.6	10.2	0.0	3.0	0.7	1.8	1.9	1.5	0.4	71.7
2009–10	59.9	19.3	11.4	0.3	3.1	1.0	1.4	1.8	1.0	0.8	71.1
2010–11	54.7	14.4	16.8	2.4	4.7	0.4	2.0	2.4	0.9	1.4	65.8
2011–12	51.0	18.6	15.0	4.2	3.4	0.6	3.4	2.5	0.3	1.0	62.8
2012–13	46.4	20.7	16.9	2.4	3.3	1.9	3.2	2.4	0.6	2.0	83.8
2013–14	39.2	20.7	21.9	3.2	3.4	4.4	2.5	2.4	1.2	1.2	84.7
Total	42.7	29.6	13.3	3.4	3.0	2.8	1.5	1.4	1.4	1.1	61.3





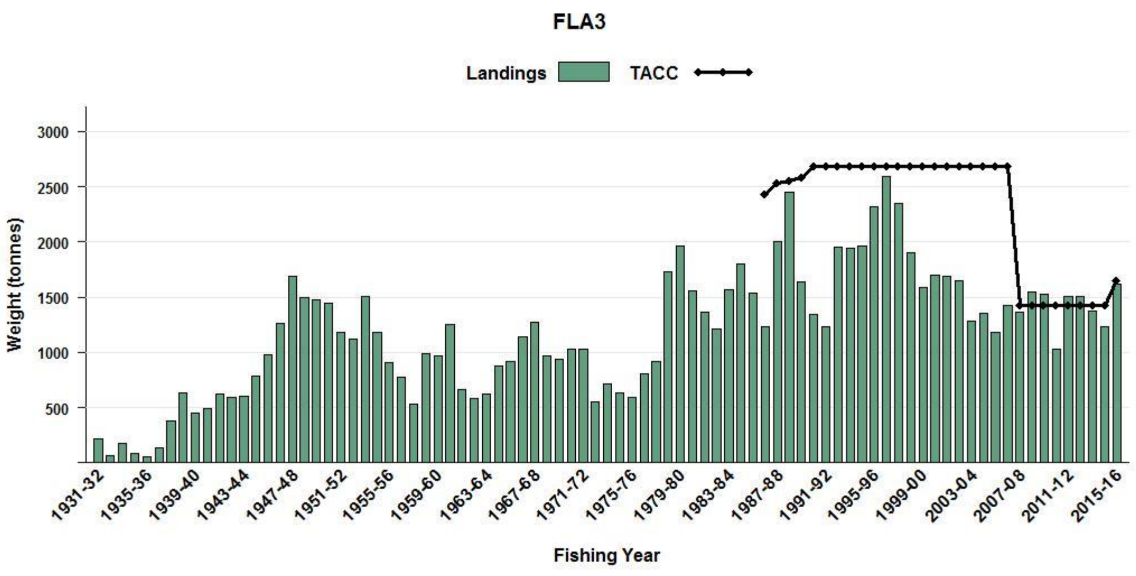


Figure 1: Historical landings and TACC for the four main FLA stocks. FLA 1 (Auckland), FLA 2 (Central), FLA 3 (South East Coast, South East Chatham Rise, Sub-Antarctic, Southland).

1.2 Recreational fisheries

There are important recreational fisheries, mainly for the four flounder species, in most harbours, estuaries, coastal lakes and coastal inlets throughout New Zealand. The main methods are setnetting, drag netting (62.8% combined) and spearing (36.1%) (Wynne-Jones et al 2014). In the northern region, important areas include the west coast harbours, the lower Waikato, the Hauraki Gulf and the Firth of Thames. In the Bay of Plenty, Ohiwa and Tauranga Harbours are important. In the Challenger FMA, there is a moderate fishery in Tasman and Golden Bays and in areas of the Mahau-Kenepuru Sound and in Cloudy Bay. In the South-East and Southland FMAs, flatfish are taken in areas such as Lake Ellesmere, inlets around Banks Peninsula and the Otago Peninsula, the Oreti and Riverton estuaries, Bluff Harbour and the inlets and lagoons of the Chatham Islands (for further details see the 1995 Plenary Report).

1.2.1 Management controls

The main method used to manage recreational harvests of flatfish are minimum legal sizes (MLS) and daily bag limits. General spatial and method restrictions also apply, particularly to the use of set nets. The flatfish MLS for recreational fishers is 25 cm for all species except sand flounder for which the MLS is 23 cm. Fishers can take up to 20 flatfish as part of their combined daily bag limit in the Auckland, Central and Challenger Fishery Management Areas. Fishers can take up to 30 flatfish as part of their combined daily bag limit in the South-East, Kaikoura, Fiordland and Southland 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 flatfish 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). The harvest estimates provided by these telephone diary surveys (Table 3) 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 (Wynne-Jones et al 2014). 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 recreational harvest taken under s111 general approvals. Recreational catch estimates from the various surveys are given in Table 4.

Table 4: Estimated number and weight of flatfish, by Fishstock and survey, harvested by recreational fishers. Surveys were carried out in different years in the Fisheries regions: South in 1991–92, Central 1992–93, North 1993–94 (Teirney et al 1997) and nationally in 1996 (Bradford 1998) and 1999–00 (Boyd & Reilly 2005). (- Data not available). National panel survey conducted 01 October 2011 through 30 September 2012, used a mean weight for flatfish of 0.41kg (Wynne-Jones et al 2014). [Continued on next page.]

Fishstock	Survey	Number	CV%	Harvest range (t)	Point estimate (t)
1991–92					
FLA 1	South	3 000	-	-	-
FLA 3	South	15 200	31	50–90	-
FLA 7	South	3 000	-	-	-
1992–93					
FLA 1	Central	6 100	-	-	-
FLA 2	Central	73 000	26	20–40	-
FLA 7	Central	37 100	59	10–30	-
1993–94					
FLA 1	North	520 000	19	225–275	-

Table 4 [Continued]

Fishstock	Survey	Number	CV%	Harvest range (t)	Point estimate (t)
FLA 2	North	3 000	-	0–5	
1996					
FLA 1	National	308 000	11	95–125	110
FLA 2	National	67 000	19	13–35	24
FLA 3	National	113 000	14	30–50	40
FLA 7	National	44 000	18	10–20	16
1999–00					
FLA 1	National	702 000	25	203–336	-
FLA 2	National	380 000	49	82–238	-
FLA 3	National	395 000	33	128–252	-
FLA 7	National	114 000	53	23–73	-
2012					
FLA 1	Panel	64 999			26.7
FLA 2	Panel	12 885			5.3
FLA 3	Panel	53 475			21.9
FLA 7	Panel	12 259			5.0
All areas combined	Panel	143 619	21		58.9

1.3 Customary non-commercial fisheries
Quantitative information on the current level of customary non-commercial catch is not available.

1.4 Illegal catch
There is no quantitative information on the current level of illegal catch available.

1.5 Other sources of mortality
The extent of unrecorded fishing mortality is unknown.

2. BIOLOGY

Some New Zealand flatfish species are fast-growing and short-lived, generally only surviving to 3–4 years of age, with very few reaching 5–6 years, others such as brill and turbot are longer lived, reaching a maximum age of 21 years and 16 years, respectively (Stevens et al 2001). However, these estimates have yet to be fully validated. Size limits (set at 25 cm for most species) are generally at or above the size at which the fish reach maturity and confer adequate protection to the juveniles.

Sutton et al (2010) undertook an age and growth analysis of greenback flounder. That analysis showed that growth is rapid throughout the lifespan of greenback flounder. Females reached a slightly greater maximum length than males, but the difference was not significant at the 95% level of confidence. Over 90% of sampled fish were 2 or 3 years of age, with maximum ages of 5 and 10 years being obtained for male and female fish respectively. This difference in maximum age resulted in estimated natural mortalities using Hoenig’s (1983) regression method, of 0.85 for males and 0.42 for females. It is suggested that 0.85 is the most appropriate estimate at this stage as only 1% of all fish exceeded 5 years. However, it was also noted that a complete sample of the larger fish was not obtained and as a result these estimates should be considered preliminary. Growth rings were not validated.

Flatfish are shallow-water species, generally found in waters less than 50 m depth. Juveniles congregate in sheltered inshore waters, e.g., estuarine areas, shallow mudflats and sandflats, where they remain for up to two years. Juvenile survival is highly variable. Flatfish move offshore for first spawning at 2–3 years of age during winter and spring. Adult mortality is high, with many flatfish spawning only once and few spawning more than two or three times. However, fecundity is high, e.g., from 0.2 million eggs to over 1 million eggs in sand flounders.

Available biological parameters relevant to stock assessment are shown in Table 5. The estimated parameters in sections 1 and 3 of the table apply only to sand flounder in Canterbury and brill and turbot in west coast South island - growth patterns are likely to be different for these species in other areas and for other species of flatfish.

Table 5: Estimates of biological parameters for flat fish.

