TASMANIAN SCALEFISH FISHERY ASSESSMENT 2020/21

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2022

This assessment of the Tasmanian Scalefish Fishery is produced by the Institute for Marine and Antarctic Studies (IMAS) using data downloaded from the Department of Natural Resources and Environment, Tasmania (NRE Tas) Fisheries Integrated Licensing and Management System (FILMS) database. The information presented here includes all logbook returns for the 2020/21 season.

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Executive Summary

The Tasmanian Scalefish Fishery is a multi-species fishery that operates in state waters and encompasses a wide variety of species and capture methods. The Scalefish Fishery Management Plan (amended in 2015) provides the legislative framework for the fishery.

Fishery assessment

Since the early 1990s, annual commercial catches of the major scalefish species have generally declined. The decline can be explained in part by changed targeting practices and market demand, declines in species abundance and biomass, the introduction of the Scalefish Fishery Management Plan in 1998, and the transfer of the Southern Shark Fishery to the Commonwealth in 2000.

The number of vessels participating in the scalefish fishery and the number of active scalefish fishing licenses have declined notably since 2000. Commercial catches have also declined over this period; however, this is only partly attributable to declining effort and there is ongoing concern or insufficient information about the status of multiple assessed species. There is also concern regarding the level of latent capacity within the fishery from licence holders who are currently participating either at low levels or not active (only about 50% of licences are active, depending on the type).

Highest commercial catches in 2020/21 were reported for Gould’s Squid (670.4 t; 279 t reported by scalefish licence holders), Southern Calamari (82.2 t), Tiger Flathead (60.8 t), and Eastern School Whiting (54.0 t). Summary tables detailing commercial catches for all assessed species and various other species groups are available in Appendix 3. Catch and effort data for the recreational fishery, which are estimated periodically, demonstrate that the recreational catch represents most (>50%) or a significant component of the total harvest of several key species, including Sand Flathead, Striped Trumpeter, and Bastard Trumpeter. The latest survey of recreational catches was conducted in 2017/18 and outcomes of the associated report were summarised in the 2018/19 scalefish assessment report (Krueck et al. 2020).

Species status

Catches of more than 100 species are reported under the commercial Scalefish Fishery in Tasmania. However, catches vary substantially among species, primarily because of differences in social and economic value. Only 22 species have been prioritised for stock status assessment in this report. Prioritisation was based on whether species are targeted, the magnitude of annual landings recorded since 1995/96, the social-economic importance of the species, and general concerns about species conservation related to fishing activities.

The status of all main scalefish species was assessed based on information available through previous assessments, new data on catch, effort, and species biology, as well as updated stock assessments by the Fisheries Research and Development Corporation (FRDC) and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (Patterson et al. 2021). Species status was assigned according to the national framework used for the Status of Australian Fish Stocks (SAFS) reports (Sustainable, Recovering, Depleting, Depleted or Undefined) (refer to the FRDC webpage for further explanation). We note that this classification framework only assesses the stock status against the limit reference point of whether it is likely to be depleted and/or recruitment impaired. Where possible, in this report, we contrast estimates of stock status also against target reference points (i.e., those that correspond to levels of biomass and fishing pressure that are considered to provide for maximum ecological or economic productivity) but these target reference points are not used as a criterion to define sustainability.

In cases where both fishery-dependent and fishery-independent data are inadequate to inform stock status assessments, species are classified as Undefined. In most cases, this is due to low catches and effort recorded in commercial logbooks over recent years. However, there are three principal considerations for assigning a status as Sustainable in this situation:

(1) Confidence that historic catches are unlikely to have caused biomass depletion (information on sustainable/unsustainable catches from other states might be consulted for justification);
(2) A clear rationale for any declining trends (if evident), such as fundamental changes in management arrangements; and
(3) In cases where catch is not recorded at the species level, confidence that neither historic nor recent catches are likely to have caused biomass depletion of the most vulnerable species within multi-species groups.

We note that the Institute for Marine and Antarctic Studies (IMAS) and the Department of Natural Resources and Environment, Tasmania (NRE Tas) have initiated a continuous data quality control and assessment procedure, which can cause changes to the Fisheries Integrated Licensing and Management System (FILMS) database and stock assessment calculations to be presented in future reports. Historical stock status classifications of each species assessed for the current season are available in Appendix 4.

We further note that Banded Morwong assessments are reported separately, reflecting differences in the reporting period for setting the annual Total Allowable Catch (TAC) (based on quota year) compared with routine assessment reporting for other scalefish species (based on financial year). Octopus catches are reported following the same reporting period as Banded Morwong and, thus, are also assessed in an independent report.

Species assessments for 2020/21

Species/Species group	Preliminary status	Explanation
State assessed species		
Australian Sardine *Sardinops sagax*	**SUSTAINABLE**	There is effectively no current commercial fishing for Australian Sardine in Tasmanian waters, with all Developmental Australian Sardine Permits now expired. As such, the current level of fishing pressure in Tasmania is unlikely to cause the biological stock to become recruitment impaired. The species was classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). Similarly, all Australian stocks are currently classified as Sustainable in the 2020 Status of Australian Fish Stocks report (Piddocke et al. 2021).
Barracouta *Thyrsites atun*	**UNDEFINED**	Catches of Barracouta have declined steadily since the mid-2000s, presumably due to a decrease in targeted effort resulting from a lack of market demand as well as possible impacts of environmental change. Low levels of fishing effort mean that catch and CPUE data are unreliable indicators of biomass and stock status. However, historic catches were substantial and, thus, there is insufficient information to confidently classify the stock.
Bastard Trumpeter *Latridopsis forsteri*	**DEPLETED**	Trends in commercial and recreational catches of Bastard Trumpeter suggest record low population levels and that the species is recruitment overfished. The current minimum legal size limit is below the size at maturity, and the fishery is based almost entirely on juvenile fish. Data-limited stock assessment methods suggest that stock recovery under current levels of catch is theoretically possible, but evidence of recovery is lacking.
Eastern Australian Salmon *Arripis trutta*	**SUSTAINABLE**	Eastern Australian Salmon has a long history of exploitation across south-eastern Australia. Low commercial landings in Tasmania in recent years are likely to be driven by market demand rather than abundance. The current level of fishing pressure in Tasmania is well below historically sustained levels

		and thus unlikely to cause the biological stock to become recruitment impaired.
Flounder *Pleuronectidae* family	**UNDEFINED**	Greenback Flounder *(Rhombosolea tapirina)* constitute the majority of the commercial catch, which remains low due to limited market demand and the requirement for fishers to attend gear for most overnight gillnetting. Low recent effort, catch and CPUE are unlikely to reflect trends in biomass, but the impact of historic catches is uncertain. Thus, the status of the stock remains undefined.
King George Whiting *Sillaginodes punctatus*	**SUSTAINABLE**	King George Whiting is an emerging species that has attracted increasing interest from both the commercial and recreational sector. The current level of fishing pressure on King George Whiting within Tasmanian waters is unlikely to cause the biological stock to become recruitment impaired. However, local impacts on stocks could still be considerable. Pre-emptive monitoring and management are needed if interest in this species continues to increase.
Leatherjackets *Monacanthidae* family	**UNDEFINED**	Several species of Leatherjacket are found in coastal waters around Tasmania. Most likely to be captured by coastal fisheries are the Brown-striped (*Meuschenia australis*), Toothbrush (*Acanthaluteres vittiger*), and Six-spine (*Meuschenia freycineti*) Leatherjacket. Leatherjackets are largely a by-product and not actively targeted due likely to a lack of market demand. However, impacts of historic catches (estimated at around 40 tonnes in 1995/96) on the biomass depletion of individual species are uncertain. Thus, there is overall insufficient information to confidently classify the status of Leatherjacket stocks, especially as multiple species are involved.
Longsnout Boarfish *Pentaceropsis recurvirostris*	**UNDEFINED**	Longsnout Boarfish are a by-product species of the gillnet fishery for Banded Morwong, with low catches due to the large minimum legal size. There is insufficient information available to confidently classify this stock.
Snook *Sphyraena novaehollandiae*	**SUSTAINABLE**	Recorded catches of Snook are at low levels, presumably because low market demand means that the species is not actively targeted. Biological

		analyses indicate that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.
Southern Calamari *Sepioteuthis australis*	**DEPLETING**	Sharp regional increases and subsequent fluctuations in catch and effort in recent years suggest that fishing pressure on Southern Calamari is likely to be too high to be sustainable. Despite closures during part of the spawning season, many operators rely on targeting spawning aggregations, which presents a high risk of recruitment impairment. Aggregation fishing also means that data on catch and CPUE are unlikely to reflect trends in biomass and could be "hyperstable". Data-poor stock assessment outcomes give further reason for concern that fishing mortality might have been excessive and that stocks on the south-east and east coast might be depleted or still recovering, while more recently targeted stocks on the north coast might be depleting.
Southern Garfish *Hyporhamphus melanochir*	**DEPLETED**	Both catch and effort data for Southern Garfish showed an overall declining trend in recent years. CPUE has fluctuated substantially but shows a recently reversing trend back to higher levels. However, given the schooling nature of the species, CPUE is unlikely to be a reliable proxy of biomass. Data-limited stock assessment methods suggest that recovery of the population under current levels of catch is theoretically possible, but empirical evidence of recovery is lacking.
Southern Sand Flathead *Platycephalus bassensis*	**DEPLETED**	Recreational catches dominate landings of Southern Sand Flathead in Tasmania. Fishery independent surveys suggest low abundances of legal sized fish in southeast and eastern Tasmania where populations are subject to heavy fishing pressure. While undersized fish appear to be abundant, newly introduced length-based assessment approaches indicate that female stock biomass is likely to be depleted in most regions. Moreover, current levels of fishing pressure are unlikely to be sustainable, specifically where stock rebuilding is likely to be most urgently needed.

Striped Trumpeter *Latris lineata*	**DEPLETED**	Following first recent records of young fish in biological samples after many years of suspected recruitment failure, evidence of population recovery of Striped Trumpeter is still lacking. Commercial catches are close to the historical low, but total levels of fishing pressure (commercial and recreational combined) might still prevent recovery, especially since the minimum size limit is below the estimated size at maturity. Newly introduced length-based assessment approaches indicate that stocks in the south-east coast region have been depleted below critical levels. More data are needed to clarify status and trends across the state.
Wrasse: *Notolabrus* spp. **Bluethroat Wrasse** *Notolabrus tetricus* **Purple Wrasse** *Notolabrus fucicola*	**SUSTAINABLE**	Catches, effort and CPUE of Wrasse have remained relatively stable for almost a decade, providing little reason for concern that the current level of fishing pressure is too high. Uncertainty remains over levels of potential localized depletion, and about the size of the catch taken by rock lobster fishers for use as bait. Relatively low catches over the last two seasons have likely been caused by a combination of COVID impacts and changes in fishery dynamics.
Yelloweye Mullet *Aldrichetta forsteri*	**SUSTAINABLE**	Yelloweye Mullet are most abundant in estuarine habitats, where netting is prohibited or restricted, which provides this species a high degree of protection throughout most of its range in Tasmania. Commercial logbook records indicate consistently low levels of catch. Thus, it is overall unlikely that the stock is recruitment impaired or that the current fishing pressure could cause the stock to become recruitment impaired in the future.
Commonwealth assessed species		
Blue Warehou *Seriolella brama*	**DEPLETED**	Blue Warehou is a predominantly Commonwealth-managed species that has been classified as “Overfished” in the ABARES Fishery Status Reports 2021 (Patterson et al. 2021). It was reported as Depleted in the 2020 Status of Australian Fish Stocks Report. This species is sporadically abundant in Tasmanian waters. Despite a reduction in Total Allowable Catch (TAC) for the Commonwealth fishery

		to 118 t and the initiation of a stock rebuilding strategy in 2008, there is no evidence of stock recovery.
Common Jack Mackerel *Trachurus declivis*	**SUSTAINABLE**	Common Jack Mackerel is a predominantly Commonwealth-managed species that has been classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). Only minor catches of this species have been taken from Tasmanian waters over the last decade due to one purse seine operator leaving the fishery. Patterns of catch and effort are unlikely to reflect stock status but the currently low level of fishing pressure in Tasmania is unlikely to cause the stock to become recruitment impaired.
Eastern School Whiting *Sillago flindersi*	**SUSTAINABLE**	Eastern School Whiting is a predominantly Commonwealth-managed species that has been classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). It has been classified as Sustainable in the 2020 Status of Australian Fish Stocks Report (Piddocke et al. 2021). Tasmanian catches fluctuate due to market demand, but generally represent only a small proportion of the Commonwealth commercial catch.
Gould's Squid *Nototodarus gouldi*	**SUSTAINABLE**	Gould's Squid is a predominantly Commonwealth-managed species that has been classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). Dual-licensed vessels fish for this species in Tasmanian waters, especially in years of peak abundance. Gould's Squid is characterised by high inter-annual variability in abundance in state waters resulting in periodically high catches compared to other scalefish species.
Jackass Morwong *Nemadactylus macropterus*	**SUSTAINABLE**	Jackass Morwong is a predominantly Commonwealth-managed species that has been classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). It has been classified as Sustainable in the 2020 Status of Australian Fish Stocks Report (Piddocke et al. 2021). Catch and effort reported by

		scalefish fishers in Tasmania have been low for the past 15 years.
Tiger Flathead *Platycephalus richardsoni*	**SUSTAINABLE**	Tiger Flathead is a predominantly Commonwealth-managed species that has been classified as “Not overfished nor subject to overfishing” by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). It has been classified as Sustainable in the 2020 Status of Australian Fish Stocks Report (Piddocke et al. 2021). In Tasmania, Tiger Flathead are caught predominantly by the commercial sector. Catches fluctuate substantially on an annual basis, but they typically represent a small proportion of Commonwealth trawl landings.

1. Introduction

This report covers assessments of 22 selected taxa within the Tasmanian Scalefish Fishery, including species of both teleosts and cephalopods. Stock status classifications follow the national reporting scheme used in the Status of Australian Fish Stocks (SAFS) reports. SAFS reports include four 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 can 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 considered where feasible but unaccounted in the basic stock status classification scheme. For more detailed information on status classification categories, please refer to the TasFisheriesResearch webpage.

A full list of common and scientific names of all species landed in the Tasmanian Scalefish Fishery is presented in Appendix 1. We note that the status of most (16) Tasmanian fishery taxa included in this report are assessed exclusively by IMAS. However, formal assessments of another six species primarily caught under Commonwealth jurisdiction (e.g., Tiger Flathead, Blue Warehou, Jackass Morwong, Eastern School Whiting and Jack Mackerel), are undertaken by the Southern and Eastern Scalefish and Shark Fishery Assessment Group (SESSF-AG). These formal assessments are summarised in fishery status reports produced by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (Patterson et al. 2021). The stock status classifications reported here for this subset of species are based on the status determined by SESSF-AG.

Data sources and analyses

Commercial catch and effort data are collected through compulsory Tasmanian Commercial Catch, Effort and Disposal Returns, and Commonwealth non-trawl (GN01 and GN01A) and Southern Squid-jig Fishery (SSJF) logbook returns. Tasmanian Scalefish fishers report catch and effort data by fishing block (see Figure 1.1). Unless noted otherwise, catch and effort data reported in this assessment relate to the commercial sector. Catch and effort information for the recreational sector are collected from surveys that are conducted periodically (generally every 5 years) and published on the IMAS webpage. Detailed information on the fishery, management objectives, data analysis, assessment criteria, and general fishery trends can be accessed online through the TasFisheriesResearch webpage.

Routine analyses

Routine assessments involve the analysis of time series of catch, effort, and catch-per-unit-effort (CPUE). For the purpose of this assessment, effort and CPUE analyses are restricted to commercial data provided for the period 1st July 1995 to 30th June 2021. A fishing year from 1st July to 30th June in the following year has been adopted for annual reporting because reporting based on financial rather than calendar year better reflects the seasonality of the fisheries for most species, which are characterised by a concentration of catch (and effort) between late spring and early autumn. In addition, this reporting schedule better encompasses the biological processes of recruitment and growth for most species.

Data have traditionally been analysed mostly for state-wide trends, but in this report analyses at a regional level are included for all species. Fishing regions can be assigned flexibly for each species according to fishing block information which is recorded along with details on catch and effort as part of routine logbook returns (Figure 1.1). Unless otherwise noted, five broad assessment regions were used: southeast coast (SEC), east coast (EC), northeast coast including Flinders Island (NEC), northwest coast including King Island (NWC), and west coast (WC).

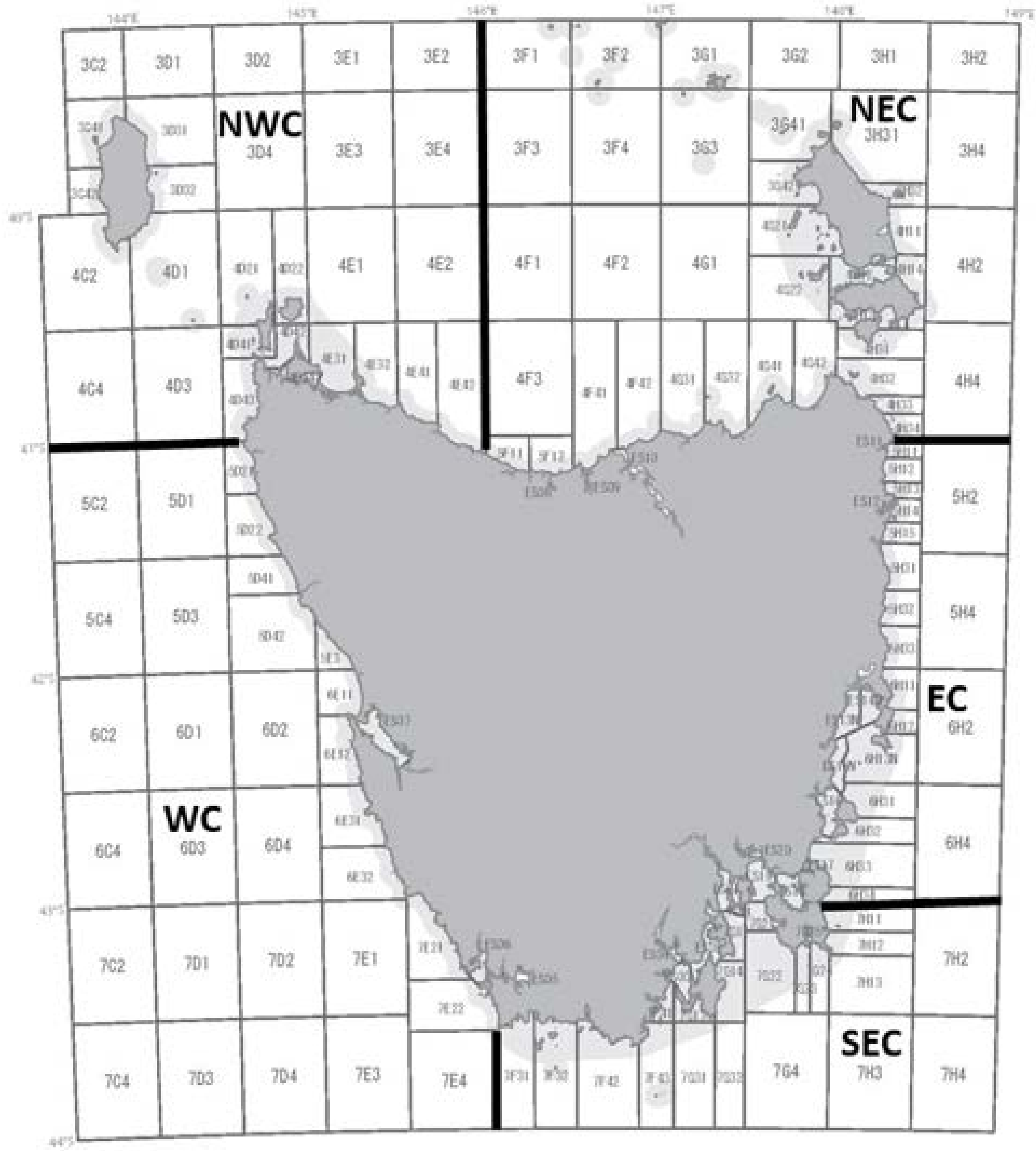


Figure 1.1 Map of Tasmania showing official NRE fishing blocks used for catch reporting, and regions used in this assessment (NWC = northwest coast, NEC = northeast coast, EC = east coast, SEC = southeast coast, WC = west coast). Light grey areas indicate Tasmanian state waters limits.

There are 14 main fishing methods used in the Tasmanian Scalefish Fishery. However, for assessment purposes, effort was expressed in numbers of days fished per gear type, irrespective of the amount of gear utilised each day. Although days fished represents a less sensitive measure of effort, it has become apparent that some fishers have misinterpreted reporting requirements for effort. Attempts have been made to reduce this problem by updating the logbook. However, past and ongoing confusion about reporting requirements can bias effort measures. Examining effort in terms of days fished overcomes any uncertainty about the reporting of effort units and provides consistency through time, assuming that there have been no major changes to fishing practices over the duration of the time series (1995-2021).

Since CPUE data are typically log-normally distributed, the geometric mean (*GM*) 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 (y_i):

$$GM_{\bar{y}} = \sqrt[n]{\prod y_i}$$

This is equivalent to computing the arithmetic mean of the natural logarithm of each number, and then taking the exponent:

$$GM_{\bar{y}} = \exp\left[\frac{1}{n}\left(\sum \ln\left(y_n\right)\right)\right]$$

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 relatively few, outstandingly high data points, which are characteristic of log-normally distributed data.

State-wide CPUE based on the geometric mean has traditionally been reported by normalising data based on the first representative values of the catch and effort time series (i.e., the reference year), which allows for the simultaneous comparison of multiple CPUE trends for different gear types. However, in this report we also report nominal CPUE trends (i.e., raw CPUE in kg/day) for each gear type and region.

Catch-based stock assessment approach: CMSY

In addition to routine analyses of spatio-temporal trends in catch and effort, we used a commonly applied catch-only stock assessment method to estimate stock depletion and catch relative to the estimated maximum sustainable yield (MSY). The results shown here are based on the “CMSY” method (Froese et al. 2017), which refers to a model-assisted stock assessment approach developed for data-poor conditions. The approach relies on the Schaefer production model, which defines the relationship between biomass and catch based on the intrinsic population growth rate (r), and which assumes that the biomass delivering MSY is equal to 50% of the unfished biomass. According to a time series of catch records and the assumed resilience of the target species (“very low” ,“low”, “medium”, or “high”, and associated ranges of plausible r values), CMSY can be used for a stock reduction analysis based upon which credible Schaefer model predictions are inferred to estimate management reference points for MSY and biomass depletion (see also Haddon 2018; Haddon et al. 2019) .

Biomass depletion fluctuating around 50% of unfished levels is a commonly defined target (B_{target} = B_{MSY} = 0.5 B/B0, where B = biomass and B0 = unfished biomass), but has also been used as a threshold in precautionary Australian harvest strategies to initiate reductions in catch of data-poor fish populations so that biomass remains above or recovers back to target levels (B > 0.5 B/B0) (see e.g., DPIRP (2020)). Biomass depletion below 20% is an internationally applied limit reference point (B_{limit}), beyond which directed fisheries under Australian harvest strategies are commonly closed (Rayns 2007; Smith et al. 2009; Punt et al. 2014).

The CMSY analyses conducted here were based on the commercial component of total fishery catch, generally excluding estimates of recreational catch. The CMSY method appears to be robust to the exclusion of recreational catch data unless trends in recreational vs commercial catch over time are divergent (Haddon 2018).

Scalefish species selected for CMSY analyses (Table 1.1) were those for which we assumed that changes to management over the duration of recorded fishery catch did not severely undermine the use of catch data to infer trends in abundance. The same implicit assumption was made with respect to changes in the spatial distribution of fishing effort and catch. Priors for initial and final biomass depletion were assigned based on expert knowledge according to the ranges for B/B0 suggested by the authors of the CMSY software (Depletion levels: “Very strong”: 0.01-0.2; “Strong”: 0.01-0.4; “Medium”: 0.2-0.6; “Low”: 0.4-0.8; “Very low”: 0.75-1).

To confirm robust CMSY results, we estimated stock depletion and MSY by also using the most recent version of the Bayesian state-space implementation of the Schaefer production model (BSM) assessment method, which can incorporate raw CPUE data (Froese et al. 2017). However, both methods produced similar results for assessed species; therefore, only CMSY results were included in this report.

Table 1.1 Assessment of the suitability of catch data available for state-assessed species for application of the CMSY approach. BMSY = biomass assumed to deliver the maximum sustainable yield, with a commonly defined target around 50% of unfished biomass.

Species name	**Historical depletion beyond target biomass**	**Suitable for CMSY**	**Prior relative biomass (B/k) ranges**		**Comment**
			Initial	**Final**	
Australian Sardine *(Sardinops sagax)*	Unlikely	No			This fishery was in a developmental stage over recent years, but no permits are currently active and, thus, limited or no catch has been recorded.
Barracouta *(Thyrsites atun)*	Likely	No			Historical catches were high (1960s – 1970s). However, subsequent declining trends are suspected to reflect a combination of environmental impacts and reduced market demand rather than fishery-

					induced stock trends. Thus, the stock status remains undefined.
Bastard Trumpeter *(Latridopsis forsteri)*	Likely	Yes	0.2-0.6	0.01-0.2	Bastard Trumpeter was highly abundant in Tasmanian waters prior to commercial and recreational fishing; however, abundance has declined substantially with fishing. Current low market demand means catches may not adequately reflect abundance.
Eastern Australian Salmon *(Arripis trutta)*	Possible	No			Only a few operators target this species opportunistically. A substantial drop in catch was noted when one major operator stopped targeting Eastern Australian Salmon in 2013/14.
Flounder *(Pleuronectidae* family)	Possible	No			Two undifferentiated species complicate the use of catch data to infer stock status. Additionally, a fundamental management change (restrictions on unattended night-netting) substantially reduced commercial catches.
King George Whiting *(Sillaginodes punctatus)*	Unlikely	No			The fishery is in development, with commercial catch data not yet revealing informative trends.
Leatherjackets *(Monacanthidae* family)	Uncertain	No			Multiple undifferentiated species complicate the use of catch data to infer stock status.
Longsnout Boarfish *(Pentaceropsis recurvirostris)*	Uncertain	No			The species is not targeted, which complicates the use of catch data to estimate population depletion and maximum sustainable catch.
Snook *(Sphyraena novaehollandiae)*	Uncertain	Yes	0.4-0.8	0.2-0.6	The species is no longer targeted commercially but catch trends might provide a reasonable reflection of abundance.
Southern Calamari *(Sepioteuthis australis)*	Possible	Yes	0.2-0.6	0.01-0.4	Spatial shifts in the distribution of fishing effort require regional applications of CMSY and BSM simulations.
Southern Garfish *(Hyporhamphus melanochir)*	Likely	Yes	0.2-0.6	0.01-0.4	Anecdotal reports suggest that currently low catches might not adequately reflect abundance.

Southern Sand Flathead *(Platycephalus bassensis)*	Likely	No			Recreational landings dominate catches of this species (~90%), but sporadically available recreational catch data cannot meaningfully be used for CMSY simulations.
Striped Trumpeter *(Latris lineata)*	Likely	Yes	0.2-0.6	0.01-0.4	Commercial catches close to historical low but this might be a reflection of low abundance.
Wrasse *(Notolabrus spp.)* Bluethroat Wrasse *(Notolabrus tetricus)* Purple Wrasse *(Notolabrus fucicola)*	Uncertain	Yes	0.4-0.8	0.2-0.6	Notable changes within the fishery are likely to affect estimates of biomass depletion. These include a decline in the use of fish traps from 2006/07, with replacement by hooks leading to reduced catches for Purple Wrasse. In addition, restaurant closures following the start of the COVID-19 pandemic in 2020 reduced the demand for live fish.
Yelloweye Mullet *(Aldrichetta forsteri)*	Unlikely	No			Low catches, also because the species is protected across much of its range.

Length-based stock assessment approaches: LBB and LBSPR

For some scalefish species with significant recreational catches that have been surveyed using fishery-dependent and/or fishery-independent collections of data on sex, lengths, age and/or maturity, we implemented additional data-poor stock assessment approaches. These approaches required prior estimates of key life history parameters for meaningful parameterization, including the infinite or asymptotic length (*Linf*), the von Bertalanffy growth rate (*k*), the length at 50% and 95% maturity (*L50* and *L95*), the length at 50% and 95% gear selectivity (*SL50* and *SL95*), and the instantaneous rate of natural annual mortality (*M*). Most of these parameters have been estimated and presented in previous assessment reports (Krueck et al. 2020). However, all parameters were re-estimated and updated as needed for this assessment using the latest available survey data.

Natural mortality (*M*) across ages was estimated by assuming a constant of 1.5% annual survival until the maximum observed age of a species available from the survey data (Dureuil and Froese 2021). *Linf*, *L50*, *L95*, *SL50*, and *SL95* were estimated using the "TropFishR" package with default settings in R (Mildenberger et al. 2017). *L50* and *L95*, which can be inferred from the age at 50% and 95% maturity using "TropFishR", were confirmed based on direct length-based estimates using the "fit_mat_ogive" function of the "gfplot" package in R. *Linf* and *k* were estimated by 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, for example, 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, which makes 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 suspected 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*). A relative fishing mortality *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 and does not undermine the precautionary principle.

The life history and selectivity parameters described above were further used to run two alternative length-based stock assessment approaches. The first of these two approaches, which is founded on classic Beverton-Holt life history theory and empirical knowledge available from FishBase (Froese and Pauly 2022), is the Length-based Bayesian Biomass (LBB) estimation approach (Froese et al. 2019). LBB requires a representative sample of length frequency combined with an optional prior for *Linf* based on which it estimates relative fishing mortality (*F*/*M*) and relative biomass (*B*/*B0*); i.e., current (fished) biomass (*B*) relative to past unfished biomass (*B0*), including 95% credible intervals. Estimates of biomass depletion *B*/*B0* can be assessed against commonly applied target reference points of 0.4-0.5 *B*/*B0* (i.e., 40%-50% of unfished levels) to determine whether stocks are overfished, i.e., supporting the maximum ecological or economic yield (maximum sustainable yield (MSY) and maximum economic yield (MEY), respectively). Values of *B*/*B0* of 0.2 (20% of unfished levels) and below are commonly used to determine whether stocks are depleted, i.e., whether reproductive output and recruitment could be impaired to an extent that populations are unable to recover to more productive levels.

The second length-based stock assessment approach, which is also founded on classic fishery life history theory and now widely applied for data-poor fisheries management, is 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 infers the relative fishing mortality (*F*/*M*) and the relative spawning potential ratio (*SPR*/*SPR0*), i.e., the current (fished) *SPR* relative to an expected unfished *SPR* (*SPR0*). The *SPR*, which is a term used synonymously to "spawning biomass per recruit" or the "fraction of lifetime egg production" (FLEP), is a well-established biological reference point. It compares 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 recognized as the 'replacement level', where fish populations might persist at current levels, but have little ability to rebuild, or decline over time. When the *SPR* reaches 10% of unfished levels (*SPR*/*SPR0* = 0.1), recruitment is expected to decline rapidly, eventually resulting in local extinction. The default target reference points for *SPR* are 40%-50% of unfished levels (*SPR*/*SPR0* = 0.4-0.5), where reproductive output and recruitment is expected to result in maximum sustainable ecologic or economic returns (MSY and MEY, respectively).

The accuracy of outcomes from both 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. In consequence, annual samples were often pooled or clustered to ensure robust outcomes. Similarly, a regional breakdown of outcomes was not generally possible. However, outcomes for pooled region samples implicitly assume that fishing pressure is unform across the state. Whenever this assumption was clearly violated, outcomes for subsamples that clustered regions with broadly similar levels of expected fishing mortality were assumed to be more reliable. Sexes were analyzed separately unless estimates of critical life history parameters (specifically *Linf*, *L50* and *L95*) were almost identical.

Unless otherwise noted, outcomes from length-based assessments 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 of analysed species tend to 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 (referring to Southern Sand Flathead).

Formal risk assessment of recruitment impairment (MSC approach)

We further introduced a risk analysis following protocols by the Marine Stewardship Council (MSC) based on an approach established by the CSIRO (Hobday et al. 2011). The MSC is globally recognised and produces a widely used Fisheries Standard for assessing if a fishery is well managed and sustainable. The Risk-Based Framework (RBF) described within the MSC Standard is suitable for assessing fisheries with limited data and for which primary indicators may be unavailable or problematic. If the Tasmanian Scalefish Fishery were assessed under the MSC Fisheries Standard, it is likely that for most species there would be sufficient information to use the default assessment method. However, application of the RBF is straight-forward and provides an alternate perspective.

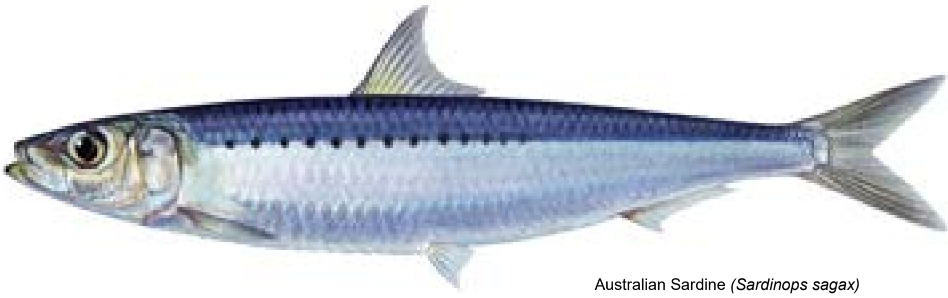
The RBF draws on information about the productivity of a target species and its susceptibility to fishery-related impacts (Productivity Susceptibility Analysis), as well as the consequence of fishing activity for the species (Consequence Analysis). Application of the RBF approach culminates in an overall score, which is indicative of the relative sustainability of the fishery. Scores > 80 are regarded as passing the assessment with a low risk of stock damage. Scores of 60 – 80 are also regarded as passing the assessment, but with a moderate risk of stock damage. Scores < 60 fail the assessment with a substantial risk of stock damage. We note that the RBF is precautionary and will likely result in a lower score than the default MSC assessment method.

Given the RBF is designed for data-poor fisheries, a cautious (worst-plausible) approach is recommended in the absence of credible information, meaning that limited species information likely results in a lower final score. The RBF approach assumes that fisheries operating at relatively high levels of exploitation inherently pose a greater risk to ecological components with which they interact than under-utilised fisheries. Therefore, lower scores will be derived for highly utilised species unless credible information is available to indicate otherwise. More information, including details on the RBF scoring system, is available on the TasFisheriesResearch webpage. The RBF was used to assess the stock status of all exclusively state-assessed target species within the Tasmanian Scalefish Fishery.

2. State-assessed species

Australian Sardine (*Sardinops sagax*)

STOCK STATUS	SUSTAINABLE
There is effectively no current commercial fishing for Australian Sardine in Tasmanian waters, with all Developmental Australian Sardine Permits now expired. As such, the current level of fishing pressure in Tasmania is unlikely to cause the biological stock to become recruitment impaired. The species was classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). Similarly, all Australian stocks are currently classified as Sustainable in the 2020 Status of Australian Fish Stocks report (Piddocke et al. 2021).	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment.
MANAGEMENT	State (Tasmania)



Australian Sardine *(Sardinops sagax)*
Illustration©R.Swainston/anima.fish

Australian Sardine is a highly productive species with a wide range, inhabiting estuaries to the continental shelf in southern Australia, from Rockhampton, Queensland, to Shark Bay, Western Australia, including northern Tasmania (Edgar 2008). The Tasmanian commercial fishery for Australian Sardine was under development but no active permits are currently in place. Australian Sardine is primarily captured using purse seine gear; however, some beach seine gear is also used to target this species. Holders of a general Scalefish Fishing Licence are entitled to a catch of 10 kg per trip. Australian Sardine is not a significant recreational species in Tasmania (Lyle et al. 2019). More detailed information on biological characteristics and current management of Australian Sardine fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

In 2020/21, total commercial catch of Australian Sardine in Tasmanian waters was negligible (86 kg) (Figure 2.2A). Historically, this species has constituted a minor and sporadic component of the scalefish fishery, with peak catches of 15.4 t recorded in 1997/98, 14.5 t in 2008/09, and 33.3 t in 2016/17, which were interspersed among years of little or no catch and effort (Figure 2.2A, B). These peak catches were largely derived from purse seine records. The earlier peak catches largely reflect incidental take of Australian Sardine by fishers targeting other small pelagic fishes (e.g., Redbait). Targeted fishing activity for the species under a developmental fishery permit commenced in 2016/17, with fishing activity in recent years based around the north coast, primarily the northeast coast (Figure 2.3, Figure 2.4). There are no active permits for Australian Sardine currently in place.

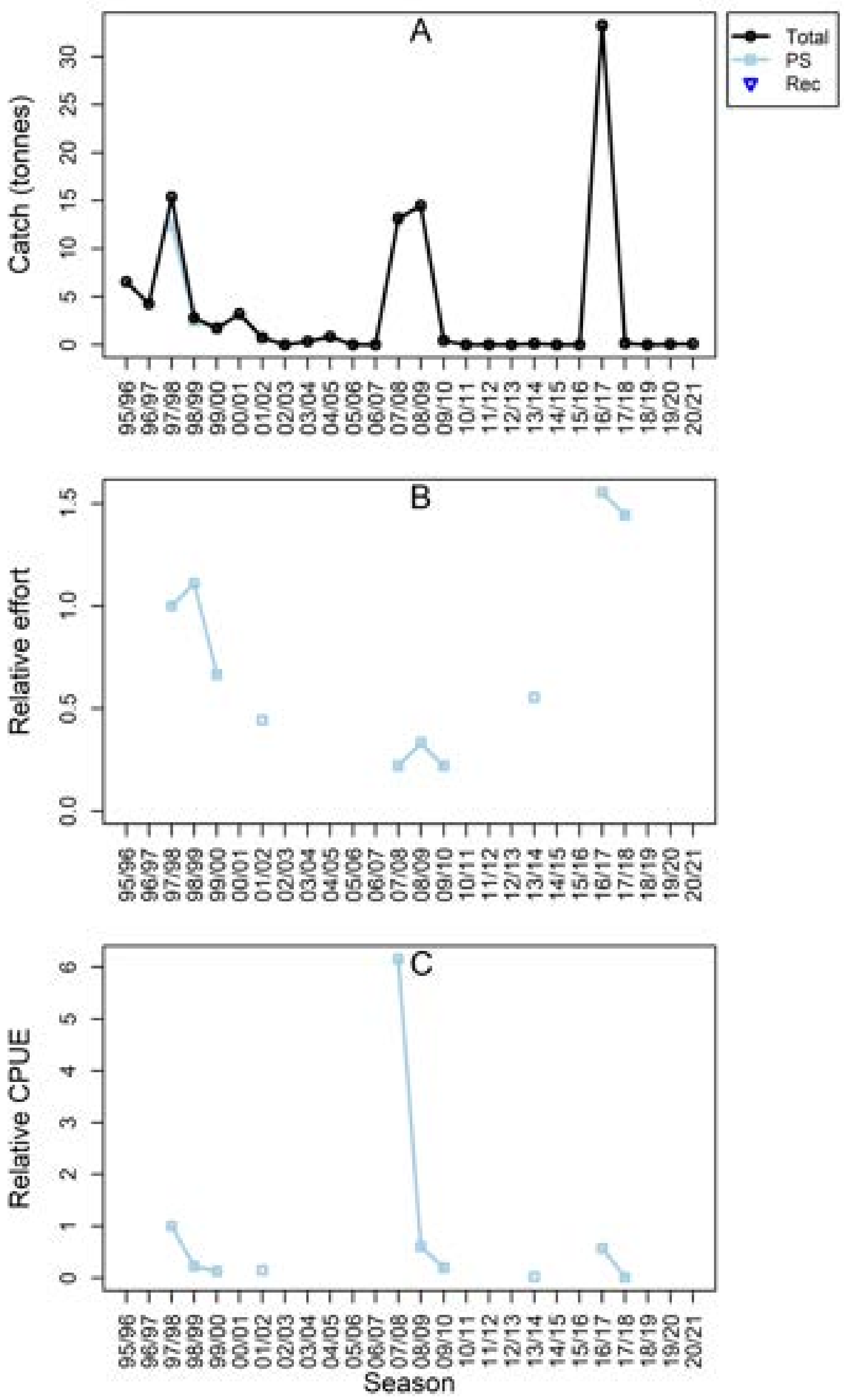


Figure 2.2 (A) Annual commercial Australian Sardine catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. PS = purse seine; no recreational catch estimates (Rec) were available for this species.

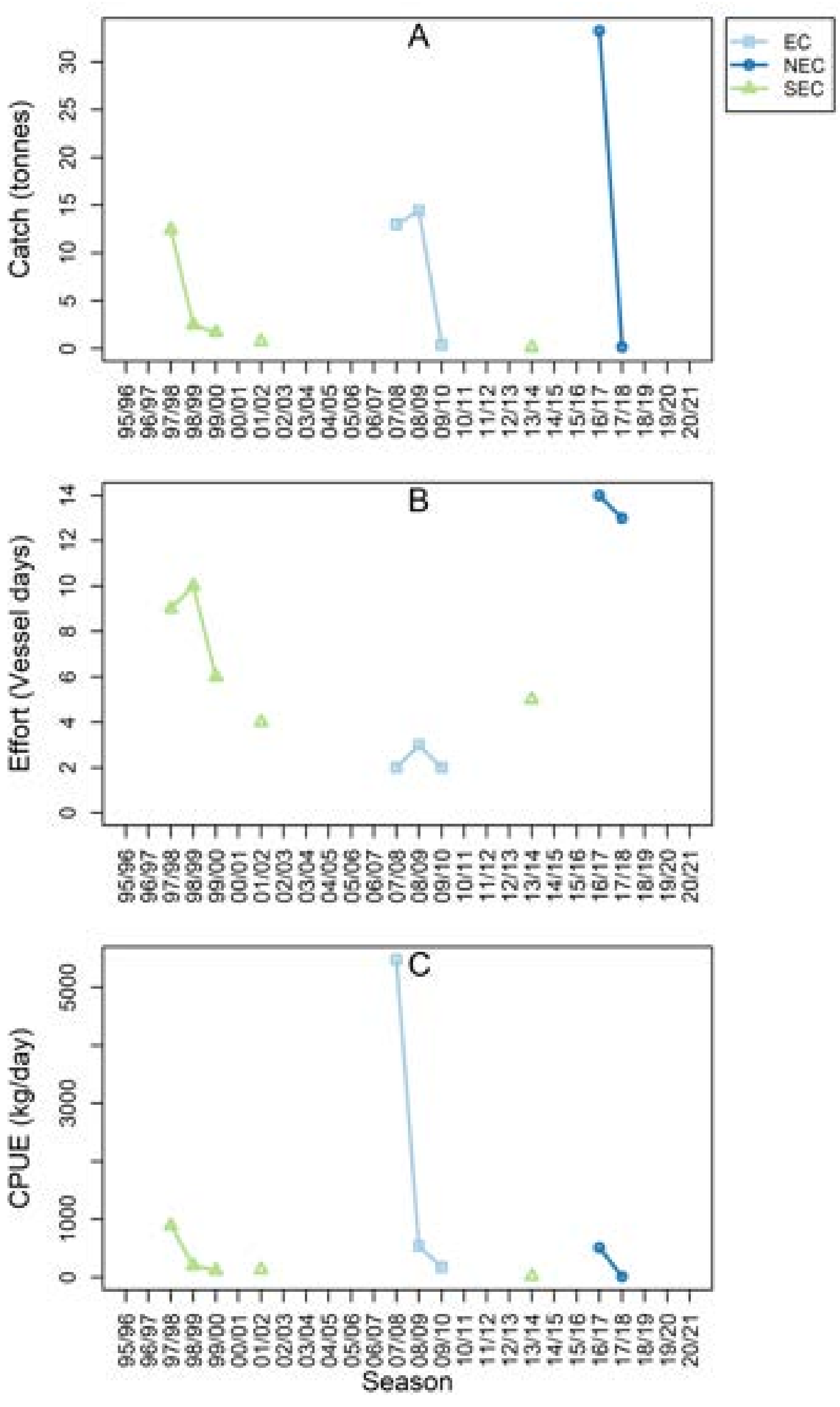


Figure 2.3 Regional commercial Australian Sardine catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for purse seine. EC = east coast, NEC = northeast coast, SEC = southeast coast.

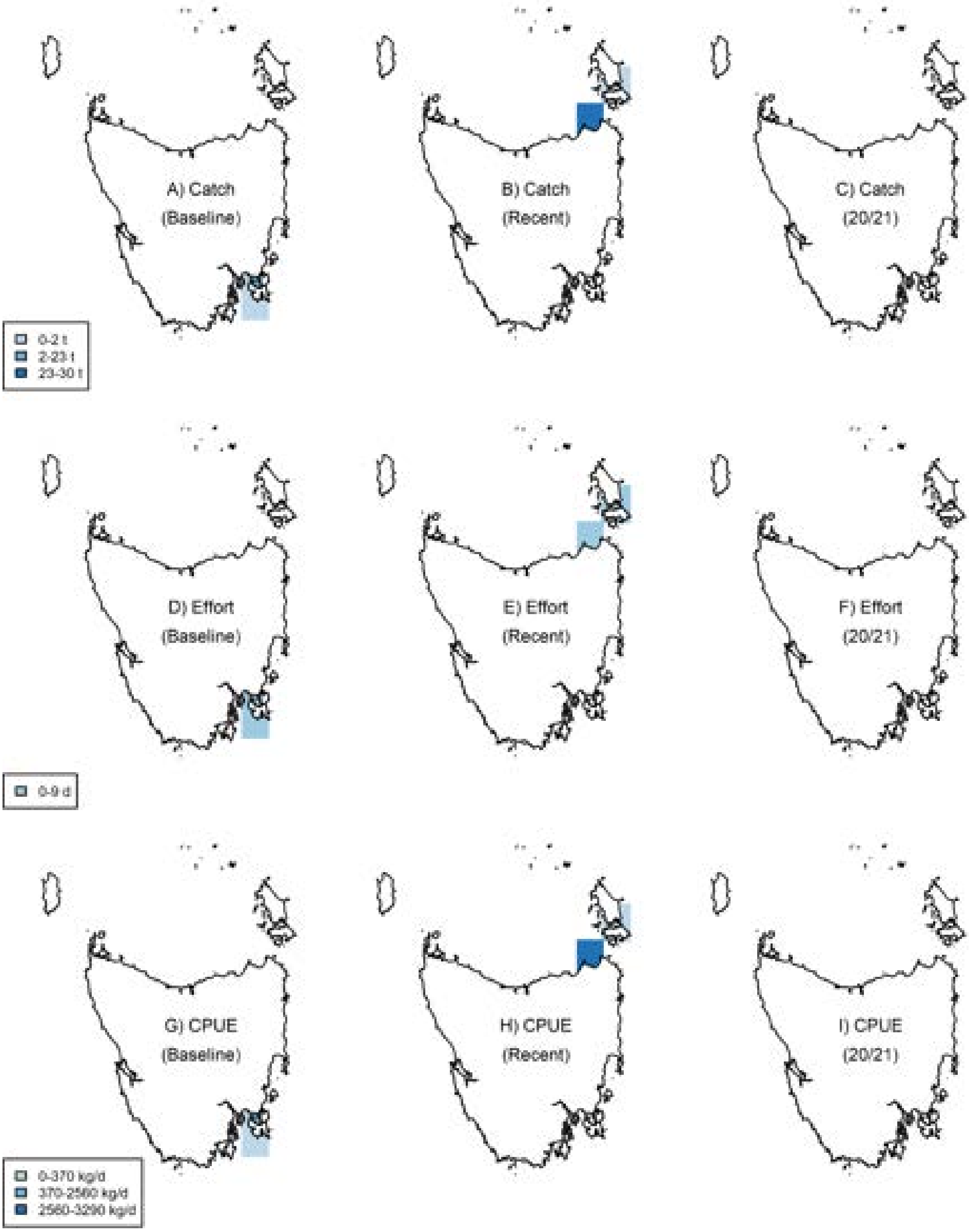


Figure 2.4 Australian Sardine catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Risk assessment of recruitment impairment

The Australian Sardine fishery scored > 80 in the risk analysis, passing assessment with low risk of recruitment impairment and stock damage. Australian Sardine is a highly productive species – a small fish that is quick to grow and relatively short-lived (Stewart et al. 2010), highly fecund (Ward et al. 2015), and occupying a low trophic level (Stewart et al. 2010). Although purse seine gear presents a high risk of capturing schools of Australian Sardine, fishing effort is minimal as there are no permits currently in operation. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

Stock status	**SUSTAINABLE**

Australian Sardine in Tasmanian waters represent a proportion of the South-eastern Sardine stock, which is shared by three jurisdictions: Tasmania, Victoria, and New South Wales. Research indicates that the spawning biomass of the South-eastern Sardine stock in 2019 may have exceeded 200,000 t (Ward et al. 2022) and that there is potential for development of a large-scale fishery for Australian Sardine in Tasmanian waters (Ward and Gardner 2022).

Since 2008, Australian Sardine populations in the Commonwealth Small Pelagic fishery have been considered to be “Not overfished nor subject to overfishing” (Patterson et al. 2021), and all four Australian stocks considered during the 2020 Status of Australian Fish Stocks assessments (Eastern Australia, South-Eastern Australia, South-Western Australia and Southern Australia) were classified as Sustainable (Ward et al. 2021). Given that current levels of effort are unlikely to result in recruitment overfishing, this ranking has been applied to the Tasmanian fishery.

Barracouta (*Thyrsites atun*)

STOCK STATUS	UNDEFINED
Catches of Barracouta have declined steadily since the mid-2000s, presumably due to a decrease in targeted effort resulting from a lack of market demand as well as possible impacts of environmental change. Low levels of fishing effort mean that catch and CPUE data are unreliable indicators of biomass and stock status. However, historic catches were substantial and, thus, there is insufficient information to confidently classify the stock.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment.
MANAGEMENT	State (Tasmania)

Barracouta *(Thyrsites atun)*
Illustration©R.Swainston/anima.fish

Barracouta is a predatory, schooling species that inhabits coastal bays and open ocean as deep as 550 m. This species is widely distributed in temperate latitudes of the southern hemisphere (Edgar 2008), including southern Australia. Barracouta was an historically important fishery species in Tasmania, with a large commercial troll fishery operating in the 1960s and 1970s when catches ranged between 600 and 1600 t per year (Kailola et al. 1993). Market demand for barracouta is assumed to have declined substantially in the mid-1970s, such that current catches are considered unlikely to reflect biomass. With relatively minimal catch and effort, current management restrictions of commercial barracouta fishing are limited to the requirement of a scalefish fishing licence. More detailed information on biological characteristics and current management of Barracouta fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Records of total commercial catches of Barracouta peaked in the early 2000s with a maximum of 136 t, but gradually declined from 101 t in 2004/05 to an historical low of 0.4 t in 2015/16 (Figure 3.1A). The total commercial catch in 2020/21 was 0.8 t. Trolling and handline are the main fishing methods used to target Barracouta. After the peak in the early 2000s, effort declined and, since 2007/08, has stabilised at a low level (Figure 3.1B). CPUE has been relatively stable over the most recent fishing years (Figure 3.1C). However, it is likely that fishers who used to target Barracouta are now targeting other species and, in consequence, catch-based statistics are unlikely to be a reliable indicator of biomass. Catches and fishing effort were traditionally concentrated off southern Tasmania (Emery et al. 2017) (Figure 3.3).

However, over the last few fishing seasons, fishing effort has been concentrated off the north coast (Figure 3.3).

Barracouta are targeted and taken as by-product by the recreational sector. Catches were estimated at 46.9 t in 2000/01 (Lyle 2005), 10.8 t in 2007/08 (Lyle et al. 2009), 31 t in 2012/13 (Lyle et al. 2014b) and 2.8 t in 2017/2018 (Lyle et al. 2019).Therefore, recreational catches generally, and sometimes considerably, exceed the commercial harvest (Figure 3.1A).

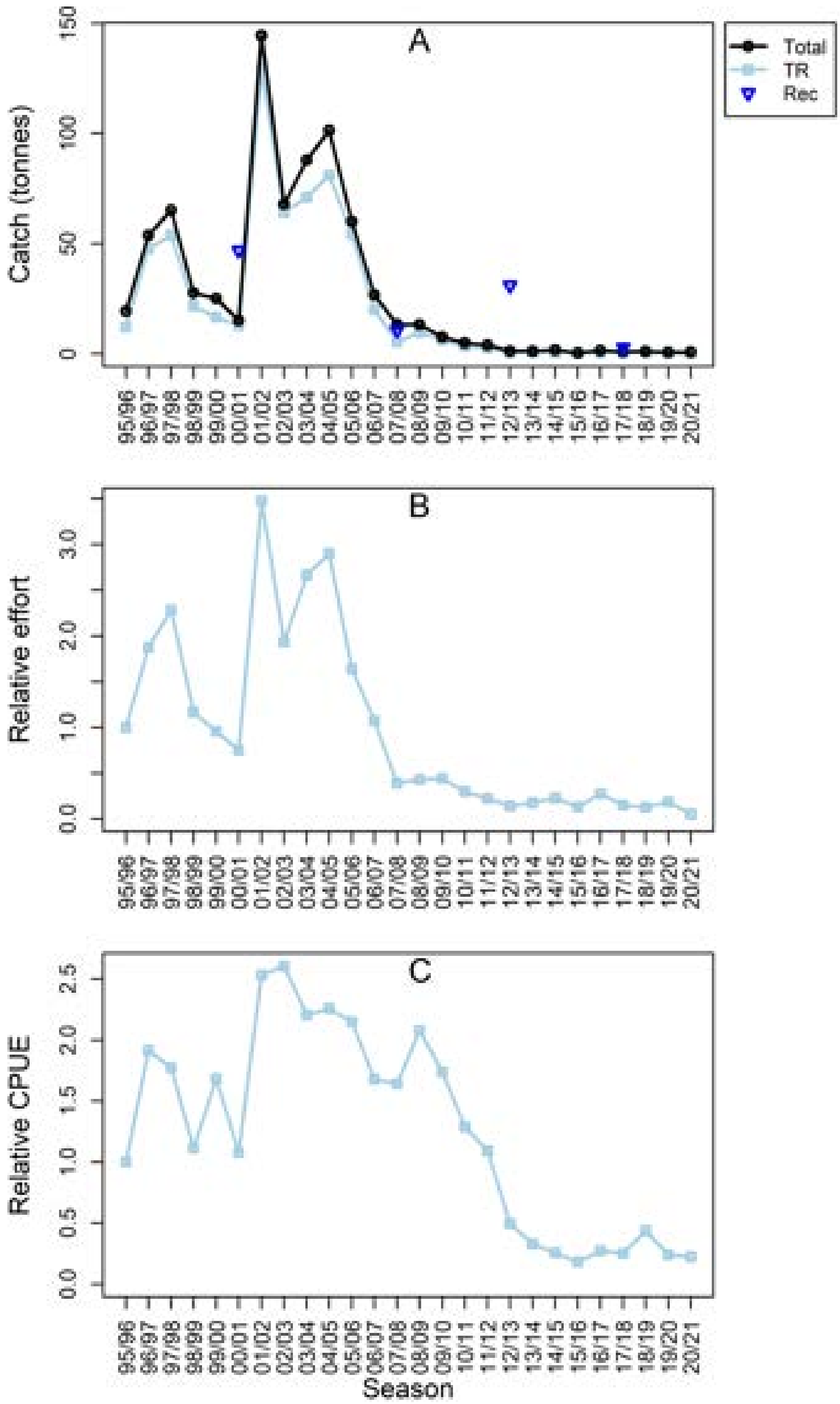


Figure 3.1 (A) Annual commercial Barracouta catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. TR= troll, Rec = estimated recreational catch.

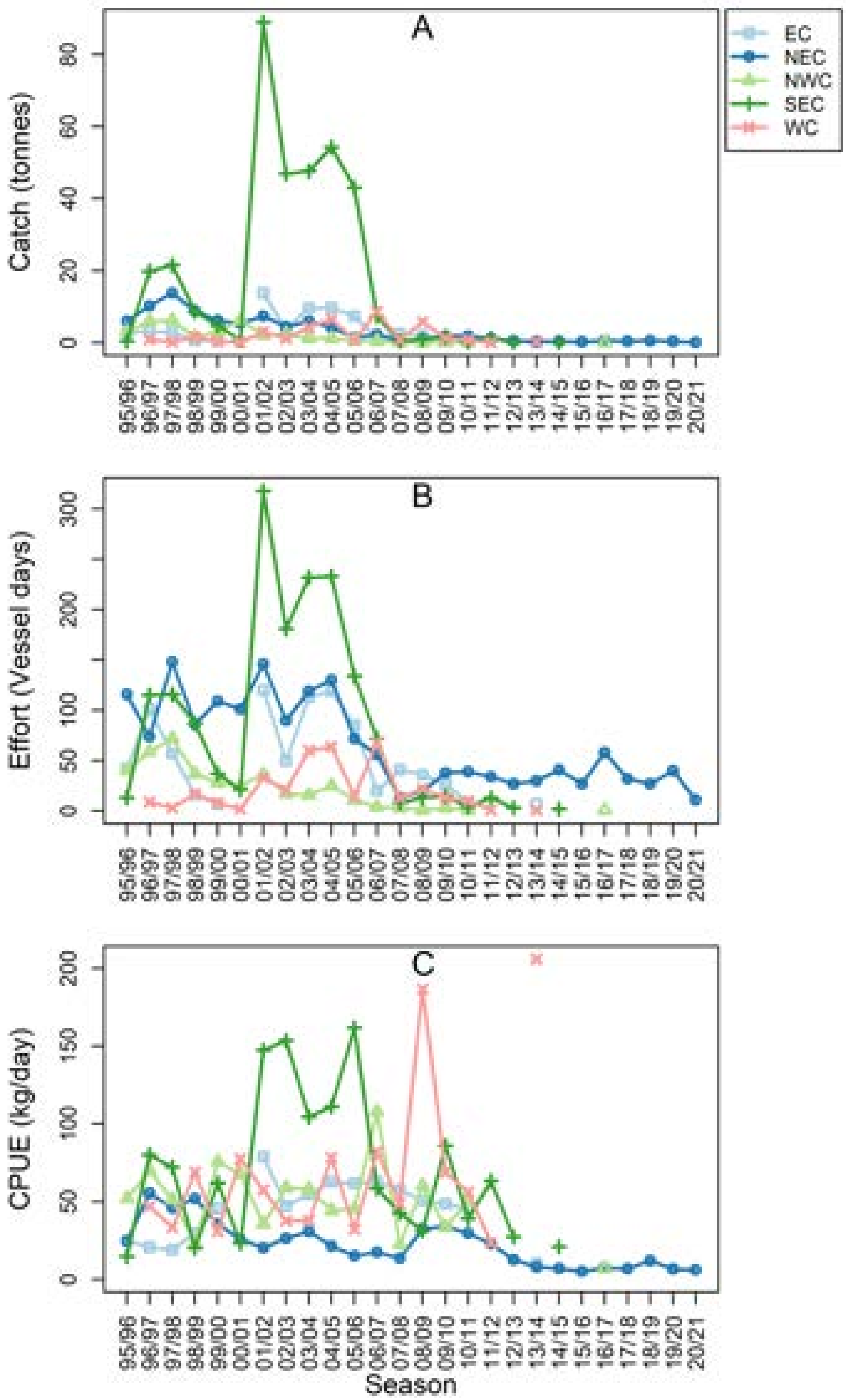


Figure 3.2 Regional commercial Barracouta catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for troll. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

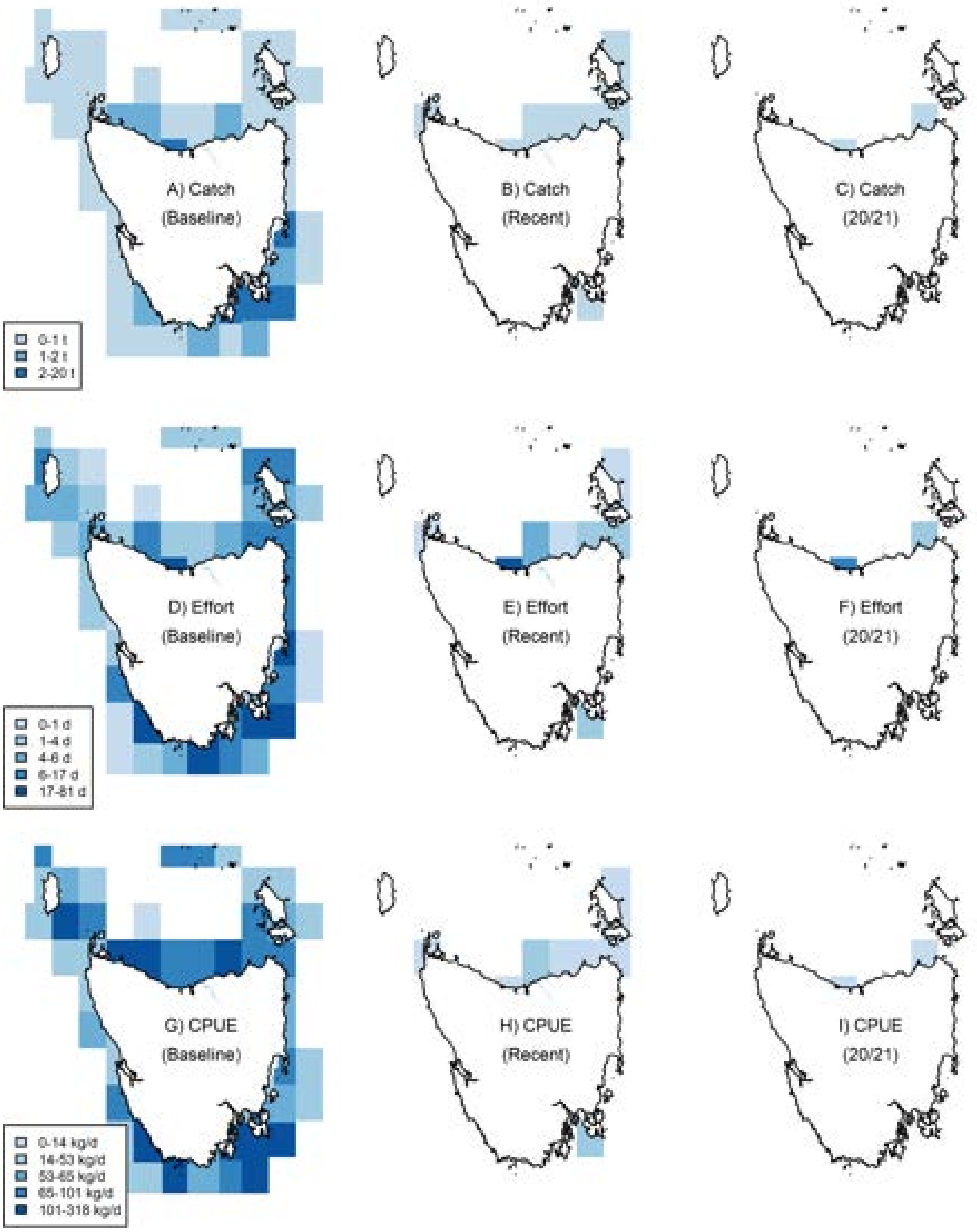


Figure 3.3 Barracouta catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. ‘Baseline’ data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). ‘Recent’ data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). ‘20/21’ represent data from the 2020/21 fishing season.

Risk assessment of recruitment impairment

The Barracouta fishery scored > 80 in the risk analysis, passing assessment with low risk of recruitment impairment and stock damage. Barracouta is a moderately productive species, which matures at a young age (Hurst et al. 2012), is highly fecund (Yemane et al. 2008) but grows to a large size (Edgar 2008) and lives longer than 10 years (Hurst et al. 2012). Targeted effort for Barracouta declined substantially from the mid-1970s onwards, in concert with putatively reduced market demand (Kailola et al. 1993). This means that impacts on stock structure and recruitment dynamics during the time period assessed here are presumably minor relative to historic impacts (prior to 1995/96). However, catch, effort, and CPUE have declined substantially compared to peak catch records of the early 2000s. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

Stock status	UNDEFINED

Historically, the population of Barracouta has undergone large fluctuations in size and availability, possibly linked to recruitment variability and environmental factors. Catches of Barracouta in Tasmanian waters have been declining steadily since the mid-2000s due to a suspected decrease in targeted effort as a result of reduced market demand. The increase in recreational catch proportion mainly reflects increased targeting by recreational fishers. Discards of Barracouta in the South East Trawl Fishery sector of the Southern and Eastern Scalefish and Shark Fishery (SESSF) have previously been estimated to be around 12% of the total discarded non-quota catch (Knuckey 2006), equating to roughly 1356–1920 t annually. The fate of such discards is unknown. While this situation suggests that Barracouta may be locally abundant within the SESSF, currently low catches combined with considerable uncertainty about the impact of historic catches means that the status of Tasmanian Barracouta stocks remains uncertain. Thus, there is insufficient information to confidently classify this stock.

Bastard Trumpeter (*Latridopsis forsteri*)

STOCK STATUS	DEPLETED
Trends in commercial and recreational catches of Bastard Trumpeter suggest record low population levels and that the species is recruitment overfished. The current minimum legal size limit is below the size at maturity, and the fishery is based almost entirely on juvenile fish. Data-limited stock assessment methods suggest that stock recovery under current levels of catch is theoretically possible, but evidence of recovery is lacking.	
IMPORTANCE	Key
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment; catch-only based assessments of biomass depletion and maximum sustainable yield.
MANAGEMENT	State (Tasmania)

Bastard Trumpeter *(Latridopsis forsteri)*
Illustration©R.Swainston/anima.fish

Bastard Trumpeter was one of the first fish species to be commercially exploited in Tasmania, with early European settlers targeting this species on shallow reefs close to Hobart. Bastard Trumpeter is a schooling species with adults inhabiting deeper water (≤ 160 m), while juveniles are associated with shallow reefs. For this reason, the Tasmanian commercial and recreational fisheries are based almost entirely on juvenile fish. In recent years, including 2020/21, Bastard Trumpeter has been taken more as a by-product of commercial fishing activities rather than as a target species, with recreational catch similar to, or exceeding, commercial landings. Since 2010, the adult stock of this species is suspected to have steadily declined. More detailed information on biological characteristics and management of Bastard Trumpeter is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Bastard Trumpeter catches have been declining since the mid-1990s. Catch has been <10 t since 2010/11, with 5.9 t landed in 2020/21 – a slight decrease from the previous year (Figure 4.1A). Bastard Trumpeter in recent years have been taken almost exclusively by gillnet from inshore waters off the east, south, and west coasts (Figure 4.2, Figure 4.3). Catches in 2020/21 were concentrated primarily around the southeast and southwest coasts (Figure 4.3). Bastard Trumpeter have been predominantly taken by recreational gillnet fishers in recent years, although the latest estimated catches in 2012/13 and 2017/18 were also historic lows (9.8 t and 3.4 t, respectively) (Lyle et al. 2014b; Lyle et al. 2019).

Commercial gillnet effort has followed a downward trend similar to catches since the mid-1990s, with a slight decrease from the previous year in 2020/21 (Figure 4.1B). CPUE remained relatively stable between 2006/07 and 2014/15; however, a declining trend is evident from 2014/15 to 2018/19, with a sharp increase in 2019/20 and a slight decline in 2020/21 (Figure 4.1C). The west coast in particular has seen a notable declining trend in CPUE over the last decade (Figure 4.2).

Bastard Trumpeter are taken primarily as by-product rather than as a target species. The majority of gillnet effort is now targeting Banded Morwong with 140 mm mesh sizes, selecting only the largest Bastard Trumpeter. Previously, a larger proportion of fishers used smaller mesh sizes (<114 mm) to target Bastard Trumpeter and Blue Warehou.

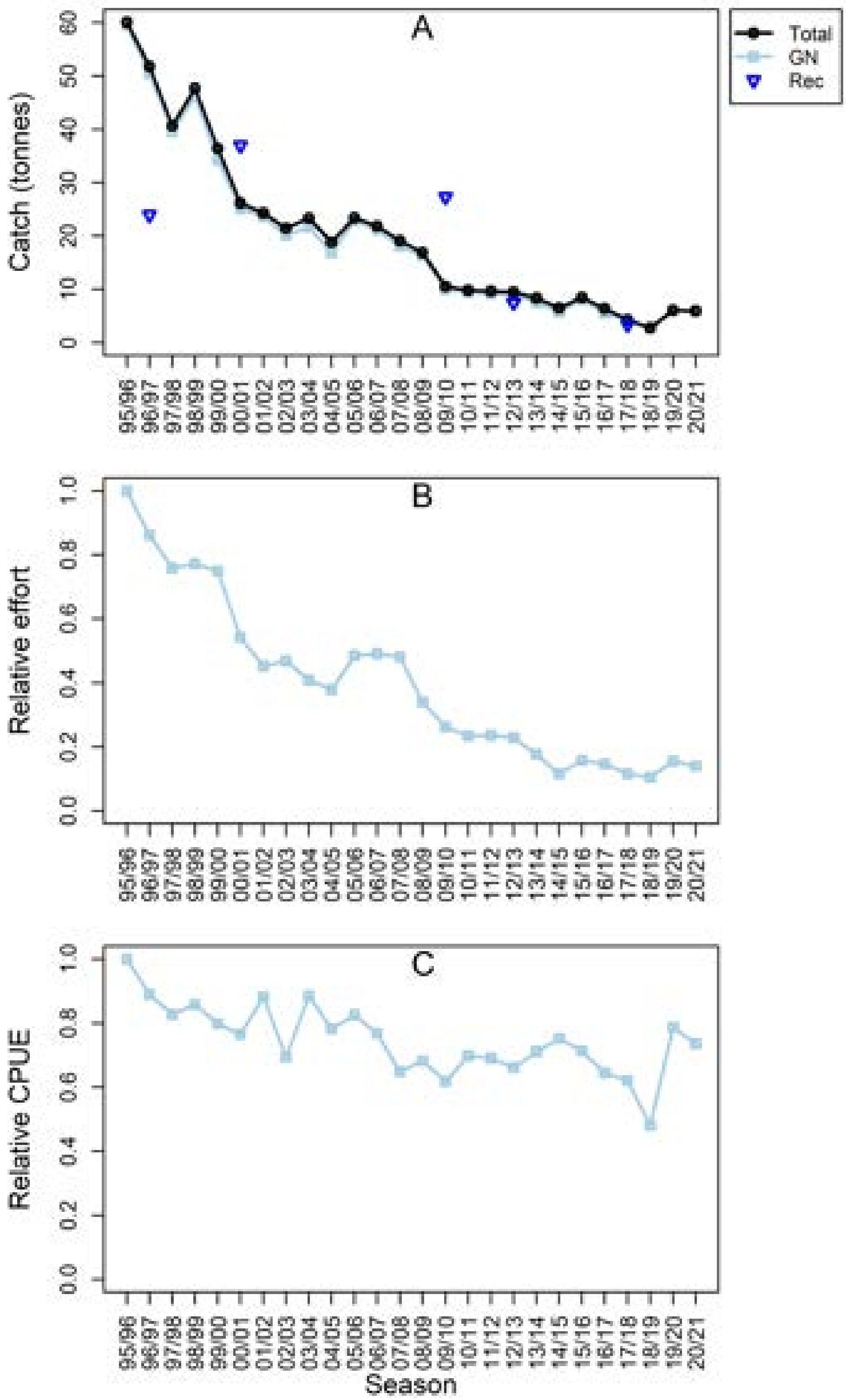


Figure 4.1 (A) Annual commercial Bastard Trumpeter catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. GN = gillnet, Rec = estimated recreational catch. Data includes Australian Fisheries Management Authority (AFMA) catch in State waters.

