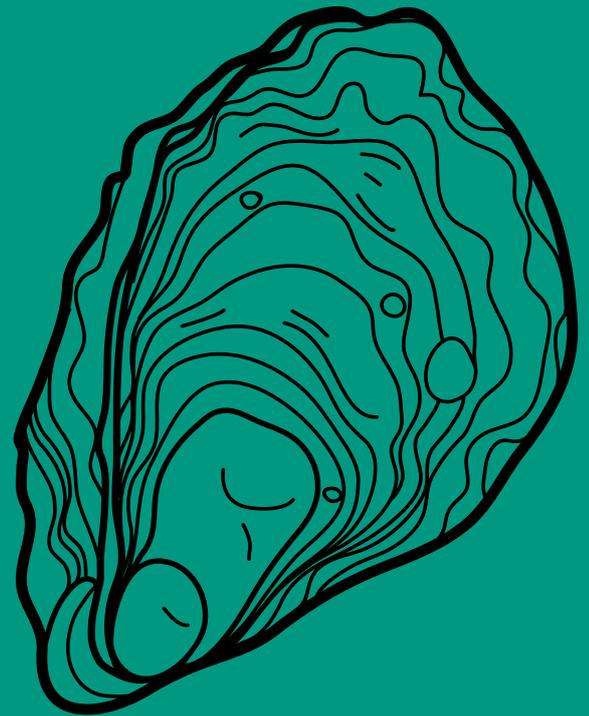


Social and Economic Evaluation of NSW Coastal Aquaculture



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ABBREVIATIONS & ACRONYMS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
AFSC	Alaskan Fisheries Science Centre
ARAC	Aquaculture Research Advisory Committee
CAEPR	Centre for Aboriginal Economic Policy Research
CATI	Computer-assisted telephone interviewing
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FRDC	Fisheries Research & Development Corporation
GCCSA	Greater Capital Cities Statistical Areas
DPI	NSW Department of Primary Industries
EMS	Environmental Management System
EPA	Environment Protection Authority
ESCR	Economic and Social Research Council
ESD	Ecologically Sustainable Development
FAO	Food and Agriculture Organisation of the United Nations
FSANZ	Food Standards Australia New Zealand
FTE	Full Time Equivalent
GRP	Gross Regional Product
GRIT	Generation of Regional Input-Output Tables
GVP	Gross Value of Production
IFS	NSW Indigenous Fisheries Strategy and Implementation Plan

IO	Input-Output
LALC	Local Aboriginal Land Council
LLS	Local Land Services
MEMA	Marine Estate Management Authority
NADSIC	National Aquaculture Development Strategy for Indigenous Communities
NSW	New South Wales
NZ	New Zealand
OECD	Organisation for Economic Cooperation and Development
POMS	Pacific Oyster Mortality Syndrome
QAP	Quality Assurance Program
QLD	Queensland
QX	Queensland Unknown (an oyster disease)
R&D	Research and development
SA	South Australia
SFM	Sydney Fish Market
SLA	Statistical Local Areas
SROI	Social Return on Investment
SRO	Sydney Rock Oyster
TAFE	Technical and Further Education
TARA	Threat and Risk Assessment
UNESCO	United Nations Educational, Scientific and Cultural Organisation
US	United States
UTS	University of Technology Sydney
VIC	Victoria

EXECUTIVE SUMMARY

What the report is about

The aquaculture industry contributes to the vitality and viability of rural and regional areas in coastal NSW. This research addresses two key information gaps about the role of aquaculture in coastal communities. First, the aquaculture industry in NSW feels that their role has not been accurately valued, and this has made them vulnerable in resource allocation decisions. Second, although NSW Government agencies are under legislative obligations to adhere to the principles of Ecologically Sustainable Development, policy prioritises biodiversity conservation and economic sustainability and lacks the processes and tools to include social aspects, such as community wellbeing. These gaps in valuation are of concern not just in NSW, but also around Australia.

In 2015-2016 a collaboration of social scientists and economists from the University of Technology Sydney, the University of Wollongong, ENVision Environmental Consulting and Western Research Institute has addressed these information gaps. Understanding the role of aquaculture in the social and economic lives of NSW coastal communities is vital for 'getting it right' in resource management and allocation. What do communities lose if oyster and prawn aquaculture declines, or if fish farming and other new forms of aquaculture fail to thrive? Using social and economic questionnaires of NSW aquaculturists, the general public, government organisations and businesses related to the industry, coupled with in-depth interviews of 34 people connected to the industry, we uncovered the significant roles that aquaculture plays in helping to sustain the vitality and viability of NSW coastal areas.

This research represents the second known example in Australia of integrating qualitative and quantitative social science and economic methods to develop an integrated and holistic picture of the aquaculture industry's contributions to community wellbeing. The first was a larger sister project *Social and Economic Evaluation of NSW Coastal Professional Wild-Catch Fisheries*, which addressed similar research questions and conducted by a core group of researchers across both projects (FRDC project 2014/301) (Voyer et al., 2016). The current aquaculture project used the same methodology as the Wild-Catch project, and several of the key findings are similar.

Background

Past studies into the NSW aquaculture industry have concentrated largely on environmental aspects of aquaculture, or the economic profitability of businesses, but have not systematically identified a comprehensive range of benefits that the aquaculture industry provides. Without a thorough understanding of these benefits it is impossible to accurately determine whether policy concerning aquaculture might inadvertently impact these benefits, or to compare these benefits with those arising from other resource uses. It is also impossible to determine how decision makers, industry or the local community can capitalise on these benefits by developing strategies that protect or enhance industry contributions in ways

that grow overall community wellbeing. It is envisaged that the data presented in this report will form an important baseline upon which future research can build to allow regular monitoring of contributions over time.

Aims/objectives

The objectives of the Project are outlined in Section 2, and include a full social and economic evaluation of contributions of aquaculture for three regions on the NSW coast (Section 4), and the establishment of a methodology to be used for ongoing social and economic evaluations (Section 7).

Methodology

The methodological framework for the project was provided through a wellbeing approach, which combines an objective evaluation of circumstances in which a community finds itself (material wellbeing) with cognitive evaluations of those circumstances (subjective wellbeing), while also giving emphasis to the social context in which forms of wellbeing arise and by which these meanings are framed (relational wellbeing). A literature review of key 'quality of life' indicators used around the world to measure community wellbeing was coupled with preliminary interviews of seafood producers and others related to the seafood industry in the sister Wild-Catch project (Voyer et al., 2016). This process identified seven 'dimensions of community wellbeing' that were considered relevant to seafood production in NSW. The project then 'ground truthed' these dimensions for the aquaculture industry, and adjusted them as appropriate for analysis of how the aquaculture industry contributes to dimensions of community wellbeing.

Material, subjective and relational aspects of these contributions by the industry to community wellbeing were explored using interviews, social and economic questionnaires and analysis of existing data sets.

Results/key findings

The following results are grouped under each of the seven identified 'dimensions of community wellbeing'.

A resilient local economy

- > Aquaculture is an integral part of the economy of coastal regional NSW. Across NSW, aquaculture and the secondary sector have a likely output in 2013–14 of \$226m, \$134m in added value, and \$69.3m in household income, and the sectors combined involve a total of 1,758 full-time jobs.
- > The aquaculture industry has complementary and interdependent social and economic relationships with a number of other industries that are important to local economies in regional areas. In particular, regional tourism is supported by, and in turn supports, aquaculture.
 - Regional tourism: 89% of NSW residents expect to eat local seafood when they visit the coast, 76% feel that eating local seafood is an important part of their coastal holiday experience, and 63% indicated they would be interested in visiting an aquaculture facility while on holidays.

- These findings indicate that negative perceptions put forward in submissions to development applications and in the media may be a minority view, and that the majority of NSW coastal holiday makers are not discouraged by the presence of aquaculture, but find it adds to their experience in terms of providing fresh local seafood and a point of interest for visiting.
- > Aquaculture plays an important role in local employment, particularly through offering entry-level jobs. Such jobs are proportionally more important in rural economies than in cities, and for disadvantaged social groups, including Indigenous people.
- > Eighty-four percent of NSW coastal residents believe the aquaculture industry provides important employment opportunities in NSW towns. These results varied slightly between regions but remained consistently high across the state.

Recommendation 1: *Undertake ongoing monitoring of the social and economic benefits arising from aquaculture in NSW coastal communities, to enable evidence-based policy development in support of the industry, and to help build the general public's awareness about those benefits.*

Recommendation 2: *Deepen collaboration between aquaculture and other regional food producers, tourism and hospitality operators and regional tourism promotion agencies all along the NSW coast, building on work already being done.*

Recommendation 3: *Collect data on the numbers and types of jobs in aquaculture by region and for Aboriginal people as part of ongoing monitoring of the social and economic contributions to NSW coastal communities.*

Community health

- > Locally sourced seafood is an important source of food and nutrition within local communities, especially in regional areas where preferences and purchasing patterns indicate moderate-to-strong consumer demand for these products. Further growth of this market is inhibited by a lack of awareness among the public as to whether the products they are buying are locally produced. While supermarkets are the primary market for seafood sales in most areas, our results indicate a strong reliance on local co-operatives for those seeking out local seafood. It is likely that consumers are less aware of the provenance of the seafood they are buying when they purchase from other popular outlets such as supermarkets, fish shops, restaurants and takeaway food shops.
- > The NSW general public believes the NSW seafood industry is important for local food security – 94% agree it is important we produce our own seafood in NSW. They also want to know where their seafood comes from – 37% were 'extremely interested' and 35% 'very interested'.

- > Ninety-six percent of NSW coastal residents indicated that the desire to support their local community was a major motivation in purchasing local product.
- > Aquaculture has the potential to contribute to the health and wellbeing of Indigenous communities in a range of ways, including the provision of culturally and materially important food, involvement in the use and management of natural resources and providing employment opportunities (see Recommendation 8).

Recommendation 4: *Using the results of the current study and ongoing monitoring of social and economic contributions, undertake promotional activities in both regional localities and metropolitan centres to build awareness of the social and economic features of the industry as well as the high quality of NSW aquaculture products. This could include location of origin labelling, including for restaurants.*

Education and knowledge generation

- > The aquaculture industry in NSW provides a range of contributions to this dimension of wellbeing, including research, formal training and on-the-job learning about how to do aquaculture well, and also local environmental knowledge, especially about water quality and how to maintain it.
- > These knowledge-generation activities involve not only owners and staff in aquaculture enterprises, researchers and government aquaculture managers, but also members of the community and school students who visit aquaculture facilities or attend talks given by aquaculturists.
- > Awareness of the education and knowledge-generation contributions of the aquaculture industry is low among the general public.
- > A lack of accessible appropriate training and education for Indigenous people is one of the key barriers to their greater participation in the aquaculture industry (see Recommendation 8).

Recommendation 5: *Collect information about the number and types of education and knowledge activities undertaken in the aquaculture industry as part of the ongoing monitoring of its social and economic contributions. Build general public awareness that the industry contributes to its communities in this way.*

A healthy environment

- > Aquaculturists contribute to environmental health through sustainable practices. Aquaculturists undertake extensive environmental stewardship activities and the industry constitutes a stakeholder group strongly motivated to ensure local water quality is maintained and even improved as the animals they are cultivating depend on it. There are interconnections with the tourism sector in this area, which shares a commercial interest in a clean environment because of tourist preferences.

- > The aquaculture industry's social licence to operate depends largely on public perceptions that it is conducted in an environmentally sustainable manner. While the industry undertakes many activities relating to environmental protection, community confidence in the industry's environmental credentials could be improved by raising public awareness of independent, credible, easily accessible information about environmental regulation and performance.
- > Seventy-one percent of the NSW public in coastal communities believe that the aquaculture industry can be trusted to act in a sustainable manner. Seventy percent support the continuation of the industry.

Recommendation 6: *Develop an easily accessible and thoroughly credible web-based source of information about the environmental credentials of NSW aquaculture, and build public awareness that this information exists. This could be based on existing DPI web-based information.*

Recommendation 7: *Raise public awareness of the importance of water quality in estuarine regions, which would increase pressure on other sectors using those catchments to avoid causing pollution. This could build on standards for water quality and its protection in the Oyster Industry Sustainable Aquaculture Strategy (NSW DPI, 2016b).*

Integrated, diverse and vibrant communities

- > The aquaculture industry contributes to social inclusion through provision of entry-level jobs in regional areas. Although not all people who take up this work are socially disadvantaged, a significant number of aquaculturists specifically recruit long-term unemployed people, helping them develop track records of employment and become ongoing members of the workforce.
- > Oyster farming in particular has long provided employment opportunities for Aboriginal people in coastal areas, particularly the Port Stephens–Great Lakes area. Aquaculture has the potential to provide many more opportunities for Aboriginal people, including in business ownership, but previous efforts to support this have not resulted in as many Aboriginal-owned and run businesses as was hoped. Lessons from past efforts indicate that interventions must be long term, business based, multi-faceted, and based on thorough consultation onwards from the planning stage.
- > Aquaculture contributions to an integrated community are influenced by the relationships the industry has internally, with the wider community and with decision makers (referred to as bonding, bridging and linking forms of social capital). The aquaculture industry plays an active role in community life and in supporting local communities through committee work, sponsorships, donations and active participation in community events.

Recommendation 8: Support the development of new business models for Aboriginal aquaculture based on a thorough examination of lessons learned from the past in NSW, elsewhere in Australia and internationally, founded on a commitment to long-term involvement and deep processes of consultation with stakeholders.

Recommendation 9: Undertake an assessment of the effectiveness of aquaculture communication strategies including: 1) how well current efforts to improve the social licence of aquaculture are working in NSW, building on earlier studies of community perceptions of aquaculture, identifying what activities are working well as well as areas for improvement; and 2) the current state of intra-industry relations in terms of achieving effective collaboration.

Cultural heritage and community identity

- > NSW has a long history of Aboriginal and non-Aboriginal aquaculture that has become part of the culture of coastal communities. Oyster farming in NSW is the longest-running commercial aquaculture type in Australia. Some of the prawn and fish farms that started since the 1980s are already multigenerational, and so are becoming part of the heritage of coastal towns.
- > Aquaculture businesses have become integral to community identity in some locations on the coast through being an integral part of the local economy, and also through place-branding work done by industries and regional tourism promotion agencies to build awareness of local producers as part of food communities.

Recommendation 10: Include the aquaculture industry, especially multigenerational farms and Aboriginal involvement in aquaculture in local public history activities, in preserving oral histories, documents and pictures, and in memorialising events and monuments.

Recommendation 11: Build on ongoing efforts promoting aquaculture as part of local food cultures, local economies and local environmental stewardship.

Leisure and recreation

- > The NSW aquaculture industry contributes special-occasion food for convivial social meals at home and at restaurants for celebrations, and importantly also while on holiday. Fresh local seafood is a central part of the enjoyment of coastal holidays for many coastal holiday makers of various ethnic backgrounds.

- > Shellfish leases provide a sheltered fish-attracting habitat that is valued by recreational fishers and also interesting for other boaters, kayakers and picnickers. At least one land-based farm also offers tours and meals that are popular, including with international tourists from various Asian countries.

Recommendation 12: *Build awareness of the recreation benefits of aquaculture infrastructure, as well as about taking care not to damage equipment when boating in the area.*

Recommendation 13: *Improve availability and visibility of local aquaculture product in coastal regions for the enjoyment of holiday makers. This could include collaborations between producers, tourism operators, tourism promotion organisations, hospitality and food retail businesses to make sure there are places to buy fresh local seafood.*

Implications for relevant stakeholders

The project results have a range of implications relevant to industry, local communities, managers or policy makers and other sectoral interest groups, including tourism bodies and recreational fishing groups. The report highlights areas where networks could enhance industry contributions to wellbeing, especially by building on the tourism potential of the seafood industry. This is not to say all aquaculturists will want to be directly involved in tourism, but connections between the sectors may nevertheless be strengthened. The report also suggests that responses to resource allocation disputes in development application processes that seek to exclude aquaculture from coastal areas in favour of tourism or high-end waterfront residential uses may be counterproductive, given the interdependence and complementary elements of different sectors in regional economies. Finally, the research suggests approaches that the NSW Government could take to further support aquaculture development, particularly through ongoing data collection and monitoring of social and economic contributions.

Keywords: *Aquaculture, community wellbeing, social contributions, economic contributions, coastal zone management*

1. INTRODUCTION

This research was borne out of a strong desire from NSW aquaculturists and the Department of Primary Industries (DPI) Aquaculture staff to accurately capture the contributions of aquaculture to coastal communities in NSW. This research generates information about the value of aquaculture that the industry can use to improve their position as stakeholders in resource management negotiations and development application processes.

Decision making around the future of coastal resources and the sectors that use them in NSW must be informed by rigorous and detailed information that can guide decision makers and allow input from community members. Sound evidence about the contributions of aquaculture will enable triple bottom line (social-economic-environmental) policies for sustainability in coastal NSW, by adding social and economic knowledge to the ecological knowledge already developed about aquaculture. A complete understanding of the social and economic benefits provided by the industry and its interconnectedness with other sectors is essential in order to predict, mitigate or avoid potential impacts that may be experienced through their loss or decline. It will also remedy the lack of understanding about the unique contributions possible in particular sections of aquaculture, such as greater involvement of Aboriginal people.

The two primary objectives of the project relate to an accurate assessment of the economic and social contributions the aquaculture industry makes to coastal communities. Prior to this study the only existing data about the economic benefits of aquaculture was the 'farm gate' value of production at the first point of sale recorded by the NSW DPI, and numbers of people who record themselves as business owners or employees in the broad field of agriculture fisheries and forestry in the Australian Bureau of Statistics (ABS) Census.

These data give inadequate information about aquaculture's position in economic networks within coastal communities. In addition, the primary value of the industry, measured through farm gate prices, may be compared unfavourably with other sectors, such as tourism. These figures may then be used as an argument towards prioritising tourism or high-end waterfront residential use ahead of aquaculture in decisions about coastal zone access. Industry considers it important to have a more accurate estimation of their value to local communities, for example, when they purchase a range of goods and services provided from the local community and from larger centres in NSW, with associated employment.

There is also a range of social contributions of aquaculture to NSW communities, and until now these have never been systematically evaluated in NSW. Information on the social contributions of aquaculture is important because it dovetails with the economic contributions and assists in building a complete picture of the overall contributions aquaculture makes to coastal regions.

We have used a social wellbeing framework to systematically explore the full array of contributions of the aquaculture industry to three regions on the NSW coast. This allowed for an exploration of the material, or tangible, contributions of the industry to local economies and community life. It also allowed for an examination

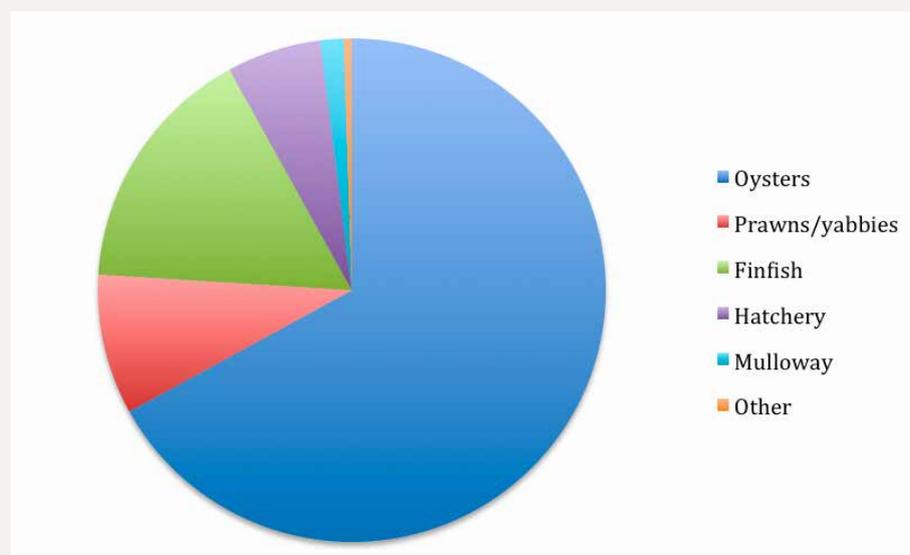
of a range of less easily quantified contributions to social networks and community harmony, as well as to subjective notions of wellbeing – that is, how the community feels about the role of industry in their area.

1.1 Background to the NSW coastal aquaculture industry

Australian aquaculture products range from seafood to pearls, food additives, jewellery, personal accessories and pets, as well as aquaculture tourism activities (Aquaculture Action Agenda Taskforce, 2002). While more than 40 species are produced commercially in Australia, five main species – pearls, oysters, salmon, prawns and southern bluefin tuna – account for more than 90% of the industry's Gross Value of Production (GVP). While many aquaculture species are farmed in each Australian state or territory, one industry typically provides the bulk of GVP in each state. In NSW it is oysters (see Figure 1) (Love and Langenkamp, 2003).

There were 308 oyster businesses in NSW in 2015. This compares with 150 other aquaculture businesses of different types in NSW, including 50 hatcheries operating (NSW DPI, 2015b). According to DPI data, the total value of NSW aquaculture production for 2014-2015 was \$60.66m. Of this 67% of industry value was in the oyster farming and hatchery sector (of which Sydney Rock Oyster constituted around 86% of the value of production). Around 9% was from the production of prawns and yabbies. There was also land-based culture of finfish such as Barramundi, Rainbow Trout and Silver Perch representing 16% of the industry's total value in NSW. Hatchery species accounted for around 6%, Mulloway for 1.5%, with sales of other species making up the final 0.5%. When inland production is excluded, \$47.45m of NSW aquaculture GVP was in coastal aquaculture (NSW DPI, 2015a).

FIGURE 1. NSW aquaculture GVP 2014-2015



Source: (NSW DPI, 2015a).

Aquaculture has a long history in NSW (see Figure 2). Prior to the colonisation of Australia, Indigenous people practised aquaculture for thousands of years. Aboriginal fish traps used by the Ngemba people in the Brewarrina region of NSW testify to traditional Aboriginal knowledge of engineering and fish migration (NSW DPI, 2009). The Arrawarra Fish Trap north of Coffs Harbour is a coastal example. Shell middens along the NSW coast provide evidence of the importance of oysters to Aboriginal communities, both as a food source and for the use of shells to produce cutting tools and fish hooks (Clarke, 2013).

Non-Indigenous commercial aquaculture operations commenced in NSW in the 1870s with oyster farming and the establishment of leases on the Georges River in Sydney (Ogburn, 2011). In 1888 European colonists introduced into NSW rivers European Brown Trout stock, which had been locally farmed elsewhere in Australia (NSW DPI, 2009).

FIGURE 2. Timeline overview of NSW aquaculture

Pre-1788	Pre European colonisation, aquaculture was practised by Aboriginal communities. Both archaeological evidence and community knowledge indicate that sophisticated methods were used to capture and hold fish, to farm eels, and to transport yabbies to restock waterholes. Oysters were a major part of the diet of coastal Aboriginal communities, with oyster shells used as cutting tools and fish hooks.
1870s	European aquaculture began in New South Wales in 1872 when systematic oyster farming commenced on the banks of the Georges River. Oysters were farmed for meat and their shells were used in lime production for building. 1877 The Oyster Culture Royal Commission introduced the first oyster leases in NSW.
1880s	Brown trout introduced and widely distributed in NSW.
1920s	1928 Oyster Farmers Association of NSW Ltd was formed.
1930s	NSW Fisheries and Oyster Farmers Act 1935
1940s	Pacific oysters first introduced to Australia by CSIRO despite concerns raised by NSW Fisheries. 1947 Port Stephens oyster growers amalgamated with an oyster-opening business in Melbourne to form Melbourne Oyster Supply Pty Ltd.
1960s	Boom period for NSW oyster farmers.
1970s	Production of Sydney Rock Oyster reached its peak in NSW, with annual production of around 140,000 bags/year. 1978 Parvo virus outbreak in Georges River impacts on oyster producers. 1979 NSW Fisheries and Oysters Amendment Act.
1980s	Techniques for large-scale hatchery of Murray cod, golden perch and silver perch developed. Eastern king prawn and Tiger prawn farming introduced on the north coast. Native fish hatcheries developed in inland NSW. mid-1980s Pacific Oysters first appeared in significant numbers in Port Stephens. 1986 NSW government declares Pacific Oysters a “noxious species” and Port Stephens growers are forced to destroy all Pacific oysters found on their leases. Many producers go out of business.
1990s	Cultivation of Silver Perch, Yabbies, Barramundi, Snapper and Blue Mussels introduced in NSW. 1991 cultivation and sale of Pacific oysters permitted in Port Stephens. 1994 NSW Fisheries Management Act. 1997 Hepatitis A outbreak in Wallis Lake has a major impact on NSW oyster farmers.
2000s	2000 NSW government begins implementation of its Aquaculture Initiative. 2002 Indigenous Fisheries Strategy and Implementation Plan. 2003 Indigenous Aquaculture workshops conducted throughout NSW.
2015	NSW aquaculture contributes over \$53m to the NSW economy and provides over 1500 jobs in regional areas.

Sources: (Clarke, 2013, Fisheries and Aquaculture Department FAO, 2016, NSW DPI, 2009, Rowland, 2004, NSW DPI, 2015b).

Historically, Sydney Rock Oysters were the main edible oyster produced in Australia. However, after peaking in the 1970s, production fell significantly in NSW during the 1980s, primarily because of increasing competition following the introduction of the Pacific Oyster in combination with a series of environmental shocks (Acil Allen Consulting, 2015), including the impact of illnesses contracted from eating oysters. Since the 1970s peak, annual production of Sydney Rock Oysters has steadily declined, and the industry currently produces around one-third of its 1970s output (Rubio, 2013). While some reports have questioned its future viability, the NSW oyster industry has persevered despite production, environmental and market pressures; production levels and prices have stabilised and increased in recent years and the NSW oyster industry has been described as “tough, resilient and unique” (Acil Allen Consulting, 2015).

NSW oyster producers are diverse, with both ‘lifestyle’ and ‘business-oriented’ lease holders identified in publications about the industry, although government policy through fees and permits is to only allow commercial aquaculture. Twenty percent have joined the industry in the last five years, with a decline in the number of permit holders for small and medium size leases, and an increase in the number of permit holders with large leases (Acil Allen Consulting, 2015). While there are 32 estuaries in NSW producing Sydney Rock Oysters, most production historically has been associated with a few large oyster-producing estuaries such as Port Stephens, Georges River, Wallis Lake and the Hawkesbury River (Rubio et al., 2013). The oyster industry has made a significant cultural contribution to the areas in which it has historically been based, with the community identity of some towns being closely linked to oyster farming (Clarke, 2013).

While the oyster industry is the major aquaculture producer in NSW, other aquaculture ventures predominate in parts of NSW, according to the environmental needs of the species being grown. The NSW DPI reports that some species such as Silver Perch and yabbies are grown widely across the state, and hatcheries that produce fingerlings for aquaculture and stock for farm dams and aquariums are also located throughout NSW. Prawns are grown on the Far North Coast, mussels near Eden and trout on the Southern and Northern Slopes (NSW DPI, 2015b).

Recent research has highlighted the difficulties of the operating environment for the NSW aquaculture industry. Schrobback and colleagues have noted that coastal resources are coming under increasing pressure from competition between recreational, commercial and conservation uses (Schrobback et al., 2014c). Domestic producers also face increasing competition from Asian producers, who typically have lower costs of production. Diversification of product is one current focus within the industry to reduce the risk from disease outbreaks and income fluctuation; an example is Mulloway as an alternate species for prawn farmers in northern NSW (Guy et al., 2014).

When oyster farming became established in the late 1800s and early 1900s in NSW, Aboriginal people helped establish farms and made up a large part of the workforce, especially in the intensively farmed Port Stephens area. Many Aboriginal people who identify as ‘saltwater’ people enjoyed oyster farm employment because it involved working out on the water, on their Country, in work that was flexible as

to the time of day work started and stopped and required little in the way of formal schooling (Clarke, 2013). Employment conditions were not equitable – it was normal practice in Australia before the civil rights campaigns starting in the late 1960s that Indigenous people were not paid as much as White people for the same work, and employment conditions such as holidays were not always respected. Nevertheless, the loss of widespread employment in the oyster industry following the decline in areas like Port Stephens since the 1980s has been a blow to local Aboriginal communities.

I've lived here around the Port all my life, I used to travel from work in little launches up from Karuah, (I) worked for the biggest oyster farmer in the world... When he started oyster farming all the Aboriginals started him off, a few of our uncles, down at Pindimar, then around to Bundabah then finished up on a bit of land in Oyster Cove and that's where we started. I did 27 years straight for the Phillips up there and I had one holiday in 27 years.

(Indigenous fisher) (Voyer et al., 2014 p. 46).

In the mid 1980s the NSW government reached an agreement with Aboriginal people about land rights, resulting in the *Aboriginal Land Rights Act (1983)*, which included the giving of pieces of land to Aboriginal communities through a Land Council system, and a cash settlement in compensation for colonial dispossession derived from a proportion of the state land tax for 15 years, totaling \$166m, which was administered through the Land Council system (Norman, 2015). The land rights settlement brought with it the opportunity for Aboriginal people to start their own businesses on the land over which they gained rights and through the settlement funding. One of the main aims of the land rights movement was to establish culturally appropriate enterprises, and in coastal areas people wanted to establish businesses in aquaculture (Norman, 2012, Norman, 2015).

