Southern Sand Flathead Assessment 2025

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2025

This assessment of the Southern Sand Flathead Fishery is produced by the Institute for Marine and Antarctic Studies (IMAS) using a combination of data generated from fishery-independent surveys between 2012 and 2025 as well as commercial fishery data downloaded from the Department of Natural Resources and Environment, Tasmania (NRE Tas) Fisheries Integrated Licensing and Management System (FILMS) database. The commercial fishery data presented here includes all logbook returns up until the 2023/24 season.

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2 Executive Summary

Stock status: **DEPLETED**

Southern Sand Flathead remains one of Tasmania's most popular recreational fish species, but the latest assessment shows the stock is still below the limit reference points and at risk of not recovering.

Status

The stock remains classified as Depleted, meaning there are not enough large females to ensure healthy reproduction and recovery. Sand flathead has been classified as Depleted since 2020/21.

Why hasn't Sand Flathead recovered?

Recovering a depleted fish stock is naturally a slow process. Decades of heavy fishing, primarily recreational, have reduced the number of large females, which are critical for egg production.

Recent rule changes, such as smaller bag limits, bigger size limits, and a ban on commercial fishing, have reduced catch and fishing mortality. This in turn has resulted in some indications of potential slow recovery, but further management measures will be needed to support a faster recovery.

What the latest science shows

- Surveys in 2024/25 found that most fish are still small. In many areas, 79–100% of fish were below the legal size (35 cm). In the southeast, only 1% were legal-sized.
- Female spawning potential is depleted in most regions— down to potentially just 5% of unfished levels in the southeast.
- Catches have likely dropped substantially, but current assessment methods cannot determine whether they have been reduced to a point to ensure rebuilding.
- New assessment methods are being introduced to estimate whether catch is below a point that will allow rebuilding and to estimate how long recovery might take.
- Flinders Island is the exception, characterised by comparatively large fish and presumably healthy stocks because fishing has likely been low.

Recommendations

Continued strict management measures and careful monitoring are essential to help the stock recover. Without strong action, Sand Flathead may not recover or could take an unacceptably long time to recover.

Extended Summary

This report provides an assessment of the status of Southern Sand Flathead (*Platycephalus bassensis*) in Tasmania in 2024-2025. It includes a summary of key biological characteristics, management arrangements, trends in commercial catch and effort (2007/2008-2023/2024), and an analysis of data from fishery-independent surveys of age and length composition across the state (2012-2025).

Following the closure of commercial take in November 2023, harvest of Southern Sand Flathead in Tasmania is currently exclusively driven by the recreational fishing sector. However, prior to the ban, commercial catches were minor, with recent estimates representing only 1% of the combined total harvest when operating.

A fishery-independent survey of Southern Sand Flathead populations in southeast Tasmania commenced in 2012 to support the assessment of this species, because data on the small commercial catch were not informative. Initial survey results revealed a low relative abundance of legal-sized fish at survey sites in the D'Entrecasteaux Channel, Frederick Henry-Norfolk Bay, and Great Oyster Bay, suggesting that local populations of Southern Sand Flathead in these areas along the south and east coasts of Tasmania are heavily fished.

In late 2015, management changes were introduced to reduce fishing mortality, including: (1) an increase in the minimum size limit from 300 mm to 320 mm, and (2) a reduction of the daily bag limit from 30 to 20 fish per fisher. Initial subsequent analyses of fishery-independent data and associated estimates of fishing mortality suggested that these management measures might have reduced fishing pressure. However, more in-depth analyses, based on increasingly comprehensive survey data from 2021 (with six additional sampling locations added), firstly estimated that female spawning biomass was depleted and that overfishing was likely to persist.

In response to the first estimates of depleted female biomass and spawning potential presented in assessment reports published from 2022 onwards, additional regulations were implemented in 2023 and 2024 (including further reduction in bag limits and size limit changes, see here for full details) with the intention to rebuild sand flathead biomass over the coming years. Assuming high compliance, it is likely that these new regulations have resulted in reductions of recreational catch and, thus, fishing mortality. However, recreational catches are not monitored annually (only every five years), and current fishing mortality cannot reliably be estimated from biological surveys (length- and age-frequency data) alone. Estimates of female spawning potential and the associated long-term fishing mortality presented in this report suggest that the fishery remains depleted, albeit with potential slight recovery over recent years. Precautionary management and continued close monitoring are needed to ensure the recovery of female spawning biomass in surveyed areas (except for Flinders Island). Thus, Southern Sand Flathead remains classified as ***Depleted***.

3 Introduction

Southern Sand Flathead (*Platycephalus bassensis*; hereafter Sand Flathead) is a bottom-dwelling species found in inlets, estuaries and coastal waters, generally at shallow depths (< 50 m), but occasionally down to around 100 m. Sand Flathead are endemic to southern Australia, including New South Wales, Victoria, Tasmania and the southern part of Western Australia (Edgar 2008; Gomon, Bray, and Kuiter 2008). The population structure of Sand Flathead is uncertain, which is why stocks are typically assessed at the state level (except for Port Phillip Bay in Victoria; see SAFS 2023). However, studies of movement, growth and reproductive biology show regional variability, indicating that population differentiation at finer scales might occur (Bani and Moltschaniwskyj 2008). A more detailed summary of key biological characteristics of Sand Flathead can be accessed here.

Sand Flathead has been the dominant recreational fishery species in Tasmania, with approximately 300 t of catch per year in the early 2000s and almost 126 t estimated for the 2022/23 fishing season (Tracey and Stark 2024). In contrast, only 1.6 t of Sand Flathead was caught in the last financial year (2022/23) by the commercial sector before the fishery was closed in November 2023 (Sharples et al. 2024). Handline, Danish seine and beach seine were the primary gears used for targeted commercial Sand Flathead fishing. Line fishing is also the dominant harvest method used by recreational fishers (Tracey and Stark 2024).

The first stock assessment, completed for the 2014/15 financial year, classified Sand Flathead as Depleting, indicating that fishing mortality rates were higher than those consistent with long-term sustainability. Fishery independent sampling was expanded across the state in 2021, with six additional regions sampled. The assessment of the species was subsequently updated to Depleted in the 2020/21 Tasmanian Scalefish Fishery Assessment Report (Fraser et al., 2022). That report, along with subsequent assessments (Krueck et al., 2023; Krueck et al., 2024), concluded from the fishing independent survey data that spawning biomass was below the limit reference point of 20% of unfished biomass in most regions.

In 2023, to reduce fishing effort, commercial fishing for Sand Flathead was banned in State waters and recreational possession limits were reduced to 10 from a combined limit for Sand and Tiger Flathead of 30 fish, bag limits from 20 to 10 fish in the Northern and Western zones including King and the Furneaux Group, from 20 to 5 fish in the Eastern Zone and from 20 to 2 fish in some areas of southeast Tasmania, including the D'Entrecasteaux Channel, Derwent River, Frederick Henry and Norfolk Bays. Furthermore, the minimum legal size was increased from 32 to 35 cm, and a maximum legal size of 40 cm was implemented in all regions except for King Island and the Furneaux Group. More detailed information on current Sand Flathead management is available from the NRE Tas website: click here.

4 Data analyses

This report provides a stock assessment for Sand Flathead in Tasmania. Stock status classification follows the national reporting scheme used in the Status of Australian Fish Stocks (SAFS) reports (https://www.fish.gov.au/). SAFS reports include four stock status classification categories: “Sustainable”, “Depleting”, “Depleted”, or “Recovering”. These four categories define the status of the stock exclusively in terms of likely recruitment impairment. Recruitment impairment occurs when the mature adult population (spawning biomass) is depleted to a level where it might no longer ensure the reproductive capacity for stock rebuilding.

Stock status compared to potential target reference points (e.g., the biomass supporting maximum sustainable ecological or economic yield) is also considered but not included in the stock status classification scheme. For more detailed information on the framework for stock status classification, please refer to the TasFisheriesResearch webpage: stock classification. Historical stock status classifications for Sand Flathead are available in Appendix 2 of this report.

4.1 Analyses of fishery-dependent data

Commercial catches of Sand Flathead used to be managed under the Tasmanian Scalefish Fishery administered by NRE Tas. Trends in commercial catch and effort were analysed using data collected through compulsory logbook returns. Detailed fishery information, including management objectives, assessment criteria, and analyses of catch and effort time series as presented below can be accessed online through the TasFisheriesResearch webpage. For the recreational sector, catch and effort is estimated from statewide surveys conducted every five years and published on the IMAS webpage.

Routine assessments of commercial scalefish fishery data are based on time series of catch, effort, and catch-per-unit-effort (CPUE). For Sand Flathead, effort and CPUE analyses are restricted to commercial data available from 1 July 2007 to 30 June 2024. A ‘fishing year’, running from 1 July to 30 June of the following year, is used for our annual commercial catch reporting. This decision is based on the understanding that reporting aligned with the financial year, as opposed to the calendar year, and provides a more accurate representation of the seasonality of fisheries for most species, which are characterised by a concentration of catch (and effort) between late spring and early autumn. Moreover, the financial year reporting schedule better accommodates the biological processes of recruitment and growth for most species, including Sand Flathead.

Commercial catch and effort data were traditionally analysed and reported at the state level. However, more recent analyses as in this report include a regional breakdown into five fishing regions: the southeast coast (SEC), east coast (EC), northeast coast (NEC), northwest coast (NWC), and west coast (WC) (see Figure 1).

Commercial effort is expressed in numbers of vessel days per gear type (almost exclusively handline). Examining effort in terms of days fished overcomes uncertainty about the reporting of effort units and provides consistency through time, assuming that there have been no major changes to fishing practices during that time (2007-2024).

Since CPUE data are typically log-normally distributed, the geometric mean rather than arithmetic mean of daily catch records has traditionally been calculated to generate CPUE statistics. The geometric mean is the n^{th} root of the product of individual CPUE values, which is equivalent to computing the arithmetic mean of the natural logarithm of each number, and then taking the exponent. CPUE calculated using this method may differ slightly from the more simplistic approach of dividing total catch by total effort or using the arithmetic mean. The advantage of calculating the geometric mean is that results are less affected by few, unusually high data points, which are characteristic of log-normally distributed data.

