

Introduction to the use of bio-economics in fisheries management for key decision makers

Timothy Emery, Caleb Gardner and Ian Cartwright

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Office Mark Oliphant Building, Laffer Drive, Bedford Park SA 5042
Postal Box 26, Mark Oliphant Building, Laffer Drive, Bedford Park SA 5042
Tollfree 1300 732 213 Phone 08 8201 7650 Facsimile 08 8201 7659
Website www.seafoodcrc.com ABN 51 126 074 048

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Australian Government

**Fisheries Research and
Development Corporation**



An Australian Government Initiative



Non-Technical Summary

Introduction to the use of bio-economics in fisheries management for key decision makers (Project No. 203/748.30 ASCRC)

PRINCIPAL INVESTIGATOR: Timothy Emery, Junior Research Fellow – Population Modelling (03) 6227 7284 and timothy.emery@utas.edu.au

ADDRESS: Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 49, Hobart, Tasmanian 7001

PROJECT OBJECTIVES:

- Increase the awareness of the current application of bio-economics to Australian fisheries;
- Provide information and training for decision-makers on the methods and potential application of economic analyses to fishery problems;
- Examine the role of government in ensuring that the economic benefits from commercial fisheries are realised; and
- Establish linkages between jurisdictions and economists for future interactions.

ABSTRACT

A bio-economic workshop for fisheries managers was held in Queenscliff, Victoria between 23 and 24 February 2015. The workshop was sponsored by the Australian Seafood Cooperative Research Centre, organised by the Institute for Marine and Antarctic Studies, University of Tasmania and facilitated by Ian Cartwright from Thalassa Consulting. The workshop attendees included 20 fisheries managers from the eight Australian jurisdictions as well as 10 invited speakers including prominent international fisheries economists Ralph Townsend (University of Winona, U.S.) and Seth Macinko (University of Rhode Island, U.S.).

At the workshop, participants discussed the importance of economic objectives and the role of government and industry in attaining those objectives. It was highlighted that many jurisdictions do not have operational economic objectives in fisheries management plans or harvest strategies. It was also advised that the National Strategy Guidelines have been released with the aim to increase the use of economic and social indicators or target reference points within harvest strategies, as required under an Ecological Sustainable Development (ESD) framework. Participants identified that the historical focus of management has been on ensuring biological objectives are met and this has meant that less money has been allocated to economic and social research. A presentation from Econsearch, who have been collecting economic data from the commercial fishing industry in South Australia for the last 17 years, discussed the value of a time series of economic data that can increase the credibility of industry when discussing marine resource use with government. This data can be collected at a low costs relative to biological data and in South Australia is funded through licence fees.

Participants learnt how economic analyses, such as bio-economics, can identify management changes that can improve fishery yield. Concurrently, they were advised that objectives need to be appropriately defined in order to determine how the fishery should be managed, the associated trade-offs and who receives the benefits from improvements in economic yield. The Goolwa Pipi fishery was discussed as a case-study where economic analyses and the formulation of decision rules have improved yield. Furthermore, participants heard how the use of economic analyses and bio-economics has increased profitability in the Shark Bay Prawn trawl and Western Australian rock lobster fisheries respectively. In New Zealand, economic information has been used to assess the impact of spatial closures and other management changes in terms of foregone economic value from harvesting and processing of catch, in order to ensure “best value use” of the resource. In discussing these examples however, the importance of initial interest and later acceptance by industry was identified as crucial.

This could be facilitated through simple communication and education of industry on economic principles.

The importance of harvest control rules and clear decision-rules in total allowable commercial catch (TACC) setting were highlighted in discussions surrounding the inability of individual transferable quotas (ITQ) to consistently foster industry stewardship. This was highlighted as a particular issue within heterogeneous ITQ fisheries where there is a separation of ownership and control between those actively fishing (lease fishers) and those owning the quota (quota owners). Participants heard how self-governance among industry can often be difficult with heterogeneous groups of fishers, particularly when industry institutions require unanimous or high-majority consent. New Zealand's attempt at a self-governance model was presented and participants learnt how government can play a major role in ensuring the transaction costs of self-governance are decreased through developing enabling legislation to devolve responsibility to industry, enforcing industry agreed rules and regulations and making a long-term commitment to self-governance to reduce uncertainty among industry over the benefits of self-governance.

Participants engaged in interactive activities using audience response tools (clickers) looking at the difficulties of making collective decisions within heterogeneous fisheries and economically rational decisions without a full cost-benefit analysis. In the former, it was highlighted that the increasing separation of ownership and control between those actively fishing (lease fishers) and those owning the quota (quota owners) can lead to a divergence in incentives and behaviours, which means relying on consensus amongst industry through co-management doesn't necessarily produce good management decision-making. In the latter, it was shown that people often make economically irrational decisions due to an absence of information and other values not captured within cost-benefit analyses. This was later expanded upon in discussions about the usefulness of economic analyses in valuing use (e.g. recreational fishing enjoyment) and non-use (e.g. existence) values through, for example, willingness to pay analysis. Participants heard how this can be used to calculate, for example, the enjoyment of recreational fishing for a particular species by working out how much people are willing to pay to go fishing on a given day. This can then assist with resource allocation and TACC setting.

Participants also discussed whether the community should receive some benefit from the profits (resource rent) that are created from fishery harvests. The need to consider this is important because fisheries management increasingly aims to reduce employment with ITQs to increase rents to the smaller number of remaining vessels; the traditional view of fisheries benefiting the community through employment no longer makes sense when management actively reduces employment with ITQs. Options for providing a share of the rent to the community include through a royalty. It was highlighted that many management changes including ITQs are introduced without adequate consideration of community objectives. In Alaska, U.S. there has been attempts to address social outcomes from ITQ allocations, such as by providing community development quotas to native groups. It was highlighted that clearer fishery objectives in legislation would help management decision-making, especially where social and economic objectives are conflicting.

In concluding, participants noted the value of the workshop and similar forums for increasing knowledge and understanding of fisheries management concepts, networking with other jurisdictions and capacity building. Participants expressed an interest in the formation of an Australian Professional Association of Fisheries Managers to facilitate further engagement on fisheries issues.

OUTCOMES ACHIEVED

The workshop provided Australian fisheries managers with an introduction to contemporary fisheries management approaches both in Australia and overseas, including bio-economic analysis to increase their understanding and uptake of new concepts in fisheries management. Within this interactive forum,

fisheries managers were able to learn and discuss how other jurisdictions are collecting and analysing economic data to inform their management approach. Participants felt that these types of workshops were a valuable opportunity to network with managers from other jurisdictions and liaise on common fisheries management issues and supported further engagement through the formation of an Australian Professional Association of Fisheries Managers.