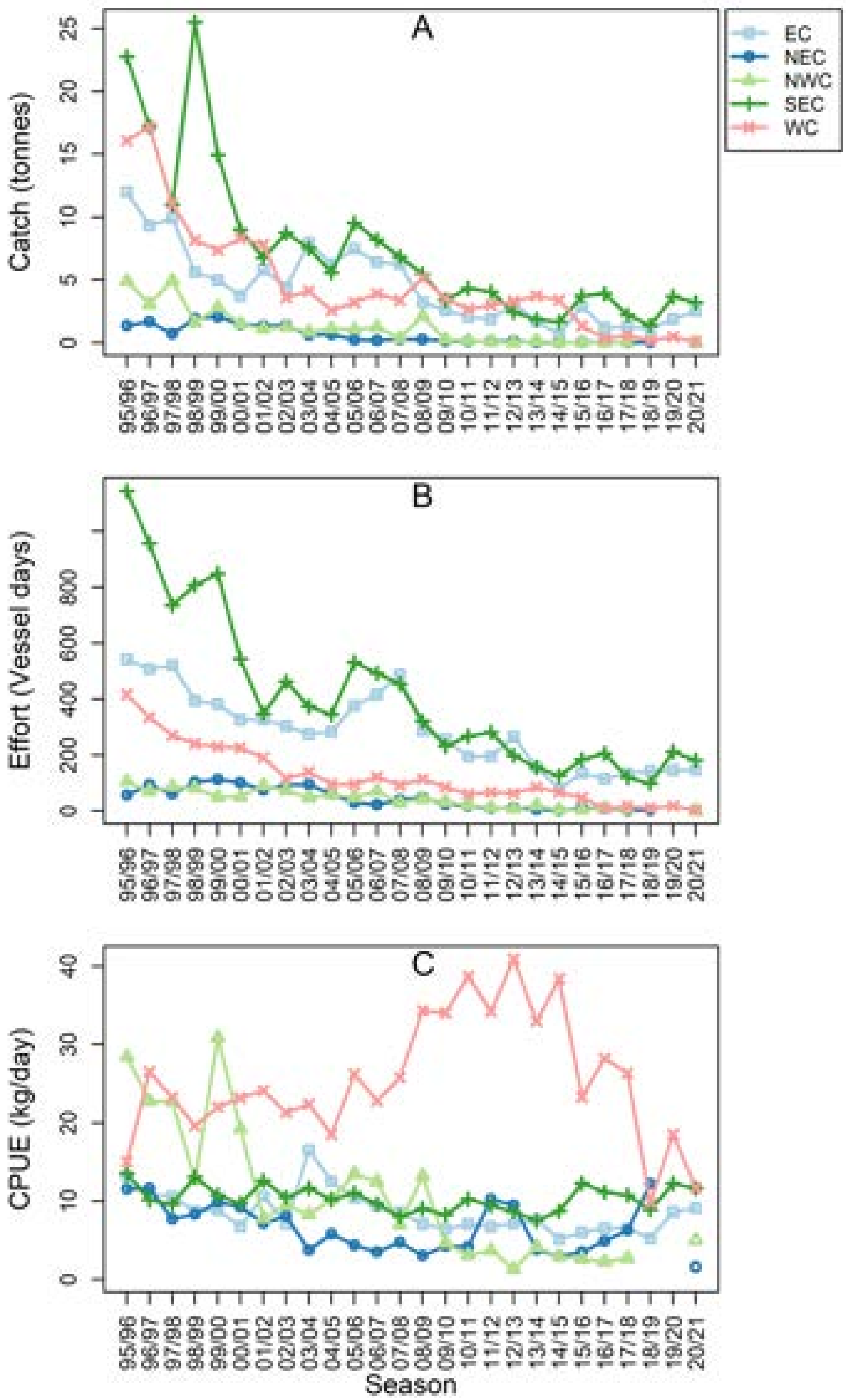


Figure 4.2 Regional commercial Bastard Trumpeter catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for gillnet. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

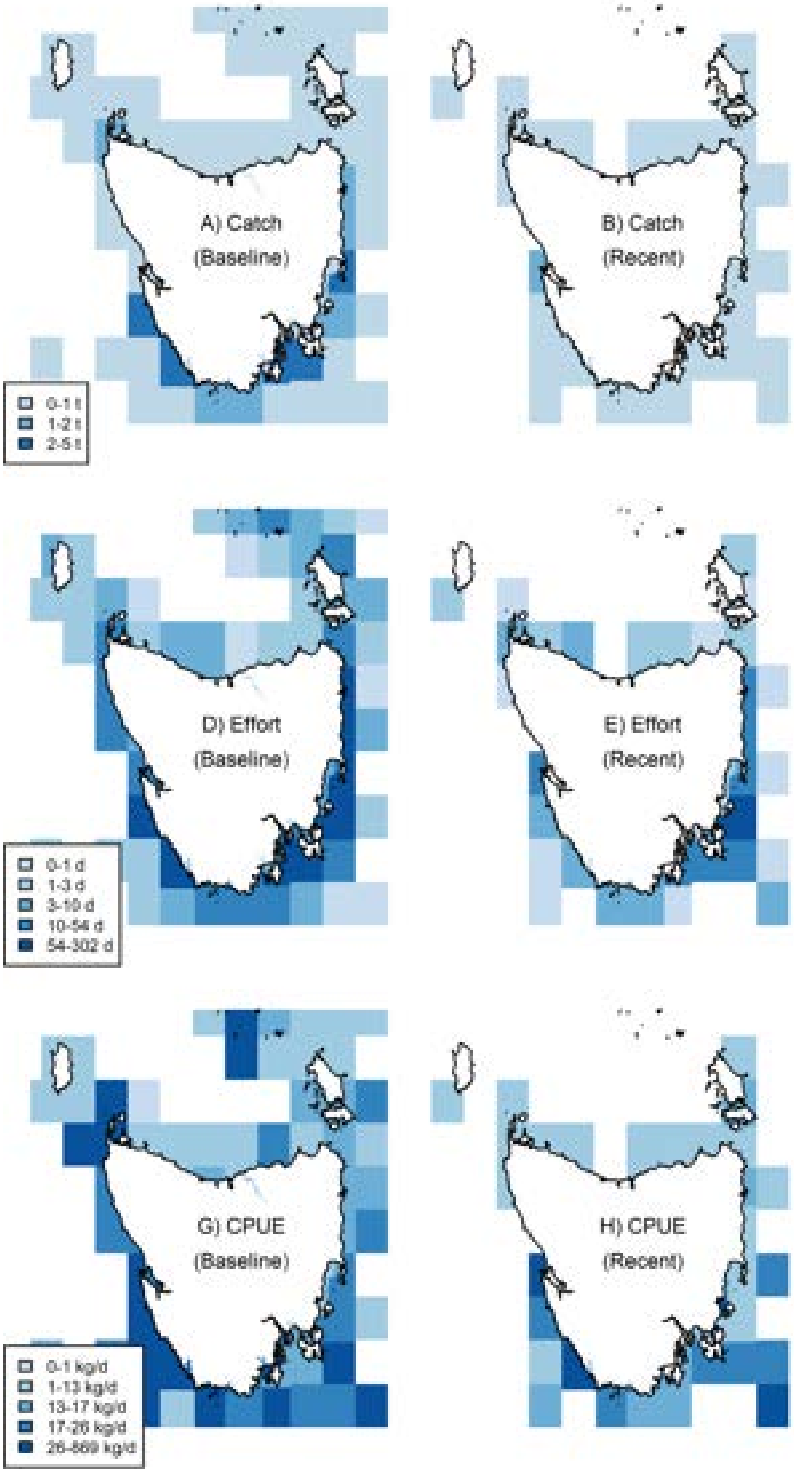


Figure 4.3 Bastard Trumpeter catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

CMSY results

CMSY results based on the assumption of "low" resilience suggest that Bastard Trumpeter biomass might be depleted to 13.7% of unfished levels (lower 95% confidence interval = 6.2% of unfished levels (Figure 4.4). Catches of Bastard Trumpeter were well above the estimated maximum sustainable yield (MSY) of 33.5 t until 1999/2000. The upper 95% confidence interval of MSY of 51.0 t was surpassed only in 1995/1996. From the 2000s, catches have steadily declined and have been well below the lower 95% MSY confidence limit of 23.1 t since 2009/10 (Figure 4.5).

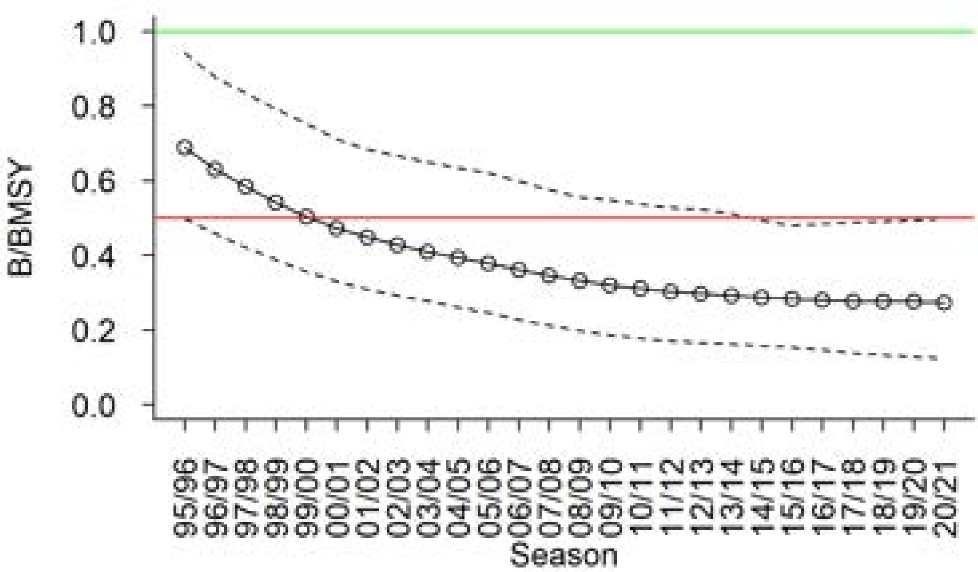


Figure 4.4 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

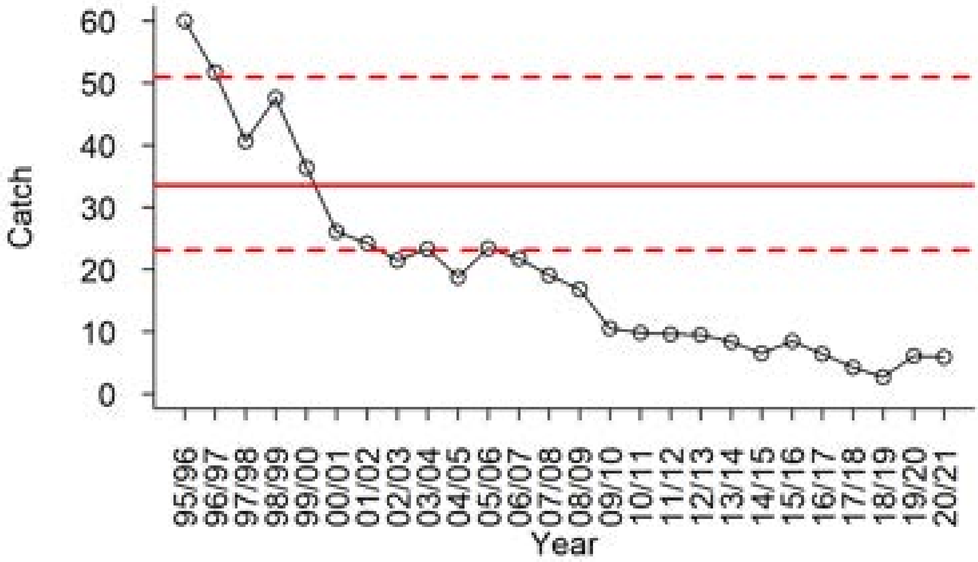


Figure 4.5 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Risk assessment of recruitment impairment

The Bastard Trumpeter fishery scored < 60 in the risk analysis, failing assessment with high risk of recruitment impairment and stock damage. Bastard Trumpeter has low productivity because it is slow to mature, relatively long-lived (Harries and Lake 1985; Murphy and Lyle 1999), and occupying a relatively high trophic level (Edgar 2008; Carscallen et al. 2012). The Tasmanian Bastard Trumpeter fishery is based almost entirely on juvenile fish and fishing effort overlaps with > 30% of stock distribution in Tasmanian waters. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

Stock status	**DEPLETED**

As Bastard Trumpeter is a by-product species, catch is a presumably better indicator of biomass than commercial CPUE. Consequently, the trend in commercial production suggests that inshore population biomass is still at historically low levels. In accordance with this observation, industry, recreational and conservation representatives have expressed concerns about the scarcity of the species in recent years (Emery et al. 2017). On-board observations suggest that Bastard Trumpeter are sometimes discarded by Banded Morwong fishers, but research suggests that post-release survival could be high (Lyle et al. 2014a). Given that the majority of gillnet effort is now targeted at Banded Morwong, thus using larger mesh sizes than those used historically to target Bastard Trumpeter, it is possible that trends in neither catch nor CPUE are representative of population status. However, fishing practices have remained fairly consistent in recent years (2007/08 – present), which is why declining catches and CPUE are likely to represent a population that has not notably recovered despite significant reductions in both commercial and recreational gillnet effort.

The Tasmanian Bastard Trumpeter fishery is based almost entirely on juveniles. As fish grow, they appear to move away from reefs, potentially into deeper waters. However, no information is available on the adult portion of the population. By-catch in shark nets, trawl, Danish seine or deep-water fish traps used by the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) appears to be negligible. Bastard Trumpeter exhibits high recruitment variability, which might be a result of historic depletion, resulting in short-term variation in catches, which has been a feature of this fishery over the past century (Harries and Croome 1989). Anecdotal reports and low inshore catches suggest that recruitment has been low in recent years. Low recruitment together with limited length frequency data available for 2011 and 2012 indicates a reduction in the number of smaller-sized individuals in the fishery relative to the late 1990s (Emery et al. 2016). Studies have demonstrated significantly higher abundances of Bastard Trumpeter in unfished marine reserves relative to fished sites around Tasmania (Edgar and Barrett 2012), which in combination with the fact that commercial and recreational fisheries are based entirely on juveniles, suggests that recruitment as well as growth overfishing may be occurring.

It is worth noting that the temporary stabilisation of catch from 2009/10 corresponds to the introduction of several management measures for the species (increase in the minimum legal size, introduction of commercial trip limits and reduction in recreational bag and possession limits). However, the current minimum size limit of 38 cm TL is still well below the size at maturity of >45 cm FL (Murphy and Lyle 1999). While there have been discussions about an increase of the minimum size limit to enable stock recovery, this management intervention was opposed during the 2015 review of the management plan because it would effectively close the current commercial and recreational fisheries for the species. Further reductions in the recreational bag limit for this species were introduced in 2015.

Based on the evidence outlined above, Bastard Trumpeter is classified as Depleted.

Eastern Australian Salmon (*Arripis trutta*)

STOCK STATUS	SUSTAINABLE
Eastern Australian Salmon has a long history of exploitation across south-eastern Australia. Low commercial landings in Tasmania in recent years are likely to be driven by market demand rather than abundance. The current level of fishing pressure in Tasmania is well below historically sustained levels and thus unlikely to cause the biological stock to become recruitment impaired.	
IMPORTANCE	Key
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment.
MANAGEMENT	State (Tasmania)

Eastern Australian Salmon *(Arripis trutta)*
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There are two species of Australian Salmon inhabiting Tasmanian waters: *Arripis trutta* (Eastern Australian Salmon) and *Arripis truttaceus* (Western Australian Salmon). Eastern Australian Salmon constitutes approximately 94% of Tasmanian commercial catches (Krueck et al. 2020). Eastern Australian Salmon is a schooling species, mainly caught by Tasmanian commercial fishers in inshore waters using beach seine, as well as some gillnet and purse seine gear. Eastern Australian Salmon constitute a single well-mixed stock in southeast Australian waters, traveling great distances among states (Queensland, New South Wales, Victoria, and Tasmania) (Stewart et al. 2011). Juveniles (4 – 6 cm fork length) appear in shallow Tasmanian waters between January and September (Kailola et al. 1993). The Tasmanian Scalefish Fishery predominantly catches subadults.

Australian Salmon have a long history of exploitation in Tasmania, with large-scale commercial fishing occurring since at least 1958 (Stewart et al. 2011). There are two distinct sectors in the commercial fishery: (1) a small number of large vessels specifically equipped to capture and store large quantities of Australian Salmon, and (2) a large number of small vessels that target the species on an opportunistic basis or take them as by-product. Changes in market demand and prices for Australian Salmon have largely driven changes in catch over time, with fishers participating in other fisheries when Australian Salmon is less economically viable. Australian Salmon is the second most important species for recreational fishers (Lyle 2005; Lyle et al. 2009; Lyle et al. 2014b; Lyle et al. 2019), who target this species mainly by using line fishing methods. More detailed information on biological characteristics and current management of Eastern Australian Salmon fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Commercial landings over the last few years have been low, with only 9.5 t landed in 2020/21 (Figure 5.1A). The low catch in recent years has been due to a substantial decline in landings by beach seine fishers, who have historically landed most of the catch (Figure 5.1A). The majority of catch in 2020/21 was taken by gillnet (4.6 t) and small mesh net (4.1 t), with beach seine landings comprising only 0.1 t.

Recent catches came from the north coast, and from the east and southeast coasts; however, in 2020/21 all catch was from the northeast coast (Figure 5.2, Figure 5.3). Both effort and CPUE remain low compared with historic peaks (Figure 5.1B, C). However, CPUE do not reveal clear trends and are unlikely to reflect biomass, which is a common problem for schooling species such as Eastern Australian Salmon.

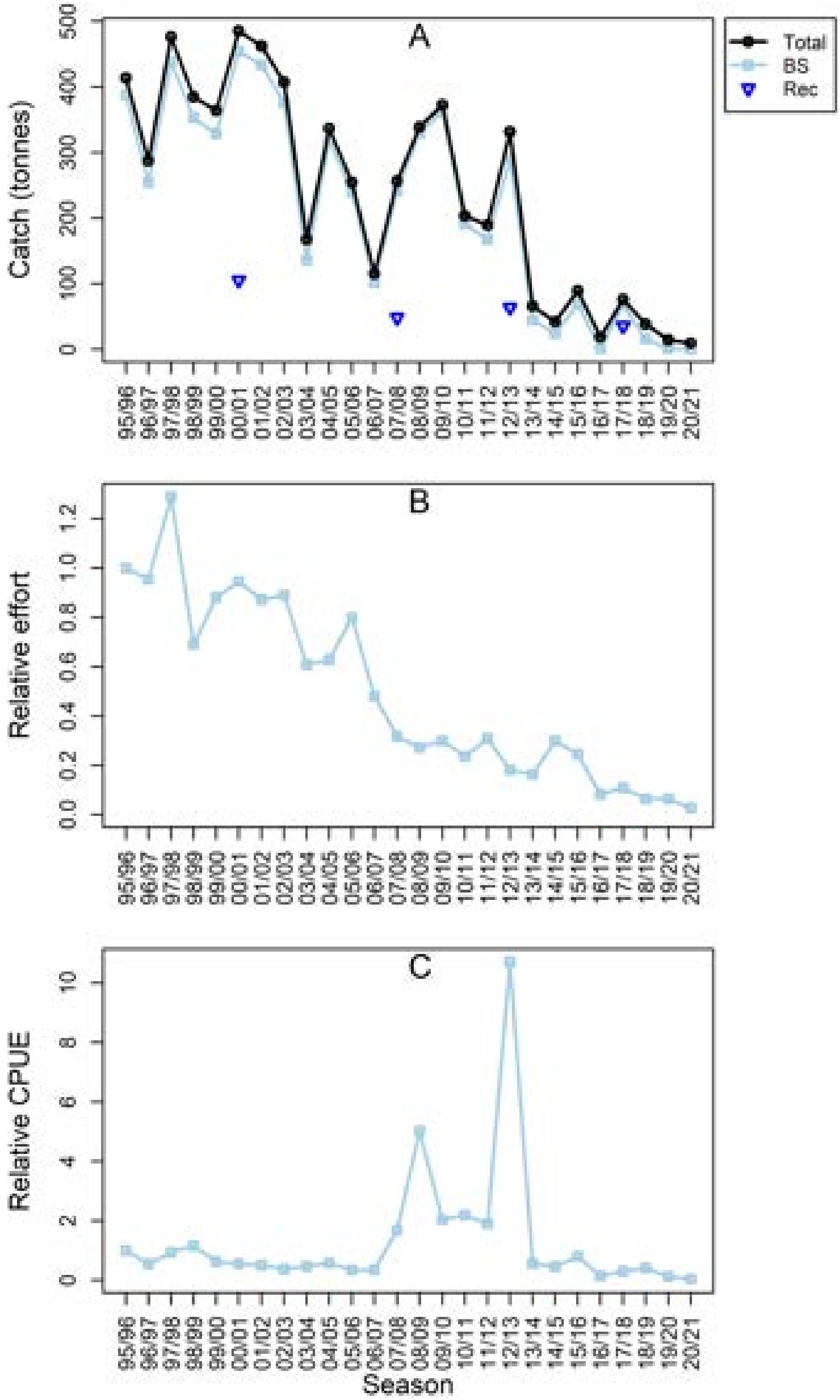


Figure 5.1 (A) Annual commercial Eastern Australian Salmon catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. BS = beach seine, Rec = estimated recreational catch.

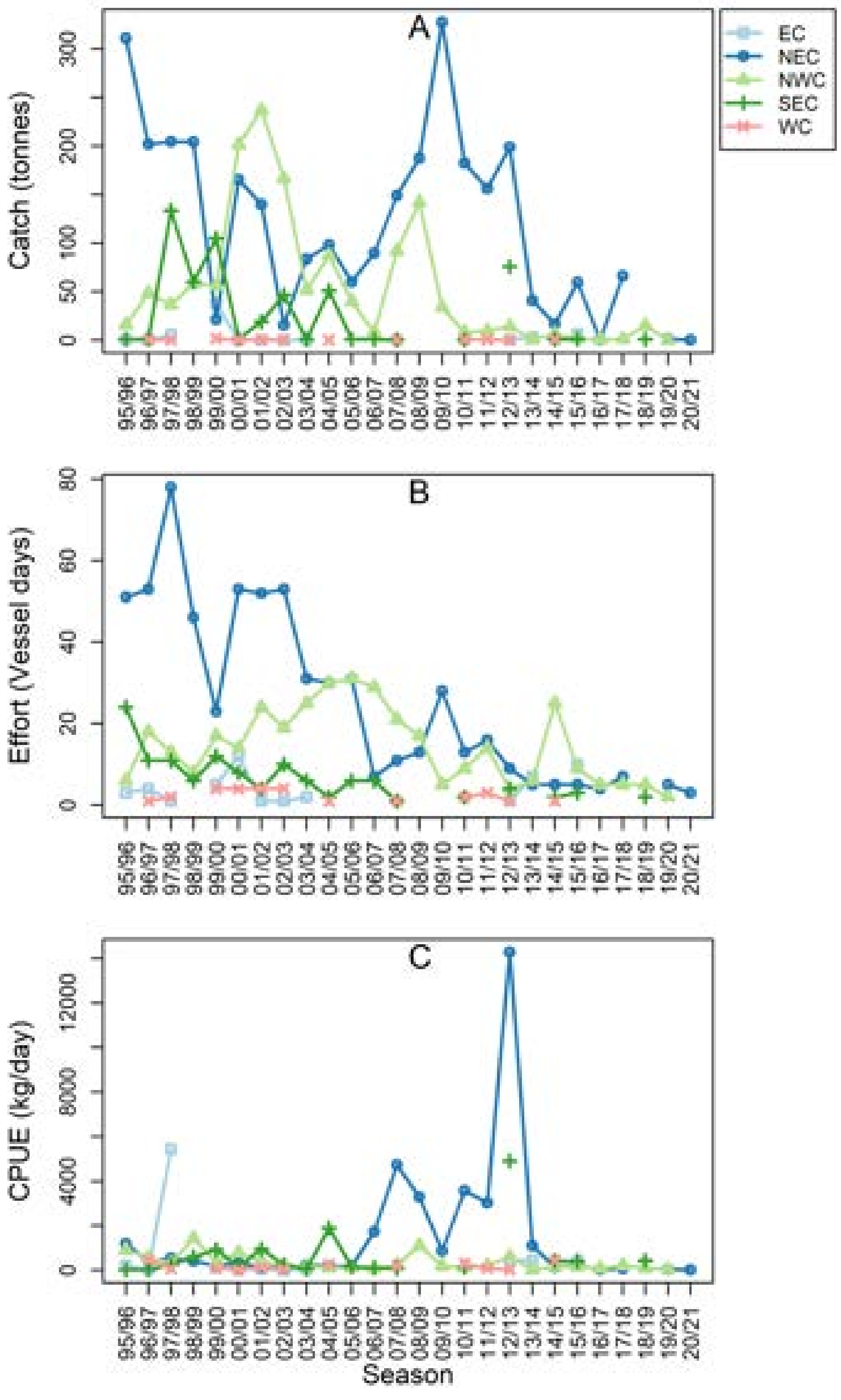


Figure 5.2 Regional commercial Eastern Australian Salmon catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for beach seine. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

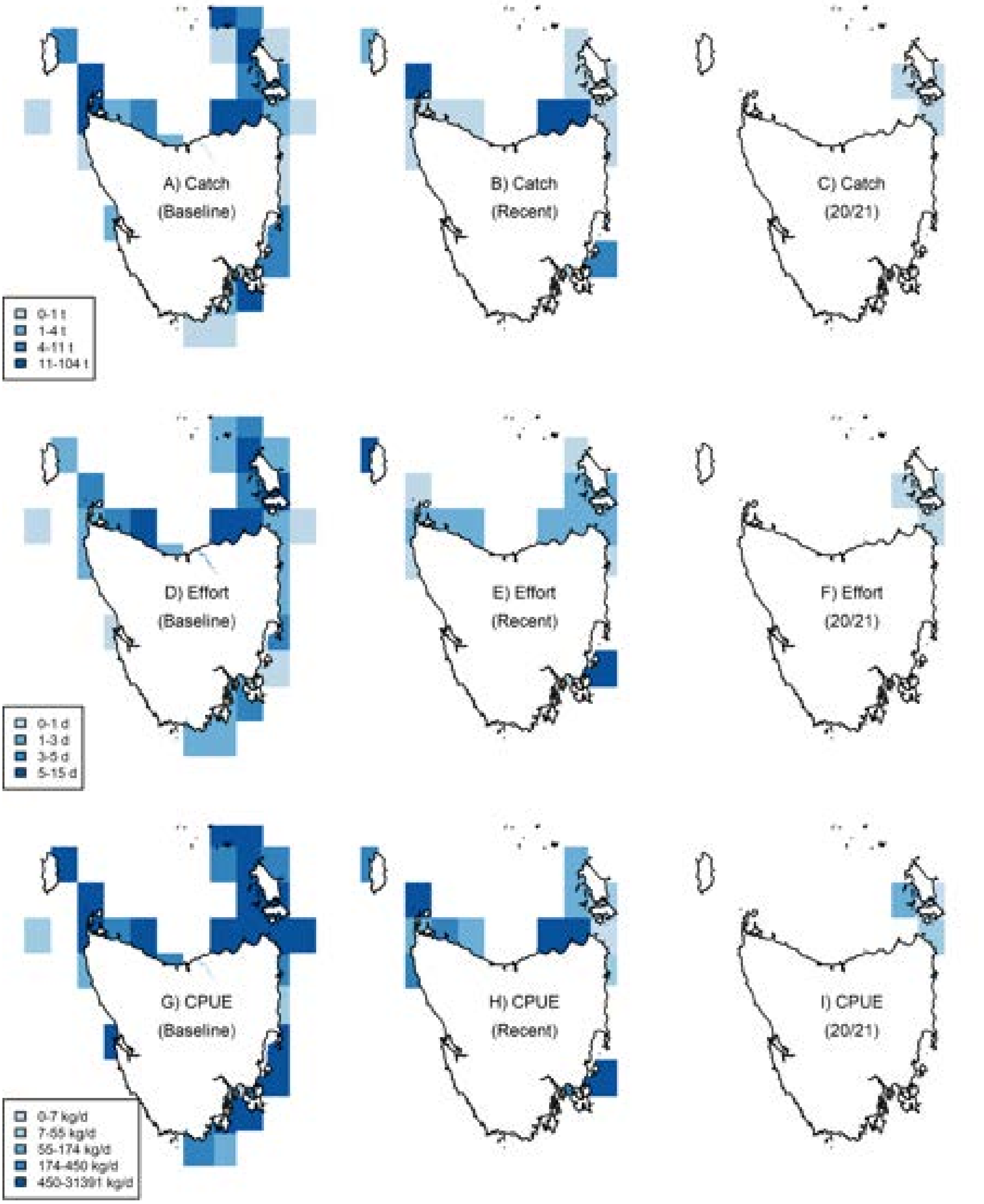


Figure 5.3 Eastern Australian Salmon catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Risk assessment of recruitment impairment

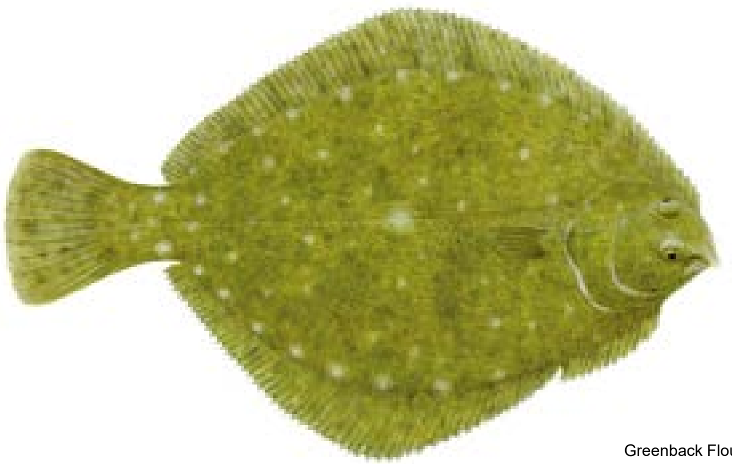
The Eastern Australian Salmon fishery scored > 80 in the risk analysis, passing assessment with low risk of recruitment impairment and stock damage. Eastern Australian Salmon is a moderately productive species – quick to mature and highly fecund, yet relatively long-lived (up to 26 years) and occupying a high trophic level (Stewart et al. 2011; Carscallen et al. 2012). This is a schooling species that frequently inhabits inshore waters (Edgar 2008); thus, the use of beach seine gear makes Eastern Australian Salmon highly susceptible to capture. However, low catches over the past decade are assumed to reflect reduced market demand rather than reduced abundance or biomass depletion (Stewart et al. 2011). Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

Stock status	**SUSTAINABLE**

Eastern Australian Salmon represents a single, well-mixed stock along southeast Australia (Stewart et al. 2011). There appears to have been little change in the size and age composition of this species while monitored in commercial catches in NSW from the 1970s up to 2008/09, with the eastern Australian biological stock classified as sustainable in the Status of Australian Fish Stocks (SAFS) 2020 (Piddocke et al. 2021) . Noting that the Tasmanian fishery catches mostly sub-adults and that the combined commercial and recreational catch in Tasmania is currently well below historical levels, it is unlikely that current fishing pressure will cause the population of Eastern Australian Salmon in Tasmania to become recruitment impaired.

Flounder (*Pleuronectidae* family)

STOCK STATUS	**UNDEFINED**
Greenback Flounder *(Rhombosolea tapirina)* constitute the majority of the commercial catch, which remains low due to limited market demand and the requirement for fishers to attend gear for most overnight gillnetting. Low recent effort, catch and CPUE are unlikely to reflect trends in biomass, but the impact of historic catches is uncertain. Thus, the status of the stock remains undefined.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment.
MANAGEMENT	State (Tasmania)



Greenback Flounder *(Rhombosolea tapirina)*
Illustration©R.Swainston/anima.fish

Flounder inhabit sheltered sand, silt, and mud habitat in estuaries and coastal waters of Tasmania. Since 2010, there has been a requirement for commercial fishers to attend their gear when gillnetting at night, unless they hold an unattended night netting endorsement for Bass Strait or are gillnetting in Macquarie Harbour. As a result, there has been a marked reduction in Flounder catch. Flounder in Tasmanian waters are primarily caught using spear. There is a substantial recreational fishery for Flounder, with most fishers also using spear. More detailed information on biological characteristics and current management of Flounder fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Records of commercial catches peaked at almost 35 tonnes at the start of the time series in 1995/96. Flounder landings have declined steadily since then, reaching an historical low of 1 t in 2015/16 (Figure 6.1A). Catch in 2020/21 was 2.7 t, a slight decline from 2019/20. Since the ban on night gillnetting in 2010, Flounder have been caught predominantly using spear (Figure 6.1A). Commercial catches and effort have contracted spatially over recent years to Norfolk Bay, the Tamar estuary, and Macquarie Harbour (Figure 6.4), with catch in the southeast (e.g., Norfolk Bay) taken mostly by spear (Figure 6.2) and catches on the west coast (e.g., Macquarie Harbour) taken mostly by gillnet (Figure 6.3).

Consistent with the trend in catches, effort for both spear and gillnet has been declining steadily since the mid-1990s (Figure 6.1B). Total CPUE for both spear and gillnet generally increased over recent years (Figure 6.1C) but underlying regional dynamics are more variable (Figure 6.2, Figure 6.3, Figure 6.4).

Flounder are a relatively important recreational species, and in recent years, catches for the recreational sector have matched or exceeded those of the commercial sector (Figure 6.1A). Similar to commercial catches, recreational catches appear to have declined progressively over recent years. Recreational catches were estimated at 15.2 t in 2000/01 (Lyle 2005), 10.1 t in 2007/08 (Lyle et al. 2009), 7.2 t in 2012/13 (Lyle et al. 2014b), and 3.8 t in 2017/18 (Lyle et al. 2019).

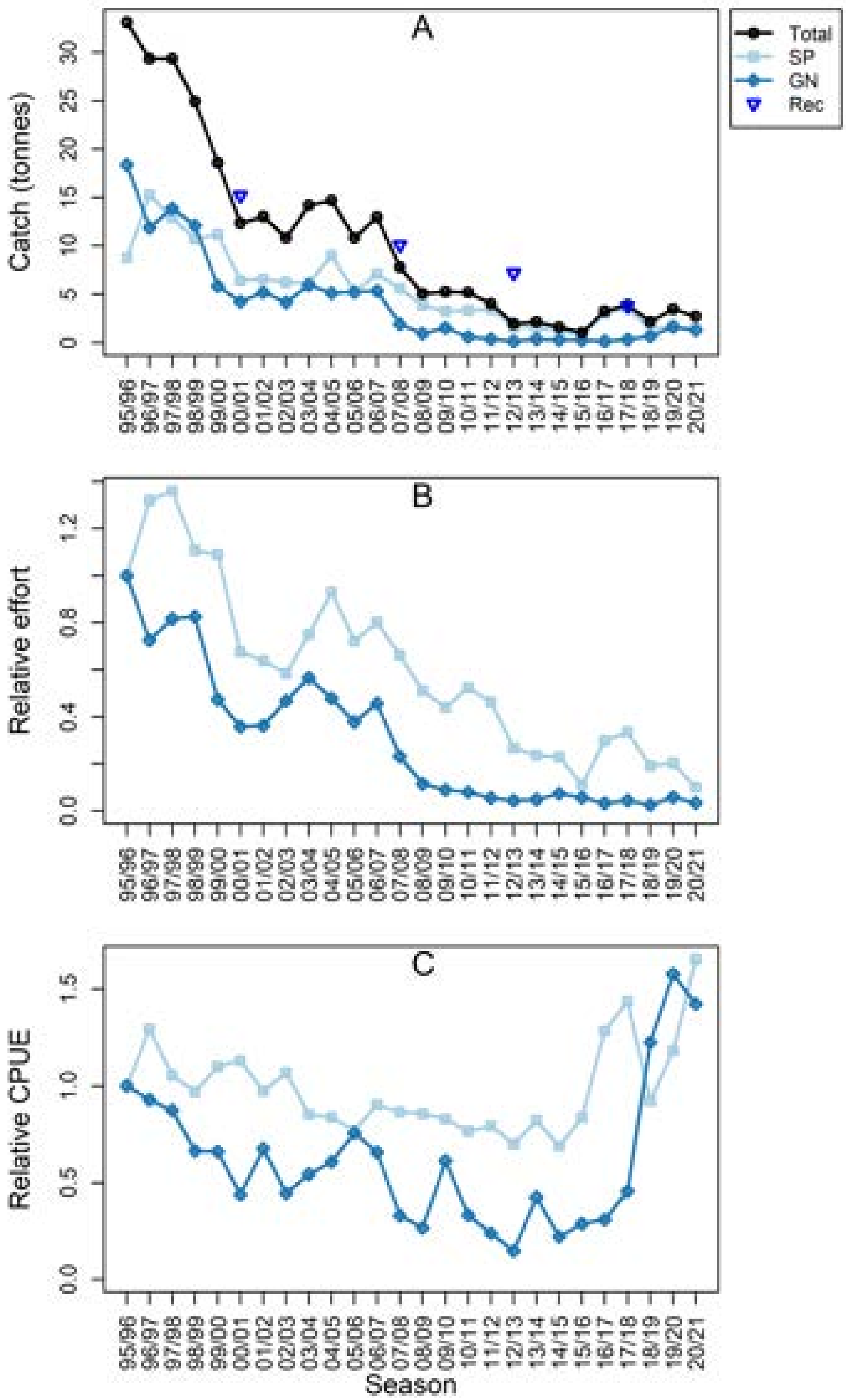


Figure 6.1 (A) Annual commercial Flounder catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. SP = spear, GN = gillnet, Rec = estimated recreational catch.

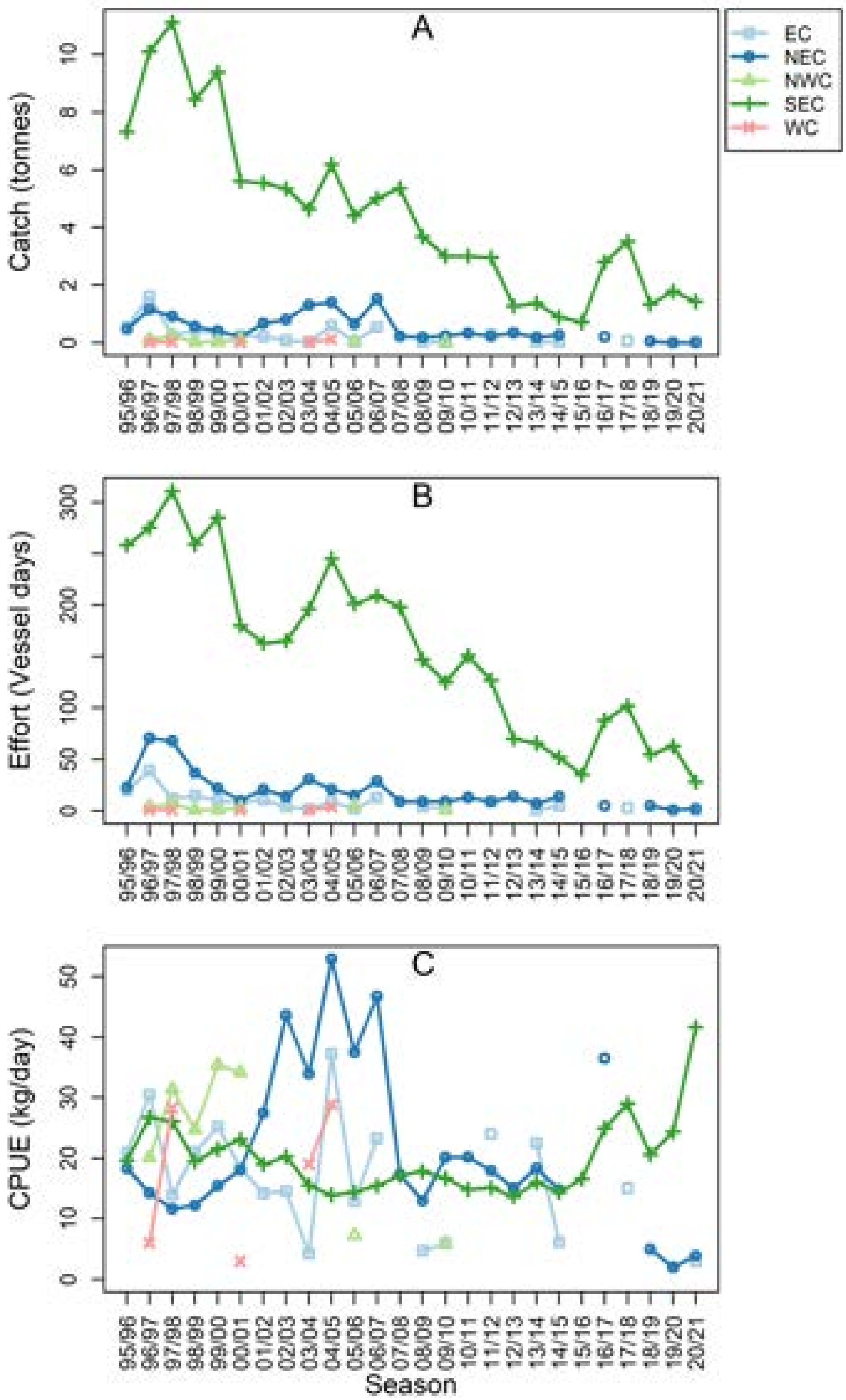


Figure 6.2 Regional commercial Flounder catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for spear. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

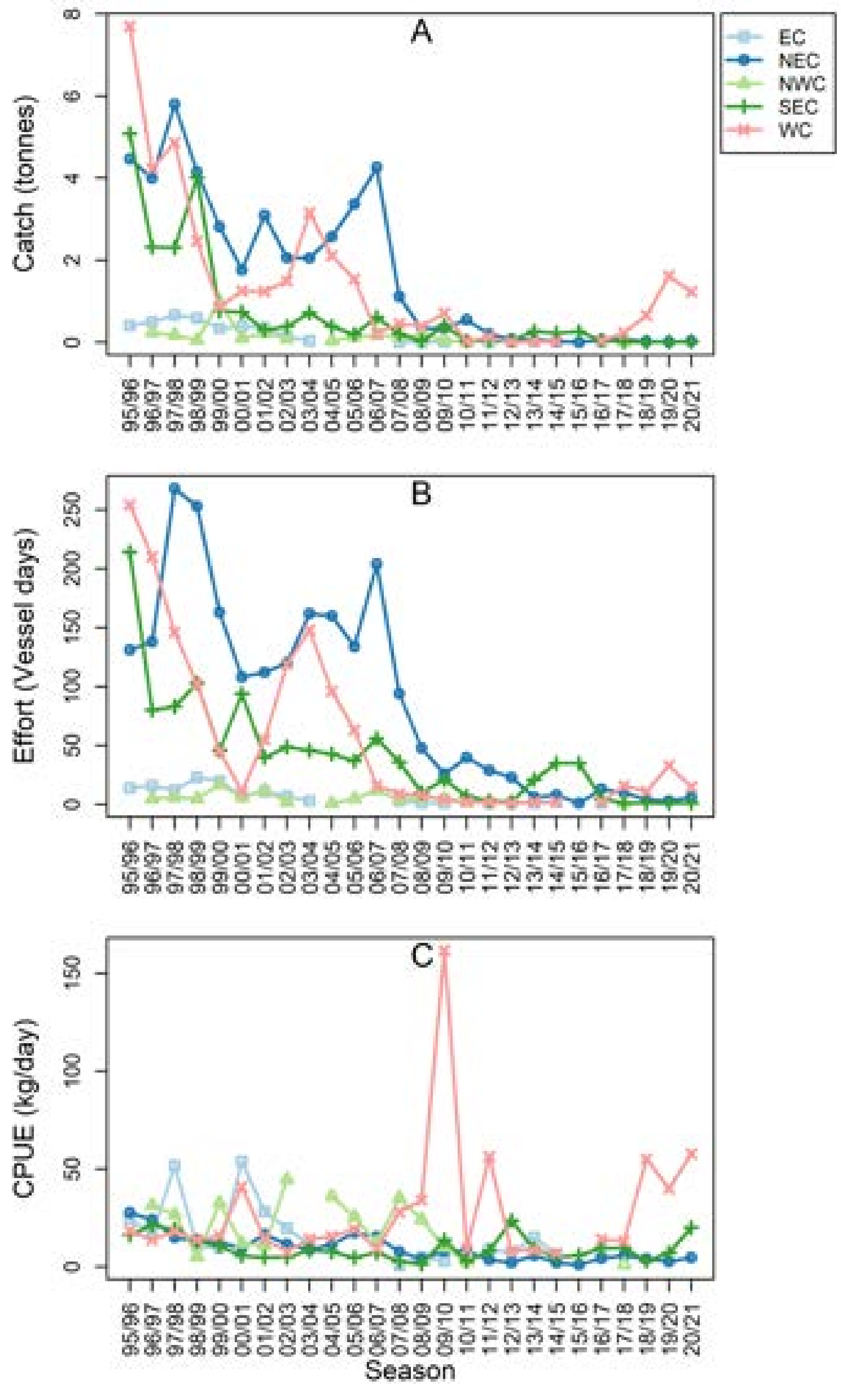


Figure 6.3 Regional commercial Flounder catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for gillnet. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

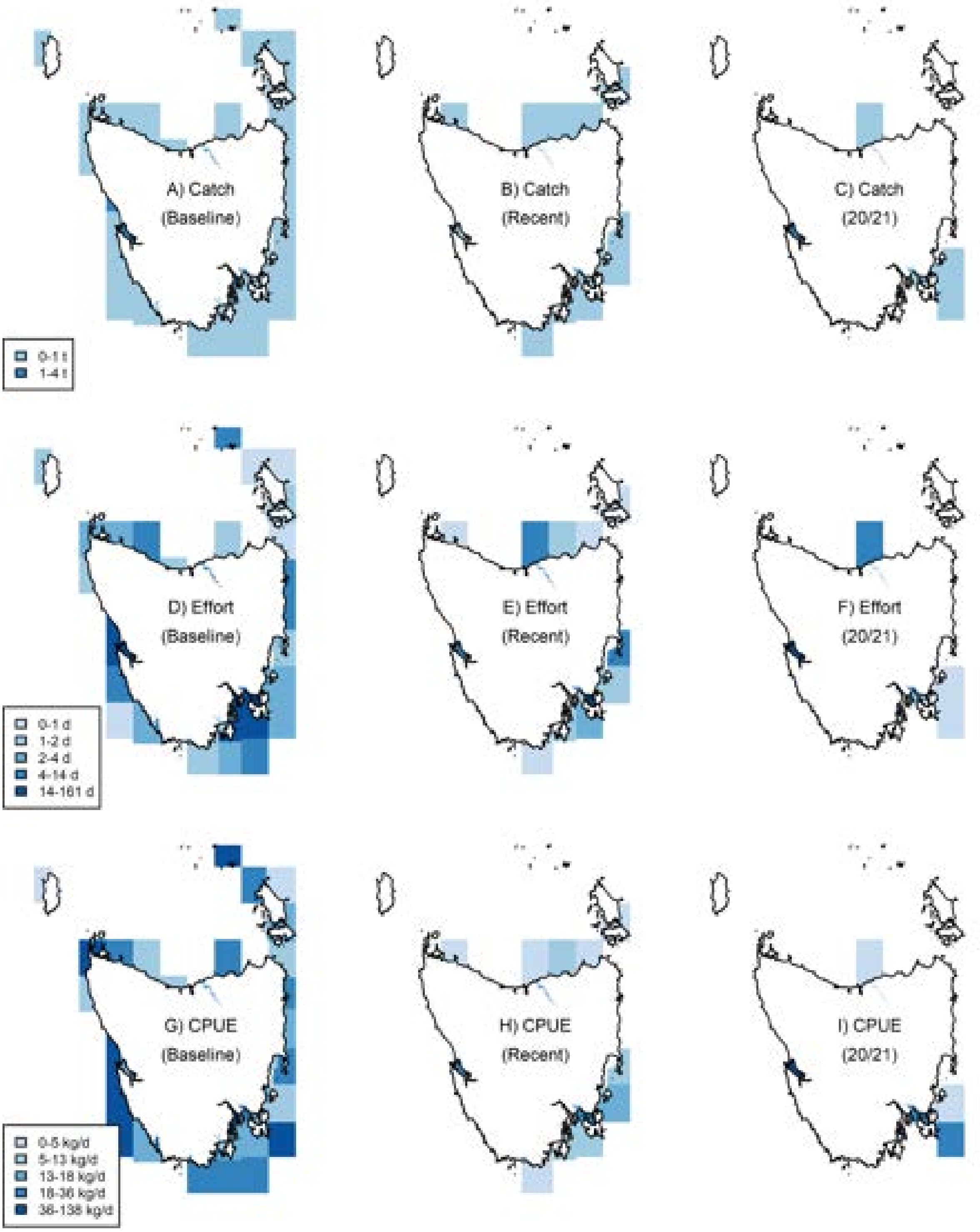


Figure 6.4 Flounder catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Risk assessment of recruitment impairment

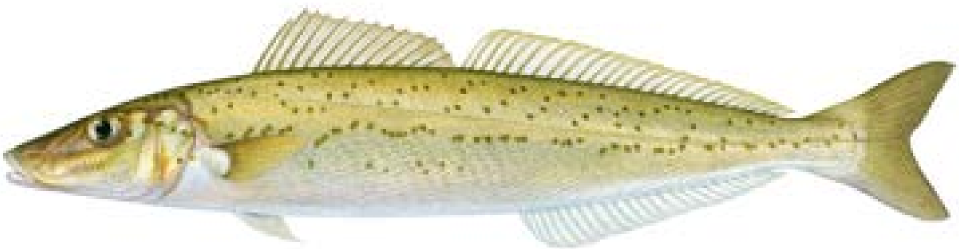
The Flounder fishery scored > 80 in the risk analysis, passing assessment with low risk of recruitment impairment and stock damage. Greenback Flounder is a highly productive species – relatively small and short lived (Sutton et al. 2010), quick to mature (Crawford 1984), with high fecundity (Crawford 1986), and occupying a moderately low trophic level (Ferguson 2006). Greenback Flounder has a low susceptibility to capture by the Tasmanian commercial fishery, largely because fishing effort is limited and restricted to the shallow component of the species' depth range (Edgar 2008). Since the 2010 restrictions on unattended night netting, catch has been minimal, also influenced by a reduction in market demand. However, from the mid-1990s to 2010, catch declined steadily, which may be attributed to over-exploitation. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

Stock status	**UNDEFINED**

The recent decline in Greenback Flounder catch is assumed to be driven primarily by management changes and reduced market demand. The Tasmanian catch is sold locally and demand for Flounder has decreased over the last two decades to an extent that both catch and CPUE are considered unreliable estimators of trends in biomass. However, Greenback Flounder catches in the mid-1990s are likely to have been 50 t or higher, considering the combined total of commercial and estimated recreational catches during this period. Uncertainty about the impact of these and earlier catches on the status of Flounder is considerable, thus there is overall insufficient information to confidently classify this stock.

King George Whiting (*Sillaginodes punctatus*)

STOCK STATUS	SUSTAINABLE
King George Whiting is an emerging species that has attracted increasing interest from both the commercial and recreational sector. The current level of fishing pressure on King George Whiting within Tasmanian waters is unlikely to cause the biological stock to become recruitment impaired. However, local impacts on stocks could still be considerable. Pre-emptive monitoring and management are needed if interest in this species continues to increase.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment.
MANAGEMENT	State (Tasmania)



King George Whiting *(Sillaginodes punctatus)*
Illustration©R.Swainston/anima.fish

King George Whiting are found in Australia's southern coastal waters, including northern Tasmania. This species is associated with sand and seagrass habitat. Juveniles commonly aggregate in large schools of similar-sized fish over patches of sand among sheltered, shallow seagrass (Graba-Landry et al. 2022), while adults tend to inhabit more exposed sandy areas (Edgar 2008). Commercial and recreational exploitation of King George Whiting in mainland state waters is well established. State catches are supporting a small but developing commercial fishery in northern Tasmania. Commercial operators use mostly beach seine gear in exposed coastal waters near Stanley in the northwest and in the Tamar estuary in the north. King George Whiting are also caught commercially around Flinders Island using beach seine. While commercial catch and effort have been increasing in northern Tasmania since 1995, catch is still relatively low and the increase is minor compared with the expansion of the recreational fishery. Recreational fishing likely accounts for the majority of landings. Although reported to have occurred in northern Tasmanian waters for at least 100 years, King George Whiting is a potential range-extending species, with some evidence of increasing numbers and distribution in Tasmanian waters, including possible movement down the east coast south of St Helens (Graba-Landry et al. 2022). More detailed information on biological characteristics and current management of King George Whiting fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

The 2020/21 commercial catch of King George Whiting in Tasmanian waters was 3.6 t (Figure 7.1A), which represents an increase from the previous year but which is still substantially lower than the most recent estimate of recreational catch – 7.2 t in 2017/18 (Lyle et al. 2019). Relative effort and CPUE have fluctuated over the duration of fishery records; however, both show generally increasing trends, with 2020/21 data indicating substantial increases from the previous year (Figure 7.1B, C). Commercial fishing activity for King George Whiting has been focused on the north coast – in the northwest and northeast, around Flinders Island (Figure 7.3). In 2020/21, fishing for this species only occurred around Flinders Island.

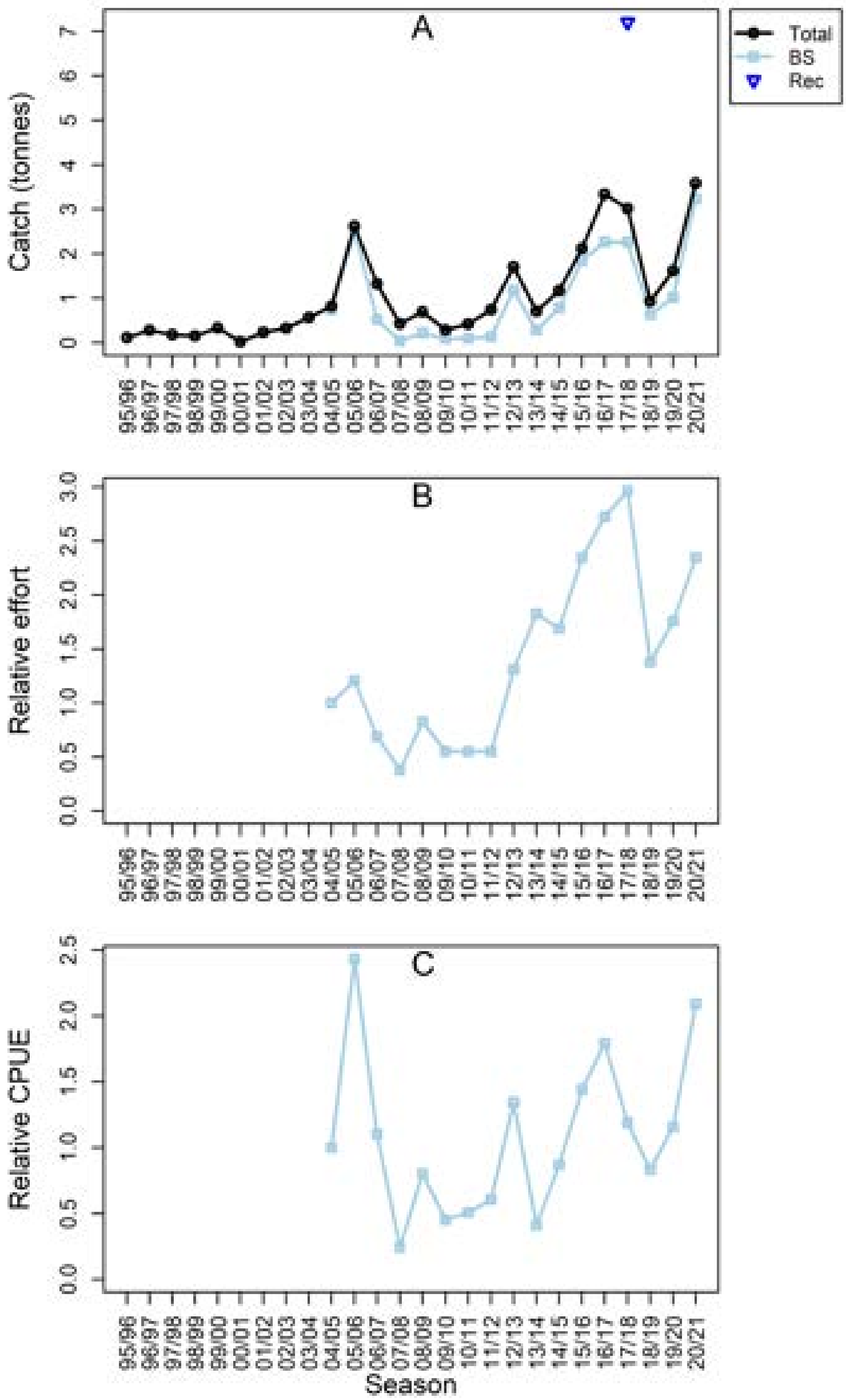


Figure 7.1 (A) Annual commercial King George Whiting catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 2004/05; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 2004/05. BS = beach seine, Rec = estimated recreational catch.

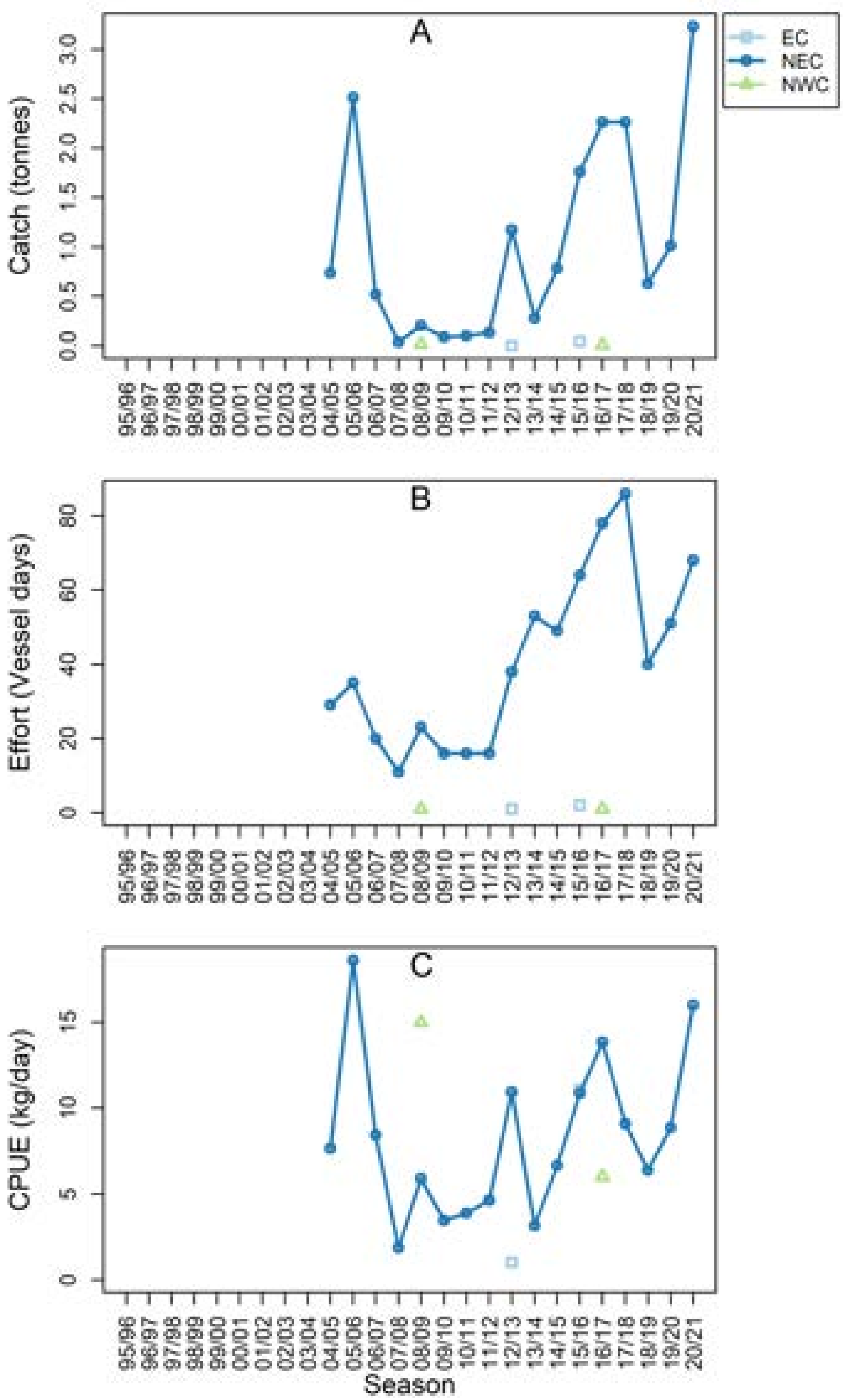


Figure 7.2 Regional commercial King George Whiting catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for beach seine. EC = east coast, NEC = northeast coast, NWC = northwest coast.

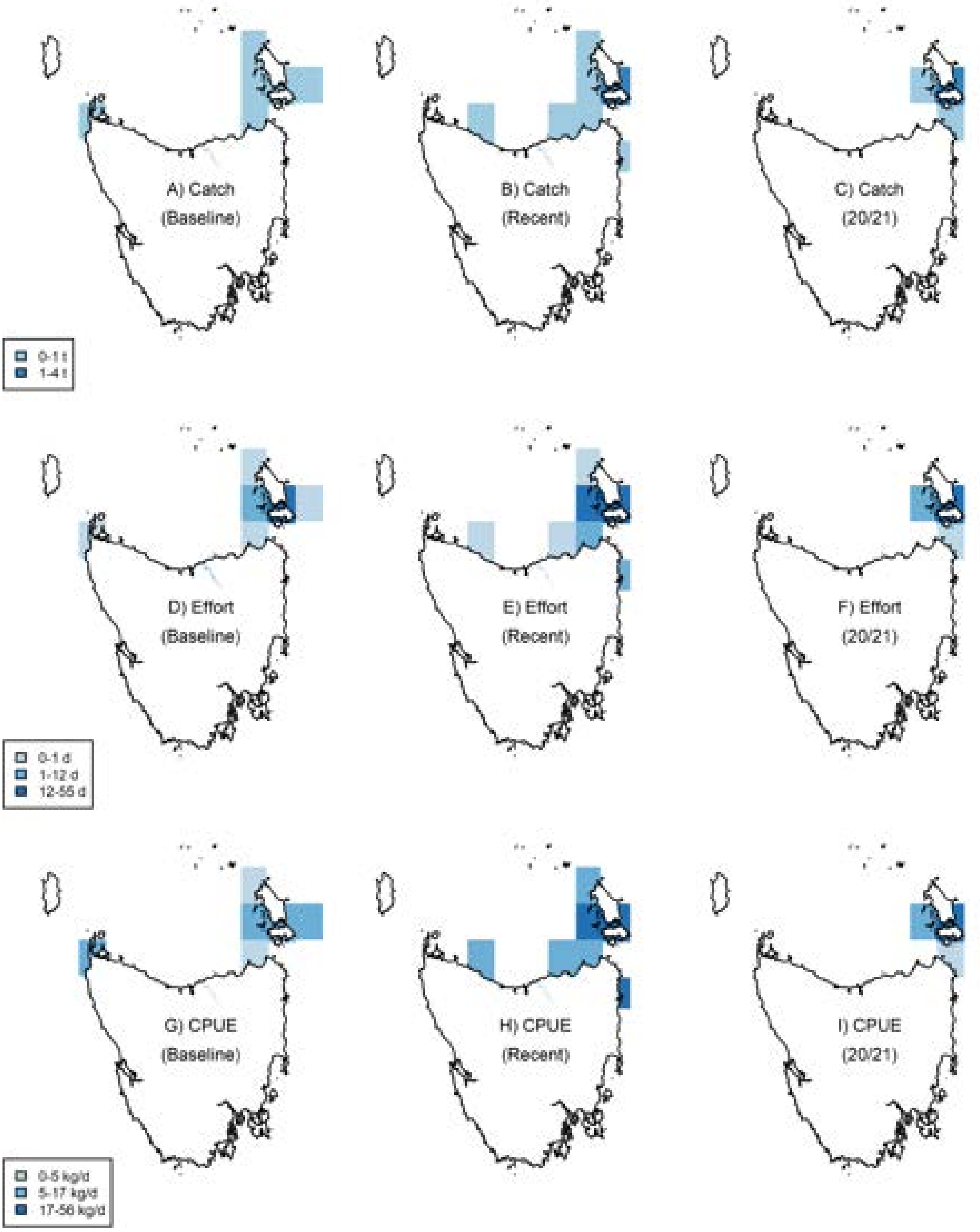


Figure 7.3 King George Whiting catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (2004/05 to 2013/14 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Risk-Based Framework Assessment

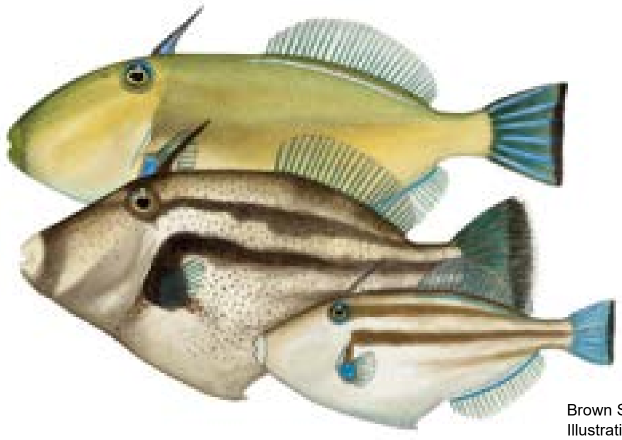
The King George Whiting fishery scored 60 – 80 in the risk analysis, passing assessment with medium risk of recruitment impairment and stock damage. King George Whiting is a moderately productive species – maturing early (Jenkins et al. 2016; Nicholls 2018) but reaching a reasonably high maximum age (Kailola et al. 1993), with high fecundity (Fowler et al. 1999). Fishing activity overlaps with > 30% of the known distribution of King George Whiting in Tasmanian waters and, although the abundance and range of this species appear to be increasing as environmental conditions change (Graba-Landry et al. 2022), the fishery is likely to continue to develop. Detailed information on the scoring that led to the current assessment outcome is available from the TasFisheriesResearch webpage.

Stock status	**SUSTAINABLE**

The Tasmanian commercial fishery for King George Whiting is developing, with both catch and effort still relatively low, but locally concentrated. An increasing trend in catch and effort, along with a potential range expansion of the species, suggest that the fishery will continue to develop. The 2017/18 survey of recreational fishing in Tasmania showed King George Whiting to be an important species for this sector (Lyle et al. 2019), and recreational catches are likely to increase as the species becomes more abundant and well-known by recreational fishers. Pre-emptive monitoring and management are recommendable, even if stocks are unlikely to be depleted and current levels of fishing are likely to be sustainable.

Leatherjackets (*Monacanthidae* family)

STOCK STATUS	UNDEFINED
Several species of Leatherjacket are found in coastal waters around Tasmania. Most likely to be captured by coastal fisheries are the Brown-striped (*Meuschenia australis*), Toothbrush (*Acanthaluteres vittiger*), and Six-spine (*Meuschenia freycineti*) Leatherjacket. Leatherjackets are largely a by-product and not actively targeted due likely to a lack of market demand. However, impacts of historic catches (estimated at around 40 tonnes in 1995/96) on the biomass depletion of individual species are uncertain. Thus, there is overall insufficient information to confidently classify the status of Leatherjacket stocks, especially as multiple species are involved.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends
MANAGEMENT	State (Tasmania)



Brown Striped Leatherjacket *(Meuschenia australis)*
Illustration©R.Swainston/anima.fish

Leatherjackets are reef-associated species of the *Monacanthidae* family (Edgar 2008). There is no substantial commercial fishery for Leatherjackets in Tasmania and a small recreational fishery for this family. In the commercial fishery, Leatherjackets are a generally discarded by-product of fish traps and netting operations. More detailed information on biological characteristics and current management of Leatherjacket fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Peak catches around 15 tonnes were recorded at the start of the commercial catch time series from 1995/96 until the early 2000s. Considering additional catches in Rock lobster traps (León et al. 2020) and by the recreational sector during this time, total catches likely amounted to values closer to 40 tonnes. Leatherjacket catches have notably declined since then, reaching a minimum of 0.6 t in 2020/21 (Figure 8.1A). Most Leatherjacket catch from 2020/21 came from the southeast coast, while previous catches were concentrated more on the northeast and east coasts (Figure 8.2, Figure 8.3, Figure 8.4).

Leatherjackets are also caught by the recreational sector, with catch estimates in recent surveys at a similar level to commercial catches (Figure 8.1A). Estimates were 8.2 t in 2000/01

(Lyle 2005), 2.6 t in 2007/08 (Lyle et al. 2009), 2.3 t in 2009/10, 1.8 t in 2012/13 (Lyle et al. 2014b), and 4.9 t in 2017/18 (Lyle et al. 2019).

Both fish trap and gillnet fishing effort have decreased through time (Figure 8.1B), both reaching record low levels in 2020/21. CPUE has been fairly consistent over time for gillnets but fluctuating more for fish traps (Figure 8.1C).