Fishstock							Estimate	Source
1. Natural mortality (*M*)								
Brill - West coast South Island (FLA 7)							0.20	Stevens et al (2001)
Turbot - West coast South island (FLA 7)							0.26	Stevens et al (2001)
Sand flounder - Canterbury (FLA 3)							1.1–1.3	Colman (1978)
Lemon sole - West coast South island (FLA 7)							0.62–0.96	Gowing et al (unpub.)
2. Weight = a(length)^b (Weight in g, length in cm total length).								
	Females			Males				
	a	b		a	b			
Brill (FLA 7)	0.01443	2.9749		0.02470	2.8080			Hickman & Tait (unpub.)
Turbot (FLA 7)	0.00436	3.3188		0.00571	3.1389			Hickman & Tait (unpub.)
Sand flounder (FLA 1)	0.03846	2.6584		-	-			McGregor et al (unpub.)
Yellow-belly flounder (FLA 1)	0.07189	2.5117		0.00354	3.3268			McGregor et al (unpub.)
New Zealand sole (FLA 3)	0.03578	2.6753		0.007608	3.0728			McGregor et al (unpub.)
3. von Bertalanffy growth parameters								
	Females			Males				
	L_∞	k	t_0	L_∞	k	t_0		
Brill								
West coast South Island (FLA 7)	43.8	0.10	–15.87	38.4	0.37	38.4		Stevens et al (2001)
Turbot								
West coast South island (FLA 7)	57.1	0.39	0.30	49.2	0.34	49.2		Stevens et al (2001)
Sand flounder								
Canterbury (FLA 3)	59.9	0.23	–0.083	37.4	0.781	37.4		Mundy (1968), Colman (1978)
Lemon sole								
West coast South island (FLA 7)	26.1	1.29	–0.088	25.6	1.85	25.6		Gowing et al (unpub.)
Greenback flounder (FLA 5)	55.82	0.26	–1.06	52.21	0.25	–1.32		Sutton et al (2010)

3. STOCKS AND AREAS

There is evidence of many fairly localised stocks of flatfish. However, the inter-relationships of neighbouring populations have not been thoroughly studied. The best information is available from studies of the variation in morphological characteristics of sand flounders and from the results of tagging studies, conducted mainly on sand and yellow-belly flounders. Variation in morphological characteristics indicate that sand flounder stocks off the east and south coasts of the South Island are clearly different from stocks in central New Zealand waters and from those off the west coast of the South Island. There also appear to be differences between west coast sand flounders and those in Tasman Bay, and between sand flounders on either side of the Auckland-Northland peninsula. Tagging experiments show that sand flounders, and other species of flounder, can move substantial distances off the east and south coasts of the South Island. However, no fish tagged in Tasman Bay or the Hauraki Gulf have been recaptured very far from their point of release.

Thus, although the sand flounders off the east and south of the South Island appear to be a single, continuous population, fish in fairly enclosed waters may be effectively isolated from neighbouring populations and should be considered as separate stocks. Examples of such stocks are those in Tasman Bay and the Hauraki Gulf and possibly areas such as Hawke Bay and the Bay of Plenty.

There are no new data which would alter the stock boundaries used in previous assessment documents.

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

FLA 1

The standardised CPUE series previously presented for FLA 1 (Kendrick & Bentley 2012) were updated with an additional three years of data (Kendrick & Bentley in prep.), 2012. The Northern Inshore Working Group concluded that the accepted indices reflect abundance. Less than half of the estimated flatfish catch in each year is identified by species, but at least 90% of flatfish caught in FLA 1 West are likely to be yellow-belly flounder. This is supported by the fact that the preferred muddy bottom habitat of yellow-belly flounder dominates the west coast harbours.

Three quarters of the west coast catch is taken from Kaipara and Manukau Harbours. Standardised CPUE trends were derived for these two areas using estimated catches described as either YBF or FLA (assumed to be YBF). In spite of fluctuations, both the Manukau and Kaipara series show a long-term declining trend and are currently below the means for each series.

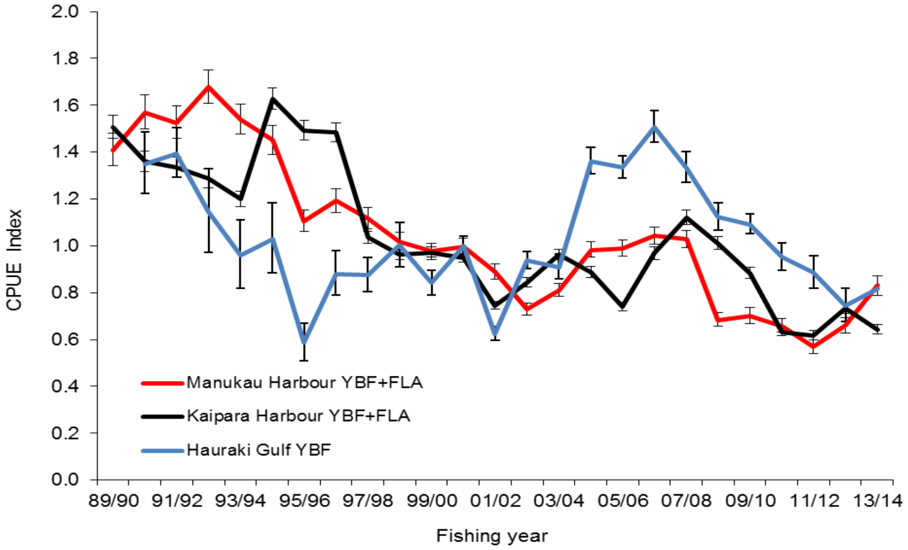


Figure 2: Comparison of standardised CPUE indices for yellowbelly flounder from models of catch rate in successful set net trips in Manukau Harbour, Kaipara Harbour (YBF or FLA) and in the Hauraki Gulf (YBF reported).

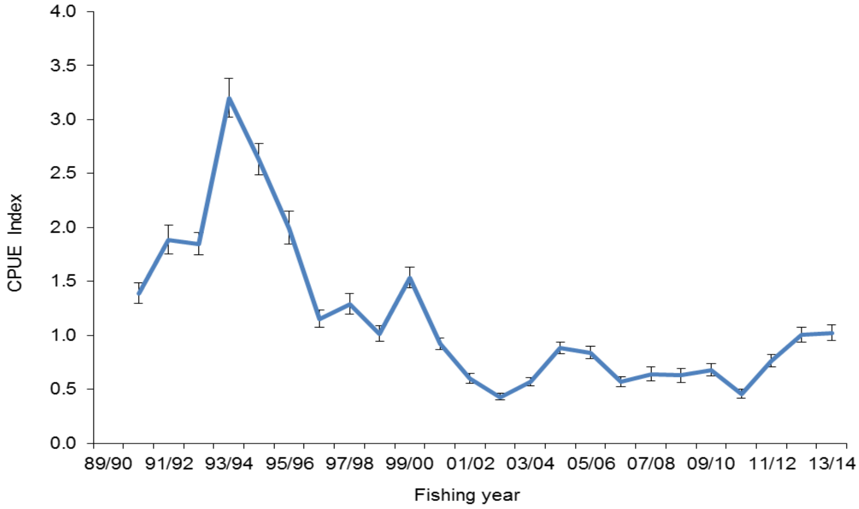


Figure 3: Standardised CPUE indices for sand flounder (SFL) from a lognormal model of catch rate in successful set net trips in the Hauraki Gulf.

Most of the flatfish catch from FLA 1 East, including a substantial and variable proportion of sand flounder, is taken in the Hauraki Gulf, particularly from the Firth of Thames. Separate indices were calculated for sand and yellowbelly flounder in Statistical Areas 005 to 007, and the portion of FLA catch not identified by species was excluded. The Hauraki Gulf yellowbelly CPUE index peaked in 2006–07 and has declined steadily since then. It currently sits below the long-term mean (Figure 2). The sand flounder index peaked between 1990–91 and 1993–94 and then declined steeply to its lowest point in 2002–03. Since then it has fluctuated without trend and is currently at about the mean for the series (Figure 3).

Coburn & Beentjes (2005) described a negative relationship between sea surface temperature and sand flounder abundance in the Firth of Thames, assuming a 2-year lag between egg production and recruitment. The abundance of yellowbelly flounder in the Firth of Thames did not appear to be related to temperature.

FLA 2

In 2017, Schofield et al (in prep.) provided standardised CPUE for FLA 2 (Figure 4) based on the flatfish target fishery in Statistical Areas 013 and 014. Estimated catches were allocated to daily aggregated effort using methodology described in Langley (2014) to improve the comparability between the data collected from two different statutory reporting forms (CELR and TCER). A core fleet of 15 vessels that had completed at least five trips per year in at least seven years was identified. The model, using a gamma error distribution, adjusted for changes in duration, month and vessel, and accounted for 33% of the variance in catch. Area was not included in the model as the change in reporting forms appears to have influenced the catch split between areas 013 and 014.

The NINS WG noted that most of the records in the aggregated data had catches of flatfish and that a binomial index was flat. As a result the positive catch index was retained as the key monitoring series. The CPUE series exhibits moderate fluctuations around the long term mean, with no overall trend up or down and appears currently to be in an increasing phase.

Characterisation using the estimated catch data suggests that the FLA 2 catch comprises mainly sand flounder (SFL) and New Zealand sole (ESO). CPUE indices for ESO and SFL were provided by Schofield et al (in prep.) for 2008 to 2016 using the tow by tow data from vessels consistently estimating catches by flatfish species. Trends were apparent in the probability of catch, so combined (binomial and positive catch modelled with a gamma distribution) indices were produced. There is reasonable consistency between the species specific indices and the overall FLA 2 index (Figure 4), noting that – as the FLA 2 fishery is small - the datasets for the individual species are small and the indices variable.

Establishing B_{MSY} compatible reference points

In 2014, the Working Group adopted mean CPUE from the bottom trawl flatfish target series for the period 1989/90 to 2012–13 as a B_{MSY}-compatible proxy for FLA 2. The Working Group accepted the default Harvest Strategy Standard definitions that the Soft and Hard Limits would be one half and one quarter the target, respectively.

