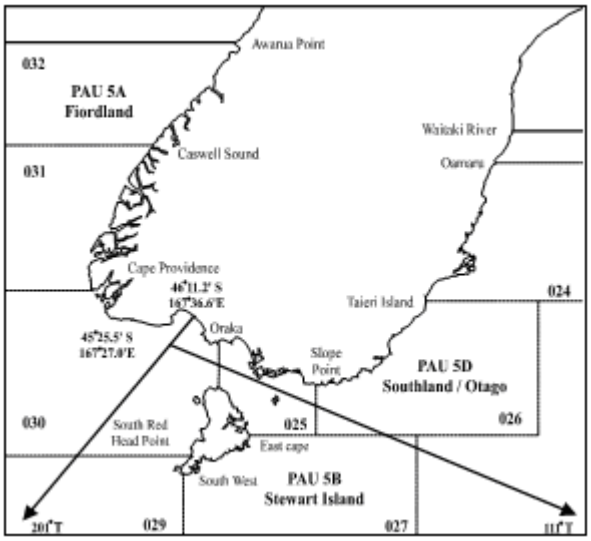
PĀUA (PAU 5A) – Fiordland

(Haliotis iris)
Pāua



1. FISHERY SUMMARY

Prior to 1995, PAU 5A was part of the PAU 5 QMA, which was introduced into the QMS in 1986 with a TACC of 445 t. As a result of appeals to the Quota Appeal Authority, the TACC increased to 492 t in the 1991–92 fishing year; PAU 5 was then the largest QMA by number of quota holders and TACC. Concerns about the status of the PAU 5 stock led to a voluntary 10% reduction in the TACC in 1994–95. On 1 October 1995, PAU 5 was divided into three QMAs (PAU 5A, PAU 5B, and PAU 5D; see the figure above) and the TACC was divided equally among them; the PAU 5A quota was set at 148.98 t.

There is no TAC for PAU 5A (Table 1): before the Fisheries Act (1996) a TAC was not required. When changes have been made to a TACC after 1996, stocks have been assigned a TAC. No allowances have been made for customary, recreational or other mortality.

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 5 and PAU 5A since introduction to the QMS.

Year	TAC	Customary	Recreational	Other mortality	TACC
1986–1991*	-	-	-	-	445
1991–1994*	-	-	-	-	492
1994–1995*	-	-	-	-	442.8
1995–present	-	-	-	-	148.98

*PAU 5 TACC figures

1.1 Commercial fisheries

The fishing year runs from 1 October to 30 September.

On 1 October 2001 it became mandatory to report catch and effort on Pāua Catch Effort Landing Returns (PCELRs) using fine-scale reporting areas that had been developed by the New Zealand Pāua Management Company for their voluntary logbook programme (Figure 1). Since 2006, the commercial industry has adopted some voluntary management initiatives which include raising the minimum harvest size for commercial fishers in specific statistical reporting areas. Starting in 2006–07, commercial fishers have been voluntarily shelving a percentage of their Annual Catch Entitlement (ACE), which is reflected by the annual catch landings falling below the TACC (Figure 2, Table 2).

These voluntary measures are now implemented under the PAU 5 Fisheries Plan approved under section 11A of the Fisheries Act by the Minister for Oceans and Fisheries in 2023.

PAU 5A landings were close to the TACC from the fishing year 1995–96 to 2005–06, but dropped to an average of 105 t a year from 2006–07 onwards (Table 2 and Figure 2) due to shelving agreed to in the fisheries plan. Landings for PAU 5 prior to 1995–96 are reported in the Introduction – Pāua chapter.