LIST OF OUTPUTS PRODUCED

- **Final minutes of the bio-economic workshop for fisheries managers**
- **FISH newsletter article on the outcomes of the workshop**

ACKNOWLEDGEMENTS

The organisers would like to thank all invited workshop speakers, with special mention to overseas contributors, Seth Macinko (University of Rhode Island, U.S.), Ralph Townsend (University of Winona, U.S.) and Steve Halley (Ministry of Fisheries, New Zealand). We would also like to thank DEPI, Victoria for allowing us to host the workshop in their offices at Queenscliff, Victoria.

Workshop on the use of bio-economics and role of government in achieving economic objectives for key decision makers

23 – 24 February 2015
Queenscliff, Victoria

1. Introduction

1.1 Welcome, introductions and overview

The Chair welcomed participants to the bio-economic workshop and provided a brief overview of the rationale for its inception. It was outlined that the workshop was sponsored by the Australian Seafood Cooperative Research Centre (Seafood CRC) and was one of their Future Harvest Projects aimed at increasing the knowledge and use of economic analyses and instruments in fisheries management and policy.

1.1.1. Participants at the bio-economic workshop

Chair

Ian Cartwright (Thalassa Consulting)

Fisheries Managers

Keith Rowling (PIRSA)
Brad Milic (PIRSA)
Graeme Baudains (WA Department of Fisheries)
Clinton Syers (WA Department of Fisheries)
Jo Klemke (DEPI)
Melissa Schubert (DEPI)
Kate Simpson (DEPI)
Roger Van Hilst (DEPI)
Andrew Goulstone (NSW DPI)
Steve Sly (DPIF NT)
David McKey (DPIF NT)
Steve Auld (AFMA)
Don Bromhead (AFMA)
Marcus Finn (AFMA)
Brodie MacDonald (AFMA)
Frances Seaborn (DPIPWE)
Hilary Reville (DPIPWE)
Andrew Thwaites (Fisheries QLD)
Michael O'Neill (Fisheries QLD)

Invited Speakers

Caleb Gardner (University of Tasmania)
Klaas Hartmann (University of Tasmania)
Rafael León (University of Tasmania)
Emily Ogier (University of Tasmania)
Julian Morison (Econsearch)
Roger Edwards (Goolwa Pipi Harvesters' Association)
Simon de Lestang (WA Department of Fisheries)
Ralph Townsend (Winona State University, U.S.)
Seth Macinko (University of Rhode Island, U.S.)
Steve Halley (MFish, New Zealand)

Observers

Kate Brooks (KAL Analysis)
Crispian Ashby (FRDC)

Executive Officer and Speaker

Tim Emery (University of Tasmania)

1.2 Workshop objectives and agenda

The Chair highlighted the specific aims for the workshop:

- To increase the awareness of the current application of bio-economics to Australian fisheries;
- To provide information to decision-makers on the methods and potential application of economic analyses to fishery problems;
- To examine the role of government in ensuring that the economic benefits from commercial fisheries are realised; and
- To establish linkages between jurisdictions and economists for future interactions.

The agenda for the workshop was adopted with only one minor change. The Australian Professional Association of Fisheries Manager's survey was postponed till the last item of the agenda on the second day.

2. Economic objectives

2.1 Overview of fisheries manager's economic objectives and role of government survey

Tim Emery gave an overview of the results of the survey that fishery managers were asked to complete prior to attending the workshop. Questions centred on economic objectives, data collection, fishing cooperatives and devolution of management responsibility to industry along with manager education and training.

Economic objectives

The majority of respondents identified implicit or explicit economic objectives within their jurisdiction's legislation and that their focus in meeting these economic objectives was through rationalising management costs (76% of respondents), removing inefficiencies so that the fixed and variable costs of fishing reduce (71%) and facilitating rationalisation of the fishing fleet (62%). Approaches that were seen as less important in meeting economic objectives included facilitating market access and value adding to the fishery product (5%) and creating employment opportunities (9%). While historically there may have been a focus on industry being solely responsible for ensuring fleet-wide economic efficiency, 87% of fisheries managers felt that both government and industry had an equal responsibility in maximising fishery economic yield.

Economic data collection

Only 55% of respondents identified that their jurisdiction collected economic data with the most common being market and quota trading prices. The collection of price data however, was inconsistent and usually spread across different spatial or temporal scales, depending on the fishery and jurisdiction. In the Commonwealth and South Australia, external organisations (ABARES and Econsearch respectively) were responsible for collecting specific fisheries economic data (e.g. operating costs) through industry surveys. Of the 55% of respondents whose jurisdictions collecting economic data however, only 50% had performance indicators based on fishery economic information and only 33% of those had a target or limit reference point. Some of the most common limitations to the collection of economic data among jurisdictions were confidentiality concerns and reluctance among industry to provide information, as well as a lack of financial resources and capacity within organisations.

Fishing cooperatives and devolution of management

Fishing cooperatives or industry associations were present in 95% of all fisheries whose managers undertook the survey but the majority (95%) of these were not inclusive of all fishers. Formal devolution of management responsibility to industry cooperatives or associations was not common across fisheries jurisdictions; however there was a varied response from managers (some strongly disagreed while others strongly agreed) on whether they believed government was reluctant to formally devolve responsibility to industry. The reluctance could stem from 76% of fisheries managers indicating that industry had opposed management changes such as ITQs or spatial management, which were designed to improve collective economic yield.

Fishery manager education and training

The educational background of the majority of managers was in biological sciences (62%) and most agreed (81%) that in their current role there was an expectation that they are familiar with economic theory. Most (71%) also agreed that further training and education in economics would improve their capability as a manager.

2.2 Review of Australian fisheries management objectives related to economic objectives

Emily Ogier gave an overview of a Fisheries Research and Development Corporation (FRDC) project looking at ways to optimise the opportunity presented by management objectives within Australian fisheries to meet and demonstrate sustainability. As part of this work, the project team are examining legislative, management and operational objectives (biological,

economic and social) across fisheries reported in the Status of Australian Fisheries Stocks 2014.

The project aims to develop a large database of objectives across key fisheries to examine whether all ecological sustainability development (ESD) principles are covered across legislative, management and operational levels. The project will also determine whether there is convergence of objectives between different jurisdictions and the extent to which high level objectives are translated into operational objectives. Emily advised that through the project they hope to identify ways to integrate high level objectives into operational objectives and examine and identify whether objectives are aligned with community expectations and public values for marine resources.

Emily gave an overview of the objective hierarchy and conceptual model, highlighting that high level (ESD) legislative objectives across Australia are framed through overarching national or jurisdictional policy drivers as well as public expectations for fisheries resources, which are highly varied across jurisdictions. She also underlined how management objectives are shaped by fisheries management plans and become operationalised through harvest strategies with the level of precision related to whether that fishery has performance measures (e.g. decision rules or reference points). This conceptual model is being compared to what is in place across Australian fisheries jurisdiction through a gap analysis (e.g. coverage of ESD components).

