Tasmanian Longspined sea urchin fishery assessment 2024/25

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Executive Summary

STOCK STATUS	SUSTAINABLE
Fishing mortality in the Centrostephanus rodgersii fishery is represented by annual catch (tonnes) as a proxy. In the most recent 2024/25 season, the annual catch in Tasmania was 300 tonnes, making the total 3139 tonnes over the last 7 seasons of the fishery, averaging 448 tonnes per year. The region with the highest catch was St Helens, consistent with previous years. Standardised catch rates show a consistent gradual decline over the most recent five seasons, which may represent an early signal of stock depletion at broader spatial scales, which would be an ecologically desirable outcome for a control fishery. However, the fishery is still classified as sustainable because biomass appears to be above that which would affect recruitment and because fishing mortality is not likely to cause recruitment overfishing. The declining catch rate trend warrants monitoring in future assessments. The mean depth of the fishery has increased over time, suggesting declining densities of stock at shallower depths. The shift in effort to different regions has been influenced by changes to the spatially structured harvest incentive program, so cannot be interpreted as evidence of stock depletion by fishing. Biomass assessed by fishery-independent transect data has increased over the last two decades. There is evidence that recruitment in Tasmania is partially decoupled from Tasmanian biomass with some larvae originating from interstate.	
STOCK	Tasmanian Longspined sea urchin fishery
INDICATORS	Catch, effort, CPUE trends and transects.

Centrostephanus rodgersii has been harvested commercially in Tasmania since 2009. The annual catch remained below 100 tonnes for the first 9 years of the fishery but increased in recent years, with a commercial catch of 300 tonnes for the most recent 2024/25 season, totalling 3139 tonnes over the last 7 seasons combined. Standardised catch per unit effort (CPUE in kg/hr) shows a consistent gradual decline over the most recent five seasons. While this trend does not yet indicate recruitment overfishing, it warrants monitoring in future assessments and may reflect early evidence that the fishery is beginning to achieve its ecological control objective in some regions.

The link between catch rate and abundance is known to be unclear in spatially aggregated fisheries due to hyperstability. This is because at high stock density the abundance of urchins is less limiting on catch rate than the logistics of diving operations. Any possible declines in catch rate may be further masked by serial depletion with divers shifting to new areas or depths, meaning there is a possibility that the observed CPUE decline underestimates the true rate of stock reduction.

A survey of the commercial divers has suggested that in some areas divers have been forced into deeper waters by using Nitrox to sustain high catch rates (Cresswell et al. 2019). This is supported by the fishery data, with the mean depth of the fishery increasing over time, suggesting declining densities of urchins at shallower more accessible depths. Fishery-independent surveys are underway and will provide stock information unaffected by catch rate biases.

Stock status definitions

We have adopted the most recent guidelines for national stock status categories, as specified by the Fisheries Research and Development Corporation.

Acknowledgements

IMAS wish to acknowledge funding from the Tasmanian Government (NRE), access to urchins and other support in data collection by Salty Roe Seafood and Tasmanian Blue Seafood, as well as many divers involved in the fishery.

Introduction

Overview

Centrostephanus rodgersii (the Longspined sea urchin or Centro) is not native to Tasmania historically, nor is it considered an introduced marine pest. Rather, this species has recently undergone a range extension to Tasmania from NSW due to extensions in the warm East Australia Current brought about by climate change (Johnson et al. 2005, Ridgway 2007, Ling 2008). Increased populations of Longspined sea urchins are of concern because they can damage kelp forests through overgrazing (Ling et al. 2009, Johnson et al. 2011, Marzloff et al. 2016). Once established on a reef, increases in urchin density and subsequent grazing pressure of this species leads to discrete patches of bare rock termed 'incipient' barrens (Johnson et al. 2005). If urchin density continues to increase in incipient barrens, the grazed patches grow and join together into larger patches, leading to the formation of 'extensive' urchin barrens. Urchin barrens represent a dramatic and persistent loss of reef biodiversity and productivity, and once formed are difficult to reverse (Chapman 1981, Andrew and Underwood 1989, Filbee-Dexter and Scheibling 2014, Ling et al. 2015).

Commercial harvesting of *C. rodgersii* in Tasmania is therefore motivated both by classical fishery production goals as well as by ecological management objectives, to reduce urchin density below the threshold at which barrens form (Cresswell et al. 2025). This mixed framing is important for interpreting all indicators in this assessment: depletion of urchin density is the desired outcome, and a stable or increasing stock is a management concern rather than a positive result.

Fishery-independent biomass data

Biomass in the *C. rodgersii* fishery is indicated by two methods: extrapolation from counts obtained from fishery-independent transect surveys; and trends in catch per unit effort (CPUE). Biomass assessed by fishery-independent transect data has increased over the last two decades. State-wide CPUE has not decreased noticeably from the geometric mean over the span of the fishery from the first 2008/09 season to the most recent 2024/25 season, even in the most heavily fished areas.

Species biology

The profitability of a sea urchin fishery relies heavily on the marketable condition of its roe, which can vary greatly between individuals depending on many factors (Blount and Worthington 2002, Blount et al. 2017, Campus 2022). Gonad yield (as a percentage of body weight) and quality (judged by texture, colour, granularity and other factors) are both affected by food availability, diet, season and individual movement, not just size and age (Andrew and Byrne 2007, Byrne and Andrew 2020). Roe quality varies seasonally, with energy intake increasingly proportioned towards gonad development resulting in higher roe quality in the lead up to spawning, which for this species occurs around August (Ling et al. 2008). During and immediately following spawning, the roe/gonads are at low quality for the fishery, so the bulk of harvesting in Tasmania occurs between December and June. The native Tasmanian Shortspined Sea Urchin *Heliocidaris erythrogramma* has a complementary spawning season, meaning processing facilities can continue operating year-round.

Commercial urchin divers in Tasmania tend to target individual Longspined sea urchins of a size range greater than approximately 85 mm test diameter. Catch weight is confirmed by a log recording from the processor who receives the catch. The location of the catch is recorded using the abalone fishery block system. Depth is estimated by a single depth recorded on the docket, and a finer-scale approximate location is recorded in the log by the diver, along with diver ID, date, and total dive time (effort in hours).

Species ecological role

Longspined sea urchins have a pelagic larval stage of ~100 days (Huggett et al. 2005) meaning this species can travel long distances in ocean currents under the right conditions for their temperature limits (Ling and Johnson 2009). Larvae have likely travelled to Tasmania through the poleward advance of the warm East Australia Current, which has extended further south with greater frequency over the past 60 years due to climate change (Ridgway 2007, Banks et al. 2010). Longspined sea urchin was first reported on the east coast of Tasmania in 1978 (Edgar and Barrett 1997) but now extends down most of the east coast, with aggregations occurring across a broad depth range (Perkins et al. 2015). There is evidence that recruitment in Tasmania is partially decoupled from Tasmanian biomass, with some larvae originating from interstate populations (Banks et al. 2010).

Sea urchin populations are spatially structured with aggregations occurring primarily because of habitat structure and food availability, making them highly patchy as a resource (Ouréns et al. 2015, Gutierrez et al. 2017). Longspined sea urchins have low mobility, homing strongly to available crevices, and do not show directional movement towards food sources (Flukes et al. 2012), unlike other sea urchin species where directional movement towards available food results in mobile grazing fronts (Lauzon-Guay et al. 2006). Tracey et al. (2015) demonstrated this lack of directional movement in a culling experiment in Wineglass Bay, Tasmania, where *C. rodgersii* densities had not increased one year after targeted culling. This patchiness means that assessment methods should avoid the assumption of uniform distribution, and that fishers will be concentrating their efforts in the higher density patches.

The barrens formation threshold for *C. rodgersii* in Tasmania is estimated at approximately 0.7 kg/m² urchin biomass density (Johnson et al. 2005, Ling and Keane 2018). Below this density, kelp beds can persist; above it, incipient barrens may form. To reverse a barren back to kelp forest a different and much lower threshold of 0.07 kg/m² urchin biomass density is needed. We have used the lower threshold as an ecological reference point in this assessment, as used in Cresswell et al. (2025).

