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Socio-economic characterisation of a small-scale commercial fishery:

Opportunities to improve viability and profitability in the Tasmanian Scalefish Fishery

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Summary of key findings

TASMANIAN SCALEFISH FISHERY

The Tasmanian Scalefish Fishery (TSF) is a multi-gear and multi-species fishery. The commercial sector is predominantly made up of small owner operated fishing businesses. Species targeted include a range of finfish and cephalopod (e.g., squid, octopus) species.

The Scalefish Fishery is managed under the *Living Marine Resources Management Act 1995* and the *Fisheries (Scalefish) Rules 2015*.

The commercial sector of the Tasmanian Scalefish Fishery is primarily managed using input controls, including species and/or gear specific licensing, limited entry, gear restrictions, and spatial and temporal fishing closures. Output controls apply in the Banded Morwong fishery, which is managed using an Individual Transferable Quota system, and as trip catch limits for selected species (e.g., Striped Trumpeter). For further information see the NRE Tas Wild Fisheries Management Branch TSF webpage.

THE COMMERCIAL FISHING FLEET

PRODUCTION

There is no dominant species that most fishers catch. Across the 2018-2020 fishing seasons, over 70% of fishers caught more than one species. On average, fishers caught four different species within a fishing season. Southern Calamari, Wrasse and tiger flathead were caught by the highest share of fishers (42–53%).

See Scalefish Species – Tasmanian Wild Fisheries Assessments (tasfisheriesresearch.org) for information on assessed species.

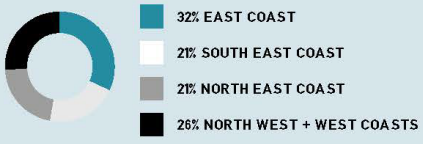
FISHING ACTIVITY

FISHER NUMBERS

117 PERSONS

The fishery consists of approximately 117 highly diverse individuals who use different combinations of gear to target varying mixes of species. At the same time, the number of fishers who are active in the TSF in a given month is relatively small (< 60 across 2018–2020).

FISHERS BY REGION



Technical efficiency of TSF fishers is high. For more than 60% of fishers, it is not possible for these fishers to increase their catch using the current mix of permitted gears or without investing in new technologies.

ACCESS

Operators must hold a fishing licence (personal) or FLP, as well as a licence package with a fishing licence (vessel) and gear licence and/or a species licence.

Currently there are ten gear type licences, three species licences and three licence types that allow access to a specific species and the use of specific gear to take that species. These licence types are described in the *Operational Guide for the commercial Scalefish Fishery*.

Fewer licences are being utilised over time, noting that some licences are non-transferable. As a result, levels of latent capacity (that is, unused licences) are high at approximately 50%.

Holders of a Fishing Licence (rock lobster) are also able to operate in the TSF although with gear restrictions.

ECONOMIC AND SOCIAL CHARACTERISTICS

LIVELIHOOD STRATEGIES

Current active fishers are generating positive earnings but there is no evidence of economic rent (or 'above-normal' profit) being generated.

Fishers operating in the TSF pursue diverse livelihood strategies in which fishing itself may be a major or minor activity, and fishing in the TSF may likewise be major or minor in terms of time commitment and proportion of overall earnings. Based on survey findings:

35%

of TSF fishers who also hold another job invest a higher percentage of their time in the TSF than the TSF accounts for percentage of their income. This suggests motivations for continuing to fish in the TSF are not primarily about maximising earnings for this group.

35%

of TSF fishers were currently working in other fisheries.

40%

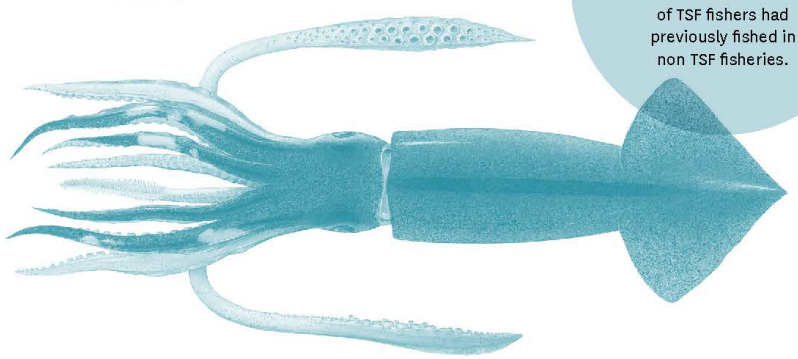
of TSF fishers were working concurrently in non-fishing jobs, commonly in trades or small businesses.

20+ YEARS

The majority of TSF fishers have fished in the fishery for more than 20 years and most intend to stay active in the fishery in the short to medium term.

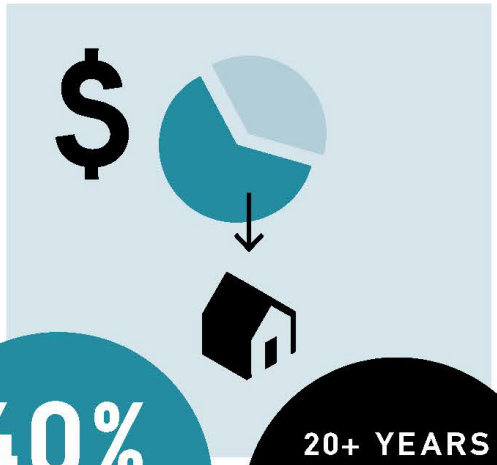
70%

of TSF fishers had previously fished in non TSF fisheries.



HOUSEHOLD INCOME CONVERSION

For the 2020-21 year, it was estimated that ~63 cents from each dollar of scalefish purchased from Tasmania is ultimately earned by Tasmanian households in wages, supporting demand for housing and consumer spending within the State.



Nototodarus gouldi © R.Swainston/anima.fish

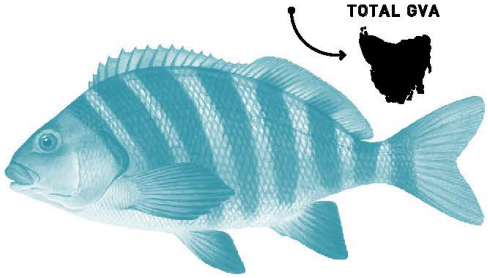
FLOW–ON BENEFITS TO TASMANIA

As TSF fishers are Tasmanian based, expenditure in the fishery and payment of wages to crew and earnings by skippers is recirculated in the Tasmanian economy. Relative to its economic size, the TSF makes a greater relative economic contribution to the Tasmanian economy, household income and employment generation that other larger but more economically efficient fisheries in Tasmania (see Rust and Ogier 2021).

ECONOMIC CONTRIBUTION TO TASMANIA

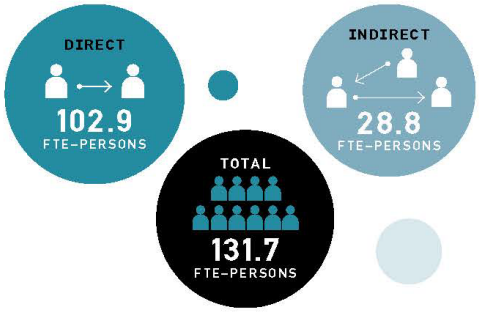
In 2020/2021, the Tasmanian Scalefish fishery contributed $6.3 million dollars (total GVA) to the Tasmanian economy.

$6.3 MILLION



CONTRIBUTION TO EMPLOYMENT IN TASMANIA

In 2020/21, the Tasmanian Scalefish Fishery contributed 131.7 FTE-persons (total employment) in Tasmania.



Employment (FTE) represents the number of full-time equivalent jobs associated with skippers and crew. We consider 1 FTE as being 37.5 hours of work per week. Note: the number of FTEs is further pro-rated by the portion of total seasonal catch caught under endorsement for each endorsed fisher.

ADDING VALUE

DIRECT GVA, 2020/21

$2.6 MILLION
FROM CATCH IN THE TASMANIAN SCALEFISH FISHERY

INDIRECT GVA

$3.6 MILLION

$2.1M
FROM HOUSEHOLD RE–SPENDING OF INCOME

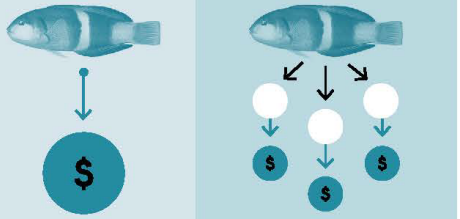
$1.5M
FROM BUSINESS RE–SPENDING IN OTHER SECTORS

Gross Value Added (GVA) represents the value of all goods and services produced in an industry, minus the cost of all inputs and raw materials consumed to produce those products and provides a measure of the net contribution of an activity to the economy (excluding net taxes).

HOUSEHOLD INCOME

TOTAL HOUSEHOLD INCOME, 2020/21

$3.9 MILLION
FROM THE TASMANIAN SCALEFISH FISHERY



$1.8M
EARNED DIRECTLY AS INCOME BY FISHING HOUSEHOLDS

$2.1M
EARNED IN OTHER TAS HOUSEHOLDS AS A RESULT OF TASMANIAN SCALEFISH FISHING

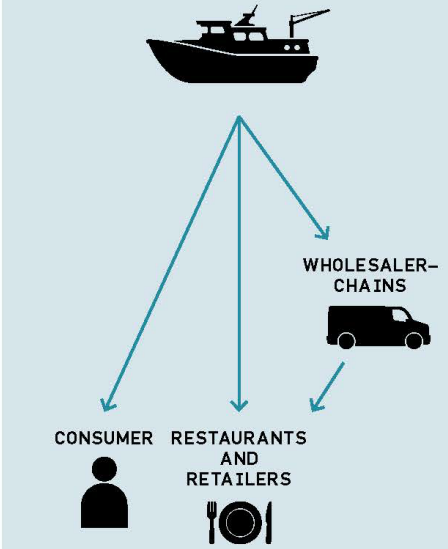
Household income represents wages and salaries paid in cash and in kind, drawings by owner operators and other payments to labour including overtime, employer's superannuation, and income tax, but excluding payroll tax.

Chirodactylus spectabilis and *Notolabrus tetricus* © R.Swainston/anima.fish

LOCAL SEAFOOD VALUE CHAINS

TSF supply chains include Direct-to-Consumer; Direct-to-Final Market (local restaurants and retailers); and Wholesaler-chains (where product is largely on-sold to Melbourne or Sydney fish markets or final markets).

SUPPLY CHAINS, TASMANIAN SCALEFISH FISHERY, 2018–2020

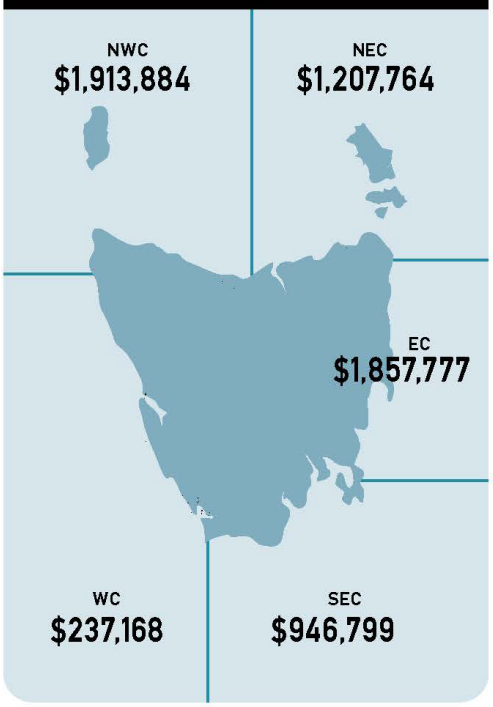


The three major classes of buyers are wholesale (60%), restaurant (20%) and retail (14%), accounting for 94% of the total sales across the years 2018-2020.

Reported sales volumes to Tasmanian consumers, restaurants and retailers represents between 17-24% of reported volumes sold in the financial years 2018/19 and 2019/20. However, the proportion of TSF product consumed in final local markets is likely to be far higher due as some portion of product sold to TSF wholesalers is on-sold locally to consumers and the Tasmanian hospitality sector.

REGIONAL CATCH VALUES

REGIONAL CATCH VALUES, TASMANIAN SCALEFISH FISHERY, 2020-2021



Catch proportion is based on logbook fishing records for the 2019-20 and 2020-21 fishing years and apportions the recorded GVP for scale-fish and shark species caught in Tasmanian waters for 2020-21.

Ogier, E., Lyle, J. Rust, S., Krueck, N., Yamazaki, S., Cosentino, T., Tinch, D., Seaborn, F., Harrington, J., Spanou, L. (2022) Socio-economic characterisation of a small-scale commercial fishery: *Opportunities to improve viability and profitability in the Tasmanian Scalefish Fishery.* FRDC Project No 2018-067. Institute for Marine and Antarctic Studies, University of Tasmania. Hobart, CC BY 3.0.

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1. Introduction

The Tasmanian Scalefish Fishery (TSF) is a multi-gear and multi-species fishery. Participants in the fishery include commercial, recreational and Tasmanian Aboriginal fishers. The commercial sector is predominantly made up of small owner operated businesses while the recreational sector is large in size and diverse in terms of fishing behaviours. The Scalefish Fishery is managed under the *Living Marine Resources Management Act 1995* and the *Fisheries (Scalefish) Rules 2015*. Species managed include a range of finfish and cephalopod species.

The *Scalefish Fishery Management Plan* was introduced in 1998 and, although the legislation has been reviewed several times (most recently in 2015), the underlying policy objectives have not been updated. A linked policy document (DPIF 1998) identifies economic and social goals in generic terms but does not identify measures or benchmarks to assess economic and social performance. The policy document has no statutory basis and is not regarded by the managing agency, Natural Resources and Environment Tasmania (hereafter, NRE Tasmania), as current for the purposes of informing recent or contemporary policy development for the TSF (*pers.comm,* 2023). The social and economic performance of the commercial sector of the TSF therefore remains poorly understood, apart from a semi-quantitative study conducted in the early 2000s (Bradshaw 2005) and a recent high-level social and economic assessment (Ogier et al. 2018).

The lack of defined economic and social goals of management for small-scale multi gear and multi-species fisheries is observed in many similar cases across Australia (Hill et al., 2020) and in developed economies globally (Cohen et al., 2019, Said et al., 2020). It is attributed to the 'general fishery' nature of these fisheries, in which they encompass a high diversity of participants with a range of stakes and interests, as well as of gears and targeted species, coupled with typically low landing volumes and values of targeted species (FAO 2015). This situation has given rise to a primary focus of management on ensuring catches remain within biologically sustainable levels. Fishery management regimes in these cases have typically arisen from the bundling together into a single large management unit the various access and input controls specific to species, gears and sub-regions (Pomeroy et al., 1994). The resulting complexity and focus on immediate stock sustainability needs is likely to have limited investment in understanding social and economic performance of small-scale multi-gear and species fisheries and in defining goals and benchmarks to direct fisheries management (Smith et al., 2019, Weeratunge et al., 2014).

1.1. Commercial sector – the Tasmanian Scalefish Fishery

The commercial sector of the Tasmanian Scalefish Fishery is primarily managed using input controls, including species and/or gear specific licensing, limited entry, gear restrictions, and spatial and temporal fishing closures. Output controls apply in the Banded Morwong fishery, which is managed using an Individual Transferable Quota system, and as trip catch limits for selected species (for example, Striped Trumpeter). Further information on fishery rules, permitted gear types, species, and licences for the commercial sector is available in the Operator Handbook on the Department of Natural Resources and Environment Tasmania (NRE Tas) Wild Fisheries Management Branch TSF webpage.

Many recent management changes have been in response to emerging resource issues, such as: increased catches of species experiencing higher market demand; and changing availability of target species. Further information on the history of changes in the management of the TSF is provided in Appendix C. Changes to access or input controls have been introduced often with limited quantitative assessment of the social and economic implications for the commercial sector (see Bradshaw 2005). Furthermore, as species and

activities have become increasingly regulated and managed under separate access and licencing rules, the flexibility for commercial operators to respond to maintain profitability has been impacted.

Over the past two decades there has been a dramatic downturn in catch and effort in the TSF. Between 2001 and 2016 the number of Scalefish licences in use has fallen by more than 50%, from 457 to 253; less than half of which (104) were active in 2021. Scalefish landings have also declined sharply over the same period, from over 1,100 tonnes to about 300 tonnes per annum. While this decline in landings can be attributed to a combination of stock depletion and management, harvest levels for a number of species managed under the TSF remain very low and under-utilised in economic terms (e.g., Australian salmon).

A recent high-level assessment of economic and social performance of the TSF at the fishery level (Ogier et al., 2018) found that the fishery was not generating high levels of revenue from catch sales for operators; the contraction in number of active licences was likely to contribute to a contraction in fleet size and therefore provide diminishing levels of employment; and the catch was estimated to be supplying less than 10% by volume of Tasmania's per capita seafood consumption annually (and this proportion was decreasing).

1.2. Knowledge gaps

Comprehensive baseline data concerning social and economic performance and contributing conditions (factors) of the TSF remains a gap. Specifically, declines in landings, total revenue, and activation of TSF licences that indicate viability of fishing operations is likely to be changing. However, no baseline data of these viability measures exists with which to track changes in viability at the operator level. Similarly, baseline data on fishery-level net social and economic performance, such as net economic rent, total employment, local seafood supply to support other local economic sectors, is not available.

A further gap is knowledge of the extent to which levels of social and economic viability for operators and fishery-wide performance are attributable to (i) biological factors, such as productivity and current stock status; (ii) institutional factors, such as design of the licencing framework and of input and output controls; and (iii) market factors, such as changing consumer preferences, competition from imported and farmed product, and under-developed processing and supply chain infrastructure. In addition, the role of factors endogenous to TSF fishers (i.e., demographic characteristics of fishers, their livelihood strategies and motivations for fishing) in explaining performance has not been assessed.

Overall, these knowledge gaps prevent identification of options to address barriers to and incentivise more socially and economically beneficial fishing and value-chain development strategies for the TSF. They also limit capacity for assessment of impacts of changes in management or external conditions (such as those introduced by the COVID-19 pandemic) on commercial operators and the sector as a whole.

The risk presented by not addressing these knowledge gaps is that of lost opportunities to capitalise on available and emerging value chains for wild caught seafood (e.g., Tasmania's burgeoning food tourism sector); and with this, continual decline in social and economic viability for operators as well as decline in the flow of benefits to regional communities through employment and other induced effects.

Box 1. Key terms

Viability
In this study, this term is used to describe the ability of TSF operators to continue to operate in the fishery across time (see Schuhbauer and Sumalia 2016). Viability is dependent on fishery conditions and comprises both:

- *social viability*, in which fishers (operators) are able to pursue a livelihood in commercial fishing which generates sufficient employment in accordance with their livelihood objectives, and which is consistent in security and continuity across time in accordance with their licenced level of access; and
- *financial viability*, in which the profitability of operators remains or increases across time.

Performance
In this study, this term is used to describe the extent to which the TSF currently generates social and economic benefits fishery as a whole (i.e., at the fishery level) consistent with public policy objectives guiding management of the fishery (see Schuhbauer and Sumalia 2016).

Profitability
This term is used to describe the profitability of licenced skippers operating in the TSF (also referred to as 'operators'). The measure of profitability used is in this study was EBITDA (or, earnings before interest, taxes, depreciation, and amortization). Skipper wages are treated as part of profit, as is quota rental payments, while crew wages are a cost.

1.3. Research need

This project addresses the need for:

- Baseline data availability and analysis of the TSF commercial fleet's fishing activities in order to determine and continue to monitor change in feet characteristics, fishing strategies and behaviours;

- Baseline data availability and analysis of social and economic operating conditions and outcomes for the commercial sector and the extent to which it is viable for current licence holders and is generating public benefits (i.e., fishery-level social and economic performance); and

- Identification of the types and operating conditions of TSF product supply chains and markets, as well as opportunities for supply chain and market improvements.

2. Objectives

Objectives of the project were to:

1. Characterise the fleet dynamics, capacity and fishing strategies of the Tasmanian Scalefish Fishery (TSF).
2. Profile key social and economic characteristics of the commercial sector of the TSF
3. Assess market conditions and supply chains for Tasmanian finfish species.
4. Identify strategies and opportunities for improving economic and social viability and returns

3. Project design and methods

3.1. Project governance

The project team included people with a wide range of expertise and perspectives, and representing research organisations and industry-based researchers, the management agency (Department of Natural Resources and Environment Tasmania, or NRE Tas hereafter), and the peak seafood industry representative body (the Tasmanian Seafood Industry Council, or TSIC hereafter). Full details are provided in Appendix A.

For the purposes of providing steerage to the project team and ensuring relevance to the TSF, a project Steering Committee was formed. The committee comprised the members of the Scalefish Fishery Advisory Committee (SFAC), which is a Ministerially-appointed committee responsible for developing independent advice to the Minister on matters of management of the TSF. An update on the project was provided with meeting papers for each SFAC meeting held during the period of the project, which included any actions for members to address. The Principal Investigator (PI) presented the update to the SFAC members at each meeting, feedback was provided and any actions were discussed and recommendations developed. In particular, the members discussed, identified and endorsed the following:

- The range of social and economic goals management of the fishery could target
- The Fisher livelihood classification developed on the basis of the TSF Fisher Survey, and the need to consider inactive licences (latent capacity)
- Factors currently limiting market development for new species or new products, including the extent of inactive licences (latent capacity) which was being re-activated by new entrants when new market opportunities become apparent
- The initial list of potential strategies to improve profitability and viability of the commercial sector, including opportunities to service the lobster fishery bait market (Australian Salmon), increasing individual quick freezing (IQF) processing capacity in Tasmania

Final results of the project were presented to the project Steering Committee at SFAC meeting 75, 9 December 2021 and again at SFAC meeting 76 on 29 July 2022. The results were reviewed and endorsed.

3.2. Project design

Social and economic indicators were selected on the basis of their relevance to the project objectives, consistency with similar studies globally, and data availability (see Table 1).

The project comprised five main research phases or focal studies (Table 2). Data collection methods included extracts of administrative data (licensing, fishing activity, retained catches, sales and transfers of landed catch), surveys of TSF fishers and seafood processors, expert consultations, a workshop, and reviews of literature. Data from each method was analysed for a range of purposes (Tables 1 and 2).

The 2018/19 financial year was the reference year for the purpose of financial analysis, as this was the year for which financial data was collected from fishers participating in the TSF Fisher Survey.

Table 1. Social and economic indicators and basis of inclusion in study (Sources: BDO EconSearch 2020; BDO EconSearch 2022b, Rust and Ogier (2021); Schuhbauer, and Sumaila (2016), Weeratunge (2014); Voyer et al. 2017; Yamazaki et al. (2018)).

Indicator	Fisher financial and social viability analysis	Fishery-level social and economic performance assessment
Catch-linked indicators: • **Annual effort** • **Annual catch** • **Gears** • **Species**	Clusters and heterogeneity in these fishing activity measures indicate classes and diversity of individual fishing operations within the fleet. Classification using these measures supports analysis of viability of specific types of fishing operations where value of catch is low or gear/species licences are to be further limited.	Total catch by species, which informs analysis of contribution to seafood supply (social performance indicator)
Fishing platform licence type	Licence type indicates extent to which licence asset is transferable or grandfathered, which indicates financial capital and security of access held by operators.	
Activation / Latency of Fishing platform licences by type	Latency indicates operators' views about the limited economic incentives and profitability of the TSF, with high levels of latency suggesting that low expected profits in the fishery do not justify fishing under current conditions. Conditions may include: catchability of target species, licencing conditions, price.	Latency indicates inferred low value of licence asset and therefore potential failure to maximise net economic returns from a fishery.
Technical efficiency	Ability of the range of types of TSF operators to obtain the maximum output (catch) from a set of inputs (gear allowances, species allowances), or to produce an output (catch) using the lowest possible amounts of inputs. High technical efficiency is an indicator of underlying: • technical capital (i.e. fishing vessel and gear and licence to catch) • Knowledge capital (i.e. fishing skills) Low technical efficiency can indicate non-technical motivations for fishing, rather than lack of technical and knowledge capital, however	Analysis can indicate the function of the licensing framework, especially in multi gear and species contexts, in constraining technical efficiency.
Fisher age	Comparison with the overall working population indicates whether the TSF is attracting and/or retaining younger or older operators (social viability)	
Fisher employment (all activities)	Extent of employment in other sectors indicates reliance on supplementary non-fishing sources of income.	Extent to which management of the TSF supports full specialisation and employment in the TSF

Indicator	Fisher financial and social viability analysis	Fishery-level social and economic performance assessment
	Varied livelihood strategy also indicates adaptive capacity	
Fisher livelihood conditions: • **Livelihood motivations** • **Future fishing intentions** • **Threats to livelihood conditions**	Motivations indicate basis of viability for operators. Future intentions indicate extent to which operators view future conditions in the TSF as viable Threats to livelihood conditions indicate issues negatively impacting social viability	Extent to which management is ensuring viable fisher livelihoods.
Fisher expenditure	Contributes to analysis of fisher profitability (financial viability).	
Fisher profitability	Fisher profitability measured as Earnings before Interest, Tax, Depreciation and Amortisation (EBITDA) is a direct measure of short-term financial viability of fishing businesses. EBITDA evaluates the profitability of a firm's primary activities by disregarding non-cash depreciation and amortisation expenses, taxes, and debt costs (which are influenced by the choices that business owners make in relation to capital structure, funding, depreciation methods, etc.).	Extent to which fisheries management settings and market conditions enable short-term financial viability of operators in the commercial sector.
Gross Value Added (GVA)	Direct GVA in a fishery serves as a simplified measure of the economic value generated directly from fishing activities. Like Net Economic Return (NER), this measure captures the difference between the value of outputs (harvested fish) and the costs of inputs (e.g., fishing gear, fuel, bait etc.). Unlike NER it considers wage earnings to be a return from fishing (rather than a cost), and which we consider appropriate for the small-scale nature of the TSF. However, it also does not take account of non-cash items (such as depreciation and amortisation) or the opportunity cost of capital.	Total GVA (direct GVA + indirect GVA) measures the contribution of the TSF to the Tasmanian economy for the 2018/19 financial year. This represents the total of business income and employee wages earned in Tasmania for the financial year that resulted from fishing activity in the TSF.
Employment (FTE)	Direct employment indicates the number of full-time equivalent positions created for crew in the TSF as a result of the fishing opportunities that exist in that fishery.	Indirect employment measures the further contribution to general employment in the Tasmanian economy through the re-spending of wages earned in the TSF and expenditure by TSF operators in their businesses.

Indicator	Fisher financial and social viability analysis	Fishery-level social and economic performance assessment
Household Income		Indicates the total wages and salaries earned by Tasmanian households (both fishing and non-fishing households) because of the employment created both directly and indirectly from fishing activities in the TSF.
Supply chain length and diversity	Length of supply chains negatively indicates bargaining power for individual operators and exposure to external supply chain shocks. Diversity positively indicates adaptive capacity of operators under conditions of change.	Diversity indicates adaptive capacity of sector under conditions of change
Landings price ($/Kg)	Revenue (financial viability) for operators	Historical analysis indicates extent to which prices are matching broader economic trends
First trade network size, value and diversity	Size and diversity of buyer sector can indicate 'thinness' of the market if the ratio of buyers to harvesters is close to 1:1 and buyers are not linked. This can mean that for individual operators there is a high transaction cost to establish new sales channels. It can also indicate that buyers do not hold market power while harvesters do hold bargaining power for first trades.	Indicates extent of supply chain links, size of buyer sector, resilience of supply chains (which is positively indicated by greater diversity of buyers).
Local supply chain volume and receiver types		Indicates extent of access of local non-fishing population to TSF seafood products via different value chains.

Table 2. Design of project phases and focal studies

Focal study	Project Objective	Data collection	Data analysis	Report section
Fleet and fishing operation characteristics	1.	NRE Tas Part A & Part B of the Commercial Catch, Effort and Disposal Return – data extract NRE Tas Fishing Licence Records – data extract	Fleet characterisation Fishing operation characterisation Technical efficiency	Section 4
Social and economic characteristics and performance of the commercial sector	2.	NRE Tas Fishing Licence Records – data extract Australian Bureau of Statistics – demographic data TSF Fisher Survey	Fisher demography Fisher livelihood strategy classification Fisher livelihood conditions Fishing expenditure profile and profitability analysis Estimation of economic contribution	Section 5
Market and supply chain conditions	2. & 3.	TSF Fisher Survey TSF Post Harvest Survey NRE Tas Fish Transfer or Sale Receipt – data extract NRE Tas Part C of the Commercial Catch, Effort and Disposal Return (sales or transfers of all retained scalefish species) – data extract	Supply chain and markets Historical landing price analysis Network analysis of first trade markets Local first trade market analysis	Section 6
Observed changes in the TSF and their social and economic implications	1., 2., 3. & 4.	TSF Fisher Survey NRE Tas Fishing Licence Records – data extract NRE Tas Part C of the Commercial Catch, Effort and Disposal Return (sales or transfers of all retained scalefish species) – data extract NRE Tas Fish Transfer or Sale Receipt – data extract	TSF sensitivity/responsiveness to market conditions: case study of Calamari fishing Impacts of COVID-19 pandemic outbreak, Jan 2020 – June 2021	Section 7
Opportunities and strategies to improve economic returns and flow-on benefits	4.	Literature review and synthesis of trends in Australian seafood consumption behaviours Expert input Industry Workshop	Trends in seafood consumption Food service sector opportunities Industry development opportunities and feasibility assessment	Section 8

3.3. Data collection and analysis

3.3.1. Fleet and fishing operations characterisation and classification

As a condition of licensing, commercial fishers are required to report their fishing activity (date fished, location and gear used) and catch (by species). This information can be used to classify operational characteristics that take account of levels of effort (days fished) and catch (harvest weights) to identify the key fisher typologies in the TSF.

Logbook and licencing data were extracted from NRE Tas's Fisheries Licensing and Monitoring System (FILMS) database. Initial data extractions were restricted to the period from fishing seasons 2014/15 until 2018/19, which represented the latest quality-controlled records available at the start of the project. Key data columns extracted contained information on fisher ID, fishing date, gear used, species caught, catch volume (weight in kg), and fishing block (Figure 1).

Limiting our analyses to the past five fishing seasons was intended to keep findings relevant to current management and socio-economic conditions. Data analyses were aimed at providing a more in-depth assessment of how fishers operate and how their activities relate to catch sale information, product price and demand.

To analyse fishing activities and characterise fleet dynamics, we firstly used data on catch and effort to identify individual operators and analyse which of those operators had been active (fished on more than one occasion) in the last two fishing seasons (2017/18 and 2018/19). We then excluded all operators that had been inactive in both of these seasons. For the remaining operators, we used catch and effort data over the last five seasons (2014/15 – 2018/19) to then calculate the mean days fished per season, the mean catch recorded per season, the types, mean number and total number of species caught per season, the types, mean and total number of regions fished per season, the types, mean number and total number of gears used per season, the mean volume and total catch volumes of each species caught per season, and the mean proportions by weight of species caught, regions fished and gears used per season.

In combination, these data provided a basis for the classification of sub-groups and subsequent use in developing a stratified sampling regime for recruitment for the TSF Fisher Survey. Classifications were done based on various combinations of catch and effort metrics and statistical techniques, including cluster analysis, multivariate non-dimensional ordination and linear regressions, implemented using the statistical program software R.

The classification adopted for the project's different analyses was based on thresholds for mean fishing days (i.e., effort) and catch per season, respectively, and was used to classify TSF operators into effort/catch groups: Low/Low, High/Low, High/High, and Low/High.

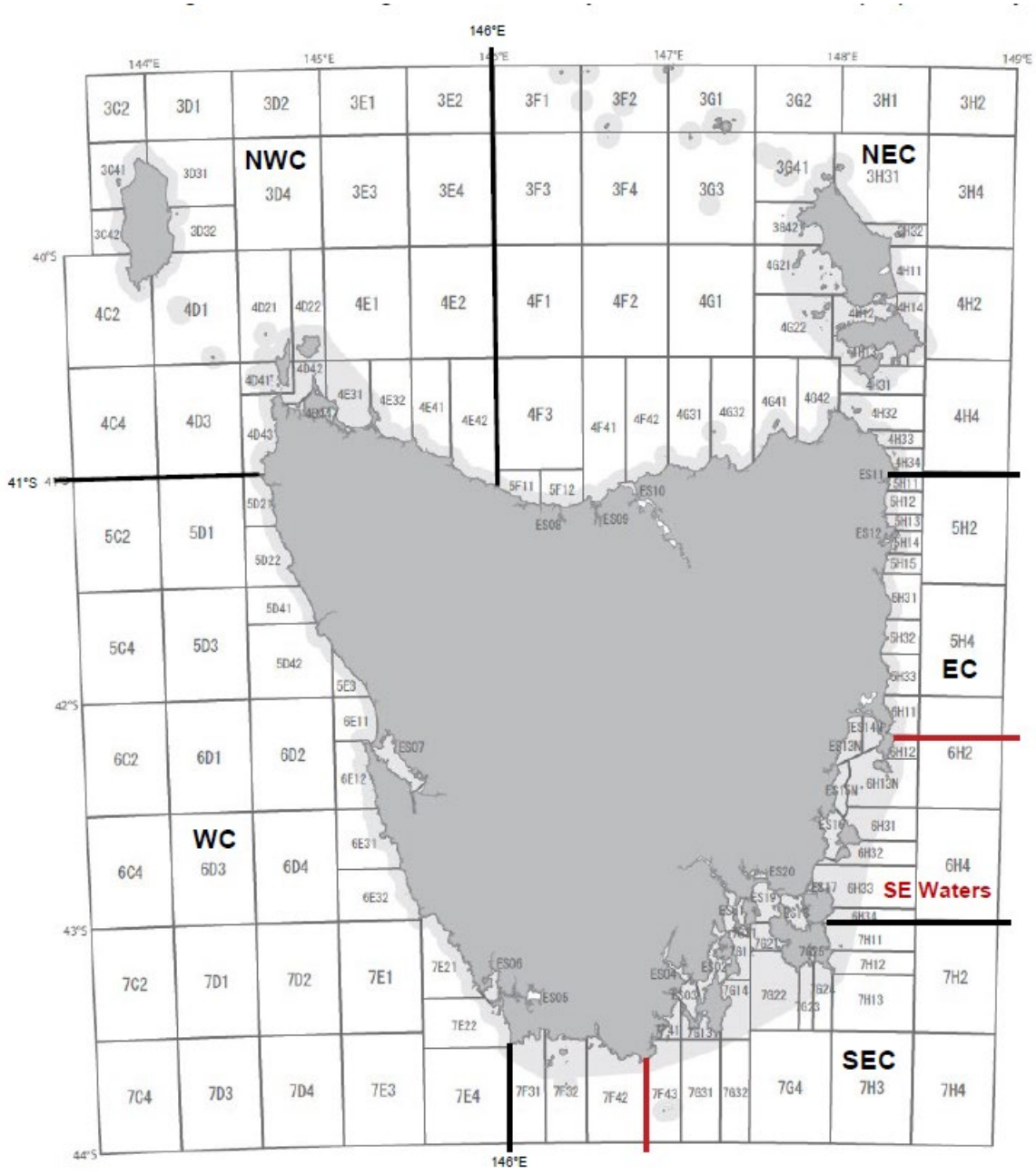


Figure 1. A map of Tasmania with the fishing blocks and assessment regions for the Scalefish Fishery. SEC = south east coast, EC = east coast, NEC = north east coast, NWC = north west coast and WC = west coast. The exception is for calamari where SEW = south east waters as indicated with the red line.

3.3.2. Fishing efficiency analysis

For a multi-gear and multi-species fishery, it is not straightforward to compare the economic performance of fishing operations among fishers and across time because different compositions of species are caught by various mix of fishing gear as well as because environmental and other operating conditions may vary over time. The concept of technical efficiency provides a standardised measure that reflects the ability of an individual operator to obtain the maximum catch for a given set of inputs for the context of multi-species, multi-gear fisheries. To estimate technical efficiency, we first consider the feasible production set that represents a set of input and output combinations that are feasible. For *N* inputs (fishing gear) and *M* outputs (species), the feasible production set, $P(\mathbf{x})$, is defined as

$P(\mathbf{x}) = \{\mathbf{y}; \mathbf{x} \text{ can produce } \mathbf{y}\}$ (1),

where $\mathbf{x} = (x_1,\ldots,x_N)$ is a vector of N inputs and $\mathbf{y} = (y_1,\ldots,y_N)$ is a vector of M outputs. For this feasible production set, we measure the technical efficiency of a fisher operating at $(\mathbf{x}_0,\mathbf{y}_0)$ by calculating the radial distance from this point to the corresponding production frontier. Specifically, we use the Farrell (1957) output measure of efficiency defined as

$$\lambda(\mathbf{x}_0,\mathbf{y}_0) = \sup\left\{\lambda \middle| \lambda\mathbf{y}_0 \in P(\mathbf{x}_0)\right\} \quad (2),$$

where $\lambda(\mathbf{x}_0,\mathbf{y}_0) \geq 1$ is the proportional increase in the output for the fisher to operate at the frontier (i.e., full efficiency). Given this, an output-oriented measure of technical efficiency for the fisher is calculated by

$$TE(\mathbf{x}_0,\mathbf{y}_0) = 1/\ \lambda(\mathbf{x}_0,\mathbf{y}_0) \quad (3),$$

which is bounded by zero and one because $\lambda(\mathbf{x}_0,\mathbf{y}_0) \geq 1$. This measure of technical efficiency reflects the maximum proportional expansion of the output vector for a given input vector. This means that a fisher with $TE < 1$ is said to be technically inefficient and it is possible to increase the quantity of outputs for the current input mix. In contrast, a fisher with $TE = 1$ operates on the production frontier and it is not possible to increase the quantity of outputs for the current input mix.

For the efficiency analysis, data on fishing date, gear used, species caught, catch volume (in kg) were extracted from NRE Tas's Fisheries Licensing and Monitoring System (FILMS) database. In total, 14,905 daily observations were extracted from the database for the period January 2018 to December 2020, while 30 observations were removed from the analysis because of missing values of some variables (e.g., fisher ID and gear). The daily data were aggregated to yearly values, thereby the technical efficiency was estimated by output-oriented Data Envelopment Analysis (DEA) for active TSF operators for each year in the study period. DEA is one of the most common estimation techniques used in efficiency analysis in the literature (Coelli et al. 2005). We do not provide the technical details of DEA here as they are available in the literature (Coeli et al. 2005). The Stochastic Production Function (SPF) approach is an alternative technique that is commonly applied to the estimation of fishing efficiency (Kompas et al. 2004; Pascoe et al. 2018). For the current context, DEA is advantageous because it can be readily applied to the multi-species, multi-gear production technologies without specifying a parametric relationship between inputs and outputs. In contrast, SPF involves a parametric estimation of the relationship while incorporating random variation in the output. The advantages and disadvantages of DEA and SPF have been discussed by Thingley et al. (2005) and Van Nguyen et al. (2021).

3.3.3. Fisher demographic analysis

Data extracted from NRE Tas's Licencing data on the TSF included the Date of Birth of TSF Scalefish A, B and C Licence holders (inclusive of licence holders and nominated supervisors). This analysis was conducted for the reference year 2018/19. TSF licence holders were classified using the following age classes: <30, 30-39, 40-49, 50-59, 60-69, 70+.

The median age for the general adult male population in Tasmania for the reference year was extracted from the Australian Bureau of Statistics, 31010DO002_201906 Australian Demographic Statistics, June 2019.

