

SUBMISSION TO PRODUCTIVITY COMMISSION INQUIRY INTO REGULATION OF AUSTRALIAN MARINE FISHERIES AND AQUACULTURE SECTORS

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Are fish stocks allocated and managed in a way so as to ensure a viable and sustainable fishing sector both now and into the future?

Australian fisheries in general are sustainable, which is evident from national and jurisdictional status reporting. It is however also clear that most fisheries are not optimally managed - there is a performance gap between their current status and the management that provides greatest community benefit.

While overall status of stocks is good, there are nonetheless some overfished stocks. These are typically small volume, data poor species. More significantly in terms of national productivity, most of our larger fisheries have substantial scope for improvement (Ridge Partners 2009).

Ridge Partners (2009) *Evaluating the Performance of Australian Marine Capture Fisheries: A Report to the Fisheries R&D Corporation - Resource Working Group.*

How should the value of recreational fishing and Indigenous customary fishing be measured and so better inform access allocation decisions?

Fisheries stakeholders have resisted measuring the value of recreational and indigenous fishing to date and this has led to decisions on resource sharing that fail to maximise the community benefit.

A barrier to valuation has been naivety around valuing these sectors. Two common mistakes are made: (i) the assumption that only commercial fisheries can be valued and that this is revealed by gross value of product; (ii) that expenditure of recreational fishing represents the economic value of that sector.

The true measure of recreational and indigenous fishing is their utility. Failing to measure this has led to a default valuation of zero, which results in a policy response of simply allowing access to non-commercial sectors rather than attempting to maximise utility.

Allocation decisions should be made on shifting catch to sectors that provide greatest marginal increase in utility. There are simple, established economic methods for this (eg Hundloe's "Is my fish worth more than yours?") but it rarely applied. Management of catch by recreational and indigenous sectors needs to be driven by the same approach.

Some examples:

- a) There is diminishing marginal utility of recreational catch as each fish is landed. I.e. people enjoy the first fish they land each day much more than the last fish. So they have low utility if they fail to catch a single fish. There is also disproportionately high recreational utility for larger fish. I.e. one 2 kg fish creates more utility than two 1 kg fish. Given this, valuation of recreational fisheries should be used to drive biomass targets for the stock that increase strike rate and size of fish, even if this means daily bag limits are reduced. But recreational fishery management in Australia is not this nuanced and is driven by the assumption that utility is equivalent to catch.
- b) Hand collection of lobsters from inshore waters was an important cultural activity for Aboriginal Tasmanians that has been lost because density of lobsters inshore is too low to allow harvesting. If we used economic approaches to value and maximise indigenous cultural activities, we would reduce total catch to rebuild stocks in some inshore locations to maintain this cultural utility. Total economic value (i.e. utility of all sectors and stakeholders) would increase.

Do the current access arrangements provide for the realisation of the highest economic value from fisheries?

Economic benefits from almost all of Australia's fisheries are currently well below their potential. This was shown by the Future Harvest Subprogram of the Australian Seafood CRC which conducted bioeconomic research on Australia's largest and best resourced fisheries. Substantial opportunities existed in all of these fisheries for increasing economic value, which implied that the scale of opportunity in Australia's smaller fisheries with less research history must be even greater (Emery et al, 2015).

An example: Australia's most data-rich and best studied fishery is the Southern Rock Lobster Fishery, with over 500 journal publications, more than double the next highest fishery, Southern Bluefin Tuna. Bioeconomic modelling of Southern Rock Lobster showed that economic yield in this fishery could be increased by at least 30% over current levels with changes to regulations such as size limits and catch settings (Green et al., 2011). So scope for increase in many other fisheries is presumably at least this great.

Emery, T and Gardner, C and Cartwright, I*, *Introduction to the use of bio-economics in fisheries management for key decision makers*, The Seafood CRC Company Ltd, the Fisheries Research and Development Corporation and IMAS, Hobart, TAS, 203/748.30 ASCRC (2015)

Green, BS and Gardner, C and Linnane, AJ* and Hobday, D* and Chandrapavan, A and Punt, AE* and McGarvey, R* and Hartmann, K and Treloggen, R* and Revill, H* and Hoare, M* and Hawthorne, R*, "Spatial management of southern rock lobster fisheries to improve yield, value and sustainability", Australian Seafood Cooperative Research Centre, Australia, Project 2006/220 (2011)

Is there a reasonable balance between the interests of different users in the current allocations of access to marine fisheries?