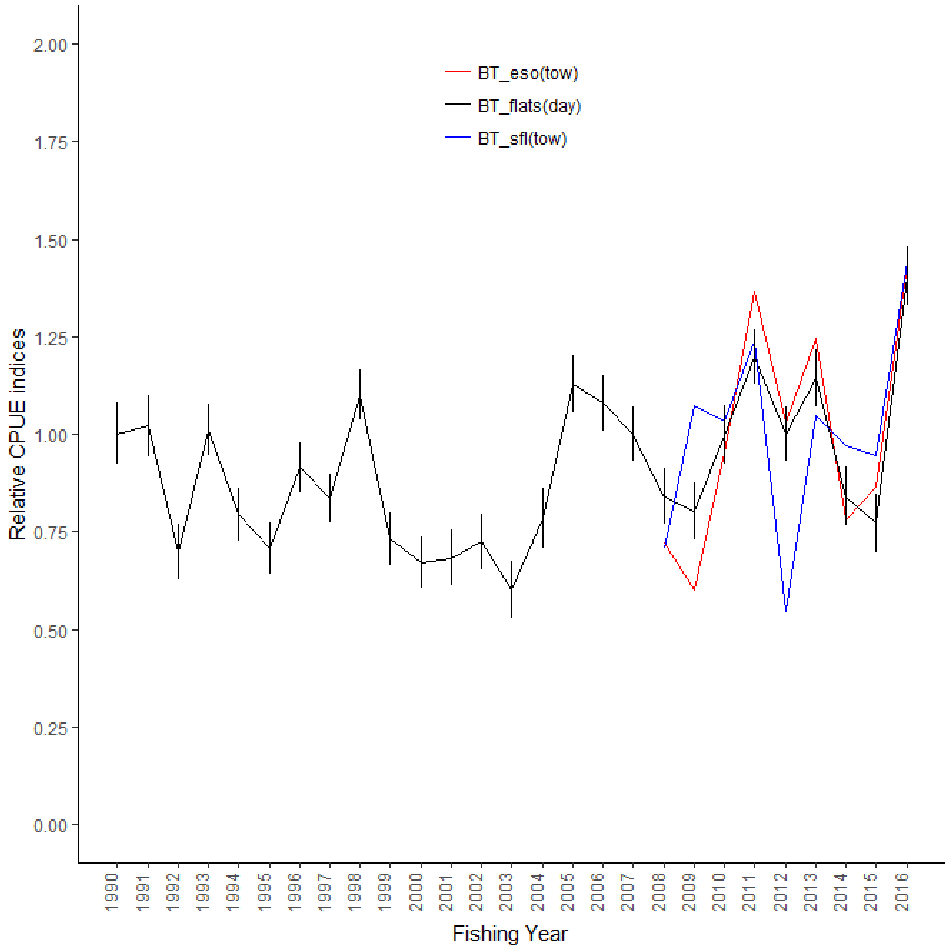


Figure 4: Standardised CPUE indices in FLA 2 for BT_targetting all species of flatfish, (aggregated to combine data across form types, BT_flats(day)), and shorter combined series for sand flounder (BT_sfl(tow)) and New Zealand sole (BT_eso(tow)) based on tow by tow resolution data (Schofield et al, in prep.).

FLA 3

CPUE trends

As in 2010 (Kendrick & Bentley in prep), CPUE trends for the three principal FLA 3 species (New Zealand sole [ESO], sand flounder [SFL] and lemon sole [LSO]) and an aggregated catch landed to FLA [TOT], based on bottom trawl catch and effort data, were estimated. The species-specific data were based on "splitter" trips, defined as trips which landed FLA 3 but which did not use the FLA code in the estimated catch section of the catch/effort form. Alternative definitions of "splitters" based on vessel performance were also investigated, but CPUE trends were found to be similar to those derived from the "trip splitter" algorithm. The latter was selected because it retained the greatest amount of catch, particular in the early years of the series.

The CPUE data were prepared by matching the landing data for a trip with the effort data from the same trip that had been amalgamated to represent a day of fishing. The procedure assigns the modal statistical area and modal target species (defined as the observation with the greatest effort) to the trip/date record. All estimated catches for the day were summed and the five top species with the greatest catch were assigned to the date. This "daily-effort stratum" preparation method was followed so that the event-based data forms that are presently being used in these fisheries can be matched as well as possible with the earlier daily forms to create a continuous CPUE series. Each analysis was confined to a set of core vessels which had participated consistently in the fishery for a reasonably long period (ESO, LSO and SFL: 5 trips for at least 5 years; TOT: 10 trips for at least 5 years). The explanatory variables offered to each model included fishing year (forced), month, vessel, statistical area, number tows and duration of fishing.

These trends were used to evaluate the relative status of these species and to predict in-season abundance of FLA based on early harvest returns for the fishery. There are similarities in the fluctuations of the four standardised CPUE indices (Figure 5), with all indices increasing in the early 1990s and peaking at some point in the five years between 1989–90 and 1993–94. All indices then have a trough in the early- to mid-2000s, followed by an increase for LSO and SFL and a decrease for ESO. The FLA, ESO and SFL indices show the greatest similarity in their fluctuations. The LSO index had its peak in the 1990s; i.e. later than the other indices, and increased sooner than the other species in the mid-2000s (Figure 5). The SFL index has continued to increase up to 2013–14 while the other three indices have dropped from peaks reached in 2009–10.

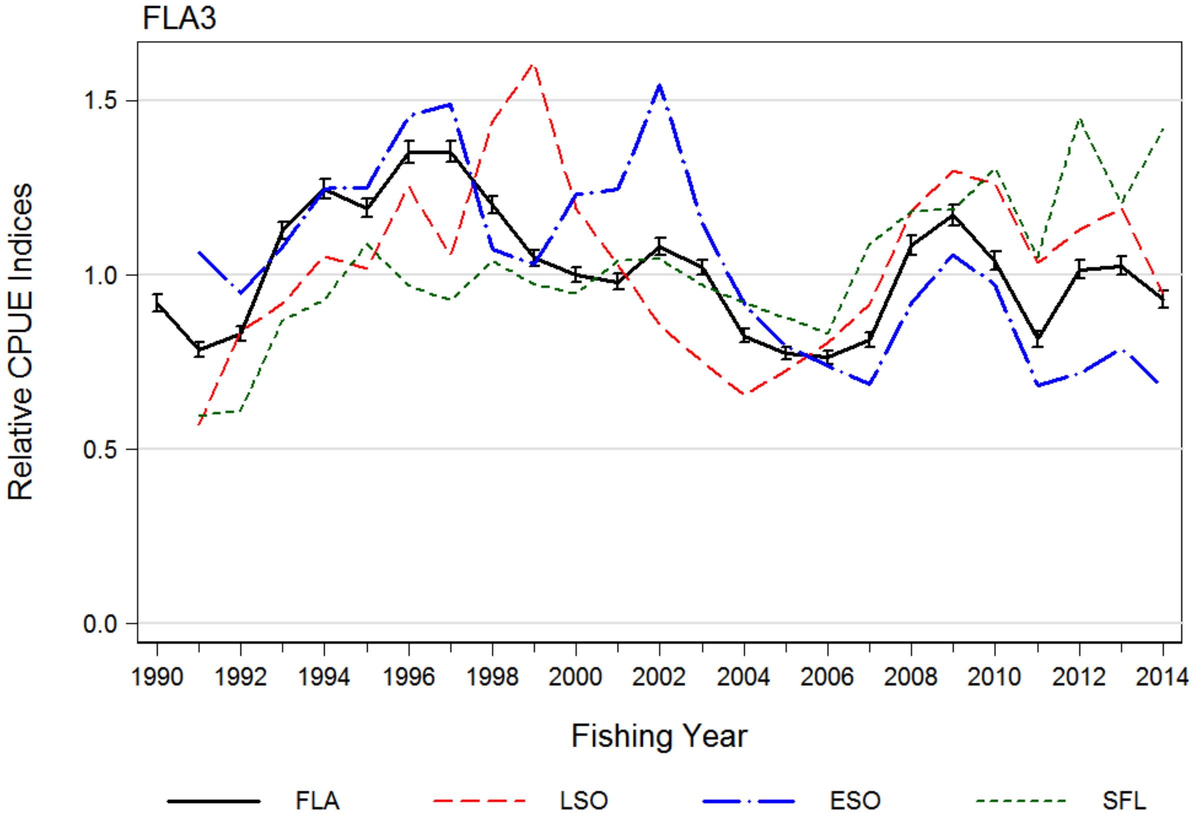


Figure 5: Comparison of standardised bottom trawl lognormal CPUE indices in FLA 3 for FLA (all flatfish species combined) LSO (lemon sole), ESO (New Zealand sole) and SFL (sand flounder). Note that only the FLA index is available for the 1989–90 fishing year because very little species composition data are available for that year (Starr & Kendrick, in prep).

ECSI trawl survey biomass estimates for LSO

Lemon sole biomass indices in the core strata (30–400 m) for the East Coast South Island trawl survey (Table 6) show no trend (Figure 6). Coefficients of variation are moderate to low, ranging from 18 to 33% (mean 24%). The additional biomass captured in the 10–30 m depth range accounted for only 4% and 1% of the biomass in the core plus shallow strata (10–400 m) for 2007 and 2012, respectively, indicating that the existing core strata time series in 30–400 m are the most important, but that shallow strata should also be monitored. A comparison of the two sets of LSO biomass indices shows that both series fluctuate without trend, with considerable variability (Figure 7). However, the correspondence between the two sets of indices is weak (rho= -0.294; R^2= 9%).

