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Review of fishery resource access and allocation arrangements across Australian jurisdictions

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ABBREVIATIONS

AFMA	Australian Fisheries Management Authority
AFMF	Australian Fisheries Management Forum
CCSBT	Convention for the Conservation of Southern Bluefin Tuna
ESD	Ecologically Sustainable Development
FRDC	Fisheries Research and Development Corporation
MDB	Murray Darling River Basin
MPA	Marine Protected Area
NLC	Northern Lands Council
NSW	New South Wales
NT	Northern Territory
OCS	Offshore Constitutional Settlement
RBC	Recommended Biological Catch
QLD	Queensland
RFMO	Regional Fisheries Management Organisation
SA	South Australia
SAFS	State of Australian Fish Stocks
SBT	Southern Bluefin Tuna
TAC	Total Allowable Catch
VFA	Victorian Fisheries Authority
WA	Western Australia
WCPFC	Western Central Pacific Fisheries Commission

EXECUTIVE SUMMARY

INTRODUCTION

In 2010, the Australian Fisheries Managers Forum (AFMF) listed access and allocation as one of the top priority policy issues to be addressed in Australian fisheries. Subsequently, the Fisheries Research and Development Corporation (FRDC) formed a working group to examine possible approaches to access and allocation issues to assist fisheries managers as they undertook their associated policy development around allocation matters. From this, a report on the principles and guidelines for fisheries resource access and allocation was produced (Neville 2012), and it highlighted the following major impediments to optimising fisheries resource access and allocation in Australia:

- Lack of clear policy statements from governments defining their preferred principles and processes;
- Lack of the necessary data across sectors;
- Lack of sophistication in, and application of, analytical methodologies to support consideration of alternative outcomes;
- Lack of effective representative organisations which can act on behalf of the sectors in allocation discussions and their practical implementation; and,
- Lack of research into specific rights-based market trading possibilities in allocation questions.

Seven years on, there have been a lot of developments in Australian fisheries resulting in demonstrable improvement in their ecological sustainability across all jurisdictions, but positive developments in the area of access and allocation are less obvious, and increasingly these issues are at the forefront of the fisheries management agenda. To assist in guiding FRDC's future RD&E investment on these issues, the FRDC requested a review of the current state of fishery resource access and allocation across the various jurisdictions.

OBJECTIVES

1. Define the elements (i.e. units to which resource access is allocated) of access and allocation.
2. Review available information and provide examples of allocation and access in Australian fisheries jurisdictions and other industries.
3. Describe the tools available for access and allocation and how they are implemented in each jurisdiction.
4. Identify jurisdictional gaps and differences and recommended potential tools/options to fill those gaps.

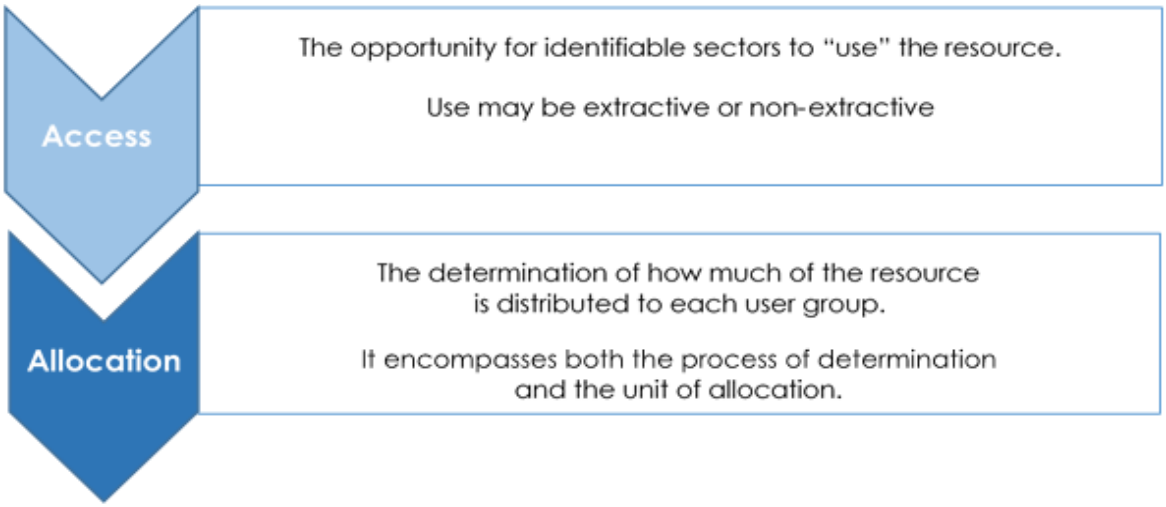
METHODS

For this review, we examined and compared access and allocation arrangements within each Australian fishery jurisdiction through a review of current government legislation and policies and interviews with fisheries managers and members of peak industry body associations.

RESULTS

COMMON POOL RESOURCES

Resource sharing encompasses access to, and allocation of, a common pool resource. Whilst these terms are often used interchangeably, we found that having clarity of definition assisted us in identifying the challenges, analysing the issues and proposing recommendations. For this report, the following definitions are used, illustrating the two-step process:



Access and allocation are both components of inter-sectoral resource sharing and involve balancing the different values and expectations of the various sectors. Underpinning all of these values, resource sustainability is paramount. For the commercial sector and charter boat operators, the value of economic return is the primary motivation. For recreational fishers, the social value of fishing is important as is accessing seafood for family and friends. Indigenous fishers don't necessarily recognise the divide between commercial, recreational and customary/subsistence fishing; their values encompass commercial, social, subsistence and spiritual objectives. People also value the non-extractive "use" of fishery areas and resources, for activities such as boating, diving, bathing, tourism or simply just the knowledge that some areas of the natural ecosystem are protected.

CURRENT LEGISLATION AND POLICIES

Across all Australian fisheries management jurisdictions, legislation gives primacy to sustainability of the resource consistent with the principle of ecologically sustainable development (ESD) giving effect to Australia's international treaty commitments. Other higher order legislative objectives such as optimal utilisation, economic efficiency and social/community benefit maximisation may influence allocation between user groups, but the overarching policy objective is to ensure an ecologically sustainable resource is available for present and future generations. An exception to the legislative emphasis of ESD in fisheries management is the *Torres Strait Fisheries Act 1984* which gives primacy to acknowledgement and protection of the traditional way of life and livelihood of traditional inhabitants, including their rights in relation to traditional fishing. We provide tables showing key aspects of each jurisdiction's policies and processes with respect to access and allocation.

ACCESS

Australian fisheries resources are owned and managed by the government on behalf of the Australian people. How the Australian people access these resources is generally well articulated in the legislation and policies of all jurisdictions. Extractive user groups are often identified (commercial, recreational and indigenous sectors), as are non-extractive uses such as tourism and general recreation.

There are about 5,800 people currently employed in commercial fishing business in Australia. For the commercial fishing sector, units of access are well defined in the form of licences, permits or statutory fishing rights. These allow holders to access a fishery and to catch fish for sale. In all fisheries across all jurisdictions, these access rights are limited and, in most cases, tradeable. Associated with this access, there is a range of input- and output-based

management controls designed to achieve various ESD (sustainability, economic and social) legislative requirements.

Currently there are an estimated 3.4 million recreational fishers and another 14 million Australians over the age of 15 years that could potentially access fishing resources for recreational purposes. In all jurisdictions, access to fish resources is unrestricted for the recreational fishing sector. Put simply, all Australians and non-Australians living in Australia have a right to access fisheries resources for recreational purposes. As with commercial fisheries, there are associated management controls including spatial/temporal closures, fishing gear restrictions and species-specific restrictions of the size and/or number of fish that can be taken. Some jurisdictions have a general or species- or gear-specific licencing system for recreational fishers (Victoria, New South Wales, Tasmania and Western Australia) but this does not limit the numbers of recreational fishers that can access the resource, nor does it confer any form of tradeable property right to the licence owner. In those states that require a recreational fishing licence, the rules about who requires one are diverse and can relate to fisher age, method of fishing, fishing platform (boat/shore) and species targeted. The licencing arrangements pertaining to charter boat operators and their clients are equally variable depending on the jurisdiction but there may be restrictions on operator numbers and bag, boat, size and trip limits that vary to those of individual fishers.

The estimated resident Aboriginal and Torres Strait Islander population of Australia in 2016 was 798,400 people and in 2000-01 it was estimated that that 186,200 Indigenous people (excluding those living in Torres Strait) participated in non-commercial fishing. All state jurisdictions give unrestricted access to people engaged in "traditional" or "customary" indigenous fishing, albeit that they have various definitions of such activity. Participation is generally for non-commercial purposes as defined by legislation but eligibility criteria are not defined. In the Northern Territory, the 2008 Blue Mud Bay High Court decision, recognised Traditional Owners' rights to the intertidal zone on Aboriginal Land, affecting somewhere between 80-85% of the Northern Territory coastline. This has significant implications for access by the commercial and recreational sectors.

Non-extractive use of aquatic resources confers important social benefits to those who seek enjoyment through natural experience (e.g. boating, bathing, photography, tourism). Many of these experiences can occur regardless of the sectoral access arrangements for fishing. Furthermore, all jurisdictions have forms of marine protected areas or closures for customary reasons with various levels of user access, specific closures for extractive users and other closures associated with significant cultural or heritage values or importance for other marine users. Although touched on, the non-extractive sector is not covered in any great detail in this report. However, non-extractive users can, through the political process, influence access to fisheries resources.

DATA

Consistent with international law and fisheries management ESD principles, the fish stock is the primary unit considered with respect to sustainability. At the most basic level, data on the catch taken from a fish stock is a critical aspect of ensuring sustainable fisheries. That catches may be taken from a combination of limited entry (commercial) access and open access (recreational and indigenous) fisheries makes collection of this information difficult.

Commercial fisheries are generally strictly managed and there is extensive catch and effort information obtained at relatively fine spatial and temporal scales from mandatory commercial logbooks. Relative to commercial catch and effort data, that for recreational

catches is far less extensive and of generally poorer quality and coarser spatial and temporal scales. There is even less information on the customary/indigenous catch.

Many access and allocation issues occur at finer spatial (and temporal) scales than is simply required to deal with stock sustainability. Allocation issues often relate to the different values placed on a resource by diverse extractive and non-extractive user groups (e.g. culturally and spiritually-important indigenous areas; high-quality recreational fishing areas/seasons; economically valuable areas/seasons for commercial fisheries; enjoyment of marine communities by tourists and, non-extractive protection areas). Cross-sectoral understanding of the "value" other sectors place on fish and fishing is required to support decisions about fair, equitable and just access and allocation of coastal/marine resources.

INTER-SECTORAL ALLOCATION

Neville (2012) concluded that a lack of clear policy statements from governments defining their preferred principles and processes on allocation was a major deficiency and recommended a series of principles to be applied nationally.

Although some progress has been made since the Neville report, particularly within the Australian Fisheries Management Forum (AFMF), there are considerable variations in the progress and current status between jurisdictions. Only four jurisdictions have a resource sharing policy — two since the Neville report (New South Wales and Northern Territory) — and, of those, only Western Australia and South Australia have implemented management arrangements in line with these policies. The 2009 Queensland Sustainable Fisheries Strategy identified the need for allocation to be an explicit component of fisheries harvest strategies. The Commonwealth only recently (late 2017) amended its legislation to include recreational and indigenous fishing interests and is currently drafting a resource sharing policy. Victoria and Tasmania have yet to develop clear government policy on inter-sectoral allocation.

Very limited progress has been made in allocation arrangements for the indigenous sector despite a clear need having been identified under the 2006 National Indigenous Fishing Principles. Only South Australia and Western Australia have explicit allocation arrangements for the indigenous sector.

Allocation units and methods

Consistent with fisheries management legislation and the principles of ecologically sustainable development (ESD), we conclude that fish stock should be the subject of allocation.

Any allocation, whether between or within sectors, requires a common currency. In line with jurisdictions that already have explicit allocation policies (South Australia and Western Australia), we recommend weight (of fish) as the common allocation unit used between sectors. This is a logical and defensible approach because weight is the common measure to determine the proportion of the fish population which can be extracted without impacting on the sustainability of the resource. Furthermore, weight can be consistently applied across, and transferred between sectors. For high value, single-species fisheries that have significant recreational interest, such as rock lobster or tuna, numbers could be used as the unit of allocation and later converted to weight for stock assessment.

Given the differing fishing gears, efficiency and capacity that exist both within and between sectors, other possible allocation units, such as days fished, access levels, or value of fish caught may not be equitable, nor would these alternate measures directly constrain the quantum of catch. As a result, such allocation approaches would require complex standardisation exercises to be applied inter-sectorally, if they could be applied at all.

Allocation for individual quota has been undertaken in many Australian commercial fisheries. Most states use some form of independent allocation panel comprising expertise in law, economics and the industry. Roles and processes of these panels are prescribed in legislation and are often supported by policy documents. Guided by the legislative objectives of the jurisdiction, the allocation determines what proportion of the total allowable commercial catch or total allowable effort is allocated to each eligible fisher. This process requires de minimis catch and effort data, can be informed by economic and social data if available, and assisted by analytical tools to assess impacts on fishers of different allocation determinations.