3.3.4. Fisher livelihood classification and conditions

A structured survey-questionnaire (the TSF Fisher Survey) was developed to collect information on current social and economic characteristics of active TSF commercial

operators. The survey was approved by the Human Research Ethics Committee, University of Tasmania (Reference Number 20241).

It included questions to determine:

- Fisher livelihood strategies, product handling behaviours, marketing and supply chain strategies
- Economic and financial conditions of fishing activities (costs of production, revenues), and associated post-harvest supply chain and marketing activities. 2018/19 financial year is used as the year for financial data.
- Experience of COVID-19 induced impacts and strategies to continue fishing
- Attitudes to the current and future conditions in the TSF for commercial operators

In designing survey questions, questions used in the 2002 survey of the TSF (Bradshaw 2005) as well as those used in existing economic survey templates for Australian fisheries (e.g., BDOEconSearch and ABARES surveys) were considered. An additional inclusion in the survey scope was the observed and anticipated impacts of the COVID-19 pandemic and associated public health restrictions on TSF operator activities, supply chains and markets. Additional questions or sections to questions were added to allow operators to report a comparison of current fishing conditions with 'business as usual' fishing conditions (2018/19 FY). The full survey-questionnaire is provided in Appendix D.

As this study was not experimental in nature, sampling was not based on demographic factors. Inclusion criteria for TSF operators included for sampling purposes were: Aged 18 or above and residing in Tasmania; Holder of a Fishing Licence Personal issued by NRE Tas; Licensed to fish the TSF in 2020 and in the last two completed fishing years (which included the reference year period of 2018/19). At the start of 2020 there were 122 operators who had actively fished in the TSF in the last two completed fishing years.

A stratified sampling strategy was used based on initial classifications of TSF operators by fishing activity and fishing region. The primary classification was based on level of production (fish landings) per annum and level of fishing effort per annum. The secondary classification was of Operator by region of fishing activity (determined by Home port as listed in the NRE Tas license data). A minimum number for each group of five was used in order to meet IMAS data aggregation requirements.

The survey was promoted through TSIC News and by NRE Tas to all TSF licence holders via letter and email to all eligible operators in their licensing database. A list of potential participants was drawn up from the list of licensed operators provided by NRE Tas for each of the sample stratifications. Potential participants who met the inclusion criteria were sorted: firstly, by level of fishing effort and production; and, secondarily, by Home Port region, in order to generate regional and fishing activity sub-populations from which to recruit.

Potential participants were contacted directly by Lyle, Rust or Ogier using their business contact details and provided with the information on the Participant Information Sheet. If the contacted operator was not available or unwilling to participate, the next listed potential participant in that stratification was contacted. Once the minimum number of participants in each sub-population had agreed to participate, no further recruitment was sought for that sub-population.

The TSF Fisher Survey was administered face-to-face or by telephone by members of the project team. Participants were read or were given to read a consent statement and were asked to indicate their consent to participate and have their data used as described before the survey was conducted.

Twenty-eight interviews were completed, representing approximately 25% of the active TSF fisher population. The sample met the stratified sampling strategy specifications.

Data was extracted from survey response forms and entered into an Excel database. Quantitative results were analysed using simple univariate and bivariate methods. This included data on fisher livelihood strategies, which was used to develop Fisher Livelihood Classifications**.** Financial data was extracted and analysed separately in order to generate the TSF fisher cost structure profiles (see below).

Qualitative response data was entered into a Nvivo Qualitative Analysis Software database to allow for responses to be systematically coded by themes. This analysis was used to identify market and management strategies used and available to improve social and economic performance. It was also used to analyse responses to questions concerning the impacts of the COVID-19 pandemic on fishing activities, supply chains, and livelihood strategies.

3.3.5. Fishing expenditure profiles and profitability analysis

As part of the TSF Fisher Survey conducted for this project (see above), vessel-level data was collected on Direct Fishing Costs (paid every fishing trip), Vessel Costs (boat maintenance, etc.), and Administrative Costs (all overhead, including quota costs related to Banded Morwong). These costs together constitute the total operating expenditures for most TSF fishing businesses in a year. Based on this information, representative expenditure profiles have been developed for TSF fishing operations. However, due to the need to reduce survey burden arising from the large number of questions proposed for the TSF Fisher Survey, questions designed to capture non-cash fishing costs (depreciation, unpaid labour) or the value of tangible and intangible assets (boat, vehicles, sheds, transferrable licences, quota, etc.) were not included.

The profiles were developed from the data collected by the TSF Fisher Survey and reflect a subset of the total respondents to that survey (since not all respondents provided answers to the economic questions). This sample consisted of 17 respondents in total (eight from the High/High sub-group, three from High/Low, three from Low/High, and three from Low/Low – see sections 3.3.1 and 4.3 for more details of the classification system). The reported groups (High Effort and Low Effort) were selected to maintain a minimum number of respondents within each of group (i.e., five respondents) while also preserving a similarity of respondents in each group.

The High Effort and Low Effort profiles presented in Table 8 represent sample averages calculated via post-stratification weights (cell weights) computed from the estimated population counts in each cell of the general fisher classification used for this study (i.e., High/High, High/low, Low/High, and Low/Low). In the case of the economic profiles, the population of interest is the Tasmanian-based fishers operating commercially in the TSF (meaning harvesting non-bait catches). The cell counts were estimated from the number of active entitlements estimated for each classification[1] *net* of the count of Tasmanian rock lobster fishers apparently catching bait in the fishery *and* net of the number of vessels with interstate home ports[2]. The high effort cells comprised 46.92% of the population weight and the low effort cells comprised the remaining 53.08%. The cell weights were: High/High (26.92%), High/Low (20.00%), Low/High (2.31%) and Low/Low (50.77%). The sample averages presented in the High Effort and Low Effort profiles are calculated from the 'cleaned' survey data. This step involved validating the information provided by respondents against independent sources, including government fee schedules (e.g., for the Marine and Safety Tasmania infrastructure administration fee, fishing licence renewal fees), membership

[1] The total number of active entitlements was determined from the Tasmanian Government Fisheries Integrated Licensing and Management System (FILMS) database (accessible under the Sustainable Marine Resource Collaboration Agreement between the University of Tasmanian and the Tasmanian Government).
[2] Please note that this correction assumes there is one active entitlement attached to each interstate Fishing Licence – Vessel (FLV) within the TSF for the 2018-19 year.

charges for industry organisations (e.g., the Tasmanian Seafood Industry Council), tax rates, and insurance quotes.

Management costs in this analysis have been limited to those recovered through licence fees. In a fully cost–recovered fishery sector, licence fees would reflect the total management cost associated with each sector and are used as a measure of management costs. For most seafood industries, however, the cost of management is not fully recovered in licence fees, and this is a limitation of our expenditure profile (i.e., potentially excluding some relevant government activity).

The post stratification weights (cell weights) detailed previously were used to calculate the grand mean expenditure profile for the economic sample.

The measure of profitability used is in this study was EBITDA (Earnings Before Interest, Tax, Depreciation, and Amortization). Data used for this calculation included financial data reported in the TSF Fisher Survey, expenditure profiles (see above) and total revenue from first sales of catch which was calculated from the extra of NRE Tas Fish Transfer or Sale Receipt records. Note that skipper wages are treated as part of profit, as is quota rental payments. Crew wages are a cost.

Gross margin analysis was also undertaken to estimate the gross margin ($/kg) for a wide range of species caught in the TSF for the twelve months to 1 April 2021. The price ('12-mth Average Price ($/kg)') and nominal catch per unit effort ('Est. Catch Per Day (kg)') were calculated from log-book records and fish transfer records for the TSF relating to the period of analysis. Catch per day was calculated from the catch per hours spent (logbook data) for a standardised 7.5 hour day (based on the full time definition of 37.5 hours per week). Many species are caught using a variety of gears by TSF fishers, and our analysis does no take account of this mix of fishing methods. Price data was obtained from the Tasmanian Government FILMS database and represents the trailing twelve-month average for the specific product form identified, as of 1 April 2021. Price was for whole fish, except in the case of Banded Morwong and Wrasses which are sold live. The daily fishing cost ('Approx. Daily Fishing Cost ($)') was estimated from the TSF Fisher Survey undertaken in this study (see the description above in this section).

Gross margin is measured as the beach price minus the variable cost fishing per kilogram of catch ('Approx. Daily Fishing Cost ($/kg)') and represents the vessel profit per day of effort dedicated to each species before vessel and gear maintenance costs and seasonal overheads such as licence fees and insurances are considered. It represents the variable profit that occurs from targeting a given species on a day of fishing and, combined with the vessel's licence conditions (licence package), helps to determine the financial outcome of the operator's fishing decisions throughout the year.

3.3.6. Estimation of economic contributions

The scope of this analysis relates to the commercial catching sector (excluding immediate processing, and any retail operations), and does not account for the direct and flow-on benefits of seafood processing (which may also be supplied by the catching or production sectors).

The measurement of economic contribution of the TSF commercial fishery production to the Tasmanian economy was based on generating a fishery-wide expenditure profile (see above). This profile represented the direct economic contribution of the TSF in 2018/19 (the 'initial round' effects, before considering the spending and re-spending of individuals and business in the economy).

Measures of direct economic contribution included were the direct industry output, GVA, number of employed persons, and household income (see section 5.6 for definitions). Non-cash fishing costs were not included for the estimation of direct GVA, as no money changes hands in the reference year for these costs.

Employment data (total number of persons directly employed) for the TSF was sourced from the Tasmanian Government FILMS database. Total employment describes the number of people directly involved in the fishery. The estimate of FTE employment has been derived from secondary sources in combination with the primary data for total number of employed persons.

Estimation of indirect (flow-on) effects in order to estimate total economic contribution involved analysis of the economic activity with sectors that supply goods and services to the commercial fishing sector of the TSF (see section 5.6 for definitions). To undertake this analysis, the expenditures in the TSF commercial fishery economic profile on the various fixed and variable costs for the financial year were allocated to the defined destinations within the RISE input-output model developed by BDO EconSearch. These were: the industry sectors, margin sectors, imports, taxes less subsidies, wages and salaries, or other value added. This process is known as *conversion from purchasers' prices to basic prices* and required information on the supply chains for goods and services purchased by operators in the TSF. This stage of our analysis relied on detailed feedback from industry contacts, review and consultation within the project team. This stage of our analysis was validated using a benchmarking process carried out in collaboration with BDO EconSearch.

Full details of the estimation method and data used are provided in Rust et al. (2021). The input-output modelling was provided by BDO EconSearch using industry cost profiles and conversion to basic prices as provided by IMAS. The estimate was prepared prior to the outbreak of the *SARS-CoV-2* (COVID-19) virus and the emergence of trade disruptions.

3.3.7. Supply chain and final market mapping and classification

A second survey-questionnaire was developed for TSF Seafood Post-Harvest Operators. The survey was similarly approved by the Human Research Ethics Committee, University of Tasmania (Reference Number 20241).

Given the small number of Seafood Post-Harvest Operators based in Tasmania, all operators were contacted and invited to participate. Surveys were completed with six post-harvest operators, representing 30% of the Tasmanian-based wholesale and retail suppliers handling TSF product. Overall, responses to this component of the study were lower than hoped, with a number of contacted businesses confirming general interest but unable/unwilling to commit to completing the survey. Data collected was also of a lower quality and more general than anticipated due to businesses being unwilling to share commercial-in-confidence data, in many cases, or simply due to the burden of accessing records on individual fish products they handle to provide the detailed data sought. Data was entered into an Excel database.

The survey collected information on product collection arrangements and subsequent steps in the supply chain, including freight and logistics, as well as on intermediate and final markets for major species. In addition, information about market strategies (including post-harvest processing/value adding), product supply and price sensitivity along with re-investment in the seafood industry was also collected. However, as these observations were more general and non-quantitative in nature, they were predominantly used to verify relevant data provided by fishers in the TSF Fisher Survey to map and classify supply chains and for final product market characterisation.

3.3.8. Landing price analysis

Data was extracted from NRE Tas Fish Transfer or Sale Receipt records on the price paid to fishers by fish receivers for landed catches of specific species. Each sale or transfer of fish by the TSF fishing licence holder is recorded and includes data on the volume and unit price by species by date of sale. Historical trends in price changes were analysed by generating a 12-month trailing average price per year by species and plotting these across the available time series for all available species.

This price data was then compared with annual catch composition data (see 3.3.1) for TSF operators fishing a minimum of 4 weeks per year for the 2018-19 and 2019-20 years. A range of lower limits were applied by which fishers were excluded from the sample (1t, 3t, 5t per year) to examine the level of consistency in catch composition across different fisher classifications.

3.3.9. Network analysis of first trade markets

For network analyses of the TSF first trade markets, we extracted catch sales and associated receiver information recorded in NRE Tas Fish Transfer or Sale Receipt records. Receiver information was recorded in Tasmanian Government Fisheries Integrated Licensing and Management System (FILMS) database as free text, which required visual examination, spelling correction, consultation of local seafood business experts, and independent research to avoid misidentifications and ambiguity. Once unique receiver names had been clarified and corrections applied to all FILMS records, receiver types were classified according to the following broad categories: (1) Wholesale (including processors), (2) Retail, (3) Restaurant, (4) Individual (e.g., ex-vessel sales), (5) Personal use, and (5) Other (e.g., bait shops). Further recognising that many wholesale businesses simultaneously operated a retail business and/or a restaurant, we applied a hierarchical structure for recording maximally three concurrent business classifications. Implicitly, this hierarchical structure assumed that wholesale businesses were the primary source of income, followed by retail as the secondary and restaurants as the tertiary. In addition to sales information, we also recorded where receivers were based, allowing for a breakdown of sales across regions and state boundaries. In alignment with stock assessment protocols, recorded regions within Tasmania included the South East Coast (SEC), East Coast (EC), North East Coast (NEC), North West Coast (NWC), and West Coast (WC). The unique conditions on Flinders Island (FI) and King Island (KI) were recorded separately. Australian states other than Tasmania included Victoria (VIC), South Australia (SA) and New South Wales (NSW).

We note that catch sales in FILMS were recorded in different tables and in a different format than records of catch and effort due to the need to reflect NRE Tas Fish Transfer or Sale Receipt records. Consistent logbook-return identification numbers allowed for linking the two datasets together. However, sales records covered a longer time period (monthly as opposed to daily), generally including multiple fishing trips but not necessarily the entire catch of each of these trips (due, for example, to personal use). Thus, in our final dataset, information on individual fishers and catch sales could be combined with information on fishing trips even though individual records were not directly comparable.

The original dataset contains 14,905 records of catch sales for the period January 2018 to December 202, while 3,771 records were removed from the final analysis because unique receiver names were not available. The final dataset with 11,134 records of catch sales was used to build a network graph that represents the relationships between fishers and receivers in first trade markets. We used the network analysis and visualisation software Gephi (https://gephi.org/) for this analysis. The network graph was used to characterise the TSF first trade markets in terms of their size, value, and diversity.

3.3.10. Local first trade market analysis

For this analysis we used the same data (NRE Tas Fish Transfer or Sale Receipt records) and method as described above in 3.3.9. We classified receivers as Tasmanian-based on non-Tasmanian, based on the information records concerning their business location. Annual volumes of sales of catches to different receiver types by Tasmanian/non-Tasmanian location would then be analysed.

3.3.11. Responsiveness to market demand: case study of Calamari fishing

This analysis investigates evidence for the supply function of the TSF, by considering a case study of Calamari. The data was obtained from the fishery stock assessment analysis, drawn from logbook data maintained by NRE Tas.

First, a graphical method is applied that considers the fishery's total catch of Calamari versus the beach price of calamari over the period 1999 to 2020 (for which complete data are available), and a potential upwards trend in both series is identified by technical analysis ('charting'). Evidence for this relationship between catch and price for Calamari is then established using linear regression between the time series, which is consistent with a supply function for price-taking firms (i.e., to whom the market price is essentially exogenous).

The translation of fishing effort to increased catch is further elucidated by the measurement of Pearson correlation between the level of fishing effort (fishing days) and the (fishery-wide) beach price of Calamari in four major regions of the fishery: North-West Coast, North-East Coast, East-Coast and South-East Coast.

3.3.12. COVID-19 pandemic impact assessment

We examined the impact of COVID-19 on fishing effort, catch and markets by comparing the number of active fishers, number of first-sale transactions, transaction volume, and number of first-sale buyers for each month in 2019 and 2020. This data was obtained from extracts of NRE Tas Fishing Licence records, Commercial Catch, Effort and Disposal Return records, and Fish Transfer or Sale Receipt records.

Qualitative survey response data collected using the TSF Fisher Survey included fisher responses to questions concerning the impacts of the COVID-19 pandemic on their fishing activities, supply chains, and livelihood strategies. This data was entered into a Nvivo Qualitative Analysis Software database to allow for responses to be systematically coded by themes. This data was compared with the observed impacts on fishing effort, catch and market conditions.

3.3.13. Trends in seafood consumption

A review of selected literature was undertaken to determine what trends were demonstrated in the preferences and consumption patterns of seafood consumers. The purpose of this review was to identify whether reported trends were consistent with any observed trends in market demand for TSF products or with identified product development strategies proposed for the TSF. Literature reviewed included peer-reviewed journal articles (n=4) and grey literature published reports (n=2). One study was specific to Tasmanian consumers, four were specific to Australian seafood consumer, and one was global in scope.

3.3.14. Food service sector opportunities

Expert consultations were conducted with high profile seafood identities in February 2021 to identify possible opportunities for TSF participants and products, including Luke Burgess (Garagiste, Templo, Seven and a half) and Matt Evans (Fat Pig Farm). This analysis also

drew from results of the project, *Identifying opportunities for developing community supported fisheries in South Australia's small scale, multi-species, multi-gear community based fisheries*, FRDC 2015-505, in which it was found that demand from high-end food service customers can generate higher than average gross profit margins for fishers. Further analysis of food service sector opportunities did not continue in 2021 due to the COVID-19 pandemic and the downward pressure the physical restrictions placed on this sector in general.

3.3.15. Industry development opportunities and feasibility assessment

A range of industry development opportunities were identified, as follows:

- Increase security of access
- Increase flexibility of fishing operations
- Supply chain enhancements
- Product development
- Brand development
- Digital marketing

An initial list of opportunities was presented for discussion to the Steering Committee at Scalefish Fishery Advisory Committee (SFAC) meeting 73 (30 March 2021). Feedback contributed by industry members was used to refine this list.

The revised list of opportunities and potential strategies was presented to NRE Tas staff for discussion at a meeting on 05 May 2021 between project staff and fishery managers. NRE Tas comments in relation to relevant strategies were provided and noted.

The final list of opportunities and potential strategies was then prepared for an Industry Workshop, which was held on 01 June 2021 in Hobart with the Industry members of the SFAC. The purpose of this workshop was to clarify the flows of social and economic benefits industry stakeholders sought from the TSF, identify any gaps in the identified strategies, and assess a range of strategies for their efficacy in achieving desired levels of social and economic performance. Potential strategies were individually assessed for impact (Very positive/Somewhat positive/No positive impact) and for feasibility (Very feasible/Somewhat feasible/Not feasible). Participants were asked to identify any specific species appropriate for a particular strategy. Finally, they were asked to indicate their preferences by indicating how much out of a total of $100 they would invest across the range of strategies. Not all of the final potential strategies were assessed at the workshop.

The outcomes of the Industry Workshop were then presented to the full Steering Committee at the following SFAC meeting 74 on 02 June 2021. The Steering Committee provided further comment and then made two recommendations for further analysis by the project team of perceived barriers to development and the feasibility of specific opportunities, as follows:

- Levels of additional fishing effort in response to recent improved demand and prices for Calamari (described earlier)
- The relationship between extra fishing and extra profit/revenue

Catch and effort for Calamari from the fisher log-book records (maintained by NRE Tas) were combined with the trailing-twelve-month average ex-vessel price for Calamari (fish transfer records, also maintained by NRE Tas) to investigate the relationship between effort, catch volume, and the ex-vessel price of Calamari over the analysis period. Methods used were graphical analysis, Pearson correlation, and linear regression analysis.

Information on the daily fishing costs in the TSF (obtained from the Fisher Survey) were combined with a profile of nominal catch per unit effort obtained from fisher log-book records

(maintained by NRE Tas). The average of ex-vessel prices over the 12-month period to 1 April 2021 as reported in fish transfer records (maintained by NRE Tas) were then used to investigate the potential increases in catch due to additional days of effort, and possible strategies to increase the exploitation of underutilised species. Methods used were productivity analysis (marginal output per fishing day) and gross margin analysis.

4. Fleet and fishing operation characterisation

4.1. Summary of findings

Findings about current viability and performance:

- While the number of operators who are active in the TSF in a given month is relatively small (< 60 across 2018-2020), the fishery consists of approximately 117 highly diverse operators who use different combinations of gear to target varying mixes of species.
- There is no dominant species that most fishers catch. Across the 2018-2020 fishing seasons, over 70% of operators caught more than one species. On average, operators caught four different species within a fishing season. Southern Calamari, Wrasse and flathead were caught by the highest share of fishers (42-53%).
- Less than 30% of active operators reported landing only one species during a fishing season. This group included fishers landing some significant quantities of species caught with highly specialised gear and licences (e.g., auto jig for Gould's squid)
- There is no single gear that all operators used in the TSF. Handline was the most common fishing gear (70% of operators used it at least once) across 2018-2020. The second and third most commonly used gears were gillnet and squid jig, which were used by 35% of operators
- The East Coast is the dominant fishing region for the highest number of operators (32%), followed by North East Coast (21%) and South East Coast (21%), across 2018-2020.
- On average, active operators spent 23 days per year in the TSF before the COVID-19 pandemic, while the mean number of fishing days dropped to 16 days in 2020. More than 20% of active operators spent less than six days per year fishing in the TSF during 2020.

Implications for future viability:

- Total TSF production was between 425 tonnes (with assessed species representing 383 tonnes) and 333 tonnes (with assessed species representing 283 tonnes) for the 2018/19 and 2019/20 fishing seasons respectively. Since recording began in 1995/96, the production of assessed species has declined by approximately 26 tonnes per year. See: Scalefish Species – Tasmanian Wild Fisheries Assessments (tasfisheriesresearch.org) for information on assessed species.
- Levels of licence activation are low and continue to decline, resulting in high levels of latent capacity (>50% for Fishing Licences (scalefish A and B) across 2018-2020).
- Holders of Fishing Licences (rock lobster) are part of the TSF and catch approximately 20% of the total annual catch.
- The number of operators who were active in the TSF for more than 100 days was 9 in 2018, 11 in 2019 and less than 5 in 2020.
- Technical efficiency of TSF fishers is high. For more than 60% of operators, it is not possible to increase their catch per day using the current mix of permitted gears or without investing in new technologies. At the same time, around 15% of fishers operate at an efficiency level of < 50%, meaning that it is possible to double their catch based on current gear technologies.
- Overall inefficiency in the TSF is therefore at least partly driven by the licensing framework through which gears and effort are controlled. Another factor maybe the cost of new fishing technology.

4.2. Fleet characteristics

Total production (landed catch) in the TSF in the 2018/19 fishing season was 425 tonnes, following a consistent downward trend from 818 tonnes in 2015/16. With only 333 tonnes recorded, this trend was continued in the 2019/20 fishing season. However, the most recent assessment (*in press*) indicates an increase to 681 tonnes in 2020/21 which can be explained largely by a sharp increase in catches of Gould Squid (almost 300 tonnes) and Tiger Flathead (> 45 tonnes).

The characteristics of the TSF fleet are at least partly determined by entry requirements. Operators in the TSF must be holders of a fishing licence (personal) or FLP, as well as holders or a nominated supervisor of a licence package with a fishing licence (vessel) and gear licence and/or a species licence. Currently there are ten gear type licences, three species licences and three licence types that allow access to a specific species and the use of specific gear to take that species. The four main types of gear/species licences held by operators fishing in the TSF are: Fishing licence scalefish A; Fishing licence scalefish B; Fishing licence scalefish C; and Fishing licence rock lobster. These licence types are described in the Scalefish Management Guide - Info for licence holders.pdf (fishing.tas.gov.au).

Levels of licence activation have been declining (Figure 2a. and b.), noting that Fishing Licence (scalefish C) are non-transferable (see Appendix C). As a result, levels of latent capacity are high: 43% and 46% for scalefish A, 52% and 53% for scalefish B, and 84% and 80% for scalefish C in 2018 and 2019, respectively.

Holders of a Fishing Licence (rock lobster) are also able to operate in the TSF although with gear restrictions. In Tasmania, there are 330 Fishing Licences (rock lobster) available, and approximately 50% of these are active in the Tasmanian Rock Lobster Fishery.

The share of the mean total annual catch for the three fishing seasons (2017/18, 2018/19 and 2019/20) between holders of the four main licence types highlights the small contribution to total production by Fishing Licence (scalefish C) holders, and the relatively significant contribution by Fishing Licence (rock lobster) holders (Figure 3). However, this analysis is limited to the 50% of TSF licence holders whose catch data could be linked by analysts with their licence data. The catch of these licence-linked TSF operators appears to represent less than half of the catch for these 20 or so main species. Total production across these years was about 1200 tonnes. Therefore, these results cannot be considered to be fully representative but strongly indicative.

Recently active operators in the TSF (for the two fishing seasons 01 March-28 February 2018/19 and 2019/20) amounted to a total number of 117. The fishing activities of these operators was highly diverse. Catch per season averaged only 4 tonnes (± 7 tonnes Standard Deviation, or SD) per operator. This low average catch was matched by a low number of fishing days: 41 ± 36 (mean ± SD) per season. The mean number of species landed was 15 ± 12. However, fishers tended to target predominately one species that accounted for much of their catch volume (58 ± 24%), and which was most frequently represented by Southern Calamari (25% of fishers), Banded Morwong (16% of fishers), and Bluethroat Wrasse (14% of fishers). The mean number of regions fished was 2 ± 1, with a single region usually dominating the source of catch (82 ± 18%). The most frequent dominant fishing regions were the East Coast (32% of fishers), and the Southeast and Northeast Coast (both 21% fishers). The mean number of different gear types used was 4 ± 2. Again, one gear type tended to dominate catch volumes (75 ± 20%), most frequently including handline (29% of fishers), gillnet (23% of fishers) and squid jig (20% of fishers).

a.

Category	Licence Type	2005	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Gear based	Automatic Squid Jig	19	18	18	18	18	18	18	18	18	18	18
	Beach Seine A	29	25	25	25	25	25	25	25	25	25	25
	Beach Seine B	26	25	25	24	24	24	24	24	24	24	24
	Danish Seine	8	6	6	6	6	6	6	6	6	6	6
	Limited Danish Seine	3	1	1	1	1	1	1	1	1	1	1
	Purse Seine Net	10	10	10	10	10	10	10	9	9	9	9
	Scalefish A	70	65	65	63	63	63	63	63	63	62	62
	Scalefish B	165	155	153	151	149	147	148	146	146	146	146
	Scalefish C	161	81	73	71	69	65	59	51	48	45	43
	Small Mesh Gillnet	12	10	10	10	10	10	10	10	10	10	10
Species based	Australian Salmon	8	7	7	7	7	7	7	7	7	7	7
	Banded Morwong	29	27	27	26	26	26	26	26	26	26	26
	Octopus		2	2	2	2	2	2	2	2	2	2
	Southern Calamari		17	17	17	17	17	17	17	17	17	17
	Wrasse	64	62	62	61	61	61	61	61	61	61	61
Other licences	Mackerel - Category A	4	4	4	4	4	4	4	4	4		
	Mackerel - Category B	1	1	1	1	1	1	1	1	1	1	1
	Personal	664	566	554	565	560	559	528	504	499	502	467
	Rock Lobster	312	311	311	311	311	311	311	311	311	311	311
	Vessel	844	745	736	722	724	719	706	690	679	672	661

b.

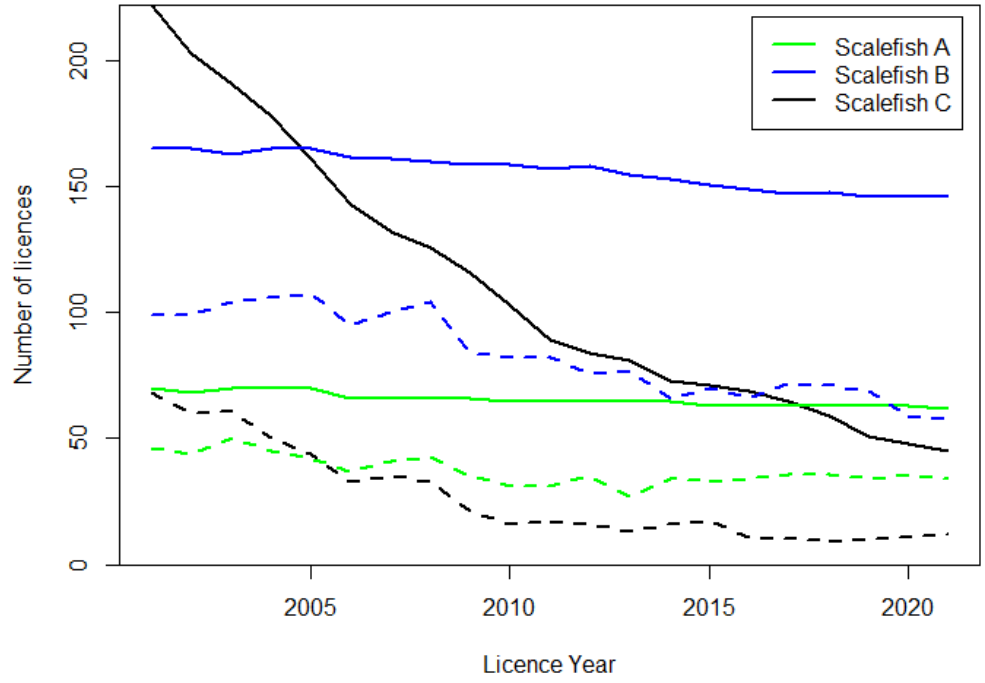
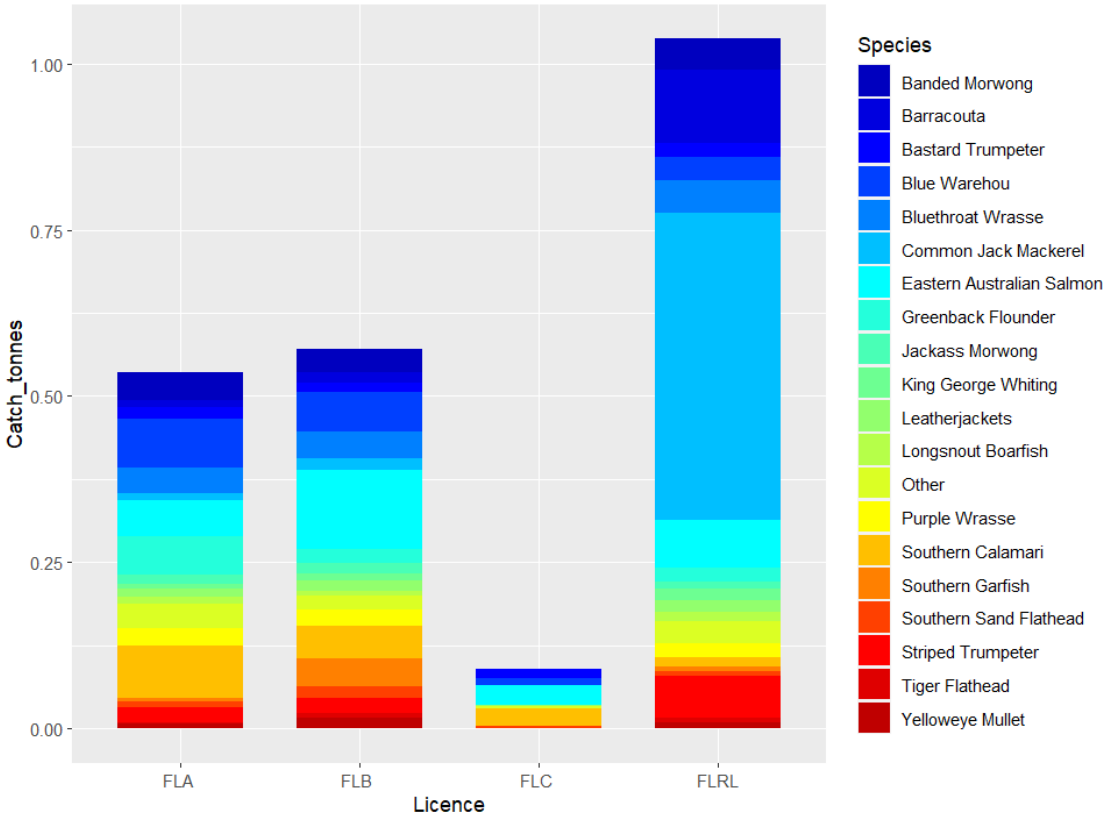


Figure 2. Levels of Licences in the TF over time; a. count of all licence types over time. Orange = decrease, black = no change; b. Scalefish A, B and C licence activation since 2000. Solid lines represent total number of available licences, and dashed lines represent the number of active licences in that year.

Overall, there was a strong positive relationship between fishing effort and catch (Figure 4). Similar, but less pronounced, positive trends were evident also between the number of fishing days and other characteristics described above, including numbers of species caught, gears used, and regions fished. Based on log-linear regressions, the mean annual catch of most fishers was within the 95% prediction interval, given the corresponding number of mean fishing days (Figure 4). Due, presumably, to this positive relationship and a similar frequency distribution of catch and effort data, neither cluster analysis nor multi-variate ordination techniques revealed strong or intuitive classifications of TSF fishers.

As a consequence, we adopted an alternative and simpler classification method which allocated TSF operators to four different groups based on thresholds for mean fishing days and catch per season. Thresholds were chosen to even out numbers of operators in two key groups along the effort and catch spectrum (Low/Low and High/High, see Figure 5), and rounded to units of weeks (4 / 28 days) and tonnes (3), respectively.

a.



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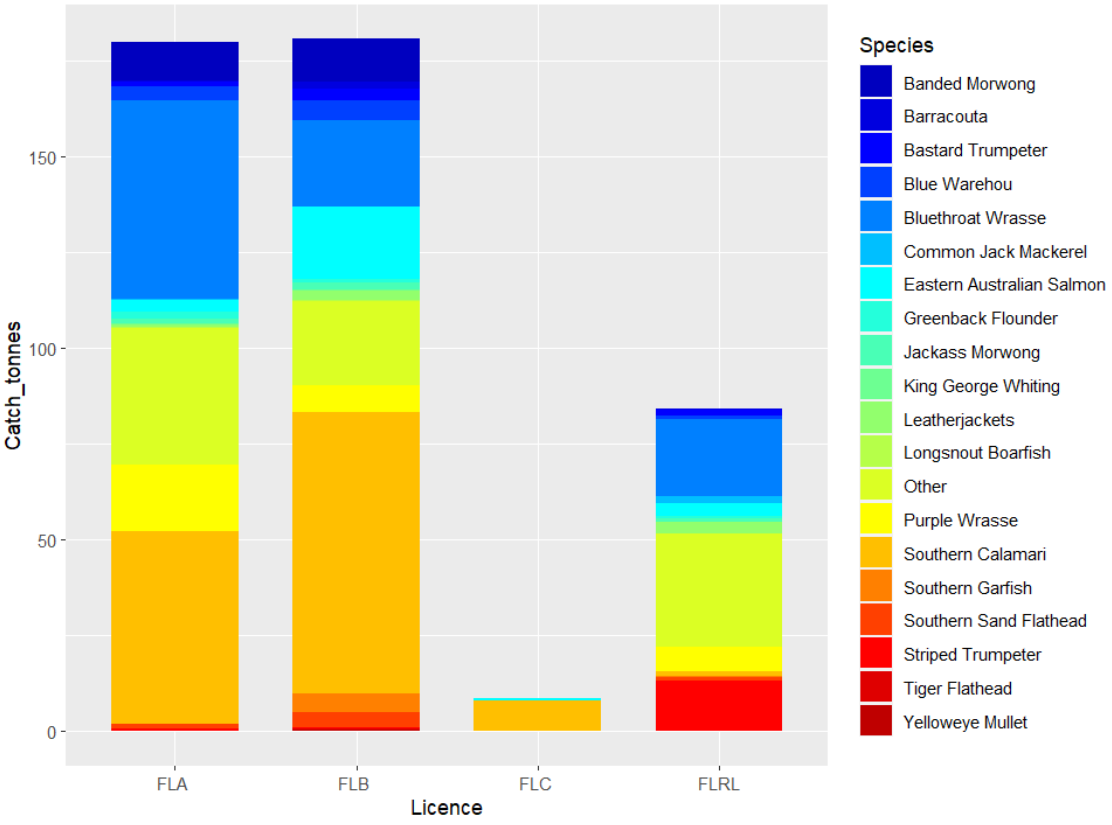


Figure 3. Distribution of TSF catches across licence types. a. Mean catches for licence-linked TSF operators across 2017/18-2019/20 fishing seasons. b. Sum of catches for licence-linked TSF operators across 2017/18-2019/20 fishing seasons.

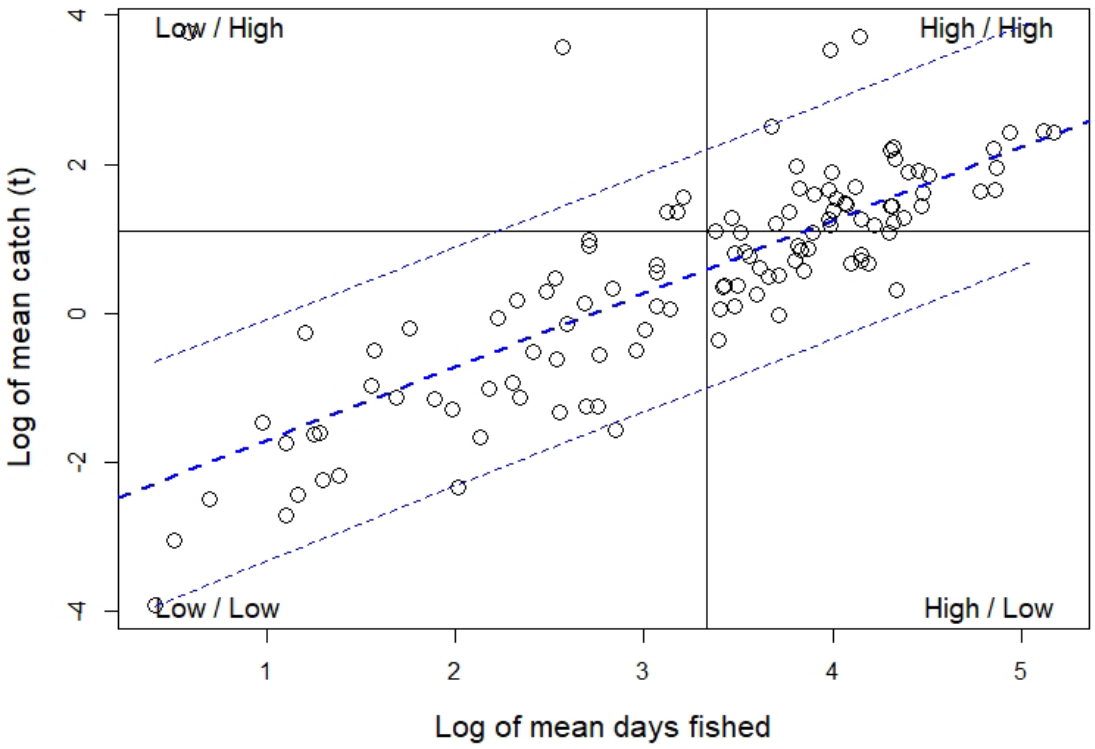


Figure 4. Log-linear regressions of catch and effort data for 117 recently active TSF fishers for the two fishing seasons 01 March-28 February 2018/19 and 2019/20. The regression fit is highlighted by the blue line (dashed), including the 95% prediction intervals (dotted lines). Vertical and horizontal black lines represent logs.