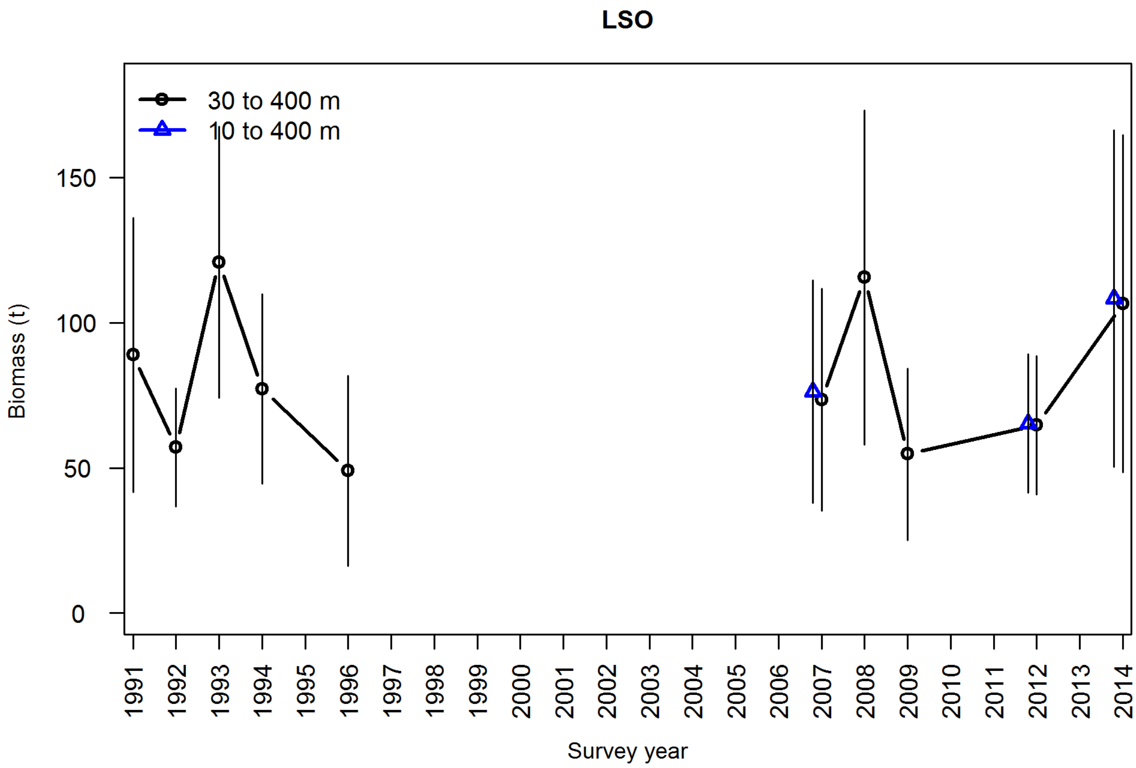


Figure 6: Lemon sole total biomass and 95 % confidence intervals for all ECSI winter surveys in core strata (30-400 m), and core plus shallow strata (10-400 m) in 2007, 2012 and 2014.

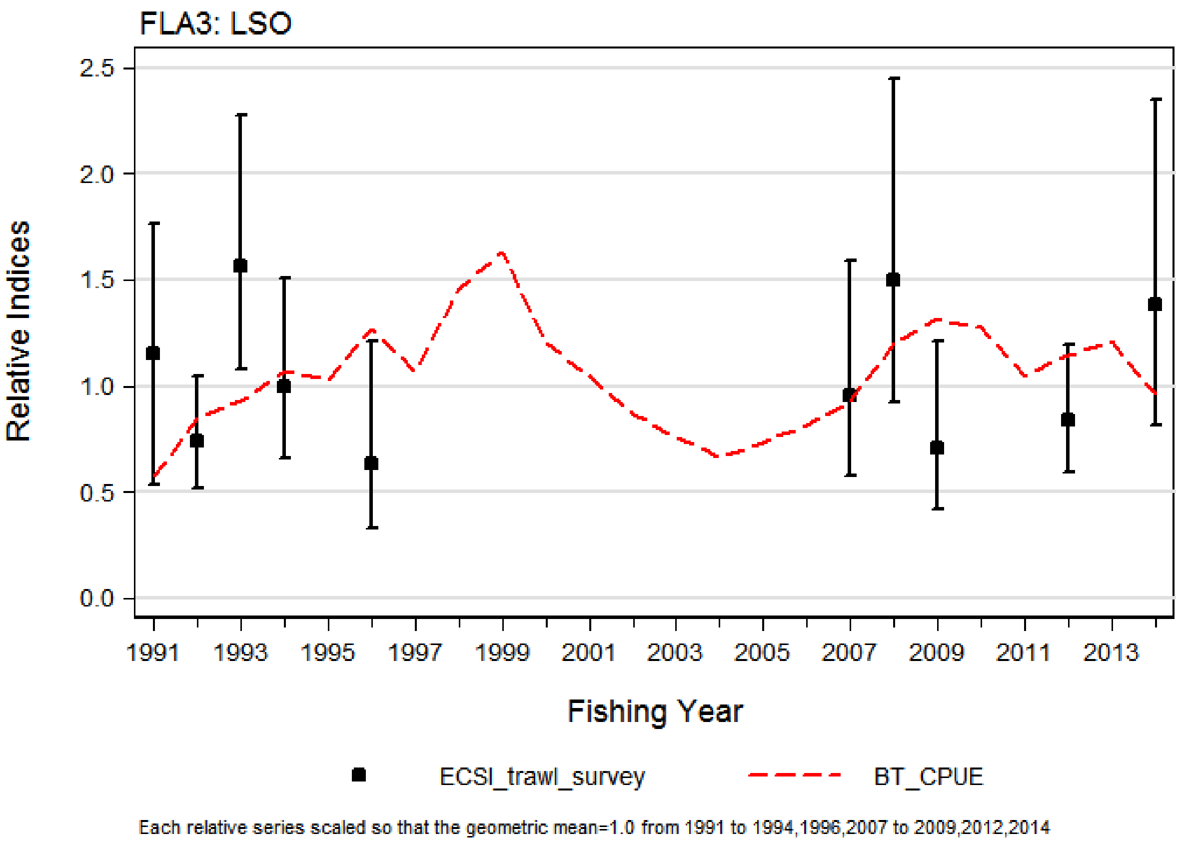


Figure 7: Lemon sole total biomass and 95% confidence intervals for the all ECSI winter surveys in core strata (30–400 m) plotted against the LSO bottom trawl CPUE series.

Table 6: Relative biomass indices (t) and coefficients of variation (CV) for lemon sole for the east coast South Island (ECSI) - winter survey area.

Region	Fishstock	Year	Trip number	Total Biomass estimate (t)	CV (%)
ECSI (winter)	FLA 3: LSO				30–400 m
		1991	KAH9105	89	27
		1992	KAH9205	57	18
		1994	KAH9406	77	21
		1996	KAH9606	49	33
		2007	KAH0705	74	26
		2008	KAH0806	116	25
		2009	KAH0905	55	27
		2012	KAH1207	65	18
		2014	KAH1402	107	27

In-season Management Procedure

A 2010 Management Procedure (MP) used to inform in-season adjustments to the FLA 3 TACC (Kendrick & Bentley in prep.) was updated and revised in 2015 (Starr & Kendrick in prep). This MP used the relationship between annual standardised CPUE for all FLA 3 species (shown as FLA in Figure 5) and the total annual FLA 3 landings to estimate an average exploitation rate which is then used to recommend a level of catch based on an early estimate of standardised CPUE. Only the period 1989–90 to 2006–07 was used to estimate the average exploitation rate because this was the period before the TACC was reduced which allowed the fishery to operate at an unconstrained level. A partial year in-season estimate of standardised CPUE is used as a proxy for the final annual index, with the recommended catch defined by the slope of the regression line (Figure 8) multiplied by the CPUE proxy estimate (Figure 9).

The previous FLA 3 MP, adopted in 2010, approximated the standardisation procedure by applying fixed coefficients to a data set specified by a static core vessel definition. This approach deteriorated over time as vessels dropped out of the core vessel fleet, thus reducing the available data set. The revised 2015 MP is based on a re-estimated standardisation procedure using a data set specified annually by a dynamic core vessel definition, allowing new vessels to enter the data set as they meet the minimum eligibiltiy criteria. The 2015 MP was validated through a retrospective analysis which used the data available up to end of the previous year and the partial data in the final year to determine how the model performed across years (Figure 9). In most years, the MP performance was satisfactory after only two months of data were accumulated. The poor performance of the model in some years (e.g., 2012) persisted across all four early months, indicating that collecting additional data in those years would not have improved the recommendation (relative to the end of year recommendation).

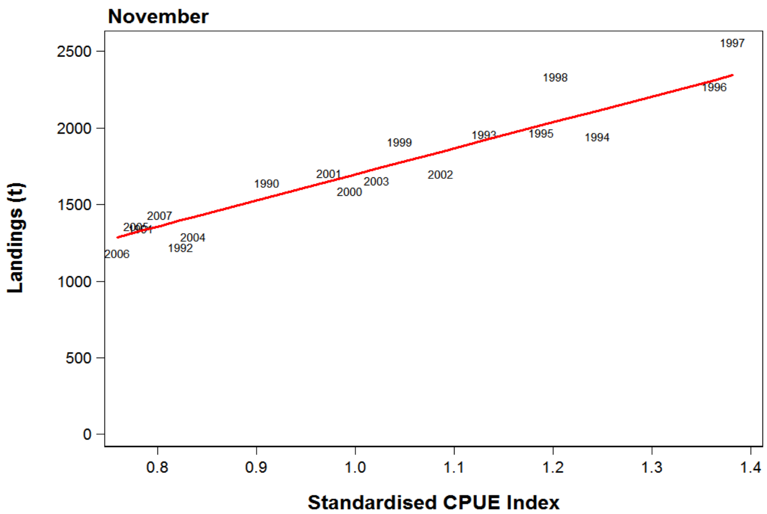


Figure 8: Relationship between annual FLA 3 CPUE (=FLA in Figure 5) and total annual FLA 3 QMR/MHR landings from 1989–90 to 2006–07.

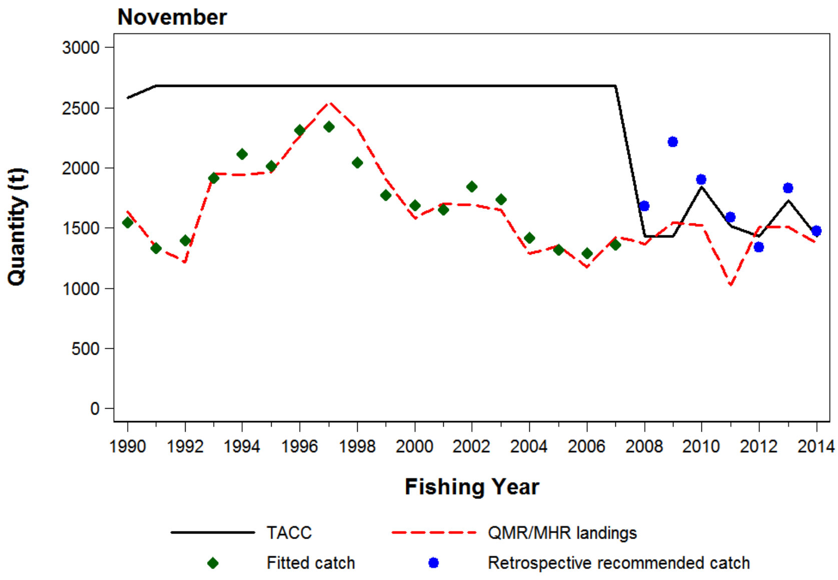


Figure 9:Operation of the 2015 FLA 3 MP, showing the relationship of the fitted catch estimates to the observed MHR/QMR landings and the annual recommended catches from 2008 onward based on the estimated standardised CPUE up to the end of November and only using the data available in the indicated year.