The allocation processes that have occurred in many commercial fisheries have yet to be applied to inter-sectoral allocation in most jurisdictions largely, we believe, because there is not a common unit of allocation between the sectors. South Australia and Western Australia are the exceptions. The Neville report described the necessary principles for a legitimate and acceptable allocation process which mirrors closely experience in commercial fisheries allocations. Strong sectoral representative groups are also a pre-requisite for a successful and acceptable allocation process. At present there is generally poor recognition and involvement of the customary/indigenous sector in most jurisdictions' policies and processes. Improved capacity of this sector will also be required to achieve this. Without clear principles and process, inter-sectoral allocation is vulnerable to political and interest group pressure potentially leading to sub-optimal ecological, economic and social outcomes. This is particularly problematic in situations where the different sectors have unequal political influence.

Where explicit inter-sectoral allocations have been made, there is a requirement (or at least an expectation) that catches will be monitored to ensure that all extractive sectors are operating within their respective allocations and appropriate management responses are taken to maintain sectoral limits.

Spatial management and reallocation

Spatial and/or temporal restrictions of access to a resource are increasingly being used as a resource sharing tool to address social issues, often without a formal allocation. This has been because some sectors have little or no incentive for pursuing a specific allocation or there are limited data to support an allocation process. Further, the development of native title claims on Freshwater and Saltwater Country by Indigenous groups adds another level of complexity, where government is not the only party controlling access to fishery resources.

Noting the expansion of recreational-only fishing areas as a sectoral allocation tool in the absence of an allocation policy, we conclude that such an approach may resolve conflicts and meet other legislative objectives, but may be inconsistent with ESD principles. With no limits to access and no catch data to demonstrate otherwise, there may be an unintentional reallocation of resources between sectors (e.g. from commercial to recreational) potentially compromising sustainability of particular fish stocks.

A COMMON ACCESS AND ALLOCATION FRAMEWORK

The jurisdictions' different stages of development with respect to access and allocation policies and processes is a likely less a reflection of their different capacities to undertake the work, but more an indication of the differing political appetite for such a move. Decisions about access, but particularly allocation, are fraught with potentially undesirable political consequences, particularly given the differing relative political influence of the sectors. While achievement of similar cross-jurisdictional policies and processes may be difficult in the short-term, it remains a realistic and worthy long-term goal, necessary to achieve sustainable

fisheries management. In the interim, it is important that an agreed cross-jurisdictional framework and tools are developed to guide sound inter-sectoral access and allocation policies and processes.

RECOMMENDATIONS

Information

Consistent and good quality catch and effort data from recreational and customary/indigenous sectors are not available in any jurisdiction but such data are critical for managing stock sustainability, and particularly for determining and evaluating any form of inter-sectoral allocation.

1. Develop and implement a national system to collect catch and effort (participation rates) data from recreational and indigenous fishers in all jurisdictions.
    - Commercial fishers generally provide at least daily catch and effort information at a reasonably fine spatial scale. The minimum spatial and temporal data requirements appropriate for recreational and indigenous sectors need to be determined based on a catch/cost/risk assessment.
    - Consider the value of a recreational licencing system to defray costs associated with data collection.

Decisions are expected and are currently being made about access to mitigate inter-sectoral conflict. A major driver of the conflict is the different economic, social or cultural values placed on the resource by different sectors.

2. Collect and collate detailed spatial and temporal information on the "value" of fishery resources to the different sectors (e.g. culturally and spiritually-important indigenous areas; high-quality recreational fishing areas/seasons; and economically valuable areas/seasons for commercial fisheries; non-extractive use areas) to inform decisions regarding inter-sectoral trade-offs in an allocation process.

Customary / Indigenous sector

3. All jurisdictions recognise historical customary / indigenous fishing through shares in the overall allocation of fishery resources.

4. Improve policies and processes to ensure adequate indigenous representation and input to allocation discussions in all jurisdictions. Indigenous capacity will need to be built to meet this requirement.

Unit of allocation

Both international law and Australian legislation refer to fish stocks as the primary management unit. A fish stock can be defined as a genetically distinct population within a geographically identified area.

5. Consistent with fisheries management legislation and ESD principles, we recommend that the fish stock is the subject of allocation.

6. Weight (of fish) should be the common unit of inter-sectoral allocation with a proportional share applied across sectors. For high value, single-species fisheries, such as rock lobster or tuna, numbers could be used as the unit of allocation and later converted to weight for stock assessment.

A range of other possible allocation units were considered, but given the differences in the size of the sector groups, their fishing gears, efficiency and capacity, other possible allocation units such as space, time, fishing effort, access levels or value of fish caught may not be equitable or would require significant conversion if they were to directly constrain the quantum of catch. Weight is a logical and defensible measure because it (biomass) is used in most assessments to determine the proportion of the fish stock which can be extracted without impacting on the sustainability. Furthermore, weight can be consistently applied and measured across, and transferred between, sectors.

Based upon the extensive literature and experience of allocation within the commercial fisheries sector, we emphasise the need to explicitly differentiate between the unit of allocation and the methods and processes to determine allocation.

National Guidelines

Building upon the success of the National Guidelines on Harvest Strategies, we recommend a similar approach be adopted for implementing inter-sectoral access and allocation.

7. Develop "National Guidelines on Access and Allocation" to achieve a consistent approach to policies and processes across jurisdictions.

   Key elements of these proposed Guidelines should cover:
   a) Agreed definitions of access and allocation
   b) Minimum data requirements
   c) Mechanism to determine allocation
      - Appropriate representation of all sectors
      - Facilitate mutual understanding of the values each sector places on fishery resources
      - Agree a common unit of currency (we recommend weight)
      - Explore possible allocation options including proportional shares
      - Evaluate trade-offs between sectors
      - Application to resources that straddle jurisdictional boundaries
   d) Appropriate methods to determine and implement sectoral funding of fisheries management based on their allocation
      - Recreational licences
   e) Appropriate methods to monitor and constrain catches within sectoral allocations
      - Cross-sectoral harvest strategies
   f) Mechanisms to reallocate sectoral shares
      - Triggers for reallocation
      - Inter-sectoral trading
   g) Data-poor approaches to access and allocation
      - e.g. spatial or temporal segregation of sectors

8. Given its cross-jurisdictional role, we recommend the Australian Fisheries Management Forum facilitates the development of the proposed "National Guidelines on Access and Allocation"

KEYWORDS

Resource sharing, access, allocation, policies, multi-sectoral, jurisdiction

INTRODUCTION

In 2010, the Australian Fisheries Managers Forum (AFMF) listed access and allocation as one of the top priority policy issues to be addressed in Australian fisheries. Subsequently, the Fisheries Research and Development Corporation (FRDC) formed a working group to examine possible approaches to access and allocation issues to assist fisheries managers as they undertook their associated policy development around allocation matters. From this, a report on the principles and guidelines for fisheries resource access and allocation was produced (Neville 2012), and it highlighted the following major impediments to optimising fisheries resource access and allocation in Australia:

- Lack of clear policy statements from governments defining their preferred principles and processes;
- Lack of the necessary data across sectors;
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- Lack of effective representative organisations which can act on behalf of the sectors in allocation discussions and their practical implementation; and,
- Lack of research into specific rights-based market trading possibilities in allocation questions.

Seven years on, there have been a lot of developments in Australian fisheries resulting in demonstrable improvement in their ecological sustainability across all jurisdictions, but positive developments in the area of access and allocation are less obvious, and increasingly these issues are at the forefront of the fisheries management agenda. To assist in guiding FRDC's future RD&E investment on these issues, the FRDC requested Fishwell Consulting to undertake a review of the current state of fishery resource access and allocation across the various jurisdictions.

OBJECTIVES

1. Define the elements (i.e. units to which resource access is allocated) of access and allocation.
2. Review available information and provide examples of allocation and access in Australian fisheries jurisdictions and other industries.
3. Describe the tools available for access and allocation and how they are implemented in each jurisdiction.
4. Identify jurisdictional gaps and differences and recommended potential tools/options to fill those gaps.

RESOURCE SHARING

MANAGEMENT OF COMMON POOL RESOURCES

Resource sharing encompasses access to, and allocation of, a common pool resource between different "users" or beneficiaries of that resource. Typically, people often only think about the extractive users of a fishery resource which may be: caught and sold (commercial); caught, grown then sold (aquaculture); caught for enjoyment (recreational); or caught as part of customary use (indigenous). However, there are also a range of non-extractive users that look at, photograph, or simply appreciate fish in their natural habitat (diving/tourism), or want a level of total protection (conservation). All of the above are beneficial uses with quantifiable cultural, social and economic benefits (Jentoft *et al.* 1998, Brooks *et al.* 2015).

A common-pool resource is such that: a) it is costly to exclude individuals from using the good either through physical barriers or legal instruments (termed non-excludability); and, b) the benefits consumed by one individual subtract from the benefits available to others (subtractability) (Ostrom 1990; Ostrom *et al.* 1994).

The terms "access" and "allocation" are often used interchangeably, but we found that having clarity of definition assisted us in identifying the challenges, analysing the issues and proposing recommendations. We modified the definitions used by Neville (2012) to encompass the potential for non-extractive use of fish[1] by a user group.

Access: The opportunity for identifiable sectors to "use" the resource. Use may be extractive or non-extractive.

Allocation: The determination of how much of the resource is distributed to each user group. It encompasses both the process of determination and the unit of allocation.

Typically, governments manage common pool resources including fisheries for the benefit of the community, but the perceived valued of a fishery resource varies between different users in that community. In considering the optimal use of a fishery therefore, it is critical that we consider the different environmental, economic and social (including spiritual) values that the community places on the resource. How is this assessed or evaluated? Who decides and on what criteria? Typically, only economic metrics are used to quantify benefits as these can be expressed (and compared) in monetary terms e.g. the gross value of production (GVP) applied to commercial fishing (Abbott 2014) or an expenditure evaluation of the value to recreational fishing (Colquohoun 2015). However, direct economic benefits measured through the value of fish (marginal utility) must also be weighed against the social benefits of recreational fishing, indigenous access, tourism (Abbott 2014) and the value of conservation (e.g. Hassall & Associates 2004).

Given the issue of subtractability, Ostrom argued for greater cooperative/collaborative action among resource users to avoid the oft-cited failures of common pool resource management (e.g. tragedy of the commons; Hardin 1968) where individuals act against the collective good because of high discount rates (encouraging short term exploitation at the expense of longer term sustainable benefits), there is little mutual trust, and a lack of capacity to enter into binding agreements with other beneficiaries. Natural resource management tends to be more sustainable (and supported by communities) if local people participate actively in resource governance (Sutinen and Johnson 2003, Sikor *et al.* 2017). In practice, however, collective action can be problematic due to the dynamic political, social, and economic context in which fisheries are managed, often leading to conflict, and not necessarily delivering the social, economic, and environmental outcomes sought by governments (Hilborn 2007 a,b). More often than not, this conflict relates to concerns about social justice and equity.

SOCIAL JUSTICE AND EQUITY

Lack of social justice principles has often been presented as a reason for failed management of common pool resources (e.g. Lukasiewicz et. al. 2013). Social justice is therefore a common driver of policy regarding access and allocation in fisheries (Jentoft *et al.* 1998, Ranjan 2014). Components of social justice include:

[1] "Fish" throughout this document describes living aquatic resources in Australian waters (inland, estuarine, coastal, marine), including finfish, sharks, shellfish, seaweed, pearls, worms, echinoderms, and any other organisms relevant to fisheries management in Australia (commercial, recreational, customary/indigenous, aquaculture, conservation).

- Procedural justice. Transparent and fair process leading to decisions of access and allocation;
- Distributive justice. Transparent and equitable access and allocation to users of the resource;
- Interactional justice. How participants are treated during the decision-making process.

We consider these principles are of importance in resource sharing policies for fisheries across Australian jurisdictions.

FISHING ACCESS RIGHTS DIFFER BETWEEN SECTORS

Fishing access rights, whether statutory or not, do not provide ownership of the fish themselves prior to capture. Hence, they are not exactly "property rights" but rather they describe the right of individuals or groups to access a fishery with the aim of capturing fish. The fish only become "owned" once they have been caught and are in the possession of an individual (or other legal entity) (WA DoF 2011). The basic concept of fishery "access rights" is simple: they are bundles of entitlements that confer both privileges and responsibilities regarding access to fisheries resources. Usually they are created, defined and specified by a fisheries management authority and, increasingly, in collaboration with the users (FAO 2005-2018). The nature of the access right, however, depends greatly on the social, cultural, and legal context of the fishery, but particularly on how the following key characteristics (Scott 2000a,b) are designed and described:

- Exclusivity: all benefits and costs accrued as a result of accessing the resource should accrue to the owner of the right.
- Transferability: rights should be able to be transferred from one owner to the other in a voluntary exchange.
- Security: rights should be secure from involuntary seizure by others (individuals, institutions or the government).
- Durability: the time span of the entitlement, which can range from one season / year to perpetuity.

In Australia, all commercial fisheries have limited entry access. Units of access are well defined in the form of licences, permits or statutory fishing rights. These allow holders to access a fishery and catch fish for sale. In all fisheries across all jurisdictions, these access rights are limited and, in most cases, tradeable.