Processes for allocation of resources are highly variable across jurisdictions. Three jurisdictions have formal overarching allocation policies or frameworks (South Australia, Western Australia, and Northern Territory).

The absence of resource allocation policies and of clearly defined economic and social objectives for fisheries in a number of jurisdictions (Ogier et al 2016) makes it challenging to apply an evidence-based approach of weighing up and trading off costs and benefits of various allocation scenarios to different users. This makes it difficult to assess the extent to which a reasonable balance between the interests of different users has been achieved.

Access arrangements affect economic value and are normally decided by politics and opinion rather than analysis. The problem with this is that representation is uneven and the best economic outcomes can be counter-initiative. Reducing catches to increase long run economic yield in commercial ITQ fisheries is an example where analysis is required to overcome opinion and lobbying.

A guiding principle to allocation of Australian fisheries should be to maximise the benefit of the resource to the community that owns the resource. This includes people who don't participate in the fishery directly as recreational, commercial or indigenous fishers. Recreational fishers are increasing seen as equivalent to the community in the creation of recreational-only fishing areas.

A problem here is that the majority of the community owners of the resource (i.e. all people residing in the jurisdiction) don't fish recreationally or commercially and aren't represented in allocation discussions.

All Australian fisheries management acts include an objective of deriving economic benefits from fishing for the community (of that jurisdiction). Beyond this, however, economic benefit is not clearly defined in terms of its form and distribution, with the exception of the Commonwealth's *Fisheries Management Act 1991*. Frequently, the default or implicit interpretation has been that this economic objective is achieved by maximising economic efficiency to achieve industry surplus and any resultant flow on benefits.

As a result, the public rarely gets a direct benefit from commercial fisheries other than from flow-on benefits from employment and other costs. Furthermore, Australian fisheries management actually attempts to reduce these economic flows in our larger fisheries by increasing fleet efficiency with catch share systems and allowing the resultant positive economic yield to be exported to quota owners outside the jurisdiction. Shifting catch to non-commercial sectors increases benefit to some members of the community but has the problem of further reducing wider community benefit from the presence of commercial fisheries.

A broader interpretation of the economic objective of ensuring economic benefits the community (i.e. community net benefit) would include benefits arising from a combination of resource rent, industry surplus, as well as consumer surplus, flow on benefits, and non-commercial utility, depending on the fishery context.

Ogier, E. Gardner, C., Emery, T., Jabour, J., Sloan, S., Stobutzki, I. (2016) *Final Report: Meeting Sustainability Expectations: Policy Translation, Objective Setting and Reporting for Australian Fisheries*. FRDC-funded project 2013-204. [In preparation]

Is there room to improve the process for determining the allocation of such rights? For example, how might competing interests be better reconciled?

Where are there overlaps or conflicts between the rights of access for the different groups of fisheries users? How are such overlaps and conflicts best addressed? How best can the common interests of users be leveraged to improve fisheries outcomes?

If we accept that the allocation of Australian fisheries should be undertaken to achieve the

fisheries management objective of maximising the benefit of the resource to the community that owns the resource, then five steps are required to reconcile competing interests. These are:

1. *Implement a flexible resource sharing system.*

Most jurisdictions have this but choose to lock-down allocations between sectors, which prevents management responding to changes in the marginal value of sectors through time. An example of this system is a catch share system where fractions of the total catch are allocated to each sector, and this fraction reviewed and adjusted every five years.

2. *Allocate the resource.*

Allocation is made to each sector based on their marginal utility. This means that methods such as contingency valuation are used to measure the recreational value, not expenditure. The “resource” here is normally the catch but could also be fractions of the coast to enable the creation of indigenous or recreational-only harvest zones.

3. *Capture the benefit.*

Benefits to recreational and indigenous users are direct. However, Australian commercial fisheries increasingly provide little direct benefit for the jurisdiction. Most product is consumed out of the jurisdiction or even overseas, while employment and other regional impact benefits are actively minimised by management strategies to increase producer efficiency. For example, we have used individual transferable quotas as a strategy to reduce labour costs (employment) by more than 30% in each of the top eight commercial fisheries in Australia. This efficiency results in a positive economic rent but is exported from the jurisdiction when quota owners holiday, invest or live interstate and overseas. This problem is resolved if the jurisdiction captures the benefit of the commercial fishery with a royalty payment. This is conceptually the same as implementing land tax or tendering for forestry harvests, and has been applied successfully to a small number of fisheries in Australia and numerous fisheries globally.