Further opportunities arose for Aboriginal people to start their own aquaculture businesses through national and state coastal zone resource management policies that unfolded in the late 1990s and early 2000s. In 1993 the National Coastal Zone Inquiry included an Indigenous Coastal Reference Group (ICRG), which identified the need for Indigenous involvement in all kinds of fisheries and aquaculture (Smyth, c. 1993). Following this, Commonwealth funding was made available to develop Indigenous fisheries strategies (including aquaculture) at the state and territory level. NSW DPI began to develop a strategy in 1998 but consultative processes were poorly timed, which led some Aboriginal communities to believe that their 'voice' would not be heard and so the first draft strategy was shelved. In 2000 an interim Aboriginal advisory group was appointed and it restarted the process. In 2001, as part of the application of Environmental Impact Statements for fisheries in NSW, impact on Aboriginal culture and heritage was introduced as a factor (Umwelt Australia Pty Limited, 2001). In 2002 the NSW Indigenous Fisheries Strategy (IFS) and Implementation Plan was launched with \$1.6m in funding. This included aquaculture as a key element of the 'socio-economic development' area of the plan. The goal was to encourage Aboriginal community involvement in commercial opportunities associated with coastal resources, for which workshops, seed funding and training were provided and a NSW Indigenous Aquaculture Reference

Group established (NSW DPI, 2002, NSW DPI, 2004, NSW DPI, 2007). In 2004 the IFS funding ran out. Activities that arose around the NSW Government-supported projects included: regional business advisory workshops; small business grants; Indigenous rangers working on eradicating Pacific Oyster infestations on the South Coast; the establishment of a South Coast Aquaculture Aboriginal Corporation (SCAAC); the Wollongong Aquaculture Aboriginal Corporation's feasibility study for a fish farm at Shellharbour; work towards abalone hatchery technology at the Port Stephens Research Centre Tomaree facility (Feary and Donaldson, 2015); and the appointment to DPI of an Indigenous aquaculture extension officer in 2003–4.

Around the same period there had also been some Commonwealth supported activities on the South Coast of NSW, overseen by the Indigenous Aquaculture Unit in Canberra, as part of the National Aquaculture Strategy (Aquaculture Action Agenda Taskforce, 2002, Faulkner, undated, Fisheries and Aquaculture Department FAO, 2016, Lee and Net, 2001).

One of the studies associated with the National Aquaculture Strategy found that for Indigenous people aquaculture had the potential for increasing employment, economic independence of communities, arresting population drift, improving self-sufficiency in food and food security, and supplementing food and income from capture fisheries (Lee and Net, 2001). Barriers to achieving this potential included:

- > Lack of financial capital
- > Lack of human capital in terms of education and relevant experience for aquaculture business development and management
- > The projects that have attempted to establish aquaculture businesses with Aboriginal people were externally driven
- > The issues affecting the success of Indigenous aquaculture enterprises are complex so they require a whole-of-government approach
- > Conflict within and between Aboriginal groups
- > Effective consultation requires talking extensively with communities to understand their interests and to build relationships
- > Community-based projects have often not been financially viable.

Of the 450 aquaculture businesses in NSW, very few are currently owned and run by Aboriginal people. There are two oyster farms with the Twofold Aboriginal Corporation on the South Coast operating in Lake Merimbula. The Karuah Local Aboriginal Land Council (LALC) and the Bodalla LALC have both expressed interest to NSW DPI in reinvigorating oyster sheds and leases in their land. The role of Aboriginal people as employees in aquaculture and related services, and the potential of aquaculture as a business opportunity for Indigenous people are explored in Sections 4.1 and 4.5.

1.2 Existing social and economic data on the NSW coastal aquaculture industry

There has been little formal investigation of the social and economic aspects of NSW aquaculture. Some of the key studies that investigated the socio-economic data are highlighted below. It has been noted that it is crucial for aquaculture to clearly communicate its social and economic benefits to the community to enable future development of the industry (Brooks et al., 2010).

An Econsearch report prepared for the National Aquaculture Council (Econsearch, 2014b) provided an overview of all publicly available economic data for the Australian aquaculture industry. NSW economic data sources included an annual production report produced by the NSW DPI providing specific data on production (NSW DPI, 2015a, NSW DPI, 2016a), and an annual “Facts and Figures” report on aquaculture in NSW, also produced by the DPI (NSW DPI, 2015b).

A national oyster benchmarking study undertaken by CDI Pinnacle identified the need for benchmarking data as a high R&D priority for oyster growers (CDI Pinnacle Management Pty Ltd, 2010). This study found that seafood producers generally had only limited knowledge of the performance of individual businesses in their sector and what actually constituted best practice. Key findings of this study were that wages represented 49.4% of the total costs of oyster production, and that labour productivity and expansion potential amongst existing leases were important areas of focus for the future development of the Australian oyster industry.

1.2.1 Existing studies of the economic contributions from aquaculture

The range of economic indicators available within an ecologically sustainable development (ESD) framework in aquaculture has been examined (Brooks et al., 2010). That study recommended the use of “net economic return” as a measure of economic profitability and regional economics to estimate flow-on benefits from aquaculture and multipliers in the general economy. Other areas, such as import replacement and exports, import demand, multipliers and taxes were all seen as potential economic indicators contributing to ESD within the national reporting framework.

Nationally, Oysters Australia has run a series of annual profitability “benchmarking program” exercises (Rural Directions Pty Ltd, 2012, 2013a). This was an initiative between Oysters Australia and the Australian Seafood Cooperative Research Centre working with collaborating Australian research agencies to “enhance the quality and marketability of product through improved supply, farming methodologies, understanding and improving the supply chain, post-harvest handling and the development of value added products” (Oysters Australia, 2013). The oysters benchmarking program involved: collecting data on financial and production performance; providing growers with an “Oyster Snapshot” benchmark report for the grower’s individual enterprise; and providing the grower with the national combined Oyster Snapshot benchmark report (Rural Directions Pty Ltd, 2013a). The results for two years of benchmark studies in the oyster sectors nationally are reported in Table 1.

TABLE 1. Oyster production average net profit (before tax and after imputed labour) per year and state as percentage of income

Average Profit	All states		South Australia		Tasmania		NSW	
	2010/11	2011/12	2010/11	2011/12	2010/11	2011/12	2010/11	2011/12
Profit (before tax and after imputed labour)	89,746	76,643	37,087	71,838	71,060	113,754	17,848	34,421
Profit as % of income	-5.60%	6.00%	4.70%	16.80%	5.20%	10.60%	-29.50%	-12.25%

Source: [Rural Directions Pty Ltd, 2013a]

The NSW industry in these two financial years had lower profitability than oyster enterprises surveyed in other states. Some of this may be due to flooding events in both years in NSW. In 2010-2011 NSW production per developed hectare was higher than other states, but the income per Full Time Equivalent (FTE) employee was lower, as was the total income per developed hectare, implying NSW farmers may have received a lower price than those interstate (Rural Directions Pty Ltd, 2012). While operational costs were similar, NSW had a significant cost in imputed labour in the 2010-2011 year, indicating a difficulty in covering business owners' drawings in that period from available income (Rural Directions Pty Ltd, 2012).

In 2011-12 the benchmark survey again indicated seven of the participating NSW oyster businesses had flooding events closing production in the north of the state, reducing total production (Rural Directions Pty Ltd, 2013a). In both financial years NSW operating costs were 77% of income, slightly lower than South Australia and Tasmania. This may be related to NSW (1% of income) having much less finance and hence debt repayment than South Australia and Tasmania (8% of income). The NSW oyster sector has high equity to income ratios and lower average profits than in South Australia and Tasmania, with one report (Rural Directions Pty Ltd, 2013b) concluding that NSW is under-capitalised. This may reflect the history of the farms, the age of the leasees (Schrobback et al., 2014c), and the rural lifestyle mode of many of the oyster lease operators. The benchmarking study points to the NSW oyster sector being diverse, having both lifestyle and business-oriented lease holders, as reflected in some of the previous economic indices which are background to the current study.

The NSW and Queensland oyster industries were studied by Schrobback (2014) in the 2011-2014 period. The study focused on the demand side of the oyster industry, comparing prices between Sydney Rock and Pacific Oysters (Schrobback et al., 2014b) and also differences between demand for oysters in NSW and Queensland and the links between NSW oyster prices and markets in other states (Schrobback, 2014). Schrobback found that Sydney Rock Oysters and Pacific Oysters are part of the same economic market, since prices in the major producing states, including South Australia, move together. She also found that the prices of Sydney Rock Oysters are adversely affected by Pacific Oyster production, but the reverse did not apply (Schrobback, 2014). The adverse impact of increased production and consumption of Pacific Oysters in Australia on the Sydney Rock Oyster industry has also been noted (Schrobback et al., 2014, Schrobback et al., 2014b).

Schrobback (2014) also emphasised the impact of environmental factors on the decline in production of the Sydney Rock Oyster industry in NSW and Queensland. The industry has faced problems such as diseases affecting the shellfish, food safety issues and environmental degradation, increasing regulation and decreasing production volume. Her study argued that relatively little attention has been given to the socio-economic profiles of fisheries and aquaculture and their effect on the future development of seafood production industries. The analysis found that the Sydney Rock Oyster industry was characterised by a mature-aged oyster farmer population and a part-time oyster farming approach. Schrobback et al. (2014) found oyster farmers were mostly male (11% female), Australian-born, with a median age of 56 years, deriving a large proportion of household income from off-farm activities. In common across agriculture in Australia, most oyster growers fell in the category of low-income households when compared with income statistics for all Australian households. This study noted the low proportion of young farmers present in the Sydney Rock Oyster industry and the high proportion of first-generation farmers, arguing that the age profile of Sydney Rock Oyster farmers has “implications for innovation and the attraction of investment” into the industry. Research by Schrobback and colleagues was primarily based on oyster farming in Moreton Bay, Queensland, rather than NSW but many of the issues identified are equally applicable to NSW Sydney Rock Oyster farmers. In particular, the authors note the increasing pressure on coastal resources from competition between recreational, commercial and conservation uses, particularly in coastal areas that are adjacent to major population centres (Schrobback et al., 2014c).

Schrobback and colleagues’ study of the history, status and future of the Sydney Rock Oyster industry found that the value of the Sydney Rock Oyster industry largely derives from its economic contribution to rural communities in NSW (Schrobback et al., 2014a). Their study noted the economic viability of the industry is increasingly coming under pressure, posing policy makers the problem of saving the Sydney Rock Oyster industry because of its historical and cultural value to Australian society, or providing oyster farmers an economic opportunity by expanding the Pacific Oyster industry. Noting the 50% decline in Sydney Rock Oyster production volume between 1980 and 2012, the researchers highlight that while the Sydney Rock Oyster contributes less than 1% to Australia’s total seafood production value. In NSW this traditional industry remains the largest single producer of commercial seafood.

EconSearch (2014b) applied a regional economic impact assessment to the aquaculture industry in South Australia across the full range of farmed species, having previously been involved in assessing regional economic benefits in the aquaculture sector since the late 1990s (see also Econsearch, 2013, 2014a, 2015). The South Australia state-wide study also gained detailed information on both the primary and secondary sectors for aquaculture to make a two sector regional economic analysis. Given the lack of secondary sector price data on aquaculture product in NSW, a detailed regional analysis of the secondary sector required imputation from previous studies.

Pierce and Robinson’s (2013) study of the social impact of the oyster industry in the Eyre Peninsula, SA found that oyster farming has had a predominantly

positive effect on the social fabric of the region. More young people were staying in coastal communities because of the availability of oyster-related employment. Other benefits identified by this study included “more government funding for infrastructure, better educational opportunities, increased community spirit, being ‘on the map’... more social network linkages, increased community pride, and strengthened social capital”, in addition to oyster farming being a tourist attraction (p. 77). These researchers found that the social impacts of oyster farming remain a significant and under-researched area compared to analysis of the industry’s environmental impacts or its economic viability. They found that the oyster farming industry in the Eyre region is primarily owned and managed by local community members.

A report was commissioned to analyse the important socio-economic factors to consider in the context of developing plans for extensive near-shore shellfish cultivation precincts in Jervis Bay, NSW (Joyce et al., 2009). The report noted the complexity of the operating environment due to the Marine Park within Jervis Bay. It identified a number of social returns on investment arising from aquaculture development, including “the availability of fresh local seafood, increased recreation and tourism potential, employment and increased public awareness of sustainable food production” (p. vi). Non-monetary values attributed to aquaculture included aesthetic and recreational values, and access to fresh and live seafood. However, the report also noted a number of the concerns that tended to be identified with shellfish aquaculture, including issues such as: sustainable scale or density of cultivation; the possible direct environmental impacts on habitat as a result of shellfish production; benthic impacts resulting from accumulation of waste materials; translocation of species and pest management; navigational, recreational, visual/scenic, noise and waste disposal; and special conditions relating to operating within a marine park. Aquaculture was also seen to potentially impact on views, commercial or recreational fishing, recreational boating, and other water-based activities. Highlighting the importance of community acceptance and support, Joyce et al.’s report recommended that a Social Return on Investment (SROI) analysis would be beneficial. The SROI approach draws on cost-benefit analysis in combination with stakeholder driven social impact analysis (Fudge et al., 2012) to assess the social impacts involved with stakeholders activities. While potentially useful, it involves attributing financial values to social costs and benefits and then conducting an economic analysis, and so constitutes a socio-economic assessment of impacts. For this current project on professional fisheries in NSW, the objective is to do a social as well as an economic analysis, so a combination of qualitative and quantitative social analysis plus economic analysis is more suitable.

1.2.2 Community perceptions of aquaculture

A major study by Mazur et al. (2005) of community perceptions of aquaculture focused on aquaculture in the Eyre Peninsula SA and Port Phillip Bay, Victoria, but again the findings have relevance for NSW. That study found that most of the community recognised aquaculture’s socio-economic benefits, but were uncertain about its specific environmental benefits and impacts. The study noted that comprehensive and timely information on aquaculture’s social dimensions was needed to avoid costly delays and conflicts in development applications and

to build public support. Positive social impacts from aquaculture identified in this study included the potential “to bring considerable economic opportunity and diversity to remote/rural regions and to supplement declining seafood supplies in the face of increasing demand”. However, negative environmental impacts from aquaculture also had social impacts, including “siting and construction impacts, and local and off-site impacts from farm operations... most often noted as effects on multiple use and amenity values” (Mazur et al., 2005, p. 4). The study found that there was a need for further research to explore the extent to which the aquaculture industry contributes to secure and safe food supplies; is acceptable to diverse communities; helps build human and social capital; provides for ongoing and meaningful employment; and persists over time with minimal social conflict; and maximises the potential to bring economic opportunity and diversity to remote and rural regions.

Other reports from research on community perceptions about aquaculture have asserted that there is scope to improve the social acceptability of the aquaculture industry. The acceptance of aquaculture activities was found to be greater where high socio-economic benefits, such as employment, were clearly demonstrated and communities and stakeholders were kept well informed about environmental impacts and the regulatory processes undertaken by government to manage aquaculture (Mazur et al., 2008).

1.2.3 Summation

The information presented from previous studies on aquaculture discussed in this section points to some of the likely contributions of the industry to local communities. None, however, systematically identifies the range of benefits that aquaculture provides. Without an extensive understanding of these benefits it is impossible to accurately determine how and to what extent proposed or existing decisions about coastal zone management might inadvertently impact these benefits, or to understand the interconnections between aquaculture and other sectors in regional coastal areas. It is also impossible to determine how decision makers, industry or the local community can capitalise on these benefits by developing strategies that protect or enhance industry contributions in ways that grow overall community wellbeing. Our current study therefore represents the first and only thorough study of both the social and economic contributions of the aquaculture industry to local communities in NSW. The data presented in this report forms an important baseline upon which the NSW Government can build regular monitoring of contributions over time and thereby identify trends and impacts.

2. OBJECTIVES

The objectives of this study are:

1. Evaluate the economic contribution of aquaculture production in relevant regions on the NSW coast, including the regional economic impacts such as multiplier effects and employment, and contributions to related sectors within regions, building on previous similar studies (see Section 4.1).
2. Evaluate the social contributions of aquaculture for the same regions, including the participation of families in community organisations, heritage values of seafood production for regions, and the social aspects of economic contributions, building on previous studies (see Section 4).
3. Establish a methodology to be used for ongoing social and economic evaluations as part of government reporting and industry engagement, building on recent and ongoing work in this field (See Sections 7.1-2).
4. Write a report integrating the social and economic evaluations for each region identifying the role of aquaculture in those communities and highlighting threats to sustainability and viability, in a form suitable for engaging with local and state government agencies.

3. METHODS¹

The project objectives include an analysis of both social and economic contributions of the aquaculture industry to local communities. The methodological approach therefore included two main components:

1. An economic survey incorporating an economic questionnaire, an analysis of existing data including production data (from DPI) and price data (from Sydney Fish Market and other sources).
2. A social survey incorporating in-depth interviews, focus groups, content analysis and three questionnaires.

Although there has been some assessment of economic contributions in the past (see Section 1.2), there is no established theoretical framework for evaluating the social and economic contributions of aquaculture to communities in an integrated and holistic manner. One of the primary objectives of this project was therefore to establish a methodological approach to assessing social and economic contributions together. Reporting on social and economic contributions separately fails to appreciate the way different aspects of social, economic and cultural life interact to influence the wellbeing of individuals and communities. The integration of these aspects was crucial to the success of this project.

3.1 Theoretical framework – a social wellbeing approach

The project's methods and analysis were informed by a consideration of the many different factors influencing the wellbeing of communities. To this end we broadened the research question to take into account the ways these different aspects of community life interact.

Research question: *How does aquaculture contribute to community wellbeing in NSW coastal communities?*

The development of an integrated approach to considering both the social and economic contributions of the wild-catch industry was guided by the 'social wellbeing' framework. We adopted the following definition of wellbeing, which is adapted from Nobel laureate Amartya Sen's (1987) capabilities approach:

Wellbeing is a state of being with others, which arises where human needs are met, where one can act meaningfully to pursue one's goals, and where one can enjoy a satisfactory quality of life

(McGregor, 2008, in Coulthard et al., 2011).

This definition recognises that the needs, freedoms and quality of life conditions that contribute to wellbeing are likely to be different across different geographical, societal and cultural contexts (Coulthard et al., 2011).

¹ Due to this study being built on the larger Wild-Catch study (Voyer et al., 2016), with the same methodology being used, large portions of this section of the report are similar to the Wild-Catch report by the same group of authors, with changes made to calibrate the approach for evaluating aquaculture.

It builds on established theory around the measurement of ‘quality of life’ or ‘standard of living’ that developed in the mid-20th century. Since that time there has been considerable scholarly and policy debate how best to measure quality of life. Central to this debate has been the role of mental and social wellbeing in influencing community and individual wellbeing and, in particular, the importance of people having the capability to live the life they choose or value (Coulthard, 2012, Nussbaum et al., 1993, Sen, 1999, Sen et al., 1987, Stiglitz et al., 2009).

Most studies into quality of life conducted around the world now recognise the interplay of a variety of different factors in influencing community and individual wellbeing. An understanding of both ‘subjective’ measures of wellbeing as well as traditional, objective measures such as income and education is now considered essential to any studies of this nature (Himes-Cornell et al., 2013, Kasperski and Himes-Cornell, 2014, New Zealand Quality of Life Project, 2007, Nussbaum et al., 1993, OECD, 2013, Partridge et al., 2011, Stiglitz et al., 2009). This is in recognition of the fact that people’s sense of wellbeing can differ considerably regardless of their economic circumstances, given the human ability and tendency to adapt expectations to their situation. Equally, focusing on goods or resources alone fails to take into account the different amounts of primary goods required by different people to satisfy the same needs (Garnham, 1999). The social wellbeing approach extends this concept further by also recognising that the notion of wellbeing can be highly malleable, with people assessing their own wellbeing in the context of socially constructed meanings formed through their relations with others (Coulthard et al., 2011, Gough and McGregor, 2007, McGregor et al., 2015). Therefore the relationships that people have within their communities can strongly influence their own sense of wellbeing.

The concept of wellbeing is thus a useful tool to explore the environmental, political and economic aspects of sustainability issues, including within the fisheries and aquaculture sector (Britton and Coulthard, 2013, McMichael et al., 2005, Pierce and Robinson, 2013, Smith and Clay, 2010). It considers values, aspirations and motivations and focuses on the wide range of social relationships that are integral to people achieving their wellbeing (Coulthard et al., 2011, McGregor et al., 2015). The ‘social wellbeing’ approach borrows from the UK-based Economic and Social Research Council (ESRC) Wellbeing in Developing Countries (WeD) conceptual framework, which measures three aspects of wellbeing (Britton and Coulthard, 2013, Coulthard, 2012, Coulthard et al., 2011, McGregor et al., 2015):

- > Material: resources people have and the extent to which needs are met including food, income and assets, access to services and environmental quality
- > Relational: extent to which social relationships enable people to act to achieve (their own conception of) wellbeing
- > Subjective: level of satisfaction with the quality of life people achieve. A person’s own perceptions and the values and beliefs that shape those perceptions.

This approach combines an objective evaluation of circumstances in which a community finds itself with a subjective evaluation of those circumstances, whilst also giving emphasis to the social context by which these meanings are framed and the social context in which conceptions of wellbeing can be achieved (Britton

and Coulthard, 2013). The current project uses a slightly different approach to understanding wellbeing and the use of the 'social wellbeing' framework.² In the context of our research into the aquaculture industry, the three aspects of what we have termed 'community wellbeing' were thus slightly modified as follows:

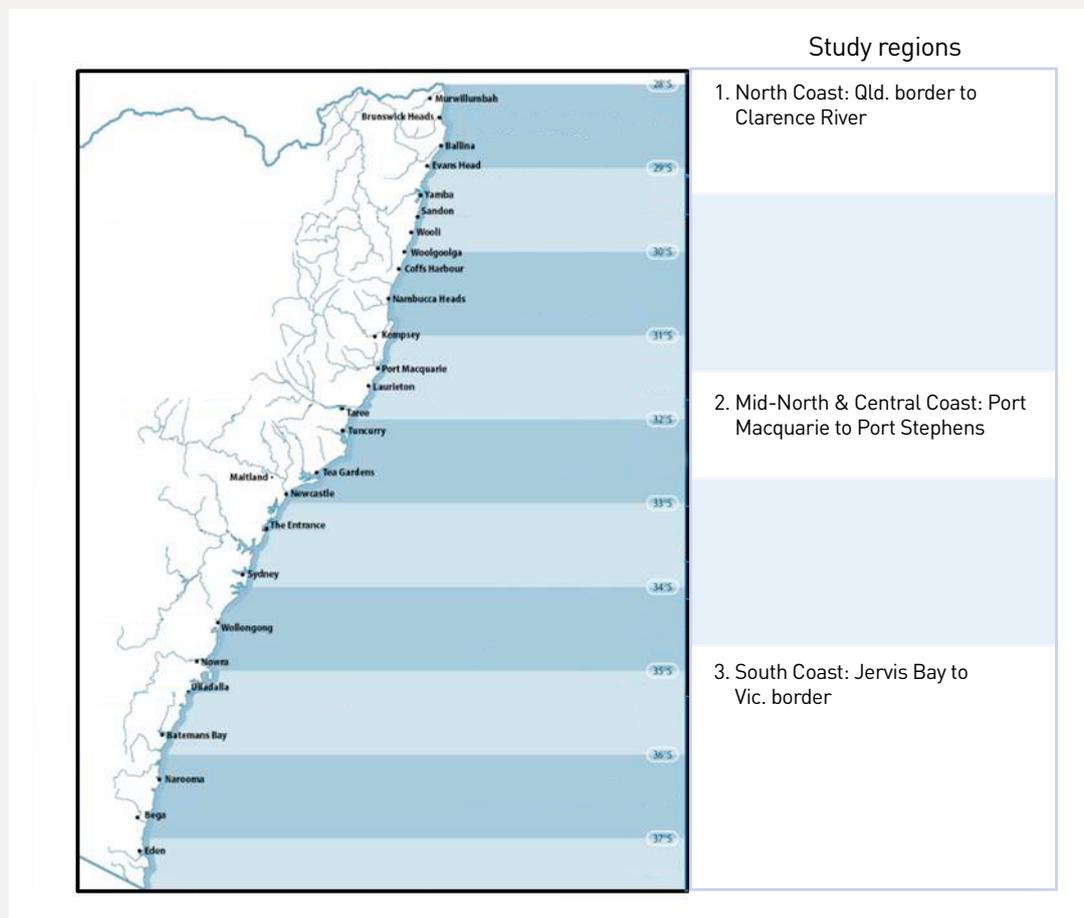
- > Material: the extent to which the aquaculture industry contributes resources for local communities to meet their needs, including food, income and assets, access to services and environmental quality
- > Relational: the extent to which the aquaculture industry contributes to the development and maintenance of social relationships that enable communities to achieve (their own conception of) wellbeing
- > Subjective: the level of satisfaction with the contributions made by the aquaculture industry to the quality of life of local communities and the values and beliefs that shape these levels of satisfaction.

3.2 Defining the study areas

The study was aimed at assessing contributions on a regional scale. The reliance on Australian Bureau of Statistics (ABS) census data for building the economic models (see below) meant that ABS statistical area boundaries were used as the basis of regional level analysis. We selected clusters of ABS areas in three regions along the coast that were identified by DPI as being of particular interest for aquaculture, because of existing businesses and also because of new industries opening up (Figure 3 and Table 2). These three study areas were used as the basis for fieldwork and data analysis.

² Given our focus on particular regional communities we will subsequently use the term 'community wellbeing' to describe our application of the social wellbeing approach to the research question.

FIGURE 3. NSW project study areas



Source: [NSW DPI, 2012].

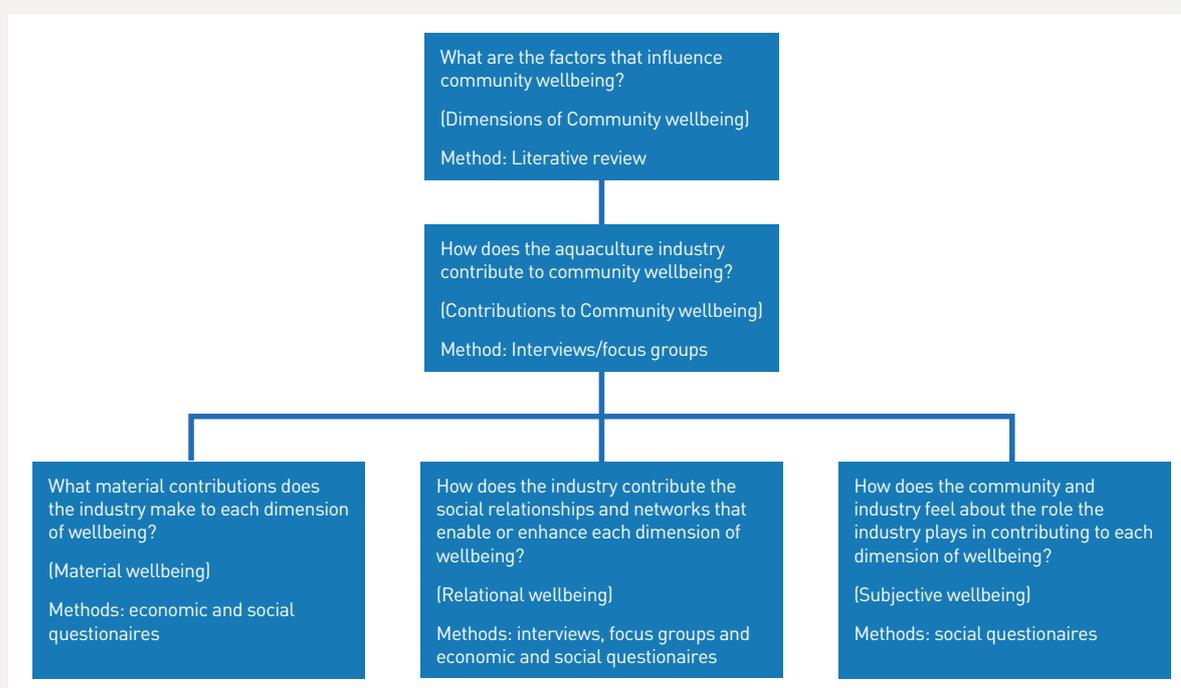
TABLE 2. Study areas

Study areas	ABS statistical area name	ABS statistical area level
1. North Coast	Tweed Valley	SA3
	Richmond Valley Coastal and Hinterland	SA3
	Clarence Valley	SA3
2. Mid North and Central Coast	Mid North Coast	SA4
	Port Stephens	SA3
3. South Coast	Shoalhaven	SA3
	South Coast	SA3

3.3 An integrated approach to understanding contributions to wellbeing

In order to determine how the industry contributes to community wellbeing it was first necessary to determine some of the important factors that influence the wellbeing of a community and the individuals within it. Figure 4 illustrates the process by which we moved from an understanding of what influences community wellbeing to a methodological approach to investigating the contributions of aquaculture to wellbeing.

FIGURE 4. Methodological approach to assessing aquaculture industry contributions to wellbeing



In order to provide a foundation for our understanding of the different factors that influence community wellbeing a detailed literature review was conducted of a variety of studies into community wellbeing and quality of life. The literature review assembled a range of different indices currently used around the world and within Australia to measure quality of life, sometimes also referred to as 'standard of living' (Himes-Cornell et al., 2013, Kasperski and Himes-Cornell, 2014, New Zealand Quality of Life Project, 2007, Nussbaum et al., 1993, OECD, 2013, Partridge et al., 2011, Stiglitz et al., 2009). These are termed 'dimensions of wellbeing'. For a summary of these indices see Appendix 1.

We also looked to the literature on Australian aquaculture to consider the types of contributions to wellbeing identified by other researchers. For example, an earlier examination of the social and economic aspects of sustainability in aquaculture has a set of research questions and suggested indicators for measuring the

socioeconomic impact of aquaculture (Brooks et al., 2010, especially Table 2). The community benefits of shellfish aquaculture found by another study in NSW included: availability of fresh local food; increased recreational fishing and tourism potential; and estuarine rehabilitation, especially through native shellfish restoration (Joyce et al., 2009). In South Australia the social benefits of aquaculture were found to be: young people staying in coastal areas; increased government funding for infrastructure; more housing; better educational opportunities; increased 'community spirit' and 'community pride'; and increased tourism (Pierce and Robinson, 2013).