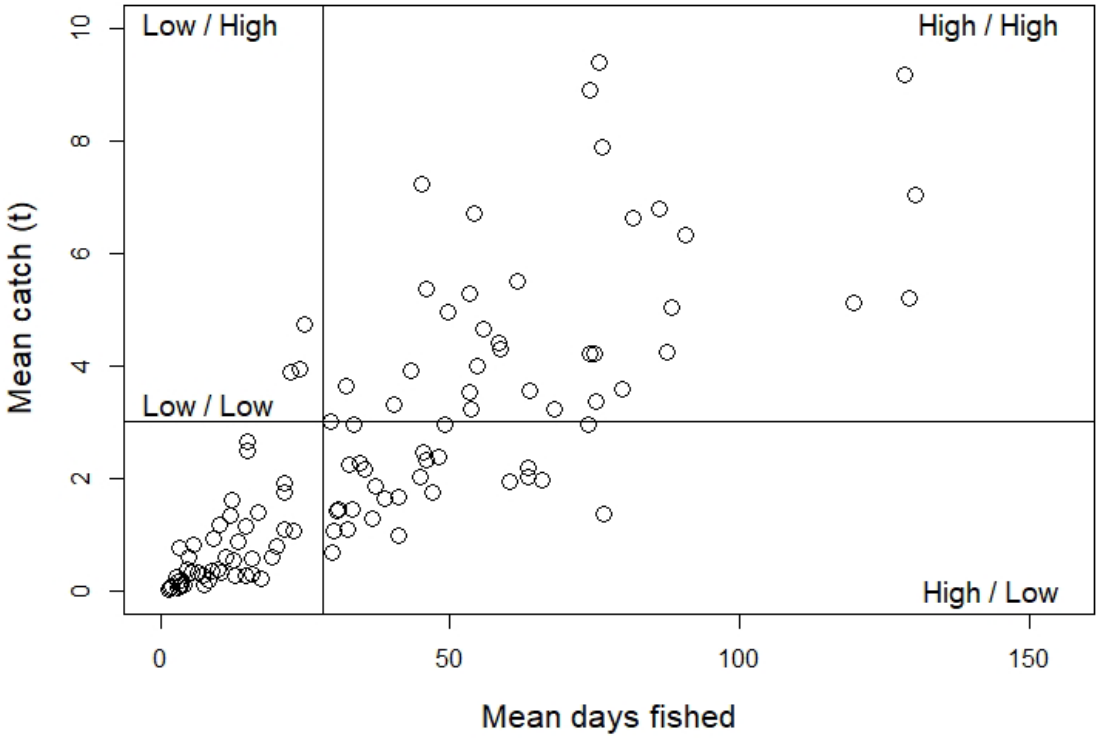


Figure 5. Classification of TSF operators for the two fishing seasons 01 March-28 February 2018/19 and 2019/20 based on thresholds for mean fishing effort (28 days) and catch (3 tonnes) per season. Vertical and horizontal black lines represent logs of thresholds for mean fishing days and catch per season, respectively, used to classify TSF operators into groups: Low/Low, High/Low, High/High, and Low/High.

4.3. Classification of fishing operators

For this analysis we applied the classification method which allocated TSF operators to four different groups based on thresholds for mean fishing days and catch per season (see section 4.2, Figure 5). A summary of key characteristics of operator types in each classification is presented in Figure 6.

Recently active operators in the TSF who fished below the catch and effort thresholds (Low/Low, n=45, 38%) had catches and effort averaging less than 1 tonne and about 10 fishing days, respectively (Figure 7). Key characteristics of operators in this “Low/Low” group included a comparatively high level of individual specialization that resemble patterns observed for the recreational sector, including handline as the dominant gear type and species, such as Striped Trumpeter and Bastard Trumpeter, but also Southern Calamari and Bluethroat Wrasse, dominating catches (Lyle et al. 2019). Furthermore, dominant fishing regions per fisher within the Low/Low group were almost evenly distributed across the Tasmanian coastline, ranging between a maximum of 24% for the East Coast and a minimum of 16% for the Northeast Coast.

The second largest group (High/High, n = 40, 34%) consisted of operators characterised by both mean catches and effort above the specified threshold values. In contrast to the Low/Low group, individual operations in this “High/High” group were more diverse, including on average 25 compared to nine species caught using on average five compared to three different gear types. Interestingly, however, catches of the High/High group were more spatially confined, with >70% of fishers taking most of their catch from the East and/or Southeast Coast. Dominant gear types were similar to those in the Low/Low group except for a higher prevalence of squid jigs given that Southern Calamari was the dominant target species (35% of fishers). The second and third most dominant target species were Banded Morwong (20%) and Bluethroat Wrasse (18%).

The third largest group of operators, which was characterised by comparatively high fishing activity coupled with low average catches, was represented by 27 operators (High/Low, 23%). Overall, the productivity of most operators in this group was within the 95% prediction interval of our linear regression model, and thus characteristics were similar to the High/High group. However, low catches would suggest specialisation for high value/low volume species (e.g., Banded Morwong) or that operators are not representing full-time commercial fishers. A notable difference between the two groups included a switch in dominant target species from Southern Calamari (35% vs 26%) to Banded Morwong (20% vs 31%). This was concurrent with a switch of dominant gears from handline and squid jig to gillnet and a switch from dominant fishing grounds in the East and Northeast to ones in the East and Southeast.

Finally, the smallest and most outlier group of operators was represented by the “Low/High” group, including only 5 operators (4%). The Low/High group was characterised by exceptionally high catches relative to the number of fishing days. Operators in this group were unlikely to focus on TSF species but have the capacity to harvest some of them effectively in an opportunistic manner. This assumption was clearly reflected by the different types of dominant species including, for example, Jack Mackerel, Eastern Australian Salmon, Tiger Flathead and Gould’s Squid. In contrast to all other groups, dominant gear types used included auto-jigs, beach seine, Danish seine and purse seine. Furthermore, catches were restricted to the eastern coasts of Tasmania, predominately the Northeast Coast.

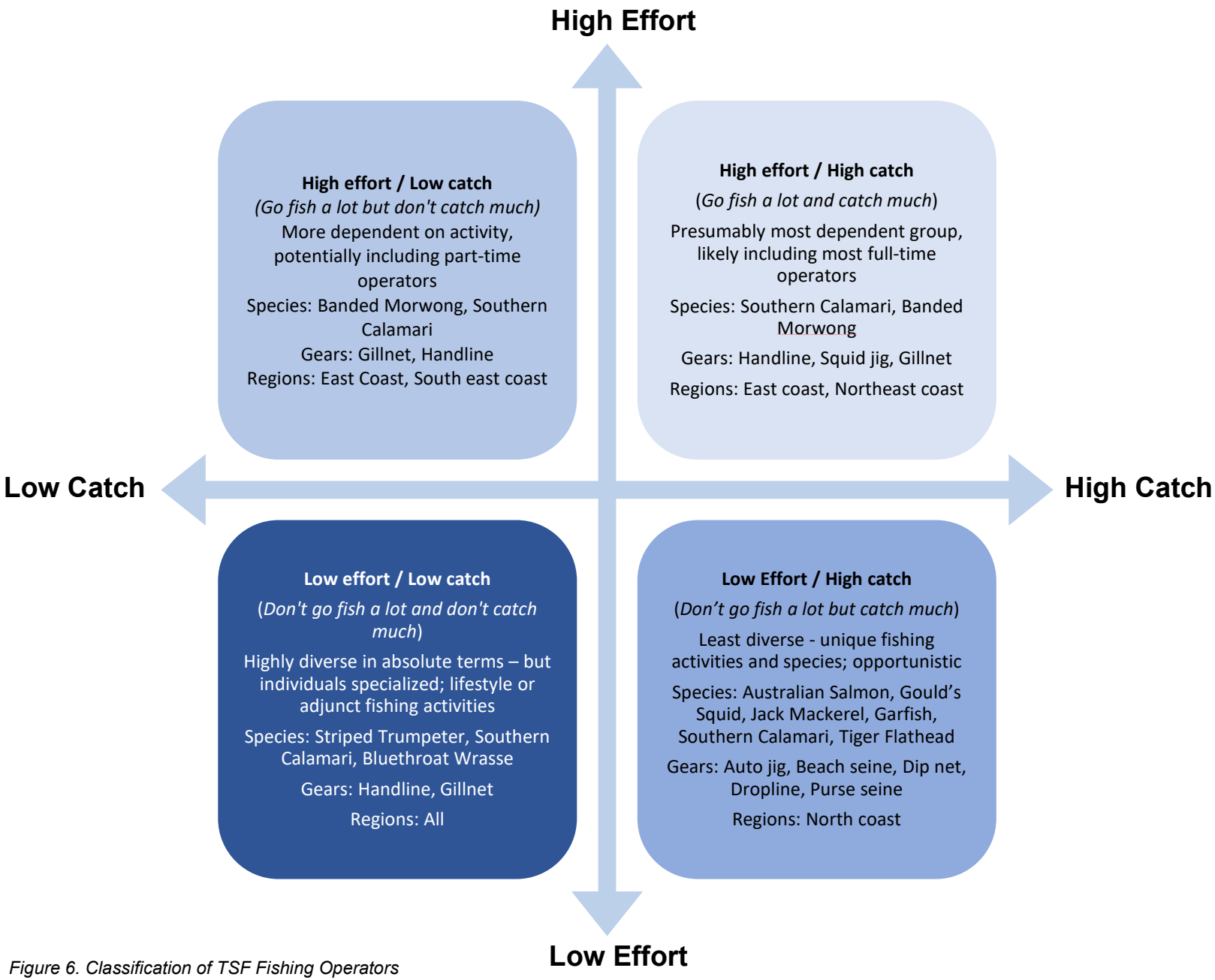


Figure 6. Classification of TSF Fishing Operators

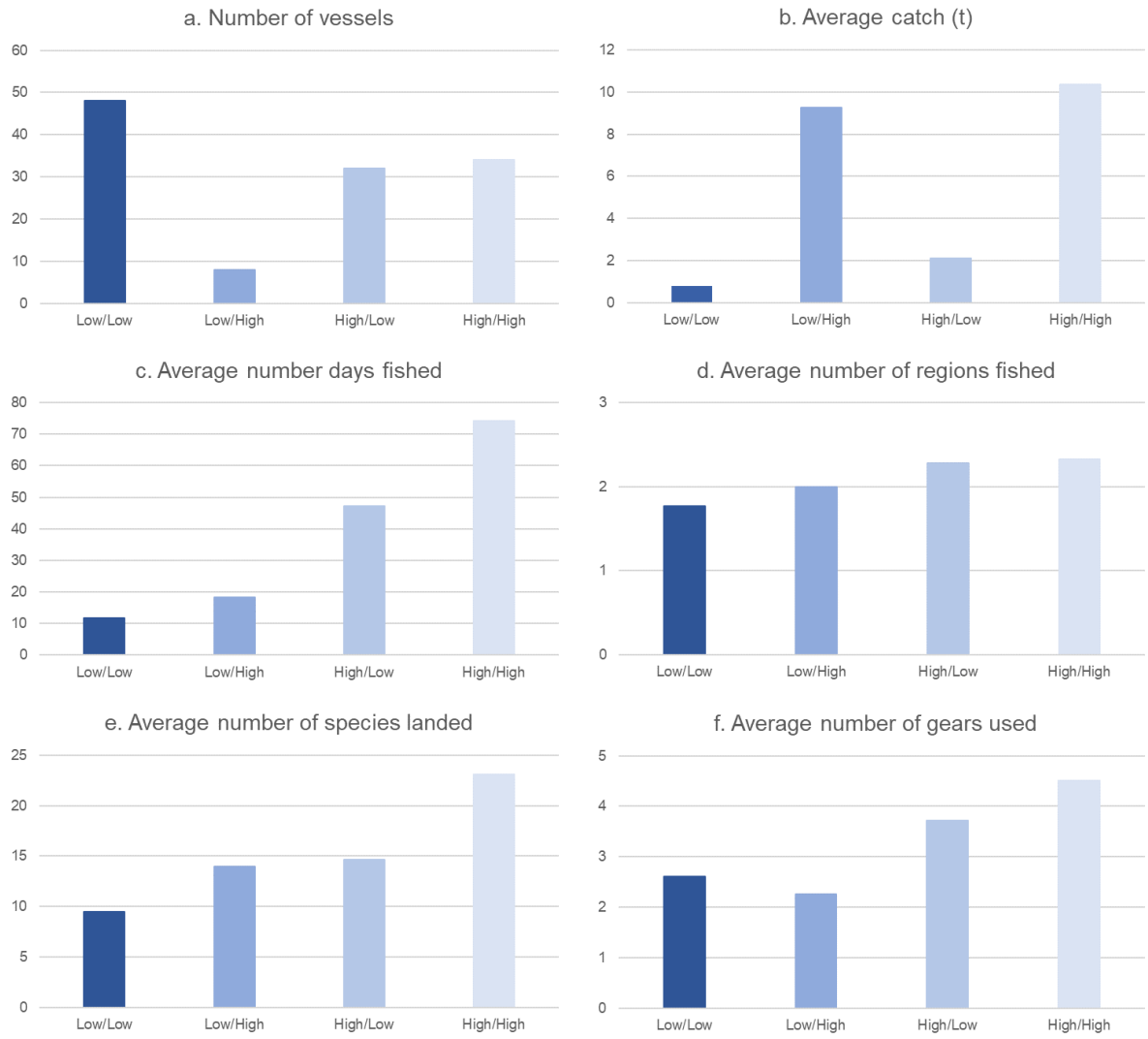


Figure 7. Comparison of TSF operator characteristics by fisher classifications based on effort / catch level for the for the two fishing seasons 01 March-28 February 2018/19 and 2019/20, as follows: a. number of vessels; b. average catch (tonnes) per operator, c. average effort (days fished) per operator, d. average number regions fished per operator, e. average number of species landed per operator, and f. average number of gears used per operator.

4.4. Fishing efficiency

We defined fishing efficiency as a form of technical efficiency, which refers to the ability of a TSF operator to obtain the maximum output (catch) from a set of inputs (gear allowances, species allowances), or to produce an output (catch) using the lowest possible amounts of inputs. For the purposes of this study, we used the former definition. Species and gear included in the efficiency analysis for the study period of the 2018/19 and 2019/20 fishing seasons are summarised in Table 2 and Table 3.

The estimated technical efficiency score of TSF fishers for the 2018/19 and 2019/20 fishing seasons is reported in Table 4. The distribution of the efficiency score is also shown in Figure 8. The overall level of technical efficiency is high, with a mean efficiency score of > 80% over the study period. More than 60% of fishers are on the production frontier, suggesting that it is not possible for these fishers to increase their output using the current mix of inputs or without investing in new technologies. In addition to production technologies, another significant factor that possibly influences fishing efficiency is the current licensing system, which consists of multiple gear type and species licences. They allow fishers to access

specific species or use specific gear to take that species but may limit fishers' ability to flexibly adjust their species or input mix in the short run. In such an operational environment, many fishers are likely to operate on their own production frontier. Despite the high average efficiency, a substantial level of technical inefficiency is still observed. This is reflected in that the least efficient fishers operate at an efficiency level of 1 to 6%. Around 15% of fishers operate at an efficiency level of < 50%, meaning that it is possible to double their production output based on current production technologies.

Table 3. List of species included for efficiency analysis

Common name	Scientific name	% active operators
Eastern Australian Salmon	*Arripis trutta*	23%
Bastard Trumpeter	*Latridopsis forsteri*	27%
Blue Warehou	*Seriolella brama*	17%
Flathead		42%
Dusky Flathead	*Platycephalus fuscus*	
Rock Flathead	*Platycephalus laevigatus*	
Tiger Flathead	*Platycephalus richardsoni*	
Southern Sand Flathead	*Platycephalus bassensis*	
Southern Bluespotted Flathead	*Platycephalus speculator*	
FLATHEAD	*Platycephalidae - undifferentiated*	
Flounder		11%
Greenback Flounder	*Rhombosolea tapirine*	
Longsnout Flounder	*Ammotretis rostratus*	
FLOUNDER	*Bothidae & Pleuronectidae spp*	
Southern Garfish	*Hyporhamphus melanochir*	15%
Gould's Squid	*Nototodarus gouldi*	12%
Jackass Morwong	*Nemadactylus macropterus*	25%
Whiting		12%
Blue Weed-Whiting	*Haletta semifasciata*	
Eastern School Whiting	*Sillago flindersi*	
King George Whiting	*Sillaginodes punctatus*	
Little Weed Whiting	*Neoodax balteatus*	
Sand Whiting	*Sillago ciliate*	
Leatherjacket		25%
Bridled Leatherjacket	*Acanthaluteres spilomelanurus*	
Leatherjackets	*Monacanthidae - undifferentiated*	
Mackerel		14%
Peruvian Jack Mackerel	*Trachurus murphyi*	
School Mackerel	*Scomberomorus queenslandicus*	
Blue Mackerel	*Scomber australasicus*	
Redbait	*Emmelichthys nitidus*	
Common Jack Mackerel	*Trachurus declivis*	
MACKEREL	*Scombridae spp.*	
Mullet		6%
Sand Mullet	*Myxus elongatus*	
Sea Mullet	*Mugil cephalus*	
Yelloweye Mullet	*Aldrichetta forsteri*	
Octopus		13%
Gloomy Octopus	*Octopus tetricus*	

Common name	Scientific name	% active operators
Maori Octopus	*Macroctopus maorum*	
Pale Octopus	*Octopus pallidus*	
Southern Octopus	*Octopus australis*	
Octopus	*Octopodidae - undifferentiated*	
Silver Trevally	*Pseudocaranx georgianus*	9%
Southern Calamari	*Sepioteuthis australis*	49%
Striped Trumpeter	*Latris lineata*	30%
Wrasse		53%
Bluethroat Wrasse	*Notolabrus tetricus*	
Purple Wrasse	*Notolabrus fucicola*	
WRASSE	*Labridae - undifferentiated*	
Banded Morwong	*Cheilodactylus spectabilis*	12%

Table 4. List of fishing gear included for efficiency analysis

Gear	Gear code	Share of fishers
Automatic squid jig	AJ	4%
Danish seine	DS	1%
Dip-net	DN	5%
Fish trap	FP	12%
Gillnet	GN	37%
Hand-line	HL	70%
Beach seine	BS	5%
Drop-line	DL	9%
Purse seine	PS	3%
Squid jig	SJ	35%
Spear	SP	5%
Trolling	TR	6%
Bottom-line	BL	14%
Mesh net	MN	5%
Set-line	SL	16%

Overall, the efficiency analysis does not reveal a significant impact arising from the COVID-19 pandemic on fishing efficiency, in terms of both the absolute and distributional terms (Table 5). There is no significant change in the mean or variance of the estimated technical efficiency score between years. This result suggests that, although the number of active fishers dropped in 2020 and each spent a lower number of days in the TSF, these behaviours were not driven by their productive efficiency but by other factors, such as supply chain failure, livelihood choice or demand-side shocks (e.g., lockdown restrictions and a change in consumer preferences impacting demand for live Wrasse and Banded Morwong).

Table 5. Summary statistics for technical efficiency

Year	Mean	Min	25%	50%	75%	Max
2018	0.833	0.009	0.739	1	1	1
2019	0.876	0.062	0.913	1	1	1
2020	0.807	0.018	0.605	1	1	1

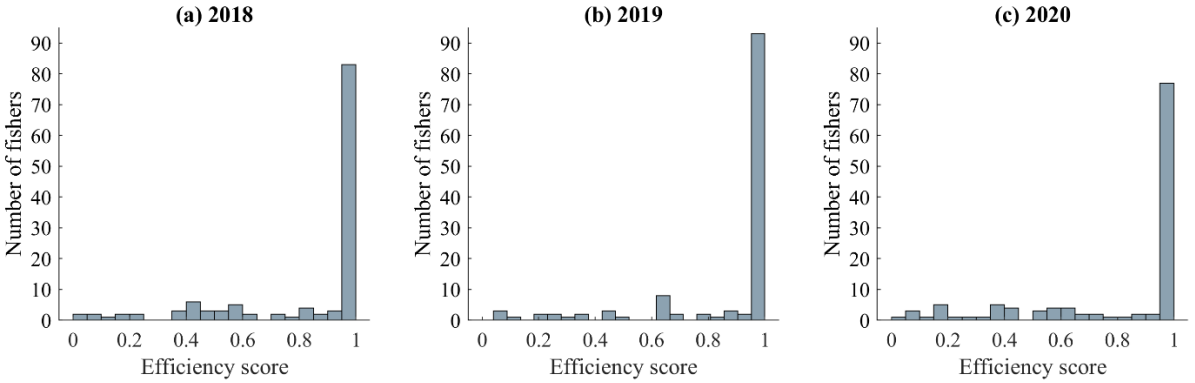


Figure 8. Distribution of technical efficiency score for 2018-2020

4.5. Discussion

The fleet of fishers operating in the TSF is characterised by a high level of diversity in levels of effort and catch, regions fished, species targeted, and gears used. This level of diversity is also found in the fishing strategies of individual operators who are predominantly generalists rather than specialists. This diversity appears to reflect the need and opportunity to target multiple species in multiple regions due to stock availability, as well as the 'general fishery' nature of the licence framework which permits multiple types of gear and species on a single platform licence. Such characteristics are comparable to other multi gear multi species small-scale fisheries managed using similar regimes in Europe (see Duarte et al., 2009; Pascual-Fernandez et al., 2019) and the United States (see Warlick et al., 2018).

However, the flexibility in fishing operations afforded by the multi gear and multi species platform licences is balanced against a high-level of input and output controls to manage catch. The exception to this observation is the Banded Morwong sub-fishery within the TSF, for which the main output control used is an annual Total Allowable Catch and associated Individual Transferable Quota system. The high level of technical efficiency observed for the majority of the fishers indicates that their capacity to increase output (catch) is limited by the licencing framework and associated input and output controls. This conclusion is supported by the observation that levels of technical efficiency did not change across 2020 at a time when the COVID-19 pandemic was causing significant disruption to TSF harvesting activity, product supply chains and markets. Currently, options for TSF fishers wishing to increase their output per unit of input are limited to increasing their investment in improved fishing technology.

The high level of latent capacity and under-utilisation of available vessel licences indicates that entry barriers to participate in the fishery are low. This may explain the presence of a group of TSF fishers whose catch levels are low and whose technical efficiency is similarly low.

The analysis undertaken in this study is explorative and not definitive. The accuracy of our characterisation is limited by data quality issues, including that:

- Links between catch and sales data are not straightforward given that catch data is recorded on a per fishing trip basis while sales records combine catches from multiple trips, making it difficult to associate information from sales directly to on water activities; and
- Personal information on fishers, their licences and catches seem to be complicated by reporting requirements (only available for supervisors but not individual fishers) and the highly dynamic nature of the fishery whereby fishers enter and exit the fishery intra-seasonally. This meant that data on ages and licences only appears to match

50% of all client IDs (unique identifiers for individual fishers) across the investigated seasons.

Moreover, the highly dynamic nature of the TSF makes it difficult to select representative fishing seasons, which is why our study aimed at focusing on recent dynamics (last three seasons) while acknowledging that these dynamics may deviate from those in previous and future years due to a combination of the impact of environmental fluctuations (specifically for short-lived species, such as Southern Calamari), changes in management regulations and market dynamics (e.g., due to the COVID-19 pandemic).

Similarly, due to the highly dynamic nature of the fishery, our thresholds for mean catch and effort based on which fishers were classified are not firm. Individuals whose fishing activities and output mean that they are located firmly above these thresholds are likely to be most representative of the characteristics outlined for their respective groups. However, individuals whose effort and catches were close to thresholds are likely to switch between groups on an interannual basis. Thus, the main aim of our classification was to better understand the dedication and likely importance of TSF species across all different types of operators.

5. Social and economic characteristics and performance of the commercial sector

5.1. Summary of findings

Findings about current viability and performance:

- Fishers operating in the TSF pursue diverse livelihood strategies in which fishing itself may be a major or minor activity, and fishing in the TSF may likewise be major or minor in terms of time commitment and proportion of overall earnings.
- More than 50% of surveyed TSF fishers have fished in the fishery for more than 20 years and most intend to stay active in the fishery in the short to medium term
- 40% of surveyed fishers were working concurrently in non-fishing jobs, commonly in trades or small businesses; 70% of surveyed fishers had previously fished in non-TSF fisheries; and 35% of surveyed fishers were currently working in other fisheries
- In terms of the costs of fishing in the TSF, approximately 6% of the fishery's expenditure went to government rates and charges; 16% to repairs and maintenance on vessels, motor vehicles, fishing gear, and other assets; 20% related to other fixed costs (e.g., insurances, accounting, and financing costs); and employment costs and other production costs combine to make up the remaining 58% of industry spending.
- Based on the combined economic profile presented, EBITDA (standard measure of profitability) for the TSF in 2018/19 was $3.89 million. Skipper wages are treated as part of profit, as is quota rental payments, while crew wages are a cost.
- In 2018/19 the TSF contributed $5.3 million in direct and indirect Gross Value Added (GVA) to the Tasmanian economy, $3.5 million in direct and indirect Household Income (HI) to Tasmanian households, and employment for 193 people (direct and indirect employment) in Tasmania.
- Overall conversion of cash revenues into business owners' income and employee wages in the TSF in 2018/19 was around 51.4%[3] (based on the survey responses). This suggests that up to $0.51 from each dollar of scalefish purchased from this industry finds its way to direct household income, which supports demand for housing and consumer spending in Tasmania.

Implications for future viability:

- The average TSF fisher is approximately 49 years old, which is slightly higher than the average age of working-aged men living in Tasmania currently in the workforce
- The surveyed TSF fishers identified five general conditions which diminish the social and economic outlook for fisher livelihoods. These were:
    - declining fish availability (50% of respondents)
    - declining control over fishing operations and first trades due to licence or vessel lease and buyer arrangements (25% of respondents)
    - inadequate industry representation for the TSF (25% of respondents)
    - declining flexibility and security due to changes in management arrangements (50% of respondents)
    - narrow profit margins (25% of respondents)
- 35% of surveyed TSF fishers who also hold another non-fishing job invest a higher percentage of their time in the TSF than the TSF accounts for percentage of their

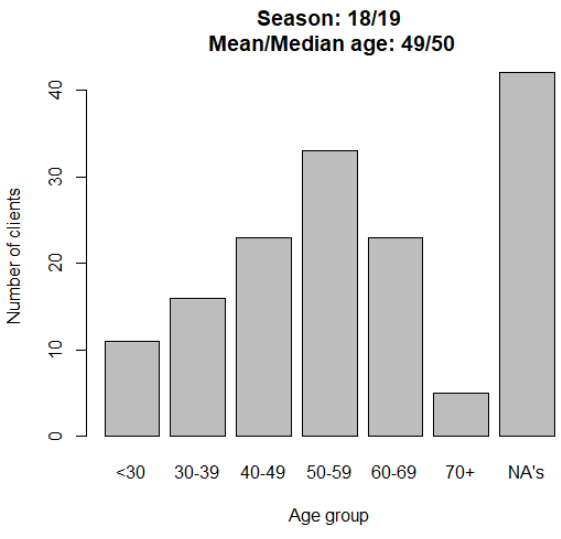
[3] This measure calculated as the ratio of crew wages and business profit to cash revenue (from fish sales).

income. This suggests motivations for continuing to fish in the TSF are not primarily about **maximising** earnings for this group.

5.2. Fisher demographic profile

The mean age of fishers active in the TSF in the 2018/19 fishing season was 49 years while the median age was 50 years (Figure 9a.). This compares with the median age of the Tasmanian male population aged between 18 and 75 years old in the same year, which was 47 years (ABS 2019). Fishers in the High effort, High catch group were not normally distributed. That is, they were predominantly found in the younger or older age cohorts, while the ages of the fishers in the other fisher groups appeared to be similar to the overall TSF fisher age distribution (Figure 9b.).

a.



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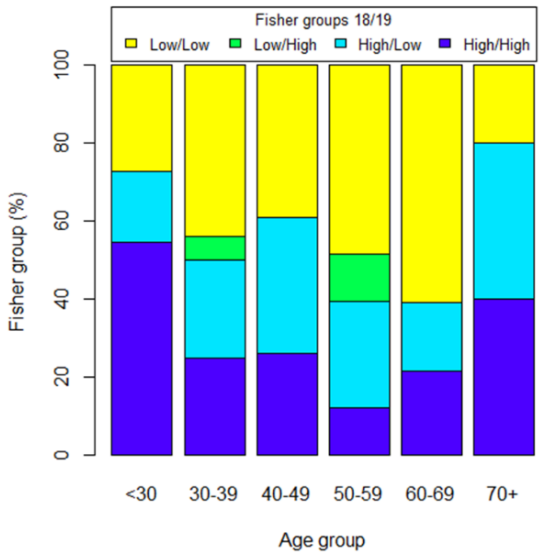


Figure 9. Age distribution of TSF fishers in the 2018/19 fishing season, as follows: a. by number of fishers, and b. by percentage of fishers in each fisher group classification.

5.3. Fisher livelihood strategy classification

Fishers operating in the TSF pursue diverse livelihood strategies in which fishing itself may be a major or minor activity, and fishing in the TSF may likewise be major or minor in terms of time commitment and proportion of overall earnings. A classification of fisher livelihood strategies was developed using the data collected in the TSF Fisher Survey (see Appendix D). Specific observations about levels of commitment to fishing generally and to fishing in the TSF from the sample of fishers surveyed (n=28) included:

- 40% of TSF fishers surveyed were working concurrently in non-fishing jobs, commonly in trades or small businesses.
- 70% of TSF fishers surveyed had previously fished in non-TSF fisheries, typically entering the fishing industry through work on lobster, abalone dive, or trawl vessels in Tasmanian or Victorian fisheries and in fisheries managed by the Commonwealth.
- 35% of TSF fishers surveyed were currently working in other fisheries, commonly in rock lobster or abalone fishing.

For the purposes of this classification, we counted fishing in the Tasmanian Rock Lobster Fishery for rock lobster as a non-TSF fishing activity, while we counted fishing under a Fishing Licence (rock lobster) for scalefish which is on-sold for human consumption as a

TSF activity. In these cases, FLRL holders may be fishing for high value species, such as Striped Trumpeter, and/or for mixed scalefish species for use as bait in rock lobster fishing.

Table 6. Fisher livelihood strategy classification developed for fishers operating in the TSF

Level of livelihood commitment to fishing	Level of livelihood commitment to fishing in the TSF	Definition
Full-time	Sole activity	100% of fishing and livelihood activity is through operating in the TSF
Full-time	Secondary activity	Works in at least one Non-TSF Fishery TSF < 100% but > 25% of income
Full-time	Minor activity	Works in at least one Non-TSF Fishery TSF < 25% of income
Part-time	Primary activity	Works in at least one other non-fishing job TSF 50% or > 50% of what time is worked 100% of fishing income is from the TSF
Part-time	Secondary/Minor activity	Works in at least one other non-fishing job TSF < 50% of what time is worked or TSF < 100% of fishing income
Latent	Speculating on future licence value	Inactive licence holder (i.e., licence has not been activated for last 2 fishing seasons or more). This classification applies to FLAs and FLBs only as FLCs are not transferrable and have low gear allowances and, therefore, hold no future value.

5.4. Fisher livelihood conditions

5.4.1. Fisher livelihood motivations

For 40% of fishers of who responded to the survey, the proportion of their time invested in fishing within the TSF was higher than the proportion of their annual income they derived from it. This suggests motivations for continuing to fish in the TSF are not primarily about **maximising** earnings for this group of fishers.

At the same time, TSF fishers are motivated to go fishing primarily for financial reasons. The most highly ranked reasons for deciding to go on a fishing trip, when weather conditions were taken into account, were market demand (27% of respondents) followed by catchability of targeted species (23%) and the need to factor in other work commitments (20%).

More than 50% of the current active TSF fishers who participated in the survey have been active in some capacity in the TSF for 26 or more years (Figure 10), indicating a strong level of commitment or dependence on the TSF for livelihood reasons.

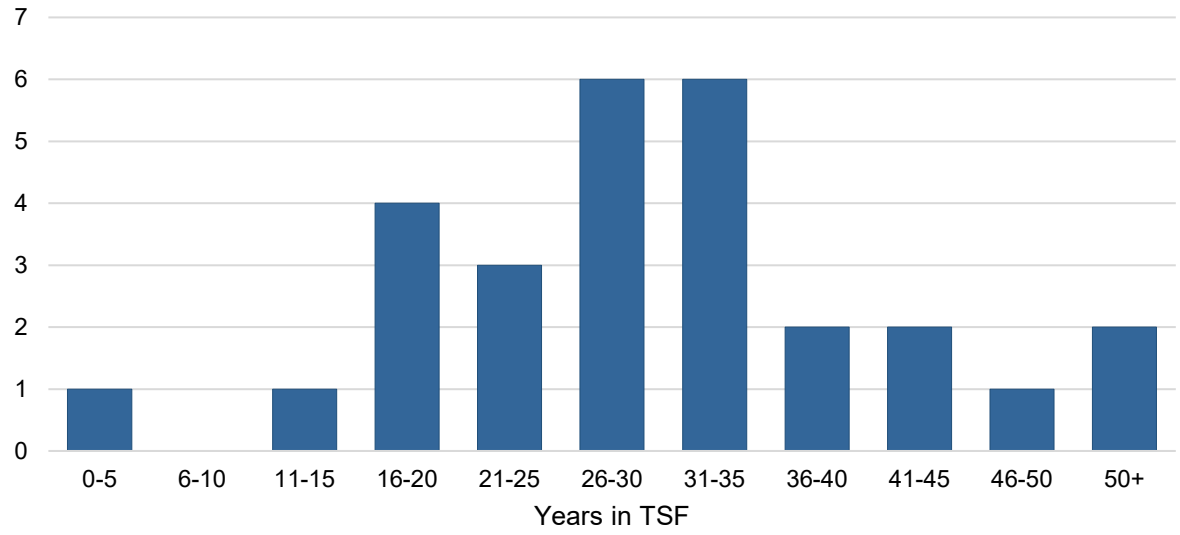


Figure 10. Number of TSF Fisher Survey respondents by years active in the TSF (n=28).

5.4.2. Future fishing intentions

TSF fishers surveyed indicated a strong intention to remain active in the TSF (Figure 11), despite reporting a range of negative disruptions due to the COVID-19 pandemic (see section 7.1) and a range of threats to livelihood provision and conditions (see below). Ageing was the main reason given for exiting the fishery within the next five years.

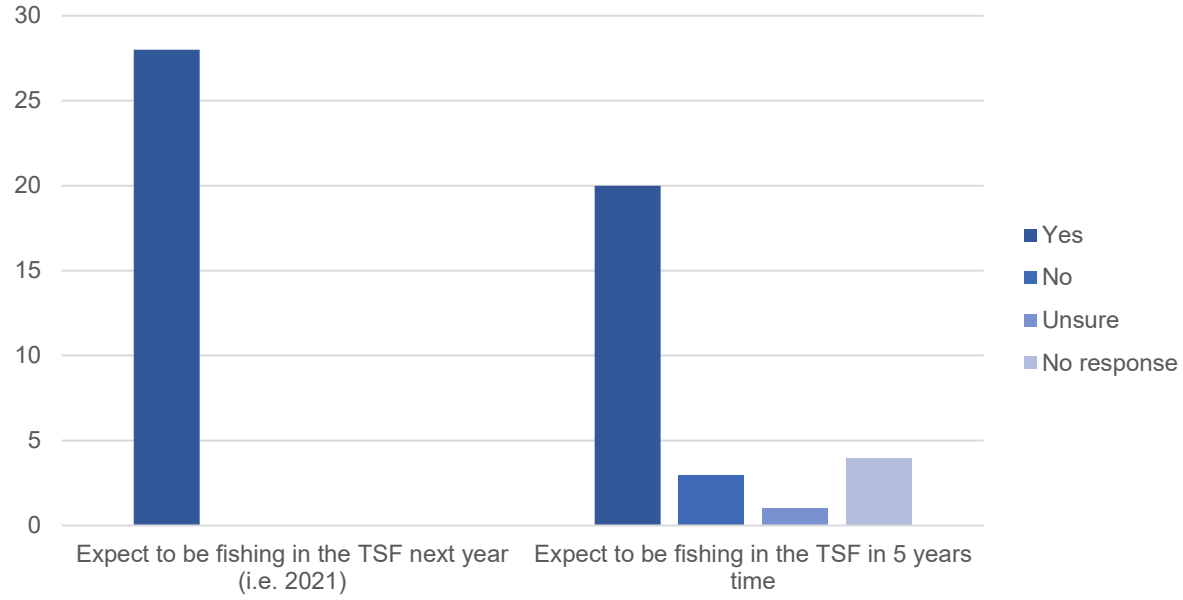


Figure 11. Number of TSF Fisher Survey respondents by their intentions to stay active in the TSF (n=28).

5.4.3. Threats to livelihood conditions

TSF fishers surveyed provided information on the outlook for the TSF in terms of livelihood provision and conditions, and the conditions (threats) they would like to see addressed in order to improve this form of social and economic performance of the fishery. In the same responses they were also asked to identify opportunities to improve livelihood conditions for current TSF fishers. These responses are reported in section 8.

TSF fishers identified five general conditions which diminish the social and economic outlook for fisher livelihoods. These were:

- declining fish availability (50% of respondents)
- declining financial control over fishing operations and first trades (25% of respondents)
- inadequate industry representation for the TSF (25% of respondents)
- declining flexibility and security due to changes in management arrangements (50% of respondents)
- narrow profit margins (25% of respondents)

They attributed these conditions to a number of drivers (Table 7).

Table 7. Perceived drivers affecting fisher livelihood conditions identified in the TSF Fisher Survey. Commonly identified drivers were those identified by 3 or more respondents out of 28 respondents.

Condition	Commonly identified drivers
Declining fish availability	– Increased pressure on fish stocks from increased recreational fishing – Increased pressure on fish stocks from increased fishing by operators (i.e., Commonwealth, Rock Lobster) not part of the TSF or not primarily TSF – Seal predation
Declining financial control over fishing operations and first trades	– Investors and fish processors increased purchase of and speculation in TSF licences – Increased vertical integration by processors also buying fishing licences – Strategic behaviour by new entrants in high value species is resulting in reduced access to these species
Inadequate industry representation for the TSF	– Lack of an effective, dedicated and recognised TSF representative body – Range of views about what's best for the TSF
Declining security due to changes in management arrangements	– Increased level of change in fishing management arrangements – Lack of assessment of risk to fishing livelihoods by management changes – High level of latent capacity which is not being addressed – Loss of 'first mover' advantage from any product, market or supply chain improvement due to lack of limits on entry which encourages new entrants and introduces additional competition for existing operators
Declining flexibility due to changes in management arrangements	– Declining flexibility and security due to changes in management arrangements – Introduction of further limited entry provisions for single high value species, forcing fishers to specialise or exit
Narrow profit margins	– Comparative high cost of freight to access interstate markets – Competition from imported and locally farmed finfish products – Under-development of local high value markets

5.5. Fisher expenditure profiles and profitability

As part of the TSF Fisher Survey (see Appendix D), vessel-level financial data was collected on Direct Fishing Costs (paid every fishing trip), Vessel Costs (boat maintenance, etc.), and Administrative Costs (all overhead, including quota costs related to Banded Morwong). These costs together constitute the total operating expenditures for most fishing businesses in a year. Based on this information, representative economic profiles were developed for two fisher groups: a High Effort Group which consisted of the High/High and High/Low fishers that provided responses to the economic questions in the survey; and a Low Effort Group which consisted of the Low/High and Low/Low fishers responding to the economic questions.