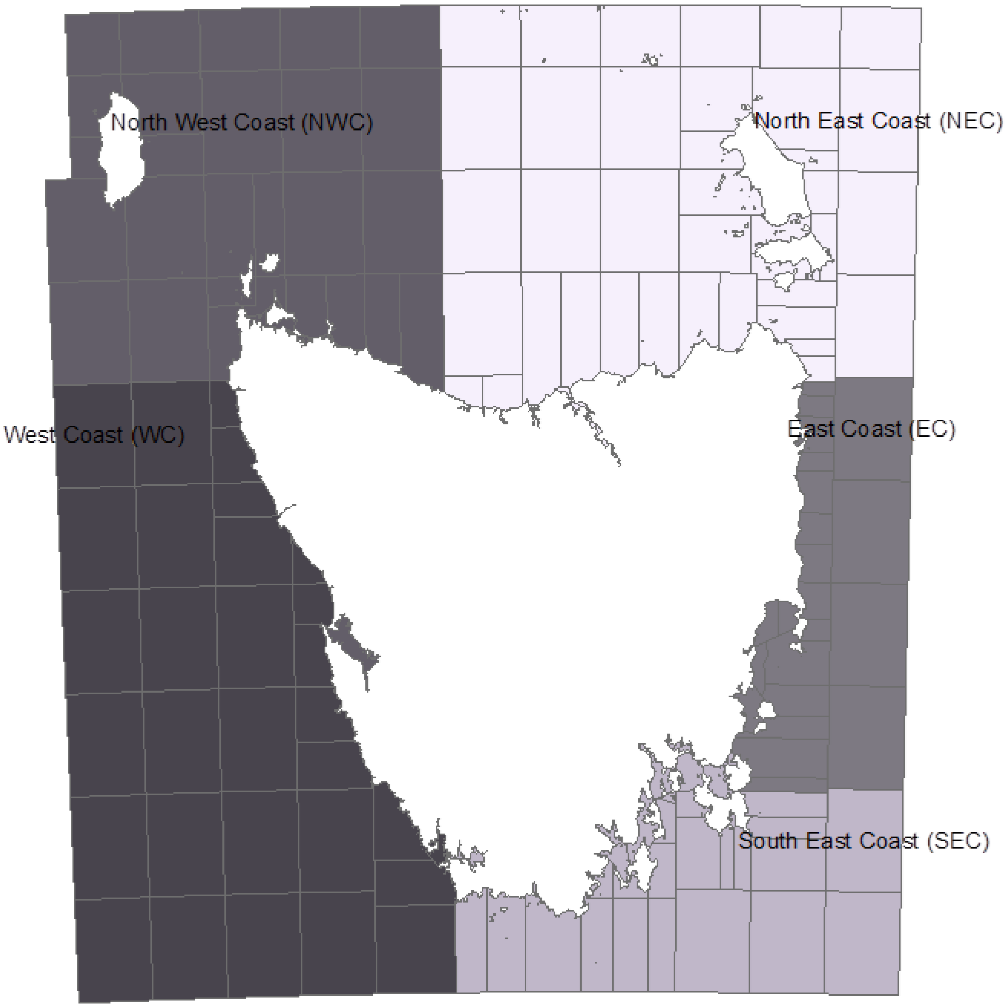

Figure 1: NRE Tas fishing blocks and management regions (in grey) for the Tasmanian Scalefish Fishery.

4.2 Analyses of fishery-independent data

Concerns surrounding the abundance of legal-sized Sand Flathead led to the establishment of an annual fishery-independent survey in 2012 (Ewing, Lyle, and Mapleston 2014). The initial survey, using fishing gear and targeting practices typical of recreational fishers, covered three regions off the south and east coasts. In 2021, the survey was extended by adding five additional regions off the east and north coasts of Tasmania (Figure 2). Surveys are conducted annually between November and April (but mostly from January to March), generally over three (not necessarily consecutive) days per region with 19-21 standard sites fished in each region (see maps here). These sampling sites represent a range of suitable habitats and depths for Sand Flathead, providing comprehensive coverage in each region. In addition to these routine sampling sites, Flinders Island was added as a survey region in 2023, with first samples collected in February 2023.

Sex-specific length and age frequencies from survey data inform Sand Flathead stock status assessments. Assessment approaches require estimates of key life history parameters for meaningful parameterisation. Key parameters include: *Linf* (the infinite or asymptotic length), the von Bertalanffy growth rate (*k*), *L50* and *L95* (lengths at 50% and 95% maturity), *SL50* and *SL95* (lengths at 50% and 95% gear selectivity), and *M* (the instantaneous rate of natural annual mortality). Most parameters have been estimated and presented in previous assessment reports (Krueck, Hartmann, and Lyle 2020; Fraser, Hartmann, and Krueck 2021; Fraser et al. 2022, Krueck et al. 2023, 2025). However, some parameters were re-estimated as presented below for the current assessment using the latest available survey data.

Following a widely applied approach parameterised according to a recent meta-analysis, the sex-specific instantaneous rate of natural mortality (*M*) was estimated by assuming 1.5% adult survival until the maximum observed age available from the flathead survey data (Dureuil and Froese 2021). *Linf*, *L50*, *L95*, *SL50*, and *SL95* were estimated using established methods as implemented in the "TropFishR" package in R (Mildenberger, Taylor, and Wolff 2017). *Linf* and *k* were also estimated using the "nls2" function in R to fit the standard von Bertalanffy growth function (VBGF) to survey data:

$$L = L_{inf}\left(1 - e^{-k(a-t_0)}\right),$$

where *L* is length (reported in cm), *Linf* is the mean length of fully grown individuals, *k* is the growth coefficient, *a* is age, and *t0* is the theoretical age when length is equal to zero. The parameter space for VGBF fitting of *k* was determined by assuming credible *M*/*k* ranges between values of 1 and 2. The parameter space for *Linf* was determined based on prior *Linf* estimates using the "Powell-Wetherall" (PW) regression as implemented in the TropFishR package. Length thresholds for inclusion of data points in PW regressions were specified according to prior estimates of *SL95* (i.e., full gear selectivity). An *Linf* range between 0.5 and 2 times the PW estimate of *Linf* was then used for VGBF fitting. However, the survey data for most species was collected from key fishing grounds of the assessed species, which made VGBF estimates of *Linf* more sensitive to size and age-truncation than PW regressions. Thus, in case of notable underestimation of *Linf* values due to evident size and age truncation, the VGBF function was fitted by constraining *Linf* to the PW estimate. The parameter space for *t0* was restricted to values between 0 and -10% of *tmax*. If gear selectivity (*SL50*) indicated an introduction of bias in the length at age of young fishes available from the survey data, *t0* was fixed to 0.

TropFishR was further used to estimate the instantaneous rate of total annual mortality (*Z*) from catch curves, including 95% confidence intervals. Values of *Z* were then used to infer fishing mortality *F* (*F* = *Z* – *M*), and relative fishing mortality (*F*/*M*). An *F*/*M* value of 1, where fishing mortality equals natural mortality, is commonly used as a threshold for overfishing. However, lower *F*/*M* values of 0.87 and 0.5 have been recommended for teleosts to ensure that *F*/*M* does not exceed the fishing mortality supporting maximum sustainable yield or does not violate the precautionary principle, respectively (Froese et al. 2016). Notably, mortality estimates from length-or age-based catch curves represent long-term trends.

The life history and selectivity parameters described above were used to run a length-based stock assessment, which is founded on classic fish life history theory and now widely applied for data-poor fisheries management worldwide: the Length-Based Spawning Potential Ratio (LBSPR) estimation approach (Hordyk et al. 2015a, Hordyk et al. 2015b). LBSPR requires estimates of *Linf*, *M*/*k*, *L50*, *L95*, *SL50*, and *SL95* as input parameters. LBSPR then calculates the relative long-term fishing mortality (*F*/*M*) and the relative spawning potential ratio (*SPR*/*SPR0*), i.e., the observed fished *SPR* relative to a theoretical unfished *SPR* (*SPR0*). The *SPR* is a term used synonymously to “spawning biomass per recruit” or the “fraction of lifetime egg production” (FLEP), which compare the average reproductive output of individuals in a fished population with the average level of reproductive output expected for an unfished population. A value of *SPR*/*SPR0* = 0.2 (i.e., 20% of unfished levels) is widely recognised as the ‘replacement level’, where fish populations might persist at current levels or even decline over time. When the *SPR* reaches 10% of unfished levels (*SPR*/*SPR0* = 0.1), recruitment is expected to decline more rapidly. The default target reference points for *SPR* are 40%-50% of unfished levels (*SPR*/*SPR0* = 0.4-0.5), where reproductive output and recruitment are expected to result in maximum sustainable ecological or economic returns.

The accuracy of outcomes from LBSPR and other length-based assessment approaches described above depends on representative length frequency samples and cannot readily be applied with confidence if sample sizes are smaller than 100. Ideally, sample sizes of n > 1000 are used. However, outcomes for pooled regions implicitly assume that fishing pressure is uniform across the state. This assumption was clearly violated. Thus, annual samples over the last three years were pooled to provide regional breakdowns with a similar level of confidence. We further note that outcomes from all length-based assessment scenarios represent female biomass and fishing mortality, because (1) female biomass is generally used to infer the reproductive potential (egg production capacity) of fish populations; (2) females grow to higher *L50* and *Linf*, which makes them more vulnerable to the impacts of fishing; and (3) females represent the majority of samples available from surveys.

In the two previous assessment reports, we used a second length-based stock assessment approach (the Length-based Bayesian Biomass estimation approach) to estimate biomass depletion and relative fishing mortality. Given that this alternative approach yielded similar depletion estimates, outcomes are not presented in this report.