In addition to the literature review we developed our version of the wellbeing framework through fieldwork in the first phase of the Wild-Catch fisheries project (Voyer et al., 2016), upon which this aquaculture project builds. Using a grounded theory approach (Glaser and Strauss, 1967), we began with a number of largely unstructured interviews where general questions were asked about the participants' beliefs about the contribution of the fishing industry to their local community. Some trends began to emerge in these early interviews, which we determined could be grouped around some of the main 'quality of life' indicators (or 'dimensions of wellbeing') identified in the initial literature review. Further fieldwork was subsequently conducted so as to test and confirm the identified 'contributions to wellbeing' themes. This process confirmed seven 'dimensions of wellbeing' to be the most relevant to the Wild-Catch study, with a range of possible contributions identified for each dimension (Table 3). During fieldwork and the literature review for this aquaculture project we validated the approach for use for aquaculture. The dimensions identified in the Wild-Catch study were found to be relevant for NSW coastal aquaculture. We did, however, make some adjustments to the contributions of industry to those dimensions, due to differences between the wild-catch and aquaculture industries. If this framework were to be applied outside NSW the dimensions of wellbeing and the possible contributions of aquaculture to those would need to be validated further.

TABLE 3. Dimensions of community wellbeing and contributions of the NSW aquaculture industry to each dimension

Dimensions of community wellbeing						
A resilient local economy	Health	Education and knowledge generation	Healthy environment	Integrated, diverse, and vibrant communities	Cultural heritage and community identity	Leisure and Recreation
Contributions of aquaculture to community wellbeing						
Revenue Employment Connections to service industries: post harvest sector & tourism	Providing nutritious food Fresh & local Food safety	Skills training: formal & practical life skills Transferring environmental knowledge	Environmental stewardship Engagement in catchments 'Canary in the coalmine' re water quality Reducing pressure on wild stocks	Food for cultural & religious celebrations Contributions to community life through sponsorships & donations Employs from diverse groups	Cultural heritage & history of aquaculture Sense of place & identity	Food for tourism Attractive locations for rec. fishers, kayakers Tourism point of interest

These common dimensions and the possible contributions identified through initial fieldwork were subsequently used as the basis for developing a theoretical approach for the economic analysis and a means of integrating the results of the social and economic analyses. This involved determining how aquaculture contributes to each of these seven dimensions of community wellbeing, looking at material, relational and subjective measures of wellbeing. Methodological tools employed included an economic questionnaire, in-depth interviews and focus groups and three social questionnaires. Each of the seven identified dimensions and contributions to them are explained in greater detail below. Indicators for the contributions are identified in the Results/Discussion Section.



3.3.1 A RESILIENT LOCAL ECONOMY

Economic or financial wellbeing has long been recognised as a fundamental component of personal and community wellbeing. Measures of wellbeing have always included employment statistics, income levels and housing conditions as key indicators of the material wellbeing of the communities undergoing assessment. The capabilities approach, pioneered by Sen (1987) and Nussbaum (1993), questioned an overreliance on these measures as an indicator of development and highlighted the need to look more broadly than simple economic statistics. Measures of material wellbeing now look beyond income levels and employment statistics to include analysis of the security of income and the availability and quality of jobs, recognising that choice of employment offers the ability for individuals to fulfil their own personal ambitions and goals (OECD, 2013). For some within the community, wellbeing may not be defined by level of income or profitability but by other factors such as flexibility, autonomy and extent to which work is challenging or stimulating. Quality of employment and wellbeing in the workplace are also increasingly considered essential components of overall wellbeing and these are influenced by such factors as earnings, social relationships at work, the level of autonomy people have and levels of support from peers and the wider community (OECD, 2013). Given that individual wellbeing is influenced by both the *availability* and *quality* of jobs, community wellbeing is likely to be enhanced by a variety of strong, stable employment options and revenue generating sectors. This allows for a range of opportunities for employment according to the diverse skills sets, ambitions and aspirations of the individuals within a community. Long-term stability of employment options provides for intergenerational equity, ensuring employment opportunities are available for future generations. Resilient economies also support local employment opportunities so workers are able to contribute to the social and economic life of their communities without having to commute long distances or travel out of the community to work. Finally, community wellbeing is likely to be enhanced if local economies are able to adapt and respond to shocks or fluctuations in economic conditions to changing circumstances through innovation (ABS, 2013, New Zealand Quality of Life Project, 2007, OECD, 2013, Partridge et al., 2011).

This study sought to understand the economic contributions of aquaculture to a resilient local economy in a number of key ways. These are detailed in Table 4.



TABLE 4. Contributions of NSW coastal aquaculture to a resilient local economy

Dimension of community wellbeing	Contributions of the aquaculture industry	
A resilient local economy	Material	<ul style="list-style-type: none">> Primary economic impact through direct revenue and business profitability> Secondary economic impacts (or multipliers) to regional economies through relationships with service industries providing inputs
	Relational	Interactions between the local aquaculture sector and other economic markets and sectors, including: <ul style="list-style-type: none">> Interactions with the post-harvest sector> Interactions with the tourism sector
	Subjective	Level of community support and understanding of the economic contributions of the aquaculture sector

3.3.2 COMMUNITY HEALTH

The importance of consuming seafood as a regular component of a healthy diet has been recognised around the world. For example, U.S. and Australian food authorities recommend consumption of fish at least twice a week due to the many health benefits associated with the high levels of Omega 3 oils and a range of others vitamins and minerals (Food Standards Australia New Zealand, 2011, U.S. Dept. of Health and Human Services, 2005). The overall wellbeing of the community is influenced by the physical and mental health of its residents. Healthy citizens are more likely to be able to contribute to the social and economic life of a community and create less direct costs to the community associated with health care. Health is also considered one of the most significant factors influencing individual happiness and wellbeing (ABS, 2013). 'Quality of life' indicators relating to community health tend to focus on life expectancy, however it is recognised that this data is strongly influenced by lifestyle factors including smoking, alcohol consumption and nutrition. There is a need for members of the community to be able to access seafood products to meet the nutritional requirements provided through seafood. This need can be met through a range of channels, including aquaculture, imported products as well as Australian and local wild-caught products. This study examined the importance of aquaculture in NSW as a supplier of nutritious food (material), as well as the importance people place on being able to access locally produced food (with relational and subjective aspects) as detailed in Table 5. Food localism is a significant social trend in which people believe buying and consuming locally produced food is better for their health, the local economy, the environment and/or it saves them money (Germov et al., 2010; McEntee 2010). For the purposes of our framework the benefits people may experience from locally produced food fit into dimensions of a Resilient Local Economy, Healthy Environment and Leisure and Recreation, as well as Community Health.

TABLE 5. Contributions of the NSW aquaculture industry to community health

Dimension of community wellbeing	Contributions of aquaculture	
Community health	Material	<ul style="list-style-type: none"> > Contributions to food supplies of local communities > Contributions to Indigenous health through working on Country
	Relational	<ul style="list-style-type: none"> > Supply chains by which consumers access NSW aquaculture products
	Subjective	<ul style="list-style-type: none"> > Importance the community puts on local production for nutrition, enjoyment, cultural, and/or ethical reasons > Satisfaction with involvement in aquaculture among Indigenous communities

3.3.3 EDUCATION AND KNOWLEDGE GENERATION

The capability to build one's skill set and knowledge is considered essential to wellbeing in order for citizens to be able to participate fully in the economic and non-economic life of their community (OECD, 2013). Knowledge and life-long learning are associated with the resilience of local communities and in particular the ability to adapt to changing social and economic conditions, including changing work environments. They are also associated with individual wellbeing as learning opportunities can significantly contribute to people's ability to fulfil personal ambitions and goals (New Zealand Quality of Life Project, 2007). The 'quality of life' literature tends to focus on people's involvement in formal learning opportunities, such as school or university based education and training, however it also recognises that much knowledge generation and transfer can also be informal and practical ('on the job'). This type of learning is often intergenerational, creating links across generations and contributing to the strength and cultural fabric of society (ABS, 2013). The project therefore sought to consider both types of learning opportunities and the benefits they provide the wider community, as detailed in Table 6.

TABLE 6. Contributions of the NSW aquaculture industry to education and knowledge generation

Dimension of community wellbeing	Contributions of the NSW aquaculture industry	
Education and knowledge generation	Material	<ul style="list-style-type: none"> > Formal training and learning opportunities provided by the professional aquaculture industry > Contributions to community knowledge, especially environmental knowledge
	Relational	<ul style="list-style-type: none"> > Social learning and informal knowledge transfer
	Subjective	<ul style="list-style-type: none"> > Levels of trust and respect for the knowledge and skills of the aquaculture industry (social licence)

3.3.4 A HEALTHY ENVIRONMENT

NSW coastal communities depend on and value the environment in a variety of ways. This includes ecosystem services such as clean air, water, food, shelter as well as economic resources that rely on the natural environment to exist. A healthy environment is closely related to many other aspects of community and individual wellbeing, including human health (ABS, 2013, Partridge et al., 2011). Visitors and residents also value the recreational, relaxation and spiritual opportunities provided by the natural environment in NSW and the protection of these values is considered to be of high importance by the Australian community (ABS, 2013, Sweeney Research, 2014). The project investigated the contribution of the aquaculture industry to a healthy environment, as detailed in Table 7.

TABLE 7. Contributions of the NSW aquaculture industry to a healthy environment

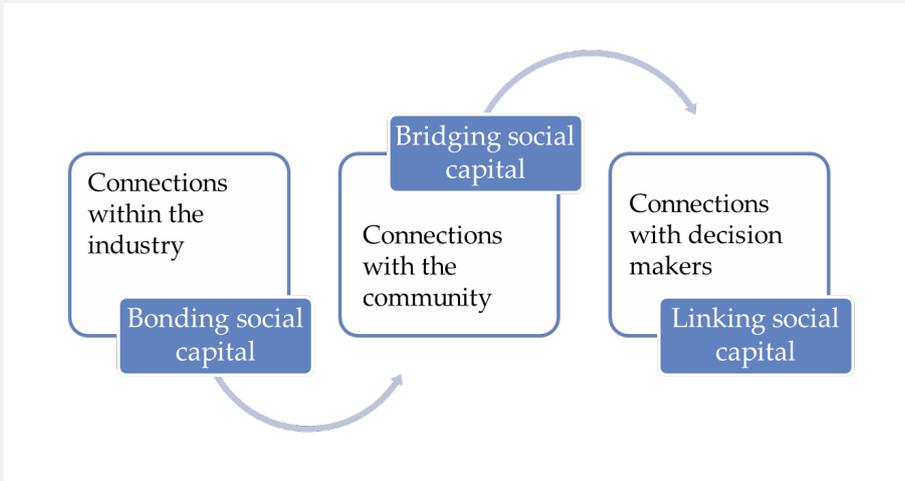
Dimension of community wellbeing	Contributions of the aquaculture industry	
A healthy environment	Material	<ul style="list-style-type: none"> > Practicing sustainable and environmentally friendly aquaculture > Involvement of the industry in stewardship activities
	Relational	<ul style="list-style-type: none"> > The role of the aquaculture industry in wider environmental management networks
	Subjective	<ul style="list-style-type: none"> > The level of trust in the aquaculture industry to operate sustainably

3.3.5 INTEGRATED, DIVERSE AND VIBRANT COMMUNITIES

This concept of wellbeing refers to communities having active cultural lives in which people from various groups feel connected and have opportunities for a good life across generations, cultures and socio-economic class divisions (ABS, 2013, New Zealand Quality of Life Project, 2007, OECD, 2013, Partridge et al., 2011). Integration allows communities to feel connected and supported, which means embracing diversity, which is also known to enhance resilience and innovation within local communities (ABS, 2013). Vibrant communities embrace opportunities for cultural expression including through the arts, community events and important holidays or celebrations.

A fundamental component of integrated communities relates to social connections and relationships. Individual wellbeing is enhanced by feeling supported and included within the community and is influenced significantly by the notion of reciprocity. Reciprocity involves people both giving and receiving from the community. This can increase a feeling of belonging and inclusion. The extent to which reciprocity occurs within communities, and the ways in which it occurs, are driven by the strength of different forms of social capital. Social capital is defined as networks as well as shared norms, values and understandings that facilitate co-operation within or between groups (Foxton and Jones, 2011). There are three main types of social capital (Figure 5). Bonding social capital refers to links between people within a common social or geographical group (for example, families or cultural groups). Bridging social capital relates to more distant connections across different groups (for example, across businesses or communities, or between different social groups). Involvement in community life, including citizenship activities, memberships of clubs or sporting organisations and volunteering are all activities that assist in the building of bridging social capital (Brooks, 2007, Foxton and Jones, 2011). Finally, linking social capital refers to connections with people in positions of power (Foxton and Jones, 2011). Linking social capital can be significant because it can assist in building support and enhancing the political voice of citizens. Individual wellbeing can be strongly influenced by whether people are given the opportunity to have a say in decisions that affect them (New Zealand Quality of Life Project, 2007, Nussbaum et al., 1993, OECD, 2013).

FIGURE 5. Forms of social capital



The project examined the contribution of the aquaculture industry to integrated, diverse and vibrant communities. This included examining the industry’s contributions to cultural diversity, participation in cultural events and celebrations as well as its role in in all three types of social capital, as detailed in Table 8.

TABLE 8. Contributions of the NSW aquaculture industry to integrated, diverse and vibrant communities

Dimension of community wellbeing	Contributions of the NSW aquaculture industry	
Integrated, diverse and vibrant communities	Material	<ul style="list-style-type: none"> > Contributions of the aquaculture industry to the needs of a diverse community > Involvement in citizenship activities and community events
	Relational	<ul style="list-style-type: none"> > Role of aquaculture in building and maintaining social networks (formal and informal) in local communities (social capital)
	Subjective	<ul style="list-style-type: none"> > Community awareness and beliefs in relation to the importance of the services provided by aquaculture for community life

3.3.6 CULTURAL HERITAGE AND COMMUNITY IDENTITY

Cultural heritage refers to the ways of living developed by a community and passed on through generations, including customs, practices, places, and objects. It includes both tangible and intangible things. Cultural heritage helps inform the way a community sees itself and helps to build a sense of common purpose and values. Community identity refers to the way communities are known and experienced: the ways people come to connect with communities and see themselves as part of them. This may in part be driven by locality but can also be influenced by common sets of values, interests or beliefs, by relationships with others within a community and by common practices or purposes (Harrington et al., 2008). The role of the aquaculture industry in contributing to a shared sense of community identity and to the cultural heritage of local communities was explored in a number of ways, as outline in Table 9.

TABLE 9. Contributions of the NSW aquaculture industry to cultural heritage and community identity

Dimension of community wellbeing	Contributions of the NSW aquaculture industry	
Cultural heritage and community identity	Material	> Contributions to the history of NSW coastal towns and regions
	Relational	> Contributions to cultural and community identity
	Subjective	> Importance to the community of the contributions of the industry to a shared sense of community identity and to local cultural heritage

3.3.7 LEISURE AND RECREATION

Many of the quality of life frameworks examined through the literature review emphasised the importance of leisure and recreation, or work-life balance to community and individual wellbeing. This included opportunities for fun, play and participation in the arts and cultural events, often measured through time use surveys (ABS, 2013, New Zealand Quality of Life Project, 2007, Nussbaum et al., 1993, OECD, 2013, Partridge et al., 2011). We considered how the aquaculture industry contributes to the recreational lives of its communities in a number of ways, as outlined in Table 10.

TABLE 10. Contributions of the NSW aquaculture industry to leisure and recreation

Dimensions of community wellbeing	Contributions of the aquaculture industry	
Leisure and recreation	Material	> Contributions of the aquaculture industry to community recreation – visitors and locals
	Relational	> Social connections and interactions between aquaculture and recreational users
	Subjective	> Importance recreational users put on local seafood and infrastructure for recreational boating, kayaking and fishing

3.4 Ethical considerations

The whole project, including the economic and social questionnaires outlined below, underwent assessment by the UTS Human Research Ethics Committee. Given the sensitive commercial nature of much of the information collected through this research special care was taken to ensure the privacy and anonymity of all participants, including:

- > No personal information was shared with anyone outside the project team.
- > The questionnaires were anonymous so the data could not be linked back to individuals.
- > The raw data (e.g. the paper copies of completed questionnaires) were seen only by the research team.
- > The aggregated data (e.g. a database or spreadsheet) will be held by A/Prof Kate Barclay as the nominated data custodian for this project. A UTS data management site will list this data as being available for re-use for research purposes only. Any potential researchers will need to contact A/Prof Barclay to gain access to that data. 'Aggregated' means the data will be grouped (by region, with a minimum of five to a group) to make it impossible to see individual businesses.
- > In terms of the interviews, we prepared a detailed consent form that we asked all our participants to complete as part of the interview process. These forms provided instructions to the project team about how the participants would like their stories to be used, including whether they consented to be identified, photographed and whether they agreed for the data to be archived and reused.

3.5 Fieldwork – interviews

Fieldwork was conducted between November 2015 and August 2016. Each of the three study regions on the coast (Section 3.2) was visited. Initial contact with interview participants was made in the following ways:

- > Recommendations from NSW DPI staff so as to include a range of oyster and non-oyster farmers from each of the regions (DPI staff phoned each of these potential participants first to ensure they were willing to have their contact details passed onto the project team)
- > Recommendations from other project Steering Committee members
- > Targeted invitations to community members including local councils (usually the Mayor and General Manager of each council area visited), Chambers of Commerce and local tourism bodies
- > 'Snowball' sampling whereby people interviewed recommended additional people to contact.

The response to the qualitative fieldwork was very receptive and numbers were limited only by availability of time rather than a lack of willingness to participate. In total 34 people were interviewed across the three regions (Table 11).

TABLE 11. Interview participants by region and farm type

	Oyster interviewees	Total lease holders	Land-based interviewees	Total farm numbers	Local government, tourism, etc.
North Coast	1 (NCO) ⁺	11	6 (NCLB)	14	3 (NCLG)
Mid North & Central Coasts	8 (MNCO)	129	5 (MNCLB)	29	-
South Coast	6 (SCO)	138	1 (MNCLB)	9	3 (MNCLG)
Indigenous			1 (IA) [*]		
Subtotals	15		13		6

+ Interviewees are coded by acronyms of their region and type of aquaculture: North Coast oyster (NCO); North Coast Land Based (NCLB); North Coast local government (NCLG), and so on.

* We secured one official interview with an Aboriginal aquaculturist (IA). Aboriginal people have been asked to participate numerous times in various reports over the decades, with very little improvement seen in their situation as a result of those reports. For this reason many are reluctant to participate anymore, so despite several approaches made by the project team through intermediaries we were unable to secure any more people willing to be interviewed. To bolster our interview material, Kate Barclay talked informally with seven more people who work closely with Aboriginal people in NSW, including in aquaculture, for background information. We have used existing literature as well.

Prior to commencement of each interview the project objectives were explained and a detailed consent form was provided to the participant to complete either before or after the completion of the interview. All participants were provided the opportunity to ask questions about the project.

The majority of interviews were audio-recorded and subsequently transcribed in full. Where it was not possible to audio-record the interview (e.g. because of problems with background noise) or the interviewee did not give consent to being recorded, detailed handwritten notes were taken. Where requested, copies of interview notes or transcripts were provided to the interview participant.

These interviews were transcribed and transcripts entered into NVivo 10, a software package for the analysis of qualitative social data. All the transcripts and interview notes were entered into NVivo 10 and coded. Coding involves researchers reading the transcripts to see how their content relates to the themes of the project and tagging pieces of text in the system as relating to aspects of the themes. This is an iterative process through which both the understanding of the themes and the coding framework in NVivo are built up through the analysis process (Bazeley and Jackson, 2013). Kate Barclay did most of the coding; however, Nicole Mazur also coded a selection of transcripts as a check on the analysis. Kate Barclay and Nicole Mazur also collaborated to write up the findings from the qualitative analysis of the interview material.

3.6 Economic methods

A range of economic methods has been used to address several economic valuation questions.

3.6.1 Gross Value of Production (GVP) & business profitability

The NSW Government uses Gross Value of Production (GVP) data that indicates primary economic aquaculture activity through direct revenue. GVP is measured by NSW DPI, according to their records of aquaculture production and average 'farm gate' prices for each species produced.

For the purposes of a more comprehensive picture of the economic contributions the aquaculture industry makes to regional communities, we also wished to examine the profitability of aquaculture businesses, as happens in other states of Australia. For this we used an economic questionnaire, which enabled us to analyse secondary economic impacts (or multipliers) to regional economies from aquaculture's relationships with service industries that provide inputs for professional fishing. This modelling was performed by the Western Research Institute (WRI).

Knowledge of business profitability provides an important context to our understanding of the economic contributions of the NSW aquaculture industry. Profitable businesses that are able to invest in their operations and make larger-scale contributions to their regional economies can be indicative of the future economic security of the industry.

Economic profitability is determined from the profit and loss accounts of fishers, with certain adjustments made as explained in Appendix 3. For example, the opportunity costs of labour and capital are included with accounting measures. So an economic profit would be a level of return that is more than a normal return to capital, and this may potentially attract investment or new entrants into the industry. An economic loss, as seen in a negative economic rate of return, means a business forgoes the opportunity costs of capital and labour, but returns can still be at a level where business operations continue. In other words, in this situation a business may be operating at a financial surplus, but not at a sufficient level to offset the potential earnings available through investing in an alternative industry.

3.6.1.1 Economic questionnaire

The purpose of the questionnaire was to estimate the profitability of aquaculture businesses and the expenses of aquaculturists for use as inputs into the regional economic modelling undertaken by WRI. It was developed based on the Wild-Catch study (Voyer et al., 2016), which in turn used the experience of previous fisheries studies in NSW, other states and the Commonwealth (Dominion Consulting, 2001, Econsearch, 2014a, Harrison, 2010, George and New, 2013). In designing the questionnaire Alistair McIlgorm consulted with economist colleagues and compared approaches with Julian Morrison from EconSearch, the questionnaire used by Peggy Schrobback in her doctoral research and that used in the Oysters Benchmarking project (Econsearch, 2014b, Rural Directions Pty Ltd, 2012, 2013a,

Guy et al., 2014, Schrobback, 2014). In discussion with DPI, Oysters Australia and other industry contacts, it was felt that the previous financial surveys in the 2010 to 2013 period (Rural Directions Pty Ltd, 2012, 2013a, Schrobback, 2014) may have caused some “survey fatigue” among farmers, and may also be seen as a requirement of the government regulator, rather than a request from industry for an independent economic analysis. This led to DPI discussions with the project Steering Committee and the identification of a sample of 50 businesses to contact with the questionnaire. This would minimise the chances of industry discontent with the proposed survey as only 50 from a total of around 450 aquaculture permit holders in NSW were approached. The aim was to come up with a questionnaire that was as short as possible to improve response rates, while still able to gather enough information to make a useful evaluation.

The questionnaire started with Alistair McIlgorm addressing a NSW oyster industry information day in mid 2015. This opportunity was used to explain the regional emphasis of the proposed survey, which was planned to commence in late 2015, after ethics approval was obtained. Out of a total of 330 aquaculture businesses in the study regions, a selection of 50 oyster and non-oyster aquaculturists in the regions covered by the study were contacted by DPI staff to ascertain their willingness to be involved in this study. Those who agreed were included in a list of names and contact details passed to the research team. A research assistant then phoned everyone on the list to confirm their willingness to participate and provide further information about the economic questionnaire. In November 2015 paper versions of the questionnaire were mailed out with a reply paid envelope to the participants. Information on the project and an invitation to participate was included in DPI and Oceanwatch industry newsletters in late 2015. Nicole Mazur reminded people about the economic questionnaire during her fieldwork interviews in late 2015 and early 2016. A research assistant then followed up with phone calls to participants to encourage them to complete and submit the questionnaire in January and February 2016. DPI staff also rang participants to follow up on the economic questionnaires in early 2016. **The response rate was 54% of those who were sent the survey (a total of 27 replies from the 50 contacts approached), or 8% of the 330 aquaculture businesses in the study regions.** The level of response limited the extent to which the profitability results could be disaggregated by species or by region.

The mail survey is an established method for aquaculture economic surveys; however, a number of factors may impact a survey response rate. The project team spent time addressing any misconceptions relating to the project and responding to industry concerns, including direct interactions on the phone, in person and online with industry group representatives and individual fishers. In response to industry concerns the original deadline to return completed questionnaires was eventually extended to enable farmers to complete the survey in less busy periods.

3.6.1.2 Regional economic analysis and economic multipliers

Regional economics investigates why economic activity takes place in different areas and the connections between different sectors of the economy in generating economic activity. Traditionally there have been “Keynesian” income and

expenditure approaches, and input-output (IO) modelling approaches based on national accounting data. In this study we use the Generation of Regional Input-Output Tables (GRIT) technique, which incorporates census national accounts and other data (for further details see Appendix 5).

Input-output modelling has been used in many regional economic studies of involving fish and seafood in Australia (Econsearch, 2014b, Powell et al. 1988, Tamblyn and Powell, 1988). The aquaculture business revenues received lead to the initial expenditure on inputs for farming production in the NSW economy. This expenditure then produces an amount of output in the NSW economy attributable to the purchases of the aquaculture producers. Aquaculture businesses require inputs in the form of good and services such as fish food, fuel oil, electricity, posts, trays and a range of repair and maintenance goods and services.

The project extended the analysis of the economic contributions of the industry to include examination of these regional economic ‘multipliers’ – that is how the income from aquaculture is expended to become a flow to other businesses in the region that provide goods and services to the aquaculture industry. The estimation of regional economic benefits was undertaken by WRI.

The economic information from the operational and financial data, collected from the economic questionnaires distributed to the sample of farmers, was used to generate regional expenditure estimates for the North Coast (the Tweed, Richmond and Clarence Rivers), the Mid North and Central Coasts (from Port Macquarie to Port Stephens) and the South Coast (the Illawarra to Eden). Inland aquaculture was not included in the expenditure survey questionnaire or regional analysis. The expenditure estimates were put into WRI’s model of the NSW regional economy to calculate the economic impacts of aquaculture on regional coastal economies and at the NSW State level. Modelling was undertaken for the financial year 2013–14. The methods used in the WRI analysis and results of this analysis can be found in Appendix 5.

3.6.2 The secondary seafood sector

The study focused on the production data and prices for aquaculture products available at first sale, also called the farm gate price. Information and price data from the post-harvest sector in aquaculture in NSW is limited as there is no formal government requirement to monitor or record it. The secondary sector associated with aquaculture is the food industry, where aquaculture product is akin to seafood products from wild-catch sources. The food and seafood secondary sector normally includes processors, wholesale and retail sales and sales to restaurants. There are no accurate data available for either the quantities after processing or prices in the secondary sector for aquaculture-sourced product.

The previous studies involving regional economics and the seafood sector in NSW are Harrison (2010), Powell et al. (1988), and Tamblyn and Powell (1988). Regional studies have been completed in other states (Econsearch, 2014b) and internationally (Jacobsen et al., 2014). There are two scenarios in the past NSW site-specific regional seafood studies cited above. One is where fish are landed and have little processing (Powell et al. 1988, Tamblyn and Powell, 1988) and the

second is where fish are further processed, as in the Northern Rivers (Harrison, 2010, Powell et al, 1988). In estimating the state-wide secondary sector estimates for aquaculture, we use the ratio of primary to secondary output in the past studies to generate an imputed output value for the secondary sector in the absence of available data on this sector.

3.6.3 Value chains

Aquaculture production is harvested and initially cleaned before entering the secondary value chain. The industry wished the research to portray some of the value chains to illustrate value adding. There are no centrally recorded prices for aquaculture products in the secondary sector. Food businesses prefer to maintain commercial transactions in confidence to protect their business interests and livelihoods. However oysters are an example of a more generic product with some complexity in terms of the genetic type, size and customer perception of growing regions. Recently there has been a price study of the Sydney Rock Oyster industry by Peggy Schrobback (2014). Confidentiality considerations for the non-oyster sector led to use of an illustrative approach for a range of species, indicating where added value is occurring.

3.6.4 Industry investment

The aquaculture industry in NSW industry has had significant capital investment by industry. However, industry members of the project Steering Committee indicated that government may underestimate the significance of these capital commitments and the risks involved. The economic questionnaire enabled some investigation into the levels of investment in the aquaculture industry. Businesses provided data on the assets associated with aquaculture business activities, enabling some analysis of the average age and value of assets. The questionnaire also asked about recent capital purchases and business debt levels, as willingness to commit to debt may indicate investor confidence in industry resilience. The available data were combined with qualitative interview comments about likely future investments.

3.7 Social questionnaires

Three questionnaires were designed by the project team in conjunction with market research company UMR, and peer reviewed by Professor Allan Curtis. These questionnaires were designed to meet the needs of both the Wild-Catch study (Voyer et al. 2016) and this aquaculture study. The questionnaires explored key aspects of the 'dimensions of wellbeing' and possible contributions of NSW seafood production identified through the interviews. The final reports from these three questionnaires are provided in Appendix 2.

3.7.1 General public questionnaire

A total of 1423 general public interviews were completed via computer-assisted telephone interview (CATI) conducted between 28 October and 9 November 2015 by UMR. This survey included a sample of both landline (65%) and mobile phones (35%) and had an overall response rate of 24%. The survey focused on coastal

residents in the eight study regions of NSW used for the Wild-Catch study, which included the three regions for this aquaculture study, but also included ABS statistical areas covering the whole NSW coast. The data were weighted so the sample matched ABS census data to ensure data were representative according to age and gender on a state level. Table 12 provides details of the demographic profiles of the respondents to this survey.

TABLE 12. Demographic profile of general public social questionnaire respondents

Demographics		Total (%)
Gender	Male	49%
	Female	51%
Age	18 to 29 years	21%
	30 to 39 years	17%
	40 to 49 years	17%
	50 to 59 years	16%
	60+ years	29%
Region	Far North Coast	11%
	Clarence	10%
	Mid North coast	11%
	Great Lakes – Port Stephens – Newcastle	11%
	Central Coast– Hawkesbury	17%
	Sydney Metro	19%
	Illawarra – Shoalhaven	12%
	South Coast	10%
Total household income	Under \$40,000	25%
	\$40,001 - \$80,000	26%
	\$80,001 - \$120,000	27%
	Over \$120,000	22%
Highest qualification	No Tertiary	27%
	TAFE/ Tech/ Trade Only	38%
	University	35%
Recreational or any other type of fisher	Recreational/Professional wild-catch fisher	35%/1%
	Non-fisher	64%

The average interview length was 18.5 minutes. The script included a range of questions focusing on four main areas:

- > Fish and seafood purchase behaviours
- > Preferences regarding provenance of seafood
- > Attitudes towards the NSW professional fishing industry
- > Holiday-driven consumption and the tourism experience.