Urchin density control

The Tasmanian Government operates a spatially structured harvest incentive program (the subsidy scheme) to encourage commercial divers to target high-density areas and regions of ecological concern. The spatial incentive structure is revised at least annually, with changes to the zone boundaries and payment rates influencing the spatial distribution of fishing effort over time. Shifts in the regional distribution of catch should therefore be interpreted in the context of subsidy zone changes rather than as evidence of stock depletion or recovery in any particular region.

In addition to commercial harvesting, targeted culling and other removal operations are conducted by IMAS and other organisations at specific reef sites. Anecdotal reports of recreational culling also occur statewide. A ‘take-all’ harvest program, the *Fortescue Bay: Restoration by Harvest Pilot Program*, funded by the State

Government’s Abalone Industry Reinvestment Fund, has conducted systematic removal operations at Southern Fortescue Bay since 2023. In take-all harvest, all sizes are removed, even below the minimum size that can be processed and sold. Removals from culling and take-all harvests are tracked and included in biomass assessments (Table 1). Because removals from take-all harvests are recorded at the factory, they are included in the total catch figure below for the commercial fishery.

The Commercial Fishery

Catch and effort

The annual catch in 2024/25 was 300 tonnes, a decrease from 380 tonnes in 2023/24. The drop in catch this season is partly attributable to the closure of the main processing facility near the end of the season. Despite this, total catch since 2019 is 3139 tonnes (average 448 tonnes per year), reflecting a sustained period of high harvest since the fishery entered its current high-catch phase (Figure 1).

Commercial harvesting of *C. rodgersii* began in March 2009 at less than 10 tonnes per year and remained below 100 tonnes for the first nine years of the fishery. Catch increased substantially from the 2017/18 season onwards following expansion of the harvest incentive program, reaching a peak of 560 tonnes in 2018/19. In total, 3750 tonnes have been removed commercially since the fishery began, with 3139 tonnes, approximately 84% of the total, taken in the last 7 seasons.

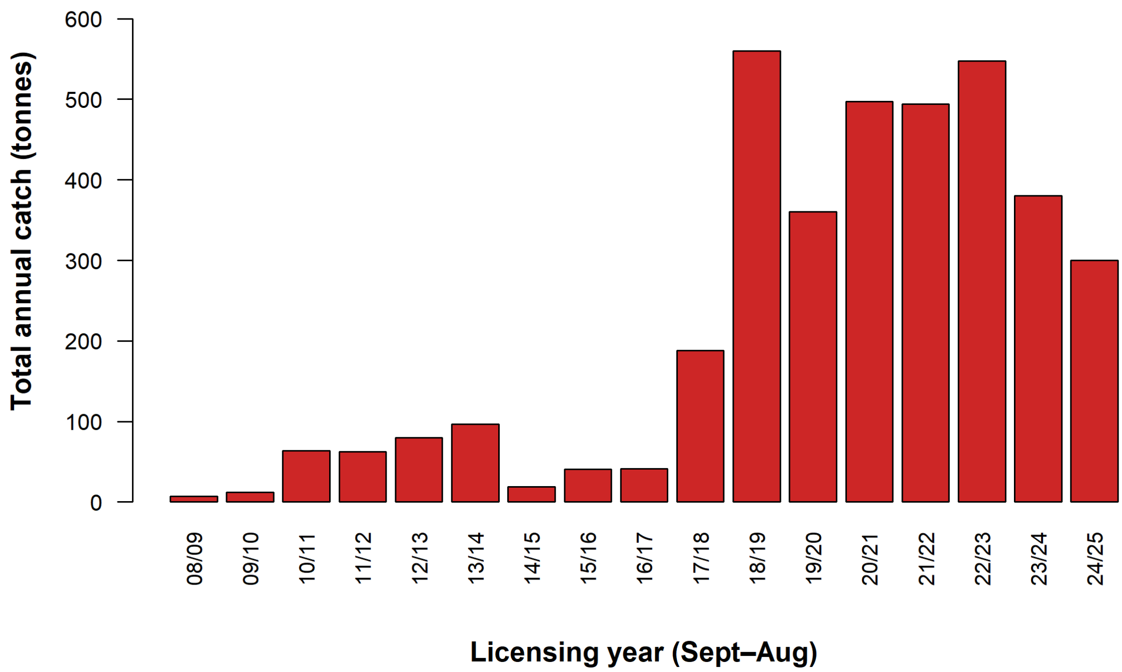

Figure 1: Annual commercial catch (tonnes) of *C. rodgersii* in Tasmania from the 2008/09 to 2024/25 season.

Monthly fishing effort is concentrated between January and June (Figure 2), preceding the winter spawning period around July/August, at which time, roe quality declines. This seasonal pattern is consistent across all years of the fishery and reflects the biology of the species, with divers targeting urchins when gonad condition is highest. In 2024/25, effort in June was proportionally lower than in the previous season and the five-year average, consistent with the closure of the main processing facility near the end of the season.

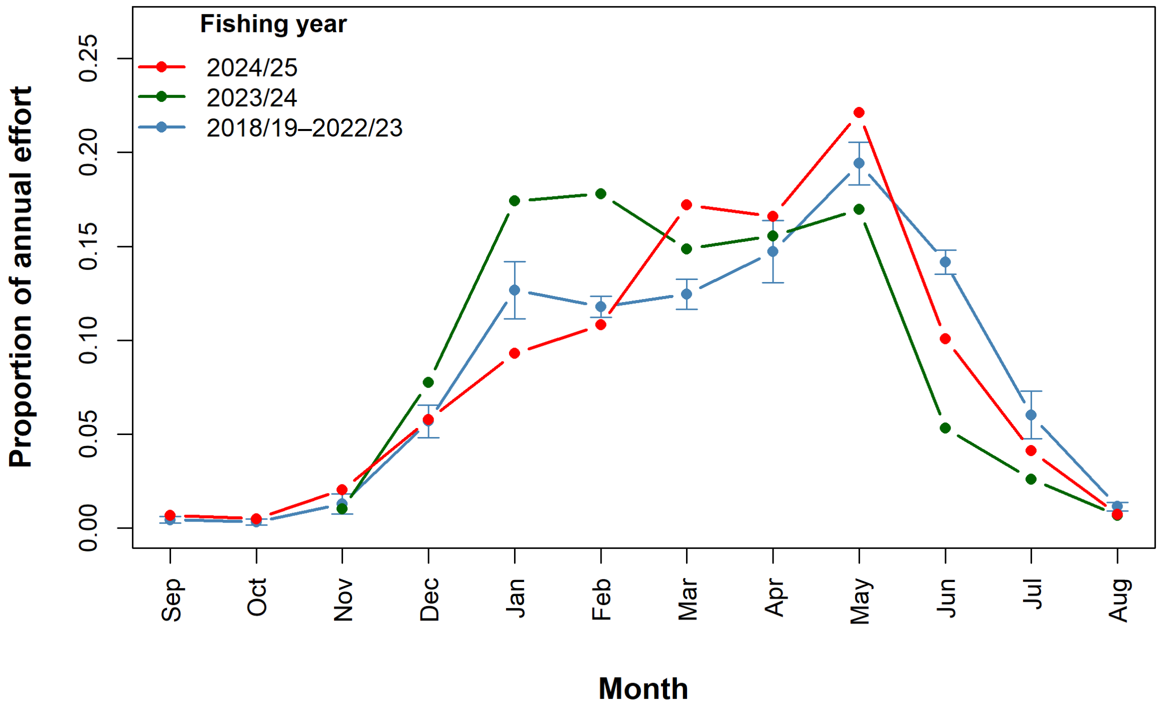

Figure 2: Proportion of annual effort by month for the latest season, previous season, and average of the preceding five years (mean ± SE). Season months run September to August.