Table 8 shows average expenditure profiles for the 2018/19 financial year for two fisher classifications used for this section of project: High Effort (High/High and High/low) and Low Effort (Low/High and Low/Low). The High Effort and Low Effort profiles presented in Table 7 represent sample averages calculated via post-stratification weights (cell weights) computed from the estimated population counts in each cell of the general fisher classification used for this study (i.e., High/High, High/low, Low/High, and Low/Low). See section 3.3.5 for details of the method applied.

The profiles in Table 8 describe the conversion of each group's revenue into vessel profits (skipper earnings), returns to labour (crew wages), spending on fishing inputs (fuel, bait, etc.) and government fees/charges.

The major cost items across both groups were fuel (incl. motor vehicle fuel) [4], crew wages, and vessel repairs and maintenance. Operators in the High Effort group commonly owned sheds and land-based assets, and which increased their fixed costs for power, repairs and maintenance (buildings and plant), and non-vessel insurances. Operators in the Low Effort group had substantial interest and borrow costs, and especially when considered on ratio to their sales revenue (i.e., 10.5% of sales for the Low Effort group compared with 2.4% of sales for the High Effort group). This suggests differing risk-profiles and resilience to market dips for fishers in the High Effort and Low Effort groups. Note that quota leasing costs and transfer fees in the case of both profiles relates solely to the Banded Morwong fishery.

[4] Please note that fuel tax credits were imputed based on the reported fuel expenditure.

Table 8. Expenditure profiles for the Tasmanian Scalefish Fishery for 2018/19 FY.

2018/19	**High Effort Group** (High/High & High/Low)	**Low Effort Group** (Low/High & Low/Low)
Revenue		
Sales of fish	$69,180.80	$49,060.43
Fishing Costs		
Boat & vehicle fuel (net of tax credits)	$7,421.44	$3,956.29
Ice	$675.74	$ -
Bait	$522.13	$ -
Crew wages / share of catch	$5,127.05	$2,347.83
Provisions (e.g., food)	$1,450.82	$569.57
Protective clothing	$ 866.26	$197.83
Other on-vessel fishing costs	$3,424.69	$97.83
Vessel Costs		
Insurances - vessels	$2,872.83	$2,178.26
Repairs and maintenance to boat - *incl. oil & filters*	$4,030.84	$6,668.48
Moorings, wharf, berthing fees	$304.92	$217.39
AMSA & MAST fees	$584.43	$686.52
Vessel lease charges	$ -	$ -
Other vessel-related expenses	$344.26	$ -
Administrative Costs (ex. Quota)		
Fishing licence fees	$2,272.07	$1,839.13
Legal & Accounting	$1,422.95	$235.65
Communication -telephone, fax, email	$430.10	$905.43
Power	$562.30	$21.74
Repairs and maintenance to Buildings/Plant	$243.93	$27.17
Repairs and maintenance to Motor Vehicles - *incl. insur. & regn*	$2,103.51	$1,830.43
Rates and Rents for property and equipment	$ -	$108.70
Interest and borrowing costs	$1,636.50	$5,165.22
Business related non-fishing travel, accommodation	$81.97	$108.70
Membership, association expenses (ex TSIC)	$ -	$ -
Insurances - other (non-vessel)	$196.72	$65.22
Other expenses	$1,065.57	$ -
Quota costs &c.		
Quota leasing cost (Banded Morwong ONLY)	$1,959.02	$ -
Quota transfer fees (Banded Morwong ONLY)	$ -	$ -
Profit before tax	**$31,539.79**	**$21,833.07**

Most fishers in the economic sample owned one boat of around seven meters in length, and engine capacity ranging from 100hp to 300hp. Displacement hull vessels were documented in the High Effort group, but most respondents had no permanent mooring and moved their boat by trailer (vessels in the Low Effort group were almost exclusively of this type). Table 9 below summarises vessel ownership, length, and engine capacity for the High Effort and Low Effort group in the economic sample respectively. The major types of fishing reported among respondents to the economic questions were seine net fishing, gillnet fishing, squid jig (including automatic squid jig), and hook and line.

Table 9. Summary of vessel ownership, length, and engine capacity for High Effort and Low Effort.

Measure	**High Effort Group** (High/High & High/Low)	**Low Effort Group** (Low/High & Low/Low)
Own Vessel/s	Yes	Yes
Average number vessels	1.1	1.0
Average length of vessel/s (m)	6.7	7.0
Average engine capacity of vessels (HP)	137.6	305.8

Figure 13[5] shows a combined expenditure profile of the TSF for the 2018/19 year, where the post stratification weights (cell weights detailed previously) are used to calculate the grand mean expenditure profile for the economic sample. This chart represents the initial incidence (i.e., economic footprint) of the fishery into the Tasmanian economy. Approximately 6% of the fishery's expenditure went to government rates and charges; 16% to repairs and maintenance on vessels, motor vehicles, fishing gear, and other assets; 20% related to other fixed costs (e.g., insurances, accounting, and financing costs); 39% related to employment costs; and the remaining 19% related to other production costs. Note: in the case of the TSF, no wage imputation has been made for unpaid labour (including skippers' time) spent in the fishing business, and this has been due to a lack of data supplied within the completed survey responses on which to base this.

[5] The cost items from the Economic Profile for the Tasmania Scalefish Fishery for 2018/19 corresponding to the expenditure groupings used in this chart are:

- **Employment costs:** skipper wages, crew wages.
- **R&M on property, plant and equipment:** Repairs and maintenance to boat; Repairs and maintenance to buildings/plant; Repairs and maintenance to motor vehicles (incl. insurance & registration).
- **Other production costs:** Boat & vehicle fuel (net of tax credits); Ice & bait; Provisions; Protective Clothing; Other on-vessel fishing costs.
- **Government rates and charges:** Fishing licence fees; AMSA/MAST fees; Rates and rents for property and equipment.
- **Overheads and non-production costs:** Insurances - vessel; Moorings, wharf, berthing fees; Legal & Accounting; Communication -telephone, fax, email; Power; Interest and borrowing costs; Business related non-fishing travel, accommodation; Insurances – other (non-vessel); Membership, association expenses (ex TSIC); Vessel lease charges; Quota leasing cost; Quota transfer fees; Other expenses (incl. vessel-related).

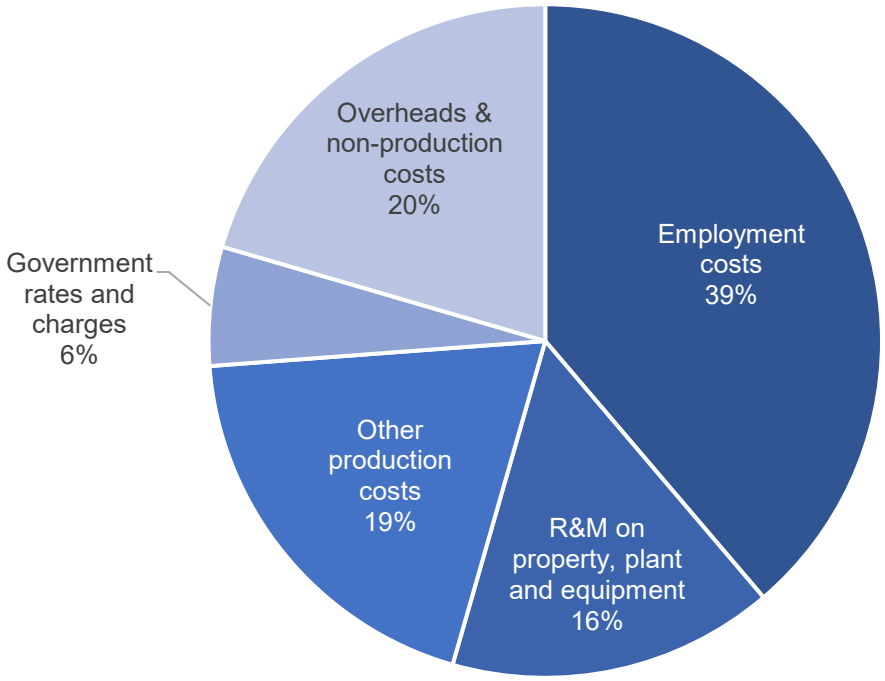


Figure 12. Combined expenditure profile of the TSF for the 2018/19 FY, using post stratification weights (cell weights detailed in this report) to calculate the grand mean expenditure profile for the survey sample.

As a final check of this combined expenditure profile for the TSF, we use the South Australian Marine Scalefish Fishery (BDO Econsearch 2020) as an analogous case to undertake a comparison of expenditure proportions within each expenditure category (employment costs; repairs and maintenance of property, plant and equipment; other production costs; government rates and charges; and overheads and non-production costs). This comparison is shown in Table 10 and reveals a broad similarity between our TSF expenditure profile and published data for the South Australian fishery.

Table 10. Comparison of the combined expenditure profile for the TSF with the South Australian Marine Scalefish Fishery, which is widely considered a comparable fishery to the TSF.

Measure	**Tasmanian Scalefish Fishery**	**South Australian Marine Scalefish Fishery[1]**
Employment costs	39%	42%
Repairs and maintenance on property, plant & equipment	16%	11%
Other production costs	19%	21%
Government rates and charges	6%	7%
Overheads and non-production costs	20%	19%

[1] Source: BDO EconSearch 2020. Economic and Social Indicators for the South Australian Marine Scalefish Fishery, 2018/19, BDO EconSearch, Adelaide, South Australia.

The measure of profitability used is in this study is EBITDA (earnings before interest, tax, depreciation, and amortisation). Based on the combined economic profile presented, EBITDA for the TSF in 2018/19 (FY) was calculated to be $3.89 million. Note that skipper wages are treated as part of profit, as is quota rental payments. Crew wages are a cost.

The vessel profits (before quota leasing costs) were reported highest for the cost-efficient Low/High group, and second highest for the High/High effort-catch group. Both these groups typically also employed at least one crew member on most fishing trips.

5.6. Economic contribution to the Tasmanian economy

The combined expenditure profile provides an indication of the effectiveness of the TSF in converting its gross revenues into direct vessel profits and wages. This is an important function of the commercial sector of the TSF in stimulating consumer demand and investment elsewhere in the Tasmanian economy. The Tasmanian community achieves a multiplier on direct spending by the commercial sector of the TSF. Direct spending by this sector creates flow-on benefits to the Tasmanian economy through business and household re-spending. Total direct spending represents the total costs incurred by businesses in the sector, excluding quota rental payments (which are transfer payments that occur between industry participants, and are not made in exchange for goods or services produced). The total direct spending by the commercial sector of the TSF represents a flow of money immediately engaged in the Tasmanian economy for the 2018/19 financial year.

For the fishing behaviours and markets that existed during the 2018/19 financial year, the overall efficiency of conversion of cash revenues into business income and wages within the TSF was around 51.4% (based on the survey responses). This suggests that up to $0.51 from each dollar of scalefish purchased from this industry finds its way to direct household income, which supports demand for housing investment and consumer spending in Tasmania.

Box 1. Definition of measures of contribution

Employment is a measure of the number of working proprietors, managers, directors and other employees, in terms of the number of jobs (employment – total) and the number of full-time equivalent (FTE) jobs (employment – FTE). For this study we consider 1 FTE as being equivalent to 37.5 hours of work per week.

Gross Value Added (GVA) represents the value of all goods and services produced in an industry, minus the cost of all inputs and raw materials used to produce those goods or services. It also represents the total household income (defined below) and gross operating surplus generated by the industry over a time-period. In this report GVA provides a basis for measuring the net contribution of the TSF to the Tasmanian economy.

Household income is a measure of wages and salaries paid in cash and in kind, drawings by owner operators and other payments to labour including overtime payments, employer's superannuation contributions and income tax, but excluding payroll tax. Household income provides a measure of the wages and salaries associated with the employment contribution of the TSF.

Box 2. Definition of direct, indirect, and total contribution

Estimates of economic contribution for GVA, employment, and household income are presented in this report in terms of:

- direct contribution;
- flow-on (or indirect) contribution; and
- total contribution.

Direct contribution measures the initial effects (GVA, employment, and household income) that are generated by the TSF within the Tasmanian economy for 2018/19. This includes spending on wages (to employees, and business owners) and the purchase of inputs. The total direct effect is the sum of all the initial effects of the fishery's activity on the Tasmanian economy for the 2018/19 financial year.

Flow-on (or indirect) contribution occurs due to the re-spending by households (consumption induced indirect effects) or re-spending of business (production induced indirect effects) following receipt of the direct spending of the industry.

- Production-induced effects are additional GVA, employment, and household income resulting from re-spending by firms (e.g., boat maintenance contractors, purchases of bait, and fishing gear) that receive payments from goods or services provided to the industry.
- Consumption-induced effects are additional GVA, employment, and household income that results from re-spending by households that receive income from employment in activities that are either directly or indirectly associated with the industry. The total indirect effect is the sum of the consumption and production induced components.

Total contribution is the sum of the direct and flow-on (indirect) contribution for TSF for the 2018/19 financial year.

The following section presents a breakdown of direct spending and economic contribution for the commercial production sector of the TSF in 2018/19 FY. Figure 13 shows results for contribution to Gross Value Added (GVA) and Household Income; and Figure 14 shows the contribution to number of persons employed in Tasmanian and the estimated contribution to the total full-time equivalent (FTE) workforce in the State[6]. In the case of GVA and Household Income, the results are shown for 'Direct', 'Production Induced' and 'Consumption Induced' components. For Employed Persons and Employment (FTE), results are shown for 'Direct' and 'Total Indirect'. In the standard input-output model, the so-called 'direct effects' arise from the initial spending of an industry into the other sectors of the economy. This includes the spending on wages (paid to employees) and the purchase of inputs. The 'indirect effects' arise from re-spending by households in the economy (the 'consumption induced' indirect effects) and by businesses (the 'production induced' indirect effects). The 'total indirect effect' is the sum of the consumption and production induced components.

[5] This estimate for FTE employment should be treated with caution. It has been derived using a range of secondary sources in combination with some primary data extracted from the FILMS database. The number of persons employed was obtained directly from the FILMS database, and is considered robust.

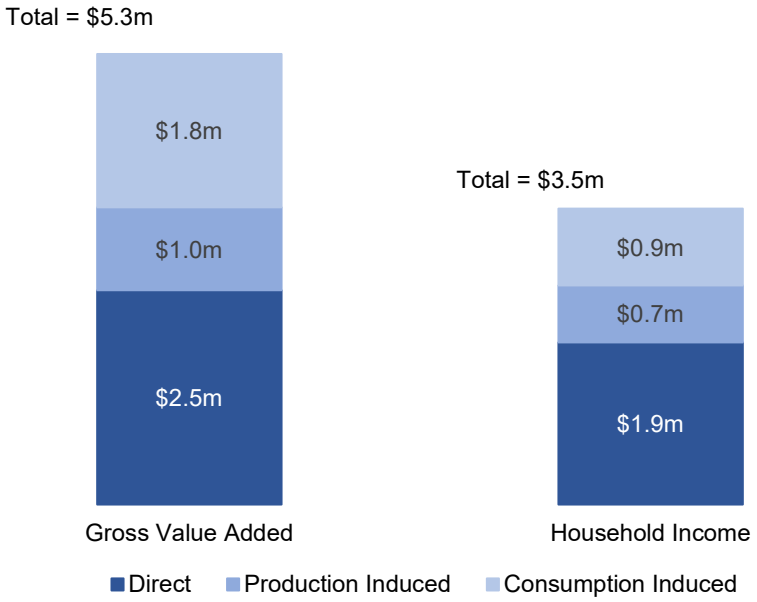


Figure 13. Contribution of the TSF commercial sector to Gross Value Added (GVA) and Household Income in the Tasmanian economy for the 2018/19 FY.

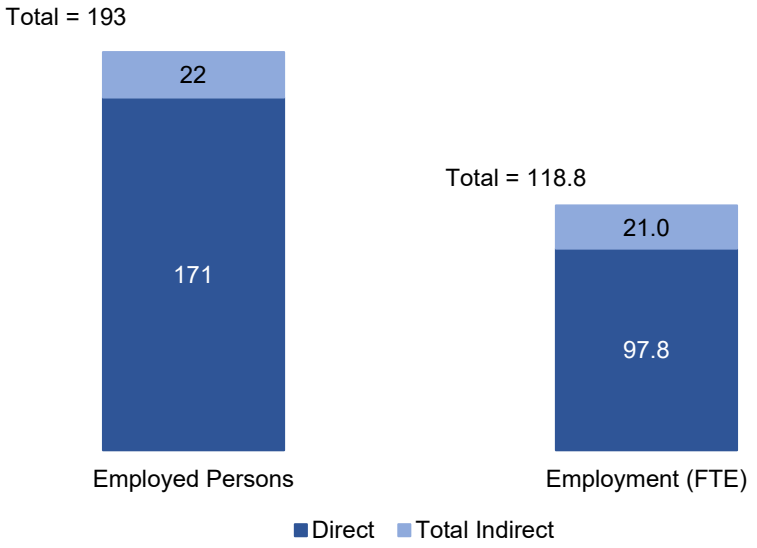


Figure 14. Contribution of the TSF commercial sector to the total number of Employed Persons and full-time equivalent (FTE) workforce (Employment (FTE)) in Tasmania for the 2018/19 FY. Direct employment in this fishery also includes part-time operators, who work primarily in other fisheries but take occasional catches from Scalefish stocks. Further work is being undertaken by Tasmanian Seafood Industry Council to better understand employment in this fishery.

Table 11. Economic contribution of the commercial production sector of the Tasmanian Scalefish Fishery to Tasmania, 2018/19 FY.

Sector	GVA ($m)	Household Income ($m)	Employment (fte)	Employment (total)
Direct effects				
Total Direct Fishing	2.5	1.9	98	171
Flow-on effects				
By component				
Production induced	1.0	0.7	7	7
Consumption induced	1.8	0.9	14	15
By top 10 sectors				
Ownership of Dwellings	0.3	0.0	0	0
Finance	0.2	0.0	0	0
Retail Trade	0.2	0.2	3	4
Other Machinery & Equipment	0.2	0.2	2	2
Public Admin & Regltry Serv	0.2	0.1	1	2
Wholesale Trade	0.1	0.1	1	1
Health & Community Serv	0.1	0.1	2	2
Road Transport	0.1	0.1	1	1
Prof Scientific Tech Serv	0.1	0.1	1	1
Education & Training	0.1	0.1	1	1
Other Sectors	1.0	0.6	9	9
Total Flow-on	2.8	1.6	21	22
Total	5.3	3.5	119	193
Total/Direct	2.1	1.8	1.2	1.1

5.7. Discussion

The TSF operates as ‘general fishery’ for a range of fishers pursuing a wide range of livelihood strategies. This includes specialist TSF fishers as well as fishers active in both in the TSF and other Tasmanian-based fisheries. It includes full time fishers as well as part-time fishers who combine fishing with non-fishing work or semi-retirement.

Active fishers are generally older than the Tasmanian male population of across the same age cohorts and have more often than not been active in the TSF for a long period of time. This observation - along with the reported threats to livelihood conditions in the fishery - suggests a slow contraction of the existing fishing fleet is taking place as catch volumes diminish for some historically important species and as entry is limited to higher-value species (e.g., Calamari, Banded Morwong).

Current active fishers are generating positive earnings but no evidence of economic rent (or ‘above-normal’ profit) was present at the fishery level. This result may differ, of course, for individual fishing businesses. As fishers are Tasmanian based, expenditure in the fishery and payment of wages to crew and earnings by skippers is recirculated in the Tasmanian economy. Relative to its economic size, the TSF makes a greater relative economic contribution to the Tasmanian economy, household income and employment generation than other larger but more economically efficient fisheries in Tasmania (e.g., the Rock Lobster and Abalone fisheries, see Rust and Ogier 2021).

Limitations of this analysis include any sample biases arising from the TSF Fisher Survey sample, and in the aggregation of costs of fishing to the whole TSF fishing fleet.

In studies where larger survey sample sizes are available, marginal distributions can be determined for the survey respondent population with which to post-weight survey responses via the available fishing records (see BDO EconSearch 2022b for a recent example).

Due to the smaller survey sample size in this study, this approach was not possible and instead cell weights were applied based on classifications from catch effort data. To partially address this limitation, this step was benchmarked against a comparable set of data for the South Australian Marine Scalefish Fishery and found to be similar. Business level statistical matching and imputation to scale up (or expand) the survey sample of fishing businesses to better represent the whole commercial fishing industry should be applied to such surveys in future wherever possible.

6. Market conditions and supply chains for Tasmanian scalefish

6.1. Summary of findings

Findings about current viability and performance:

- TSF supply chains include Direct-to-Consumer; Direct-to-Final Market (local restaurants and retailers); and, Wholesaler-controlled.
- TSF products are sold into Tasmanian retail and food services sectors as well as directly to Tasmanian consumers. Other products are sold to Tasmanian wholesalers who on-sell to seafood wholesalers or retailers in Melbourne, and to a lesser extent in Sydney. In some cases, TSF fishers sell directly to Melbourne or Sydney seafood wholesalers.
- For the years 2018-2020, the large majority of reported first sales of TSF products were sold by fishing operators to Tasmanian-based buyers. 16% of first sales were to Victorian-based buyers. However, the total volume sold to interstate buyers was much higher than the share of sales transactions as many local sales were small in volume.
- Based on a sample of reported first sales data for the financial years 2018/19-2020/21, volumes of TSF product sold directly to Tasmanian-based restaurants, retailers and direct to local consumers was between 17-24% of total reported volumes sold. The proportion of TSF product consumed in final markets within Tasmania is likely to be higher when accounting for sales of TSF products by Tasmanian wholesalers to Tasmanian consumers, retailers and restaurants.
- In the 2018/19 financial year, total revenue earned by TSF fishers from first sales of fish was **$7,605,199**.

Implications for future viability:

- Overall, TSF fish prices paid on landings have increased at a rate above inflation:
    - High value species which have experienced sustained price increases are live Banded Morwong, King George Whiting, Striped Trumpeter, live Wrasse, Southern Garfish, and Southern Calamari.
    - Tiger Flathead is a mid-range product form in this time series which has risen in price from $2.21 per kg (trailing twelve-month average) in September 1999 to $9.64 per kg (trailing twelve-month average) in April 2021.
    - Three low performing species clustered at below $5 per kg are Australian Salmon, whole Wrasse, and School/Sand Whiting. These species still demonstrated price growth over this period that exceeded the Australian All Groups consumer price inflation.
- TSF wholesalers have very limited market power in their major wholesale markets
- TSF operators consistently “fish to market”. They show rational fishing behaviour, responding to both market conditions and catchability.

6.2. Supply chains and markets for TSF products

The schematic provided in Figure 15 shows the current major supply chains for TSF products into Tasmanian and interstate markets and to final consumers. The existence of multiple supply chains highlights the decentralised nature of the intermediate and final markets for TSF products, in which there are multiple chains for multiple species. For example, Wrasse is sold both fresh into Tasmanian markets and live into Melbourne markets.

The status of value chains for major TSF species (Table 11) shows that most are well-developed.

Species which do not have well-developed value chains include Australian Salmon, which remains under-utilised due to lack of consistent large supply and infrastructure to support post-harvest product quality and processing (Howieson et al. 2019). Sardine appears to be present in large quantities, with a recent IMAS survey suggested biomass is substantial (Ward et al. 2022). However, current management settings (i.e., trip limits) limit any real fishery development. Developmental fishery permits do not appear to have been effective in encouraging the establishment of a fishery, mainly due to the NRE Tas policy of not allowing investment in a permit fishery at the time, so there was no incentive to invest in processing infrastructure.

Species with variable availability to operators in the TSF, and therefore less established value chains, include Jack Mackerel, Blue Mackerel and Gould's Squid.

Table 12. Major TSF products; their level of value-chain development and supply chain and market characteristics

Species	Value chain status	Marketed form/s	Types of final market/s	Location of final market/s
Banded morwong & Wrasse	Established	Live	Restaurant	Interstate
Wrasse	Established	Fresh	Retail, local - mainly takeaway	Local / Interstate
Calamari	Established	Fresh/Frozen	Retail and restaurant	Local/ Interstate
Garfish	Established	Fresh	Retail and restaurant	Interstate
Striped Trumpeter	Established	Fresh	Retail/restaurant/ ex-vessel	Local
King George Whiting	Emerging	Fresh	Restaurant/ ex vessel	Local
Australian Salmon	Under-utilised	Fresh/ Frozen	Bait (local fishing sector) Value-added (restaurant/retail)	Local / Interstate
Tiger flathead	Established	Fresh	Wholesale/Retail/ Restaurant	Local/ Interstate
School whiting	Established	Fresh	Wholesale/retail	Interstate
Mixed fish (incl shark)	Established	Fresh	Wholesale/retail	Local

The generalised supply chains identified through the TSF Fisher Survey and Processor Survey include:

1. Direct-to-Consumer
2. Direct-to-Final Market, these being local restaurants and retailers
3. Wholesaler-controlled

6.2.1. Direct-to-Consumer supply chains

- This short supply chain is based on ex-vessel sales direct to final consumers of TSF product.
- Species commonly sold fresh via this chain include Striped Trumpeter; Tuna; Australian Salmon; Mullet; Mixed white fish[7].
- This chain is not typically the primary supply chain for TSF fishers but a secondary one in which catches of specific species are sold via this chain to obtain higher prices compared with wholesale buyers.
- TSF fishers reported having established links with consumers who would be notified by SMS message or via social media platforms of fish for sale.
- TSF fishers emphasised the critical importance of product handling to ensure product received higher unit prices.

6.2.2. Direct-to-Final Market supply chains

Restaurant sales:

- This short supply chain involves fishers either delivering or arranging collection of product directly with individual restaurant operators.
- Species commonly sold fresh via this chain include Southern Calamari; Striped Trumpeter; Flathead; King George Whiting; Tuna; Mixed white fish, Wrasse[6].
- TSF fishers typically sold to between 1-3 restaurants on a semi-regular basis
- This chain is not typically the primary supply chain for TSF fishers, but a secondary one in which catches of specific species are sold via this chain because demand matches supply (small volumes), and better prices are obtained compared with wholesale buyers.
- TSF fishers view this chain as reliable for small volumes of catches and catches of lesser-known species.

Retail sales:

- This short supply chain involves fishers delivering product directly with individual local retail operators.
- Species commonly sold fresh via this chain include Striped Trumpeter; Flathead; Snook; Mullet; Mixed white fish (including Silver Trevally, Goatfish); Wrasse; Southern Calamari[6].
- TSF fishers typically sold to between 1-3 retailers on a semi-regular or occasional basis.
- This chain is not typically the primary supply chain for TSF fishers, but a secondary one in which catches of specific species are sold via this chain because demand reliably matches supply (small volumes).
- TSF fishers view this chain as reliable for small volumes of catches and catches of lesser-known species.

[7] Not listed by order of importance (volume or value).

6.2.3. Wholesaler-controlled supply chains

Sales to wholesalers / processors:

- This longer-supply chain can involve multiple segments between TSF fisher and final market, including the immediate wholesaler/processor (who in some cases is also a retailer) and in some cases a second wholesaler/processor who the immediate buyer may on-sell to (e.g., a Melbourne or Sydney seafood wholesaler).
- Species commonly sold through this chain include Wrasse, Banded Morwong, Calamari; Goulds squid; Shark; Garfish[6].
- TSF fishers typically sold to between 1-3 wholesalers.
- This chain is a mainstay for many TSF fishers, the majority of whom sell to wholesalers on most trips. In the case of TSF fishers targeting live fish markets, this was the dominant supply chain used.
- TSF fishers view this chain as reliable, although not necessarily the chain offering best price for their product. In some cases, Banded Morwong fishers sold to specific wholesalers primarily because their access to quota was linked to the wholesaler.

Consignment through wholesalers:

- This longer-supply chain involves TSF fishers supply their product on consignment to a wholesaler who sells the fish on their behalf (for example, Sydney Fish Market) through a seafood auction.
- Species commonly sold through this chain include Garfish, Flathead, Calamari, School Whiting, Pike[6].
- TSF fishers typically consigned product to 1 consignee.
- This chain is less commonly used however for some TSF fishers regularly targeting species sold into mainland markets, it is a mainstay supply chain. Other TSF fishers only use this supply chain for some trips when they are targeting species sold into these markets.
- TSF fishers view this chain as less reliable, as generating higher prices (although not reliably) and well-suited for smaller catches of lesser-known species or species targeted at specialist markets.

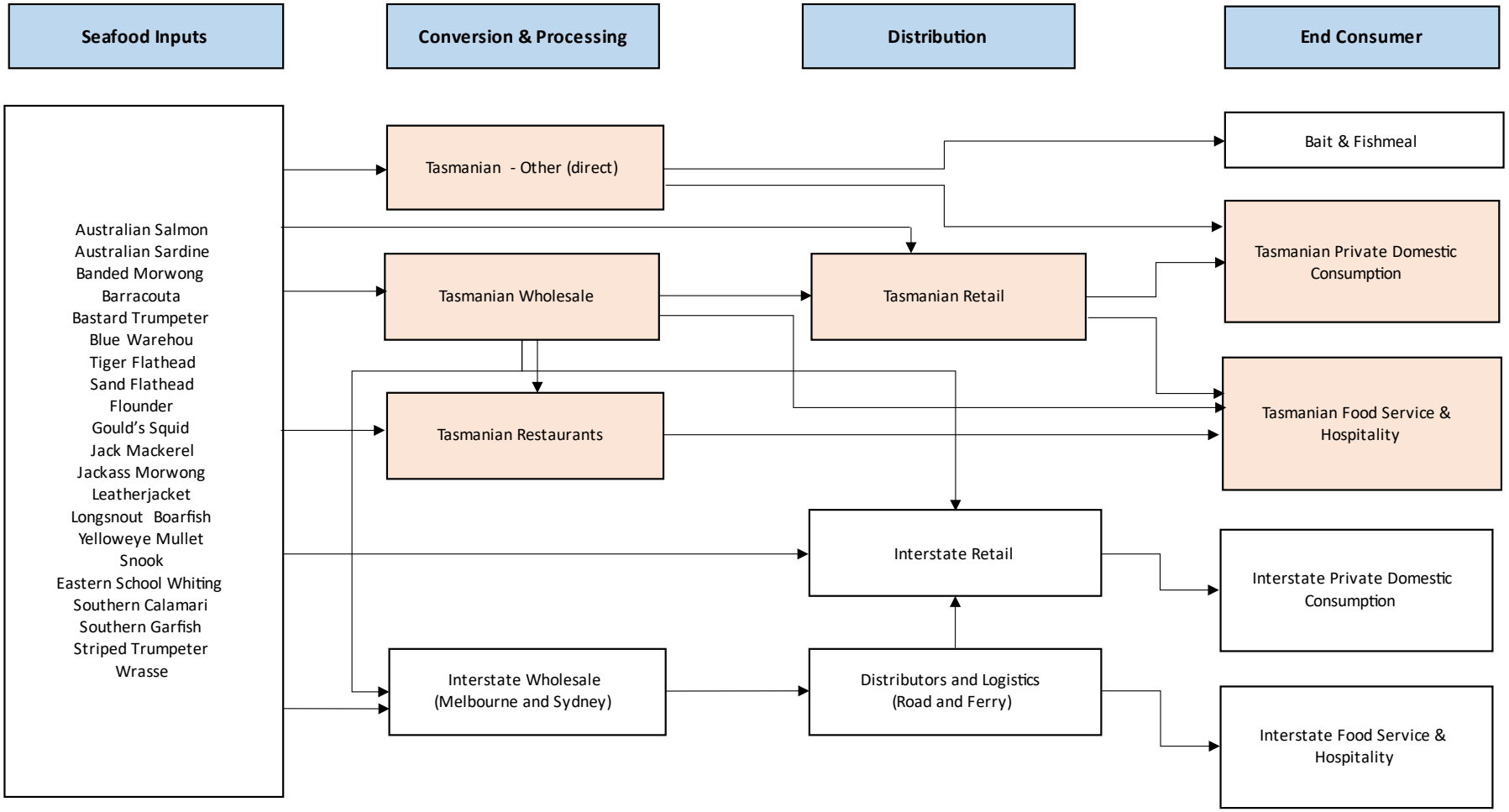


Figure 15. Schematic of Tasmanian Scalefish Fishery supply chains

6.3. TSF product landing prices and performance

The twelve-month trailing average for landing (beach) prices for key TSF species from September 1999 to April 2021 is presented in Figure 16. It indicates the general trends in price over this period.

Major growth species having been live Banded Morwong, King George Whiting, Striped Trumpeter, live Wrasse, Southern Garfish, and Southern Calamari. This reflects the tastes/preferences of a large live fish market primarily in Melbourne and Sydney and efforts to develop markets for the Southern Calamari over this timeframe (both locally and interstate).

Tiger Flathead is a mid-range product form in this time series which has risen in price from $2.21 per kg (trailing twelve-month average) in September 1999 to $9.64 per kg (trailing twelve-month average) in April 2021. This represents price inflation of about 336% over the period, which compares to the Australian All Groups consumer price inflation from the September quarter in 1999 to the June quarter in 2021 of 73% (ABS Cat No. 6401.0).

Three low performing species clustered at below $5 per kg are Australian Salmon, whole Wrasse, and School/Sand Whiting. These species still demonstrated price growth over this period that exceeded the Australian All Groups consumer price inflation. The price of Australian Salmon, for example, increased by approx. 189% over the period.

Given these market conditions, dedicated TSF operators consistently “fish to market”. The top species caught (by volume) by the dedicated TSF operators are the higher value species, with the exception of Australian Salmon (Figure 17). The main species by volume are School whiting, Wrasses, Southern calamari, Banded Morwong, Tiger Flathead and Australian Salmon. These species dominate catch for low, medium and high volume catch fishers. This indicates the same general types of fishing are occurring at different scales in the fishery (i.e., a log-linear catch-effort relation). Comparing the main species caught by volume (Figure 17) with the historical price data (Figure 16) suggests rational fishing behaviour, overall, that responds to both market conditions and catchability.

Supporting this finding, TSF fishers who were interviewed indicated that market demand and high enough beach price were the primary reasons they decided to go fishing, weather conditions permitting. The second most common reason identified was catchability of targeted species, which is also linked to costs of fishing and therefore economic performance.

For the 2018/19 financial year, total revenue from sales of fish was **$7,605,199**.

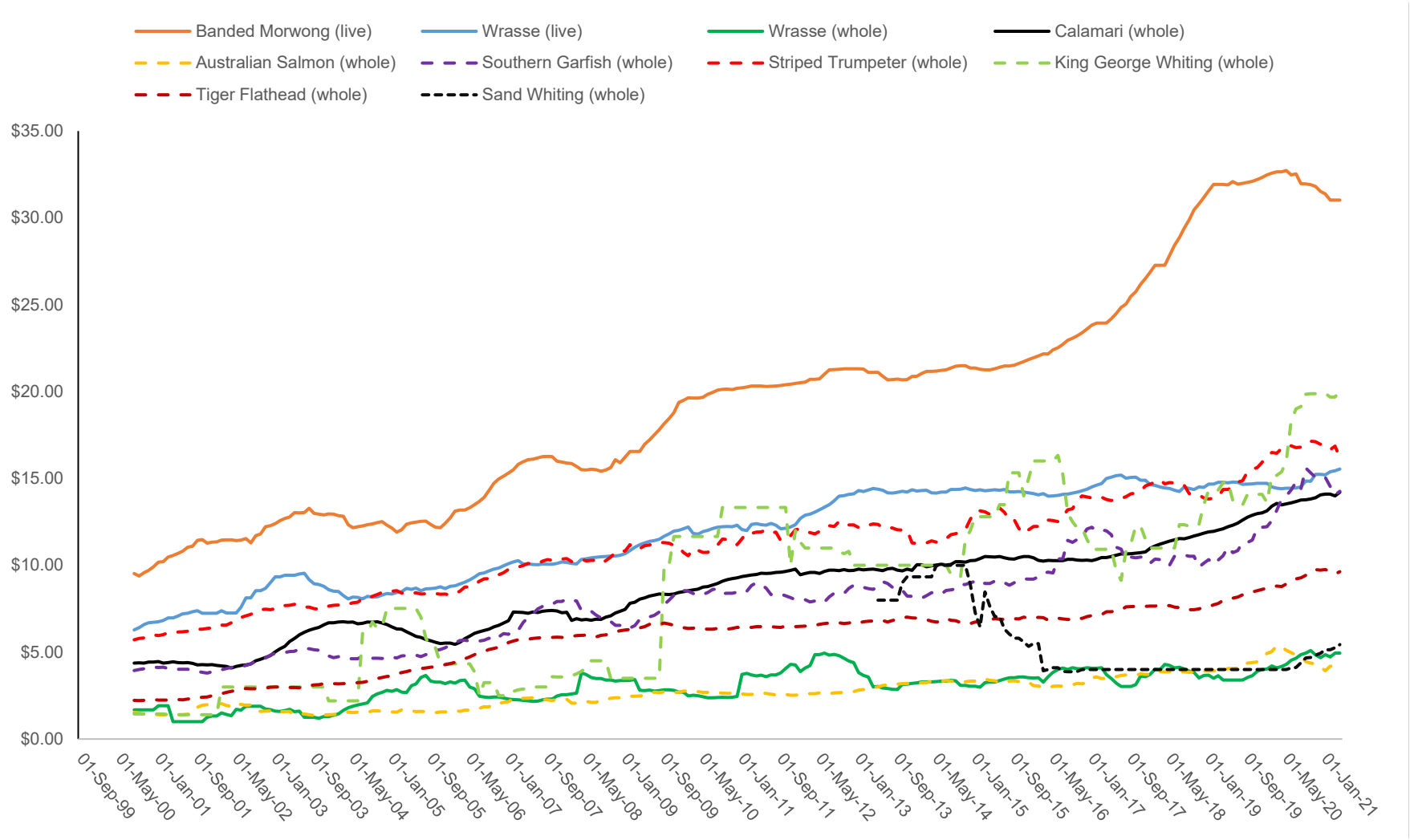


Figure 16. Twelve-month trailing average for mean landing (beach) prices for key TSF species from September 1999 to April 2021.