In contrast, other user groups are not limited in their access to a fishery and they do not have rights which are either exclusive or tradeable. Moreover, the value that they place on a fishery resource is more likely to be social, cultural or environmental in nature, not economic. It is these fundamental differences that make access and consequently, allocation between sectors much more difficult to manage. The Productivity Commission (2016) Inquiry Report on Marine Fisheries was clear in its statement that "*The allocation of access to fisheries should address social and cultural benefits, as well as economic benefits*".

SCOPE OF THE REPORT

Over the last three decades, all Australian fishery jurisdictions have tackled the issue of ensuring equity in the allocation of access rights for at least some of their commercial fisheries, often using some form of independent allocation panel to determine equitable distribution mechanisms. Although this process is never straight forward, such "**intra-sectoral**" allocation within the commercial sector is nothing new and is aided by the fact that the "value" placed on the resource by users within this sector is generally similar — economic value. It is not a current focus of the present study.

Offshore Constitutional Settlement (OCS) arrangements (those arrangements which deal with division of responsibility across State Commonwealth waters) can be quite complicated and often reflect historically defined combinations of target species, fishing methods and fishing areas. It is generally recognised that management arrangements for shared stocks across Australia is inefficient and that more practical and cost-effective arrangements could be made in managing stocks across jurisdictional boundaries as recommended by two reviews (Borthwick 2012, Productivity Commission 2016). Accordingly, OCS arrangements and commercial fishery resource sharing arrangements are only touched on briefly in our review. We also do not examine fisheries resource sharing arrangements across international boundaries because this has been adequately dealt with elsewhere FAO 2018).

The focus of this report is on "**inter-sectoral"** access and allocation as highlighted by the blue shaded area below (Figure 1).

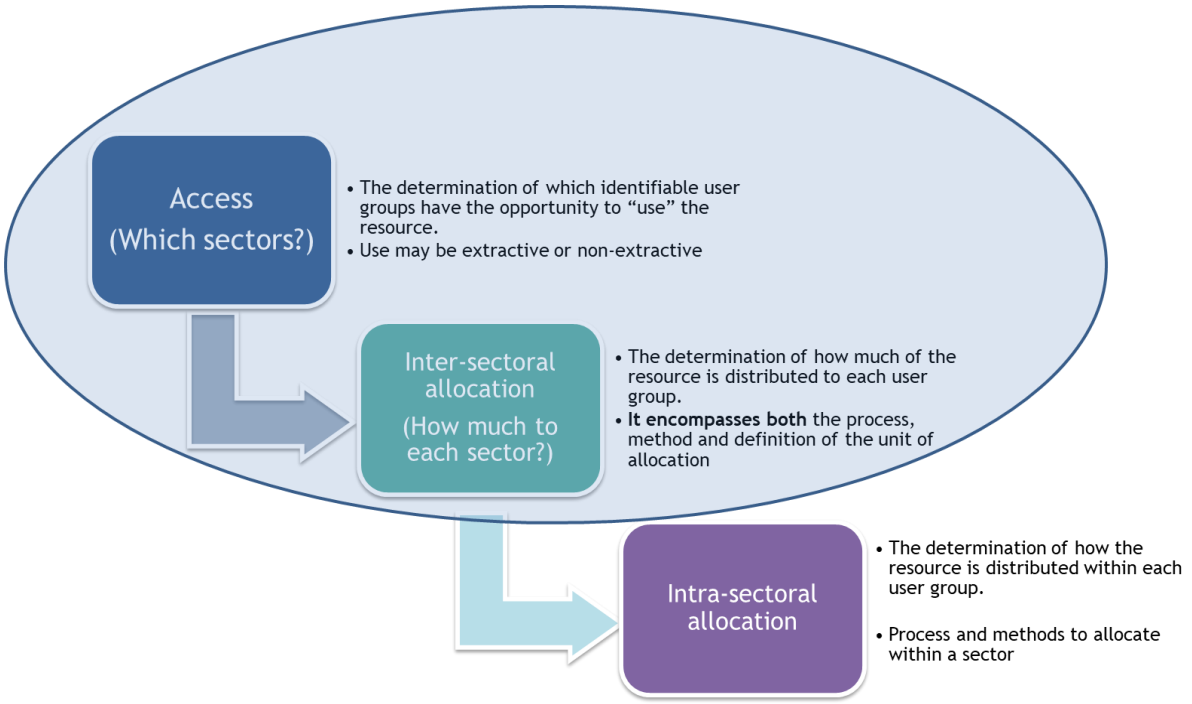

Figure 1 Definitions and scope of report

METHODS

A literature review (including departmental websites where applicable) of access and allocation within each Australian fisheries management jurisdiction (Commonwealth, States, Northern Territory) was conducted.

On the basis of issues identified in the literature review, in-person and telephone interviews were conducted with experienced fisheries managers, peak body leaders, and prominent industry persons (including New Zealand) guided by a set of questions (Appendix 1). Their responses were analysed, collated, and informed the findings of this report. We also evaluated (through a literature review) access and allocation approaches in other primary industries (Appendix 2).

CURRENT LEGISLATION AND POLICIES

Australia, as a Federation, includes fisheries managed under multiple jurisdictions. The Offshore Constitutional Settlement (OCS) sets out arrangements between the different Australian jurisdictions regarding responsibilities for fisheries, mining, shipping and marine reserves. Under the OCS, the various States of Australia and the Northern Territory manage aquatic resources in lakes, rivers, estuaries within their boundaries and those coastal/marine fishery resources located out to 3 nm to sea. The Commonwealth, through the Australian Fisheries Management Authority (AFMA) has responsibility for managing fish stocks (usually offshore or migratory species) from 3 nm to 200nm (within Australia's Exclusive Economic Zone). Fish stocks are often highly mobile, however, and may straddle one or more Australian jurisdictions and even migrate into the high seas, where joint management arrangements may apply through Regional Fisheries Management Organisations (RFMOs).

Across all Australian fisheries management jurisdictions, legislation gives primacy to sustainability of the resource, consistent with the principle of ecologically sustainable development (ESD). We apply the commonly-used definition of ESD: using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased. This definition includes a requirement to manage fish stocks sustainably but also recognises the economic and social contribution that fisheries resources bring to the Australian community. An exception to the legislative emphasis of ESD in fisheries management is the *Torres Strait Fisheries* Act 1984 which gives primacy to acknowledgement and protection of the traditional way of life and livelihood of traditional inhabitants, including their rights in relation to traditional fishing.

Throughout this review we will refer to ESD principles consistent with the definition above. This primary focus on ESD provides clear direction for our discussion on inter-sectoral access and allocation by anchoring it firmly to resource sustainability. Other high-order legislative objectives such as optimal utilisation, economic efficiency and community benefit maximisation can influence inter-sectoral access and allocation but cannot undermine the primary objective of ecological sustainability.

Australian fisheries resources are owned and managed by the government on behalf of the Australian people. Access is generally well articulated in the legislation and policies of all jurisdictions (see Table 1). Extractive user groups are often identified (commercial, recreational and customary/indigenous sectors) as are non-extractive uses such as tourism, recreational diving industry and conservation in marine protected areas (MPAs).

The Neville (2012) report observed that, with the exception of Western Australia and South Australia, most jurisdictions did not have clear policies, or transparent decision-making frameworks, or guiding principles to assist with fisheries access and allocation. Some progress has been made since then. New South Wales and the Northern Territory have developed policies for access and allocation addressing objectives and guiding principles (Table 1). Queensland has a reform strategy for fisheries which includes developing a policy on access and allocation. The Commonwealth is in the process of drafting a policy. Victoria and Tasmania have made little progress.

With regard to policies on preferred methods of inter-sectoral allocation, progress has been slower with the exception, again, of South Australia and Western Australia. In these two jurisdictions' legislation (Western Australia) and policy (South Australia) state that inter-sectoral allocation is to be based upon each sector's (historical) share of total catches. Additionally, in South Australia there are mechanisms within a fishery's management plan that trigger review should these relative shares change, but how such changes are assessed is not well specified. Under Western Australia's new Aquatic Resources Management Act "tool boxes" called Aquatic Resource Use Plans will apply to each sector. However, under these plans there will be 'working' tolerance levels around the extent to which catch shares can deviate from the target catch/TAC for the sector before management action is taken to bring the sector back to its allocated catch share. There is no explicit statement of allocation mechanisms in any of the other fisheries jurisdictions.

The Productivity Commission (2016) highlighted that "*The allocation of access to fisheries should address social and cultural benefits, as well as economic benefits*". Importantly, despite social benefits derived from customary/indigenous and from recreational fishing, and their importance in ESD, social metrics have yet to be explicitly accounted for in any intra-sectoral allocation policy or implementation, partly because the collection of social and cultural data across all sectors is generally deficient in most (if not all) jurisdictions as well as how this information, if it existed, could be practically applied to an allocation process.

Table 1. Legislative Objectives of Australian fishery jurisdictions that relate specifically to Access and Allocation

Jurisdiction	Legislative Objectives
Commonwealth *Fisheries Management Act 1991* *Amendment (Representation) Bill 2017*	The amendment now provides for explicit recognition of recreational and Indigenous fishers in Commonwealth legislation. …ensuring that the interests of commercial, recreational and Indigenous fishers are taken into account; …to include expertise in matters relating to recreational and Indigenous fishing.
New South Wales Fisheries Management Act 1994	….to appropriately share fisheries resources between the users of those resources

Northern Territory *Fisheries Management* Act 1988	…to maintain a stewardship of aquatic resources that promotes fairness, equity and access to aquatic resources by all stakeholder groups, including: (i) indigenous people (ii) the commercial fishing, aquaculture and fishing tourism industries (iii) amateur fishers; and (iv) others with an interest in the aquatic resources of the Territory
Protected Zone Joint Authority *Torres Strait Fisheries Act 1984*	…to acknowledge and protect the traditional way of life and livelihood of traditional inhabitants, including their rights in relation to traditional fishing; …to share the allowable catch of relevant Protected Zone commercial fisheries with Papua New Guinea in accordance with the Torres Strait Treaty;
Queensland *Fisheries* Act 1994	The other functions of the chief executive are: …to ensure the fair division of access to fisheries resources for commercial, recreational and indigenous use;
South Australia *Fisheries Management Act 2007*	…access to the aquatic resources of the State is to be allocated between users of the resources in a manner that achieves optimum utilisation and equitable distribution of those resources to the benefit of the community; … a management plan must specify: • the share of aquatic resources to be allocated to each fishing sector under the plan; and • prescribe a method, or establish an open and transparent process for determining the method, for adjusting allocations of aquatic resources between the different fishing sectors during the term of the plan; and • provide that compensation will be paid to persons whose licences or licence entitlements are compulsorily acquired in order to reduce the share of aquatic resources allocated to the commercial fishing sector and increase the share allocated to another sector. In determining the share of aquatic resources to be allocated to a particular fishing sector under the first management plan for an existing fishery, the share of aquatic resources to which that fishing sector had access at the time the Minister decided to prepare the plan (based on the most recent information available to the Minister) must be taken into account.
Tasmania *Living Marine Resources Management* Act 1995	…take account of the community's needs in respect of living marine resources; and take account of the community's interests in living marine resources.
Victoria *Fisheries Act 1995* *Victorian Fisheries Authority Act 2016*	…to facilitate access to fisheries resources for commercial, recreational, traditional and non-consumptive uses; The objectives of the Authority are— (a) to promote sustainability and responsibility in fishing and fishing-related activities in Victoria; and (b) to optimise the social, cultural and economic benefits of the fisheries sectors; and (c) to support the development of recreational fishing; and (d) to support the development of commercial fishing and aquaculture;

Western Australia *Fish Resources Management* Act 1994 Will Be Superseded in 2019 by *Aquatic Resources Management* Act 2019	…to share and conserve the State's fish and other aquatic resources and their habitats for the benefit of present and future generations. Achieved by: • enabling the allocation of fish resources between users of those resources, their reallocation between users from time to time and the management of users in relation to their respective allocations …ensuring that the interests of different sectors of the community that use aquatic resources or aquatic ecosystems are identified and considered; An aquatic resource management strategy must specify: • the quantity of the aquatic resource that is to be available in a fishing period for customary fishing and public benefit uses; • the proportion of the TAC that is to be available for recreational fishing for the resource; • the proportion of the TAC that is to be available for commercial purposes.

HOW IS ACCESS REGULATED?

COMMERCIAL SECTOR

There are about 5,800 people employed in the commercial fishing sector in Australia (Mobsby 2018; not including processors and wholesalers) with access to either State or Commonwealth waters (Table 2). In all jurisdictions, units of access are well defined for the commercial sector in the form of licences, permits or statutory fishing rights. These allow holders to access a fishery and catch fish for sale. Such access rights are capped (limited entry) and, in many cases, tradeable. Associated with this access, there is a range of input- and output-based management controls designed to achieve various sustainability, economic, and (to a lesser extent) social legislative requirements consistent with ESD principles. As a requirement of the permit or licence, all commercial fishers must report their catch and effort information through a paper-based or electronic logbook system.

RECREATIONAL SECTOR

Australians and non-Australians living/visiting Australia have access to fisheries resources for recreational purposes. The number of recreational fishers is not capped (open access). The last nationwide survey of recreational fishers, conducted in 2003 (Henry and Lyle, 2003) estimated that there were 3.4 million recreational fishers (Table 2). However, there are around an additional 13 million Australians between the ages of 15-85 (Mobsby, 2018) that could access fishing resources for recreational purposes if they so wished; together with an unknown number of temporary residents and visitors to Australia.