3.7.2 Fish merchants and co-operatives questionnaire

A total of 77 interviews with fish retailers/wholesalers and co-operatives were completed via CATI conducted between 30 October and 15 December 2015 by UMR. A small selection of sample contacts (of fish retailers/wholesalers and co-operatives) was provided by DPI from their 'fish receiver' licence database, after contacting those businesses first to confirm they were willing to have their contact details passed on for the purpose of this questionnaire. In addition, wholesalers/retailers and co-operatives who were interviewed in the first round of qualitative fieldwork for the Wild-Catch study were invited to participate. This amounted to 16 co-operatives and 15 fish retailers/wholesalers. The balance was sourced via the electronic yellow pages. Table 13 provides an overview of the firmographic characteristics of interview participants.

TABLE 13. Firmographic profile of fish merchant social questionnaire respondents

Firmographics		Total	Sample Size N=
Region All	Far North coast	13%	10
	Clarence	4%	3
	Mid North coast	17%	13
	Great Lakes – Port Stephens – Newcastle	8%	6
	Central Coast – Hawkesbury	8%	6
	Sydney Metro	36%	28
	Illawarra – Shoalhaven	8%	6
	South Coast	16%	12
	Other NSW	5%	4
	Other State	1%	1
Main Business type	Co-op	11%	9
	Wholesaler	14%	11
	Retailer	53%	40
	Other (Restaurant, Exporter, Importer)	17%	13
	Fisher (Professional, Aquaculture, Indigenous)	5%	4
Turnover	Less than \$1 million	32%	25
	\$1 – \$5 million	34%	26
	\$6+ million	12%	9
	Unsure/refused	22%	17
Business operation	0 – 5 years	5%	4
	6 – 10 years	6%	5
	Over 10 years	88%	68

The average interview length was 15 minutes. The script included a range of questions focusing on four main areas:

- > Purchase and supply activity
- > The importance of 'local product' to these businesses
- > Attitudes towards the NSW professional fishing industry
- > Involvement in training and education and contributions to the wider community and industry.

3.7.3 Tourism and hospitality providers questionnaire

An online questionnaire of the tourism and hospitality industry was conducted between 28 October and 14 December 2015. The survey was distributed through a range of channels including regional and local tourism bodies in coastal NSW and a range of industry groups, including:

- > Destination Tweed
- > Visit Byron Bay
- > Ballina Tourism
- > Richmond Valley Tourism
- > Clarence Valley Tourism
- > Coffs Coast (includes Bellingen)
- > Nambucca Valley Tourism
- > Kempsey Council Tourism networks
- > Port Macquarie-Hastings tourism networks
- > Destination Port Stephens
- > Central Coast Tourism networks
- > Tourism Transport Forum
- > Shoalhaven Tourism
- > Eurobodalla Tourism
- > Bega Valley Tourism
- > North Coast Regional Tourism Organisation
- > Hunter Regional Tourism Organisation
- > Central Coast Regional Tourism Organisation
- > South Coast Regional Tourism Organisation
- > Caravan, Camping and Touring Industry Association of NSW
- > Bed & Breakfast and Farmstay Association NSW
- > The Accommodation Association of Australia
- > Restaurant and Catering Industry Association.

The online questionnaire resulted in 40 completed responses, including responses across a broad cross section of the industry. All of the study areas were represented in the survey, with the majority coming from the northern areas (see Table 14). The maximum theoretical margin of error at 95% confidence level is ± 15 . Given the survey used opportunistic sampling, the data produced cannot be considered to be representative of the tourism industry at large.

TABLE 14. Firmographic profile of tourism and hospitality operator social questionnaire survey respondents

Firmographics		Total	Sample Size N=
Region (Multi)	Far North Coast	23%	9
	Clarence	28%	11
	Mid North Coast	25%	10
	Great Lakes – Port Stephens – Newcastle	5%	2
	Central Coast – Hawkesbury	10%	4
	Sydney Metro	8%	3
	Illawarra – Shoalhaven	8%	3
	South Coast	13%	5
	Other NSW (e.g. West, Central West, South West)	3%	1
	Victoria Coast	3%	1
	Others	5%	2
Turnover	Less than \$1 million	60%	24
	\$1 – \$5 million	23%	24
	\$6+ million	3%	9
	Unsure/refused	22%	1
Business Type (Multi)	Restaurant	15%	6
	Caravan Park	13%	5
	Motel	13%	5
	Tourist attraction	10%	4
	Tourism, Marketing and Advertising	10%	4
	Visitor Information Centre	8%	3
	Fishing charter operation	8%	3
	Bed and breakfast	5%	2
	Hotel	3%	1
	Guest house	3%	1
	Real Estate offering holiday accommodation	3%	1
	Serviced Units	3%	1
	Others	15%	6
Business operation	Less than 1 year	3%	1
	1 – 5 years	20%	8
	6 – 10 years	10%	4
	Over 10 years	65%	26

The survey took approximately 10 minutes to complete and included questions focused on the following key areas:

- > Business focus and peak demand periods
- > Attitudes and perceptions regarding the contribution of professional fishing/ seafood to tourism
- > Restaurant-specific questions on seafood sourcing and sales
- > Services provided and promotions undertaken related to the seafood industry.

3.7.4 Overall analysis

The data derived through the methods outlined above was analysed, collated and examined within the framework of the wellbeing approach, guided by the seven identified 'dimensions of community wellbeing'. Emphasis was given to ensuring that data included material, relational and subjective measures of wellbeing. Table 15 details the finalised list of 'dimensions of wellbeing', the aquaculture contributions to these dimensions, the indicators and the data sources for each.

Many of the indicators listed in Table 15 were not been broken down so that they could be quantitatively measured. This is due to the exploratory nature of this work, particularly on the social dimensions and the connections between social and economic aspects of the analysis. It was not feasible to develop all of the indicators fully within the scope of this project. We have measured some aspects of these indicators with the economic and social questionnaires and other quantitative data. For other indicators we have qualitative data from interviews and documents reviewed, and we analysed the extent to which these indicators seem to be present in the discussion of each dimension (Section 4). The research thus illuminates how the indicators may be further developed in further work, including through quantitative measurement.

3.7.5 Validating results and assessing the strength and importance of industry contributions

Following completion of the analysis, a workshop that included project Steering Committee members was conducted to validate and confirm results. This workshop included an exercise to develop indices measuring the strength and importance of the industry's contribution to overall community wellbeing. Workshop participants considered the data presented by the project team, and their own knowledge, and rated the strength and importance of the industry's contribution to each of the seven 'dimensions of wellbeing'. This involved allocating a score between 1 and 5 for each dimension, 1 being not at all important or strong and 5 being very important or strong.

In future, as part of ongoing monitoring of the social and economic contributions of aquaculture to coastal NSW, this exercise could be done separately with different stakeholder groups: industry, government and general public. The exercise would then reveal similarities and differences in ideas about the importance and strength of industry contributions that might exist between these stakeholder groups, indicating which benefits are at risk, and highlighting where communication

strategies may be targeted. It would also provide insight into where each sector feels the potential of the industry contributions can be developed further. This will assist in prioritising actions to protect, support or grow industry contributions.

TABLE 15. Methodological framework for evaluating contributions of aquaculture to community wellbeing

Dimensions of community wellbeing	Contributions of the aquaculture industry		Indicators	Methods
A resilient local economy	Material	Primary economic impact through direct revenue into communities and business profitability	GVP	Analysis of production and price data
			Business profitability	Economic questionnaire Input/output analysis
		Secondary economic impacts (or multipliers) to regional economies through relationships with service industries providing inputs for aquaculture	Regional impact (multipliers)	Qualitative interviews
			Investments	
	Relational	Interactions between the aquaculture industry and the post-harvest sector	Value of the secondary (post-harvest) sector	Production and price data – DPI Qualitative interviews
			Post-harvest supply chain characteristics	Social questionnaire – fish merchants
			Importance of aquaculture to the secondary (post-harvest) sector	
	Relational	Interactions between the aquaculture industry and the tourism and hospitality sector	Importance of the aquaculture industry to the NSW tourism and hospitality sectors	Qualitative interviews Social questionnaire – general public Social questionnaire - tourism and hospitality businesses Production and price data – DPI Literature review
	Subjective	Level of community support and understanding of the economic contributions of the aquaculture sector	Stakeholder beliefs about economic importance of the industry in its region, including connections to other sectors	Social questionnaire – general public Qualitative interviews

Dimensions of community wellbeing	Contributions of the aquaculture industry		Indicators	Methods
Community health	Material	Contributions to food supplies of local communities	Purchasing patterns – local seafood	Social questionnaires – general public, fish merchants
			Seafood preferences – local seafood	
	Relational	Contributions to Indigenous health through working on Country	Indigenous people employed in or owning aquaculture or related businesses	Qualitative interviews
		Supply chains by which consumers access NSW aquaculture products	Supply chains by which people can buy local aquaculture product	Literature review
		Importance the community puts on local production for nutrition, enjoyment, cultural, and/or ethical reasons	Beliefs about importance of producing local seafood for community consumption	Social questionnaires – general public
Subjective	Satisfaction with involvement in aquaculture among Indigenous communities	Feelings about aquaculture in Indigenous communities	Qualitative interviews	
			Literature review	
Education and knowledge generation	Material	Satisfaction with involvement in aquaculture among Indigenous communities	Education and training levels and opportunities for learning in aquaculture, including: <ul style="list-style-type: none"> > Aquaculture technology and science > Day-to-day farm practices > Boat handling > Food handling (safety & quality) > Regulatory knowledge > Environmental knowledge > Developing work ethic and habits > Etiquette and ‘unwritten laws’ of coastal areas 	Social questionnaire – fish merchants
		Contributions to community knowledge, especially environmental knowledge		
	Relational	Social learning and informal knowledge transfer		
	Subjective	Levels of trust and respect for the knowledge and skills of the aquaculture industry (social licence)		
				Qualitative interviews

Dimensions of community wellbeing	Contributions of the aquaculture industry		Indicators	Methods
A healthy environment	Material	Practising sustainable and environmentally friendly aquaculture	Sustainability assessments of the fishing industry	Literature review Qualitative interviews
		Involvement of the industry in stewardships activities	Involvement in environmental stewardship activities	Qualitative interviews
	Relational	The role of the aquaculture industry in wider environmental management networks	Involvement in environmental management programs and committees	Qualitative interviews Social questionnaire – fish merchants
	Subjective	The level of trust in the aquaculture industry to act in a sustainable manner	Community trust in industry/social licence	Social questionnaire – general public
Integrated, diverse & vibrant communities	Material	Contributions of the aquaculture industry to the needs of a diverse community	Role of aquaculture in providing opportunities for different socio-economic and cultural groups	Qualitative interviews Literature review
			Providing food for different cultural groups	
		Involvement in citizenship activities and community events	Contributions by aquaculture sector to cultural events	
			Sponsorship and donations by aquaculture sector	
	Relational	Role of the aquaculture industry in building and maintaining social networks (formal and informal) in local communities (social capital)	Contributions to social capital – bridging, bonding and linking	Qualitative interviews Social questionnaire – fish merchants
	Subjective	Community awareness and beliefs in relation to the importance of the services provided by the aquaculture industry for community life	Importance of the industry in community life for economic opportunities for diverse groups	Qualitative interviews
Importance of seafood for community celebrations				

Dimensions of community wellbeing	Contributions of the aquaculture industry		Indicators	Methods
Cultural heritage and community identity	Material	Contributions to the history of NSW coastal towns/regions	Historical role of the industry in regional growth and formation	Literature review Qualitative interviews
			Cultural heritage related to aquaculture	
	Relational	Contributions to cultural heritage and community identity	Historical role of aquaculture in Indigenous communities	Literature review Qualitative interviews
			Historical involvement of diverse ethnic groups in aquaculture	
			Community identification with aquaculture heritage and notion of 'oyster towns'	
	Subjective	Importance to the community of the aquaculture industry's contributions to a shared sense of community identity and local cultural heritage	Concern over decline in aquaculture Participation in community events and activities led by aquaculture industry	Literature review Qualitative interviews
Leisure and recreation	Material	Contributions of the aquaculture industry to community recreation – visitors and locals	Utilization of aquaculture product through food retail and hospitality sector	Qualitative interviews Social questionnaires – fish merchants, tourism operators, general public
			Utilization of aquaculture product or facilities in tourism	
			Recreational fishers using fish aggregating tendencies of oyster farms and sea cages	
	Relational	Connections between the aquaculture industry and recreational users	Market channels for local aquaculture product	Qualitative interviews
			Accessibility of aquaculture facilities for locals, tourists and recreational fishers	
	Subjective	Importance users put on local seafood and infrastructure for recreational boating, kayaking and fishing	Importance of fresh local seafood for special occasions for locals and holiday-makers	Social questionnaire – general public Social questionnaire – fish merchants Qualitative interviews
			Importance of aquaculture sites for recreational fishing, kayaking and boating	
		Utilization of aquaculture product through food retail and hospitality sector		

4. RESULTS AND DISCUSSION

This chapter is structured according to each of the seven identified 'dimensions of community wellbeing'. The results of our investigations into industry contributions towards each of these dimensions is outlined and, where necessary, subdivided according to the methods used to gather the necessary data (i.e. social questionnaires, interviews or economic questionnaire). Each section also contains a discussion of the findings of the project specific to each 'dimension of wellbeing'. A broader analysis of the project findings overall is contained in Section 5.

4.1 A RESILIENT LOCAL ECONOMY

Table 16 outlines the key indicators and methods used to measure each of the identified contributions to a resilient local economy.

TABLE 16. Indicators and methods used to investigate the contribution of aquaculture to a resilient local economy

Contributions of the aquaculture industry		Indicator	Methods
Material	Primary economic impact through direct revenue and business profitability	GVP	Analysis of production and price data Economic questionnaire
		Business profitability	
	Secondary economic impacts (or multipliers) to regional economies through relationships with service industries providing inputs for aquaculture	Regional inputs (multipliers)	Input/output analysis
		Investments	Qualitative interviews
Relational	Interactions between the aquaculture industry and the post-harvest sector	Value of the secondary (post-harvest) sector	Production and price data – DPI Qualitative interviews
		Post-harvest supply chain characteristics	Social questionnaire – fish merchants
	Interactions between the aquaculture industry and the tourism and hospitality sector	Importance of aquaculture to the secondary (post-harvest) sector	
		Importance of the aquaculture industry to the NSW tourism and hospitality sectors	Qualitative interviews Social questionnaire – general public Social questionnaire – tourism and hospitality businesses Production and price data – DPI Literature review
Subjective	Level of community support and understanding of the economic contributions of the aquaculture sector	Stakeholder beliefs about economic importance of the industry in its region, including connections to other sectors	Social questionnaire – general public Qualitative interviews



4.1.1 Overview of aquaculture in NSW

In 2013–14 there are just over 300 oyster businesses and 150 other aquaculture businesses of different types, including hatcheries, as reported in Table 17.

TABLE 17. The different aquaculture permit classes, numbers of farms and species grown in 2013-14

Permit Class	No. of permits	Main species grown
Extensive water based	308	Sydney Rock Oysters
Extensive land based	25	Yabby & Murray Cod
Fishout	24	Trout, Mulloway, Silver Perch
Hatchery	56	Numerous species
Intensive land based	101	Silver Perch, Barramundi, trout

Source: [NSW DPI, 2015b]

Aquaculture activities can be divided between intensive and extensive farming and also between land-based and water-based activities. Given the features of the coastline of NSW, most of the on-water farms are in estuarine areas and the majority are extensive water-based oyster farms, growing Sydney Rock, Pacific and/or Native Oysters. Intensive farming involves high input costs, such as feed, examples being prawn farms in the north of the State, Salmonids on the ranges and native fish production across the State. Some finfish farming is related to tourism through the 'fish out' angling experience, where anglers pay for access to recreational fishing and to take home their catch. Other extensive aquaculture for yabbies, for example, is low density with no feed input and takes place in rural land-based ponds. Finally the aquaculture industry requires seed for stocking and there is a range of different hatchery businesses for oysters, finfish and crustacea. Some farms import seed from other states with the permission of the DPI in respect of health and translocation policies and species-specific criteria. There are also few developmental and small scale farms for mussels, other oyster varieties and tubeworms.

In Table 18 it can be seen that the total value of aquaculture production for 2013–14 at farm gate sale prices was \$53.36m. Of this approximately \$38m (70%) of industry value in 2013–14 was in the oyster farming and hatchery sector, of which the Sydney Rock Oyster was about 90% of the value of production. Around \$4.77m (9%) is from the production of prawns and yabbies. Land-based culture of finfish such as barramundi, silver perch and mulloway with annual sales of \$8.19m represents 15% of industry value.



TABLE 18. Total NSW aquaculture production for 2013-2014
Source: adapted from (NSW DPI, 2015a)

Grouping	Common Name	Scientific Name	Production Kilograms	Average Price per unit	Value (\$)	Percentage (%)
Crustaceans	Black Tiger Prawn	<i>Penaeus monodon</i>	287,307	\$15.64	\$4,494,632	
	Yabby	<i>Cherax destructor</i>	6,322	\$10.25	\$64,789	
	Yabby (bait)	<i>Cherax destructor</i>	11,200	\$19.63	\$219,827	
Subtotal					\$4,779,248	9.0%
Freshwater Fish	Barramundi	<i>Lates calcarifer</i>	58,813	\$15.94	\$937,648	
	Golden Perch	<i>Macquaria ambigua</i>	484	\$10.54	\$5,101	
	Longfinned Eel	<i>Anguilla reinhardtii</i>	33,600	\$10.46	\$351,360	
	Murray Cod	<i>Maccullochella peelii</i>	85,292	\$16.86	\$1,438,089	
	Rainbow Trout	<i>Oncorhynchus mykiss</i>	253,040	\$10.82	\$2,738,836	
	Silver Perch	<i>Bidyanus bidyanus</i>	194,750	\$13.95	\$2,717,599	
Subtotal					\$8,188,633	15.3%
Marine Fish	Mulloway	<i>Argyrosomus japonicus</i>	92,918	\$11.00	\$1,022,098	
Subtotal					\$1,022,098	1.9%
Hatchery	Hatchery Species				\$2,782,153	
Subtotal					\$2,782,153	5.2%
Molluscs	Sydney Rock Oyster	<i>Saccostrea glomerata</i>			\$31,844,593	
	Pacific Oyster	<i>Crassostrea gigas</i>			\$2,114,696	
	Native Oyster	<i>Ostrea angasi</i>			\$103,080	
	Oyster Spat				\$1,823,071	
	Oyster Nursery Species				\$117,625	
Subtotal					\$36,003,065	67.5%
Others*					\$589,614	1.1%
Total value \$					\$53,364,811	100%

4.1.2 Economic contribution results

The economic contribution of the aquaculture industry in NSW is made at several levels and can be measured by several economic indicators. In this section we report on three economic values: (i) the gross value of production (GVP); (ii) the estimated economic profit among aquaculture business operators; and (iii) the regional economic impact of aquaculture in the NSW economy. Investment in the industry is also discussed.

4.1.2.1 Gross Value of Production (GVP)

The gross value of production (GVP) is a revenue measure estimated from the available production and price data and is often referred to as a gross measure



of the economic contributions of the aquaculture industry to the NSW economy. GVP relies on production data from NSW DPI and uses an estimated average price per species at the first point of sale. Thus the GVP is an aquaculture production value at point of first sale and does not include the secondary food sector (e.g. processors, wholesalers and retailers).

The GVP data are produced by NSW DPI each year and the data relevant to the study are for 2013–14, during which \$53.36m GVP was produced (NSW DPI, 2015a). Of this \$47.46m was in coastal aquaculture, that is, excluding inland production. In the year following the study period, 2014–15, the GVP rose by an estimated 14% (NSW DPI, 2016a).

4.1.2.2 The estimated economic profit among aquaculture business operators

A financial and economic survey of a range of NSW aquaculture businesses was undertaken to determine the business profitability and viability of the industry. The results are reported in Appendix 3. There were 27 surveys returned from the 50 businesses contacted. Of the 27 returned 21 could be used in the profitability analysis due to a number of omissions and missing data. The responding 21 businesses had revenue of \$9.16m (19.23%) from a total GVP of \$47.6m, excluding inland areas. The 21 replies were 4.7% of 450 permit holders by number.

Thus the 4.7% of the permit holders that replied provide 19.23% of the coast aquaculture GVP. The survey looked to capture more active and possibly larger producers and was unlikely to represent all permit holders. The low response rate meant that the sample was not sufficient to complete an analysis of the performance of businesses for each aquaculture species, but instead necessitated the aggregation of results for the oyster and non-oyster aquaculture sectors. However, the survey returns were sufficient to produce an analysis of three regions of the NSW coast (North Coast, Mid North and Central Coasts and South Coast) by regional economic modelling.

Operating profit in the Oyster and Non-oyster activity groups' businesses was estimated as 21.9% and 29.9% of gross revenue respectively. However, conclusions on long-run viability are difficult to draw from accounting data alone. Certain economic adjustments have to be made to determine more meaningful profitability results, such as an economic rate of return, that are comparable with other industries through the economy.

The financial profitability results indicate that returns to full equity of 8% for the oyster sector and 9.8% for the non-oyster sector. However, once a range of opportunity costs and adjustments are made, the economic profitability is 1.1% for oyster businesses and -0.8% for non-oyster businesses. Non-oyster businesses are just below a zero rate of return, which indicates they are just below covering opportunity costs and earning a normal return to capital (zero percent). Oyster businesses had a small 1% economic surplus over all economic costs. The results indicate that both business categories are earning at a level equivalent to other industries, and so industry-wide exiting and entry of businesses would be minimal. Negative economic returns would likely cause farmers to leave the industry, while positive returns would attract other businesses into it.

The sampled businesses in the oyster section of this survey indicate an improved level of economic performance in the industry as seen in economic returns to capital relative to the previous oyster benchmarking studies (Rural Directions Pty Ltd, 2012; 2013a). There have been no previous analyses of the non-oyster sector, but the small sampling of more active businesses means we need to interpret the results of this survey with some caution as to their representativeness across the industry.

4.1.2.3 Regional economic impact

Regional economic activity takes place in different areas and regional economics investigates the connections between different sectors of the economy. In this study we use an input-output (IO) modelling approach as described in Section 3 (on methods) and in the WRI report (see Appendix 5). From business receipts received by aquaculture businesses, the initial expenditure on inputs for aquaculture is made in the NSW economy and this expenditure then produces an amount of output in the general economy. Aquaculture businesses require inputs in the form of goods such as fuel, power, fish food, equipment and services, such as maintenance provided by different trades.

The responses from the profitability survey have been used to derive the impacts on regions via economic modelling and to estimate the relationships with other businesses along supply chains in the local areas. This project uses a sophisticated IO model called Generation of Regional Input-Output Tables Technique (GRIT) (see WRI report, Appendix 5). This form of IO model avoids the problems of over-estimation sometimes associated with IO. The WRI state economy modelling utilises ABS data in analysing regional economies. This is one reason it is important for the study to be organised into regions lining up with the ABS Statistical Areas, as it enables survey results to be inserted into a state wide regional model of the NSW economy so that the regional economic impacts of aquaculture can be established.

This study extended the analysis of the economic contributions of the aquaculture industry to include examination of economic 'multipliers' – that is, how the income from aquaculture flows through to other businesses through expenditure on goods and services for the aquaculture industry. The estimation of regional economic benefits was undertaken by the regional development research organisation Western Research Institute (WRI). The economic information from the operational and financial data, collected from the economic questionnaires distributed to the sample of aquaculture operators, was used to generate regional expenditure estimates.

The expenditure estimates were inserted into WRI's model of the NSW regional economy to calculate the economic impacts of aquaculture on regional coastal economies and at the NSW State level. Modelling was undertaken for the financial year 2013–14. The full results of this analysis can be found in Appendix 5.



The project covers aquaculture production for the NSW coast, divided into regions as per the Australian Bureau of Statistics (ABS) Statistical Local Areas (SLA):

- > Richmond, Tweed and Clarence (North Coast),
- > Port Macquarie south to Port Stephens (Mid North and Central Coasts);
- > Jervis Bay south to the Victorian border (South Coast).

The regional analysis used three area tables equating to North Coast, Mid North and Central Coasts, and South Coast, using a mixture of SLA3 and SLA4 areas (see WRI report, Appendix 5).

The output can be measured for the three coastal aquaculture areas and then for the whole of NSW. From the sales revenue obtained by industry there is an initial expenditure on inputs in the general economy of \$31.06m, which produces an amount of economic output across the economy of \$113.5m. The total estimates are made up of the initial stimulus, plus the flow-ons as reported in Table 19.

TABLE 19. Initial and flow-on economic impacts of commercial aquaculture on the total NSW

Expenditure by region - NSW (\$m) \$31.06m	Output (\$m)	Value added (\$m)	Household income (\$m)	Employment (no.)
Initial	47.44	30.66	13.83	550.00
Flow-on	66.04	34.23	16.18	198.10
Total impact	113.48	64.89	30.00	748.10
Type II multiplier	2.39	2.12	2.17	1.36

Source: WRI Report (Appendix 5).

The direct initial output is \$47.44m and the indirect flow-on is an output of \$66.04m (Gross Regional Product – GRP) giving the state total of \$113.48m. Aquaculture in NSW has a direct \$30.66m of value added, has an indirect flow-on in the economy of \$34.23m making a total of \$64.89m across the NSW economy. Similarly there is a total of \$30m generated in household incomes. The initial direct Full Time Equivalent (FTE) employment is 550 jobs and there are then 198 indirect FTE jobs in supplying inputs for aquaculture businesses, making a total employment of 748 jobs. The value added is the output, less the intermediate consumption (the cost of materials, supplies and services used to produce final goods or services).

The total impact can be presented as a ratio of the initial impacts and is referred to a Type II multiplier. For example for output, \$113.48m divided by \$47.44m gives a Type II output multiplier of 2.39. The Type II added value and income multipliers are 2.12 and 2.17 respectively and the Type II employment multiplier 1.36 for all NSW. These indicate the dimensions of multiplication in the general economy associated with aquaculture production.

The output can be measured for different areas, such as for the three coastal areas in this study and then for the whole NSW economy. In Table 20 the results of the regional economic analysis are presented for each regional area along the



NSW coast. The total NSW results cover all three areas and account for economic activity between areas, not calculated in each region, or by adding those regions (the all regions column).

TABLE 20. Economic impacts of aquaculture on the study regions
Source: WRI Report (Appendix 5).

	North Coast	Mid North and Central Coast	South Coast	All Regions	NSW
Initial expenditure (\$m)	7.82	14.15	9.08	31.06	31.06
Output (\$m)	21.54	40.25	25.38	87.17	113.48
Value added (\$m)	10.6	25.36	15.66	51.62	64.89
Household income (\$m)	4.37	11.63	6.88	22.88	30
Employment (no. FTE)	143.60	361.20	182.10	686.90	748.10

At the regional level, results from the economic modelling in Table 5 show the greatest increase in GRP in the Mid North and Central Coasts region (\$25.36m), followed by the South Coast (\$15.66m) and North Coast (\$10.6m), with a total increase in GRP for all regions of \$51.62 million and all of NSW (\$64.89).

Household income had the highest impact in the Mid North and Central Coasts (\$11.63m) followed by the South Coast (\$6.88m). The largest employment impacts were seen in the Mid North and Central Coasts (361), South Coast (182) and the North Coast (143) regions, with a total of approximately 686 FTE positions achieved across all regions.

4.1.2.4 Investment in the industry

Capital investment in the aquaculture industry takes place in several areas. The standard process of investing in land sites is made problematic due to many farms being on aquaculture leases on Crown land. However, some farms are not on leases. Most farms have buildings, ranging from lockups and sheds to protect equipment, to more substantial buildings for product handling and packing. This diversity makes land and building investment value difficult to measure. There are also shorter-term capital investments in other infrastructure for farm equipment farm vehicles and smaller machinery. Farmers were asked to estimate the historical cost and the replace cost of these asset classes. The state-wide estimates of the investments tied up in the three coastal aquaculture areas was estimated to be \$94m historical cost with a \$124m replacement cost. However this estimate should be treated with caution given the measurement issues discussed above.

There was some evidence of new investment among the businesses that responded, some in new types of farming, but most investment appeared to be in smaller operational and equipment items presumably arising from the need for replacement. The debt levels among those surveyed appeared to be low with 10 out of the sampled 21 business having debt interest payments averaging \$5,000 per annum (average of \$50k to \$60k loans). The businesses sampled were not taking on large amounts of debt.



4.1.2.5 Public perceptions of economic contributions from aquaculture

The extent to which the economic contributions of the NSW aquaculture industry are recognised and valued within local communities was explored through the general public questionnaire. The vast majority (94%) of respondents agreed or strongly agreed with the statement “I believe it is important we produce our own seafood in NSW and reduce our reliance on food imports”. A very high proportion (84%) agreed or strongly agreed with the statement “aquaculture provides important employment opportunities in many NSW coastal towns” (Appendix 2). Furthermore, the general public questionnaire shows a strong perception that the seafood industry is important in the economies of rural towns: 96% of respondents said the reason they prefer local seafood is because it is better for the local community (see Section 4.2.1.2 on preferences for local seafood). In the fish merchants’ questionnaire, most (76%) respondents also agreed that the aquaculture industry provides important employment in NSW towns.

The employment provided by the NSW aquaculture industry is likely to be of stronger significance in some communities than others. Regional areas such the Clarence and sections of the South Coast have high levels of unemployment and limited employment opportunities (see Table 21). In these areas the impact of the aquaculture industry is of higher significance because the reliance on income in the agriculture/forestry/fishing sector is correspondingly higher.

TABLE 21. Regional employment (%) in agriculture, forestry and fishing and median incomes
Source: (ABS, undated).