The seasonal pattern of catch closely mirrors that of effort (Figure 3), with the majority of catch taken between January and May/June. The proportion of catch taken in the early part of the season (September to December) has remained consistently low across all years of the fishery, reflecting the poor roe quality immediately following the winter spawning period.

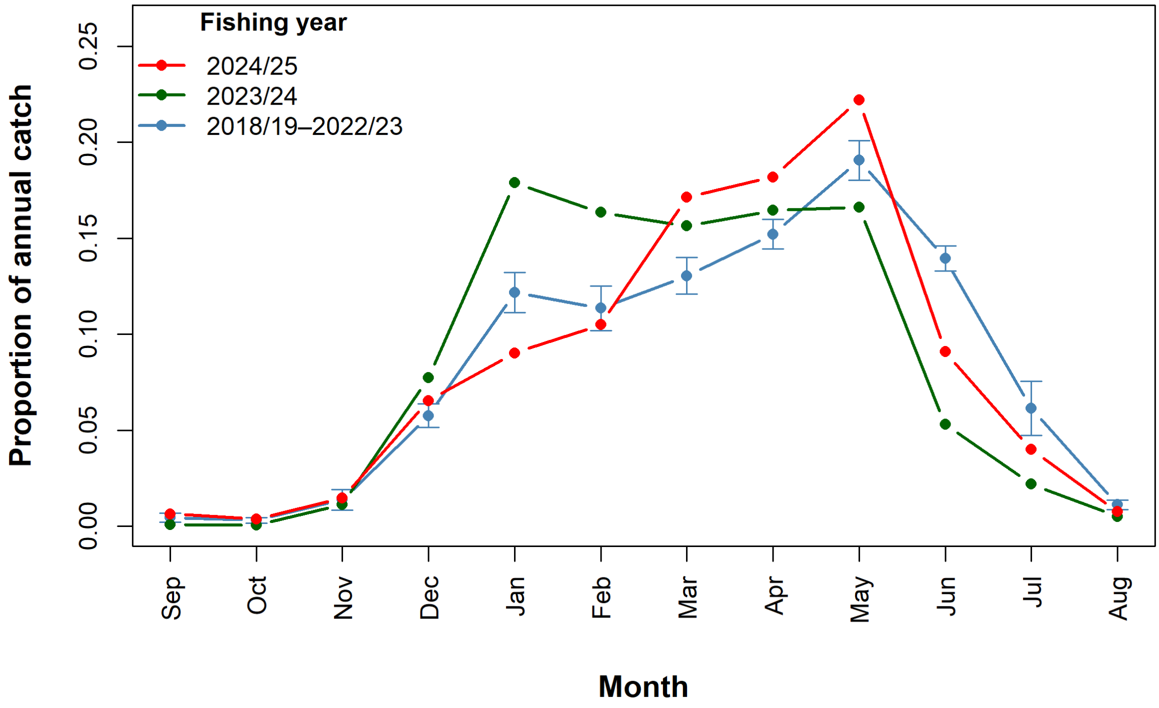

Figure 3: Proportion of annual catch by month for the latest season, previous season, and average of the preceding five years (mean ± SE). Season months run September to August.

Spatial distribution of the catch

The fishery operates within a spatially structured harvest incentive program funded by the Abalone Industry Reinvestment Fund. The subsidy structure is reviewed annually by the Centro Subcommittee and has changed in structure a number of times since its introduction in late 2016. The most recent structure for 2024/25, operational from 1 December 2024, is shown in Figure 4. Zone 1 (blocks 25 to 27, inclusive, and block 31A) was incentivised at $1.00/kg; Zone 2 (block 24 and subblock 31A) at $1.25/kg; Zone 3 (blocks 22 and 23) at $2.00/kg; and Zone 4 (blocks 20 and 21) at $3.50/kg. Approximately $300,000 of incentive funding was applied across the four zones. The spatial distribution of fishing effort in any given season should be interpreted in the context of the prevailing subsidy structure, as divers respond strongly to the financial incentives when choosing where to fish.

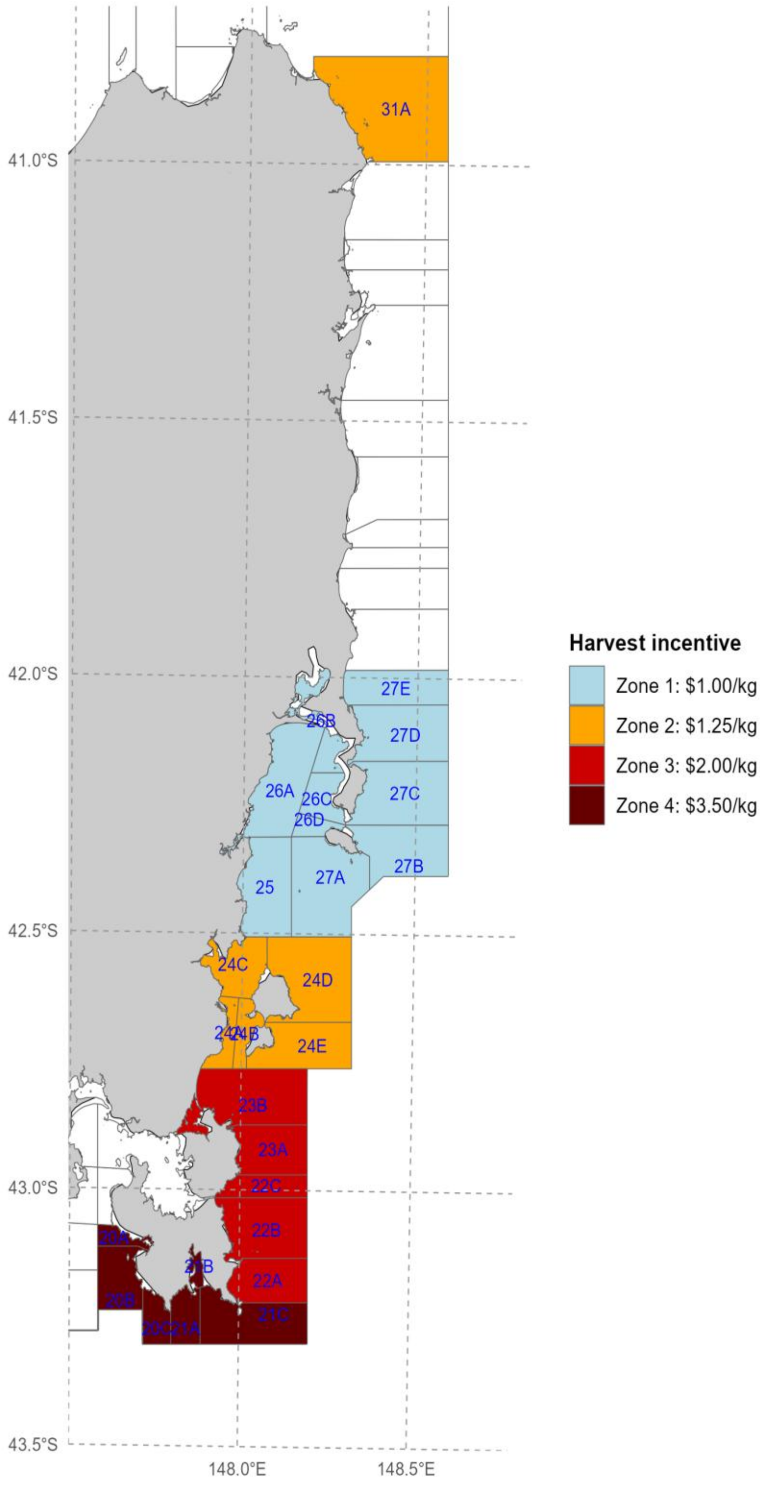

Figure 4: Map of the harvest incentive subsidy zones for the 2024/25 season, operational from 1 December 2024. Light blue: Zone 1 ($1.00/kg, blocks 25-27); orange: Zone 2 ($1.25/kg, block 24 and 31A); red: Zone 3 ($2.00/kg, blocks 22-23); dark red: Zone 4 ($3.50/kg, blocks 20-21).