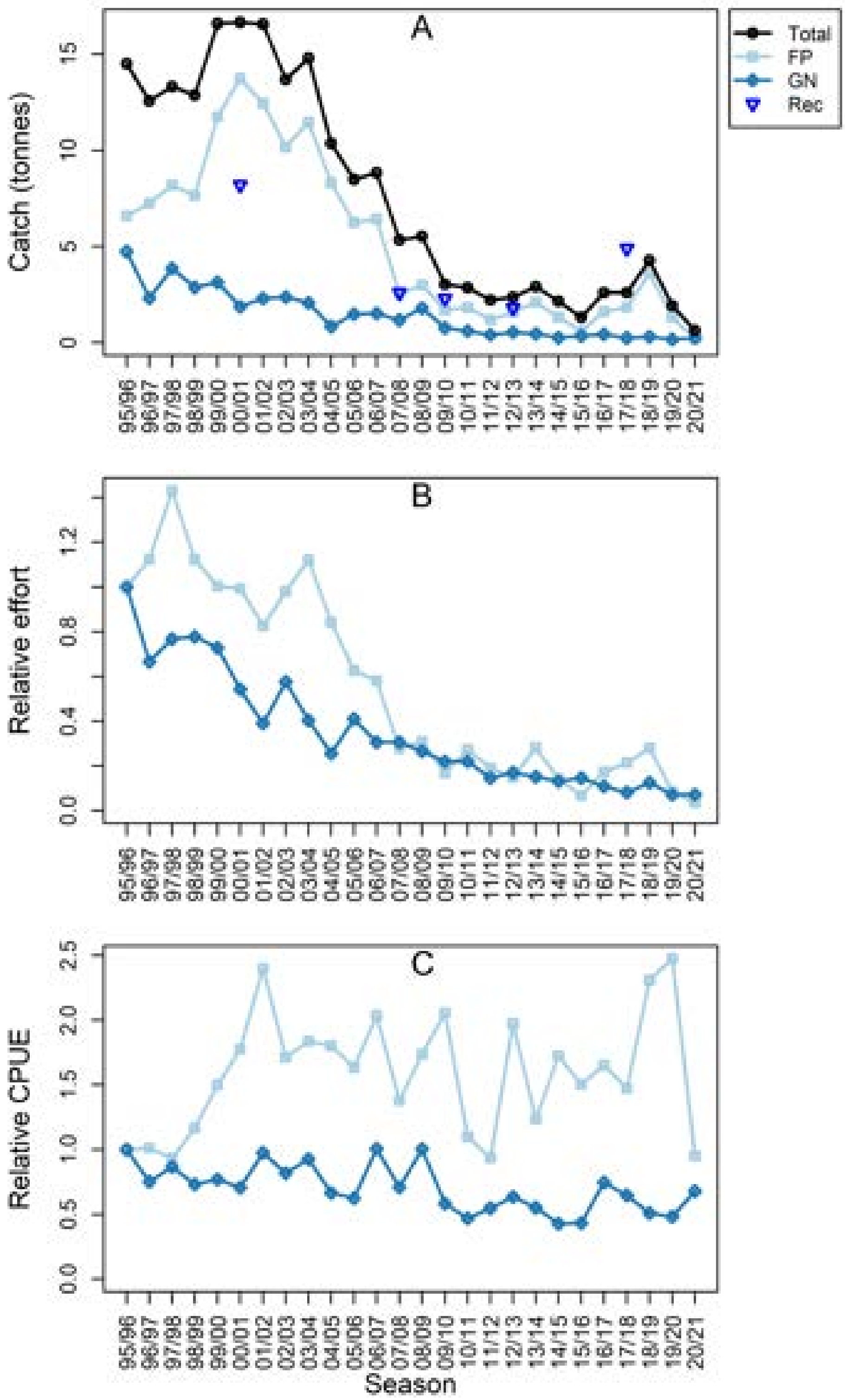


Figure 8.1 (A) Annual commercial Leatherjacket catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort

(CPUE) based on weight per days fished relative to 1995/96. FP = fish trap, GN = gillnet, Rec = estimated recreational catch.

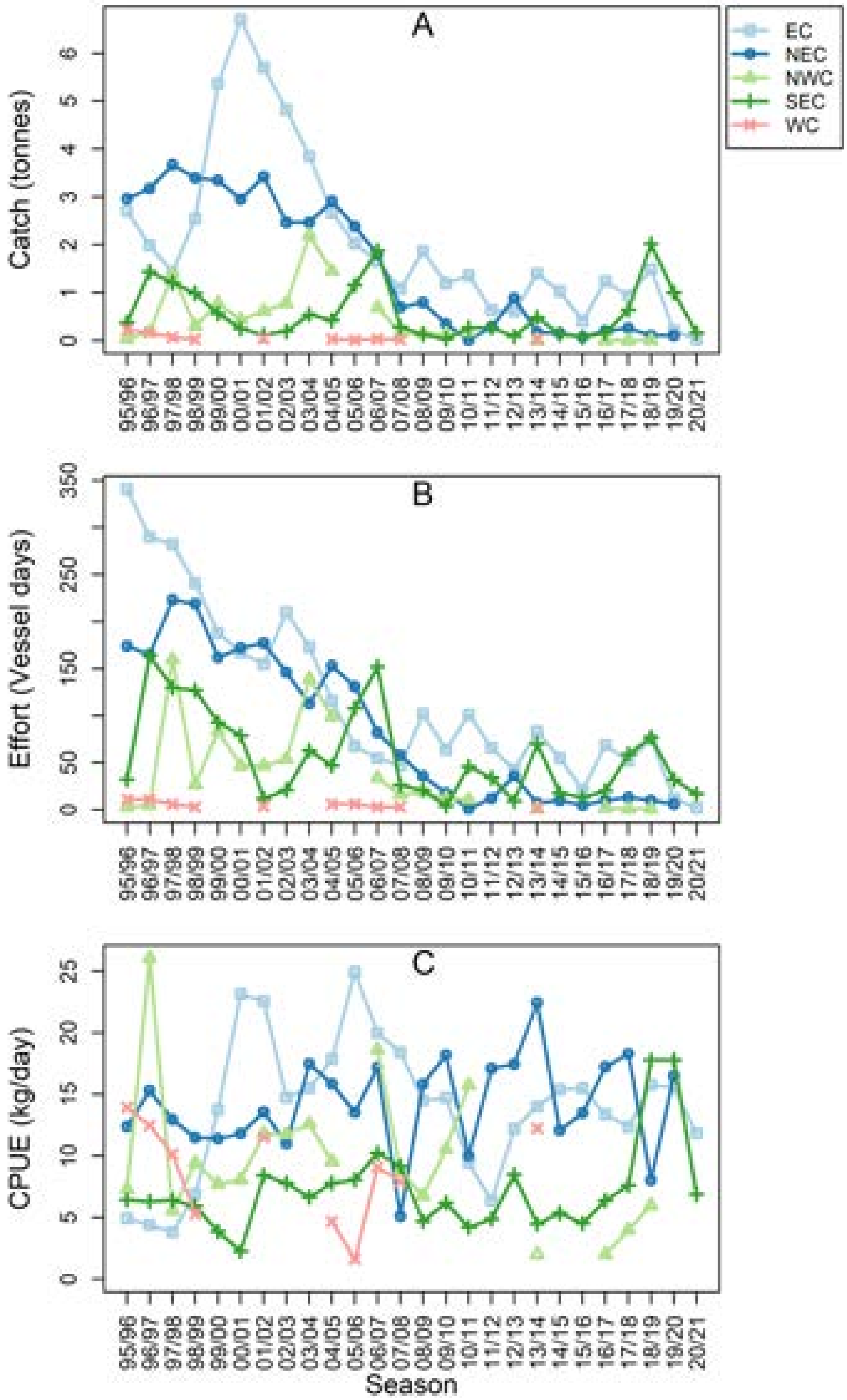


Figure 8.2 Regional commercial Leatherjacket catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for fish trap. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

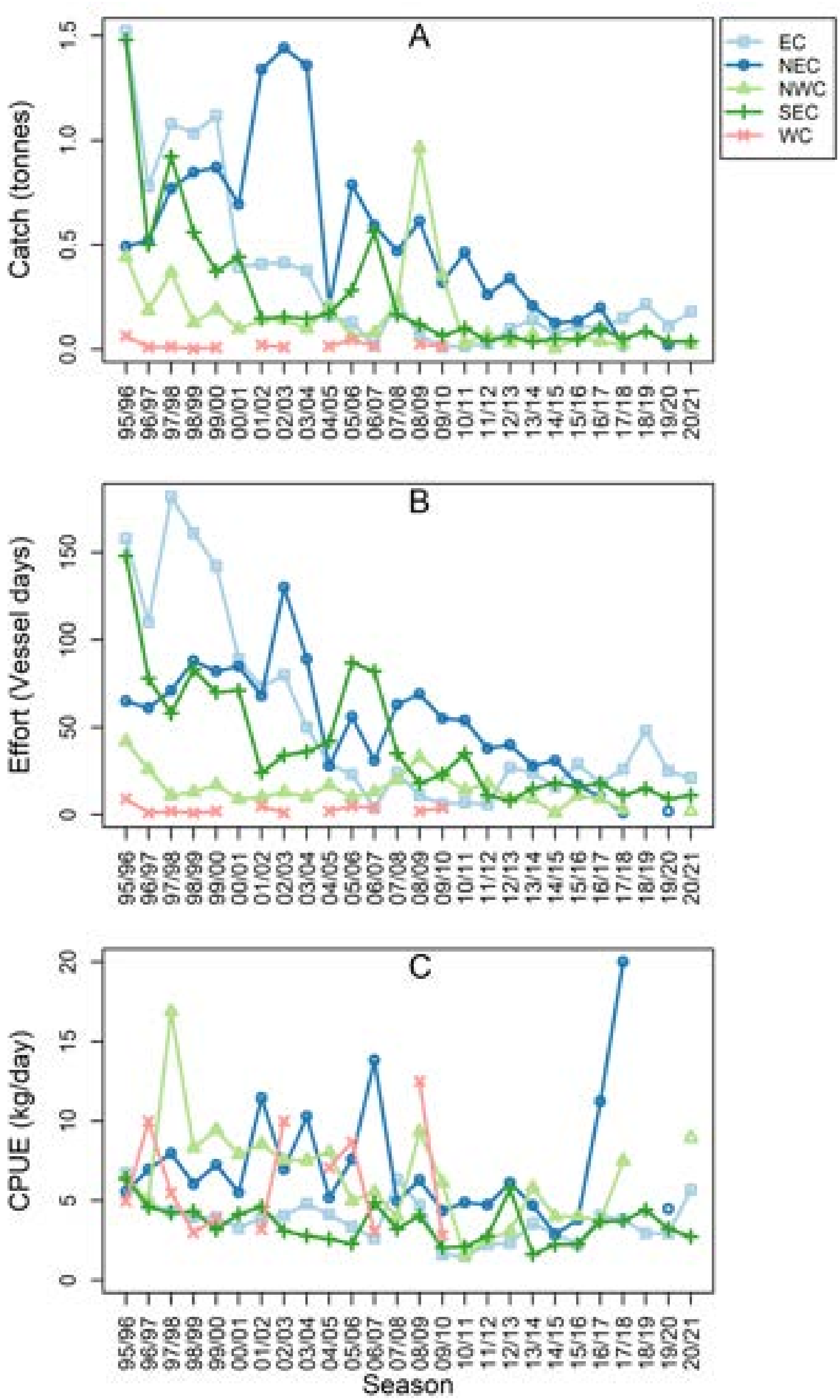


Figure 8.3 Regional commercial Leatherjacket catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for gillnet. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

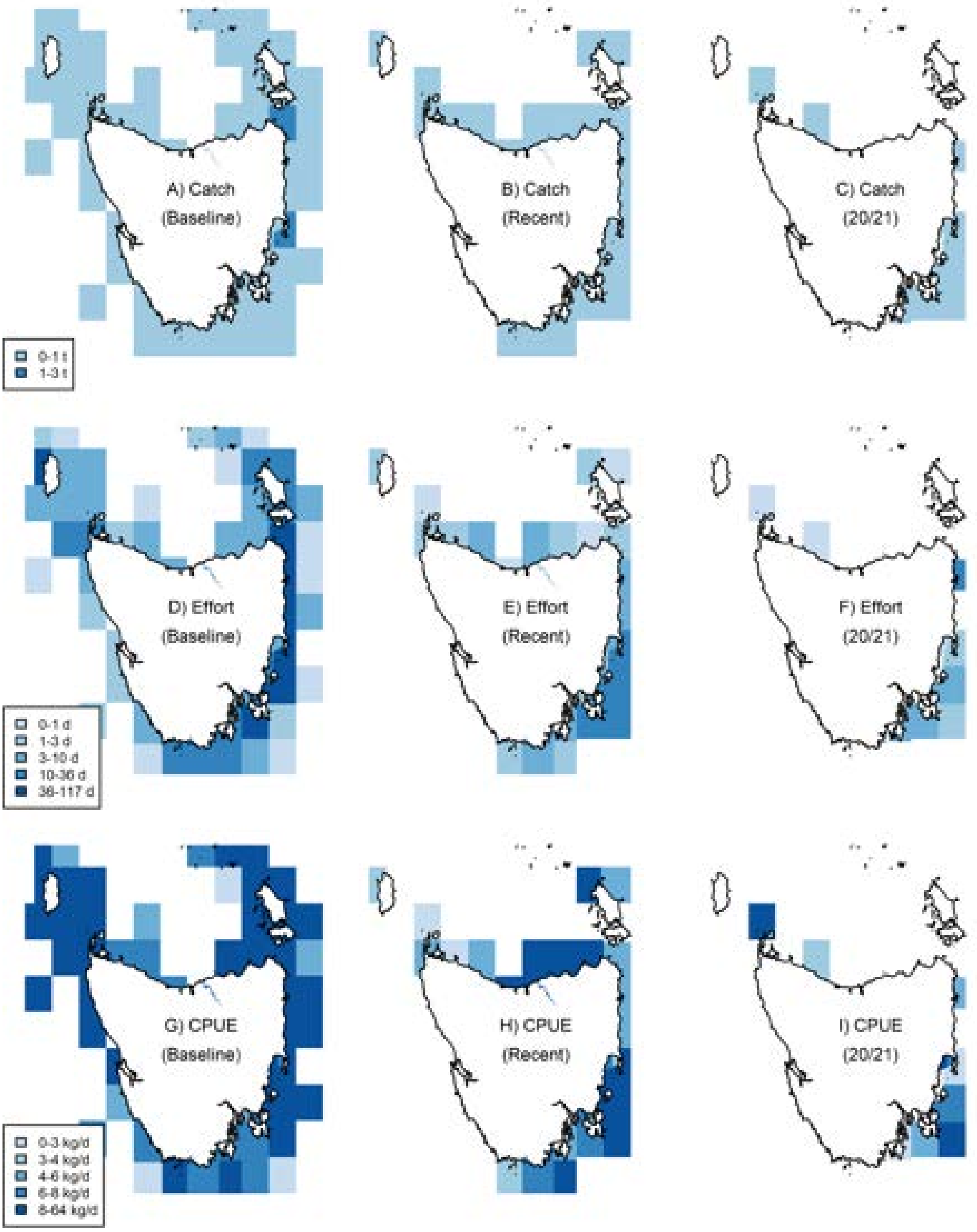


Figure 8.4 Leatherjacket catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Risk assessment of recruitment impairment

Leatherjacket catch data do not distinguish among genera or species and the high level of diversity within the *Monacanthidae* family meant that an accurate risk analysis could not be conducted.

Stock status	UNDEFINED

Recent low landings of Leatherjacket in the scalefish fishery are likely to be driven by a general decline in the use of fish traps and a lack of market demand and are thus unlikely to represent reliable indicators of trends in biomass.

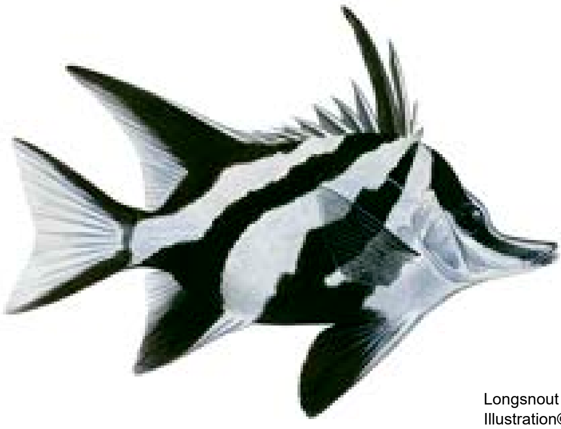
Twenty-five years of monitoring Tasmanian Marine Protected Areas (MPAs) indicated no significant difference in the abundance of several Leatherjacket species, including Brown-striped and Toothbrush Leatherjacket, when data from sites within MPAs were compared with data from sites outside of MPAs (Barrett et al. 2007; Barrett et al. 2018). These results indicate that recent impacts of fishing activity on Leatherjacket abundance might be low.

Although Leatherjackets are a generally discarded by-product species, they are assumed to show high post-release survival following capture in gillnets (Lyle et al. 2014a). Post-release survival from fish traps is uncertain. However, Leatherjackets are highly susceptible to barotrauma which is suspected to limit survival if fish traps are set >25 m deep or retrieved too quickly (León et al. 2020). Leatherjackets are also a bycatch species of the Southern Rock Lobster fishery, with an estimated mean annual biomass from 2000 to 2017 of 5.0 ± 4.1 t (León et al. 2020).

Despite catch data being an unreliable indicator of biomass, low total catches and fishery-independent monitoring indicate that the current level of fishing is unlikely to cause the stock to become recruitment impaired. However, historic catches and potential depletions of species biomass are uncertain and there is overall insufficient information to confidently classify the status of Leatherjacket stocks, especially given that multiple species are caught.

Longsnout Boarfish (*Pentaceropsis recurvirostris*)

STOCK STATUS	UNDEFINED
Longsnout Boarfish are a by-product species of the gillnet fishery for Banded Morwong, with low catches due to the large minimum legal size. There is insufficient information available to confidently classify this stock.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends
MANAGEMENT	State (Tasmania)



Longsnout Boarfish *(Pentaceropsis recurvirostris)*
Illustration©R.Swainston/anima.fish

Longsnout Boarfish is a by-product of gillnetting operations primarily targeting Banded Morwong. Trip limits, the high minimum size limit mean captured Longsnout Boarfish are regularly discarded. The survival rate of released Longsnout Boarfish is high (99.7%) (Lyle et al. 2014a). Longsnout Boarfish are reef-associated and inhabit depths of 4–260 m (Edgar 2008). However, a ban on spearing this species means it is unlikely that it is commonly caught by recreational fishers. No data are available for recreational gillnet landings of this species. More detailed information on biological characteristics and current management of Longsnout Boarfish fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Longsnout Boarfish catches in Tasmanian waters are primarily derived from gillnet; however, some by-product catch was recorded from the shark net fishery on the northeast coast in the last two years, for the first time since 2011/12 (Figure 9.1A, Figure 9.3). Catches have been declining from peaks of approximately 10 tonnes (recorded in 1996/97) but appear to have stabilised at low levels since 2013/14, with a total catch of 1.1 t recorded in 2020/21 (Figure 9.1A). Longsnout Boarfish from gillnet fishing were taken exclusively from the east and southeast coasts in 2020/21 (Figure 9.2). This represents a contraction from previous seasons during which this species was taken from waters around the state, albeit with minimal catch and effort on the west coast, and a long standing focus on the east and southeast coasts (Figure 9.2, Figure 9.4).

Longsnout Boarfish are not caught by rod and line and no recreational catch estimates are available for gillnet for this species. However, about 1000 individuals were recorded (both kept and released) in the 2012/13 recreational fishing survey (Lyle et al. 2014b), which indicates that Longsnout Boarfish are not a common recreational species.

Following a peak in 2008/09, commercial gillnetting effort declined and has since remained below or close to effort levels from the reference year (Figure 9.1B). CPUE also shows a general declining trend, with notable annual fluctuation (Figure 9.1C).

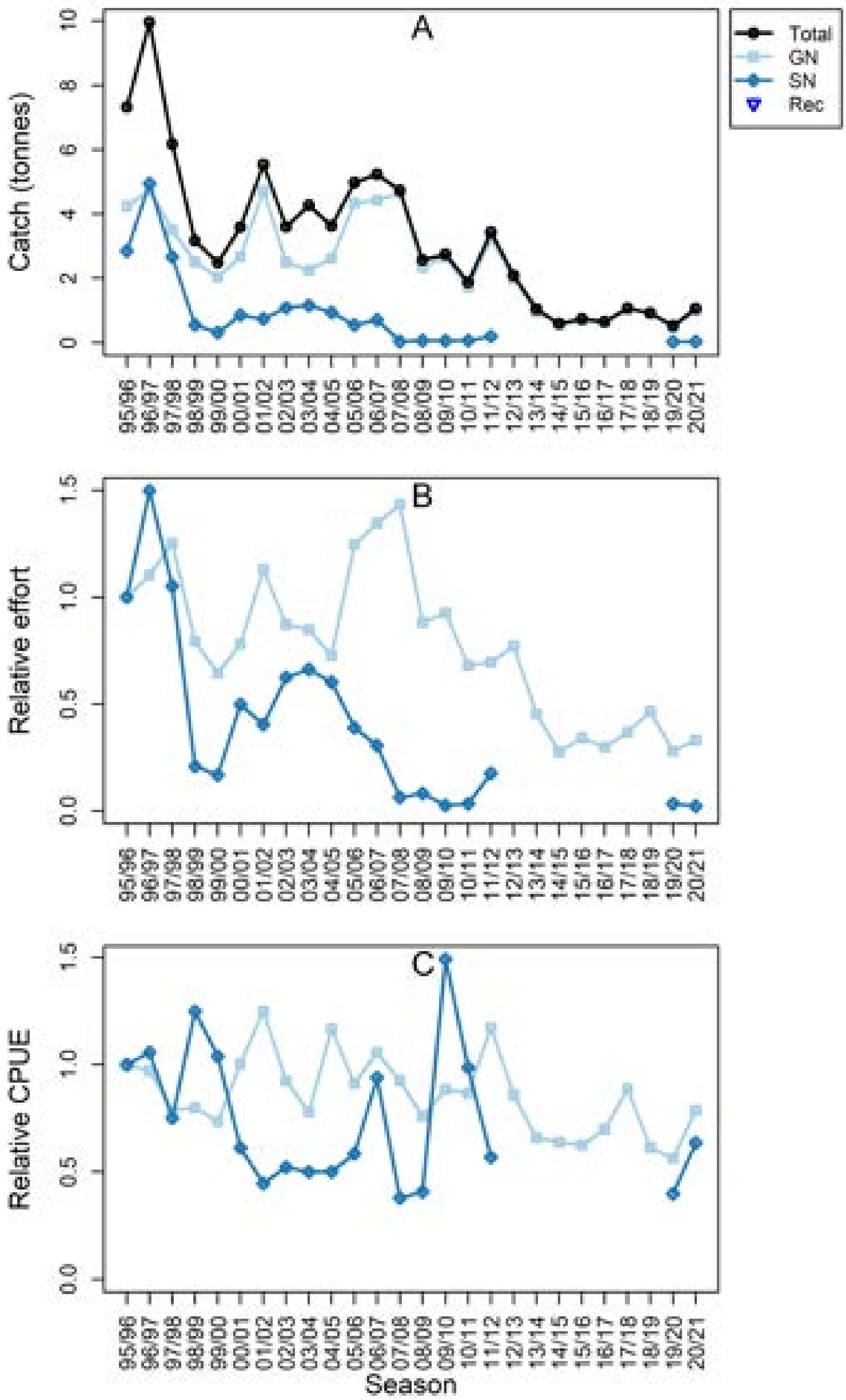


Figure 9.1 (A) Annual commercial Longsnout Boarfish catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 2000/01; (C) annual commercial catch per unit effort (CPUE) based on kg per days fished relative to 2000/01. GN = gillnet; no recreational catch estimates (Rec) were available for this species.

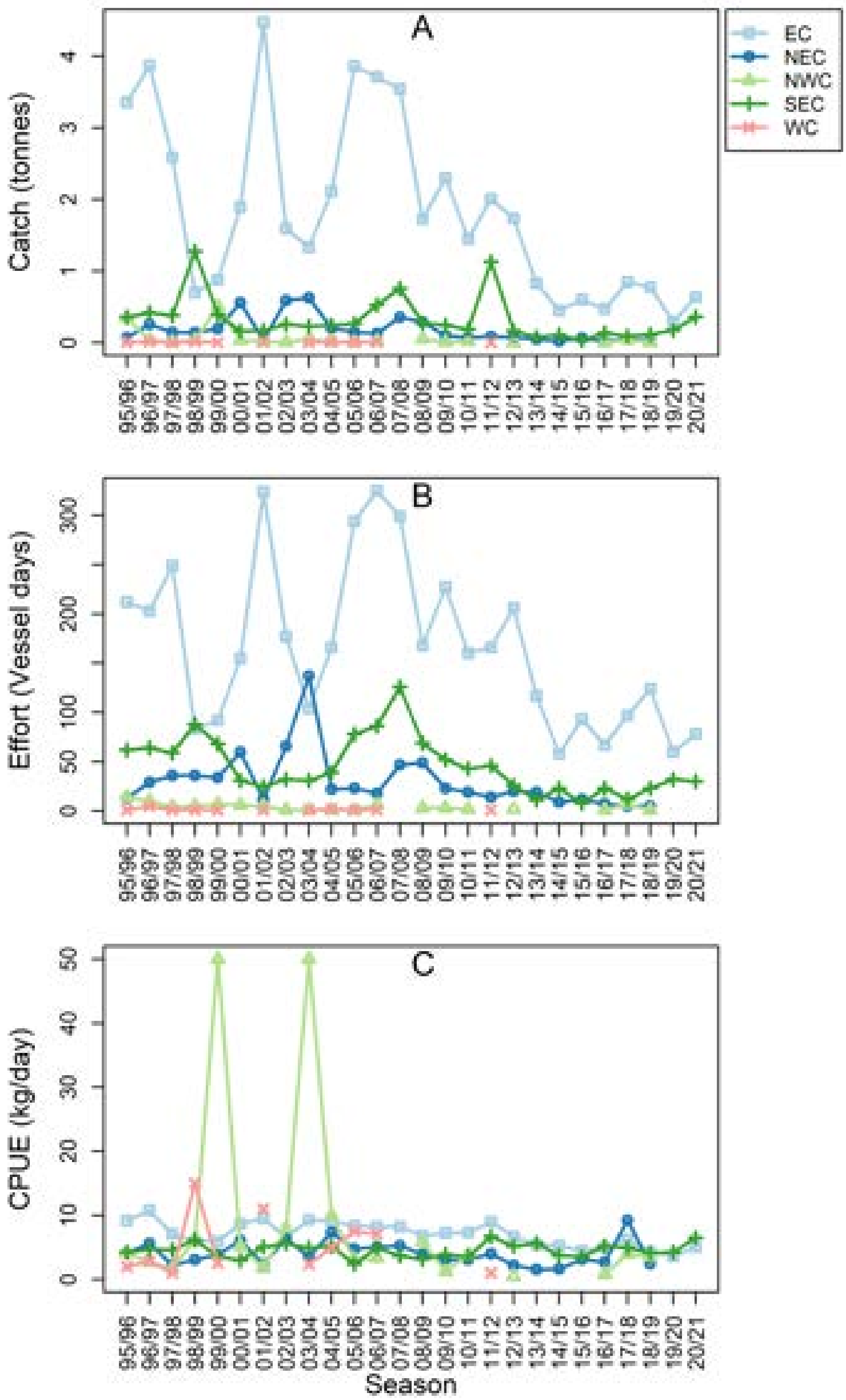


Figure 9.2 Regional commercial Longsnout Boarfish catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for gillnet. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

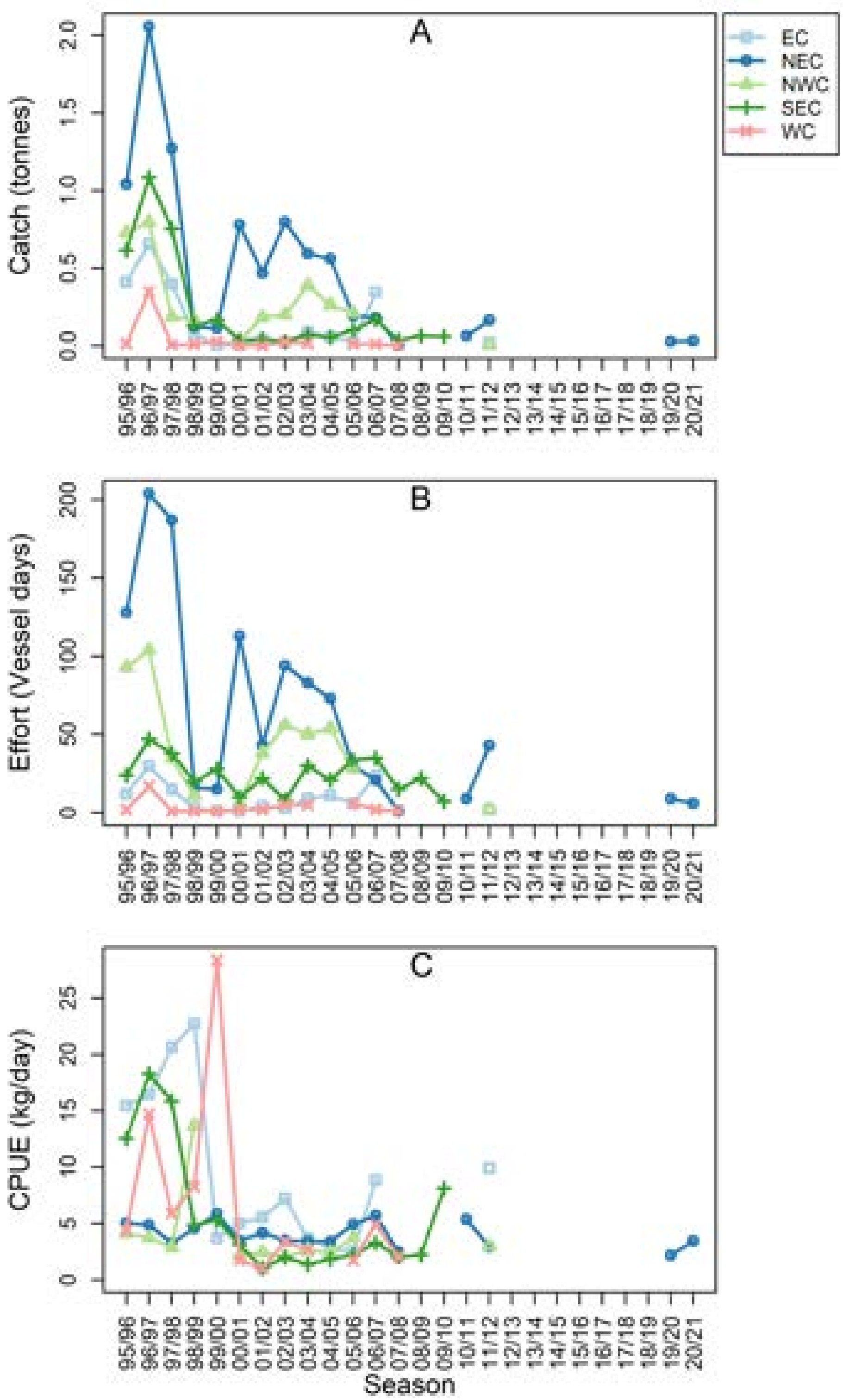


Figure 9.3 Regional commercial Longsnout Boarfish catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for shark net. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

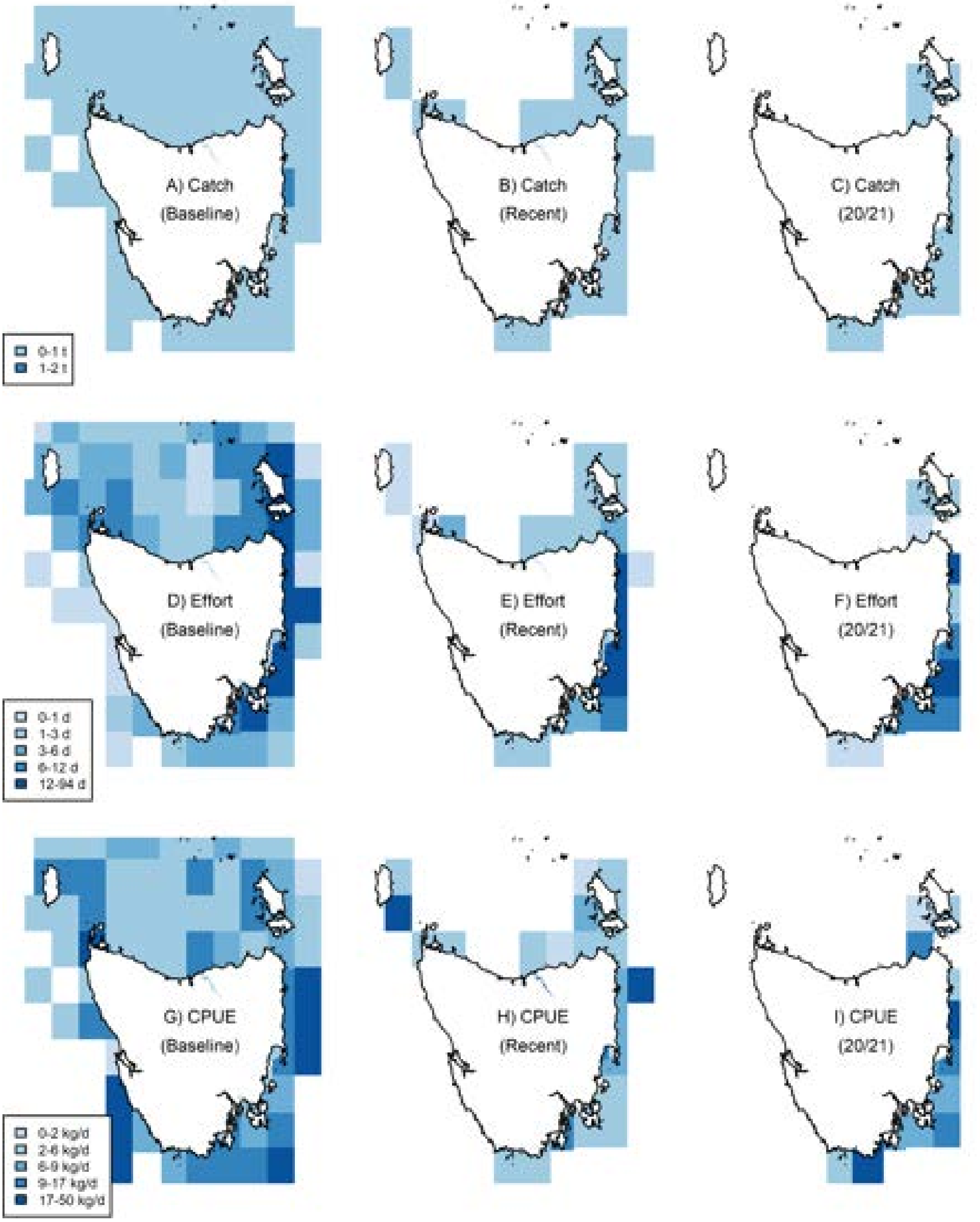


Figure 9.4 Longsnout Boarfish catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (2000/01 to 2009/10 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Risk assessment of recruitment impairment

The risk analysis principle presented in this report was developed for assessing the risk of recruitment impairment and stock damage of target species, not by-product species. As such, Longsnout Boarfish was not assessed using this approach.

Stock status	UNDEFINED

Longsnout Boarfish is a by-product species, therefore trends in CPUE are not assumed to be reliable indicators of abundance or biomass. However, this species is taken in very small quantities in Tasmanian waters. In addition to catches taken in state waters, there is also a by-product fishery from Commonwealth shark netting activity. The high minimum size limit and commercial trip limit of 50 kg mean that many individuals are released, but the species is assumed to show high post-release survival (Lyle et al. 2014a). Overall, there is insufficient information available to confidently classify this stock.

Snook (*Sphyraena novaehollandiae*)

STOCK STATUS	SUSTAINABLE
Recorded catches of Snook are at low levels, presumably because low market demand means that the species is not actively targeted. Biological analyses indicate that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment; catch-only based assessments of biomass depletion and maximum sustainable yield.
MANAGEMENT	State (Tasmania)

Snook *(Sphyraena novaehollandiae)*
Illustration©R.Swainston/anima.fish

Snook inhabits shallow coastal and surface (≤ 20 m) offshore waters, often occurring in large schools. This species is mainly targeted using troll and small mesh net gear but is also a by-product of beach seining and gillnetting. Snook is not an important recreational target species in Tasmania; however, landings do occur. Another species of 'Pike', *Dinolestes lewini* (Longfin Pike) is also caught in Tasmanian waters, but the vast majority of 'Pike' catches are likely to be Snook. More detailed information on biological characteristics and current management of Snook fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Records of Snook catches peaked at 17 t in 1997/98 and have remained relatively stable around 3 – 9 t since 1998/99 (Figure 10.1A). Catch in the 2020/21 season was close to the historical low at 2.3 t (Figure 10.1A). Effort and catch for Snook have been concentrated on the north coast in recent years, including the current season (Figure 10.2, Figure 10.4). The northeast coast has been the focus for troll gear (Figure 10.2), while small mesh net fishing has occurred in both the northeast coast and northwest coast regions across the time series (Figure 10.3).

Past surveys of recreational fishing suggest that neither pike species is an important target for recreational fishers (Lyle et al. 2009), and that around 57% of all pike caught by recreational fishers are released (Lyle et al. 2009). No estimates of recreational landings by weight have been made but catch estimates by number are available and it's reasonable to assume an average weight of 1 kg per fish. Based on this assumption, estimates of recreational catch were notably higher than commercial catch in the most recent recreational survey (~9 t in 2017/18, when commercial catch was 5.8 t) (Lyle et al. 2019).

Commercial troll and small mesh net effort, the main capture methods for Snook, have been variable through time. In 2020/21, effort was less than half of the effort value from the reference year (Figure 10.1B).

CPUE has been variable through time (Figure 10.1C). Troll CPUE is influenced by species availability and targeting practices, whereas CPUE for both beach seine and small mesh net, for which snook is a by-product species, is not particularly informative (Figure 10.1C).

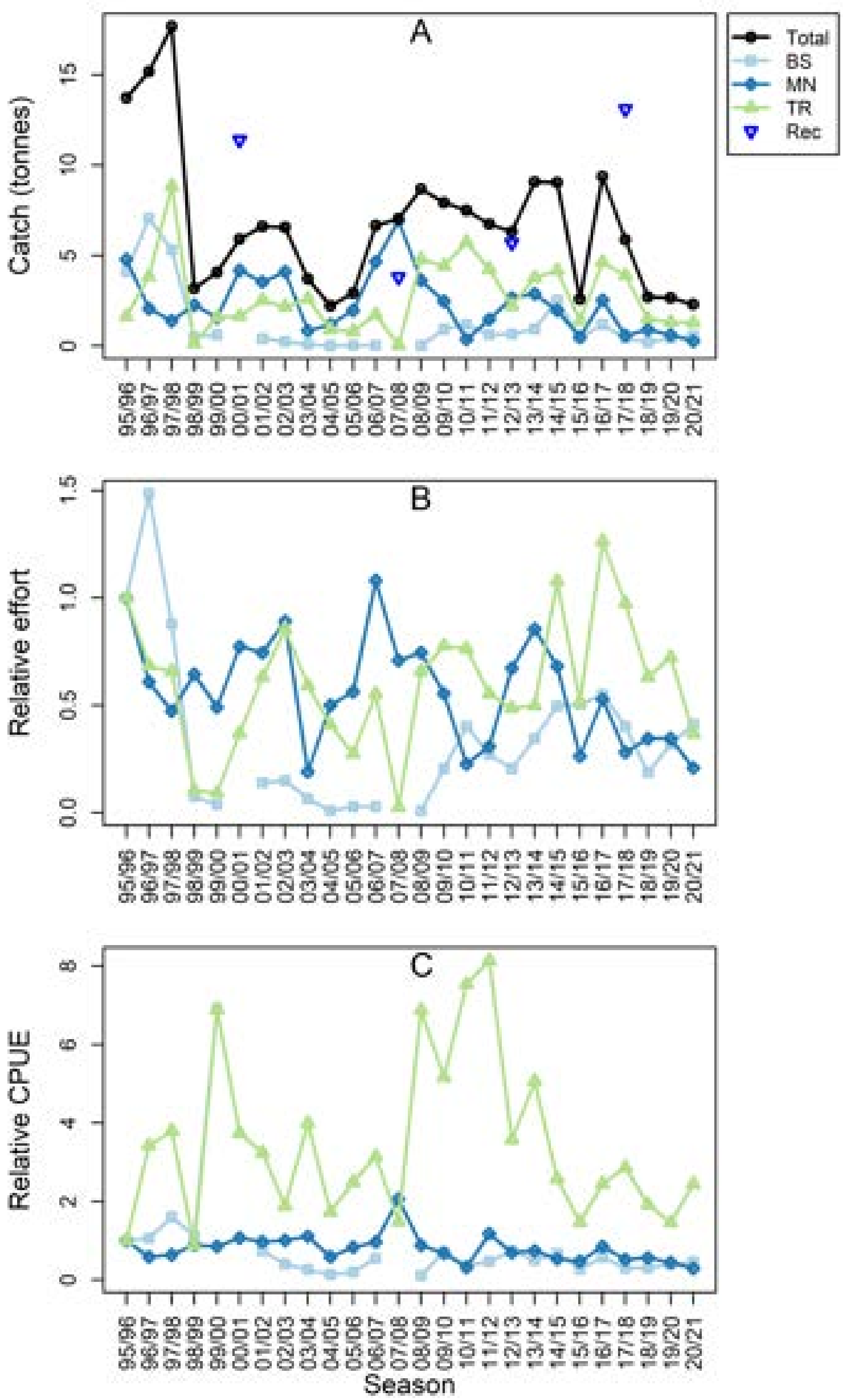


Figure 10.1 (A) Annual commercial Snook catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. BS = beach seine, MN = small mesh net, TR = Troll, Rec = estimated recreational catch.

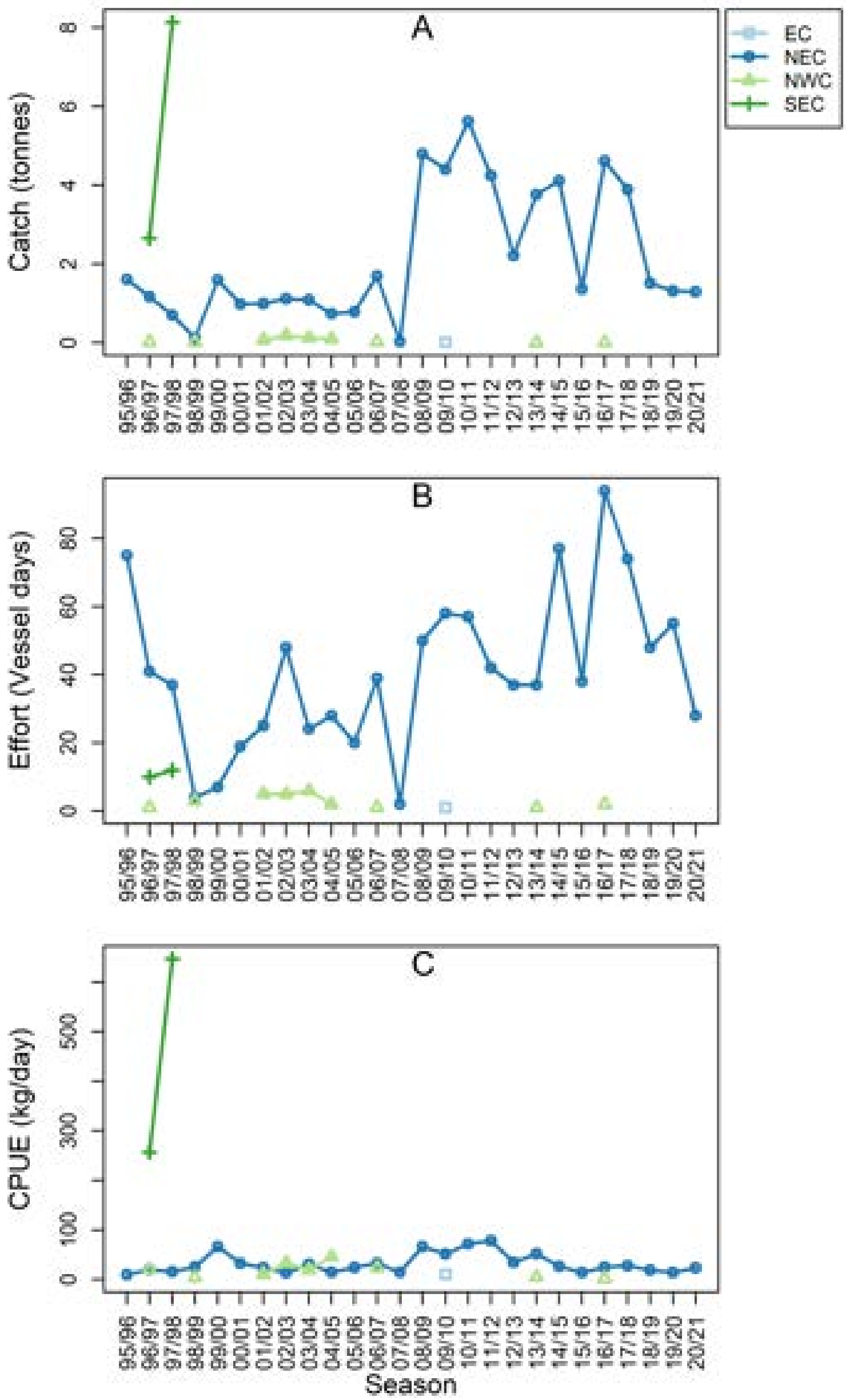


Figure 10.2 Regional commercial Snook catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for troll. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast.

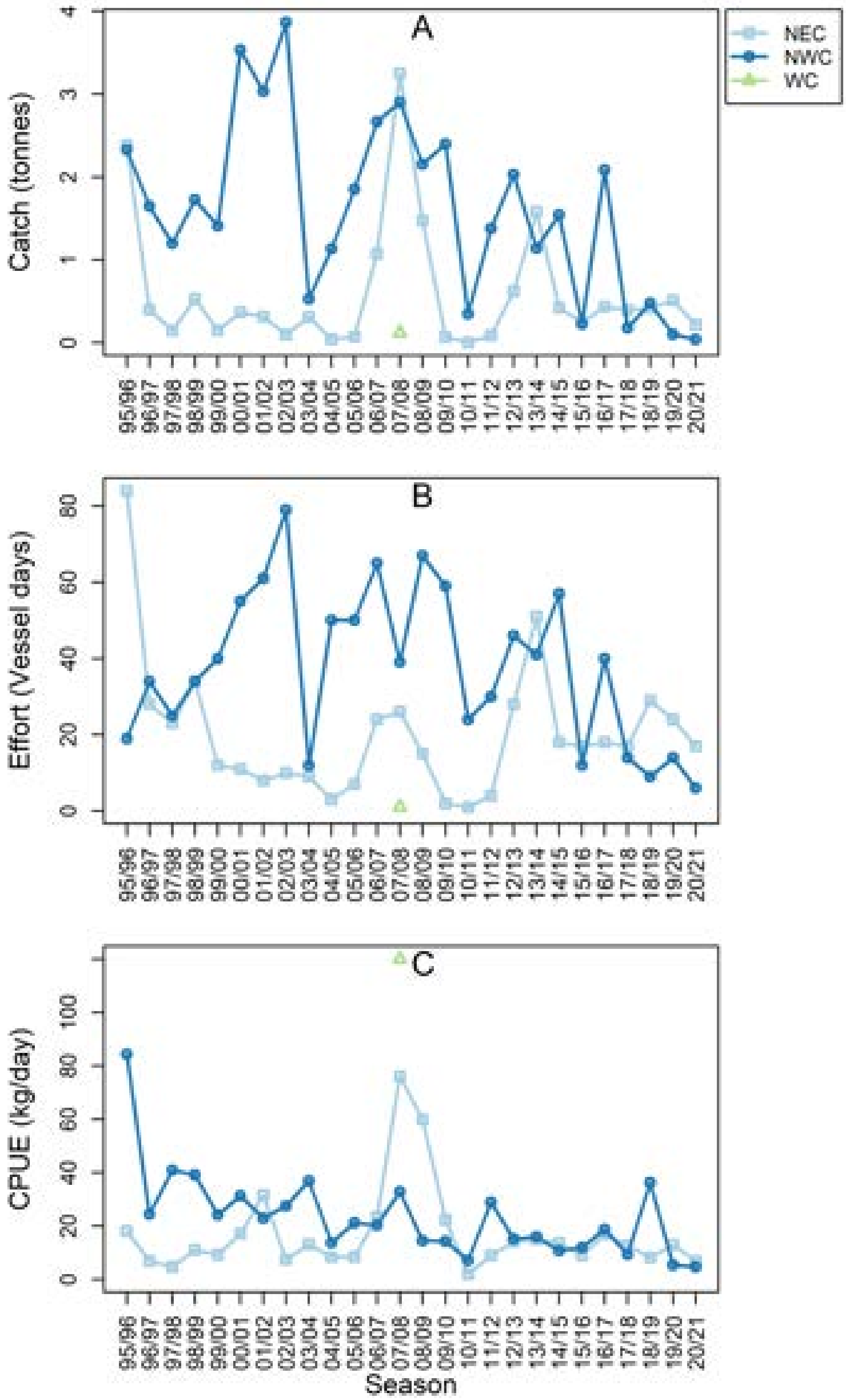


Figure 10.3 Regional commercial Snook catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for small mesh net. NEC = northeast coast, NWC = northwest coast, WC = west coast.

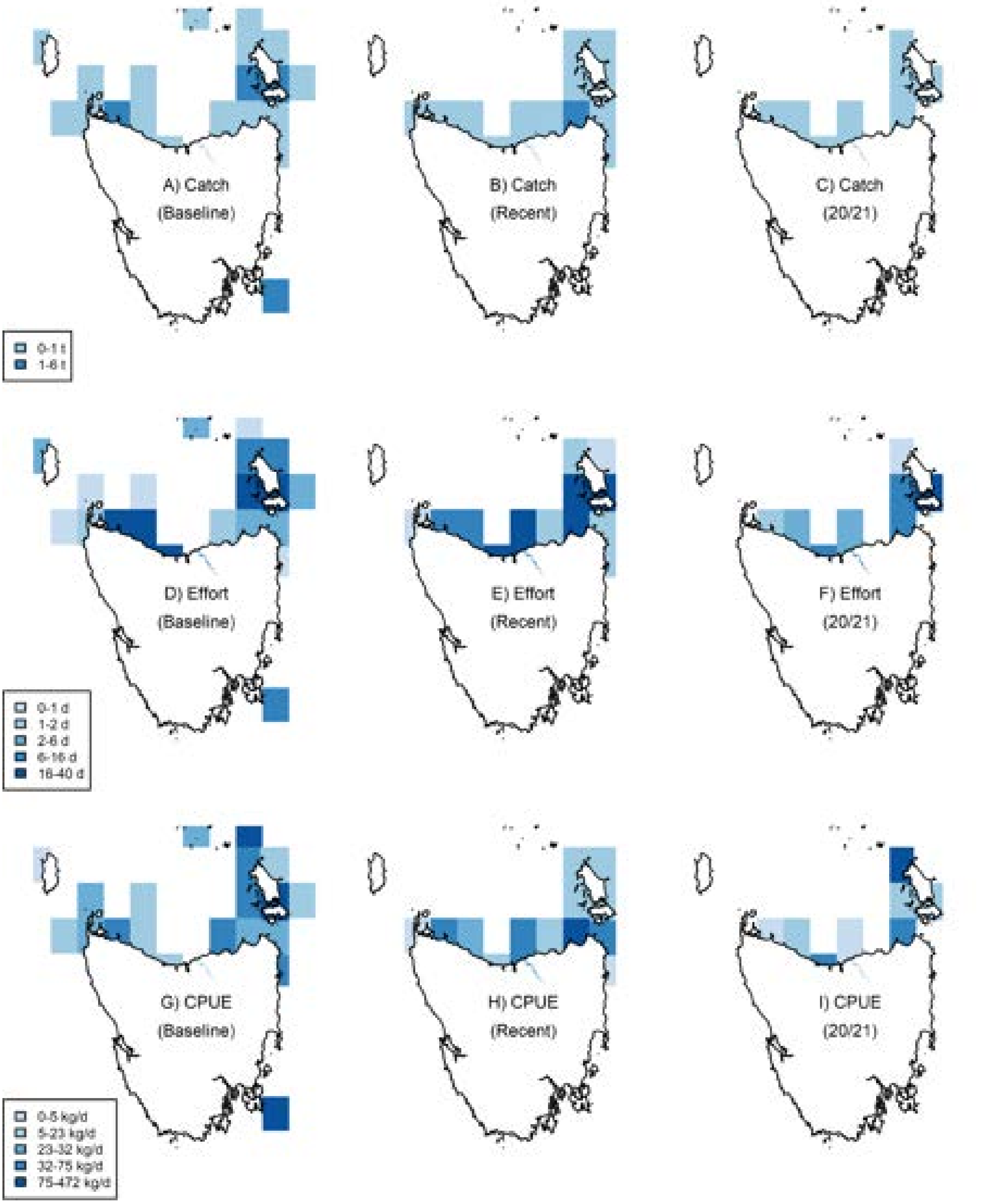


Figure 10.4 Snook catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

CMSY results

CMSY results based on the assumption of “low” resilience suggest that Snook biomass might be depleted to 40.0% of unfished levels (lower 95% confidence interval = 24.0%), which is close to the common target reference for BMSY at 50% of unfished levels (Figure 10.5). Following initial peak catches in 1997/98 above the upper 95% confidence interval of the estimated maximum sustainable yield (MSY) of 14.7 t, catches have declined and stayed below the estimated MSY of 9.4 t since then (Figure 10.6).

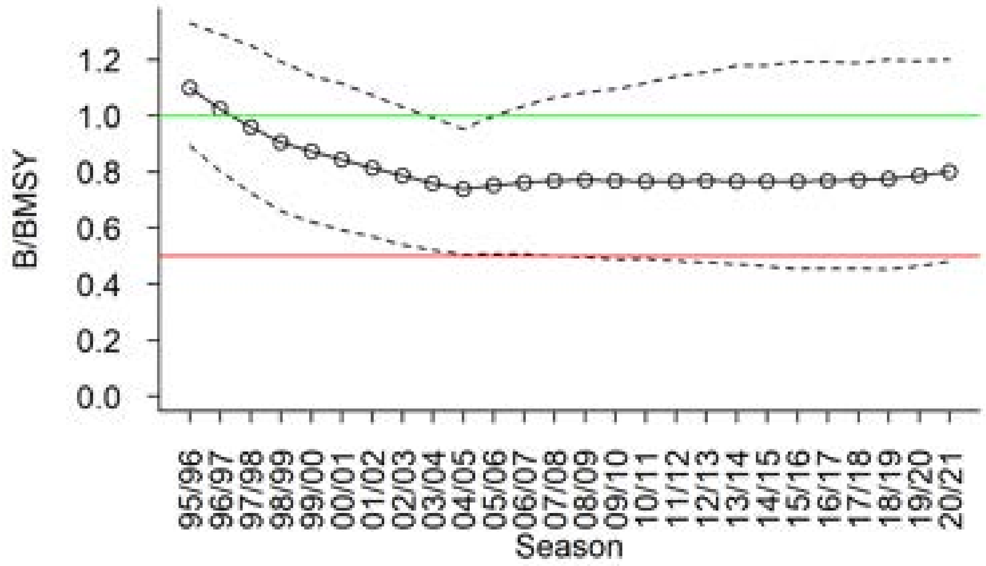


Figure 10.5 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

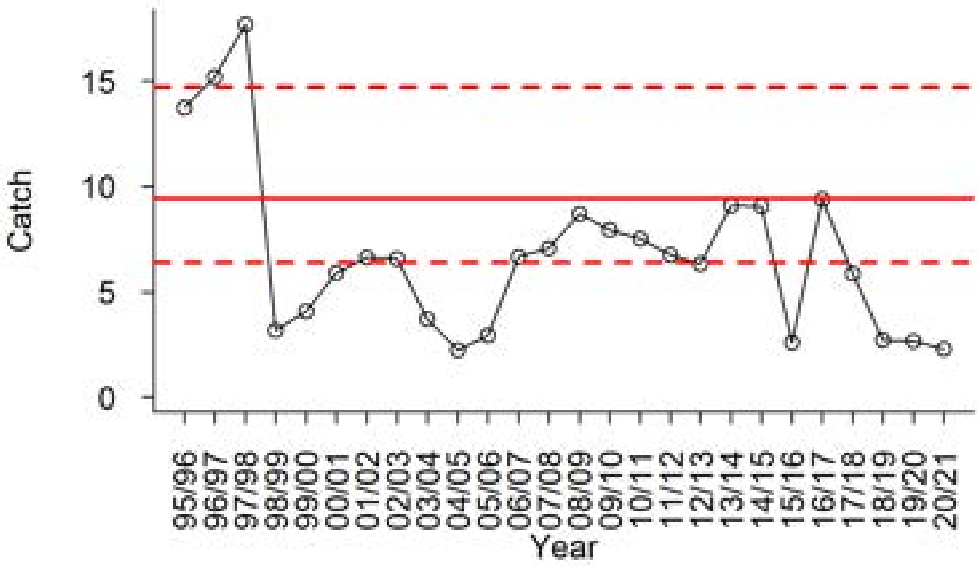


Figure 10.6 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Risk assessment of recruitment impairment

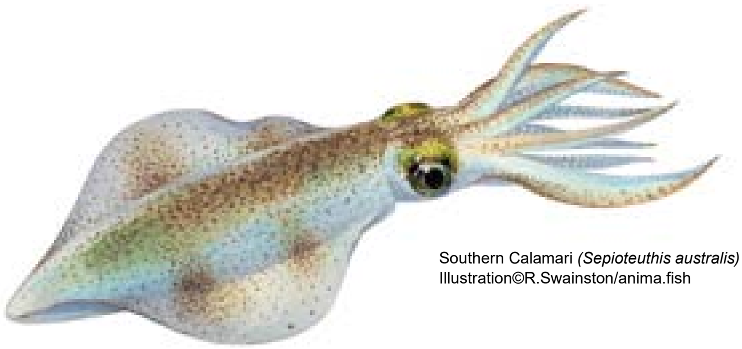
The Snook fishery scored 60 – 80 in the risk analysis, passing assessment with medium risk of recruitment impairment and stock damage. Snook is a moderately productive species – maturing early, with a high fecundity (Bertoni 1994), but relatively long lived (Kailola et al. 1993) and occupying a high trophic level (Coleman and Mobley 1984). Fishing effort overlaps substantially (> 30%) with the known distribution of Snook in Tasmanian waters and the primary shallow habitat of this species is commonly fished (Edgar 2008), giving Snook a high susceptibility to capture by the fishery. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

Stock status	SUSTAINABLE

The commercial fishery for Snook is relatively small and commonly limited to the northern part of Tasmania. Despite comparatively high estimates of recreational landings, the species is not assumed to be an important target for recreational fishers. A fishery-dependent sampling program conducted in the north of the state estimated that fishing mortality (*F*) was approximately one quarter of natural mortality (*M*) (*F*=0.06 per year and *M*=0.24 per year) (Webb 2017), which is indicative of sustainable exploitation. Annual catches of Snook have not changed substantially since this research was conducted. The current level of fishing pressure is thus unlikely to cause the stock to become recruitment impaired.

Southern Calamari (*Sepioteuthis australis*)

STOCK STATUS	DEPLETING
Sharp regional increases and subsequent fluctuations in catch and effort in recent years suggest that fishing pressure on Southern Calamari is likely to be too high to be sustainable. Despite closures during part of the spawning season, many operators rely on targeting spawning aggregations, which presents a high risk of recruitment impairment. Aggregation fishing also means that data on catch and CPUE are unlikely to reflect trends in biomass and could be “hyperstable”. Data-poor stock assessment outcomes give further reason for concern that fishing mortality might have been excessive and that stocks on the south-east and east coast might be depleted or still recovering, while more recently targeted stocks on the north coast might be depleting.	
IMPORTANCE	Key
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment; fishery-independent monitoring; catch-only based assessments of biomass depletion and maximum sustainable yield.
MANAGEMENT	State (Tasmania)



Southern Calamari *(Sepioteuthis australis)*
Illustration©R.Swainston/anima.fish

Southern Calamari is endemic to Australia and northern New Zealand and inhabits shallow, inshore waters. Females deposit eggs in collective egg masses over several months (September to February), attaching capsules to the substrate (often seagrass) (Pecl 2004). Temporal fishery closures are in place to protect regional stocks during part of the spawning season, but fishers generally target spawning aggregations of Southern Calamari outside of these regional 1-month closure periods. Southern Calamari landings (predominantly by squid-jig) represented the second highest catch of all Scalefish Fishery species in 2020/21 and the stock status of this species was classified as ‘Depleting’ in the most recent three assessments. More detailed information on biological characteristics and current management of Southern Calamari fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

The total commercial catch of Southern Calamari in 2020/21 was 82.2 t, a slight decline from the previous year (Figure 11.1A). Total effort also showed a slight decline from the previous year (Figure 11.1B).

Substantial regional variation is apparent in catch and effort trends for this species over the duration of the time series (Figure 11.2). Catch and effort were historically highest on the east and southeast coasts, including Great Oyster Bay (Figure 11.3). Following subsequent declines in catch and effort in these regions, catch and effort then shifted to the north coast, (Figure 11.2A). In 2020/21, both catch and effort declined slightly from the previous year on the northwest coast and increased on the northeast coast (Figure 11.2A, B). Catch and effort for Great Oyster Bay, the southeast coast, and the east coast both declined in 2020/21 compared with the previous year (Figure 11.2A, B), while data from Mercury Passage showed a slight increase in catch and a slight decrease in effort (Figure 11.2A, B).

State-wide CPUE for the whole fishery has remained relatively stable since 1998/99 (Figure 11.1C). However, these trends mask substantial regional variation that follow generally similar patterns to those described above for catch and effort (Figure 11.2C, Figure 11.3).

Estimates of recreational catches have generally been lower than commercial catches in corresponding seasons (Figure 11.1A). Estimates from the most recent two recreational fishing surveys (Lyle et al. 2014b; Lyle et al. 2019) indicate recreational landings of Southern Calamari represent >50% of commercial landings. Thus, recreational harvest is a significant or dominant component of total catches for this species.

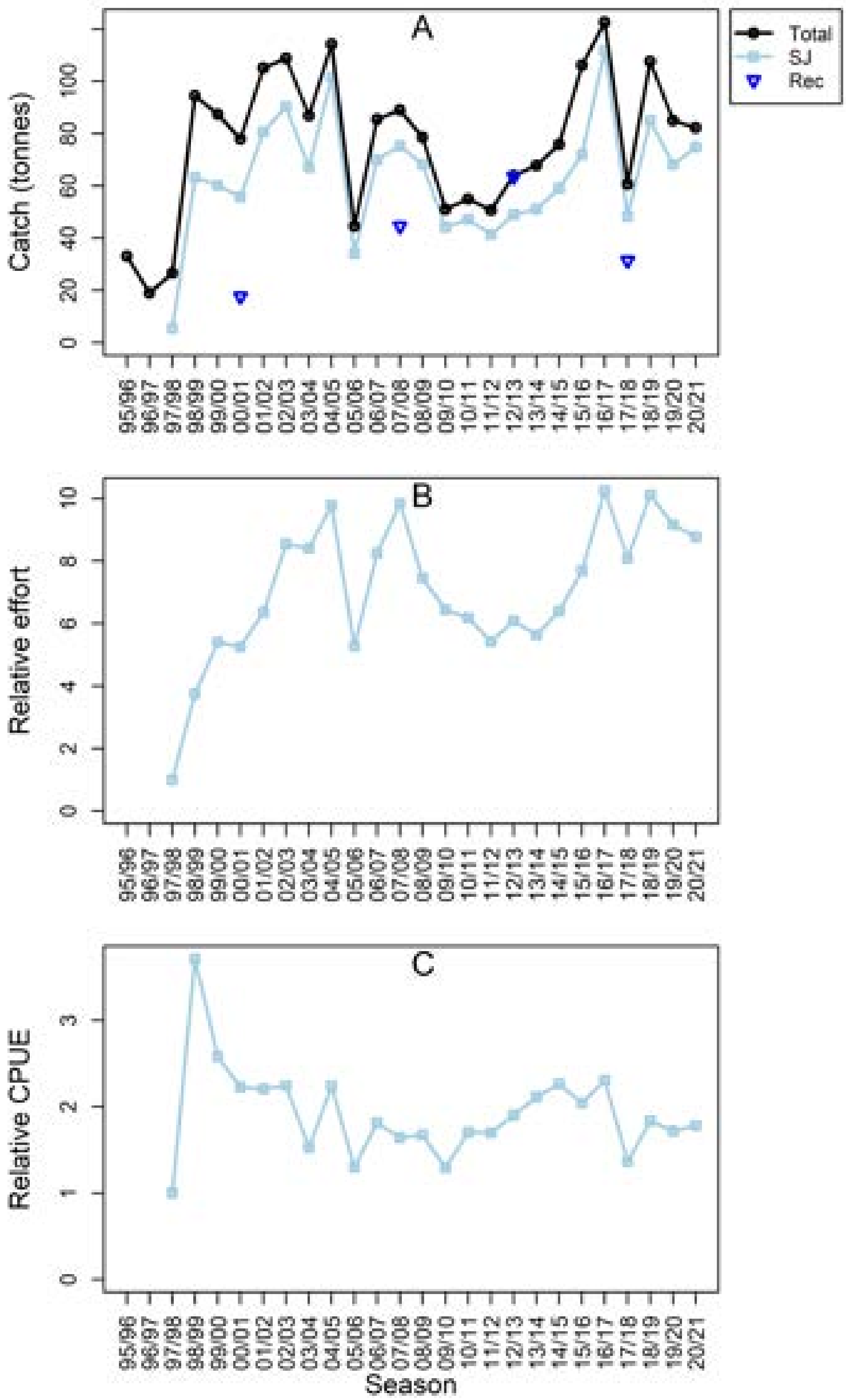


Figure 11.1 (A) Annual commercial Southern Calamari catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1997/98; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1997/98. SJ = Squid jig, Rec = estimated recreational catch.

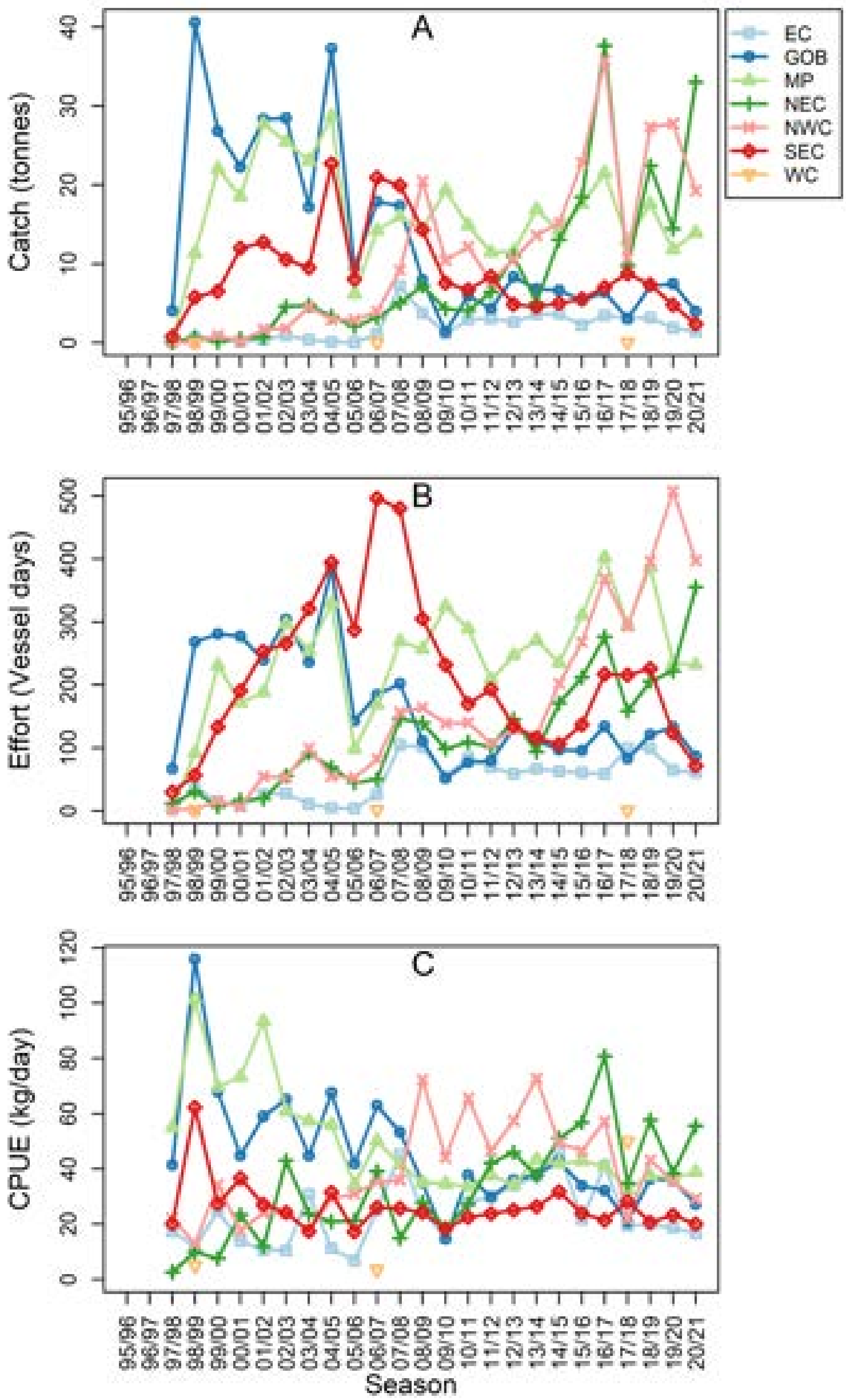


Figure 11.2 Regional commercial Southern Calamari catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for squid jig. EC = east coast, GOB = Great Oyster Bay, MP = Mercury Passage, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = West Coast.

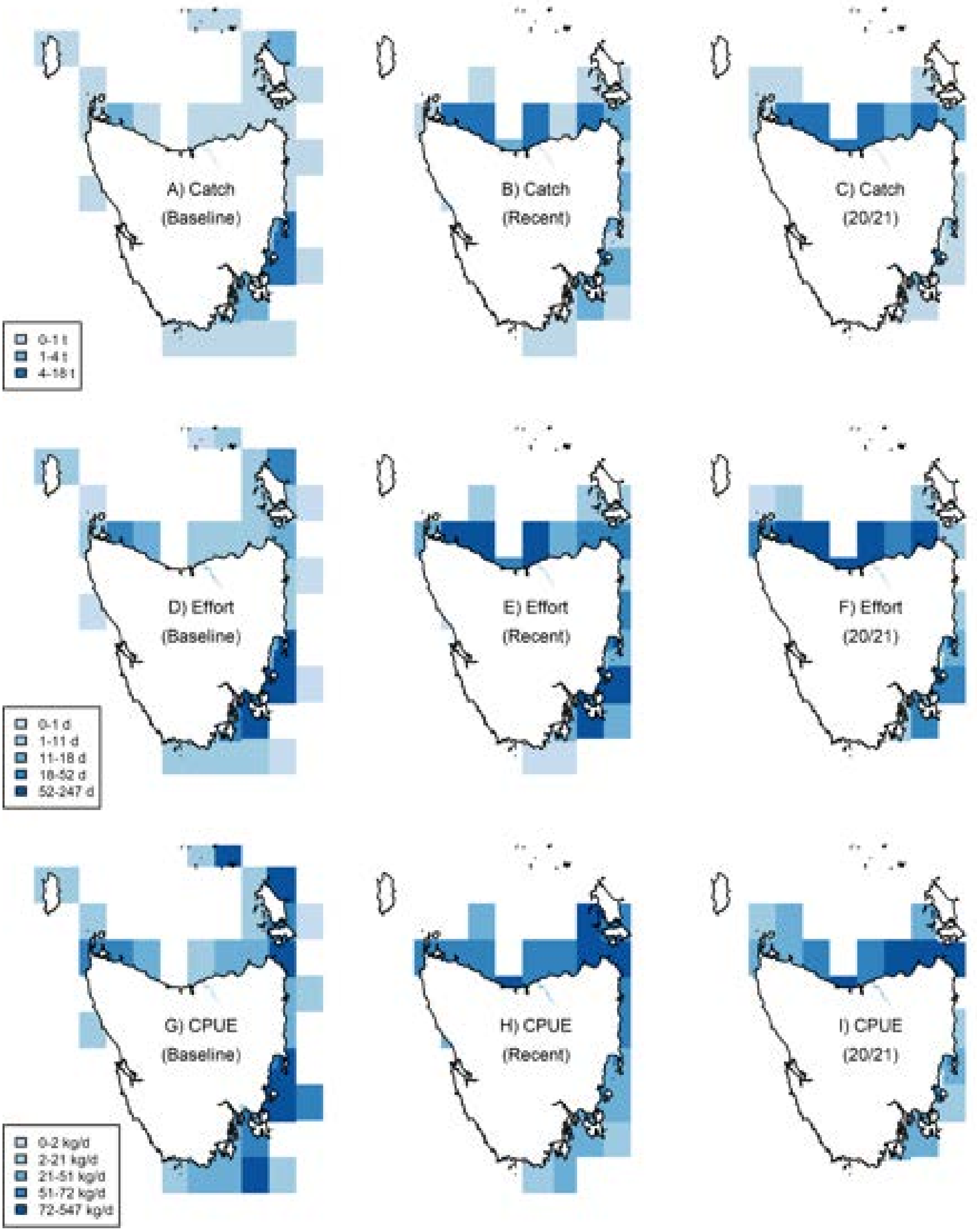


Figure 11.3 Southern Calamari catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1997/98 to 2006/07 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

CMSY results

CMSY results based on the assumption of "medium" resilience are presented below by region.

