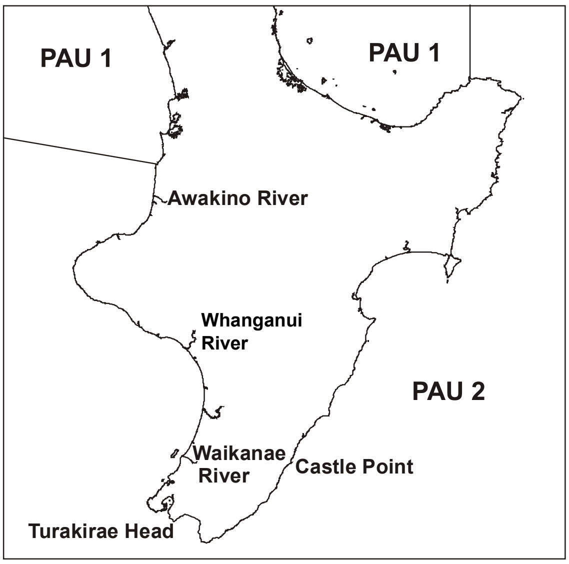
PĀUA (PAU 2) – Wairarapa / Wellington / Taranaki

(*Haliotis iris*)
Pāua



1. FISHERY SUMMARY

PAU 2 was introduced into the Quota Management System in 1986–87 with a TACC of 100 t. As a result of appeals to the Quota Appeal Authority, the TACC was increased to 121.19 t in 1989. On 1 October 2023, a TAC of 192.19 t was set with a TACC of 121.19 t, a customary allowance of 12 t, a recreational allowance of 48 t and an allowance of 11 t for other sources of mortality (Table 1).

Table 1: Total allowable catches (TAC, t), allowances for customary fishing, recreational fishing, and other sources of mortality (t), and Total Allowable Commercial Catches (TACC, t) declared for PAU 2 since introduction to the Quota Management System (QMS).

Year	TAC	Customary	Recreational	Other mortality	TACC
1986–1989	–	–	–	–	100
1989–2023	–	–	–	–	121.19
2023- present	192.19	12	48	11	121.19

1.1 Commercial fisheries

The fishing year runs from 1 October to 30 September. Most of the commercial catch comes from the Wairarapa and Wellington South coasts between Castlepoint and Turakirae Head. The western areas between Tirua Point and the Whanganui River, and Turakirae Head and the Waikanae River, and the eastern area between Cape Runaway and Blackhead Lighthouse are closed to commercial fishing.

On 1 October 2001 it became mandatory to report catch and effort on PCELRs using the fine-scale reporting areas that had been developed by the New Zealand Pāua Management Company for their voluntary logbook programme (Figure 1). Landings for PAU 2 are shown in Table 2 and Figure 2. Landings have been at or very close to the TACC since 1988–89.

1.2 Recreational fisheries

The most recent National Panel Survey (Heinemann & Gray 2024), estimated that about 33 t of pāua were harvested by recreational fishers in PAU 2 in 2022–23.

Because pāua around Taranaki are naturally small and never reach the minimum legal size (MLS) of 125 mm, a new MLS of 85 mm was introduced for recreational fishers from 1 October 2009. The new length was on a trial basis for five years and now applies between the Awakino and Wanganui rivers.

In September 2023, the recreational daily bag limit for pāua in PAU 2 was reduced from 10 yellowfoot pāua and 10 blackfoot pāua per fisher per day to 5 of each species per fisher, per day.

For further information on recreational fisheries refer to the Introduction – Pāua chapter.

