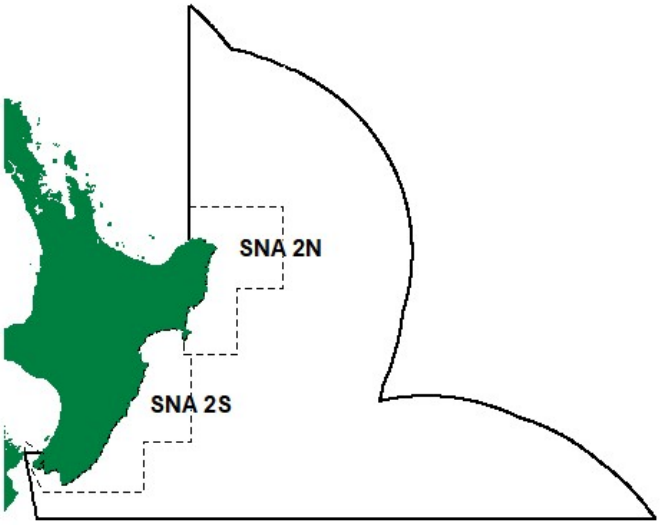
SNAPPER (SNA 2)

(*Chrysophrys auratus*)
Tamure, Kouarea



1. FISHERIES SUMMARY

1.1 Commercial fisheries

Table 1 and Table 2 provide a summary of the reported commercial catches, TACCs, and TACs for SNA 2. Landings and TACC are plotted in Figure 1.

Table 1: Reported landings (t) of snapper from SNA 2 from 1931 to 1990.

Year	Landings (t)	Year	Landings (t)	Year	Landings (t)
1931–32	0	1951	265	1971	861
1932–33	0	1952	220	1972	878
1933–34	21	1953	247	1973	798
1934–35	168	1954	293	1974	716
1935–36	149	1955	309	1975	732
1936–37	78	1956	365	1976	732
1937–38	114	1957	452	1977	374
1938–39	122	1958	483	1978	454
1939–40	100	1959	372	1979	662
1940–41	103	1960	487	1980	636
1941–42	148	1961	589	1981	283
1942–43	74	1962	604	1982	160
1943–44	60	1963	636	1983	160
1944	49	1964	667	1984	227
1945	59	1965	605	1985	208
1946	77	1966	744	1986	255
1947	36	1967	856	1987	122
1948	53	1968	765	1988	165
1949	215	1969	837	1989	227
1950	285	1970	804	1990	429

Notes:
1. The 1931–1943 years are April–March but from 1944 onwards are calendar years.
2. The 'QMA totals' are approximations derived from port landing subtotals, as follows: SNA 2 Gisborne to Wellington/Makara
3. Before 1946 the 'QMA' subtotals sum to less than the New Zealand total because data from the complete set of ports are not available.
4. Data up to 1985 are from fishing returns: data from 1986 to 1990 are from Quota Management Reports.
5. 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 include both foreign and domestic landings.

Table 2: Reported landings (t) of snapper from SNA 2 from 1983–84 to present and gazetted and actual TACCs (t) for 1986–87 to present. QMS data from 1986–present.

Fishstock	SNA 2	
FMAs	2	
	Landings	TACC
1983–84†	145	–
1984–85†	163	–
1985–86†	177	–
1986–87	130	130
1987–88	152	137
1988–89	210	157
1989–90	364	157
1990–91	428	157
1991–92	373	157
1992–93	324	252
1993–94	307	252
1994–95	308	252
1995–96	280	252
1996–97	351	252
1997–98	286	252
1998–99	283	252
1999–00	390	252
2000–01	360	252
2001–02	252	252
2002–03	334	315
2003–04	339	315
2004–05	399	315
2005–06	389	315
2006–07	329	315
2007–08	328	315
2008–09	307	315
2009–10	296	315
2010–11	320	315
2011–12	358	315
2012–13	310	315
2013–14	313	315
2014–15	271	315
2015–16	321	315
2016–17	373	315
2017–18	373	315
2018–19	364	315
2019–20	330	315
2020–21	321	315

† FSU data. SNA 2 = Statistical Areas 011–016

In SNA 2, snapper is primarily caught as a bycatch of the tarakihi and gurnard bottom trawl fisheries and, more intermittently, in the gurnard target Danish seine fishery. From 1 October 2002, the TACC for SNA 2 was increased from 252 t to 315 t, within a total TAC of 450 t (Table 3). Nevertheless the 315 t TACC has regularly been over-caught since 1987–88, except in the fishing years 2008–09 to 2009–10 and 2012–13 to 2014–15. The minimum legal size (MLS) for snapper in SNA 2 is 25 cm.