Southeast Coast

CMSY results suggested that the biomass of Southern Calamari in the southeast coast region might be depleted to 23.3% of unfished levels (lower 95% confidence interval = 6.9% of unfished levels) (Figure 11.4). Catches peaked at levels well above the estimated maximum sustainable yield (MSY) of 14.8 t between 2000/01 and 2007/08, surpassing the upper 95% MSY confidence limit of 19.9 t between 2000/01 and 2006/07 (Figure 11.5). Catches have since declined and have remained at levels generally well below the lower 95% MSY confidence limit of 11.5 t since 2008/09 (Figure 11.5).

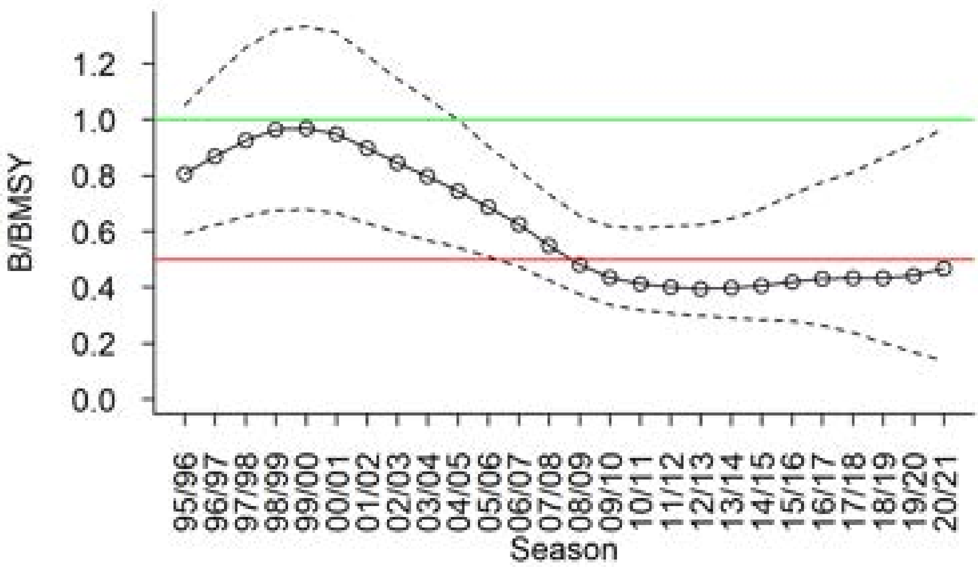


Figure 11.4 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

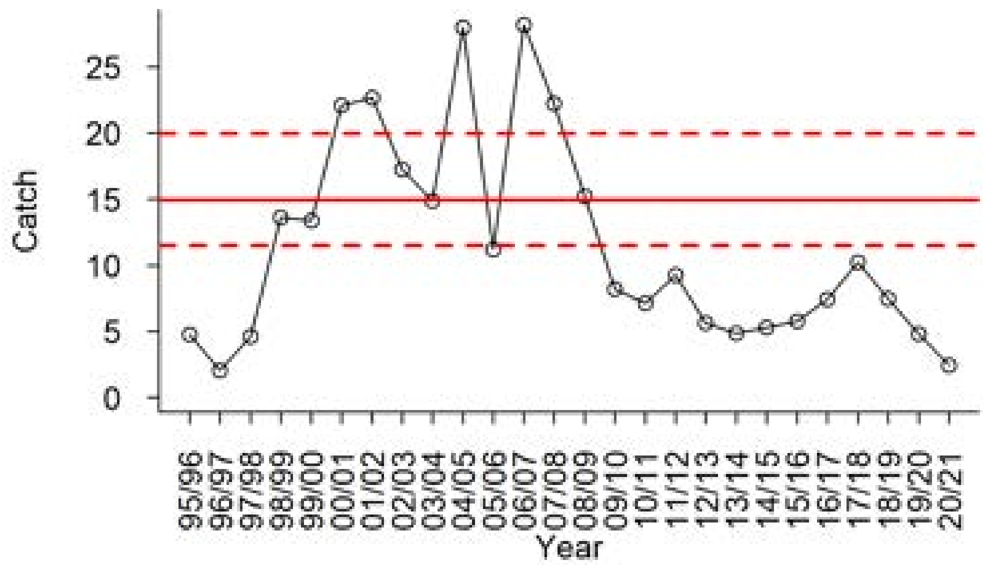


Figure 11.5 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Mercury Passage

CMSY results suggest that the biomass of Southern Calamari in the Mercury Passage region might be depleted to 28.3% of unfished levels (lower 95% confidence interval 8.2%) (Figure 11.6). Catches peaked at levels well above the estimated maximum sustainable yield (MSY) of 20.5 t between 1999/2000 and 2004/05, surpassing the upper 95% confidence limit of 26.5 t between 2001/02 and 2004/05 (Figure 11.7). Catches have since declined and remained below or close to MSY since 2005/06. Catches in the last two seasons were below the lower 95% confidence limit of MSY of 16.4 t (Figure 11.7).

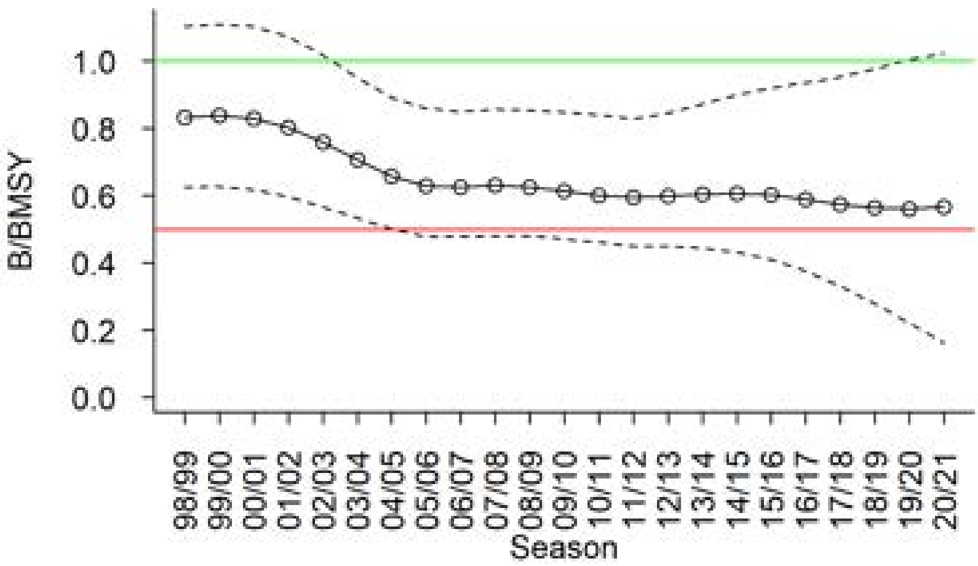


Figure 11.6 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

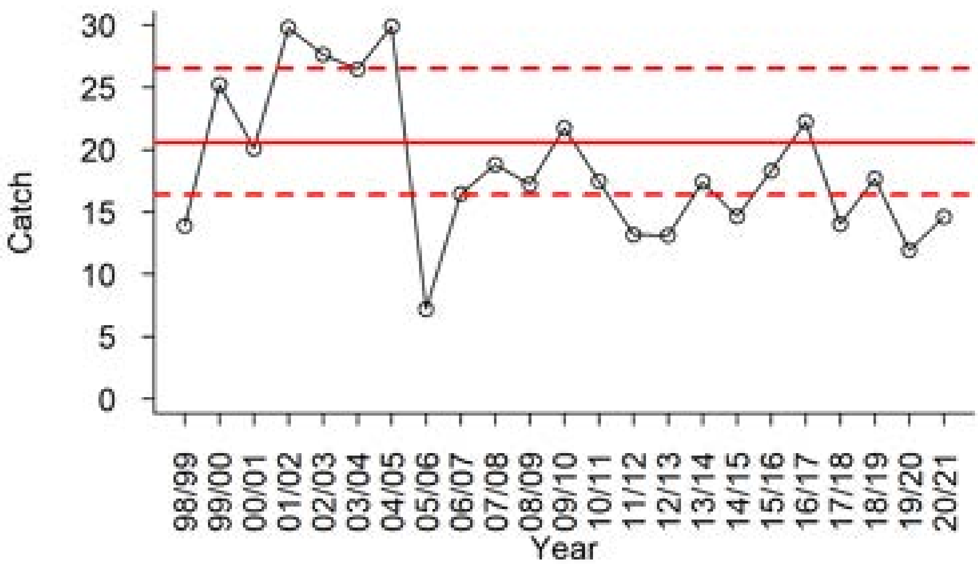


Figure 11.7 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Great Oyster Bay

CMSY results suggest that the biomass of Southern Calamari in the Great Oyster Bay region might be depleted to 19.8% of unfished biomass (lower 95% confidence interval = 5.8%) (Figure 11.8). Catches peaked at levels well above the estimated maximum sustainable yield

(MSY) of 26.5 t between 1998/99 and 2004/05, surpassing the upper 95% confidence limit of 35.9 t in 1998/99 and 2004/05 (Figure 11.6). Catches have since declined and have remained below the lower 95% confidence limit of MSY of 19.6 t since 2005/06 (Figure 11.6).

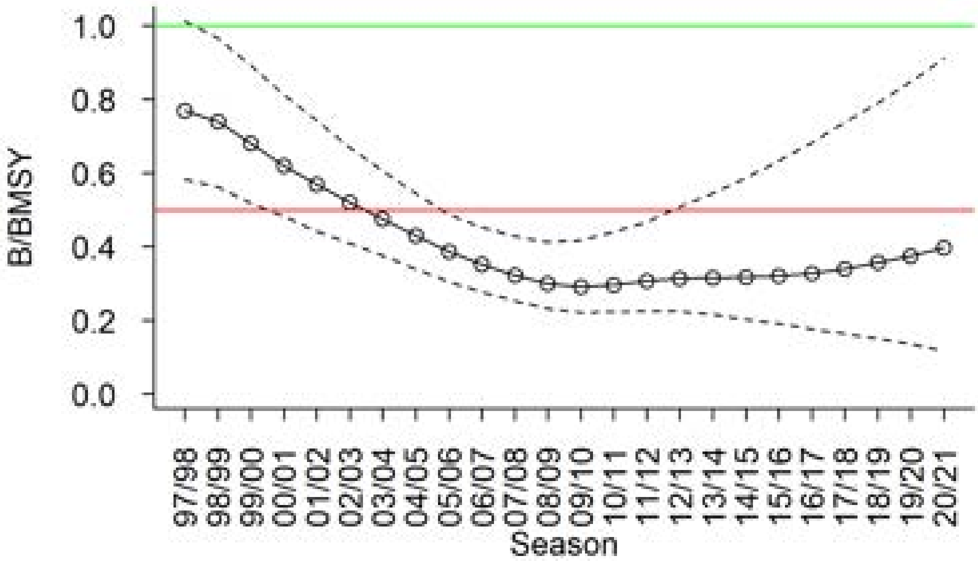


Figure 11.8 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

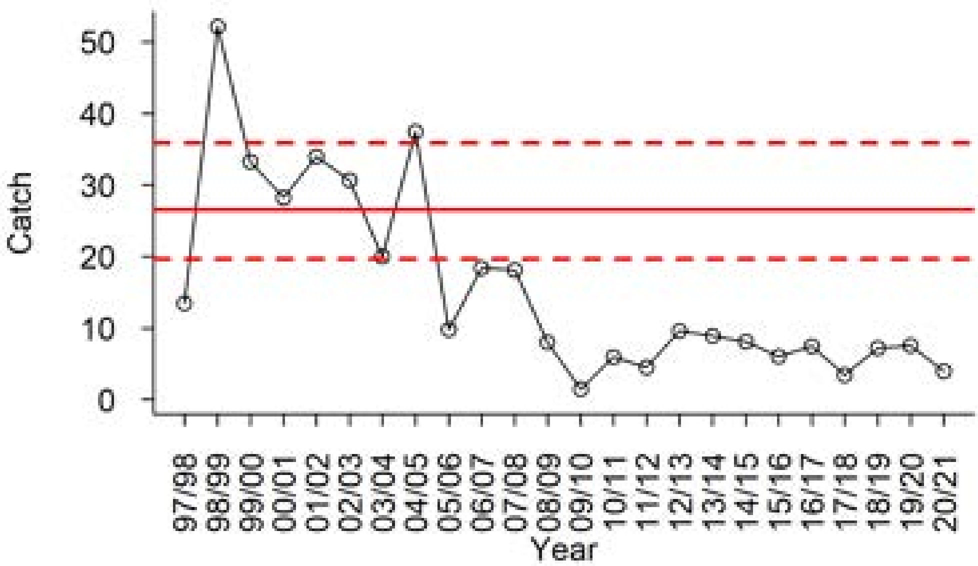


Figure 11.9 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Northeast Coast

CMSY results suggest that the biomass of Southern Calamari biomass in the northeast coast region might be depleted to 31.2% of unfished levels (lower 95% confidence interval = 10.8%) (Figure 11.12). Recent peak catches have started exceeding the estimate of maximum sustainable yield (MSY) of 25.3 t since 2015/16, surpassing the upper 95% confidence limit of MSY of 38.2 t in 2015/16 and 2016/17 (Figure 11.13). Catch in 2020/21 was close again to the upper 95% confidence limit of MSY (Figure 11.13).

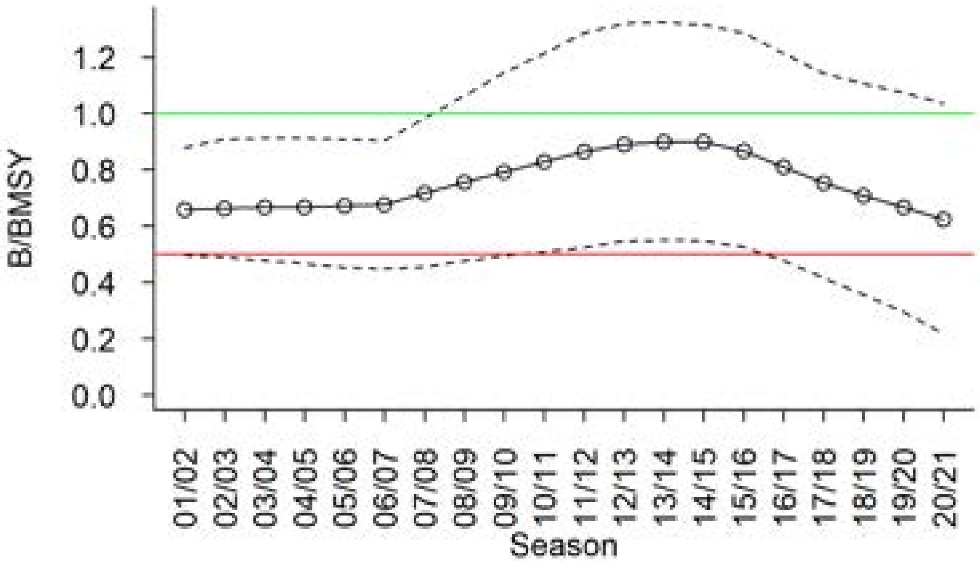


Figure 11.10 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

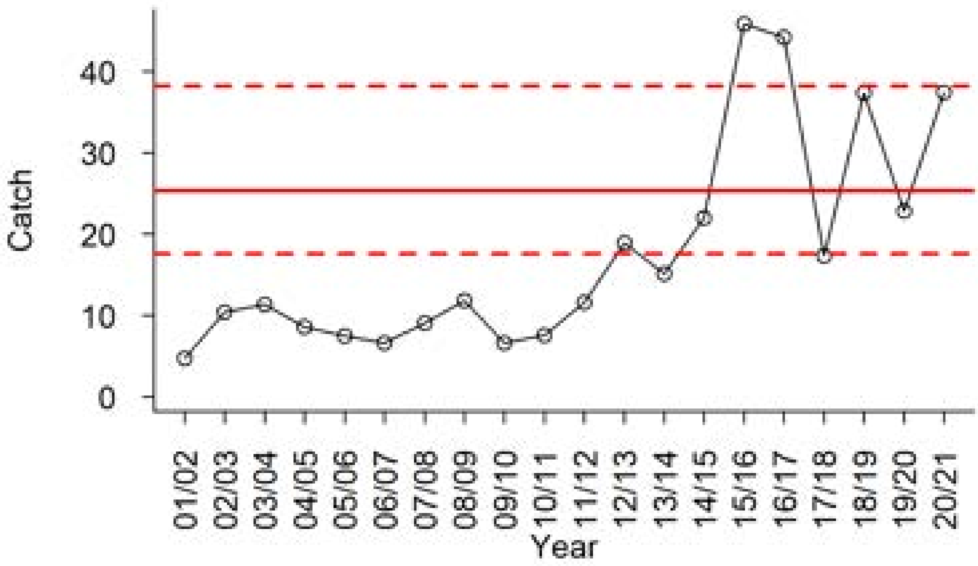


Figure 11.11 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Northwest Coast

CMSY results suggest that the biomass of Southern Calamari in the northwest coast region might be depleted to 27.9% of unfished levels (lower 95% confidence interval = 6.5%) (Figure 11.14). Recent peak catches from 2016/17 have started exceeding estimates of the maximum sustainable yield (MSY) of 35.4 t (95% confidence interval = 22.6-56.4 t) (Figure 11.15).

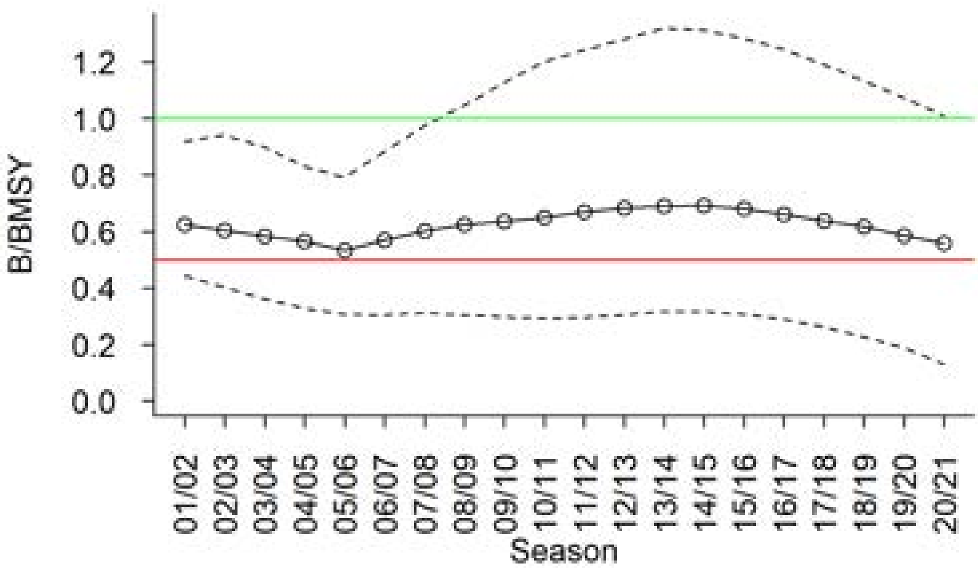


Figure 11.12 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence

intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

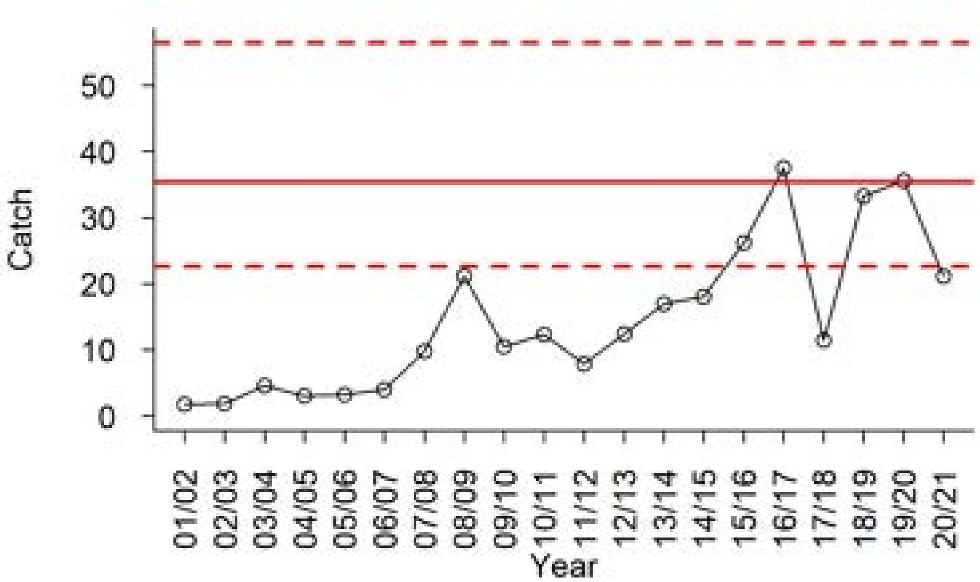


Figure 11.13 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Risk assessment of recruitment impairment

The Southern Calamari fishery scored < 60 in the risk analysis, failing assessment with high risk of recruitment impairment and stock damage. Southern Calamari is a moderately productive species – short lived (< 1 year) and quick to mature (Pecl 2004), but with moderate fecundity (Pecl 2001) and a relatively energy-intensive reproductive strategy (demersal egg laying) (Moltschaniwskyj et al. 2003), occupying a moderately high trophic level (Norman 2000; Carscallen et al. 2012). Southern Calamari is highly susceptible to capture by the Tasmanian Scalefish Fishery. Fishing effort overlaps with > 30% of the known distribution of the stock in Tasmanian waters (Edgar 2008). Southern Calamari in Tasmania aggregate to spawn and lay multiple batches of large eggs over several months (Pecl 2001). The timing of spawning varies with environmental conditions (Pecl 2004). Despite closures during part of the spawning season, the fishery targets spawning aggregations effectively around the spawning closure (Ewing et al. 2020), which might affect the reproductive potential of the population. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

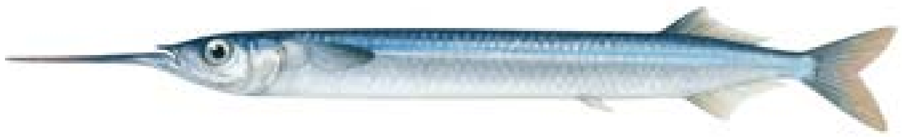
Stock status	**DEPLETING**

Vulnerability of Southern Calamari to fishing pressure is unclear, but presumably high because individuals are targeted at spawning aggregations. Considering the species' annual or sub-annual life span, this situation renders the stock susceptible to recruitment failure. Moreover, CPUE data for aggregation fisheries are unlikely to reflect biomass, which is a phenomenon referred to as "hyperstability". Spatial and temporal closures have been implemented to address these challenges by reducing fishing pressure during part of the spawning period. With a regional species-specific fishing licence in place, commercial effort has effectively been capped in the traditional fishing grounds in southeast Tasmania (defined as waters between Whale Head to Lemon Rock for Southern Calamari management). However, fishing effort has subsequently shifted to the north coast, including a number of new entrants who did not qualify for a licence to fish in the southeast.

Sharp declines and increases in recent catch and effort raise concerns about the sustainability of current fishing levels on the north coast, especially since fishing activities target the species during its peak spawning period as observed previously in the southeast coast region. Egg surveys conducted from 2016 on the north coast confirm that commercial catches are closely correlated with spawning activity, and that the historically highest catches in 2016/17 were followed by comparatively low abundance of eggs and thus spawning adults and catch in 2017/18 (Ewing et al. 2020). Although the roles of local environmental drivers of spawning activity are unclear, these current findings suggest that recruitment might be sensitive to the number of individuals left to reproduce in any given spawning season. Furthermore, CMSY results provide evidence of potentially depleted/recovering populations in previously targeted regions (south-east and east coast), which is indicative of the future trajectory of north coast populations that are subject to similar levels of fishing pressure in recent years. On the basis of these findings, Southern Calamari in Tasmania is classified as a depleting stock.

Southern Garfish (*Hyporhamphus melanochir*)

STOCK STATUS	DEPLETED
Both catch and effort data for Southern Garfish showed an overall declining trend in recent years. CPUE has fluctuated substantially but shows a recently reversing trend back to higher levels. However, given the schooling nature of the species, CPUE is unlikely to be a reliable proxy of biomass. Data-limited stock assessment methods suggest that recovery of the population under current levels of catch is theoretically possible, but empirical evidence of recovery is lacking.	
IMPORTANCE	Key
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment; research and monitoring of changes in size/age composition; catch-only based assessments of biomass depletion and maximum sustainable yield.
MANAGEMENT	State (Tasmania)



Southern Garfish (*Hyporhamphus melanochir*)
Illustration©R.Swainston/anima.fish

Southern Garfish is endemic to southern Australia and inhabits shallow (≤20 m) inshore waters in association with seagrass beds (Gomon et al. 2008). Southern Garfish is a schooling species, feeding near the surface at night. Beach seine fishing in the northeast and around Flinders Island has landed the highest catches of Southern Garfish since the mid-1990s. Dip net fishing on the southeast and east coasts was important in the late 1990s and early 2000s but this has since declined. Following the introduction of dip-nets, catches have also increasingly been taken over the summer months. Currently, Garfish on the northeast coast are caught mostly by beach seine while on the southeast and east coasts they are caught mainly by dip-nets. More detailed information on biological characteristics and current management of Southern Garfish is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Southern Garfish catch in 2020/21 was 17 t, an increase from the previous three seasons' low catches. Most of the catch was taken using beach seine gear in the northeast coast region (Figure 12.1A, Figure 12.2A). The recent increase in beach seine catch follows a general declining trend since 2010/11 (Figure 12.1A). After many years of relative stability in Southern Garfish catches of 80-90 t per fishing year, catches fell sharply in 2006/07 and 2007/08. Catches appeared to recover to around 60 t in 2008/09 before the declining trend commenced.

The northeast coast has historically been the region with the highest catch of Southern Garfish, as well as the highest beach seine effort (Figure 12.2). Dip net effort and catch were highest in the east and southeast coast regions in the earlier years of the fishery, shifting to the northeast coast in the mid-2000s (Figure 12.3). In 2020/21, the region with the highest catch, effort, and CPUE across gear types was the northeast coast (Figure 12.4).

Recreational Southern Garfish catches are low compared with commercial catches, estimated at ≤ 2 t in all surveys (Lyle 2005; Lyle et al. 2009; Lyle et al. 2014b; Lyle et al. 2019). Thus, the recreational fishery does not contribute significantly to total catches of this species.

Effort for both major gear types, beach seine and dip net, has been declining steadily and substantially over time, with values in 2020/21 close to the historic low (Figure 12.1B). CPUE has fluctuated substantially over time and is unlikely to provide for a robust reflection of abundance or biomass given that Southern Garfish is a schooling species. However, notable trends are evident by a peak for both gear types in 2012/13 followed by a steep decline until 2017/18, which substantiated concerns about Southern Garfish stocks. In 2020/21, the CPUE for beach seine was higher than in the reference year, and dip net CPUE was near equivalent to the reference year (Figure 12.1C).

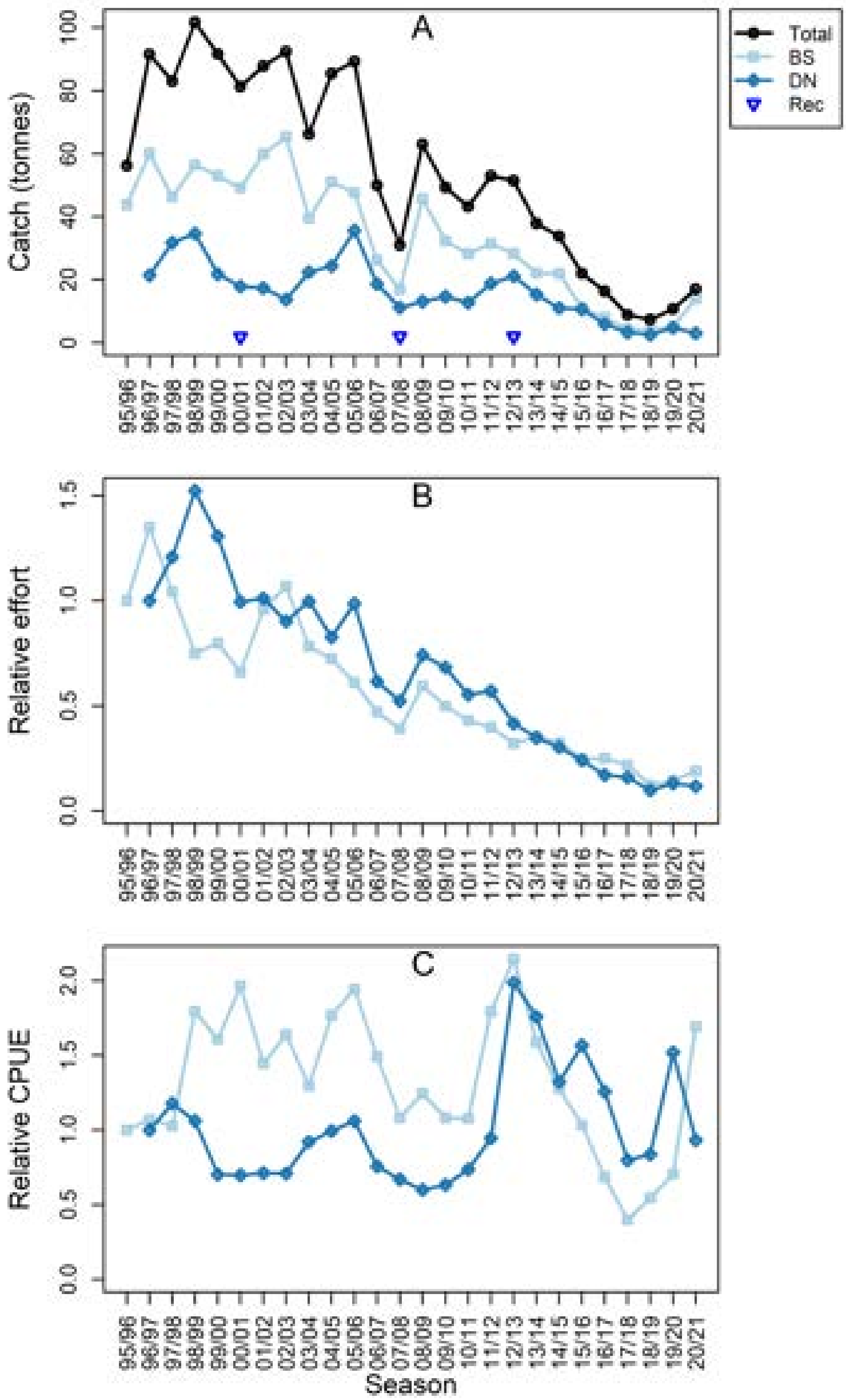


Figure 12.1 (A) Annual commercial Southern Garfish catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. BS = beach seine, DN = dip net, Rec = estimated recreational catch.

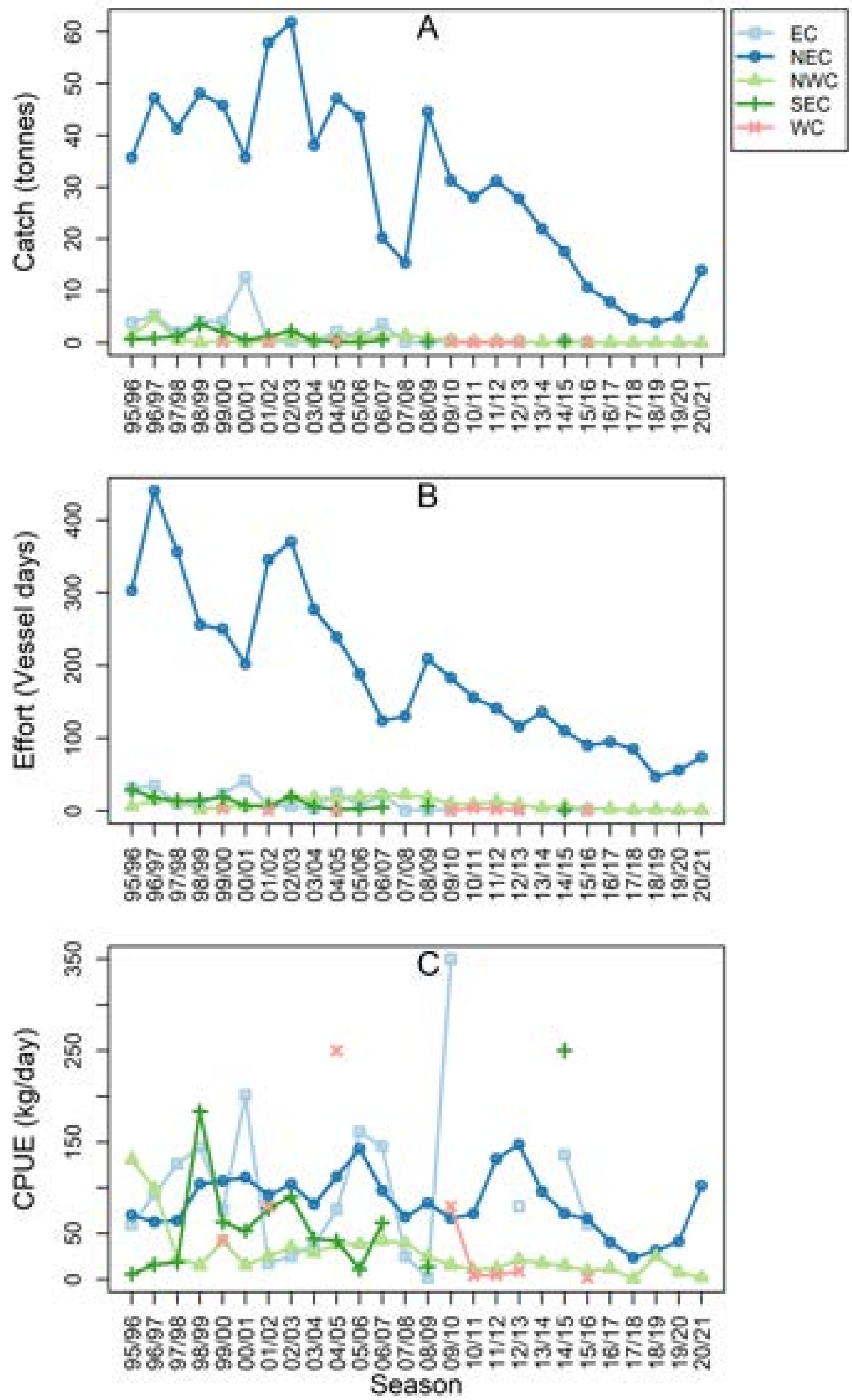


Figure 12.2 Regional commercial Southern Garfish catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for beach seine. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

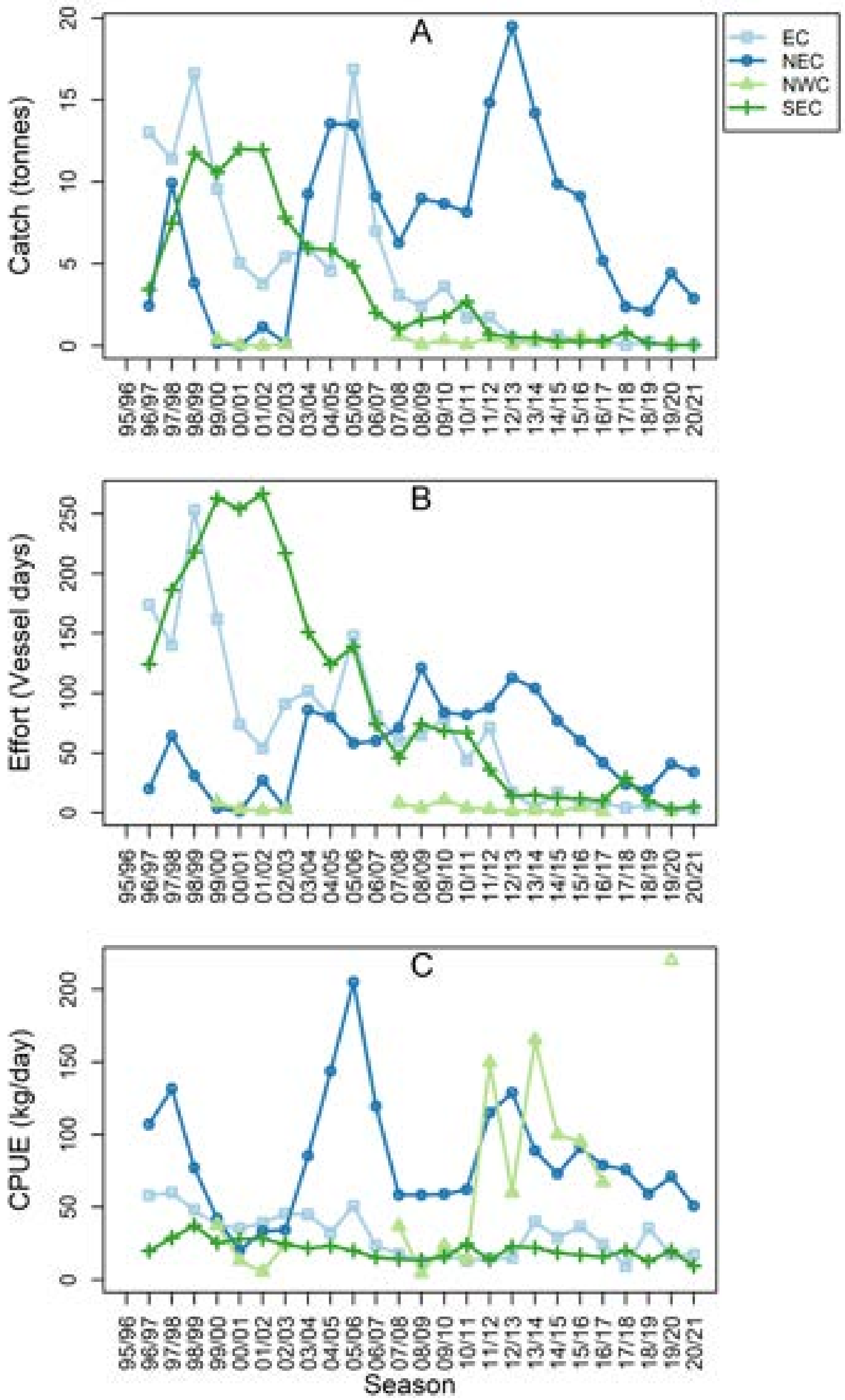


Figure 12.3 Regional commercial Southern Garfish catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for dip net. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast.

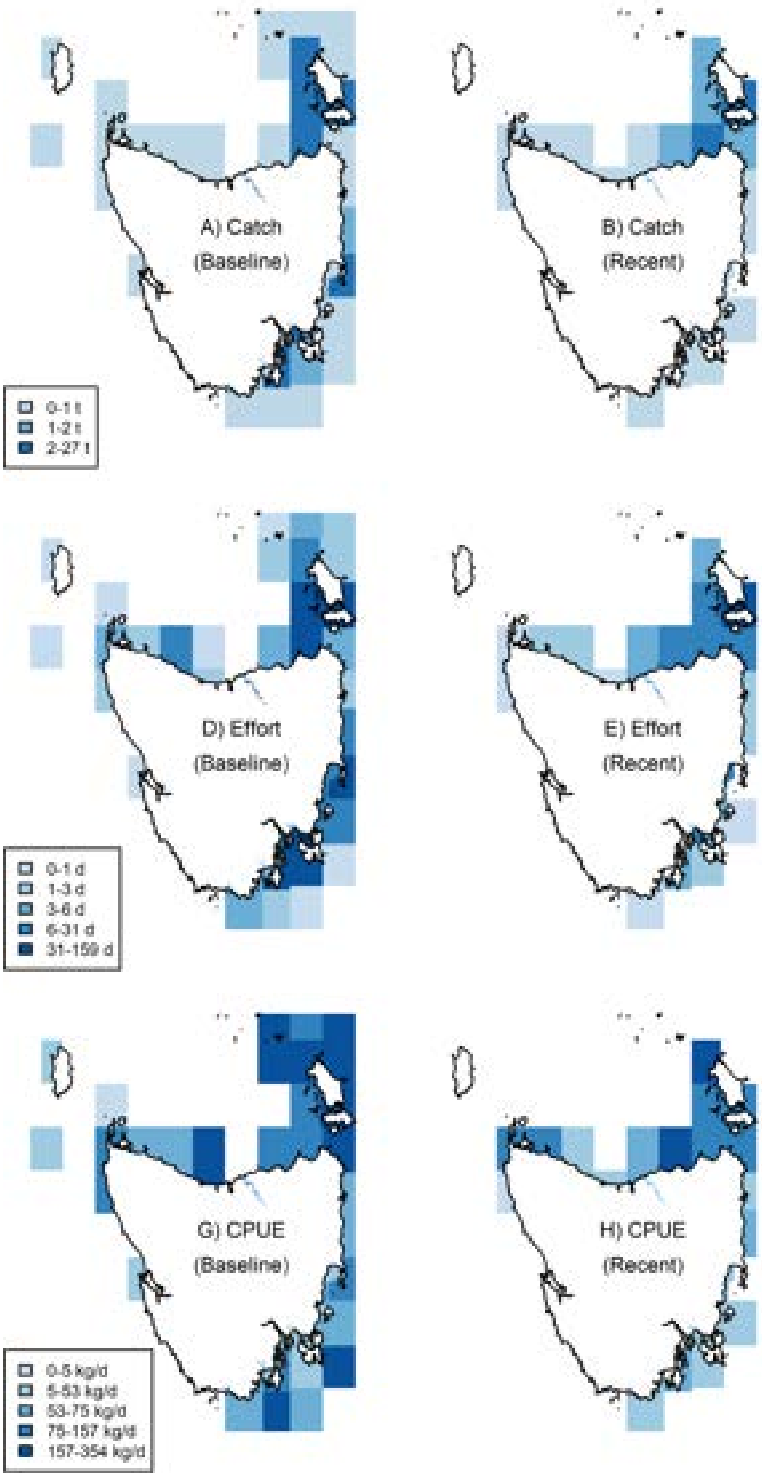


Figure 12.4 Southern Garfish catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

CMSY results

CMSY results based on the assumption of "medium" resilience suggest that the biomass of Southern Garfish might be depleted to 19.8% of unfished levels (lower 95% confidence interval = 7.1%) (Figure 12.5). Catch peaked at levels above the estimated maximum sustainable yield (MSY) of 72.6 t between 1996/97 and 2005/06, surpassing the upper 95% confidence limit of MSY of 94.6 t in 1998/99 (Figure 12.6). Catches then declined and have remained below the lower 95% confidence limit of MSY of 56.6 t since 2009/10 (Figure 12.6).

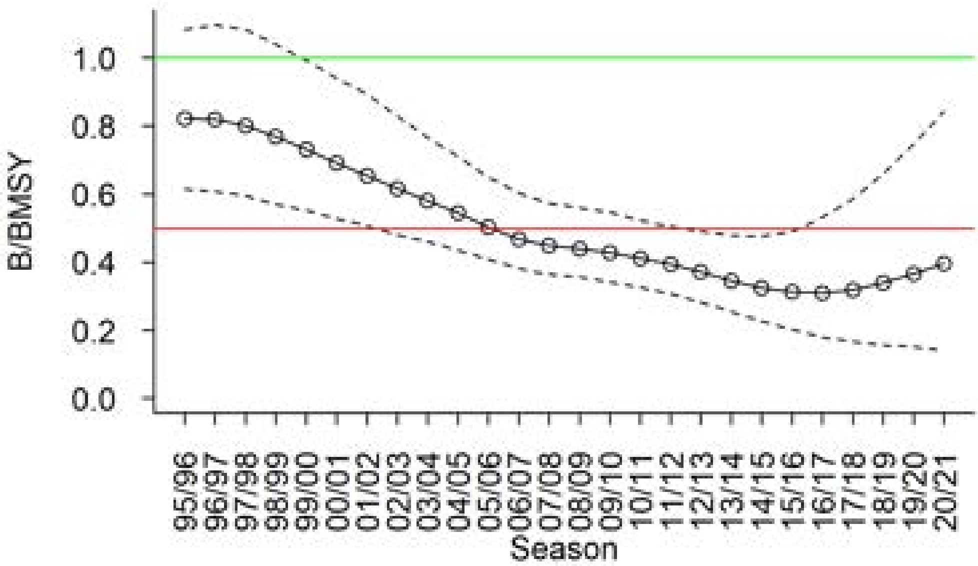


Figure 12.5 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

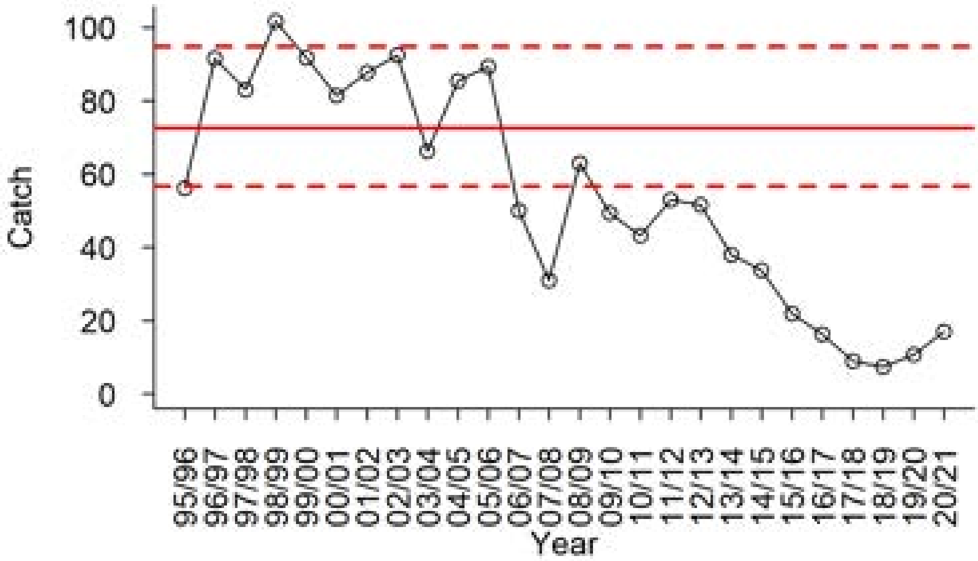


Figure 12.6 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Risk assessment of recruitment impairment

The Southern Garfish fishery scored < 60 in the risk analysis, failing assessment with high risk of recruitment impairment and stock damage. Southern Garfish is a productive species – a relatively small fish (Edgar 2008) that matures early but lives to a moderate age (up to 9 years), is moderately fecund (Jordan et al. 1998) and, as a predominant herbivore, occupies a low trophic level (Klumpp and Nichols 1983). As a schooling species (Jones et al. 2002), Southern Garfish are highly susceptible to capture by dip net and beach seine gear, and there is a risk of immature fish being captured with the school. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

Stock status	**DEPLETED**

Spawning closures introduced in 2009 appear to have initiated population recovery (increasing size and age in 2012), but subsequent declines in catches and CPUE suggested that any such assumed recovery was short-lived. Current fishing mortality is likely to exceed values estimated for the late 2000s, when catches dropped sharply and the stock was assumed to be in a depleted state (Reid 2018), implying that stock biomass has remained at depleted levels.

In general, the vulnerability of Southern Garfish to fishing pressure is likely to be moderate or high, considering: (1) the schooling behaviour of the species, which means that individuals can be effectively targeted even if stocks are depleted and that CPUE is thus unlikely to reflect biomass (hyperstability); (2) that the species is short-lived and its Tasmanian populations are dominated by few age classes, which makes them sensitive to recruitment variability. Based on the available evidence, Southern Garfish is therefore classified as depleted. However, fishery-independent biological data on Southern Garfish have not been analysed in detail since 2018 (Reid 2018). More comprehensive updated sampling and analysis are necessary to confirm or revise the status of the Southern Garfish stock.

Southern Sand Flathead (*Platycephalus bassensis*)

STOCK STATUS	**DEPLETED**
Recreational catches dominate landings of Southern Sand Flathead in Tasmania. Fishery independent surveys suggest low abundances of legal sized fish in southeast and eastern Tasmania where populations are subject to heavy fishing pressure. While undersized fish appear to be abundant, newly introduced length-based assessment approaches indicate that female stock biomass is likely to be depleted in most regions. Moreover, current levels of fishing pressure are unlikely to be sustainable, specifically where stock rebuilding is likely to be most urgently needed.	
IMPORTANCE	Key
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment; fishery-independent monitoring; length-and age-based estimates of mortality, length-based estimates of biomass depletion.
MANAGEMENT	State (Tasmania)

Southern Sand Flathead *(Platycephalus bassensis)*
Illustration©R.Swainston/anima.fish

Southern Sand Flathead inhabit sheltered, shallow, coastal waters, typically over sand or silt (Edgar 2008). This is the most important species in the Tasmanian recreational fishery, with the most recent estimate of recreational harvest representing 98% of the total catch for that season (2017/18) (Lyle et al. 2019). Commercially, Southern Sand Flathead are caught primarily by handline, with some by-catch in the gillnet and Danish seine fisheries. The stock status for this species was classified as Depleting in the last two Scalefish Fishery stock assessments (Fraser et al. 2021). More detailed information on biological characteristics and current management of Southern Sand Flathead fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Whilst Southern Sand Flathead has a long history of commercial fishing in Tasmania, this species has only been distinguished from Tiger Flathead in fishery returns data since 2007/08. Previous stock assessment reports show back-calculated estimates of species-specific catch prior to 2007/08 (Krueck et al. 2020; Fraser et al. 2021). Total commercial catch for Southern Sand Flathead in 2020/21 was only 3.3 t, which is a slight increase from last season (2.1 t) but lower than peak commercial catches of 13 t reported in 2008/09. However, commercial catches are dwarfed by estimates of recreational catches available from recreational fishing surveys conducted since 2000/01 (Lyle 2005; Lyle et al. 2009; Lyle et al. 2014b; Lyle et al. 2019). In recreational fishing survey reports prior to 2017/18, recreational catch was reported for all flathead species combined, assuming that Southern Sand Flathead accounted for approximately 90% of reported catches (Lyle 2005; Lyle et al. 2009; Lyle et al. 2014b). For all flathead species combined, recreational catches were estimated at 361 t in 2000/01 (Lyle 2005), 292 t in 2007/08 (Lyle et al. 2009), and 235.9 t in 2012/13 (Lyle et al. 2014b). In 2017/18, the recreational fishing survey for the first time distinguished between Southern Sand Flathead and Tiger Flathead, finding Southern Sand Flathead represented 96% of total Flathead catch by number (Lyle et al. 2019). The recreational catch of Southern Sand Flathead was estimated at 184.4 t in 2017/18 (Lyle et al. 2019), which was approximately 98% of the estimated total catch (recreational and commercial combined) in that season and represents 56 times the commercial catch in the current season (see Figure 13.1A).

The distribution of catch and effort is concentrated in the most populated regions across Tasmania. Almost all commercially harvested Southern Sand Flathead has recently been taken by handline on the east, southeast, and northwest coasts (Figure 13.2A, Figure 13.3). In the recreational fishery in 2017/18, just over half of estimated total Flathead catch was derived from the southeast coast, with the central east (including Great Oyster Bay) and northwest coasts also representing important regions (Lyle et al. 2019).

Although commercial catches are insignificant for this species, it is worth noting that commercial handline CPUE shows an overall declining trend (Figure 13.1C). This was associated with a clear overall decline in commercial handline effort (Figure 13.1B). However, regional differences highlight that these trends could mask spatial heterogeneity in fishing activity or population dynamics (Figure 13.2).

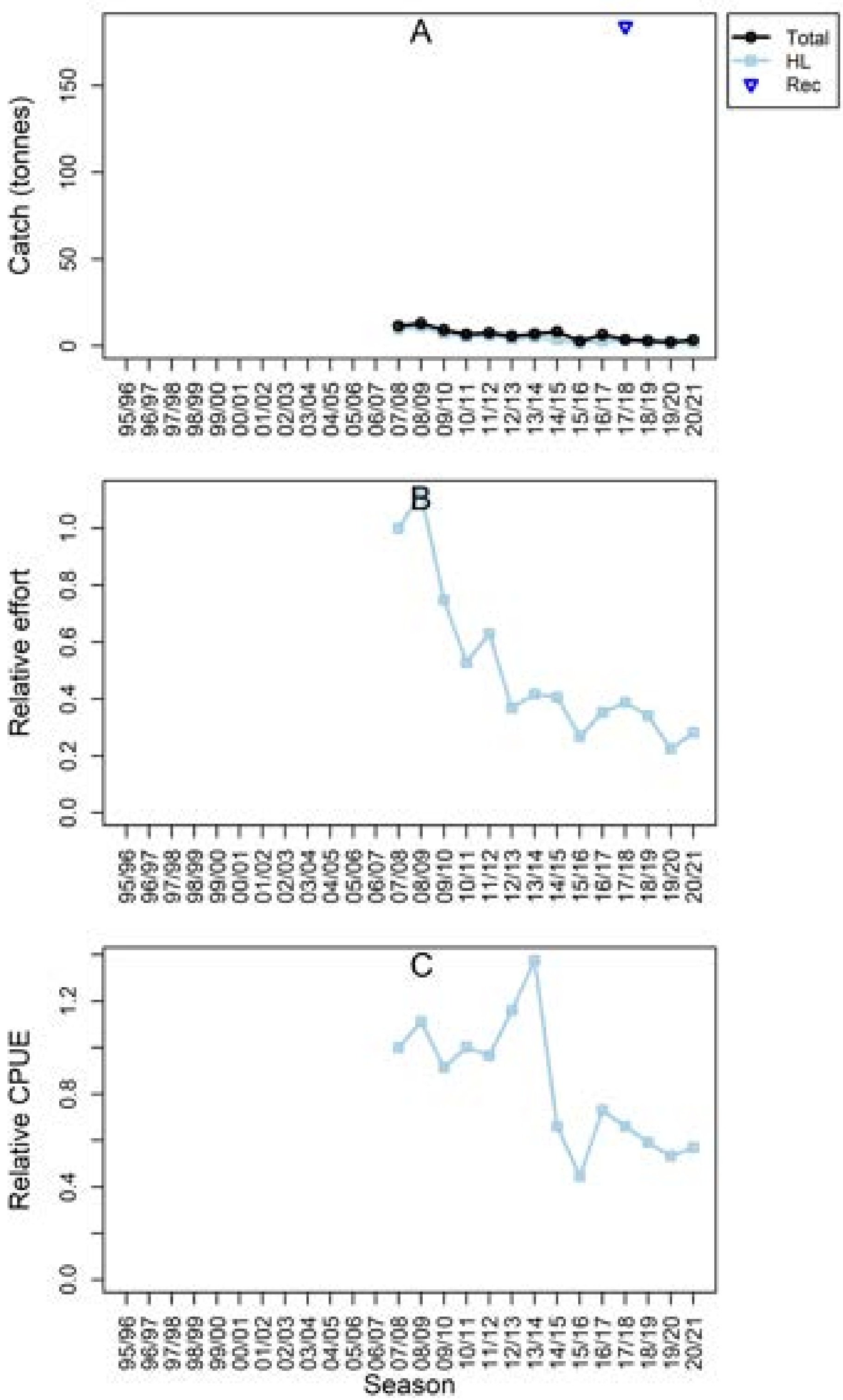


Figure 13.1 (A) Annual commercial Southern Sand Flathead catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 2007/08; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 2007/08. HL = handline, Rec = estimated recreational catch.

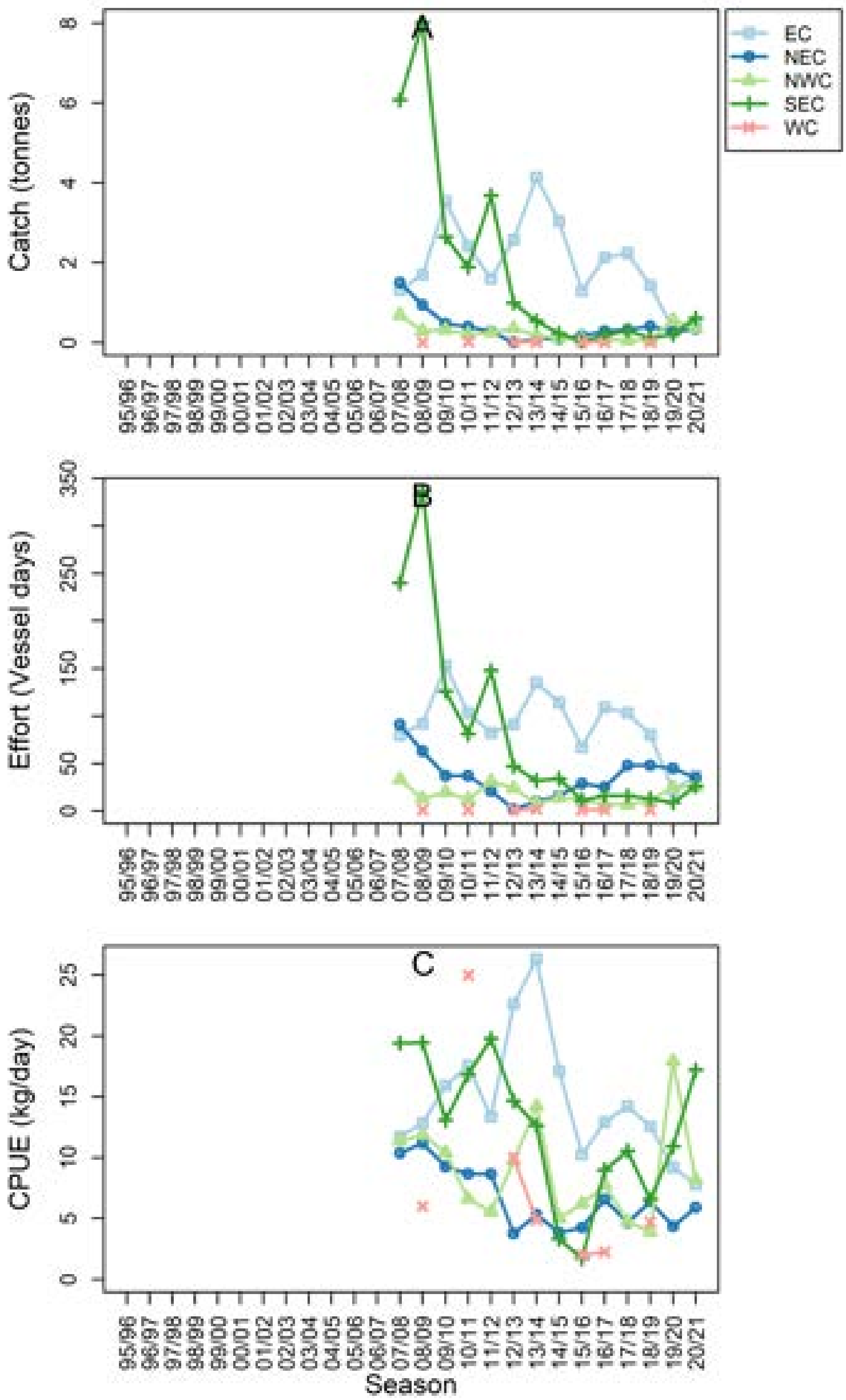


Figure 13.2 Regional commercial Southern Sand Flathead catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for hand line. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

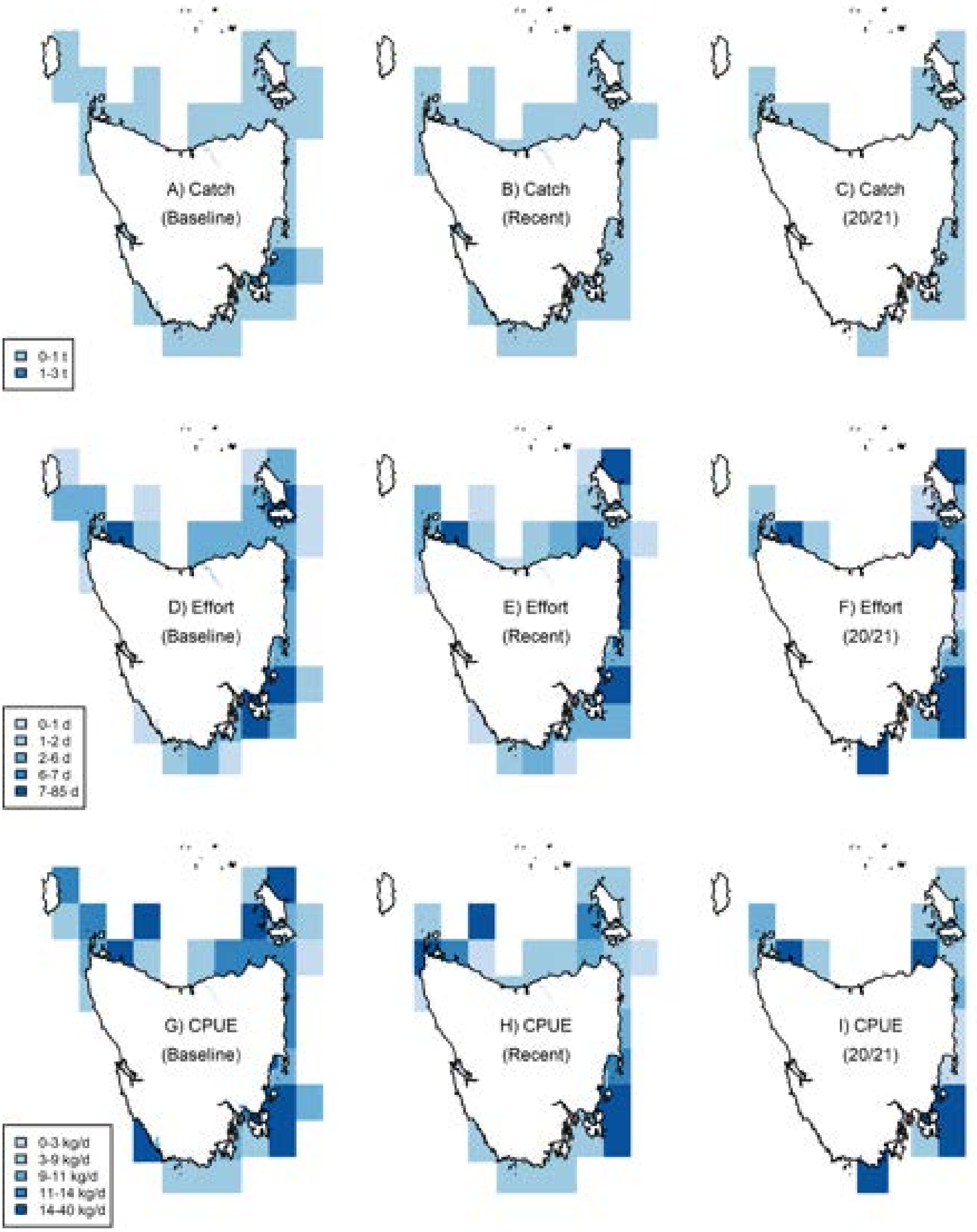


Figure 13.3 Southern Sand Flathead catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (2007/08 to 2016/17 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Fishery-independent surveys

Concerns surrounding the abundance of Southern Sand Flathead led to the establishment of an annual fishery-independent survey, which has been conducted since 2012 (Ewing and Lyle 2020). The survey uses fishing gear and targeting practices typical of recreational fishers in areas of significant effort, including the D'Entrecasteaux Channel, Norfolk Bay and Frederick Henry Bay, and Great Oyster Bay, with sampling occurring during February and March. Fishing was generally conducted over three (not necessarily consecutive) days per region with 19-21 standard sites fished in each region. The sampling sites represent a range of suitable habitats (including depths) for targeting Southern Sand Flathead, providing wide spatial coverage in each region.

Previous assessment reports have highlighted high estimated levels of fishing mortality (Krueck et al. 2020; Fraser et al. 2021), which strengthened ongoing concerns that led to the expansion of fishery-independent surveys and intensified research on Southern Sand Flathead conducted in the context of a project supported by the Fisheries Research and Development Corporation. In the context of this ongoing project, fishery-independent surveys have been continued, intensified, and expanded to include additional areas on both the east and north coasts of Tasmania. These data provide the basis for analyses of the size- and age-composition of the species up to the latest sampling period in 2022 and are firstly used in this report to assess stock status and trends against common reference points for management as detailed in the methods section.

Size composition

Sampling conducted in 2022 yielded 497 individuals with very low bycatch. The smallest individual encountered in the 2022 sampling was 119 mm and was captured in the Frederick Henry-Norfolk Bay region. The largest fish encountered was 515 mm and was captured in Great Oyster Bay. As in previous years, catches were dominated by undersized fish. Females dominated the catch of legal sized fish in each region (see Figure 13.4, Figure 13.5, Figure 13.6).

The length structure of sand flathead in the D'Entrecasteaux Channel and Frederick Henry-Norfolk Bay is still dominated by fish smaller than the minimum size limited of 320 mm (Figure 13.4, Figure 13.5). However, catches in 2022 at Great Oyster Bay show a higher proportion of fish ≥ 320 mm than in 2021 (Figure 13.6), with a ratio of undersize (< 320 mm) to size increasing form 0.07:1 to 0.29:1 in 2022.

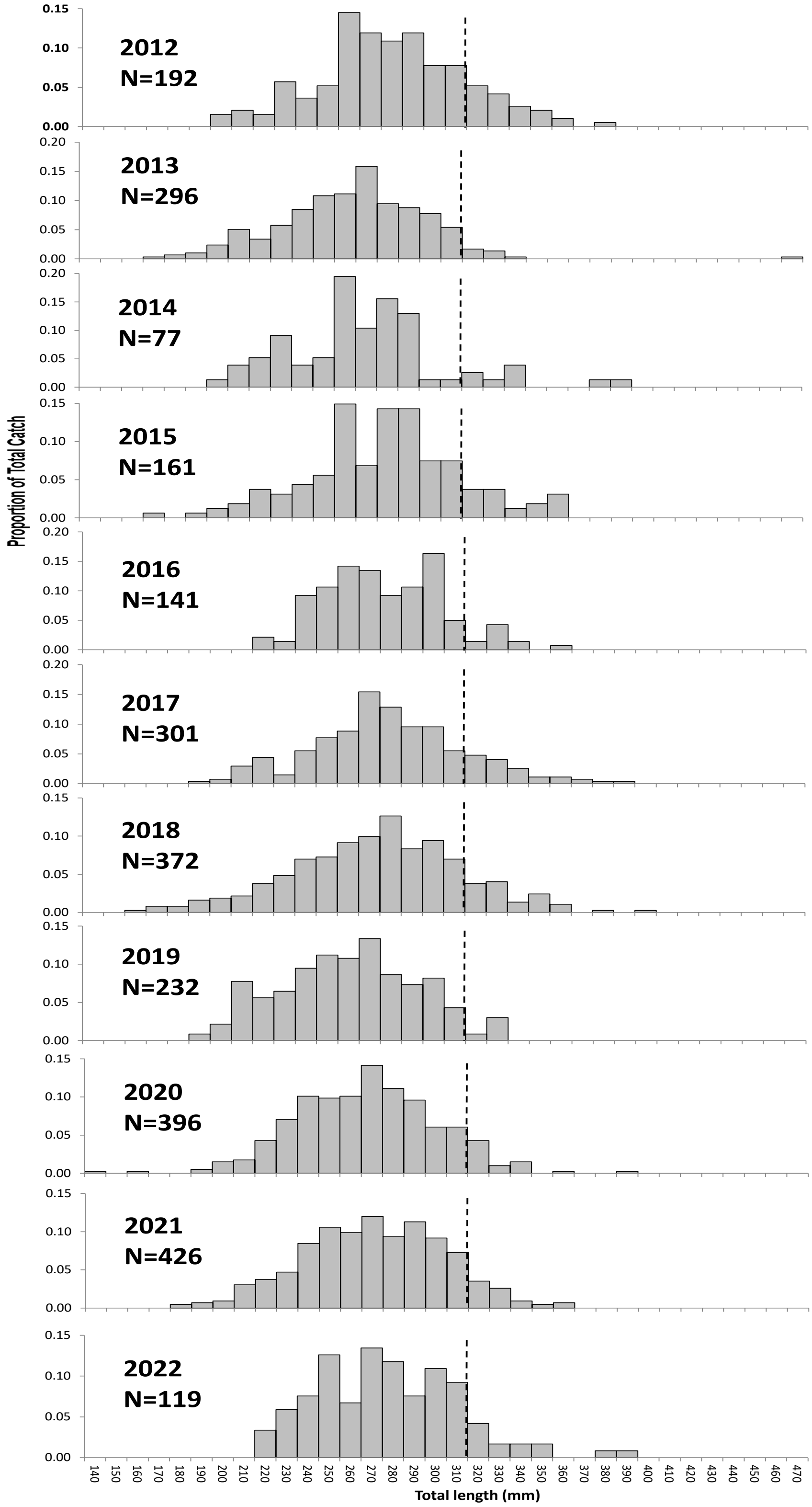


Figure 13.4 Length frequency histograms for Southern Sand Flathead captured in the D'Entrecasteaux Channel region between 2012 and 2022. Dotted lines indicate the minimum legal-size limit (320 mm).