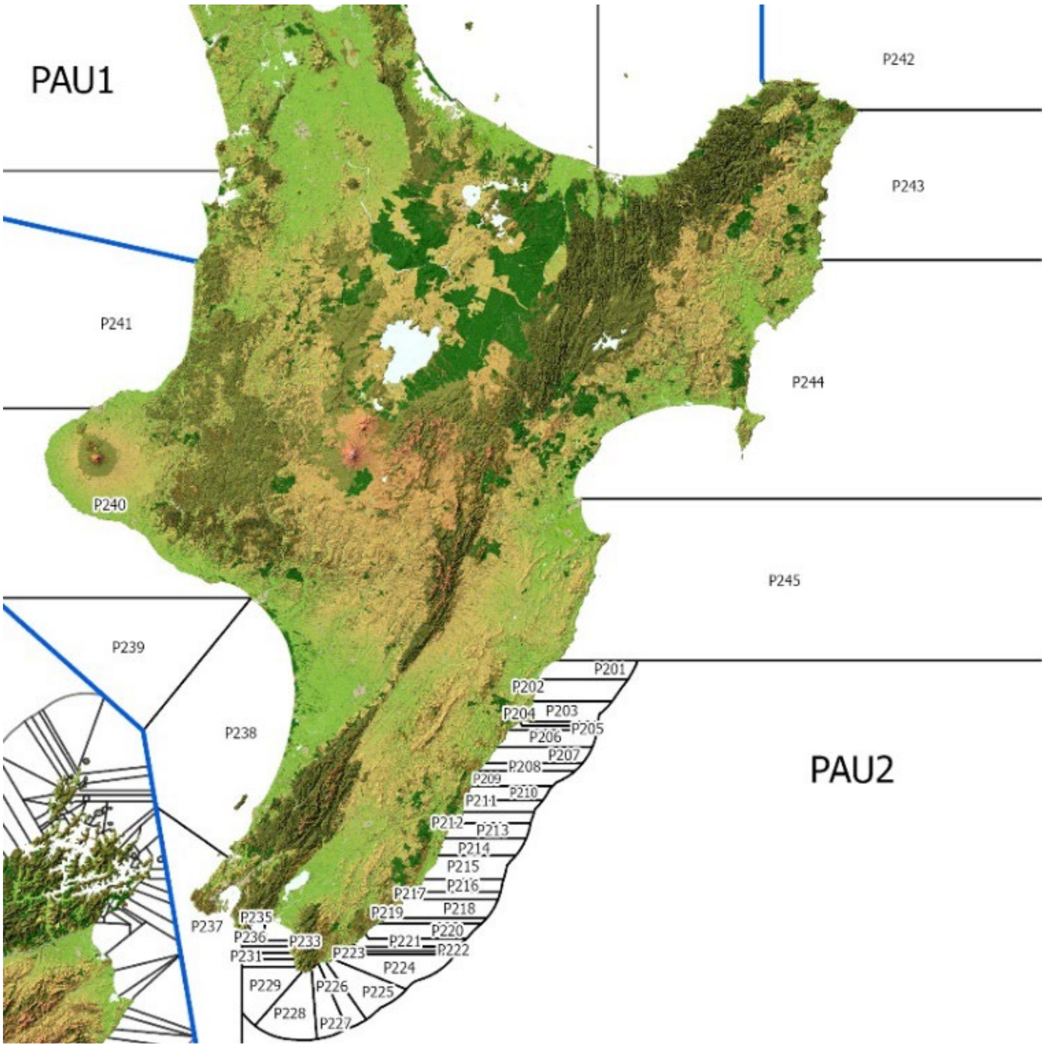


Figure 1: Map of fine-scale statistical reporting areas for PAU 2.

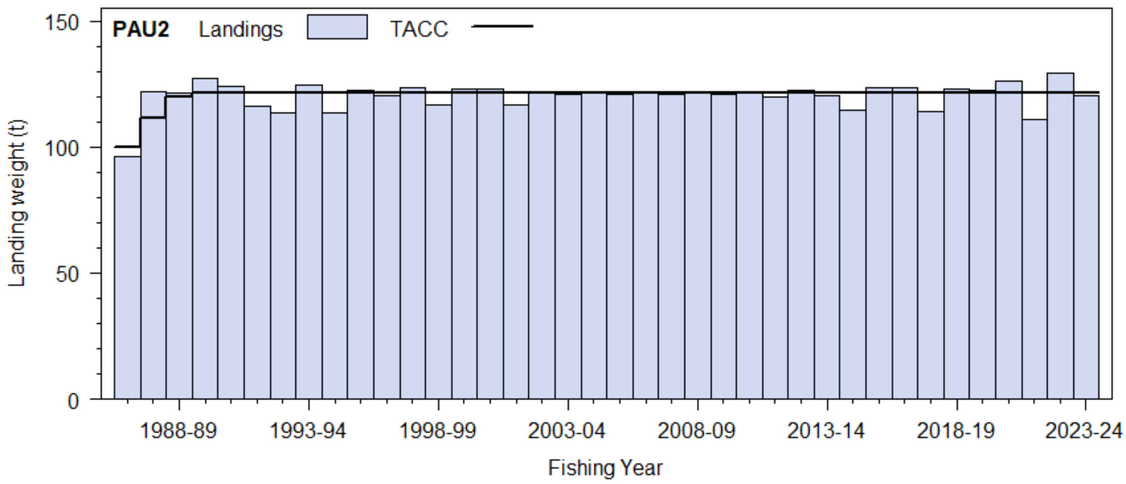


Figure 2: Historical landings and TACC for PAU 2 from 1983–84 to the present. QMS data from 1986 to present.