Emily gave an overview of the results of the study to date, advising that in some jurisdictions legislative objectives are predominantly high level and in others a mixture of high level and specific lower level objectives. Across jurisdictions, the congruence (theme and level) of biological objectives was high but economic and social objectives were low. High level implicit or explicit economic objectives included: (i) maximising the use/benefit (Comm, NSW, VIC, SA, SA and NT); (ii) industry access, development and viability (NSW, VIC, WA, SA and NT) and; (iii) minimise cost (through governance) (Comm, SA, VIC and NSW). In some jurisdictions, management objectives were direct derivatives of legislative objectives (i.e. paraphrased), while in others fishery specific, with limited evidence of consideration of interactions between objectives and the associated trade-offs. While all fisheries included biological objectives, this was not equivalent for social, economic and governance management objectives. The majority (68%) of fisheries had high level objectives operationalised but these were often weakly defined and typically process-orientated. Biological and ecological operational objectives were typically determined through Ecological Risk Assessment (ERA) or ESD reporting process but a similar process was absent for social, economic and governance management objectives. Economic objectives were only partially-operationalised through, for example, harvest strategy policies and the use of B_{MEY} reference points in some (8/84) fisheries.

Emily suggested outcomes of the project could include: (i) developing a template of objective hierarchies for various fishing scenarios; (ii) best practice operational objectives, performance indicators and measures for generic conceptual objectives and; (iii) case studies of effective mechanisms to improve alignment and translation (congruence) of objective hierarchies (high level legislative to operational).

Discussion

The cost and benefits of “hard-wiring” actions into operational objectives was discussed and it was noted that this can be difficult when fishery indicators could be trending a particular way due to a multitude of reasons and there may not be an immediate obvious response. It

was highlighted that the FRDC project wasn't attempting to prescribe an individual "best practice" response for each fishery but only examine the presence/absence of "hard-wiring" of operational objectives across different jurisdictions and costs and benefits.

The difficulty of developing operational objectives within fisheries management plans and policies when high level legislative objectives are not explicit was also raised in relation to the confusion it can create for managers determining priorities. It was highlighted, however, that the absence of explicit high level objectives and then operational objectives specifying management actions can create flexibility for managers trying to justify management decisions and may not be a barrier unless there are hard political decisions to make. In this case, the minister could choose their preferred approach and there is no guarantee that this will align with that of the managing authority. Alternatively, "hard-wiring" of operational objectives was also seen as a positive by some in being able to justify decision-making and circumvent some of the political issues that arise from changing management measures as well as reducing time and costs.

Industry interest and engagement was viewed as an important prerequisite by jurisdictions for the development operational economic objectives. When there is strong collaborative discussion between managers and the commercial industry it was noted there can be greater specificity in objectives. The presence of other sectors (e.g. recreational or indigenous) however, was seen as an obstacle to the development of operational economic objectives and when specificity was lacking, uncertainty in management outcomes.

It was also discussed how legislative economic objectives related to maximising benefits to the community has been narrowly interpreted by many jurisdictions as maximising returns to industry through targets such as maximum economic yield (MEY). Alternatively, the public may view this objective as one of maximising returns for regional communities through the collection of a royalty.

3. Role of government and industry in economic decision-making

3.1 Should management stop at sustainability and leave economics to industry?

Caleb Gardner gave a presentation on how bio-economics can be used to increase economic yield in commercial fisheries through changes to: (i) management decisions/regulations; (ii) business structures and; (iii) production through enhancement or translocation. He provided some examples of Seafood CRC Future Harvest projects that have improved economic yield within commercial fisheries, such as translocation of rock lobster in Tasmania and the shift to MEY target reference points in both Western Australia and Tasmania. Concurrently, he also provided examples where projects were not implemented due to a lack of industry acceptance, such as regional size limits for rock lobster in Tasmania. Given the latter, he questioned workshop participants on the role of government and industry in meeting fishery economic objectives.

Caleb stressed that economic objectives need to be appropriately defined so that managers can determine how the fishery should be managed, the associated trade-offs and who receive the benefits from improvements in economic yield. For example, should economic target reference points be set by industry or inclusive of all stakeholders? While a MEY target reference point increases the economic benefit to quota owners, it simultaneously reduces the amount of seafood available for consumers and reduces employment in the fishery. A number of examples were provided from different jurisdictions, which indicated how the economic benefit to the quota owner is often prioritised under an individual transferable quota (ITQ)

management system at the expense of other stakeholders (e.g. community). Caleb highlighted that government has a responsibility to determine the trade-offs of legislative objectives prior to their institution to prevent a plethora of competing performance indicators and target reference points within management frameworks with no clear method of prioritisation.

Discussion

Participants discussed the need to identify who and what fisheries are being managed for in order to develop and prioritise legislative objectives. It was highlighted that this was difficult when management priorities may change between governments in power. As each political party seeks to differentiate themselves from each other it can be difficult for managers to ensure that the priorities for objectives don't change. It can also be problematic when stakeholders within the one or multiple sectors have varied perspectives on which objectives should be prioritised. The importance again of government initially prioritising objectives was raised as a solution to this issue.

3.2 TACC decision-making: unreliability of stewardship and importance of economic decision rules

Rafael León gave an overview of his research examining stewardship in Australian and New Zealand ITQ systems through investigating total allowable commercial catch (TACC) decision-making. Theoretically, ITQs promote stewardship by creating an incentive for fishers to ensure the stock remains healthy, as it directly impacts on their quota asset value.

Rafael investigated 35 rock lobster and abalone ITQ fisheries to examine whether associated management advisory committees chose to increase or decrease the TACC relative to the current state of the stock (e.g. increasing or decreasing catch rates). If the TACC was decreased when the catch rates were declining he inferred this was evidence of stewardship and aligned with economic theory. In the reverse if the TACC was increased when the catch rates were declining then there was no evidence of stewardship.

Rafael found evidence of a lack of stewardship in various ITQ fisheries, indicating that the allocation of quota units itself, is not sufficient to promote stewardship and additional conditions are required. Rafael highlighted several reasons why stewardship may not have been evident during the TACC decision-making processes he investigated. These included fishers not understanding the difference between changes in revenue and profit and being unable to estimate future changes in costs as easily as changes in revenue. Also the uncertainty surrounding modelling and stock rebuilding outcomes could be of concern and there may be difficulties achieving a consensus view among large groups of heterogeneous fishers. The latter of which could include fishers with high discount rates who therefore have less incentive to reduce revenue in the short-term. Fishers may also be less inclined to reduce the TACC in the short-term if they perceive the exclusivity of their right is weak (i.e. can be caught by other sectors).