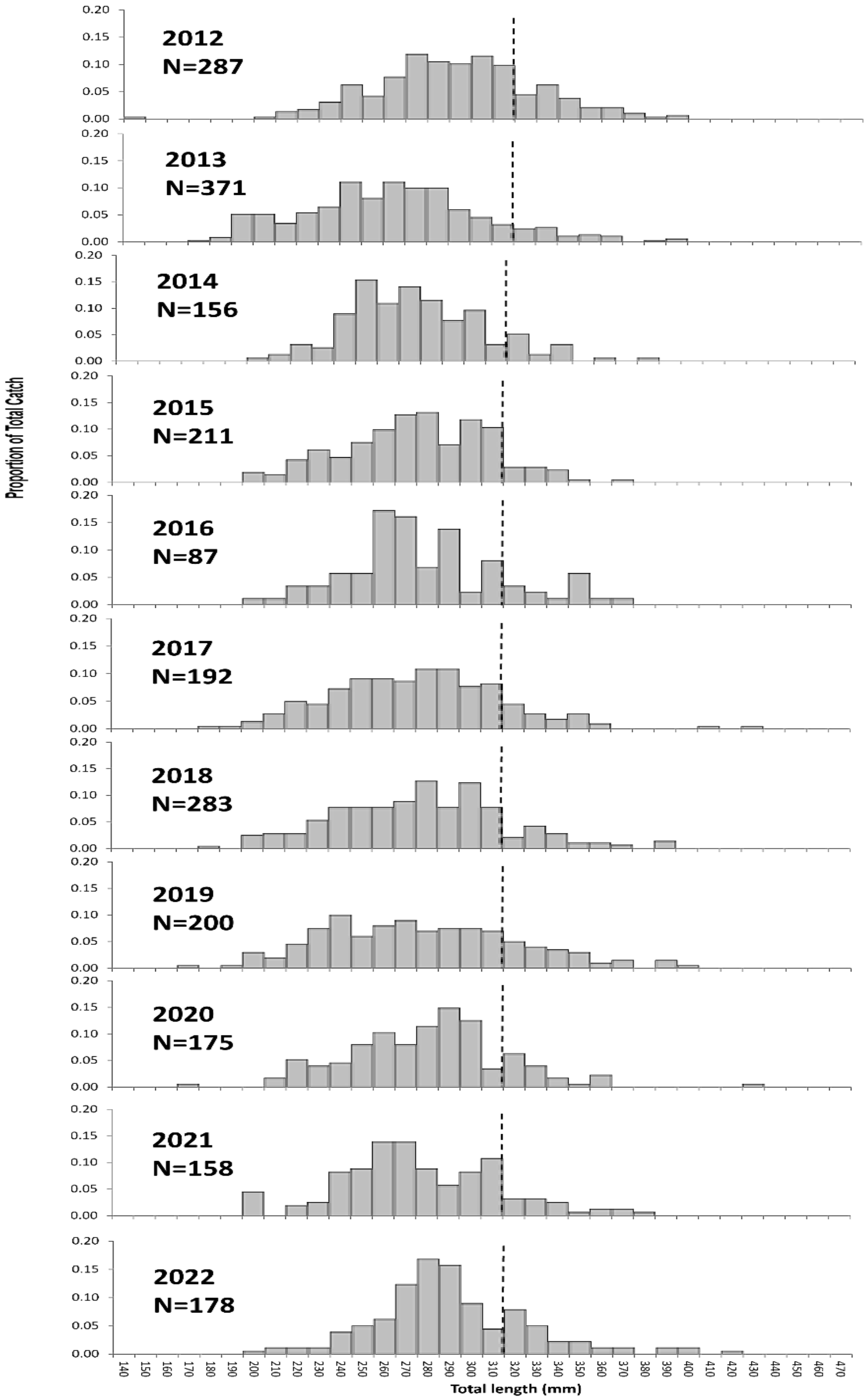


Figure 13.5 Length frequency histograms for Southern Sand Flathead captured in the Frederick Henry-Norfolk Bay region between 2012 and 2022. Dotted lines indicate the minimum legal-size limit (320 mm).

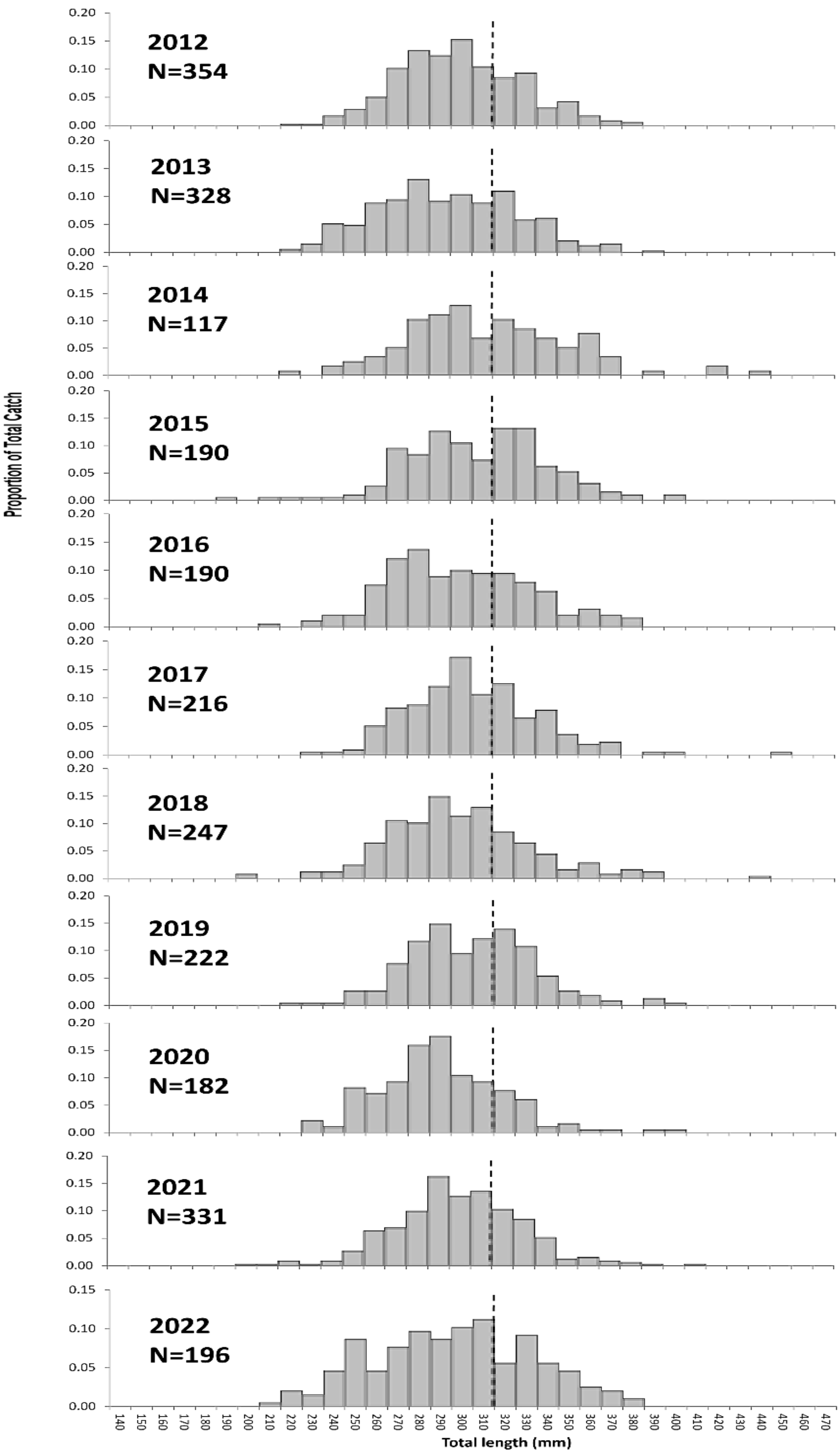


Figure 13.6 Length frequency histograms for Southern Sand Flathead captured in the Great Oyster Bay region between 2012 and 2022. Dotted lines indicate the minimum legal-size limit (320 mm).

Age composition

Ages were estimated for 301 individuals sampled in 2022. The oldest individual was an 11-year-old male captured in Frederick Henry Bay (315 mm). The largest fish aged was 408 mm (9-year-old) female, also caught in Frederick Henry Bay. The youngest fish encountered were 2-year-olds caught in the D'Entrecasteaux Channel, and Great Oyster Bay. The abundance and proportion of females was found to decline rapidly in the older age classes reflecting the earlier exposure of this sex to the fishery due to faster growth and greater length at maximum age (Figure 13.7, Figure 13.8).

Survey results further indicated that females, on average, do not attain the minimum size limit (MSL) of 320 mm until they are between 5 and 8 years old while males, on average, might never attain a size greater than the MSL.

Response to the increased minimum size limit (MSL)

Earlier assessments of the recreational sand flathead fishery (Ewing and Lyle 2014) showed evidence of a reliance on new recruits with sharp declines in the proportion of fish above the minimum size limit (300 mm), and dominance of slower growing males in the older age classes where the faster growing females had become exposed to the fishery. These effects were particularly strong in the D'Entrecasteaux Channel. The minimum size limit was increased from 300 mm to 320 mm in November 2015 with the intention of improving yield per recruit, reducing fishing mortality and increasing egg production (by extending the period prior to recruitment to the fishery).

Regional data provide no clear signals of changes in age or size structures to indicate variability in recruitment potentially linked to increased protection of spawners (Figs. 54-58). There is, however, an increase in the representation of fish in the 300-320 mm size range in most regions since the size limit increase.

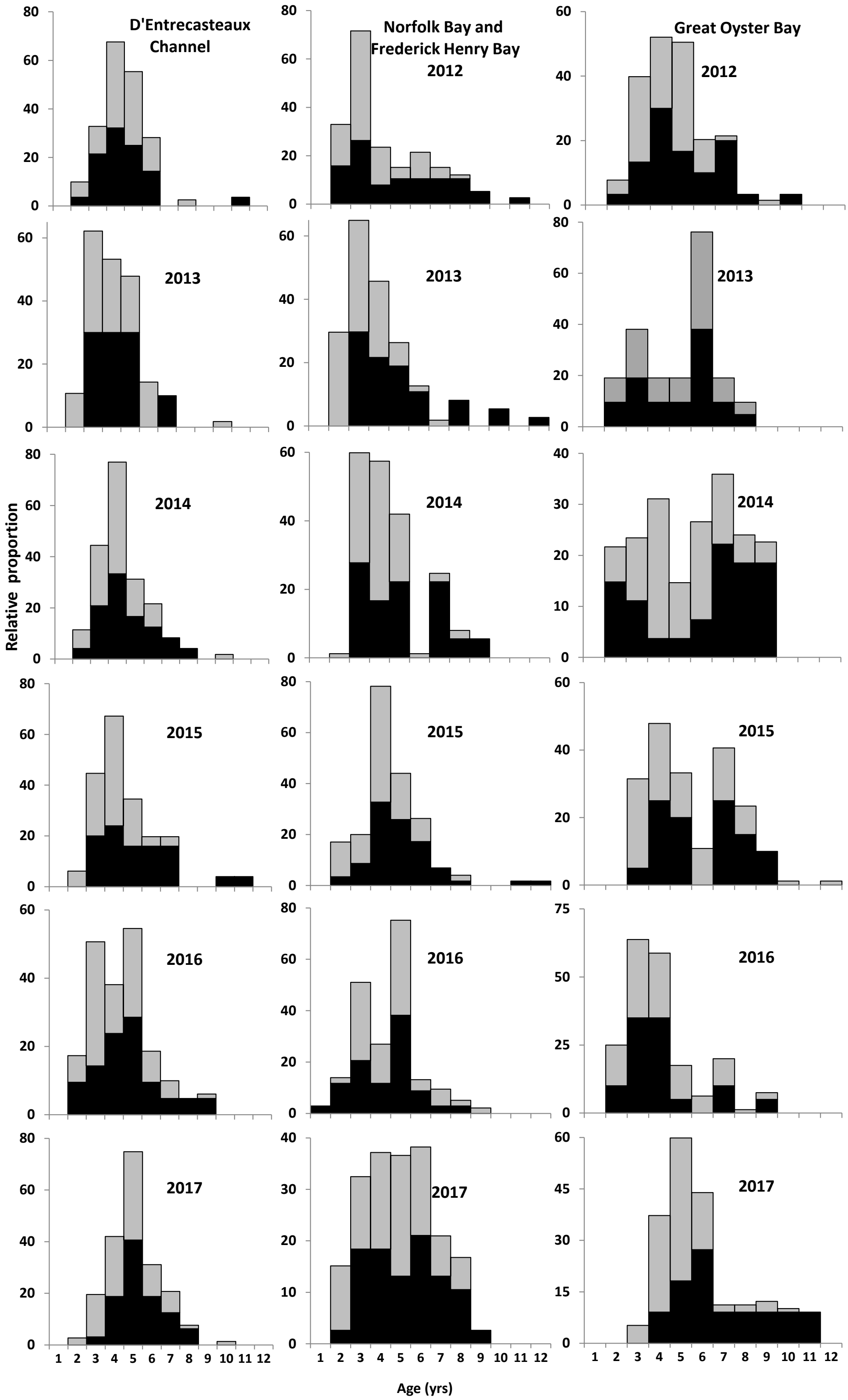


Figure 13.7 Age frequency histograms for sand flathead in the D'Entrecasteaux Channel, Frederick and Henry-Norfolk Bays and Great Oyster Bay in south-eastern Tasmania between 2012 to 2017. The black bars are males and grey bars are females.

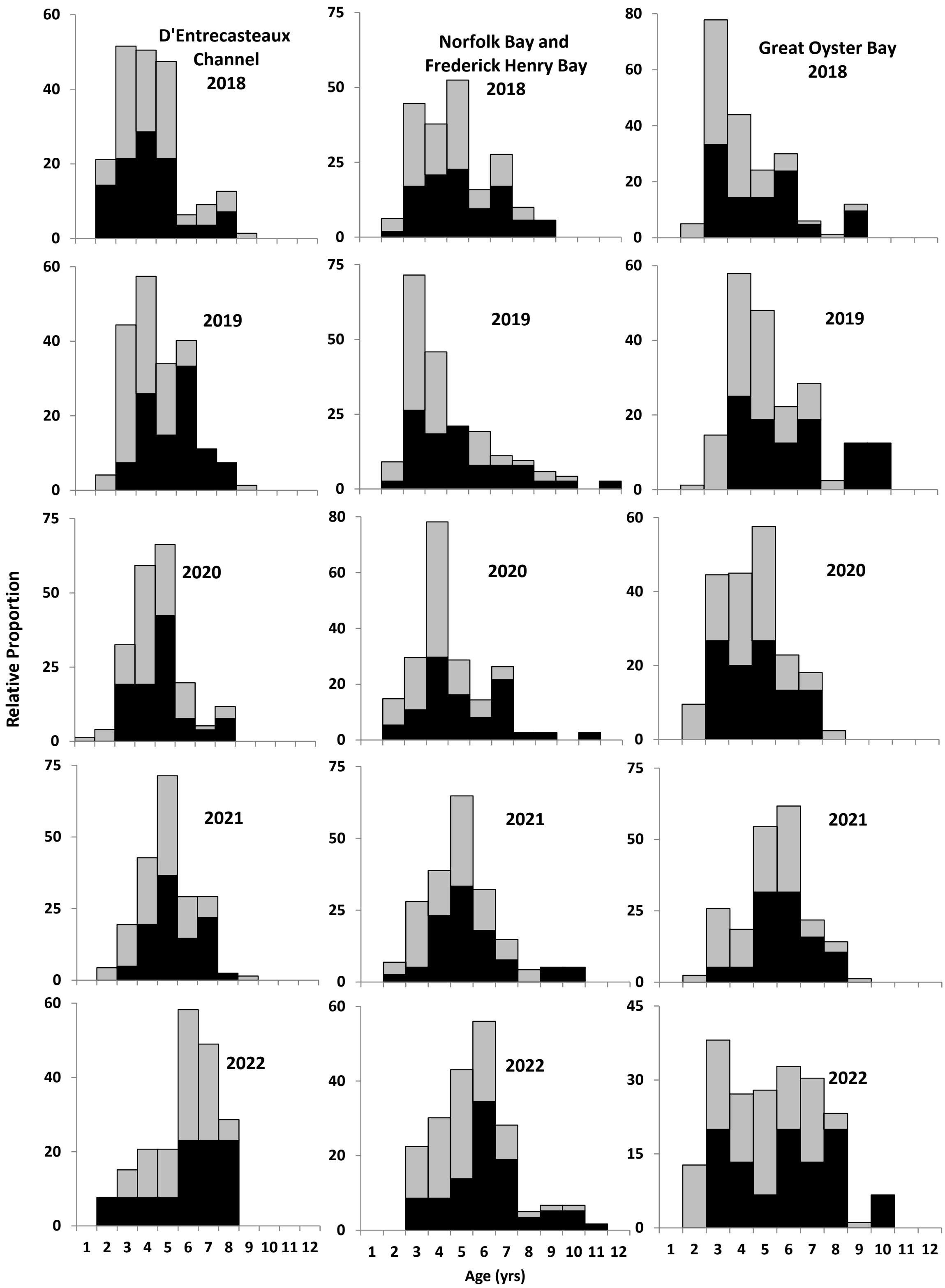


Figure 13.8 Age frequency histograms for sand flathead in the D'Entrecasteaux Channel, Frederick and Henry-Norfolk Bays and Great Oyster Bay in south-eastern Tasmania between 2018 to 2022. The black bars are males and grey bars are females.

Catch per unit effort (CPUE)

CPUE in each of the regions initially declined to lowest levels between 2014 and 2016 before recovering to levels comparable to, or greater than, those in 2012 over the following years. This period of increases was consistent with the introduction of an increase in the minimum size limit from 300 mm to 320 mm. However, CPUE has generally decreased again since then (Figure 13.9).

Standardised CPUE for fish above the MSL in all regions has generally declined from peaks in 2018 (D'Entrecasteaux Channel) and 2019 (Henry-Norfolk Bays and Great Oyster Bay). However, current CPUE in 2022 is at a level that is close to or higher than the average across all survey years.

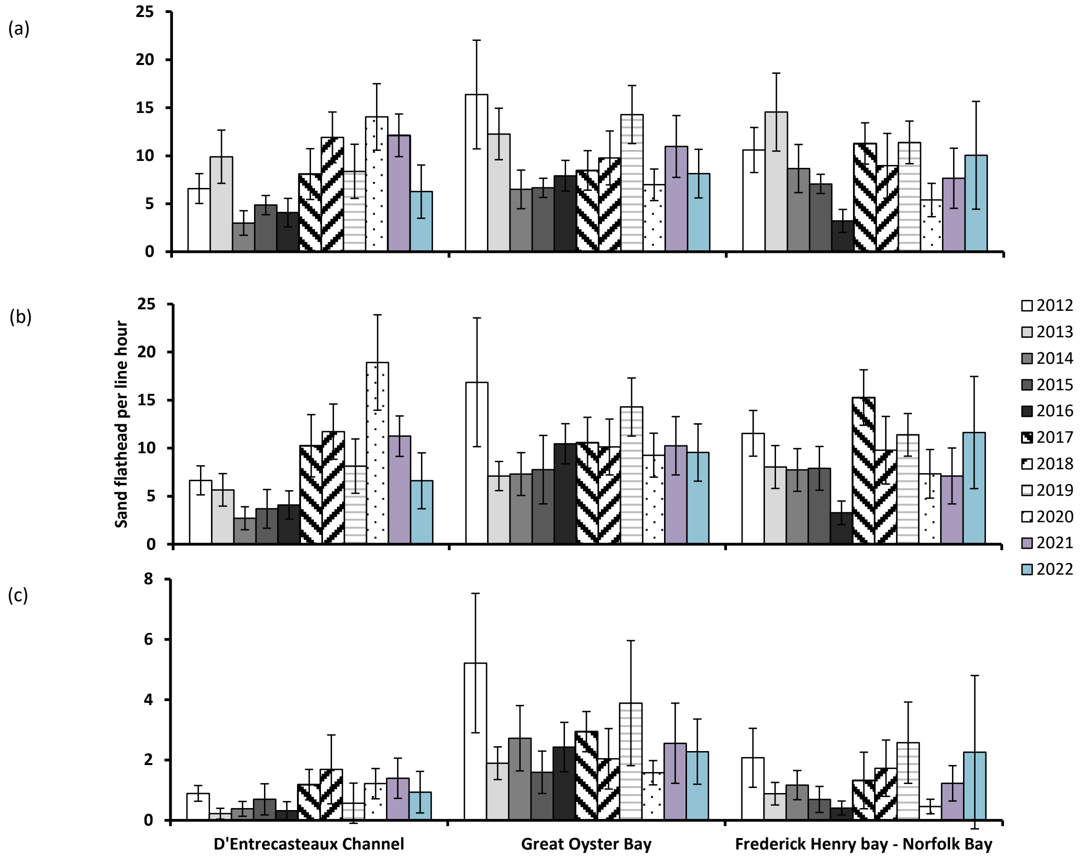


Figure 13.9 Mean CPUE (fish per line hour) by region and year in the D'Entrecasteaux Channel, Frederick and Henry-Norfolk Bays and Great Oyster Bay in south-eastern Tasmania: (a) raw CPUE; (b) standardised CPUE; and (c) standardised CPUE for fish above the 320mm MLS. Error bars represent 95% confidence intervals.

Length-based assessments: stock status and trends

Estimating representative life history parameters for data-poor stock assessments from fishery-independent survey data was complicated by the size- and age-truncation of populations before surveys commenced in 2012. In consequence, 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 heavy fishing pressure in the past has led to the complete absence or rarity of the largest individuals in sampled populations, which in turn is causing VBGF estimates of *Linf* to be closely aligned with the minimum size limit of 32 cm (see Figure 13.10A). The impact of size truncation on estimates of *Linf* was slightly less pronounced when length samples from more recent additional survey sites on the east and north coasts were included (see Figure 13.10B).

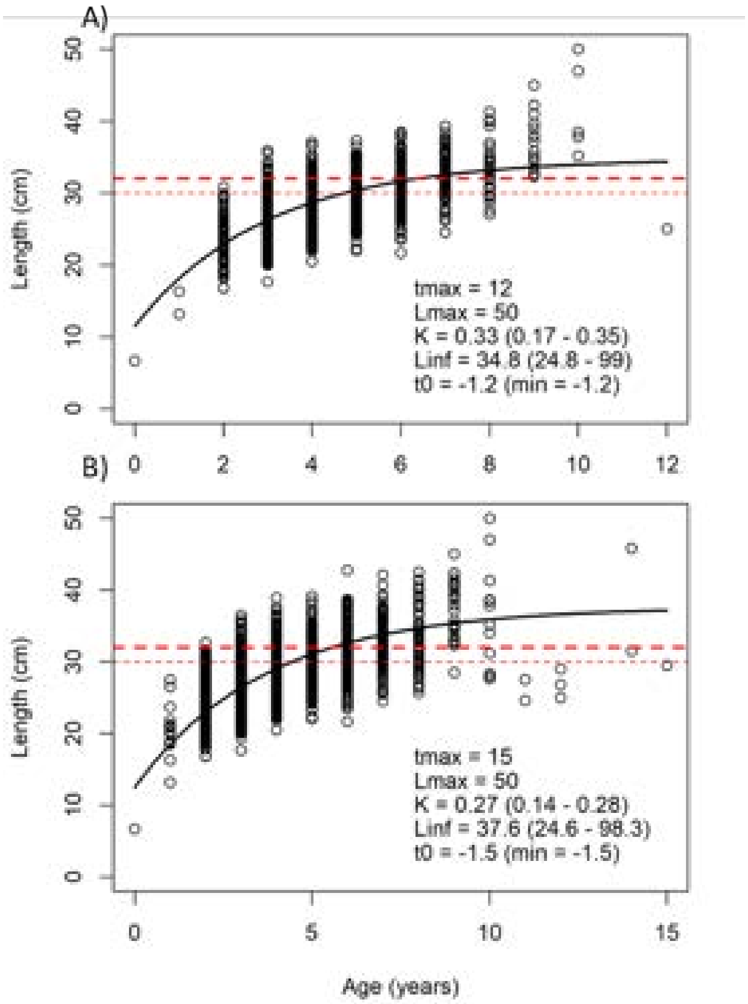


Figure 13.10 Estimates of von Bertalanffy life history parameters using age- and size truncated survey data from consistently sampled regions in the south-east coast region. A) includes the D'Entrecasteaux Channel, Frederick Henry-Norfolk Bays and Great Oyster Bay. B) includes multiple additional areas on the east and north coast. *tmax*: maximum measured age; *Lmax*: maximum measured length; *Linf*: infinite or asymptotic length; *k*: von Bertalanffy growth rate; *t0*: theoretical age when length is zero. Values in brackets denote the parameter space explored to determine the best fit. Dashed red lines mark the former (thin) and current (thick) minimum size limit.

Powell-Wetherall regressions, which are less sensitive to the bias introduced by size truncation and gear selectivity, indicated that *Linf* of female Sand Flathead is between 49 and 50 cm (Figure 13.11). This more realistic estimate of *Linf* was subsequently used to parameterize length-based stock assessment approaches. In combination with the standard assumption of the von Bertalanffy parameter *t0* = 0 (i.e., the theoretical age at an average length of 0 cm is assumed to be 0), we further used the *Linf* estimate of 49.5 cm to infer the von Bertalanffy growth rate *k*. The combination of *Linf* and *k* was then used also to estimate the life history ratio *M*/*k* and for length-based catch curve regressions to estimate total current mortality (*Z*) of female Southern Sand Flathead over the last three years (2020-2022) (Table 13.1, Table 13.2).

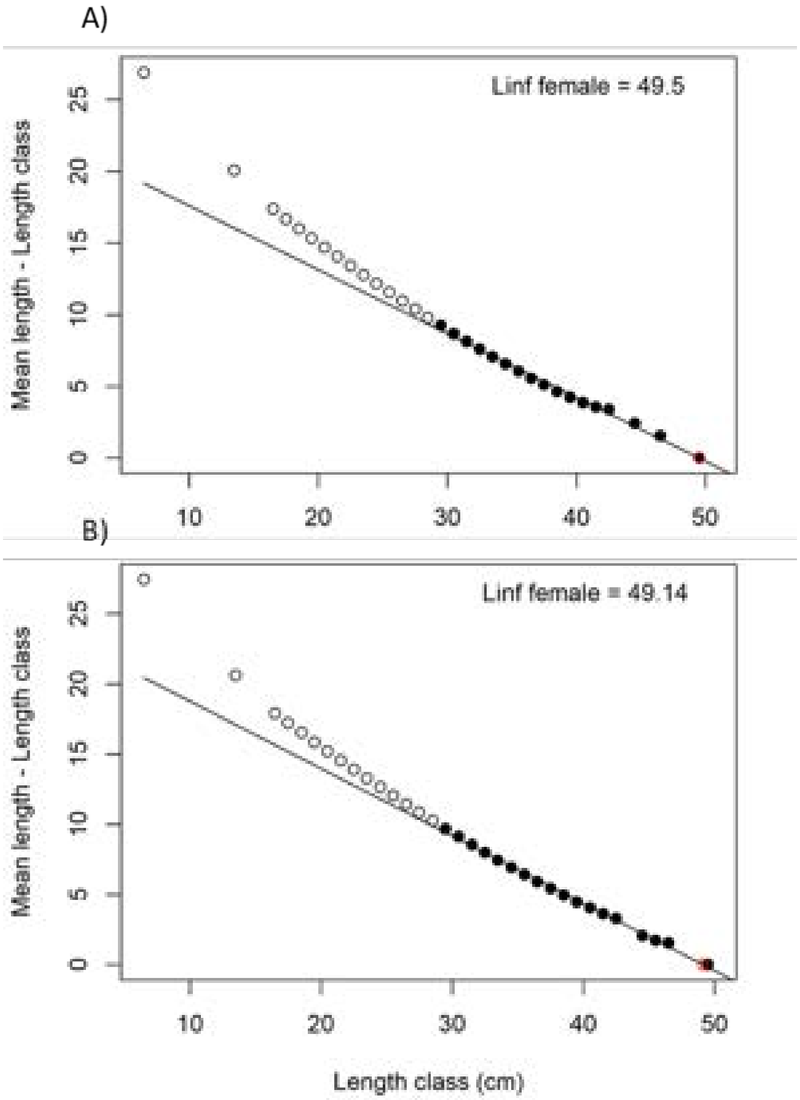


Figure 13.11 Estimates of the infinite length of female Southern Sand Flathead using Powell-Wetherall regressions based on survey data from consistently sampled regions on the south-east coast. Panel A) includes the D'Entrecasteaux Channel, Frederick Henry-Norfolk Bays and Great Oyster Bay. Panel B) includes multiple additional areas on the east and north coast. Hollow circles indicate data points that represented length classes that are not fully selected by handline fishing and were therefore excluded from the regression (see *SL95* in Table 13.1 below). The hollow red circle marks *Linf*.

Table 13.1 Key parameters used for length-based assessments of stock status and trends. *SL95*: length at 95% gear selectivity; *Linf*: infinite or asymptotic length; *k*: von Bertalanffy growth rate; *M*: instantaneous rate of natural mortality; the ratio *M*/*k* determines the shape of the estimated unfished length-frequency distribution. All results represent females only and all lengths are given in cm.

Region	*SL95*	*Linf*	*k*	*M*	M/k
SE Coast	30.31	49.5	0.2	0.3	1.5
All regions	29.93	49.14	0.22	0.3	1.36

Outcomes from length-based catch curves revealed a high instantaneous rate of total annual mortality *Z* of 1.57, which translates to approximately 80% mortality of adults per year. The instantaneous annual rate of fishing mortality was estimated at 1.27, indicating an annual mortality of 72% (95% confidence interval: 65%-77%) caused by fishing. In other words, fishing mortality was estimated to account for 90% of total annual deaths of adult females in the south-east coast region over recent years. This estimated level of fishing mortality is substantial as further indicated by the estimated ratio of fishing mortality relative to natural mortality (*F*/*M*), which far exceeded putatively sustainable levels of *F*/*M* between values of 0.5 and 1. The inclusion of survey data from additional sites on the east and north coasts resulted in reduced levels of estimated fishing mortality. However, values for both *F* (55%) and *F*/*M* (2.7) were still substantially higher than levels that are likely to be sustainable (Table 13.2). While lower estimates of *F* and *F*/*M* across all regions still indicate that female Southern Sand Flathead populations in some regions on the east and north coast might be less heavily fished than those in the south-east coast region, consistent downward bias in regional estimation of *Linf* indicated that a breakdown of fishing mortality estimates by individual sampling areas might not be reliable until more samples are available. Overall, the level of overfishing inferred from length-based catch curves presented above were even higher than age-based estimates presented in previous assessment reports (Krueck et al. 2020; Fraser et al. 2021).

Table 13.2 Estimates of recent total mortality (*Z*), fishing mortality (*F* = *Z*-*M*), and fishing mortality relative to natural mortality (*F*/*M*) based on length-based catch curve regressions using fishery-independent survey data between 2020 and 2022. All results represent females only and state 95% confidence intervals in brackets.

Region	*Z*	*F*	*F*/*M*
South-east coast	1.57 (1.35-1.79)	1.27 (1.05-1.49)	4.23 (3.5-4.97)
All regions	1.1 (0.96-1.24)	0.8 (0.66-0.94)	2.67 (2.2-3.13)

Outcomes from the Length-based Bayesian Biomass (LBB) estimation approach corroborated the findings above by highlighting that relative fishing mortality in the south-east coast region might far exceed putatively sustainable levels indicated by *F*/*M* values < 1 (Figure 13.12A). Moreover, LBB results indicated that substantial overfishing in the south-east coast region might have caused biomass depletion of female Southern Sand Flathead below putatively critical levels of 20% of the unfished biomass (Table 13.3, Figure 13.12B).

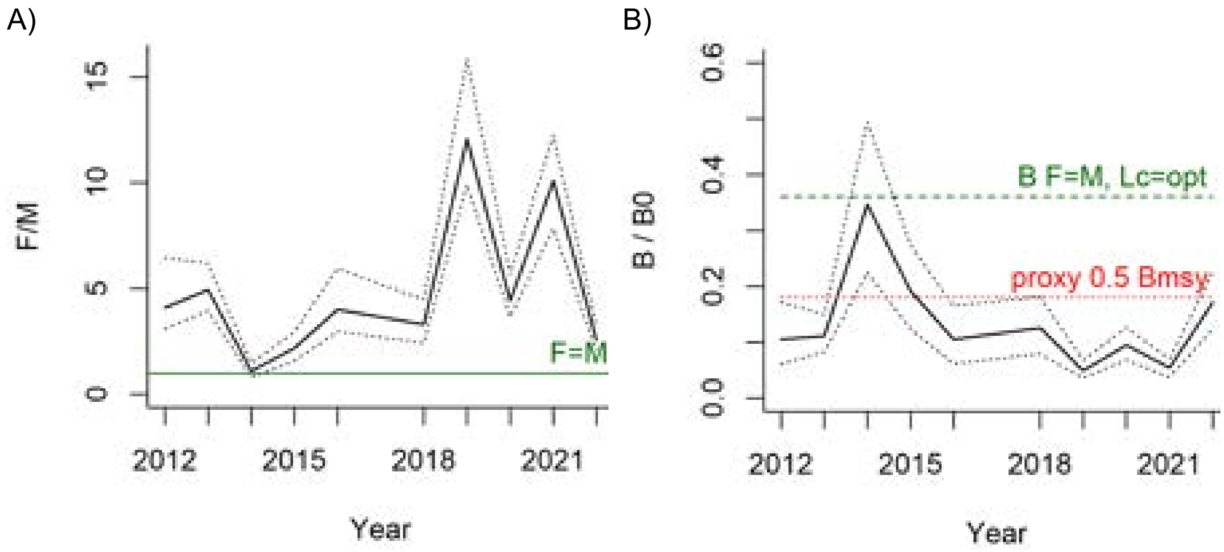


Figure 13.12 Estimates of relative fishing mortality (A) and biomass depletion (B) for female Southern Sand Flathead in the south-east coast region using the Length-based Bayesian Biomass (LBB) estimation approach. Fishing mortality relative to natural mortality (*F*/*M*) ratios of 1 are widely used as a threshold to identify unsustainable levels of fishing (solid line in A). LBB estimated a biomass target reference point where catch equals the maximum sustainable yield (Bmsy; i.e., *B* where *F* = *M* and mean length at first capture (*Lc*) is optimal) when *B*/*B0* = 0.37 (dashed black line in B). A limit reference point for critical biomass depletion at 0.5 Bmsy is also highlighted (red dotted line in B).

Table 13.3 Estimates of relative fishing mortality *F/M* and biomass depletion B/B0 (B) of female Southern Sand Flathead in the south-east coast region in 2022 using the Length-based Bayesian Biomass (LBB) estimation approach.

***F*/*M* in 2022**	***B/B0* in 2022**
2.6 (2.1-3.2)	0.17 (0.12-0.23)

A preliminary regional breakdown of LBB outcomes, representing samples collected over the past two years from multiple additional locations on the east and north coast, indicated that the risk of depletion and further stock damage are high across Tasmania (Table 13.4). However, not all stocks might already be depleted to critical levels. Biomass below critical levels was estimated for populations in most regions. Biomass between potentially critical and target levels were estimated for Bridport (NC) and Mercury Passage (SEC), albeit fishing pressure was estimated to be unsustainable in these two areas too. More samples are needed to confirm these findings.

Table 13.4 Regional breakdown of estimated levels of fishing mortality and biomass of female Southern Sand Flathead based on the Length-based Bayesian Biomass (LBB) approach applied to samples collected in 2021 and 2022. Results are preliminary.

Region	*Fishing mortality*	*Fish biomass*
Bridport (NC)	Unsustainable	Between limit and target
D'Entrecasteaux Channel (SEC)	Highly unsustainable	Below limit
Great Oyster Bay (SEC)	Highly unsustainable	Below limit
Mercurcy Passage (SEC)	Unsustainable	Between limit and target
Frederick Henry and Norfolk Bays (SEC)	Highly unsustainable	Below limit
Stanley (NC)	Undefined	Undefined
St Helens (EC)	Highly unsustainable	Below limit
Tamar (NC)	Highly unsustainable	Below limit

The Length-Based Spawning Potential Ratio (LBSPR) assessment approach revealed outcomes similar to those of the LBB approach (Figure 13.13). However, the estimated level of relative fishing mortality was even higher (Table 13.5).

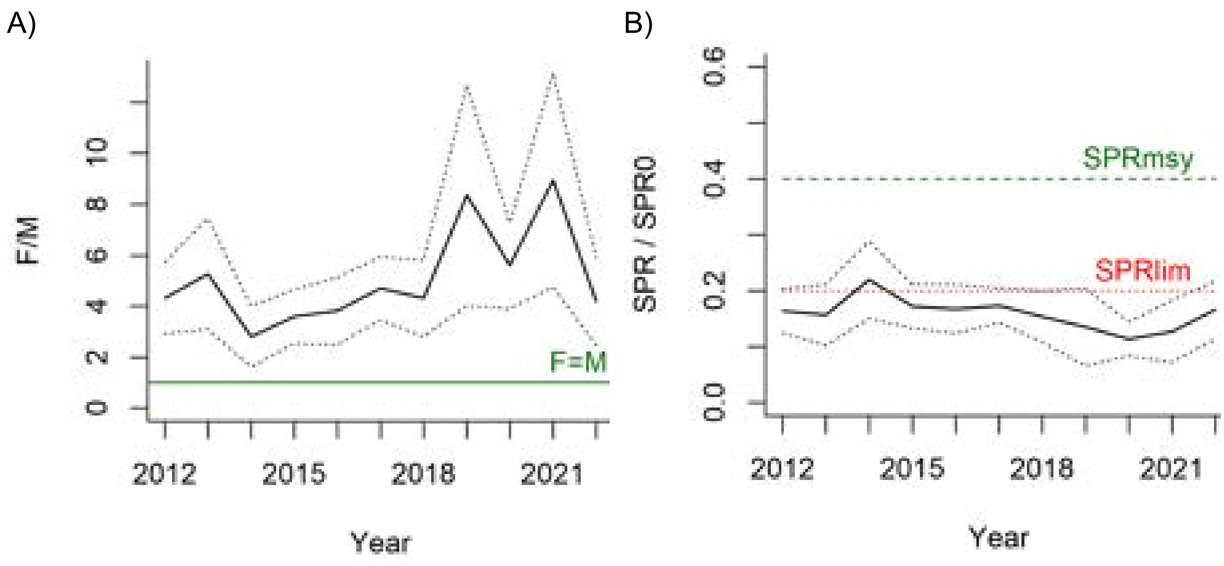


Figure 13.13 Estimates of relative fishing mortality (A) and spawning potential (B) of female Southern Sand Flathead in the south-east coast region using the Length-Based Spawning Potential (LBSPR) assessment approach. Fishing mortality relative to natural mortality (*F*/*M*) ratios > 1 are widely used to infer overfishing (solid line in A). Estimates of the current spawning potential ratio relative to unfished levels (*SPR*/*SPR0*) is generally assessed against a minimum value of 0.2 (20% of unfished levels) to infer stock depletion and against a target value of 0.4 (40% of unfished levels) to assess performance.

Table 13.5 Estimates of relative fishing mortality (*F*/*M*) and spawning potential (*SPR*/*SPR0*) of female Southern Sand Flathead in the south-east coast region using the Length-Based Spawning Potential Ratio (LBSPR) assessment approach.

***F*/*M* in 2022**	***SPR*/*SPR0* in 2022**
4.18 (2.46-5.9)	0.17 (0.11-0.22)

A preliminary regional breakdown of LBSPR outcomes confirmed that populations in most regions have likely been depleted below critical levels and that estimated levels of fishing mortality are unsustainable across Tasmania (Table 13.6). The highest relative spawning potential was estimated for female flathead populations at Stanley (NC), Bridport (NC) and in the Mercury Passage (SEC).

Table 13.6 Regional breakdown of estimated levels of fishing mortality and spawning potential of female Southern Sand Flathead based on the Length-Based Spawning Potential Ratio (LBSPR) approach applied to samples collected in 2021 and 2022. Results are preliminary.

Region	***Fishing mortality***	***Fish biomass***
Bridport (NC)	Unstainable	Close to limit
D'Entrecasteaux Channel (SEC)	Highly unsustainable	Below limit
Great Oyster Bay (SEC)	Highly unsustainable	Below limit
Mercurcy Passage (SEC)	Unsustainable	Close to limit
Frederick Henry and Norfolk Bays (SEC)	Highly unsustainable	Below limit
Stanley (NC)	Unsustainable	Between limit and target
St Helens (EC)	Highly unsustainable	Below limit
Tamar (NC)	Highly unsustainable	Below limit

Risk assessment of recruitment impairment

The Southern Sand Flathead fishery scored < 60 in the risk-based risk analysis, failing assessment with high risk of recruitment impairment and stock damage. This is because Southern Sand Flathead is a moderately productive species – long lived (up to 20 years) (Bani 2005), maturing early (Bani and Moltschaniwskyj 2008), and occupying a relatively high trophic level (Ayling et al. 1975). Southern Sand Flathead is not highly susceptible to capture by the commercial fishery in Tasmania, and thus the impact from this fishery is likely to be minor. In contrast, Southern Sand Flathead is highly susceptible to capture by the recreational fishery, heavily fished in its preferred habitat, with evidence of depletion in population biomass, reproductive capacity, and age and size structure (Ewing and Lyle 2020). Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

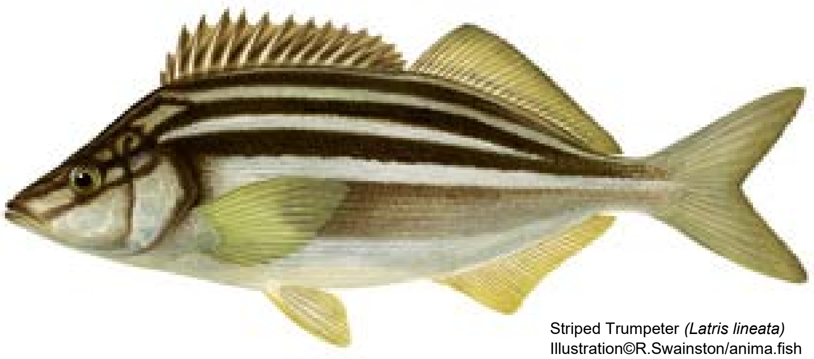
Stock status	DEPLETED

The main impact on Southern Sand Flathead stocks is from the recreational sector, with commercial catches most recently estimated to represent less than 2% of the combined total catch. Due to an absence of targeting among commercial fishers, a Southern Sand Flathead fishery-independent survey commenced in 2012 to support the assessment of this species.

The survey over recent years has identified a low relative abundance of legal-size fish in the D'Entrecasteaux Channel, Frederick Henry-Norfolk Bay, and Great Oyster Bay, suggesting that stocks in the main fishing areas are depleted. In late 2015, management changes were introduced to improve the status of this species, including: (1) an increase in the minimum size limit from 300 mm to 320 mm, the introduction of (2) a daily bag limit of 20 per fisher, and (3) a possession limit of 30 per fisher. Initial analyses of fishery-independent data and estimated levels of fishing mortality suggested that these management measures might have supported stock recovery. However, more in-depth analyses based on increasingly comprehensive data indicate heavy fishing pressure, specifically on female Southern Sand Flathead. Additionally, first estimates of the relative biomass and spawning potential of females presented in this report indicate that Southern Sand Flathead might be depleted below critical levels in most regions across Tasmania, specifically in the south-east coast region. While more comprehensive sampling is needed to corroborate estimates of female stock status in some regions, current levels of estimated fishing mortality are unlikely to prevent or allow for recovery from depletion in most areas where surveys have been conducted to date. Thus, Southern Sand Flathead is classified as Depleted.

Striped Trumpeter (*Latris lineata*)

STOCK STATUS	DEPLETED
Following first recent records of young fish in biological samples after many years of suspected recruitment failure, evidence of population recovery of Striped Trumpeter is still lacking. Commercial catches are close to the historical low, but total levels of fishing pressure (commercial and recreational combined) might still prevent recovery, especially since the minimum size limit is below the estimated size at maturity. Newly introduced length-based assessment approaches indicate that stocks in the south-east coast region have been depleted below critical levels. More data are needed to clarify status and trends across the state.	
IMPORTANCE	Key
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment; fishery-dependent and -independent monitoring; length- and age-based estimates of mortality, length-based estimates of biomass depletion; catch-only based assessments of biomass depletion and maximum sustainable yield.
MANAGEMENT	State (Tasmania)



Striped Trumpeter *(Latris lineata)*
Illustration©R.Swainston/anima.fish

Striped Trumpeter is a relatively large and long-lived species. Juveniles inhabit shallow inshore reefs moving offshore with maturity to deeper exposed reefs ≤ 300 m (Edgar 2008). Striped Trumpeter are mainly caught offshore using handline, with some offshore dropline and inshore gillnet use. Management of Striped Trumpeter stocks has changed significantly over time, incorporating Tasmanian commercial operators and Commonwealth operators. Trip limits and a temporal closure during spawning are currently in place. However, the minimum legal size is below the size at maturity and the population of Striped Trumpeter has previously been found to be aging, suggesting that recruitment is limited, potentially because the spawning biomass of the population has been depleted. More detailed information on biological characteristics and current management of Striped Trumpeter fisheries is available from the Tas Fisheries Research webpage.

Catch, effort and CPUE

Total Striped Trumpeter catch in Tasmanian waters (south of latitude 39° 12'S) in 2020/21 was 8.2 t, including 6.2 t by Tasmanian vessels. Waters south of latitude 39° 12'S represent waters incorporated within the OCS agreement for Striped Trumpeter. The Commonwealth catch reported in 2020/21 was 1.9 t but catches are believed to have been substantially underreported in the past. Coupled with limited information on recreational catches, this situation represents a major source of uncertainty in estimating the total level of exploitation of Striped Trumpeter in Tasmanian waters.

Historically, Striped Trumpeter catch in Tasmanian waters included significant catches by Victorian vessels, peaking at around 37 t in the early 1990s (Table 14.1). Since the mid-1990s, data from this sector have been unavailable, though it is assumed that subsequent catches have been reported in Commonwealth logbooks. Commonwealth catches have been consistently low compared to catches by Tasmanian vessels, with generally less than 5 t caught.

Total annual catch in Tasmanian waters was highest at over 110 t in the early 1990s, with Victorian vessels accounting for 17-39% of total catch. Total catch then fluctuated between 70-80 t through the mid-1990s before increasing again to over 100 t for two years in the late 1990s (Table 14.1). Catches almost halved in 2000/01 to less than 50 t and have remained low since that time. A similar trend was observed across fishing gears used by Tasmanian vessels (Table 14.1). In 2015/16, total catches of Striped Trumpeter fell to an historic low of 7.1 t (6.0 t from Tasmanian vessels) (Table 14.1). After slight increases in 2016/17 and 2017/18, total catch has remained around 7-8 t (6-7 t from Tasmanian vessels) for the most recent three fishing seasons (Table 14.1; Figure 14.1A).

The recreational sector has targeted Striped Trumpeter as an important species. In 2000/01 and 2012/13, estimated recreational catch was less than the Commercial catch (Figure 14.1A) (Lyle 2005; Lyle et al. 2014b). However, estimates of recreational catch in 2011/12 and 2017/18 were substantially higher than the commercial catch (Figure 14.1A). Notably, recreational catch estimates do not fully represent catches by charter fishing boats.

Striped Trumpeter catches have historically been reported from all areas around the state, with the exception of the central north coast (Figure 14.5). In 2020/21, fishing activity was focused mainly on the southeast and west coasts (Figure 14.2) for gear types (Figure 14.2, Figure 14.3, Figure 14.4).

Catch trends appear to reflect the influence of strong year classes assumed to have entered the fishery before 1998/99. This was followed by a lack of recruitment and associated declines in catches in the early 2000s. Industry representatives suggest that the trip limit of 250 kg from 2000 provided a disincentive for operators to target the species, which might have contributed to the continued reduction in dropline and handline effort since 2000/01 (Figure 14.1B).

CPUE for handline and dropline, the currently dominant gear types on which Striped Trumpeter are caught, have been variable, with a general downward trend over recent years (Figure 14.1C).

Table 14.1 Annual commercial catches (t) of Striped Trumpeter south of latitude 39° 12'S. Data based on Tasmanian (General Fishing return), Victorian and Commonwealth catch returns.

	Catch (t)			
Year	Tasmania	Victoria	Commonwealth	Combined
1990/91	74.5	37.1		111.6
1991/92	58.2	36.8		95.0
1992/93	52.7	19.8		72.5
1993/94	56.5	16.0		72.5
1994/95	72.4	14.6		87.0
1995/96	60.3			60.3
1996/97	79.7		0.7	80.4
1997/98	75.4		5.7	81.1
1998/99	98.4		8.9	107.4
1999/2000	86.3		14.5	101.8
2000/01	41.2		7.5	49.6
2001/02	40.0		4.8	44.9
2002/03	36.8		3.2	40.0
2003/04	36.8		3.7	40.5
2004/05	24.0		2.2	26.2
2005/06	19.1		4.7	23.8
2006/07	18.8		3.5	22.3
2007/08	13.1		3.0	16.1
2008/09	10.5		2.8	13.3
2009/10	10.0		2.3	12.3
2010/11	15.0		4.8	19.8
2011/12	15.9		5.4	21.3
2012/13	12.3		5.1	17.4
2013/14	8.0		2.5	10.5
2014/15	9.6		3.4	13.0
2015/16	6.0		1.1	7.1
2016/17	8.3		4.0	12.3
2017/18	7.8		6.3	14.1
2018/19	4.5		2.6	7.1
2019/20	6.8		1.0	7.8
2020/21	6.2		1.9	8.2

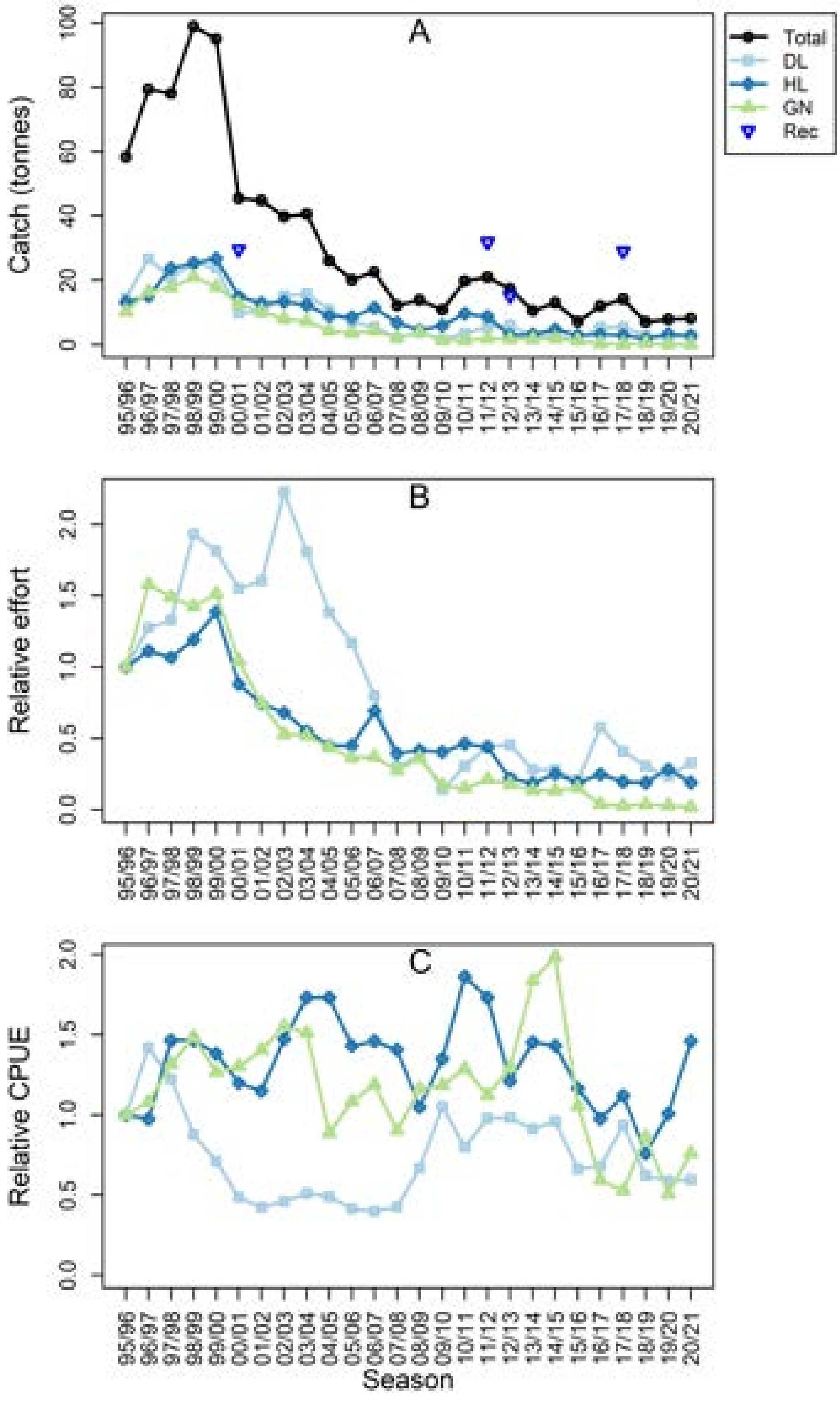


Figure 14.1 (A) Annual commercial Striped Trumpeter catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. DL = dropline, HL = handline, GN = gillnet, Rec = estimated recreational catch. Data include Commonwealth catch in state waters.

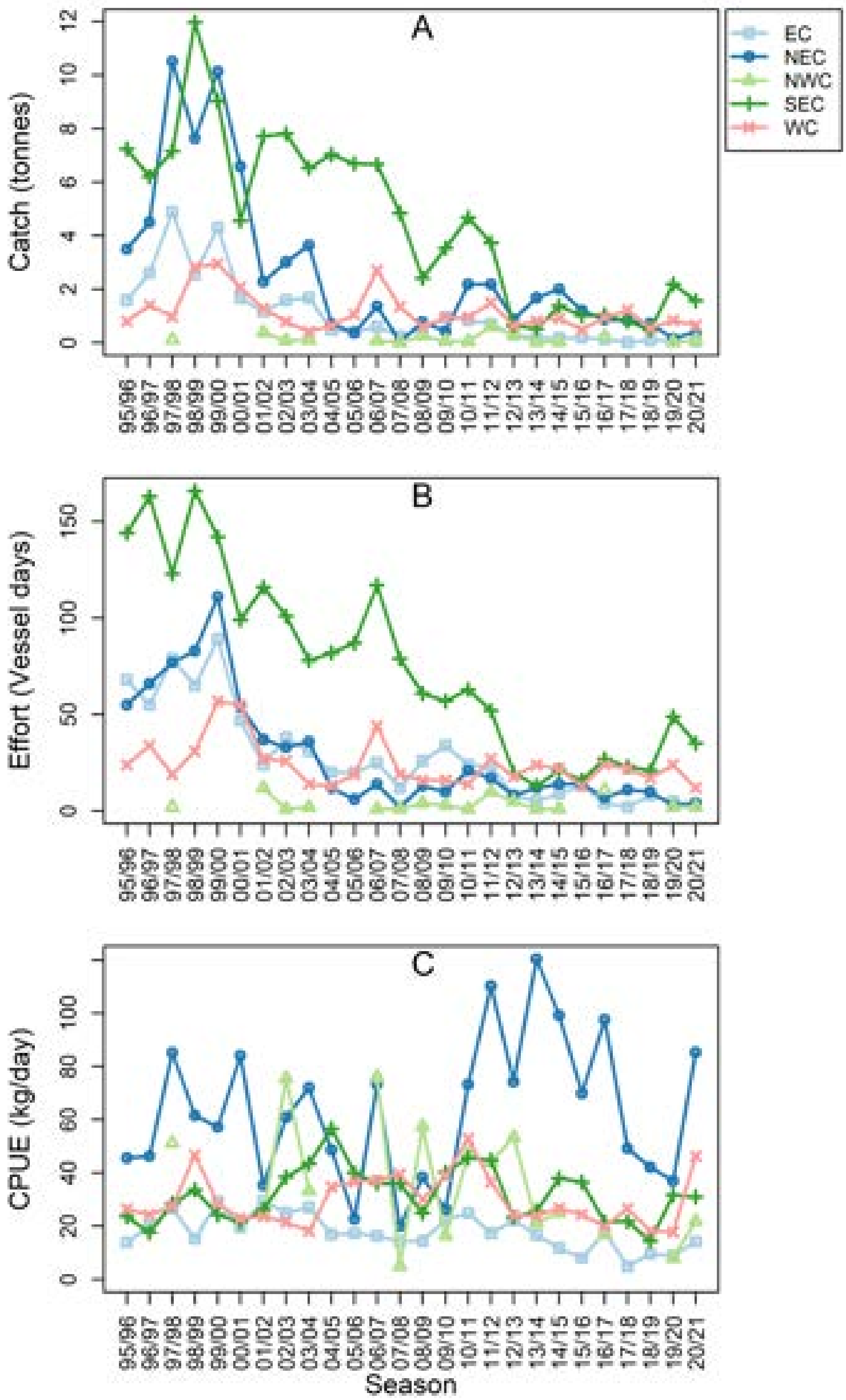


Figure 14.2 Regional commercial Striped Trumpeter catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for handline. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

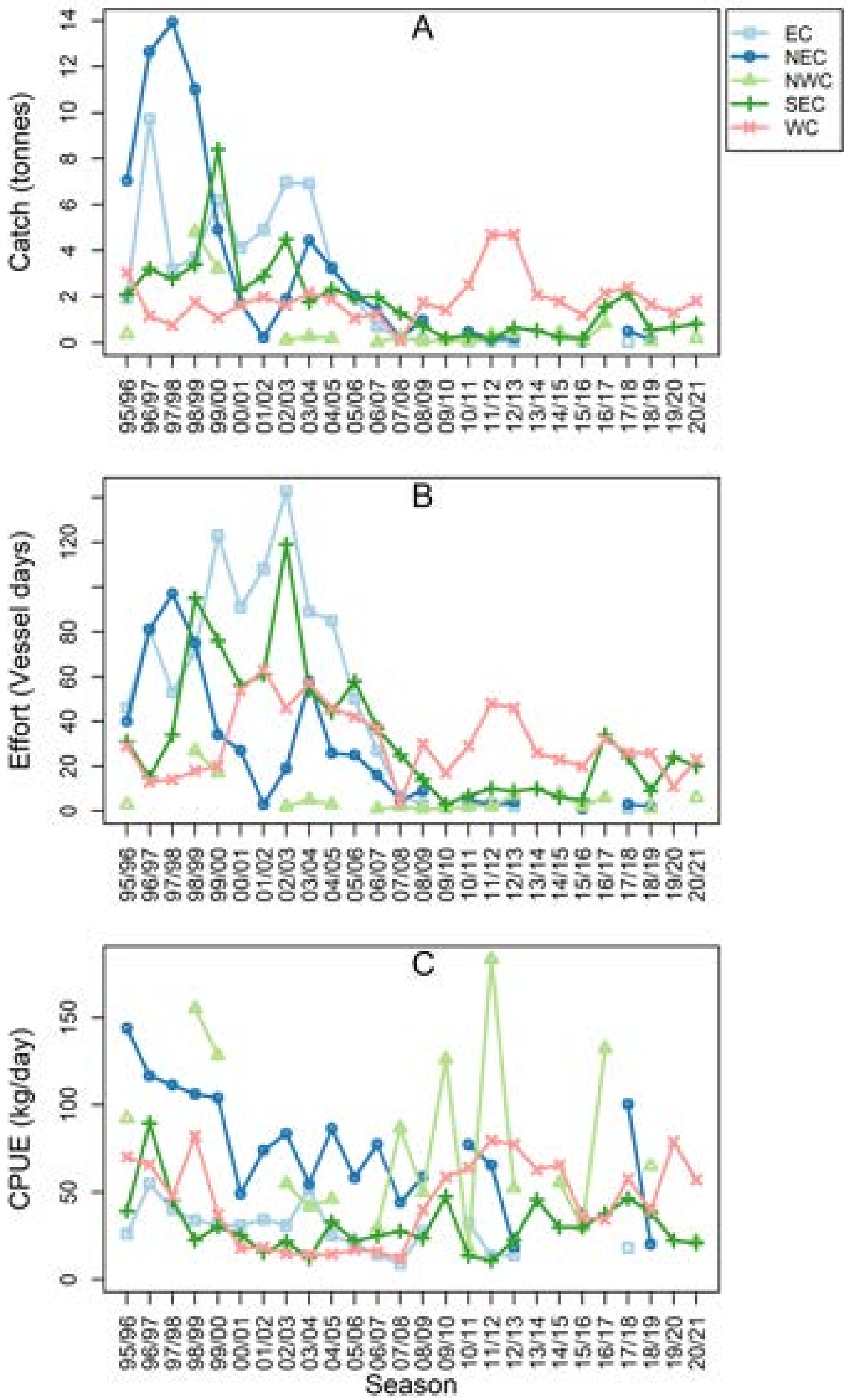


Figure 14.3 Regional commercial Striped Trumpeter catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for drop line. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

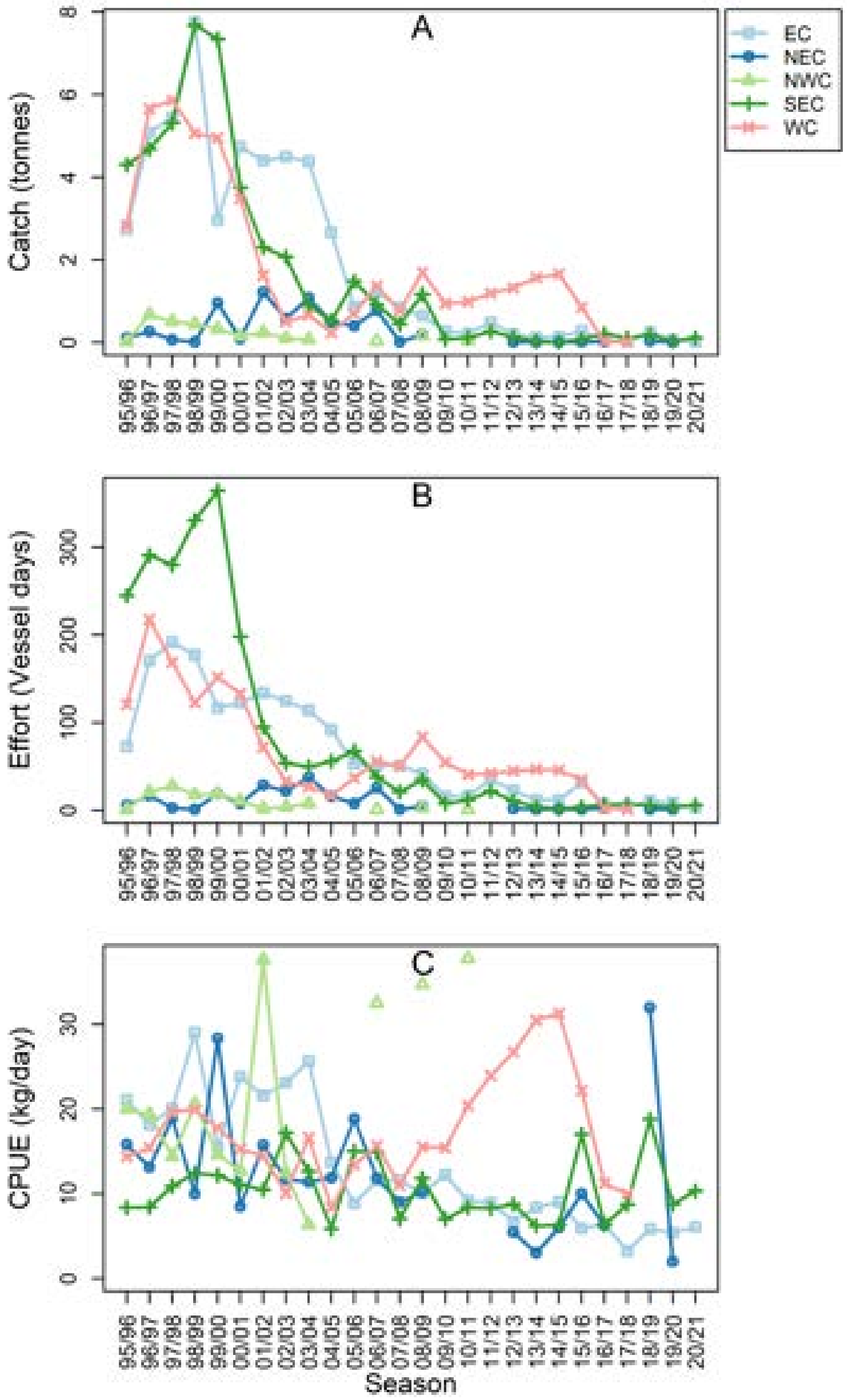


Figure 14.4 Regional commercial Striped Trumpeter catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for gillnet. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

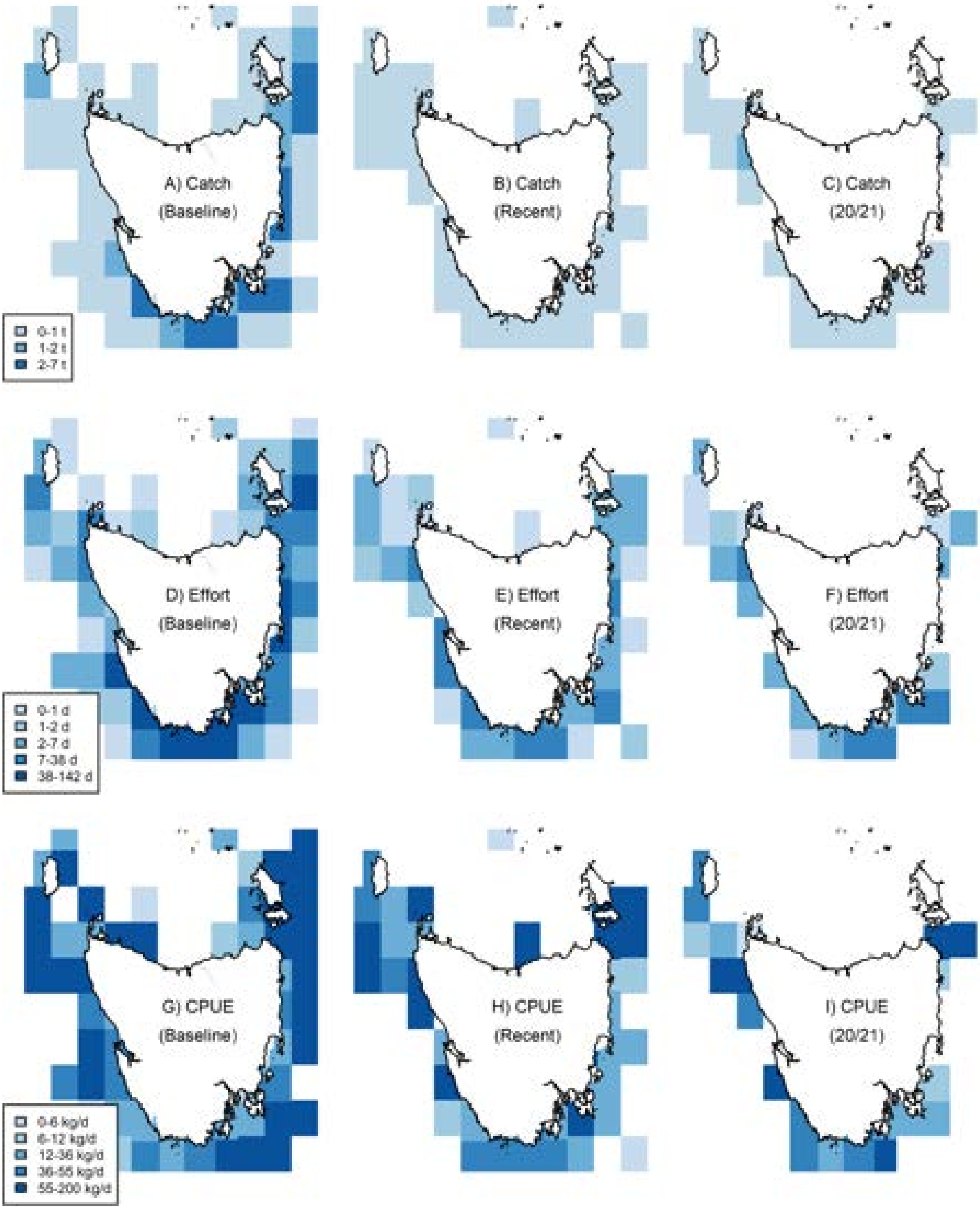


Figure 14.5 Striped Trumpeter catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

CMSY results

CMSY results based on the assumption of "very low" resilience suggest that the biomass of Striped Trumpeter might be depleted to 22.2% of unfished levels (lower 95% confidence = 11.1%) (Figure 14.6). Records of peak commercial catches between 1996/97 and 1999/2000 surpassed the estimated maximum sustainable yield of 69.3 t, but never exceeded the upper 95% confidence limit of 106.7 t. Since 2002/03, catches have been below the lower 95% MSY confidence interval of 44.0 t (Figure 14.7).

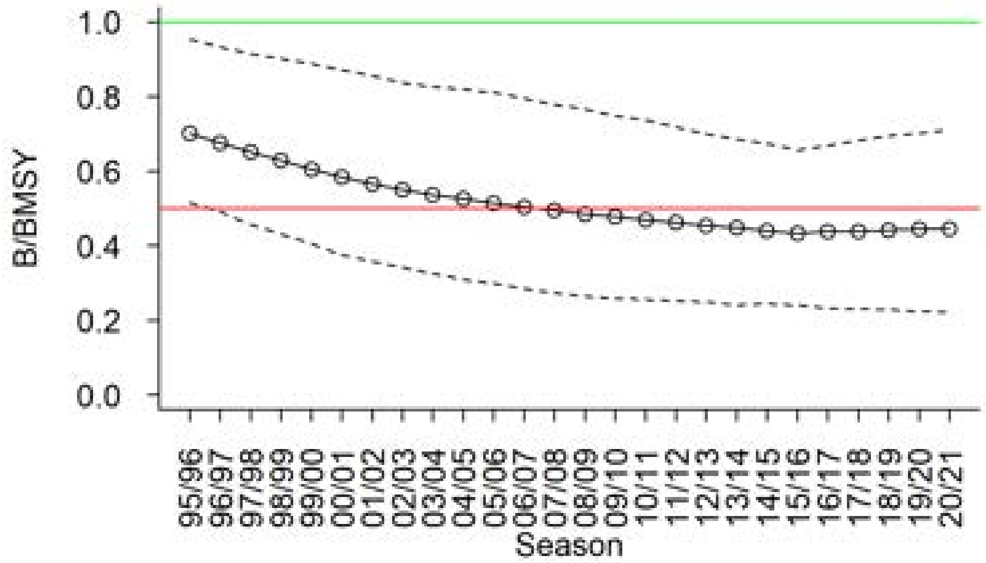


Figure 14.6 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

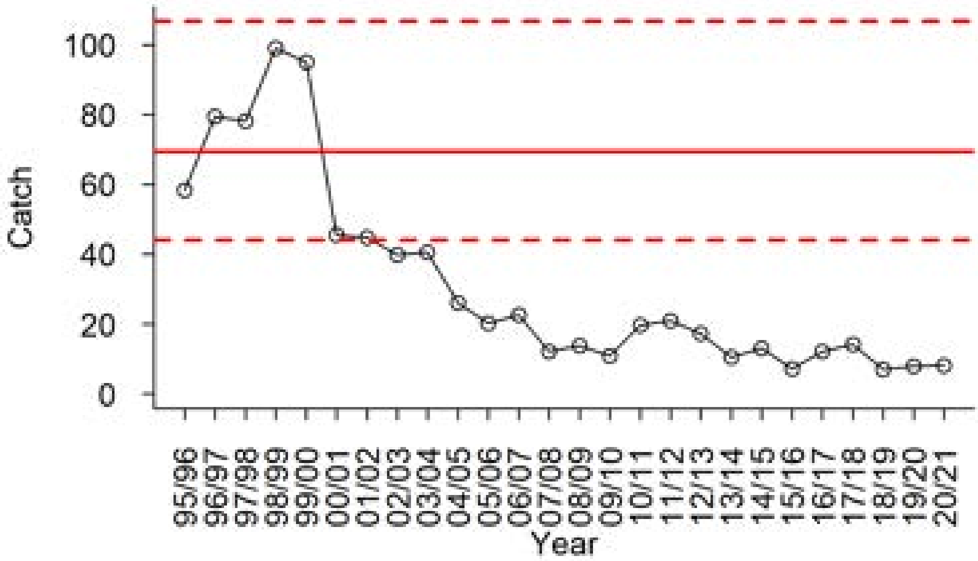


Figure 14.7 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Length and age frequency surveys

Length frequency composition

The length frequency distribution of Striped Trumpeter has been monitored since 1998/99. Sampling has been limited and opportunistic in some years, and consequently, some samples are unlikely to adequately represent population dynamics. Overall, there appears to have been a shortage of small fish (recruitment) up until 2009/10 (Figure 14.8). In 2009/10, new recruits appear to have entered the fishery, which has clearly contracted the range and median of lengths. From 2012/13 onwards, length frequency distributions have started to flatten again. The stabilising trend indicates an ageing population similar to the years before 2009/10, albeit with evidence of recruitment of smaller individuals in recent years (Figure 14.8A).