Table 2: TACC and reported landings (t) of pāua in PAU 2 from 1983–84 to the present.

Fishing year	Landings	TACC	Fishing year	Landings	TACC
1983–84*	110	–	2004–05	121.19	121.19
1984–85*	154	–	2005–06	121.14	121.19
1985–86*	92	–	2006–07	121.20	121.19
1986–87*	96.2	100	2007–08	121.06	121.19
1987–88*	122.11	111.33	2008–09	121.18	121.19
1988–89*	121.5	120.12	2009–10	121.13	121.19
1989–90	127.28	121.19	2010–11	121.18	121.19
1990–91	125.82	121.19	2011–12	120.01	121.19
1991–92	116.66	121.19	2012–13	122.00	121.19
1992–93	119.13	121.19	2013–14	120.00	121.19
1993–94	125.22	121.19	2014–15	115.00	121.19
1994–95	113.28	121.19	2015–16	123.74	121.19
1995–96	119.75	121.19	2016–17	123.69	121.19
1996–97	118.86	121.19	2017–18	113.87	121.19
1997–98	122.41	121.19	2018–19	122.89	121.19
1998–99	115.22	121.19	2019–20	122.28	121.19
1999–00	122.48	121.19	2020–21	126.26	121.19
2000–01	122.92	121.19	2021–22	110.91	121.19
2001–02	116.87	121.19	2022–23	129.39	121.19
2002–03	121.19	121.19	2023–24	120.14	121.19
2003–04	121.06	121.19			

* FSU data.

1.3 Customary fisheries

Pāua is a taonga species and as such there is an important customary use of pāua by Maori for food, and the shells have been used extensively for decorations and fishing devices.

For information on customary catch regulations and reporting refer to the Introduction – Pāua chapter.

Estimates of customary catch for PAU 2 are given in Table 3. These numbers are likely to be an underestimate of customary harvest because only the catch in kilograms and numbers are reported in the table. In addition, many tangata whenua also harvest pāua under their recreational allowance and these are not included in records of customary catch.

Table 3: Fisheries New Zealand records of customary harvest of pāua (approved and reported as weight (kg) and in numbers) in PAU 2 since 1998–99. – no data.

	Weight (kg)		Numbers	
Fishing year	Approved	Harvested	Approved	Harvested
1998–99	40	40	–	–
1999–00	–	–	1 400	820
2000–01	–	–	–	–
2001–02	–	–	–	–
2002–03	–	–	–	–
2003–04	–	–	4 805	4 685
2004–05	–	–	2 780	2 440
2005–06	–	–	5 349	4 385
2006–07	–	–	7 088	3 446
2007–08	–	–	11 298	6 164
2008–09	–	–	30 312	24 155
2009–10	–	–	5 505	4 087
2010–11	–	–	20 570	17 062
2011–12	243	243	29 759	23 932
2012–13	10	6	51 275	27 653
2013–14	–	–	61 486	30 129
2014–15	–	–	25 215	16 449
2015–16	–	–	11 540	6 383
2016–17	100	100	13 698	6 877
2017–18	–	–	6 960	1 942
2018–19	–	–	8 585	3 189
2019–20	–	–	–	–
2020–21	–	–	–	–
2021–22	–	–	–	–
2022–23	–	–	–	–
2023–24	–	–	200	90

1.4 Illegal catch
It is widely believed that the level of illegal harvesting is high around Wellington and on the Wairarapa coast. For further information on illegal catch refer to the Introduction – Pāua chapter.

1.5 Other sources of mortality
For further information on other sources of mortality refer to the Introduction – Pāua chapter.

2. BIOLOGY

For further information on pāua biology refer to the Introduction – Pāua chapter. A summary of published estimates of biological parameters for PAU 2 is presented in Table 4.

