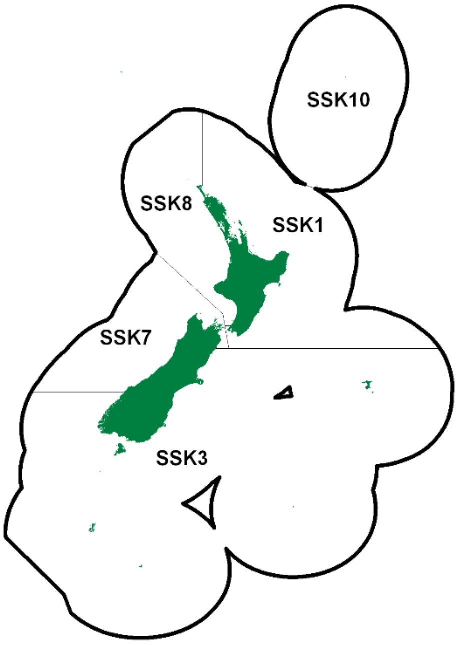
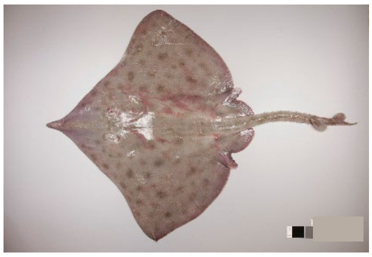
SMOOTH SKATE (SSK)
(*Dipturus innominatus*)





1. FISHERY SUMMARY

Smooth skates were introduced into the QMS as a separate species from 1 October 2003. Allowances, TACCs, and TACs are shown in Table 1.

Table 1: Recreational and Customary non-commercial allowances, other mortality, TACCs, and TACs (t) for smooth skate by Fishstock.

Fishstock	Recreational allowance	Customary non-commercial allowance	Other sources of mortality	TACC	TAC
SSK 1	1	1	1	37	40
SSK 3	1	1	6	579	587
SSK 7	1	1	2	213	217
SSK 8	1	1	5	53	60
SSK 10	0	0	0	0	0

1.1 Commercial fisheries

Smooth skate (*Dipturus innominatus*, SSK), which are also known as barndoor skates, are fished commercially in close association with rough skates (RSK) in New Zealand. Smooth skates grow considerably larger than rough skates, but both species are landed and processed. Two other species of deepwater skate (*Bathyraja shuntovi* and *Raja hyperborean*) are large enough to be of commercial interest but are relatively uncommon and probably comprise a negligible proportion of the landings.

Skate flesh ammoniates rapidly after death, so the wings are removed at sea, and chilled or frozen. On arrival at the shore factories, the wings are machine-skinned, graded, and packed for sale. Most of the product is exported to Europe, especially France and Italy. Skates of all sizes are processed, though some factories impose a minimum weight limit of about 1 kg (200 g per wing), and occasionally wings from very large smooth skates are difficult to market.

Smooth skates occur throughout New Zealand, but are most abundant around the South Island in depths down to 500 m. Most of the catch is taken as bycatch by bottom trawlers, but skates are also taken by longliners. Significant longline bycatch has been reported from the Bounty Plateau in QMA 6. While there is no clear separation of the depth ranges inhabited by rough and smooth skates, smooth skates tend to occur slightly deeper than rough skates (Beentjes & Stevenson 2000, 2001, Stevenson &

Hanchet 2000).

Many fishers and processors did not previously distinguish rough and smooth skates in their landing returns, and coded them instead as 'skates' (SKA). Because it is impossible to determine the species composition of the catch from landings data prior to introduction of these species into the QMS, all pre-QMS data reported here consist of the sum of the three species codes RSK, SSK, and SKA. Landings have been converted from processed weight to whole weight by application of conversion factors. Further, following introduction into the QMS in 2003, the two skate species were not always correctly identified and, a considerable, but unknown catch of either species is misidentified with over-reporting of rough skate and, correspondingly, under-reporting of smooth skate (Beentjes 2005). Neither fishers nor processors were distinguishing between the two skate species or reporting catches of each species correctly at the time of the study in 2004. It is not known if reporting has improved since that time.

There have been historical changes to the conversion factors applied to skates by MAF Fisheries and Ministry of Fisheries. No record seems to have been kept of the conversion factors in use before 1987, so it is not possible to reconstruct the time series of landings data using the currently accepted factors. Consistent and appropriate conversion factors have been applied to skate landings since the end of the 1986–87 fishing year. Before that, it appears that a lower conversion factor was applied, resulting in an underestimation of landed weight by about 20%. No correction has been made for that in this report.

New Zealand annual skate landings, estimated from a variety of sources, are shown in Table 2. No FSU deepwater data were available before 1983, and it is not known whether deepwater catches, including those of foreign fishing vessels, were significant during that period. CELR and CLR data are provided by inshore and deepwater trawlers respectively. 'CELR estimated' landings were always less than 'CELR landed' landings, because the former include only the top five fish species (by weight) caught by trawlers, whereas the latter include all species landed. As a relatively minor bycatch, skates frequently do not fall into the top five species. The sum of the 'CELR landed' and CLR data provides an estimate of the total skate landings. This estimate usually agreed well with LFRR data supplied by fish processors, especially in 1993–94 and 1994–95, but in 1992–93 the difference was 467 t. The 'best estimate' of the annual historical landings comes from FSU data up to 1985–86, and LFRR data thereafter.

Table 2: New Zealand skate landings for calendar years 1974–1983, and fishing years (1 October–30 September) 1983–84 to 1995–96. Values in parentheses are based on part of the fishing year only. Landings do not include foreign catch before 1983, or unreported discards. FSU = Fisheries Statistics Unit; CELR = Catch, Effort and Landing Return; CLR = Catch Landing Return; LFRR = Licensed Fish Receivers Return; Best Estim. = best available estimate of the annual skate catch; - = no data.