4. *Manage harvests to maximise utility.*

This means targeting maximum economic yield for commercial sectors or maximum utility for non-commercial. In practice these tend to result in very similar target reference points and high stock abundance.

5. *Review allocations between sectors.*

Return to step (b) periodically and shift allocations between sectors to maximise overall benefit from the resource through time. This does not require transfer of quota units or any market trading, just a decision by government on the size of the allowable catch of each sector.

Relative to other costs (such as fuel and labour), how significant are the costs of complying with fisheries regulation? Do so-called ‘input controls’ (such as limits on boat size and fishing gear) unduly restrict fishing operations, result in lost opportunities and/or discourage investment within the Australian commercial fishing industry?

The cost of compliance, management and regulation in Australian fisheries is minor relative to fuel, labour and depreciation of capital, which is apparent through occasional quantitative research on fishing costs (eg Gardner et al. 2015 or surveys of SA fisheries by EconSearch). Nonetheless, many Australian fisheries are limited by cost of harvesting rather than stock abundance (eg Commonwealth Tuna and Billfish species). Management costs are typically a fixed cost so are less important to fishing activity than variable costs and price of product. Most management costs are subsidised by the Australian government even in fisheries that claim full cost recovery. This is apparent, for example, in leverage of research contributions.

Most Australian fisheries have input controls that reduce the efficiency of the commercial fishery. An example is the vessel limits of pots in the Tasmanian lobster fisheries that almost double the level of employment / cost of labour over what could occur without these controls (note that catch is unaffected by this control because it is limited by a total allowable catch quota).

Gardner, C., Hartmann, K., Punt, A. and Jennings, S. (2015). In pursuit of maximum economic yield in an ITQ managed lobster fishery. *Fisheries Research*. 161: 285-292.

Are there any other aspects of fisheries regulation (such as uncertainty over the permanency of arrangements) that deter investment?

Uncertainty over permanency of access is often cited as a factor deterring investment but there's evidence that this is not particularly important for most coastal fisheries, which seems to be due to low barriers to entry. For example:

- a) Permanency of access is typically addressed in Australia for licences and catch shares / quota units. The ownership of these access entitlements is increasingly separated from the fishing operations with different individuals / firms conducting the fishing from those who own the entitlements. Fishers who lease quota for their businesses have no permanency and rely on leasing quota though the market each fishing season. We see no shortage of fishers reliant on leased catch.
- b) Developmental fishery permits were opened in Tasmania in 2015 and demand was high despite explicit warnings that these permits did not imply permanency.

What are the major challenges and opportunities facing the commercial fishing industry over the next 20 years? What aspects of fisheries regulation need to change for the industry to best meet those challenges and opportunities?

a) The internationalisation of seafood.

Seafood has become one of the most traded food categories – seafood produced by Tasmanian commercial operations is now mainly directed to export markets while seafood consumed in Australia is now mainly imported. This affects the way that marine resources provide benefit to the community. Consumers of commercially produced Tasmanian seafood are now mainly overseas, so the benefit to the Tasmanian community is now mainly through employment and profitability of firms. This contrasts to the way commercial seafood industries were historically viewed, which was more around food security.

This creates a regulatory need for processes to facilitate trade, such as reporting and managing food safety and traceability, organic certification, environmental certification and fish welfare.

b) Growth in supply outstripping growth in demand

Contrary to popular perception, seafood production globally is rising faster than demand which increases competition in the international marketplace. This creates pressure on prices and accounts for falls in real price of many globally traded species such as abalone, salmon, white fish and prawns. This driver is complicated though. Supply of some species, notably lobster, is constrained so that price has increased. There are also some species of seafood that have achieved “brand” status so are not substitutes for other seafood product. For example, flathead has become a well-known species, has found greater status in the marketplace, supply is constrained, and price has risen.

There are four regulatory responses here:

1. target lower cost of harvest with stock management. Higher abundance means lower cost of fishing which increases competitiveness. The need here is for bioeconomic testing of target reference points;
2. move beyond the paradigm that if you catch fish then you can sell fish. We need to create harvest strategies that target niche price segments, for example managing/reducing total catch of abalone and prawns to increase supply of large size grades that can be differentiated from aquaculture product. The change required here is to use bioeconomic research / analysis in setting regulations.
3. management needs to be flexible enough to allow fishing types and methods that reduce costs (for example, factory trawlers);
4. leasing of harvest rights to lower cost operators from other countries (for example, for tuna harvest).

c) Public scrutiny

Public scrutiny of aquaculture and fisheries has never been more intense so there's a need to keep management in order. It's also an opportunity to promote aspects of Australian marine resources where we are leaders.