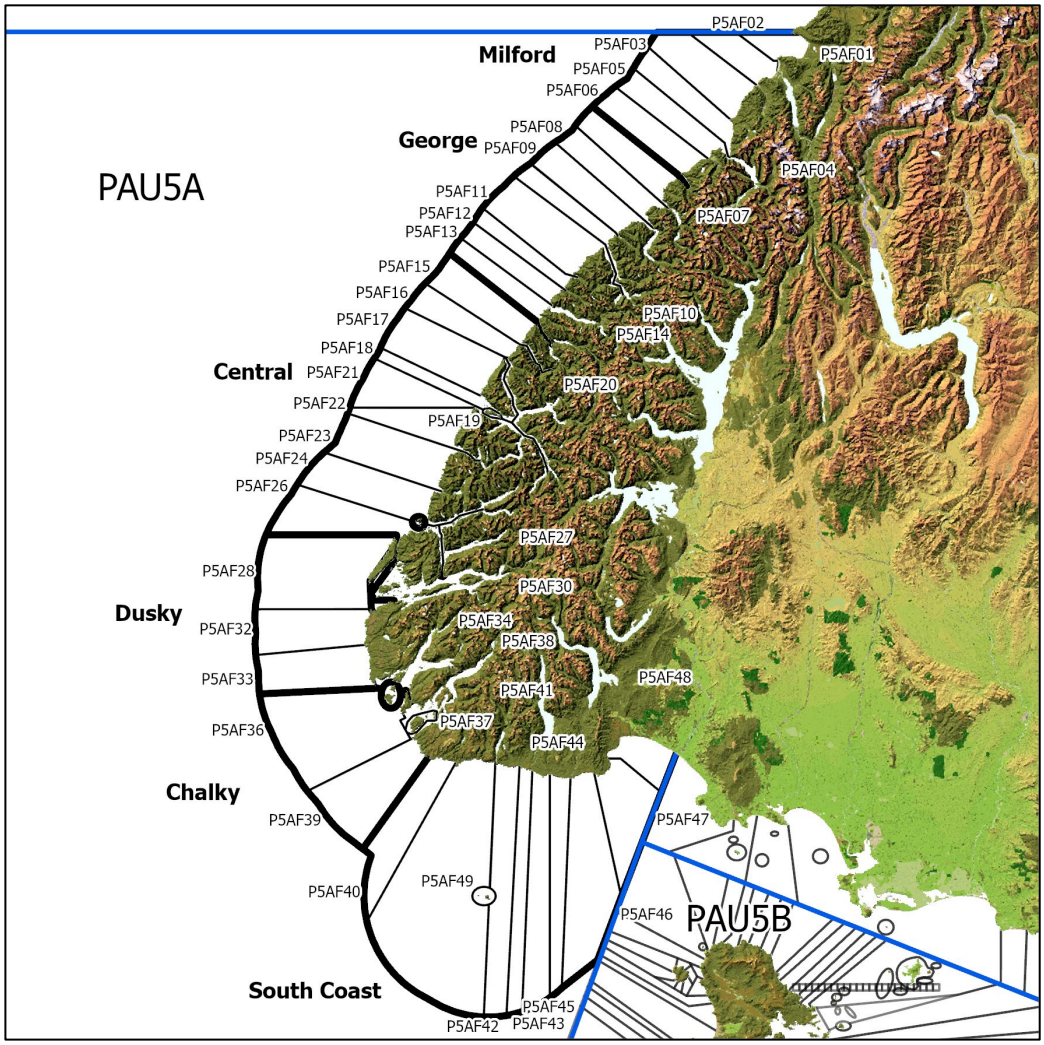


Figure 1: Map of Pāua Statistical Areas, and voluntary management strata in PAU 5A.

Table 2: TACC and reported landings (t) of pāua in PAU 5A from 1995–96 to the present from MHR returns. The last column shows the TACC after shelving has been accounted for.

Year	Landings	TACC	Shelving	Year	Landings	TACC	Shelving
1995–96	139.53	148.98	–	2010–11	104.40	148.98	104.29
1996–97	141.91	148.98	–	2011–12	106.23	148.98	104.29
1997–98	145.22	148.98	–	2012–13	105.56	148.98	104.29
1998–99	147.36	148.98	–	2013–14	102.30	148.98	104.29
1999–00	143.91	148.98	–	2014–15	106.95	148.98	104.29
2000–01	147.70	148.98	–	2015–16	106.84	148.98	104.29
2001–02	148.53	148.98	–	2016–17	106.50	148.98	104.29
2002–03	148.76	148.98	–	2017–18	107.45	148.98	104.29
2003–04	148.98	148.98	–	2018–19	99.66	148.98	104.29
2004–05	148.95	148.98	–	2019–20	103.03	148.98	104.29
2005–06	148.92	148.98	–	2020–21	106.02	148.98	104.29
2006–07	104.03	148.98	104.29	2021–22	114.88	148.98	104.29
2007–08	105.13	148.98	104.29	2022–23	111.51	148.98	111.74
2008–09	104.82	148.98	104.29	2023–24	93.86	148.98	111.74
2009–10	105.74	148.98	104.29				

1.2 Recreational fisheries

The National Panel Survey estimated that about 0.42 t (CV 0.76) of pāua were harvested by recreational fishers in PAU 5A in 2011–12 (Wynne-Jones et al 2014). The National Panel Survey was repeated in 2017–18 (Wynne-Jones et al 2019) and the estimated harvest for PAU 5A was 0.71 t (CV 0.81). The most recent survey harvest estimate for PAU 5A is 1.58 t (CV 0.68) for 2022–23 (Heinemann & Gray 2024).