	FSU			CELR			CELR		
Year	Inshore	Deepwater	Total	Estim.	Landed	CLR	Landed +CLR	LFRR	Best Estim.
1974	23	–	–	–	–	–	–	–	23
1975	30	–	–	–	–	–	–	–	30
1976	28	–	–	–	–	–	–	–	28
1977	27	–	–	–	–	–	–	–	27
1978	36	–	–	–	–	–	–	–	36
1979	165	–	–	–	–	–	–	–	165
1980	441	–	–	–	–	–	–	–	441
1981	426	–	–	–	–	–	–	–	426
1982	648	–	–	–	–	–	–	–	648
1983	634	178	812	–	–	–	–	–	812
1983–84	686	298	983	–	–	–	–	–	983
1984–85	636	250	886	–	–	–	–	–	886
1985–86	613	331	944	–	–	–	–	–	944
1986–87	723	285	1 007	–	–	–	–	1 019	1 019
1987–88	1 005	421	1 426	–	–	–	–	1 725	1 725
1988–89	(530)	(136)	(665)	(252)	(265)	(28)	(293)	1 513	1 513
1989–90	–	–	–	780	1 171	410	1 581	1 769	1 769
1990–91	–	–	–	796	1 334	359	1 693	1 820	1 820
1991–92	–	–	–	1 112	1 994	703	2 698	2 620	2 620
1992–93	–	–	–	1 175	2 595	824	3 418	2 951	2 951
1993–94	–	–	–	1 247	2 236	788	3 024	2 997	2 997
1994–95	–	–	–	956	1 973	829	2 803	2 789	2 789
1995–96	–	–	–	–	–	–	–	2 789	2 789

Total skate landings (based on the 'best estimate' in Table 2) were negligible up to 1978, presumably because of a lack of suitable markets and the availability of other more abundant and desirable species. Landings then increased linearly to reach nearly 3000 t in 1992–93 and 1993–94 and remained between 2600 and 3100 t until the separation of skate species under the QMS. Reported landings of smooth skate are provided in Table 3.

Figure 1 shows the historical landings and TACC values for the main SSK stocks. Owing to problems associated with identification of rough and smooth skates, reported catches of each species are probably not accurate (Beentjes 2005). Initiatives to improve identification of these species begun in 2003 may have resulted in more accurate data. The largest smooth skate Fishstock is SSK 3, which on average has contributed 60% of landings since the fishing year 2003–04. SSK 3 landings have always remained below the TACC, ranging between 408 t and 473 t from 2003–04 to 2006–07, before decreasing to about 300 t in 2009–10 to 2012–13. Landings then increased again, peaking at 511 t in 2017–18, but declined to 269 t by 2022–23. Landings in SSK 7 fluctuated around the TACC from 2010–11 to 2016–17 but have generally been lower than 200 t (and consistently below the TACC) since then. The SSK 8 catch has been consistently over-caught, relative to the TACC, since the fishing year 2007–08, until 2022–23. It was put on Schedule 6 on 1 October 2006. Owing to discarding and misidentification of the two skate species, RSK and SSK, catches are likely to be inaccurate.

Table 3: Reported landings (t) of SKA and SSK by QMA and fishing year, 1996–97 to present.

Fishstock	**SSK 1**		**SSK 3**		**SSK 7**		**SSK 8**		**SSK 10**		**Total**	
FMAs	**1–2**		**3–6**		**7**		**8–9**		**10**		**All**	
Skate (SKA)*	Land.	TACC	Land.	TACC	Land.	TACC	Land.	TACC	Land.	TACC	Land.	TACC
1996–97	43	–	894	–	380	–	30	–	0	–	1 347	–
1997–98	44	–	855	–	156	–	31	–	0	–	1 086	–
1998–99	48	–	766	–	228	–	12	–	0	–	1 054	–
1999–00	75	–	775	–	253	–	25	–	0	–	1 128	–
2000–01	88	–	933	–	285	–	28	–	0	–	1 334	–
2001–02	132	–	770	–	311	–	35	–	0	–	1 248	–
2002–03	121	–	857	–	293	–	32	–	0	–	1 303	–
2003–04	< 1	–	< 1	–	< 1	–	< 1	–	0	–	1	–
Smooth skate (SSK)												
1996–97	10	–	782	–	102	–	5	–	0	–	899	–
1997–98	5	–	901	–	121	–	4	–	0	–	1 031	–
1998–99	5	–	1 011	–	100	–	15	–	0	–	1 131	–
1999–00	5	–	877	–	73	–	16	–	0	–	971	–
2000–01	9	–	859	–	104	–	7	–	0	–	979	–
2001–02	17	–	794	–	89	–	7	–	0	–	907	–
2002–03	19	–	704	–	167	–	3	–	0	–	893	–
2003–04	79	37	431	579	146	213	15	20	0	0	671	849
2004–05	82	37	408	579	125	213	15	20	0	0	630	849
2005–06	72	37	468	579	163	213	12	20	0	0	715	849
2006–07	58	37	473	579	155	213	6	20	0	0	693	849
2007–08	47	37	422	579	171	213	21	20	0	0	661	849
2008–09	38	37	332	579	168	213	22	20	0	0	560	849
2009–10	36	37	290	579	194	213	26	20	0	0	546	849
2010–11	27	37	307	579	243	213	32	20	0	0	609	849
2011–12	24	37	283	579	209	213	27	20	0	0	544	849
2012–13	36	37	292	579	231	213	39	20	0	0	598	849
2013–14	43	37	336	579	225	213	39	20	0	0	641	849
2014–15	27	37	361	579	198	213	30	20	0	0	617	849
2015–16	38	37	405	579	222	213	30	20	0	0	695	849
2016–17	56	37	481	579	244	213	46	20	0	0	827	849
2017–18	58	37	511	579	198	213	52	20	0	0	819	849
2018–19	32	37	445	579	178	213	47	20	0	0	702	849
2019–20	24	37	368	579	192	213	68	20	0	0	652	849
2020–21	24	37	388	579	212	213	54	20	0	0	678	849
2021–22	14	37	322	579	182	213	47	20	0	0	566	849
2022–23	14	37	269	579	180	213	36	53	0	0	499	882
2023–24	7	37	318	579	173	213	22	53	0	0	520	882

*Use of the code SKA ceased once skates were introduced into the QMS in October 2003 and rough skates and smooth skates were recognised as a separate species. From this time all landings of skates have been reported against either the RSK or SSK code.