Table 3: TACs, TACCs, and allowances (t) for SNA 2 from 1 October 2021.

Fishstock	TAC	TACC	Customary allowance	Recreational allowance	Other mortality
SNA 2	450	315	14	90	31

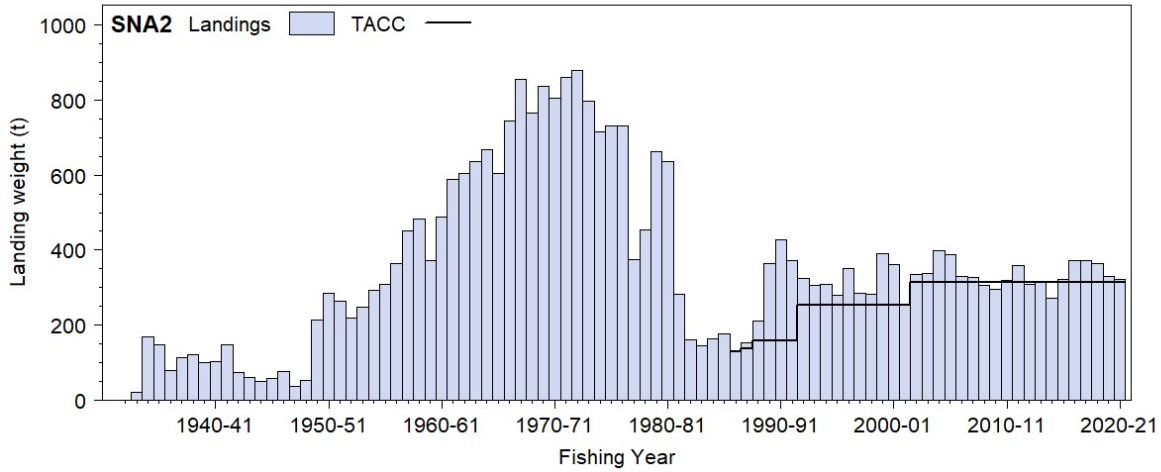


Figure 1: Total reported landings and TACCs for SNA 2.

1.2 Recreational fisheries

The snapper fishery is the largest recreational fishery in New Zealand. It is the major target species on the northeast and northwest coasts of the North Island and is targeted seasonally around the rest of the North Island and the top of the South Island. The current allowance within the SNA 2 TAC is shown in Table 3.

1.2.1 Management controls

The two main methods used to manage recreational harvests of snapper are minimum legal size limits (MLS) and daily bag limits. Both have changed over time (Table 4). The number of hooks permitted on a recreational longline was reduced from 50 to 25 in 1995.

Table 4: Changes to minimum legal size limits (MLS) and daily bag limits used to manage recreational harvesting levels in SNA 2.

Stock	MLS	Bag limit	Introduced
SNA 2	25	30	1/01/1985
SNA 2	27	10	1/10/2005

1.2.2 Estimates of recreational harvest

A background to the estimation on recreational harvest of snapper is provided in the Introduction – Snapper chapter. Recreational harvest estimates for SNA 2 are provided in Table 5a. Partitioned between the SNA 2 sub-areas, the 2017–18 panel survey provides estimates of recreational harvest from SNA 2N of 35 t and SNA 2S of 58 t (Bruce Hartill, NIWA, pers. comm.).

Table 5a: Recreational catch estimates for SNA 2. Totals for a stock are given in bold. The telephone/diary surveys ran from December to November but are denoted by the January calendar year. Mean fish weights were obtained from boat ramp surveys (for the telephone/diary and panel survey catch estimates). Numbers and mean weights are not calculated in the tag ratio method. Includes charter boat catch and panel survey estimates of s111 catches.