Table 4: Estimates of biological parameters (*H. iris*)

Area			Estimate	Source
1. Size at maturity (shell length)				
Wellington	50% mature		71.7 mm	Naylor et al (2006)
Taranaki	50% mature		58.9 mm	Naylor & Andrew (2000)
Meta-analysis for fished areas (all QMAs)	50% mature		90.5 mm	Neubauer & Tremblay-Boyer (2019)
2. Fecundity = a (length)^b (eggs, shell length in mm)				
Taranaki		a = 43.98	b = 2.07	Naylor & Andrew (2000)
3. Exponential growth parameters (both sexes combined)				
Wellington	g_{50}		30.58 mm	Naylor et al (2006)
	g_{100}		14.8 mm	
Taranaki	G_{25}		18.4 mm	Naylor & Andrew (2000)
	G_{75}		2.8 mm	
Assessment fit for commercially fished area	G_{75}		14.01 mm (SE 1.36mm)	Neubauer (2022)
	G_{125}		2.00 mm (SE 0.30 mm)	

3. STOCKS AND AREAS

For further information on stocks and areas refer to the Introduction – Pāua chapter.

4. STOCK ASSESSMENT

In 2020, the Shellfish Fisheries Assessment Working Group evaluated the overall CPUE trend and concluded (given experience with other QMAs) that the data were potentially sufficient to conduct a full length-based stock assessment in line with those run for other QMAs (e.g., Neubauer & Tremblay-Boyer 2019, Neubauer 2022). However, the Fisheries Assessment Plenary considered the stock assessment results to be insufficiently robust given concerns about the choice of the base-case scenario and sensitivities, and issues with use of the early CPUE data (i.e., FSU and CELR data). Concerns were also raised about the validity of region-wide CPUE and Catch Sampling Length-Frequency (CSLF) trends given the fine-scale stock structure of pāua. An updated model addressing concerns raised in the 2020 plenary was presented to plenary in May 2021, including updated data to the 2020 fishing year. In reviewing standardised CPUE series in 2025 the Plenary raised significant concerns over the plausibility of the 2021 assessment (given its sensitivity to assumptions, concerns about hyper-stability and the lack of signal in the standardised PCELR CPUE series). The Plenary therefore considered that the 2021 assessment was no longer appropriate for future assessment and management and undertook a qualitative evaluation on the basis of a standardised ERS CPUE series which only covers the most recent 5 years.

4.1 2025 Management procedure development and standardised CPUE series

4.1.1 Management procedure development

Two projects in 2025 were combined to develop management procedures (MPs) and harvest control rules across all PAU QMAs in order to facilitate timely TACC adjustments based on trends in CPUE and length compositions of the catch. Although much of the development has been completed, the process to develop, simulation-test and implement management procedures is ongoing, and no management procedures developed under the projects had been adopted by May 2025.

The types of management procedures under consideration rely on standardised CPUE in recent years, as well as trends in CPUE and the over-all length compositions. Although no management procedures have been adopted, developing MP inputs showed a number of areas with consistent declines in CPUE over a number of years. These trends are substantial enough to pose a potential sustainability risk, and the Shellfish Working Group therefore decided to explore a partial quantitative stock assessment for PAU 2 on the basis of recent (PCELR & ERS) CPUE trends.

4.1.2 Standardised CPUE for PCELR and ERS data

CPUE standardisation was carried out using a Bayesian Generalised Linear Mixed Model (GLMM) which partitioned variation among management zones within QMAs. The model was run independently over PCELR (2002–2020) and ERS (2020–2025) data, using offset year CPUE (April-March) in order to include the most recent available data.

CELR data prior to 2002 were considered unreliable and unlikely to reflect abundance trends, in accordance with other recent assessments. Gear improvements and fisher turnover in the fishery during the late 1980s to the late 1990s likely cause substantial hyper-stability in CELR CPUE indices for pāua. In addition, spatial reporting during CELR years was at scales of CELR statistical areas, which do not line up with QMA boundaries. As a result, large amounts of CELR catch-per-unit effort data cannot be used for CPUE analyses at the QMA scale as the data cannot be unambiguously attributed to a single QMA.

CPUE was defined as the log of daily catch per hour and number of statistical areas. Variables in the model were fishing year, client number (ACE holder), management zone (region), and diver ID. Unlike previous standardisations of PCELR and ERS CPUE, the statistical area was not used as a covariate, but the number of statistical areas fished was treated as an additional component of fishing effort.

Variability in CPUE was mostly explained by differences among divers and ACE-holders (Clients; Figure 3). CPUE declined early in the PCELR series but was largely fluctuating without strong trends at the QMA level during the PCELR years. At the regional level, some differences are apparent, with slow and steady declines over the first half of the time-series in South Wairarapa and Palliser, followed by a flat trend, while Turakirae had above average CPUE towards the end of the PCELR time-series after initial declines. The northern statistical areas (Statistical Areas 001–020) appear to fluctuate without a clear trend. The Plenary rejected the PCELR CPUE series because of apparent standardisation effects and concerns that it may not reflect abundance. Recent CPUE trends showed a substantial decline since 2021 in all areas (Figure 4) and for the stock as a whole (Figure 5).