Whilst there are no restrictions on the number of recreational fishers that can access a resource, all jurisdictions implement measures to regulate recreational fishing and two states, Victoria[2] and New South Wales[3], require most recreational fishers to obtain a licence and pay a licence fee. There are occasional surveys of recreational fishers in these states from which participation and catch data is collected, but generally holders of recreational fishing licences

[2] https://vfa.vic.gov.au/recreational-fishing/fishing-licence

[3] https://www.service.nsw.gov.au/transaction/renew-recreational-fishing-licence

are not required to provide fishing catch or effort information. A recent exception to this rule is the Victorian trial requiring all recreational rock lobster fishermen to tag and report every lobster they retain. Recreational fishing licences are also required but not restricted for some types of fishing in Western Australia[4] and Tasmania[5]; no licences are required for recreational fishing in Queensland and Northern Territory or Commonwealth waters.

The number of recreational charter boats is restricted in some jurisdictions. South Australia, New South Wales and Western Australia restrict the number of licences in the charter boat fishery and South Australia also restricts the number of passengers which can be taken onboard[6]. Queensland and Northern Territory require charter boats to be licenced but there are no restrictions on the number of licences; Victoria and Tasmania do not require a charter fishing licence.

As with commercial fisheries, there are associated management controls applied to recreational fishing including spatial/temporal closures, fishing gear restrictions and species-specific restrictions of the size and/or number of fish that can be taken. There is no consistent application of these controls between the jurisdictions.

Table 2. Number of recreational fishers by state of residency (Henry and Lyle, 2003) and number of people resident in each state employed (full time and part time) in commercial fishing operations in either state or commonwealth fisheries (adapted from Mobsby and Koduah 2017).

	NSW	Vic	Qld	SA	WA	TAS	NT	ACT	Total
No. of recreational fishers	998,000	550,000	785,000	328,000	479,000	125,000	44,000	53,000	3,362,000
No. of commercial fishers	1,056	579	1,274	968	1,091	528	217	7	5,777

* Based on the 2016 Australian Bureau of Statistics Census data. Figures do not include aquaculture or seafood processing or wholesaling.

CUSTOMARY/INDIGENOUS SECTOR

The estimated resident Aboriginal and Torres Strait Islander population of Australia in 2016 was 798,400 people (Mobsby, 2018). In 2000-01 Henry and Lyle (2003) estimated that 186,200 Indigenous people (excluding those living in Torres Strait) participated in non-commercial fishing, but there is virtually no current information on the level of fishing by the customary/indigenous sector (Evans *et al.* 2017).

All state jurisdictions give unrestricted access to people engaged in "traditional" or "customary" fishing. Customary/indigenous fishing is defined by legislation in all jurisdictions but eligibility criteria are not well defined, if at all. In some jurisdictions, permits are required for

[4] A recreational fishing licence is required for recreational fishing from a boat, netting, freshwater angling, and fishing for rock lobster, abalone, or marron. http://www.fish.wa.gov.au/Fishing-and-Aquaculture/Recreational-Fishing/Pages/Recreational-Fishing-Licences.aspx

[5] A licence to fish with a rod and line in marine waters in Tasmania is not required. https://dpipwe.tas.gov.au/sea-fishing-aquaculture/recreational-fishing/recreational-sea-fishing-licences

[6] http://pir.sa.gov.au/fishing/commercial_fishing/fisheries/charter_boat_fishery ; http://www.fish.wa.gov.au/Fishing-and-Aquaculture/Recreational-Fishing/Pages/Charter-Boats.aspx ; https://www.dpi.nsw.gov.au/fishing/recreational/resources/charter

ceremonial purposes (Queensland, Tasmania) and some customary/indigenous fishers require licences in the Torres Strait – but neither of these permits or licences are capped.

The impact, scope and applicability of Native Title to customary/indigenous access to fisheries resources varies in each jurisdiction. Notably, in the Northern Territory, the 2008 Blue Mud Bay (BMB) High Court decision granted Traditional Owners rights to the intertidal zone on Aboriginal land — affecting between 80-85% of the Northern Territory coastline. Although various exemptions have applied over the last decade, during 2019, permission to access tidal waters over Aboriginal land will be mandatory in accordance with the requirements of the *Aboriginal Land Rights (Northern Territory)* Act 1976 (Cth) (ALRA). This has obvious implications regarding future access arrangements for both commercial and recreational fishers in the Northern Territory. For example, although a commercial fisher in the Northern Territory may have access rights to a coastal fishery through a licence granted by the NT Fisheries department, he/she may not be able to operate in/across Aboriginal Land without the permission of the land owner and a permit from the relevant Land Council. This restriction of access on Aboriginal land also applies to the recreational sector in some areas. The potential and extent to which this situation could occur in other jurisdictions is unclear.

NON-EXTRACTIVE USERS

There is a wide range of people that enjoy non-extractive "use" of fishery areas and resources, such as boating, diving, bathing, tourism etc or simply just the knowledge that some areas of the natural ecosystem are protected. Non-extractive uses influence public perception of resource sustainability and, potentially, fisheries resource access and allocation (Triantafillos *et al.* 2014).

More directly, all jurisdictions have various forms of closures or Marine Protected Areas (MPAs, also referred to as Marine Parks) that impact on access and allocation. Such closures and MPAs, which have various levels of user access, may have been introduced for a range of reasons including: protection of biodiversity; protection of unique habitats; significant cultural or heritage values; fishery benefits; tourism; indigenous customary reasons; or importance to other marine users (e.g. shipping channels, oil and gas facilities).

Overall, the Australian state and territory governments have established marine parks around the country, covering 3.3 million square kilometres or 36 per cent of our oceans. The level of impact on access is determined by the "zoning" applied to a park, which can range from virtually zero access in a strict

Marine Park compensation
South Australia.

Section 21 of the SA *Marine Parks* Act 2007 provides that the Minister may compulsorily acquire a statutory authorisation in the creation of a marine park but must pay fair and reasonable compensation to holder of that statutory authorisations if their rights are affected by the creation of a zone or the imposition of a temporary prohibition or restriction of activities in a marine park. Regulations under the Act (Statutory Authorisation Compensation Regulations 2015), establish a process for holders of statutory authorisations to apply for compensation if they believe a right granted by their authorisation is affected by the creation of a marine park zone or by a temporary prohibition or restriction of activities in a marine park. A process for review and appeal is also provided.

sanctuary zone (IUCN[7] 1a) to general access in a multiple-use zone (IUCN VI). Based on the objective and design of the park, some or all users may not be permitted access, depending on sector type, or the fishing gear allowed. In cases where implementation of marine parks has negatively impacted the commercial sector, some jurisdictions recognise that this is effectively a reallocation and mechanisms to compensate for that loss have been legislated (e.g. South Australia – see box).

DATA

CATCH AND EFFORT DATA

Consistent with international law[8] and all jurisdictions' fisheries management legislation and ESD principles, the fish stock is the primary unit considered with respect to sustainability (e.g. SAFS[9]). At the most basic level, data on the catch taken from a fish stock are a critical aspect of ensuring sustainable fisheries. That catches may be taken from a combination of limited entry (commercial) access and open access (recreational and indigenous) fisheries makes collection of this information difficult. This is only further complicated by the fact that jurisdictional lines often cut across stock boundaries.

Commercial fisheries are generally strictly managed and there is extensive catch and effort information obtained at relatively fine spatial and temporal scales from mandatory commercial logbooks – at least for the retained catch of main target and by-product species. Relative to commercial catch and effort data, that for recreational and indigenous catches is far less extensive and of generally poorer quality and coarser spatial and temporal scales.

Reliable and, more importantly, regular time-series data on catches and catch rates are generally unavailable for most Australian recreational fisheries (Evans *et al.* 2017). A comprehensive national survey of recreational fishing conducted in the early 2000's (Henry and Lyle, 2003), provided the best snapshot of levels of recreational fishing around Australia. Subsequently there has been a number of recreational surveys within single jurisdictions, e.g. South Australia (Giri and Hall, 2015); Victoria, (Ryan *et al.,* 2009); Western Australia, (Ryan *et al.,* 2017); Northern Territory, (West *et al.,* 2012); New South Wales, (West *et al.,* 2015) Tasmania, (Lyle *et al.,* 2014); Queensland, (Taylor *et al.* 2012); and the Commonwealth (Green *et al.,* 2012). However, there isn't a coordinated effort to align the timing of, and data collected in, these surveys, making it particularly difficult to assess catch levels in cross-jurisdictional stocks. In some cases, recreational catches are similar to, or even greater than commercial catches e.g. Snapper, Flathead, Blue Crabs, Mud Crabs, Barramundi (*Lates clacarifer*), King George Whiting (Lyle *et al.* 2014, Giri and Hall 2015, West *et al.* 2016), highlighting the need for recreational data on catches to understand the impact on stocks. For other species such as Southern Bluefin Tuna (*Thunnus maccoyii*) and other game fish (e.g. Marlin) which are managed by the Commonwealth, there is a requirement to estimate all sources of fishing mortality responsive to harvest strategies and internationally-imposed catch quotas (Griffiths and Fay 2015).

[7] https://www.iucn.org/theme/protected-areas/about/protected-area-categories

[8] 1982 United Nations Convention on the Law of the Sea and its 1995 Implementation Agreement of its Provisions relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks; 1992 Convention on Biological Diversity.

[9] State of Australian Fish Stocks (http://www.fish.gov.au/)

There is even less information on customary/indigenous catch and effort. Some information on indigenous catch in Northern Australia was collected by (Henry and Lyle, 2003), but there are otherwise very little data available.

Recommendation 1. Develop and implement a national system to collect catch and effort (participation rates) data from recreational and indigenous fishers in all jurisdictions.

FINE-SCALE DATA ON SECTORAL VALUES

Even if good catch and effort data were available from each extractive sector for stock assessment, many access and allocation issues occur at finer spatial (and temporal) scales than is simply required to deal with stock sustainability. Moreover, these allocation issues often relate to the different values placed on a resource by diverse extractive and non-extractive user groups (e.g. culturally and spiritually-important indigenous areas; high-quality recreational fishing areas/seasons; economically valuable areas/seasons for commercial fisheries; enjoyment of marine communities by tourists and, non-extractive protection areas). Each sector has areas of a fishery/coastline that are important to them for different cultural, social, environmental and economic reasons. Cross-sectoral understanding of fine-scale spatial dynamics of fish and fishing and their value to each sector is required to support decisions about fair, equitable and just access and allocation of coastal/marine resources. Increased levels of data, including social and economic data, particularly from the customary/indigenous and recreational sectors, will be required to inform decision makers.

Existing allocation policies require account be taken of social and economic considerations and values in allocation methods. Many respondents commented that in practice, economic and to a lesser, extent social factors are not explicitly considered due to a lack of information and there being no common metric for each sector or value. For example, participation rates can be used as an indicator of social value for the recreational sector where access is unrestricted; but this is not appropriate for the commercial sector where access is restricted. Unsurprisingly, recreational participation rates are highest in waters near major population centres; influencing political support for commercial fishing closures in many bays, inlets, and estuaries. But social values may also be derived from public access to retail seafood: either in retail outlets selling fresh seafood or dining experiences afforded by restaurants and other related venues. Without data and the concomitant cost-benefit analysis, it is difficult to determine and justify allocation decisions. Attempts to measure social value in fisheries (e.g. Pascoe *et al.* 2013) reveal that stakeholders generally rank social values below economic or environmental values. Thus, in the absence of standardised metrics, taking into account these different social and economic values is challenging when considering trade-offs between different sectoral values.

Torres Strait Rock Lobster

(Panulirus ornatus)

In Torres Strait, the draft harvest strategy gives explicit recognition of the socio-cultural value of the fishery for traditional inhabitants. Target biomass has been set higher than B_{MEY} specifically to allow for the importance of this species to Indigenous communities for food security.

Recommendation 2. Collect and collate detailed spatial and temporal information on the social, economic and environmental "value" of fishery resources to the different sectors to inform decisions regarding inter-sectoral trade-offs in an allocation process.

INTER-SECTORAL ALLOCATION

The Neville (2012) report concluded that a lack of clear policy statements from governments defining their preferred principles and processes on allocation was a major deficiency and recommended a series of principles to be applied nationally. Although some progress has been made since that report, there is considerable variation in the achievements of the various jurisdictions in this respect.

HOW WELL HAS IT BEEN DONE?

Five years on from the Neville report, the Productivity Commission (2016) concluded that "the basis for allocation is often opaque, uncertain and/or of questionable efficiency" and that "stated policy objectives include multiple and sometimes competing goals that often provide limited guidance on how judgements should be made".

At the time of writing this report, there remains considerable variation in the various jurisdictions' adoption and implementation of policies on allocation or inter-sectoral resource sharing (Table 3). Only four jurisdictions have a resource sharing policy – two developed since the Neville report. There are a range of stages that the different jurisdictions are at regarding a resource sharing policy: from those that have an explicit policy that has already been implemented, such as South Australia and Western Australia; through those that have a policy in place with general concepts but no explicit sharing arrangements that have been implemented (Queensland, NSW, NT); those developing a policy (Commonwealth); and those yet to develop a policy (Victoria and Tasmania). Victoria is an interesting case, as it appears to have had quite an explicit sharing policy proposal outlined in its Future Fishing Strategy (VIC DPI 2011), which does not appear to have been subsequently addressed and is largely absent from the new VFA Act and the Ministerial statement of expectations of the VFA[10] [11].