Rafael advised that the results highlight the importance of objective information (e.g. bio-economic modelling) with associated harvest control rules to aid TACC decision-making.

Discussion

Participants discussed the inherent heterogeneity within the commercial fishing sector caused by diverse business structures, motivations and incentives (e.g. the divergence in incentives between lease fishers and quota owners) and how this can lead to differences in opinion in

TACC decision-making and difficulties in reaching collective agreement on management changes. Short-run incentives to maximise revenue rather than long-term stewardship it was noted are particularly apparent in some fisheries where those actively fishing are leasing quota units.

Participants also discussed that stewardship could also be confused in the study with shelving (i.e. lowering or refusing to increase the TACC to maintain prices). It was highlighted however that if you used a definition of stewardship which meant the fishery targets economic yield, (which is more aligned with prevailing economic theory), then there would have been even less evidence of stewardship. It was also advised that the lack of adjustment on some TACCs could have been due to pre-agreed plans or rebuilding strategies for stocks and not necessarily a lack of stewardship.

It was noted that while the TACC setting process in many jurisdictions allows industry to voice their opinion or put forward a case for how the TACC should be set, ultimately the final decision rests with government. If the results of this study indicate that the correct TACC decisions might not have been made, maybe government and industry are equally responsible. Participants discussed that government can't step back once ITQs are instituted and let industry necessarily make decisions surrounding TACC setting. Rather there needs to be an analysis of different options for setting the TACC and measurement of economic performance in the fishery to inform and justify decision-making.

3.3 Engaging stakeholders in putting economic policy into practice

Ian Cartwright gave an overview of his experience working with stakeholders on various advisory groups and as a member on the AFMA Commission. He advised that in his experience there have been various examples of fishers disputing or rejecting management changes that could be construed as stewardship and that were likely to improve the long-term economic profitability of the fishery. He believed this was due to: (i) a fundamental lack understanding among fishers as to the collective benefits of management changes; (ii) inherent fears and inertia to change; (iii) a lack of trust between industry and government; (iv) the increasing separation of ownership and control between those actively fishing and those who own the quota; (v) other sectors (e.g. recreational sector) lobbying politicians against management measures and; (vi) the perception within industry that managers should leave economics and business outcomes to them. Ian suggested getting economics into rational decision-making and management advisory committees is difficult and requires managers to get more actively involved, collect economic data and industry to have strong leaders advocating economic change.

3.4 Industry perspective on the importance of economic objectives and bio-economics

Roger Edwards gave an overview of his experience as an industry representative within various South Australian fisheries and advised that he had learnt that management decisions needed to be based on strong science and sound economic targets. He stressed the importance of economics in relation to increasing industry profitability and advised that some of the barriers to adoption of economics within fisheries, included: (i) a lack of clear direction in fisheries legislative objectives; (ii) continual reductions in the exclusivity and security of quota owner's ITQ rights, which increase discount rates; (iii) management regulations that reduce fisher efficiency such as input controls in ITQ fisheries; (iv) a lack of clear, concise and straightforward economic advice to fishers; (v) a lack of compulsion to collect economic

data and; (vi) a lack of a funding of economic research to the same extent as biological research.

Roger was of the opinion that economic objectives such as maximising profits needed to be included in legislative objectives as well as management plans to utilise economics and promote the funding of research to collect and analyse economic data. He also advised that economically inefficient management measures needed to be removed, resource shares allocated and industry educated on the benefits of economic analysis through improved communication, which would overcome disinterest and misunderstanding.

Discussion

The uniqueness of the Goolwa pipi fishery was discussed in relation to how the price is directly affected by supply. It was suggested that the optimal utilisation objective of the South Australian fishery in relation to community benefit would be to set a higher TACC so there is more supply on the market, while the optimal utilisation in relation to quota owners is to have a lower TACC, which maximises their economic rent. It was challenged to what extent economic rent should be maximised when overseas investors own the majority or all of the quota units in a fishery.

The education of industry on economic principles was also identified by participants as important first step to the increased uptake of economic analyses within fisheries management frameworks. It was highlighted that the Commonwealth has placed economists on management advisory committees and resource assessment groups to increase awareness and that there are FRDC young leaders programs and economic workshops held for industry with the aim of increasing understanding of fishery economics. The importance of managers using simple terminology when discussing the results of economic analyses with fishers was also raised by participants as necessary to improve comprehension.

4. Case studies on the use of fisheries economics and bio-economics

4.1 Bio-economics in Australian data rich commercial fisheries

Simon de Lestang demonstrated the usefulness of economics in fisheries management and policy by providing a presentation on two fisheries (Shark Bay Prawn Trawl and Western Rock Lobster) in Western Australia where economic data is used to assist in management.

In the case of the shark bay prawn trawl fishery his group undertakes an empirical MEY analysis to direct the amount of effort. While the primary objective in the fishery is sustainability, economics is used as a supplementary tool to provide advice. Simon highlighted that an issue in the fishery was that there were periods during the year where fishers were losing money either side of moon fishery closures. A subsequent empirical analysis recommended that moon closures were extended to shorten the fishing periods and increase profitability during those times the fishery remained open. This had the impact of reducing fishing effort and moving the fishery slightly towards MEY (although evidence suggests further effort reductions are required). Simon stressed the benefit of the economic work undertaken in the western rock lobster as the reasoning behind fishers' interest in pursuing these economic management changes in the shark bay prawn trawl fishery.

In the western rock lobster fishery there is a bio-economic model used to set particular targets. While the primary objective in the fishery is sustainability, economics is a secondary objective. Simon advised that prior to the large reduction in recruitment in the late 2000s,

industry were not interested in pursuing a MEY approach and believed they were responsible for looking after economic profitability, not government. Following the recruitment failure and concurrent effort reductions on the basis of sustainability reasons, the fishery inadvertently ended up at MEY anyway. This allowed industry to experience the higher catch rates and profitability associated with MEY (also caused in part by a price increase) and lead to a shift in the opinion of the usefulness of economic analysis in fisheries management frameworks.

Simon highlighted that in the western rock lobster fishery there is an economic model attached to the population dynamics model, which includes price-catch and costs of fishing relationships. Sensitivity tests revealed that although the MEY target was resilient to underlying assumptions in costs, it was highly sensitive to changes in the price catch relationship. He highlighted that there was some disagreement over the price-catch relationship and that it was difficult to convince industry sometimes that the targets were meant to ensure collective profitability, not solely individual profitability.

4.2 Harvest strategies to meet economic objectives in data poor fisheries

Keith Rowling gave an overview of the development of the National Harvest Strategy Guidelines on behalf of Sean Sloan, which he advised were endorsed by the Ministers of each Australian jurisdiction at a meeting in December last year. Keith stipulated that harvest strategies were widely used but inconsistently applied in the Australian fisheries management context. Economic and social indicators or reference points were also not widely used in harvest strategies as required under an ESD framework and there was an absence of target reference points. Given that harvest strategies are recognised as best practice in fisheries management by organisations such as the Marine Stewardship Council (MSC), this FRDC project aimed to improve their design and congruence across Australia fisheries.