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

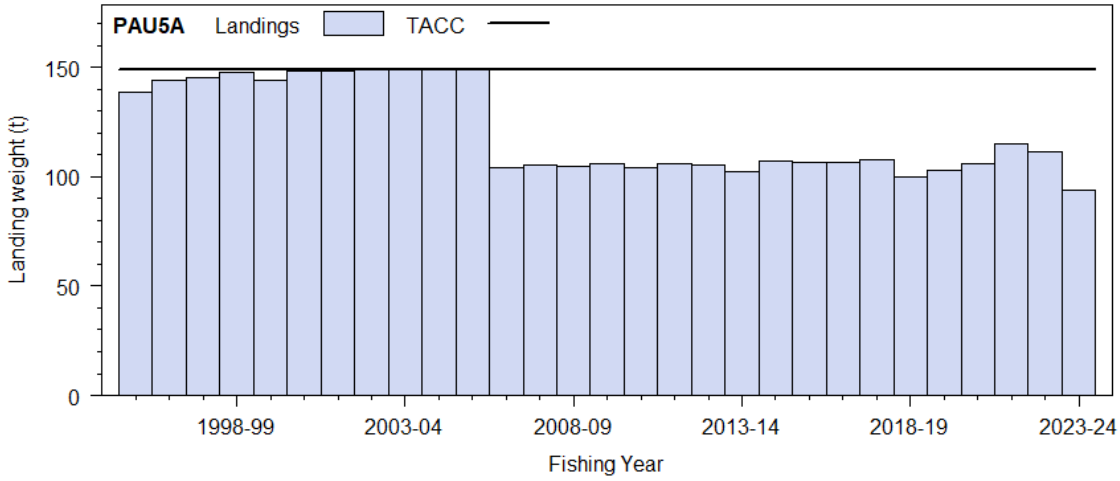


Figure 2: Landings and TACC for PAU 5A from 1995–96 to the present. For historical landings in PAU 5 prior to 1995–96, refer to figure 1 and table 1 in the Introduction – Pāua chapter.

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 5A are shown in Table 3. These numbers are likely to be an underestimate of customary harvest as only the catch approved and harvested in numbers is 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 in numbers) in PAU 5A since 2001–02. – no data.

	Numbers			Numbers	
Fishing year	Approved	Harvested	Fishing year	Approved	Harvested
2000–01	80	70	2012–13	–	–
2001–02	–	–	2013–14	–	–
2002–03	–	–	2014–15	255	50
2003–04	–	–	2015–16	–	–
2004–05	–	–	2016–17	200	200
2005–06	–	–	2017–18	–	–
2006–07	100	100	2018–19	–	–
2007–08	100	100	2019–20	850	820
2008–09	150	150	2020–21	–	–
2009–10	150	150	2021–22	–	–
2010–11	512	462	2022–23	–	–
2011–12	590	527	2023–24	–	–

Records of customary non-commercial catch taken under the South Island Regulations show that about 70 pāua were taken in 2001–2002, then nothing until 2007–08. From 2007–08 to 2012–13, 100 to 500 pāua were collected each year. Since then, less pāua have been reported as caught (maximum 200 t in 2017–18).

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

1.4 Illegal catch

There is qualitative data to suggest Illegal, unreported, unregulated (IUU) activity in this Fishery. There are no quantitative estimates of illegal catch for PAU 5A.

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. Biological parameters derived using data collected from PAU 5A are summarised in Table 4. Size-at-maturity, natural mortality and annual growth increment parameters were estimated within the assessment model.

Table 4: Estimates of biological parameters (*H. iris*). All estimates are external to the model.