Establishing B_{MSY} compatible reference points

The Working Group accepted mean CPUE from the bottom trawl flatfish target series for the period 1989–90 to 2006–07 as a B_{MSY}-compatible proxy for FLA and 1990–01 to 2006/07 for LSO, SFL and ESO. These periods were chosen as catches were not constrained by the TACC. 1989–90 to 2006–07 was also the period used to determine average exploitation rate for the in season adjustment Management Procedure. The Working Group accepted the default Harvest Strategy Standard definitions that the Soft and Hard Limits would be one half and one quarter the target, respectively.

4.2 Other Factors

The flatfish complex is comprised of eight species although typically only a few are dominant in any one QMA and some are not found in all areas. For management purposes all species are combined to form a unit fishery. The proportion that each species contributes to the catch is expected to vary annually. It is not possible to estimate *MCY* for each species and stock individually.

Because the adult populations of most species generally consist of only one or two year classes at any time, the size of the populations depends heavily on the strength of the recruiting year class and is therefore thought to be highly variable. Brill and turbot are notable exceptions with the adult population consisting of a number of year classes. Early work revealed that although yellow belly flounder are short-lived, inter-annual abundance in FLA 1 was not highly variable, suggesting that some factor, e.g., size of estuarine nursery area, could be smoothing the impact of random environmental effects on egg and larval survival. Work by NIWA (McKenzie et al 2013) in the Manukau harbour has linked the decrease in local CPUE with an increase in eutrophication, suggesting that there may be factors other than fishing contributing to the decline.

Flatfish TACCs were originally set at high levels so as to provide fishers with the flexibility to take advantage of the perceived variability associated with annual flatfish abundance. This approach has been modified with an in-season increase procedure for FLA 3.

4.2 Research needs

- Conduct CPUE analyses for brill and turbot, which are two of the longest-lived flatfish species and as such may be more susceptible to overfishing and depletion, particularly if they are caught in conjunction with other more productive species.

5. STATUS OF THE STOCKS

Estimates of current and reference biomass are not available.

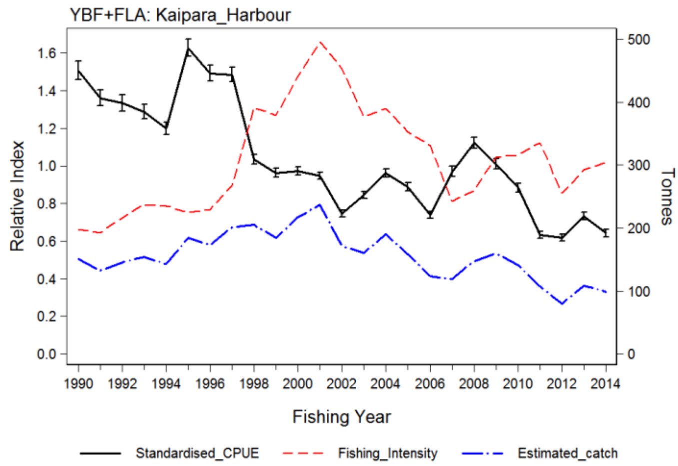
- **Yellow-belly flounder in FLA 1**

Stock Structure Assumptions

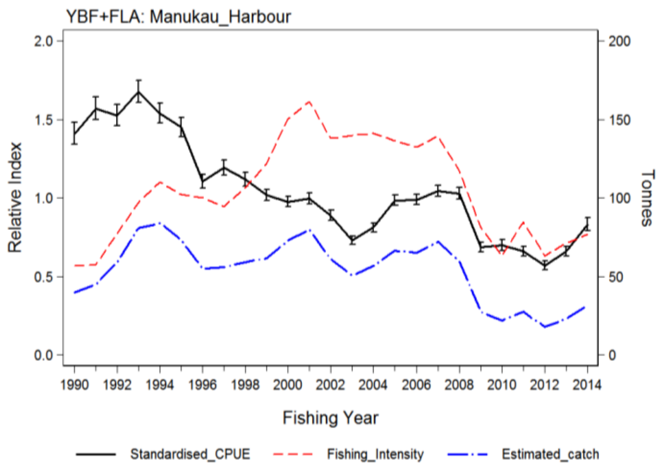
Based on tagging studies, yellow-belly flounder appear to comprise localised populations, especially in enclosed areas such as harbours and bays.

Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	CPUE in Manukau and Kaipara harbours, and the Hauraki Gulf
Reference Points	Target: Not established but B_{MSY} assumed Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing Threshold: F_{MSY}
Status in relation to Target	Manukau: Unknown Kaipara: Unknown Hauraki Gulf: Unknown
Status in relation to Limits	Unknown
Status in relation to Overfishing	Unknown

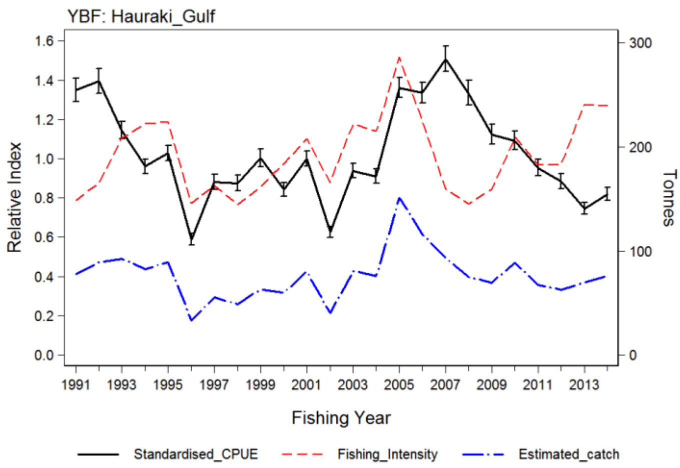
Historical Stock Status Trajectory and Current Status



CPUE and total annual estimated catches for YBF in Kaipara Harbour. Also shown is the fishing intensity (catch/CPUE), standardised relative to the geometric mean. Fishing year designated by second year of the pair.



CPUE and total annual estimated catches for YBF in Manukau Harbour. Also shown is the fishing intensity (catch/CPUE), standardised relative to the geometric mean. Fishing year designated by second year of the pair.



CPUE and total annual estimated catches for YBF in the Hauraki Gulf. Also shown is the fishing intensity (catch/CPUE), standardised relative to the geometric mean. Fishing year designated by second year of the pair.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	In spite of fluctuations, both the Manukau and Kaipara series show a long-term declining trend. The Hauraki Gulf yellowbelly CPUE index has fluctuated with a peak in 2006–07 being the highest point in the series, it has declined since then to currently sit at its lowest level since the mid-1990s.
Recent Trend in Fishing Intensity or Proxy	-
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-
Projections and Prognosis	
Stock Projections or Prognosis	Unknown
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unknown Hard Limit: Unknown
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown

Assessment Methodology and Evaluation		
Assessment Type	Level 2 – Partial Quantitative Stock Assessment	
Assessment Method	Standardised CPUE based on positive catches	
Assessment Dates	Latest assessment: 2015	Next assessment: 2018
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Catch and effort data	1 – High Quality
Data not used (rank)	-	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	- Uncertainty in the stock structure and relationship between CPUE and biomass	

Qualifying Comments
Work by NIWA (McKenzie et al 2013) in the Manukau harbour has linked the decrease in local

CPUE with an increase in eutrophication, suggesting that there may be factors other than fishing contributing to the decline. The lack of species specific reporting for FLA stocks is limiting the ability to assess these stocks, as is the possible reduction in carrying capacity for Manukau and Kaipara Harbours.

Fishery Interactions
Main bycatch is sand flounder, especially on the east coast. FLA 1 species are mostly targeted with setnets in harbours. Interactions with protected species are believed to be low.

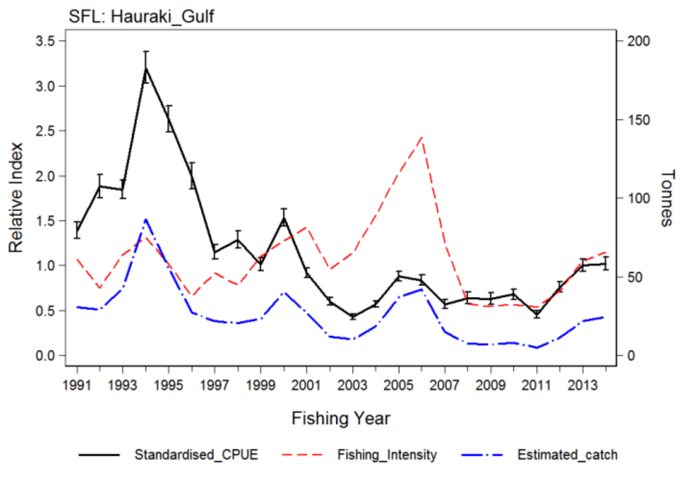
- **Sand flounder in FLA 1**

Stock Structure Assumptions

Based on tagging studies and morphological analysis, sand flounder appear to comprise localised populations, especially in enclosed areas such as harbours and bays.

Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	Standardised CPUE for Hauraki Gulf
Reference Points	Target(s): Not established but B_{MSY} assumed Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: -
Status in relation to Target	Unknown
Status in relation to Limits	Unknown
Status in relation to Overfishing	Unknown

Historical Stock Status Trajectory and Current Status



CPUE and total annual estimated catches for SFL in the Hauraki Gulf. Also shown is the fishing intensity (catch/CPUE), standardised relative to the geometric mean. Fishing year designated by second year of the pair.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The sand flounder index peaked from 1990–91 to 1993–94 and then declined steeply to its lowest point in 2002–03, after which it has fluctuated at or below the long term mean.
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	Unknown
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unknown Hard Limit: Unknown
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown

Assessment Methodology		
Assessment Type	Level 2 - Partial Quantitative stock assessment	
Assessment Method	Standardised CPUE based on positive catches	
Assessment Dates	Latest assessment: 2015	Next assessment: 2018
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Catch and effort data	1 – High Quality
Data not used (rank)	-	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	- Uncertainty in the stock structure and relationship between CPUE and biomass	

Qualifying Comments
Coburn & Beentjes (2005) described a negative relationship between sea surface temperature and sand flounder abundance in the Firth of Thames, assuming a 2-year lag between egg production and recruitment to the fishery. The lack of species specific reporting for FLA stocks limits the ability to assess these stocks.

Fishery Interactions
Main QMS bycatch species is yellow belly flounder, especially on the east coast. FLA 1 species are mostly targeted with setnets in harbours. Interactions with protected species are believed to be low.

- **FLA 2**

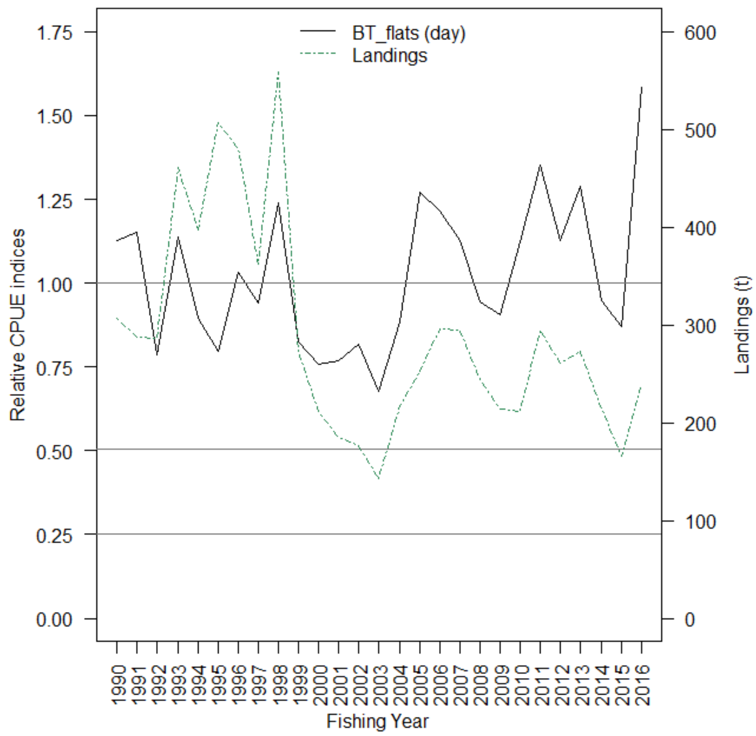
Stock Structure Assumptions

Sand flounder off the East Coast of North Island appear to be a single continuous population. The stock structure of New Zealand sole (ESO) is unknown.

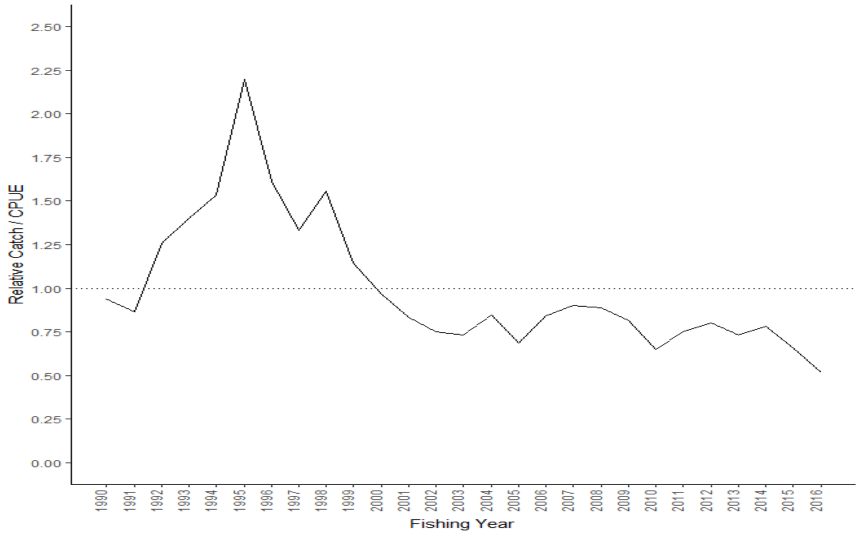
Stock Status	
Year of Most Recent Assessment	2017
Assessment Runs Presented	Standardised CPUE for all flatfish combined in FLA 2
Reference Points	Target: B_{MSY}-compatible proxy based on the mean CPUE 1989–90 to 2012–13 for the bottom trawl flatfish target series Soft Limit: 50% of target Hard Limit: 25% of target Overfishing threshold: F_{MSY}
Status in relation to Target	Likely (> 60%) to be at or 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 in 2016 is Very Unlikely (< 10%) to be occurring

Historical Stock Status Trajectory and Current Status



Annual landings and standardised CPUE index based on positive catches for BT_flats, (all flatfish species combined) at day resolution (Schofield et al, in prep.). Fishing years are labelled according to the second calendar year e.g. 1990 = 1989–90. Horizontal lines are the target and the soft and hard limits.



Annual relative exploitation rate for flatfish in FLA 2.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Relative abundance has fluctuated without trend since 1989/90 and is currently above the target.
Recent Trend in Fishing Intensity or Proxy	Fishing intensity has be reasonably stable since 2001and is currently below the long term average
Other Abundance Indices	Tow based CPUE analysis for SFL and ESO from 2007–08 to 2015–16 data are reasonably consistent with the aggregated data

	index for combined species.
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	Stock is likely to continue to fluctuate around current levels
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unknown for TACC; Unlikely (< 40%) for current catch Hard Limit: Unknown for TACC; Unlikely (< 40%) for current catch
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown for TACC; Unlikely (< 40%) for current catch

Assessment Methodology		
Assessment Type	Level 2 – Partial Quantitative stock assessment	
Assessment Method	Standardised CPUE based on positive catches	
Assessment Dates	Latest assessment: 2017	Next assessment: 2018
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	Statistical area omitted from the standardisation model	
Major Sources of Uncertainty	-	

Qualifying Comments

Fishery Interactions
The fishery is mainly confined to the inshore domestic trawl fleet except for a small incidental bycatch of soles, brill and turbot by offshore trawlers. The main fisheries landing flatfish as bycatch in FLA 2 target gurnard, snapper and trevally. Interactions with protected species are believed to be low. Incidental captures of seabirds occurs.

- **FLA 3 (all species combined)**

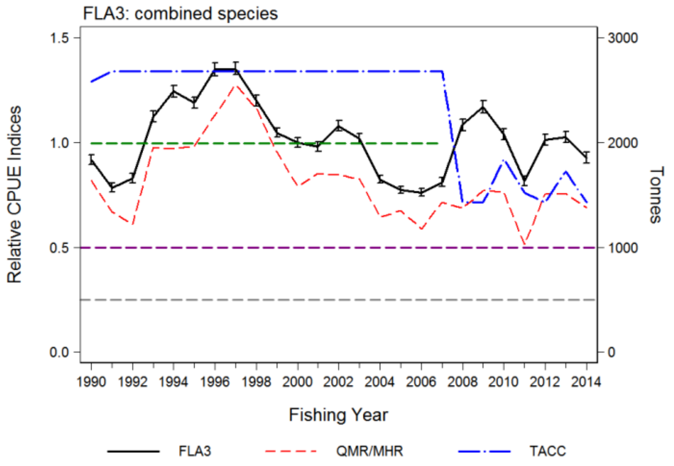
Stock Structure Assumptions

New Zealand sole and lemon sole appear to be a continuous population extending from Canterbury Bight to Foveaux Strait. Sand flounder off the East and South Coasts of South Island show localised concentrations that roughly correspond to the existing statistical areas. The stock relationships among these localised concentrations are unknown.

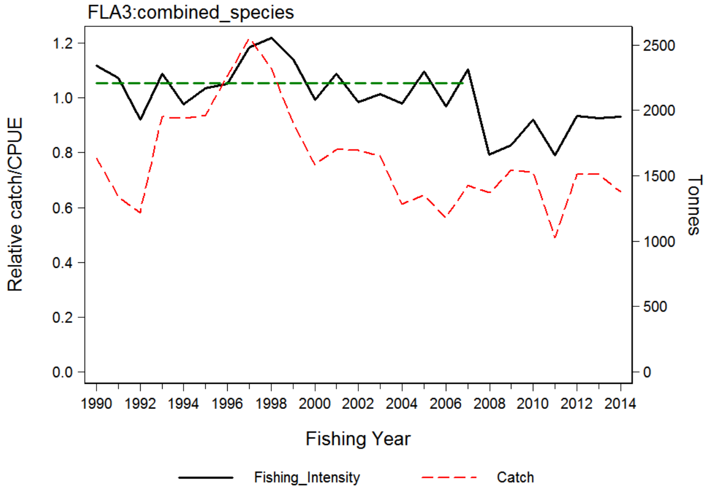
Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	Standardised lognormal bottom trawl CPUE for all flatfish combined in FLA 3
Reference Points	Interim Target: B_{MSY} proxy based on the mean standardised lognormal CPUE from 1989–90 to 2006–07 (the final year of unconstrained catches) Soft Limit: 50% B_{MSY} proxy Hard Limit: 25% B_{MSY} proxy Overfishing threshold: F_{MSY}

Status in relation to Target	About as Likely as Not (40–60%) 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	Unlikely (< 40%) that overfishing is occurring

Historical Stock Status Trajectory and Current Status



Standardised CPUE indices based on positive catches for all flatfish species combined, showing the agreed B_{MSY} proxy (green dashed line: average 1989–90 to 2006–07 CPUE index) and the associated Soft (purple dashed line) and Hard (grey dashed line) Limits (Starr & Kendrick in prep). Also shown are the QMR/MHR declared FLA 3 landings and the annual FLA 3 TACC. Fishing year designated by second year of the pair.