Stock	Year	Method	Number of fish (thousands)	Mean weight (g)	Total weight (t)	CV
SNA 2						
Total	1993	Telephone/diary	28	1 282	**36**	–
Total	1996	Telephone/diary	31	1 282[2]	**40**	–
Total	2000	Telephone/diary	268	1 200[4]	**322**	–
Total	2001	Telephone/diary	144	–[5]	**173**	–
Total	2011–12	Panel survey	55	1 027	**57**	**0.25**
Total	2017–18	Panel survey	83	1 117	**93**	**0.24**

[2] Mean weight obtained from 1992–93 boat ramp sampling.
[4] Mean weight obtained from 1999–2000 commercial landed catch sampling.
[5] The 2000 mean weights were used in the 2001 estimates.

Web camera/creel survey monitoring has been undertaken within SNA 2 since 2014–15 (monitoring at Napier and Gisborne). These data show a generally increasing trend in snapper harvest, but since the series only overlaps with one National Panel Survey (2017–18), scaled estimates of annual harvest (Table 5b) from the relative boat ramp harvest index should be considered preliminary (B. Hartill, pers. comm.).

Table 5b: Preliminary recreational catch estimates for SNA 2, split by SNA 2N and SNA 2S, on basis of National Panel Survey and web camera/creel survey monitoring.

Year	SNA 2N	SNA 2S	SNA 2	source
2011–12	29.5	26.3	55.8	NPS
2012–13				
2013–14				
2014–15	10.9	25.8	36.7	Scaled creel survey
2015–16	18.4	33.6	52.0	Scaled creel survey
2016–17	13.9	36.5	50.4	Scaled creel survey
2017–18	35.2	57.9	93.1	NPS
2018–19	41.8	87.8	129.7	Scaled creel survey
2019–20	34.6	43.8	78.4	Scaled creel survey
2020–21	53.1	60.5	113.6	Scaled creel survey

1.3 Customary non-commercial fisheries

Snapper form important fisheries for customary non-commercial fisheries, but the annual catch is not known. The information on Māori customary harvest under the provisions made for customary fishing is limited and it is likely that Māori customary fishers utilise the provisions under recreational fishing regulations.

1.4 Illegal catch

No new information is available to estimate illegal catch.

1.5 Other sources of mortality

With the introduction of Electronic Reporting in 2019, commercial fishers must provide comprehensive reporting of all discards and returns. All fish under the minimum legal size ("sub-MLS fish") must be returned to the sea; in SNA 2 reported quantities of sub-MLS snapper have been small (1–3 t in 2020 and 2021).

2. BIOLOGY

For further information on snapper biology refer to the Introduction – Snapper chapter. A summary of published estimates of biological parameters for SNA 2 is presented in Table 6.

Table 6: Estimates of biological parameters.

Fishstock	Estimate			Source
1. Instantaneous rate of natural mortality (M)				
SNA 1, 2, 7, & 8	0.075			Hilborn & Starr (unpub. analysis)
2. Weight = a(length)^b (Weight in g, length in cm fork length)				
All	a = 0.04467		b = 2.793	Paul (1976)
3. von Bertalanffy growth parameters				
	Both sexes combined			
	K	t_0	L_∞	
SNA 2N	0.027	-8.85	98.7	Walsh et al (2012)
SNA 2S	0.097	-2.02	71.7	Walsh et al (2012)

3. STOCKS AND AREAS

A review of catch at age data collected from SNA 2 in 2008 and 2009 found differences in length and age structure, year class strength and growth for snapper in northern and southern subareas of SNA 2 (Walsh et al 2012). The boundary between the areas was defined as the Mahia Peninsula, with most catch from the northern area landed and sampled in Gisborne, and from the southern area in Napier. Previous genetic sampling (Smith et al 1978) suggested snapper in Hawke Bay were genetically more similar to snapper on the west coast of the North Island than other east coast snapper, and that there was an indication of stock mixing at East Cape between the Bay of Plenty and northern SNA 2. Walsh et al (2012) concluded that there was evidence that the northern and southern areas in SNA 2 represented separate sub-stocks with minor level of mixing and migration occurring between the northern area of SNA 2 and the Bay of Plenty, similar to that seen between the sub-stocks of SNA 1.