The management response includes:

- The targets or objectives of benefit from our marine resource industries. These tend to be focused on the producer but could involve more consideration of societal benefits. This includes sharing between sectors.
- Communication systems and public transparency (eg water quality, protected species interactions, stock concerns)
- Third party certification and EPBC Act reporting (or meeting benchmarks some other way).
- Emerging issues, such as monitoring and management of CO2 emissions, fish welfare, life cycle analyses, source of inputs, labour force safety and ethics.
- Supply chain regulation to ensure food safety

d) Shocks and changes in production

Marine systems and thus marine resource industries are naturally highly variable which creates challenges for management and use. Climate change means this variation is likely to increase. Change and shocks to production also comes from disease outbreaks, toxic algal blooms, and market shocks (SARS, food health scares, trade disputes). There's a regulatory need here around building resilience into systems and preparedness.

Preparedness to these can include diversity in markets and products and contingency planning. It's clear that resilience to shocks in wild fisheries is linked to the design of the harvest strategy. For example, Western Rock Lobster are experiencing record low recruitment to the fishery as a result of climate change but this has had no effect on their catch – because their current harvest strategy is resilient. Preparedness in aquaculture can involve development of new stock lines.

e) Foreign and corporate ownership

Ownership of Australian fisheries is changing rapidly due to: (i) the creation of tradeable catch shares or ITQs for all of our larger fisheries; (ii) the separation between ownership of catch shares and the fishing firms that actually take the catch; (iii) increase in resource rents paid to owners of catch shares, aided by management policies targeting economic yield; (iv) the absence of controls on foreign ownership of Australian fisheries; (v) the competitive advantage of larger / foreign corporations in bidding for shares.

Larger / foreign corporations are increasingly able to outbid smaller/local operators. This is a critical issue for Australian commercial fisheries because our management creates more efficient fisheries with less labour inputs and higher economic yield. Yet the benefit of this higher yield is being exported. Examples of the strategies that are being used by companies to shift ownership in Australian fisheries are:

- companies that own both the processing sector and a large share of the quota can set the price paid to fishers artificially low. This reduces their Australian tax payable on quota rents by shifting the taxable profit offshore to the final sale in export markets. It also reduces the yield to local investors, which manipulates the market price of quota units lower.
- Larger companies tend to have greater ability to offset profits from quota rents against other losses in their businesses. Some companies such as the large Maori seafood companies also have lower tax treatment in their home jurisdiction. This enables them to out-complete local buyers of quota units.
- There is asymmetry of power in some quota trades so that the market fails. For example, there are cases of larger companies forcing local fishing operations to not bid for quota shares. The control / threat in this case has been that local fishers are dependent on leasing of quota from the larger company. They are threatened with being excluded from any future leasing if they compete for ownership of quota.

The regulatory solution to this is the same as for other scarce Australian resources –the scarcity rent needs to be captured for the community with a royalty. If that occurred then foreign ownership of fisheries would be positive in the same way that foreign capital investment can be beneficial for mining.

***Are fish stocks managed in way that will ensure a viable and sustainable commercial fishing sector?
How effective are harvest strategies, such as the Commonwealth Harvest Strategy, in guiding the management of fish stocks?***

The National Guidelines define a harvest strategy as:

“a framework that specifies the pre-determined management actions in a fishery for defined species (at the stock or management unit level) necessary to achieve the agreed ecological, economic and/or social management objectives” .

http://frdc.com.au/research/Final_Reports/2010-061-DLD.pdf

This is clearly a required and sensible approach to modern management. Harvest strategies solve long running problems in Australian fisheries of lack of objectives and politicisation of decisions on stock management.

That said, there's scope for improvement in most of the harvest strategies being rolled out in the following areas:

- Objectives tend to be focussed on commercial fishery surplus, not public good.
- The target reference point are often based on opinion or historical reference years rather than bioeconomic analysis so they don't maximise economic benefits.
- Decision rules are often not tested before they are implemented.
- Wider inclusion of ecological objectives in harvest strategies to enable EBFM approaches (Fletcher et al., 2016)

Nonetheless, the roll out of harvest strategies represents a huge step forwards.

Analysis currently being undertaken by Ogier et al (2016) for the FRDC-funded project 2013-204
'Meeting Sustainability Expectations: Policy Translation, Objective Setting and Reporting for

Australian Fisheries' is examining the extent to which fisheries for which harvest strategies are in place achieve higher levels of:

- biological stock status as reported in the *Status of Australian Fish Stocks 2014*; and
- policy connectivity and coherence.