Table 3. Jurisdictional inter-sectoral Resource Sharing Policies

Jurisdiction and date	Policy Principles	Applied?
C'wealth DAWR (2017)	No explicit allocation policy available. DEWR are in the process of drafting a policy (pers comm) but not available for review during this project.	No
NSW	The central principle to be applied in determining and adjusting **access** ….. is that the fishery resources are to be managed consistently with the principles of ecologically sustainable development.	Not yet

[10] http://agriculture.vic.gov.au/__data/assets/pdf_file/0014/370004/Fisheries-Report-2016-17.pdf

[11] https://vfa.vic.gov.au/__data/assets/word_doc/0007/389266/2018-2020-Statement-of-Expectations.docx

NSW DPI (2015)	Additional principles are to guide the determination and adjustment of **allocation** of resource access and use: • Sustainability…. is paramount. • Fairness and equity • Optimum utilisation- the best use of the resource for the community at large • Certainty for users • Transparency • Existing access rights and arrangements will be respected • Compensation – a reduction of access to any sector needs to be accompanied by appropriate offsets. • Information - decisions should be based on the best available ecological, cultural, economic and social information. Where information is limited, resource sharing decisions should be made on a risk management basis with the ecologically sustainable use of the resource as the primary objective. • Integrity of fisheries management.	
NT NT DPIR (2015)	**Access**: ability of a sector to access the resource. **Allocation**: level of access to able to be exercised by an individual or class of individuals to the resource within a sector. Catch by weight (at relevant temporal and spatial scales) is to be used as the preferred unit for estimating level of access and/or allocation of the fisheries resource by a sector. • Sustainability is….. paramount. • Customary Use: Resource allocations will ensure the right of Aboriginals to use aquatic resources in a traditional manner is maintained. • Stewardship: Every Territorian may access the NT aquatic resources in accordance with the applicable management rules. • Information: Decisions should be based on the best available ecological, cultural, economic and social information. • Transparency • Goal Orientation: Outcomes must be focused on meeting the objectives set out in the Act. • Strategic Development: Resource sharing decisions should be justifiable, balance overall economic, social and cultural benefit to the Territory and provide for optimum utilisation of the resource. • Social Performance: Resource sharing decisions must seek to maximise the long-term social benefits that are derivable from the resource [giving] consideration to the full diversity of uses. • Practicality • Certainty: Each sector will be allocated a proportional share of the resource. • Structural Adjustment and cost contributions: Where there is clear and demonstrable financial loss to a licensee as a result of a resource sharing decision, structural adjustment options for those licensees will be considered.	Not yet
QLD QLD DAF (2016) QLD DAF (2017)	Clarity on how resources are accessed and shared between different users. Stable and predictable approach to resource allocation. Economic, social and cultural value of fisheries resources are maximised. Develop a resource allocation policy to outline how decisions about allocation and reallocation of access will be made with: • A transparent and repeatable process with clear reasons for decisions; • Opportunities for stakeholder input, with a particular requirement for engagement with affected stakeholders; • Criteria for when and how to explicitly allocate fisheries resource access;	Not Yet

	• The value (economic or social) of the fishery or resource to Queensland; • A method to adequately quantify the benefits to the community; Solutions that are cost-effective and capable of being implemented; • Specific consideration of the Indigenous sector allocations. • Determine allocations as an explicit part of harvest strategies for individual stocks or regions.	
SA PIRSA (2011)	Catch by weight used as the preferred unit for estimating shares. Where reliable catch data are not available, shares may need to be estimated by other means, such as the existing level of access to fishing areas or fishing period. Central principle to be applied in determining and adjusting the allocation between fishing sectors is that aquatic resources are to be managed consistently with the principles of ecologically sustainable development. • Other principles: • Optimum utilisation; • Equitable distribution; • Fishing is to be fostered; • Certainty; • Opportunity to be heard; • Rights of existing users recognised; • No acquisition of licences/entitlements without compensation; • No reduction of other rights without compensation; • Use best available science/information.	Yes
Tasmania	No explicit allocation policy available.	No
Victoria VIC DPI (2011)	No explicit allocation policy available. Previously, the Victorian Future Fishing Strategy had the following proposals for reform. Establish a resource sharing framework. • Management plans explicitly allocate shares of the resource to each sector Initial allocation based on best estimate of current shares. • Recognise Aboriginal customary fishing through agreements with Traditional Owners. • Changes to catch or effort will be applied in proportion to specified shares. • Management plans will set out how any future adjustments in shares may occur. • If the share of one sector is re-allocated in favour of another it will be offset in a fair way. • Set a total catch for a fishery each year and within that set a commercial catch limit and a recreational catch limit. • Aboriginal customary fishing will be fully recognised in this catch setting process. Develop a resource sharing policy to guide the legislative framework and management plans • Consider the best methods for adjusting shares - a preferred model would involve all relevant sectors in reaching a solution. • Cross-jurisdictional sharing for fish species that cross State and Commonwealth boundaries.	No

VFA (2016)	• Address the types of information to be used to estimate initial shares, including the level of assessment needed for different fisheries, depending on their value and risk profile. The above has not eventuated, but there is a statement in the Victorian Fisheries Authority Act 2016 that the VFA would work closely with many stakeholders to deliver three core outcomes: • Sustainable fishing and aquaculture; • Clear resource access and sharing arrangements; • Increased economic, social and cultural value.	
WA DoF WA (2009) DoF WA (2016)	Fish resources are a common property resource managed by the Government for the benefit of present and future generations. An independent body, currently the Integrated Fisheries Allocation Advisory Committee (IFAAC), will provide advice to WA Government on inter-sectoral allocations. • Sustainability is paramount • Decisions must be made on best available information • A harvest level, that as far as possible includes the total mortality consequent upon the fishing activity of each sector, should be set for each fishery and the allocation designated for use by the commercial sector, the recreational sector, the customary sector, and the aquaculture sector, should be made explicit. • The total harvest across all sectors should not exceed the allowable harvest level. • Appropriate management structures and processes should be introduced to manage each sector within their prescribed allocation. • Allocation decisions should aim to achieve the optimal benefit to the Western Australian community from the use of fish stocks and take account of economic, social, cultural and environmental factors. • It should remain open to government policy to determine the priority use of fish resources where there is a clear case to do so. • Management arrangements must provide sectors with the opportunity to access their allocation. An aquatic resource management strategy must specify: • the quantity of the aquatic resource that is to be available in a fishing period for customary fishing and public benefit uses; • the proportion of the TAC that is to be available for recreational fishing for the resource; • the proportion of the TAC that is to be available for commercial purposes.	Yes

Only Western Australia and South Australia have actually undertaken explicit sectoral allocations by applying their policies. Both of these jurisdictions base allocation on a percentage of the catch or TAC. In the Western Australian rock lobster fishery, for example, resource allocation for customary/indigenous fishing is considered to have priority over commercial and recreational allocations. Customary / indigenous fishers are allocated 1 tonne, commercial fishers are allocated 95% of the catch and recreational fishers are allocated 5% of the catch[12]. In contrast, for Pink Snapper in Western Australia's Shark Bay

[12] http://www.fish.wa.gov.au/Species/Rock-Lobster/Lobster-Management/Pages/default.aspx

Snapper in Shark Bay, WA

In 2003, given concerns about the sustainability of the resource in Shark Bay, a TAC (in weight) was set for both commercial and recreational fishers. A tagging system was applied to manage the recreational TAC. The tags were initially unpopular with the sector (because of cost) but were eventually accepted given the obvious recovery of the Snapper fishery. The tagging system was later abandoned given recovery of Snapper in Shark Bay.

Fishery, the recreational sector is allocated 75% of the TAC and the commercial sector is allocated 25% [13].

As another example, in the South Australian Marine Scalefish Fishery there are specific allocations of both primary and secondary species to the commercial and recreational sectors based on catch history and a nominal share of 1% has been made to the customary/indigenous sector which is deducted from the recreational share (PIRSA, 2013b). Recognition of (and compensation for) loss of commercial fisheries access because of MPAs applies in South Australia. Non-extractive use is not explicitly considered under other jurisdictional policies but is recognised as part of the social benefit arising from ESD principles.

The 2009 Queensland Sustainable Fisheries Strategy has identified the need for allocation to be an explicit component of fisheries harvest strategies, but this has yet to be implemented as policy. The Commonwealth only recently (late-2017) amended its legislation to include recreational and customary/indigenous fishing interests and is currently drafting a resource sharing policy. For other jurisdictions, particularly Victoria and Tasmania, the findings of the Productivity Commission Inquiry report on Marine Fisheries and Aquaculture remain valid.

Lack of a clear policy on allocation has been associated with business uncertainty and inter-sectoral conflict in a number of jurisdictions (see example from Port Philip Bay, Victoria; (King and O'Meara, 2018) and certainly can be quickly eroded when allocation formulae change even in jurisdictions with well-established policies (e.g. see later discussion regarding Western Australia Rock Lobster).

Another example has emerged as the ramifications of the Blue Mud Bay decision begin to take hold in the Northern Territory, causing significant uncertainty amongst the all sectors (including government) about future access

Port Philip Bay, Victoria

The Victorian government does not have a clear policy on inter-sectoral fisheries resource allocation.

For example, a commitment to increasing participation in recreational fishing — "Target 1 million" — by 2020 (Andrews 2015) is resulting in a "*phase out of all commercial netting of Port Phillip Bay over an eight-year period beginning from the government's election in late 2014*" through a mandatory licence buyout. Effectively a re-allocation from the commercial to recreational sector, the lack of a clear policy under which this decision was made led to concerns about principles of social justice and equity and uncertainty about future security of commercial fishing access rights in other Victorian bays and inlets.

[13] http://www.fish.wa.gov.au/Species/Pink-Snapper/Pages/Pink-Snapper-Management.aspx

and allocation rights[14],[15]. On 4 December 2018, the Northern Land Council (NLC) agreed to an extension of the permit waiver for commercial and recreations fishers to access the Aboriginal-owned intertidal zone until 28 June 2019 while negotiations can take place among commercial, recreational, and indigenous sectors[16].

Regardless of the current issue in the Northern Territory, generally, incorporation of explicit access and allocation arrangements for customary/indigenous fishers is undeveloped in most jurisdictions (e.g. Hawkins 2004; Schnierer and Egan 2016). This is despite the development of indigenous fisheries strategies (New South Wales) in 2002 (Schnierer and Egan 2016). In 2004, the National Indigenous Fishing Technical Working Group established a set of principles to guide customary/indigenous fishing policy across all jurisdictions (Schnierer and Egan 2016). These principles included *inter alia*:

- Customary fishing is to be defined and incorporated by Governments into fisheries management regimes so as to afford it protection.
- Recognition of customary fishing will translate, wherever possible, into a share in the overall allocation of sustainably managed fisheries.
- In the allocation of marine and freshwater resources, the customary sector should be recognised as a sector in its own right, alongside recreational and commercial sectors, ideally within the context of future integrated fisheries management strategies.

Despite this, the Productivity Commission (2016) continued to find that "Indigenous customary fishing is not clearly recognised or managed in fishery laws. This has resulted in uncertainty over the rights and obligations of customary fishers and tensions between sectors in some high-demand fisheries".

We also highlight the slow progress on developing guidelines for allocation of fish resources to the indigenous sector despite a clear need having been identified in various reports across the past decade. Only South Australia and Western Australia have explicit allocation arrangements for the customary/indigenous sector. It is worth noting that Northern Territory is in the process of establishing indigenous allocation arrangements following the Blue Mud Bay decision.

Recommendation 3. All jurisdictions recognise historical customary / indigenous fishing through shares in the overall allocation of fishery resources.

Through the literature reviews and interviews conducted for this study, it was also very apparent that very few jurisdictions had explicit indigenous positions on management advisory committees or resource assessment groups, even in coastal fisheries that have had a significant history of indigenous fishing.

[14] https://www.abc.net.au/news/2018-11-15/blue-mud-bay-fishing-nt-coastline-closed-traditional-owners/10502200

[15] https://www.abc.net.au/news/2018-11-14/fishing-permits-delay-native-title-blue-mud-bay/10494138 (Accessed 28/11/18).

[16] https://www.nlc.org.au/our-land-sea/sea-country-rights (Accessed 12/03/2019).

Recommendation 4. Improve policies and processes to ensure adequate indigenous representation and input in all jurisdictions. Indigenous capacity will need to be built to meet this requirement.

ALLOCATION UNIT

Any allocation, whether between or within sectors requires a common currency and identification of what is being allocated: is it the fish stock, time (e.g. months / seasons), fishing effort, area or the value of the fish? We considered the pros and cons of these potential units.