Study areas	ABS statistical area name	ABS statistical area level	Employed by industry – agriculture, forestry and fishing 2011 (%)	Median income for area 2013 (excluding govt. pensions)
NSW	New South Wales	S/T	2.2%	\$44,780
Sydney	Greater Sydney	GCCSA	0.4%	\$47,281
1. North Coast	Tweed Valley	SA3	2.6%	\$36,844
	Richmond Valley	SA3	4%	\$34,421
	Clarence Valley	SA3	5.6%	\$32,965
2. Mid North and Central Coast	Port Macquarie	SA3	2.6%	\$36,209
	Taree - Gloucester	SA3	5.8%	\$34,829
	Great Lakes	SA3	4.3%	\$32,458
	Port Stephens	SA3	1.4%	\$40,413
3. South Coast	Jervis Bay	SA3	N/A	N/A
	Shoalhaven	SA3	2%	\$36,295
	South Coast	SA3	4.7%	\$34,247



Interviewees identified a range of economic contributions from aquaculture. Many talked about the inputs they buy locally, and how their primary product then supports other business down the seafood supply chain, including multiplier effects.

It puts money directly into the local economy... It then puts money into the local town... we do all our shopping there... Then the follow on effect is we also support infrastructure. Like buying stuff for the oysters or support the freight companies. We support - yeah, so it has a domino effect then. So what our product is, is the primary product and then that gets forwarded to wholesalers. So they then add on to what they sell us. Then of course from the wholesalers it then goes to the restaurants, whether it's for a high-end restaurant or a normal restaurant. So they can value add. So it assists them with their business as well... There is a flow on effect.

SC06

Interviewees also talked about aquaculture contributing diversity and therefore resilience to rural town economies.

If it wasn't there, would it matter but in some ways there are a lot of things that have left Grafton from Telstra to projects that are no longer there, and saw mills shut down and this sort of thing. If it's not there, does it matter but I don't know. Probably, it's more death from 1000 cuts to a community you know? So from that point of view, we're probably just another paving stone on the footpath but if you didn't have all of them, you'd be walking in the dirt...

NCLB1

It does make us resilient because it provides other industries for people to work in. So it's not like if you lost your job in one industry that you would have to move away from the area. There are other forms of, like you say, the fishery - the fishing and then there's the tourism industry as well as financial services and all the industries that make up the local economy...

NCLG3

A couple of interviewees also talked about economic diversity in a slightly different way, in terms of introducing the idea of new possibilities to their region.

With aquaculture being one of the newer industries it probably contributes a little bit of a lift to the ability of the area to change and to move with the times. We see things like the sugar cane industry that's dominated here for a long, long time and grazing of course and timber. But there'd never been much change in any of that and that's changing rapidly now. But the aquaculture industry was I guess the first of the new industries to come along to show that there is something else you can do here... We're seeing now people growing alternative crops. So sugar cane farmers now growing soy beans and changing to macadamias and a number of different things happening where that simply would not happen...

NCLB2



Contributions to employment

The companies interviewed for the study presented a cross-section of sizes in terms of employment. NCLB6 was then employing 30 people and intending to employ as many as 200 as this new business reached full production. SCLB1 was also involved in developing a new business, aiming to employ 300 people at full production. Then there was a big drop to the next largest employer: one of the oyster farms employing 35 people. The rest of the interviewees employed less than 10 people, with some of the oyster farms only employing family with occasional help from a casual employee.

The small operators pointed out how important even a few jobs could be in rural towns. SCO2 is a sole operator but he described himself as creating two jobs – his own job and the job he would be doing if he wasn't farming oysters, which is now free for someone else to take. In a similar vein, after the global financial crisis hit Europe it was found that seafood production was a buffer against unemployment because people could start businesses when they lost their job (Britton and Coulthard, 2013). MNCLB4 employed four people, and he saw that providing those jobs plus the relationships between workers and between his family and his workers contributed greatly to social cohesion in his small community.

Threats to economic contributions

Interviewees were asked an open-ended question about what they thought the threats to the economic contributions of the aquaculture industry were. Most interviewees (19 out of 34) cited a range of financial threats to the industry including: high start-up costs for buying oyster leases or investing in land, equipment and permissions to start a land-based venture; high costs relative to farm gate prices; competition from lower cost imported products; and banks not understanding the aquaculture industry well so credit is difficult.

The banks weren't - the banks aren't very friendly when it comes to aquaculture, refer to ponds as mud puddles and there's no real interest or experience held by banks in respect to being able to value properties such as this... It was up to us to find somebody on their board that they were happy with who actually knew about aquaculture and was able to value it accordingly, which we did at great expense to us.

MNCLB1

Australia's market is still, for farmed prawns, still - I think it's 60 per cent coming in from overseas. We've got to overcome cheap imports... All primary production in Australia - we had a fruit and vegetable business for 10 years and the farmer's getting less now than what we had in 1990, 1992, and that's - prawn farming is pretty well the same.

NCLB5

The next most common response (nine interviewees) to the question about threats to contributions was the amount of time taken up dealing with regulation. Many of the comments were about the sheer amount of regulation and the many departments



aquaculturists have to deal with, particularly the land-based farmers where issues of water quality, habitat, farming and so on are all subject to regulation.

We had to jump through seven departments just to fix up the bank down there... It started off with a 20-page application to do riverine works and then there was Fishery Department and Lands, Department of Agriculture, Environment and Heritage, the Clarence Valley Council, the Office of Water. That was all to stabilise the riverbank.

NCLB5

Some comments about government processes were about problems at start up with getting development applications through and dealing with opposition, leading to lengthy delays in starting production and in some cases legal proceedings. In the early 2000s the Productivity Commission found that aquaculture in Australia

is subject to an unnecessarily complex array of legislation and agencies - covering marine and coastal management, environmental management, land use planning, land tenure, and quarantine and translocation

(Productivity Commission, 2004 p.xx).

In response to issues arising with long delays to development applications the NSW Government developed the North Coast Sustainable Aquaculture Strategy under the *State Environmental Planning Policy 62 – Sustainable Aquaculture*, which was later updated in the Land Based Sustainable Aquaculture Strategy (Industry & Investment NSW, 2009).

Five oyster farmers mentioned environmental threats from diseases such as QX and POMS, high rainfall events causing harvesting to cease for food safety reasons, and water quality problems from land-based activities in the catchment.³

[Last year] we were shut for 111 days. So yeah. Just three floods and we had a sewerage spill. So that's three weeks automatic. Yeah lots of some small events that added up to quite an amount of time... So I mean it's pretty scary just growing a single species and having the potential disease of QX which Sydney rocks get. You go to bed and you come back to work in the morning and... you don't have a business any more.

SC05

Only two interviewees mentioned the high average age of the industry workers or lack of succession planning as issues.

³ Land-based aquaculturists work with closed water systems so are not as vulnerable to environmental threats as the oyster farmers, who use public waterways.



Aquaculture as a 'lifestyle' business

Many of our interviewees discussed the reputation aquaculture has for being a 'lifestyle' business. NSW DPI staff pointed out that because oyster farming mostly uses public waterways the government policy is to have a fair rent and productive use of the leases, so hobbyist oyster farmers have been discouraged through licensing and fee structures. Nevertheless, the notion of aquaculture being a lifestyle business persists because it is outdoors, often in beautiful natural landscapes, without traffic jams or other issues associated with city businesses. Because the word 'lifestyle' may imply that it is easy or always pleasant, however, it is important to present a more comprehensive and realistic picture of what life is like in an aquaculture business in order to think through the potential of aquaculture as an economic opportunity.

There is no doubt several of our interviewees would fit the 'lifestyle' category in terms of having non-aquaculture business interests as well as their farm, and in being very small scale – not employing anyone other than family and the occasional casual over busy periods. Furthermore, many of our interviewees spontaneously volunteered that the lifestyle of aquaculture work was what attracted them to the business. For many of them it was about working outdoors on the water, in a natural environment, and working with living creatures. Some were keen recreational fishers or surfers so the physical location of coastal aquaculture fitted with their personal interests.

I was going to be a chef myself. Then I was working in a kitchen and looked out the window and looked at the water and just went, no. I want to be out there. Not in here. The lifestyle part is a big factor of why people are attracted to doing it.

SC05

I find it very rewarding, I really do enjoy it. I'm also a chartered loss adjuster, something I did for a lot of years and I gave that - it was a far better income than my oyster farming is but I'd give away that tomorrow if I - well, I have, I've given that totally away to continue oyster farming. Have a look at it. It's so peaceful. Oysters don't argue.

NC01

Well, considering that I came - well, I grew up on a farm, so I like the open air. Spent a few years in the office and realised it wasn't my thing. So I find - and because I've been doing it now for 40 years, I've found that it's really lifestyle, first choice. Income wise, no, we've had a lot of setbacks over the years and we've struggled...

MNC02

We can see in these quotes, however, that while the natural environment of aquaculture appealed, there are some other aspects of the business that are difficult, such as lack of financial returns. Financial struggle was a common theme in the interviews, and was one of the threats to economic contributions identified by interviewees. The difficult aspects of the business, however, were not always described in negative terms. They were also mentioned by several interviewees as part of what attracted them to the business.



Because I was bored. I'm a lawyer in Sydney... I don't know. It's just it was a challenge for me to do something from nothing, to develop a concept, a business that really hasn't - there have been many silver perch farmers before.

MNCLB5

Some people are driven wholly and solely by money. Some people are driven by challenges. I think that's what this industry has been to me. The financial rewards certainly haven't been there but geez it's been a real challenge on trying to get it right... I'm a licenced electrician... I found electrical work just got boring. Once you know how to do electrical work it gets boring. So no challenge there.

MNCLB3

Those people have developed over the years as oyster farmers or as fishermen, like Steve said, he's exactly right. They've weathered the good times, the bad times, they enjoy just as much being in bad weather as they do in good weather, you know? You like getting beaten around as much... The challenge, it's a challenge.

MNC06

The preceding quotes show that as well as a beautiful natural environment, the difficult aspects of the business were appreciated by some aquaculturists as part of the lifestyle. Other interviewees were less positive about the level of work involved.

I guess it's the industry's own fault and it's the people who have promoted the industry over the years have sort of sold it as a lifestyle thing, and it's just not a lifestyle thing. It's hard work, it's seven days a week. They're growing animals, they need to be fed and if you're going to do one on an intensive basis then you need to be here or someone needs to be here... There's three types of farming; there's the extensive, there's semi-intensive and there's intensive. So if you're a yabby farm running extensively well there's not much really work to do at all, but then you're not going to really make any money either. So the level of intensity determines whether you want to make a quid out of them or not, and that's probably why a lot of people don't make any money out of it and haven't chosen to...

MNCLB1

I'm very focussed on trying to make a living because it's not always good because we've got a lot of variables in this work. Some years are better. Some years are not as good... It's a way of life. Personally, I get up in the morning and I love the changes of the season, winter time, summer time, spring, autumn. I like all that, and just - in the beginning, when you start a business, I mean things like - the [farm] we have brought (sic) because - I mean most of them were derelict... The farms we had that were - they had huge - they had tons and tons of rocks and derelict infrastructures and things like that, and we cleaned them. It was a huge mess. I haven't got any photos to show you, because there was - for many - it's not possible for me to get the hours I've put back. There's no [unclear] because I've worked so [hard]...

SC03



So, when thinking about aquaculture as a lifestyle business, we should bear in mind that part of the normal condition of this lifestyle is that it includes significant challenges, long hours and a lot of hard work.

4.1.3 Estimates of the regional impacts of the secondary sector

The secondary sector includes post-farm gate sales activities and functions such as product receivers, processors, wholesalers and retailers. There is little published data on these supply chains in NSW aquaculture. Retail prices are known for oyster species in places like the Sydney Fish Markets, but many aquaculture products also end up in the retail and restaurant trade – the food industry. To estimate the secondary sector of the aquaculture economy we are going to assume it is similar to the NSW seafood sector (Productivity Commission, 2004 p. xx). From that study we drew on previous site- and port-specific estimates, to provide a state-wide estimate.

There are previous regional economic studies of the wild-catch and seafood sector in areas of NSW (Voyer et al., 2016). Regional studies have been completed in other states (Econsearch 2015). There are two scenarios in the past NSW site-specific regional seafood studies noted above. One is where fish are landed and have little processing (Harrison, 2010, Powell et al., 1988, Tamblyn and Powell, 1988) and the second is where fish are further processed, as in the Northern Rivers (Harrison 2010). In estimating the state-wide secondary sector estimates, we use the ratio of primary to secondary output in the past studies to generate an imputed output value for the secondary sector. These ratios were 0.99 of the primary output value and 1.29 where there was fish processing in the Clarence region (Powell et al., 1988, Tamblyn and Powell, 1988). The secondary sector for aquaculture uses the lower figures as reported in Table 22.

TABLE 22. Adjustment factors used to impute values of the secondary sector from the primary sector estimates

All NSW	Output (\$m)	Added Value (\$m)	Income (\$)	Employment (\$m)
Primary to secondary adjustment factor	0.99	1.06	1.31	1.35

The estimated lower and higher secondary sector estimates are presented in Table 23.

TABLE 23. The regional aquaculture sector with retail and processing estimates (low and high)

Expenditure by region - NSW (\$m) \$31.06m	Output (\$m)	Value added (\$m)	Household Income (\$m)	Employment (no.)
Aquaculture sector	113.5	64.9	30.0	748.1
Retail and processing estimate	112.3	68.8	39.3	1,009.9
Total estimate	225.8	133.7	69.3	1,758.0

The secondary sector estimates in Table 8 show that for the year 2013–14 the state-wide estimates of both the aquaculture growing and secondary sector are an output of \$226m, added value \$134m, and \$69.3m in household income, and the sectors employ a total of 1,758 full time jobs across NSW. This would translate into many more part-time and casual jobs, as seen across the aquaculture and secondary seafood retailing industries in NSW. The accepted estimates likely exceed those of the NSW DPI website (undated), which states:

The seafood industry, which includes aquaculture and oyster farmers is a vibrant industry which generates over half a billion dollars of economic activity each year, employing more than 4000 people

(NSW DPI, undated).

The estimates in the Wild-Catch study (Voyer et al., 2016) that preceded the current aquaculture study indicate that professional fishing and the secondary seafood sector had a likely output in 2012–13 of \$436m to \$501m with an estimated 3,291 and 3,857 full time jobs across NSW (Harrison, 2010). This current aquaculture study indicates that aquaculture and the associated secondary seafood sector had a likely output in 2013–14 of \$225.8m with an estimated 1,758 full time jobs across NSW. In light of these studies the DPI quote can be updated to become:

The seafood industry, which includes aquaculture and oyster farmers is a vibrant industry which generates over \$650m dollars of economic activity each year, with 5,000 full time equivalent jobs, performed by many more actual people as full time and part-time employees.

The small-scale and family nature of part-time fishing and aquaculture businesses leads to many other people being represented in full-time equivalent employment estimates.

4.1.3.1 Perceptions and practices of fish merchants

The questionnaire given to fish merchants indicated that the majority (73%) felt the NSW aquaculture industry was important to the success of their businesses. Locally produced seafood consistently sells well across these businesses, although the extent of this varied between study areas (see Table 25 in the discussion of Community Health, Section 4.2).



Most of the fish merchants interviewed as part of the social questionnaires indicated that they purchased their local seafood from wholesalers (44%) or direct from local producers (40%). A smaller, yet still significant percentage of fish merchants purchased their seafood from the SFM (38%) or local co-operatives (19%). These results, and our fieldwork interviews, indicate that fish merchants rarely rely completely on local producers to source their products. These businesses need to ensure continuity of supply and often aim to stock a range of products to meet the different tastes and budgets of their customers. This means they must source their products from a range of suppliers, with local producers being one of several sources. The availability of a variety of products in relatively reliable and consistent quantities means that SFM and larger-scale wholesalers play a significant role in the supply chain catering for the needs of both big and small operators across local, state-wide, national and international scales. In addition, the SFM plays an important role in benchmarking prices, giving producers, fish merchants and consumers an insight into the current market value of a range of seafood products.

4.1.4 Relationships with tourism and hospitality sectors

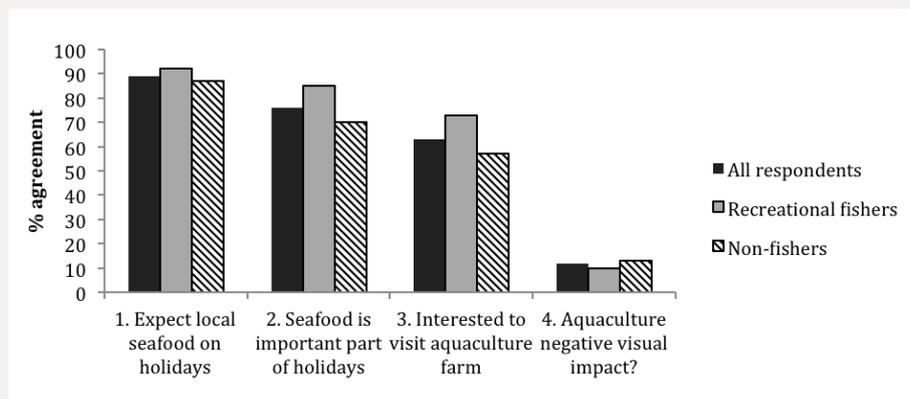
The fieldwork interviews indicated a range of ways in which the aquaculture industry supports and enhances the economic potential of other important sectors within regional communities. One of the most significant of these relationships was the role the aquaculture industry plays in local tourism markets, as the producers of fresh local seafood. This concept was explored through the fieldwork interviews and social questionnaires of the general public and hospitality industry.

4.1.4.1 Perceptions of the importance of local seafood production for tourism

The social questionnaire explored both aspects of contribution to the local tourism industry – the provision of seafood products to the local tourism market and the provision of a tourism experience. The results indicate that relationships between local seafood production and tourism are, at present, largely informal and not clearly understood by the seafood or tourism sectors as a whole, although tourism promotion organisations and some individual operators use and understand these links. This relationship thus has great potential to provide increased mutual and community wide economic benefits.

The general public questionnaire indicated that 89% of respondents expect to eat local seafood when they visit NSW and 76% felt that eating local seafood was an important part of their coastal holiday experience (Figure 6). In addition, amongst the members of the general public surveyed, 63% of respondents indicated they would be interested in visiting an aquaculture operation while on holidays. The visibility of coastal aquaculture is not a problem for tourism, with 81% of all respondents disagreeing with the statement that “seeing aquaculture farms detracts from my enjoyment of the coastal environment when on holiday”. These figures indicate that recreational fishers are potentially a very receptive audience for including local aquaculture with tourism experiences, because they are more interested than the general public in having local seafood on holidays and significantly more interested than the general public in visiting aquaculture operations (see Figure 6).

FIGURE 6. General public questionnaire – seafood and aquaculture preferences when on holiday at the coast



Notes: Participants were asked to respond on a scale of 1 to 5 from strongly agree to strongly disagree for the following statements: 1) I expect to eat local fish or seafood from the local region when I visit the NSW coast; 2) Eating seafood caught or grown in the local region is an important part of my coastal holiday experience; 3) I would be interested in visiting an aquaculture facility when on a coastal holiday; and 4) Seeing aquaculture farms detracts from my enjoyment of the coastal environment when on holiday.

The reason we asked questions like these in the general public questionnaire was to investigate the extent of perceptions raised in public submissions for recent development applications for new aquaculture ventures, as exemplified by the question “The [aquaculture] contribution to the local and regional economy is estimated to be no more than \$2 million. Is it worth risking a \$700 million tourism industry for this small return?” This submission went on to say that aquaculture constituted visual pollution, that it spoils the way waterways look and that tourists would be discouraged from coming to an area with aquaculture operations (NSW DPI, 2014). Similar kinds of arguments have been raised in the media (Long, 2015a, Long, 2015b, Watts, 2016a).

The general public survey findings indicate that the negative perceptions put forward in such submissions to development applications and in the media may be a minority view, and that the vast majority of NSW coastal holiday makers are not discouraged by the presence of aquaculture, but find it adds to their experience in terms of providing fresh local seafood, and a point of interest for visiting. Our fieldwork interviews and questionnaires for fish merchants and tourism operators explore this point further.

The link between aquaculture and tourism was also frequently mentioned in our fieldwork interviews. These discussions fell into two main categories. The first involved the contribution of the industry to tourism through the provision of sought-after seafood meals for visiting tourists. The second was the provision of an experience for visitors wishing to visit aquaculture facilities or watch aquaculturists at work. Increasingly sophisticated marketing approaches are beginning to emerge around local seafood supply as a tourism product through, for example, seafood inclusion in tourism ‘food trails’ that tap into the growth of ‘food ethics’ and ‘food



localism' amongst consumers. A key example noted is the Australian Oyster Coast initiative on the South Coast.

Tourism Australia... recognised a couple of years ago that Australia isn't really world renowned for its food, however when people come to Australia and then leave they do rave about the freshness etc, etc. One of those is our seafood. For our region it's the oysters... we're marketing oysters as an experience as well as some fresh produce, which is the dairy... The combination of those two together is working out really well... The results of that campaign have been really quite - were pretty excellent actually. They've been really excellent for the whole of region... We've got some really good data coming back from Destination New South Wales that says that the products that we've chosen to showcase, which is like I say oysters as part of that, is resonating and resulting in visitation... We've got an increase in the visitation, but also the amount of money that they're spending.

SCLG1-2

Plus, it also - people come here because they want to buy oysters. So they come to the - they Google you up on the internet and they see we've got oysters. So they'll drive here and they'll get oysters, but then they might like the place and they'll stay. So they'll stay at the caravan park or they'll go to the general store and have lunch or a cappuccino or something like that. So that directly assists this little community.

SC06

It's - we have a direct outlet in Tweed, so that I guess directly contributes to the economy and to - we also have some of the tour boats come in, so that's - again it's a draw card for other businesses to... and one of their skippers has now been taught how to give lectures on oysters and he does a presentation as they go. Obviously they take our oysters and use on their boats.

NC01

So I think it gives our visitors to the region an activity to participate in. So we say Ballina is synonymous with fresh seafood. It's on some of the marketing that we use here and so just today we've had people in and they say, where can we get unshucked oysters from, and a lot of people come in and they will say, what's a good seafood restaurant, where can I eat, where are your seafood cooperatives?

NCLG3

The interviews show not only the connection between tourists wanting to eat local seafood when on holiday, but also a deeper connection between the two sectors through having a natural environment that is perceived by visitors as clean, healthy and beautiful. In this sense the economic contribution to a resilient economy through interdependent sectors is also related to other dimensions of wellbeing, such as community health, and a healthy environment.



So again, as far as tourism and promoting the area, actively our product does that when it's out there in the marketplace. Okay, if you want to eat oysters they come from Wallis Lake. Okay Wallis Lake must be a nice place to go to because they grow oysters there... So back in the hepatitis time, back when we had hepatitis here and the estuary was closed, the tourist industry collapsed here because we had hepatitis in the water... So the tourism - people just started cancelling their bookings for the next season. So then the tourist industry got on board and came and hounded us and said what can we do to get the oyster industry back up and running again because we need the oyster industry in this port as a tourist attraction and get the stigma off the estuary.

MNC05

Our interviews also revealed that in addition to the traditional tourist market of domestic visitors wanting oysters when holidaying at the coast, there are some international market segments that are particularly interested in local food as part of their tourism experience, and this extends to fish farms as well as shellfish.

We're actively trying to promote the business to people if you like for tours, especially the inbound tourists. We find that China is now our second largest tourism customer. So we have a company that's been bringing a lot of people through the doors from Singapore. We've had students from Singapore, but also just bus after bus during their holidays.

MNCLB3

In addition to the attraction of locally produced food for tourists, interviewees identified other areas where aquaculture contributed to the experiences of visitors. These included some instances of river tour boats using shellfish leases as a feature, as noted in the quote above, but also recreational fishers using the sheltered locations where fish aggregate around shellfish leases for fishing, and kayakers liking to view shellfish leases on their travels (for further details see Section 4.7).

There is some unmet demand for fresh local seafood on the part tourists because of lack of supply into local markets. Much of the product goes to the capital cities. Most of our aquaculturist interviewees said they sold some product locally, but for any of the larger-scale operators their main markets will always remain the capital cities because they produce too much for local markets. The lack of supply locally also seems to be in part due to food retailers and restaurants not stocking local product.

The food and the produce side of things - the one thing people say it lacks is local seafood or the availability of local seafood... It gets shipped into Sydney... It's also a lot of people, they're not fussed as to where that comes from, whether that's grown commercially or freshwater, saltwater - they don't - there's no - they don't differentiate from that. They do expect - they do like to come to destinations that can offer that. They are - we've actually had quite a few people really disappointed that they can't go to a local restaurant and pick up local seafood...

SCLG1-2



We do get a lot of people interested in seafood and they will specifically come in and say, where can I dine for seafood, what's a seafood restaurant, and we don't particularly have any that serve just seafood and they're set up as a seafood [restaurant]...

NCLG3

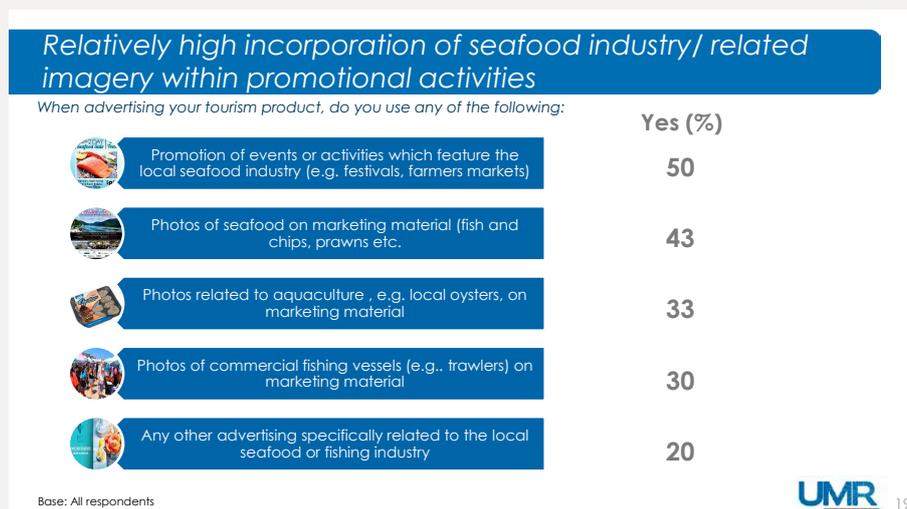
Yet you get walk into the seafood co-op down at Laurieton and see all sorts of wonderful fresh fish, but it's all getting sold to Sydney. Yeah, I think food service industry in the area has become quite lazy.

MNC01

The interview results mentioned above were supported by the results of the questionnaire for tourism operators. All of the businesses who responded to the questionnaire felt that visitors and tourists expect to eat local seafood when they visit the NSW coast, 98% believed that eating seafood was an important part of their customers' holiday experience, and 93% believed the local tourism industry would suffer if fresh local seafood was not available. Seventy-five percent strongly agreed that aquaculture contributed an important part of the local tourism product, and 65% agreed that the history of the aquaculture industry and the opportunity to visit an aquaculture facility (60%) were important aspects of the tourism experience in their area (see Appendix 2).

Half of the tourism operators we surveyed had previously undertaken some form of promotional activity that featured the seafood industry (Figure 7). These included advertising local seafood-specific or fresh produce events, and utilising industry related images in print and digital formats (for example, videos, social media and blogs). The focus of the images used in marketing was mostly on seafood, indicating that a local seafood industry is already being used as part of the marketing strategies of local tourism and hospitality businesses. This is likely to be, at least in part, a reflection of the knowledge of these operators about what their customers are looking for when they visit the coast. Of the businesses surveyed, 84% said they are 'often' or 'always' asked to provide advice to tourists on where to access local seafood, and 58% said they participate in cross-promotional activity with seafood outlets.

FIGURE 7. Tourism operator questionnaire – local seafood and promotional practices



In the questionnaire, respondents were asked an open-ended question about promotional events and activities that feature the local seafood industry. Most answers (30%) were about festivals and major events in the region or local markets, in which local produce featured. The next most common answers (20%) were about using images of local produce in marketing, in which oysters were specifically mentioned. Oysters were mentioned again in the 10% of answers that were about posting stories on Facebook and blogs (Appendix 2).

4.1.5 Discussion

The results of our analysis of the contribution of the aquaculture industry to resilient local economies suggest that the industry is in an ongoing process of evolution. While experiencing a range of challenges from rising expenses and competition from imports, the industry remains an important part of local economies, both directly through the primary production of revenue and employment, and indirectly through its relationships with service industries, post-harvest businesses, and the tourism and hospitality sectors. The project indicates that across NSW, aquaculture and the secondary sector would have a likely output in 2013–14 of \$226m, \$134m in added value, and \$69.3m in household income, and the sectors combined employ a total of 1,758 full time jobs. Overall the industry enjoys high levels of community support across all the regions surveyed, with 94% of NSW coastal residents agreeing that it is important that NSW produces seafood and that the reliance on imports should be reduced. Eighty-four percent believe the aquaculture industry provides important employment opportunities in NSW towns.

The literature and our interviews indicate a number of threats to the economic benefits flowing from the NSW aquaculture industry. The oyster industry was declining and there are productivity problems in some areas due to high production pressure and water quality issues, although DPI figures indicate production is now



trending upwards (NSW DPI, 2016a). There is high turnover, with nearly half of the industry having joined in the last decade (Acil Allen Consulting, 2015). Many interviewees talked of high costs of operation relative to the prices of imported seafood, the difficulties in complying with complex regulatory frameworks, having development applications approved, and accessing finance.

An important underlying principle is that economies need diversity in order to be resilient regional. Some of the public representations against aquaculture development applications pit aquaculture against other sectors such as tourism or high-end waterfront residential uses (South Coast Register, 2013, Wright, 2013a, 2013b, 2015, Watts, 2016a). This kind of 'either/or' discourse about coastal resource use obscures the fact that aquaculture is actually interdependent with these other sectors, and strengthens rather than detracts from tourism and hospitality businesses. Furthermore, our research shows that representations that aquaculture is economically unimportant to regional economies do not reflect the majority view – the vast majority of our respondents said aquaculture is important for regional economies.