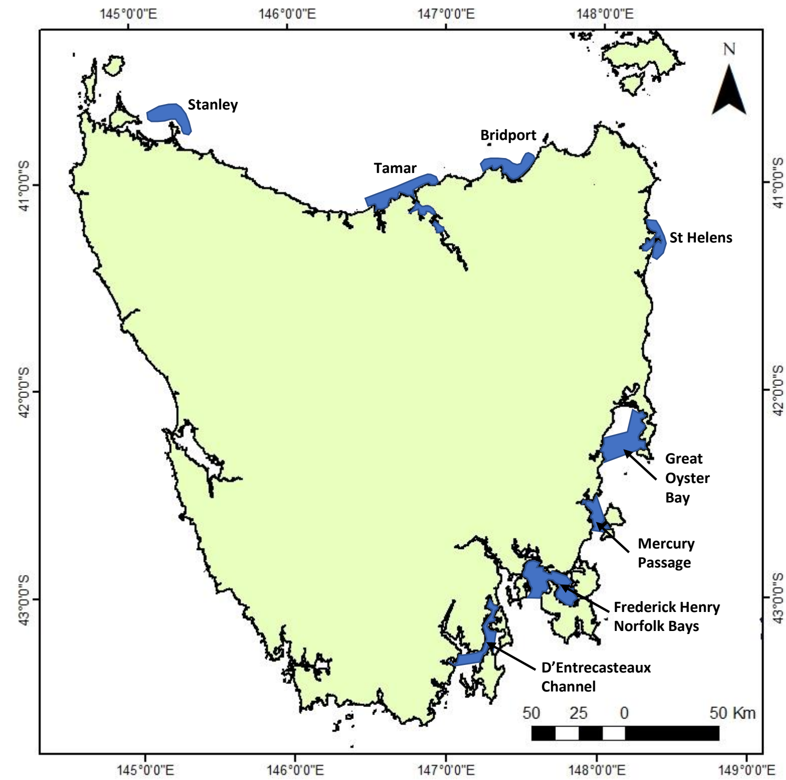

Figure 2: Map showing eight survey regions around Tasmania: (1) D'Entrecasteaux Channel, (2) Frederick Henry-Norfolk Bay, (3) Mercury Passage, (4) Great Oyster Bay, (5) St Helens, (6) Bridport, (7) Tamar Estuary, and (8) Stanley. Flinders Island off the northeast corner of the state was also surveyed for the first time in 2023 (see detailed maps here).

Uncertainty, limitations and next steps

Scientific assessments of the status of fish populations are influenced by substantial uncertainty, including multiple different types: 1) observation uncertainty (e.g. of estimates of recreational catches and of measurements of the size and age of flathead); 2) process uncertainty (e.g. the variability in recruitment, growth and length composition of flathead within regions); 3) model uncertainty (e.g. the potential misspecification of model parameters and/or structure, such as state-wide or local estimates of growth and asymptotic length of flathead); and 4) estimation uncertainty (e.g. the confidence intervals around model outputs, including spawning potential and long-term fishing mortality). The first type of uncertainty is not presented here and of presumably low importance for assessment outcomes (e.g. measurement error around size and age), or accessible in other reports (e.g. estimates of recreational catches, Tracey and Stark 2024). The second type of uncertainty has been addressed by expanding fishery-independent surveys and analysing resulting data, including the clustering of data across years and/or regions where the variability in length- and age composition is likely to be inadequately captured (e.g. where <100 samples are available, but noting that up to 1000 samples might be needed for robust representation of variability). However, substantial uncertainty remains about stock structure and its adequate representation in assessment models, specifically about regional differences in growth, asymptotic length and natural mortality, all of which result in potentially significant process and model uncertainty. We address this uncertainty here by using a precautionary scenario testing approach, defining alternative estimates of growth and asymptotic length based on data from Flinders Island, where large fish are common and fishing is likely to be low, to define our baseline assumption for a theoretical unfished population. Estimates of growth and asymptotic length based on data from the south-east coast region were used in this report to capture the influence of process and structural model uncertainty on assessment outcomes by representing an alternative baseline assumption. Estimation uncertainty, which is generally lower than process and structural uncertainty (alternative growth scenarios and regional baselines), is presented for all assessment outcomes in associated tables and figures.

Notably, one of the important limitations of the assessment approaches applied here is that they are equilibrium-based, implicitly assuming constant mortality and recruitment through time. Thus, while giving an adequate assessment of the status of fish populations and an associated estimate of the long-term fishing mortality that led to the current state, they do not estimate current fishing mortality, which can be substantially lower. In other words, outcomes from LBSPR and similar equilibrium-based assessment approaches are not sensitive to recent stock trends and, thus, cannot be used to project forward for management strategy evaluation (MSE). To complement outcomes from LBSPR and better support management aiming to recover Southern Sand Flathead populations over the coming years, we are currently investigating multiple internationally recognised stock assessment modeling packages, including the Blue Matter OpenMSE and the Stock Assessment Continuum Tool (SACT). These frameworks fit models to multiple data sources, including catch, and project stock dynamics forward over 5-30 year timeframes under different management scenarios (e.g., varying size limits, spatial closures, harvest controls). While these approaches are more difficult to parameterise, a key strength is their ability to inform managers now about the likely risks, recovery timeframes, and outcomes of alternative management rule changes. Through sensitivity analyses and alternative parameterisations, we can thereby identify strategies that are likely to minimize risk to sustainability, achieve efficient stock recovery within management rule constraints, and determine which management approaches perform robustly under alternative assumptions about stock productivity.

Validating predictions from both OpenMSE and SACT models and contrasting results against those from the equilibrium-based LBSPR approach is critically important. Thus, this work is still in progress as we refine temporal projections and complete sensitivity analyses to fully characterise uncertainty around recovery predictions. We are also investigating various defensible baseline assumption scenarios that could be considered in future assessments. Until this validation of models and baseline scenarios is complete, management recommendations will continue to follow the current best estimate recommendations inferred from trends in catch, length-and age frequencies, catch-curves and LBSPR assessments.

5 Trends in catch and effort

Sand Flathead has been distinguished from Tiger Flathead in commercial fishery data since 2007/08. Previous stock assessment reports show back-calculated estimates of Sand Flathead catches up to almost 15 t (Krueck, Hartmann, and Lyle 2020; Fraser, Hartmann, and Krueck 2021).

The total commercial harvest for Sand Flathead in the 2023/24 financial year was 0.4 t between July 2023 and the end of June 2024 (Figure 3A), which is a decrease from the previous seasons due in part to the commercial fishery closure for Sand Flathead (Sharples et al., 2024), and considerably lower than peak Sand Flathead commercial harvest of 13 t reported in 2008/09 (Ziegler and Lyle, 2010). Before the commercial Sand Flathead fishery closed in November 2023, most commercial catch was taken by handline, Danish seine and beach seine. However, commercial harvest was minor relative to estimates of recreational catches available from statewide recreational fishing surveys conducted since 2000/01 (Lyle 2005; Lyle et al. 2009; Lyle, Stark, and Tracey 2014; Lyle et al. 2019; Tracey and Stark 2024). In 2022/23, the recreational harvest of Southern Sand Flathead was estimated at 125.8 t (Tracey and Stark 2024), which represented approximately 99% of the estimated total harvest (recreational and commercial combined) for that season (see Figure 3A).

The distribution of catch and effort is concentrated in the most populated regions across Tasmania, as well as Flinders Island. Before commercial Sand Flathead fishing was closed, most catch was taken off the east, southeast, and northwest coasts (Figure 4A). For the recreational fishery in 2017/18, just over half of the catch was from the southeast coast, with the central east (including Great Oyster Bay) and northwest coasts also representing important regions (Lyle et al. 2019). In 2022/23, again just over half (57%) of the total recreational catch was derived from south-eastern Tasmania (Tracey and Stark, 2024).

Although commercial catches were insignificant, it is worth noting that up until the closure, commercial handline CPUE showed a declining trend (Figure 3B and C). There was also a decline in commercial handline effort over the same period (Figure 3B). However, regional differences highlight that these trends could mask spatial heterogeneity in fishing activity or population trends (Figure 4 & 5).

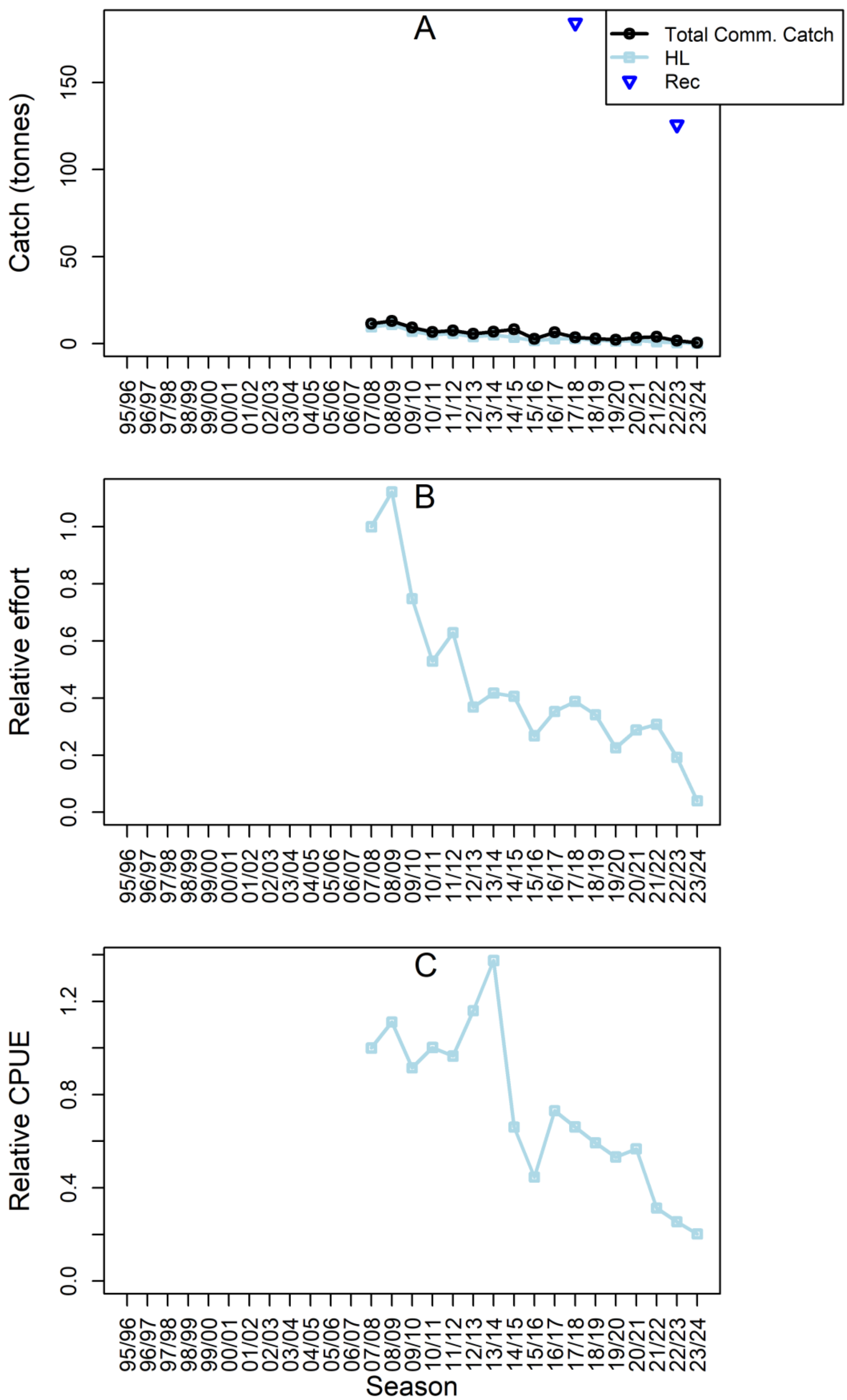

Figure 3: (A) Annual commercial Sand Flathead catch (t) by gear (dark blue triangles represent recreational catch estimates); (B) annual commercial effort for main gear type(s) based on days fished relative to 2007/08; and (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 2007/08. HL = handline, Rec = estimated recreational catch.