Stock area		Estimate	Source
1. Weight = a (length)^b (weight in kg, shell length in mm)			
PAU 5A	a = 2.99E-08	b = 3.303	Schiel & Breen (1991)
2. Size at maturity (shell length)			
PAU 5A	50% mature	91 mm (89–93)	Median (5–95% range) estimated outside of the assessment
	95% mature	103 mm (101–105)	
3. Estimated annual growth increments (both sexes combined)			
PAU 5A	At 75 mm	16.65 mm (15.96–24.29)	Median (5–95% range) estimated outside of the assessment
	At 120 mm	4.57 mm (3.27–6.40)	

3. STOCKS AND AREAS

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

4. STOCK ASSESSMENT

For 2010 and 2014, the stock assessments for PAU 5A had split PAU 5A into two subareas; the southern area which included the Chalky and South Coast strata, and the northern area which included the Milford, George, Central, and Dusky strata (Figure 1). Separate stock assessments were conducted in each subarea. The division was based on the availability of data, differences in exploitation history and management initiatives. Prior to 2010 the area was assessed as a single area. The 2020 assessment re-evaluated the split of PAU 5A into two subareas, and concluded that the data used for the separate assessments did not adequately reflect the differences in these areas, and the 2020 assessment was therefore run in two configurations: as a single area assessment over all of PAU 5A, and by splitting the area into three areas (statistical areas around Milford Sound (large scale Statistical Area 032) were separated from the previously defined Northern area due to slower growth) and fitting a spatial version of the assessment model (Neubauer 2020). Initial assessment runs suggested no difference in key estimated quantities between the spatial and single-area models, and the SFWG decided to proceed with the more parsimonious single area model. In reviewing the standardised CPUE series in 2025 the Plenary raised significant concerns over the plausibility of the 2020 assessment (given its sensitivity to assumptions, concerns about hyper-stability and the lack of signal in the standardised PCELR CPUE series despite significant shelving of catch since 2007). The Plenary therefore considered that the 2020 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 Relative abundance estimates from research diver surveys

Relative abundance of pāua in PAU 5A has previously been estimated from research diver surveys conducted in 1996, 2002, 2003, 2006, and 2008–2010. Not every stratum was surveyed in each year, and before 2005–06 surveys were conducted only in the area south of Dusky Sound.

Concerns about the reliability of this data as an estimate of relative abundance instigated several reviews in 2009 (Cordue 2009) and 2010 (Haist 2010). The reviews assessed i) the reliability of the research diver survey index as a proxy for abundance and ii) whether the Research Diver Survey Index (RDSI), when used in the pāua stock assessment models, results in model outputs that do not adequately reflect the status of the stocks. Both reviews suggest that outputs from pāua stock assessments using the RDSI should be treated with caution. Consequently, these data were not included in the assessment. For a summary of the conclusions from the reviews refer to the Introduction – Pāua chapter.

4.2 2025 Management procedure development and standardised CPUE series

4.2.1 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 overall 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 5A on the basis of recent (PCELR & ERS) CPUE trends.

4.2.2 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). Early variation in CPUE between 2002 and 2010 is likely to be attributed to catch reductions (shelving) since 2007 and associated catch-spreading arrangements, leading to region scale CPUE series that were fluctuating without trends during the PCELR years, and a PAU 5A series that was very stable. 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 (Figure 4, Figure 5).