The St Helens region (Region 2) has consistently contributed the greatest proportion of the catch, reflecting the highest urchin densities on the east coast (Figure 5). In

2024/25, St Helens accounted for 32% of total catch, consistent with its historical dominance of the fishery.

The spatial distribution of catch has shifted over time, with proportionally more catch taken from central and southern regions in recent seasons compared with the early years of the fishery. This shift reflects changes to the spatially structured harvest incentive program, which has progressively encouraged divers to target blocks outside the northern St Helens area. The change in spatial distribution of effort cannot therefore be interpreted as evidence of stock depletion by fishing in any particular region, but rather as a deliberate management response to incentivise broader spatial coverage of harvesting effort.

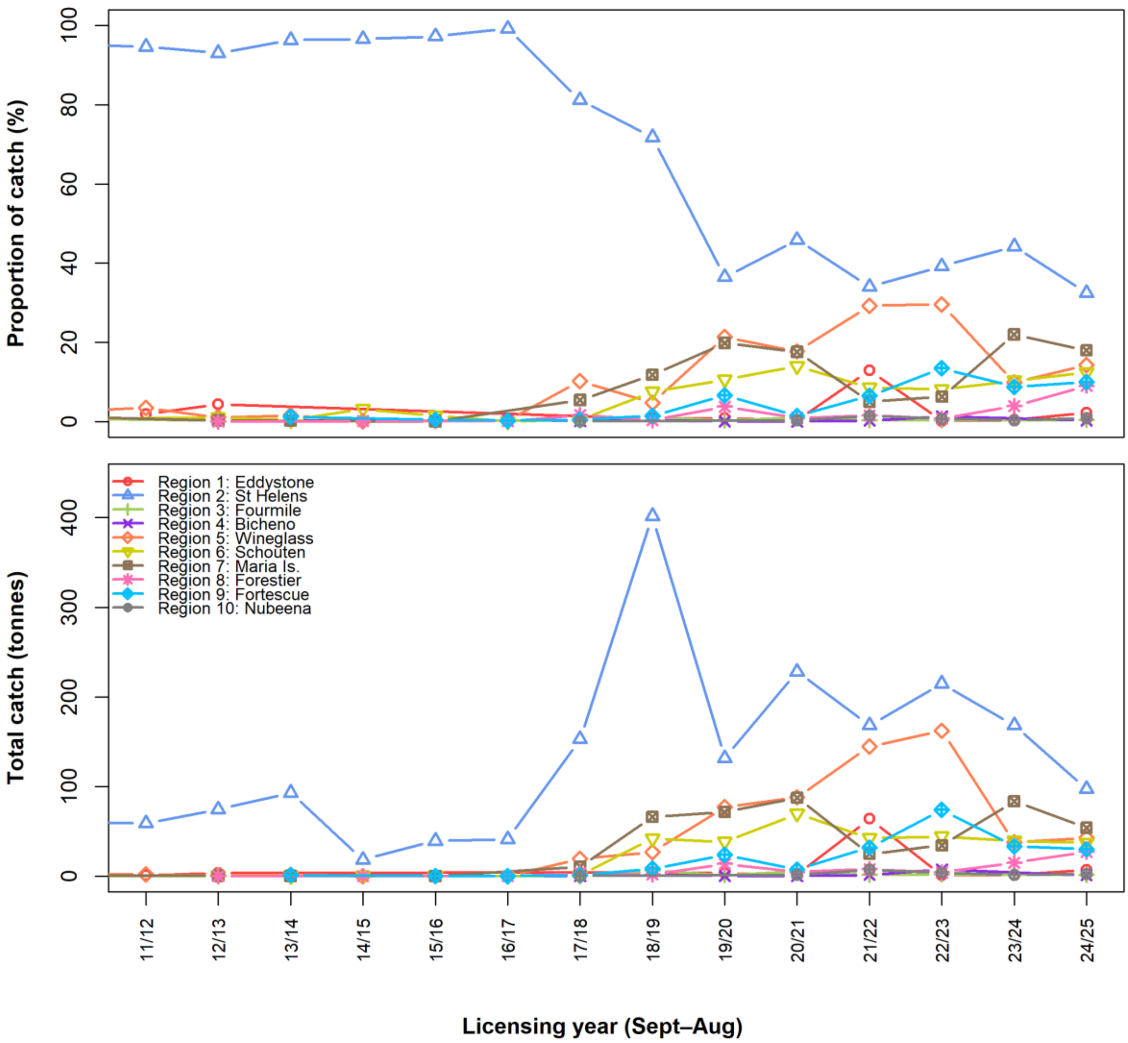

Figure 5: Annual catch (tonnes, bottom) and proportion of total catch (top) by region from the 2008/09 season to the most recent season.

The spatial distribution of catch in 2024/25 reflects the overall reduction in total harvest, with lower tonnage recorded across most blocks compared with previous seasons (Figure 6). The catch was also less spread down the east coast. This contraction in spatial extent could be related to the processor closure reducing the total number of active fishing days rather than reflecting a change in stock distribution, as urchins remain abundant across much of the east coast reef system.

The proportion of catch taken from each block over time shows the shift in fishing pressure that has occurred since the introduction of the spatial subsidy scheme (Figure 7). Blocks in the St Helens area (30A, 30B) continue to receive the greatest fishing pressure, though the subsidy program has encouraged progressively greater catches from central and southern blocks in recent seasons.