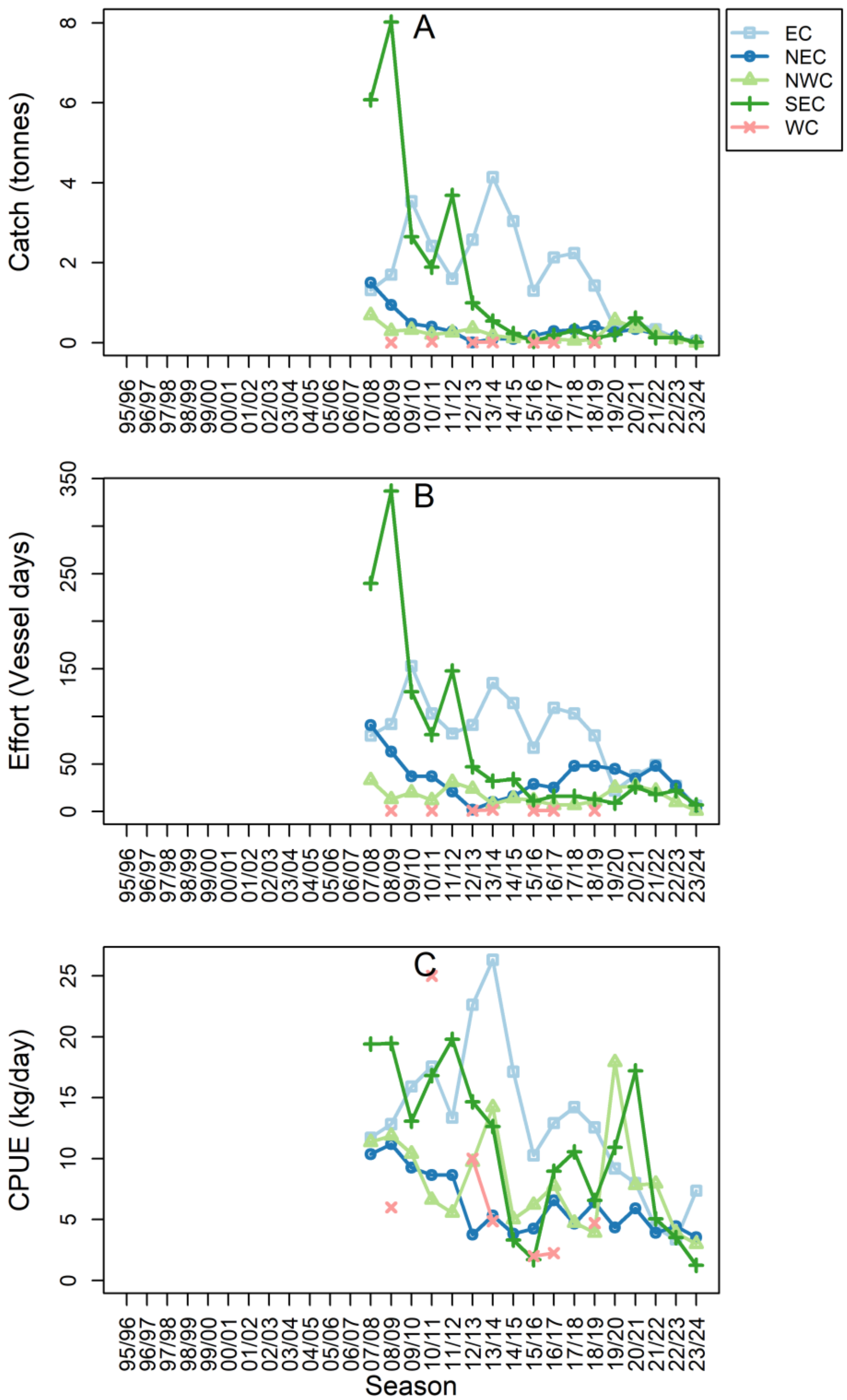

Figure 4: Regional commercial Sand Flathead catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for handline gear. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

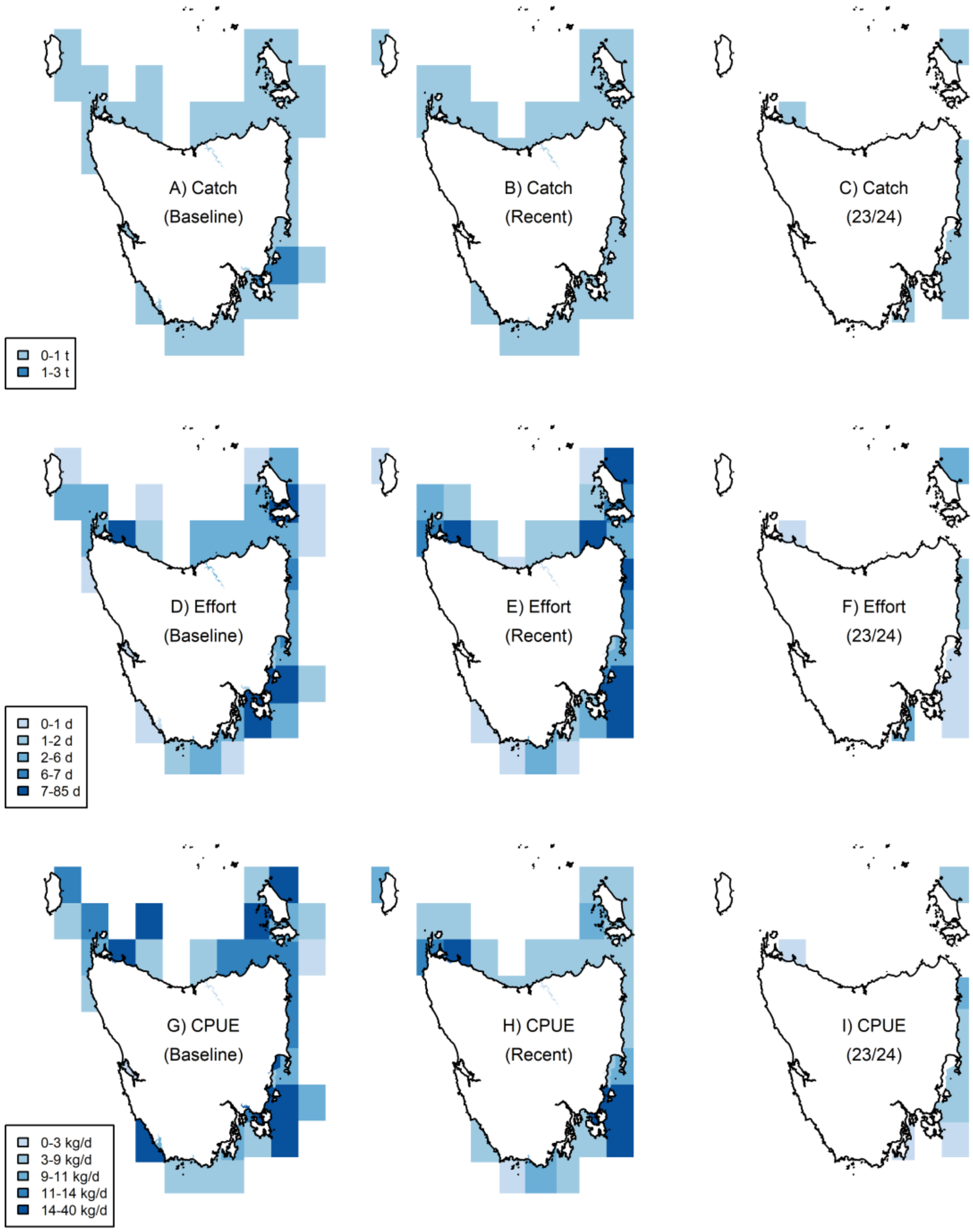

Figure 5: Sand Flathead commercial catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (2007/08 to 2016/17 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2018/19 to 2022/23). '23/24' represent data from the 2023/24 fishing season.

6 Length- and age composition

Fishery-independent surveys provide length- and age frequency data for Sand Flathead which are used to analyse trends and assess stock status against management reference points. All length- and age-frequency data can be accessed on the Tas Fisheries research website.

Between December 2024 and March 2025, a total of 762 Sand Flathead were collected across nine locations within five regions, including Flinders Island (Table 1). Fish lengths ranged from a minimum of 200 mm (caught in the D'Entrecasteaux Channel) to a maximum of 553 mm (caught off Flinders Island) (Table 1). Except for Flinders Island, the proportion of Sand Flathead caught below the minimum legal size (MLS) (350 mm) ranged between 79% and 100% (Table 2; Fig. 6). The proportion of Sand Flathead caught below the previous minimum legal size (MLS) of 320 mm ranged between 53% in the north and 95% in the south (Table 2; Fig. 6). In contrast, only 24% of fish caught off Flinders Island were < 320 mm and only 57% < 350 mm. Of the legal-sized fish that were collected during the surveys, females constituted 100% of fish in all regions, except at Stanley and Flinders Island where 83% of fish ≥ 350 mm were females.