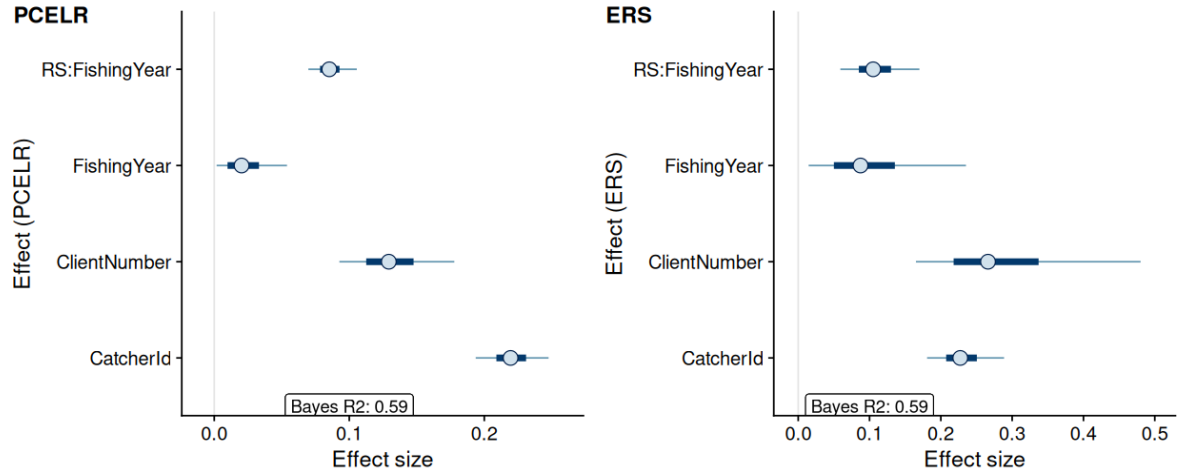


Figure 3: Effect size for the CPUE index standardisation models across PCELR data (2002–2020) and ERS (2020–2025) offset-year data, used to explore partial quantitative stock assessment in 2025. RS: management zone (research stratum), CatcherID: diver number.

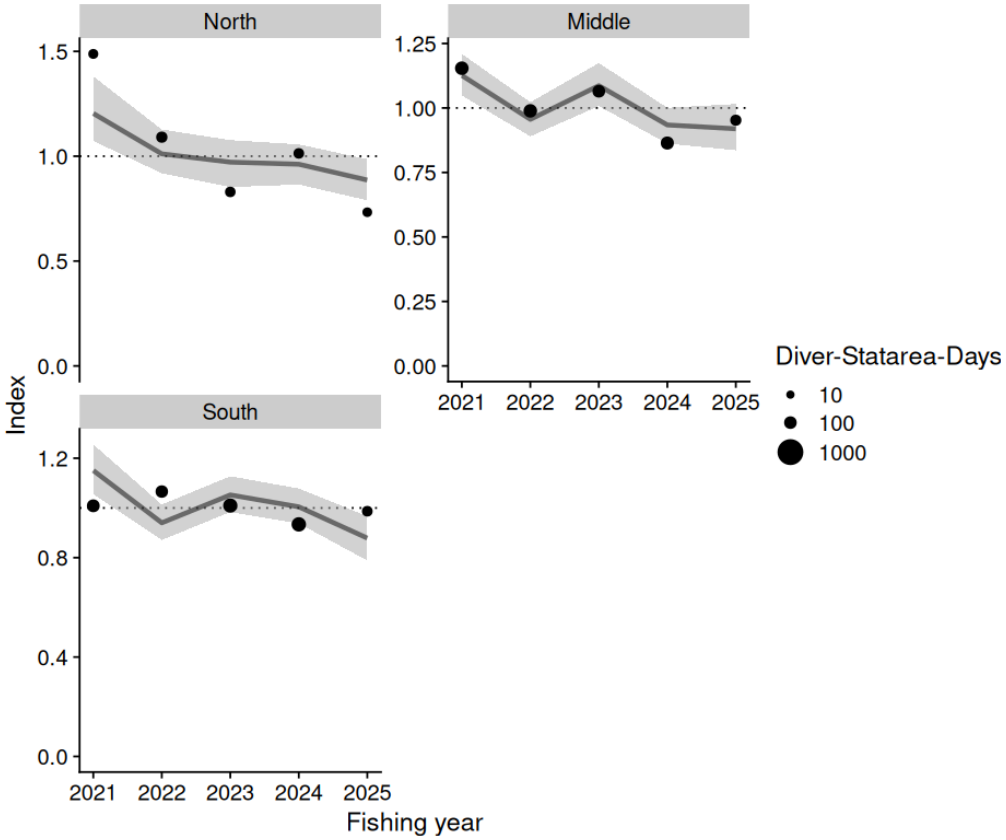


Figure 4: Standardised CPUE indices with 95% confidence intervals (solid line and ribbon) and unstandardised geometric CPUE (points) for the ERS time-series for the individual PAU 5A fishery regions.