4. STOCK ASSESSMENT

A full quantitative stock assessment was completed for SNA 2 in 2009 (Langley 2010). This assessment is not reported here because it assumed that SNA 2 comprised a single biological stock and the Plenary gave it a quality ranking of '2' at the time of review. In 2017, standardised CPUE indices for the two sub-stocks were derived using data from the mixed target bottom trawl fishery for the recent period of the fishery (2001–02 to 2015–16).

4.1 Standardised CPUE

In 2017, Schofield et al (2018a) completed a standardised CPUE analysis for the two sub-stocks of SNA 2 using commercial catch and effort data from the bottom trawl fishery. Two data series were considered: vessel-day records from TCER, TCELR, and CELR (pre-2008) forms aggregated using the Langley method (Langley 2014); and tow by tow records from TCER and TCELR forms. The analysis included tows targeting snapper, trevally, tarakihi, and red gurnard and was limited to Hawke Bay and north, because there were very limited catches of snapper in the southern and eastern areas of SNA 2.

Due to changes in regulations and reporting behaviour between 1989–90 and 2001–02, data from this period were excluded from the analysis. Throughout this period the SNA 2 TACC was consistently over-caught, in 2000 Annual Catch Entitlement was introduced, in 2001 differential deemed values were introduced, and in 2002 the SNA 2 TACC was increased to 325 t.

The boundary between the northern and southern sub-stocks was assumed to lie off the southern tip of Mahia Peninsula, splitting Statistical Area 013 into Eastern and Western sub-areas at 177.87° E. A classification partitioning model was used to allocate catch and effort reported from Statistical Area 013 on CELR forms to one of the two sub-stocks, trained using the high-resolution data available since 2007. The partition tree used landing port for the primary split and then target species as a secondary split when landing port was not Auckland, Gisborne, or Tauranga. Actual area (013W or 013E) was correctly assigned for 88.9% of records in the training dataset.

A Generalised Linear Modelling (GLM) approach was applied to model the occurrence of snapper catches (presence/absence) and the magnitude of positive snapper catches. The dependent variable of the catch magnitude CPUE models was the natural logarithm of catch. For the positive catch CPUE models, a Weibull error structure was adopted following an evaluation of alternative distributions. The presence/absence of snapper catch was modelled based on a binomial distribution. The range of potential explanatory variables included vessel, fishing year, month, location, depth, target species, trawl speed, trawl distance, and trawl duration.

The Inshore WG adopted the combined vessel day CPUE indices as indices of abundance for the SNA 2 sub-stocks (22 June 2017). These indices were updated in 2018 (Schofield et al 2018b) to include data to 30 September 2017.

The daily (pseudo-CELR) and event-based CPUE indices for SNA 2N and SNA 2S were updated in 2022, with data to 30 September 2021 and minor modifications:

- the core vessel selection required that vessels caught at least 100 kg over the course of the series rather than at least 1 kg on each trip counted in the core vessel trips/years criterion;
- interaction terms between statistical area and month were eliminated, as these caused estimation problems in the lower effort areas and did not materially change the indices;
- the error distributions were modified from Weibull to lognormal in the SNA 2S daily index and gamma in the SNA 2N event index due to slightly improved diagnostics; and
- southern statistical areas (the Wairarapa coast) were included in the SNA 2S model after observations of slightly increased catches from these areas.

The daily series for the northern sub-stock increased from 2002 to 2006, declined from 2006 to 2010 then, following a period of stability from 2010 to 2016, increased to 2020 with a small decline evident to 2021 (Figure 2). The southern sub-stock also was also at a higher level from 2002 to 2006, then declined substantially from 2006 to 2008. It showed a slower decline from 2008 to 2016, before increasing at a similar rate to SNA 2N with the increase continuing to 2021.

The event-based series, beginning in 2008, show very similar trends to the daily series for the common years (Figure 2). While the 2002 start date implies the SNA 2 CPUE series are relatively short, trends in abundance in the northern and southern areas are similar, but the variation in SNA 2S has been greater, reaching higher relative abundance in the early 2000s, and in 2021, and a lower relative abundance in 2013 -2016.