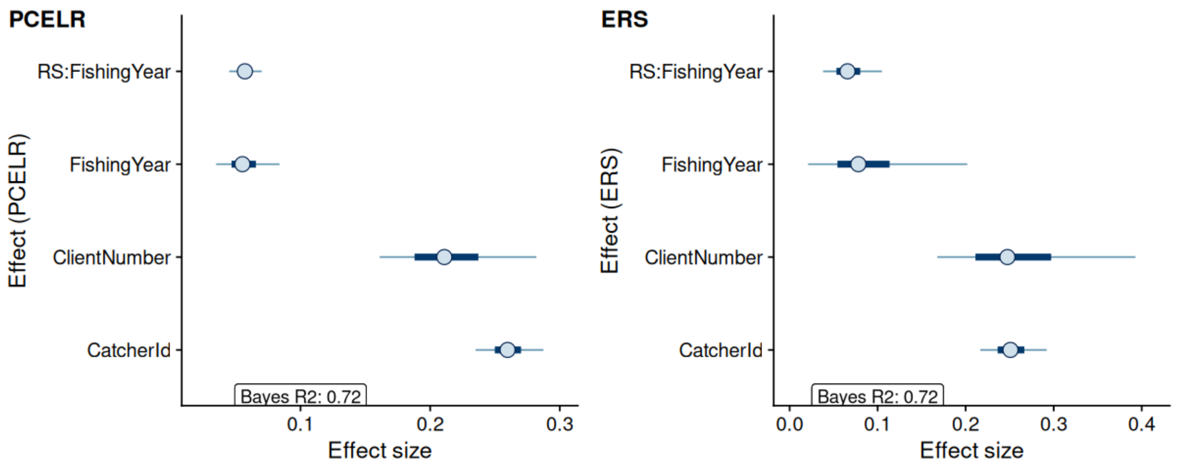


Figure 3: Effect size for the CPUE index standardisation models across PCELR data (2002–2020) and ERS (2020–2025) offset-year data, used to explore partial quantitative stock assessment in 2025. RS: management zone (research stratum), CatcherID: diver number.