The youngest fish caught in the Tamar was 1 year old while the youngest fish caught across all other regions was 2 years old. The oldest fish from each region ranged between 7 years at Bridport to 16 years at Flinders Island (Table 2). The percentage of fish aged ≤ 6 years was > 70% in all regions except Flinders, where only 65% of fish were ≤ 6 years of age (Figure 7).

Table 1: The total number (*n*), minimum (Min), maximum (Max) and mean total lengths (TL, mm) and ages (years) of Sand Flathead caught from nine locations within five regions around Tasmania in 2025.

Region	Location	*n*	Min TL	Max TL	Mean TL	Min Age	Max Age	Mean Age
SEC	Channel	100	167	342	261	2	10	5
	Nor-Fred	100	188	376	273	2	12	4
EC	Mercury	80	251	391	307	2	10	4
	GOB	99	221	396	310	2	13	5
	St Helens	64	218	400	293	2	12	4
NEC	Bridport	73	251	406	319	2	7	4
	Tamar	111	202	372	286	1	10	4
NWC	Stanley	80	200	385	289	2	13	5
FI	Flinders Is.	55	284	553	369	2	16	6

Table 2: The number (*n*) and percentage of Sand Flathead below and above the minimum size limit (MSL) of 320 mm (until May 2023) and 350 mm (from May-2023) caught at nine locations within five regions around Tasmania in 2025. %F denotes the percentage of females.

Region	Location	< 320 mm			> 320 mm			< 350 mm			> 350 mm		
		n	%	%F	*n*	%	%F	*n*	%	%F	*n*	%	%F
SEC	Channel	94	94	66	6	6	100	100	100	68	0	0	N/A
	Nor-Fred	95	95	73	5	5	80	99	99	73	1	1	100
EC	Mercury	57	71	60	23	29	91	72	86	65	8	10	100
	GOB	62	63	74	37	37	97	85	86	80	14	14	100
	St Helens	47	73	55	17	27	71	57	89	54	7	11	100
NC	Bridport	39	53	46	34	47	94	58	79	60	15	21	100
	Tamar	90	81	43	21	19	71	109	98	48	2	2	100
NWC	Stanley	65	81	52	15	19	73	74	93	54	6	8	83
FI	Flinders Is.	13	24	54	42	76	79	26	47	61	29	53	83

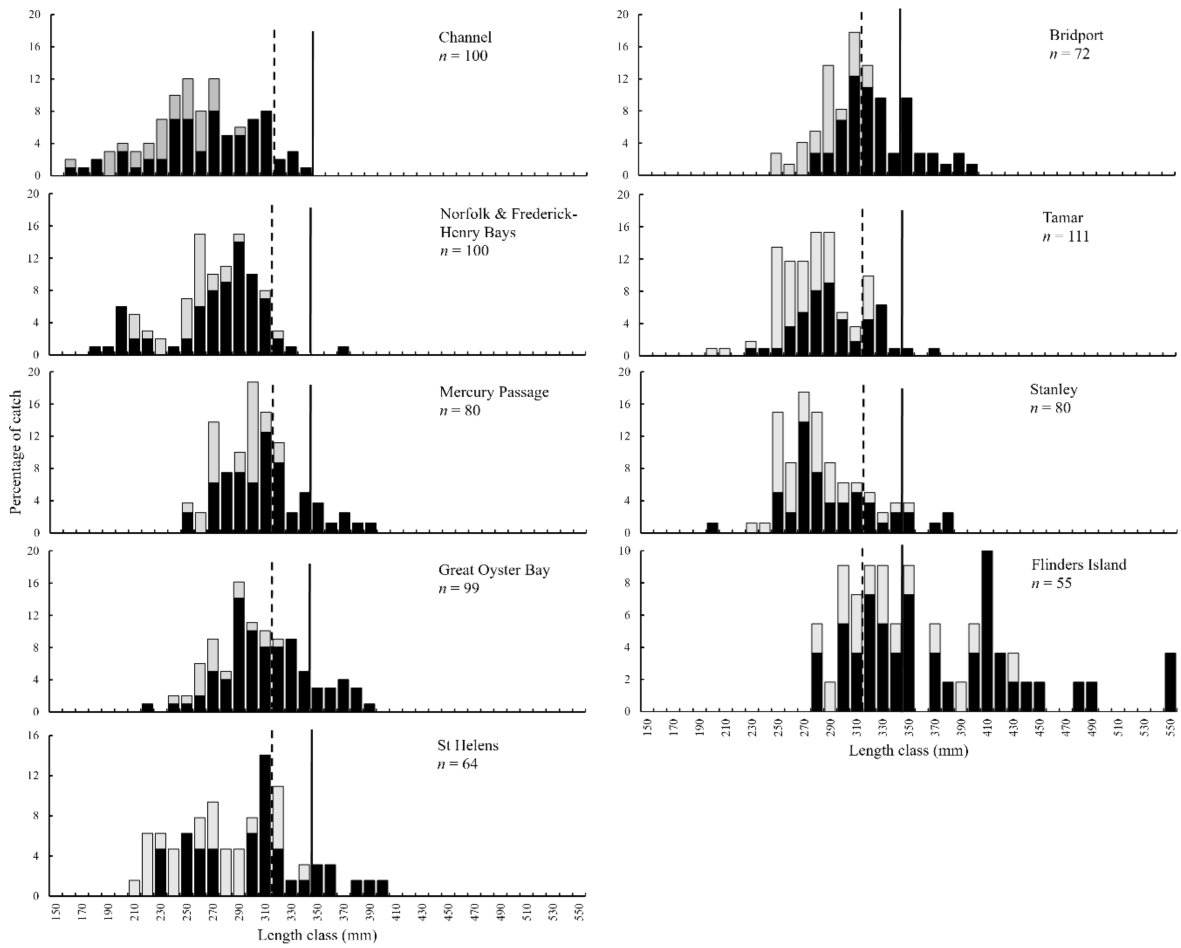

Figure 6: Length frequency distributions for female (black bars) and male (grey bars) Sand Flathead caught at nine locations around Tasmania in 2025. The dotted lines indicate the previous minimum size limit (MSL) of 320 mm, while the solid lines indicate the new MSL of 350 mm.

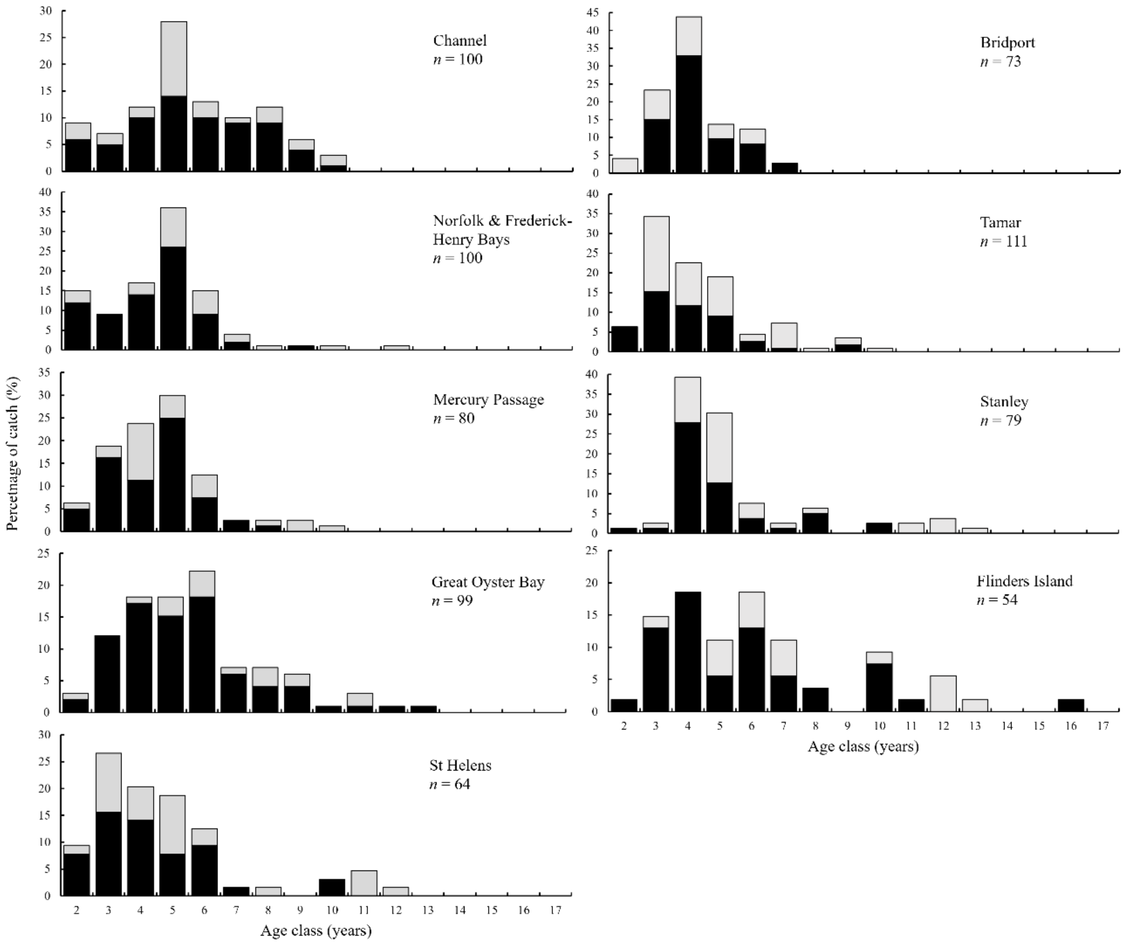

Figure 7: Age frequency distributions for female (black bars) and male (grey bars) Sand Flathead caught at nine locations around Tasmania in 2025.

7 Length-based assessments

Estimating representative life history parameters for length-based stock assessment from fishery-independent survey data was complicated by the size- and age-truncation of populations before surveys commenced in 2012. Consequently, for most regions, infinite or asymptotic length (*Linf*), which is the mean length of fully grown adults if there was no fishing, could not reliably be inferred using standard fits of the von Bertalanffy growth function (VBGF). This is because fishing pressure in the past has led to the rarity or complete absence of the largest individuals in most regions across Tasmania. Thus, Powell-Wetherall regressions were used as an additional approach for *Linf* estimation.