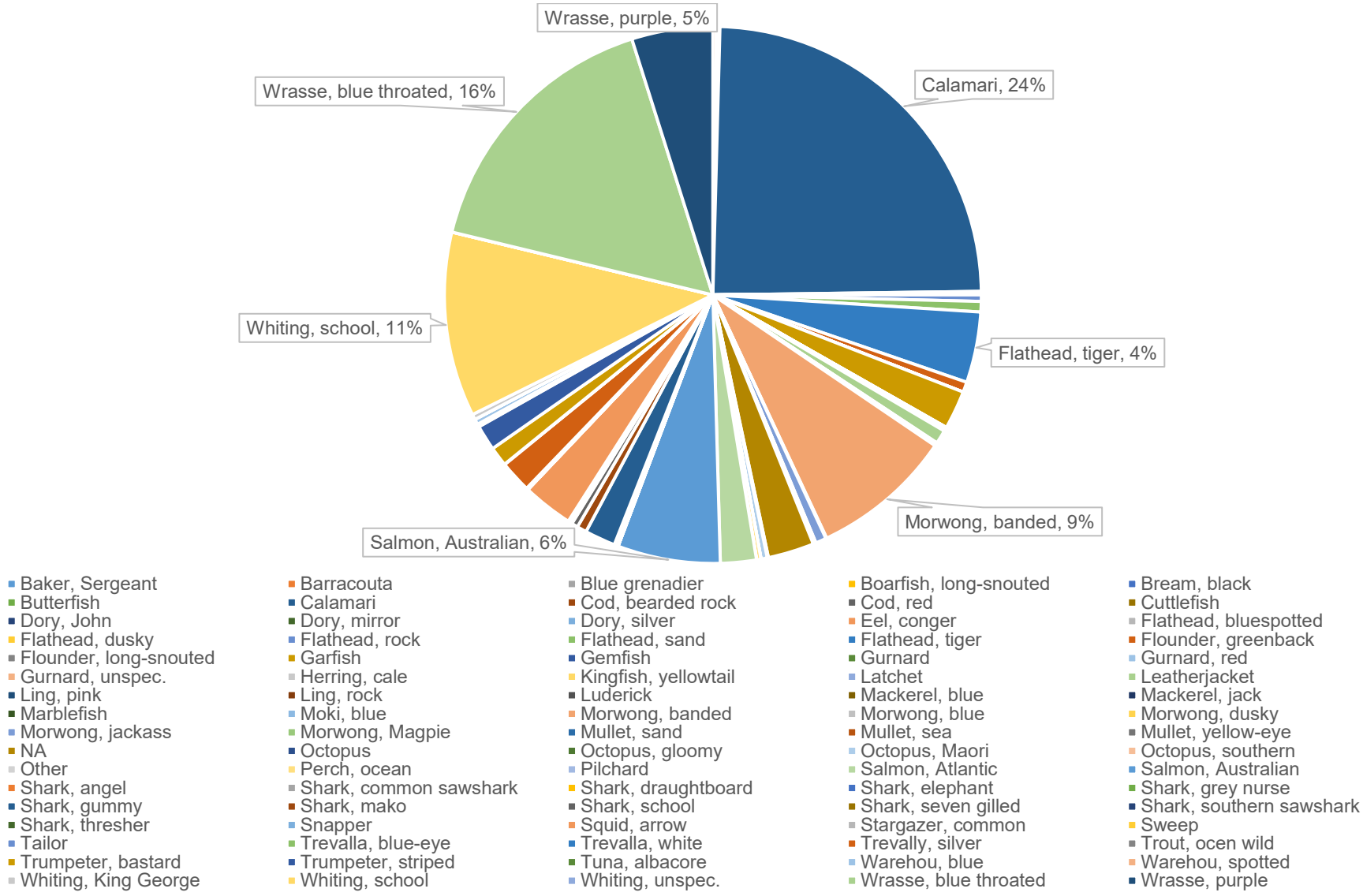


Figure 17. Average annual catch composition by TSF species for 2018/19 and 2019/20 financial years for TSF operators fishing a minimum of 4 weeks per year.

6.4. First sale network characteristics

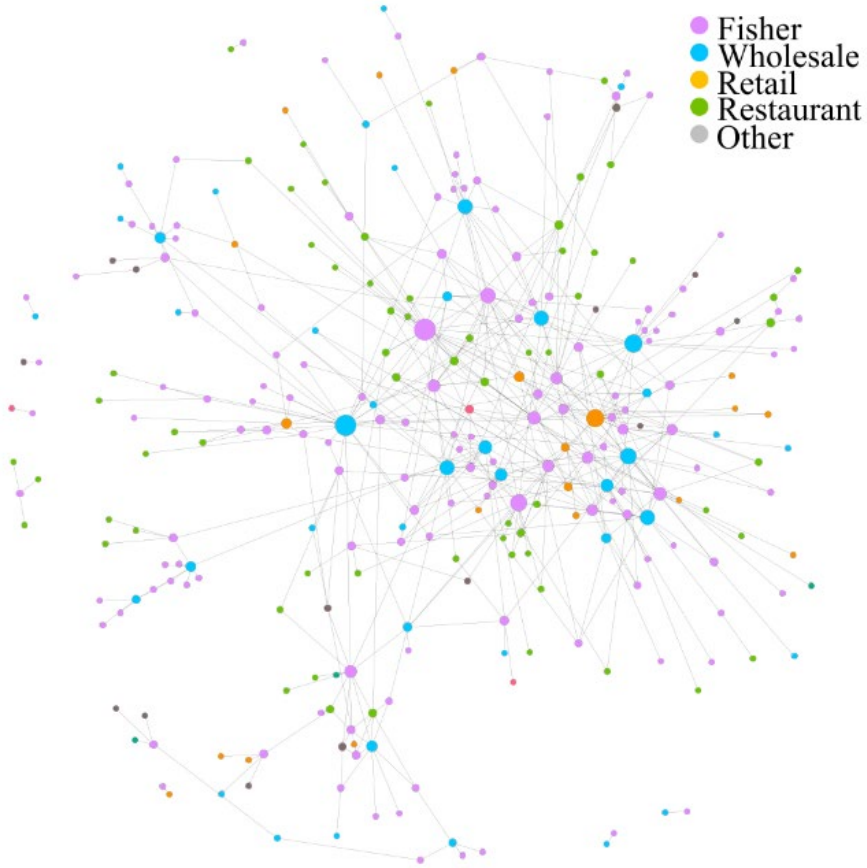
Figure 18 shows the network linkages of TSF fishers and first-sale buyers from January 2018 to December 2020. Each node represents either a fisher (purple) or a buyer (other colours). Buyers are categorised by their class (Figure 18.a) and region (Figure 18.b). The size of the node shows the number of links between fishers and first-sale buyers. Of the 11,134 transactions considered in this analysis, the network identifies 142 unique fishers and 146 unique first-sale buyers. In total, there were 480 unique links between fishers and buyers. These statistics suggest that the first-sale market in TSF is highly diverse and there is no dominant buyer who is connected to the majority of fishers. This is advantageous feature of the current market structure in the sense that there is no buyer who has market power at the sectoral level (i.e., monopsony). The three major classes of buyers are wholesale (60%), restaurant (20%) and retail (14%), accounting for 94% of the total transactions. Likewise, three major regions, South East Coast (SEC) (43%), East Coast (EC) (23%) and Victoria (VIC) (16%), account for over 80% of the total transactions.

Table 13 reports the summary statistics for the number of links each fisher had during the sample period (2018-2020). Over 50% of fishers had only one or two buyers, and around 75% fishers dealt with < 5 buyers. This means that fishers relied on a small, personal network of buyers. This observation is reflected in that the number of fishers (142) is almost identical to the number of buyers (146) who participated in the TSF first-sale market. Given the small number of links most fishers have, it is suggested that the transaction costs of establishing a new sales mechanism is high, making the TSF fishers vulnerable to any shocks that break the current fisher-buyer linkage.

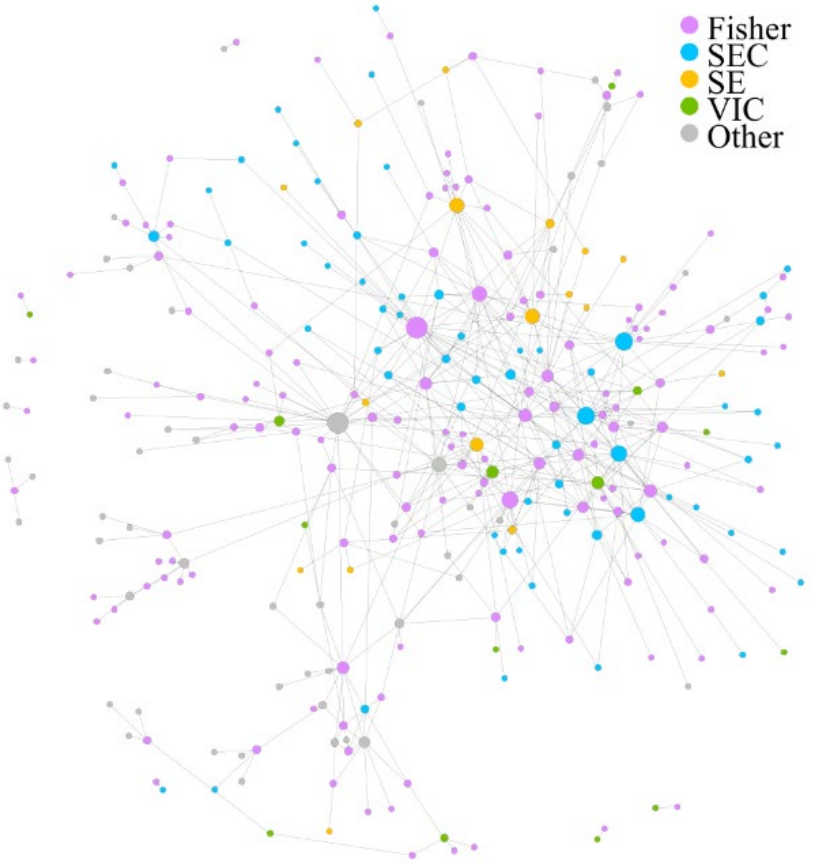
This observation is confirmed by the results of the TSF fisher survey, in which most respondents identified that trust and personal relationships were key factors to maintaining supply chains and access to markets. One respondent stated that they “have a good established relationship with [their] buyer – happy with the way things are”. The primary sources of information fishers used when deciding where to sell catch were Established arrangements (70% of respondents) and Word of mouth from other fishers and those in seafood supply chains (28% of respondents).

Table 13. Summary statistics for the number of buyers per fisher, January 2018 to December 2020

	Mean	Min	25%	50%	75%	Max
Total	3.4	1	1	2	4	26
Wholesale	1.8	0	1	1	2	9
Retail	0.5	0	0	0	1	4
Restaurant	0.9	0	0	0	1	14
South East Coast	1.5	0	0	1	2	19
East Coast	0.5	0	0	0	1	6
Victoria	0.4	0	0	0	1	3



(a) Class



(b) Region

Figure 18. Network of fishers and first-sale buyers in the Tasmanian Scalefish Fishery, January 2018 to December 2020, by buyer class (a) and region (b).

Table 14 summarises the volume (kg) and value (AUD) per transaction during the sample period (2018-2020). The median volume and value of transactions were 25 kg and $272, respectively. However, there is a significant discrepancy between the mean and median values, indicating that a large proportion of fishers had a relatively small volume (< 100 kg) and value (< $1,000) of transactions. As one would expect, the volume and value of transactions with wholesalers were consistently greater than those with retailers or restaurants. Nearly 95% of the large volume transactions (> 1,000 kg) were associated with the sales of four species, namely eastern school whiting, Gould's squid, Tiger Flathead and Australian salmon. In terms of regional differences, SEC was the largest market for TSF products in terms of the number of transactions. However, the average transaction volume and value in Victoria are greater than those in the two major Tasmanian regions (SEC and EC), signifying the importance of the interstate first-sale market for TSF fishers.

Table 14. Volume (a) and value (b) per transaction per fishers, January 2018 to December 2020.

	Mean	Min	25%	50%	75%	Max
(a) Volume per transaction per fisher (kg)						
Total	99	0	9	25	67	51495
Wholesale	138	0.1	10	34	95	51495
Retail	41	0	10	21	43	899
Restaurant	22	0.3	6	12	23	264
South East Coast	62	0	10	23	50	51495
East Coast	36	0.3	5	16	34	4380
Victoria	253	0.1	7	39	120	18800
(b) Value per transaction per fisher (AUD)						
Total	848	1	75	272	804	255858
Wholesale	1145	1	109	427	1152	255858
Retail	423	2	62	188	441	11659
Restaurant	262	2	44	130	279	3424
South East Coast	616	1	78	244	602	255858
East Coast	344	1	41	147	394	21762
Victoria	1743	1	77	519	1427	93679

6.5. Local supply chains

The first-sale buyers identified in the data on transactions (see section 6.4) were further grouped into a more detailed set of classes for the purposes of exploring local sales of TSF products for Tasmanian consumption. This entailed further classification of buyers based on Google.com searches of buyer business name and location to determine whether buyers were:

- Based in Tasmania
- Buyers who on-sold product to other Tasmanian businesses / consumers

This preliminary analysis found that a large proportion of TSF product is sold to Tasmanian-based wholesalers, which can then be sold into local markets (Figure 19). However, these sales are not monitored and therefore the total share of TSF production which contributes to local seafood supply in Tasmanian cannot be quantified.

The quantum of product reported as sold directly to Tasmanian-based restaurants, retailers and direct to local consumers was 73 t in 2018/19, 57 t in 2019/20 and 20 t in 2020/21. The data presented in Figure 19 indicates that reported Tasmanian sales volumes combined represented between 17-24% of reported volumes sold. However, for reasons indicated above, the proportion of TSF product consumed in final local markets is likely to be far higher.

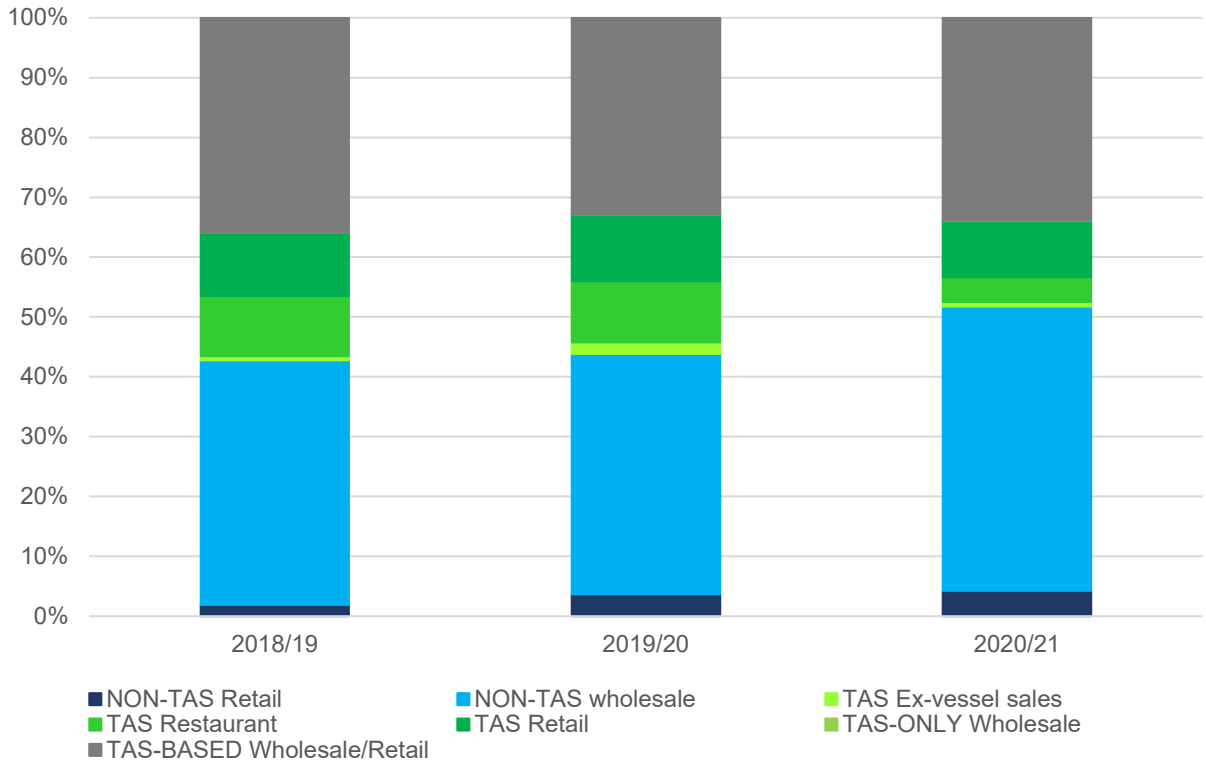


Figure 19. Proportion of total first-buyer sales of TSF product into Tasmanian and non-Tasmanian markets, 2018/19-2020/21 financial years.

6.6. Discussion

TSF operators currently "fish to market" and respond efficiently to the catchability of species, within the constraints of management controls on gear, effort and in some cases catch in place to meet stock sustainability objectives. However, their decisions to go fishing are commonly also influenced by their broader livelihood strategy and objectives, whereby choices to not fish may reflect the opportunity cost given their other non-TSF earning alternatives.

Most TSF operators primarily rely on sales to seafood wholesalers, although direct sales to local restauranteurs, retailers and consumers are financially significant for many operators and the only supply chains for many of the smaller-volume species (see Box 3).

The variety of supply chains for TSF product reflects both the volumes and consistency fishers are able to supply, given variable availability of stocks as well as gear and catch restrictions, and market demand.

Generally, TSF fishing operators have limited market power or opportunity to improve market access or revenues under current conditions (i.e., licencing framework and controls on gear and trip limits; the large number of micro fishing firms pursuing diverse fishing and livelihood

strategies). The extent of TSF operator's ability to change their sales mechanism or buyer to improve prices is limited by a number of factors, namely:

- the low degree of competitiveness of some TSF products (i.e., supply side factors), such as Wrasse outside of live markets;
- the "thinness" of the existing market which is highly individualistic and organised around many micro firms rather than collectives or larger enterprises;
- the predominance of small and medium buyers that are:
    - sensitive to market shocks
    - potentially limited in their capacity (or willingness) to purchase extra quantity of fish (i.e., demand side factors)

TSF fishing operators and wholesalers have a lack of market power over wholesale prices for most TSF species. Prices in wholesale markets for TSF species are directly affected by supply of imported finfish product and farmed Australian finfish (see Box 4.). In wholesale markets more generally, price increases are driven by demographic change and change in demand, not because of TSF marketing strategies or supply. TSF operators and wholesalers are effectively "price takers". This lack of bargaining power is likely to be exacerbated by the "thin" TSF markets (section 6.4) and the smaller size of many TSF fish receivers.

Box 3. Major drivers of small volume local sales

A key finding from the interviews with buyers was that lack of access to TSF seafood (or *placement*) of seafood made consistent purchase difficult. Several factors contribute to lack of reliable access for TSF seafood, including inflexible or costly logistics, especially when costs are applied to small consignments.

Established value chains of small volume local sales which have persisted across time are characterised by high levels of trust and personal relations between TSF operators and buyers. This finding was reflected in the analysis of first buyer networks, which identified the "thin" markets for TSF products which relied on one-to-one fisher-buyer relations (section 6.4). It was reinforced through the interviews with TSF fishers where fishers emphasised the level of trust as a condition of sustainable buyer relations.

Box 4. Major drivers of wholesale market conditions for TSF products

Pascoe et al. (2021) investigated the sensitivity of seafood prices in major Australian markets in Melbourne and Sydney to various changes in demand and supply, and the interconnectedness between different products/sources of supply. Key findings include:

- Changes in the quantity landed of fish species into NSW has little impact on farmed salmon prices, but changes in the quantity of farmed salmon sent to the NSW market has a substantial impact on the price of the wild-caught fish.

- Similarly, quantities of wild caught fish landed has little impact on import prices, but the level of imports – particularly fresh imports – has an impact on the price of low value fish species, and to a much lesser extent high valued fish species.

7. Observed changes in the TSF and their social and economic implications

7.1. Summary of findings

Implications for future viability:

- TSF fleet response to increasing demand for Calamari reveals the extent to which TSF operators both “fish to market” and fish to the limits of constraints applied by licensing and other fishing controls regulating fishing activity for the purposes of stock sustainability.
- The temporary disruptions to fishing activity during the initial state-wide lockdown in Tasmania in early 2020 due to COVID-19 pandemic containment reveal that – overall – TSF fishing operators were able to cease fishing operations but then re-start with limited impact.
- The more extended disruptions to the live fish markets in Melbourne and Sydney across 2020 and 2021 due to COVID-19 lock downs in destination markets reveal the vulnerability of the TSF live fish supply chain. Fishers specialising or dependent on this supply chain were exposed to border and travel restrictions which limited the number of inbound tourists from Asian countries, as well to physical movement restrictions which limited consumers’ movement and the operation of food service (dine-in) restaurants in major interstate cities, both of which significantly reduce demand.
- A further effect of the COVID-19 pandemic and linked trade tensions with China has been the significant dampening of the Chinese market for Southern Rock Lobsters. In 2020 and 2021, TSF Operators who held dual licences in the Tasmanian Rock Lobster fishery were far more active in the TSF than previously. The TSF functioned as a “sink” fishery for these dual-licensed fishers.
- In many cases, TSF fishing operators were able to draw on their multi-faceted livelihood strategies to shift their activity to non-live supply chains or non-fishing activities to ensure livelihood sustainability. 40% of TSF Survey respondents have livelihood strategies which included work in sectors outside of fisheries.
- In the case of TSF fishers who specialise in live fish, shifting their fishing activities has come at a cost given the degree to which their fishing operations, vessels and gear needed to be adjusted to target non-live products.

7.2. Case study 1: Fleet response to increased demand for Calamari

The response of the TSF fleet to increasing demand for Calamari reveals the extent to which TSF operators both “fish to market” and fish to the limits of constraints applied by input controls regulating fishing activity for the purposes of stock sustainability.

Figure 20 illustrates the trend of Calamari production by the TSF to the price of Calamari over the period from 1999 to 2020. The series Calamari Catch (tonnes) in light grey shows the seasonal catch[8] of Calamari in tonnes over this period, and the solid black series Average Calamari Price (whole) shows the average price for whole Calamari as reported in the seasonal logbook records for the fishery (in $ per kg). More variation is seen in seasonal catches over this period than the average beach price, which reflects the variability of fishing conditions and fish availability relative to the market price of fish. Despite this, a general up-trend is apparent in both series.

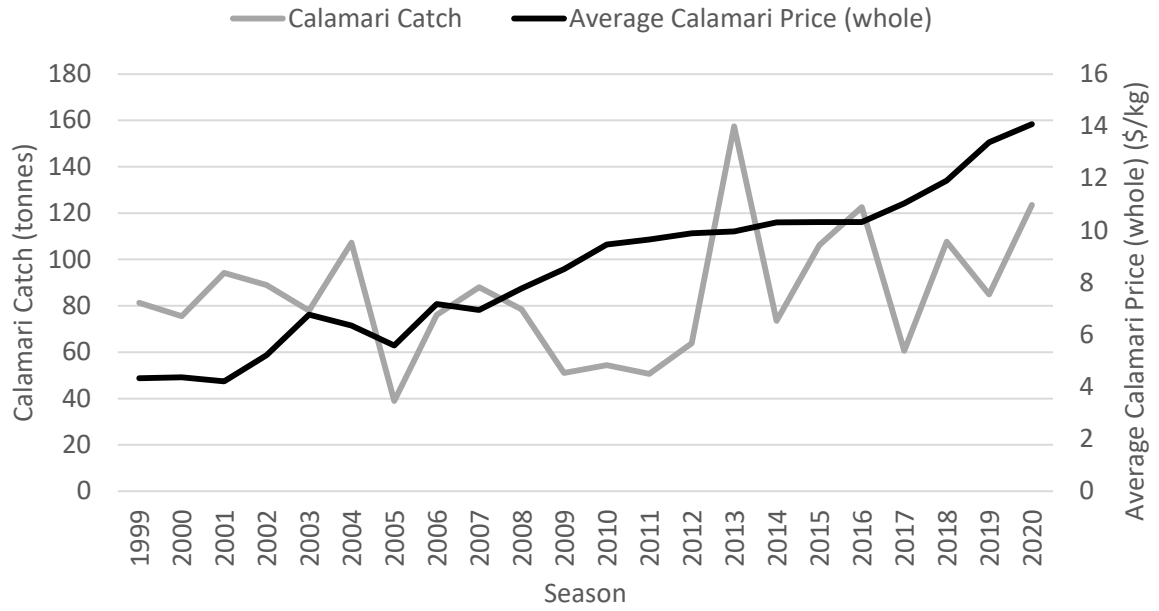


Figure 20. Trend of Calamari production by the TSF to the price of Calamari over the period from 1999 to 2020.

Table 15 shows the correlation between fishing effort (as measured by total days fished) and the average price for whole Calamari in four main regions of the fishery: North-West Coast, North-East Coast, East Coast, and South-East Coast. The table reveals a migration of fishing effort over this period of rising price which has occurred from the East Coast and South-East Coast regions to the North-East Coast and the North-West Coast regions. This coincided with restricted season lengths being imposed in the eastern parts of the fishery, due to biological concerns affecting those areas, and a slight increasing trend in nominal catch per unit effort in the northern parts of the fishery. Overall, the migration from east and south to north has allowed total effort to remain reasonably steady over the period, while fishers have been increasing their overall catch (Figure 20).

[8] The season for Southern Calamari runs from 1 March in each year to the end of February in the following year.

Table 15. Pearson correlation between fishing effort (as measured by total days fished) and the average price for whole Calamari in four main regions of the fishery from 1999 to 2020.

Calamari fishing region	**Pearson correlation between days fished and average beach price for whole Calamari ($/kg) from 1999 to 2020**
North-West Coast	0.75
North-East Coast	-0.39
East Coast	0.88
South-East Coast	-0.83

A linear regression (Figure 21) between the seasonal catch of Calamari and the average beach price over this period shows a strong proportional relationship between catch and price ($R^2=0.8618$). Suggesting a supply response by Calamari fishers that is consistent with micro-economic theory (the rising price of calamari leads to the cost-benefit principle being satisfied at higher reservation prices for fishers as their production increases). Noting that we have not conducted an in-depth econometric analysis in establishing this result.

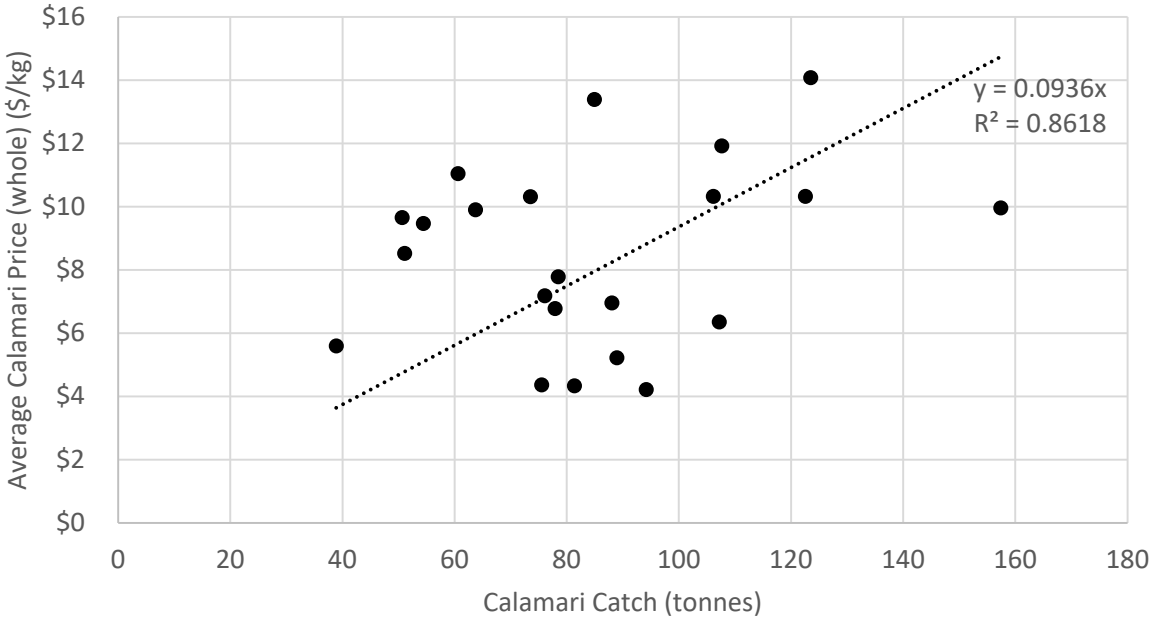


Figure 21. Linear regression between the seasonal catch of Calamari and the average beach price from 1999 to 2020.

7.3. Case study 2: Fleet response to shocks arising from the COVID-19 pandemic

This section presents a timeline of events related the COVID-19 pandemic and impacting on the TSF over the January 2020 to June 2021 period (Table 15). These events are drawn from a diary record over this period that was maintained by the Institute for Marine and Antarctic Studies in relation to the COVID-19 pandemic and published in part in the FRDC-funded report, *Impacts of COVID-19 on the Australian Seafood Industry: January-June 2020* (Ogier et al., 2021). This record relates to publicly available information (ABC news broadcasts, media releases, and online sources such as Thomson Reuters), and represents a daily diary of environmental factors over this period.

The timeline has been prepared on the basis that the major markets and supply nodes for many TSF species were in Melbourne and Sydney during this period. For example, Wrasse and Banded Morwong sold live to a specific market that is concentrated in those two locations, and many mixed scalefish species are aggregated at either Melbourne or Sydney before being traded back into the Tasmanian or interstate markets. Species of Wrasse are caught in Tasmania and freighted live to Melbourne Seafood Centre and Sydney Fish Market, where they are auctioned to restaurants in Melbourne and Sydney's Chinatown districts. Other than this major higher-value channel, only very small local markets exist for fresh Wrasse, generally linked to fish and chips food service outlets or retail.

The focus of the timeline in this section is therefore on changes to physical distancing guidelines, and specific lockdown controls implement in Victoria and New South Wales in response to virus events that occurred in these states over the period. The timeline excludes lockdowns that occurred in South Australia and Brisbane over this period and tracks changes in Tasmanian border controls *only* were those related to Victoria or New South Wales (which together comprised two thirds of the Australian economy prior to COVID-19, and still represented a major market for interstate tourism over our timeframe). Stimulus by the Australian Government is reported where it directly benefitted household incomes and therefore support consumer spending on seafood products (*inter alia*). Grants and fee relief are reported where those directly benefit fishers in the TSF, and world economic events are reported where they directly impacted the Tasmanian fishers.

A major impact for the TSF over this period was the closure, reopening, and then closure again of the demand nodes in Melbourne and Sydney. For example, Live Wrasse and Banded Morwong in the TSF were impacted by physical distancing restrictions that affected the food service sector. International border closures over this period also resulted in a loss of foreign tourists, students and temporary visa holders, which reduced the demand for these live fish. For finfish species generally, there were disruptions from the loss of restaurant markets, but also an increase in competition from other high value seafood that was being pushed onto domestic markets following the loss of international trade. Fishers in Tasmania and Victoria reported the substitution of live Rock Lobster by restaurants and diners as these became available at historically low prices on the domestic market.

The general impact of lockdowns for domestic markets was highlighted by the first six months of the pandemic. Over the January-June 2020 period eating seafood in restaurants declined in Australia and that share of the market was replaced by takeaway food service via online ordering platforms and home cooking. The disruption to tourism due to international and domestic border closures and seafood tourism specifically due to physical distancing requirements also negatively impacted dine-in seafood food service and retail (Ogier et al., 2020).

Table 16. Timeline of major events from Jan 2020-Jun 2021 impacting the TSF arising from the COVID-19 pandemic.

2020

25-Jan: First case of COVID-19 detected in Australia.

07-Mar: World oil price drops as OPEC+ fails to maintain agreement on production, which decreases fuel costs for wild catch fishers.

17-Mar: Tasmanian Government waives annual fees for Tasmanian Scalefish Fishers as part of a $3.7 million relief package for Tasmanian fishers.

19-Mar: State & Territory border closures begin (all non-essential travellers to Tasmania required to quarantine for a period of 14 days).

20-Mar: Australian Government announces closure of international borders, further affecting tourism and resident population for seafood trade.

20-Mar: Australian Taxation Office announces COVID-19 support for business (including ability to vary PAYG instalments).

23-Mar: Australian physical distancing restrictions come into effect (restaurants, hospitality shutdown; takeaway increases).

27-Mar: Tasmanian Government announces a further $1.8 million fee relief package for fishing sector.

28-Mar: Tasmanian Government announces small business hardship grants of up to $5000 for those affected by the pandemic (fisheries eligible).

30-Mar: Australian Government announces A$130billion JobKeeper wage subsidy, which supports demand for consumer spending (including for seafood products) during lockdown.

08-May: Australian physical distancing restrictions ease as national cabinet announces a 'roadmap' to recovery.

16 May: Tasmanian Seafood Industry Council is undertaking Eat More Seafood campaign to support domestic seafood consumption.

12-Jun: National cabinet continues easing of physical distancing.

30-Jun: Victoria imposes local hotspot stay-at-home orders for 10 postcodes; Tas borders remain closed, SA & QLD continue closure with VIC.

14-Jul: NSW tightens restrictions (pubs, clubs, corporate events, and weddings/funerals)

21-Jul: Government announces a tapered removal of the JobKeeper wage subsidy through to March 2021.

23-Jul: Australian Government extends early access superannuation to 31 Dec 2020.

2 Aug: Curfew imposed for Melbourne & Mitchell Shire.

11-Nov: Victorian restrictions largely come to an end, and Tasmania reopens borders to Victoria.

3 Dec: NSW dramatically eases restrictions (caps removed for weddings, funerals and corporate events; standing allowed if outside, and 4sqm rule reduced to 2sqm).

11 Dec: Tasmanian Government continues to ease restrictions, with stand-up drinking and 100 people allowed in homes.

24 Dec: Melbourne food and fish markets are open and trading for Christmas.

26 Dec: Sydney northern beaches district returns to stay at home orders as nine cases are recorded.

2021

2-Jan: New restrictions on gatherings introduced for Sydney, incl. masks to be mandatory in some indoor settings.

10-Jan: NSW northern beaches lockdown ends.

29-Jan: Sydney physical distancing rules ease; restaurants and cafes still subject to density limits.

4-Feb: Melbourne reintroduces restrictions after positive case detected in hotel quarantine.

26-Feb: Melbourne eases restrictions; offices allowed to return at 75% capacity.

11-Mar: Tasmanian Government announces further $663,000 in fee relief for commercial wild catch fishers.

28-Mar: The JobKeeper wage subsidy officially comes to an end.

28-Mar: NSW restrictions generally ease from midnight

12-Apr: Victorian border restrictions downgraded, travellers free to come and go.

27-May: Victoria to enter 7-day lockdown from midnight.

2-Jun: Victoria's lockdown extended for at least another week, with different restrictions for Greater Melbourne and regional areas.

4-Jun: Victorian lockdown ends in regional areas.

10-Jun: Melbourne restrictions begin to ease today and are gradually lifted over the course of the next two weeks.

24-Jun: NSW imposes new physical distancing and travel restrictions as cases linked to the Bondi cluster grows.

7.3.1. Impacts of COVID-19 on first sales of TSF product

We examine the impact of COVID-19 by comparing the number of active fishing operators, number of first-sale transactions, transaction volume, and number of first-sale buyers for each month in 2019 and 2020 (Figure 22). The number of active TSF operators clearly decreased as a consequence of COVID-19. In 2019, there were around 50 operators who consistently participated in TSF, and the number remained unchanged until COVID-19 hits in February 2020. The number of active fishers in each month was also similar in 2018. The number of operators from March to December 2020 was, however, about 10- 50% less than that in 2019.

In response to the decline in the number of active fishing operators, the number of first-sale transactions and transaction volume have dropped by 28% and 35%, respectively. The number of first-sale buyers also dropped by 14% during the same period.

These results indicate the importance of interstate markets for TSF products. Although Tasmania did not experience a prolonged lockdown in 2020 as other states did, TSF has experienced the adverse impact of COVID-19 at the sectoral level throughout the year. The size of the interstate market in Victoria is as large as the market in Tasmania in terms of the total volume and value of first-sale transactions.

The TSF Fisher Survey findings indicate COVID-19 affected both the supply and demand for TSF products, which supports the observed reduction in numbers of active fishers and numbers of transactions. From the supply side, fishers were initially hampered by physical restrictions and lock downs which affected their fishing operations (for example, beach seining operations requiring three people to operate had to cease). Even after the Federal Government declaration of fishers as essential workers (and therefore exempt from physical distancing and movement restrictions) TSF fishers reported other disruptions to fishing activity, such as loosing access to beaches to launch vessels due to closures of National Parks. Other supply-side factors contributing to reduced activity include the lack of flights to Sydney and therefore access to the Sydney Fish Market. Some TSF fishers reported deciding to cease fishing due to the high transaction costs of ensuring COVID-19 safe operations and due to the uncertainty of supply chains and market conditions. Although not reported directly as a factor affecting responses to COVID-19 disruptions, findings of the survey include that 40% of respondents have livelihood strategies which included work in sectors outside of fisheries. Fishers choosing not to fish during this period may have elected to focus on these alternative livelihoods, if not also affected by COVID-19.

Demand-side factors affecting levels of fishing activity included the decision by some processors and major seafood wholesalers and retailers (e.g., Mures) to close for a period. Tasmanian restaurants closed for a period in early 2020, and even when lockdown restrictions were lifted the lack of inbound tourists reduced demand through this market. The effects of lockdowns and lack of inbound international tourists significantly dampened demand for live fish (Wrasse and Banded Morwong) from the dine-in food service markets in Melbourne and Sydney (Ogier et al., 2021). TSF fishers reported being told by their buyers to temporarily simply stop live fishing. The Victorian interstate market for live fish and Calamari did resume at a lower level after the initial lockdown period in 2020.

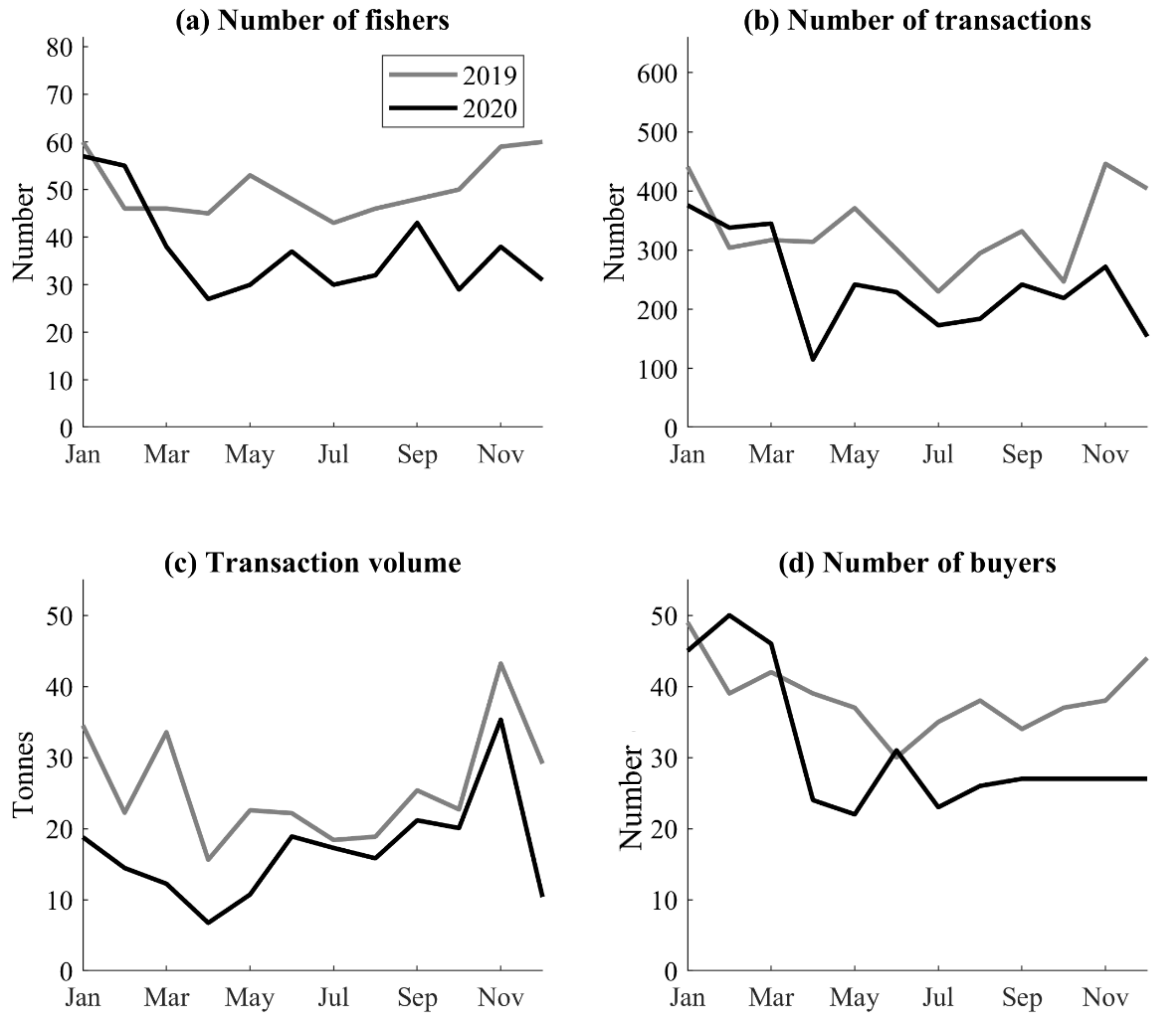


Figure 22. Number of fishers (a), number of transactions (b), volume of transactions (c) and number of buyers (d) per month from January 2019 to December 2020.