Unstandardised recreational harvest rates from creel surveys at boat ramps in Gisborne and Napier show similar trends to commercial CPUE from 2015 to 2021 (Figure 3).

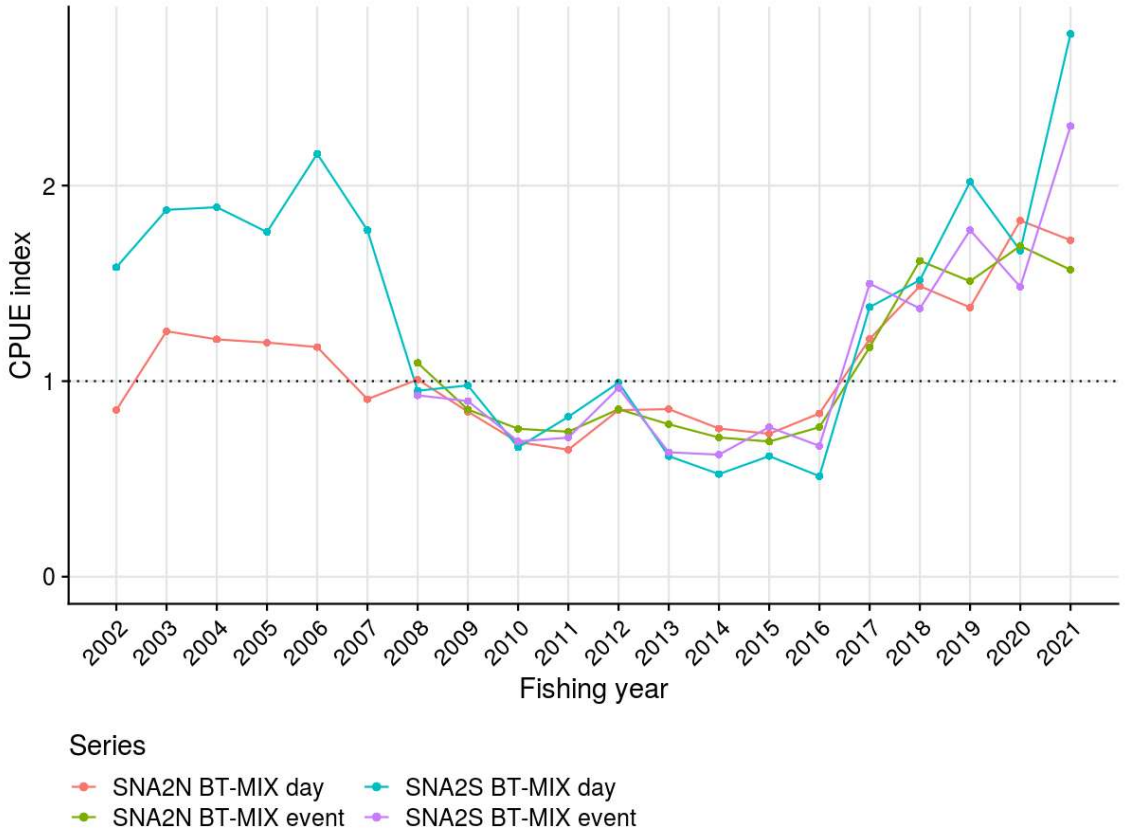


Figure 2: Comparison of standardised combined catch per unit effort (CPUE) indices for the northern and southern sub-stocks of SNA 2 from bottom trawling targeting gurnard, snapper, tarakihi, and trevally combined over all form types and aggregated to CELR resolution (BT-MIX daily), and from data reported at the event level (BT-MIX event). Series are scaled relative to the geometric mean of the years they have in common. Fishing years are labelled according to the second calendar year, e.g., 2002 = 2001–02.