As stated previously, "value" is fraught as a cross-sectoral allocation unit because each sector may place different economic, social, cultural or environmental value on a resource. Even when just economics is considered, different sectors may view the economic value of their catch differently (Hundloe, 2004). Given the vastly differing fishing gears, efficiency and capacity that exist between sectors, other possible inter-sectoral allocation units, such as days fished or fishing effort may not be equitable, nor might they directly constrain sectoral allocations in terms of catch. As a result, they would require complex standardisation exercises to be applied inter-sectorally, if they could be applied at all. Allocation of access to a resource by division of space or time is another option. There are many jurisdictions where one sector may be assigned certain areas or time where they can fish but others can't. Whilst relatively simple to implement and manage, fish stocks often do not remain evenly distributed over either space or time, so if days fished or units of fishing effort were to be used as an allocation unit, they would have different relative allocation values over space and/or time – not what managers are looking for when they are endeavouring to achieve equity, justice and security in an allocation process. More importantly though, such input approaches to allocation units, may not directly constrain sectoral allocations in terms of catch, thereby undermining their potential to achieve an ESD outcome.

Ultimately, we concluded that to be consistent with Australian fisheries management legislation, international law and ESD principles, the fish stock — as the object of management — must be the primary subject of allocation. We have found that where this is not explicitly stated, other forms of allocation, such as those based on space or participation, are less defensible from an ESD perspective.

Recommendation 5. Consistent with fisheries management legislation and ESD principles, we recommend that the fish stock is the subject of allocation.

In jurisdictions with explicit allocation policies (South Australia, Western Australia), weight of fish is used to allocate the stock between sectors. This is a logical and defensible approach because weight (biomass) is the common unit used in fishery stock assessments and the common measure to determine the proportion of a fish population that can be extracted without impacting on the sustainability of the resource. Furthermore, weight can be consistently applied across, and transferred between sectors.

Victoria is currently undertaking an innovative three-year trial legally requiring recreational fishers to tag and report the rock lobsters they retain in order to obtain more accurate recreational catch data[17]. Tags are unlimited but must be fully accounted for on an annual basis before a fisher can obtain tags for the next year. A requirement that tags must be

[17] https://vfa.vic.gov.au/recreational-fishing/tagging-of-recreationally-caught-rock-lobsters# Accessed November 2018).

attached to caught fish provides for compliance and monitoring. Some "citizen science" fishers also report the sex and size of their retained catch. Tagging is also useful in raising awareness of resource limits and encourages sustainable fishing practice in the recreational fishing community. The commercial fishery for rock lobsters in Victoria is managed by ITQs and the management plan allows for an arbitrary recreational catch of 10% of the commercial catch. Conceivably, once inter-sectoral catches are known, an allocation could be implemented based on weight and converted for the recreational sector into a number of individual lobsters using mean rock lobster weights from boat ramp interviews or citizen science data. Tags reflecting this number could then be issued (allocation method to be determined) to the recreational sector.

Thus, for high-value species such as lobster, mud crab, snapper or tuna, for example, use of number of fish as a unit of allocation to non-commercial sectors may be preferable compared to weight. Number is often easier for compliance reasons, but it also allows for value associated with "trophy fish" to the recreational sector. Conversions between weight and number are relatively straight forward if required to move between allocation units and stock assessment requirements.

Recommendation 6. Weight (of fish) should be the common unit of inter-sectoral allocation with a proportional share applied across sectors. For high value, single-species fisheries, such as rock lobster or tuna, numbers could be used as the unit of allocation and later converted to weight for stock assessment.

ALLOCATION METHODS/FORMULAE

Based upon the extensive literature and experience of allocation within the commercial fisheries sector, we emphasise the need to explicitly differentiate between the process of, and the formulae or method used to determine, allocation.

The Neville (2012) report described the necessary principles for a legitimate and acceptable inter-sectoral allocation *process* covering natural justice, governance, fisheries legislation and fisheries management. These principles closely mirror how allocations have been undertaken in many Australian commercial fisheries. Some form of independent allocation panel comprising expertise in law, economics and industry, is tasked to consult with stakeholders, consider options and make recommendations to the decision-maker. Roles and processes of these panels are prescribed in legislation and are often supported by policy documents. Guided by the legislative objectives of the jurisdiction including requirements of natural justice, an allocation formula determines what proportion of the total allowable commercial catch or total allowable effort is allocated to each eligible fisher.

In most commercial fisheries where ITQs are introduced, it is the allocation formula that is probably the most contentious issue dealt with by managers and the commercial sector. This is because different formulae can have a major economic impact on individual fishers, and possibly others directly and indirectly involved with the fishery, such as harvesting crew, the processing sector, and fishing communities. In all cases, the aim is to be fair and equitable and to minimise economic impact on individuals, but there are always some winners and losers (Geen et al, 1999). Depending on the fishery, various eligibility criteria are considered and allocation formulae have taken into account: the characteristics of the access right (such as whether they are transferable); catch history; fishing gear entitlements (e.g. pot holdings); and, if data are available, the results of analyses to assess economic and social impacts on individuals of different allocation determinations (Geen et al, 1999).

In South Australia and Western Australia, the formulae for inter-sectoral allocation has been based on catch history for the commercial and recreational sector and, a nominal percentage allocated to the customary/indigenous sector. To our knowledge no other explicit formulae are used.

In any case, consideration could be given to establishment of pre-determined shares of a resource to extractive sectors with provision for trading among sectors. If a decrease to TAC is warranted (because of ESD concerns) a proportional decrease occurs across all sectors. Similarly, if an increase can be justified (e.g. as was the case for Western Australian rock lobster) and individual sectors choose not to take additional catches then trading among sectors could apply. Thus, a base line allocation with fixed shares among sectors could apply with provision for trading of any surplus arising from stock assessments. This is consistent with Neville's (2012) recommendation for market-based approaches to inter-sectoral allocation.

In jurisdictions with no allocation policy (or not yet implemented), both the process and the allocation method is vulnerable to political and/or interest group pressure with the potential to lead to inter-sectoral inequity and sub-optimal ecological, economic and social outcomes.

SPATIAL SEGREGATION AS AN INTER-SECTORAL ALLOCATION METHOD

Blue Crabs (SA)

South Australia is proposing a closure of inshore areas to commercial fishing for blue crabs to allow greater recreational access. The proposed changes to access also reflects summer migration of crabs into the shallow waters favoured by recreational fishers. This spatial segregation of SA's most popular recreational species would coincide with an increased allocation to commercial fishers given demonstrable sustainable management.

The greatest conflict between commercial and recreational sectors occurs when there is direct contact between the sectors. Contact can occur when fishing vessels operate in the same waters as recreational fishers (e.g. Port Phillip Bay, New South Wales estuaries, South Australian crabbing, the eastern tuna and billfish fishery, the Western Australian Demersal fishery, New South Wales mud crabs, Snapper New Zealand) or at boat ramps/piers where commercial fishers unload their catch amongst recreational fishers (e.g. Port Phillip Bay). This triggers concern among recreational anglers that commercial fishing adversely affects their catch. A blunt but effective response to inter-sectoral conflict has been to spatially (or temporally) segregate either one or both sector's access to the resource. This method has been used to a varying extent in every state jurisdiction, usually focussing on the segregation of commercial fishing away from major population centres where recreational fishing is most popular.

We have found that some jurisdictions have not only used spatial segregation as a tool to minimise conflicts between sectors but also as a proxy for a formal inter-sectoral allocation process and method.

For example, In May 2002, 30 areas along the NSW coast became Recreational Fishing Havens (RFHs). In these areas commercial fishing was either completely closed, or significantly restricted, leading to the closure of 24% of the State's estuarine waters, to commercial fishing,

including several major lakes and rivers[18]. The stated purpose was to provide better angling opportunities for recreational fishers and to reduce inter-sectoral conflict, but they were also considered to promote tourism and to create employment in the local area. Commercial fishers were bought out using funds from recreational licence fees. At a 2010 NSW Select Committee on Recreational Fishing in New South Wales (NSW Parliament, 2011), the Committee was advised by government that the primary role of RFHs was also to deal with the allocation of fish catch between the commercial and recreational fishing sector. The Committee noted that any informed debate on the [ecological] impact of recreational fishing catches could not occur until there was an accurate assessment of recreational catch. They therefore recommended that the New South Wales government implement recreational fishing surveys every five years and that they consider funding and commissioning an environmental impact statement to review and evaluate recreational fishing catch and effort in New South Wales waters. A survey is currently being undertaken. Although allocation was an intended objective of the RFHs, without recreational catch data to support the decision, using area as an allocation method for fish stocks is not only hard to justify as a formula but is also difficult to defend based on positive contribution to the achievement of ESD.

Goolwa pipis, South Australia

The management plan allocates shares of the TAC (based on area/beach access) at 73% (commercial), 26% (recreational) and 1% (indigenous) reflecting SA's allocation policy. However, the commercial sector has also voluntarily reallocated 25% of their TAC to the indigenous (the Ngarrindjeri people). This reallocation provides demonstrable social benefits (employment opportunities for Ngarrindjeri people) together with a potent value proposition (high quality local certified sustainable) seafood produced from Ngarrindjeri country.

A formal inter-sectoral allocation based on area has been applied in the Goolwa Pipi (*Plebidonax deltoides*) fishery in South Australia (see box) where there is also specific allocation to the customary/indigenous sector PIRSA 2016). In this case, area of beach is used as a proxy for stock biomass, supported by annual fishery-independent surveys to determine the harvestable biomass and TAC. Robust catch data are available from the commercial sector, but surveys are required to determine the recreational (and indigenous) catch.

In general, we consider that spatial segregation may be an effective inter-sectoral conflict management tool. However, where access is unregulated for one or more sectors, and/or allocation of catch is impossible to accurately apportion due to limited catch data, segregation alone is not a defensible allocation method to ensure ESD.

Where spatial segregation is used as an allocation tool, it may also result in (unintentional) re allocation of fish resources. Changes to stock distribution, for example because of climate change, can also undermine such allocation over time. In many cases, if a reduction in Recommended Biological Catch (RBC) is required for ESD purposes, the commercial sector is the only sector where catch can be effectively reduced due to the combined effects of limited entry, harvest strategies, and the existence of catch data and regular monitoring, control and enforcement. Reductions in catch for other open-access sectors, in particular the recreational sector, is more problematic as there is no control on numbers of participants, there

[18] https://www.dpi.nsw.gov.au/fishing/recreational/resources/info/recreational-fishing-areas/rfh

are no regular catch data, no harvest strategy and limited monitoring and enforcement capability. Additional recreational management measures (for instance reduced bag limits) can be introduced, but without reliable catch data there is no way of determining their effectiveness, which could be simply undermined by increased participation rates (i.e. latent recreational effort activated). Currently, South Australia and Western Australia are the only jurisdictions that have a process for addressing such a reallocation.

KEEPING WITHIN INTER-SECTORAL ALLOCATIONS

Where explicit inter-sectoral allocations have been made (e.g. to Snapper in Western Australia, (WA DoF 2015b) Pipis (PIRSA 2016) and marine Scalefish (PIRSA 2013) in South Australia), there is a requirement (or at least an expectation) that catches will be monitored to ensure that all extractive sectors are operating within their respective allocations and appropriate management responses are taken to maintain sectoral limits. However, in cases where the recreational catch has been recorded and has exceeded limits, deciding what management responses should occur has created a challenge for managers and potential conflict with the commercial sector (whose catches are more strictly controlled).

Harvest strategies, now an integral part of commercial fisheries management in all jurisdictions in Australia are starting to be used (or at least considered) for the recreational sector. They are attractive because they link to clearly understood and agreed decision rules, performance indicators, and management responses (Fletcher *et al.* 2016) and could include a series of responses should a sector exceed its allocation. Harvest strategies developed in South Australia and Western Australia include extension to the recreational sector (PIRSA 2015, WA DoF 2015a). A draft Management Plan for Recreational Fishing in South Australia outlines the management response for the recreational sector when limit/trigger reference points for key species are breached; any changes are to maintain the allocations between three fishing sectors and ensure sustainability. A recent strategic review of fisheries in Queensland also presents aspirations to extend harvest strategies to the recreational and other sectors (QLD DAF 2017).

SECURITY OF ACCESS AND ALLOCATION

Despite recommendations from the Neville review (2012) and the Productivity Commission (2016), security of access and allocation remain problematic. This was well exemplified recently in Western Australia — a state with one of the clearer policies on inter-sectoral allocation — where business certainty was quickly eroded by a proposed change in the allocation formulae.

During December 2018, the Western Australian government announced a proposed change in rock lobster allocation[19] whereby the current 6,300 tonne annual quota would increase within sustainable limits to 8,000 tonnes per annum. Of the 1,700-tonne increase, 315 tonnes would be issued to current licence holders in 2019 and the remaining 1,385 tonnes (17.3 % share) would be available to the Western Australian Government over five years to "…*increase the supply of lobsters for Western Australians and tourists, create hundreds of WA jobs (particularly in the regions), and significantly increase economic return to the benefit of every Western Australian*". The proposed change in allocation was subject to public consultation and ultimately did not proceed. Regardless, the decision sparked concern around the nation about potential implications for access rights and allocation in other fisheries and community resources. Despite all of this, and perhaps highlighting the political nature of the fisheries

[19] https://www.mediastatements.wa.gov.au/MediaDocuments/Lobster%20fact%20sheet.pdf Accessed 20/12/18

allocation process, following intense lobbying, particularly from the commercial sector (claiming that the additional catch would have an adverse economic impact), the government reversed its decision[20]. This case highlights the need for a clear policy and process for managing reallocation including compensation provisions for individual sectors.