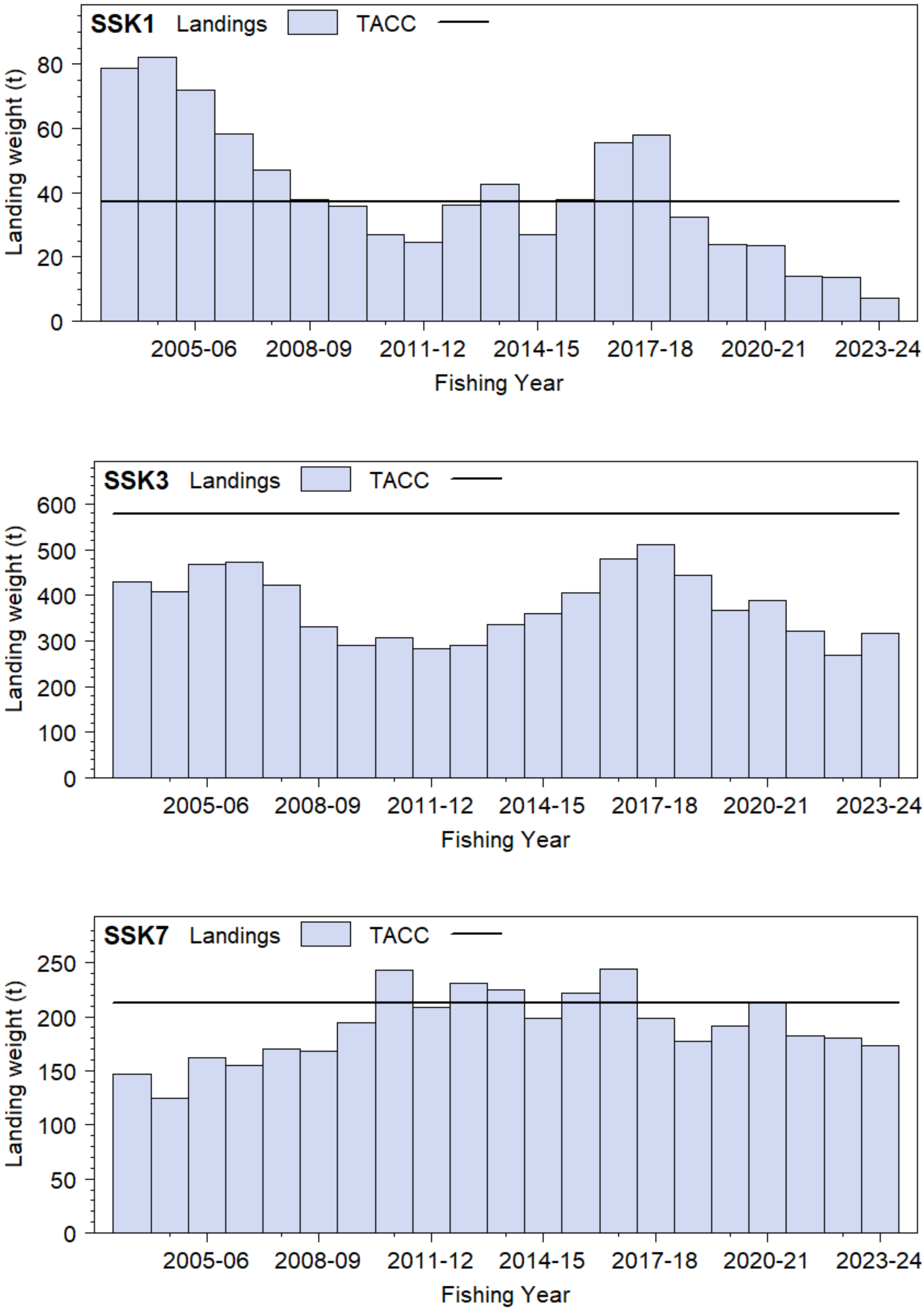


Figure 1: Reported commercial landings and TACCs for the four main SSK stocks. From top: SSK 1 (Auckland East) and SSK 3 (South East Coast, South East Chatham Rise, Sub-Antarctic, Southland), and SSK 7 (Challenger). [Continued on next page]

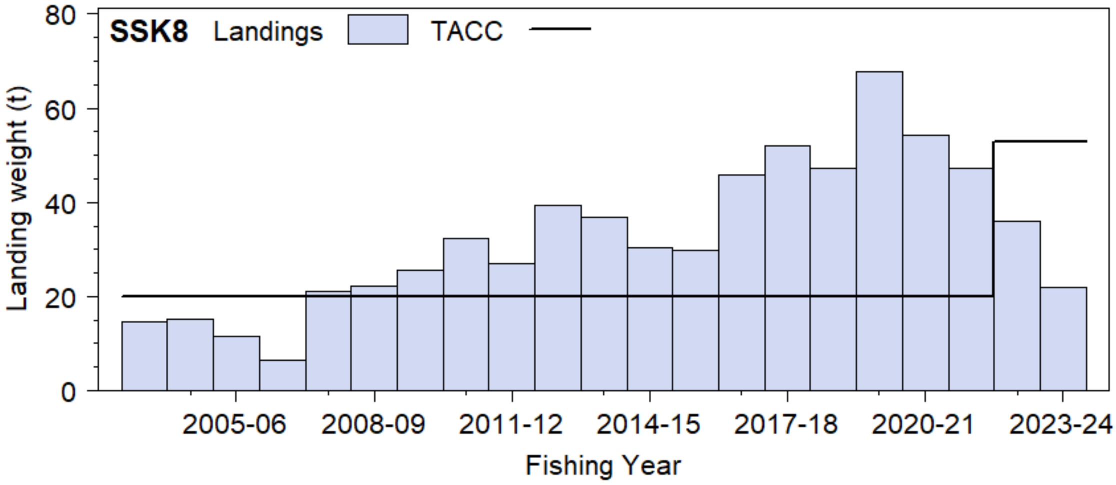


Figure 1 [Continued]: Reported commercial landings and TACCs for the four main SSK stocks. SSK 8 (Central Egmont, Auckland West).

1.2 Recreational fisheries
Recreational fishing surveys indicate that skates are very rarely caught by recreational fishers.

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

1.4 Illegal catch
Quantitative information on the level of illegal catch is not available.

1.5 Other sources of mortality
Because skates are taken mainly as bycatch of bottom trawl fisheries, historical catches have probably been proportional to the amount of effort in the target trawl fisheries. Past catches were probably higher than historical landings data suggest because of unrecorded discards and unrecorded foreign catch before 1983.

2. BIOLOGY

Little is known about the reproductive biology of smooth skates. Smooth skates reproduce by laying yolky eggs, enclosed in leathery cases, on the seabed. Two eggs are laid at a time, but the number of eggs laid annually by a female is unknown. A single embryo develops inside each egg case and the young hatch at about 10–15 cm pelvic length (body length excluding the tail) (Francis 1997). Biological parameters relevant to stock assessment are shown in Table 4.

Table 4: Estimates of biological parameters for skates.