In this assessment, *Linf* was re-estimated based on the extended survey dataset, which included more size and age frequency information from Flinders Island, where populations are lightly fished compared to other regions across Tasmania. Confirming this assumption and findings in the first independent assessment report (Krueck et al. 2023), Powell-Wetherall regressions revealed estimates of *Linf* for female fish on Flinders Island that were closely aligned again with those from standard VBGF fits to the same data (54.4 cm vs 52.7 cm). These estimates were very similar to last year's estimate (54.4 cm vs 54.6 cm). Importantly also, *Linf* estimates from both the last assessment reports as well as VBGF fits to Flinders Island data were firmly within the confidence interval of those resulting from Powell-Wetherall regressions (49.9 to 61.7 cm). To capture this uncertainty range around *Linf* and around the associated growth rate *k*, we followed the scenario testing approach introduced in last year's report, which parameterised baseline conditions for an unfished female population of Sand Flathead for subsequent estimates of fishing mortality and biomass depletion by defining three alternative baselines: 1) the "Best estimate" scenario (default assumption: *Linf* = 54.4 cm; *k* = 0.18); 2) the "Fast growth" scenario (*Linf* = 49.9; *k* = 0.3); and 3) the "Slow growth" scenario (*Linf* = 61.7 cm; *k* = 0.14). In addition, for this report, we included a new scenario termed "SEC baseline" which used pooled data from our three traditionally surveyed key fishing areas in the south-east coast (SEC) region (D'Entrecasteaux Channel, Frederick Henry & Norfolk Bays and Great Oyster Bay) as an alternative baseline to estimate life history parameters from VBGF fits to data from this region (see Figure 8). The additional "SEC baseline" scenario was established to capture potential regional differences in growth caused by environmental conditions (such as differences in temperature or habitat between Flinders Island and the SEC region) but optimistically assumes that life history parameter estimation from SEC data are unaffected by the truncated length frequencies observed at these key fishing grounds.

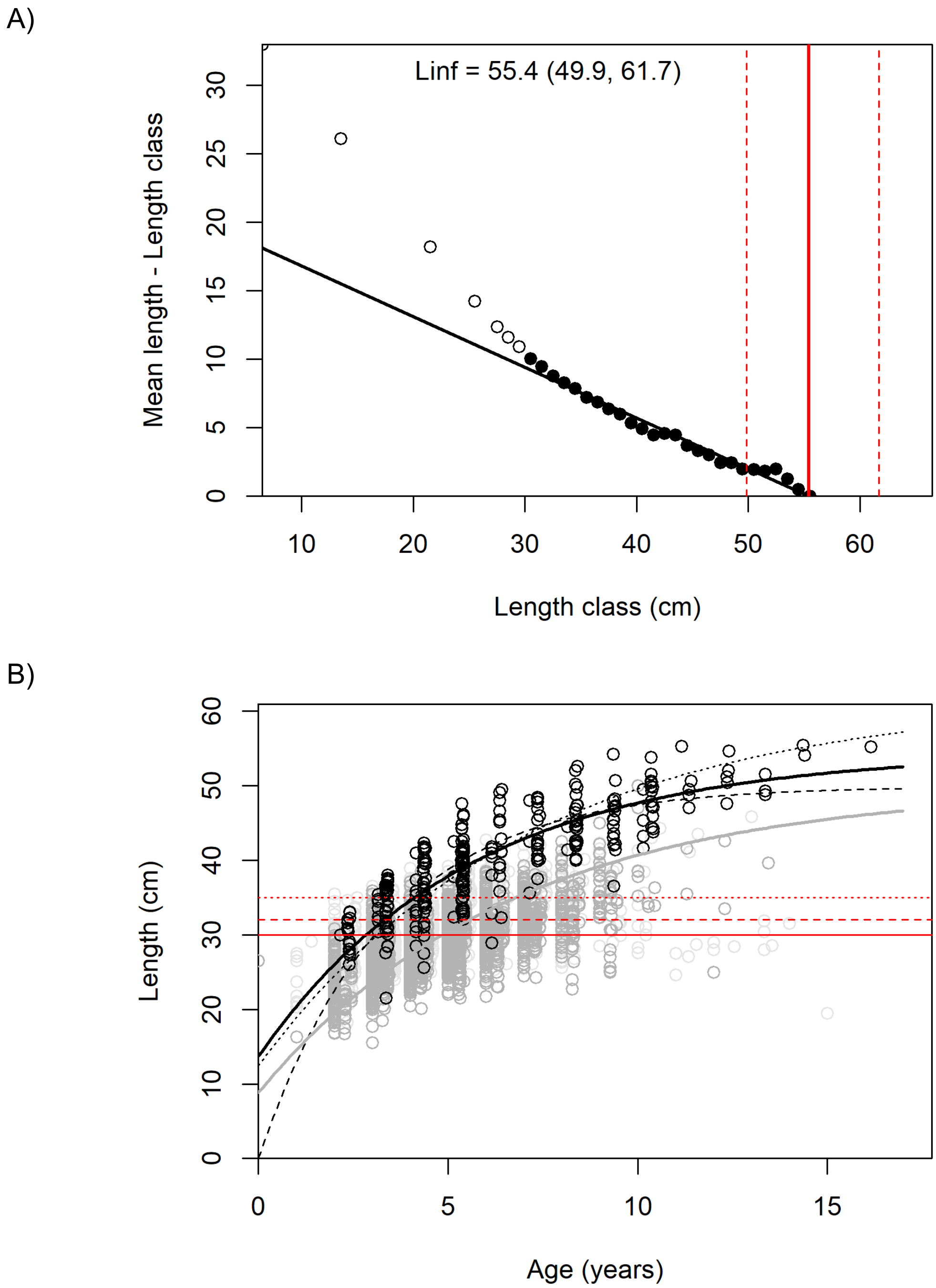

Figure 8: A) Powell-Wetherall regression to estimate the asymptotic length (*Linf*) of female Sand Flathead based on data from lightly fished survey sites on Flinders Island. Filled circles highlight data for individuals ≥30 cm in length, which was representative of the estimated length of "full" gear selectivity (≥95% of individuals). Red vertical lines mark the estimate of *Linf* (solid) and associated confidence intervals (dashed). (B) Alternative fits of the von Bertalanffy growth function (VBGF) to estimate *Linf* and the associated growth coefficient (*k*). The black solid line represents the "best estimate" scenario (default assumption) while the dashed and dotted black lines represent the alternative "fast growth" and "slow growth" scenarios, respectively, all based on fits to the black dots which represent the assumed baseline data from Flinders Island. The solid grey line represents an alternative baseline assumption by fitting the VBGF to length-at-age data from the consistently surveyed south-east coast ("SEC") region (dark grey dots), where fishing is more intense. The light grey dots represent data from other survey sites across the state. Red lines represent the long-term initial (solid: 30 cm), previous (dashed: 32 cm) and current (dotted: 35 cm) minimum size limit.

The growth rate *k* for the default scenario (0.18) was very similar though slightly lower than estimates from previous years (0.19-0.2). Similarly, the updated estimate of natural mortality (0.26) of females was slightly lower than 0.28 and 0.3 in the previous two assessments, which was caused by a new maximum recorded age of 16 years for female fish in Tasmania (updated from 14 and 15 years in the previous two reports). We note again that, in comparison, the oldest recorded age for males in Tasmania is now 22 years, which results in a notably lower natural mortality estimate for male fish. It is possible that females could reach a similar age, which would warrant additional sensitivity analyses in the future, considering that reduced mortality is generally associated with a higher sensitivity to fishing pressure, thus affecting estimates of fishing mortality as well as biomass depletion. As expected, the additional "SEC baseline" scenario represented an overall more resilient stock, revealing the lowest estimate of *Linf* (49.8 cm) combined with comparatively slow growth (k = 0.15) and thus high *M/k* (1.73).

Plausible combinations of *Linf*, *k* and *M* captured by our three alternative baseline scenarios representing Flinders Island as well as the additional one representing the SEC region (Table 3) were used firstly to estimate mortality using length-based catch curve analyses, and secondly, to estimate the depletion of spawning potential and relative fishing mortality (*F/M*) using LBSPR. If not otherwise specified, results refer to the best estimate scenario, including an associated life history ratio *M/k* of 1.44 (0.26/0.18), which is closely aligned with default assumptions according to classic life history theory (median *Mk* = 1.5).

Table 3: Key parameters used for length-based assessments of stock status and trends. *Linf*: infinite or asymptotic length; *k*: von Bertalanffy growth rate; *M*: instantaneous rate of natural mortality; *M/k*: the ratio between natural mortality and growth determines the shape of the estimated unfished length-frequency distribution. All results represent females only.

Scenario	***Linf***	***k***	***M***	**M/k**
"Best estimate"	54.4 cm	0.18 (t0=-1.6)	0.26	1.44
"Fast growth"	49.9 cm	0.3 (t0 = 0)	0.26	0.87
"Slow growth"	61.7 cm	0.15 (t0=-1.5)	0.26	1.86
"SEC baseline"	49.8 cm	0.15	0.26	1.73

Outcomes from length-based catch curves revealed a high instantaneous rate of long-term total annual mortality (*Z)* of 1.51 at the three survey locations in the southeast and east coast region that have been sampled from 2012 onwards (D'Entrecasteaux Channel, Frederick Henry and Norfolk Bays and Great Oyster Bay). This *Z* value translates to approximately 78% long-term mortality of adults per year. The instantaneous rate of annual fishing mortality was estimated at 1.25, translating to a long-term annual mortality of 71% (95% confidence interval: 63%-78%) caused by fishing alone (Table 4). In other words, fishing mortality through time was estimated to have accounted for 91% of total annual deaths of the current adult population of females at traditionally surveyed locations in the south-east coast region. This estimated level of fishing mortality is substantial, as further highlighted by the estimated long-term ratio of fishing mortality relative to natural mortality (*F/M* = 4.81), which far exceeded putatively sustainable levels of *F/M* below 1. The inclusion of survey data from all additional sites on the east and north coasts, including Flinders Island, which have been sampled from 2021 (and since 2023 for Flinders Island) onwards resulted in considerably reduced levels of estimated long-term fishing mortality (23%) and *F/M* (1) for pooled data. However, these values for pooled data masked concerning levels of both long-term fishing mortality and biomass depletion of females in all coastal waters of Tasmania except for Flinders Island, which became evident again when Flinders Island samples were excluded (see Table 4). Flinders Island itself, where fishing pressure is comparatively low, revealed an estimate of total long-term mortality Z of only 0.27 (0.21-0.33). This value and associated uncertainty range was a close match to our independent maximum age-based estimate of natural mortality M of 0.26, indicating that fishing pressure off Finders Island was indeed likely to be very low as expected by defining baseline life history parameters using Flinders Island data.