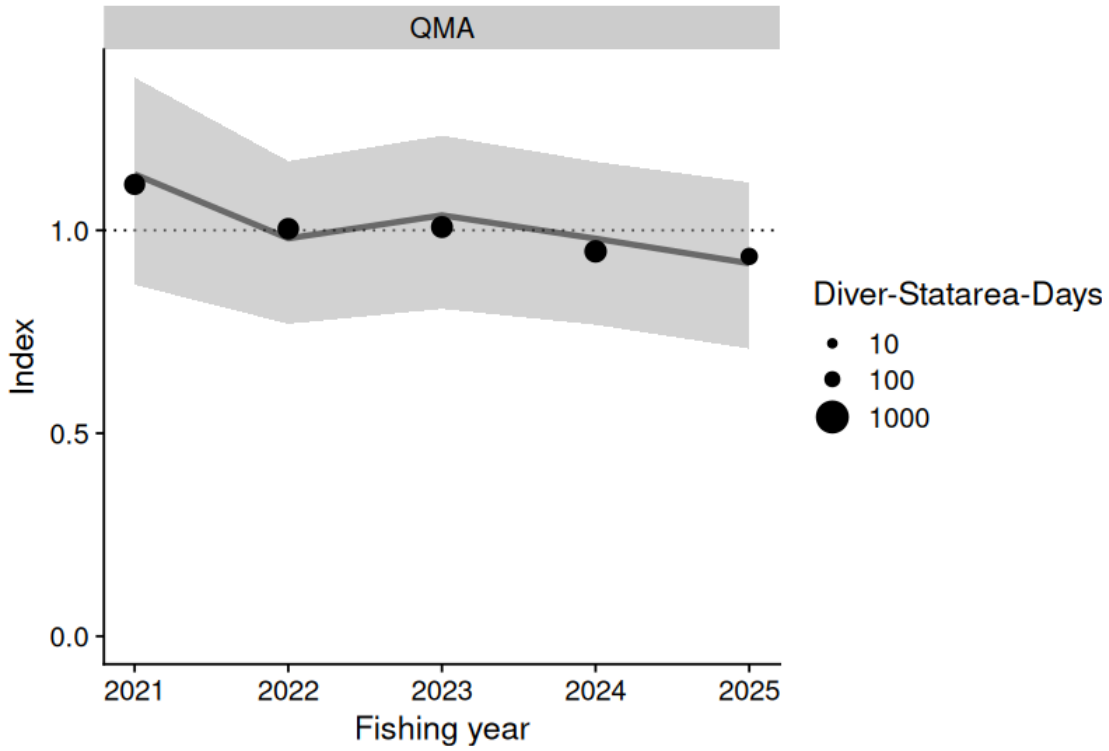


Figure 5: Standardised CPUE indices with 95% confidence intervals (solid line and ribbon) and unstandardised geometric CPUE (points) for the ERS time-series for PAU 5A.

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.

4.3 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 5A 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 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 5A 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.

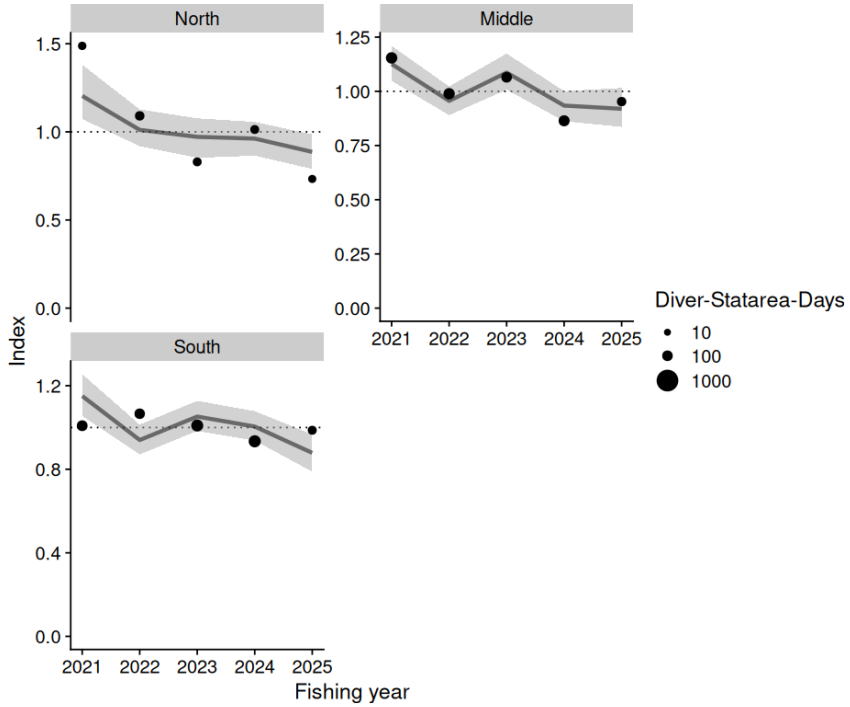
5. STATUS OF THE STOCKS

Stock Structure Assumptions
A genetic discontinuity between North Island and South Island pāua populations was found approximately around the area of Cook Strait (Will & Gemmell 2008).