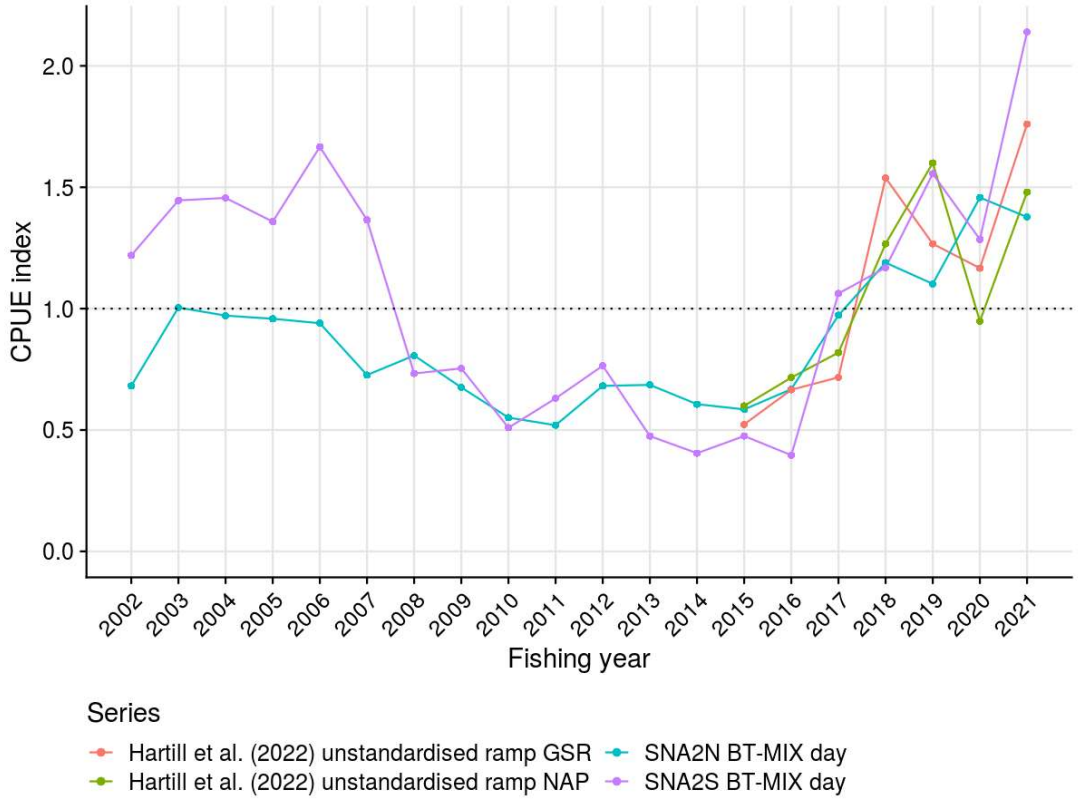


Figure 3: Comparison of standardised combined catch per unit effort (CPUE) indices for the northern and southern sub-stocks of SNA 2 from bottom trawling targeting gurnard, snapper, tarakihi, and trevally combined over all form types and aggregated to CELR resolution (BT-MIX daily) with unstandardised recreational harvest rates from monitoring of boat ramps in Gisborne (GSR) and Napier (NAP). Fishing years are labelled according to the second calendar year, e.g., 2002 = 2001–02.

Establishing B_{MSY} compatible reference points

In 2022, the Inshore Working Group adopted geometric mean standardised CPUE from the BT-MIX event-resolution model for the period 2008 to 2012 as the soft limit reference point for SNA 2S. This period had stable catch and standardised CPUE. The historical catch suggested that the stock was at a low point in the early 1980s. The longer daily resolution index (beginning in 2002) indicated that the stock was higher prior to the reference period, but it was thought that it was unlikely it had recovered to be substantially higher than the target by that time. The Working Group adopted the default Harvest Strategy Standard definitions for the target and hard limit of twice and half the soft limit, respectively. No reference point was adopted for SNA 2N, pending further work contracted as part of the SNA 1 stock assessment.

4.2 Catch at age data

Seven years of age frequency data were available from the commercial fisheries for the 2009 assessment. There was considerable variability in the age compositions among years, likely due in part to the sampling of the snapper bycatch from a number of different target fisheries. The age compositions were principally composed of younger age classes and few old fish were sampled from the catch. There are concerns regarding the representative nature of the sampling and comparability of the ageing in earlier years.