Table 4: Estimates of long-term total mortality (Z), fishing mortality ($F = Z$-M), and fishing mortality relative to natural mortality (F/M) based on length-based catch curves using fishery-independent survey data between 2023 and 2025. Results for the southeast coast region represent females from three traditionally sampled survey sites (D'Entrecasteaux Channel, Frederick Henry and Norfolk Bays and Great Oyster Bay). All results state 95% confidence intervals in brackets.

Region	***Z***	***F***	***F/M*** (Target: 0.5-1)
Pooled - all regions	0.52 (0.46-0.58)	0.26 (0.2-0.32)	1 (0.77-1.23)
Pooled - Flinders excluded	1.28 (1.12-1.44)	1.02 (0.86-1.18)	3.92 (3.31-4.54)
Southeast coast traditional	1.51 (1.26-1.76)	1.25 (1-1.5)	4.81 (3.85-5.77)

Outcomes from the Length-Based Spawning Potential Ratio (LBSPR) estimation approach corroborated the findings above by highlighting that the long-term relative fishing mortality in the south-east coast region far exceeded putatively sustainable levels (Table 5, Figure 9A). Moreover, LBSPR results indicated that overfishing in the south-east coast region has caused the depletion of female spawning potential below the limit reference point of 20% of the unfished spawning potential (Table 5, Figure 9B). These general findings were robust to alternative assumptions about growth and asymptotic lengths using data from Flinders Island as the baseline for life history parameter estimates. Results for the "best estimate" and "slow growth" scenarios were almost identical while those for the "fast growth" scenario revealed slightly higher estimated depletion and relative fishing mortality. However, results according to the alternative baseline data from the south-east coast region ("SEC baseline") revealed notably lower estimated depletion and relative fishing mortality (Table 5, Figure 10). While populations were still estimated to be potentially depleted, the estimated spawning potential for the "SEC baseline" scenario was then close to the limit reference point (20-25% of unfished conditions) (Table 5). Notably, while mortality and depletion estimates were higher than reported last year due primarily to input parameter re-estimation (including SL50 and SL95), smoothed trends over time in the relative SPR and associated long-term fishing mortality indicated that female spawning biomass might have been slowly recovering over recent years (Figure 9 and 10).

Table 5: Estimates of the long-term relative fishing mortality (*F*/*M*) and spawning potential (*SPR*/*SPR0*) of female Sand Flathead at traditional sampling areas in the south-east coast region using the Length-Based Spawning Potential Ratio (LBSPR) assessment approach. See text above and Table 3 for details on scenarios.

Scenario	***F*/*M* in 2025**	***SPR*/*SPR0* in 2025** (Target >0.2)
Estimate	6.62 (5.48-7.76)	0.06 (0.05-0.07)
Fast growth	8.5 (7.08-9.92)	0.05 (0.04-0.05)
Slow growth	6.57 (5.43-7.71)	0.06 (0.05-0.07)
SEC baseline	3.79 (3.09-4.49)	0.22 (0.20-0.25)

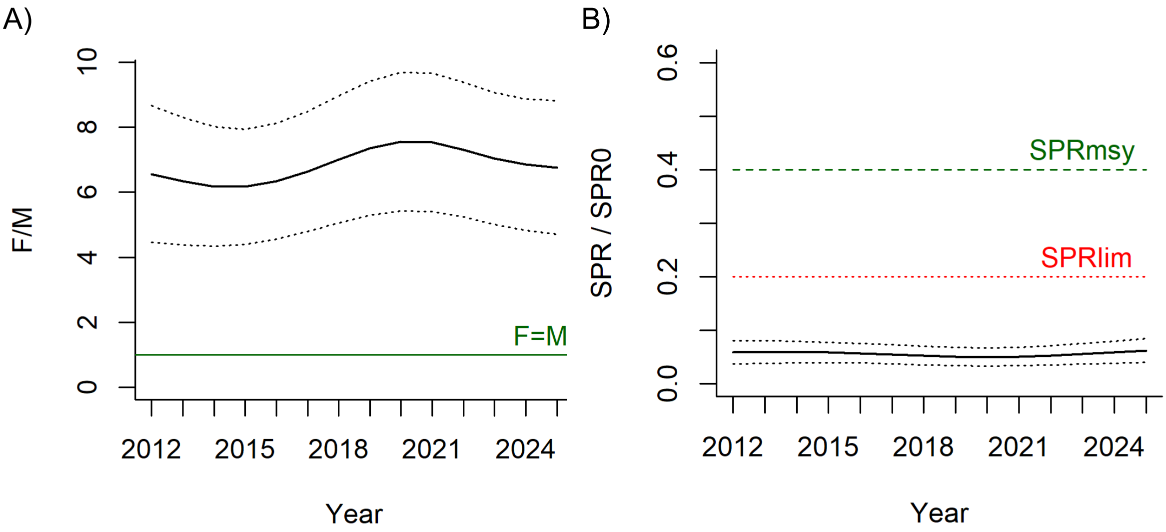

Figure 9: Smoothed trends in the long-term relative fishing mortality (A) and spawning potential (B) of female Sand Flathead in the south-east coast region using the Length-Based Spawning Potential (LBSPR) assessment approach. Fishing mortality relative to natural mortality (*F*/*M*) ratios > 1 are widely used to infer overfishing (solid line in A). Estimates of the current spawning potential ratio relative to unfished levels (*SPR*/*SPR0*) is assessed against the standard limit reference point of 0.2 (20% of unfished levels) to infer depletion and against a desirable target reference point of 0.4 (40% of unfished levels) to assess productivity.

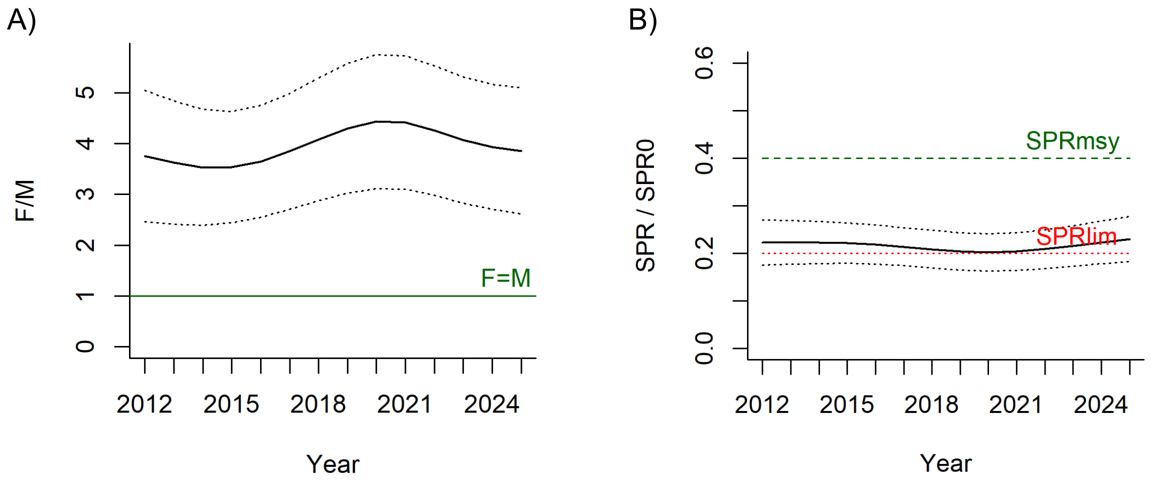

Figure 10: Smoothed trends in the long-term relative fishing mortality (A) and spawning potential (B) of female Sand Flathead in the south-east coast region using the Length-Based Spawning Potential (LBSPR) assessment approach. Results are as presented in Figure 9 but using pooled data from the south-east coast region ("SEC baseline") to estimate key input parameters.

To clarify fundamental differences between the two baseline assumptions for our alternative growth scenarios (the "best estimate" representing Flinders Island data and the "SEC baseline" representing south-east coast data), we illustrated observed against theoretical unfished length-frequency distributions in R using LBSPR functions (Figure 11). The length-frequency distributions underpinning our default scenario ("best estimate") resulted in predicted unfished length frequencies that closely matched those observed (sampled in the field) at Flinders Island (Figure 11A). This close match explains why the estimated long-term fishing mortality and spawning potential depletion for Flinders Island were very low. In contrast, recent samples from the south-east coast region were highly depleted compared to the theoretical unfished length-frequency distributions derived from Flinders Island data, missing any considerable representation of fish >40 cm and resulting in an even more severe estimate of depletion in female biomass and spawning potential down to only 5% of unfished levels (Figure 11B, see also Figure 9).

For the alternative SEC baseline scenario, explained previously, length frequency comparisons looked different. Effectively, the alternative "SEC baseline" scenario assumed that the fish observed at Flinders Island could not exist in the south-east coast region, as illustrated by the much higher relative abundance of large individuals in the "sample" than assumed even if there was no fishing (the "target", Figure 11C). Similarly, in this scenario, the smallest and most abundant individuals expected under unfished conditions were not present or not selected by the gear at Flinders compared to the theoretical baseline conditions estimated for the south-east region (Figure 11C). In line with this, the estimated depletion of populations in the south-east coast region based on observed data was less severe, because the expected relative abundance of large individuals was much lower for the south-east coast region baseline than for the Flinders Island baseline (Figure 11D).