Keith highlighted how harvest strategies utilise the overarching legislative objectives to develop defined operational objectives. Performance indicators are then identified with associated reference points based on acceptable levels of risk. Decision control rules are also developed to control catch or effort and a monitoring strategy put in place to assess fishery performance. Keith used the example of the South Australian Goolwa pipi fishery as an example of how fishery performance is assessed using biological and economic indicators that are linked to operational objectives with associated reference points and decision rules. The pipi fishery is unique however, in that many fisheries don't have performance indicators or decision rules linked to economic factors and this prevents them from maximising profitability. Keith stressed that the FRDC project highlighted the need to develop cost effective methods to integrate economic information into harvest strategies and formulate proxies for MEY as an alternative to high cost bio-economic models.

4.3 New Zealand perspective on the use of economic data and bio-economics

Steve Halley presented an overview of the collection and use of economic data in New Zealand. He highlighted that the collection of economic data was driven by overarching policy (Fisheries 2030), legislation and more specifically in fisheries management plans.

Steve stipulated that there was a rich variety of economic data collected from commercial fisheries, such as quota transfer prices but there was not a lot of money spent on socio-economic research. He stated that about NZ\$20 million is spent on biological research but only NZ\$300,000 on socio-economic research. Despite using economic instruments such as ITQs, the focus of management continues to remain on biological objectives.

Steve advised that some of the economic data collected was used to measure fishery performance. He provided the example that an assessment of quota values revealed an increase of 40% between 1996 and 2007. Economic data was also used in the setting of biomass targets. While there was no legal obligation to manage stocks to an MEY target reference point (and an absence of cost information prevents its determination anyway), in some fisheries a quasi-MEY is achieved through collaboration with the fishery industry. For example, in New Zealand rock lobster the fishery industry decided they wanted a higher CPUE to reduce costs so were prepared to reduce catches in the short-term and shift towards an MEY target. This had the impact of increasing catches for both commercial and recreational sectors.

Steve discussed the catch balancing regime or annual catch entitlement (ACE) in New Zealand, where fishers are required to balance their catches with ACE and pay a deemed value for anything in excess. The deemed value is a unique economic tool and is a civil financial penalty that is set at a rate that will remove the excess profit from the landing of the fish but not remove the value entirely such that fishers are incentivised to discard. Thus the value is set between the ACE price and port price and does an effective job of managing over-catch.

Steve highlighted how economic analyses are used to assess the impact of spatial closures in terms of forgone economic value from direct harvesting and processing of catch. Steve suggested that this type of economic analysis can assist in ensuring the “best value use” of the resource across a variety of users. A number of issues remain however, including a lack of economic data, realistic governance, approval from stakeholders on how policy outcomes are informed by economic data and an inability for industry to adapt to changes in marine space and accept economic impacts.

Discussion

Participants discussed how to define “best-value use” and that it should include biological, economic and social values but working out how to amalgamate these to get a meaningful outcome is difficult.

Participants discussed how there was a large economic loss incurred by the community when the recreational sector harvest rock lobster in New Zealand. It was discussed that the historical allocation of 70% of quota for rock lobster to the commercial sector reflected this to an extent but it was difficult for a government to reduce the recreational share of rock lobster, despite these divergent values.

Participants also noted how administration costs were reduced through the New Zealand ITQ system by separating ACE from quota to increase the efficiency of transactions and using a deemed value system to balance catches, reducing the incentives of fishers to discard.

5. Economic rationality interactive exercise

5.1 Implications of assumed collective economic rationality: an interactive exercise

Tim Emery gave an overview of his experimental economic research examining the impact of assignment problems in quota managed fisheries. He highlighted how assignment problems are caused by variation in the spatial and temporal productivity of the stock and proximity of fishing grounds to ports/markets. This creates divergence in the economic value of quota units

and results in competition among fishers within those areas or during times that profitability is high, dissipating economic rent through production (e.g. stock depletion) and congestion (e.g. gear conflict) externalities. Tim advised that assignment problems could be resolved through either fisheries managers fully spatially or temporally delineated the quota units or fishers agreeing to collectively coordinate their fishing effort.

Tim gave an overview of how experimental economics can be used to gain an insight into potential outcomes of public policy prior to their implementation to avoid unexpected outcomes. Experimental economics was used in his research to examine whether groups of participants (acting as fishers) could resolve assignment problems through agreeing to coordinate their fishing effort within a dynamic fishing environment. Results indicated that the absence of communication prevented participants from coordinating their fishing effort and led to a cyclical pattern of resource depletion and dissipation of economic rent. The introduction of communication among participants did not lead to significant improvements in coordination and the prevention of assignment problems within heterogeneous (quota owners and lease fishers) fisheries relative to homogenous (quota owner only) fisheries. Tim highlighted that this was because lease fishers were less likely to make socially-optimal decisions due to having: (i) inequality in wealth; (ii) insecurity in tenure and; (iii) asymmetric information exchange. The divergence in incentives between the two types of fishers meant that it was difficult to elicit trust and maintain cohesion within heterogeneous groups. The results provide an insight into the difficulties associated with collective decision-making within heterogeneous fisheries.

Participants at the workshop engaged in an interactive experimental economic simulation using audience response tools (i.e. clickers). In the first experiment, ten participants were allocated the role of either a quota owner or lease fisher and asked to make decisions about where to fish and how much quota to allocate to particular areas, within a dynamic fishing environment. Six rounds were run and participants were unable to coordinate to prevent assignment problems despite being able to communicate. In the second experiment, the same simulation was run but with only six participants who were all allocated the role of a quota owner. Once more, participants were unable to coordinate to prevent assignment problems and reduce economic rent dissipation despite being able to communicate. Both experiments highlighted the difficulty of coordination and preventing assignment problems.

6. Bio-economics interactive exercise

6.1 Crystal ball gazing: bio-economic modelling exercise

Klaas Hartmann gave an interactive presentation looking at the economic cost of decision-making, illustrating the key elements of cost-benefit analysis using some everyday examples, such as purchasing a vehicle or installing solar cells. In doing so, Klaas highlighted the difficulties of making an informed decision in the absence of a full cost-benefit analysis and knowledge of an individual's discount rate. An individual's discount rate allows an adjustment to be made to those future costs and profits on today's values. If an individual's discount rate is high, then things that happen in the future will have less impact on their decision today. For example, if buying a new car will require a considerable service in ten years' time, this has less influence on that person's decision to purchase it today.