Fishstock			Estimate	Source
1. Natural mortality (M)				
SSK 3			0.12–0.15	Francis et al (2004)
2. Weight = a (length)^b (weight in g, length in cm pelvic length)				
		a	b	
SSK both sexes		0.0268	2.933	Francis (1997)
3. von Bertalanffy growth parameters				
	K	t_0	L_∞	
SSK 3 (both sexes)	0.095	-1.06	150.5	Francis et al (2001b)
SSK 3 (Males)	0.117	-1.28	133.6	Francis et al (2004)

The greatest reported age for smooth skate is 28 years for a 155 cm pelvic length female (Francis et al 2004). Females grow larger than males and also appear to live longer (Francis et al 2001a, b). There are no apparent differences in growth rate between the sexes. Males reach 50% maturity at about 93 cm and 8 years, and females at 112 cm and 13 years. However, the small sample size of mature animals, particularly females, means that the maturity ogives are poorly defined. The most plausible estimate of M is 0.10–0.20.

3. STOCKS AND AREAS

Nothing is known about the stock structure or movement patterns of smooth skates. Smooth skates are distributed throughout most of New Zealand, from the Three Kings Islands to Campbell Island and the Chatham Islands, including the Challenger Plateau, Chatham Rise, and Bounty Plateau. Smooth skates have not been recorded from QMA 10.

In this report, smooth skate landings have been presented by QMA. QMAs form appropriate management units in the absence of any information on biological stocks.

4. STOCK ASSESSMENT

4.1 Biomass estimates

4.1.1 Trawl Surveys

Relative biomass estimates are available for smooth skates from a number of trawl survey series (Table 5). In the first survey (1991) of each of two series (east coast South Island and Chatham Rise) the two skate species were not (fully) distinguished. Furthermore, there are doubts about the accuracy of species identification in some other earlier surveys (prior to 1996).

All potential surveys were reviewed to determine which might provide reliable indices for abundance (Holmes et al 2022). Surveys rejected are listed in Table 6 together with the main reasons for their exclusion. Indices taken forward for consideration for partial quantitative assessment were:

- east coast South Island (ECSI) *Kaharoa* trawl survey,
- Chatham Rise *Tangaroa* trawl survey,
- west coast South Island (WCSI) *Kaharoa* trawl survey, and
- west coast South Island (WCSI) *Tangaroa* trawl survey.

The series of biomass estimates from these four survey series are shown in Figures 2 to 5.

Chatham Rise trawl surveys

The Chatham Rise survey series using core strata starts in 1992 and data indicate this series covers an adequate depth range to track smooth skate abundance because only insignificant amounts of smooth skate have been caught from deeper strata added in more recent years (Figure 2). CVs are between 20% and 30% in most years and relative biomass estimates change without wide inter annual fluctuations. Length frequency data suggest all adult sizes are represented in the survey (as are all sizes seen in the commercial fishery), but smaller sizes caught shallower than 200 m in the Canterbury Bight and Pegasus Bay are not represented (Holmes et al 2022).

ECSI trawl surveys

The east coast South Island winter surveys from 1991 to 1996 (30–400 m) were replaced by summer trawl surveys (1996–97 to 2000–01) which also included the 10–30 m depth range; but these were discontinued after the fifth in the annual time series because of the extreme fluctuations in catchability between surveys (Beentjes & Stevenson 2001). The winter surveys were reinstated in 2007, and this time were expanded to include the 10–30 m depth range, to monitor elephantfish and red gurnard which were officially included in the list of target species in 2012. In contrast to rough skate, almost no smooth skate are caught in the 10–30 m depth range (Figure 3) indicating that in terms of biomass, only the existing core strata time series in 30–400 m should be monitored.

Smooth skate biomass estimates in the core strata (30–400 m) for the east coast South Island winter trawl surveys in recent years were higher overall than in the 1990s (Table 5, Figure 3) (MacGibbon et al 2023). There is no consistent trend in biomass since 2007. Survey CVs are reasonable, with only two values above 25% (35% in 2012 and 28% in 2021).

The smooth skate length distributions for the east coast South Island winter trawl surveys are not consistent between surveys and comprise multiple year classes with indications of juvenile modes corresponding to 0+ fish in some years (Beentjes & MacGibbon 2013, Beentjes et al 2015, 2016, 2021, 2022, MacGibbon et al 2019, 2024). The rest of the distribution includes multiple year classes from about 1 to 25 years. The 30–100 m strata tend to have larger skates than the deeper strata (Beentjes & MacGibbon 2013). The surveys appear to be monitoring pre-recruited lengths down to 0+ age, but not the full extent of the recruited distribution (the latter was confirmed by comparison to lengths measured in commercial observer data, Holmes et al 2022). No lengths were measured before 1996.

Table 5: Doorspread biomass estimates (t) and coefficients of variation (CV %) of smooth skates.

Year	Trip Code	Biomass	CV
East coast North Island (SSK 1) Autumn 20–400 m			
1993	KAH9304	23	52
1994	KAH9402	144	38
1995	KAH9502	20	59
1996	KAH9602	85	36
Discontinued			
East coast South Island (SSK 3) Winter 30–400 m			
1991	KAH9105	–	–
1992	KAH9205	609	18
1993	KAH9306	670	24
1994	KAH9406	306	25
1996	KAH9606	385	24
2007	KAH0705	705	20
2008	KAH0806	554	18
2009	KAH0905	736	23
2012	KAH1207	1 025	35
2014	KAH1402	637	20
2016	KAH1605	663	17
2018	KAH1803	664	22
2021	KAH2104	909	28
2022	KAH2204	641	32
2024	KAH2402	405	16
East coast South Island (SSK 3) Summer 30–400 m			
1996–97	KAH9618	721	32
1997–98	KAH9704	485	21
1998–99	KAH9809	450	26
1999–00	KAH9917	369	30
2000–01	KAH0014	248	33
Sub–Antarctic (SSK 3) Summer 300–800 m			
1991	TAN9105	386	23
1992	TAN9211	119	45
1993	TAN9310	118	43
2000	TAN0012	435	66
2001	TAN0118	636	43
2002	TAN0219	299	65
2003	TAN0317	475	60
2004	TAN0414	331	52
2005	TAN0515	34	86
2006	TAN0617	995	43
2007	TAN0714	483	52
2008	TAN0813	1 406	51
2009	TAN0911	648	76
2011	TAN1117	1 660	79
2012	TAN1215	680	74
2014	TAN1412	1 012	37
2016	TAN1614	323	50
2018	TAN1811	141	92
2020	TAN2014	803	60
West Coast South Island (*Tangaroa*) (SSK 7) 200–800m			
2012	TAN1210	239	30
2013	TAN1308	272	23
2016	TAN1609	238	46
2018	TAN1807	225	22
2021	TAN2107	212	31