Ogier, E. Gardner, C., Emery, T., Jabour, J., Sloan, S., Stobutzki, I. (2016) *Final Report: Meeting Sustainability Expectations: Policy Translation, Objective Setting and Reporting for Australian Fisheries*. FRDC-funded project 2013-204. [In preparation]

Fletcher W.J., Wise, B.S., Joll, L.M., Hall, N.G., Fisher, E.A., Harry, A.V., Fairclough, D.V., Gaughan, D.J., Travaille, K., Molony, B.W., Kangas, M. (2016) Refinements to harvest strategies to enable effective implementation of Ecosystem Based Fisheries Management for the multi-sector, multi-species fisheries of Western Australia. *Fisheries Research* [In press].

Are there regulatory approaches that are better suited to achieving the objectives of fisheries regulation compared to quotas? What, if any, challenges exist in the processes for the initial allocation of quotas (for states) and subsequent determinations of allowable catch? Is quota trading functioning effectively?

Quota management has been effective at solving many economic problems in Australian fisheries such as reducing incentives for capital stuffing and increasing technical efficiency so that economic rent increases.

There are however many challenges/problems which have arisen in part because of the lack of clearly defined economic and social objectives which make clear what types of benefits are sought from the allocation and how these benefits are to be distributed.

These challenges and problems include:

- a) Initial allocation of quota is occasionally auctioned (eg the Victorian dive scallop fishery) or sold (the Tasmanian giant crab fishery) but more commonly it is permanently given away. This is an unusual approach with a public asset and inconsistent with the way public assets are normally transferred to private ownership. It is inconsistent with the objective of most Australian fisheries management which is for fisheries to benefit the community, not a privileged subset.
- b) Many inefficiencies remain in ITQ fisheries. For example, competition for individual fishers for premium product / fishing locations is not eliminated so that economic yield is reduced. An example is the incentive for lease fishers to land product even when the price is low if they can operate profitably individually (Emery et al., 2015).
- c) ITQs theoretically provide incentives for fishers to support TACs that maximise future economic yield. In practice this rarely happens because of a suite of reasons such as fishers having a high discount rate and a lack of understanding of the dynamics of the fishery (Gardner et al. 2015). For this reason, ITQs will rarely maximise economic yield unless a harvest strategy defines a target based on economic analyses and includes a decision rule for setting catch.
- d) ITQs have led to a separation between ownership of quota and fishing operations (van Putten and Gardner, 2010). Rents flow to quota owners while the fishing sector competes for access to quota and drives up the lease price. The fishing sector subsequently suffers margin squeeze which has been found to increase fishing in poor weather and risk of injury and death (Emery et al, 2014).

- e) ITQs are typically paired with targeting of maximum economic yield, which reduces public utility from fisheries to increase producer surplus of commercial fishers. For example, supply of seafood to Australian consumers from the South East Scalefish Fishery has been reduced and given lower priority than profitability of commercial fishers. Lower supply, higher seafood price, and lower industry cost occurs when maximum economic rather than maximum sustainable yield is targeted.
- f) ITQs are effective at reducing employment and increasing economic rent, which is paid to quota owners. Quota owners clearly benefit from this process but the benefit to the Australian public is ambiguous. Labour, associated businesses and food supply to consumers are all reduced. Higher economic rents may lead to higher taxation revenue but this is collected by the Commonwealth rather than in the jurisdiction / region where the employment is reduced.

Emery, T.J., Hartmann, K., Green, B.S., Gardner, C. and Tisdell, J. (2014). Fishing for revenue: how leasing quota can be hazardous to your health. *ICES Journal of Marine Science*.

Emery, T.J., Tisdell, J., Green, B.S., Hartmann, K., Gardner, C. and Leon, R. (2015). An experimental analysis of assignment problems and economic rent dissipation in quota managed fisheries. *Ocean and Coastal Management*, 106: 10-28.

Gardner, C., Hartmann, K., Punt, A. and Jennings, S. (2015). In pursuit of maximum economic yield in an ITQ managed lobster fishery. *Fisheries Research*. 161: 285-292.

van Putten, I. and Gardner, C. (2010). Lease quota fishing in a changing rock lobster industry. *Marine Policy*, 34: 859–867.

How well is recreational fishing recognised in current fisheries management and regulatory arrangements (including in relation to access rights)?