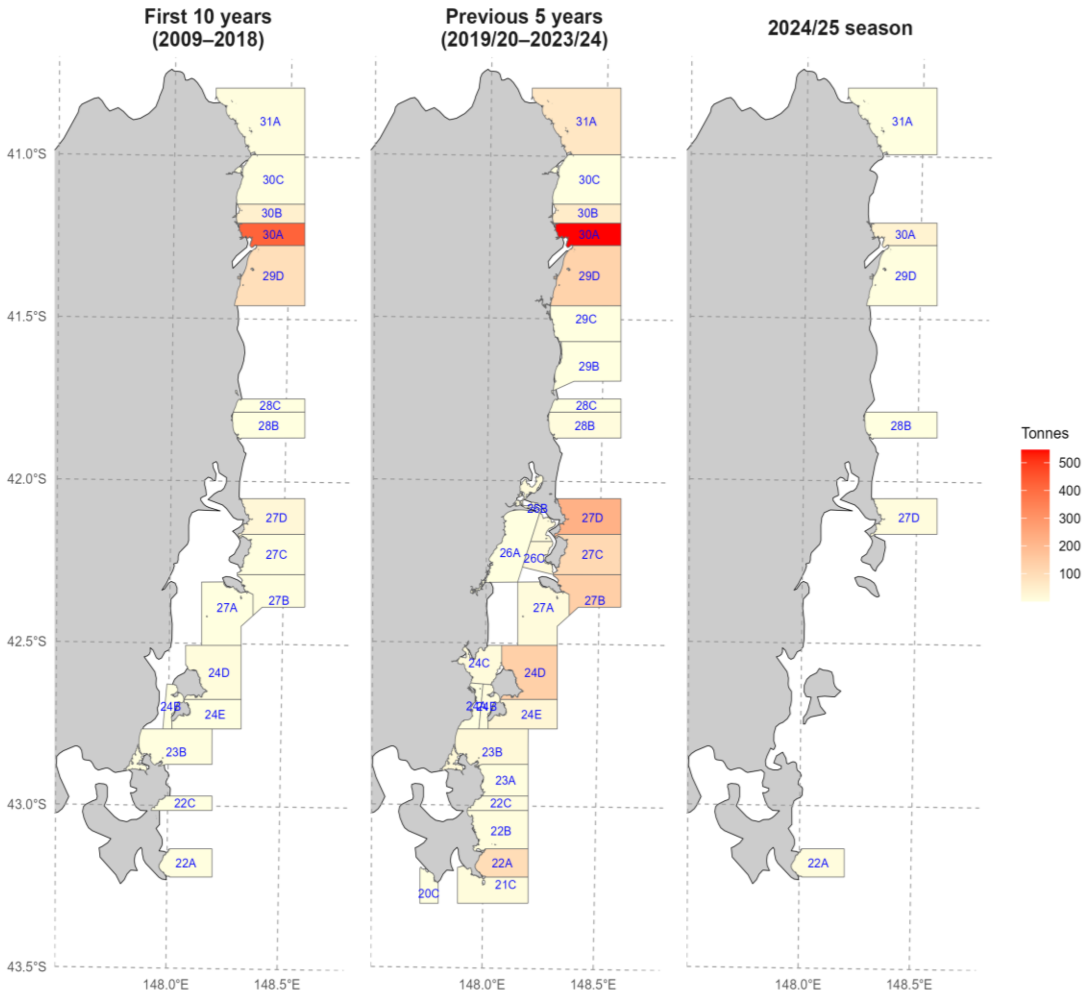

Figure 6: Total catch (tonnes) per fishing block for the first 10 seasons of the fishery (2009 to 2018), the previous 5 seasons, and the most recent 2024/25 season. Block names shown where catch was recorded (> 0.2 tonnes).

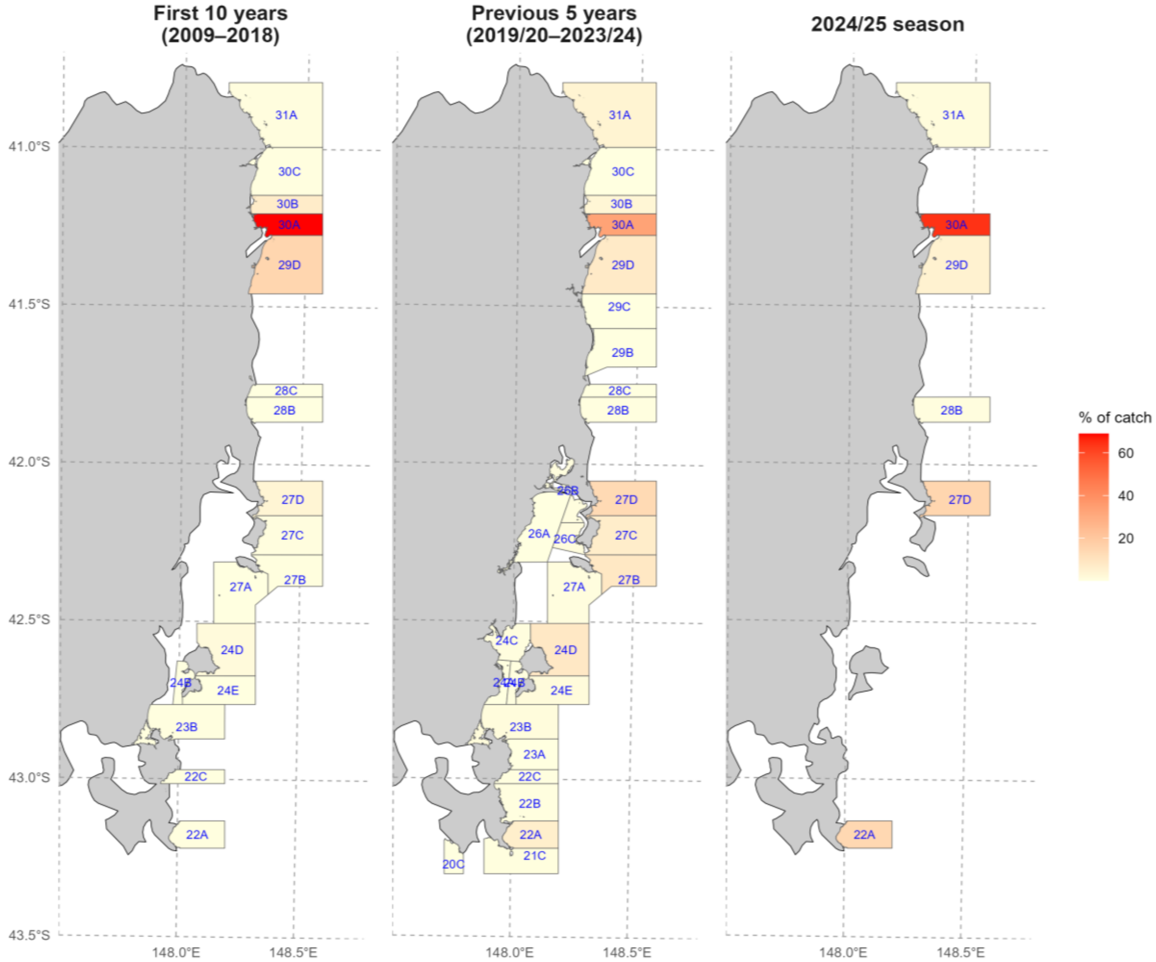

Figure 7: Proportion of total catch per block for the first 10 seasons (2009 to 2018), the previous 5 seasons, and the most recent season. Block names shown where catch was recorded.

Length and weight of the catch

A selection of the catch has been measured for test diameter (the diameter of the shell without spines) at the processing facility since early 2020, with the aim of sampling at least 250 to 300 urchins from a minimum of three different divers per factory visit.

The size of urchins in the catch was generally larger in 2024/25 compared with the two preceding seasons across all regions sampled (Figure 8). Most urchins measured were within the 80 to 125 mm size range, with the size distribution shifting noticeably towards larger size classes in 2024/25. This increase in mean size may reflect reduced fishing pressure in 2024/25 due to the processor closure, allowing larger individuals to accumulate in the catch, or may indicate a spatial shift towards less heavily fished areas where older and larger urchins remain more abundant. Changes in mean size of the catch are expected to vary with fishing intensity and spatial coverage, and continued monitoring of length frequency data will help distinguish between these explanations.

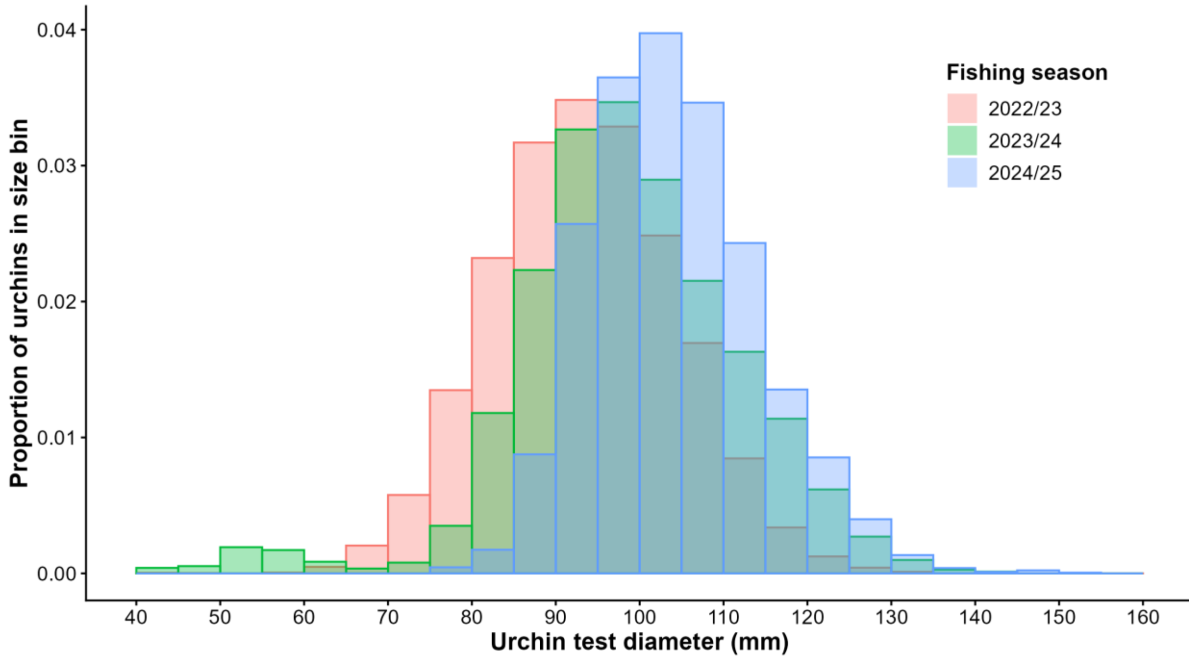

Figure 8: Proportion of urchins in different size categories (test diameter is the diameter of the shell without spines) in the catch for all factory data combined over each of the three most recent seasons, with size bins of 5 mm.