Figure 23 shows how the proportions of transactions undertaken by classes and in regions of first-sale buyers changed in each month between 2019 and 2020. The share of transactions of wholesalers was the highest at between 50 and 80%, but the share in 2020 was consistently lower. By contrast, there was no notable difference in the share of retailers and restaurants over the two-year period. The share of transactions by retailers and restaurants remains stable at around 15 to 20%. The retail and restaurant share increased and the wholesale share decreased towards the end of the year – reflecting the upswing in sales in seafood typically experienced at this time of year due to Christmas and end of year festivities and food traditions - and such a trend was confirmed in both years. There was no drastic change in the share of transactions of the three major regions between 2019 and 2020 — the only exception is April 2020 when Tasmania was in lockdown restrictions. In this month, the share of SEC increased to 65% while the share of EC decreased to 3%. By contrast, the share of VIC remained constant in the first two quarters of 2020, but it dropped in the third quarter when Melbourne was the middle of the second lockdown.

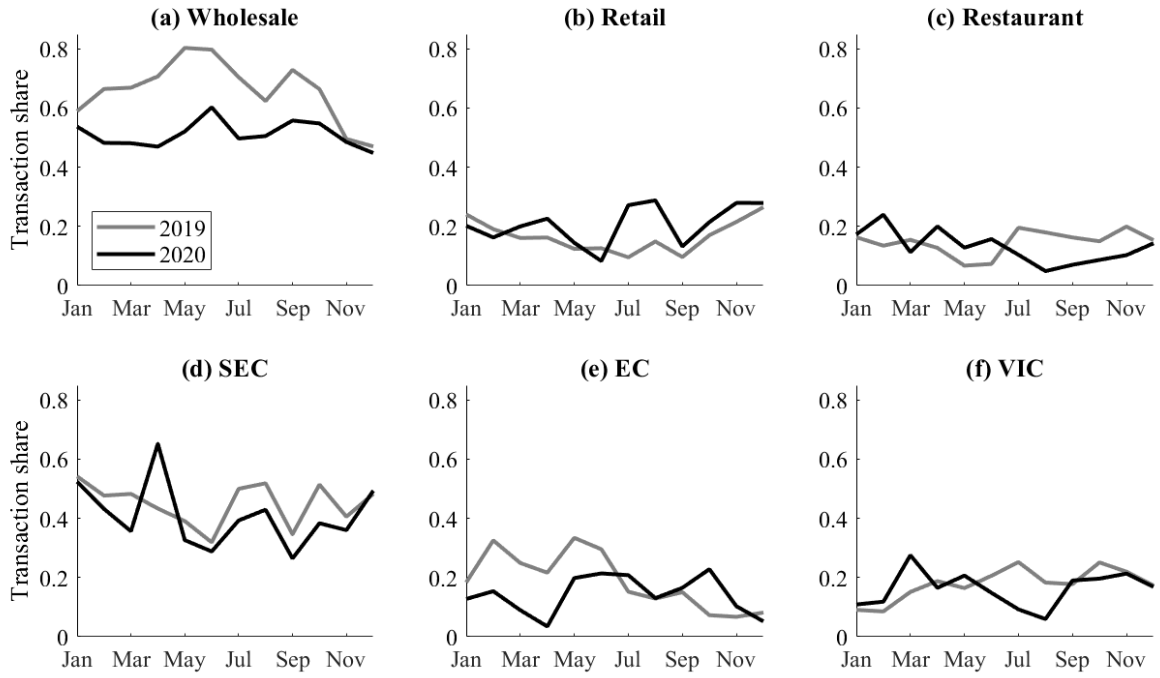


Figure 23. Proportion of transactions by buyers' class (a-c) and region (d-f), January 2019 to December 2020.

7.4. Discussion

The change in demand for Calamari and the COVID-19 pandemic disruptions to the TSF present opportunities to examine how TSF operators can and do respond to changing conditions, given the limits of stock availability and license, gear and species allocations. However, in both cases these analyses were data limited and allow limited conclusions to be drawn.

The fleet's historical response to changes in both demand for and in availability of Calamari due to the introduction of restricted season lengths in the eastern fishing area shows that TSF operators "fish to market" (that is, they increase their targeting of a species in line with price increases). Moreover, the TSF fleet as whole responded to migrate fishing effort to maximise fishing activity within the permitted season and spatial restrictions introduced during this period.

The disruptions to firstly fishing activity more generally, and then to market demand for live fish specifically, triggered by the COVID-19 pandemic, present a different example of change. During the initial lockdown in Tasmania, TSF operators appear to have responded rapidly by limiting fishing activity and resuming at lower levels of fishing when permitted and where there was demand. TSF fishers appear to have drawn on their diverse livelihood options, in many cases, across this period of dampened demand and disrupted supply chains. Those TSF fishers who did resume found alternative, more direct supply chains in many cases to get product to consumers. However, in the case of TSF fishers specialising in live fish supply chains, the financial and transaction costs of these alternative strategies were notable.

These observations strengthen the case for considering reforms to licencing regulations and the need for the development of diversified markets for TSF products, particularly interstate, both of which will help improve the economic and social viability of the TSF.

8. Opportunities and initiatives to improve viability and economic returns

8.1. Summary of findings

Findings about current viability and performance:

- A range of factors contribute to current viability for TSF operators and to current social and economic performance of the TSF at the fishery level, as listed below.

Biological factors	Institutional factors	Market factors	Operator factors
• **Reduced availability of high-value stocks** fished in the TSF limits profitability and financial viability of operators targeting those species (section 4.2, 4.3 and 6.3) • **Changing availability of high-value stocks** fished in the TSF limits capacity for product aggregation to support development of higher value products and markets (section 4.2, 4.3 and 6.2)	• **Extent of input controls** to manage the TSF limits the capacity output (and, potentially, profitability) of operators (section 4.4 and 5.4) • **Extent of latency** in vessel, gear and species licences reduces security of access for current active TSF operators but provides opportunities to new entrants (section 4.3 and 5.4.3)	• **High levels of diversity in the first trade network** limits any one buyer gaining excessive market power but also limits buyer capacity to secure sufficient supply to develop new higher-value product lines (section 6.4) • **'Thinness' of the first trade market** increases transaction costs for operators trying to establish new sales channels (section 6.4) • **Competition** from high-volume and lower-priced imported and farmed seafood product reduces demand and bargaining power of TSF operators and wholesalers (section 6.2).	• **Mixed livelihood strategies**, including those based on non-financial motivations to continue fishing, limits economic efficiency of the TSF at the fishery level (section 4.3, 5.3 and 5.4); • **Limited pre-competitive cooperation** at a sector level (both operators and buyers) limits opportunities to develop higher value markets for species through aggregation (section 5.4 and 6.2) • **High levels of adaptive capacity** of current operators supports financial and social viability (section 7.2 and 7.3).

Implications for future viability and improving economic returns:

- There is a need for a *strategy* that describes how improvement to the viability and economic returns from the TSF could be achieved for the stakeholders (the current operators and the Tasmanian community).

- Such a strategy requires the type of assessment of the TSF and identification of contributing factors provided by this project. However, further work is required to support such a strategy and would include quantitative assessment and evaluation of the various initiatives in terms of timeframes, resources, risks, benefits, responsibilities, ongoing monitoring needs, etc.
- As a first step, a range of initiatives were identified through this project to improve viability and economic returns from the TSF. A first-pass qualitative assessment of a selection of potential initiatives was undertaken, in partnership with industry and government stakeholders.
- Specific opportunities which were identified by industry representatives as both feasible and likely to generate positive impacts include:
    - Investment in shared infrastructure and technologies for low-cost value-adding, packaging and alternate product formats for low-moderate volume TSF products
    - Increase collaborative producer aggregation and wholesale of TSF products
    - Brand development for specific TSF products to target local retail and restaurant markets
    - Review the effectiveness and efficiency of regulations (including licensing) in achieving stock sustainability to identify opportunities to reduce regulatory burden on existing active TSF fishers.

8.2. Increase security of access

There is no formal resource sharing policy in place for the TSF which accounts for inter-sectoral allocation (i.e., shares of the catchable fish stocks to Tasmanian Aboriginal, recreational and the commercial fishing sectors). The commercial sector of the TSF is managed as a limited entry fishery and all licences are allocated. However, approximately 50% of TSF licences have not been recently activated (i.e., are latent) and could – in theory – be readily reactivated and at low cost, indicating entry is not strongly limited and new entrants do not face substantial barriers. Not all TSF licenses are transferable.

Broadly, increased security of access for active fishing rights holders is assumed to be linked to increased access to financial capital (therefore, improved financial and livelihood outcomes for those rights holders) and willingness to re-invest in that resource-dependent activity. In terms of wider community benefit, if this re-investment occurs locally it may lead to expansion in fishing capital (e.g., boat building) and post-harvest processing economic activities, and therefore to increased economic contributions to the Tasmanian economy through flow-on effects.

8.2.1. Potential initiatives

Initiative:	Source:	Rationale:
Develop resource sharing policy which recognises social and economic benefits of the TSF to the Tasmanian community and economy, and which allows for more direct management of recreational fishing pressure on stocks targeted by TSF fishers.	Project Steering Committee (SFAC – industry members) TSF Fisher Survey responses TSIC	Applies to fishers who target species also targeted by recreational fishers (e.g., flathead). Increasing this group of fishers' security of access: • Increases their livelihood security; • Reduces their risk from investment in TSF harvesting and processing capacity • Indirectly, increased re-investment in the TSF may be lead to increased economic activity and therefore economic contributions to the Tasmanian economy.
Review intra-sectoral allocation policy which provides Fishing Licence (Rock Lobster) (FLRL) holders access to the TSF	Project Steering Committee (SFAC – industry members)* TSF Fisher Survey responses* *Not all members/respondents	As above - applies to fishers who target species also targeted by FLRL fishers. It also potentially limits the expansion of fishing pressure (effort) where the beach price and quantities demanded for a species rises (also requires that limited entry to the fishery is maintained and latent capacity reduced).
Convert TSF Endorsements to transferable licences	Project Steering Committee (SFAC – industry members) TSIC	As above – applies only to Endorsement Holders
Reduce extent of latency in TSF FLA and FLB licence holdings by requiring evidence of recent catch history linked to licence (i.e., within last 5 years) in order to renew.	Project Steering Committee (SFAC – industry members) TSF Fisher Survey responses TSIC	As above – applies to all active TSF fishers. In addition, TSF fishers report the low barriers to entry of new entrants increases the risk of their private investment in developing any niche markets or supply chains for TSF species. As information about developing markets emerges, the additional effort this attracts drives down any price gains the "first mover" fisher would have received to offset their initial investment.
Develop policy for prioritising **active TSF fishers who are dependent on the TSF** when granting limited access to TSF species (i.e., when defining eligible catch history and setting thresholds)	Project Steering Committee (SFAC – industry members)* TSF Fisher Survey responses* *Not all members/respondents	As above - applies to active TSF fishers who specialise in targeting species in question.

8.2.2. Impact and feasibility

No quantitative assessment of impacts or feasibility of the proposed initiatives was undertaken. The assessment below is qualitative (i.e., draws on stakeholder judgement and interpretation of study results) and preliminary (Table 16).

The potential benefits arising from **increased security of access of existing active commercial TSF fishers** include those stemming from investment in processing capacity, such as building and construction trades, and consumption spending by on-going employees.

For TSF species experiencing positive market conditions, limiting the pace of expansion in fishing effort (to that extent that this is achieved) might also qualify as a benefit. However, this would create a loss for businesses and employees servicing those extra vessels.

Potential costs are to new entrants (whose entry barriers would increase) and less active TSF participants (who would have reduced access).

Whether it is a net benefit overall (i.e., to the Tasmanian community) really relies on the investment backing up the 'secure' access right, and the policy recommendation would need to include a government package to support an investment project that requires the recipient to implement that investment and deliver measurable economic contributions to the Tasmanian economy (some of which might result in clawing-back).

The assumption of a significant increase in levels of reinvestment is not clearly supported by evidence in all cases. Examples, such as Tasmania's Rock Lobster and South Australia's Abalone fisheries, highlight the persistence of low levels of reported re-investment, despite the secure access afforded by strong fishing rights in the form of individual transferable quotas (see Rust et al. 2021, BDO EconSearch 2022a).

Table 17. Impact and feasibility of proposed initiatives to increase security of access

Initiative	Industry workshop assessment	NRE Tas assessment	Study assessment
Develop **resource sharing policy** which recognises social and economic benefits of the TSF to the Tasmanian community and economy, and which allows for more direct management of recreational fishing pressure on stocks targeted by TSF fishers.	Impact: Very positive Feasibility: Somewhat feasible Identified barriers include: • Political will needed • Strength of recreational fishing groups and their influence	This is a matter of fisheries management policy. Pursuing this strategy would involve a trade-off between social and economic gains by commercial TSF operators (by increasing their security of access) and social losses to recreational fishers from decreased access. Lack of appropriate NRE Tas resources.	No specific assessment was undertaken. Qualitative information available from the TSF Fisher Survey includes that: • TSF fishers reported increased levels of interaction with recreational fishers in all regions • TSF fishers reported concern for the sustainability of stocks predominantly targeted by recreational fishers (e.g., flatheads), and for commercially valuable stocks where recreational take is increasing but less monitored. They reported concern that the next 5 years will be a period when they will lose access to fishing areas and stocks which will be allocated to the recreational fishing sector.
Review **intra-sectoral allocation policy** which provides FLRL holders access to the TSF	Impact: Somewhat positive Feasibility: Somewhat feasible Identified barriers include: • Political will needed • Strength of rock lobster fishing interests	This access is granted under the Offshore Constitutional Settlement Agreement (OCS) between the Commonwealth and Tasmania and was facilitated through the Scalefish Rules. Under current direction from the LMRMA, the TSF is managed to support diversified fishing operations across multiple fisheries. FRL holders are considered as rights holders in the TSF with the same access. The Tasmanian Government is not in a position to fund any adjustment packages	No specific assessment was undertaken. More analysis is required to understand which TSF species are targeted by FRL holders and the extent of the anticipated change in catch composition for existing active commercial TSF operators if FRL holders no longer had access. This would allow the potential economic costs and benefits to different sectors to be assessed.

Initiative	Industry workshop assessment	NRE Tas assessment	Study assessment
		currently to compensate for losses to FRL holders. Lack of appropriate NRE Tas resources.	
Convert TSF Endorsements to transferable licences for **active TSF operators currently fishing their entitlements**	This is a matter NRE Tas is reviewing.		
Reduce extent of latency in TSF FLA and FLB licence holdings by requiring evidence of recent catch history linked to licence (i.e., within last 5 years) in order to renew.	Impact: Very positive Feasibility: Somewhat feasible Identified barriers include: • Political will needed • Strength of existing licence holders (including those acting as investors) interests and influence	This a matter of fisheries management policy. A number of licence types are non-renewable (FLCs). Reasons for latency can be various, and the availability of licences creates opportunities for new entrants and for changes in fishing operations at relatively low financial and transaction cost. Under current interpretation of the LMRMA, the TSF is managed to support diversified fishing operations. Licences which are latent may function to support these diversified strategies. The Tasmanian Government is not in a position to fund any adjustment packages currently. Potentially, a 'show cause' requirement could be used to prevent renewal of licences without vessels attached them. However, given the general policy with regard to fishery access, NRE Tas would have difficulty arguing that a range of causes were not consistent with	Levels of latency in licence holdings and activation are high: 43% and 46% for FLAs, 52% and 53% for FLBs, and 84% and 80% for FLCs in 2018 and 2019, respectively (see section 4.1). More analysis is needed to determine causes of latency in licence holdings, including analysis of conditions in the TSF licence market. The case study of the changes in demand, effort and catch of Calamari (section 7.2) illustrates that TSF fishers are highly responsive to price improvements and other market signals.

Initiative	Industry workshop assessment	NRE Tas assessment	Study assessment
		management of the TSF in such a way as to support diversified fishing operations.	
Develop policy for prioritising **active TSF fishers** who are dependent on the TSF when granting limited access to TSF species (i.e., when deeming what level of catch history is eligible when granting limited access to a species)	Impact: Very positive Feasibility: Somewhat feasible Identified barriers include: • Political will needed • Strength of interests and influence by new entrants/less active TSF fishers	This a matter of fisheries management policy. Current application of the LMRMA requires recognition of previous participation and catch history as the basis of allocation when limiting access to a species or gear type. Lack of appropriate NRE Tas resources.	The TSF fleet comprises a group of approximately 50 operators who are active and largely dependent on the TSF for their livelihood (see sections 4.3 and 4.4). Their fishing characteristics indicates they are pursuing efficient fishing strategies within the limits of the licensing framework and species catchability. The remaining ~40% of the recently active TSF operators are part-time in their level of participation and low in their contribution to catch. This group appears to be pursuing a range of livelihood strategies not consistent with maximising fishing efficiency in the TSF, but possibly consistent with other implicit social objectives for the TSF.

8.3. Increase flexibility of fishing operations

The TSF regulatory framework for commercial fishing is highly complex and uses multiple types of input and output (i.e., harvest) controls.

Having more flexibility in fishing operations may help to increase the efficiency of some TSF fishers, and therefore reduce their operating costs and increase their opportunity to generate higher economic returns. Greater flexibility and reduced associated costs may also support TSF fishers in maintaining their businesses and livelihoods through periods of disruption (e.g., the loss of the live fish markets due to COVID-19 pandemic containment measures). It would also allow fishers to be more responsive to weather conditions and demand, for example, allowing them to switch fishing modes which better match conditions as required.

The primary benefit being pursued through initiatives to increase flexibility of fishing operations (section 8.3.1, below) is to improve economic and social returns from the TSF **for specific groups of existing active commercial TSF fishers**.

In terms of wider community benefit, increased flexibility of fishing operations and reduced operating cost may result in removing barriers to greater levels of utilisation of some under-utilised TSF species, which may generate additional economic activity and therefore economy contribution through flow on effects.

8.3.1. Potential initiatives

Initiative:	Source:	Rationale:
Review the effectiveness and efficiency of regulations (including licensing) in achieving stock sustainability to identify opportunities to reduce regulatory burden on **existing active TSF fishers**. Specific examples include: • Rule which restricts use of limited lengths of small mesh net for targeting Australian salmon, mullet and mackerel on the East Coast • Rule which limits FLA and FLB holders to two fish traps	Project Steering Committee (SFAC – industry members) TSF Fisher Survey responses TSIC	In some cases, regulations which prevent use of certain types of gear to target specific species in specific fishing areas could be removed where biological stock sustainability is satisfactory. Regulatory burden introduces costs and limits the operational flexibility and therefore the economic efficiency of existing active TSF fishers. Given the effort and catch characteristics of the TSF commercial sector has changed considerably across the last decade, review of some controls may be warranted. The ecological risk posed by some TSF practices which are highly regulated may no longer warrant such high level of regulation.
Review regulations which make **existing active TSF fishers** less efficient and inflexible and for which the sustainability objective could be achieved by limiting access and effort (i.e., fleet contraction) instead.	Project Steering Committee (SFAC – industry members)* TSF Fisher Survey responses* *Not all members/respondents	The use of some regulations, such as trip limits, are in place because of the threat of overfishing due to the high numbers of licences which permit access to these species (including latent licences). By limiting access to the TSF further (see strategies in 8.2), a number of these controls may no loner be required and could be removed. This is likely to allow increased flexibility for existing active TSF fishers.

Initiative:	Source:	Rationale:
Allow a fishing licence (vessel) to have up to two vessels named for **TSF fishers operating multiple modes of fishing**	Affected TSF fishers via SFAC	Certain licence packages allow for multiple modes of fishing (e.g., 'live' vs. 'dead'). Fishing modes like live Wrasse, or Banded Morwong, are done using specially fitted boats, whereas other fishing uses a more 'general' scale fish vessel. For fishers operating two different fishing modes currently, if they want to run two vessels set up for different modes of fishing they have to either: • Buy a completely separate FLV and licence package; or • Transfer the vessel off the licence and replace it with the other, at a cost of around $440 plus the time required to complete and submit paperwork.

8.3.2. Impact and feasibility

No quantitative assessment of impacts or of feasibility of the proposed initiatives was undertaken. The assessment below is qualitative (i.e., draws on stakeholder judgement and interpretation of study results), or based on economic modelling, and preliminary (Table 17).

Potential impacts include benefits to **existing active TSF fishers** due to reduced constraints on fishing operations and potentially reduced operational costs of fishing. These impacts, in turn, would improve the financial and livelihood conditions for those fishers.

Impacts may also include biological costs arising increased fishing effort should that effort be directed towards fish stocks under high fishing pressure. This could lead to reduced catchability of those species. This cost would not arise however, if changes to regulations can be identified which reduce regulatory burden but do not trigger an increase in fishing pressure on at-risk fish stocks. Another cost may be to those fishers who lose or have their access to the TSF restricted in order to provide more operational flexibility to existing active TSF fishers.

The administrative cost of reviewing and assessing the effectiveness and ecological risks addressed by fishing regulations is a barrier to the feasibility of these strategies being implemented.

Table 18. Impact and feasibility of proposed initiatives to increase flexibility of fishing operations

Initiative	Industry workshop assessment	NRE Tas assessment	Study assessment
Review the effectiveness and efficiency of regulations (including licensing) in achieving stock sustainability to identify opportunities to reduce regulatory burden on **existing active TSF fishers.** Specific examples include: • Rule which restricts use of limited lengths of small mesh net for targeting Australian salmon, mullet and mackerel on the East Coast • Rule which limits FLA and FLB holders to two fish traps	Impact: Very positive Feasibility: Somewhat feasible Identified barriers include: • Political will needed to make this strategy a priority and make NRE Tas resources available to review and assess • Perception held by some groups that TSF commercial fishers don't care about sustainability	The primary management objective of the TSF is to ensure sustainability of fish stocks. Gear restrictions are in place to enable this objective to be met. Any relaxing or removal of regulations to limit fishing effort would need to be assessed to check whether pressure on at-risk fish species and stocks would increase as a result. NRE Tas has very limited resources to undertake such assessments. The trade-off with any potential relaxation or removal of regulation is likely to involve the requirement for more real-time, fine-scale monitoring of catch and effort (e.g., through vessel requirements for VMS) to ensure the sustainability objective is met.	No specific assessment was undertaken of overall effectiveness and efficiency of the TSF regulatory framework. However, qualitative information available from the TSF Fisher Survey (section 5.2) includes that: • Many TSF fishers consider the regulatory framework to be 'blunt' and in some cases not working to protect fish stocks • Rules are in force which could be modified to make certain types of fishing activity more flexible while still meeting the sustainability objective • Changing regulations is a slow process and doesn't demonstrate adaptive management Analysis of fishing efficiency (section 4.3) highlights that ~60% of fishers are fishing as efficiently as they can, given the limits of their vessel and fishing gear technologies, the licensing and regulatory framework, and the catchability of stock. Therefore, any increased flexibility created through changes to the licensing and regulatory framework is likely to increase the efficiency of these fishers, and potentially fishing effort in some cases. More detailed analysis would be required to anticipate where these increases would occur.

Initiative	Industry workshop assessment	NRE Tas assessment	Study assessment
Review regulations which make **existing active TSF fishers** less efficient and inflexible and for which the sustainability objective could be achieved by limiting access and effort (i.e., fleet contraction) instead.	This strategy was not assessed at the Industry Workshop or by the Project Steering Group.	In addition to the above, this a matter of fisheries management policy. Under current direction from the LMRMA, the TSF is managed to support diversified fishing operations across multiple fisheries. All FLA, B and C holders as well as FRL holders are considered as rights holders in the TSF with the same access. NRE Tas has indicated that the Tasmanian Government is not in a position to fund any adjustment packages currently.	No specific assessment was undertaken of the extent to which access and effort would need to be limited in order to permit greater operational flexibility for remaining TSF fishers. However, as stated above, increased operational flexibility is likely to increase the fishing efficiency of the remaining TSF fleet (section 4.3).
Allow a fishing licence (vessel) or FLV to have up to two vessels named for **TSF fishers operating multiple modes of fishing**	This strategy was not assessed at the Industry Workshop or by the Project Steering Group.	The primary management objective of the TSF is to ensure sustainability of fish stocks. Any relaxing or removal of regulations to limit fishing effort would need to be assessed to check whether pressure on at-risk fish species and stocks would increase as a result.	No specific assessment was undertaken of this proposed strategy. Because the proposed strategy would reduce costs for the fishers in question, it is assumed it would lead to increased fishing effort by those operators. However, this increased effort would be limited by their licence packages. A more general assessment was undertaken of the anticipated impact of an additional day of effort in the TSF in the event that greater flexibility in fishing operations was permitted. The analysis assumed the average pattern of fishing in the TSF was continued (see below).

8.3.3. Marginal change in catch with additional day of effort

Making fishing operations more flexible may make it economic to fish more (increase effort) and target certain species and thus increase the potential effort in the fishery. This additional catch, and targeting of catch, represents an increase in economic return to some operators, and potentially a biological cost if the increased catch of species targeted by the additional effort exceeds sustainable catch limits.

For the purposes of this preliminary analysis, we modelled the change in catch from one additional day of effort, which we assumed followed the average pattern of effort observed for the fishery. Catch per day was calculated from the catch per hours spent (logbook data) for a standardised 7.5-hour day (based on the full-time definition of 37.5 hours per week).

Using this scenario, the change in catch for each additional day of effort in the TSF (as measure referred to as the 'marginal output by weight') was estimated. Notable increases in marginal output by weight were for the following species:

- Leatherjacket,
- Bastard Trumpeter,
- Wrasses,
- Calamari.

For other major species included in the analysis, the marginal output by weight was extremely low or negligible.

The value of this additional catch in total (approximately $619.27), less the cost of a fishing day (approximately $210.14), represents an estimate of the increase in economic return to the fishery ($409.13) for each additional day of effort that is made possible through increased flexibility.

The limitations of this analysis include that the marginal output by weight arising from one additional day of fishing effort is also dictated by licence caps, gear restrictions and species limits that apply in the fishery. Therefore, depending on the exact nature of the flexibility that is introduced, and hence whom this applies to within the fishery, the marginal output by weight may be different. For example, additional catches of Banded morwong are unlikely in the TAC area, unless the quota is under-caught. Similarly, additional catches of species with trip limits are unlikely (e.g., Bastard Trumpeter).

8.4. Supply chain enhancement

The opportunity available through initiatives to enhance TSF supply chains is for increased economic returns for **existing active TSF fishers** through improved efficiency, reduced supply chains costs and/or improved first sales prices, and less vulnerable supply chains. A further opportunity may be generated through achieving efficiencies in supply chains which enable greater utilisation of under-utilised TSF product.

Globally, the profitability of small-scale fisheries is heavily influenced by the value chain - most meaningful improvements come from supply side changes.

As the TSF has multiple supply chains for different seafood products, potential strategies apply to specific types of supply chains based on volume and consistency of supply.

8.4.1. Potential initiatives

Initiative:	Source:	Rationale:
Combine freezing, defrosting, storage and export strategies for **high volume, consistent supply TSF product lines**	Supply chain analysis	This strategy is aimed at deploying freezing (e.g., IQF) and storing technologies to allow high volumes of TSF product to be processed and available as long-shelf life, higher-value or value-added product lines to larger wholesale and retail markets interstate and potentially overseas. It also aims to increase supply chain diversification to reduce risk in the event of market or supply chain disruptions. As well, increased availability of this technology could remove a disincentive to catch higher volumes of under-utilised species. TSF species this strategy could apply to include Australian salmon, Calamari, Wrasses.
Shorten supply chains for **low volume TSF product lines**	TSF Seafood Post-Harvest Operators Survey Supply chain analysis Project Steering Committee (SFAC – industry members)* *Not all member	This strategy is aimed at achieving increased first sale prices for TSF fishers catching and selling small volumes of species not consistently available. By increasing the level of sales direct to consumers or final markets (e.g., local restaurants, retailers), the wholesaler and transporter share of the first sale price is removed and some retained by the fisher. Examples of species include Striped Trumpeter, Flathead, Tunas, Gummy.
Increase levels of collaborative freight for **high volume inconsistent (i.e., opportunistic) TSF product lines**	TSF Seafood Post-Harvest Operators Survey Supply chain analysis	This strategy recognises that establishing and maintaining supply chains to higher-value interstate markets for species which are caught opportunistically or sporadically (due to availability) is costly and prohibitive. Leveraging the urchin and calamari shipments might also provide cost effective freight options. By increasing the level of collaborative agreements between TSF fishers or first receivers (i.e., wholesalers) for freight to markets such as Sydney Fish Market, cost efficiencies can be achieved through coordinating supply. Examples of species include Goulds squid, Garfish.
Invest in shared infrastructure to support collaborative aggregation and wholesale for **low-to-moderate volume TSF product lines**	TSF Seafood Post-Harvest Operators Survey Supply chain analysis Project Steering Committee (SFAC – industry members)* *Not all members	This strategy is aimed at ensuring availability of necessary cold chain transport, post-harvest processing and storing infrastructure is available to handle high volume catches of species which are caught opportunistically or sporadically (due to availability). As well, the infrastructure could support collaborative aggregation and storage of TSF product to be on sold to local Tasmanian retail markets, ensuring more consistent supply. Further, increased availability of this infrastructure could remove a disincentive to catch higher volumes of under-utilised species. Examples of species include Leatherjacket, Mullet, Jackass Morwong, Australian salmon, Sardine, Snook.

8.4.2. Impact and feasibility

No quantitative assessment of impacts or of feasibility of the proposed initiatives was undertaken. The assessment below is qualitative (i.e., draws on stakeholder judgement and interpretation of study results) and preliminary (Table 18).

The proposed initiatives are aimed at positively impacting financial viability and ultimately economic returns of **existing active TSF fishers** through improving supply chain resilience, efficiency, and availability to support product development (see 8.5, below). Indirectly, they may lead to increased availability of TSF seafood products for local consumers and food service sectors. Although, as the results of this study highlight, approximately a third of transactions (first sales) of TSF product is to local consumers and markets already, and no quantitative assessment of the extent for further local demand for existing TSF products is available.

Potential negative impacts (costs) of pursuing these initiatives include lost business for the Tasmanian seafood transport and wholesaling sectors where TSF fishers shorten supply chains and sell direct to consumers or final markets, cutting out these intermediate sectors. Capital expenditure in new technologies and infrastructure is another cost and feasibility consideration also. The extent to which public funding would be available to support initial investment is likely to be linked to the extent of any anticipated flow-on effects to the Tasmanian economy through additional economic activity in linked sectors.

A further feasibility consideration is that of capacity for pre-competitive collaboration between TSF operators. Collaborative arrangements for shared freight, for example, are already in place between some operators. However, the levels of collaboration proposed have not been tested in the TSF context to date.

Industry members identified a current lack of skills of many TSF operators to establish and operate the proposed business development models. Capacity building as well as seed funding were identified as necessary enabling conditions to make proposed initiatives feasible.

Table 19. Impact and feasibility of proposed initiatives to enhance supply chains

Initiative	Industry workshop assessment	Study assessment
Combine freezing, defrosting, storage and export strategies for **high volume, consistent supply TSF product lines**	This strategy was not assessed at the Industry Workshop or by the Project Steering Group. Comments provided by SFAC Industry members highlighted that: • This strategy is already being applied to specific TSF species (e.g., Calamari). • Further investment in freezing and storage facilities requires capital investment. Therefore, the proposed strategy is relevant to larger sized seafood companies	No specific assessment was undertaken of this proposed strategy. Recent findings from analyses of seafood supply chain and market disruption due to COVID-19 (Ogier at al. 2021) include that seafood businesses who thrived were those who were able to diversify their supply chains to increase their inventory of product as well as develop alternative product formats which were less perishable.
Shorten supply chains for **low volume TSF product lines**	This strategy was not assessed at the Industry Workshop or by the Project Steering Group. Comments provided by SFAC Industry members highlighted that this strategy is already successfully pursued by multiple TSF fishers. However, it is again only suited to specific low volume specialist TSF species which can be matched to the Tasmanian consumer and food service sector (see below).	The study determined that short supply chains in the form of direct sales to consumers and to local restaurants and retailers currently exist (section 6.5). The capacity for individual TSF fishers to increase the volumes sold through these channels may therefore be limited. The quantum of product reported as sold directly to Tasmanian-based restaurants, retailers and direct to local consumers was 73 t in 2018/19, 57 t in 2019/20 and 20 t in 2020/21. The TSF Survey results identified that TSF fishers who sold product via these short supply chains did so because demand matched supply and there were price gains in some cases (section 6.2). Analysis of first sale records found that 34% of first sales by TSF fishers across the period 2018-2021 were to local retail and restaurants, although the mean volume of product sold per transaction was significantly lower than sales to wholesalers (section 6.4).

Initiative	Industry workshop assessment	Study assessment
Increase levels of collaborative freight for **high volume inconsistent (i.e., opportunistic) TSF product lines**	Impact: Somewhat positive / No impact Feasibility: Somewhat feasible Identified barriers include: • Already occurring and limited opportunity to increase levels • High cost of air freight to access Sydney Fish Market • May only be suitable for very limited number of Tasmanian seafood products for which there is demand from Sydney markets, e.g., garfish	No specific assessment was undertaken of this proposed strategy. Demand analysis of SFM (referred to in section 6.6) highlights that this strategy is relevant for species where there is demand from Sydney markets. It is more likely to be feasible if these arrangements leverage off existing freight arrangements for Calamari and urchins.
Invest in shared infrastructure to support collaborative aggregation and wholesale for **low-to-moderate volume TSF product lines**	Impact: Very positive Feasibility: Very / Somewhat feasible Identified barriers include: • Requires high level of cooperation between TSF fishers • Small groups of TSF fishers already doing this to some extent • Needs to be effective at generating consistent supply and pricing mechanism to be successful • Needs supporting product and marketing strategy	No specific assessment was undertaken of this proposed strategy. All fish receivers interviewed identified the issue of inconsistent supply as a major barrier to establishing stronger local retail markets for TSF product in Tasmania. At the same time, they noted the importance of targeted product and market development to minimise competition with farmed salmon and other low cost ready-to-eat seafood products already on market (see below). Successful models of collaborative producer aggregation to supply local markets include cooperatives. Examples include: 1. **<u>FairFish: South Australia's Community Supported Fishery</u>** Fair Fish (SA) Co-Operative Limited is a Community Supported Fishery ('CSF'); a grass roots, alternative business model for local fishermen to sell their seafood. They allow direct sales to local consumers and provide a facility that encourages community engagement and food traceability. The original model allowed consumers to purchase a share of the day's catch directly from local fishermen through an online platform. Due to COVID-19, our business model has had to evolve to adapt to our new way of living.

Initiative	Industry workshop assessment	Study assessment
		The business model we now have now is virtual shop front via the Fair Fish website. The website is updated daily with the available catch, you can then select your fish species, pay for it online and it will be delivered straight to your home. Simple as that! Fresh South Australian fish direct from our local fishers. The establishment of Fair Fish (SA) was informed by an FRDC-funded project, Alternative models for Community-Supported Fisheries. 2. **Walking Fish Community-supported Fishery** Walking Fish is a community supported fishery (CSF) that links fishermen on the coast of North Carolina to consumers in the Triangle. A **community supported fishery** (CSF) is based on the community supported agriculture (CSA) model. A CSF involves pre-payment by consumers for a 'share' of fresh, locally harvested seafood (i.e., a set amount of seafood generally picked up by the consumer on a weekly or bi-weekly basis). Just as CSAs can encourage sustainable and profitable farming practices, CSFs have the potential to do the same for fishing. In 2011 the core fishermen involved in Walking Fish formed a cooperative to assume leadership for Walking Fish.

8.4.3. Market opportunities: Matching the right fishing businesses with the hospitality sector

Interviews were conducted with two of Tasmania's leading restauranteurs. The objective of the interviews was to gain insights into barriers and opportunities to improve value and profitability in the TSF from a demand side and uniquely Tasmanian perspective.

Luke Burgess, formerly of Agrarian Kitchen and Garagiste provided the following insights:

- Access to high quality local seafood is poor. It is attainable in small quantities but requires too much time & effort on the part of the restaurant managers.
- The retail cost of seafood inputs is incomparable to other proteins in regard to food-cost and menu construction.
- Readily available wholesale supply often lacks product information which customers expect from seafood (place of origin, time of landing, producers name and harvesting practices).
- Price agreements through direct relationships with producers are difficult to maintain.

Matthew Evans of Fat Pig Farm provided the following insights:

- Access to local seafood (for restauranteurs and general public) in regional parts of Tasmania is poor.
- There is a demand for local seafood in regional parts of Tasmania and expected the demand will hold at current price levels.
- Tasmanian's have a culture of easy access to seafood through recreational fishing which the restauranteurs compete with.
- Provision of a consistent travelling supply of seafood in regional Tasmania would be well received.

8.5. Product development

Product development initiatives include value-adding as well as packaging innovations to create alternate product formats from the same fish for customers. The opportunity available to the TSF is to use product development strategies to increase the value and economic returns from currently lower-value species. In addition, product development initiatives can be used to diversify product lines and therefore markets for species which can reduce the vulnerability of TSF product supply chains to disruptions to single markets.

Given the investment required, the proposed initiatives take account of volumes, consistency of supply and means to reduce the cost of investment.

8.5.1. Potential initiatives

Initiative:	Source:	Rationale:
Investment in value-adding, packaging and alternate product formats for **moderate-to-high volume consistent supply TSF product lines**	TSF Seafood Post-Harvest Operators Survey Market analysis Project Steering Committee (SFAC – industry members)	Capacity to develop alternative product formats and store product at volume would allow better coordination of supply to market and allow producers to meet demand for a range of product formats, from fresh to non-perishable. A number of TSF species which are currently under-utilised require post-harvest processing to convert to product formats for which there is greater demand (e.g., Australian salmon). Investment in technologies to enable alternate product development may remove this barrier to higher levels of utilisation of these species. More consistent supply to market as well as alternative product formats which are better matched to demand will generate higher revenues for processors. In turn, this may result in higher beach prices for these TSF species.
Collaborative producer investment in low-cost packaging for **low volume and inconsistent supply TSF product lines** to enhance brand awareness (see 8.6)	TSF Seafood Post-Harvest Operators Survey Market analysis Project Steering Committee (SFAC – industry members)	Simple packaging technologies and facilities which can be available on demand for lower volumes would support greater brand awareness of these TSF products. It would also support access to some markets where convenience and increased shelf-life (supported by packaging) are required. These product lines would not generally support higher-cost value adding or branding campaigns given their inconsistent supply and low volumes. Collaboration between TSF fishers to invest in these facilities may make packaging cost-effective for more TSF fishers.