Recommendation 1: *Undertake ongoing monitoring of the social and economic benefits arising from aquaculture in NSW coastal communities, to enable evidence-based policy development in support of the industry, and to help build the general public's awareness about those benefits.*

4.1.5.1 Interconnections with other sectors

One of the most significant findings of the project was the highly complementary and interdependent social and economic relationships that currently exist between aquaculture and regional tourism, particularly for fresh local seafood, but also for activities like river tours and recreational fishing. The general public questionnaire indicated that 89% of respondents expect to eat local seafood when they visit the NSW coast and 76% felt that eating local seafood was an important part of their coastal holiday experience. In addition, 63% of respondents indicated they would be interested in visiting an aquaculture operation while on holidays. The questionnaire with tourism operators corroborated these findings, with 75% agreeing that aquaculture was an important part of their local tourism product. The interviews revealed some local examples of tourism and hospitality operators tapping into this market potential. Regional tourism promotion agencies seem only to be actively campaigning around the connection in the South Coast, so there would appear to be room to build further on locally produced food as a feature in tourism for mutual benefit. Some of the tourism-related festivals that oyster producers participate are: Oysters in the Vines (Port Macquarie); Seafood and Semillon (Hunter Valley); Karuah Oyster and Timber Festival; Oysters in the House (Sydney); Narooma Oyster Festival; Brisbane Waters Oyster Festival; and the Bega Show. Aquaculture was featured in media coverage of a Love Sea Food Festival held at Port Stephens, showcasing oysters as well as wild-catch seafood, and mentioning the planned fish farm by Huon Aquaculture (Watts, 2016b).



Our findings resonate with a study on inter- and intra-sectoral connections in coastal regions of Australia (van Putten et al., 2016). That study concludes that while the structure of economic networks varies from place to place, on the whole the seafood production sector is more important in regional coastal communities than any other types of community in Australia, and that a decline in these industries will have a disproportionate effect on the wellbeing of those communities. Furthermore, a recent study on the economic and social benefits of SFM found that it is one of Sydney's major tourist destinations, attracting three million visits a year from domestic and international tourists, and that this is a result of the links between fresh food, water and outdoor experiences in images of Australia as a holiday destination (Deloitte Access Economics, 2016a, b). Improved local connections between the tourism and seafood production industries would facilitate professional relationships between aquaculturists and hospitality businesses as well as assisting to improve social licence concerns and attract additional tourism dollars. Regional and state government agencies seeking to foster regional development may also benefit from closer working relationships between the tourism and seafood industries, as well as the agencies that manage them.

The research also reveals that certain sections of the market are particularly interested in local food production as part of their tourism or holiday experience. Our interviews show that one land-based farm already has Chinese tour groups as its second-largest market, as well as significant levels of interest from other Asian countries, and that some tourism promotion agencies are aware of the attractiveness of local food experiences for tourists from China. The questionnaire of the general public shows that recreational fishers are much more engaged in questions around seafood quality and provenance than non-fishers and therefore are more likely to support their local industry when purchasing seafood products. They were also significantly more likely to be interested in purchasing local seafood and visiting aquaculture facilities than non-fishers when on holidays, suggesting that efforts to market the seafood industry as a tourism product may benefit from targeted campaigns amongst the recreational fishing community.

Experiences elsewhere highlight the potentially positive links between local seafood production and tourism industries. The 'seafood seduction' campaign in Tasmania is one Australian example (Pennicott Wilderness Journeys, undated). One study looks at this issue in Scotland, where coastal areas are shared between aquaculture, tourism and recreational angling and boating, in some cases giving rise to conflict between these resource users (Nimmo et al., 2009). The tourist economy is 12 times larger than the aquaculture economy in Gross Value Added (GVA) and 130 times larger in terms of jobs. The visual scenery is very important to the tourists, but fish farms don't necessarily detract from that, with 22% of respondents in one study feeling positively about fish farms in the landscape. Sampling local food is important to tourists too, with 75% of respondents wanting to eat locally produced food when visiting Scotland. Recreational anglers also gain benefits from the proximity of fish farms due to their fish attracting properties. Similarly, in Canada and Maine (USA) shellfish farming is used as a tourist attraction for sea kayaking, boating, recreational fishing and bird watching (Ecotrust Canada, 2013).



Seafood production need not be seen to be in competition with tourism over access to coastal space. This research suggests an alternative to the 'either/or' discourse about access to coastal resources: aquaculture is an integral part of the coastal tourism experience. Arguments that pit aquaculture against tourism in terms of their respective importance to regional economies are likely to be counterproductive to the interests of both groups, and indicate a failure to recognise the complexity of factors that drive tourists to visit regional NSW communities. For example, recreational fishers are rarely likely to be 'purely' recreational fishing tourists. Recreational fishing is one of range of activities that visitors might undertake when on holidays and for a large proportion of them these activities are also likely to include eating local seafood at restaurants and takeaway food shops, or buying prawns or oysters from retailers. Likewise, tourists who visit the coast to see beautiful natural scenery also want to experience that place in other ways, including through eating food grown in that environment.

Recommendation 2: *Deepen collaboration between aquaculture and other regional food producers, tourism and hospitality operators and regional tourism promotion agencies all along the NSW coast, building on work already being done.*

4.1.5.2 Economic contributions to regional and Indigenous communities

The relative importance of the aquaculture industry's economic inputs is likely to vary across the regions of the state. For example, smaller regional communities in areas such as the Clarence, Nambucca, Taree and Forster-Tuncurry, Eden and parts of the Illawarra, are all ranked within the top 50 areas of social disadvantage within the state. In these areas reliance on employment in the agriculture, forestry and fishing sector is also very high (see Table 21). It is therefore likely that the aquaculture industry would be of greater relative importance to these communities.

The benefits of aquaculture to local Aboriginal communities are in some cases substantial but could be much greater with larger community involvement. In 2012-13 the national employment rate within Indigenous communities was 47.5%, much lower than the overall employment rate for Australians generally of 72.1%. Unemployment rates are significantly higher for men with a Year 10 or below level of education – an education rate attained by nearly half of all Aboriginal men of workforce age (Commonwealth of Australia, 2016) The importance of secure, intergenerational work opportunities involving coastal resources in the places with which Aboriginal people identify cannot, therefore, be overstated, particularly in regional communities where employment options are more limited.

Aquaculture businesses owned and run by local Aboriginal people could also make substantial contributions to the economic wellbeing of their own communities. Aboriginal Land Councils as well as State and Commonwealth agencies launched a range of activities aiming for this outcome in the late 1990s and early 2000s. There is still only a handful of Aboriginal aquaculture businesses operating in NSW. However, knowledge from employment in oyster farming and various training exercises over the years means the potential is still there to increase



Aboriginal aquaculture business involvement in the future, as long as lessons are learned from earlier less successful attempts. Points to highlight from this section of the report relevant to developing Aboriginal aquaculture businesses include the challenging nature of aquaculture as a business. When discussing threats to the industry, aquaculture business owners interviewed for this project identified difficulties with raising capital, maintaining profitability and meeting regulatory requirements, especially for land-based aquaculture. In addition they highlighted the very long hours, hard work and animal husbandry that ties aquaculturists to their farms seven days a week. In sum, owning and running an aquaculture business is not for everyone, and would seem to be particularly difficult for people from disadvantaged socio-economic backgrounds, as is the case for many people within Aboriginal communities. Gaining greater Aboriginal ownership of aquaculture business will thus require careful and thorough groundwork, learning lessons from past attempts, a whole-of-government approach to complex issues relating to business practices, as well as technical knowledge about aquaculture, and so on. These possibilities are discussed further in Section 4.5 (on integrated, diverse and vibrant communities).

Recommendation 3: *Collect data on the numbers and types of jobs in aquaculture by region and for Aboriginal people as part of ongoing monitoring of the social and economic contributions to NSW coastal communities.*

4.2 COMMUNITY HEALTH

As noted earlier, the overall wellbeing of communities is informed by the physical and mental health of its residents. Seafood is widely recognised as part of a healthy diet. Aquaculture can be one of several channels communities draw on to access seafood products. Table 24 outlines the main indicators and methods used to investigate aquaculture industry contributions to community health.

TABLE 24. Indicators and methods used to investigate the contributions of aquaculture to community health

Contributions of the aquaculture industry		Indicators	Methods
Material	Contributions to food supplies of local communities	Purchasing patterns – local seafood	Social questionnaires – general public, fish merchants
		Seafood preferences – local seafood	Qualitative interviews Literature review
	Contributions to Indigenous health through working on Country	Indigenous people employed in or owning aquaculture or related businesses	
Relational	Supply chains by which consumers access NSW aquaculture products	Supply chains by which people can buy local aquaculture product	Social questionnaires – general public, fish merchants
Subjective	Importance the community puts on local production for nutrition, enjoyment, cultural, and/or ethical reasons	Beliefs about importance of producing local seafood for community consumption	Social questionnaire – general public Qualitative interviews
	Satisfaction with involvement in aquaculture among Indigenous communities	Feelings about aquaculture in Indigenous communities	Qualitative interviews Literature review

The data gathered through the interviews and social and economic surveys show a variety of products are produced by the NSW aquaculture industry. These largely include growing fish and mollusks for seafood, but also growing algae and seaweed for nutritional and pharmaceutical purposes, and producing bait. The interviews and data also show that communities prefer local seafood products for a variety of reasons. The following sections provide more detailed data on interviewees' views on aquaculture's contributions to community health, consumer preferences for local seafood, and consumers' purchasing patterns and channels used to buy local seafood.

4.2.1 Contributions to food supplies of local communities

The role of aquaculture in food production is one of the most immediately obvious contributions that the industry makes to local communities. While 'food security' is about the provision of nutrients, it also encompasses people being able to access their preferred foods. In this way, food security and enjoyment of food relates also to other dimensions of wellbeing, including a resilient local economy and leisure and recreation.

The contribution of the industry to the food of local communities was one of the most frequently raised ideas within the fieldwork interviews (discussed by 24 of our 34 fieldwork interviewees). Most aquaculture operators are proud of their ability to supply fresh and nutritious local seafood to local and further flung communities, as illustrated by the following quotes:

Silver perch have one of the highest levels of Omega 3 in any fish... It's always good to eat fish... it's a natural product. It's a native species... It's not processed really. It's all fresh.

MNCLB5

Just eat oysters and you'll be right. It's really simple [laughs].

MNC03

The interview data also revealed that aquaculture operators are well aware of how important food safety is to their ability to provide this health benefit to communities. Shellfish disease outbreaks and water quality problems can significantly damage economic and market opportunities for the aquaculture industry, as was the case with an outbreak of Hepatitis in Wallis Lake, NSW, in 1997. Interviewees were very cognisant of how hard it can be to come back from incidents like that and are proud of their hard work to ensure food safety risks are minimised, as illustrated by the following quotes:

Now people will tell you that you can't get any better than the ocean, but it doesn't take long for you to jump on the internet and find out how far the radioactivity has travelled from Fukushima, all the way to the West Coast of the United States... I don't have that problem here, because we run a static pond, we have to record all chemicals that go into the pond; we have to record everything that goes into the pond. So it's a captured environment.

MNCLB4

We spend a lot of money, approximately \$50,000 a year, as an industry ourselves to test the river. We do water samples, meat samples, biotoxins and water plankton. We test all the harvest areas. So you could say we have - and we invest that \$50,000 of our own money, that we invest every year to keep a check on the river, so the river health in the area here. So we can pretty sure - obviously we have to be for our own right, but we put a lot of money into that ourselves. So I think that's a pretty large contribution...

MNC02

So we do - there's periodic testing for plankton, so toxic algae. Then we do meat and water E. coli tests, periodically throughout the year but also after events. So there's what we call event testing. So that's like - so fecal coliforms, algae, heavy metals. We do that every five years... So it's formally the [unclear] to harvest shellfish, to have a license to harvest shellfish, we need to do it... it's the Shellfish Quality Assurance Program, under the Food Authority.

SC01

Supplying customers with high quality, nutritious food was not the only way that interviewees saw aquaculture contributing to communities. Some spoke about how community health is enhanced by a healthy natural environment, the kind required to produce seafood in the first place:

Ooh, I think that we contribute immensely to community health because of the environmental service that the oysters do for cleaning the estuaries. Similarly, we're producing a very healthy product for people to consume ... Also I just think as far as general wellbeing goes I think, again, if you live in an environment where you can produce a healthy oyster then that has a flow on effect to the community and obviously you are living in a nice place to grow up and have kids and just to live and be!

SC05

[Oysters are] a natural product. It's grown in - it has to be grown in water quality that is of a very high standard. So that ensures that the people around those areas are educated that you can't pollute the water. You can't put fuel in it. You can't dump crap in it. You've got to make sure that if you've got a septic system or something like that. You make sure it's audited properly. Or if you've got an issue that you understand that if it is audited and you've got an issue, you've got to fix it. So I think generally, the health of the community is good because you've got good water quality. Yeah. So I think that's the basic thing. Because all the communities [unclear] along the coastline, they're all dependent on some sort of marine activity or water activity. Whether it's fishing. Wild caught or where there's aquaculture. So you've got to have good water and people are very mindful to make sure that they don't pollute their waters... Because they're actually obtaining a food source from that water. Or swimming in it or whatever.

SC06

4.2.1.1 Purchasing patterns – local seafood

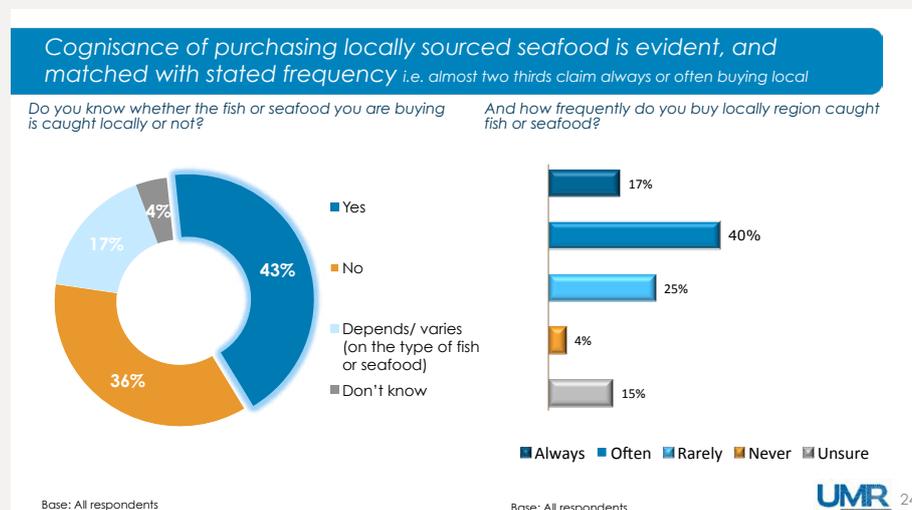
The data from the general public and seafood merchant questionnaires supports interviewees' views about the valuable provision of seafood that aquaculture makes to wider community and to local communities in particular. NSW consumer purchasing patterns show preferences for regular consumption of Australian, regional, and local seafood.

Eighty-six percent of all participants in the general public questionnaire said they had purchased seafood within the past 3 months. Most reported making purchases at least once a month (80%), with just over half of these (42%) doing so at least once a week. Only 5% said they never buy fish or seafood. In general, purchase incidence and frequency increased relative to age, education and income. Products reported as purchased were predominantly fish (94%), then prawns (66%) and followed by other varieties of shellfish. These findings resonate with the findings of a recent study in Queensland, finding that people prefer local seafood if it is available, and report willingness to pay an average of 11% more for locally produced fish (Feary and Donaldson, 2015, Lee and Net, 2001).

After establishing seafood consumption patterns the general public questionnaire went on to investigate the extent to which local product was an important food source for local communities. This involved first establishing the way consumers think of 'local' product. Around half the respondents (51%) interpreted the term 'local' to mean their region (within a 100km radius), and roughly equal amounts defined it as their immediate town or city (13%) versus those who saw it as more encompassing of their state (10%) or country (14%). Opinions were clear, however, with only 1% classifying themselves as unsure. Definitions did vary by location, with respondents in Clarence most likely to think 'region' and those in Sydney most likely to think 'country'.

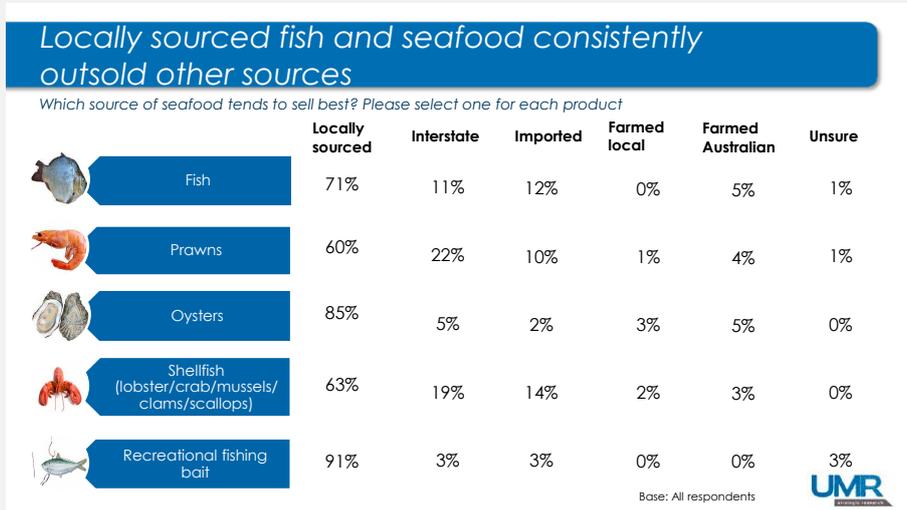
When directed to think of 'local' in terms of regional product (i.e. within a 100km radius), over half (57%) of public survey respondents claimed that they always or often purchase locally sourced seafood. However, just over a third (36%) were not confident that they know whether the seafood they purchase is indeed caught locally or not, and almost one fifth (17%) think it depends on the type of product purchased (Figure 8). Across the state, frequency of purchase of local product was highest in the study areas of Far North Coast, Clarence and Mid North coast, and lowest in Sydney and Central Coast areas.

FIGURE 8. General public questionnaire – purchasing frequency of local product and awareness of provenance



The results of the fish merchants' questionnaire were very consistent with those found in the general public questionnaire. Fish merchants indicated that local product was consistently the highest selling product across all product lines, underlining the importance of a local industry, not just for their businesses but also to meet consumer demand (Figure 9).

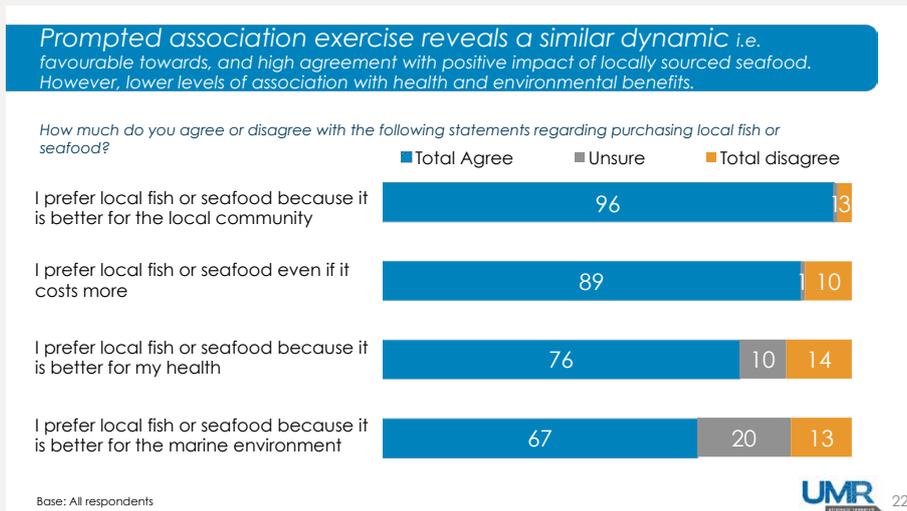
FIGURE 9. Fish merchant questionnaire – best selling products



4.2.1.2 Preference for local seafood

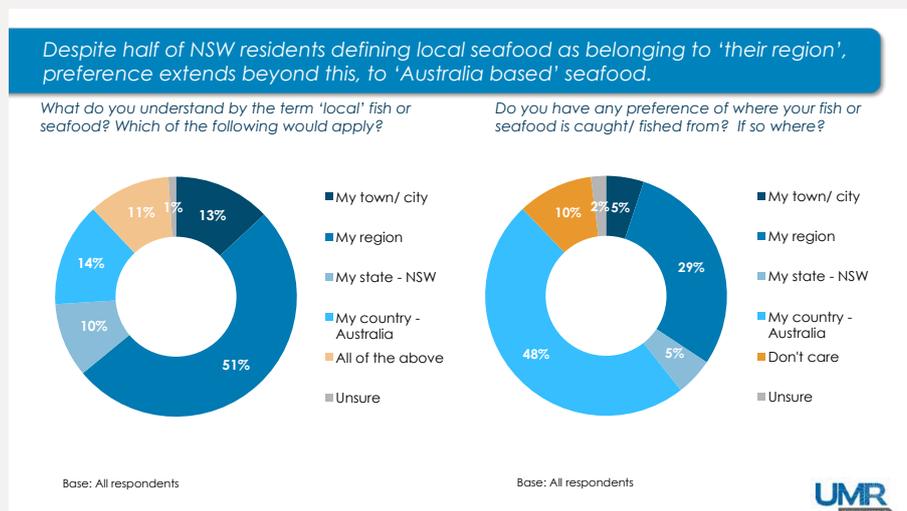
Data from the general public questionnaire showed clear preferences for local seafood, because respondents believed it is better for communities and the environment, despite the higher cost (see Figure 10).

FIGURE 10. General public questionnaire – reasons for preferring local seafood



How do people think about what is 'local' and what is not in relation to the seafood they consume? The general public questionnaire also asked about people's preferences in relation to local product. While the majority (48%) of respondents preferred Australian product, a large portion also displayed preferences for local product from either their region (29%) or town/city (5%) (Figure 11).

FIGURE 11. General public questionnaire – preferences and awareness regarding local provenance



These preferences were strongly influenced by the geographical location of the respondents, with residents of the more metropolitan areas (Sydney and Central Coast) significantly more likely to prefer Australian product and residents of the Clarence significantly more likely to prefer regional product (Table 25). In addition, respondents were significantly more likely to purchase local product if they were aged 60 and over, had a strong preference for local or regional product, or identified as a recreational fisher.

TABLE 25. General public questionnaire – preferences for and purchasing of local seafood by study area

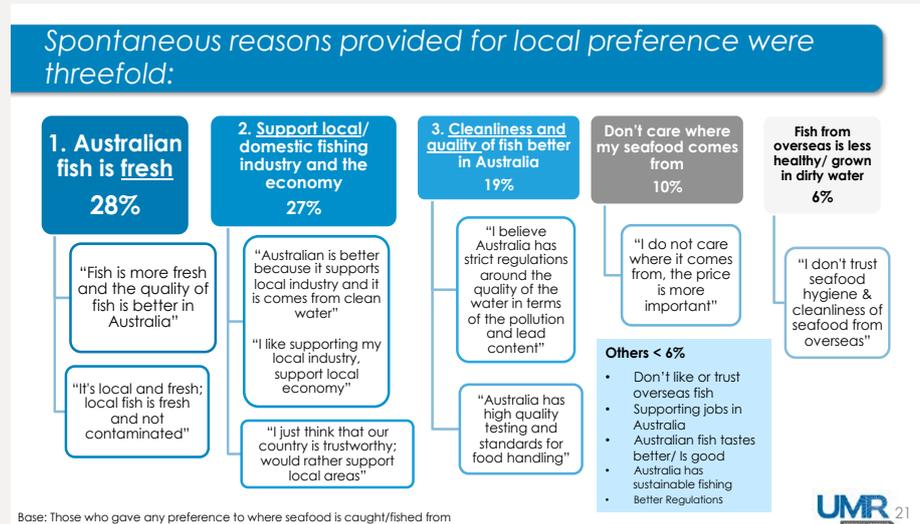
	Prefer Australian seafood (%)	Prefer local seafood (%)	Always purchase local (%)	Often purchase local (%)	Rarely purchase local (%)
NSW state	48	29	17	40	25
Far North Coast	39	38	26	45	21
Clarence	36	48	26	50	18
Mid North Coast	37	37	24	36	24
Great Lakes-Hunter	43	34	14	38	25
Central Coast	52	21	11	36	33
Sydney	66	11	10	31	27
Illawarra-Shoalhaven	52	27	15	41	26
South Coast	42	37	16	51	23
Recreational fisher	46	33	19	44	24

Notes: Statistically significant differences are highlighted in blue (significantly higher) and red (significantly lower). The original interview question in survey referred to local seafood as 'regional', defined as within a 100km radius.

Table 25 also compares purchasing preferences with purchasing behaviour across the regions. Overall it indicates that the number of respondents that preferred local seafood correlated most closely to purchase patterns of 'often'. Further work would be required by industry to determine the key barriers to growing this market (that is, to facilitate a shift from 'often' to 'always') and to attracting new customers. Some indications of the reasons why people would prefer to buy local seafood does provide some insights into this area.

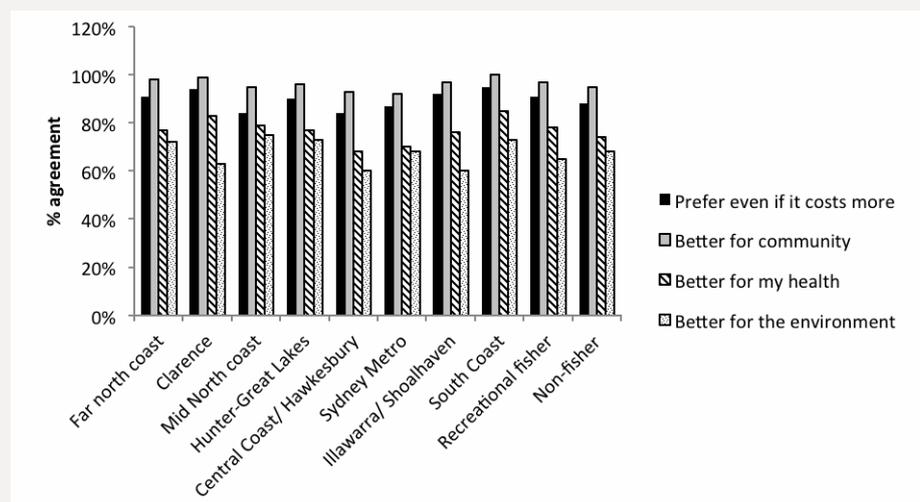
The reasons why people show preferences for local product were also explored. Unprompted, qualitative responses from the general public recorded by the CATI interviewers included associations of freshness, cleanliness and quality, and the willingness to 'support local' (Figure 12).

FIGURE 12. General public questionnaire – unprompted responses to open ended question about provenance preferences



On prompting, the strength of the relational components of purchasing preferences became clear, with 96% of respondents indicating the desire to support their local community as a major motivation in purchasing local product (Figure 13). This was consistently strong across all the study areas but strongest in the regions to the north and south of Sydney and lowest in Sydney and the Central Coast area.

FIGURE 13. General public questionnaire - reasons for preferring local seafood

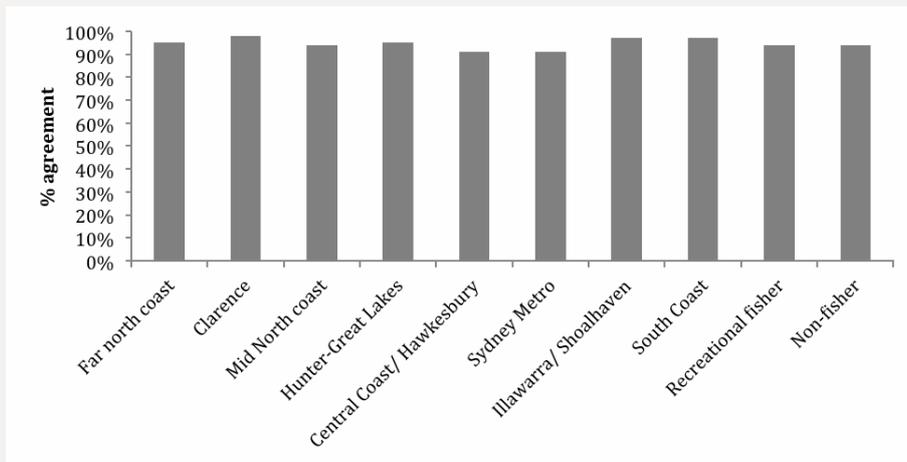


Note: respondents were asked to agree or disagree with the following statements: 1) I prefer local fish or seafood even if it costs more; 2) I prefer local fish or seafood because it is better for the local community; 3) I prefer local fish or seafood because it is better for my health and 4) I prefer local fish or seafood because it is better for the marine environment.

4.2.1.3 Beliefs supporting the value of local seafood production

Additional reasons people prefer local seafood products are likely to be linked to ideas relating to the food localism movement. Food localism is a value that spreads across health, environment, cultural heritage of place, and leisure and recreation. It seeks to increase local food production for local consumers, in order to reduce greenhouse gas emissions from transportation, show support for local agriculture and its diversification, and to promote local food security, sometimes framed as food ‘sovereignty’. Despite the stronger preference for Australian product there was almost universal agreement among general public survey respondents that the NSW industry is important for local food security, with 94% of respondents agreeing with the statement that ‘I believe it is important we produce our own seafood in NSW and reduce our reliance on food imports’. NSW has very high levels of seafood imports – in the early 2000s seafood imports made up 87% of seafood consumed in NSW (Wilkinson, 2004). This response was consistent across all regions and for recreational fishers (Figure 14).