A further commercial catch sampling programme was conducted in the 2007–08 and 2008–09 fishing years (Walsh et al 2012). The study found evidence for two sub-stocks within SNA 2: a northern stock located between Mahia Peninsula and Cape Runaway, and a southern stock within Hawke Bay. Walsh et al (2012) demonstrated that, although strong year classes were consistent between stocks, a range of year classes were present in the northern area (similar to the eastern Bay of Plenty), whereas the southern area was dominated by a few strong year classes. Snapper from the southern sub-stock grew considerably faster than those from the northern sub-stock weighing 50–60% more at any given age.

Catch sampling was carried out in 2020, in the northern subarea only. Results suggest a higher proportion of 20+ fish in 2020 than in 2008 and 2009.

Future research considerations

- The pre-QMS catch history for SNA 2 requires partitioning between the northern and southern areas.
- Estimation of recreational catch histories from 2008 from the national panel survey estimates and boat ramp monitoring and other information for SNA 2N and SNA2S, based on assumption recreational catch is proportional to biomass.
- Develop fishing intensity series and reference point including recreational harvest.
- Catch sampling in both northern and southern areas is required to allow similarities and differences in year class strengths to be assessed for years other than 2008 and 2009, and to establish whether changes in growth rates observed in other snapper fisheries have also occurred in SNA 2.
- Stock assessments, including catch at age information for years prior to 2008 - which is yet to be partitioned into the two sub-stocks - and recent catch at age from SNA 2N, may be feasible.
- Further analyse information informing stock structure, including the recent genetics information for SNA stocks (VUW study).
- Explore sensitivity of the index to the composition of the core fleet.

5. STATUS OF THE STOCKS

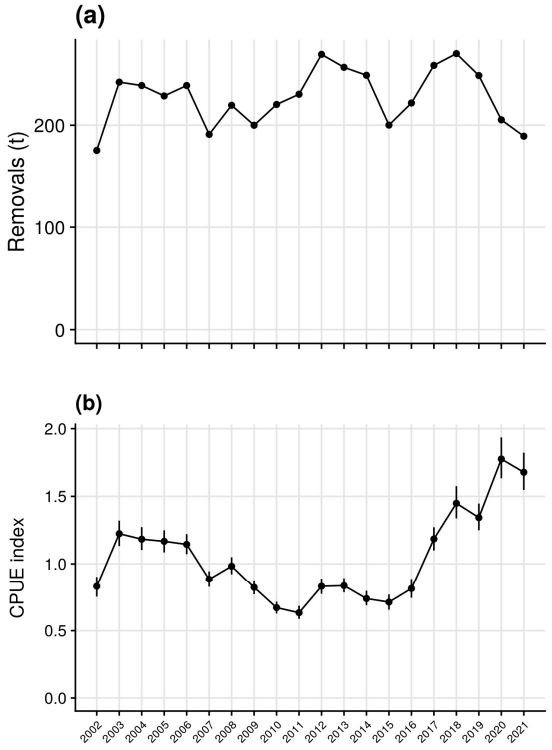
Stock Structure Assumptions

SNA 2 is assumed to occur in two sub-stocks. The northern sub-stock occurs between the southern tip of the Mahia Peninsula and Cape Runaway and may be associated with the SNA 1 Bay of Plenty stock. The southern sub-stock occurs within Hawke Bay and may be peripheral to the northern stock rather than entirely discrete. The majority of the SNA 2 catch is taken from the northern sub-stock, and this is assumed to be the primary stock in SNA 2.

- **SNA 2N**

Stock Status	
Year of Most Recent Assessment	2022
Assessment Runs Presented	Standardised combined CPUE (positive + binomial) model based on SNA, TRE, GUR, and TAR target single trawl pseudo-CELR data
Reference Points	Target: B_{MSY}-compatible proxy based on CPUE: not determined Soft Limit: 50% of target Hard Limit: 25% of target Overfishing threshold: F_{MSY}
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



(a) Annual commercial removals for SNA 2N; (b) the standardised catch per unit effort (CPUE) index for SNA 2N from trawling targeting gurnard, snapper, tarakihi and trevally.