8.5.2 Impact and feasibility

No quantitative assessment of impacts or of feasibility of the proposed initiatives was undertaken. The assessment below is qualitative (i.e., draws on stakeholder judgement, review of literature and interpretation of study results) and preliminary (Table 19).

A critical consideration for assessing the feasibility of product development initiatives is the level of existing and potential demand for product. Recent published studies of trends in

demand for seafood globally (FAO 2022) and within Australia (Steven et al. 2020) have identified growing demand for seafood globally and in Australian markets, at the same as increasing capacity to meet growing demand for low-cost seafood in Asian aquaculture sectors

Within Australia, demand has been greatest for more convenient (i.e., ready-to-eat) and less perishable (i.e., frozen) seafood product (McManus et al. 2014; Sparks 2019).

Growing consumer awareness of seafood production is being reported, as is higher levels of agreement with statements indicating a preference for buying fresh Australian-produced wild-caught seafood (NRM South 2020; McManus et al. 2014; Sparks 2019). Since the outbreak of COVID-19 pandemic and associated disruptions to imported seafood supply and to dine-in food service sectors, demand in Australia for Australian seafood generally has increased as illustrated by price rises for Sydney Fish Market sales (wholesale and retail). Demand for finfish specifically has increased, as illustrated by the rise in Australian household consumer apparent consumption of Fin fish products (ABS 2022), and in the average weighted prices for products caught in the South East Shark and Finfish Fishery (Ogier et al. 2021). However, growth in demand for these higher-cost product forms has not been as high as for lower-cost, ready-to-eat product forms most often made from Australian or imported farmed finfish (NielsenIQ Homescan 2022).

Australian wild-caught seafood is priced higher (from as low as $33/kg for fresh fillets) than Australian produced beef (~$25/kg), Australian farmed salmon (~$26/kg), and chicken ($10-$14/kg), based on a scan of major supermarket retail outlets at the time of publication.

Notwithstanding, caution is needed when assuming that product development strategies can help increase targeting of under-utilised species. The feasibility of such strategies is influenced by multiple factors, but largely by the extent to which such strategies can lead to the transformation of under-utilised species into products for which there is domestic consumer demand. In his review of projects concerned with improved exploitation of underutilised species, Stephens (2019: 8) found that:

- “The fundamental problem with underutilized species for the Australian fishing industry is lack of market demand by domestic consumers.
- Attempting to change the economic equation by building demand in the domestic market is costly and high risk.
- The high-cost structure of Australian fishing relative to export markets in Asia precludes access to those markets where there is a demand for low value fish.
- In light of the above, the decision to attempt exploitation of an underutilized species in the domestic or export market is a business one, likely to be based on low profit margins.”

An example relevant to the TSF is the failure to develop high-value high-volume markets for Australian salmon, despite considerable producer collaboration, research and development (see Howieson et al. 2019).

Table 20. Impact and feasibility of proposed initiatives for product development

Initiative	Industry workshop assessment	Study assessment
Investment in value-adding, packaging and alternate product formats for **moderate-to-high volume consistent supply TSF product lines**	Impact: Very positive Feasibility: Very / Somewhat feasible Identified barriers include: • Requires private investment • Supply of TSF product in some cases limited by latency of some TSF licence holders, and by licensing and regulatory framework to manage fishing • Needs supporting product and marketing strategy	No specific assessment was undertaken. However, preliminary analysis was undertaken of price improvements required to lead to greater levels of targeting of currently under-utilised species. This analysis is presented below. TSF fishers have and are deploying product development strategies at small-scales. 35% of respondents to the TSF survey indicated that in the last 5 years they had participated in packaging innovations, product development and/or product marketing strategies. Examples of successful implementation of these types of strategies include: 1. Fergusons Australia value adding and packaging of their catches of multiple finfish species into convenience packs aimed at different premium markets. 2. T.O.P. Fish Tas - Octopus value-adding and packaging into multiple product formats and branding of their product for premium markets.
Collaborative producer investment in low-cost packaging **for low volume and inconsistent supply TSF product lines** to enhance brand awareness (see 8.6)	Impact: Very positive Feasibility: Very / Somewhat feasible Identified barriers include: • Requires high level of cooperation between TSF fishers • Individual TSF fishers already doing this to some extent. Efficiency gains and trust need to be high to create incentive for increased collaboration. • Needs supporting product and marketing strategy	No specific assessment was undertaken. TSF fishers have reported that the unit cost of small batches of packaging is too high and unrecoverable by TSF fishers (i.e., can't be fully passed on to buyers) in many cases.

8.5.2. Price improvements to increase catch of under-utilised species

Gross margin is a measure of the opportunity cost for targeting one species on a given day of fishing activity, when the option is available to target other species on that day. In general, and subject to catching conditions, licences (with restricted access to certain species or modalities of fishing), and operators' availability for fishing (e.g., family commitments, alternative occupations, holidays, etc.), operators can be expected to direct effort towards the highest gross margin species on a given day of fishing.

Generally, the higher gross margins are for well-known target species (Banded Morwong $27.78 per kg, Calamari $11.80 per kg, Blue-throat Wrasse $10.56 per kg). Underutilised species aren't necessarily uneconomic (e.g., Australian Salmon returns an estimated gross margin of $3.90 per kg) but they may have a high opportunity cost when compared to the common main stay species for the fishery. Operators who hold harvest rights to these species or gear suited to targeting these species may find other uses of their time more profitable than directing it towards the exploitation of these underutilised fish. In other cases, species that are considered underutilised may have a negative return after fishing costs (e.g., Leatherjacket has an estimated gross margin of -$7.58 per kg).

Table 21 shows a comparison of the relative daily fishing profitability (measured by Gross Margin, $/Kg) of a range of TSF species.

In the context of 'product development' initiatives for addressing underutilisation, which would attempt to gain a premium price for the currently underutilised fish, the new price must also represent a large enough improvement on the current price to give fishers an incentive to switch effort away from alternative options during the season. For example, the difference in gross margin between Leatherjacket and Blue-throat Wrasse ($18.14 per kg) would be approximately the size of a price improvement in Leatherjacket that would support the exploitation of that species on an equivalent basis to Wrasse.

Stricter licensing conditions on some high-value species (to limit the availability of those species for 'general' TSF fishers) may help to reduce the opportunity cost of targeting alternative species for some fishers. This could encourage the development of underutilised species, subject to the return from those species not being less than the alternative livelihoods that are available to the fishers outside of the fishery.

Improving the flexibility of fishing operations is unlikely to increase the use of underutilised species. Most species in the TSF are not output-controlled, and hence this mechanism has no way of ensuring additional effort is directed towards the underutilised fish.

This analysis highlights that market price and variable costs of fishing are not the only constraint on greater utilisation of under-utilised species. As noted by SFAC industry members, and supported by the analysis of fishing efficiency (section 4.4), constraints due to vessel, gear and species licences have a significant impact the targeting and catching of specific species.

*Table 21. Comparison of daily fishing profitability (Gross Margin or $/Kg) and opportunity cost of targeting selected alternative TSF species based on catches[1] and prices[2] in the 2020/21 fishing season. * indicates species with a trip limit or some form of restricted access.*

Relative level of daily fishing profitability (Gross Margin or $/Kg)	TSF species
High	Banded morwong*, Blue mackerel
Moderate	Garfish, Striped trumpeter*, Calamari*, Blue-throated wrasse*, Tiger flathead, King George Whiting, Greenback flounder
Low	Purple wrasse, Gould squid, Australian salmon*, Rock flathead, Blue warehou, Silver trevally, Snapper*, School whiting
Negative	Mackerel, Pilchard, Leatherjacket, Bastard trumpeter*, Jackass Morwong, Long snout flounder, Blue morwong, Dusky morwong

[1] Catch per day is calculated from the catch per hours spent (logbook data) for a standardised 7.5-hour day (based on the full-time definition of 37.5 hours per week). Many species are caught using a variety of gears by TSF fishers, and our analysis does no take account of this mix of fishing methods.

[2] Price is obtained from the Tasmanian Government FILMS database and represents the trailing twelve-month average for the specific product form identified as at 1 April 2021. Price is for whole fish, except in the case of Banded Morwong and Wrasses which are sold live.

8.6. Brand development and enhancement

The opportunity presented by brand development and supporting digital marketing campaigns is to generate demand for alternative product formats, and achieve price improvements for previously unbranded existing TSF products and thereby increase economic returns for **existing active TSF fishers**.

Market research by TSIC and NRM South (2020) indicates that Tasmanian consumers have low awareness of what fin fish products are Tasmanian-produced and wild-caught, and which are imported or farmed. Fresh or frozen fin fish is a mainstay of Tasmanian consumers seafood diet, however consumers report that they most frequently buy and consume farmed salmon, flathead, flake and hoki.

Product branding can be used to meet the deficit in product information which customers expect from seafood (place of origin, time of landing, producers name and harvesting practices), which was identified by leading entrepreneurs in the Tasmanian hospitality sector (see section 8.4).

8.6.1. Potential initiatives

Initiative:	Source:	Rationale:
Develop or enhance branding of alternate, value-added product formats developed for **moderate-to-high volume consistent supply TSF product lines**	TSF Seafood Post-Harvest Operators Survey Market analysis TSIC Project Steering Committee (SFAC – industry members)	Brand development can be leveraged to maximise price of product. Digital marketing is available, low-cost and can be scaled up to support brand development of alternate product formats. Consistent social media messaging to support brand development compliments consistent supply.
Develop premium product branding for **low-to-moderate volume consistent supply TSF product lines** targeting retail and restaurant markets	TSF Seafood Post-Harvest Operators Survey Market analysis TSIC Project Steering Committee (SFAC – industry members)	Local consumer awareness of TSF products is low, based on results from consumer surveys completed by TSIC as parts of its Eat More Tassie Seafood campaign, and NRM South (2020). Local restaurants and retailers are likely to have similar levels of awareness. Both of these studies recommended brand development for specific Tasmanian seafood products which targeted specific segments of the Tasmanian and interstate market. Developing premium product branding for specific TSF product would function to both increase awareness and differentiate TSF products from imported or aquaculture-produced finfish alternatives available to local buyers. Low-cost brand development options include supportive digital marketing and consistent social media messaging through social media platforms such as Instagram, Facebook.

8.6.2. Impact and feasibility

No quantitative assessment of impacts or of feasibility of the proposed initiatives was undertaken. The assessment below is qualitative (i.e., draws on stakeholder judgement, review of literature and interpretation of study results) and preliminary (Table 21).

Effective brand development is commonly considered to require these conditions (de Veld 2004):

1. A unique selling proposition which is:
    - positive (a benefit)
    - something that you can provide (supply) for a long time to come
    - something that your customers genuinely need
    - communicated consistently every time you interact with a customer.
2. Target markets which are selected based on best available market and demographic information
3. Active management of client relationships.

TSIC has launched its Eat More Tassie Seafood campaign, cookbook and seafood trail listings of producers, wholesalers and retailers. This campaign is broadly aimed at linking

Tasmanian seafood to ‘Brand Tasmania’. Given the breadth of types of seafood products (oysters, scallops, lobster, scalefish, octopus, etc), further brand development under this campaign is to be specific to products and in partnership with producers.

Further resources exist to support operators in seafood brand development and digital marketing. including UK seafish’s webinar; Marketing Masterclass: an into to local search engine optimisation.

Table 22. Impact and feasibility of proposed initiatives for brand development

Initiative	Industry workshop assessment	Study assessment
Develop or enhance branding of alternate, value-added product formats developed for **moderate-to-high volume consistent supply TSF product lines**	Impact: Somewhat positive Feasibility: Very / somewhat feasible Identified barriers include: • High cost of brand development and associated marketing strategy, relative to impact • Extent of market power held by farmed salmon and imports indicates branding alone may not be highly effective in securing a market share and should be used as a supporting strategy for product development	No specific assessment was undertaken. Further market research by firms would be required specific to the TSF product and target market. Assessment of cost-effectiveness of any branding strategy would be for the firm to determine.
Develop premium product branding for **low-to-moderate volume consistent supply TSF product lines** targeting retail and restaurant markets	Impact: Somewhat positive Feasibility: Very / Somewhat feasible Identified barriers include: • High cost of brand development and associated marketing strategy, relative to impact • TSIC has a marketing strategy in development • TSF operators experience suggests personal networks more effective at building markets and product recognition and loyalty than branding campaigns • Increasing demand for these TSF species would create competition between fishers and increase pressure on those stocks	No specific assessment was undertaken. Results from the TSF Fisher Survey (section 6.2) and the first sales network analysis (section 6.4) highlight TSF fishers' preference for building brand and markets through personal relations, informal information sharing and pricing arrangements, and social networks rather than through formal brand development strategies. This contrasts with the gaps identified by leading entrepreneurs in the Tasmanian hospitality sector (see section 8.4), as well as by the NRM South baseline consumer sentiment survey (2020), which included the need for increasing the availability of product information to increase consumer awareness about product brand attributes. This difference suggests there may be a further opportunity for TSF fishers to re-consider the use of brand development campaigns as platform for meeting buyers need for product information.

9. Discussion and conclusion

9.1.1. Meeting the project's objectives

The assessment this project has provided of the TSF fleet and fishing activity (objective 1) and its social and economic characteristics (objective 2) provides a baseline and assessment framework to support further monitoring of change and more detailed impact assessment as required. The profile of market conditions, first sale networks, and supply chains for TSF species (objective 3) generated by the project can similarly be used as a baseline to support further monitoring and assessment, as well as further market and demand analysis. Combined, this characterisation has informed the development and consideration of a range of proposed strategies (objective 4) to improve economic returns and flow-on effects of the commercial sector of the TSF.

9.1.2. Learning from limitations

While the project's objectives have been successfully achieved, data limitations and research design limitations are important to observe and reflect on. These included the following:

- Only 50% of TSF catch and effort data could be matched to TSF licence data. This meant that the findings described a sample of the population rather than the full population, and limited the certainty in any conclusions drawn due to sample bias.
- We recognise the limited extent of the financial information collected in the survey, due to the inclusion of broad range of non-financial questions that related to other aspects of the fishery. Further refinement of survey instruments to collect economic data from TSF fishers will be required to improve the coverage of economic and financial information available for the TSF.
-
- Similarly, given the variance in types of TSF operations and firms, the survey response number was too low to ensure saturation of themes in identifying barriers and constraints to viable fishing livelihoods.
- Very limited data was available on market conditions and on post-harvest activity for TSF products. Aside from fish receiver data received by NRE Tas, no quantitative data is collected on Tasmanian TSF product post-harvest, retail or hospitality sectors. Low numbers of respondents to the TSF Seafood Post-Harvest Operator survey were partly a result of the survey being conducted while the COVID-19 disruptions were impacting these operators, and partly the design of the survey which required operators to be willing to share commercial-in-confidence information on pricing, sourcing, value-adding etc.
- Available data on local consumer preferences was limited to consumer sentiment data provided by NRM South and TSIC (2020). Because of the occurrence of the COVID-19 pandemic and associated disruptions to seafood supply chains and consumption patterns, the decision was made to not conduct any local consumer willing-to-pay studies to quantitively measure local consumer surplus from locally available TSF products as part of this project. This remains a significant data gap, however the project's analysis of market conditions can function as a pre-design phase if any further consumer value research goes ahead.

As such, no overall cluster or factor analysis methods were used to determine which factors affect social and economic performance of TSF fishers or the TSF commercial sector as a whole. This was partly due to the nature of the project objectives, which were broad and focused on basic characterisation, and partly because of the range of primary, secondary and third-party data sources the project drew on which limited capacity for cross-analysis of multiple factors.

9.1.3. Key insights and conclusions

The characteristics of the TSF fleet reflect the 'general fishery' nature of the fishery, whereby multiple species are targeted using multiple types of gears under an array of licence packages. The complexity of licence packages reflects the various legislative changes throughout which commercial fishers who have a catch history with species in the TSF have been allocated access in the form of one of the main platform licences.

Today, fishers who operate in the TSF may also operate in the Tasmanian Rock Lobster Fishery and/or various Commonwealth-managed fisheries for scalefish. The complexity is also a function of the trajectory the TSF regulatory framework has taken, whereby as a species or fishing areas come under increasing fishing pressure, various forms of limited access (i.e., gear or species licences) have been introduced.

This trajectory is continuing and observable in the changes to the Calamari fishing regulations. In effect, the TSF is becoming a suite of sub-fisheries with a smaller and smaller 'general fishery' remaining for mixed fish species and non-specialist fishers without access to either Banded morwong quota or limited species or gear licences for targeting the higher value species managed as 'sub-fisheries'.

Nonetheless, a current broad social function of the TSF is the recognition of equal entitlement to access the basic 'general fishery' of any holders of these main platform licences which can be in conflict with current TSF operators interests in more secure access rights.

Fishers operating in the TSF today are similarly diverse in their fishing and livelihood strategies. Notwithstanding, the largest group of fisheries in the TSF are operating technically efficient fishing operations and generating the levels of economic returns they can within the constraints of the current licensing and regulatory framework, the availability of species, and market demand. This group of professional fishers is predominantly full time and largely dependent on the TSF for their livelihoods.

The remaining TSF fishers comprise a mix of dual-licensed fishers operating in other fisheries and part-time fishers who – in many cases – combine fishing in the TSF with non-fishing forms of earning. This reflects one of the other key social functions of the TSF – that of supporting operators pursuing diverse livelihoods within the TSF and across multiple fisheries and other non-fishing sectors, typically in regional areas of Tasmania.

Collectively, the average commercial operator in this sector generate a low level of profit. At the very best, such a business may have short-term viability but without knowledge of the value of the assets of the business, it has not been possible to assess medium- or long-term viability. Economic rent (above normal profit levels) is not being generated. This reflects that the TSF functions to support direct employment of operators in the fishery rather than economic returns to those operators.

Relative to its economic size, the TSF makes a greater relative economic contribution to the Tasmanian economy, household income and employment generation than other larger but more economically efficient fisheries in Tasmania (e.g., the Rock Lobster and Abalone fisheries, see Rust and Ogier 2021). This reflects a second key economic function of the TSF – that of contributing to indirect employment and general economic prosperity through its links and expenditure into other sectors of the Tasmanian economy and through the spending of people earning wages from their direct employment in the TSF.

A further social and economic key function of the TSF is that of supplying fresh seafood directly to Tasmanian consumers and to the Tasmanian food and hospitality sector. The proportion of production which is sold or eaten within Tasmania is far higher for the TSF than

for the Rock lobster and Abalone fisheries. This study determined that the TSF's contribution to local seafood supply is larger than previously understood.

Opportunities exist to improve viability and profitability (i.e., increase economic returns for existing TSF operators) and improve the flow-effects to the Tasmanian community through increased access to TSF products and through expansion of the seafood postharvest sector locally.

For the management agency, NRE Tas, there is the option to improve capacity output and flexibility for current active operators through reviewing the regulatory framework for opportunities to reduce regulatory burden without increasing fishing pressure on depleted, depleting or recovering fish stocks.

For TSF industry operators and organisations, it may be possible to increase economic returns through local value chain improvements including through innovations in business models to create access to low-cost packaging and value-adding to generate alternative product formats, collaborative producer aggregation of product to overcome issues with consistency of supply, and improved branding and marketing to ensure product information is available to buyers and TSF products are consistently differentiated from farmed and imported finfish products.

A second set of opportunities exist for NRE Tas to increase economic returns which require trade-offs with one or other of the key social and economic functions of the TSF. These include initiatives to pursue further fleet consolidation and rationalisation through reducing latent effort, reviewing the access to the TSF of holders of FLRLs, and allocating limited access to highly active fishers, for example. These are clearly matters of fisheries management policy and legislation.

Industry representatives have indicated that currently the very high levels of latent effort, and the behaviour of part-time TSF operators contribute to a 'race to fish' for species whose value has increased because of value chain investment and development by full-time TSF fishers, are disincentives to further value chain development. Further fine-scale analysis of TSF licence market conditions and fleet behaviour over time could be undertaken to examine these concerns.

Currently, none of the management objectives for the TSF provide direction to introduce measures to pursue maximisation of net economic returns such as the ones mentioned above. At the same time, the current management objectives for the TSF do not articulate any clear ecological, social, or economic objectives for the fishery. This makes it challenging to ensure that further fisheries management changes introduced to meet the sustainability objective through further limiting access to stocks under increasing fishing pressure do not have perverse social or economic outcomes on specific groups of TSF fishers (e.g., increasing their vulnerability to disruption) or on the social and economic benefits which are generated by the fishery to the Tasmanian community. However, should such diverse policy objectives for the TSF be introduced, they would necessarily be constrained by the need to first ensure that TSF stocks have recovered to target levels.

Nonetheless, recognition in policy of the key social and economic functions of the commercial sector of the TSF, and of other sectors with interested in the TSF, will also contribute to fair and transparent resource sharing policy development.

10. Implications

In achieving the project's objectives, the project has had these implications and contributed to these outcomes, as follows:

Beneficial outcome	End user(s)
Quantitative information about the TSF commercial sector which profiles the extent of its current social and economic contributions to the Tasmanian economy and community	Industry Management
Social and economic assessment of the commercial sector of the TSF with which to inform the development of fit-for-purpose fisheries management strategies in future.	Industry Management
Baseline social and economic information, indicators and economic modelling capacity with which to evaluate proposed management strategies management. This will help ensure strategy plan development will generate a strategy which delivers intended benefits and avoids perverse outcomes.	Industry Management
Identification and preliminary assessment of initiatives to increase viability and economic returns to TSF fishers	Industry
Identification and preliminary assessment of initiatives to increase flow-on social and economic benefits from the TSF commercial sector to the Tasmanian economy and community (e.g., increased supply of premium TSF product which matches local consumer and hospitality sector demand).	Community Consumer

11. Recommendations

A range of recommendations have arisen as a result of the project's activities and findings. These will be raised by the project team with the Chairs or Officers of the Scalefish RAG, TASRAC, and the FRDC's HDR Coordination Program to consider.

1. Provision of social and economic objectives and performance indicators of management for the TSF as a whole and for the commercial sector specifically.

2. Development of a strategic plan for the commercial sector of the TSF, including a framework for identifying and evaluating potential actions for their impact and risk.

   Recommendation 2 to be further supported by the following:

3. Further identification of factors limiting operator viability and fishery-level social and economic performance:
   - Review the licensing and regulatory framework for the TSF and identify any opportunities to reduce regulatory burden without reducing the effectiveness of stock sustainability protections;
   - Analyse TSF licence market operations and conditions to determine factors influencing the high level of latency in licence activation.

4. Further identification of factors enabling operator viability and fishery-level social and economic performance for key species:
   - Review the feasibility of specific models of collaborative producer arrangements and community-supported fisheries and determine the level of industry interest in a pilot project.
   - Determine local consumer willingness-to-pay for a range of Tasmanian-produced seafood products (inclusive of TSF products) in order to inform new product development, branding and marketing.

5. Improvement of ongoing social and economic data collection to inform fisheries management:
   - Address databases issues limiting data linkage of TSF administrative licensing data with TSF effort, catch and landings data;
   - Revise the TSF Fishery Survey questions to meet the purpose of ongoing data collection social, economic and financial data collection, including non-cash fishing costs and the value of tangible and intangible assets;
   - Repeat the TSF Fishery Survey every 3 years to ensure a representative profile of cost structures for different types of operators is maintained; and
   - Design a market survey of TSF seafood wholesalers and processes with TSIC and industry partners to enable collection of data on supply chains for Tasmanian seafood downstream of first receivers.

12. Extension and Adoption

The project's findings have been **adopted as part of two other projects**, as follows:

The findings of the survey relating to COVID-19 impacts on TSF fishers – the Wrasse sub-sector particularly - were used to inform the FRDC-funded report, Impacts of COVID-19 on the Australian Seafood Industry: January-June 2020. FRDC 2016-128 (Ogier et al. 2021)

The TSF fisher cost structure profiles were used to estimate economic contributions as part of the study, *Tasmanian Fisheries and Aquaculture Industry 2018/19: Economic Contributions Summary 2021* (Rust et al. 2021).

The key sector summary of the TSF's economic contributions 2018/19 has been circulated and shared with and by industry members as well as NRE Tas fisheries management staff

The project team has engaged with end users (Industry and Management members of the Scalefish Fisheries Advisory Committee), as well as Industry representative officers from the Tasmanian Seafood Industry Council (TSIC) and the Tasmanian Rock Lobster Fishermen's Association (TRLFA), for the purposes of presenting preliminary results, checking assumptions and research priorities. The primary forms of this engagement with key stakeholders have been:

- Presentations to the Scalefish Fisheries Advisory Committee throughout the project. The project has been a dedicated agenda item for the committee, and pre-meeting discussion papers have been circulated and presentations and discussion sessions delivered at the following SFAC meetings:
    - SFAC Meeting 70, 71 – Jeremy Lyle and Nils Krueck
    - SFAC Meeting 72 – Jeremy Lyle, Emily Ogier and Nils Krueck
    - SFAC Meeting 73, 74, 75, 76 – Emily Ogier and Nils Krueck
- Participation by Julian Harrington (TSIC CEO) and by Frances Seaborn (NRETas Scalefish Fishery Senior Management Officer) in the project team and in project team meetings

Results of the research were presented at the World Fisheries Congress in 2022:

Abstract:

Small-scale fisheries are characterized by diverse fishing activities and target species, a lack of formal stock assessments and high uncertainty about management decisions. Most small-scale fisheries are concentrated in tropical developing countries, but similar fishery conditions are also common in developed countries. The sustainability and economic viability of small-scale fisheries is likely to depend on marketing and management approaches that explicitly consider different types of fishing activities along with associated impacts on local ecosystems and communities.

Here, we present findings from a study aimed at developing a framework for the classification of diverse fishing activities. Using the Tasmanian Scalefish Fishery (TSF), Australia, as a case study, we identified four operational groupings. The first group was represented by a few highly efficient, corporatised operators, which accounted for the majority of landings (by weight), primarily supplying wholesalers outside of Tasmania with a single species. The second group was represented by a similarly small number of commercial operators, but characterized by lower landings, much higher fishing activity, and the highest diversity in both target species and supplied businesses. A third and slightly larger group showed characteristics similar to the second group but with a lower level of fishing activity, lower associated landings and numbers of sales, fewer target species and a lower diversity in supplied businesses. The last group represented by far most operators (85%) but accounted for only 6% of landings. While average numbers of sales, weights per sale, target species, fishing locations, supplied businesses and business types in this group were very low compared to other groups, the total diversity of species, locations, businesses and business locations were likely to be most valuable for local economies and regional communities.

This talk will focus on the characteristics, marketing opportunities and targeted management approaches to help sustain the environmental and socio-economic diversity of such non-corporatised fishing activities in the TSF.

13. Project materials developed

The following project materials have been developed:

1. Final report
2. Summary flier
3. World Fisheries Congress 2021, abstract and presentation by Nils Krueck

Appendix A – Project staff

Name	Organisation	Role
Ass. Prof. Jeremy Lyle	IMAS, University of Tasmania	Principal Investigator (start to May 2021) - Fisheries assessment
Dr Emily Ogier	IMAS, University of Tasmania	Co-Investigator then Principal Investigator (2021-2022) – Social science
Dr Nils Krueck	IMAS, University of Tasmania	Co-Investigator – Fisheries assessment
Dr Steven Rust	IMAS, University of Tasmania	Co-Investigator - Economics
Dr Satoshi Yamazaki	College of Business and Economics, University of Tasmania	Co-Investigator - Economics
Dr Dugald Tinch	College of Business and Economics, University of Tasmania	Co-Investigator - Economics
Tom Cosentino	Margo Consulting	Co-Investigator – Seafood markets and supply chains
Julian Harrington	Tasmanian Seafood Industry Council	Co-Investigator - Industry
Frances Seaborn	Dept. Natural Resources and Environment, Tasmania	Co-Investigator – Management
Dr Elisavet Spanou	IMAS, University of Tasmania	Junior Research Fellow – Data analysis

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Appendix C – History of changes to management of the Tasmanian Scalefish Fishery

Source: Wild Fisheries Branch, Department of Natural Resources and Environment, Tasmania (2021)

Year	Management Change
Pre 1987	Unrestricted access to Tasmanian Fishing Boat Licences (TBFLs) Unlimited access to scalefish and shark using all gear types No restrictions on the amount of graball net that could be used. Unrestricted access to all other gear types (i.e., beach seine, purse seine, dip net, squid jig, fish traps, small mesh gillnets, mullet nets, longlines, droplines and spears).
1987	Issue of fishing TFBLs capped at 850 Unlimited access to scalefish and shark using all gear types No restrictions on the amount of graball net that could be set in State waters. Unrestricted access to all other gear types (i.e., beach seine, purse seine, dip net, squid jig, fish traps, small mesh gillnets, mullet nets, longlines, droplines and spears).
1990	Use of gillnets in shark nursery areas restricted. Prohibition on the taking of school and gummy sharks in Shark Nursery Areas (SNAs). Restricted gillnetting in SNAs. Commercial access to SNAs limited to holders of non-transferable endorsements (38 endorsees). Commercial access to shark gillnets restricted to holders of a non-transferable shark gillnet licence (94 licences issued). Commercial access to small mesh gillnets restricted to holders of non-transferable endorsements for north coast waters only (18 endorsees). Commercial access to beach seine nets on the north west coast restricted to holders of non-transferable endorsements (2 endorsees).

Year	Management Change
1995	Commercial access to shark hooks restricted to holders of non-transferable shark hook fishing licence (22 issued). Skipper authorisation provisions introduced for shark gillnet, shark hook and inshore trawl fishing licences introduced (12 non-transferable inshore trawl fishing licences). Commercial access to the live fish fisheries (banded morwong and wrasse) restricted to the holders of a non-transferable endorsement (approximately 100 issued). A Ministerial warning was issued in May 1994, warning fishers to be cautious if investing in the fishery and that if catch history was to be used to determine future access to the fishery, catches after that date would not be counted. No commercial fisher would lose access, however their level of future access was generally based on their level of prior involvement, as evidenced by past catch histories in the fishery—prior to May 1994. ***Banded morwong closure*** Annual two month (March/April) closed season was introduced for banded morwong to coincide with the peak spawning period.
1996/1997	Coles Bay closed to any beach seine, purse seine, lampara or ring net from 1 December 1996 to 31 March 1997 inclusive. Offshore Constitutional Settlement (OCS) Agreement (*Commonwealth of Australia Gazette, No. S 531, 31 December 1996*) for the arrangement between the Commonwealth and State of Tasmania in relation to the fishery for finfish to be managed under both Commonwealth & State Law in waters relevant to Tasmania. The OCS also includes the arrangement between the Commonwealth and State of Tasmania in relation to the fishery for invertebrates and certain finfish to be managed under State law in waters relevant to Tasmania. Details of scalefish gear allowed by Tasmanian rock lobster licence holders to catch scalefish • 150 metres demersal gillnet • trolling lines • not more than 2 fish traps • one demersal longline not exceeding 1000 metres (limited to 200 hooks); or not more than two droplines (limited to 200 hooks) ***Banded morwong closure*** Fishery closed for two months in March and April banded morwong to coincide with the peak spawning period.

Year	Management Change
1998	Implementation of the scalefish fishery management plan. Total number of scalefish licences capped and categorised into 4 classes of scalefish licence: • fishing licence (scalefish A) • fishing licence (scalefish B) • fishing licence (scalefish C) • fishing licence (rock lobster) ***Gear entitlements*** *Fishing licence (scalefish A)* • 1000 metres graball net; and • 2 fish traps; and • 200 hooks *Fishing licence (scalefish B)* • 500 metres graball net; and • 2 fish traps; and • 200 hooks *Fishing licence (scalefish C)* • 150 metres graball net; or • 1 fish trap; or • 200 hooks *Fishing licence (rock lobster)* • 150 metres graball; and • 2 fish traps; and • 200 hooks Fishing licence (vessel) with access to scalefish (limited to 690 licences). *Gear based licences* and limited for the use of beach seines (52 licences), purse seines (9) and small mesh gillnets (21). *Species based licences* created and limited for Australian salmon (8), banded morwong (29) and wrasse (63). Use of spears restricted to holders of a fishing licence (scalefish A, B and rock lobster). Changes to no netting areas and areas managed predominantly for recreational fishing, further restricting commercial scalefish fishing. Coles Bay seine closure introduced as new rule. ***Banded morwong closure*** Fishery closed for two months in March and April banded morwong to coincide with the peak spawning period.

Year	Management Change
1999	No take or possession of calamari in Great Oyster Bay by any person from: • 25 October 1999 to 7 November 1999; and • 22 November 1999 to 5 December 1999 inclusive. ***Banded morwong closure*** Fishery closed for two months in March and April to coincide with the peak spawning period.
2000	Examination of the performance of the scalefish fishery. Commercial access restricted and limited for the automatic squid jig fishery (16 permits issued) Transfer of jurisdiction of school and gummy shark fishery to the Commonwealth under quota management system (60 permits allow school & gummy shark fishing in Tasmanian coastal waters). Approximately 29 Tasmanian dual and State only shark fishing licences surrendered. Introduction of scalefish bycatch provisions for southern shark fishers (possession limit of 200kg of scalefish species when using more that 1800m of shark net, or more than 1000 hooks). Introduction of possession limits for striped trumpeter applying to all scalefish fishers (250kg per trip combined limit with snapper & yellowtail kingfish). No take or possession of calamari in Great Oyster Bay by any person from 2-5 Oct 2000, and 29 Oct to 12 Nov 2000, and 26 Nov 2000 to 10 Dec 2000 inclusive. ***Banded morwong closure*** Fishery closed for two months in March and April to coincide with the peak spawning period.
2001	***Formal review of the scalefish fishery management plan*** *Major outcomes:* • Demersal board trawling banned in State waters. • Limited entry fishery for the automatic squid jig sector (17 licences issued based on catch history or investment criteria). • Prohibition on shark finning. • Non-transferability of fishing licence (scalefish C). • Possession limit for pelagic shark. • Increased minimum size limit for wrasse. • Increased netting restrictions (graball) for shark fishers. • Recreational bag & possession limits introduced. No take or possession of calamari in Great Oyster Bay by any person from 1 to 14 October 2001 & 1 to 14 November 2001 inclusive. ***Banded morwong closure*** Fishery closed for two months in March and April to coincide with the peak spawning period.
2002	No take or possession of calamari in Great Oyster Bay by any person from: • 14 to 27 October 2002 inclusive; and • 11 to 24 November 2002 inclusive. ***Banded morwong closure*** Fishery closed for two months in March and April to coincide with the peak spawning period.

Year	Management Change
2003	No take or possession of calamari in Great Oyster Bay by any person from 1 September 2003 to 30 Nov 2003 inclusive.
2004	***Formal review of the scalefish fishery management plan (Fisheries (Scalefish) Rules 2004) in force from 1 November 2004.*** *Major Outcomes:* • FLCs made non-transferable and endorsed for nominated natural person to operate (no supervisors). Rule 18 • FLA/FLBs with nil catch history between 1 July 1998 to 28 Feb 2003 made non-transferable and endorsed for nominated natural person to operate (no supervisors). Rule 18 • Bycatch limits implemented for scalefish species for holders of Fishing licence (rock lobster). Rule 94(4) • Night netting prohibited for recreational fishers. Rule 73 • Attended night netting for commercial fishers • Non-transferable north coast night netting endorsement introduced for fishers with a demonstrated catch history in the area. Rule 73(2)(b) • Commercial and recreational night netting permitted in Macquarie Harbour, subject to review during the term of this management plan. 73(2)(a) • Trigger limit on Australian salmon for holders of a fishing licence (Australian salmon) set in policy document along with an explicit review process. Set at 20% higher than the 10 year average (435 tonnes). • Recreational daily bag limits removed and possession limits to apply everywhere and a possession limit set for each species. Rule 69 & Schedule 4 • Overall limit on 'all species combined' is removed. • Boat/trip limit of 5 shark for commercial & recreational fishers. Rule 70 • 50kg trip limit for boarfish. Rule 95 • SRAs extend protection to all sharks and rays excluding elephantfish. Rule 71 • All types of set lines are banned in SRAs. Rule 85(d) • Robbins Passage made a 'no gillnetting area'. Rule 89 • Gillnetting is prohibited in the northern end of Great Oyster Bay. Southern boundary of SRA moved to a line from Seaford Point to Weatherhead Point. Rule 89 • Gillnetting prohibited in Blackman Bay. Rule • No gillnetting in Norfolk and Eaglehawk Bay. Rule 89 • No gillnetting within 100m of Stringers Cove. Rule 89 • No gillnetting in The Narrows, Southport. Rule 89 • No commercial gillnetting in Macquarie Harbour except for those with recorded catch between 1 July 1998 and 28 Feb 2003. Rule 22(2)(c) • No gillnetting in Georges Bay and within 200m of Scamander River mouth. Rule 89 • Danish seine permitted to fish the waters of River Derwent and FHNB on weekdays only (licence condition). • Min size of striped trumpeter increased to 450mm. Schedule 3 • Holder of a fishing licence (banded morwong) can use buoys of any colour and shape. Rule 84(3) ***Calamari closure***

Year	Management Change
	No take or possession of calamari in Great Oyster Bay and Mercury Passage by commercial fishers from 1 September 2003 to 30 November 2003 inclusive. No take or possession of calamari in Coles Bay & Promise Bay by recreational fishers from 1 September 2003 to 30 November 2003 inclusive. Daily recreational take of 5 and a boat limit of 10 calamari in Great Oyster Bay and Mercury Passage ***Banded morwong closure*** Fishery closed for two months in March and April to coincide with the peak spawning period.
2005	***Calamari closure*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°10'49" South [AGD 66]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'11" South [AGD 66]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 15 September 2006 to 14 December 2006 inclusive. ***Banded morwong closure*** Fishery closed for two months in March and April to coincide with the peak spawning period.
2006	***Calamari closure*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°10'49" South [AGD 66]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'11" South [AGD 66]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 15 September 2006 to 14 December 2006 inclusive. ***Banded morwong closure*** Fishery closed for two months in March and April to coincide with the peak spawning period.
2007	***Calamari closure*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°11'44" South [GDA 94]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'06" South [GDA 94]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 1 October 2007 to 14 December 2007 inclusive. ***Banded morwong closure*** Fishery closed for two months in March and April to coincide with the peak spawning period.
2008	***Scalefish amendment review*** In October 2008 a new species licence, fishing licence (calamari), was introduced (qualifying catch criteria applied) for the take and possession of southern calamari in south east waters. There were 17 licences issued. Rule 23A ***Banded morwong*** 2008/09 Quota Year

Year	Management Change
	TAC is set at 19,231 fish (25 tonnes) In October 2008 quota was introduced to the banded morwong fishery. A total of 1169 quota units were issued along with a 5 month TAC of 25 tonnes. Division 6 The quota unit value was set in kilograms (21.4kg), however, fishers landed in numbers. The numbers were then converted to kilograms by applying a conversion ratio of 1.3 to give the total kilograms landed. The TAC was undercaught by 28.7% in the short 2008/09 quota year. The fishery is closed in March and April. Ability in the rules for transferable commercial Macquarie Harbour scalefish endorsements ***Calamari closure*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°11'44" South [GDA 94]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'06" South [GDA 94]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 1 October 2008 to 14 December 2008 inclusive.
2009	***Banded morwong*** In July 2009 an extra 24 banded morwong quota units were issued, bringing the total number of units to 1193. For the 2009/10 Quota Year the TAC was set at 34,186 fish (44.4 tonnes) The unit value was 38 kg/quota unit—noting a conversion ratio of 1.3. The Banded Morwong TAC was in numbers of fish and was 17.6 % under caught in the 2009/10 season. The fishery is closed in March and April. The 2009/10 TAC was 34,186 fish (44.4 tonnes). ***Formal review*** *Scalefish Fishery Management Plan Review outcomes (in force from 1 November):* *Changes to striped trumpeter:* • increased size limit to 500 mm; Schedule 3 • on water possession limit of 4 (8 on land); Schedule 4 • landing Striped Trumpeter whole or as 2 fillets with the complete frame (including head & tail). Rule 101A *Bastard trumpeter* • minimum size increase to 380 mm Schedule 3 • recreational possession limit reduced to 10 Schedule 4 • commercial limit 200 kg Rule 94(7) *Other changes:* • snapper min size limit 300 mm Schedule 3 • snapper & yellowtail kingfish possession limit 5 of each Schedule 4 • elephantfish not included in shark possession and boat limits Rule 70 • commercial elephantfish limit 100kg outside SRAs Rule 70 • Rock Lobster licence holders and recreational fishers limited to 10 calamari inside east coast waters. Rule 23A(4) & Schedule 4 • Blue eye trevalla recreational on water possession limit of 5 (8 on land) Schedule 4

Year	Management Change
	• Shark must be landed with dorsal and pectoral fins attached. Rule 72 • Introduction of 6 hour soak time for commercial gillnets; Rule 73AA • As above + 2 hour soak time in SRAs for recreational fishers Rule 73AA • No change to night netting in Macquarie Harbour other than recreational now need to identify their night nets with a red buoy Rule 73(4) & (5) Introduction of fishing licence (octopus); limited to 2 licences each operating 10,000 octopus pots on north coast & Flinders. Part 5A ***Calamari closure*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°11'44" South [GDA 94]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'06" South [GDA 94]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 15 October 2009 to 14 November 2009 inclusive.
2010	***Banded morwong*** The 2010/11 Quota Year TAC was set at 31,018 fish (40.3 tonnes) shared between 1193 units. The unit value was 26 fish/quota unit—noting a conversion ratio of 1.3. The Banded Morwong TAC was in numbers of fish and was 8.9 % under caught in the 2010/11 season. The fishery is closed in March and April. ***Calamari closure*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°11'44" South [GDA 94]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'06" South [GDA 94]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 15 October 2010 to 14 November 2010 inclusive.
2011	***Banded morwong*** The TAC was set at 31,018 fish (40.3 tonnes) for the 2011/12 Quota Year shared between 1193 units. The unit value was 26 fish/quota unit—noting a conversion ratio of 1.3. The Banded Morwong TAC was set in numbers of fish and was 6.6 % under caught in the 2011/12 season. Fishery closed for two months in March and April banded morwong to coincide with the peak spawning period. ***Calamari closure*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°11'44" South [GDA 94]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'06" South [GDA 94]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 15 October 2011 to 14 November 2011 inclusive. ***Garfish Closure*** *Northern waters* are closed from 15 January 2011 and 14 February 2011.