Age frequency composition

Age data, which has been collected along with length data from 1998/1999 onwards, showed trends very similar to those apparent from length data, revealing an increasing lack of young individuals (3–5-year-olds) up until 2009/10 (Figure 14.8). During this period, the population might have been sustained largely by strong year classes recruited during the 1990s. In 2009/10, new recruits appear to have contracted the age frequency distribution similarly to what was observed in the 1990s. Samples up until 2015/16 were then dominated by 4–6-year-olds, which is the age at which the species tends to recruit to the offshore line fishery. However, the relative strength of cohorts in samples is unknown and the number of individuals sampled between 2012/13 and 2015/16 was low. Previous assessments suggested that the adult segment of the population is likely to remain in a depleted state due to continued fishing under a lack of recruitment over many years. Some young fish have entered the population in recent years, but there is an overall trend of an ageing population similar to that observed in the years before 2009/10 (Figure 14.8B).

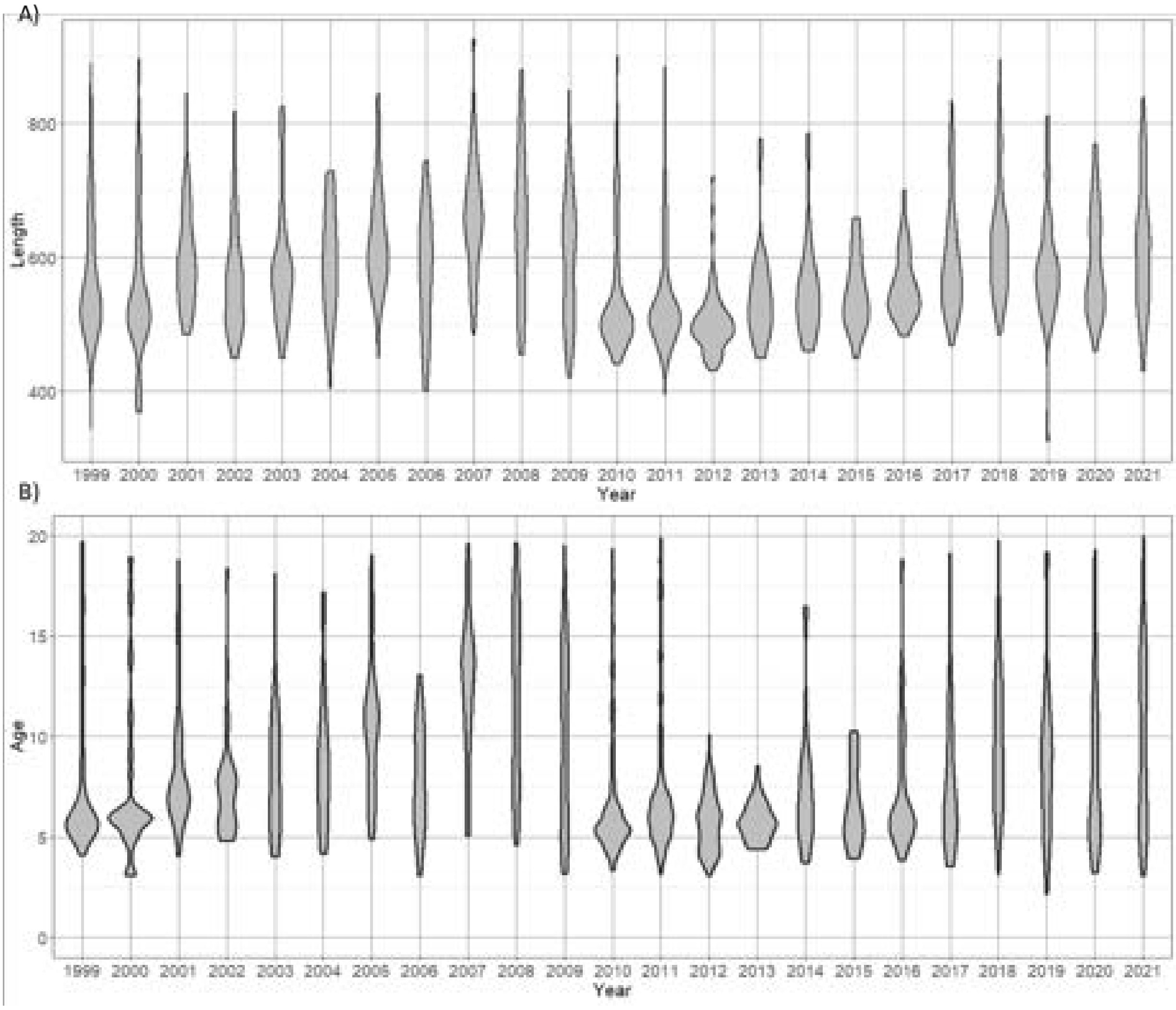


Figure 14.8 A) Striped Trumpeter length composition from 1998/99 (1999) to 2020/21 (2021) sampled from both commercial and recreational catches. Length is fork length in mm. B) Striped Trumpeter age composition between 1998/99 (1999) and 2020/21 (2021) sampled from both commercial and recreational catches. Age is in years. Note that, for clarity, the graph excludes individuals older than 20 years of age, which accounted for 4.6% of all samples.

Length-based assessments: stock status and trends

Life history, mortality and selectivity parameters estimated from survey data for length-based stock assessments (see Table 14.2) were closely aligned with previous reports (Krueck et al. 2020; Fraser et al. 2021). Results for females and males were so similar that data for both sexes were pooled and subsequent analyses based on a single set of VBGF, mortality and selectivity parameters (Figure 14.9), which is also in agreement with previous reports.

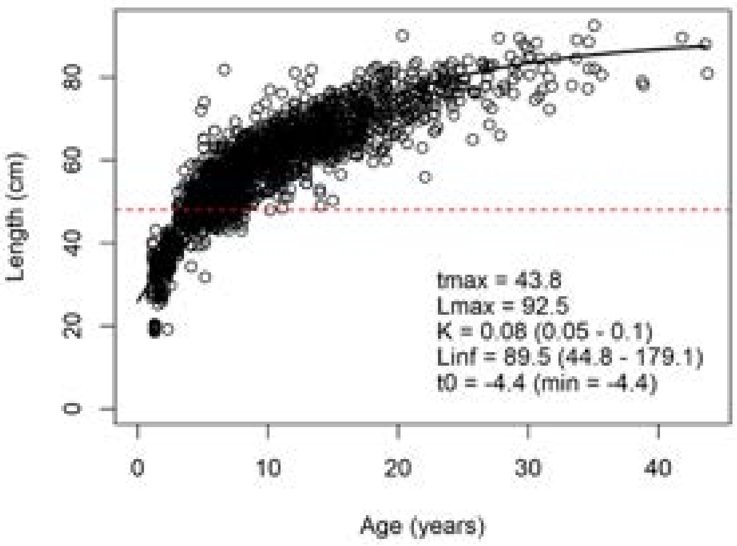


Figure 14.9 Estimates of von Bertalanffy life history parameters for Striped Trumpeter using age- and size frequency data from irregular surveys. *tmax*: maximum measured age; *Lmax*: maximum measured length; *Linf*: infinite or asymptotic length; *k*: von Bertalanffy growth rate; *t0*: theoretical age when length is zero. Values in brackets denote the parameter space explored to determine the best fit. Lengths are reported as fork length and the dashed red line marks minimum size limit (55 cm total length, i.e., approximately 48 cm fork length).

Table 14.2 Key parameters used for length-based assessments of stock status and trends. *Linf*: infinite or asymptotic length; *k*: van Bertalanffy growth rate; *M*: instantaneous rate of natural mortality; *M/k*: life history ratio that determines estimates of the unfished length-frequency distribution; *t0*: theoretical age when length is zero. Lengths are given in cm and represent fork length.

Region	**Sex**	**Linf**	***k***	**t0**	***M***	***M/k***
All regions	Pooled	89.5	0.08	-4.4	0.10	1.23

Outcomes from length-based catch curve regressions revealed an instantaneous rate of total annual mortality *Z* of 0.16 across all sampled regions and of 0.39 in the south-east coast region, which translates to approximately 15% and 32% adult mortality per year, respectively (Table 14.3). The instantaneous annual rate of fishing mortality was estimated at 0.06 and 0.29, respectively, indicating an annual adult mortality of 6% (all regions pooled) and 25% (south-east coast region) that is caused by fishing. In other words, fishing mortality was estimated to account for 78% of total annual deaths in the south-east coast region over recent years, or approximately three times as much as deaths due to natural causes (*M*). This estimated level of regional fishing mortality is high and unlikely to be sustainable. That is, with an estimated ratio of fishing mortality relative to natural mortality (*F/M*) of 2.9, with a 95% confidence interval of 1.3-4.5, fishing mortality far exceeds putatively sustainable levels of *F/M* between 0.5 and 1. The inclusion of survey data from other regions, including from the putatively largely unfished west coast region, resulted in reduced levels of estimated fishing mortality for all regions combined. However, more samples are needed for a regional breakdown of trends in fishing pressure.

Table 14.3 Estimates of recent total mortality (*Z*), fishing mortality (*F* = *Z*-*M*), and fishing mortality relative to natural mortality (*F*/*M*) based on length-based catch curve regressions using fishery-independent survey data over the last three years. The 95% confidence intervals are stated in brackets.

Region	Sex	*Z*	*F*	*F*/*M*
All regions	Pooled	0.16 (0.12-0.2)	0.06 (0.02-0.1)	0.6 (0.2-1)
South-east coast	Pooled	0.39 (0.23-0.55)	0.29 (0.13-0.45)	2.9 (1.3-4.5)

Both length-based stock assessment approaches were run using samples clustered for years up to 2010 and from 2011 to 2021 to meet minimum data requirements. Outcomes from the Length-based Bayesian Biomass (LBB) estimation approach supported the general findings above, suggesting that fishing mortality in the south-east coast-region over the last two decades was unsustainable (*F*/*M* > 2) while values across all regions (*F*/*M* = 1.2) were closer to the commonly assumed threshold for overfishing of 1 (see Table 14.4). Importantly, LBB outcomes further revealed that Striped Trumpeter stocks in the south-east coast region might be depleted, with *B*/*B0* estimated below the common limit reference point of 20% of unfished levels (Figure 14.10). This was not the case for all regions combined, again indicating that more comprehensive sampling is needed to help disentangle regional differences in stock status and trends for targeted management.

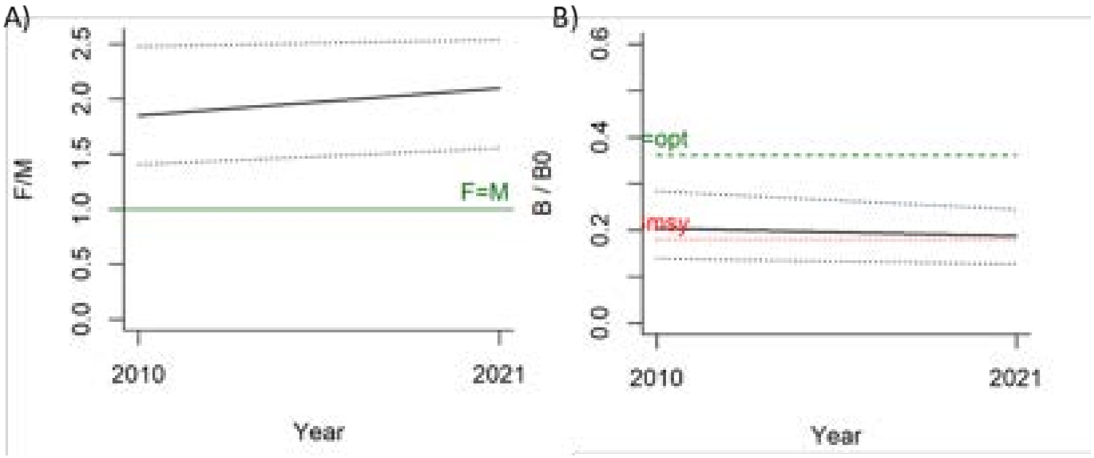


Figure 14.10 Estimates of relative fishing mortality (A) and biomass depletion (B) for Striped Trumpeter in the south-east coast region using the Length-based Bayesian Biomass (LBB) estimation approach. Fishing mortality relative to natural mortality (*F*/*M)* ratios of 1 are widely used as a threshold for overfishing (solid line in A). LBB (B) infers a biomass target reference point (dashed black line) where catch is predicted to equal the maximum sustainable yield (Bmsy; i.e., *B* where *F* = *M* and mean length at first capture (*Lc*) is optimal). A limit reference point that indicates biomass depletion is highlighted by the red dotted line at 0.5 Bmsy.

Table 14.4 Estimates of relative fishing mortality *F*/*M* and biomass depletion *B*/*B0* of Striped Trumpeter in the south-east coast region using the Length-based Bayesian Biomass (LBB) estimation approach.

Region	Sex	*F*/*M* 2011-2021	*B*/*B0* 2011-2021
South-east coast	Pooled	2.1 (1.6-2.5)	0.19 (0.13-0.24)
All regions	Pooled	1.2 (0.89-1.7)	0.31 (0.19-0.45)

Outcomes from the Length-Based Spawning Potential Ratio (LBSPR) estimation approach, which was run using the same year clustering, revealed very similar results, indicating a high fishing mortality and depleted spawning potential in the southeast coast region (Table 14.5).

Table 14.5 Estimates of relative fishing mortality (F/M) and spawning potential ratio (SPR/SPR0) of Striped Trumpeter using the Length-Based Spawning Potential Ratio (LBSPR) estimation approach. 1.

Region	Sex	*F*/*M* 2011-2021	*SPR*/*SPR0* 2011-2021
South-east coast	Pooled	2.79 (2.29-3.29)	0.12 (0.1-0.14)
All regions	Pooled	1.38 (1.19-1.57)	0.25 (0.22-0.28)

Risk assessment of recruitment impairment

The Striped Trumpeter fishery scored < 60 in the risk analysis, failing assessment with high risk of recruitment impairment and stock damage. Striped Trumpeter has low productivity – large (up to 1.2 m), long lived (up to 43 years) (Tracey and Lyle 2005), relatively slow to mature (Tracey et al. 2007), and occupying a high trophic level (Nichols et al. 1994), albeit with high fecundity (Battaglene and Cobcroft 2007). Striped Trumpeter is highly susceptible to capture by the fishery. Fishing activity overlaps with > 30% of the known range of Striped Trumpeter in Tasmanian waters. The minimum legal size limit for Striped Trumpeter in Tasmania (55 cm total length) is below the species' size at maturity (females: 62 cm total length; males: 61 cm total length) and data indicate that the age and size structure of the stock have been impacted. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

Stock status	**DEPLETED**

Sharp declines in commercial catches since 2000/01 gave reason for concerns about the status of Striped Trumpeter stocks. Several management measures have since been implemented to address these concerns. For example, a spawning season closure during September and October (not recognised by the Commonwealth managed sector), when fish are particularly vulnerable to capture, was introduced in 2009. Additionally, a bag limit of four fish and a boat limit of 20 fish was implemented to help to constrain recreational harvest.

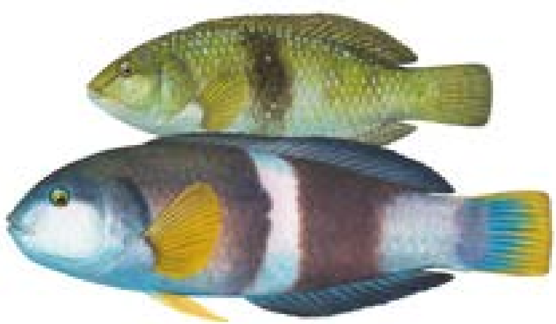
The 2017/18 assessment highlighted the presence of 4–6-year-old individuals between 2010 and 2016, providing indication of recruitment after a prolonged period of limited or no recruitment. This observation led to the stock status of Striped Trumpeter being revised from

Undefined to Transitional-Recovering to Recovering. The status as Recovering was maintained in 2018/19, but changed to Depleted in 2019/20 given a higher level of uncertainty and lack of evidence for a positive stock trajectory. In 2020/21, there are still no signs of population recovery, indicating that even current levels of catch could risk further depleting the spawning biomass and recruitment potential of the stock. Moreover, first estimates of stock status using length-based assessments for data-poor conditions indicate that the spawning biomass in major fishing areas on the south-east coast might be depleted below critical levels. The recreational sector is of particular concern in this respect, given that it represents an increasingly significant proportion of the total catch (estimated at 67% for 2017/18). Research undertaken during 2010 highlights that the current minimum size limit (55 cm TL) is still below the estimated size at maturity (> 60 cm TL). Aligning the size limit with the assumed size at maturity should allow more fish to spawn before they become vulnerable to capture, thus, likely increasing spawning biomass and recruitment potential. Increasing the minimum size limit should also help discourage high grading, which is likely to result in high discard mortality as fishers seek to maximise the weight of their catch under a reduced bag limit.

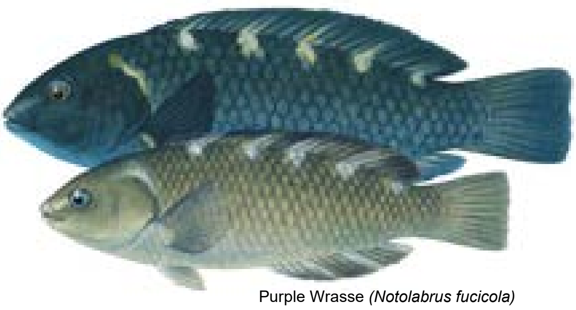
On the basis of the evidence presented above, Striped Trumpeter are classified as a Depleted stock.

Wrasse (*Notolabrus* spp.)
Bluethroat Wrasse (*Notolabrus tetricus*)
Purple Wrasse (*Notolabrus fucicola*)

STOCK STATUS	**SUSTAINABLE**
Catches, effort and CPUE of Wrasse have remained relatively stable for almost a decade, providing little reason for concern that the current level of fishing pressure is too high. Uncertainty remains over levels of potential localized depletion, and about the size of the catch taken by rock lobster fishers for use as bait. Relatively low catches over the last two seasons have likely been caused by a combination of COVID impacts and changes in fishery dynamics.	
IMPORTANCE	Key
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment; catch-only based assessments of biomass depletion and maximum sustainable yield.
MANAGEMENT	State (Tasmania)



Bluethroat Wrasse *(Notolabrus tetricus)*
Illustration©R.Swainston/anima.fish



Purple Wrasse *(Notolabrus fucicola)*
Illustration©R.Swainston/anima.fish

Two species of Wrasse are taken commercially in Tasmanian waters: *Notolabrus tetricus* (Bluethroat Wrasse) and *Notolabrus fucicola* (Purple Wrasse). The two species have only been distinguished in catch data since 2007, despite their different size, depth, and tendency to be captured by different gear. Both species are protogynous hermaphrodites, with all individuals beginning life as females and some undergoing a sex inversion after maturity. Both Wrasse are reef-associated and are targeted primarily using fish traps (mainly Purple Wrasse) and handline (mainly Bluethroat Wrasse). Live fish trade is the main interstate market for Wrasse, while the local market comprises dead Wrasse for rock lobster bait and some human consumption. The live-fish fishery has accounted for > 90% of total reported catches since 2001/02 and there is no significant recreational fishery for these species. More detailed information on biological characteristics and current management of Wrasse fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Bluethroat and Purple Wrasse have a long history of commercial fishing in Tasmania, but the two species have only been separated in fishery returns data since 2007/08. Previous stock assessment reports show estimates of Wrasse catches prior to 2007/08 (Fraser et al. 2021).

From 2007/08 to 2018/19, Bluethroat Wrasse catches showed an increasing trend, with a peak of 64.3 t in 2014/15, before a steep decline in 2019/20 and 2020/21 (Figure 15.1A). Bluethroat Wrasse catch in 2020/21 was 26.3 t. Purple Wrasse catches have generally been lower than Bluethroat Wrasse catches, showing a declining trend from 2008/09, an increase to 21.4 t in 2017/18, and a steep decline in 2019/20 and 2020/21 (Figure 15.5A). Purple Wrasse catch in 2020/21 was only 7.3 t. Steep declines in catches of both species in 2019/20 and 2020/21 are likely due to the impact of the COVID-19 pandemic on live fish markets, with widespread restaurant closures and restricted air freight.

Lower catches of both species since the late 2000s were accompanied by a decline in the use of fish traps that resulted from the prohibition of abalone gut usage as bait. This prohibition was a response to the appearance of the abalone viral ganglioneuritis in Victoria and forced fishers to seek alternative, but less effective baits.

Catch and effort for fish traps have been at low and declining levels for over a decade (Figure 15.1B, Figure 15.5B). Fish trap CPUE has fluctuated during this period, showing a general increasing trend for both species (Figure 15.1C, Figure 15.3C, Figure 15.5C, Figure 15.7C). Handline catch, effort, and CPUE for both species have been relatively stable or slightly increasing over the last decade (Figure 15.1, Figure 15.5).

Wrasse traded dead and used as bait in rock lobster pots have been historically under-reported. These data are not included in the catch data described above.

With Bluethroat Wrasse being more susceptible to line fishing methods and Purple Wrasse more vulnerable to trap capture, Bluethroat Wrasse are now taken in larger quantities in the live fishery. Gillnets account for the bulk of the remaining catch, but because survival in nets is poor, gillnet caught Wrasse are rarely marketed live.

In recreational survey data, the two Wrasse species have not been distinguished. However, given Bluethroat Wrasse represent ~70% of commercial catch and Purple Wrasse ~30%, it can be assumed for rough approximation that the species' relative proportion in recreational catches is similar. Combined recreational Wrasse catches have typically represented about 10% of total Wrasse catch (Lyle 2005; Lyle et al. 2009; Lyle et al. 2014b; Lyle et al. 2019) - see the 2019/20 Scalefish Fishery Assessment report for trends (Fraser et al. 2021). Thus, neither Wrasse species is considered to be an important recreational target species. Bluethroat Wrasse are a reasonably common by-catch species of recreational gillnet fishers, with research showing that this species has a moderate to low post-release survival, particularly when gillnets are deployed for more than 4 hours (Lyle et al. 2014a).

Wrasse are reef-associated species and it is important to note that state-wide analyses are insensitive to changes in abundance at the level of individual reefs at which the fishery might impact stocks. Regional shifts in effort over the years (Figure 15.2, Figure 15.6, Figure 15.4, Figure 15.8) may have masked localised depletions, with fishers moving to new lightly fished areas to maintain catches and CPUE.

Bluethroat Wrasse

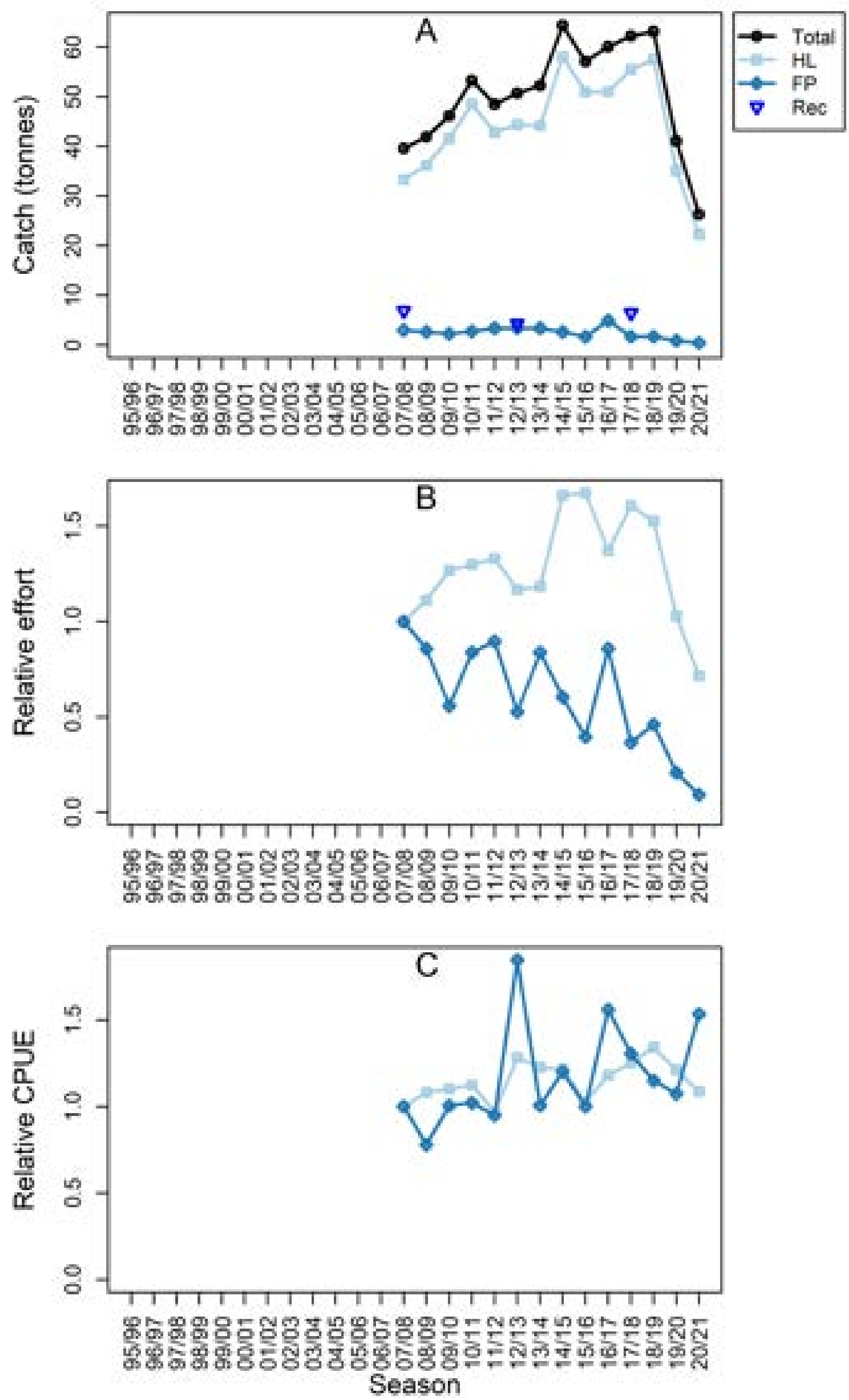


Figure 15.1 (A) Annual commercial Bluethroat Wrasse catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 2007/08; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 2007/08. HL = handline, FP = fish trap, Rec = estimated recreational catch.

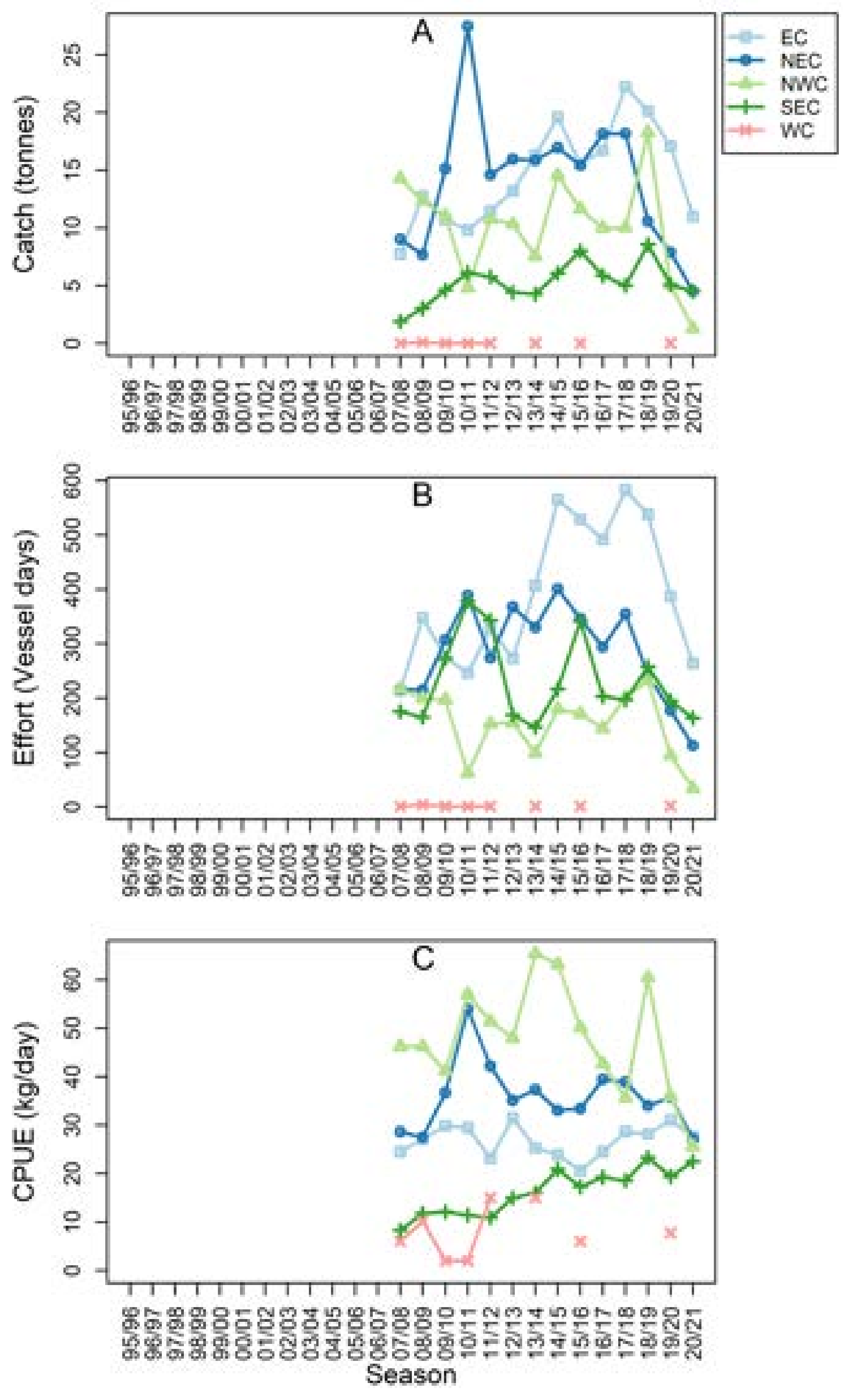


Figure 15.2 Regional commercial Bluethroat Wrasse catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for hand line. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

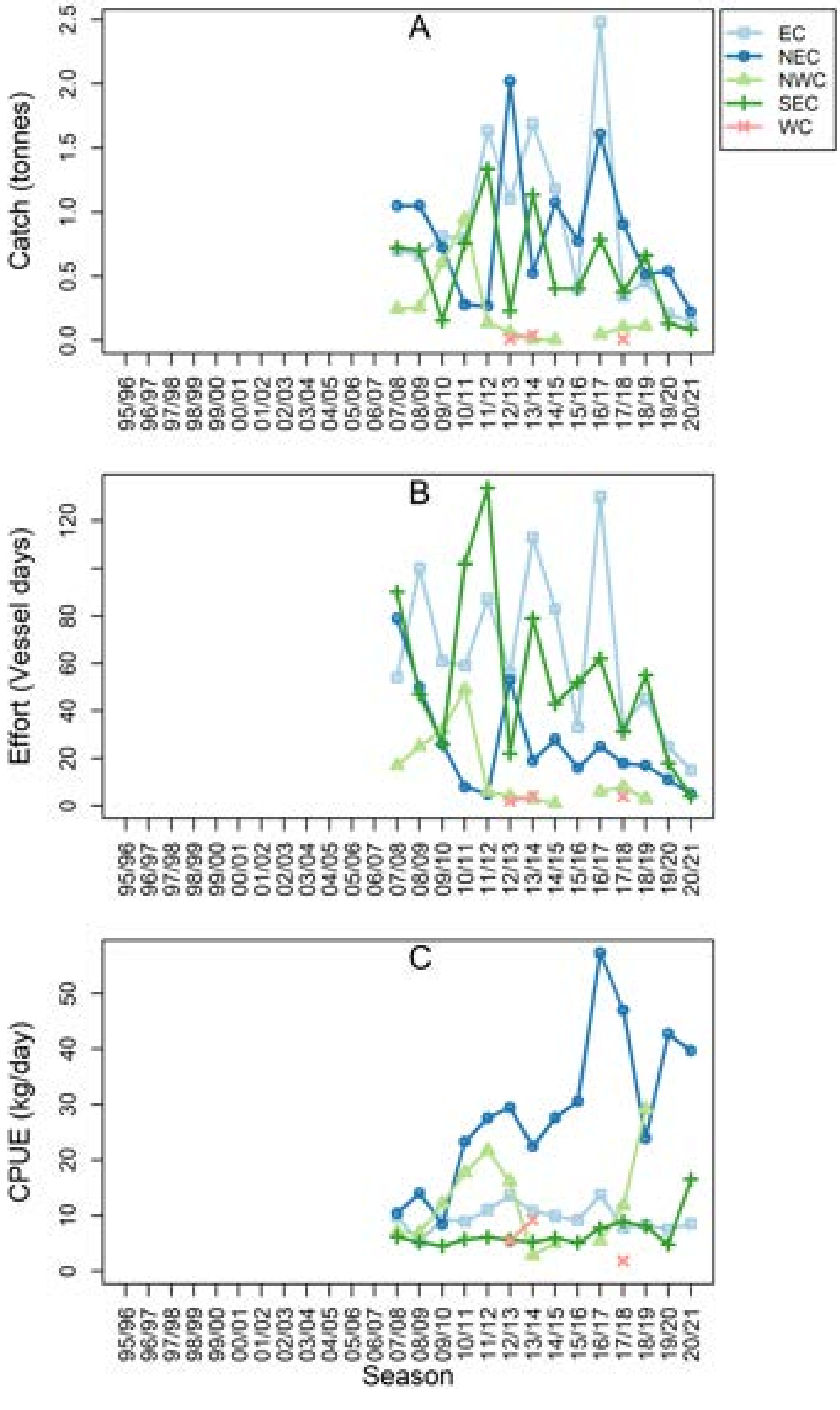


Figure 15.3 Regional commercial Bluethroat Wrasse catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for fish trap. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

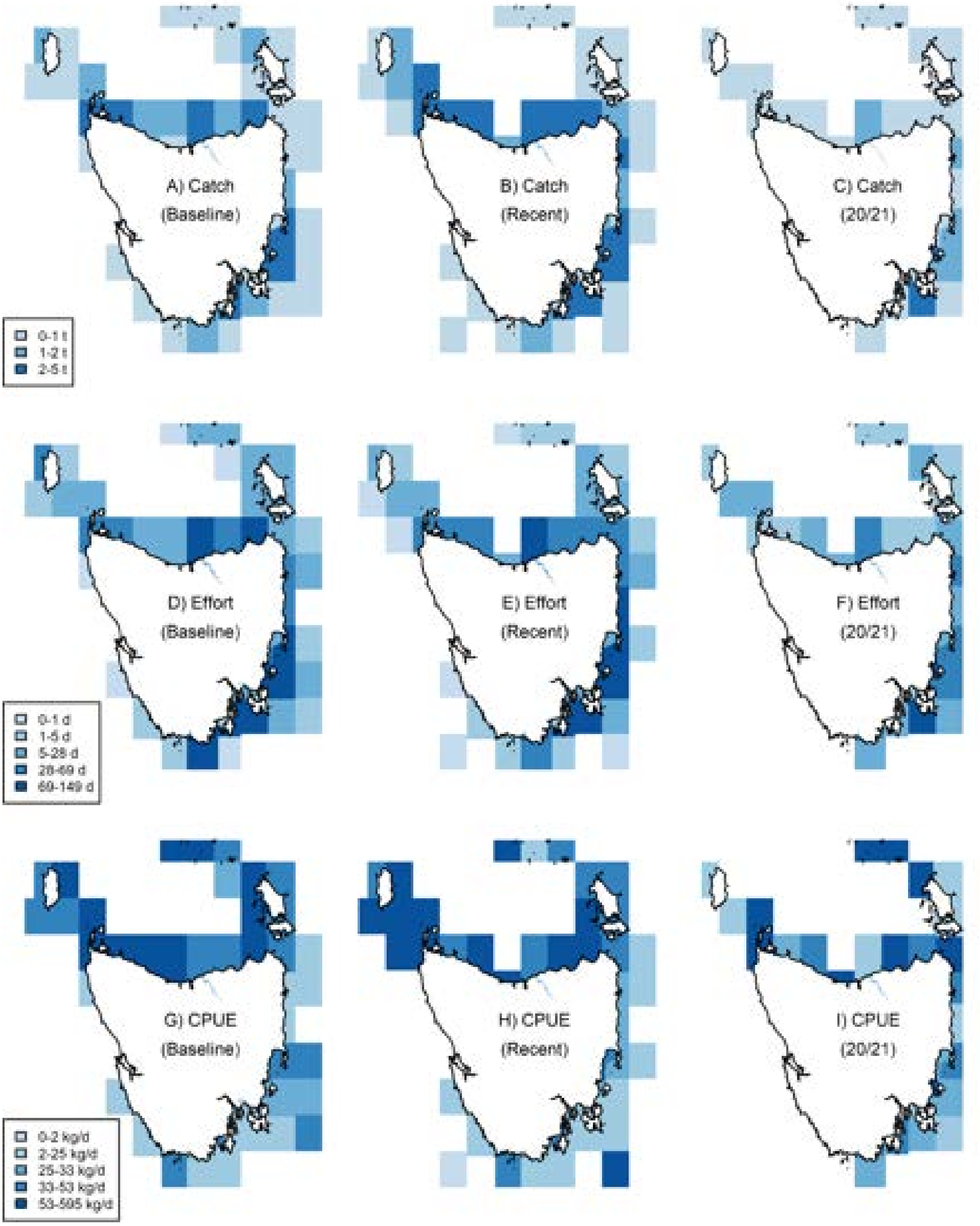


Figure 15.4 Bluethroat Wrasse catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (2007/08 to 2016/17 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Purple Wrasse

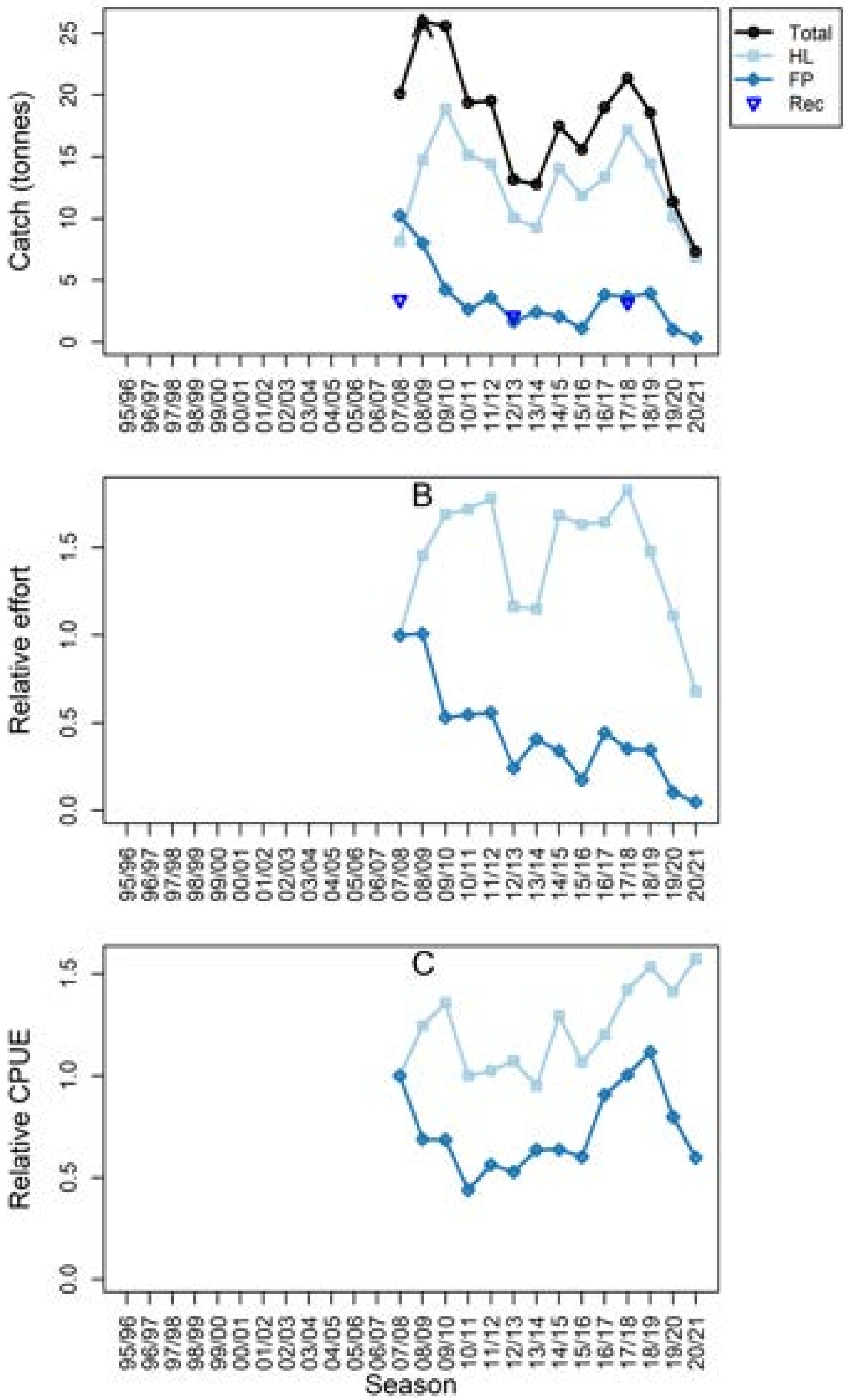


Figure 15.5 (A) Annual commercial Purple Wrasse catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 2007/08; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 2007/08. HL = handline, FP = fish trap, Rec = estimated recreational catch.

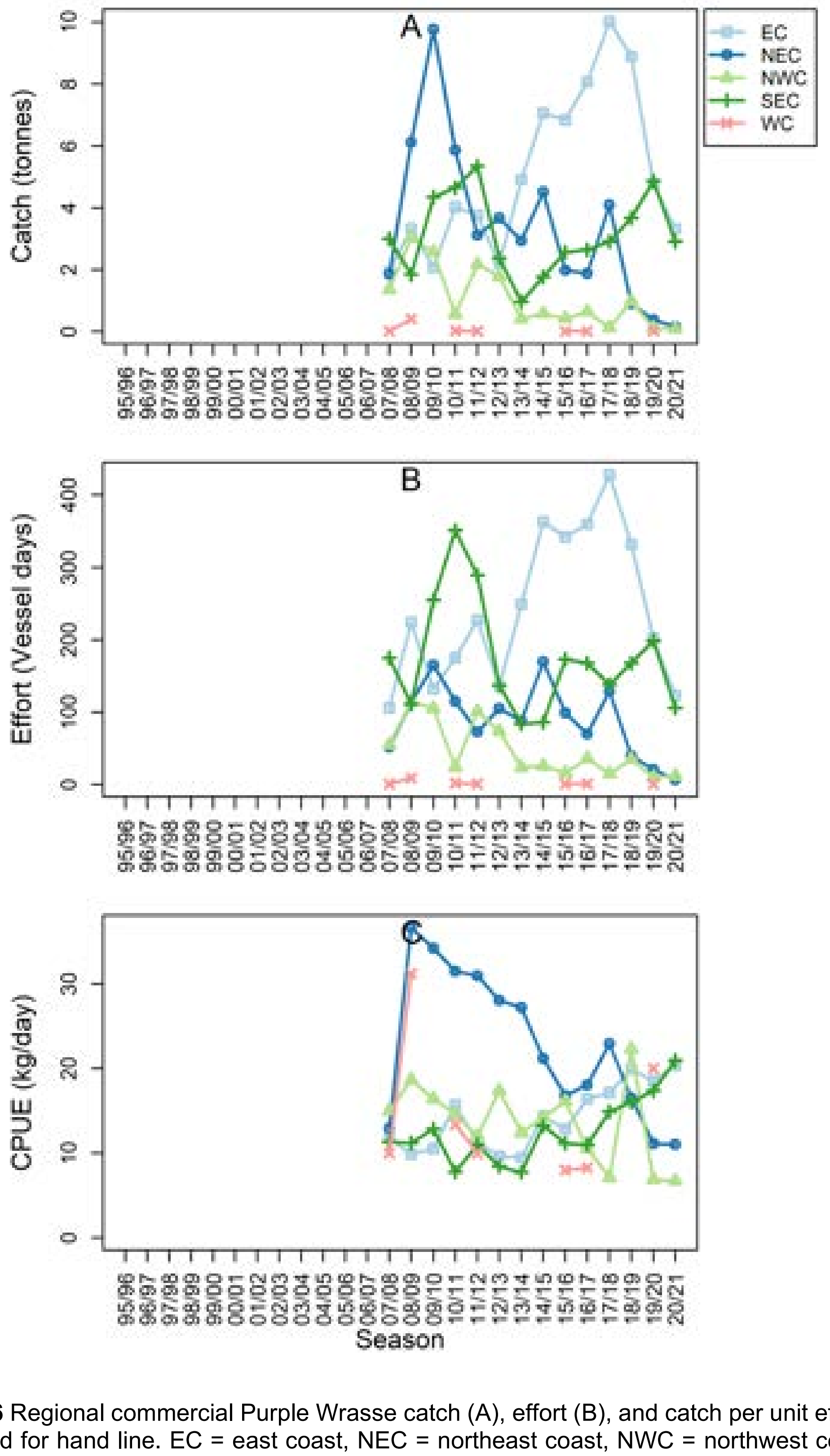


Figure 15.6 Regional commercial Purple Wrasse catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for hand line. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

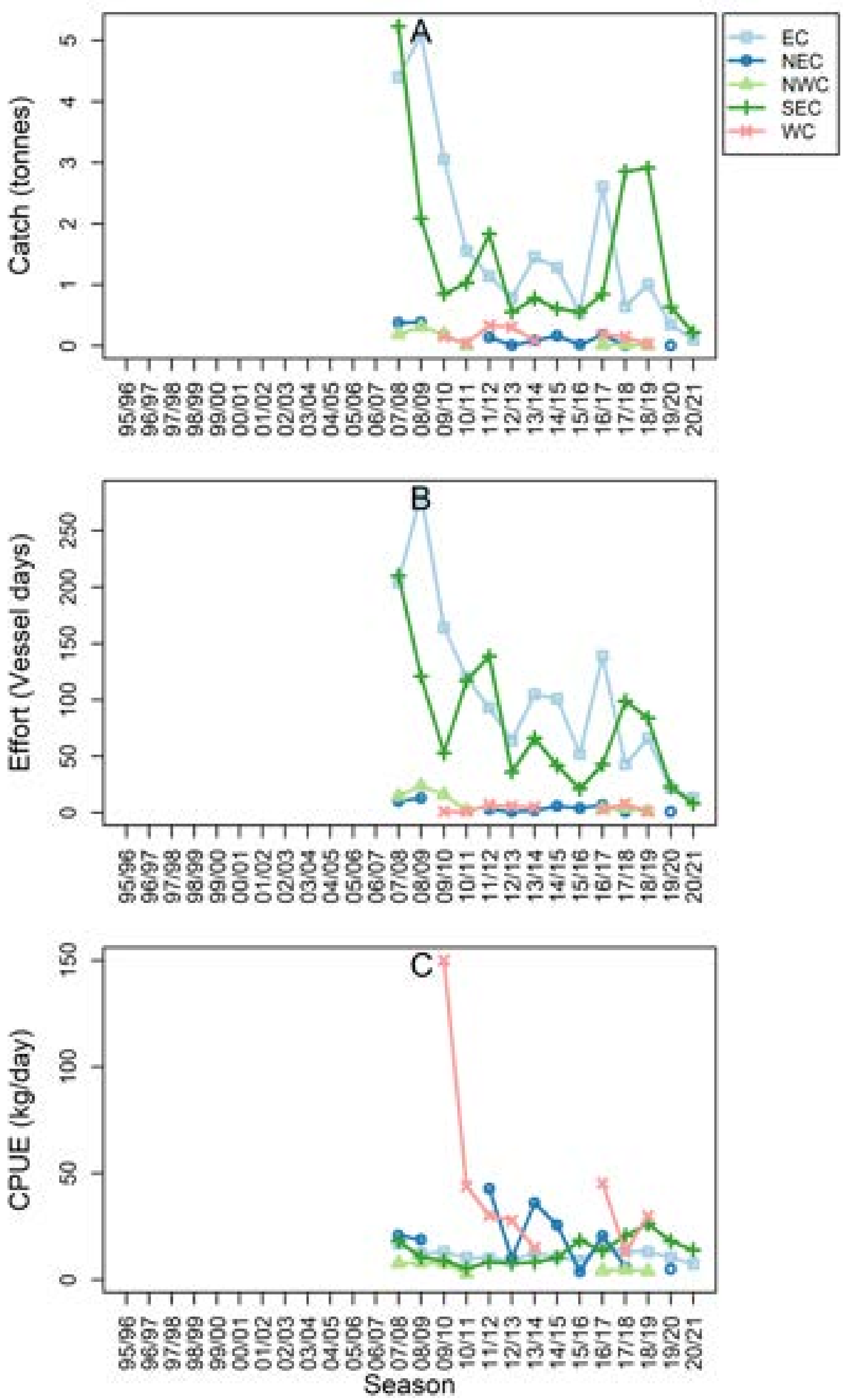


Figure 15.7 Regional commercial Purple Wrasse catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for fish trap. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

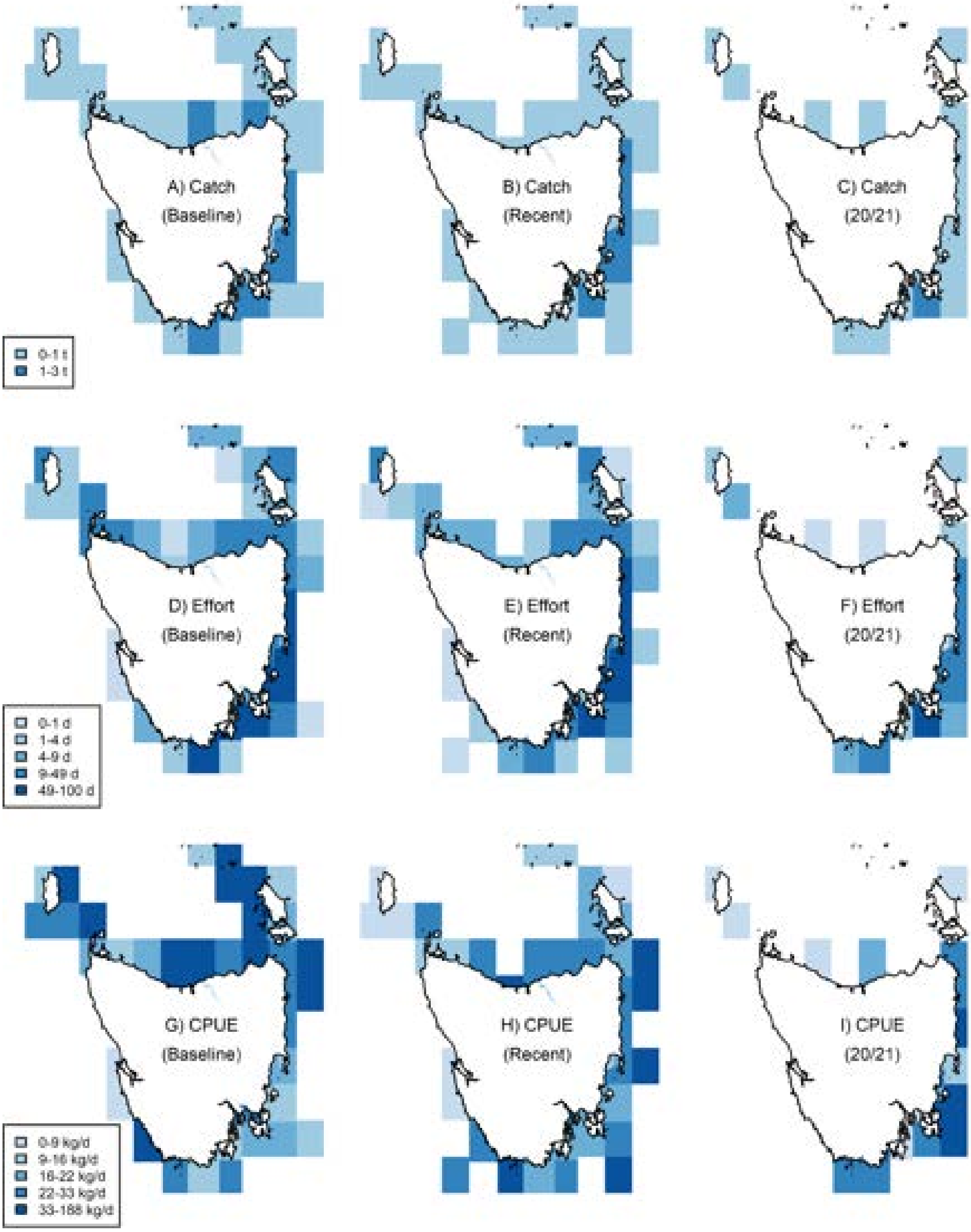


Figure 15.8 Purple Wrasse catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (2007/08 to 2016/17 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

CMSY results

Bluethroat Wrasse

CMSY results based on the assumption of “low” resilience suggest that Bluethroat Wrasse biomass might be depleted to 47.7% of unfished levels (lower 95% confidence interval = 33.4%) (Figure 15.9), which is close to the common target reference point for BMSY of 50% of unfished levels. Recorded catches were close to the estimated maximum sustainable yield (MSY) of 50.5 t, never surpassing the upper 95% confidence interval of 69.9 t) and only falling below the lower 95% confidence interval of 36.5 t in 2020/21, presumably due to recent COVID impacts on market demand (Figure 15.10).

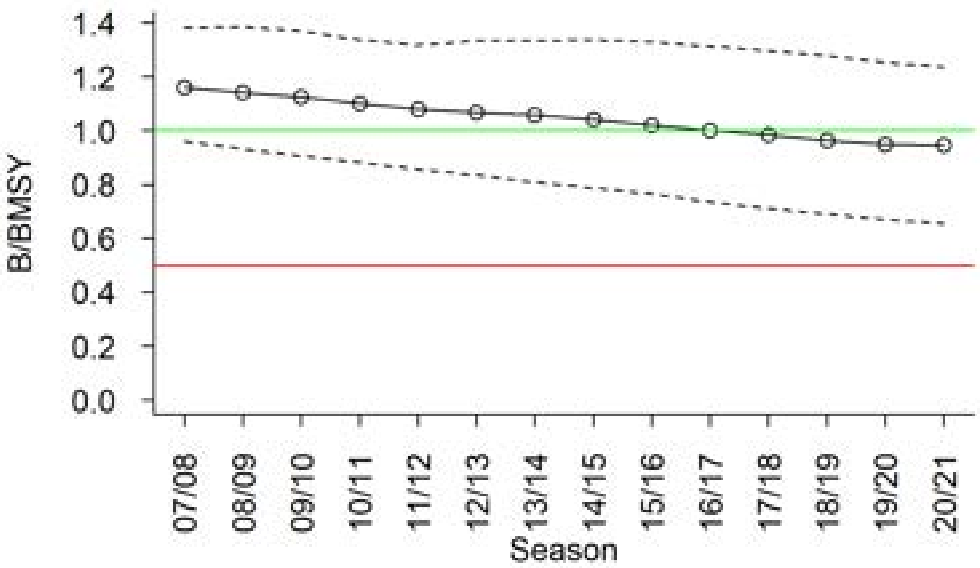


Figure 15.9 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

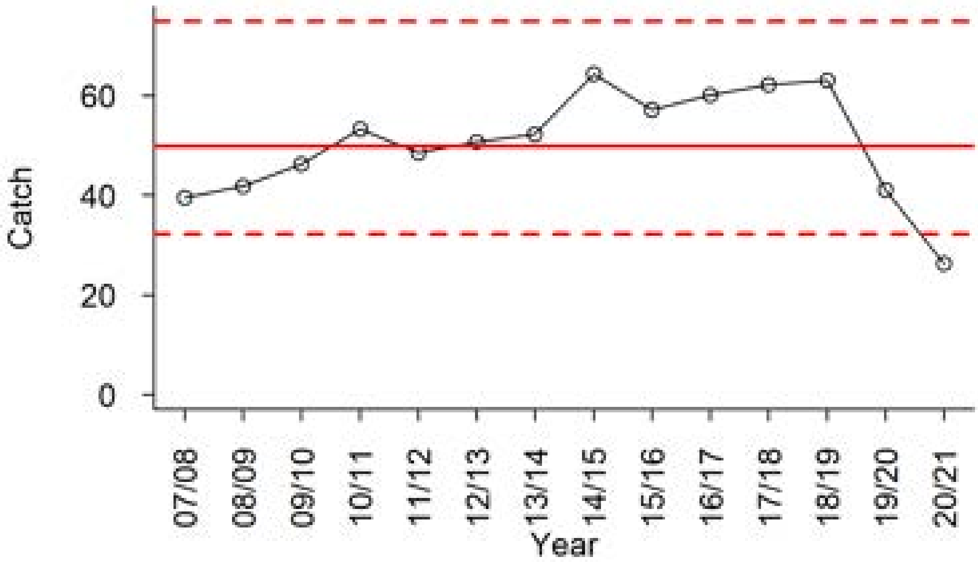


Figure 15.10 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Purple Wrasse

CMSY results based on the assumption of "low" resilience suggest that Purple Wrasse biomass might be depleted to 46.0% of unfished levels (lower 95% confidence interval = 30.8%) (Figure 15.11), which is close to the common target reference point for BMSY of 50% of unfished levels. Catch has been fluctuating around the estimated maximum sustainable yield of 18.6 t, and never surpassed the upper 95% confidence interval of 26.5 t. Similar to Bluethroat Wrasse, catch has fallen below the lower 95% confidence interval of 13.3 t in the most recent two seasons presumably due to COVID impacts on markets (Figure 15.12).

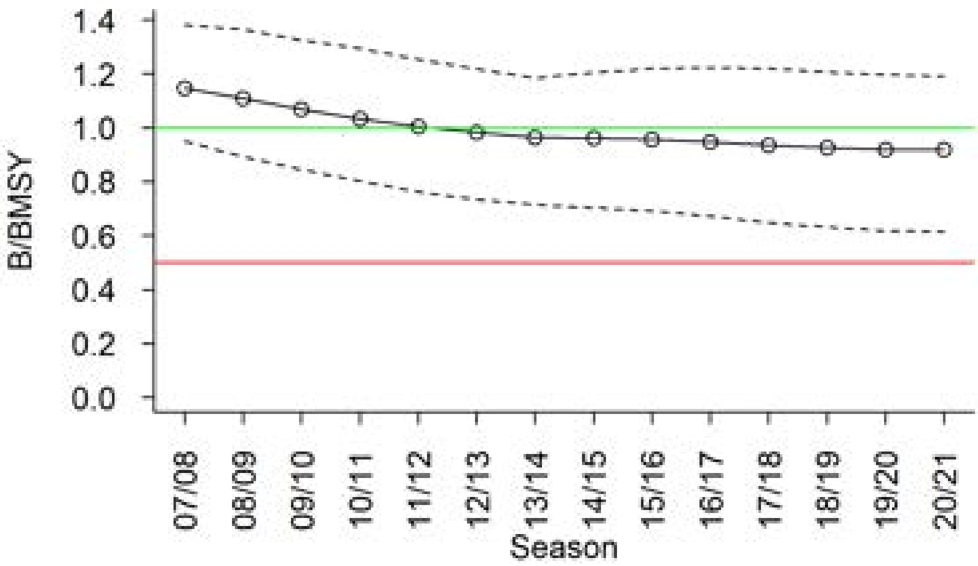


Figure 15.11 Trends in estimated biomass depletion (circles; biomass divided by the biomass supporting the maximum sustainable yield, i.e., 50% of unfished levels) and associated confidence intervals (dashed line). The green line indicates B equals BMSY, which is a common target reference point. The red line indicates a common limit reference point, which is half the biomass assumed to deliver the maximum sustainable yield.

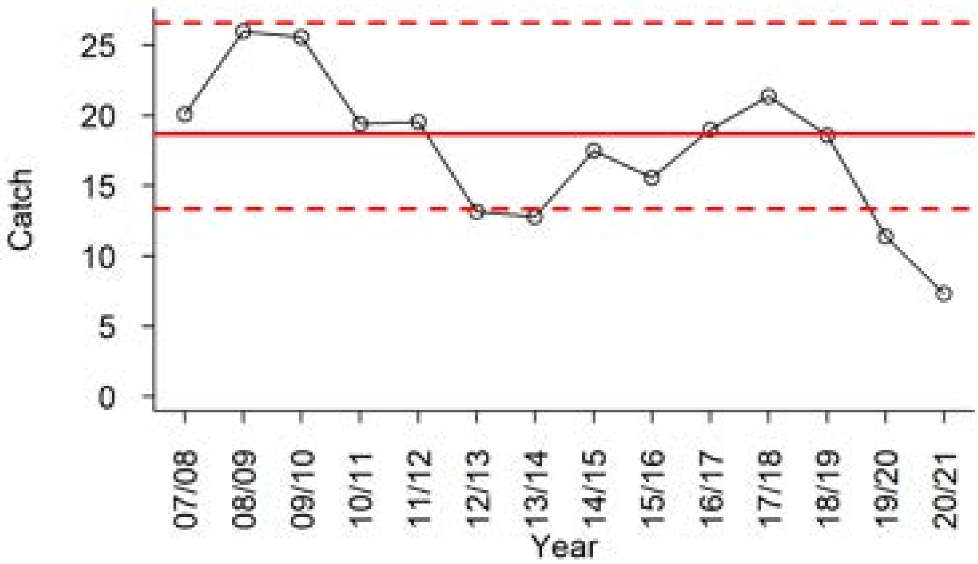


Figure 15.12 Trends in catch (tonnes; circles) relative to estimated maximum sustainable yield. Continuous red line indicates maximum sustainable yield; dashed lines represent 95% confidence intervals.

Risk assessment of recruitment impairment

Bluethroat Wrasse

The Bluethroat Wrasse fishery scored > 80 in the risk analysis, passing assessment with low risk of recruitment impairment and stock damage. Bluethroat Wrasse is a productive species

– slow to mature, moderately short lived (< 11 years) (Barrett 1995), relatively small (Edgar 2008), highly fecund (Smith et al. 2003) but occupying a relatively high trophic level (Shepherd and Clarkson 2001). This species is moderately susceptible to capture by the fishery with high (> 30%) overlap of fishing effort and known distribution in Tasmanian waters, and a limited chance of juveniles being captured. CPUE has remained relatively stable or increasing across the state, suggesting the fishery has not significantly impacted the stock. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

Purple Wrasse

The Purple Wrasse fishery scored > 80 in the risk analysis, passing assessment with low risk of recruitment impairment and stock damage. Purple Wrasse is a productive species – a small fish (Edgar 2008), quick to mature (Harwood and Lokman 2006) but relatively long lived (< 24 years) (Welsford 2003), highly fecund (Harwood and Lokman 2006), but occupying a relatively high trophic level (Denny and Schiel 2001). Like Bluethroat Wrasse, Purple Wrasse is moderately susceptible to capture by the fishery. Fishing effort overlaps with > 30% of the known distribution of the species in Tasmanian waters and there is some chance that juveniles will be captured. There is no evidence that the fishery has significantly impacted the stock. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

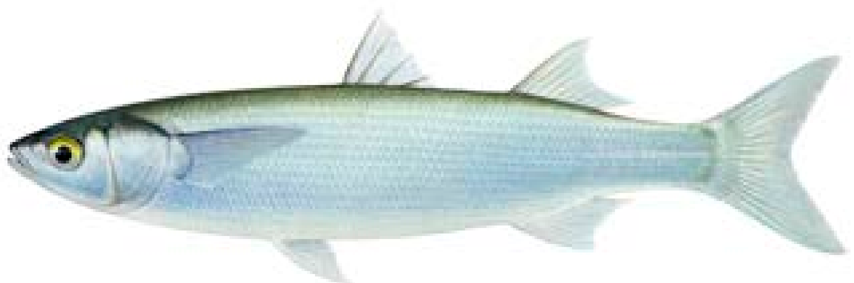
Stock status	**SUSTAINABLE**

The minimum size limit for Wrasse should provide protection for several years from reaching maturity to spawning age for Purple Wrasse and for female Bluethroat Wrasse. Male Bluethroat Wrasse, in contrast, develop from sex change typically after they have entered the fishery. This situation, along with the fact that male Wrasse are strongly site-attached and have a higher catchability (being more aggressive than females), suggests that males are most vulnerable to fishing.

Past underwater visual census surveys revealed contrasting results about the abundance of Wrasse in fished and easily accessible sites (e.g., areas near boat ramps) vs. protected sites (Stuart-Smith et al. 2008; Walsh et al. 2017), highlighting the possibility that localised fishing pressure could deplete resident populations and spawning potential. Previous assessments have shown that increasing catches up to 2006/07 reflected a strong interest in the species and was associated with concerns that fishing mortality might not be sustainable given notable declines in CPUE. Thus, close monitoring of potential localised depletion is recommendable, especially in areas where effort is known to be concentrated. However, with the exception of COVID-19 induced changes in market-demand over the last two years, state-wide catch and CPUE have been relatively stable or increasing for more than a decade, providing overall little concern that current levels of fishing mortality are too high. Both Wrasse species are therefore classified as Sustainable.

Yelloweye Mullet (*Aldrichetta forsteri*)

STOCK STATUS	SUSTAINABLE
Yelloweye Mullet are most abundant in estuarine habitats, where netting is prohibited or restricted, which provides this species a high degree of protection throughout most of its range in Tasmania. Commercial logbook records indicate consistently low levels of catch. Thus, it is overall unlikely that the stock is recruitment impaired or that the current fishing pressure could cause the stock to become recruitment impaired in the future.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends; risk assessment of recruitment impairment.
MANAGEMENT	State (Tasmania)



Yelloweye Mullet (*Aldrichetta forsteri*)
Illustration©R.Swainston/anima.fish

Yelloweye Mullet is a schooling species that inhabits shallow (≤20 m), sheltered waters over sand and seagrass, with highest abundances recorded in estuaries (Edgar 2008). Yelloweye Mullet are occasionally targeted commercially using beach and purse seine nets as well as small mesh nets. The vast majority of commercial Mullet catch in Tasmanian waters is Yelloweye Mullet; however, some catch may include Sea Mullet (*Mugil cephalus*). Recreationally, Yelloweye Mullet are targeted using rod and line or small mesh gillnets ('mullet nets'). More detailed information on biological characteristics and current management of Yelloweye Mullet fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Commercial Mullet catches peaked in 1999/2000 at 4.9 t, and again in 2012/13 at 4.4 t. Aside from these peaks, catches have shown a decreasing trend and have generally been less than 2 t since 2006/07 (Figure 16.1A). The commercial Mullet catch in 2020/21 was only 0.8 t (Figure 16.1A).

Beach seine has historically been the dominant fishing gear used to harvest Mullet, but small mesh nets started to increase in relative importance in 2010/11 and were responsible for higher albeit very small catches than beach seine in 2020/21 (Figure 16.1B). Recent fishing activity for both main gear types has been concentrated on the northeast and northwest coasts (Figure 16.2, Figure 16.3, Figure 16.4), while the southeast coast was also important historically for beach seine (Figure 16.2, Figure 16.4).

Recreational catch estimates for Mullet have generally been substantially higher than commercial catches (Figure 16.1) (Lyle 2005; Lyle et al. 2009; Lyle et al. 2014b; Lyle et al. 2019). Thus, the recreational fishery represents a more considerable source of impact on Mullet than the commercial fishery.

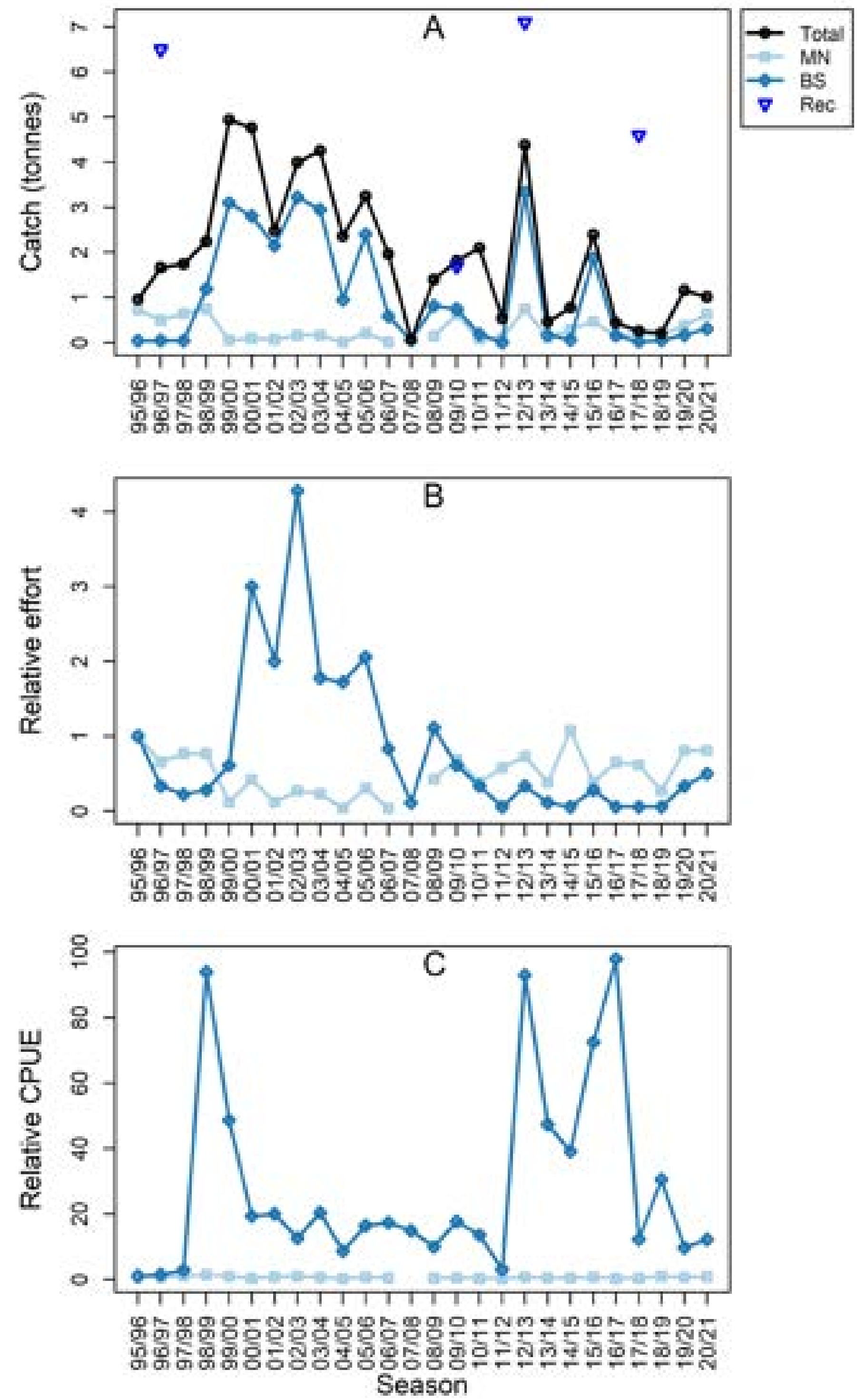


Figure 16.1 (A) Annual commercial Yelloweye Mullet catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort

(CPUE) based on weight per days fished relative to 1995/96. MN = small mesh net, BS = beach seine, Rec = estimated recreational catch.