Establishment of secure, transferrable fishing concessions applicable to the commercial sector follow government policy for Ecologically Sustainable Development (ESD) of fisheries: equitable and economically efficient management of fisheries (Fletcher *et al.* 2002). Yet legal challenge (for example under the Administrative Appeals Tribunal and/or the Federal Court) to decisions of resource allocation by AFMA have raised issues of transparency, equity, and fairness given limited entry fisheries and the economic impact on individuals affected by allocation decisions (Productivity Commission 2016). Compensation provisions for inter-sectoral reallocation vary across jurisdictions (Table 3).

Changes to access can apply to sectors given legal challenge (e.g. the Blue Mud Bay decision), proclamation of marine parks, expansion of off shore aquaculture leases, or a change in government policy (e.g. Target one million, Victoria). Of all jurisdictions, South Australia has the clearest and most explicit compensation provisions including provisions for displaced commercial fishers following proclamation of MPAs (see SA Marine Parks box above). Where adjustment in inter-sectoral allocation is necessary, the South Australian government prefers market mechanisms. For South Australia, adjustments in favour of non-commercial users will be funded by the government whereas adjustments in favour of the commercial sector will be self-funded.

INTER-SECTORAL TRADING

Market mechanisms to facilitate trading between sectors is often raised as a potential solution to change inter-sectoral allocation (e.g. Neville 2012), and is the preferred approach of South Australia. We considered that the application of market mechanisms can only be extended to inter-sectoral allocation processes once:

- There are identifiable access rights holders. This could be individuals (such as licence holders), communities, associations; and
- There is an agreed unit of currency. Catch by weight is the obvious unit. However, it is feasible that area could also be unitised.

Given the differing fishing gears, efficiency and capacity that exist both within and between sectors, other possible allocation units such as days-fished or value of fish caught may not be equitable, nor would they directly constrain sectoral allocations in terms of catch. As a result, they would require complex standardisation exercises to be applied inter-sectorally, if they could be applied at all.

For most jurisdictions, the prerequisites above have not been achieved, so the prospect of inter-sectoral trading remains some way off.

[20] "WA government backflips over rock lobster crackdown". ABC News 8th February 2019.

CROSS-JURISDICTIONAL STOCKS

Our report has discussed inter-sectoral allocation within a single jurisdiction. Difficult as this is, there is an additional complexity to allocation of fish resources where there is: 1) a resource shared within the same sector in different jurisdictions; and the particularly difficult case of 2) a shared resource between more than two sectors across two or more jurisdictions.

Snapper (*Pagrus auratus*)

Snapper, more so than any other species, has polarised fisheries resource access and allocation in Australia. Snapper are caught in most jurisdictions in Australia (except the Northern Territory) and is one of the most important recreational species in Australia. Commercial fisheries for Snapper are generally included in state-managed multi-species fisheries. There is inconsistency in the regulations applicable to Snapper across jurisdictions. Participation rates in recreational fisheries are uniformly high when compared with commercial participation. Regulations (particularly bag limits and size limits) vary substantially (even for the same stock) across jurisdictions. Only in South Australia and Western Australia there is a specific allocation (as part of the TAC) to the recreational sector.

The appendix of the Productivity Commission report (2016) contains insightful case studies on the shared management arrangements for Southern Bluefin Tuna (SBT), Eastern School Whiting, Snapper, Gummy Shark, School Shark, Southern Rock Lobster and Southeast Australian Scallops. The case studies illustrate the range of problems presenting in the management of cross-jurisdictional fisheries. Relating to this, they found that: "*Arrangements between governments for the management of cross-jurisdictional fish stocks should be streamlined to improve their effectiveness and reduce costs. This will require governments to prioritise and dedicate sufficient resources to reform*".

Our report has highlighted the significant amount of work that is still required on access and allocation arrangements within individual jurisdictions. The issues associated with access and allocation of stocks that cross jurisdictional boundaries only add more complexity. The first priority in dealing with cross-jurisdictional access and allocation is for each jurisdiction to develop a similar approach so processes can be "streamlined" and "reformed" as suggested by the Productivity Commission report (2016). How this might be achieved is discussed below.

Southern Bluefin Tuna

Southern Bluefin Tuna (SBT) is a transoceanic migratory species considered to be overfished by the Convention for the Conservation of Southern Bluefin Tuna (CCSBT). Commercial fisheries for SBT are managed in Australian waters by the Commonwealth through AFMA, responsive to international catch quotas applied by CCSBT. SBT is also a highly prized recreational species targeted by sports fishers and a growing Charter Boat sector (typically operating off the eastern seaboard of Australia). A proportion of the increase in allocated quota of SBT will be set aside for recreational fishers (250 t) as a step towards formal resource sharing and its consequences for sustainable management. Supporting this was a dedicated survey of SBT recreational fishers in 2018.

DEVELOPING A COMMON ACCESS AND ALLOCATION FRAMEWORK

Considerable disparity and variation between management approaches is not a new situation in which fishery jurisdictions find themselves. For example, two decades ago, the inter-jurisdictional differences in harvest strategies for commercial fishery (if they even existed) were extreme with respect to application of ESD, target and limit reference points, rebuilding strategies etc. Since this time, seminal research and management work (e.g. Sainsbury *et al.* 2000; Fletcher *et al.* 2002; Smith *et al.* 2008; Hobday *et al.* 2011; Sloan *et al.* 2014) and most recently, the State of Australian Fish Stocks (SAFS) process (Stewardson 2018), have played a critical role in shaping and guiding policy to a point now, where the different Australian fishery jurisdictions adopt fundamentally the same globally-recognised harvest strategy approaches.

The jurisdictions' different stages of development with respect to access and allocation policies and processes is a likely less a reflection of their different capacities to undertake the work, but more an indication of the differing political appetite for such a move. Decisions (or even discussions) about access, but particularly allocation, are fraught with potentially undesirable political consequences. The relative political influence of the different extractive sectors has been, and continues to be, different in each jurisdiction. Moreover, many of our examples have also shown that even within jurisdictions, the relative political influence of the sectors is in a state of flux. Thus, it is probably unrealistic to expect all jurisdictions to achieve similar levels of policies and processes in the short-term, but it certainly remains a realistic and worthy long-term goal. In the interim, it is important that an agreed cross-jurisdictional framework and tools are developed to guide sound access and allocation policies and processes, so that when the opportune political window opens, a jurisdiction can move quickly to align itself with best-practice fisheries management arrangements regarding inter-sectoral access and allocation. Obviously, the advances already made in some states should be considered in the development of such a framework.

Based upon the success of the National Guidelines on Harvest Strategies (Sloan *et al.* 2014) and the SAFS process in achieving consistent cross-jurisdictional methodologies, we recommend a similar approach be adopted for inter-sectoral access and allocation.

Recommendation 7. Develop "National Guidelines on Access and Allocation" to achieve a consistent approach to policies and processes across jurisdictions.

Based on the findings of the current project, we recommend key elements of the proposed "National Guidelines on Access and Allocation" should cover:

h) Agreed definitions of access and allocation
i) Minimum data requirements
j) Mechanism to determine allocation
   - Appropriate representation of all sectors
   - Facilitate mutual understanding of the values each sector places on fishery resources
   - Agree a common unit of currency (we recommend weight)
   - Explore possible allocation options including proportional shares
   - Evaluate trade-offs between sectors
   - Application to resources that straddle jurisdictional boundaries
k) Appropriate methods to determine and implement sectoral funding of fisheries management based on their allocation
   - Recreational licences

l) Appropriate methods to monitor and constrain catches within sectoral allocations
   - Cross-sectoral harvest strategies

m) Mechanisms to reallocate sectoral shares
   - Triggers for reallocation
   - Inter-sectoral trading

n) Data-poor approaches to access and allocation
   - E.g. spatial or temporal segregation of sectors

An obvious body to initiate and oversee this process would be the Australian Fisheries Management Forum (AFMF). Although it is only an informal network comprised of the heads of Commonwealth and state/territory fishery management agencies, it is tasked with sharing information between the state and federal government agencies involved in managing fisheries and aquaculture in Australia. Specifically, with regard to the current project, its roles include:

- facilitating communication and cooperation on fisheries matters between jurisdictions;
- developing and promoting best practice policy principles for fisheries management;
- promoting implementation and adoption of best practice fisheries management; and,
- strategically addressing the range and complexity of cross jurisdictional fisheries responsibilities and issues through improved communication and collaboration.

These roles are well aligned with the requirement to develop a framework under which a consistent cross-jurisdictional approach to access and allocation policies and processes might be achieved. Furthermore, The AFMF's second goal in its Statement of Intent is "Secure access to fisheries and aquaculture resources" recognising the issue of "Stakeholder dissatisfaction with resource allocation processes and/or outcomes that they may not see as "fair and equitable" nor providing 'optimal' benefit to the community". Their key focus areas are:

- Development of transparent allocation principles and processes;
- Defining clear management objectives for each fishery (secure 'rights' to promote certainty and investment confidence, impacts of other activities / sectors);
- Incorporation of broader social and economic information where appropriate to inform decision making.

Recommendation 8. The Australian Fisheries Management Forum facilitates the development of the proposed "National Guidelines on Access and Allocation"

CONCLUSIONS

Since Peter Neville's review in 2012, there has been varied progress by the various jurisdictions. Two states (South Australia and Western Australia) have explicit access and allocation policies that have already been implemented. Some have since put a policy in place with general concepts but no explicit sharing arrangements that have been implemented (Queensland, NSW, NT); the Commonwealth is developing a draft policy which is not yet available; and Victoria and Tasmania have yet to develop a policy.

One of the main challenges for inter-sectoral access and allocation is the different access arrangements between sectors. These differences create significant hurdles to managing sectoral allocations where access is not controlled or restricted. Access is only capped and controlled in the commercial fisheries sector; anyone is eligible to fish recreationally, and, even where licences or permits are issued, the number of people allowed access is unrestricted (in areas where fishing is allowed). Thus, there is potential to activate latent effort especially in fisheries adjacent to high population areas. In the Customary/Indigenous sector, access is

restricted to those whom are eligible but only the Torres Strait has clarity about eligibility criteria in either legislation or policies.

We separate access from allocation and define the fish stock as the overall unit to which these processes need to apply. This is consistent with primacy of ESD in most fisheries legislation and will assist decision-makers when considering allocation options and reduce the risk of unsustainable fishing. Related to this is the need for a common currency to allocate across sectors. Catch by weight, used in Western Australia, Northern Territory and South Australia, is a logical and defensible approach because weight (biomass) is the common measure to determine the proportion of the fish population which can be extracted without impacting on the sustainability of the resource. Furthermore, weight can be consistently applied across, and transferred between sectors. Other possible allocation units such as fishing gear, days fished, social and economic value of a fish require complex standardisation exercises to be applied inter-sectorally, if they could be applied at all. For high value, single-species fisheries, such as rock lobster or tuna, numbers could be used as the unit of allocation and later converted to weight for stock assessment.

We also explored whether spatial segregation of sectors (particularly commercial and recreational) was a feasible alternative allocation method. Currently, spatial segregation is primarily used as a conflict management tool but with "allocation undertones." Here, we reiterate that the object of any allocation is the fish stock. Thus, for some less mobile species (e.g. Pipis), using space as an allocation method may be possible and bring collateral benefits of minimising any conflicts between sectors. For a large number of finfish stocks, however, spatial segregation is likely to be a sub-optimal allocation method without accompanying measures to keep catches of each sector within their allocated limits. Development of harvest strategies that explicitly include all extractive sectors could facilitate this.

We found that the jurisdictional system of management adds an additional layer of complexity to allocation. Although progress is being made for commercial fisheries through harmonisation of OCS arrangements and shared stock assessments, little progress has been made with regard to inter-sectoral allocations.

The lack of a consistent approach to collecting good quality recreational and indigenous catch data, together with poor information on the ecological, social and economic "values" of fishery resources to the different sectors is a major barrier to fair and equitable allocation processes. This is particularly problematic where recreational catches are likely to be a significant impact on a resource. Experience indicates that without this comprehensive data, access and/or allocation decisions are difficult and subject to political influence, which is likely to lead to sub-optimal ESD outcomes.

The jurisdictions' different stages of development with respect to access and allocation policies and processes is likely less a reflection of their different capacities to undertake the work, but more an indication of the differing political appetite for such a move. Decisions about access and particularly allocation, are fraught with potentially undesirable political consequences, so it is unrealistic to expect all jurisdictions to achieve similar levels of policies and practices in the short-term, but it remains a realistic and worthy long-term goal. In the interim, it is important to develop National Guidelines that outline agreed cross-jurisdictional framework and tools for sound access and allocation policies and processes.

RECOMMENDATIONS

Recommendation 1. Develop and implement a national system to collect catch and effort (participation rates) data from recreational and indigenous fishers in all jurisdictions.

Recommendation 2. Collect and collate detailed spatial and temporal information on the social, economic and environmental "value" of fishery resources to the different sectors to inform decisions regarding inter-sectoral trade-offs in an allocation process.

Recommendation 3. All jurisdictions recognise historical customary / indigenous fishing through shares in the overall allocation of fishery resources.

Recommendation 4. Improve policies and processes to ensure adequate indigenous representation and input in all jurisdictions. Indigenous capacity will need to be built to meet this requirement.