Fisheries management acts for the majority of Australian jurisdictions include objectives to ensure the provision of recreational fishing opportunity as one of the forms of social and economic benefit arising from fisheries management. Recreational fishing is less well recognised at the operational level where harvest strategies are predominantly designed to meet biological and economic objectives of commercial fisheries. In small number of cases harvest objectives or decision rules have been designed to meet recreational fishing objectives, such as maximising fisher satisfaction levels either through desired strike rates/CPUE or trophy-size fish (eg. NT Demersal Fishery).

What are the key influences on, or barriers to, innovation and productivity improvement in the commercial fisheries sector? Where does regulation most affect resource use and incentives to improve? What management settings should be changed or implemented to maximise productivity growth?

Greatest opportunity for productivity gains in wild fisheries lies in changing regulation to target economic yield and to better deliver gains to the community. The Australian Seafood CRC recently concluded after 7 years of operations at which point the ROI of their investments were analysed. It was found that greatest productivity gains were made through increasing efficiency of wild fishery regulation. The reason for this is that technical efficiency (eg better boats, smarter operators) is already well addressed through global markets for engines, vessel hull design, sounders, etc. Likewise, price is difficult to alter by marketing because the products are highly traded and sold into international markets. In contrast, regulations can be changed easily and tend to have substantial scope for improvement. Fisheries regulations tend to contain rules that have been in place for decades but never evaluated in terms of economic outcomes.

For example, size limits in the Tasmanian rock lobster fishery affect economic outcomes and have barely been altered in the last 100 years. Bioeconomic analyses have shown that current settings result in foregone economic yield of many \$10's millions each year. Changes to the size limits were

put up as recommendations by industry leaders but voted down by the wider membership of the commercial industry representative body (Gardner et al, 2014).

There are three lessons here:

1. bioeconomic methods need to be used to identify rule changes to increase productivity in Australian fisheries. Outcomes will be fishery specific. Formal economic methods are needed rather than expert opinion or co-management. This is because economically optimal regulations are often counter-intuitive to fishers.
2. The scale of opportunity to increase production in Australian fisheries is large. We tend to find large scope for improvement whenever bioeconomic methods are applied.
3. Industry resistance to change tends to be a significant barrier to changing regulations to increase profitability. Co-management thus gives greater power to agents who are resistant to change. The solution here is for Governments to step up to their responsibility of managing fisheries to create economic benefit for the community. Governments (ministers) often see their role as being mainly to ensure biological sustainability, while economic decisions are left to the control of the commercial industry. This is an abdication of responsibility to the objectives of fisheries legislation.

Gardner, C., Hartmann, K., Punt, A. and Hoshino, E. (2014). Fewer eggs from larger size limits: counterintuitive outcomes in a spatially heterogeneous lobster fishery. *ICES Journal of Marine Science*. doi:10.1093/icesjms/fsu165

Are the underlying objectives of fisheries management regulation clear and widely understood?

Economic and social objectives as established in the various pieces of fisheries management legislation are generally not clearly defined, with the exception of the Commonwealth Government's *Fisheries Management Act* 1991 in which case the economic objective is clearly defined. In the case of the States and Territories these objectives are predominantly stated in highly generalised terms, such as "ensure social and economic benefits" (Triantafillos et al., 2014). While it is recognised that economic and social objectives can vary between fisheries within a jurisdiction, neither these acts nor other high level policies provide direction as to how to interpret or define these benefits and how they should be distributed (Ogier et al. 2016).

Less than half of Australia's managed fisheries have formally approved and publically available management objectives at the fishery level (Ogier et al., 2016).

Ogier, E. Gardner, C., Emery, T., Jabour, J., Sloan, S., Stobutzki, I. (2016) *Final Report: Meeting Sustainability Expectations: Policy Translation, Objective Setting and Reporting for Australian Fisheries*. FRDC-funded project 2013-204. [In preparation]

Triantafillos, L., K. Brooks, et al. (2014). *Managing the social dimension of fishing: Part 1 Introduction to social objectives and indicators in fisheries management*. FRDC Project 2010-040 - Final Report. Adelaide, Primary Industries and Regions SA, Fisheries and Aquaculture.

What should be the main objectives of fisheries management and regulation?

In addition to the primary objectives relating to biological and ecological sustainability of the resource and supporting ecosystems, a main objective of fisheries management should include: maximise the benefits of the resource to the community that owns the resource.