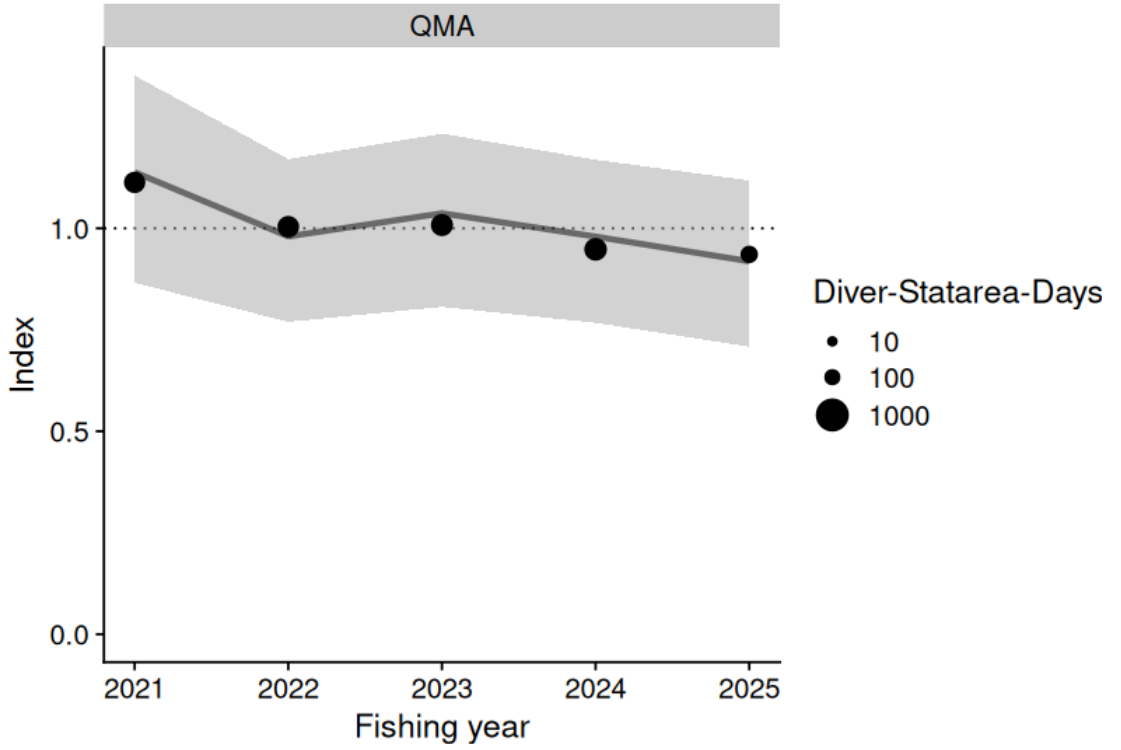
- **PAU 5A - Fiordland**

Stock Status		
Most Recent Assessment Plenary Publication Year	2025	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2023–24	Catch: 93 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 5A fishery regions.



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

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Recent CPUE is declining overall and in most regions.
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	Likely (> 60%) at current catch levels Very Likely (> 90%) at TACC levels

Assessment Methodology and Evaluation		
Assessment Type	Level 3 - Qualitative Evaluation	
Assessment Method	Standardised CPUE 2020–21 to 2024–25 (offset year)	
Assessment Dates	Latest assessment Plenary publication year: 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	3 – Medium or Mixed Quality: uncertainty over standardisation and ability to link with ERS series

	- Commercial sampling length frequencies	2 – Medium or Mixed Quality: not believed to be fully representative of the entire QMA
	- Tag recapture data (for growth estimation)	1 – High Quality
	- Maturity at length data	1 – High Quality
	- Research Dive Survey Indices	3 – Low Quality: not believed to index the stock
	Research Dive Length Frequencies	3 – Low Quality: not believed to be representative of the entire QMA
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 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
The short time series of CPUE makes estimation of stock status and biological reference points difficult.

Fishery Interactions
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6. FOR FURTHER INFORMATION

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