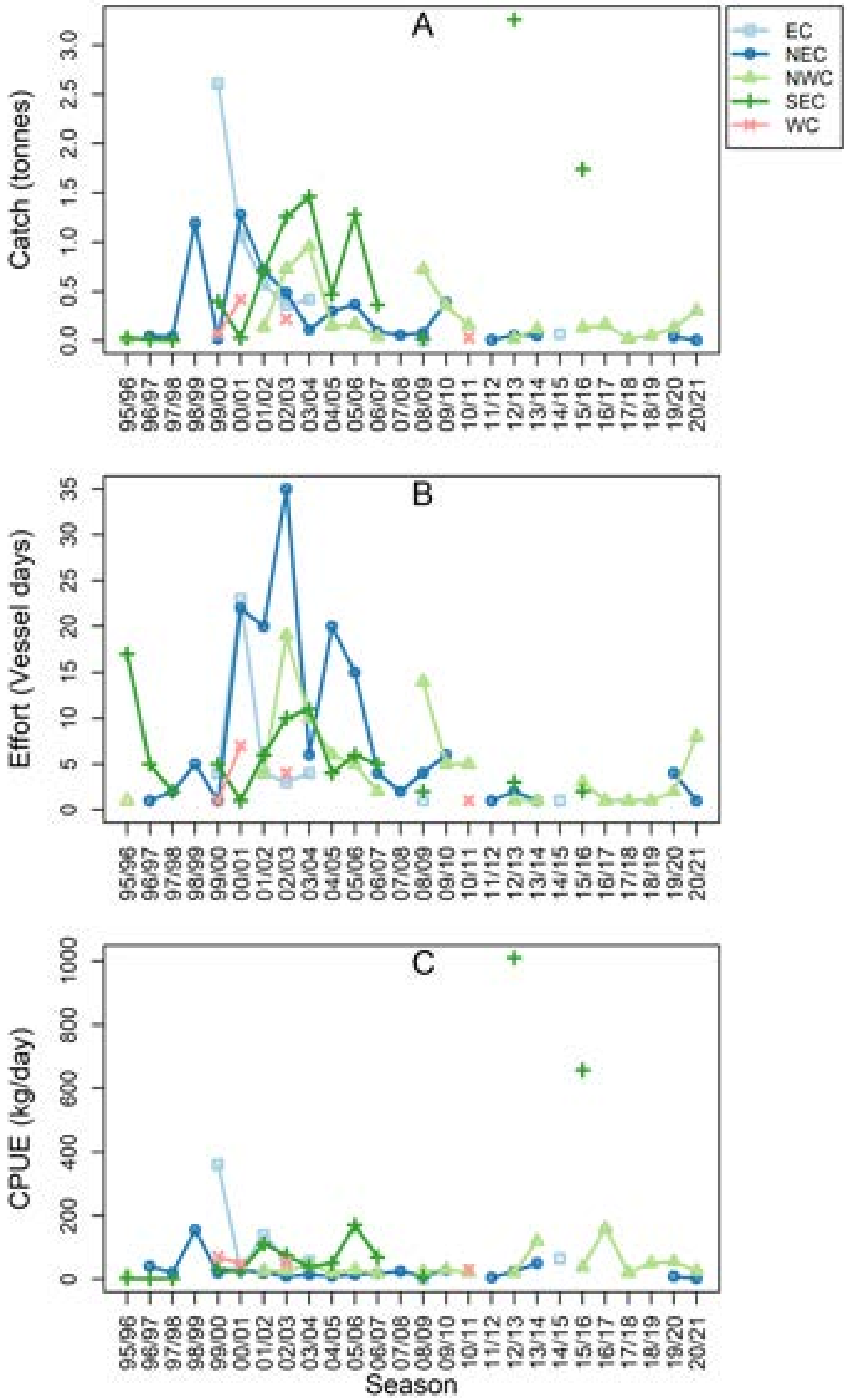


Figure 16.2 Regional commercial Yelloweye Mullet catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for beach seine. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

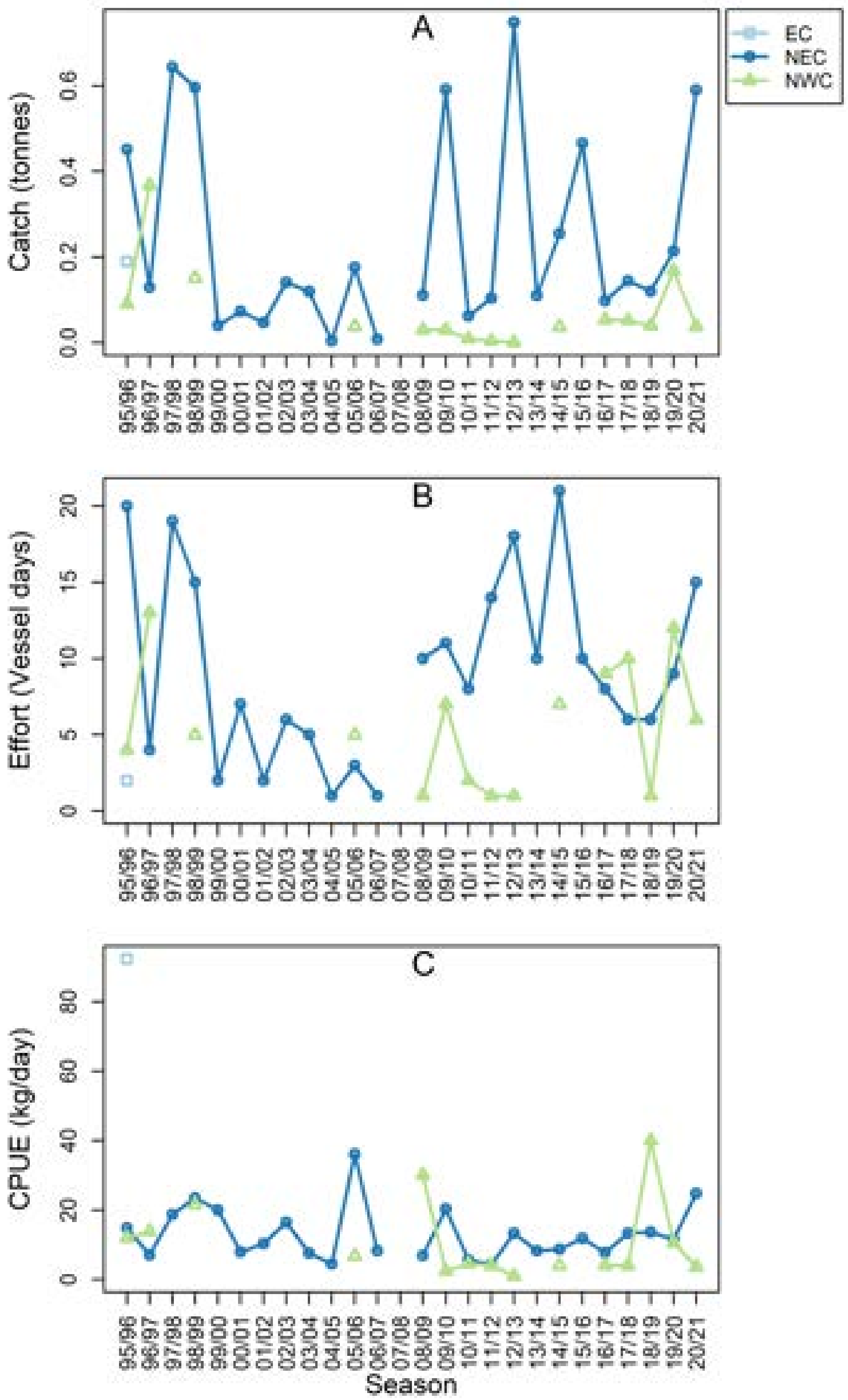


Figure 16.3 Regional commercial Yelloweye Mullet catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for small mesh net. EC = east coast, NEC = northeast coast, NWC = northwest coast.

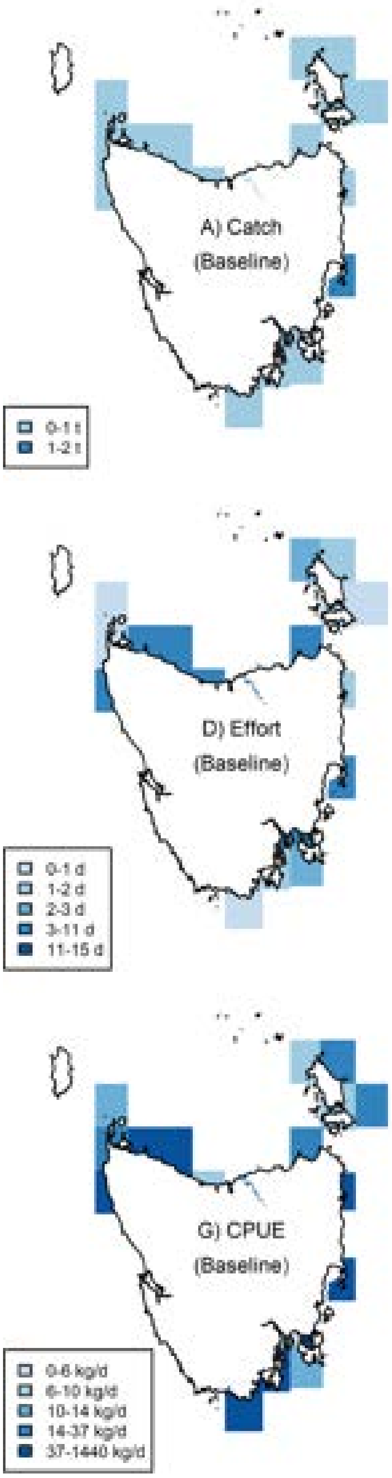


Figure 16.4 Yelloweye Mullet catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Risk assessment of recruitment impairment

The Yelloweye Mullet fishery scored > 80 in the risk analysis, passing assessment with low risk of recruitment impairment and stock damage. Yelloweye Mullet is a highly productive species – a small (Edgar 2008), short-lived fish (Curtis and Shima 2005) that is quick to mature and highly fecund (Chubb et al. 1981), occupying a relatively low trophic level (Edgar 2008; Carscallen et al. 2012). As a schooling species, Yelloweye Mullet is moderately susceptible to capture by the beach seine fishery. However, the ban on netting in most estuaries, the spawning habitat for this species and the habitat in which Yelloweye Mullet is most abundant, significantly reduces the risk of capture. Relatively low levels of beach seine effort since 2006/07 suggest the current fishery poses a low risk to this species. Detailed information on the scoring that led to this assessment outcome is available from the TasFisheriesResearch webpage.

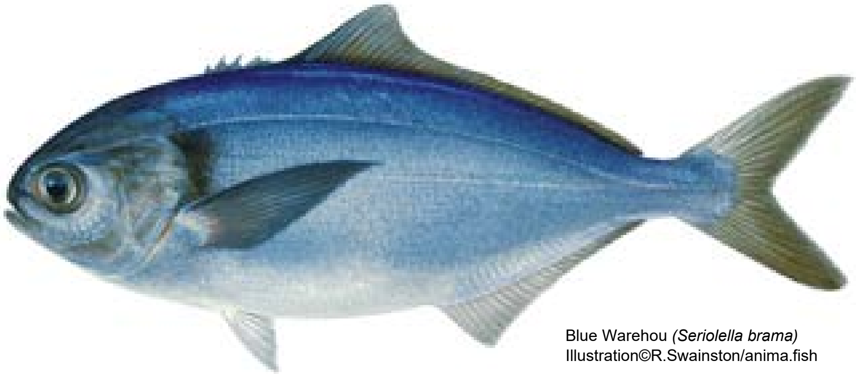
Stock status	**SUSTAINABLE**

Yelloweye Mullet are the most abundant mullet species in southern Australia, and are highly abundant in Tasmanian estuaries (Edgar 2008). Catches of Mullet (predominantly Yelloweye Mullet) have been relatively stable at low levels across the time series of commercial logbook records. Limited commercial fishing and no recreational gillnetting occurs in most Tasmanian estuaries, meaning that the species experiences a high degree of protection throughout much of its range. Recreational catches are the main source of fishing mortality for Yelloweye Mullet (>90% of total fishing mortality in 2017/18), but total catches on the order of 5 t are unlikely to result in recruitment impairment. Yelloweye Mullet stocks in Tasmanian waters are thus classified as sustainable.

3. Commonwealth-assessed species

Blue Warehou (*Seriolella brama)*

STOCK STATUS	DEPLETED
Blue Warehou is a predominantly Commonwealth-managed species that has been classified as "Overfished" in the ABARES Fishery Status Reports 2021 (Patterson et al. 2021). It was reported as Depleted in the 2020 Status of Australian Fish Stocks Report. This species is sporadically abundant in Tasmanian waters. Despite a reduction in Total Allowable Catch (TAC) for the Commonwealth fishery to 118 t and the initiation of a stock rebuilding strategy in 2008, there is no evidence of stock recovery.	
IMPORTANCE	Key
INDICATOR(S)	Catch, effort and CPUE trends
MANAGEMENT	Commonwealth



Blue Warehou *(Seriolella brama)*
Illustration©R.Swainston/anima.fish

Blue Warehou is a highly mobile schooling species, occurring seasonally with inter-annual variability in Tasmanian inshore waters, mostly likely in association with suitable oceanographic conditions and the availability of prey species (mostly salps). A small recreational gillnet fishery for Blue Warehou represents < 10% of the total annual harvest of this species in Tasmanian waters. The Blue Warehou stock has been classified as Depleted (Overfished) since 2008, despite a stock rebuilding initiative (the Blue Warehou Stock Rebuilding Strategy) that has been in place since then (AFMA 2014). The stock rebuilding strategy established Blue Warehou as an incidentally caught species, and the Commonwealth Total Allowable Catch has decreased a number of times. More detailed information on biological characteristics and current management of Blue Warehou fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

In Tasmania, Blue Warehou are primarily taken using gillnet gear (Figure 17.1A). A variety of methods are used by Commonwealth fisheries, including other gillnet categories (e.g., shark gillnets), Danish seine, and trawl.

Due to the low availability of Blue Warehou since the early 2000s, the species has been rarely targeted. Catch dropped to 10.9 t in 2010/11, and remained below 10 t until 2017/18, when it reached 12.6 t (Figure 17.1A). In the most recent three seasons, catch has been less than 2 t, with only 1.1 t landed in 2020/21. Peak Tasmanian landings were 317.6 t in 1991/92, which corresponded with the peak of Australia-wide landings of almost 3,000 t (AFMA 2014). Commonwealth commercial landings have also been down in recent years, with 10.1 t harvested in 2019/20 and 2.4 t harvested in 2020/21 (Patterson et al. 2021).

Two stocks of Blue Warehou are believed to occur in southern Australian waters, the east and the west Bass Strait stocks (Bruce et al. 2001), which has led to the species being managed by AFMA as two stocks. The Tasmanian fishery is now mainly centred off the southeast coast (Figure 17.2, Figure 17.3), and thus probably targets the eastern stock. Historically, catches have also been taken off the north and northwest coasts (Figure 17.3), which are presumably harvested from the western stock.

In Tasmania, Blue Warehou are also targeted by recreational fishers using gillnets, and to a lesser extent, line fishing. Historically, recreational catches have been lower than commercial catches (Figure 17.1A). However, in 2012/13, the recreational catch of Blue Warehou was almost double the commercial catch (Lyle et al. 2014b). In 2017/18, recreational catch declined again, representing approximately 6% of total catch (Lyle et al. 2019).

Following an increase in commercial gillnet effort and CPUE on the southeast and east coasts between 1995/96 and 1998/99 that resulted in an increase in landings, effort has fallen to substantially lower levels ever since (Figure 17.1B). This situation is influenced by the limited availability of Blue Warehou in Tasmanian waters. After an initial increase and substantial drop, CPUE has stabilised since 2000/01, showing notable fluctuations around the refence value, with an historical low CPUE value in 2020/21 (Figure 17.1C).

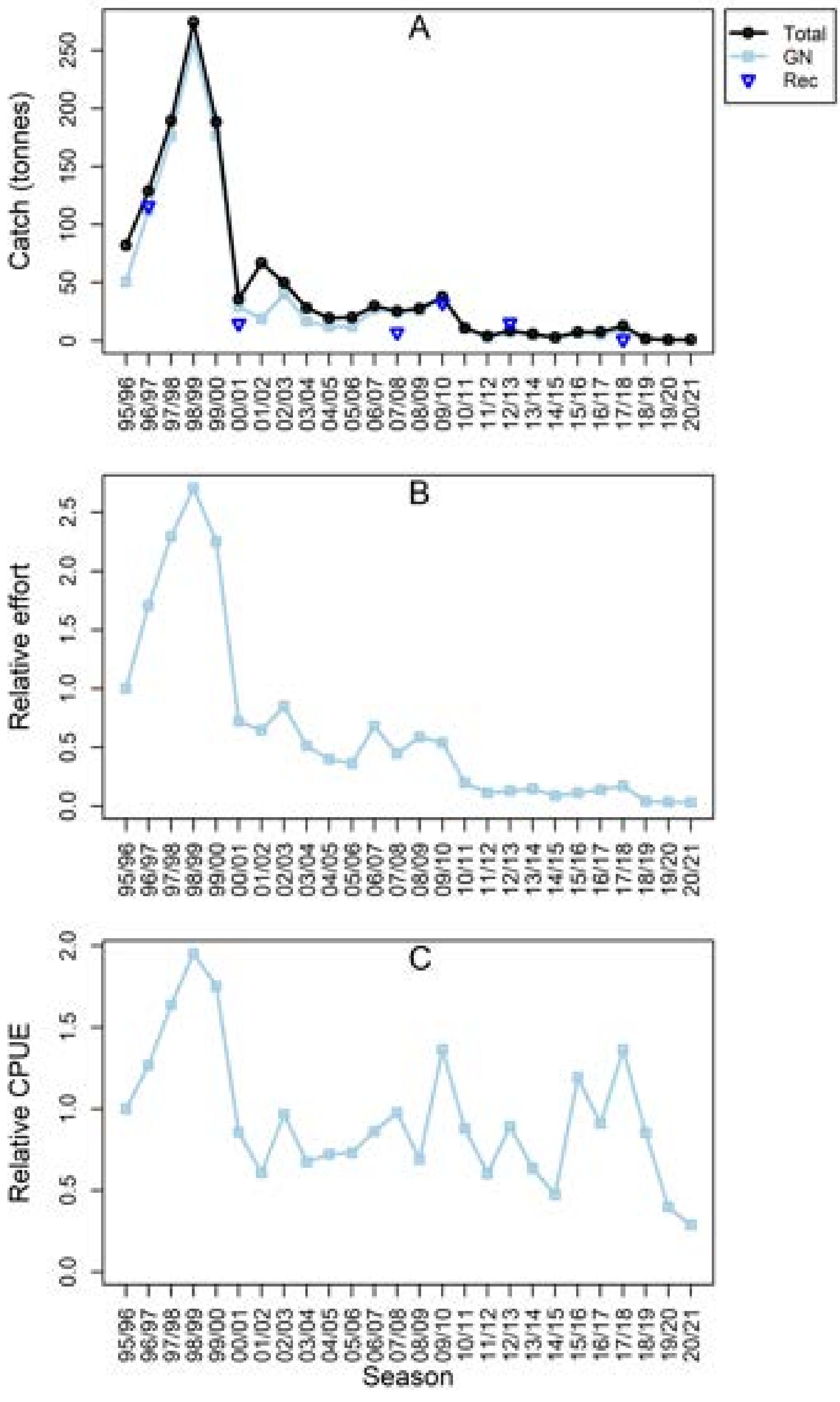


Figure 17.1 (A) Annual commercial Blue Warehou catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. GN = gillnet, Rec = estimated recreational catch.

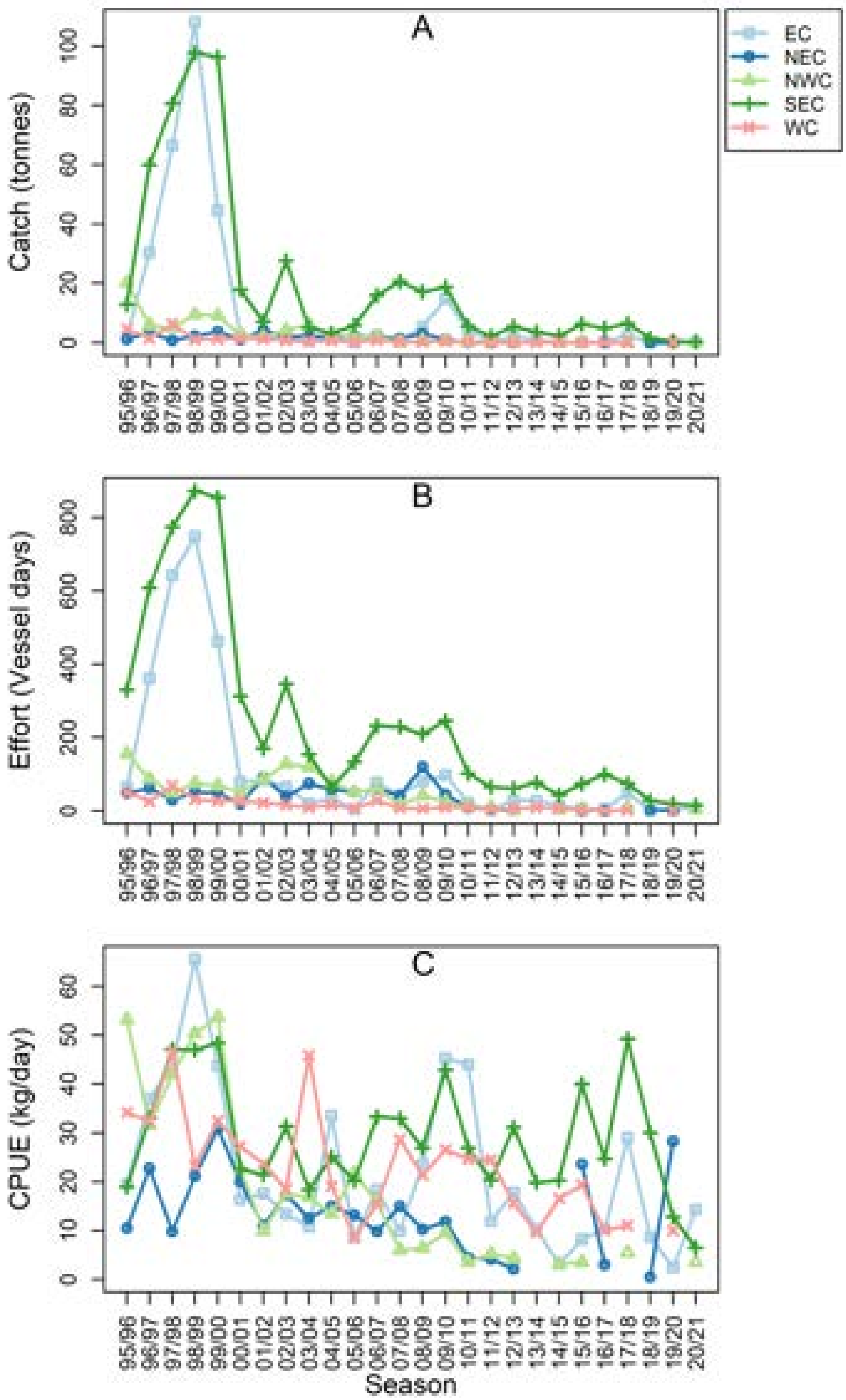


Figure 17.2 Regional commercial Blue Warehou catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for gillnet. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

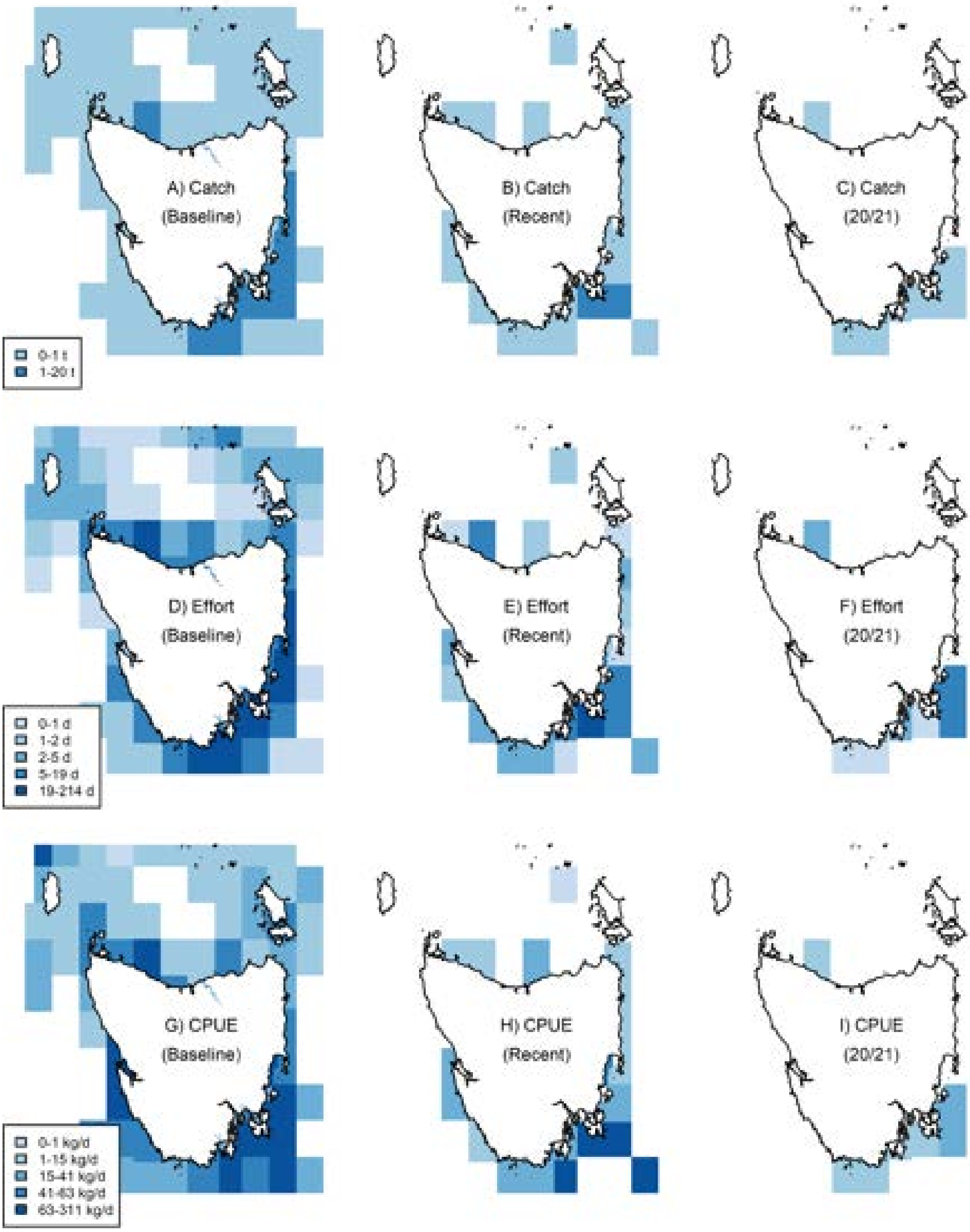


Figure 17.3 Blue Warehou catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Stock status	**DEPLETED**

The decreasing catch of Blue Warehou over the last 20 years is almost certainly linked to reduced biomass, which is predominantly a result of overfishing by Commonwealth and state fisheries during the 1990s when catches exceeded 2,500 t in several years and consistently reached > 1,000 t annually between 1987 and 1998 (AFMA 2014). These figures include state landings, with Tasmanian catches accounting for about 10% of the total (AFMA 2014). In recent years, catches of Blue Warehou have declined substantially and it is now possible, as it was in the 2017/18 season, that the Tasmanian recreational catch exceeds the commercial catch. While the reduced Commonwealth and Tasmanian catches should facilitate stock recovery, a lack of both fishery-dependent and fishery-independent data makes the level of current stock depletion difficult to assess.

Blue Warehou is under a Commonwealth stock rebuilding strategy (first introduced in 2008 and later reviewed in 2014), which aims in the first instance to rebuild both east and west coast stocks to or above the default limit reference biomass point of 20 per cent of the unfished spawning biomass by 2024 (AFMA 2014). Consequently, the Commonwealth Total Allowable Catch (TAC) for Blue Warehou has been progressively reduced since 2003, and it was further reduced to 118 t (split 27 t in the east and 91 t in the west) in 2012/13 (AFMA 2012). AFMA considers the reduction in recent Commonwealth catches (1.9 t in 2015/16, 16 t in 2016/17, 25 t in 2017/18, 54 t in 2018/19, 10 t in 2019/20) to be due in part to their active management and education program. Further management measures include SESSF fishery closures and gear restrictions. There was also a voluntary Commonwealth industry closure implemented between 2008 and 2012 in areas of high Blue Warehou abundance, which were believed to be spawning grounds. However, this assumption was challenged following a review in 2013 due to the patchiness and unpredictability of the species in these areas (AFMA 2014). In Tasmania, management measures include recreational bag and possession limits and a minimum size limit. However, if Blue Warehou stocks start to recover, these regulations may be insufficient to prevent excessive catches from commercial and recreational fishers.

Despite the Commonwealth and Tasmanian management measures outlined above, there have been few signs of recovery of the species, which is why the ABARES Fishery Status Reports classified Blue Warehou stocks as “Overfished” (for biomass) and “Uncertain” (for fishing mortality) (Patterson et al. 2021). Thus, Blue Warehou in Tasmanian waters remains classified as Depleted.

Common Jack Mackerel (*Trachurus declivis*)

STOCK STATUS	SUSTAINABLE
Common Jack Mackerel is a predominantly Commonwealth-managed species that has been classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). Only minor catches of this species have been taken from Tasmanian waters over the last decade due to one purse seine operator leaving the fishery. Patterns of catch and effort are unlikely to reflect stock status but the currently low level of fishing pressure in Tasmania is unlikely to cause the stock to become recruitment impaired.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends
MANAGEMENT	Commonwealth

Jack Mackerel *(Trachurus declivis)*
Illustration©R.Swainston/anima.fish

Common Jack Mackerel is a schooling species that inhabits open water over the continental shelf from southern Queensland to Shark Bay, Western Australia, including Tasmania. Jack Mackerel are mainly targeted using purse seine and beach seine gear. The Jack Mackerel fishery in Tasmania peaked in 1986/87 with a catch > 40,000 t (Kailola et al. 1993). However, by 2000 surface schools were less available in Tasmanian waters and fishers began midwater trawling in Commonwealth waters. There was another, smaller peak in the Tasmanian commercial fishery in 2008/09 due to a sharp increase in purse seine effort. However, since then both catch and effort have been low. There is a small recreational fishery for Jack Mackerel using line gear in Tasmania. More detailed information on biological characteristics and current management of Jack Mackerel fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Catches of Jack Mackerel in Tasmanian waters that are reported in the General Fishing Returns have been variable, mostly fluctuating between 2.6 and 59.8 t until 2007/08, when there was a sharp increase in purse seine effort targeting Jack Mackerel on the east coast that lasted three years (Figure 18.4, Figure 18.5, Figure 18.7). Over the assessed time series, Jack Mackerel catches peaked at 919.6 t in 2008/09, then declined sharply in 2010/11 and 2011/12 to around 60 t because the major purse seine operator ceased activities. In 2020/21, only 396 kg of Jack Mackerel were landed in Tasmania, following similarly low catches in the preceding eight years (Figure 18.4A). Targeted purse and beach seine catches were historically taken mostly from the southeast coast but incidental catch in recent years was taken as by-product by beach seine mostly from the northwest coast (Figure 18.6, Figure 18.7).

Notably, between 1995 and 1999, purse seine catches of Jack Mackerel were taken as part of a separately documented fishery (Zone A fishery) ranging from 447 t in 1995/96 to 8,458 t in 1997/98 and averaging 4,485 t per year for that period. These data are not presented in Figure 18.4.

Jack Mackerel is not an important recreational species in Tasmania. Estimates of recreational catch range from approximately 1-5 t, or 1-200 t less than the commercial catch for the year in which estimates were made (Figure 18.4A).

The use of purse seine gear by one major operator between 2008/09 and 2009/10 resulted in a peak in effort and catch during this short period (Figure 18.4). Beach seine effort has been declining slowly over time, noting that Jack Mackerel represents a by-product of the beach seine fishery and no meaningful CPUE trends can be drawn from these data (Figure 18.4C). With the exception of the years in which the purse seine fishery actively targeted Jack Mackerel, purse seine CPUE has remained low as the species has not been targeted in Tasmanian waters (Figure 18.4C).

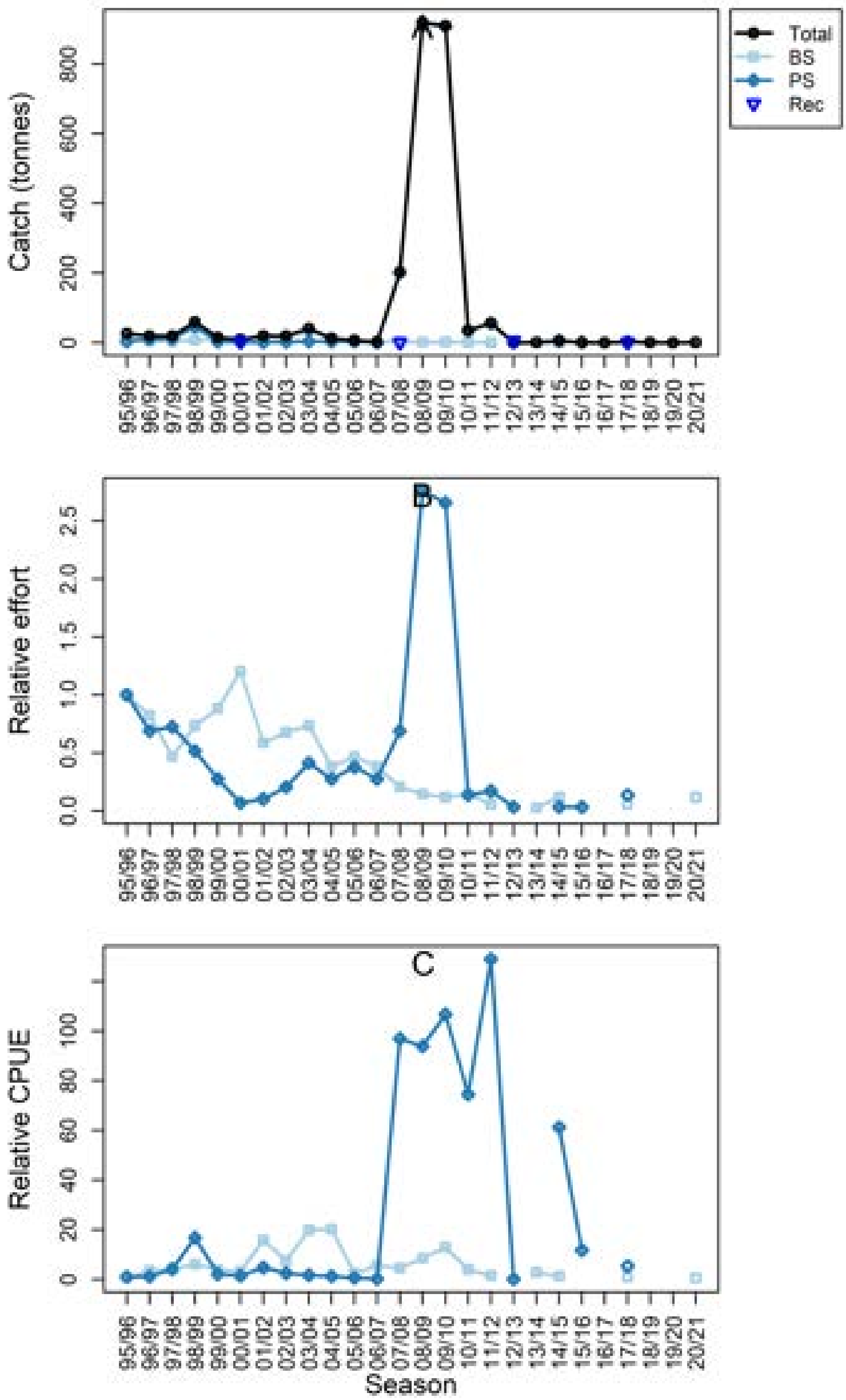


Figure 18.4 (A) Annual commercial Common Jack Mackerel catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. BS = beach seine, PS = purse seine, Rec = estimated recreational catch.

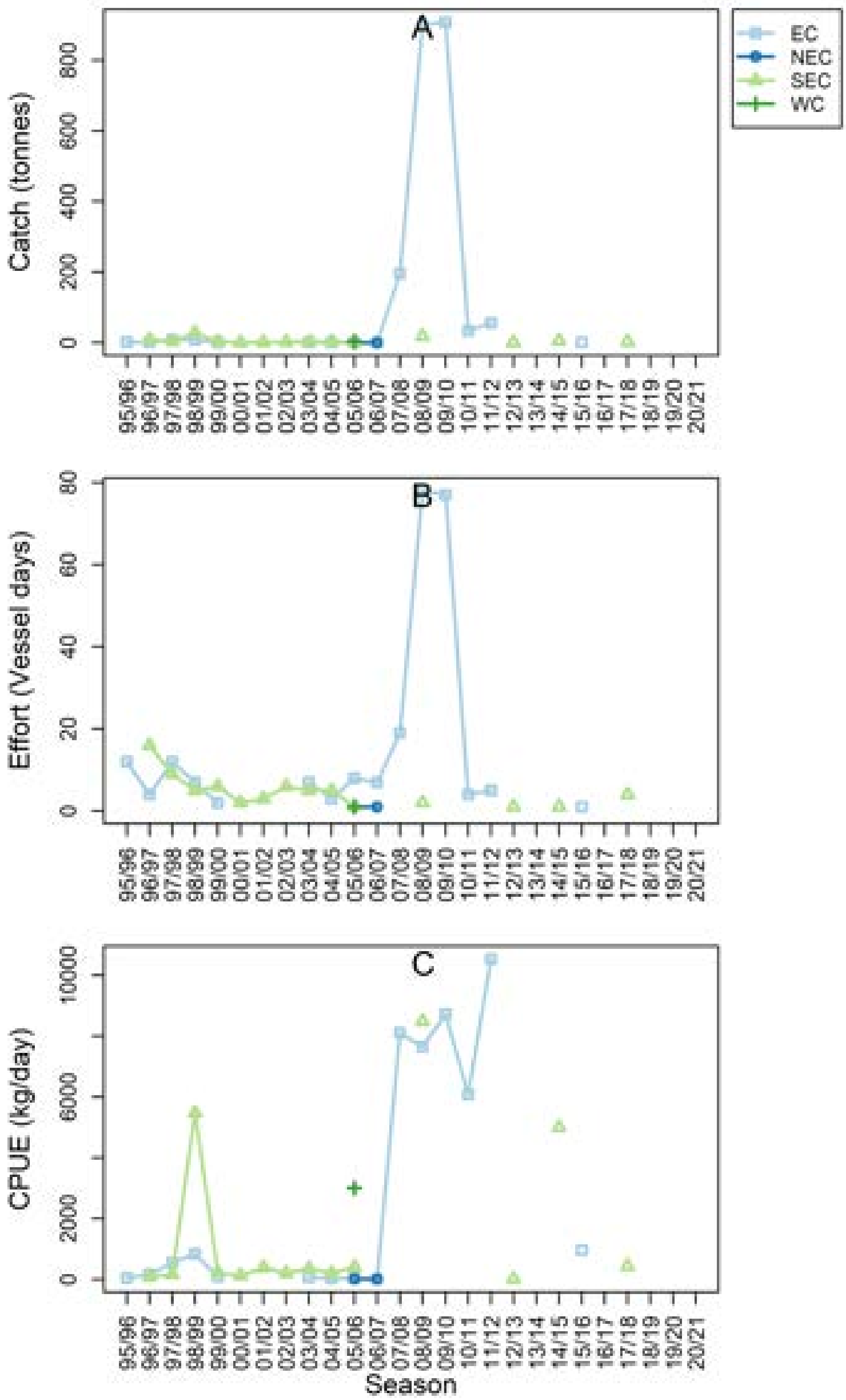


Figure 18.5 Regional commercial Common Jack Mackerel catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for purse seine. EC = east coast, NEC = northeast coast, SEC = southeast coast, WC = west coast.

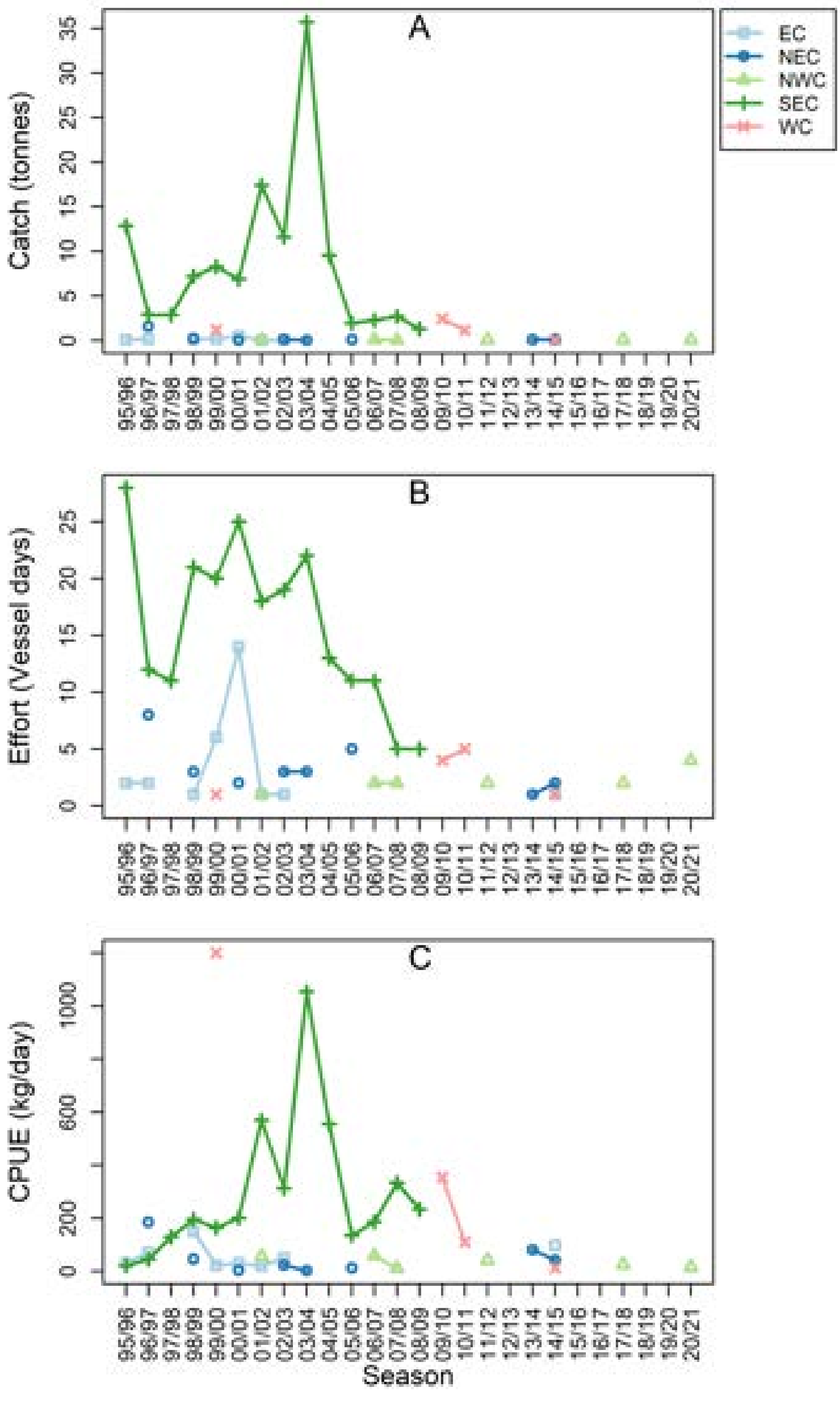


Figure 18.6 Regional commercial Common Jack Mackerel catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for beach seine. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

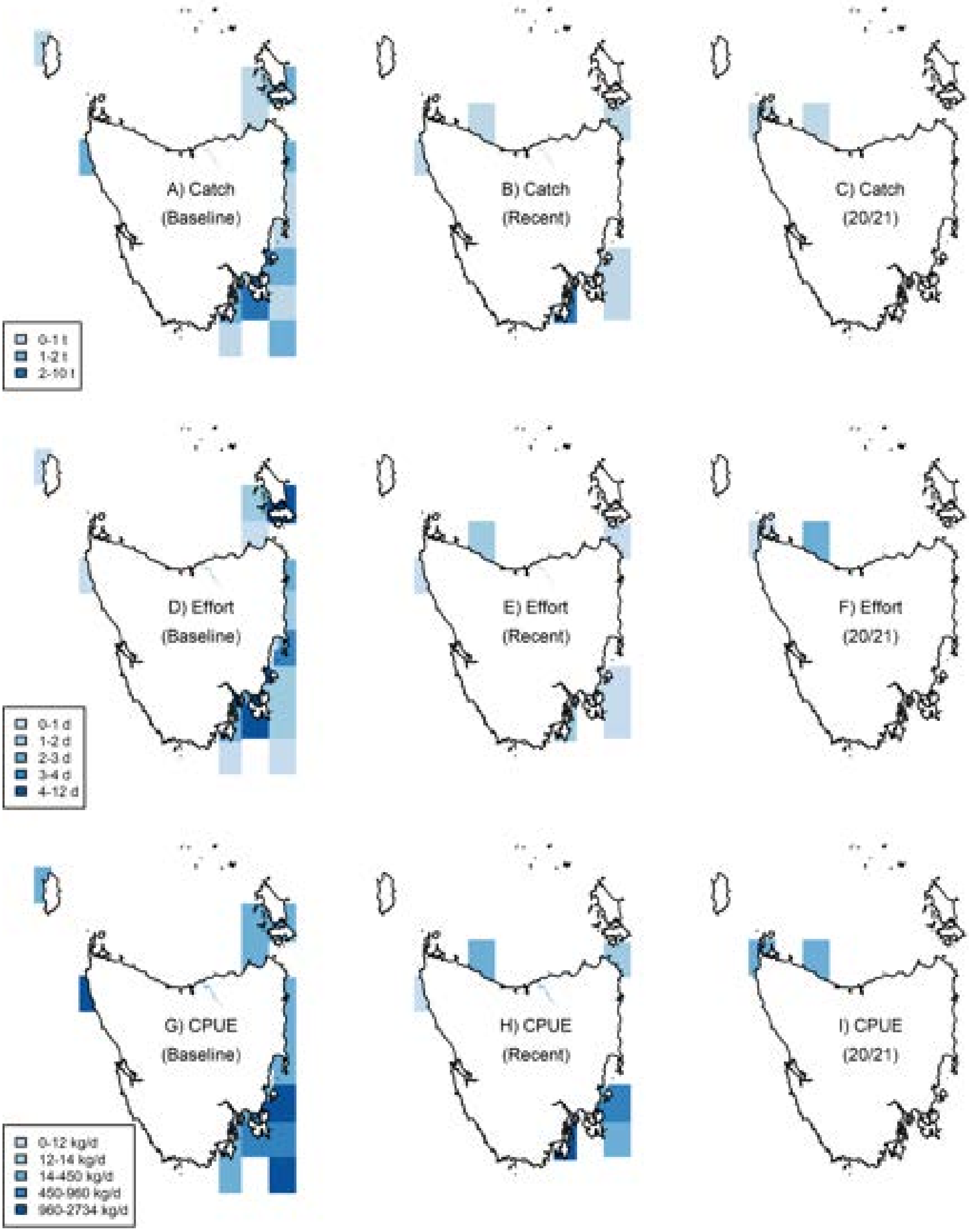


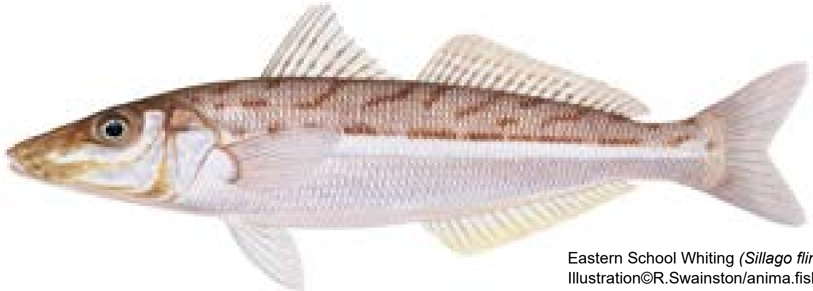
Figure 18.7 Common Jack Mackerel catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Stock status	SUSTAINABLE

Minimal fishing for Common Jack Mackerel has occurred in Tasmanian waters in recent years. Very low commercial catch means that the proportion of recreational catch tends to be higher than historically even if recreational catches are not notably higher. A 2014 study assessed the spawning stock biomass for eastern Australia to be in the order of 150,000 tonnes (Ward et al. 2015). Common Jack Mackerel are assessed by the Commonwealth Small Pelagic Fishery Scientific Panel and, based on current catch levels and spawning biomass, the eastern Jack Mackerel stock has been classified as Sustainable (Patterson et al. 2021). This assessment has been applied to the Tasmanian component of the fishery.

Eastern School Whiting (*Sillago flindersi*)

STOCK STATUS	SUSTAINABLE
Eastern School Whiting is a predominantly Commonwealth-managed species that has been classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). It has been classified as Sustainable in the 2020 Status of Australian Fish Stocks Report (Piddocke et al. 2021). Tasmanian catches fluctuate due to market demand, but generally represent only a small proportion of the Commonwealth commercial catch.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends
MANAGEMENT	Commonwealth



Eastern School Whiting *(Sillago flindersi)*
Illustration©R.Swainston/anima.fish

Eastern School Whiting is endemic to south-eastern Australia, from southern Queensland to western Victoria and around Tasmania. This schooling species is associated with sandy habitats and is found in deeper coastal waters as well as coastal lakes and estuaries (Gomon et al. 2008). In Tasmania, Eastern School Whiting is caught primarily using Danish Seine gear in the south of the state. Danish seine fishing operations target either Eastern School Whiting or Flathead (primarily Tiger Flathead) and each target species represents the main by-product species when the other is targeted, leading to opposing trends in catch and effort for Eastern School Whiting and Tiger Flathead. There is a small recreational line fishery for Eastern School Whiting in southern Tasmania. More detailed information on biological characteristics and current management of Eastern School Whiting fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Eastern School Whiting landings in Tasmania have fluctuated widely since 1998/99, with an historical peak catch of 54.0 t recorded in 2020/21 (Figure 19.1A). Catches from this fishery are influenced by a small number of Danish seine operators, who mostly operate on the southeast coast, in particular in the Derwent Estuary (Figure 19.2, Figure 19.3), although the Tamar Estuary has also been targeted in previous years (Figure 19.3).

Recreational catches of Eastern School Whiting are generally low, and this species is not an important target for the recreational fishery. Estimates of recreational catch have fluctuated between approximately 10-50% of commercial catch (Figure 19.1A).

Danish seine fishing effort has been variable over time, showing notable drops in 2005/06 and 2014/15 (Figure 19.1B). Effort in 2020/21 matched effort from the reference year, and CPUE showed a slight increase from the previous year (Figure 19.1C).

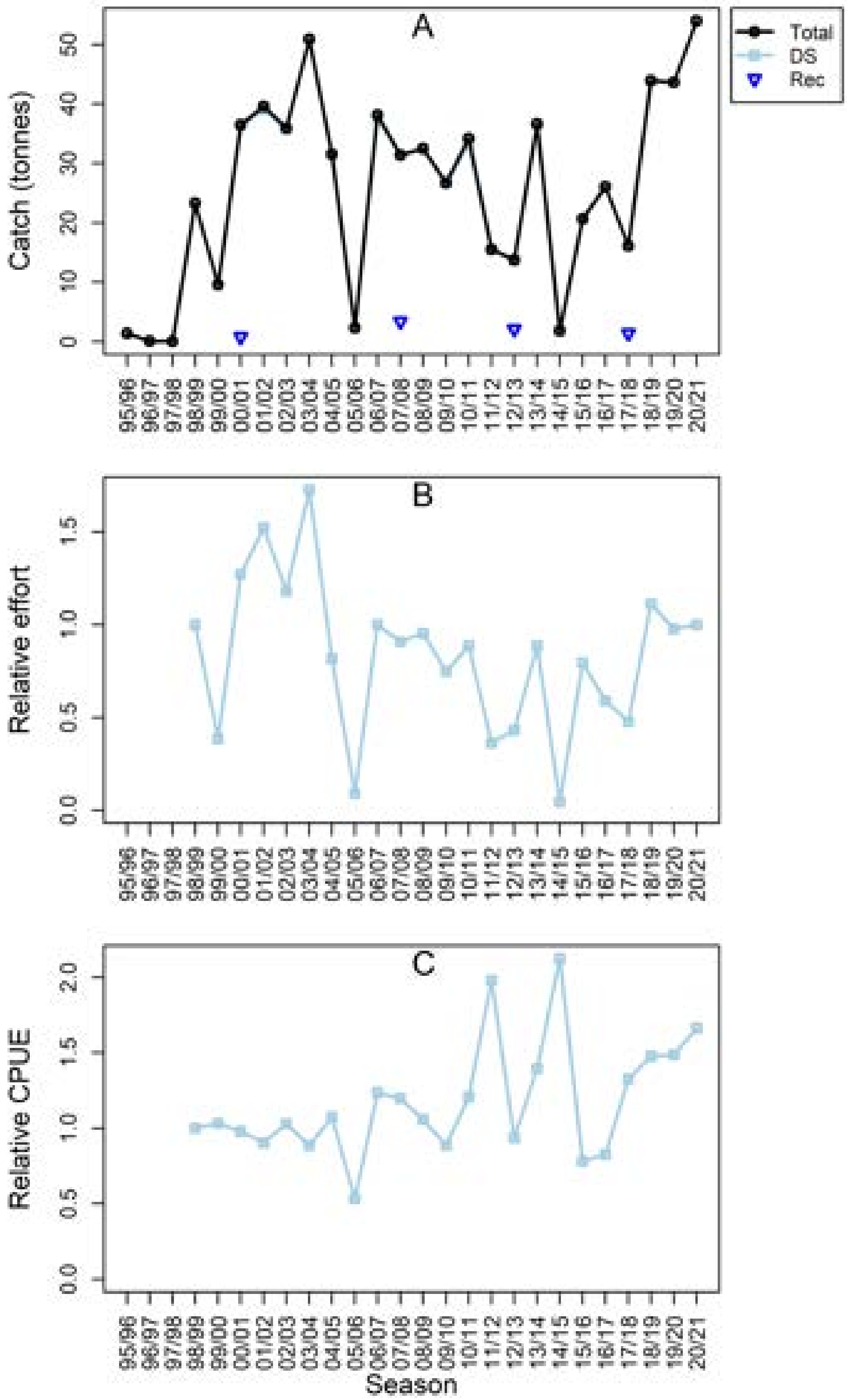


Figure 19.1 (A) Annual commercial Eastern School Whiting catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1998/99; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1998/99. DS = Danish seine, Rec = estimated recreational catch.

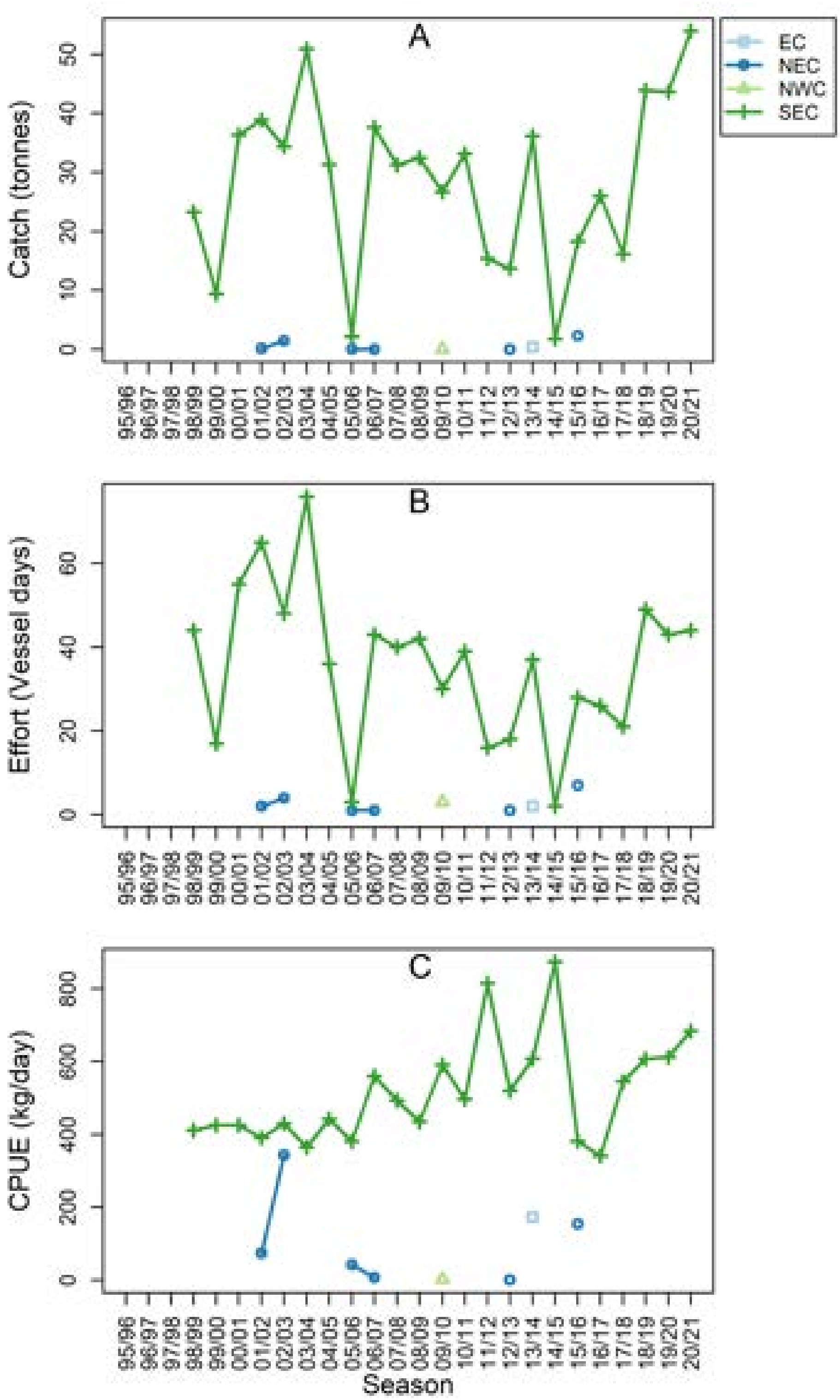


Figure 19.2 Regional commercial Eastern School Whiting catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for Danish seine. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast.

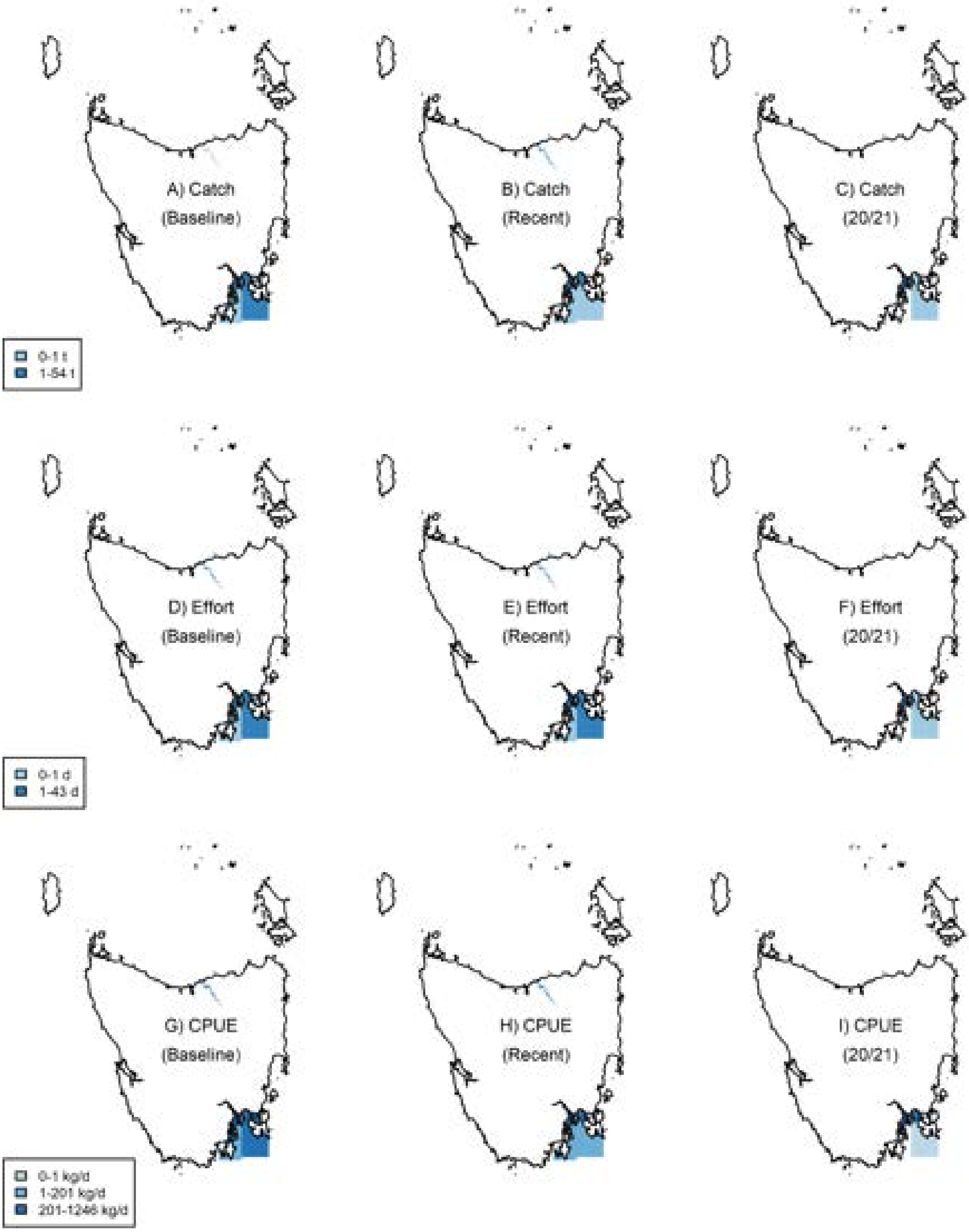


Figure 19.3 Eastern School Whiting catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1998/99 to 2007/08 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

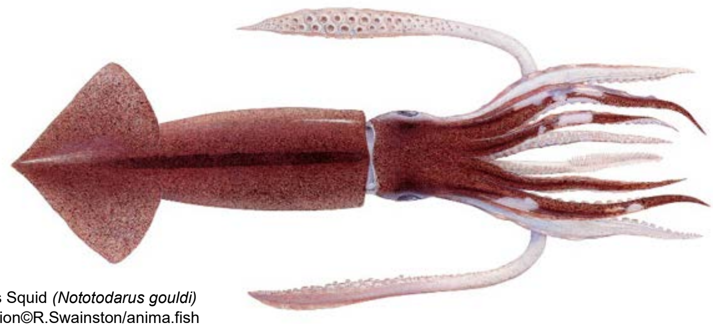
Stock status	SUSTAINABLE

Catch, effort, and CPUE patterns for Eastern School Whiting have been determined to a large extent by the level of targeting. The primary fisher is known to switch between Tiger Flathead and Eastern School Whiting, presumably depending on market demand and the season – Eastern School Whiting tends to be a winter fishery, while Tiger Flathead is targeted in summer. Catches by the recreational sector remain low and are inconsequential given the assumed size and distribution of the Eastern School Whiting stock.

Overall, the Tasmanian component of the fishery lands only a small proportion of the catch when compared with Commonwealth landings (43.7 t vs 538 t and 54.0 t vs 526 t in the last two years). The latest Fishery Status Report (Patterson et al. 2021) classified the Eastern School Whiting fishery as Sustainable in terms of both stock status and current fishing mortality. In accordance with this assessment, the Tasmanian component of this fishery is classified as Sustainable.

Gould's Squid (*Nototodarus gouldi*)

STOCK STATUS	SUSTAINABLE
Gould's Squid is a predominantly Commonwealth-managed species that has been classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). Dual-licensed vessels fish for this species in Tasmanian waters, especially in years of peak abundance. Gould's Squid is characterised by high inter-annual variability in abundance in state waters resulting in periodically high catches compared to other scalefish species.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends
MANAGEMENT	Commonwealth



Gould's Squid *(Nototodarus gouldi)*
Illustration©R.Swainston/anima.fish

Gould's Squid is targeted by the Commonwealth Southern Squid-Jig Fishery, a single gear, single species fishery that operates in Bass Strait waters using automatic squid jig gear. Like most cephalopod species, Gould's Squid has a very brief life cycle, is semelparous (reproduces once before death), and can vary significantly in abundance among years, presumably depending on environmental conditions. Occasionally, Gould's Squid are available in high abundance in south-eastern Tasmanian waters, however there is limited local market demand for the commercial fishery. Consequently, dual-licensed fishing vessels tend to operate in state waters during summer before moving back to Commonwealth fishing grounds in Bass Strait. There is a substantial recreational fishery for Gould's Squid in Tasmania, but recreational catches are dwarfed by those of the commercial sector in years of significant effort. More detailed information on biological characteristics and current management of Gould's Squid fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Gould's Squid availability in Tasmanian waters is highly variable with a few notable peaks in abundance and thus effort, as reflected by its catch history (Figure 20.1A). The highest Gould's Squid catch over the assessed time series was 1,071.8 t in 2012/13, with the Australia-wide catch for that year predominantly coming from Tasmanian waters (Flood et al. 2014). In 2020/21, Gould's Squid catch in Tasmania was 670.4 t (Figure 20.1A), 279 t of which was caught by fishers operating under scalefish licences, the remainder (391.6 t) landed by Commonwealth-licenced fishers. The majority of catch in 2020/21 was taken around the east coast, as well as the northwest coast as far offshore as King Island (Figure 20.2, Figure 20.3).

Gould's Squid catches from the recreational fishery are considerably lower than commercial catches during recreational survey years, ranging from 2-80% of commercial catches (Figure 20.1A). Recreational catches, however, are similar to commercial catches during normal (i.e., low catch) seasons.

Effort for automatic squid jig tends to match temporal patterns in catch, presumably largely reflecting the availability of Gould's Squid in Tasmanian waters (Figure 20.1B). In some seasons, higher catches have been achieved with relatively low effort, including the 2012/13 peak in catch and 2020/21 (Figure 20.1A, B).

Following initially low levels up until 2006/07, CPUE has been highly variable and thus non-informative, i.e., largely reflecting broad trends in catch effort and effort (Figure 20.1C).

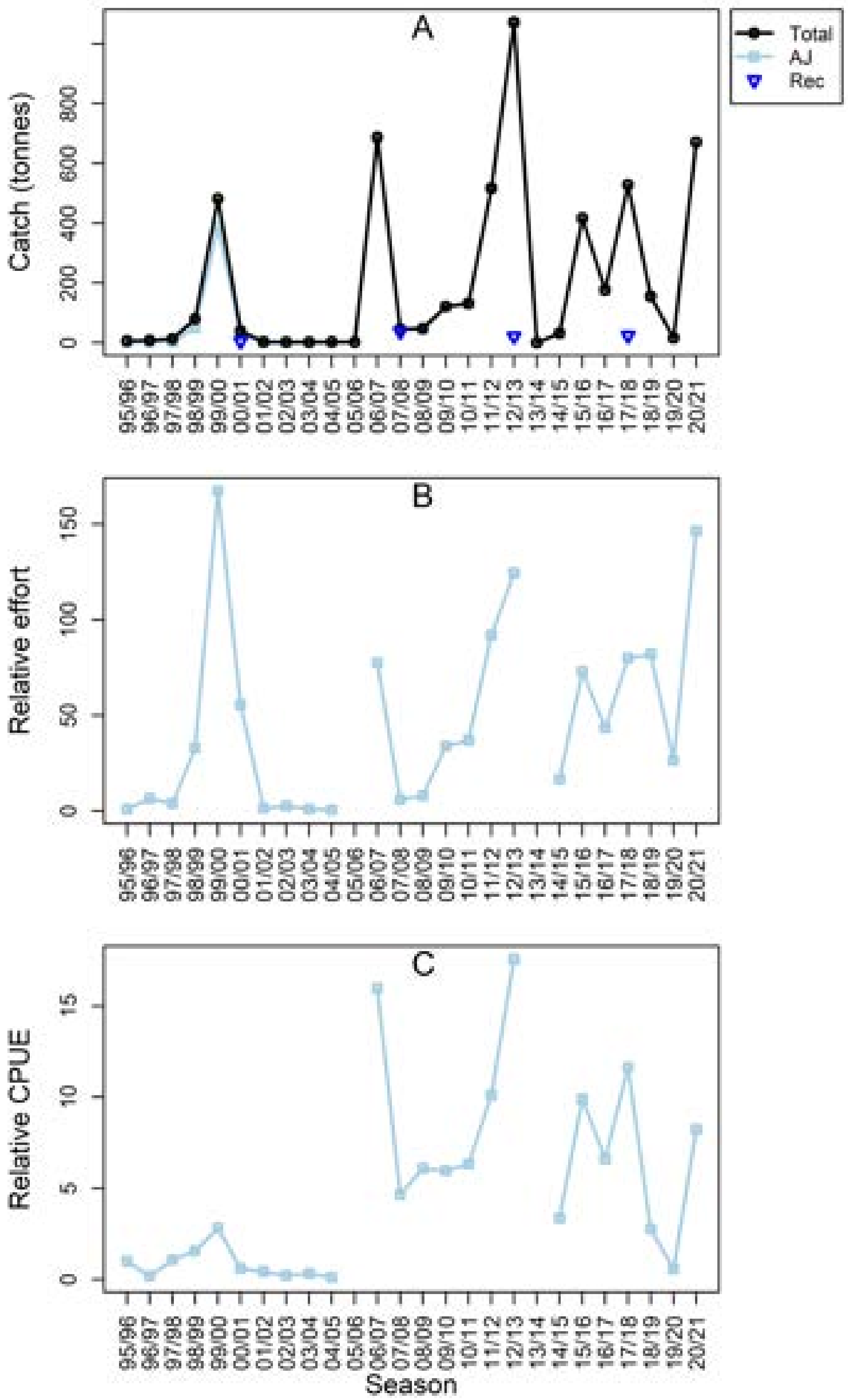


Figure 20.1 (A) Annual commercial Gould's Squid catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. AJ = automatic squid jig, Rec = estimated recreational catch.