FIGURE 14. General public questionnaire – Importance of producing seafood in NSW and reducing reliance on imports by region



Notes: respondents were asked to agree or disagree with this statement: ‘I believe it is important we produce our own seafood in NSW and reduce our reliance on food imports’. This questionnaire was conducted for both the Wild-Catch study (Voyer et al., 2016) and the current aquaculture study so the regions for the table are the regions included in the Wild-Catch study.

In addition, respondents had high levels of interest in knowing where their seafood comes from – 37% were ‘extremely interested’ and 35% ‘very interested’. This suggests a desire to be actively engaged in decision making about the source of their seafood based on their beliefs and preferences. As indicated in Figure 13, 76% of questionnaire respondents believed local seafood was better for their health.

4.2.1.4 Purchasing channels – local seafood

In addition to showing clear preferences for Australian, regional and local seafood, the general public questionnaire was also used to examine where/how consumers access their seafood. The data indicated that the outlets frequented most often by the general public for purchase of seafood include supermarkets (51%) and fish co-operatives (40%) (Figure 15). Only small numbers of consumers (8%) appear to be purchasing directly from producers themselves. Consumers in the Clarence and recreational fishers in general were significantly more likely to purchase their seafood from their local co-operative while consumers in Sydney were more likely to purchase from fish shops. Consumers in the Great Lakes-Port Stephens-Hunter and Central Coast study areas were significantly more likely to purchase from the supermarket.

These findings are consistent with the interviews undertaken with aquaculture operators. These data showed that there were 10 aquaculture operators who talked about how they sold the majority of their products to wholesalers. The quotes below also illustrate that while this may be the trend, aquaculture business owners also like to be able to sell some of their product through local channels.

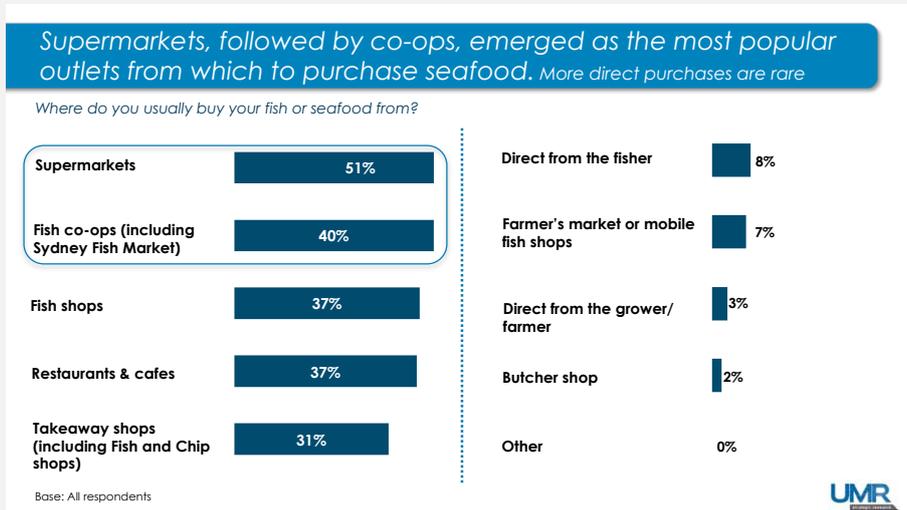
In saying that too, we'd be able to - if we were making a bigger profit margin in Sydney, that'd let us sell product locally at a better price, we don't sell a lot of product locally because when all the little farms set up, we said then and there we'd much rather the little farms have access to the local markets where they're going to be able to do the weekend markets and the stalls and all the rest of it and become part of that scene, where our production was always going to be too big for those Saturday markets. So the one little farm that's still going, Marcia down the road, she does the local markets, she does Pymont market, she does fish into Newcastle Co-op where the majority of our fish goes straight to the Sydney market.

MNCLB4

We sell fish in to the local economy too, that's a practical side of it. Not as many as I would like but we trickle a few into a very good fish shop in town here.

NCLB1

FIGURE 15. General public questionnaire – where people purchase seafood



4.2.2 Contributions to Indigenous health

The primary tools for investigating the contributions of the NSW wild-catch industry to Aboriginal health and nutrition were fieldwork interviews, background information provided by key informants who have worked in the area of Indigenous aquaculture and a review of reports about Indigenous involvement in aquaculture in NSW and other parts of Australia. Material and relational contributions to wellbeing from the food produced by aquaculture include the health benefits Aboriginal people share with the rest of the population, and the particular health benefits Aboriginal people experience from working on Country. Subjective contributions can arise when people feel satisfied with their involvement with aquaculture – an area that has significant room for improvement.

Aboriginal people have identified that the health of coastal Indigenous people in NSW is connected to the health of the coastal environment, their active involvement in the management of coastal resources and their economies being based in those natural resources (Umwelt Environmental Consultants, 2005). The most recent 'Closing the Gap' report found life expectancy for Indigenous Australians remains stubbornly low at 69.1 years for males and 73.7 years for females, a gap of 10.6 years for males and 9.5 years for females between Indigenous and non-Indigenous citizens (Commonwealth of Australia, 2016). It is well known that there are significant health benefits to Indigenous people of maintaining a connection with their ancestral lands, family and communities and in working with natural resources so they can nurture and maintain these connections (Australian Institute of Health and Welfare, 2015). Access to traditional lands has been recognised as a determinant of health in both remote and urban contexts, with evidence suggesting that connection to country strengthens self-esteem, self-worth, pride, cultural and spiritual connections and positive wellbeing. In addition, Indigenous Australian adults who live on homelands/traditional country are more likely to have no current long-term health conditions compared with those who did not

recognise homelands and were less likely to report having a high/very high level of psychological distress (Kingsley et al., 2013).

Our identity as human beings remains tied to our land, to our cultural practices, our systems of authority and social control, our intellectual traditions, our concepts of spirituality, and to our systems of resources ownership and exchange. Destroy this relationship and you damage – sometimes irrevocably – individual human beings and their health

(Anderson, 1996, cited in Australian Institute of Health and Welfare, 2015, p.152).

This important link to country was also seen by an interviewee as critically important to Indigenous Australian's well-being and something that could be part of being involved in aquaculture. They saw aquaculture as something providing the ability to produce one's own food, being engaged with others in a sustainable way of life, and living a more healthy, outdoor lifestyle:

So we need to go back into growing our own food... self-sufficient farming it could easily happen. I just think that people who are likeminded... could work together, because I think that city lifestyle will be a lot harder soon. I just think it's a better way of living... So it really just gets you back in this - the health side of it - the health side of it living in the country and self-sufficient farming... It's really the most bulletproof industry - is the food industry... People are always going to need food. Getting back to the Aboriginals, it'd be a way of getting back into things. They're the way they are because it's not the right way of living for them.

IA1

Involvement in aquaculture could provide another channel for Indigenous Australians to access fresh seafood in a way that could be very important to their wellbeing. Aboriginal people living in coastal areas have reported declines in seafood consumption as being a critical factor in poor health (Australian Institute of Health and Welfare, 2015). For example, one study into the cultural and social influences on managing diabetes within a Melbourne Aboriginal community found that a reduction in opportunities for men to contribute to the family meal decreased the strength of their family and cultural connections and made them less likely to take care of their health (Thompson and Gifford, 2000).

4.2.3 Discussion

The desire to buy locally produced food is a strong and growing movement internationally as well as in Australia. The key reasons people have been found to prefer local food include health and other considerations which may overlap with health, including:

- > Freshness and nutritional content
- > Support for family-run farms and the social and economic fabric of rural communities
- > Food safety and quality regulations applied to production
- > 'Food miles' (distance food travels between production and consumption with implications for carbon usage as well as freshness)

- > Globalisation and industrialisation of agriculture involving increased use of herbicides and pesticides and homogenisation of crop types
- > For seafood in particular, concern about the environmental regulations applied to production
- > Food security and food sovereignty.

Freshness and quality, along with desire to support local farmers, usually rate highest in research on the strength of these motivations among consumers, with environmental benefits rated as the primary reason for buying local by smaller numbers of respondents (Campbell, 2014, Germov et al., 2010).

It is important to note that food localism is more significant in the purchasing patterns of some demographics and less prevalent for others. People into alternative consumption and food networks value local production very highly (Campbell et al., 2014, Roheim et al., 2007). One study divides the movement into 'contemporary localism', which values alternative food networks (outside industrial mass production networks) and involves higher income groups, and 'traditional localism', which values fresh and affordable food without rejecting industrial methods, and is associated with lower income groups (Germov et al., 2010). Furthermore, it is also important to note that even when people report in questionnaires that local production of food is important to them, factors such as price and convenience are also very important and may trump localism in purchase decisions (McEntee, 2010).

All three social questionnaires indicated that consumers in NSW regional areas see locally sourced seafood as an important source of food and nutrition within local communities, especially in regional areas where preferences and purchasing patterns indicate a strong consumer demand for these products. While further investigation would be required to determine actual purchasing patterns in addition to the stated preferences explored in our research and the reasons behind these (such as price differentials), the data from our analysis suggests that further growth of this market is at least partially inhibited by a lack of awareness amongst the public as to whether the products they are buying are locally caught. The strong reliance on local co-operatives for seafood sales indicates that these outlets are the premier location for retail sales for those seeking local product. It is likely that consumers are less aware of the provenance of the seafood they are buying when they purchase from other popular outlets such as supermarkets, fish shops, restaurants and takeaway food shops. Part of the challenge in addressing this lack of understanding may lie in improving traceability of local product through the supply chain, especially as it moves through wholesalers – the major source of product for most of the fish merchants surveyed.

In addition, the lack of a local industry large enough to service the Sydney and Central Coast markets, or the lack of awareness of the existence of a local industry in these areas, is a likely driver of the stronger preferences for Australian product over local or regional product in those areas. A potential opportunity for the NSW industry may lie in growing local brands in these more metropolitan areas.

In regional areas the reasons people prefer local product provide important insights into how contributions to the idea of food being part of community wellbeing could

be further maximised. Tapping into the desire of consumers to support their local businesses and local economy may assist in growing local markets. This could be achieved by raising awareness within local communities of the people working in this industry and the role the industry plays in local economies.

Recommendation 4: *Using the results of the current study and ongoing monitoring of social and economic contributions, undertake promotional activities in both regional localities and metropolitan centres to build awareness of the social and economic features of the industry as well as the high quality of NSW aquaculture products. This could include location of origin labelling, including for restaurants.*

In relation to Indigenous health and wellbeing, our results suggest that the ability to work on Country is an important part of the social determinants of Indigenous health. Working on the water is simultaneously a cultural, social, professional and recreational act. The involvement of Aboriginal Australians in aquaculture has and can still provide important links to improved health outcomes through enabling productive work on Country, improved nutrition, income, and strengthening social connections and cultural bonds within and between Aboriginal and other Australian communities (see Sections 4.1 and 4.5 for recommendations on these points).

4.3 EDUCATION AND KNOWLEDGE GENERATION

As noted earlier in Chapter 3, formal and informal learning throughout all stages life is an important part of an individual’s wellbeing, and collectively the health of communities of which they are a part. Table 26 outlines the main indicators and methods used in this Project to investigate the aquaculture industry’s contributions to education and knowledge generation.

TABLE 26. Indicators and methods used to investigate the contributions of aquaculture to education and knowledge generation

Contributions of the aquaculture industry		Indicators	Methods
Material	Formal and informal training and learning opportunities provided by the aquaculture industry Contributions to community knowledge, especially environmental knowledge	Education and training levels and opportunities for learning in aquaculture, including: > Aquaculture technology and science > Day-to-day farm practices	Social questionnaire – fish merchants Qualitative interviews
Relational	Social learning and informal knowledge transfer	> Boat handling > Food handling > Regulatory knowledge > Environmental knowledge > Developing work ethic and habits > Etiquette and ‘unwritten laws’ of coastal areas	
Subjective	Levels of trust and respect for the knowledge and skills of the aquaculture industry (social licence)	Community and sectoral interest in aquaculturists’ knowledge by: > Researchers/managers > Indigenous communities	Qualitative interviews

The process of learning involved in aquaculture is important not just for the individuals working in the industry, it also provides wider benefits for local communities, intersecting across all of the other identified ‘dimensions of community wellbeing’ (see Table 27).

TABLE 27. Intersections between aquaculture knowledge and other dimensions of community wellbeing

Dimension of wellbeing	Contribution of aquaculture knowledge
A resilient economy	Learning to be an effective, productive and sustainable aquaculturist ensures ongoing revenue and employment benefits to local communities.
Community health and safety	Learning to be an effective, productive and sustainable aquaculturist ensures ongoing supply of fresh local product to the community and wider markets. In addition it provides important knowledge and awareness of boat handling.
A healthy environment	The process of learning to be an aquaculturist builds environmental knowledge (see Section 5). Our interviews indicated that many people who work in aquaculture develop their knowledge of the local environment and carry this with them after leaving the industry.
Integrated, diverse and vibrant communities	The fishing industry provides educational opportunities and employment prospects to disadvantaged sections of the community.
Cultural heritage and community identity	Aquaculture knowledge handed down within families strengthens the cultural heritage values of aquaculture, as well as being a rich source of information on the environmental history of many NSW waterways.
Leisure and recreation	Stock enhancement from aquaculture facilities for popular fresh water and marine species. Some indication of contributing to knowledge about good recreational fishing spots in estuaries.

These intersections indicate that the knowledge generated through aquaculture is a fundamental component of industry contributions to community benefits investigated through this Project. The fieldwork interviews and to a lesser extent the survey data identified a range of forms of knowledge generated through aquaculture activities. These data are presented below and incorporate both material and relational contributions to wellbeing.

4.3.1 Formal and informal knowledge generation in aquaculture

The aquaculture industry contributes to people's learning through structured formal initiatives, such as school 4.3.1 and courses. The industry also contributes through more informal activities, such as hands-on training in entry-level jobs, tours, and incidental interactions. These learnings are focused on how aquaculture is conducted, food and workplace safety, business management, knowledge of environmental regulations, ecology, work ethics, and boat handling.

4.3.1.1 Science and aquaculture practices

There is a range of opportunities for employees in the aquaculture industry and members of the broader community to learn through formal and informal means about how molluscs, crustacea, fish and algae are raised for high quality seafood

production, as well as a number of related biophysical science subjects (e.g. veterinary, fisheries sciences). A previous study of Sydney Rock Oyster farmers found that 53% of respondents had no post-school qualifications, 33% had tertiary education, and of the remainder some had trade qualifications (Langley, 2013).

Most of the interviewees spoke with pride about hosting a range of (formal) educational activities associated with primary and secondary schools, as well as TAFE programs, as shown by the following quote;

I like to put time and effort back into young people because that's where our future is. So it's very, very rare for me to say no. So we have the local kids who do their Year 10 ag. classes will come and do a day here, or a week if they want to do it as one of their co-studies. So yeah, look, education that is how we put back.

MNCLB4

These activities included regional high schools offering specific aquaculture courses, as well as TAFE Certificates in aquaculture production. The delivery of these courses included visits to aquaculture sites where students could see firsthand how shellfish and fish were bred, maintained, and harvested. In a number of cases interviewees also provided work experience opportunities for students.

As discussed further below, informal, practical and 'hands-on' learning, is something that is often passed on over multiple generations or through mentoring, as well as individual trial and error. In the aquaculture context, this knowledge includes familiarity with techniques and methods as well as building an understanding of animal behavior, the influence of weather events, temperature and water quality on production. While much more difficult to quantify than the numbers of training courses attended or offered, this form of knowledge transfer is central to aquaculture. In discussions about teaching and learning, 46% of the participants in our fieldwork interviews highlighted the importance of this informal, practical skills training.

The interview data also showed that learning about aquaculture, marine sciences, and environment is not restricted to primary, secondary, or tertiary student audiences. Several aquaculture operators talked about providing farms tours for other community members:

Aquaculture for us in what we do I think we probably serve a little bit more than the norm because we're also educational... We are continuously doing tours that I suppose enlighten people... wanting to visit to look at our operation, understand why we're doing what we're doing and how we do what we're doing... I think the educating people about what's going on in our world, in our oceans, the population, declining fish stocks [is important]...

MNCLB3

We participate in the events around the Shire and always have our environmental information there and are handing out pamphlets on how to protect estuaries and that kind of thing to the general public. But we also run estuary tours as well, so with Council and other sort of departments and also landholders. So we've done estuary tours on Pambula Lake with majority landholders just to

talk about the sediment load that we were having coming into the estuary and other environmental factors. Then we've had another one down at Wonboyn Lake similarly talking about the sediment, but that was more oyster farmers from different estuaries coming down to look at the different growing conditions in Wonboyn, because that's quite a different estuary to the other estuaries in the Valley. Then a lot of Council, State Forest, National Parks people there as well just to have a look at the specific estuary issues for Wonboyn as well.

SC04

4.3.1.2 Food handling, workplace safety, boat handling

A range of formal qualifications and informal learning opportunities provided to aquaculture employees were revealed in the interviews. These included staff being able to obtain experience handling boats and forklifts and then obtaining their boat and forklift licences, as illustrated by the following quotes:

We are training people... They can - if they've worked on this farm, they can work at any oyster farm anywhere. Just general skills, handling boats, driving forklifts, working as a team.

SC01

Forklift tickets and those sort of things... [and] in our processing part they could leave with food hygiene, [kind of]... Yeah, food safety skills, that sort of thing... Safe lifting practices... Driving a boat is one of those things, it's pretty - it's not one of those things that are easily taught. It's more a matter of learning by doing... It's more - everybody can get behind a boat and steer it, but it's reading the tide and the wind and all of those sort of things, which only comes through experience.

MNC08

Aquaculture businesses, including post-harvest businesses, also provide employees with opportunities to learn about and practise food safety, occupational health and safety procedures, and customer service. The fish merchants' questionnaire indicated that 88% of respondents provide training for their staff in safe food handling, 81% in occupational health and safety, and 79% in customer service.

4.3.1.3 Developing work ethic and habits

A number of interviewees spoke about the importance of the aquaculture industry's contribution to providing entry level employment opportunities, particularly in rural areas that might have low employment levels and associated incidences of poverty:

Especially in rural areas, what we're finding is there's not a lot of job employment opportunities around. Aquaculture's a really good one, because you can have casual workers that can work seasonal or can work like three days a week for 12 months a year. So that gives people employment chances.

SC06

A lot of people come here, they've left school at 16 or whatever, had a pretty hard life and that but we talk. We talk a lot about stuff, the issues of the day and things like that. We chat about all sorts of subjects and it's generally a good thing for people that haven't expected it. They've just expected to turn up to work but it's a lot more than that, you know?... So yeah, I think from that, that's a satisfying contribution I guess, if you look at it like that, that you've sort of helped people out of a rut... When [one employee] was here for his job interview, he basically said he had nothing. He had four kids. He's house had a dirt floor ... They're down and out and he said I really need this job and I think you know, when he left I said you were a wretched poor bastard when you got here but I think you're travelling pretty well know. He said yeah, he said it's been no problem.

NCLB1

These jobs also were seen by interviewees as helping people to develop strong work ethics. The work can be very interesting, but it can also involve long hours, in all kinds of weather, and doing fairly repetitive tasks. Learning to stick with a job that is not always easy to do was seen by interviewees as a very valuable work habit.

The nature of our business, there's something about it that amazes people that we can do what we do. It interests them about how we go about doing things and how we get through our years like we do. Like nine degrees, there's ice on the net but sadly we've got to go fishing you know? It's minus four, we're loading the truck at five o'clock in the morning to go to Sydney. It's cold, other times it's hot, other times it's flooding. You've got this whole conceptual thing of an animal that you can't see, that you're keeping alive and getting the growth out of it.

NCLB1

So you'll be able to do the job and you'll get told what you do and how to do it, while you're doing it. Well they'd be leaving with skills particular to the oyster farming industry, other than, hopefully, a fairly good work ethic and ability to work hard.

MNC08

I think some of my other younger employees, I know that they really do like the fact that I can train them in that basic sort of work ethic and everything and even if they don't stick around for very long, at least they've seen it and they can transfer that and help them to find better work somewhere along the line.

MNC01

4.3.1.4 Business management & innovation

Interviewees also talked about how formal and informal education and training in aquaculture can provide staff and the wider industry with information about various business practices, including traineeships where they manage all aspects of running an aquaculture business (for example, accounting and supply chain management), not simply focus on animal husbandry (SCO4). One interviewee (NCLB3) who had worked overseas was employed in Australia to help improve the

management of large-scale prawn farming. Another recalled the business risk and innovation that has been taken to help develop prawn farming in Australia:

It was a pioneering, trailblazing exercise. [He] decided there was no money in cane, so he thought he'd dig a hole and put prawns in it. They actually went out and caught prawns out of the river, got prawns, brought them in and fattened them up in the ponds with chook food. That's how it started. Then it's progressed from there until they actually finished up breeding them in their own hatchery and rearing them. It was an exercise. Lots and lots of catastrophes and mistakes and he nearly went broke several times... Yeah, contribution in the form of innovation. Ground-breaking stuff, because it hadn't been done in Australia. Just trial and error... They did, in the early days, export to Japan. They were exporting live japonicus prawns [to Japan] ... he broke into the Japanese market and they used to fly them over and fly them live in sawdust ... they experimented with several different types of prawns ... and they've settled on the black tiger as being the most resilient and the best return to farm. That was, again, trial and error, and that's something that the industry now, most farms do the black tiger. Some do banana prawns.

NCLB5

4.3.1.5 Environmental knowledge

The interview data reveals that the aquaculture industry contributes to various audiences learning about environmental matters, especially managing healthy catchments, water quality, marine/estuarine ecology and health. This knowledge is passed on to people working in the industry, students, and members of the wider community through formal education programs and informal activities. The quotes below illustrate the different ways environmental knowledge is generated:

Also, you've got the thing that some people now do, TAFE aquaculture courses... It's actually educating the locals in regards to environmental factors. How to look after the area. How we look after the area.

SC06

It also provides I guess a knowledge base about the aquatic environment. You often encounter members of the community who have an opinion on the river or the aquatic environment or the commercial fishing industry that's not accurate. You're able to inform them better about what's actually happening in the river because they - an example, last week I was having a job done at a local upholsterer and they were bagging the commercial fishing industry saying that they're to blame for the decline in the fish stocks. I said no, that's not right. They're the cause of part of the decline but a small part of it. My guess here, maybe 20 per cent. The other 80 per cent is environmental change, environmental degradation and I was able to give them examples of that that they don't see and they don't realise and they don't understand. At the end of the conversation they were saying oh, the picture is a lot bigger than we understood. We didn't realise that and so that was - I think that's important.

The more that the community understands about the aquatic environment the more chance there is that there'll be a number of people requesting that it be improved and by gee it needs some work. Certainly in this area and I think lots of places.

NCLB2

I mean basically the... building ideas of environmental management in the community but we also do, do it with the workforce that the industry does employ, I mean they're out on the river, they see the impacts of rain, they understand through conversations the runoff from urban areas and how that effects the business and so that effects them because they're getting paid by the business. So and those workers - a percentage of them stay in the industry, but by the far the large majority of them move on to other jobs and so they take with them an appreciation of aquaculture and the problems with aquaculture and managing an estuary and waterway.

MNC06

So as far as the schools' program goes that involves an oyster farmer and a member from Sapphire Wilderness Discovery Centre going into the classroom and doing a class visit. Just sort of talking to the kids about how oysters are grown, what the environmental conditions are, what it means to be somebody who's a water user and also wanting to have healthy oysters produced. So it's just building that awareness of the kids and they then take that information home and it filters through. So particularly trying to get out into our local catchments and make sure that they've got that awareness of what they put down the drain potentially has an impact on how we're growing our oysters.

SC04

4.3.2 Contributions to community knowledge and beliefs about the importance of aquaculture knowledge

The fieldwork interviews studied both the relational and subjective aspects of industry contributions to community knowledge by exploring the role of the industry in wider knowledge systems, and attitudes towards aquaculturists' knowledge amongst these networks.

4.3.2.1 Researchers/Managers

Our interviews uncovered ways in which researchers and managers in state, federal and local governments, universities and other businesses are currently benefiting from data and knowledge provided by the NSW aquaculture industry. These include developing new species, feeds, and growing infrastructure.

Several of the aquaculturists we interviewed indicated they were currently or had been previously involved in research programs undertaken by private companies, DPI, CSIRO, and universities. It is difficult to quantify the extent of these contributions as support took a range of different forms. Some aquaculturists applied the information to developing their businesses further, being paid for their involvement, and others volunteered their time, facilities or expertise. As the following quotes

illustrate, the scale and purpose of the projects also varied considerably, from improving breeding techniques to establish husbandry practices for new species and using new kinds of infrastructure.

So I'm involved with the... Select Oyster Company. They're breeding for disease resistance and faster growth and better shell. So we're one of the brood stock carriers for them. So I have my finger on the pulse with the breeding program and try and contribute and tell them where they're going wrong...

SC05

I went looking for a product that we could produce in an aquaculture format. I was fortunate to find [someone] doing [their] PhD... we don't have [that species here in X part of Australia]... So I employed [that person] and set [them] up at the [X] Research Station to continue [their] research. Two years later [we worked on] building systems and pulling them down, building them up and we spent another six or seven years doing that until such time as we were comfortable that we had a good modular production system that we could replicate... DPI were pushing the barrow very hard. They were actively seeking investment in land-based aquaculture.

MNCLB6

So I've done - I've used every system available. I mean, we usually pioneer on this estuary pretty well the new techniques of growing. So I started out with growing sticks... So what I do now is I grow - I start from catch, I catch my spat. It put it into tumblers, which is a rotating cylinder, which keeps them separate and gives them a bit of a shake. Then from there they go into either smaller mesh bags, floating bags, with - or pontoons. Then they go back onto intertidal trays after that to harden up. So the thing is we probably started - well, myself and DPI pioneered deep water culture here with [Dr X]... [we] fine-tuned it over the years and now it's used pretty much everywhere. Then the floating bag. Well, one of the farmers here... got the idea from America.

MNC02

We've been involved with DPI for 22 years. During the formative years of [x species] there were a lot of health issues and DPI themselves did a health management, through FRDC, a health management study for want of a better word. To do that, they required so many figures off the ponds, like parameters, needed to be studied properly. So they decided they were going to do two ponds on four different farms to get an overview. After six months, they wiped all the other farms because they weren't getting the parameter measurements accurately and they did six ponds here because Mum and I were both doing all the water readings, the meter readings of the different things and then I did all the health checks... So we had field officers and a DPI vet on site, once a month, for four years. So a lot of the health management plan came off stuff that was done here. We've also - my door has been open for DPI to bring anybody through the place they want... DPI... used to bring people here to see

what was happening with the nutrition studies. We did a lot of their original research, figures on food conversion and - then we went the next step and I did a lot of comparison work between the select nutrition feed they were doing and Ridleys and Skrettings to work out in my own mind where the best value for money was.

MNCLB4

Interviewees MNC08 and NCLB2 discussed how they assisted in the design of education programs. In one instance a TAFE coordinator for a Certificate III in aquaculture made several visits to an aquaculture business to observe the various work tasks. In this way, the instructor could draw more specific links between the operational needs of aquaculturists and the aquaculture course content. In the other instance, this aquaculture operator helped design course materials for an aquaculture certificate course:

I was on an industry committee that helped to get the aquaculture courses up and running... once they got started they contacted me and said look, we're writing course materials. The courses were run by distance education from books with practical workshops where the students came in and did their practical work in blocks of a few days or a week at a time. They had a free call phone number so they could ring and speak to a teacher at any time. Later on that was email as well and we had extra stuff on the web for them. So they rang up and asked could you write some of the material for one of the books. They said you designed your own farm and built your own farm, could you help with the writing of the farm design and construction module. Why not. Yeah, I suppose, I'll have a go at that. So I did and then I wrote other stuff for them.

NCLB2

The interview data also pointed to how government agencies and researchers make use of the knowledge and skills of the aquaculture industry by involving aquaculturists in decision-making processes, committees or programs. Formal participation in committees and advisory boards is discussed in greater detail in Section 4.5. Community groups, businesses and managers also tap into aquaculture knowledge to build understanding of environmental change over time.

4.3.2.2 Indigenous communities

Similar research undertaken in the wild-catch fishing sector (Voyer et al., 2016) shows that education for Indigenous fishers (professional and otherwise) tends to be dominated by informal, relational learning through such means as mentoring and on the job training. For Indigenous fishers, however, there is an additional and highly valued cultural element to this training process that involves passing on customary knowledge and cultural practices. When it came to discussion about the nature of this transference of cultural knowledge the dominant discourse focused on loss – both potential and current.

The National Aquaculture Development Strategy for Indigenous Communities (the NADSIC) noted the interest of many Australian Indigenous communities in participating in aquaculture (Faulkner, undated, Lee and Net, 2001). It referred to

an affinity for fishing and related activities held by many coastal Aboriginal people. It also identified how compatible aquaculture is with the lifestyles of Aboriginal people in the coastal areas where many communities live. This finding is consistent with an observation made by one of the interviewees, himself Aboriginal, who strongly believed that aquaculture could benefit Aboriginal people and in turn the wider community across NSW:

It's really the most bulletproof industry - is the food industry. I mean it's not going to go out of style. People are always going to need food. Getting back to the Aboriginals, it'd be a way of getting back into things. They're the way they are because it's not the right way of living for them. This would be a perfect thing and when it happens, and it will, Australia will have a whole new business.

IA1

However, the NADSIC also found that at that time, there was a very low level of Indigenous involvement in aquaculture in some parts of Australia. Participation was primarily located in Western Australia, the Northern Territory, and Tasmania, with other projects in various states limited to conceptual or early planning stages (Lee and Net, 2001). There remain significant obstacles to Indigenous involvement in owning and running aquaculture businesses. These limit the education of Indigenous people in the industry and interfere with communities then passing on those learnings to the wider community (see also Sections 1.1, 4.1 and 4.5 in this report).

4.3.3 Discussion

Learning is a valuable part of individual and community wellbeing. Our findings indicate a range of examples where aquaculture business operators, staff, community members, and researchers have learned and continue to learn to be more proficient in aquaculture production as well as building their environmental knowledge. Those learning activities occur in formal and informal settings. Interview material indicates that while the industry contributes substantially to this dimension of community wellbeing, there is low awareness of this contribution.