Year	Trip Code	Biomass	CV
Chatham Rise (SSK 3) Summer 200–800 m			
1991–92	TAN9106	–	–
1992–93	TAN9212	1 071	18
1994	TAN9401	958	23
1995	TAN9501	769	31
1996	TAN9601	1 511	30
1997	TAN9701	1 932	22
1998	TAN9801	10	26
1999	TAN9901	1 738	20
2000	TAN0001	1 369	23
2001	TAN0101	2 321	19
2002	TAN0201	2 111	17
2003	TAN0301	1 355	21
2004	TAN0401	2 006	21
2005	TAN0501	1 780	24
2006	TAN0601	1 521	29
2007	TAN0701	1 922	17
2008	TAN0801	1 376	26
2009	TAN0901	1 162	18
2010	TAN1001	1 576	21
2011	TAN1101	1 009	32
2012	TAN1201	813	22
2013	TAN1301	38	20
2014	TAN1401	1 309	22
2016	TAN1601	1 662	22
2018	TAN1801	1 529	22
2020	TAN2001	847	29
2022	TAN2201	1 266	28
Stewart–Snares shelf (SSK 3) Summer 30–600 m			
1993	TAN9301	528	20
1994	TAN9402	342	21
1995	TAN9502	335	19
1996	TAN9604	504	29
Discontinued			
South Island west coast and Tasman Bay/Golden Bay			
1992	KAH9204	339	19
1994	KAH9404	341	18
1995	KAH9504	315	20
1997	KAH9701	302	26
2000	KAH0004	140	29
2003	KAH0304	91	79
2005	KAH0503	80	30
2007	KAH0704	55	44
2009	KAH0904	67	61
2011	KAH1104	185	33
2013	KAH1305	188	29
2015	KAH1503	342	25
2017	KAH1703	62	37
2019	KAH1902	204	28
2021	KAH2103	123	39

Table 6: Surveys considered but rejected for providing indices of abundance of smooth skates and main reason(s) for their rejection.

FMA	Survey	Reason(s) for rejection
SSK 1	HAGU Hauraki Gulf	Very low biomass of smooth skate present. Only very shallow strata (< 75 m) in recent surveys.
SSK 1	BPLE Bay of Plenty	Very low biomass of smooth skate present. Only very shallow strata (< 100 m) in recent surveys.
SSK 3	Sub-Antarctic Summer	Shallowest strata too deep (>300m). Relative biomass CVs always > 40% (often much higher).
SSK 3	Sub-Antarctic Autumn	Discontinued survey.
SSK 3	Stewart-Snares Shelf	Discontinued survey.
SSK 8	WCNI	Max depth only 200 m. CVs 40% or higher (for surveys of full latitudinal range).

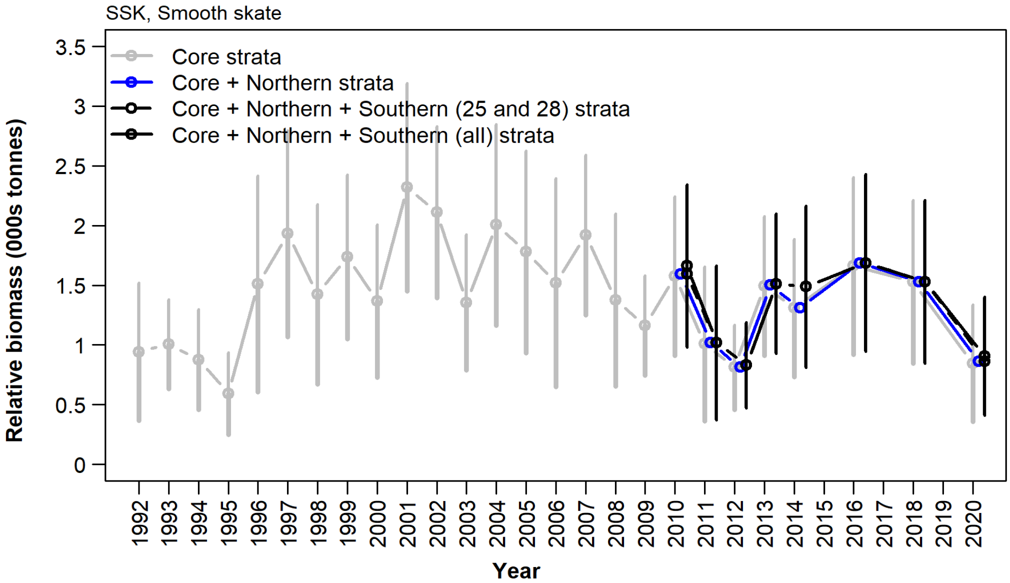


Figure 2: Smooth skate biomass for the Chatham Rise in core strata (200–800 m) and after addition of northern deep strata (1000-1300 m), two southern deep strata (800-1300 m), and further southern deep strata (800-1300 m).

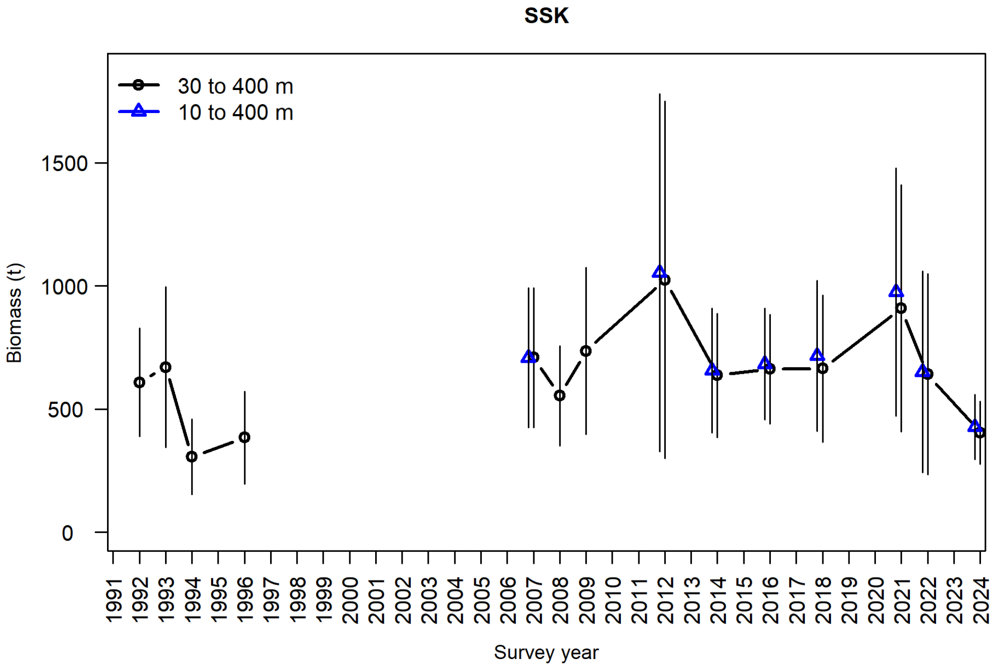


Figure 3: Smooth skate biomass for the ECSI winter surveys in core strata (30–400 m), and core plus shallow strata (10–400 m). Error bars are ± two standard deviations.