If social objectives should be included as objectives of fisheries laws, what priority should they be afforded relative to the other objectives of fisheries regulations?

The objective of maximising the benefits of the resource to the community that owns the resource is a social objective in that it takes into consideration the extent to which the management of a fisheries resource is delivering desired public goods. These can include social and economic benefits to commercial fisheries, recreational fisheries, indigenous customary fishers and communities, and the non-fishing community, which are outlined in detail in Triantafillos et al., (2014).

Triantafillos, L., K. Brooks, (2014). *Managing the social dimension of fishing: Part 1 Introduction to social objectives and indicators in fisheries management. FRDC Project 2010-040 - Final Report*. Adelaide, Primary Industries and Regions SA, Fisheries and Aquaculture.

Are there other countries that provide useful lessons for governance arrangements in Australia?

The governance arrangements of commercial fisheries in Australia are at the extreme end of privatisation of resources that are more commonly valued and retained as public assets. Other countries with a similar approach to Australia are Iceland and New Zealand. They privatised their commercial fisheries with ITQs earlier than Australia so provide some guidance on our future. This is likely to be concentration of ownership by a small number of larger companies. Rents flow out of the jurisdictions to these companies. The employment benefits from fisheries reduce with the fleet shifting to a small number of lease-reliant, high volume, low profit fishers.

Some effective approaches elsewhere include:

- The Maine lobster fishery has an objective to maximise the economic benefit of the fishery to the community rather than quota owners. They limit the total number of traps allowed, access is non-transferable, and entry is not limited. If a person wants to enter the fishery then they receive an allocation of traps from the total pool. This system maximises employment, provides equity of access to all citizens, and controls total harvest so that it is sustainable.
- Many fisheries have royalty leasing so that the community retains ownership of the resource and it is leased through a tender process to provide income to the community. This is the same as applied in Australia to scarce assets such as gambling licences and forestry reserves but is used with fisheries in many areas such as Chile and Pacific Island tuna fisheries. Royalty leasing is sometimes conducted for periods of more than 1 fishing season to give fishers some stability and to promote investment. This provides greater surety to fishers than occurs in Australia where quota is leased from quota owners for a single fishing season only.
- Some Alaskan quota fisheries reduce export of economic rent by requiring quota owners to be present aboard vessels catching the quota, and also restrictions on where product can be landed.
- Labour laws are used in some countries to ensure that quota of that country is harvested by citizens of the country.

Where and in what circumstances has the co-management of fisheries been particularly effective or ineffective? What are the advantages and disadvantages of the different co-management approaches of the jurisdictions and/or in individual fisheries?

Co-management of Southern Rock Lobster Fisheries illustrates common problems with the approach:

- A bias towards higher catches so that risk of stock decline increases and economic rent is dissipated (for example, resistance to reducing catch in the northern zone of South Australia and in Tasmania; Linnane et al., 2010; Gardner et al, 2015).
- Resistance to change due to factors including a lack of understanding of dynamics and the difficulty in reaching consensus on change with a large group of people (for example, 12 management changes were identified for increasing economic yield in the Tasmanian fishery by >50%. 11 of these were rejected by co-management forum and the remaining option only partially implemented).
- The wider public are not represented in advisory committee meetings or other co-management processes. Community representation is typically interpreted as an ENGO representative. This means that information provided to the minister is biased towards private commercial benefit.

Gardner, C., Hartmann, K., Punt, A. and Jennings, S. (2015). In pursuit of maximum economic yield in an ITQ managed lobster fishery. *Fisheries Research*. 161: 285-292.

Green, BS and Gardner, C and Linnane, AJ* and Hobday, D* and Chandrapavan, A and Punt, AE* and McGarvey, R* and Hartmann, K and Treloggen, R* and Revill, H* and Hoare, M* and Hawthorne, R*, "Spatial management of southern rock lobster fisheries to improve yield, value and sustainability", Australian Seafood Cooperative Research Centre, Australia, Project 2006/220 (2011)

Linnane, A., Sloan, McGarvey, Ward. 2010. Impacts of unconstrained effort: Lessons from a rock lobster (*Jasus edwardsii*) fishery decline in the northern zone management region of South Australia. *Marine Policy* 34(5):844-850

What groups most directly benefit from the regulation of Australian fisheries? Of those groups, who obtains greater benefits?

What aspects of fisheries management costs are and should be recoverable from users? How well targeted and administered are current cost-recovery arrangements? Are there better cost recovery approaches than others in this area?

Should there be a charge on the use of fisheries to provide a return to the community from the use of marine resources?