The shift towards larger urchins in the catch was most pronounced in the St Helens region (Region 2), where the length frequency distribution in 2024/25 showed a clear peak at approximately 110 mm test diameter, compared with peaks around 90 to 95 mm in the two preceding seasons (Figure 9). This shift was less pronounced in other regions, suggesting that the reduced fishing pressure associated with the processor closure had the greatest effect on the size composition of the catch in the most heavily fished part of the fishery. The St Helens region has the longest history of commercial fishing and the highest catch volumes, making it the most likely area to show a size response to changes in fishing intensity.

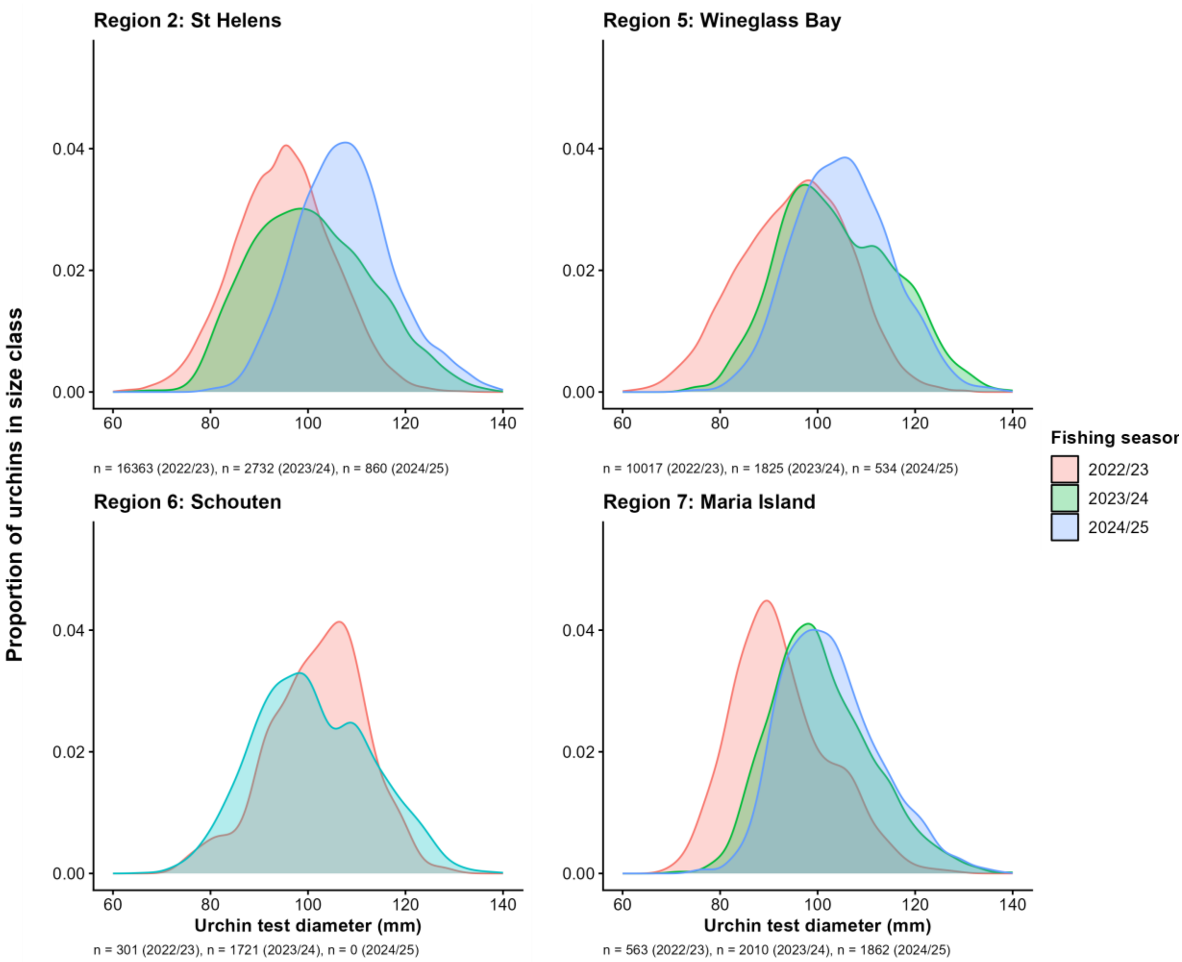

Figure 9: Length frequency density of the catch from the four most heavily fished regions for the three most recent seasons.

Depth of catch

The annual mean depth of fishing has increased over time, and this trend persists after standardisation for diver identity, region and season (Figure 10). This suggests that divers progressively moved to deeper depths in the earlier years of the fishery to maintain catch rates as shallower aggregation density declined. However, the standardised mean depth has stabilised at approximately 17 m (mean standardised depth) over the past seven seasons, suggesting that the fishery has reached an equilibrium depth range and is no longer expanding into deeper water.

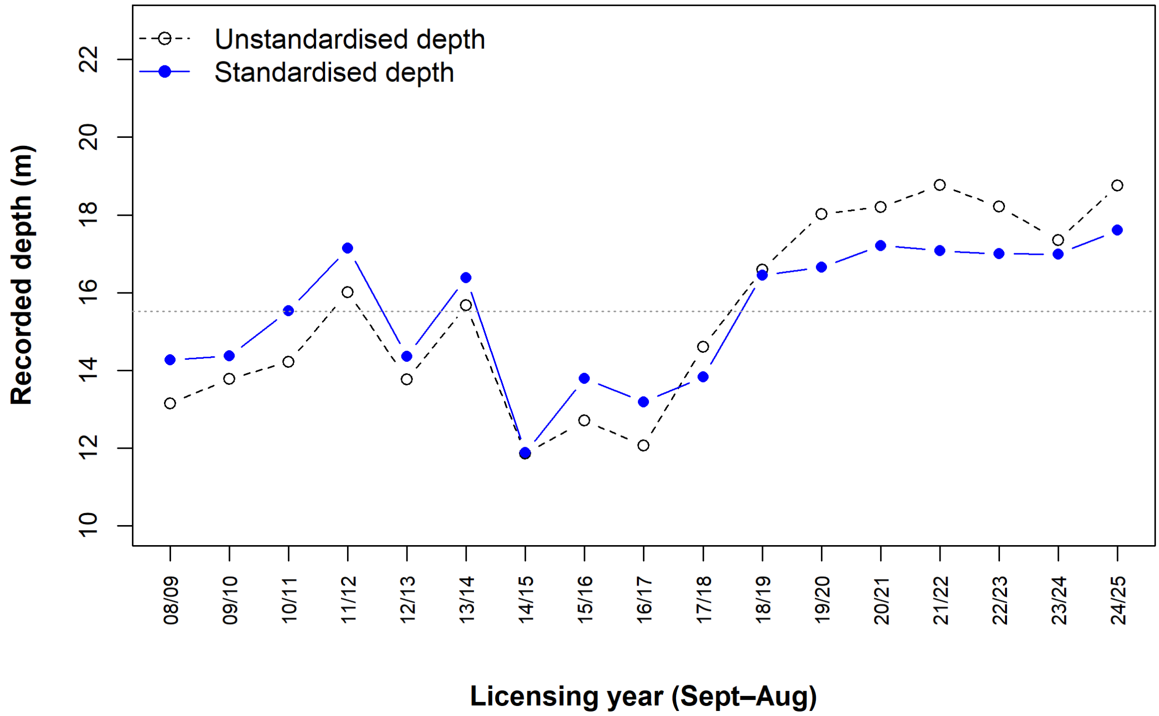

Figure 10: Standardised annual mean depth of the catch (solid line) with the annual geometric mean depth (dashed line). Horizontal grey line is the geometric mean depth across all years.