West coast South Island inshore (*Kaharoa*) trawl surveys

West coast South Island inshore trawl surveys (Figure 4) indicate that the relative biomass of smooth skate in FMA 7 declined substantially from 1997 to 2009, then recovered but with strong fluctuations in recent years. The biomass estimates have relatively high associated CVs since 2011 (25–43%).

Smooth skate are rarely caught in Tasman Bay and Golden Bay, with most of the smooth skate catch being from the west coast strata (Figure 4), particularly south of Greymouth and in depths greater than 100 m (MacGibbon 2019). Too few are caught for length frequency distribution plots to be informative. Comparison with length frequencies from the west coast South Island offshore surveys indicate the inshore surveys do not catch a representative sample of adult fish from either sex (Holmes et al 2022).

West coast South Island offshore (*Tangaroa*) trawl surveys

West coast South Island offshore trawl surveys (Figure 5) show the importance of including depths between 200 and 800 m. Addition of strata deeper than 800 m leads to almost no additional catch of smooth skate. Results from strata covering the 200–800 m depth range have reasonable CVs (20–30% except for 2016 at 46%), and length frequency data suggest the surveys are catching the full age range of smooth skates (O'Driscoll & Ballara 2019, Holmes et al 2022).

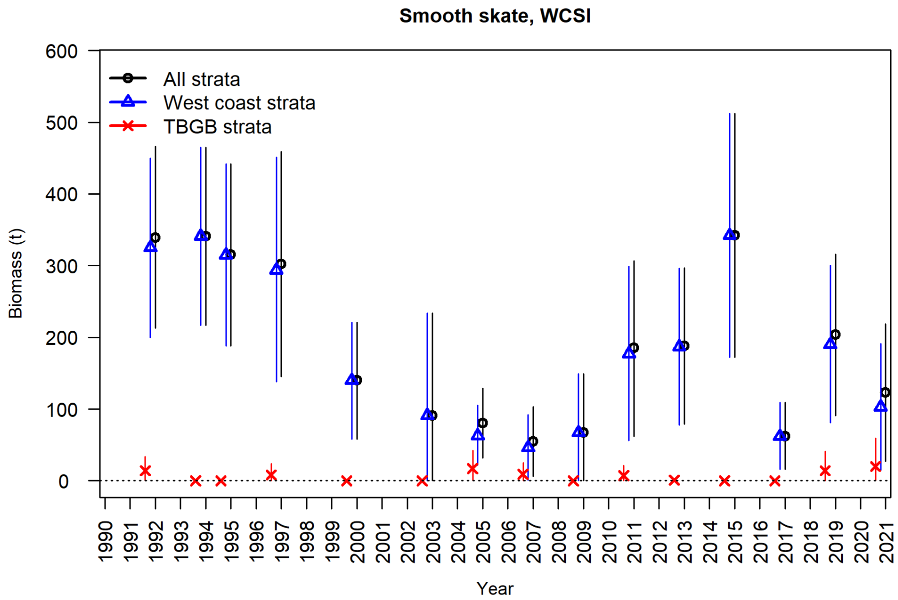


Figure 4: Smooth skate biomass for the west coast South Island (*Kaharoa*) trawl surveys. Error bars are ± two standard deviations. TBGB=Tasman Bay, Golden Bay.

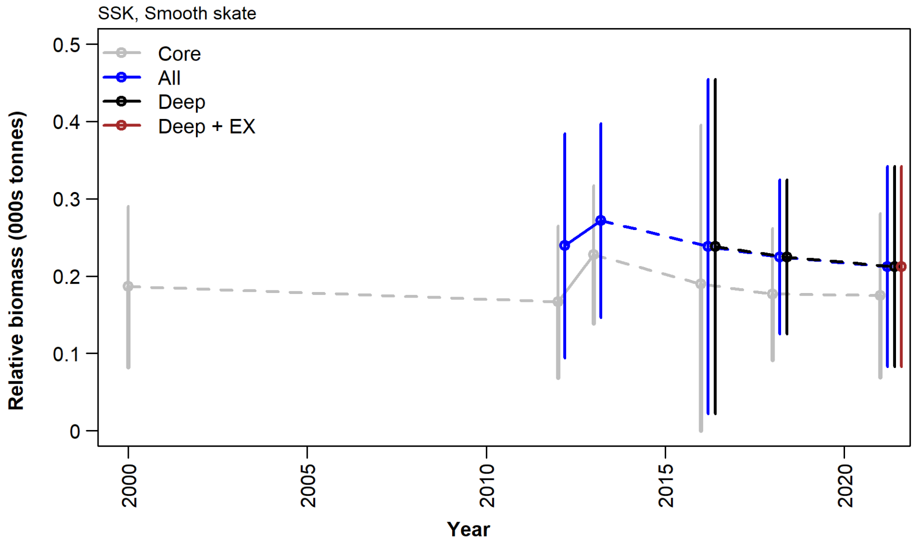


Figure 5: Smooth skate biomass for the west coast South Island (*Tangaroa*) trawl surveys for core strata (300–650 m) and 'all' strata (200–800 m). Also 'all' strata plus addition of deep strata (800–1000 m) and 'all'+deep strata plus an experimental stratum (1000–1050 m) (2021 only). Error bars are ± two standard deviations.

Establishing B_{MSY} compatible reference points

In 2022 the Working Group accepted the mean of relative biomass estimates from the 'all strata' (200–800 m) WCSI *Tangaroa* survey over the years 2012–2021 to act as B_{MSY} proxy for smooth skate in SSK 7. Both catch and estimated biomass are stable over the 2012–2021 period (Figure 6A).

The WCSI *Kaharoa* survey was not considered appropriate to derive a B_{MSY} proxy because there was no period of stable and relatively high biomass and biomass estimates have seen high inter-annual variation in recent years (Figure 6B). In addition, the WCSI *Kaharoa* survey is only considered to survey juvenile smooth skate (Holmes et al 2022).