Klaas reiterated the difficulties of making economically rational decisions due to imperfect information, before suggesting that people also make economically irrational decisions because they place a higher utility value on externalities, such as having a safe vehicle, reducing emissions or receiving enjoyment from owning a new vehicle. Therefore, if people

seemingly make economically irrational decisions, it is because some externality exists that has been overlooked in the cost-benefit analysis.

Klaas highlighted that many externalities are often overlooked or difficult to quantify in a cost-benefit analysis such as (using the example of a fishery), a failure to include all costs (e.g. labour costs of family members), sunk costs (e.g. costs of holding existing quota units) and benefits (e.g. value to community of a scenic fishing port). He also mentioned that there can be large heterogeneity in the utility of individuals, which can make it difficult to determine the cost or benefit for the collective.

Klaas discussed cost benefit analysis within fisheries and asked participants to determine whether a fishery with a zero net present value was worth retaining. He advised that if a fishery had a net present value of zero it meant that the resource rent was nil, so quota units weren't worth anything but the fishery was still providing employment and a fair wage to fishers, meaning labour costs were covered and there was still a benefit to the community through food production. If a fishery had a positive net present value then Klaas advised there would be a higher possibility of investors being present in the fishery, who are able to make a positive return on their asset without actually fishing. The presence of a positive net present value in fisheries and investors has led to discussions about whether government should collect a royalty to ensure the financial benefits from the marine resource don't leave the community, which is of particular concern if there are overseas investors.

Klaas used the example of southern rock lobster in Tasmania to discuss the advantages and disadvantages of setting a TACC higher or lower. If the TACC is set lower, then this can increase the quota value and lead to higher resource rents, while if it is set higher, it can lead to greater employment and food production. How it is set is dependent on over-arching objectives for the fishery but is usually targeting MEY, which benefits quota owners to the detriment of lease fishers.

Klaas also highlighted the usefulness of bio-economic models in working out the economic value of prospective management changes in fisheries. He provided the example of regional changes to male and female size limits in the Tasmanian southern rock lobster fishery that were shown to significantly increase (by \$100 million) the profitability of the fishery. Despite the potential economic benefit however, these changes have been consistently opposed by industry due to a lack of trust in the model and a divergence of opinion between generally quota owners and lease fishers. He then asked participants whether management in this instance should force changes on fishers that increase the net present value of the fishery and most people believed that a compromise should be reached instead. The difficulty with this approach in reality however, was that a divergence in opinion among industry made it difficult to reach a compromise.

In concluding, Klaas revisited the issue of equity and highlighted that these management or TACC changes predominately benefit quota owners at the expense of other lease fishers but that this may change if some royalty could be collected for the community. He asked participants whether a royalty should be captured for the community and there was an even split between those saying yes and no. The overall objectives for the fishery were noted as an important guide to decisions over royalties.

Discussion

Participants heard how in New Zealand they try to factor community benefit into decision-making through such things as cost recovery and limitations on foreign ownership of quota. It

was highlighted that in New Zealand managers look at the overall economic benefit from changes to fisheries management rather than looking at how it may impact specific sectors (e.g. quota owners or lease fishers).

Participants discussed how net present value is usually a technique used in investment analysis and is a difficult concept for people to understand. An alternative approach was suggested using annual average fisher profit now and in the future, which would improve comprehension. Participants heard this was currently done in Western Australia and had increased fisher understanding.

Participants discussed the issue of resource rent and that this amount comes out of any fishery that is making above average profit. Charging a royalty redistributes this rent from quota owners to the government. It was discussed that in Tasmania there are licensing fees for quota, which go up in CPI each year and are collected by treasury. This money is then redistributed to DPIPW but there is no relationship between the returned amount and the amount it costs to manage each fishery. It was discussed whether the licensing fees should go up to redistribute money back to the community but it was suggested that this should be kept separate as there is the perception that licensing fees are paid to deliver a service.

7. Measuring other objectives with economics

7.1 Collecting economic data and measuring the community benefit from commercial fisheries

Julian Morison gave a presentation on the collection of economic data in South Australia and measuring community benefit. He advised that his company EconSearch had been collecting fishery economic data in South Australia for 17 years. Management costs in South Australia are cost recovered so the service is paid for by industry.

Julian advised that financial surveys of the nine or ten South Australian commercial fisheries are undertaken every three years and highlighted the importance of building a rapport with industry in order to ensure a high response rate. He stated that the current average response rate was about 40% and that they worked hard to increase this through *inter alia*, surveying industry only every third year to reduce fatigue, providing support through emails, newsletters, offering confidentiality agreements to industry, anonymising all data and presenting draft/final results to industry.

Julian discussed the type of financial (e.g. operating costs, vessel profitability) and economic data (e.g. lease price, export price) collected to inform their analysis for each fishery, before visually displaying a few examples to participants. He discussed how community benefits (in terms of the fishery's contribution to the regional and State economy) can be measured by estimating indicators, such as employment and household income, to determine the economic impact of fishing and indicators, such as net value of local retail and landed beach value of production, to determine economic impact of the value chain. Again, a few examples were visually displayed to participants and it was discussed how this data can be applied to projects, such as assessing the impact of marine parks and spatial closures on the fishing industry in South Australia.

Julian highlighted that additional data (beyond the requirements of their contract with PIRSA) can be collected through the survey that may be useful to the relevant industry association or other economic projects because the marginal cost of collection is low. He advised that

recently they have collected some social data, such as industry perceptions of the security of their fishing rights and the level of management fairness.

Discussion

Participants discussed how the survey response rate could be poor within some commercial fisheries and questioned whether this could limit the applicability of Julian's work. Julian highlighted that the required response rate depends on what confidence level you want and the level of error you're willing to accept. Using the example of the southern zone rock lobster in South Australia (a relative homogenous fishery), Julian highlighted that the required response rate for a 95% confidence interval with 10% error could be quite low, in this case only 15% (around 25 responses).

State fisheries managers acknowledged the usefulness of Julian's work but highlighted that funding could be an issue for smaller states such as Victoria and Tasmania as well the need to overcome a general resistance from industry to provide economic data. In larger States, such as New South Wales, Northern Territory and Western Australia there are already some sporadic economic surveys undertaken for different projects but regular funding is an issue and there is a need to get wider support from industry through espousing the benefits. It was acknowledged that in South Australia, the cost of the survey is not a large proportion of the licence fees to industry. Participants then discussed the importance of industry understanding the benefits of the research to drive commitment. The example of the Commonwealth Northern Prawn fishery was used, where industry collects annual economic data on AFMA's behalf and therefore understands the benefit so it works effectively, as in South Australia.

Participants discussed the benefit of Julian's work for both industry and managers when it comes to making difficult decisions in regard to marine resource use and the cost-benefit of fishery closures. It was highlighted that in South Australia, industry is content to pay for the collection of economic data as it provides credibility to discussions between industry and government on marine resource use.