Fisheries and Stock Trends	
Recent Trend in Biomass or Proxy	The standardised CPUE index was relatively stable between 2008 and 2016 then increased 2.5 times in the period to 2020.
Recent Trend in Fishing Mortality or Proxy	Relative exploitation rate decreased steadily from 2011 to 2021.
Other Abundance Indices	Unstandardised recreational CPUE from 2015 to 2021 increased three-fold and was similar to the trend in standardised commercial CPUE.
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	For current (1 October 2021) catch levels: 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	
Assessment Dates	Latest assessment: 2022	Next assessment: 2025
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Standardised single trawl CPUE index of abundance	1 – High Quality
Data not used (rank)	N/A	

Changes to Model Structure and Assumptions	-
Major Sources of Uncertainty	-

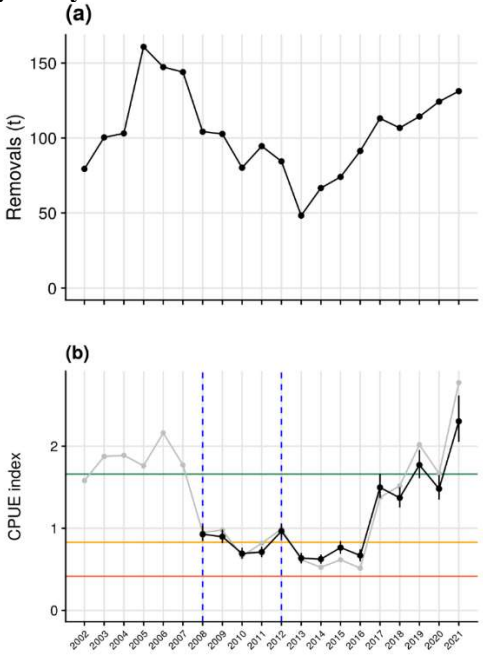
Qualifying Comments
Recreational harvest was 13% of removals in 2018 but the full recreational catch history is not known. The pattern in exploitation rate from commercial removals is only correct if recreational harvest is a constant proportion of removals.

Fisheries Interactions
Snapper is principally a bycatch of the tarakihi bottom trawl fishery in SNA 2N.

- **SNA 2S**

Stock Status	
Year of Most Recent Assessment	2022
Assessment Runs Presented	Standardised combined CPUE (positive + binomial) models based on SNA, TRE, GUR, and TAR target single trawl event resolution and pseudo-CELR resolution data
Reference Points	Management Target: 40% B_0, interpreted as twice the geometric mean standardised CPUE from the event resolution model for the period 2008–2012 Soft Limit: geometric mean standardised CPUE in the period 2008–2012 Hard Limit: 50% of the soft limit Overfishing threshold: Half the relative exploitation rate in 2008–2012
Status in relation to Target	About as Likely as Not (40–60%) to be at or above the target in 2021
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



(a) Annual commercial removals for SNA 2S; (b) the standardised event resolution catch per unit effort (CPUE) index (black line), relative to the agreed reference points, for SNA 2S from trawling targeting gurnard, snapper, tarakihi and trevally. Reference period by blue vertical dashed lines. Longer daily resolution standardised CPUE index shown in grey.

Fisheries and Stock Trends	
Recent Trend in Biomass or Proxy	The standardised CPUE index declined slowly between 2008 and 2016 then increased three-fold to 2021.
Recent Trend in Fishing Mortality or Proxy	Unknown
Other Abundance Indices	- Unstandardised recreational CPUE from 2015 to 2021 increased 2.5 times and was similar to the trend in standardised commercial CPUE.
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	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	
Assessment Dates	Latest assessment: 2022	Next assessment: 2025
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Standardised single trawl CPUE index of abundance	1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	- Reference points developed on event resolution standardised CPUE index	
Major Sources of Uncertainty	- Recreational harvest was 54% of removals in 2018 but the full recreational catch history is not known. Relative exploitation rate could not therefore be calculated.	

Qualifying Comments
The standardised CPUE index in the final year was given less weight in the assessment of stock status because it showed a large increase and was relatively poorly estimated.

Fisheries Interactions
Snapper is principally a bycatch of the red gurnard bottom trawl fishery in SNA 2S. Anecdotal feedback from fishers indicates that the operation of this fishery is constrained by the SNA 2 TACC.

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