Year	Management Change
	Southern waters are closed to fishing from 15 November 2011 to 14 December 2011 and Northern and southern waters are delineated by a line following the north coast of Tasmania, joined and bounded in the west by a line of latitude through Cape Grim and in the east by a line of latitude through Cape Naturaliste.
2012	***Banded morwong*** The 2012/13 TAC was set at 29,825 fish (38.8 tonnes) shared between 1193 units. The unit value was 25 fish/quota unit—noting a conversion ratio of 1.3. The Banded Morwong TAC was set in numbers of fish and was 14.9 % under caught in the 2012/13 season. Fishery closed for two months in March and April banded morwong to coincide with the peak spawning period. ***Calamari closure*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°11'44" South [GDA 94]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'06" South [GDA 94]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 15 October 2012 to 14 November 2012 inclusive. ***Garfish Closure*** *Northern waters* are closed from 15 January 2012 and 14 February 2012. *Southern waters* are closed to fishing from 15 November 2012 to 14 December 2012 and Northern and southern waters are delineated by a line following the north coast of Tasmania, joined and bounded in the west by a line of latitude through Cape Grim and in the east by a line of latitude through Cape Naturaliste.
2013	***Banded morwong*** The 2013/14 TAC was set at 28,632 fish (37.2 tonnes) shared between 1192 units. The unit value was 24 fish/quota unit—noting a conversion ratio of 1.3. The Banded Morwong TAC was in numbers of fish and was 9.1 % under caught in the 2013/14 season. Fishery closes for two months in March and April for banded morwong to coincide with the peak spawning period. ***Calamari closure*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°11'44" South [GDA 94]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'06" South [GDA 94]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 15 October 2013 to 14 November 2013 inclusive. ***Striped trumpeter closure*** Fishery closes for two months in September and October for striped trumpeter to coincide with the peak spawning period. ***Garfish Closure*** *Northern waters* are closed from 15 January 2013 and 14 February 2013. *Southern waters* are closed to fishing from 15 November 2013 to 14 December 2013.

Year	Management Change
	Northern and southern waters are delineated by a line following the north coast of Tasmania, joined and bounded in the west by a line of latitude through Cape Grim and in the east by a line of latitude through Cape Naturaliste.
2014	***Banded morwong*** The 2014/15 TAC is 27,439 fish (35.7 tonnes) shared between 1192 units. TAC is 27,439 fish (35.7 tonnes). The unit value was 23 fish/quota unit—noting a conversion ratio of 1.3. The Banded Morwong TAC was set in numbers of fish and was 10.7 % under caught in the 2014/15 season. Fishery closes for two months in March and April for banded morwong to coincide with the peak spawning period. ***In process of formal remake of the Scalefish Fishery Management Plan (to be effective from 1 Nov 2014). This remake was delayed a year by the Minister and the remake of the management plan was completed in October 2015*** Same seasonal closures apply for banded morwong, striped trumpeter, southern calamari and garfish. ***Striped trumpeter closure*** Fishery closes for two months in September and October for striped trumpeter to coincide with the peak spawning period.
2015	***New management plan introduced on 1 November 2015 – Fisheries (Scalefish) Rules 2015*** ***Banded morwong*** Will move to a weight based quota management system commencing from the 2016/17 quota year. The 2015/16 TAC was set at 27,439 fish (35.7 tonnes) shared between 1192 units. The TAC is 27,439 fish (35.7 tonnes) The unit value was 23 fish/quota unit—noting a conversion ratio of 1.3. The Banded Morwong TAC was in numbers of fish and was 7.6 % undercaught in the 2015/16 season. ***Banded morwong closure (now a rule in the management plan)*** Fishery closes for two months in March and April for banded morwong to coincide with the peak spawning period. ***Calamari closure (now a rule in the management plan)*** No take or possession of squid species (including calamari) by any person from all east coast Tasmanian waters between an imaginary straight line running due east through Lemon Rock (42°11'44" South [GDA 94]) to the outer limit of State waters and an imaginary straight line running due east from the northern end of Marion Beach (42°46'06" South [GDA 94]) to the outer limit of State waters and includes Coles Bay, Great Oyster Bay and Mercury Passage from 15 October to 14 November inclusive. ***Striped trumpeter closure (now a rule in the management plan)*** Fishery closes for two months in September and October for striped trumpeter to coincide with the peak spawning period. Size limit increased to 550mm. ***Garfish Closure (by public notice)*** *Northern waters* are closed from 15 January 2015 and 14 February 2016. *Southern waters* are closed to fishing from 15 November 2016 to 14 December 2016.

Year	Management Change
	Northern and southern waters are delineated by a line following the north coast of Tasmania, joined and bounded in the west by a line of latitude through Cape Grim and in the east by a line of latitude through Cape Naturaliste. Minimum age limit (10) introduced for holders of a recreational gillnet and setline licences. Re-introduction of recreational bag and possession limits with allowable bag limits reduced (schedule 4) Recreational gillnet set times (except in Macquarie Harbour) have been limited to no earlier than from sunrise and nets must be removed one hour before sunset to minimise wildlife interactions. New or extension of existing gillnet free areas introduced for further protection of seabirds such as little penguins or to extend to mullet net closures Greater Derwent River, Spectacle Island, Sloping Island, Neck Beach, Waubs Bay, Musselroe Bay, Low Head, Lillico Beach, Parsonage Point, Godfreys Beach, and Bonnet Island (Macquarie Harbour entrance). A large closure in Macquarie Harbour also applies to recreational gillnet fishers for the protection of Maugean skate. (Schedules 6 and &) Recreational gillnet set times are now from one hour before sunset to one hour after sunrise in Macquarie Harbour. Set lines prohibited in Leven River, Forth River, Mersey River, Ansons River, Musselroe Bay (inside Ryans Arm), Macquarie Harbour and Southport (western side of bay). Number of hooks for recreational set lines has been reduced from 30 to 15. In waters less than 150 m two set lines can be joined together. Recreational set line soak time has been limited by prohibiting their use at night, from one hour before sunset to one hour before sunrise. New minimum size limits (which apply to both commercial and recreational fishers) for: • Flathead – 320mm for tiger/sand and 400mm for bluespotted/rock. • King George whiting – 350mm • Yellowtail kingfish – 450mm • Silver warehou – 250mm • No take of blue groper. Skipjack tuna can be used as bait, but only the heads and frames of other tuna species. Mammal flesh, blood or offal (other than in pellets) cannot be used as berley. Auxiliary fishing gear (recreational) such as kites and balloons may be used to deploy or retrieve not more than 200m of fishing licence with up to 5 hooks, but not in rivers or shark refuge areas or close to swimmers or jetties. Seine nets have been prohibited in Robbins Passage. Recreational spearing of flounder now permitted in the Inglis, Leven and Mersey Rivers.
2016	***Banded morwong*** The banded morwong quota management system is now based on weight not numbers. The 2016/17 TAC was set at 32,184 kg (32.2 tonnes) and is shared between 1192 units. Unit value = 27kg/quota unit and was 3% under caught in the 2016/17 season.

Year	Management Change
	The fishery is closed in March and April 2016. ***Garfish Closure (by new public notice for three years)*** *Northern waters* are closed from 15 January 2015 and 14 February 2016. *Southern waters* are closed to fishing from 15 November 2016 to 14 December 2016. Northern and southern waters are delineated by a line following the north coast of Tasmania, joined and bounded in the west by a line of latitude through Cape Grim and in the east by a line of latitude through Cape Naturaliste.
2017	***Banded morwong*** The 2017/18 TAC was set at 30,992 kg (31 tonnes) and is shared between 1192 units. Unit value = 26kg/quota unit and was 10.3% under caught in the 2017/18 season. ***Spawning closure introduced for north coast calamari*** The commercial and recreational southern calamari and squid fisheries in two areas off Tasmania's north coast were closed from Friday, 6 October 2017 to Sunday, 22 October 2017 (inclusive) to provide protection for spawning calamari. The **north-west area** closure applies to all State waters from a southern boundary running west from Woolnorth Point, then to the north at longitude 144° 30'E. The eastern boundary is at Table Cape from a line of longitude 145°43'30". The **central-north area** closure applies to all State waters from Point Sorell to Stony Head — including Port Sorell and kanamaluka/Tamar River. ***Garfish closures as per notice published in 2016***
2018	**Banded Morwong** The 2018/19 TAC was set at 30,992 kg (31 tonnes) and is shared between 1192 quota units. The unit value was equivalent to 26kg/quota unit. The banded morwong TAC was 1.3% under caught in the 2018/19 season. The fishery is closed in March and April 2016. **Determination of market value** Public notice for the change to banded morwong market value from $20/ kilogram to $27/kilogram on 18 October 2018. ***North coast calamari spawning closure*** The Minister has approved a temporary spawning closure of the north coast for the take and possession of all squid species, including southern calamari (*Sepioteuthis australis*) from Monday, 1 October 2018 to Wednesday, 31 October 2018 (inclusive). These closures will apply to both the commercial and recreational fisheries. It will be prohibited to take and possess squid in any area along the north coast during the spawning closure. Transiting the areas in possession of squid taken outside the closed areas is not permitted unless the holder of a Commonwealth authority or a Tasmanian fishing licence (automatic squid jig) and the squid (Gould's squid) were taken outside the closed areas. The area closed to squid fishing are in State waters adjacent to the north coast of Tasmania — (a) Bounded in the west by an imaginary line starting at Cape Grim and then running due west along the line of latitude at 40°40'S to the limit of State waters; and (b) Bounded in the north by the limit of State waters; and (c) Bounded in the east by an imaginary line starting at Cape Naturaliste and then running due east along the line of latitude at 40°50'S to the limit of State waters.

Year	Management Change
2019	***Review of Fisheries (Mackerel) Rules*** The mackerel rules were remade and came into force on 20 February 2019. Public Notice re public consultation
2019	***Banded Morwong*** The 2019/20 TAC was set at 30,992 kg (31 tonnes). The unit value was equivalent to 26kg/quota unit and is shared between 1,192 quota units. The Banded Morwong TAC was 1.2% under caught in the 2019/20 season. The Banded Morwong Fishery is closed in March and April. An instrument of exemption was published to enable banded morwong fishers to transit the TAC area east of Whale Head without making their transit report to factor in poor mobile signal. View Public Notice **INFORMATION (on instrument of exemption)** Subrules 73(2) and (3) provide as follows: (2) the holder of a fishing licence (banded morwong) must not take, or be in possession of, banded morwong in the TAC area unless the number of banded morwong quota units that may be taken under the licence is specified on the licence. (3) However, subrule (2) does not apply to banded morwong possessed by the licencee in the TAC area if – (a) the banded morwong were taken outside the TAC area; and (b) the licencee made a report to the reporting service, in relation to the transportation of the banded morwong into the TAC area, no earlier than 2 hours before entering the TAC area. ***North coast calamari spawning closure*** Timing and area as per the 2018 north coast calamari closure. **Information (from notice)** *(This information does not form part of the notice)* The squid fishery (including calamari and Gould's squid) will be subject to a spawning closure from 1 October 2019 to 31 October 2019 (inclusive). The closure applies to both non-commercial and commercial fishers. This closure is a precautionary measure aiming to restrain catch and limit disturbance during part of the peak spawning activity to help maintain calamari stocks into the future. The closure applies to all squid species for effective compliance purposes. It is prohibited to take squid (including calamari and Gould's squid) in this area during the closure. In addition, a person cannot possess squid for use as bait unless they can prove that the squid being used for bait were purchased from a commercial supplier or was taken by a commercial fisher in an open season and open area. Squid jigs are not permitted to be attached to a line (hand line or rod and line) when in the closed area. Transiting the closed area in possession of squid taken outside the area is not permitted—with some exceptions as detailed in part 2(b)(i) of the notice. See more details at the DPIPWE website (www.fishing.tas.gov.au). Please contact the Wild Fisheries Management Branch on (03) 6165 3044 if you require further information. ***Garfish closure***

Year	Management Change
	In September 2019 a closure notice for garfish that covers part of 2019, 2020 and 2021 for the southern closure, and 2020, 2021 and 2022 for the northern closure. This closure applies to commercial fishers only. View Public Notice Area and timing of these closures is the same as that published in 2016 and 2017.
2020	***Banded Morwong*** The TAC for the 2020/21 Quota Year was set at 30,992 kg (31 tonnes) and was shared equally between 1192 quota units. The unit value was equivalent to 26kg/quota unit. Public Notice The Banded Morwong TAC was 26.7% under caught in the 2020/21 season due to impacts on live fish markets as a result of Covid-19. The Banded Morwong Fishery is closed in March and April. ***Mackerel*** The TAC for the Mackerel Fishery was set for the 2020/21 and 2021/22 seasons for holders of a fishing licence (mackerel A) and fishing licence (mackerel B). Blue mackerel (*Scomber australasicus*) • fishing licence (mackerel A) – 1,496 tonnes • fishing licence (mackerel B) – 499 tonnes Redbait (*Emmelichthys nitidus*) • fishing licence (mackerel A) – 394 tonnes • fishing licence (mackerel B) – 131 tonnes Jack mackerels (Genus *Trachurus*) • fishing licence (mackerel A) – 1,875 tonnes • fishing licence (mackerel B) – 625 tonnes. Public Notice ***North coast calamari closure*** Timing and area as per the 2019 north coast calamari closure.
2021	***Banded Morwong*** The TAC for the 2021/22 Quota Year was set at 35,760 kg (35.7 tonnes) and was shared equally between 1,192 quota units. The unit value is equivalent 30kg/quota unit. Public Notice The banded morwong fishery is closed in March and April. ***North coast calamari closure*** Timing and area as per the 2020 north coast calamari closure.

Appendix D – TSF Fisher Survey

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Private Bag 49 Hobart
Tasmania 7001 Australia
Phone + 61 03 6226 8277
www.imas.edu.au

UNIVERSITY of TASMANIA | IMAS INSTITUTE FOR MARINE & ANTARCTIC STUDIES

Socio-economic characterisation of the Tasmanian Scalefish Fishery: Opportunities to improve viability and profitability

Invitation

This study aims to determine the social and economic characteristics of current commercial operators in the Tasmanian Scalefish Fishery (TSF). This information will support more evidence-based decision making about the socio-economic effects of changes in the fishery. Fisheries researchers Drs Emily Ogier, Jeremy Lyle and Steven Rust from the Institute for Marine and Antarctic Studies (IMAS) are inviting you as a member of the commercial TSF to take part in this survey.

What is the purpose of this survey?

The survey aims to gather socio-economic information about commercial scalefish fishing and aid management and industry to make better informed decisions about socio-economic performance and impact. This survey is aiming to fill gaps in knowledge of the TSF relating to social and economic performance. These knowledge gaps include the costs of fishing, employment and livelihood provision, and fish marketing strategies. Tasmanian fisheries are managed to ensure ecological sustainability, and to take account of the community's needs and interest in living marine resources (*Living Marine Resources Management Act 1995*).

Why have I been invited to participate?

You have been invited to participate in the survey as you are, or have been, a commercial fisher and/or quota unit holder in the TSF in 2018/19.

What will I be asked to do?

You are asked to complete a structured questionnaire administered either by over the telephone or online meeting arrangement (for example, zoom or skype). The surveys will be carried out by the researcher from IMAS (Emily Ogier, Jeremy Lyle or Steven Rust).

Participation is entirely voluntary and information from the survey will be kept confidential.

The survey should take around 60 minutes depending upon your responses and will cover a range of issues relating to the TSF, including fishing operations, costs of fishing, product sales and marketing strategies.

Your data will be temporarily re-identifiable. The IMAS researcher (Emily Ogier, Jeremy Lyle or Steven Rust) will maintain a table during the process of administering this survey that will link your unique respondent identifier to your contact details, and this will be done for the purposes of contacting you in order to undertake this survey. The table will not be stored permanently and will be destroyed by the IMAS researcher (Emily Ogier, Jeremy Lyle or Steven Rust) following completion of this study.

Once the surveys have been completed, your data will be permanently de-identified and securely stored for use in future IMAS research projects in the same general area of this research.

Are there any possible benefits from participation in this study?

Yes, this research will contribute to the establishment of a fishery assessment to aid in the management of the TSF. It will also help identify any economic effects or impacts of changes in the fishery. It will identify potential market opportunities and strategies to improve economic performance for fishers.

Are there any possible risks from participation in this study?

No, all individual survey responses will be treated in confidence and any information that is reported publicly will be generalised across all respondents to describe the commercial fleet as a whole. No results will be directly attributable to individual operators.

What if I change my mind during or after the study?

Involvement in the survey is entirely voluntary. You are at liberty not to answer any specific questions and are able to withdraw from the survey at any time without providing an explanation. If you wish to withdraw your responses, then you will be asked to indicate that you wish to do this via return email to the IMAS researcher (Emily Ogier, Jeremy Lyle or Steven Rust) by 30 September 2020. In this case, your study data will be destroyed by IMAS and the only records we keep will be a note of your initial and your email advising that you no longer wish for your responses to be used in our study.

What will happen to the information when this study is over?

Hard copies of transcripts and electronic documents will be securely stored by the researchers for a period of 5 years after the research project concludes. After this all hard copy documents will be destroyed, while de-identified electronic study data will continue to be securely stored and used for future IMAS research projects in the same general area of this research.

How will the results of the study be published?

A summary of the survey results will be sent to you if you participate in the survey.
General results of this project will be made regularly available to stakeholders through progress reports, research reviews, briefings to resource managers and the Tasmanian Seafood Industry Council, and articles in industry magazines (e.g. Fishing Industry News). Information will also be extended through presentations at industry workshops, and the general public though media releases.

What if I have questions about this study?

If you have any further questions please contact

Emily Ogier	emily.ogier@utas.edu.au	(03) 6226 8225
Jeremy Lyle	jeremy.lyle@utas.edu.au	(03) 6226 8255
Steven Rust	steven.rust@utas.edu.au	(03) 6226 8254

Other researchers involved in the study include:

Nils Krueck	nils.krueck@utas.edu.au	(03) 6226 8226
Satoshi Yamazaki	satoshi.yamazaki@utas.edu.au	(03) 6226 2820
Dugald Tinch	Dugald.Tinch@utas.edu.au	(03) 6226 1877

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 2975 or email ss.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number 20241.



Dr Emily Ogier Assoc Prof Jeremy Lyle Dr Steven Rust

CONFIDENTIAL

Institute for Marine and Antarctic Studies

University of Tasmania

Private Bag 49, Hobart TAS 7001

Tel: 03 6226 xxxx

Socio-economic characterisation of the Tasmanian Scalefish Fishery: Opportunities to improve viability and profitability

[SCRIPT TO BE READ TO PARTICIPANT]

In order to comply with Research Ethics requirements (NATIONAL STATEMENT ON ETHICAL CONDUCT IN HUMAN RESEARCH 2007 updated 2018) I need your verbal consent to participate in this study, noting that:

- Participation is entirely voluntary and should you wish to withdraw during this interview any information you have provided will be deleted. There are no negative consequences for withdrawing.
- You can also withdraw your information at any time up until and including 30 September 2020. To withdraw your information you need to advise the IMAS researcher in writing.
- Any information you provide will not identify you personally but will be grouped with information from other participants, and any personal contact details will be removed from the database at the end of the study.
- The de-identified information you provide can be shared and used for future research projects in the same general area of this research

Based on this and your understanding of the study scope, and any risks and benefits it may pose to you, [REFER TO INFORMATION SHEET PROVIDED], do you give your consent to participate in this study?

[IF CONSENT NOT GIVEN THANK AND TERMINATE, OTHERWISE NOTE DATE/TIME ON QUESTIONNAIRE AND PROCEED TO INTERVIEW]

Date:

Time:

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Socio-economic characterisation of the Tasmanian Scalefish Fishery: Opportunities to improve viability and profitability

Unique ID: _____

Interviewer: _____

Interview date: _____

Interview method: _____

Contents

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PART A. INVOLVEMENT IN SCALEFISH FISHERY

1. *How would you describe your involvement in the Tasmanian Scalefish Fishery*?

(tick only one)

Scalefish Fisher ONLY (i.e. catch fish as an authorised supervisor, not a holder of TSF fishing licence other than a FLP)	
Scalefish Fisher AND Licence Holder (i.e. catch fish, holder of at least one TSF fishing licence)	
Rock Lobster Fisher (i.e. catch Scalefish under the authority of a Rock Lobster licence)	
Other, specify ……	

2. a) *How many years have you been involved in commercial fishing in Tasmania*?
……

b) *How many years have you fished in the TSF*?
……

c) (if not revealed above) *Have you been involved in any other fisheries, if so which fisheries?*

…….

…….

3. a) *Did you fish in the Tasmanian Scalefish Fishery in <u>each</u> of the last five years* (i.e. from 2016 onwards)?
Yes/No

b) (if No in Q3a) *Which years didn't you fish in the TSF?*
Tick

2016	
2017	
2018	
2019	
2020	

c) *Are you expecting to fish in the Tasmanian Scalefish Fishery next year* (i.e. 2021)?

Yes/No/Unsure

4. (If No in Q3a/c, ask as appropriate) a) *What were your reasons for NOT fishing*?; b) *What are you reasons for not planning to fish next year*?(tick as many as apply)

(From Q3b) Reason(s) NOT fished		(From Q3c) Reason(s) NOT likely to fish	
Fish hard to catch		Fish hard to catch	
Beach price too low		Beach price too low	
Demand for fish too low		Demand for fish too low	
Distance to markets too great		Distance to markets too great	
Other work available		Other work available	
Fishing income not needed		Fishing income not needed	
Fishing not the most valuable use of my time		Fishing not the most valuable use of my time	
Health issues		Health issues	
Did not hold a licence		No access to licences	
Vessel not fit for fishing		Vessel not fit for fishing	
Other (specify): ……..		I am retiring from fishing	
		Too much uncertainty (virus etc)	
		Other (specify): ……..	

5. *In the last year you fished, which of the following gear types did you use? Please rank the gear by level of use, where 1 = most used gear type, 2 = second most used, etc*.

Gear type	**Used** *(tick)*		**Level of use (1, 2, …)**
Automatic squid jigging machines			
Danish seine			
Dipnet			
Fish trap			
Gillnets			
Hook and line			
Setline (longline/dropline)			
Octopus pots			
Seine nets			
Small mesh gillnet			
Spears			
Squid jigs			

6. *In the last year you fished, which of the following species did you catch (under the authority of the TSF), … was it a target species, not a target species but mostly retained (byproduct), or a bycatch species which was mostly discarded*?

Species	Caught	Target	Non-target retained	Bycatch discards
Australian salmon				
Bastard trumpeter				
Blue warehou				
Boarfish				
Flathead (tiger or sand)				
Flathead (rock or blue-spot)				
Flounder (all species)				
Garfish				
Gould's squid				
Jackass morwong				
King George whiting				
Leatherjacket				
Mackerel (jack/blue mackerel)				
Marblefish				
Mullet				
Octopus				
Pike				
School whiting				
Shark (all species)				
Silver trevally				
Snapper				
Southern calamari				
Striped trumpeter				
Wrasse				
Yellowtail kingfish				
Other:				

PART B. FISHING REGIONS

1. *When operating in the TSF what regions do you normally fish* (show map or describe)? *Please indicate the main species you target (up to three) in each of the regions you fish.*

Region	Species (1)	Species (2)	Species (3)
South east coast			
East coast			
North east coast			
North west coast			
West coast			
King Island			
Flinders Island			

2. *In total, how many different boat ramps/ports did you land your catch at during your last year's fishing?*

……

3. *What collection arrangements do you typically have with different receivers/buyers? Please identify the collection arrangements from the list below, the proportion of your last year's <u>total catch</u> that was collected in that way, and the main species for which each arrangement applied.*

Type of arrangement	Y/N	% of total catch	Species
Receiver collects catch from the landing site/ or 'halfway point'			
Receiver collects catch from your home/business location			
You transport the catch to the receiver's business			
Catch is sold ex-vessel to the public			
Other:			

4. *Has the coronavirus situation impacted on any of these arrangements;* (if yes) … (*which and) in what ways?*

……

……

……

PART C. TIMING OF YOUR FISHING

1. *How many days did you **fish in the TSF** in your most recent active fishing year (**prior to the coronavirus**) (*e.g. 2019)?

_____ days – Specify which year _____

2. a) *Were there any blocks of time (2 plus weeks) that you did not go fishing in that year*?

Yes / No

b) (If yes) *Please identify the reason for not fishing and the time period* (interviewer to identify month*)*:

Month/ Period	Family reasons	Weather	Other job/ fishery	Management restriction (eg closures)	Low catch rates	Low demand	Low price	Competition from other fishers (incl rec)

PART D. YOUR DECISIONS

1. *After taking account of the weather, what other key factors do you normally take into account when deciding whether or not to go fishing? Rank the 5 factors which affect your decision the most, where 1 = the factor that has the most influence*.

Factors important in the decision to go fishing	Tick	**Rank** (1 to 5)
Market demand (incl. consignment arrangements)		
Beach price		
Time of year		
Other work or family commitments at the time		
Distance to fishing location		
Catchability of targeted species		
Catchability of other saleable species (byproduct)		
Availability of crew		
Need for turn-over / loan payments due		
Potential for seal interactions		
Potential on-water competition with other fishers		
Other specify: ……		

PART E. CATCH HANDLING

1. *What are your **usual procedures** in handling catch (to be retained) once it is removed from the fishing gear.* (Tick whichever are relevant)

	Immediately upon removal from the gear	**Periodically throughout the day**
Bleed fish		
Brain spike fish (Ike Jime)		
Set aside on deck or in a fish bin (no seawater or ice)		
Put into unchilled seawater tank (incl live fish tank)		
Put on ice or into chilled seawater (brine)		
Gill and gut or trunk fish		
Fillet fish		

2. *Are there particular species for which the above handling procedures have been specifically modified for;* (If yes) *… which species and in what ways and for what reasons?*

Species	**Key modifications**	**Main reasons**

3. *How do you mainly store your catch onboard your boat? Please select from the list below:*

(tick as appropriate)

In tub of sea water	
In ice slurry	
In tub, on ice	
In tub (no sea water or ice), covered	
In tank (live fish)	
In freezer	
Other (specify)	

4. *What is your usual practice for handling fish when transferring catches to your fish receiver (excluding direct sales)? Please select from the list below*: (tick as appropriate)

Nally bin	
Plastic liner (separating fish)	
Ice on fish	
Ice on plastic (no direct contact with fish)	
Fish graded for size	
Fish graded for condition	
Fish separated by species	
Transfer by dipnet	
Other (specify)	

PART F. SALES AND MARKETS

1. *Estimate what proportion of your annual catch of your top 5 species were sold to the following types of fish receivers during your last 12 months of fishing (**prior to the coronavirus**). Firstly, what are the species you catch the most?*

Species	Restaurant	Retailer	Wholesale consign	Wholesale processor	Direct ex-vessel
1.					
2.					
3.					
4.					
5.					

2. *Has the coronavirus outbreak impacted on your ability to access any of your usual fish receivers;…* (if so) *… which ones and in what ways?*

…….

…….

3. By type of receiver (interviewer refer to Q1)*, number of businesses, key species sold, frequency of sales and main reasons for supplying receivers during your last 12 months of fishing (**prior to the coronavirus**)?*

Type of fish receiver	**No. of this type of receiver you sell to** *(circle one option)*	**Species sold to this type of receiver** *(top 3, starting with the species you sell the most in volume to this type of receiver)*	**Frequency of sales to this type of receiver** (*circle one option*)	**Main reasons for supplying fish to this type of receiver** *(circle as many as apply)*
Restaurant	NA 1 2-5 6 +	1._____ 2._____ 3._____	Rarely Occasional trips Most trips Every trip	Best price Matches quantity landed Only available market Convenience Reliable market Other. specify: …….
Retailer	NA 1 2-5 6 +	1._____ 2._____ 3._____	Rarely Occasional trips Most trips Every trip	Best price Matches quantity landed Only available market Convenience Reliable market Other. specify: …….
Wholesaler – consigner	NA 1 2-5 6 +	1._____ 2._____ 3._____	Rarely Occasional trips Most trips Every trip	Best price Matches quantity landed Only available market Convenience Reliable market Other. specify: …….
Wholesaler - processor	NA 1 2-5 6 +	1._____ 2._____ 3._____	Rarely Occasional trips Most trips Every trip	Best price Matches quantity landed Only available market Convenience Reliable market Other. specify: …….
Off-the-boat direct sales	NA Relevant	1._____ 2._____ 3._____	Rarely Occasional trips Most trips Every trip	Best price Matches quantity landed Only available market Convenience Reliable market Other. specify: …….

4. (If relevant) *For direct sales to restaurants and the public (ex-vessel sales), estimate the average beach price, range in beach price, and total weight of your top 5 species sold to these receivers during the last 12 months.*

Species	**Av beach price ($/kg)**	**Total annual weight (kgs)**
1.	Restaurant _____ $/kg Public/ex-vessel ____$/kg	Restaurant _____ kg Public/ex-vessel _____ kg
2.	Restaurant _____ $/kg Public/ex-vessel ____$/kg	Restaurant _____ kg Public/ex-vessel _____ kg
3.	Restaurant _____ $/kg Public/ex-vessel ____$/kg	Restaurant _____ kg Public/ex-vessel _____ kg
4.	Restaurant _____ $/kg Public/ex-vessel ____$/kg	Restaurant _____ kg Public/ex-vessel _____ kg
5.	Restaurant _____ $/kg Public/ex-vessel ____$/kg	Restaurant _____ kg Public/ex-vessel _____ kg

5. *What proportion (%) of your catch in the last 12 months did you sell on consignment (e.g. sold through a fish processor/wholesaler to a fish market, and for which the receiver is obligated to pay you based on prices, less fees, achieved when sold at market)?*

……. %

PART G. MARKET STRATEGIES

1. *What are the main sources of information you use when deciding where to sell your catch? Please select all options that apply.*

(tick as appropriate)

Word of mouth from other fishers	☐
From social networks	☐
From the internet	☐
From other receivers	☐
From industry organisations	☐
Established arrangements	☐
Other, specify:_ ……	☐

2. *For the five species you catch the most, how often do you obtain information from fish receivers about demand and price **before** going fishing?*

	Frequency of obtaining information from fish receivers			
Species	**Rarely**	**Occasionally**	**Most trips**	**Every trip**
1.				
2.				
3.				
4.				
5.				

3. *Have you been involved in any of the following market strategies designed to improve market conditions and/or price of scalefish in the last five years? Please select strategies as relevant and your primary goals* (tick as appropriate)

	Goal				
Market strategy	**Access to new market(s)**	**Improved price**	**Improved market security**	**Successful (circle)**	**Comments**
Product grading / QA program ☐	☐	☐	☐	Y / N / Unsure	
Packaging innovation ☐	☐	☐	☐	Y / N / Unsure	
Value adding (post-harvest) ☐	☐	☐	☐	Y / N / Unsure	
Product branding campaign ☐	☐	☐	☐	Y / N / Unsure	
Co-operative marketing strategy ☐	☐	☐	☐	Y / N / Unsure	
Direct sales ☐	☐	☐	☐	Y / N / Unsure	
On-line sales ☐	☐	☐	☐	Y / N / Unsure	

4. *Which of these strategies do you consider were successful and which failed*? Please list in table (Q3) above and note comment:

PART H. IMPACT OF CORONAVIRUS

The next few questions relate to how the coronavirus situation has impacted on your fishing business.

1. *In what ways, if any, have your fishing activities changed, in relation to:*

   a) *Species you target:*

   ……..……

   ……..……

b) Market demand (quantities, ease of selling product):

……

……..

c) Markets (access to specific markets):

……

……

d) Sale prices:

……..

……

2. (If not obvious from above) Have you made any changes to your fishing activity and/or marketing strategies to offset or accommodate the changed situation?

a) Fishing strategy (could include changes types of gear used, location fished, species, crew numbers, etc)

…….

…….

b) *Marketing strategy* (could include direct sales, online co-operative, etc)

…….

…….

Thank you for participating in this part of the survey which has focussed on operational and marketing aspects of the scalefish fishery. The next part will address economic aspects of your fishing and ***relates to the 2018/19 financial year.***

SKIP TO PART K IF RESPONDENT DID NOT FISH IN THE TSF DURING 2018/19

PART I. FISHING VESSEL

1. *Did you own the main fishing vessel that you operated in 2018/19, or was it leased*?

Yes / No / Leased

2. If leased, what arrangement did you have to pay the vessel owner? Please select from the following options:

Share of value of landed catch **Yes / No**

Annual lease fee **Yes / No**

Trip-based lease fee **Yes / No**

Other (specify) _____

2. What is the length of the vessel(s)?

_____ (feet / meters)

3. *What is the engine capacity of the vessel(s)?*

_____(HP / KW)

PART J. ECONOMIC CONTRIBUTIONS

1. *What was your gross income from sales of fish you caught from the Tasmanian Scalefish Fishery in 2018/19?*

$_____

J1. EXPENDITURE

1. *Please provide estimates of your direct costs and administrative costs associated with your fishing (i.e. for all your fishing activities) for the whole of the 2018/19 financial year* (please provide values **exclusive** of GST). *Do you anticipate having any new cost items over the next 12 months that you did not have in the 2018/19 financial year?* (please enter up to five (5) new costs in the spaces provided at the end of each table)

Direct Fishing Costs (2018/19)	**2018/19 $ (excl. GST)**
Boat Fuel	
Ice	
Bait	
Skipper wages / share of catch	
Crew wages / share of catch	
Provisions (e.g. food)	
Protective Clothing	
Other on-vessel fishing costs, including fishing gear that needed to be replaced (provide details)	
(a new cost going forwards)	
(a new cost going forwards)	
(a new cost going forwards)	
(a new cost going forwards)	
(a new cost going forwards)	

Vessel Costs (2018/19)	**2018/19 $ (excl. GST)**
Insurances – vessels	
Repairs and maintenance to boat and equipment (e.g. paint, boat surveys, AMSA fees, slippage costs)	
Moorings, wharf, berthing fees	
MAST fees	
AMSA fees	
Vessel lease charges	
Lubricants (oil)	
Other vessel-related expenses (specify)	
(a new cost going forwards)	
(a new cost going forwards)	

Administrative Costs (2018/19)	**2018/19 $ (excl. GST)**
Fishing licence fees (FLP, FLV, SF gear and/or species licences, and other fishing licence renewal, includes TSIC and FRDC fees)	
Fishing licence lease fees	
Legal & Accounting	
Communication –telephone, fax, email	
Power	
Repairs and maintenance to Buildings/Plant	
Repairs and maintenance to Motor Vehicles	
Rates and Rents for property and equipment	
Quota leasing cost (Banded Morwong ONLY)	
Quota transfer fees (Banded Morwong ONLY)	
Interest and borrowing costs	
Business related non-fishing travel, accommodation	
Membership, association expenses (other than TSIC)	
Insurances – other (non-vessel)	
Other expenses (specify)	
(a new cost going forwards)	
(a new cost going forwards)	

J2. FISHING AS PART OF YOUR WORK

1. *Did you fish in other commercial fisheries while fishing in the TSF in 2018/19?*
   Yes / No

2. (If yes) *Please list these and provide the percentage of your time and total fishing related income spent fishing in each fishery in 2018/19.*

Fishery	% overall time spent fishing	% total fishing related income

3. *Do you also work outside of the catching sector of the fishing industry?*
   Yes / No

4. a) (if yes) *what type of job(s) do you do?* _____

   _____

   b) *Please provide an estimate of the proportion of your overall yearly gross income in 2018/19 that came from fishing:*
   _____ (%)9.1.2

   c) *How many hours do you work overall per week (include the total hours from all jobs you do)? Please provide the weekly average for 2018/19:*
   _____ hours

   d) *Please estimate the % of your overall working time spent in non-fishing jobs in 2018/19:*
   _____ (%)

PART K. FUTURE OUTLOOK

1. *Do you expect to be actively fishing in the TSF in five years time*? **Yes/No**

2. *If you intend to stay actively fishing in the TSF, what changes would you like to see in the following areas? Please describe*:

Fish stocks:
_____
_____

Licensing and access arrangements:
_____
_____

Security of access under current management settings:
_____
_____

Industry representation:
_____
_____

Fish handling:

_____

_____

New species/product development:

_____

_____

Access to markets:

_____

_____

Market conditions (prices, etc.):

_____

_____

PART M. FURTHER COMMENTS

Please provide any additional comments that could assist in understanding economic conditions in the fishery.

_____

_____

_____

_____

_____

Thank respondent for completing this survey

This study has been approved by the Tasmania Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, you can contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 2975 or email ss.ethics@utas.edu.au The Executive Officer is the person nominate to receive complaints from research participants. You will need to quote H20241.