7.2 Non-commercial: recreational users and ecosystem objectives

Caleb Gardner gave a presentation on how it is possible to use economics to put a value on use (e.g. recreational fishing enjoyment) and non-use (e.g. existence) values, which is important when assessing the cost-benefit of management decisions.

The most widely used method for non-market valuation of use-values is willingness to pay (or accept) approaches. Using a fishing example, you can calculate the enjoyment of recreational fishing for a particular species by working out how much people are willing to pay to go fishing on a given day. This can then assist with resource allocation and TACC setting for the commercial sector and bag limits for the recreational sector. For example, if fishers highly value catch rates then managers might prefer to reduce bag limits to increase the probability that fishers catch something.

Caleb outlined a number of other methods for non-market valuation of use values, including the productivity method, which estimates the value of ecosystem services and hedonic pricing, which estimates the value people place on a particular characteristic. For example, you can work out the value of an ocean view (i.e. a person's willingness to accept higher payment) in a property by comparing the price between similar houses with and without views. Travel-cost method is also used as a way of measuring how far people are willing to

travel to increase their utility. Lastly, benefit transfer methods quantify the value of ecosystems by using secondary sources (other studies).

8. Governance, policy and economic objectives

8.1 Self-governance and achieving economic objectives through cooperation: the New Zealand experience

Ralph Townsend gave a presentation on the benefits of industry self-governance in fisheries. He highlighted that self-governance is not co-management. Co-management is a system of shared governance or decision-making, while self-governance redistributes the decision-making responsibility from government to industry. He advised that self-governance can improve industry profitability through reducing costs associated with inefficient government regulations. Ralph gave the example of a large offshore scallop fishery in Canada where industry collectively managed fishing effort in order to prevent the capture of small scallops. This was achieved through information sharing. When a load of scallops was landed, an independent observer sized the catch and the size-distribution data was shared with the whole of industry the next morning. The identification and chastisement of fishers with catches of smaller sized scallops therefore increased the incentive among fishers to avoid these areas where possible.

Ralph highlighted that most international examples of self-governance are within shellfish fisheries, which due to the sedentary nature of the stock are more predictable systems of production. This improves the likelihood that rotating fishing effort will increase short-term profitability and make self-governance a more attractive proposal for fishers.

Ralph discussed how self-governance was pursued in New Zealand fisheries between 1994 and 2002. He noted that in New Zealand, the ITQ right is much more secure than in other countries and is considered a private property right in perpetuity, which improves the possibility for self-governance. Ralph discussed how the Challenger Scallop Enhancement Company developed to re-seed and rotate scallops and was the first comprehensive self-governance institution in New Zealand. Following on from this in 1996, legislation was changed to allow for the devolution of management responsibility from government to industry, with one example being that quota accounting and record keeping were devolved to an industry run service bureau called FishServe in 2001. In 2002, however the political climate changed and the focus of government shifted away from pursuing industry self-governance.

Ralph advised that government has a major role to play in facilitating self-governance, for example, through providing enabling legislation and enforcement of industry fishing rules and regulations. In New Zealand however, the transaction costs of decision-making were not appropriately considered by the government when developing the self-governance model. Ralph highlighted that expectations for unanimous decision-making within industry institutions increased transaction costs and was a major obstacle to reaching agreement, particularly among larger groups. The Challenger Scallop Enhancement Company in fact was one of the few successful international examples of self-governance among larger-sized groups. Unrealistic expectations about the ability of self-governing industry institutions to

negotiate and solve recreational and environmental issues also burdened the self-governance model. Furthermore, government expected industry to develop civil contracts and enforce their own rules and regulations. Lastly, the government was unwilling to make a long-term commitment to self-governance, which allowed Ministers to change their opinion, thereby increasing uncertainty among industry over the benefits of self-governance.

8.2 Economic objectives: the Alaskan experience

Seth Macinko gave a presentation on economic objectives in the United States and to start gave a brief overview on the Magnuson-Stevens Fishery Conservation and Management (MSFCM) Act 1976. He highlighted that the national standards of the MSFCM Act are focused on biological sustainability, aimed at achieving optimum yield, which is the greatest benefit in terms of food production (i.e. MSY) as reduced by relevant economic, social and ecological factors. While New Zealand and Australia are focused on MEY, this is not the case in the U.S. due to a lack of information on costs of fishing. Furthermore, the national standards 4 and 5 of the MSFCM stipulate that any allocation to fishers should be fair and equitable and management measures should consider economic efficiency but not have economic allocation as a sole purpose. Alternatively, national standard 8 stipulates that congress should consider the importance of fishing resources to communities and minimise adverse economic impacts on them.

Seth advised how discussions by economists (and biologists) over the allocation of rights to fisheries in the U.S. and Alaska have often excluded adequate consideration of the social effects of decision-making in terms of *inter alia*, people losing their preferred employment and having to leave their community. Seth gave the example of the Halibut ITQ system where initial discussions among stakeholders revealed how the social impact of the ITQ allocation on particular individuals, groups and regions was classified as an income distribution issue and given little consideration due to the focus on the national net economic benefit. While the sustainability of the halibut stock has improved since the implementation of ITQs, Seth advocated that this was due to scientifically set and enforced TACCs rather than the allocation itself.

Seth highlighted that when ITQs for halibut were instituted, a variety of social considerations including caps on ownership and owner-on-board provisions were included, due to concerns of the effects on coastal communities. He also highlighted that since the initial allocation a variety of amendments have been introduced to deal with resulting social problems. For example, processors originally did not receive any catch shares, as 100% of the catch history was allocated to vessel owners on the basis that they invested capital in the fishery. This was despite processors having invested in their business and now having redundant processing capacity due to the extension of the fishing season from two days to 8.5 months. This later led to the processor sector being given individual processor quotas. Another example was the establishment of community development quotas to deal with the effects of quota consolidation. Community quotas were allocated to 65 native communities and managed by six groups in Alaska where royalties are extracted from fishing and reinvested in the community. Lastly permit banks, which hold a collection of fishing permits, were set up at a cost of \$10 million in taxpayer money to provide access rights to those originally disadvantaged by the initial ITQ system. Consequently, what seems to be occurring in Alaska

is that the costly allocation of a public resource to fishers has created a vicious cycle of increased public spending to ameliorate the social impacts of the initial allocation.

Discussion

Participants discussed the difficulties of balancing social and economic objectives and how to ensure a fair allocation when you have both small and large operators with different business structures and incentives. It was highlighted that political guidance on objectives is crucial to improve management decision-making. It was discussed how politicians will often make clear decisions around recreational allocation, such as introducing recreational fishing closures but will not make decisions around fair allocation and ensuring viable communities. It was noted that in other primary industry sectors in Australia rationalisation has similarly occurred and led to the demise of small primary producers at the expense of larger primary producers.