Catch rate

The standardised catch rate across the entire Tasmanian east coast fishery has declined gradually and consistently over the past seven seasons, though the rate of decline remains low (Figure 11). The magnitude of this decline is small relative to the overall range of catch rates observed across the fishery, and state-wide CPUE remains above levels that would indicate recruitment overfishing. The gradual nature of the decline is consistent with the hyperstability expected in dive fisheries targeting aggregated, low-mobility species, where catch rates are maintained by divers relocating to new patches rather than reflecting true stock abundance. The observed decline may therefore underestimate the true rate of stock reduction occurring at finer spatial scales. In the context of this control fishery, a sustained declining trend in CPUE is an ecologically positive signal, suggesting that the cumulative effect of commercial harvesting could be beginning to have a measurable effect on urchin abundance across the fishery as a whole.

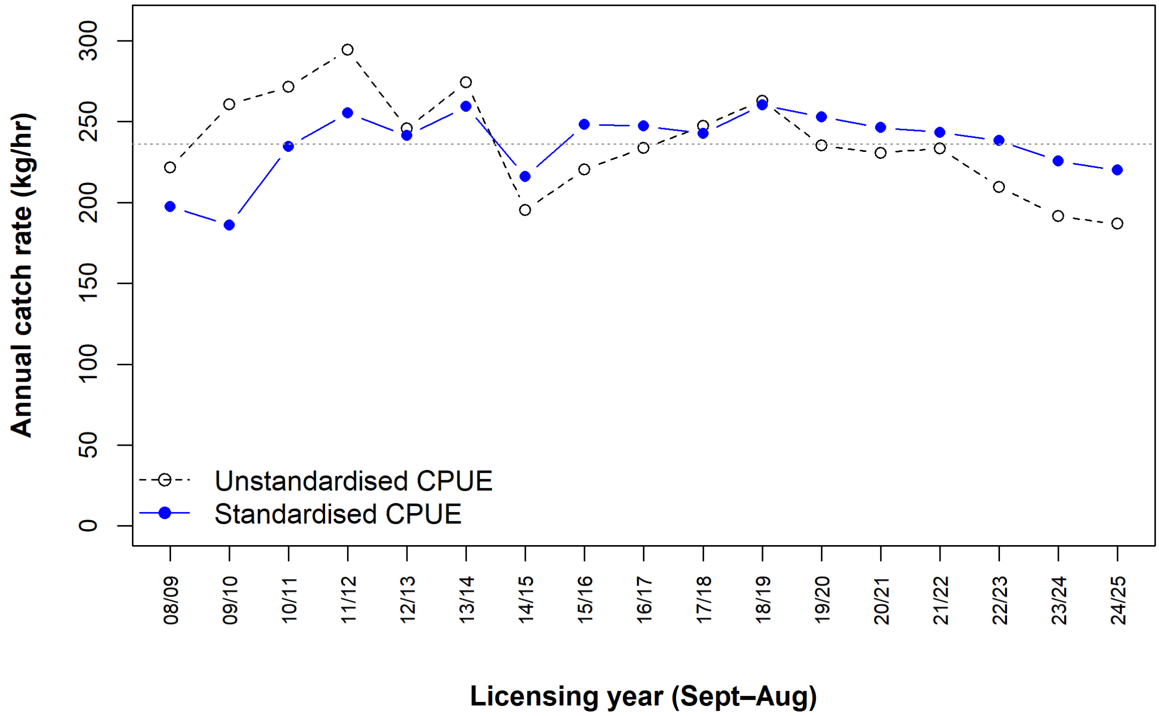

Figure 11: Standardised annual catch per unit effort (CPUE, solid line) averaged for the entire Tasmanian east coast relative to the annual geometric mean (dashed line). Horizontal grey line is the geometric mean of all catch rate data.

When examining block 30A, the most heavily fished area within the St Helens region, a more pronounced decline in catch rate is apparent over the past four seasons compared with the state-wide trend (Figure 12). Despite this localised decline, the standardised CPUE for block 30A remains close to the long-term geometric mean, indicating that catch rates have not yet fallen to levels that would suggest significant depletion of the local stock. The stronger signal of decline in block 30A compared with the coast-wide index is consistent with the expectation that the most intensively fished areas will show the earliest and most pronounced response to harvesting pressure. This pattern warrants continued monitoring, as block 30A represents the core of the St Helens fishery and any sustained decline below the geometric mean would be an important indicator of localised stock reduction.

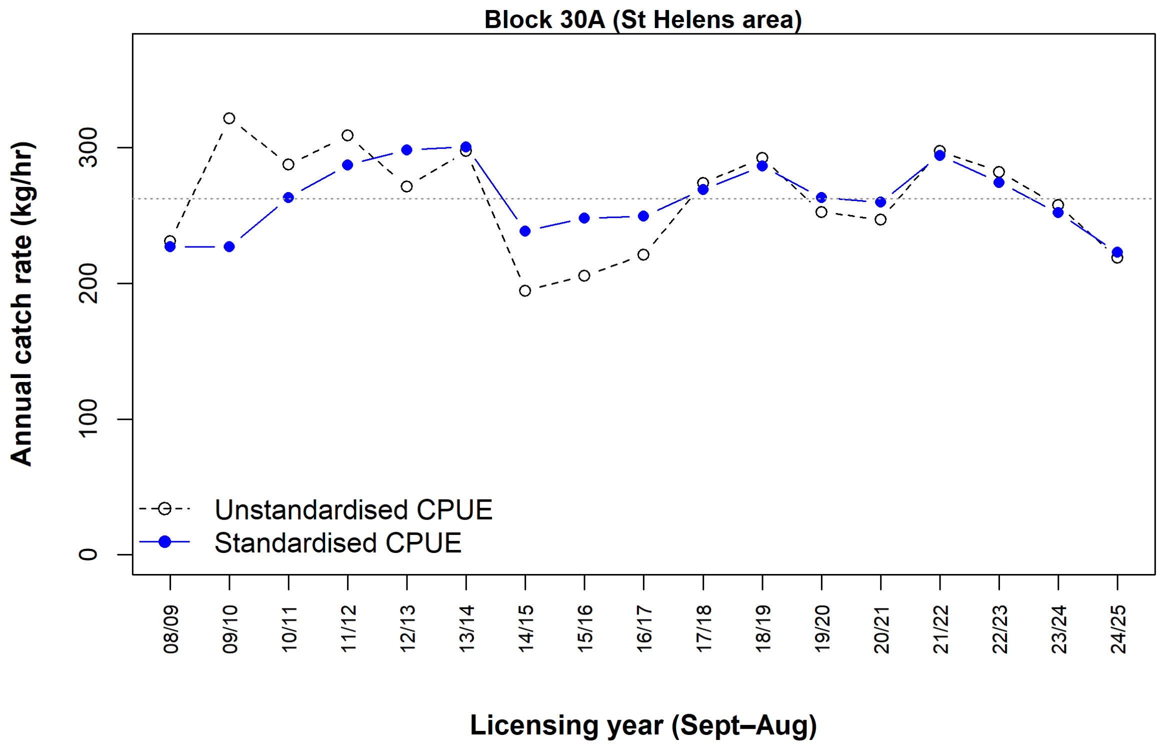

Figure 12: Standardised catch per unit effort (CPUE) for block 30A relative to the geometric mean (dashed line). Horizontal grey line is the geometric mean of all catch rate data for block 30A.