Fishing intensity (catch/CPUE), standardised relative to the geometric mean, plot over time for FLA 3 (combined species). Also shown are the trajectory of total QMR/MHR catches (t) and the mean fishing intensity from 1989–90 to 2006–07 (green line). Fishing year designated by second year of the pair.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	CPUE has fluctuated over the long-term near the 25-year mean.
Recent Trend in Fishing Intensity or Proxy	Fishing intensity has dropped since the reduction of the TACC in 2007–08 and the introduction of in-season TACC variation and remains below the F_{MSY} proxy.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	Stock managed with annual in-season adjustment procedure: expected to vary in abundance around the long-term mean

Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unknown for TACC; Unlikely (< 40%) for current catch Hard Limit: Unknown for TACC; Unlikely (< 40%) for current catch
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown for TACC; Unlikely (< 40%) for current catch

Assessment Methodology		
Assessment Type	Level 2 – Partial Quantitative stock assessment	
Assessment Method	Standardised CPUE based on positive catches	
Assessment Dates	Latest assessment: 2015	Next assessment: 2020
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	- mixed species complex managed without explicitly considering each species - uncertainty in stock structure assumptions - the decline in fishing intensity in recent years is inconsistent with the increases for individual stock components	

Qualifying Comments
The lack of historical species specific reporting for FLA stocks limits the ability to assess the long-term trends in these stocks; there is evidence that reporting by flatfish species has substantially improved in FLA 3 in 2012–13 and 2013–14.

Fishery Interactions
The fishery is mainly confined to the inshore domestic trawl fleet except for a small incidental bycatch of soles, brill and turbot by offshore trawlers. The main target species landing flatfish as bycatch in FLA 3 are red cod, barracouta, stargazer, gurnard, tarakihi and elephant fish. Interactions with protected species are believed to be low. Incidental captures of seabirds occur.

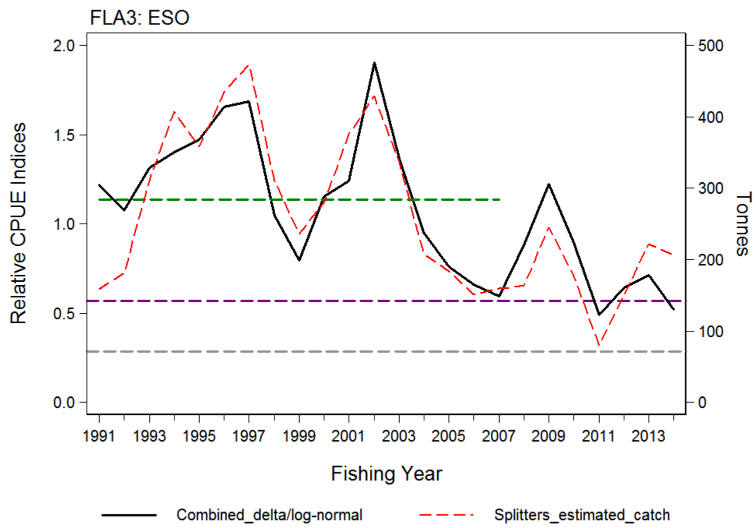
- **FLA 3: New Zealand (ESO) sole**

Stock Structure Assumptions
New Zealand sole appear to be a continuous population extending from Canterbury Bight to Foveaux Strait.

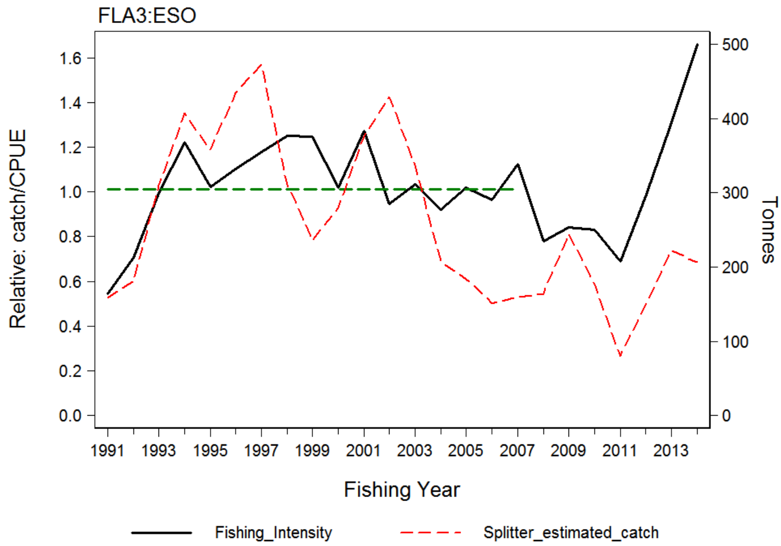
Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	Standardised combined delta-lognormal bottom trawl CPUE for ESO in FLA 3, based on trips which landed FLA 3 but which did not use the FLA species code
Reference Points	Interim Target: B_{MSY} proxy based on mean standardised CPUE from 1990–91 to 2006–07 (the final year of unconstrained catches) Soft Limit: 50% B_{MSY} proxy Hard Limit: 25% B_{MSY} proxy Overfishing threshold: F_{MSY} proxy based on mean relative exploitation rate for the period 1989–90 to 2006–07
Status in relation to Target	Unlikely (< 40%) to be at or above 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	Likely (> 60%) that overfishing is occurring

Historical Stock Status Trajectory and Current Status



Standardised CPUE indices based on combined delta-lognormal CPUE series for New Zealand sole (ESO), showing the agreed B_{MSY} proxy (green dashed line: average 1990–91 to 2006–07 CPUE index) and the associated Soft (purple dashed line) and Hard (grey dashed line) Limits (Starr & Kendrick in prep). Also shown is the ESO estimated catch by trips that landed FLA 3 but which did not use the FLA code. Fishing year designated by second year of the pair.



Fishing intensity (catch/CPUE, standardised relative to the geometric mean) plot over time for New Zealand sole (ESO) in FLA 3. Also shown are the trajectory of ESO estimated catches by trips that landed FLA 3 but which did not use the FLA code and the mean fishing intensity from 1990–91 to 2006–07 (green line). Fishing year designated by second year of the pair.

Fishery and Stock Trends

Recent Trend in Biomass or Proxy	CPUE has declined from a peak reached in 2001–02 and has been near the Soft Limit since 2010–11.
Recent Trend in Fishing Intensity or Proxy	Fishing intensity has increased since 2010–11 to more than 50% above the mean level.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis

Stock Projections or Prognosis	-

Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: About as Likely as Not (40–60%) for current catch Hard Limit: Unlikely (< 40%) for current catch
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Likely (> 60%) for current catch

Assessment Methodology and Evaluation		
Assessment Type	Level 2 – Partial Quantitative Stock Assessment	
Assessment Method	Standardised CPUE based on positive catches	
Assessment Dates	Latest assessment: 2015	Next assessment: 2020
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	- uncertainty in stock structure assumptions	

Qualifying Comments
The lack of historic species specific reporting for FLA stocks limits the ability to assess the long-term trends in these stocks; there is evidence that reporting by flatfish species has substantially improved in FLA 3 in 2012–13 and 2013–14.

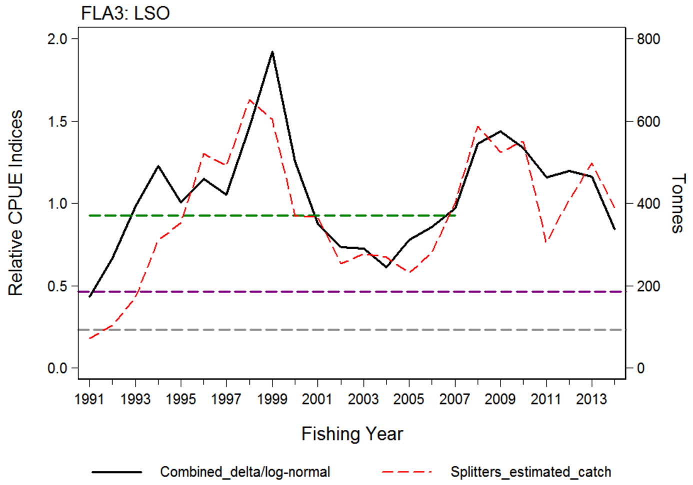
Fishery Interactions
The fishery is mainly confined to the inshore domestic trawl fleet except for a small incidental bycatch of soles, brill and turbot by offshore trawlers. The main target species landing flatfish as bycatch in FLA 3 are red cod, barracouta, stargazer, gurnard, tarakihi and elephant fish. Interactions with protected species are believed to be low. Incidental captures of seabirds occur.

- **FLA 3: Lemon (LSO) sole**

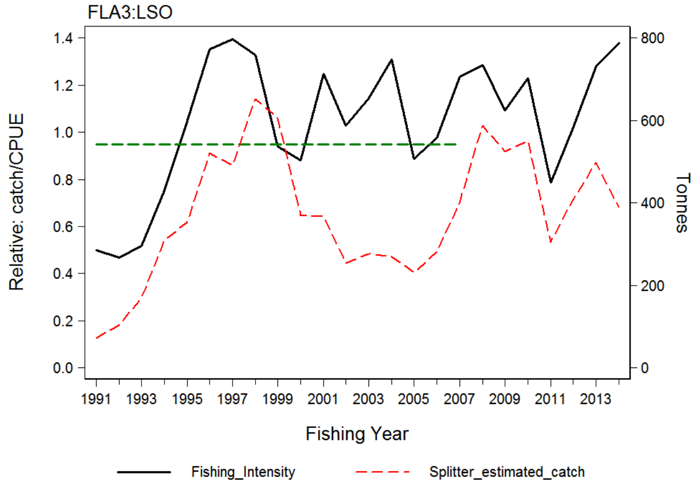
Stock Structure Assumptions
Lemon sole appear to be a continuous population extending from Canterbury Bight to Foveaux Strait.

Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	Standardised combined delta-lognormal bottom trawl CPUE for LSO in FLA 3, based on trips which landed FLA 3 but which did not use the FLA species code
Reference Points	Interim Target: B_{MSY} proxy based on mean standardised CPUE from 1990–91 to 2006–07 (the final year of unconstrained catches) Soft Limit: 50% B_{MSY} proxy Hard Limit: 25% B_{MSY} proxy Overfishing threshold: F_{MSY} proxy based on mean relative exploitation rate for the period 1989–90 to 2006–07
Status in relation to Target	About as Likely as Not (40–60%) to be at or above 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	Likely (> 60%) that overfishing is occurring

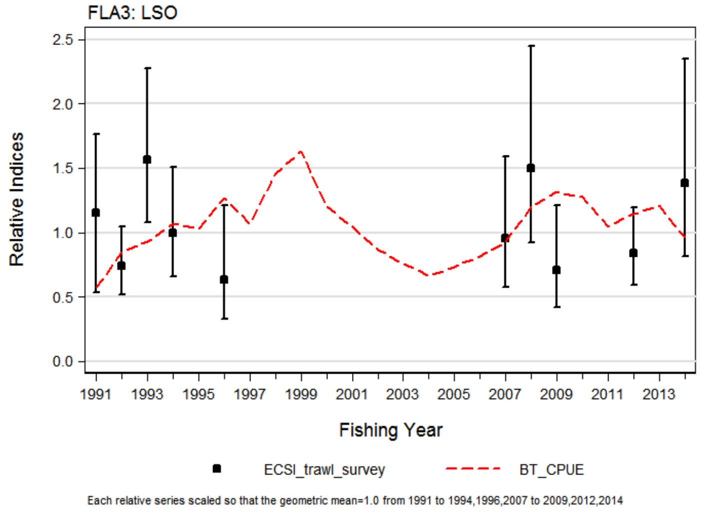
Historical Stock Status Trajectory and Current Status



Standardised CPUE indices based on combined delta-lognormal CPUE series for Lemon sole (LSO), showing the agreed B_{MSY} proxy (green dashed line: average 1990–91 to 2006–07 CPUE index) and the associated Soft (purple dashed line) and Hard (grey dashed line) Limits (Starr & Kendrick in prep). Also shown is the LSO estimated catch by trips that landed FLA 3 but which did not use the FLA code. Fishing year designated by second year of the pair.



Fishing intensity (catch/CPUE, standardised relative to the geometric mean) plot over time for Lemon sole (LSO) in FLA 3. Also shown are the trajectory of LSO estimated catches by trips that landed FLA 3 but which did not use the FLA code and the mean fishing intensity from 1990–91 to 2006–07 (green line). Fishing year designated by second year of the pair.



Standardised CPUE indices based on combined delta-lognormal CPUE series for Lemon sole (ESO), shown with the 10 trawl survey LSO biomass indices from the Kaharoa ECSI winter trawl survey. Fishing year designated by second year of the pair.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	CPUE reached a nadir in 2003–04, but then climbed to a high level in 2007–08 and has since declined to the long-term mean level.
Recent Trend in Fishing Intensity or Proxy	Fishing intensity has fluctuated, mostly above the F_{MSY} proxy since 1994–95, and in 2013–14 was nearly 40% above this level.
Other Abundance Indices	Relative abundance from the ECSI trawl survey has fluctuated without trend since 1991.
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	-
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unlikely (< 40%) Hard Limit: Very Unlikely (< 10%)
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Likely (> 60%)

Assessment Methodology and Evaluation		
Assessment Type	Level 2 – Partial Quantitative Stock Assessment	
Assessment Method	Standardised CPUE based on positive catches	
Assessment Dates	Latest assessment: 2015	Next assessment: 2020
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	- uncertainty in stock structure assumptions	
Qualifying Comments		
The lack of historic species specific reporting for FLA stocks limits the ability to assess the long-term trends in these stocks; there is evidence that that reporting by flatfish species has substantially improved in FLA 3 in 2012–13 and 2013–14.		

Fishery Interactions
The fishery is mainly confined to the inshore domestic trawl fleet except for a small incidental bycatch of soles, brill and turbot by offshore trawlers. The main target species landing flatfish as bycatch in FLA 3 are red cod, barracouta, stargazer, gurnard, tarakihi and elephant fish. Interactions with protected species are believed to be low. Incidental captures of seabirds occur.

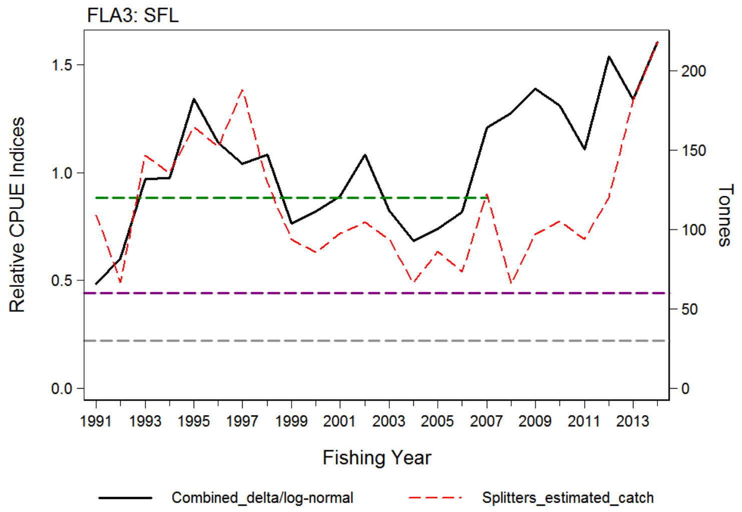
- **FLA 3: Sand Flounder (SFL)**

Stock Structure Assumptions
Sand flounder off the East and South Coasts of South Island show localised concentrations that roughly correspond to the existing statistical areas. The stock relationships among these localised concentrations are unknown.

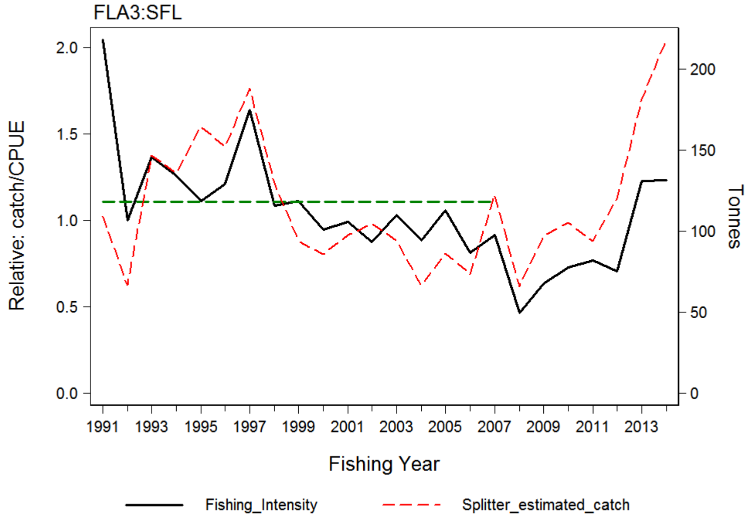
Stock Status	
Year of Most Recent Assessment	2015
Assessment Runs Presented	Standardised combined delta-lognormal bottom trawl CPUE for SFL in FLA 3, based on trips which landed FLA 3 but which did not use the FLA species code

Reference Points	Interim Target: B_{MSY} proxy based on mean standardised CPUE from 1990–91 to 2006–07 (the final year of unconstrained catches) Soft Limit: 50% B_{MSY} proxy Hard Limit: 25% B_{MSY} proxy Overfishing threshold: F_{MSY} proxy based on mean relative exploitation rate for the period 1989–90 to 2006–07
Status in relation to Target	Very Likely (> 90%) to be at or above 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	About as Likely as Not (40–60%) that overfishing is occurring

Historical Stock Status Trajectory and Current Status



Standardised CPUE indices based on combined delta-lognormal CPUE series for Sand flounder (SFL), showing the agreed B_{MSY} proxy (green dashed line: average 1990–91 to 2006–07 CPUE index) and the associated Soft (purple dashed line) and Hard (grey dashed line) Limits (Starr & Kendrick in prep). Also shown is the SFL estimated catch by trips that landed FLA 3 but which did not use the FLA code. Fishing year designated by second year of the pair.



Fishing intensity (catch/CPUE, standardised relative to the geometric mean) plot over time for Sand flounder (SFL) in FLA 3. Also shown are the trajectory of SFL estimated catches by trips that landed FLA 3 but which did not use the FLA code and the mean fishing intensity from 1990–91 to 2006–07 (green line). Fishing year designated by second year of the pair.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	CPUE has been climbing steadily from a nadir in 2003–04.
Recent Trend in Fishing Intensity or Proxy	Fishing intensity dropped to relatively low levels in the late 2000s, and has since climbed back to the level of the F_{MSY} proxy
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	-
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Very Unlikely (< 10%) for current catch Hard Limit: Very Unlikely (< 10%) for current catch
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown

Assessment Methodology and Evaluation		
Assessment Type	Level 2 – Partial Quantitative Stock Assessment	
Assessment Method	Standardised CPUE based on positive catches	
Assessment Dates	Latest assessment: 2015	Next assessment: 2020
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	- uncertainty in stock structure assumptions	

Qualifying Comments
The lack of historic species specific reporting for FLA stocks limits the ability to assess the long-term trends in these stocks; there is evidence that reporting by flatfish species has substantially improved in FLA 3 in 2012–13 and 2013–14.

Fishery Interactions
The fishery is mainly confined to the inshore domestic trawl fleet except for a small incidental bycatch of soles, brill and turbot by offshore trawlers. The main target species landing flatfish as bycatch in FLA 3 are red cod, barracouta, stargazer, gurnard, tarakihi and elephant fish. Interactions with protected species are believed to be low. Incidental captures of seabirds occur.

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