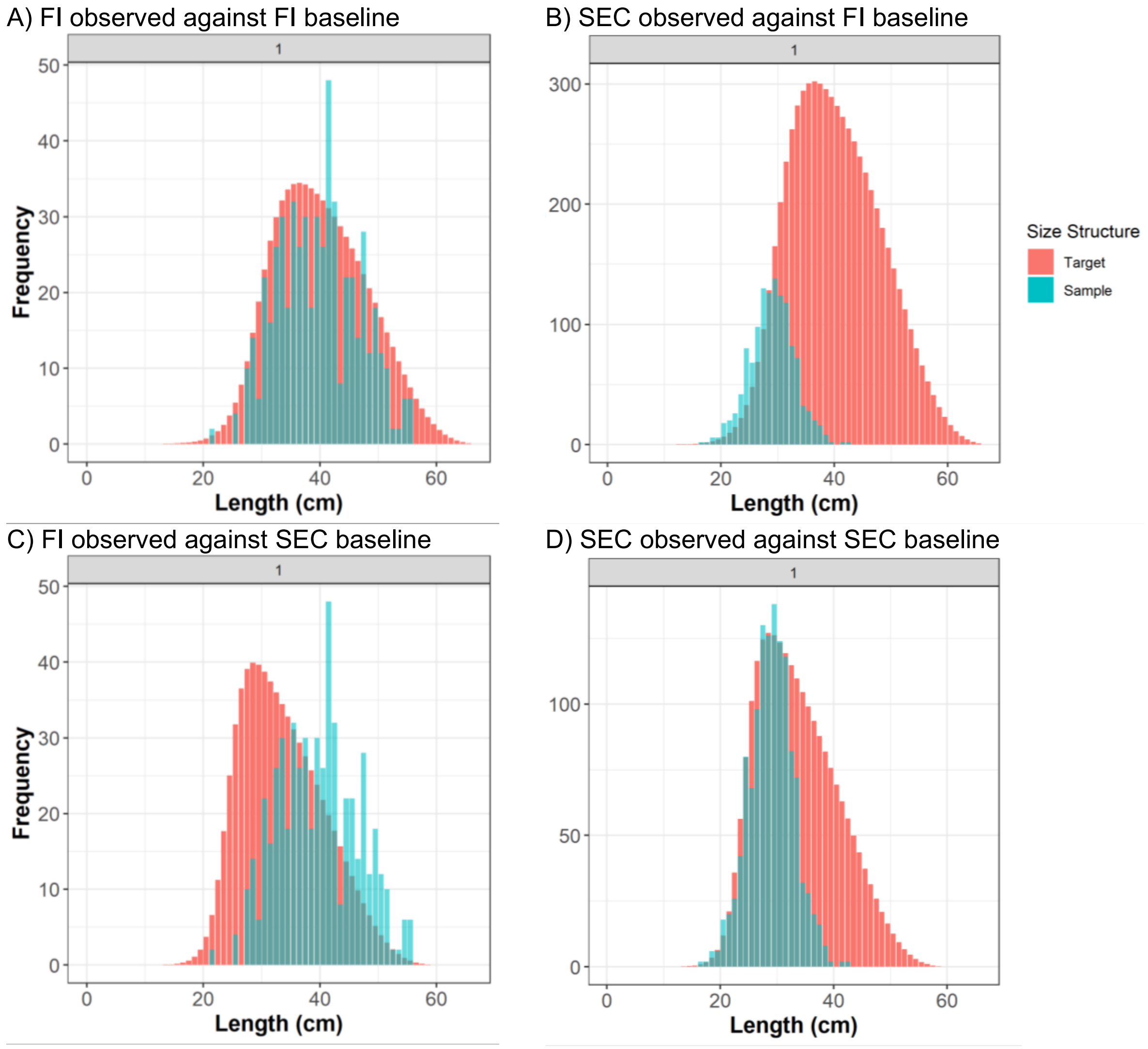

Figure 11: Contrasting baseline assumption and depletion estimates illustrated by observed vs theoretical unfished length-frequency distributions using LBSPR. Survey data observed over the last three years (the sample) are compared here to theoretical unfished length frequencies (the target) to estimate depletion. Upper panels represent the more conservative assumption that all fish could grow as observed at Flinders Island if fishing stopped, indicating that observed length frequencies A) at Flinders Island represent nearly unfished conditions, while B) in the south-east coast region are heavily size truncated. Lower panels represent the more optimistic assumption that growth conditions in the south-east coast region are different from those at Flinders Island and that growth estimates using regional data is unaffected by fishing mortality, indicating that observed length frequencies C) at Flinders Island are higher than expected even if there was no fishing, and B) size truncation in the south-east coast region is still concerning but less alarming. Note that numbers of fish for the theoretical (unfished) “target” in all plots (“Frequencies”) are auto-generated by the LBSPR function for adequate comparison to numbers observed in the “sample”.

A regional breakdown of LBSPR outcomes, representing samples collected over the past three years from multiple additional locations on the east and north coast, indicated that current levels of population depletion are still high across Tasmania (Table 6). That is, in all regions except for Flinders Island, populations were estimated to be potentially depleted below the limit reference point of 20% of the unfished spawning potential. Similar outcomes were evident for estimates of long-term relative fishing mortality, with *F/M* exceeding values of 2 in all regions except for Flinders Island.

According to the alternative growth scenario ("SEC baseline"), which used data from traditionally surveyed areas in the south-east region as the baseline, depletion estimates were slightly more optimistic, with the spawning potential of fish in both Great Oyster Bay and the Mercury Passage then estimated above the limit reference point (0.2) but below the target reference point (0.4) levels (see Table 7). However, the spawning potential ratio in both the D'Entrecasteaux Channel and Frederick Henry & Norfolk Bays was still estimated to be depleted, and all areas exhibited unsustainable (*F/M* > 2) levels of long-term fishing mortality.

Table 6: Regional estimates of the long-term relative fishing mortality (*F/M*) and the spawning potential ratio (*SPR/SPR0*) for female Sand Flathead sampled between 2023 and 2025. Results are based on the "best estimate" of growth using Flinders Island data as the baseline. Sustainable *F/M* < 1. Limit reference point >0.2 and target reference point >0.4.

Region	**Fishing mortality *(F/M)***	**Spawning Potential *(SPR/SPR0)***
Bridport (NEC)	Overfished (>3)	Below limit (<0.2)
D'Entrecasteaux Channel (SEC)	Overfished (>8)	Below limit (<0.1)
Flinders Island (FI)	Not overfished (<1)	Above target (>0.4)
Frederick Henry & Norfolk Bays (SEC)	Overfished (>7)	Below limit (<0.1)
Great Oyster Bay (EC)	Overfished (>6)	Below limit (<0.1)
Mercury Passage (EC)	Overfished (>4)	Below limit (<0.2)
Stanley (NWC)	Overfished (>2)	Below limit (<0.2)
St Helens (EC)	Overfished (>5)	Below limit (<0.2)
Tamar (NEC)	Overfished (>7)	Below limit (<0.1)

Table 7: Estimates of the long-term relative fishing mortality (*F/M*) and the spawning potential ratio (*SPR/SPR0*) for female Sand Flathead sampled between 2023 and 2025. Results are based on the alternative growth estimate using the traditionally surveyed south-east coast data as the baseline ("SEC baseline"). Classification thresholds are the same as above.

Region	**Fishing mortality *(F/M)***	**Spawning Potential *(SPR/SPR0)***
D'Entrecasteaux Channel	Overfished (>5)	Below limit (<0.2)
Frederick Henry & Norfolk Bays	Overfished (>4)	Below limit (<0.2)
Great Oyster Bay	Overfished (>3)	Below target (<0.3)
Mercury Passage	Overfished (>2)	Below target (<0.3)

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9 Appendix 1: Data quality control

There have been multiple administrative changes that affected the collection of commercial catch and effort data from the scalefish fishery. The following restrictions and adjustments have been applied when analysing these data as an attempt to ensure comparability among years, especially when examining trends over time.

i) Correction of old logbook landed catch weights

Prior to 1995, catch returns were reported as monthly summaries of landings. With the introduction of a revised logbook in 1995, catch and effort was recorded daily for each method used. Since catch data reported in the old general fishing return represent landed catch, it has been assumed to represent processed weights. For example, where a fish is gilled and gutted, the reported landed weight will be the gilled and gutted and not the whole weight. In contrast, in the revised logbook all catches are reported in terms of weight and product form (whole, gilled and gutted, trunk, fillet, bait or live). If the catch of a species is reported as gilled and gutted, then the equivalent whole weight can be estimated based on a conversion factor[1].

Without correcting for product form, old logbook and revised logbook catch weights are not strictly compatible. To correct for this issue and provide a 'best estimate', a correction factor was calculated using catch data from the revised logbook and applied to catches reported in the old logbook. A species-based ratio of the sum of estimated whole weights (adjusted for product form) to the sum of reported catch weights was used as the correction factor.

ii) Effort Problems

Records of effort (based on gear units) of zero or null, or appearing to be recorded incorrectly (implausible), were flagged. While catch can then still be included in catch summaries, such records need to be excluded from calculations of gear unit effort, complicating associated calculations of CPUE for most species. However, all records of effort can be considered in calculating daily CPUE.

iii) Vessel restrictions

In all analyses of catch and effort, past catches from six vessels (four Victorian based and two Tasmanian based) have been excluded from historic records. These vessels were known to have fished consistently in Commonwealth waters and their catches of species, such as Blue Warehou and Ling tended to significantly distort catch trends. In fact, all four Victorian vessels and one of the Tasmanian vessels ceased reporting on the General Fishing Returns in 1994. With the introduction of the South East Fishery Non-Trawl logbook (GN01) in 1997, the remaining Tasmanian vessel ceased reporting fishing activity in the Tasmanian logbook.

[1] Conversion factors to whole weights are 1.00 for whole, live or bait; 2.50 for fillet; 1.50 for trunk; and 1.18 for gilled and gutted.

10 Appendix 2: History of stock status classifications

Annual stock status classifications of Southern Sand Flathead. Terminology of status classifications has changed over time; however, colours represent equivalent classifications. Yellow: Depleting; Red: Depleted; NA indicates catch, effort, and CPUE data for the species were included in an assessment report, but no classification was conducted. Consideration of Sand Flathead data in Tasmanian Scalefish Fishery assessment reports started in 2011/2012. The first classification of Sand Flathead stock status was published for the 2014/2015 season. The first independent stock assessment report for Sand Flathead was published for 2023.

10/ 12	12/ 13	13/ 14	14/ 15	15/ 16	16/ 17	17/ 18	18/ 19	19/ 20	20/ 21	21/ 22	2023	2024	2025
NA	NA	NA											