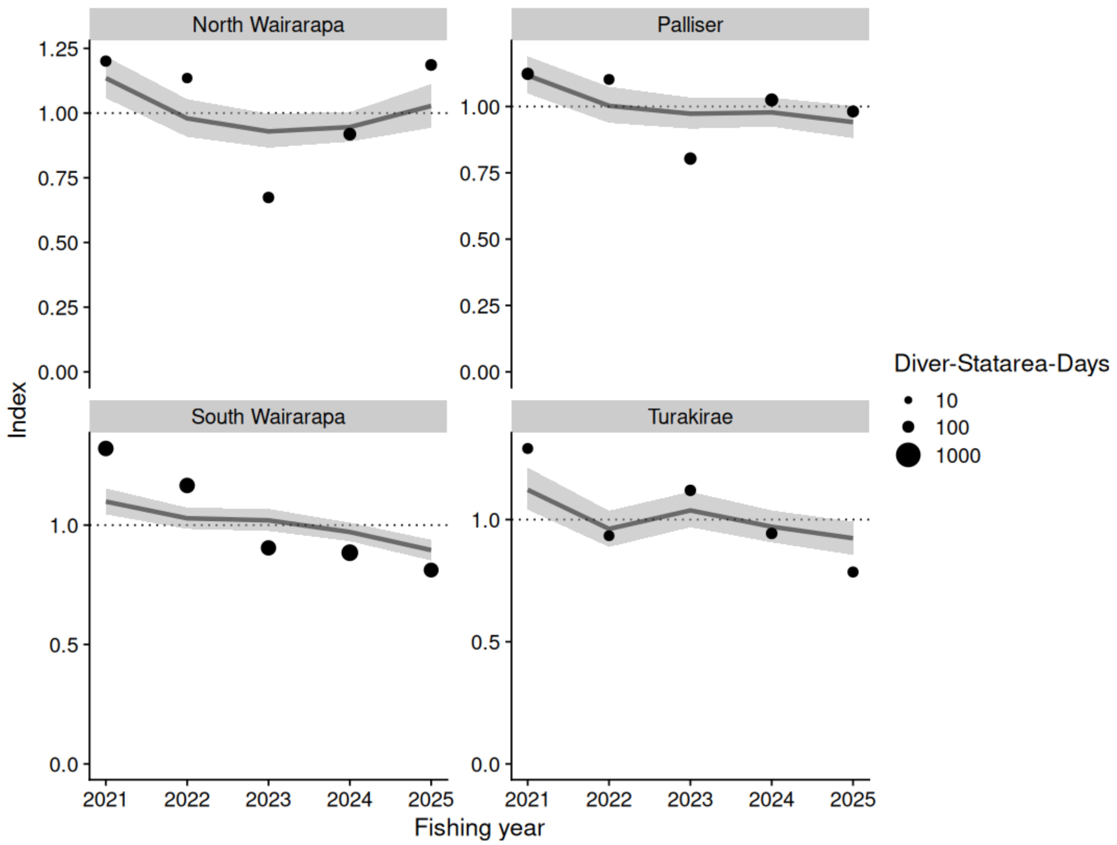


Figure 4: Standardised CPUE indices with 95% confidence intervals (solid line and ribbon) and unstandardised geometric CPUE (points) for the ERS time-series for the individual PAU 2 regions.

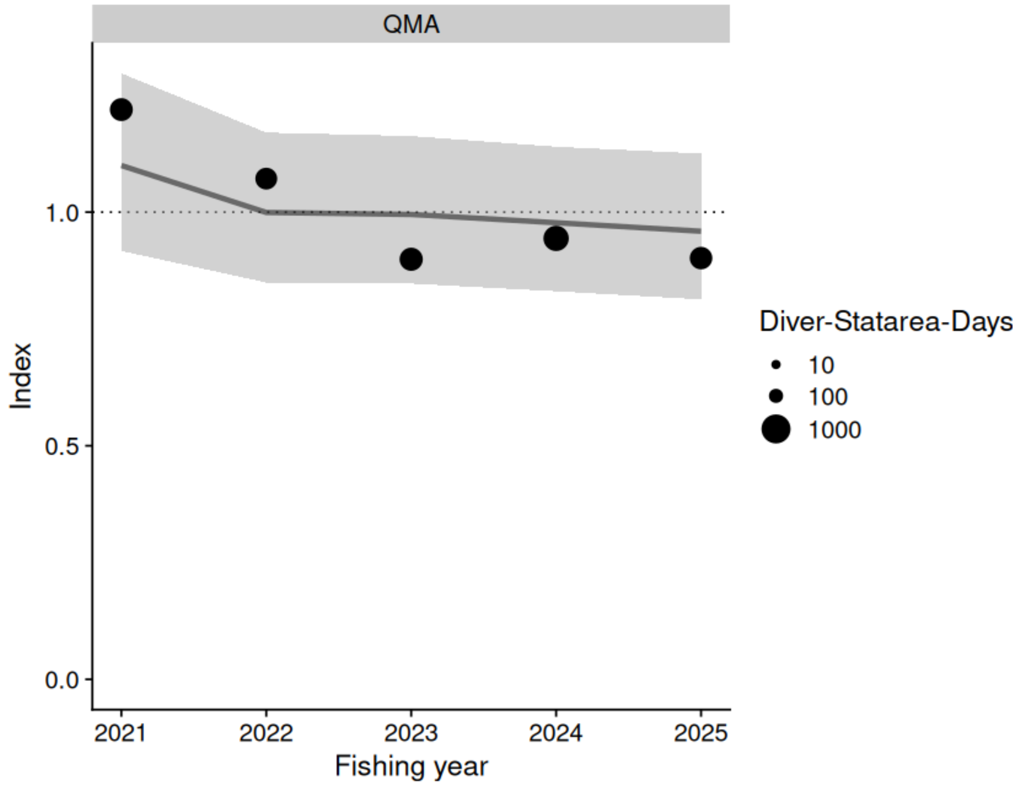


Figure 5: Standardised CPUE indices with 95% confidence intervals (solid line and ribbon) and unstandardised geometric CPUE (points) for the ERS time-series for PAU 2.

The Shellfish Working Group explored options for a partial quantitative stock assessment using a combined CPUE series aligning the separate PCELR and ERS CPUE series, defining a reference period between 2010 and 2018 (catch and PCELR series stable), but this approach was rejected by the Plenary owing to concerns over the PCELR series, and uncertainty over the appropriateness of aligning the two series.