Recommendation 5. Consistent with fisheries management legislation and ESD principles, we recommend that the fish stock is the subject of allocation.

Recommendation 6. Weight (of fish) should be the common unit of inter-sectoral allocation with a proportional share applied across sectors. For high value, single-species fisheries, such as rock lobster or tuna, numbers could be used as the unit of allocation and later converted to weight for stock assessment.

Recommendation 7. Develop "National Guidelines on Access and Allocation" to achieve a consistent approach to policies and processes across jurisdictions.

Recommendation 8. The Australian Fisheries Management Forum facilitates the development of the proposed "National Guidelines on Access and Allocation"

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APPENDIX 1: GENERIC QUESTIONS FOR EACH JURISDICTION

1. When making decisions about access to a fishery (catch, area, gear) how are extractions from other sectors (recreation, indigenous, MPA, aquaculture) taken into account?
2. Who is able to participate in current decision-making and policy processes regarding access and benefits in specific fisheries?
3. How is spatial planning for use of aquatic living resources undertaken e.g. aquaculture zones, recreational fishing havens, special use zones? What costs and benefits are included in the spatial planning process? How is an aquaculture lease given priority over other uses (e.g. fishing, recreation, community access)? How do communities get involved in spatial planning?
4. How are allocations (quotas and licences) allocated among different groups (commercial, recreation, indigenous) and types of fisheries and how are these groups benefitting economically?
5. What cost benefit analyses are made when deciding access and allocation issues in fisheries? Are these explicit (e.g. economic analyses) or implicit (e.g. social impact and benefits)?
6. Through which pathways does access to fisheries and other coastal resources (and changes to this access) impact the well-being of different groups (e.g. producers, processors, charter boat operators, tourism operators, women, youth) in coastal communities? How is this evaluated?
7. How are conflicts in resource use among users resolved or managed? Are there any formal conflict resolution mechanisms or fora?
8. How will coastal community access issues change under future socio-economic and environmental scenarios. How might climate change influence access?
9. How do notions of equity, justice, and fairness guide decisions relating to access and allocation?
10. What values are associated with access to areas of the coast (including bays and inlets) or other water bodies (lakes and rivers) and how are these values presented (e.g. as social benefits, other measures of wellbeing)?
11. How, is access to fisheries prioritised and who is involved in processes defining prioritisation?
12. How is access transferred (and how will it be in the future): inter-generationally, between sectors and between industries?
13. How are different types of knowledge (formal, informal) considered in access and allocation decisions?
14. To what extent will your government support co-management of fisheries? What mechanisms are in place to devolve responsibility for management of fisheries from the government to other users? What weighting is given to particular user groups (e.g. commercial, recreational, indigenous, conservation) and how is such weighting applied in co-management?
15. What methods are applied to assess trade-offs and cumulative effects in the resource allocation process?

APPENDIX 2: ACCESS AND ALLOCATION IN OTHER COMMON POOL RESOURCES

WATER

The Murray Darling River Basin (MDB) is the most important water catchment in Australia supporting a large agricultural sector and many other important beneficial uses. It is often promoted as an exemplar of cooperative water resource management with an emphasis on ecologically sustainable development and a balanced approach to resource sharing. In fact, the MDB has been bedevilled by unresolved conflict, poor compliance, and politically-motivated resource allocation decisions. An independent review prompted by media exposure of "water theft" has revealed dysfunctional monitoring of water and low levels of compliance. In reality, it is difficult to measure unregulated and un-supplemented water just as it is difficult to measure extraction of fish by (effectively) unregulated participation by recreational fishers. As with most fisheries, water is a public good but a price now applies for access to that resource. With increasing demand and increasing scarcity, water prices will increase. This affects allocation to other sectors, most notably the environment. Water sharing to provide for environmental flows (particularly in NSW) has not occurred particularly during low flows. Conflict among states reflects the vulnerability of lower riparian states such as South Australia (responsive to water extraction from upper riparians (particularly NSW and Queensland). Sanctions for non-compliance vary among states. This lack of consistency is but one source of conflict among states vying to meet user demand with ever decreasing water resource availability.

As in fisheries, Australian management agencies have based allocation and resource sharing principles for water on ESD. This follows the establishment of the Council of Australian Government established in 1992. Water governance, traditionally the responsibility of state agencies has now shifted to new governance arrangements applicable to whole of catchment management (e.g. the Murray Darling Basin). Again, as in fisheries management, these arrangements rely on stakeholder consultation typically through natural resource management boards. However, water allocation decisions are often challenged in Australia on the basis of non-consultation and a lack of social justice.

Surface water and groundwater are essential natural assets generally managed as common property. The use of both water sources is regulated to some extent to prevent overexploitation and to minimise externalities (e.g. dryland salinity from overirrigation of pasture, erosion, ecosystem impacts). Facing increasing scarcity (particularly in Australia), water management includes:

- The development of alternative sources of water (e.g. desalination);
- Conservation of existing resources;
- Modification of current allocation methods.

Increasingly, market mechanisms are being used to allocate water. Irrigated agriculture requires a licence for water used. There is an intersection of water resource allocation with forestry. Forests intercept rainfall and thus aquifer recharge, but also extract water from groundwater. Accordingly, in South Australia, a water licencing system was introduced for forestry plantations and water budget planning (reducing the allocation to irrigators). In Victoria, water is managed through the Water Allocation and Entitlement system. This is a hierarchical system: the Victorian government has the overall right to the use, flow and control of all surface and groundwater for consumption (Patrick *et al.* 2014). The Minister for Water

then allocates water through bulk entitlements and for maintaining environmental flows through the Environmental water reserve. The remaining entitlement is then sold to private individuals as water rights, licences and shares. A water share is a property right: a tradeable secure share of water owned by an individual.

Recent changes to governance of water in Australia make an explicit allocation to the environment notably in the Murray Darling Basin (Lukasiewicz *et al.* 2013). This affects not only irrigators but rural and urban communities. Allocation among multiple users of water resources reflects intra- and intergenerational issues of social justice and equity. Increasingly, the conservation and protection of vital ecosystem services is recognised in policies applicable to both water and fisheries. Payments for ecosystem services are emerging as market-based mechanisms for water allocation (Daniell *et al.* 2014). Yet few studies have provided a comprehensive evaluation of the qualitative value of social uses and cultural significance of water to communities (Gillet *et al.* 2014). Similarly, while notional in fisheries, there is no explicit valuation of social or cultural benefits in resource sharing for water.

In Australia, availability of water is decreasing and demand for water is increasing. However, recovery from prolonged drought has eased this supply demand issue. As in fisheries management, water shortage can be presented as insufficient water supply (or fish stock) or as excessive water consumption (of fish catch). How the issue of water scarcity is framed (supply vs demand) relates to issues of social justice. Should users with legitimate expectations of water allocation be penalised for poor management of water resources? This situation inevitably leads to conflict in resource use (e.g. irrigators vs environment). These conflicts are typically addressed over a range of administrative and institutional scales (as in fisheries management). These scales do not often match catchment or groundwater boundaries. However, the emergence of a consolidated catchment management plan for the Murray Darling goes some way to tackling management on representative scales. Yet how can water be reallocated given the social and economic impact that this will have particularly on dependent rural communities? On the one hand, communities traditionally reliant on water intensive industries (citrus, grapes, cotton, rice) present powerful social and economic arguments in favour of retention of water access rights. They support jobs and livelihoods with the political and social power that attach to rural communities. On the other hand, degradation or loss of ecosystem services has a demonstrable environmental impact with consequent economic impact (e.g. dry land salinity, erosion, aquatic habitat destruction).

FORESTRY

Forests are a vital common property resource which are becoming increasingly privatised. In the present context, forestry is similar to aquaculture. Exclusive access is provided to a resource often within a common property environment (land or water). Access rights are determined by licences which specify operating requirements (e.g. for farming Tasmanian Atlantic Salmon). Forests also provide a range of goods and services (including vital ecosystems) such as timber, clean air, non-timber forest products, water purification, habitat for beneficial flora and fauna, erosion protection and maintenance of biodiversity. Forests also provide social benefits including aesthetic value, recreation and cultural amenity. Increasingly, forests store carbon and provide a valuable service in decreasing carbon emissions responsive to the need to mitigate climate change. Carbon stores can provide a capital asset just as timber itself is an asset once harvested.

Typically, forests are slow growing and harvesting is episodic (often over lengthy time periods). In mixed species forests the harvest or retention of one species may affect the sustainable yield

of another (e.g. through light availability). Deforestation, to provide other land use (agriculture, urban development, mining) will have an impact on all of the above. Land management, like fisheries management should explicitly address trade-offs in the access and allocation process.

The extraordinary expansion of oil palm in developing countries such as Indonesia creates many undesirable externalities. As the number one source of GDP (through palm oil) there are economic (and political) incentives to increase oil palm plantations. Yet the loss of ecosystem services including provisioning services (crops, vegetables, timber, medicines, other non-timber forest products), regulating services (carbon stock, water purification, air purification, erosion control) and cultural services (traditional livelihoods, ancestry, meeting places, recreation) must be balanced against the economic value of palm oil yields (Afentina *et al.* 2017). Similarly, the use of fire to clear land for oil palm plantations presents considerable risk to the environment (e.g. smoke, carbon emissions) and to local communities (health impacts) together with an economic impact (many activities cannot operate because of high smoke density). The favouring of a direct economic benefit (money from palm oil) over considerable indirect costs (or externalities) causes perverse outcomes.

Plantation forests often occur on private land. Exclusive access and management applies. Yet some of the externalities referred to above can influence public utility. Accordingly, governments have a role (as for the aquatic equivalent: aquaculture) in spatial planning to minimise impact on other beneficial uses (including ecosystem services).

MINERALS

Extraction of minerals (through mining), in contrast to fish, is an unrenewable process. The user (miner) has two sources of value: sale of minerals, and the value of the asset (minerals in the ground). The user accrues capital gain only when the entitlement is sold (much like a fishing licence). Often, minerals are extracted from common property or "Crown" land. In such cases, operators pay a royalty to the government for access to the resource. The notion of a resource rent (payable for exclusive access to a common property resource) is important for non-renewable resources perhaps even more so than for renewable resources such as fisheries. Even so, minerals and the benefits that accrue from their use (in industry) have important economic and social benefits.

Mining is a risky and capital-intensive industry. Investors must balance the need for a minimum return on investment versus a fair return to the community for access to a particular resource (e.g. iron ore, oil, coal). Accordingly, States apply royalties to mined goods that are sold. Rates are readily available and published on government websites e.g. Queensland for various minerals and hydrocarbons. Mining operations, however, often present undesirable and harmful externalities (e.g. pollution, loss of biodiversity, groundwater impacts). The extraction and burning of coal, in itself an economically viable activity, ignores the externality of carbon emissions and pollutants (e.g. sulphur dioxide, nitrous oxides). The cost of these environmental impacts (externalities) is not generally borne by the operator. In economic terms, such externalities are considered to be market failures. That is, the tendency for free markets to encourage efficient (and profitable) utilisation of natural resources by users is offset by environmental impacts which impose cost burdens on others. Solutions include internalising the costs by imposing taxes equivalent to the emissions of pollutants. In Australia, this has been clearly rejected with the opposition to an emissions trading scheme (which would internalise costs in the energy generating sector).

RADIO FREQUENCY SPECTRA

Radio spectra management is responsive to national and international regulation. The International Telecommunication Union (ITU) allocates frequencies to specific uses (e.g. satellite and terrestrial television, wireless broadband). The military also has exclusive access to radio frequency spectra. Early in the development of radio spectra utilisations economists have argued for property rights for secure access (e.g. Coase 1959). The involvement of governments in allocation and access decisions has been criticised as crippling innovation, providing no incentives for innovation or efficiency (Sims *et al.* 2016, Michalis 2016).

Radio spectrum management has acquired high economic and political significance. This reflects the rapid expansion of mobile telephony and broadband networks responsive to the digital revolution across the world. Radio spectrum is a natural but finite resource. Typical uses operate in the frequency range from 3 Hz to 3000Ghz. Higher frequencies support higher bandwidth (i.e. data) but have shorter ranges. Like fish, frequencies do not follow state borders. Given the explosion in demand and scarcity of spectra, how is allocation managed? Various industries make competing claims on spectra with high economic stakes related to market opportunities (e.g. internet service providers, mobile telephone companies). Wireless Broadband (WBB) is increasingly competing (with greater economic and political power) with digital terrestrial television (DTT). However, DTT is associated with public broadcasting and presents a public good (Michalis 2016).

Demand for radio frequency spectra can be addressed in three ways (Michalis 2016):

- Change in use (reallocation from broadcasting to WBB). This requires planning and negotiation and can be very time consuming.
- Spectrum expansion (getting more from available spectra e.g. with change from analogue to digital technology).
- Substitutes (e.g. switch from wireless to cable technology, change to satellite technology).

There are relevant parallels to Australian fisheries. With population growth near major cities and the popularity of recreational fishing, competition for fisheries resources in accessible coastal waters (estuaries, bays and inlets) is increasing. Indeed, several jurisdictions notably Victoria are actively encouraging expansion of participation in recreational fishing (e.g. target 1 million). This will increase competition for finite fisheries resources particularly high-profile species such as snapper. Inevitably, this leads to an allocation from commercial fishers to recreational fishers.