When standardised catch rate is examined by region across all years of the fishery, a consistent latitudinal pattern is apparent, with catch rate declining from north to south (Figure 13). Region 1 (Eddystone) in the north shows the highest standardised CPUE, with values decreasing progressively through to Region 9 (Fortescue) in the south. This pattern is consistent with observations from fishery-independent surveys showing higher urchin densities in the northern regions of the east coast, and provides important validation that CPUE is tracking real differences in stock abundance across the fishery rather than simply reflecting differences in fishing behaviour or effort allocation. The correspondence between the latitudinal CPUE gradient and independently surveyed density provides confidence that the CPUE index has value as a relative abundance indicator for this fishery, despite the limitations of hyperstability noted above.

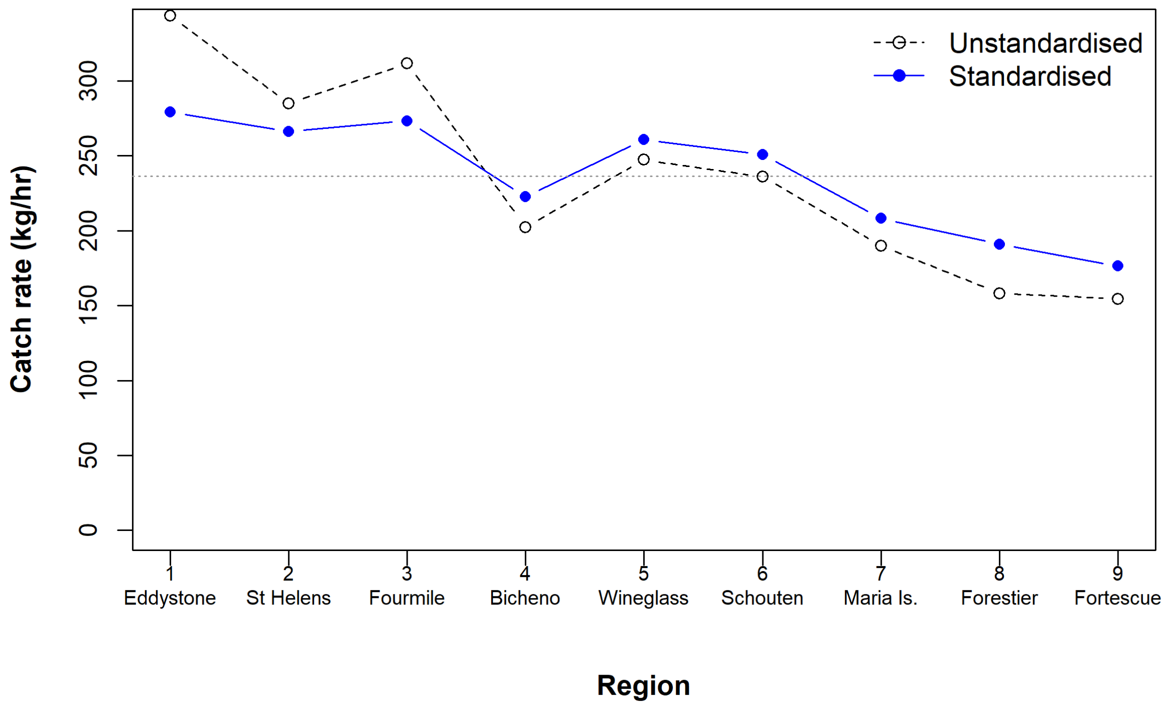

Figure 13: Latitudinal trend in CPUE from north (Region 1) to south (Region 9), standardised (solid line) and unstandardised (dashed line).

Conclusion

State-wide CPUE has not declined significantly in magnitude over the full span of the fishery. However, the standardised CPUE index shows a consistent gradual decline over the most recent five seasons, which may represent an early signal of stock depletion, or reduced urchin densities, at a broader spatial scale. On a smaller spatial scale, the most heavily fished block in the heaviest fished St Helens region shows a similar pattern, noting that hyperstability is expected in dive fisheries at high density and any declines in CPUE are likely to underestimate true depletion. The increase in mean fishing depth over time may indicate progressive depletion of stock at shallower depths.

The chosen CPUE standardisation model included Year, Diver identity, Region, Season month and log(Depth), as this model had the lowest AIC and highest adjusted R^2 of all candidate models tested.

In summary, the commercial fishery data present a consistent picture across all indicators. Annual catch in 2024/25 was 300 tonnes, a decrease from 380 tonnes in 2023/24, partially attributable to the closure of a major processor near the end of the season. The St Helens region has consistently dominated the catch and shows the highest sustained CPUE, reflecting the greatest urchin abundance on the east coast. Despite high total removals over the last 7 seasons (3139 tonnes combined), CPUE has remained broadly stable over the full span of the fishery, though a consistent gradual decline is apparent over the most recent five seasons. This recent trend warrants monitoring and may indicate the fishery is beginning to have a measurable effect on stock density, which would be an ecologically desirable outcome given the management objective. The ongoing increase in mean fishing depth is the strongest signal of localised depletion, suggesting that shallower, more accessible aggregations are being progressively removed. Fishery-independent surveys still suggest that the rate of removal continues to lag behind population growth in most regions, and increased effort will be required to achieve density control targets across the coast.

Biomass

Table 1. Biomass estimated from scientific surveys (bold) in 2001/02, 2016/17 and 2020/21, with average linear biomass increase between surveys and removals from harvesting, culling and take-all harvests.

Year	Estimated biomass (t)	Avg annual increase (t)	Harvest removals (t)	Culling (t)	*Take-all (t)*
2001/02	**4,147**				
2002/03 to 2015/16		139	varies		
2016/17	**5,856**		41		
2017/18		340	185		
2018/19		340	560		
2019/20		340	328	14.8	*34.9*
2020/21	**6,104**	435	494		
2021/22			494		*3.4*
2022/23			527		*22.2*
2023/24			381		*5.4*
2024/25			300		*0*

Average linear biomass increase from the 2001/02 season to the 2016/17 season is 139 tonnes per year, and from 2016/17 to 2020/21 is 435 tonnes per year. We calculated biomass using densities recorded to 18 m depth in the scientific surveys, multiplied by the reef area recorded to 26 m.

When examining estimates of total biomass increase per year compared to catch removed each year, the total catch removed has exceeded the estimated biomass increase since the 2017/18 season. In 2024/25 the commercial harvest was 300 tonnes.

Bycatch, habitat and other mortality

Bycatch

No significant bycatch of non-target species has been reported in the Longspined sea urchin fishery, as urchins are harvested by hand.

Protected species interaction

Interaction between the habitat and fishery is limited to catch bags and considered negligible risk. The fishery (removal of urchins) promotes habitat recovery.

Habitat interaction

The removal of urchins from barrens habitat is the primary mechanism of this fishery and is intentional from an ecological management perspective.

Indigenous fishing

The species has only been present in Tasmanian waters since 1978 thus there was no historic Indigenous harvesting. There is no regulation of current Indigenous harvesting. No information has been collected but the volume of catch is considered negligible relative to commercial harvesting.

Recreational fishing

Recreational harvesting is known to occur, but catches are deemed negligible. No information has been collected but the volume of catch is considered negligible relative to commercial harvesting.

Culling

No commercial culling events were sponsored for this season. Liming has been investigated as a complementary urchin removal tool (Keane 2021). There are anecdotal reports of recreational culling activities statewide.

“Take-all” harvests

The *Fortescue Bay: Restoration by Harvest Pilot Program*, funded by the State Government’s Abalone Industry Reinvestment Fund, has conducted systematic removal operations at Southern Fortescue Bay since 2023. The primary target area is a 5 km stretch of shoreline from the boat ramp to Cape Hauy. No take-all harvest was conducted during the 2024/25 season (0 tonnes removed).

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