4.2 Other factors

A key assumption of using CPUE in stock assessments or MPs is that CPUE is a reliable index of abundance. The literature on abalone fisheries suggests that this assumption is questionable and that CPUE is difficult to use in abalone stock assessments due to the serial depletion behaviour of fishers along with the aggregating behaviour of abalone. Serial depletion is when fishers consecutively fish-down beds of pāua but maintain their catch rates by moving to new unfished beds; thus CPUE stays high while the overall population biomass is actually decreasing. The aggregating behaviour of pāua results in the timely re-colonisation of areas that have been fished down, as the cryptic pāua, that were unavailable at the first fishing event, move to and aggregate within the recently depleted area. Both serial depletion and aggregation behaviour cause CPUE to have a hyperstable relationship with abundance (i.e., abundance is decreasing at a faster rate than CPUE) thus potentially making CPUE a poor proxy for abundance. The strength of the effect that serial depletion and aggregating behaviour have on the relationship between CPUE and abundance in PAU 2 is difficult to determine. However, because fishing has been consistent for a number of years and effort has been reasonably well spread, it could be assumed that recent CPUE is not as strongly influenced by these factors, relative to the early CPUE series.

The assumption of CPUE being a reliable index of abundance in PAU 2 can also be upset by exploitation of spatially segregated populations of differing productivity. This can conversely cause non-linearity and hyper-depletion in the CPUE-abundance relationship, making it difficult to accurately track changes in abundance by using changes in CPUE as a proxy.