It was not possible to agree on a target for SSK 3. Catches after 2004 tended to follow the Chatham Rise survey biomass estimates and neither were stable (Figure 6C). Biomass estimates for 1997–2007 were stable, but this period only includes three years from when skate catches were first required to be reported by species. Use of the ECSI survey was also rejected. It was not possible to find a period of both stable catch and biomass estimates since the introduction of skates into the QMS (Figure 6D). In addition, only juvenile female smooth skate are considered caught in representative numbers.

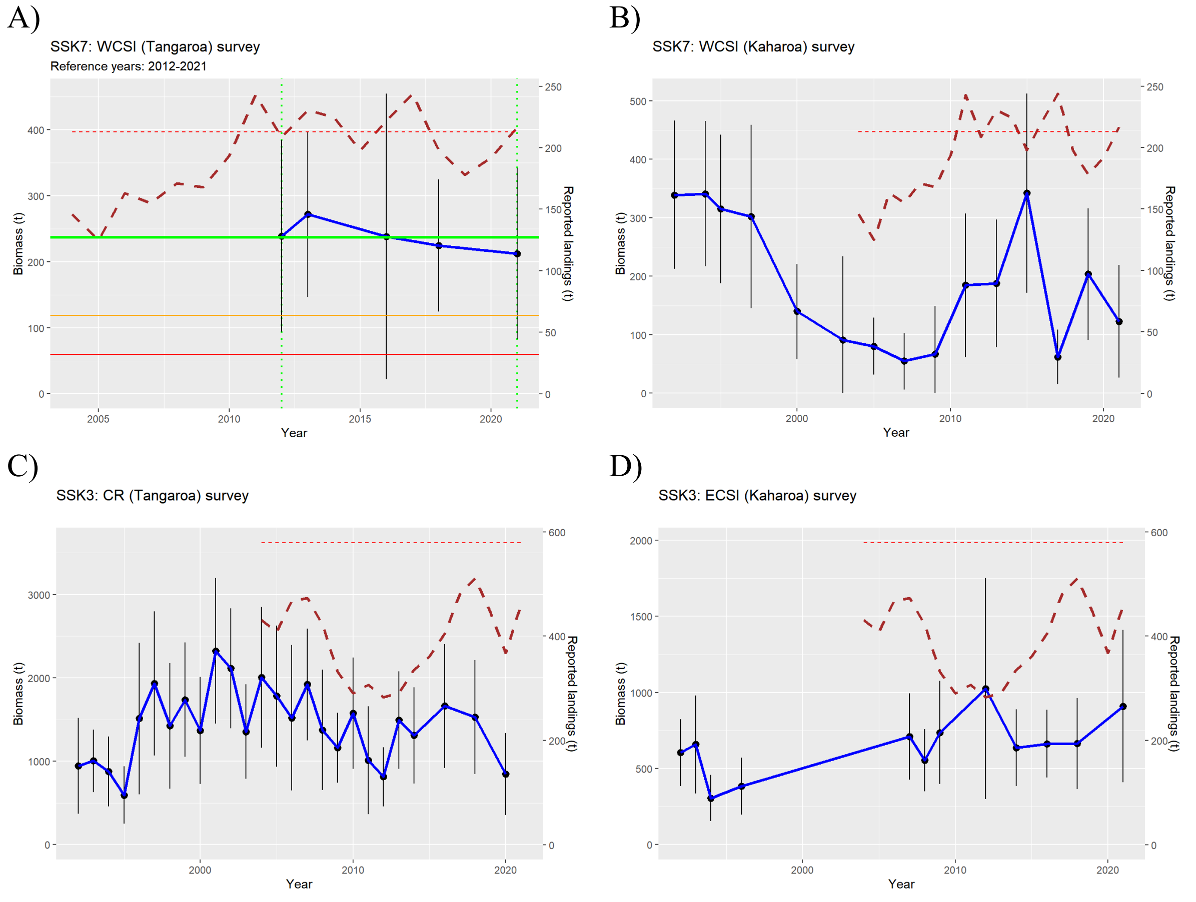


Figure 6: Relative biomass (blue line plus vertical lines showing ± 2 s.d. (left axis)) from A) WCSI *Tangaroa* trawl survey, B) WCSI *Kaharoa* trawl survey, C) Chatham Rise trawl survey, and D) ECSI *Kaharoa* trawl survey. In each plot QMR/MHR landings are shown by brown dashed line and TACC for the management area by red dotted line, with scale on right axis. For WCSI *Tangaroa* survey, the green line represents the proposed B_{MSY} proxy of mean abundance over the years indicated at the top of the figure, the orange line shows soft limit (50% B_{MSY} proxy), and the red line shows hard limit (25% B_{MSY} proxy).

4.2 Other factors

Species that constitute a minor bycatch of trawl fisheries are often difficult to manage using TACCs and ITQs. Skates are widely and thinly distributed and would be difficult for trawlers to avoid after the quota had been caught. A certain level of incidental bycatch is therefore inevitable. However, skates are relatively hardy and frequently survive being caught in trawls (although mortality would depend on the length of the tow and the weight of fish in the cod end). Skates returned to the sea alive probably have a greater chance of survival than most other fishes.

A data informed qualitative risk assessment was completed on all chondrichthyans (sharks, skates, rays, and chimaeras) at the New Zealand scale in 2014 (Ford et al 2015). Smooth skate was ranked second highest in terms of risk of the eleven QMS chondrichthyan species. Data were described as existing but poor for the purposes of the assessment and consensus over this risk score was achieved by the expert panel. This risk assessment does not replace a stock assessment for this species but may influence research priorities across species.

4.3 Future research considerations

- Work to determine the extent of current misidentification of RSK and SSK in commercial fisheries (the study of Beentjes 2005 was conducted not long after RSK and SSK were required to be reported separately under the QMS).
- Explore the potential for modelling a combined index from both the *Kaharoa* and *Tangaroa* west coast trawl surveys.
- Nothing is known about the stock structure or movement patterns of smooth skates.
- Investigate currently available maturity information (largely for males), to determine whether more information on female maturity should be collected from trawl surveys.
- Reliable catch information at species level limits our current determination of stable reference periods for SSK 3 on the Chatham Rise as well as estimates of relative exploitation rate for all SSK stocks, but trend in effort could be used to infer historical catches or relative fishing mortality to identify stable periods.
- The estimation of catches by models using species mix data from reported landings or observer data could be explored, particularly where the TACC may be limiting landings. This would be particularly useful for estimating relative exploitation rate.