9. Thoughts and Discussion

9.1 Information on the Australian Professional Association of Fisheries Managers

Ian Cartwright surveyed workshop participants at the conclusion of the workshop to gauge whether they would be interested in joining a professional association of fisheries managers. Results indicated that:

- People were interested in joining a professional association of fisheries managers and would be willing to pay, particularly fisheries managers;
- The majority of people would be happy to pay up to \$100 annually;
- There was some doubt over whether fisheries organisations would be willing to fund payment of individual member fees or financially support the association in its entirety;
- Participants were more interested in the establishment of a website/ mailing list than a web-based discussion forum;
- All participants but particularly managers were interested in future forums and workshops being held; and
- Participants were supportive of a FRDC or equivalent project being funded to facilitate the formation of a professional association of fisheries managers.

The Chair thanked everyone for their participation and closed the workshop.

ATTACHMENT A

Workshop on the use of bio-economics and role of government in achieving economic objectives for key decision makers

Final agenda

Monday 23rd February 2015

Introduction

~9.00am – 9.30am

- Welcome, introductions and overview (*Ian Cartwright – Chair*)
- Workshop objectives and agenda (*Ian Cartwright*)

Economic objectives

~9:30am – 10:30am

Presentations ~ 15 mins followed by general discussion

- Overview of fisheries manager's economic objectives and role of government survey (*Tim Emery*)
- Review of Australian fisheries management objectives related to economic objectives (*Emily Ogier*)

Morning Tea

Role of government and industry in economic decision-making

~10.45am – 12.45pm

Presentations ~ 15 mins followed by general discussion

- Should management stop at sustainability and leave economics to industry? (*Caleb Gardner*)
- TACC decision-making: unreliability of stewardship and importance of economic decision rules (*Rafael Leon*)

- Engaging stakeholders in putting economic policy into practice (*Ian Cartwright*)
- Industry perspective on the importance of economic objectives and bio-economics (*Roger Edwards*)

Lunch

Case studies on use of fisheries economics and bio-economics

~1.45pm – 3.30pm

Presentations ~ 15 mins followed by general discussion

- Bio-economics in Australian data rich commercial fisheries (*Simon de Lestang*)
- Harvest strategies to meet economic objectives in data poor fisheries (*Sean Sloan*)
- New Zealand perspective on use of economic data and bio-economics (*Steve Halley*)

Afternoon tea

Economic rationality interactive exercise

3:45pm – 5:00pm

- Implications of assumed collective economic rationality: an interactive exercise (*Tim Emery*)

Thoughts and discussion

~5:00pm – 5:15pm

- Information on the Australian Professional Association of Fisheries Managers (*Ian Cartwright and Sean Sloan*)

Dinner 7.30pm – Athelstane House (4 Hobson Street, Queenscliff)

Tuesday 24th February 2015

Bio-economics interactive exercise

~9:00am – 10:30 am

- Crystal ball gazing: bio-economic modelling exercise (*Klaas Hartmann*)

Morning tea

Measuring other objectives with economics

~10.45am – 11.45am

Presentations ~ 15 mins followed by general discussion

- Collecting economic data and measuring the community benefit from commercial fisheries (*Julian Morison*)
- Non-commercial: recreational users and ecosystem objectives (*Caleb Gardner*)

Governance, policy and economic objectives

~11.45am – 12.45pm

- Self-governance and achieving economic objectives through cooperation: the New Zealand experience (*Ralph Townsend*)

Lunch

~1:45pm – 2:45pm

- Economic objectives: the Alaskan experience (*Seth Macinko*)

Thoughts and discussion

~2:45pm – 3:15pm

- Workshop wrap up and where to from here (*Ian Cartwright*)

ATTACHMENT B

List of workshop attendees and contact details

<i>Names</i>	<i>Association</i>	<i>Email Address</i>
Ian Cartwright (Chair)	Thalassa Consulting	thalassa@bigpond.com
Timothy Emery	University of Tasmania	timothy.emery@utas.edu.au
Caleb Gardner	University of Tasmania	caleb.gardner@utas.edu.au
Klaas Hartmann	University of Tasmania	klaas.hartmann@utas.edu.au
Emily Ogier	University of Tasmania	emily.ogier@utas.edu.au
Rafael León	University of Tasmania	Rafael.Leon@utas.edu.au
Julian Morison	Econsearch	jbmorison@econsearch.com.au
Simon de Lestang	WA Fisheries	simon.deLestang@fish.wa.gov.au
Ralph Townsend	Winona State University, U.S.	rtownsend@winona.edu
Seth Macinko	University of Rhode Island, U.S.	sethmacinko@gmail.com
Roger Edwards	Goolwa Pipi Harvesters' Association	roger@centrestateexports.com.au
Crispian Ashby	FRDC	crispian.ashby@frdc.com.au
Steve Halley	MFish, New Zealand	steve.halley@mpi.govt.nz
Kate Brooks	KAL Analysis	Kate@kalanalysis.com.au
Keith Rowling	PIRSA	keith.rowling@sa.gov.au
Brad Milic	PIRSA	brad.milic@sa.gov.au
Graeme Baudains	WA Fisheries	graeme.baudains@fish.wa.gov.au
Clinton Syers	WA Fisheries	clinton.syers@fish.wa.gov.au
Jo Klemke	VIC Fisheries	jo.klemke@depi.vic.gov.au
Melissa Schubert	VIC Fisheries	melissa.schubert@dpi.vic.gov.au
Kate Simpson	VIC Fisheries	kate.simpson@depi.vic.gov.au
Roger Van Hilst	VIC Fisheries	roger.vanhilst@ecodev.vic.gov.au
Andrew Goulstone	NSW Fisheries	andrew.goulstone@dpi.nsw.gov.au
Andrew Thwaites	QLD Fisheries	andrew.thwaites@daff.qld.gov.au
Michael O'Neill	QLD Fisheries	Michael.O'Neill@daff.qld.gov.au
Steven Sly	NT Fisheries	Steve.Sly@nt.gov.au
David McKey	NT Fisheries	David.McKey@nt.gov.au
Steve Auld	Commonwealth Fisheries	Steve.Auld@afma.gov.au
Don Bromhead	Commonwealth Fisheries	Don.Bromhead@afma.gov.au
Marcus Finn	Commonwealth Fisheries	Marcus.Finn@afma.gov.au
Brodie MacDonald	Commonwealth Fisheries	Brodie.Macdonald@afma.gov.au
Frances Seaborn	TAS Fisheries	Frances.Seaborn@dpipwe.tas.gov.au
Hilary Revill	TAS Fisheries	Hilary.Revill@dpipwe.tas.gov.au