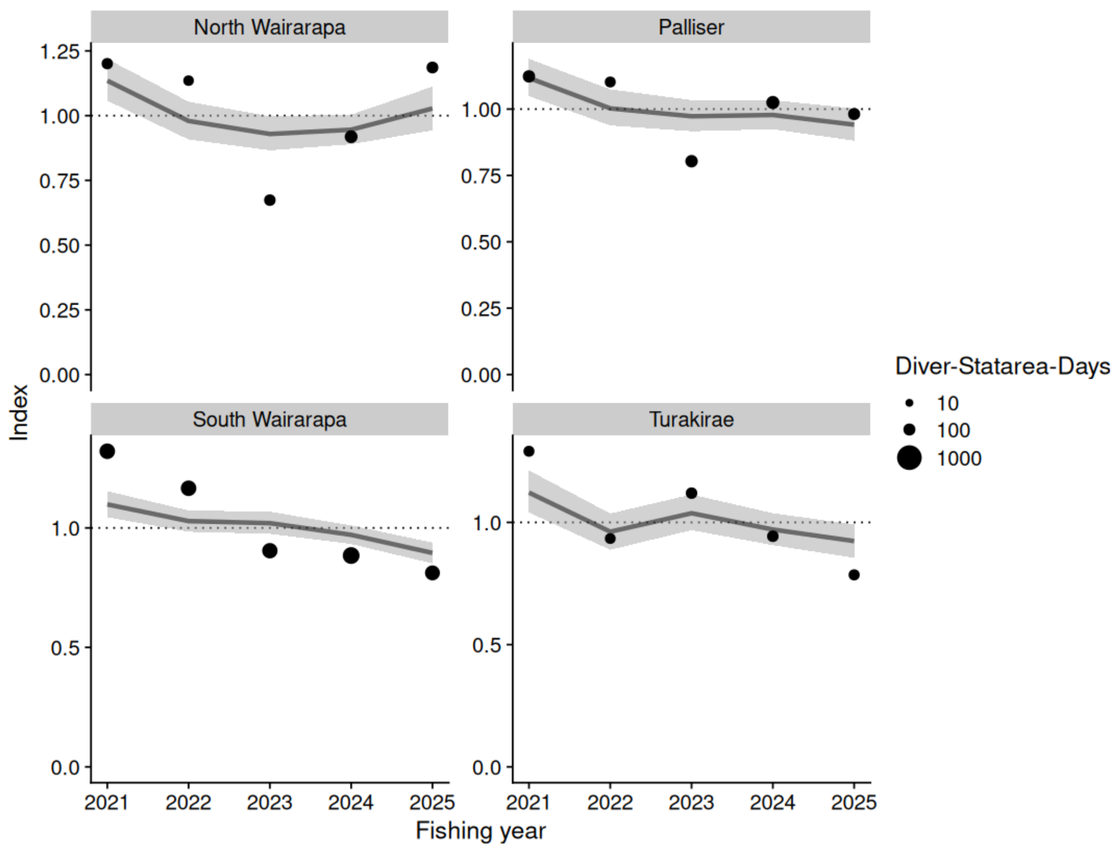
5. STATUS OF THE STOCKS

Stock Structure Assumptions

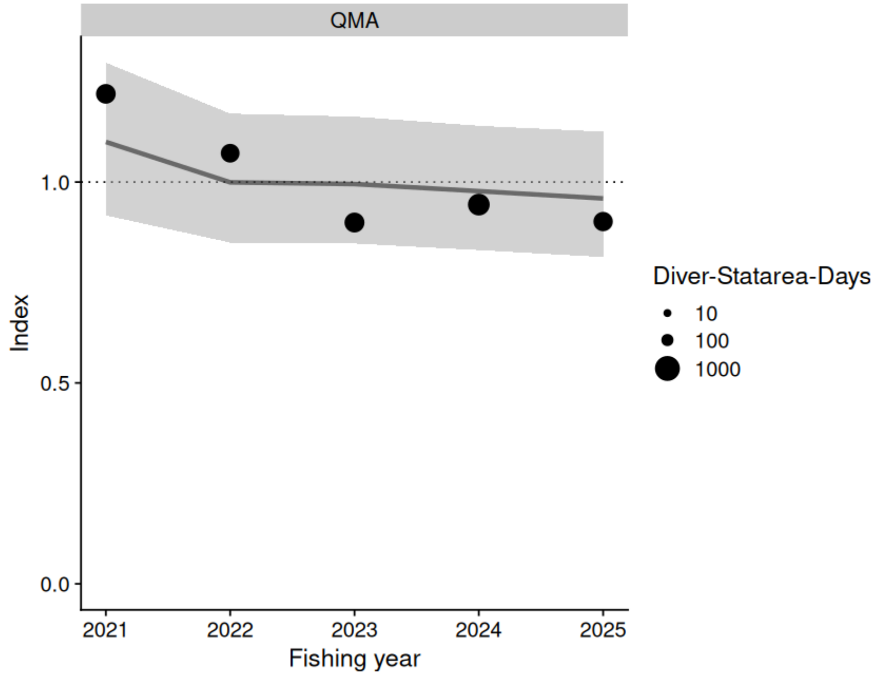
- **PAU 2 - Wairarapa**

Stock Status		
Most Recent Assessment Plenary Publication Year	2025	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2023–24	Catch: 120 t
Assessment Runs Presented	Standardised CPUE for the ERS period (offset year April-March, excluding 2019–20)	
Reference Points	Target: 40% B_0 (Default as per HSS) Soft Limit: 20% B_0 (Default as per HSS) Hard Limit: 10% B_0 (Default as per HSS) Overfishing threshold: $U_{40\%B0}$	
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



Standardised CPUE indices with 95% confidence intervals (solid line and ribbon) and unstandardised geometric CPUE (points) for the ERS time-series for the individual PAU 2 regions.



Standardised CPUE indices with 95% confidence intervals (solid line and ribbon) and unstandardised geometric CPUE (points) for the ERS time-series for PAU 2.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Recent CPUE is declining in all regions
Recent Trend in Fishing Mortality 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 commence	Unknown

Assessment Methodology		
Assessment Type	Level 3 - Qualitative Evaluation	
Assessment Method	Standardised CPUE 2020–21 to 2024–25 (offset year)	
Period of Assessment	Latest assessment: 2025	Next assessment: 2030
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	ERS CPUE series	1 – High Quality
Data not used (rank)	- PCELR CPUE series - CELR CPUE series	3 – Medium or Mixed Quality: uncertainty over standardisation and ability to link with ERS series 3 – Low Quality: variable catchability and changes in technology
	- FSU CPUE series	3 – Low Quality: poor recording

	- Commercial sampling length frequencies	1 – High Quality
Changes to Model Structure and Assumptions	Rejection of standardised PCELR series, analysis of recent ERS data only	
Major Sources of Uncertainty	Selectivity in the commercial fishery has varied spatially and over time as the voluntarily agreed Minimum Harvest Size (MHS) has changed. Different MHSs have been applied to different statistical areas within the assessed area in the same year. CPUE may be hyperstable.	

Qualifying Comments
A large proportion of PAU 2, including the Wellington south coast and west of Turakirae, is either a marine reserve or voluntarily closed to commercial fishing. This means that the data collected from the commercial fishery are exclusive of this large area and therefore the assessment only applies to the south-east component of PAU 2 (Wairarapa). The short time series of CPUE makes estimation of stock status and biological reference points difficult.

Fishery Interactions
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