5. STATUS OF THE STOCKS

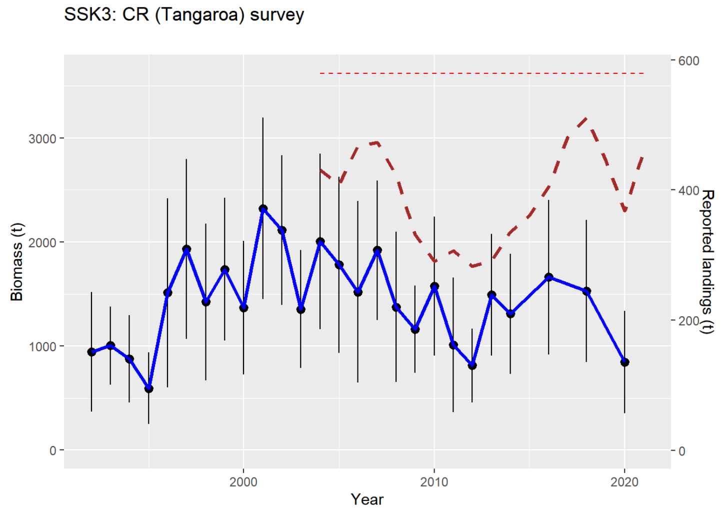
No estimates of current or reference biomass are available for SSK 1, SSK 8 and SSK 10.

- **SSK 3**

Stock Structure Assumptions
For the purposes of this summary SSK 3 is considered to be a single management unit.

Stock Status		
Most Recent Assessment Plenary Publication Year	2022	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2020–21	Catch: 388 t
Assessment Runs Presented	Abundance index based on Chatham Rise *Tangaroa* research trawl survey	
Reference Points	Target: B_{MSY} proxy Soft Limit: 50% B_{MSY} proxy Hard Limit: 25% B_{MSY} proxy Overfishing threshold: F_{MSY} proxy	
Status in relation to Target	Unknown	
Status in relation to Limits	Soft Limit: Unknown Hard Limit: Unknown	
Status in relation to Overfishing	Unknown	

Historical Stock Status Trajectory and Current Status



SSK 3 relative biomass from Chatham Rise *Tangaroa* trawl survey (blue line, vertical lines showing ± 2 s.d. (left axis)) and reported QMR/MHR landings (brown dashed line) and TACC for SSK 3 (red dotted line) (right axis). Reported landings are believed to be inaccurate.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Relative biomass rose to its highest recorded level in the early 2000s before declining back to the same level seen in the early 1990s by 2012. After another rise then fall, biomass in 2020 was again at the same level as in the early 1990s.
Recent Trend in Fishing Intensity or Proxy	Unknown
Other Abundance Indices	The ECSI *Kaharoa* survey indicated abundance has been relatively stable since 2007 and the relative biomass in 2021 is the second highest recorded value in the series. Large smooth skate are known to be under-represented in the ECSI *Kaharoa* survey.
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	Survey abundance index	
Assessment Dates	Latest assessment Plenary publication year: 2022	Next assessment: Unknown
Overall assessment quality rank	2 – Medium or Mixed Quality: survey catches small and highly variable	
Main data inputs (rank)	Survey abundance index	1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

Qualifying Comments
- Estimates of relative fishing mortality are likely unreliable owing to issues related to misidentification of catch between rough skates and smooth skates as well as discarding. - Because there was no period with stable catch and abundance available, it was not possible to determine reference points.

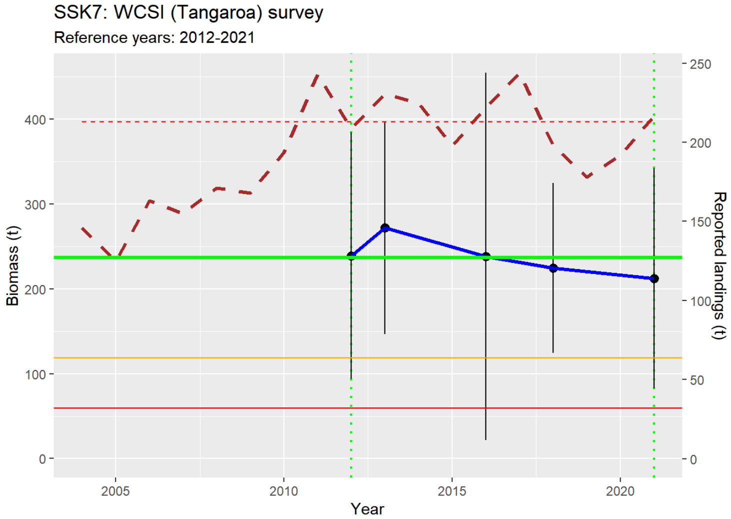
Fishery Interactions
Smooth skate constitute a bycatch of trawl fisheries. Skates are widely distributed and difficult for trawlers to avoid.

- **SSK 7**

Stock Structure Assumptions
For the purposes of this summary SSK 7 is considered to be a single management unit.

Stock Status		
Most Recent Assessment Plenary Publication Year	2022	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2020–21	Catch: 213 t
Assessment Runs Presented	Abundance index based on WCSI *Tangaroa* research trawl survey	
Reference Points	Interim Target: B_{MSY} proxy based on arithmetic mean survey index for the period 2012 to 2021 (a period with high yield when both catch and survey index were stable) 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 2012 to 2021	
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	Unknown	

Historical Stock Status Trajectory and Current Status



SSK 7 relative biomass from WCSI *Tangaroa* trawl survey (blue line, vertical lines showing ± 2 s.d. (left axis)) and reported QMR/MHR landings (brown dashed line) and TACC for SSSK 7 (red dotted line) (right axis). The green line represents the B_{MSY} proxy of mean abundance series from 2012 to 2021. The orange line shows soft limit (50% B_{MSY} proxy) and the red line shows hard limit (25% B_{MSY} proxy). Reported landings are believed to be inaccurate.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Relative biomass was stable between 2012 and 2021.
Recent Trend in Fishing Intensity or Proxy	Unknown
Other Abundance Indices	The core area series for the WCSI *Tangaroa* survey indicated the abundance has been relatively stable since 2000.
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	Survey abundance index	
Assessment Dates	Latest assessment Plenary publication year: 2022	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Survey abundance index	1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

Qualifying Comments
- Estimates of relative fishing mortality are likely unreliable owing to issues related to misidentification of catch between rough skates and smooth skates as well as discarding. - The survey series is relatively short and we do not have historical information on abundance, although the WCSI *Kaharoa* survey samples juveniles and shows a decline between 1994 and 2007 and then an increase to a biomass approximately half that of the early 1990s.

Fishery Interactions
Smooth skate constitute a bycatch of trawl fisheries. Skates are widely distributed and difficult for trawlers to avoid.

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