Cost recovery is a normal part of management of public assets. It is reasonable to apply it to fisheries management. It is also reasonable to review costs and find efficiencies where possible.

Tasmania has one unusual example of cost recovery that could be more widely applied. This is where 1% of the rock lobster fishery is retained as a public ownership and leased to commercial fishers each year. This creates income to fund research. It could also be used for all other shared costs.

Cost recovery systems in Australia do not fully cover costs with public subsidy present, for example for research.

Cost recovery is often confused with a payment to the community for access to the resource but they are two completely different concepts / payments. As discussed in several places, many other countries have objectives for their fisheries of maximising economic benefit to the community. We cannot achieve this in Australia without introducing payments for access to scarce resources. Economic benefit is increasingly being reduced and lost through implementation of efficient ITQ systems that lower employment and produce rents paid to owners outside the jurisdiction.

Payments for access to fisheries resources can be implemented in existing quota fisheries. This is analogous to the implementation of land tax in Australia. Land tax is a form of Georgist taxation and

was implemented gradually in Australia, which could also be done in fisheries. In both cases the asset (land / fish) is scarce, the ability to use the resource was transferred from public to private, but benefit remained ultimately in public control (hence mining provisions and compulsory purchase of land).

What effects — or likely effects — is climate change having on wild catch fisheries? If these effects are substantial, what management techniques are being, or could be, used to mitigate or adapt to negative impacts?

Aside from climate change, are there any developing environmental, technological or socioeconomic trends likely to impact on fisheries over the next 20 years?

Climate change adaption has been examined for a range of Australian fish stocks. Not surprisingly, effects of climate change vary from fishery to fishery with both positive and negative impacts on productivity through changes to recruitment, growth and natural mortality. Changes to the range of several harvested species have also been detected that are consistent with climate change.

Climate change adaption is an important part of the broader need for managing fisheries to be resilient to change in productivity, either normal change or climate-change driven. Resilience is increased at higher stock levels, which coincidentally also occurs by setting biomass targets for economic yield.

An example here is the targeting of MEY by the Western Rock Lobster fishery. Implementing this economic target led to exceptionally high biomass even during a period of exceptionally low recruitment attributed to climate change (Caputi et al., 2015).

Other sources of variation that also require resilient management include disease (eg POMS in oysters, AVG in abalone), market closures (eg SARS, trade disputes), and harmful algal bloom closures.

Other trends likely to impact on fisheries over the next 20 years include decreased levels of impact on protected species as well as species of significant societal value (for example, most species of marine mammals and seabirds) from seafood production which are deemed to be societally-acceptable amongst segments of the Australian community. These levels are likely to decrease despite the increasing robustness of risk-based assessments and approaches to managing fisheries within ecosystem-based management frameworks.

N Caputi, S de Lestang, C Reid, A Hesp, J How. 2015 . Maximum economic yield of the western rock lobster fishery of Western Australia after moving from effort to quota control. *Marine Policy* 51, 452-464

How effective and efficient are regulatory arrangements covering marine parks and reserves?

How well coordinated and consistent have the jurisdictions been in designating their respective marine parks? What are the economic, environmental and social impacts of marine park areas?

Marine parks in Australia have been promoted by the Department of Environment as being fisheries management tools (see <http://www.environment.gov.au/system/files/resources/5eaad4f9-e8e0-45d1-b889-83648c7b2ceb/files/benefits-mpas.pdf>) however emphasis is now more on biodiversity conservation.

Marine parks do not increase fisheries productivity except in overfished stocks (Buxton et al., 2014). This means that in the Australian context, where overfishing is uncommon and is being actively addressed, marine reserves will tend to reduce rather than increase fisheries production.

Marine reserves contribute to fisheries management as research sites to examine ecosystems in the absence of fishing. There have been numerous research studies conducted in marine reserves in Australia that improve the knowledge base for fisheries management. Small regional MPAs are valued for this purpose.

There have been expectations in the past that data collected from marine reserves could be used for year-to-year decision making in fisheries, for example by contributing to fishery assessments and harvest strategies. That has not occurred with no decision rules for ecosystem protection based on data collected from marine reserves. The problem here has been that marine reserves provide information on the ecosystem status under only the extreme case of no catch of any species.

Buxton, C., Hartmann, K., Kearney, B. and Gardner, C. (2014) When is spillover from marine reserves likely to benefit fisheries? PLoS ONE 9(9): e107032. doi:10.1371/journal.pone.0107032.