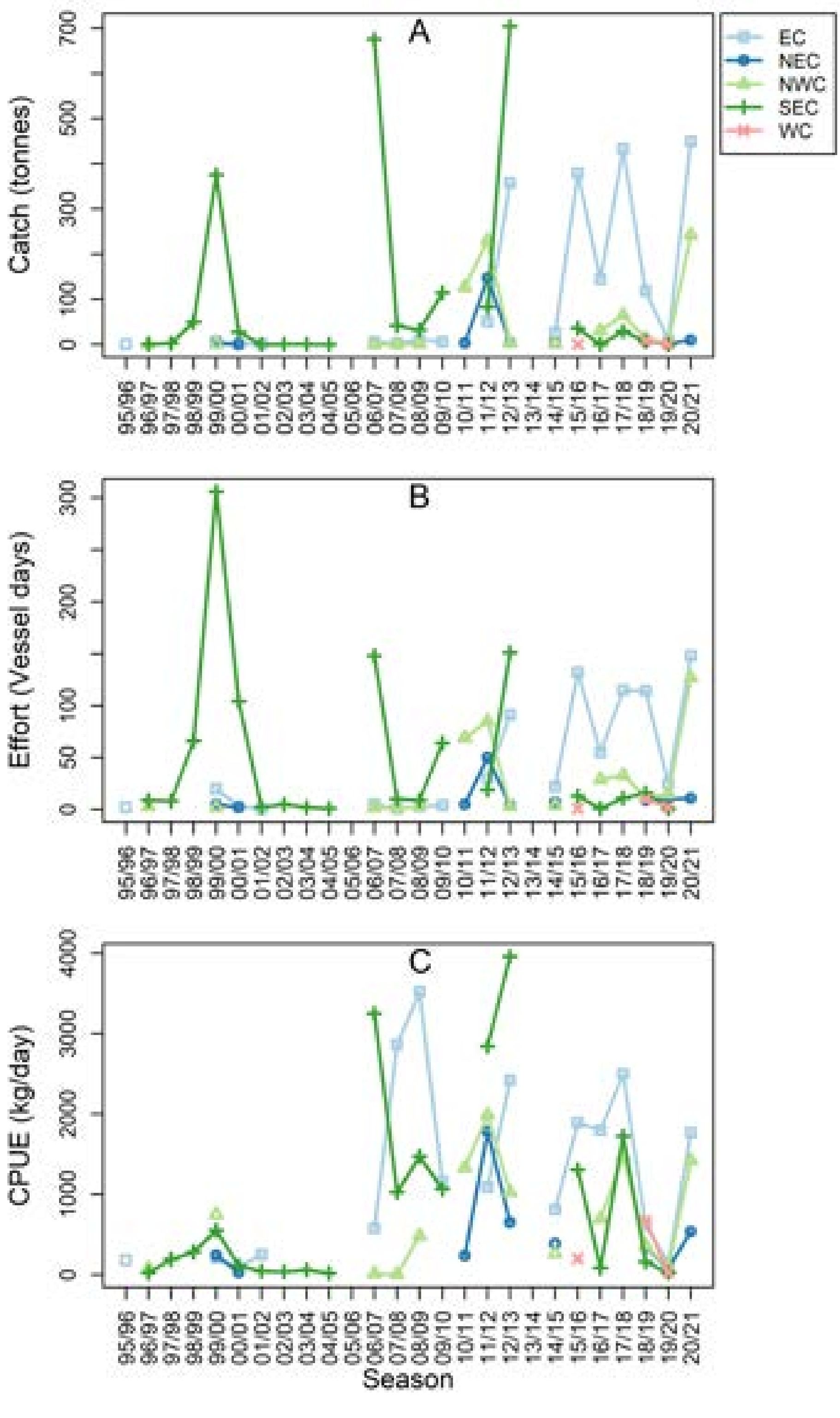


Figure 20.2 Regional commercial Gould's Squid catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for automatic squid jig. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

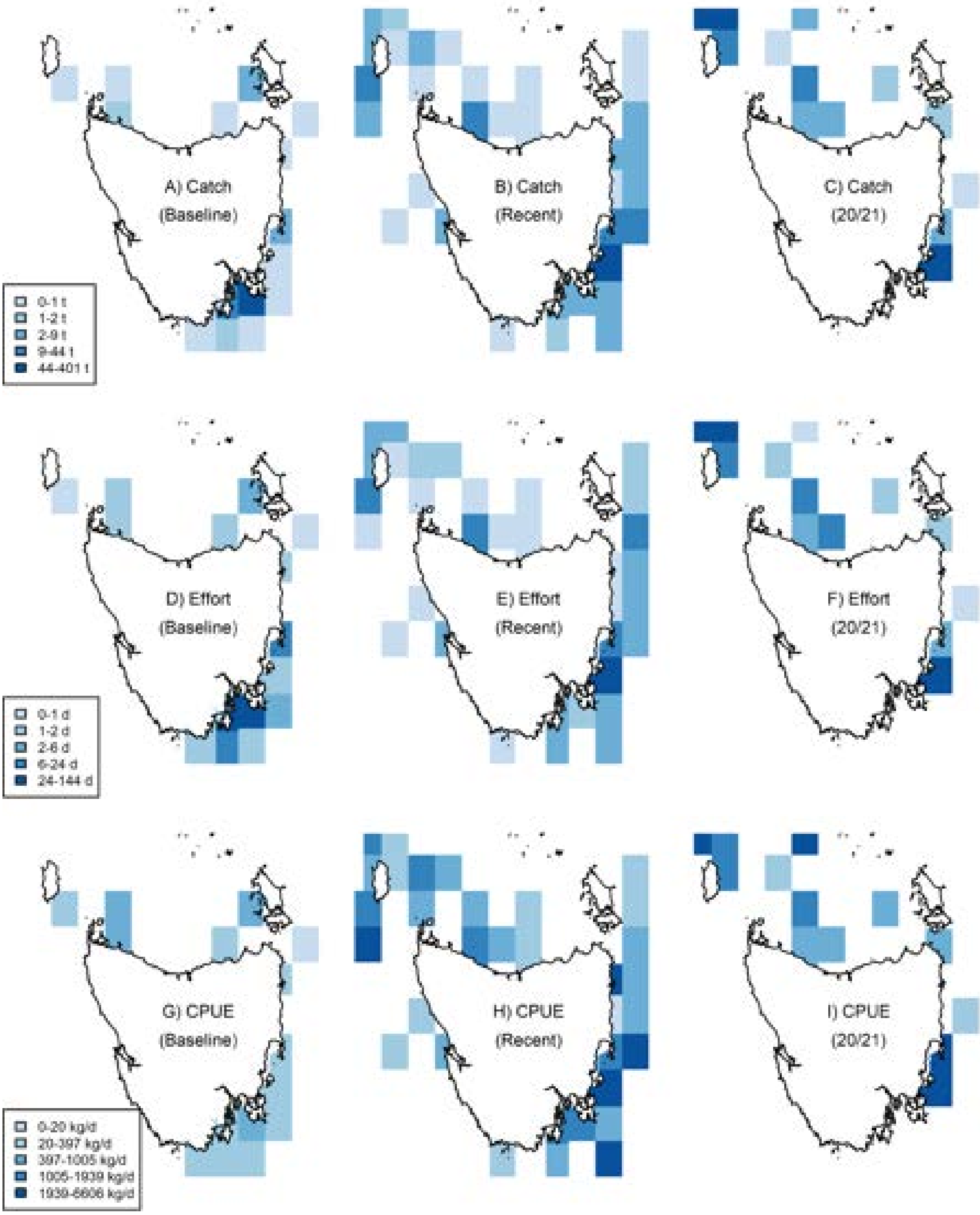


Figure 20.3 Gould's Squid catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

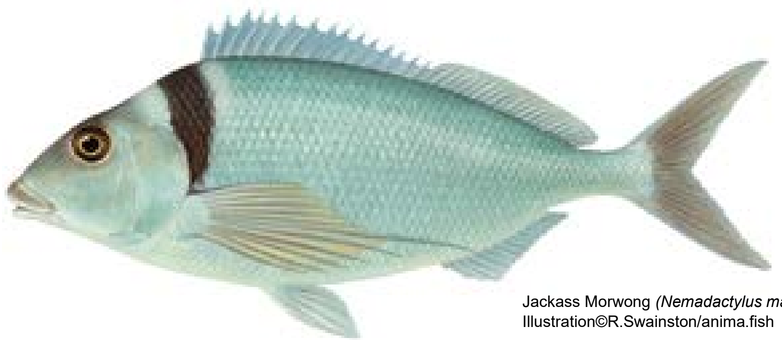
Stock status	SUSTAINABLE

Gould's Squid are short lived, spawn year-round, displaying highly variable growth and size/age at maturity, which means that they can show rapid increases in abundance during favourable environmental conditions. As a result, Gould's Squid might be less susceptible to overfishing than longer-lived species (Flood et al. 2012). However, their short life span (1 year) implies a reliance on a single cohort, which leaves the species susceptible to environmental and fishing impacts on subsequent recruitment.

Fishing effort in the Commonwealth Southern Squid-jig Fishery has decreased markedly since the late 1990s, presumably due to economic factors. A study on the depletion of the Gould's Squid stock concluded that no overfishing had occurred (Sahlqvist and Skirtun 2011). In accordance with Commonwealth assessments and the most recent Status of Australian Fish Stock Reports (Noriega et al. 2018; Noriega et al. 2021), the Tasmanian Gould's Squid fishery is classified as Sustainable.

Jackass Morwong (*Nemadactylus macropterus*)

STOCK STATUS	SUSTAINABLE
Jackass Morwong is a predominantly Commonwealth-managed species that has been classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). It has been classified as Sustainable in the 2020 Status of Australian Fish Stocks Report (Piddocke et al. 2021). Catch and effort reported by scalefish fishers in Tasmania have been low for the past 15 years.	
IMPORTANCE	Minor
INDICATOR(S)	Catch, effort and CPUE trends
MANAGEMENT	Commonwealth



Jackass Morwong *(Nemadactylus macropterus)*
Illustration©R.Swainston/anima.fish

Jackass Morwong is a large, long-lived species associated with exposed sand and silt habitat from central Queensland to southern Western Australia, including Tasmania (Edgar 2008). Abundance of Jackass Morwong is low in Tasmanian waters and, as such, the species is not targeted in Tasmania, but landed as by-product of gillnetting. Commonwealth assessments concluded that Jackass Morwong stocks were Overfished from 2008 to 2010, but stocks have since been classified as Sustainable (Patterson et al. 2021). There is a significant recreational fishery for Jackass Morwong in Tasmania, primarily targeting the species using gillnet gear. More detailed information on biological characteristics and current management of Jackass Morwong fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Commercial landings of Jackass Morwong in Tasmanian waters have declined steadily since peak catch records of almost 35 t in 1997/98, fluctuating between approximately 1-5 t since 2007/08 (Figure 21.1A). Total commercial catch in 2020/21 was 4.6 t, the highest catch since 2009/10. Jackass Morwong is taken mainly using gillnet gear from the east and southeast coasts (Figure 21.2, Figure 21.3), with some previous fishing activity on the northeast, northwest, and west coasts (Figure 21.3). The Tasmanian Scalefish Fishery predominantly accesses the eastern Jackass Morwong stock, which is also accessed by the Commonwealth managed Southern and Eastern Scalefish and Shark Fishery (SESSF). In 2019/20, the SESSF recorded 76.7 t of eastern Jackass Morwong catch (Piddocke et al. 2021).

Jackass Morwong is an important recreational species with all estimates of catch at higher levels than those of the commercial fishery operating in the state (Figure 21.1A). Recreational catches have generally represented approximately 60-70% of total catch during survey years. In addition to gillnetting, Jackass Morwong are commonly caught recreationally by handline and often associated with targeted fishing for Striped Trumpeter.

Catches have fluctuated in general agreement with fishing effort (Figure 21.1B), which has resulted in relatively stable CPUE at reduced levels since 2007/08 (Figure 21.1C). Most of the fishing effort occurred on the east coast, with effort in other regions low and relatively stable (Figure 21.2B). Trends in nominal CPUE by region were largely masked by an apparent outlier value of peak CPUE on the northeast coast when catch was relatively low but effort almost zero. The most notable trend was the above-mentioned initial decline in CPUE until 2007/08, which was attributable to the region of peak fishing effort on the east coast (Figure 21.2C).

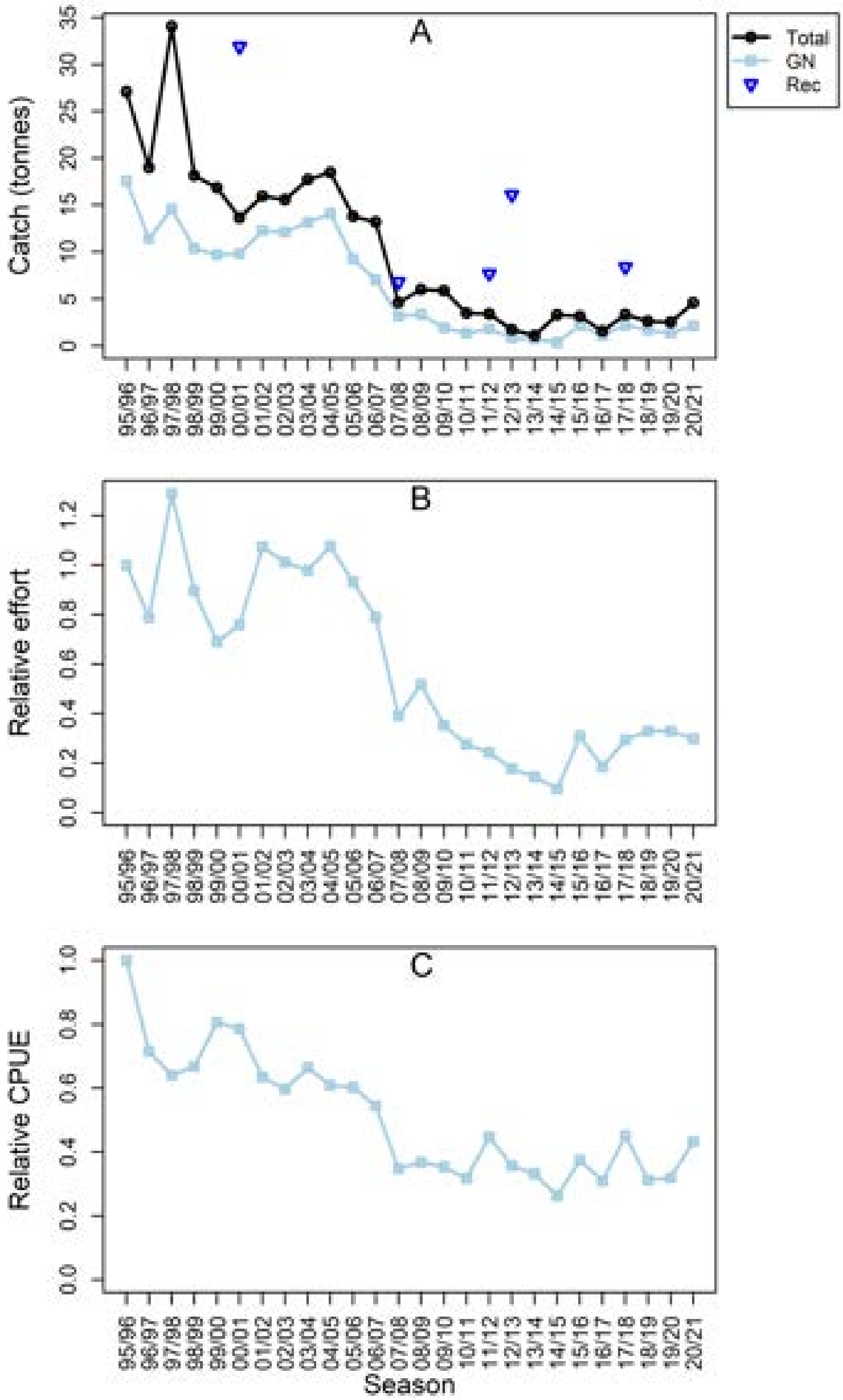


Figure 21.1 (A) Annual commercial Jackass Morwong catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 1995/96; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 1995/96. GN = gillnet, Rec = estimated recreational catch.

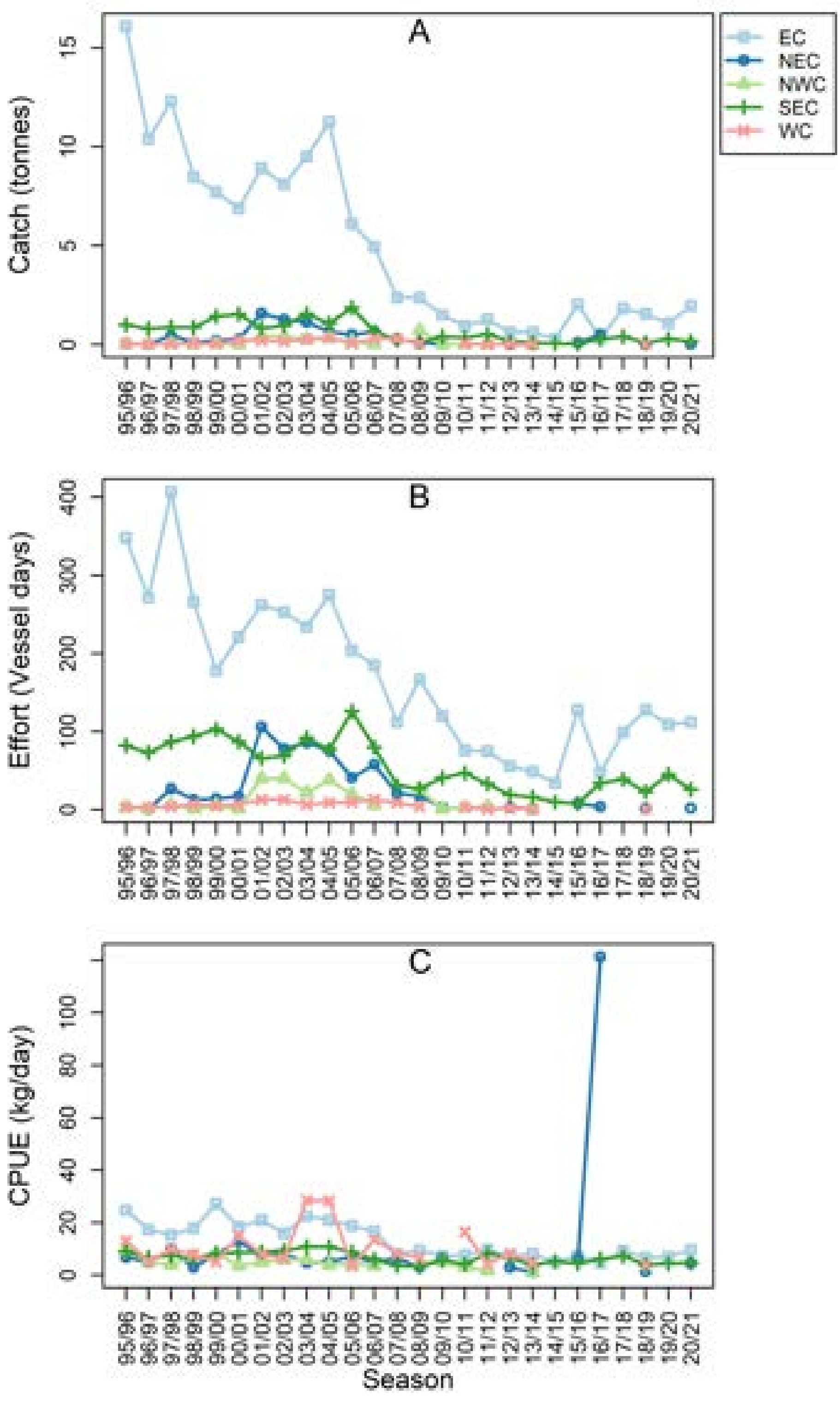


Figure 21.2 Regional commercial Jackass Morwong catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for gillnet. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast, WC = west coast.

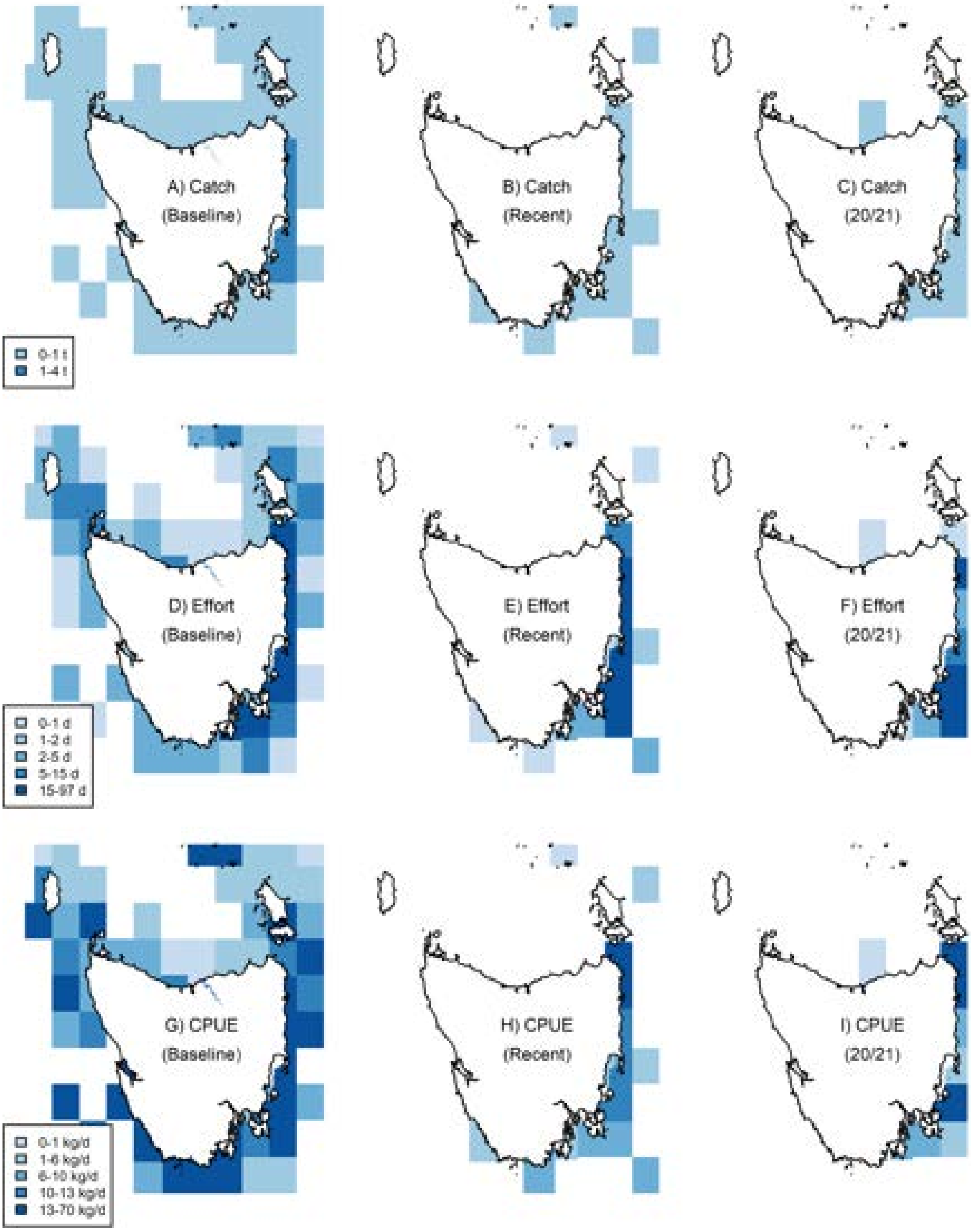


Figure 21.3 Jackass Morwong catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (1995/96 to 2004/05 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

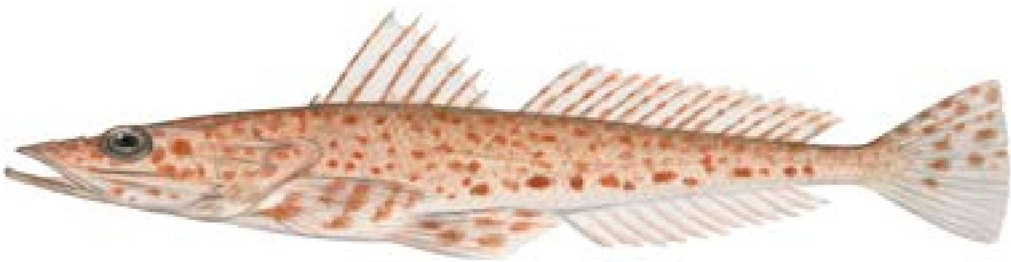
Stock status	SUSTAINABLE

A single east Australian stock of Jackass Morwong is shared between the Commonwealth and Tasmania. Catch and CPUE have declined in a similar fashion between the two jurisdictions. Catch declines may have been driven, in part, by a prolonged period of reduced recruitment that could be a result of climate-induced changes to ocean current flow in eastern Tasmania (Wayte 2013). Due to an extended early life history period of Jackass Morwong in the open ocean, the species might be particularly sensitive to changes in ocean current flow, which can cause widespread larval dispersal and highly variable levels of recruitment success (Wayte 2013).

The Jackass Morwong stock was considered to be “Overfished” in the late 2000s, but since 2011 has been classified as “Not overfished nor subject to overfishing” (Woodhams et al. 2013; Flood et al. 2014; Patterson et al. 2021). The change of assessment status was associated with a reduction of catches for the species in response to management actions in the Commonwealth fishery as well as a revision of the stock assessment model. The total catch estimate (recreational and commercial) of Jackass Morwong in Tasmania (4.6 t in 2020/21) is low compared to the most recent estimate of Commonwealth catch (190.8 t in 2019 (Piddocke et al. 2021)). Commonwealth assessment of the eastern Jackass Morwong stock (fished in Tasmania) indicated significant increases in spawning biomass from 2011 to 2014 (Tuck et al. 2015), with unpublished Commonwealth data suggesting the east coast stock is still rebuilding under current total allowable catch levels. No further reductions in allowable catch are anticipated. Given Fishery Status Reports describe both the stock biomass and fishing mortality as Sustainable (Patterson et al. 2021) this classification is applied to the Tasmanian fishery.

Tiger Flathead (*Platycephalus richardsoni*)

STOCK STATUS	SUSTAINABLE
Tiger Flathead is a predominantly Commonwealth-managed species that has been classified as "Not overfished nor subject to overfishing" by ABARES in the Fishery Status Reports 2021 (Patterson et al. 2021). It has been classified as Sustainable in the 2020 Status of Australian Fish Stocks Report (Piddocke et al. 2021). In Tasmania, Tiger Flathead are caught predominantly by the commercial sector. Catches fluctuate substantially on an annual basis, but they typically represent a small proportion of Commonwealth trawl landings.	
IMPORTANCE	Key
INDICATOR(S)	Catch, effort and CPUE trends
MANAGEMENT	Commonwealth



Tiger Flathead *(Platycephalus richardsoni)*
Illustration©R.Swainston/anima.fish

Tiger Flathead is associated with exposed sand and silt at depths of 10 – 400 m in southeast Australian waters of New South Wales, Victoria, and Tasmania (Edgar 2008). Southern Sand Flathead and Tiger Flathead are the most commonly targeted flathead species in Tasmania, with Tiger Flathead most dominant in commercial catches. Commercially, Tiger Flathead is taken mainly by Danish seine, with some recreational handline catches. Commercial Danish seine fishing operations in Tasmania target either Tiger Flathead or Eastern School Whiting (primarily Tiger Flathead) and each target species represents the main by-product species when the other is targeted, leading to opposing trends in catch and effort for the two species. More detailed information on biological characteristics and current management of Tiger Flathead fisheries is available from the TasFisheriesResearch webpage.

Catch, effort and CPUE

Whilst Tiger Flathead has a long history of commercial fishing in Tasmania, this species has only been distinguished from Southern Sand Flathead in fishery returns data since 2007/08. Since 2007/08, Tiger Flathead catches have fluctuated widely, between approximately 15-75 t (Figure 22.1A). In 2020/21, the total commercial catch of Tiger Flathead was 60.8 t, a substantial increase from the previous two years and similar to earlier peaks of >60 t in 2007/08, 2009/10, 2015/16 and 2016/17 (Figure 22.1A). In 2020/21, all Tiger Flathead landings were taken from the east and southeast coasts, which have been the dominant regions for the fishery since 2007/08 (Figure 22.2B, Figure 22.3). Previous stock assessment reports show back-calculated estimates of species-specific catch prior to 2007/08 (Fraser et al. 2021). These earlier estimates show fluctuations similar to fishing years post-2007/08, with annual catches between 20 and 80 t without an obvious trend.

Danish seine effort and CPUE in 2020/21 increased on both the east and south east coasts relative to the previous year (Figure 22.1B, C, Figure 22.2B, C). Peaks in Danish seine catch, effort, and CPUE are influenced by a small number of operators that have primarily targeted Tiger Flathead. Therefore, fluctuations in these metrics are likely a reflection of the degree of targeting by those fishers in any given year.

Estimates of recreational Flathead catch did not distinguish between Tiger Flathead and Southern Sand Flathead until 2017/18. However, Tiger Flathead constitute approximately 10% of recreational flathead harvest, placing recreational catches of this species well below commercial catches across the time series (Fraser et al. 2021). In 2017/18, the recreational catch of Tiger Flathead was estimated to be approximately 39% of the commercial catch (Figure 22.1A), and approximately 8% of the recreational catch estimate for southern Sand Flathead (Lyle et al. 2019). Thus, the recreational fishery for Tiger Flathead is significantly less important than for Southern Sand Flathead, and less important than the commercial Tiger Flathead fishery.

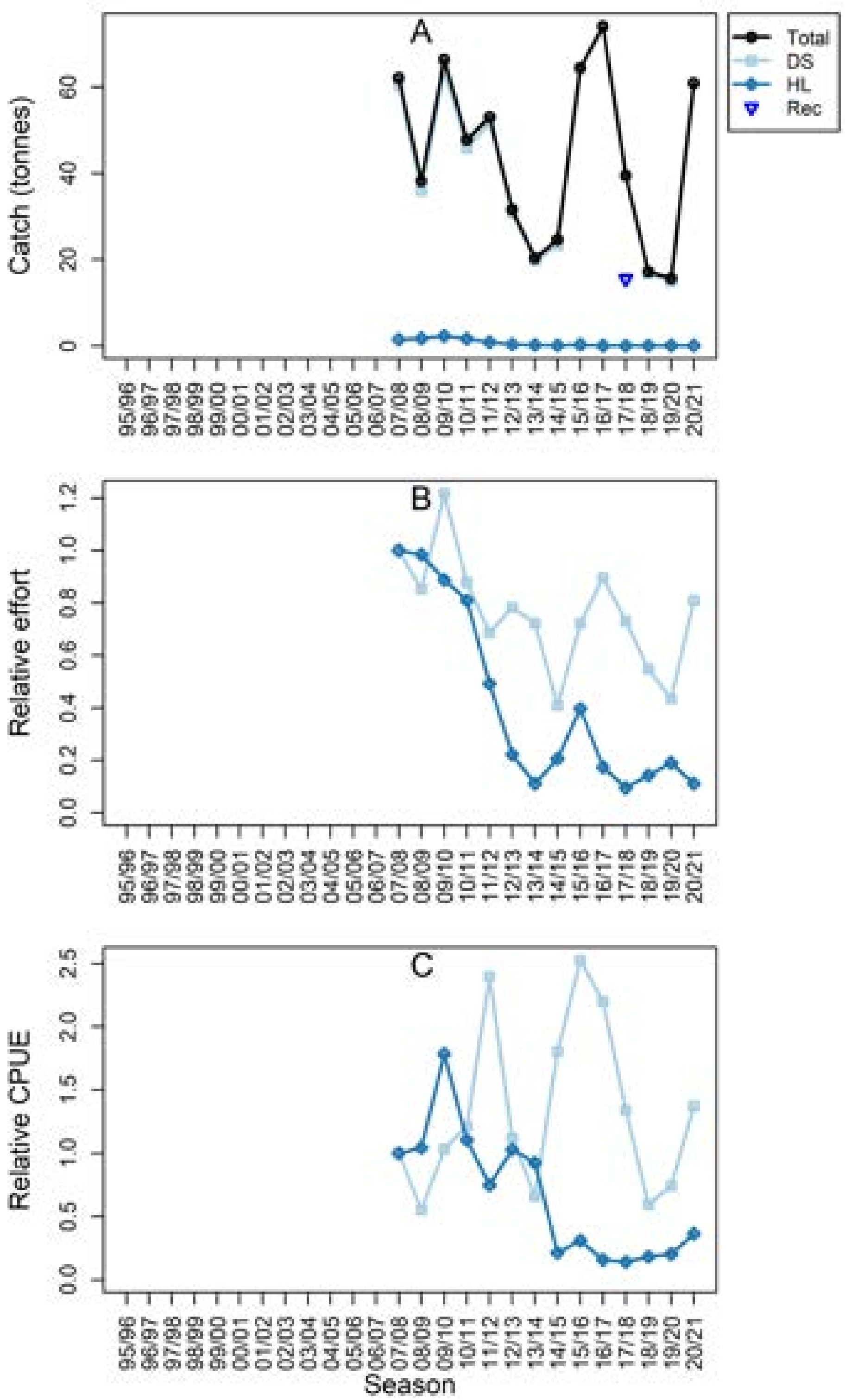


Figure 22.1 (A) Annual commercial Tiger Flathead catch (t) by gear; (B) annual commercial effort for main gear type(s) based on days fished relative to 2007/08; (C) annual commercial catch per unit effort (CPUE) based on weight per days fished relative to 2007/08. DS = Danish seine, HL = handline, Rec = estimated recreational catch.

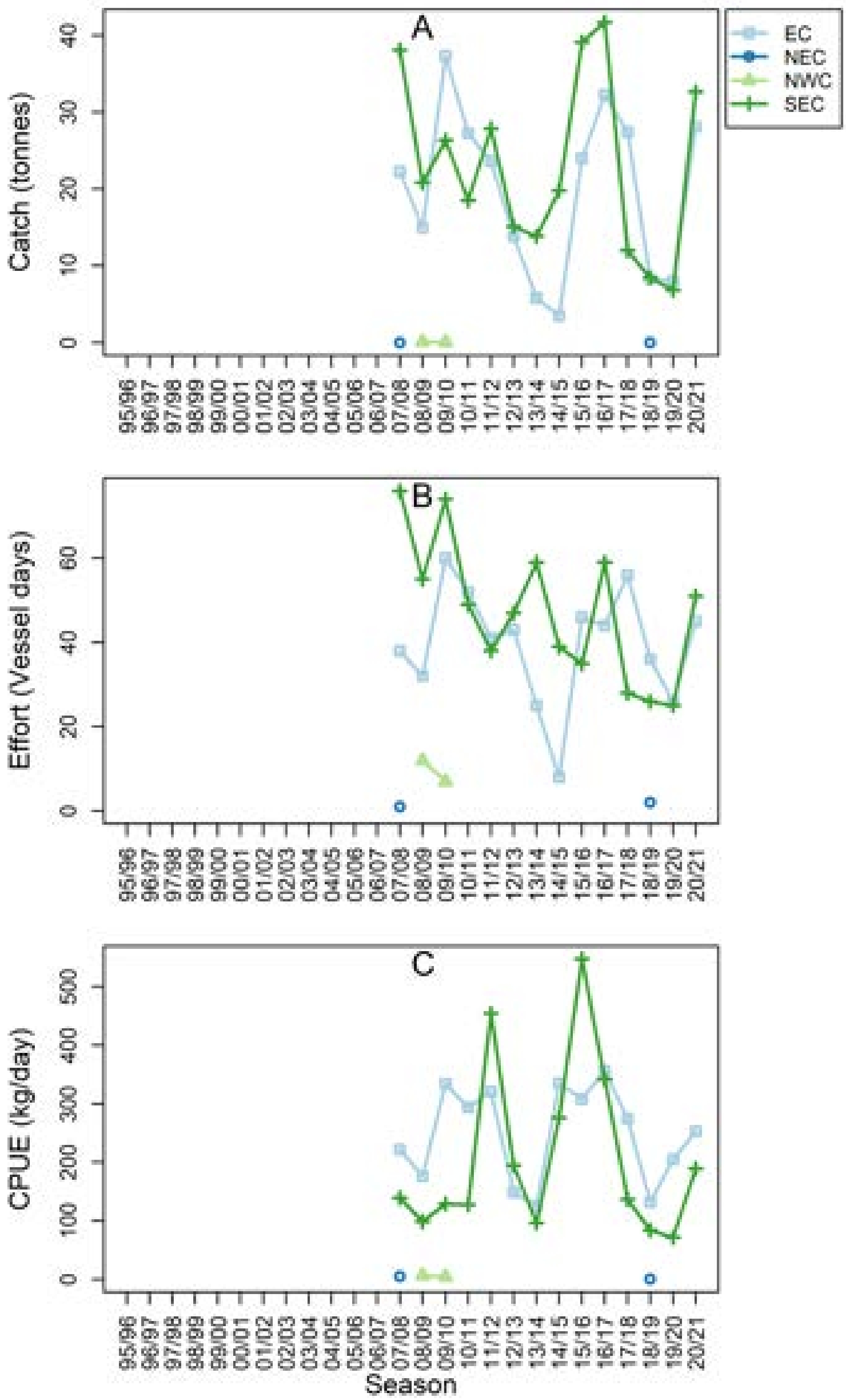


Figure 22.2 Regional commercial Tiger Flathead catch (A), effort (B), and catch per unit effort (CPUE) (C) recorded for Danish seine. EC = east coast, NEC = northeast coast, NWC = northwest coast, SEC = southeast coast.

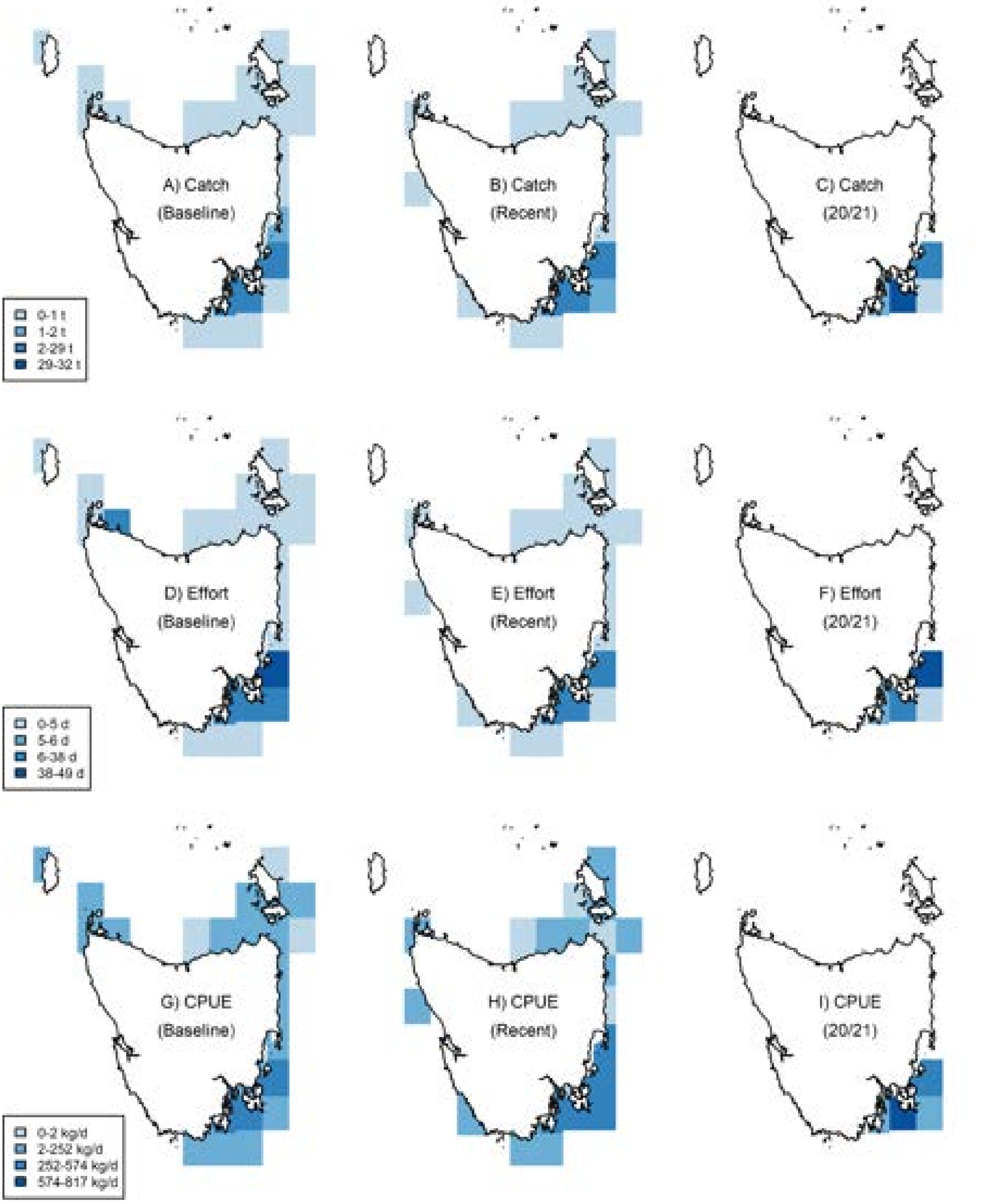


Figure 22.3 Tiger Flathead catches (t), effort (fishing days), and CPUE (kg/day) by fishing block for all main gear types combined. 'Baseline' data represent the average per fishing block across the ten-year period from the reference year (2007/08 to 2016/17 for this species). 'Recent' data represent the average per fishing block across the last five fishing seasons (2015/16 to 2019/20). '20/21' represent data from the 2020/21 fishing season.

Stock status	SUSTAINABLE

Danish seine catches are highly variable and have historically tended to be inversely related with catches of Eastern School Whiting (refer Figure 19.1) which are targeted using the same fishing method. Thus, a decrease in catches of Tiger Flathead in 2018/19 was associated with an increase in catches of Eastern School Whiting (from 19 t in 2017/2018 to 42 t in 2018/19). Catch for both species remained similar in 2019/20, while in 2020/21 catches of Tiger Flathead and Eastern School Whiting were both notably high.

Total commercial catches of Tiger Flathead have been maintained at comparable levels in the past, with the most significant landings taken from Commonwealth waters by the South East Trawl Fishery (Patterson et al. 2021). In 2020/21, the total Commonwealth catch of flathead (almost exclusively Tiger Flathead) was 2,170 t, an increase from 1,955 t in 2019/20 and 2,035 t in 2018/19 (Patterson et al. 2021). Tasmanian catches represent only a small fraction of these more significant catches, which have been classified as sustainable (Patterson et al. 2021). In accordance with this assessment, Tiger Flathead in Tasmanian waters is therefore classified as Sustainable.

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Appendix 1: common and scientific names of species

Common name	Scientific name	Common name	Scientific name
Alfonsino	*Beryx* spp.	Pilchard	Fam. Clupeidae
Anchovy	Fam. Engraulidae	Rays bream	Fam. Bramidae
Atlantic salmon	*Salmo salar*	Redbait	*Emmelichthys nitidus*
Australian Salmon	*Arripis* spp.	Red fish	Fam. Berycidae
Barracouta	*Thyrsites atun*	Red Mullet	*Upeneichthys* spp.
Boarfish	Fam. Pentacerotidae	Silverfish	Fam. Atherinidae
Bream	*Acanthopagrus butcheri*	Snapper	*Pagrus auratus*
Butterfish	Spp unknown	Stargazer	Fam. Uranoscopidae
Cardinal fish	Fam Apogonidae	Sweep	*Scorpis* spp
Cod deep sea	*Mora moro*	Tailor	*Pomatomus saltatrix*
Cod, bearded rock	*Pseudophycis barbata*	Thetis fish	*Neosebastes thetidis*
Cod, red	*Pseudophycis bachus*	Trevalla, white	*Seriolella caerulea*
Cod, unspec.	Fam. Moridae	Trevally, silver	*Pseudocaranx dentax*
Dory, john	*Zeus faber*	Trout, rainbow	*Oncorhynchus mykiss*
Dory, king	*Cyttus traversi*	Trumpeter, bastard	*Latridopsis forsteri*
Dory, mirror	*Zenopsis nebulosus*	Trumpeter, striped	*Latris lineata*
Dory, silver	*Cyttus australis*	Trumpeter, unspec.	Fam. Latridae
Dory, unspec.	Fam. Zeidae	Warehou, blue	*Seriolella brama*
Eel	*Conger* spp.	Warehou, spotted	*Seriolella punctata*
Flathead	Fam Plactycephalidae	Whiptail	Fam. Macrouridae
Flounder	Fam. Pleuronectidae	Whiting	Fam. Sillaginidae
Garfish	*Hyporhamphus melanochir*	Whiting, King George	*Sillaginoides punctata*
Gurnard	Fam. Triglidae & Fam. Scorpaenidae	Wrasse	*Notolabrus* spp.
Gurnard perch	*Neosebastes scorpaenoides*	**'Commonwealth' spp**	
Gurnard, red	*Chelidonichthys kumu*	Blue grenadier	*Macruronus novaezelandiae*
Hardyheads	Fam. Atherinidae	Gemfish	*Rexea solandri*
Herring cale	*Odax cyanomelas*	Hapuka	*Polyprion oxygeneios*
Kingfish, yellowtail	*Seriola lalandi*	Oreo	Fam. Oreosomatidae
Knifejaw	*Oplegnathus woodwardi*	Trevalla, blue eye	*Hyperoglyphe antartica*
Latchet	*Pterygotrigla polyommata*	Tunas	
Leatherjacket	Fam. Monocanthidae	Albacore	*Thunnus alalunga*
Ling	*Genypterus* spp.	Skipjack	*Katsuwonus pelamis*
Luderick	*Girella tricuspidata*	Southern bluefin	*Thunnus maccoyii*
Mackerel, blue	*Scomber australasicus*	Tuna, unspec.	Fam. Scombridae
Mackerel, jack	*Trachurus declivis*	**Sharks**	
Marblefish	*Aplodactylus arctidens*	Shark, angel	*Squatina australis*
Morwong, banded	*Cheilodactylus spectabilis*	Shark, blue whaler	*Prionace glauca*
Morwong, blue	*Nemadactylus valenciennesi*	Shark, bronze whaler	*Carcharhinus brachyurus*
Morwong, dusky	Fam. Cheilodactylidae	Shark, elephant	*Callorhynchus milii*
Morwong, grey	*Nemadactylus douglasii*	Shark, gummy	*Mustelus antarcticus*
Morwong, jackass	*Nemadactylus macropterus*	Shark, saw	*Pristophorus spp.*
Morwong, red	Fam. Cheilodactylidae	Shark, school	*Galeorhinus galeus*
Morwong, unspec.	Fam. Cheilodactylidae	Shark, seven-gilled	*Notorynchus cepedianus*
Mullet	Fam. Mugilidae	Shark, spurdog	Fam. Squalidae
Nannygai	*Centroberyx affinis*	**Cephalopods**	
Perch, magpie	*Cheilodactylus nigripes*	Calamari	*Sepioteuthis australis*
Perch, ocean	*Helicolenus* spp.	Cuttlefish	*Sepia* spp.
Pike, long-finned	*Dinolestes lewini*	Octopus	*Octopus* spp.
Snook	*Sphyraena novaehollandiae*	Squid, Gould's	*Nototodarus gouldi*

Appendix 2: data restrictions and quality control

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

Tasmanian logbook data

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. In an attempt 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.

Appendix 3: annual Tasmanian Scalefish Fishery production

Table A1 Catch (tonnes) of selected species and species groups classified as finfish, small pelagics, cephalopods, and sharks.

Species	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Selected finfish species (excl. small pelagics)																										
Australian Salmon	413.2	287.3	475.7	384.7	363.7	485.0	462.1	407.2	167.2	336.5	254.2	115.0	256.1	338.8	372.3	203.5	189.4	331.3	65.6	42.2	89.3	18.9	76.1	38.7	10.1	0.1
Barracouta	19.3	53.8	65.2	27.6	25.0	15.1	136.0	67.5	87.5	101.0	60.1	26.6	13.3	13.3	7.6	5.0	4.0	1.1	1.1	1.7	0.4	1.4	0.9	1.1	0.7	0.8
Boarfish	7.3	10.0	6.2	3.2	2.5	3.6	5.5	3.6	4.3	3.6	5.0	5.2	4.7	2.6	2.7	1.9	3.4	2.1	1.0	0.6	0.7	0.7	1.1	0.9	0.5	1.1
Cod	18.6	12.8	9.4	9.6	8.8	3.7	3.0	2.3	2.1	1.6	2.0	2.6	2.3	3.3	2.6	2.8	2.4	2.0	2.0	2.0	1.5	1.3	0.9	0.3	0.6	2.0
Flathead, sand	13.7	12.7	13.0	10.1	12.5	8.2	13.1	10.8	10.6	13.9	12.6	12.0	11.5	13.0	9.2	6.7	7.5	5.5	6.8	8.1	2.7	6.4	3.5	2.8	2.1	3.3
Flathead, tiger	34.1	31.3	44.5	37.1	44.4	53.0	35.9	27.2	17.9	58.8	75.7	44.8	62.0	37.8	66.3	47.6	52.7	31.2	20.2	23.5	64.4	74.0	39.4	16.8	16.7	60.8
Flounder	33.4	29.4	29.7	25.2	18.6	12.3	13.0	10.9	14.9	14.7	10.9	13.0	7.8	5.1	5.2	5.2	4.0	2.0	2.1	1.5	1.0	3.3	3.9	2.2	2.7	2.8
Garfish	56.2	91.6	83.0	101.7	91.7	81.4	87.8	92.5	66.2	85.5	89.3	50.0	31.0	63.0	49.3	43.2	53.0	51.5	37.9	33.8	21.9	16.4	8.9	7.4	10.7	17.0
Gurnard	13.5	10.4	9.1	7.0	9.6	7.4	5.3	9.7	6.8	6.1	5.1	5.7	4.7	2.6	1.5	2.1	1.2	1.1	0.6	1.9	2.1	2.7	1.8	1.0	2.1	3.0
Leatherjacket	14.5	12.6	13.3	12.9	16.6	16.7	16.6	13.7	14.8	10.4	8.5	8.8	5.3	5.5	3.0	2.9	2.2	2.4	2.9	2.1	1.3	2.6	2.6	4.3	2.3	0.6
Ling	15.0	13.3	8.3	4.3	1.8	1.2	0.9	0.4	0.8	0.7	0.4	0.4	0.4	0.1	0.1	0.1	0.1	0.1	1.2	0.0	0.1	0.1	0.1	0.1	0.3	0.2
Marblefish	3.5	5.6	3.0	2.6	4.2	4.0	4.4	3.1	0.6	1.1	0.5	2.2	2.3	1.1	0.5	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.0	0.1	0.1	0.1
Morwong, banded	85.8	78.0	72.6	42.4	34.2	39.0	53.7	56.0	46.4	45.6	54.4	50.3	52.6	37.1	44.6	40.9	40.3	37.9	34.1	30.1	32.9	34.0	30.3	36.0	31.3	28.2
Morwong, jackass	27.1	18.7	33.2	17.5	15.9	13.1	14.8	14.7	16.6	17.5	13.1	11.7	4.6	5.3	5.9	3.2	3.1	1.5	1.0	0.8	3.2	1.6	3.3	2.6	2.5	4.6
Morwong, other	5.4	7.4	7.4	6.3	1.4	0.6	1.4	1.9	1.2	1.8	1.3	1.3	2.5	1.4	1.2	0.9	0.7	0.7	0.6	0.7	0.3	0.6	0.3	0.4	0.2	0.2
Mullet	1.0	1.7	1.7	2.2	4.9	4.8	2.5	4.0	4.3	2.4	3.2	2.0	0.1	1.4	1.8	2.1	0.5	4.4	0.5	0.8	2.4	0.4	0.3	0.2	1.2	1.0
Snook	13.7	15.2	17.7	3.2	4.1	5.9	6.6	6.6	3.7	2.2	2.9	6.7	7.0	8.7	7.9	7.5	6.7	6.3	9.1	9.0	2.6	9.4	5.9	2.7	2.7	2.4
Trevally	8.4	6.0	5.4	6.5	2.7	1.6	4.7	5.9	3.4	3.7	6.3	3.6	8.8	4.5	3.8	1.9	2.1	5.4	4.3	5.7	2.8	3.6	3.3	3.7	11.4	4.3
Trumpeter, bastard	60.1	51.8	40.7	47.7	36.4	26.1	23.9	21.0	23.2	18.5	23.4	21.3	19.1	16.7	10.5	9.8	9.6	9.5	8.3	6.5	8.4	6.4	4.2	2.7	6.1	5.9
Trumpeter, striped	58.3	79.4	78.1	99.0	95.0	45.5	39.9	36.6	36.9	23.9	19.0	18.7	12.2	10.7	10.8	19.7	20.9	17.3	10.5	13.0	7.1	12.1	14.1	7.1	6.8	8.2
Trumpeter, unspec.	0.0	0.1	0.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.3	0.2	0.0	0.0	0.0	0.0	0.0
Warehou, blue	82.3	128.4	187.6	272.2	187.1	34.2	66.4	49.3	27.6	19.1	20.0	29.3	25.3	26.8	37.5	10.7	3.8	8.5	5.8	2.8	7.4	7.6	12.6	1.8	0.8	1.1
Warehou, other	14.6	15.6	4.2	1.0	0.0	0.0	0.1	0.2	0.1	0.8	0.1	0.0	0.1	0.6	0.2	0.0	0.0	0.2	0.0	0.1	0.3	0.4	1.2	0.5	0.0	0.0

Whiting, combined	1.4	0.1	0.0	23.3	9.6	36.5	39.6	35.9	50.9	31.6	2.3	38.1	31.4	32.5	26.7	34.2	15.5	13.8	36.6	1.9	20.7	26.0	16.1	41.5	45.3	57.6
Wrasse, combined	83.4	110.1	100.0	90.7	85.5	88.4	92.3	72.0	75.1	100.1	92.9	112.9	87.6	68.1	72.0	72.7	68.0	64.2	65.1	81.8	72.7	79.1	83.8	82.1	52.3	33.7
Total	**1084**	**1083**	**1310**	**1241**	**1076**	**987**	**1130**	**953**	**683**	**901**	**763**	**582**	**653**	**700**	**743**	**525**	**491**	**600**	**318**	**271**	**347**	**309**	**315**	**257**	**178**	**237**

Table A1 Continued. Whole weight in tonnes by financial year.

Species	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Small pelagics																										
Australian sardine	6.6	4.3	15.4	2.8	1.7	3.2	0.7	0.0	0.3	0.8	0.0	0.0	13.2	14.5	0.4	0.0	0.0	0.0	0.1	0.0	0.0	33.3	0.1	0.0	0.0	0.1
Mackerel, jack	26.2	19.3	19.7	59.8	14.7	9.1	19.4	19.4	41.1	12.8	6.8	2.6	202.8	919.7	910.2	35.7	56.4	0.2	0.4	5.5	1.0	0.1	2.0	0.2	0.1	0.4
Mackerel, other	2.0	1.3	1.0	0.5	2.1	0.1	0.0	0.1	0.0	0.5	0.5	0.2	10.3	0.2	0.3	0.8	0.1	1.9	4.2	1.1	0.2	2.8	0.5	0.2	0.6	0.8
Redbait	0.1	0.0	0.0	4.0	0.0	0.0	0.0	0.0	3.4	1.0	1.4	0.3	300.1	521.4	121.6	15.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**34.9**	**24.9**	**36.1**	**67.1**	**18.5**	**12.4**	**20.1**	**19.5**	**44.8**	**15.1**	**8.7**	**3.1**	**526.4**	**1456**	**1033**	**51.5**	**56.6**	**2.2**	**4.7**	**6.6**	**1.2**	**36.2**	**2.6**	**0.4**	**0.7**	**1.3**
Cephalopods																										
Calamari, southern	33.0	19.0	26.6	94.4	87.4	78.0	105.2	108.8	86.8	114.2	44.6	85.4	89.0	78.6	51.1	54.9	50.8	63.9	67.8	75.9	106.2	122.6	60.6	107.4	85.3	82.2
Cuttlefish	0.2	0.3	0.2	0.0	0.0	0.0	0.7	2.4	1.0	0.2	0.4	0.1	0.3	0.3	0.1	0.1	0.1	0.2	0.1	0.1	0.5	0.3	0.2	0.1	0.1	0.1
Octopus													3.0	2.2	2.1	5.9	3.8	4.5	8.3	4.7	7.5	19.2	6.7	1.1	0.3	1.4
Squid, Gould's	5.7	7.8	12.9	79.7	481.3	39.7	2.4	1.9	2.1	2.7	1.8	687.7	45.9	47.1	121.3	131.2	516.6	1071.8	0.0	31.4	416.8	175.6	528.0	155.2	15.8	670.4
Total	**38.9**	**27.1**	**39.7**	**174.1**	**568.7**	**117.7**	**108.3**	**113.1**	**89.9**	**117**	**46.8**	**773.2**	**138.2**	**126.6**	**174.6**	**192.1**	**571.3**	**1140.4**	**76.2**	**112.1**	**531**	**317.7**	**595.5**	**132.5**	**101.5**	**793.8**
Sharks[2]																										
Elephant shark	58.0	48.9	21.4	14.7	17.0	16.7	18.4	16.5	10.2	7.6	5.7	9.0	1.9	1.5	2.4	1.3	2.7	1.9	1.4	0.6	0.2	1.8	1.2	0.8	0.7	1.6
Gummy shark	750.5	543.8	348.6	113.4	109.7	53.9	23.5	14.2	24.7	41.6	12.4	13.6	13.8	9.8	9.8	9.3	7.5	7.9	6.0	7.6	8.2	11.1	9.1	7.7	6.9	10.8
Draughtboard shark	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.7	1.0	0.8	1.3	1.2	0.4	0.3	0.2	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
Sawshark	127.4	74.4	29.2	6.8	3.4	12.3	21.4	20.4	20.6	23.5	5.9	3.4	0.3	0.1	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
School shark	252.1	171.5	71.7	31.5	11.3	1.7	2.2	1.4	7.0	2.6	0.6	1.8	1.0	0.7	1.8	1.4	1.9	2.1	1.1	1.4	1.1	1.7	2.0	1.4	1.6	3.1
Seven-gilled shark	6.1	4.9	6.1	1.9	10.3	16.3	18.8	7.4	11.5	8.4	3.8	3.9	0.5	2.3	1.1	1.4	1.1	0.8	0.7	1.0	1.1	0.4	0.2	0.3	0.0	0.1
Other shark	26.4	16.1	11.3	6.8	6.5	4.8	5.8	3.6	3.2	1.1	0.6	2.3	0.9	0.7	0.3	0.9	0.6	0.6	0.7	0.9	0.8	0.9	1.8	2.8	3.5	3.2
Total sharks	**1221**	**859.6**	**488.3**	**175.1**	**158.2**	**105.7**	**91.8**	**64.2**	**78.2**	**85.6**	**30.3**	**35.2**	**18.8**	**15.4**	**15.7**	**14.7**	**14.2**	**13.4**	**9.9**	**11.5**	**11.4**	**15.9**	**14.3**	**13.0**	**12.7**	**20.4**

[2] Since 2001/02, shark catches have been reported in Commonwealth logbooks. Tasmania has jurisdiction of all shark species inside 3 nm except gummy and school shark, and fishers are on bycatch possession limits for all species. Figures in the table refer to Tasmanian Scalefish Fishery records only.

Table A2 Catch (tonnes) of all species assessed in this report and ordered by volume in the 2020/21 season.

Species	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Gould's Squid	5.7	7.8	12.9	79.7	481	39.7	2.4	1.9	2.1	2.7	1.8	688	45.9	47.1	121	131	517	1078	0.0	31.4	417	176	528	155	15.8	670
Southern Calamari	33	19	26.6	94.5	87.4	78	105	109	86.8	114	44.6	85.4	89	78.6	51.1	54.9	50.8	63.9	67.8	75.9	106	123	60.6	108	84.3	82.2
Tiger Flathead													62	37.8	66.3	47.7	53	31.6	20.3	24.6	64.4	74	39.4	17.1	15.6	60.8
Eastern School Whiting	1.4	0.1	0	23.3	9.6	36.5	39.6	35.9	50.9	31.6	2.3	38.1	31.4	32.4	26.7	34.2	15.4	13.7	36.5	1.8	20.6	26	16.1	43.9	43.6	54.0
Bluethroat Wrasse	5.5	2.1	3.5	2.9	3	3.1	7.3	11.6	7.1	13.4	3	2.2	39.6	41.9	46.2	53.3	48.5	50.7	52.3	64.3	57.1	60.1	62.2	63.1	41.1	26.3
Southern Garfish	56.2	91.6	83	102	91.7	81.4	87.8	92.5	66.2	85.5	89.3	50	31	63	49.3	43.2	53	51.5	37.9	33.8	21.9	16.4	8.9	7.4	10.7	17.0
Eastern Australian Salmon	413	287	476	385	364	485	462	407	167	337	254	115	256	339	372	204	189	331	65.6	42.2	89.3	18.9	76.1	38.7	14.5	9.5
Striped Trumpeter	58.3	79.4	78.1	99	95	45.5	39.9	36.6	36.9	23.9	19	18.7	12.2	10.7	10.8	19.7	20.9	17.3	10.5	13	7.1	12.1	14.1	7.1	7.8	8.2
Purple Wrasse	5.6	6.8	2.4	0.3	1.3	1.4	5	9.7	3.8	0.8	3.9	5.3	20.1	26	25.6	19.4	19.5	13.2	12.8	17.5	15.6	19	21.4	18.6	11.4	7.3
Bastard Trumpeter	60.1	51.8	40.7	47.7	36.4	26.1	23.9	21	23.2	18.5	23.4	21.3	19.1	16.7	10.5	9.8	9.6	9.5	8.3	6.5	8.4	6.4	4.3	2.7	6.2	5.9
Jackass Morwong	27.1	19	34.1	18.2	16.8	13.7	14.8	14.7	16.6	17.5	13.1	11.7	4.6	5.3	5.9	3.5	3.4	1.7	1.1	3.3	3.1	1.6	3.3	2.6	2.5	4.6
King George Whiting	0.1	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.6	0.8	2.6	2	0.7	0.7	0.3	0.4	0.7	1.7	0.7	1.2	2.1	3.3	3	0.9	1.6	3.6
Southern Sand Flathead													11.5	13	9.2	6.7	7.5	5.5	6.8	8.2	2.7	6.4	3.5	2.8	2.1	3.3
Greenback Flounder	8.7	7.8	7.6	4.6	13.9	10.8	13	10.7	13.9	14.7	10.8	12.9	3.4	4.3	5.2	4.9	3.7	1.9	2	1.5	1	3.3	3.9	2.2	3.5	2.7
Pike/Snook (Short Finned)	13.7	15.2	17.7	3.2	4.1	5.9	6.6	6.6	3.7	2.2	2.9	6.7	7	8.7	7.9	7.5	6.7	6.3	9.1	9	2.6	9.4	5.9	2.7	2.7	2.3

Blue Warehou	82.3	129	190	274	189	36	66.4	49.3	27.6	19.1	20	29.3	25.3	26.8	37.5	10.9	4.1	8.5	5.8	2.8	7.4	7.6	12.6	1.8	0.8	1.1
Longsnout Boarfish	0.6	1.2	0.4	0	2.3	3.6	5.5	3.6	4.3	3.6	5	5.2	0.7	1.5	2.7	1.9	2.9	2.1	1	0.6	0.7	0.6	1.1	0.9	0.5	1.1
Yelloweye Mullet	1	1.7	1.7	2.2	4.9	4.8	2.5	4	4.3	2.4	3.2	2	0.1	1.3	1.8	2.1	0.5	4.4	0.5	0.7	2	0.2	0.1	0.2	0.8	0.8
Barracouta	19.3	53.8	65.2	27.6	25	15.1	136	67.5	87.5	101	60.1	26.6	13.3	13.3	7.6	5	4	1.1	1.1	1.7	0.4	1.4	0.9	1.1	0.7	0.8
Leatherjackets	14.5	12.6	13.3	12.9	16.6	16.7	16.6	13.7	14.8	10.4	8.5	8.8	5.3	5.5	3	2.9	2.2	2.4	2.9	2.1	1.3	2.6	2.6	4.3	2.3	0.6
Common Jack Mackerel	26.2	19.3	19.7	59.8	15.1	9.2	19.4	19.4	41.1	12.8	6.8	2.6	203	920	910	35.7	56.4	0.2	0.4	5.5	1	0.1	2	0.2	0.1	0.4
Australian Sardine	1.1	0	0	0	0	0.1							13.1	14.5	0.4				0.1	0		33.3	0.1	0	0	0.1

Table A3 Total commercial catches (t) in selected estuaries around Tasmania by fishing season.

a) By fishing year	ES01	ES06	ES07	ES08	ES09	ES10	ES11	ES12	ES17	ES18	ES19	ES20	Total
1995/96	17.39	0.67	4.43		0.41	10.75		0.43	2.92	26.44	14.12	3.22	80.78
1996/97	16.71	0.35	2.63		0.56	15.01		0.92	6.12	12.29	6.98	1.78	63.35
1997/98	14.28	0.16	1.41	<0.05	0.63	15.62		2.48	11.47	20.79	13.47	1.35	81.66
1998/99	14.21		1.38		0.90	19.60		1.59	10.04	36.50	23.19	4.87	112.28
1999/00	4.73		0.98		0.45	14.15	0.18	2.56	18.90	28.51	10.23	2.77	83.46
2000/01	16.10		0.25		0.13	12.70	0.05	1.17	15.46	27.93	27.33	1.88	103.00
2001/02	13.88		2.23		0.19	73.82		1.19	8.86	64.06	32.33	2.00	198.56
2002/03	28.13		8.02		0.16	27.64	0.55	0.81	14.55	35.23	23.00	1.57	139.66
2003/04	40.05		6.06		1.00	25.12			5.17	59.52	21.83	0.81	159.56
2004/05	25.99		4.93		1.76	34.47		<0.05	9.46	25.87	23.14	0.66	126.28
2005/06	2.19	0.07	23.16		0.95	33.15	1.29		6.64	14.18	9.67	0.84	92.14
2006/07	30.97	0.25	9.93		2.00	23.60	0.17		8.72	20.01	19.74	1.36	116.75
2007/08	31.87	<0.05	3.16			15.26		<0.05	12.31	26.94	12.11	0.87	102.52
2008/09	32.22		1.14		0.18	20.90		<0.05	8.38	15.75	10.45	2.07	91.09
2009/10	26.91		0.72		0.46	15.22	<0.05	<0.05	3.93	15.57	4.39	2.07	69.27
2010/11	27.84	0.11	0.44		0.60	10.25			5.65	5.82	13.71	1.69	66.11
2011/12	13.88		0.28			8.39			4.95	6.88	6.70	1.89	42.97
2012/13	12.19	0.07	0.13		<0.05	12.22	0.20		6.72	13.27	3.11	0.85	48.76
2013/14	32.28		1.06		0.29	9.69			2.97	6.74	8.75	1.09	62.87
2014/15	1.76	<0.05	<0.05		0.40	8.90		0.10	3.25	8.51	0.87	0.72	24.51
2015/16	17.51				0.82	10.34		0.13	3.10	5.11	3.81	0.58	41.40
2016/17	26.24		0.05		0.17	12.63			2.77	4.13	4.61	2.36	52.96
2017/18	16.07		0.78			8.79			1.94	6.59	3.81	3.03	41.01
2018/19	31.70		12.50			7.64			5.63	1.73	13.56	2.89	75.64
2019/20	42.33		18.67			7.74			1.91	4.55	4.60	1.58	81.33
2020/21	53.67	0.85	9.47			9.14	0.45	0.13	1.53	1.59	3.01	1.39	81.23

ES	Description
ES01	Derwent River
ES06	Port Davey
ES07	Macquarie Harbour
ES08	Mersey River
ES09	Port Sorell
ES10	Tamar River
ES11	Ansons Bay
ES12	Georges Bay
ES17	Blackman Bay
ES18	Norfolk Bay
ES19	Frederick Henry Bay
ES20	Pitt Water

Table A4 Species catches > 0.2 tonnes total from estuaries in the 2020/21 season, ordered by total catch.

Species	ES01	ES06	ES07	ES10	ES11	ES12	ES17	ES18	ES19	ES20	Total
Eastern School Whiting	53.55								0.40		53.95
Atlantic Salmon (Marine Farmed)			6.5								6.50
Eastern Australian Salmon			1.74	3.12					0.02	0.08	4.96
Southern Calamari				1.65			1.29	0.40	1.14		4.48
Greenback Flounder	0.01		1.23	0.01				0.03	0.08	1.32	2.67
Gummy Shark		0.77			0.14				1.20		2.12
Bluethroat Wrasse				0.62	0.31	0.13	0.08		0.09		1.23
Māori Octopus				0.03				1.09	0.02		1.14
Southern Garfish				0.82					0.02		0.83
Silver Trevally	0.00			0.75							0.75
Yelloweye Mullet				0.60							0.60
Barracouta				0.36							0.36

Appendix 4: annual stock status classifications by species

Table A5 Annual stock status classifications of Tasmanian Scalefish Fishery species assessed in the current report. Terminology of status classifications has changed over time; however, colours represent equivalent classifications. Green: Sustainable; Yellow: Depleting; Orange: Recovering; Red: Depleted; Grey: Undefined. NA indicates catch, effort, and CPUE data for a species were included in an assessment report, but no classification was conducted. Blanks indicate a species was not considered in an assessment report.

Species	97/ 98	98/ 99	99/ 00	00/ 01	01/ 02	02/ 03	03/ 04	04/ 05	05/ 06	06/ 07	07/ 08	08/ 09	09/ 10	10/ 12	12/ 13	13/ 14	14/ 15	15/ 16	16/ 17	17/ 18	18/ 19	19/ 20	20/ 21
State-assessed species																							
Australian Sardine																							
Barracouta														NA	NA	NA	NA						
Bastard Trumpeter		NA	NA	NA	NA																		
Eastern Australian Salmon		NA	NA	NA	NA																		
Flounder			NA	NA	NA									NA	NA	NA	NA						
King George Whiting																							
Leatherjackets																							
Longsnout Boarfish														NA	NA	NA	NA						
Snook														NA	NA	NA							
Southern Calamari																							
Southern Garfish														NA	NA								
Southern Sand Flathead														NA	NA	NA							
Striped Trumpeter																							
Wrasse														NA	NA	NA							
Yelloweye Mullet														NA	NA	NA							

Species	97/ 98	98/ 99	99/ 00	00/ 01	01/ 02	02/ 03	03/ 04	04/ 05	05/ 06	06/ 07	07/ 08	08/ 09	09/ 10	10/ 12	12/ 13	13/ 14	14/ 15	15/ 16	16/ 17	17/ 18	18/ 19	19/ 20	20/ 21
Commonwealth-assessed species																							
Blue warehou		NA	NA	NA	NA																		
Common Jack Mackerel																							
Eastern School Whiting														NA	NA								
Gould's Squid		NA			NA																		
Jackass Morwong			NA	NA	NA									NA	NA								
Tiger Flathead					NA										NA								