The material, relational and subjective contributions to education and knowledge generation are central to building the aquaculture industry's social licence to operate. The more relationships are strengthened within the industry (bonding social capital) and between the aquaculture industry and the wider community and other stakeholders (bridging social capital), the greater the likelihood that the industry will achieve its social, economic and environmental sustainability goals. Other aquaculture research has found strong correlations between people who have had personal contact with the industry and their positive views of the industry (Mazur et al., 2005, Robertson and Comfort, 2014).

Discussions with interviewees reveal some factors that may be limiting the industry's contributions to education and knowledge generation. For Aboriginal communities seeking to be involved in and more knowledgeable about aquaculture there has long been a need for education and training programs more tailored to their social and cultural needs (Lee and Net, 2001) (for a recommendation on this point see Section 4.5). In the Australian context

more generally, obstacles include the need to include in secondary, TAFE, and tertiary courses more information about the practical challenges in operating fish and shellfish farms. During a stakeholder workshop for this Project held in July 2016, some participants expressed concern about a limited career path for students emerging from these programs, particularly for those students with higher degrees who may not necessarily be seeking to develop their own businesses. Participants in the stakeholder workshop also discussed how part-time aquaculturists or those with less experience might limit opportunities for technical efficiency or innovation.

Recommendation 5: *Collect information about the number and types of education and knowledge activities undertaken in the aquaculture industry as part of the ongoing monitoring of its social and economic contributions. Build awareness that the industry contributes to the community in this way.*

4.4 A HEALTHY ENVIRONMENT

A healthy environment is a key component of the overall viability of the aquaculture industry, particularly for the shellfish and sea cage sectors (Figure 16). Aquaculture practices (positive and negative) directly impact the health of the environment. A healthy environment is necessary to maintain the quality and quantity of aquaculture production, and it is also a key factor influencing the quality of relationships between the aquaculture industry and the general public, and by extension regulators. Previous research (Brooks et al., 2010, Mazur et al., 2014) has shown that the wider community and key stakeholders support aquaculture and wild-catch fishing industries, as long as those sectors can demonstrate good environmental protection practices.

FIGURE 16. Interrelationships between environmental health and community trust of industry



Public submissions opposing recent aquaculture development applications in NSW, and media articles in the areas affected, reveal some of the concerns that members of the public have about aquaculture. These include: visual amenity; navigational hazards for recreational boaters; negative impact on tourism; negative impact on property values; noise; odours; land-based infrastructure; marine debris; impacts on biodiversity values of marine parks; pollution of the water column and sediment; introduction of pests and diseases; impact on surrounding ecology; increasing flood risk in flood prone areas; reducing cane farm land in sugar growing areas; sharks being attracted to sea cages; whether management monitoring and reporting processes are adequate; and whether allowing current developments might lead to increased future development (NSW DPI, 2014, Hasham, 2013, Long, 2015a, b, South Coast Register, 2013, Tweed Daily News, 2004, 2005, 2008, Watts, 2016a, Wright, 2013a, b, 2015).

The NSW Government has addressed environmental regulation as well as promoting community understanding of aquaculture through the NSW Oyster Industry Sustainable Aquaculture Strategy, which was drafted in 2006 and is now in 3rd edition (NSW DPI, 2016b), and the Land Based Sustainable Aquaculture Strategy (Industry & Investment NSW, 2009).

Table 28 outlines the main indicators and methods this Project used to investigate the NSW aquaculture industry's contributions to a healthy environment. The subsequent sections examine the data obtained from the literature, public and fish merchant questionnaires, interviews and stakeholder workshop.

TABLE 28. Indicators and methods for investigating the contributions of aquaculture to a healthy environment

Contributions of the aquaculture industry		Indicators	Methods
Material	Practising sustainable and environmentally friendly aquaculture	Sustainability assessment of the industry	Literature review Qualitative interviews
	Involvement of the industry in stewardships activities	Involvement in environmental stewardship activities	Qualitative interviews
Relational	The role of the aquaculture industry in wider environmental management networks	Involvement in environmental management programs and committees	Qualitative interviews Social questionnaire – fish merchants
Subjective	The level of trust in the aquaculture industry to act in a sustainable manner	Community trust in industry/social licence	Social questionnaire – general public

4.4.1 Interdependencies between aquaculture and tourism in environmental health

Aquaculture and much of the coastal tourism in NSW both rely on a healthy environment. This fact was highlighted by the case of the Wallis Lake hepatitis outbreak in 1997 and its aftermath (Murphy and Kruger, 2008). Heavy rains one summer in combination with old infrastructure allowed sewage into the waterways and this contaminated the oysters, leading to over 400 cases of hepatitis. The oyster industry in the area voluntarily shut itself down until the problem was fixed. Health warnings were also put out about ingesting water while swimming in the area. This combination was detrimental for the local tourist industry, which also suffered huge losses in the year following. The oyster industry and tourism industry collaborated with local governments to rehabilitate the waterways, fix the sewerage infrastructure, and set in place systems to prevent future pollution problems, including an environmental levy to provide Council with sufficient funds. This work enabled the oyster and tourism industries to recover within a few years and then go on to strengthen their situation for the future. Wallis Lake now has some of the best water quality in NSW. It is so highly rated that its oysters do not need purging before retail and there is much shorter cessation of harvesting after heavy rains than in other estuaries, both of which improve productivity. The hepatitis crisis revealed to all stakeholders in the region how important environmental

health in the catchment is to the regional economy. This means oyster farmers' calls to prevent pollution are actively received, more so than in other estuaries that have not had such a crisis (MNC05, MNC06).

4.4.2 Practicing environmentally sustainable aquaculture

The ability of the aquaculture industry to contribute to a community's wellbeing is closely tied with the health of the local environment. Industry members undertake a range of 'best practices' that maintain catchment and estuarine health, and thereby sustain industry viability and wider environmental health. Several interviewees referred to the industry's Environmental Management Systems and Quality Assurance Programs that are part of government regulation of the industry, and which require aquaculturalists to undertake rigorous training in water quality and food safety systems and standards, thus helping to ensure quality seafood and improved riparian and estuary protection. Interviewees also spoke about pursuing organic certification and maintaining good environmental practices that benefit coastal ecotourism, local fauna, and agriculture:

The oyster farmers actively monitor the quality of the oyster - of the river. So we spend a lot of money every year in every estuary making - and monitoring the health of the estuary... So we do testing every two weeks... The EMS, Environmental Management System. For the [X] River, we have one. Obviously that's inward looking. So we're obviously committed to change our methods of farming, and cleaning up historical rubbish.

SC01

Well we grow an endangered fish. You can't catch a silver perch in the wild legally. Native fish, yes. We provide unlimited food supply for myriads of birds. Okay? So every bird needs water; there's a lot of water here. I think the biggest contribution we made to a healthy environment is that the water, once it's been used on site, is then used for irrigation purposes, either side, either farm, either side. So they grow silage and have feed lots. They would normally access their water straight out of the river, irrigate it off into the atmosphere. So we use the water at least once, sometimes twice in ponds, before it's irrigated. So the same water is being used to grow at least two crops, which is unheard of. Normally you get the water out of the river, you throw it on a crop. So we use river water, we use it through the fish, it then goes into the water storages down the bottom, it's all part of DPI rules and regulations and then it's irrigated either side of us so that the same water gets used twice.

MNCLB4

We're scrutinised like mad by the EPA, but the big thing and the comfort they know is that if we mess the water up, we mess up. So it's not in our interests to do anything but have the best quality water that we can, and environment as well. We're as close to organic as you can get, because we're not allowed to use chemicals and antibiotics and all that... Well, firstly, with the compliance with the Environmental Protection Act, which is very detailed, very stringent on

water quality, pollution of all sorts. Noise, dust, physical pollutions. Regulation as to chemical use and documentation. Our best practice in environmental management, I guess. It's a huge... [What are the key environmental impacts that people are concerned about from prawn farms?] The first one would have to be water pollution. The river. Because the [river] is so pristine... Discharge... Well, we do what's called exchange. We have to test, now, every four weeks we have to do a full range of suites of testing and send it to the university in Lismore for water quality monitoring. We have to monitor daily.

NCLB5

4.4.2.1 Involvement of the aquaculture industry in stewardship activities

A majority of the interviewees (19) talked about the voluntary measures (above and beyond government and/or industry requirements) they took to improve local environmental health. These activities included water quality monitoring that exceeded requirements, helping to contain oil spills, participating in Clean Up Australia Days, advocating for appropriate coastal development and effective catchment management responses (for example, acid sulfate soils, upstream water quality), and public education.

So that's been a really big step forward as far as just that environmental stewardship. The oyster industry does annual foreshore clean ups of not only windblown oyster structure but any sort of rubbish that's around the foreshore to coincide with Clean Up Australia Day. We also... do Pacific Oyster smashes, so we try and have an annual clean-up of that noxious fish species as well, just to try and reduce the numbers and keep them under control. So we're quite aware of what's happening with the numbers of them from our catch flats, you can sort of see when they're sort of building up again. So yeah, we try and do that routinely. But also we do try and be involved in educating the broader community particularly about sedimentation.

SC04

There's so much development up above there that it's eventually been built up so much that it's just coming down and destroying the river... Yeah, so the community health... that's probably what we'd consider. Of course, we're right onto any pollution things that occur. We certainly fought for the sewerage to be put on over here. We did that so all the septic tanks will be - in this year some time will be gone. So they're just in the middle of putting a sewerage thing all through over here, so every resident will be on sewerage, on town sewerage. So that was a big push over the years and we've been involved in helping the residents push for that as well... It was all septic tanks, yeah. Well, it's still presently septic tanks, yeah. We've pressed to get them checked and monitored over the years as well.

MNC02

We probably have a bigger contribution in terms of our presence in the catchment and the things - for example, we pretty much get asked to be part of just about everything that's going on here in terms of catchment management issues and developments and all those sorts of things which are going on which are relevant to water quality and management and all the things associated with it, so we have a very high profile locally. We've worked hard to get that over the last 20 or 30 years. So I think we contribute an enormous amount locally as an industry... It's for anything that's really going on in the valley. I mean, predominantly, it's always going to be coming back to focussing on the river. Given the Manning is a large river with a big catchment - a lot of people, a lot of cattle - there's lots of issues. So we try to get involved with as many of the projects as we can that are relevant to us, although we do support projects that might be - even one of the upper river catchments.

MNC03-4

4.4.2.2 Involvement of aquaculturists in environmental management networks

Our interviewees talked about how one of the most significant ways in which the aquaculture industry contributes to a healthy environment is through the accumulated environmental knowledge held by individual aquaculture families - some of whom have been working in particular waterways or sections of coast for multiple generations.

The ways in which knowledge such as this is shared with decision makers, scientists and the wider community is largely ad hoc and occurs in various formal and informal ways. The most common formal method by which environmental knowledge is shared is through involvement in research projects and environmental committees. Aquaculturists are able to participate in the planning process through commenting on developments that may affect water quality through sewage and on-site sewage management systems; any Development Application that has potential to impact oyster harvest water quality must be passed to NSW DPI for assessment as mandated in *State Environmental Planning Policy 62*. Of the aquaculturists we interviewed, seven discussed having been actively involved in environmental or fisheries management committees either currently or in the past, including the Statutory Shellfish Committee and the Aquaculture Research Advisory Committee. It is worth noting that interviewees were selected in part for their knowledge and experience in the industry.

Over the years I've been involved in various committees. There was a [X] River Committee that was very much pushing for improved care of the environment of the river and its catchment. Then I was a foundation member of the Catchment Management Committee... I spent two terms on the Catchment Management Committee and so I was able to take my water quality knowledge and my knowledge of the river to that and I think I was a valuable contributor.

NCLB2

The oyster industry has three members on the Coastal Planning Committee with Council. So yeah, we do lots of things that are proactive and all of the estuaries in the [X] Valley apart from [X town] have an estuary wide environmental management system. So through those we're working with Council and landholders looking for point sources of pollution and ways that we can be reducing that impact on the estuaries for better water quality for us and also for the broader community.

SC04

4.4.3 Community trust in the aquaculture industry to operate sustainably

As noted earlier, where stakeholders and communities have strong faith in the aquaculture industry's environmental trustworthiness the industry will have a reliable 'social licence to operate'. This Project investigated these matters through the general public questionnaire, and they also came up in the interviews.

Nearly half of the interviewees (12) raised the issue of social licence for their industry. They were well aware of how valuable community support is and felt relatively confident that they had such support. The interviewees spoke about the reasons for this: it was particularly evident that the NSW oyster industry had long been operating in the regions, was highly visible to locals and tourists as contributing economically, and oyster farmers were seen as good environmental stewards. One interviewee in the prawn industry said that that sector's reputation had not been as strong, but it had improved in recent times in parallel with the growth of people's awareness and understanding. The following quotes illustrate these perspectives:

It's a very visual industry down here in that most of the major estuaries have an oyster industry, particularly in Merimbula which is probably our most urban estuary. So it does have a very high profile and I just think that because of the way the oyster industry has gone about that environmental stewardship and building that social licence that it definitely does have a broader impact on the whole of the community. That works in our favour as well because then you do get that community support and Council support for maintaining water quality so that it's that win-win situation.

SC04

This is just a quiet, achieving farm. We... contribute. We all do. We spend money locally, we turn over a couple of million bucks a year, which has got to go somewhere. It fits in as a healthy, environmentally - well, environmentally sympathetic, and it doesn't detract from anything.

NCLB5

There's - yeah, there's quite a number of ways that we do contribute. We don't have too many complaints from people. Most come to the markets - to the farmers' markets, I find that a great area of communication. People come on a regular basis and discuss water and water quality.

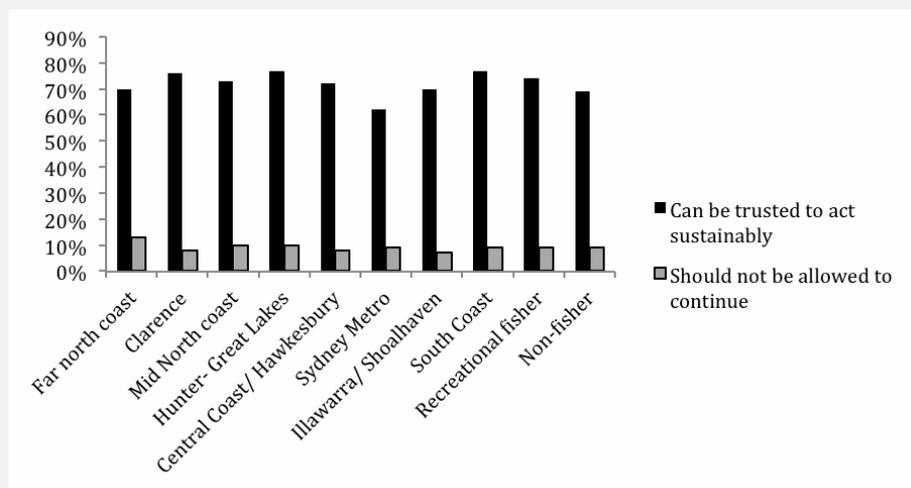
NC01

I think social acceptance of farmed prawns is certainly now better than it was. There's been a bit of an impact in society now accepting - it gets back to what I said about the high standards and the high quality of the produce. It's been a positive thing, I'm sure, for the Australian economy to not just recognise prawns but Australian produce.

NCLB5

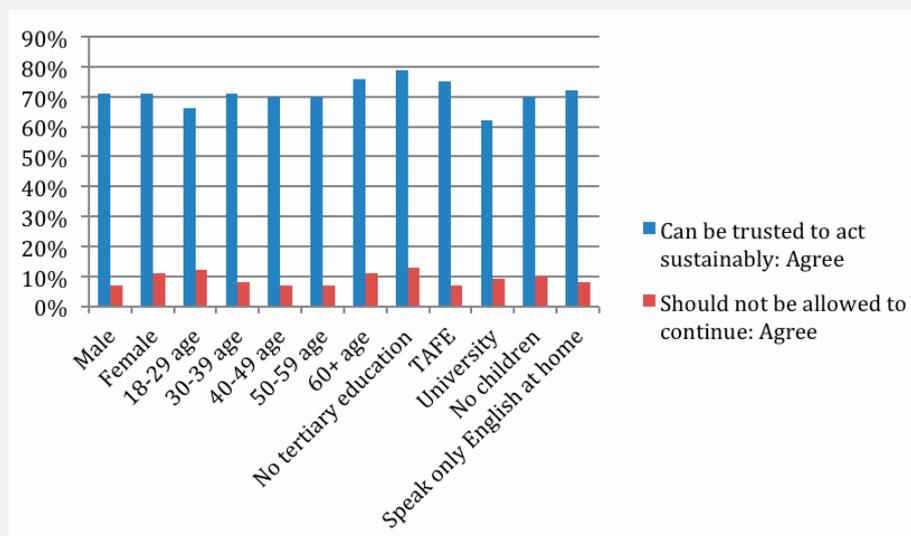
The general public questionnaire data is consistent with interviewees' opinions that the NSW community has a good level of trust that the industry will act in appropriate ways to sustain environmental health in the future. Seventy-one percent of respondents overall indicated that they believed that the industry could be trusted to act in a sustainable manner. Seventy percent supported the continuation of the industry (Appendix 2). Figure 17 shows that while there were no significant differences across the study areas, support was highest in regional areas and lowest in the metropolitan areas of Sydney and the Central Coast. Levels of support were also relatively consistent amongst recreational fishers and non-fishers, with 69% of the recreational fishers surveyed indicating that they felt the local industry could be trusted to act sustainably and 87% supporting the continuation of the industry. Figure 18 shows further breakdowns by social groupings, with older Australians, males, and people with less education more likely to be supportive of aquaculture, and women and young people less trusting of the sustainability of the industry.

FIGURE 17. General public questionnaire – trust in the sustainability of aquaculture by region



Note: Respondents were asked to agree or disagree with the following statements: 1) "I can rely on the local aquaculture industry to act in ways that will sustain fish populations for future generations" and 2) "The NSW aquaculture industry should not be allowed to continue, because its environmental costs outweigh its social and economic benefits".

FIGURE 18. General public questionnaire – trust in aquaculture by demographic characteristics



Note: Respondents were asked to agree or disagree with the following statements: 1) "I can rely on the local aquaculture industry to act in ways that will sustain fish populations for future generations" and 2) "The NSW aquaculture industry should not be allowed to continue, because its environmental costs outweigh its social and economic benefits".

While the majority of general public questionnaire respondents had largely positive beliefs about NSW seafood producing industries, their support remains conditional. They were also asked, "Is there anything else you want to tell us about the commercial fishing and aquaculture industries in NSW?" Seventeen percent of those responding indicated their preference for ongoing and strong regulations. The following quote is typical:

As long as both commercial fishing and aquaculture are managed well both from a sustainability point of view, and environmentally - friendly regarding aquaculture i.e. no chemicals.

Another 10% suggested that there was room for aquaculture (generally) to be even more sustainable in contributing to other food production processes:

Aquaculture should be used in more sustainable ways/use fish waste to grow vegetables/use aquaponics technique to grow them.

More in supporting aquaculture, good food source.

4.4.4 Discussion

The ability of aquaculturalists to contribute to community wellbeing is inextricably linked to the health of the environments in which they work. The interview data showed that aquaculture industry members undertake a range of mandatory and voluntary 'best practices' that help them to grow quality products as well as to maintain and improve ecological function in catchments and estuaries. These practices include not only physical works (e.g. regulation compliance, modernising infrastructure, water monitoring, pollution control), but also the vitally important social interactions within the aquaculture industry and across other place-based and interest-based 'communities' that are vital to building social capital and trust (e.g. advocating for appropriate riparian and coastal development, raising public environmental awareness, etc.).

The public questionnaire and interview data suggest there are good levels of trust within the community that aquaculture in NSW is worth having because it provides social, economic, and environmental benefits. These findings provide cause for optimism about the industry's future. Nonetheless, some challenges remain. Some interviewees talked about a range of environmental impacts that can compromise aquaculture production – oysters in particular – such as residential development, river pollution, flooding, acid sulfate soils. Other kinds of (social) threats to the industry's social licence to operate include low awareness of the industry's environmental credentials. Where there is a lack of understanding of good aquaculture performance or when environmentally unfriendly practices occur, community trust can drop away. It is well established that social licence for seafood production industries (like any other industry that relies on natural resources) depends on society believing the industry is effectively regulated, which requires the industry and regulators to continually and clearly communicate about their environmental stewardship activities and the ecological sustainability of their operations (Mazur et al., 2014).

Recommendation 6: *Develop an easily accessible and thoroughly credible web-based source of information about the environmental credentials of NSW aquaculture, and build public awareness that this information exists. This could be based on existing DPI information.*

Recommendation 7: *Raise public awareness of the importance of water quality in estuarine regions, which would increase pressure on other sectors using those catchments to avoid causing pollution. This could build on standards for water quality and its protection in the Oyster Industry Sustainable Aquaculture Strategy (NSW DPI, 2016b).*

4.5 INTEGRATED, DIVERSE AND VIBRANT COMMUNITIES

Analysis of the research data identified different ways the aquaculture industry contributes to community life by providing economic opportunities for various sections of the community and, to a lesser extent, food for diverse ethnic groups. Table 29 outlines the main indicators and methods used to investigate the aquaculture industry's contributions to integrated, diverse and vibrant communities.

TABLE 29. Indicators and methods used to investigate the contributions of aquaculture to integrated, diverse and vibrant communities

Contributions of the aquaculture industry		Indicators	Methods
Material	Contributions of the aquaculture industry to the needs of a diverse community	Role of aquaculture in providing work and business opportunities for different socio-economic and cultural groups	Qualitative interviews Literature review
		Providing food for different groups	
	Involvement in citizenship activities and community events	Contributions by aquaculture sector to cultural events	
		Sponsorship and donations by aquaculture sector	
Relational	Role of the aquaculture industry in building and maintaining social networks (formal and informal) in local communities (social capital)	Contributions to social capital – bridging, bonding and linking	Qualitative interviews Social questionnaire – fish merchants
Subjective	Community awareness and beliefs in relation to the importance of the services provided by the aquaculture industry for community life	Importance of the industry in community life for economic opportunities for diverse groups	Qualitative interviews
		Importance of seafood for community celebrations	

4.5.1 Contributions to the needs of a diverse community

4.5.1.1 Economic opportunities for various socio-economic and cultural groups

Entry-level employment for socially disadvantaged people

As discussed earlier in Section 4.3, the aquaculture industry in NSW offers entry-level employment, typically involve labouring work. Since much of it is set outdoors, often in beautiful environments, and involves looking after living creatures, aquaculture jobs can be much more interesting and engaging than other kinds of labouring work, such as packing boxes or digging holes for construction work.

It also involves mud and storms, and the animals cut, bite and sting, so while not all people are attracted to aquaculture, some prefer it to other entry-level employment on offer. Our interviewees indicated that entry-level employees are not always socially disadvantaged – they may be school leavers just joining the workforce or people who had established careers in other sectors seeking a ‘sea change’. However, around a third of the aquaculturists we interviewed specifically employed young men who would have difficulty working elsewhere, and who through developing work practices and an employment track record in aquaculture become employable more broadly.

I’ve had some young fellows come down and work for me... I literally handed him a broom and said can you sweep up? And he took the broom and he looked at me and didn’t understand what I meant by sweep up. I had to show him the basics of work. He’d got six kids and he was 24 years old... Some of the more troubled people can find work in it and I have seen it sort of save a few relationships and things like that.

MNC01

The same farmer, MNC01, said he had employed a number of people over the years who would have found it difficult to secure a job otherwise – people who had spent time in prison, or had been out of work for a long time, and older people. Interviewee SC05 employs two men who did not finish school and are unable to read and write. Oyster farmer SC03 estimates he has employed around 50 people over the years, including some who had just come out of jail. SCLB1 noted that some oyster farmers have an arrangement with the South Coast Correctional Centre whereby people coming to the end of their sentence and needing to prepare to re-enter society work shucking oysters. Two oyster farmers, MNC02 and MNC08 have employed people through a Centrelink-administered program for long-term unemployed people so they gain some work experience and a TAFE qualification.

Those casual prawn harvesters were often people who were on the dole and were struggling to find a job, so they were convenient for me because they were someone who was available and I could call up at short notice. It’s amazing how many of those once they had some work here were then able to get other work. You’d ring them up the next time, oh no... I’ve got a job now. I’d say oh, that’s great. How did you manage that? Oh, once they knew that I was working - he said, I’ve tried to get a job in this place several times before and they’ve never been interested. Once they knew I was working they gave me a job.

NCLB2

So we’ve had some young kids or younger people that maybe have not had the easiest start in the world or have been unemployed for a period of time and we’ve offered them employment. That’s led to them also gaining these qualifications... Yeah, I think they’ve got a sense of achievement out of it.

MNC08

So it does help the socially disadvantaged people in terms of as long as they're young, strong and able to work. Of course it has a flow on effect to them because they get a job. They feel better. They contribute to their community.

MNCLB5

Aboriginal people

Aboriginal communities make up some of the most disadvantaged groups on the NSW coast. Some of the communities have very low median incomes, low levels of formal schooling and very high rates of unemployment. As discussed earlier in Sections 1.1 and 4.1, oyster farming has long been an important source of employment for Aboriginal people in coastal areas of NSW, and since the Land Rights settlement there have been hopes for Aboriginal-owned and run aquaculture enterprises. There have been State and Commonwealth government-funded initiatives to try to foster Aboriginal-owned aquaculture in NSW, and a handful of oyster farms currently operate on the South Coast.

FIGURE 19. Aboriginal study visit to Port Stephens NSW DPI aquaculture facility (photo credit: NSW DPI)



Around one third of the aquaculturists we interviewed said they employed Aboriginal people (four land-based businesses and five oyster farms):

The young bloke we've got working with us, he's Aboriginal and his family actually was mainly farming up in Port Stephens and they've moved down the coast as things changed. So yeah, they've got a really good rapport with it. They're very good with what they do and they've got a good really feel about the area. So yeah, they work really well and they're good to work with... So it has that sort of spin off that you get with their work with how they love the land. How they work the land and how they can assist us with making sure that we are more in tune with the environment that we're working with.

SC06

We used to employ quite a few back in the day. As far as doing oyster work, I don't know what it is but the local - the Aboriginal people they've got it. Somehow they have an understanding or I don't know what it is but they're excellent oyster farmers.

SC05

Actually there would be two that I can think of over the years. I don't currently but yeah, they've just been - something that they've just been good employees as - it's not something that I've targeted.

NCLB2

Many of the Aboriginal people working in aquaculture would be included in the category of socially disadvantaged through having low levels of schooling and life situations that make getting a job and keeping it difficult.

We're a very large Indigenous employer, and a flexible workplace, which allows the guys to come and go... Just I do notice that people that we employ in the industry are generally people that are either - are troubled, unemployable elsewhere. It is, like I said, quite a flexible industry so that those kinds of guys that come and go, in and out of the industry, with minimal disruption.

SC01

Other employers found it more difficult to accommodate the flexibility of Aboriginal employees needing to leave for periods to deal with family issues, especially around funerals (MNCLB3).

In addition to the work on oyster farms as such, interviewees SC02, SCLG1 and SCLG 2 talked about related work opportunities in landcare activities, particularly on the South Coast. SCLG3 told us:

We've had a number of projects where we've linked in the Koori work crews that some of the local Aboriginal Lands Councils have got down here. They've worked with the oyster industry to do things like Pacific oyster culls. So the wild ones, the pest species and also derelict infrastructure clean ups. So these are leases that fisheries and marine parks down here we've been able to overlay the Batemans Marine Park information and identify priority leases in estuaries that just need to be cleaned up and returned to natural habitat in sanctuary zones. So there are a number of those in the Clyde for example that the Aboriginal community worked with the oyster industry to clean up. So this was having oyster farmers basically supervise the Koori work crew who were paid to do these works. Yeah, it was great actually... So there have actually been situations where jobs have been created for these guys afterwards where they've just had that contact with the oyster farmers. In the Clyde in particular, because I know that quite well because I've worked with them for years, but they have actually got quite a high proportion of Indigenous people employed.

SCLG3

In addition to labouring work, Aboriginal people have also taken on management roles in oyster farms, which has meant forgoing holidays, working long hours and

attending to equipment during storms, which aquaculturists note are significant challenges of the work (Voyer, 2013, Clarke, 2013).

Although the large oyster farms around Port Stephens and the Great Lakes area are where many Aboriginal families first gained experience in oyster farming during the 20th century (Sutherland, 2011), in more recent times it is on the South Coast where Aboriginal oyster farmers seem to be doing best. We were unable to secure interviews with Aboriginal aquaculturists on the South Coast, but some of our non-Aboriginal interviewees in that region talked about Aboriginal oyster businesses, and we also gained some background information from DPI staff and Aboriginal people with connections to Land Councils and coastal Aboriginal communities. Interviewee SCO4 noted that one of the Aboriginal corporations runs an oyster processing facility, and that there are Aboriginal families running oyster leases in Merimbula and Wonboyn (SCO5).

FIGURE 20. Aboriginal oyster farmer in the Shoalhaven River (photo credit: Andy Myers)



We were unable to find news of currently active Aboriginal-owned aquaculture operations elsewhere in NSW. We interviewed one Aboriginal man (IA1) who had a technical background, had worked on land-based farms, completed a TAFE qualification in aquaculture, and developed a multi-species system for farming prawns with algae. He had developed the first phase of his project and was seeking investment to continue when the Global Financial Crisis hit, so he was unable to continue. He had also contacted his local Land Council to see if they were interested in developing some aquaculture, but they saw it as too risky and declined his offer to help them establish the venture.

There is a bit of a - there is a fair cost of setting up so you've really - the ones I went up and saw are so simple. They had these aerators on top, which used a lot of electricity. See my pond's design it's not even a pond. It's like this giant tank, as I said. It really changes everything. They're about \$50,000 to build each one, but they'll just go forever... Yeah, I know, it'd change their lives basically

because... As a food source and it's just a way of living - a good way of living. It's not even hard work to actual keeping them going. The farms I worked on you'd just go around twice a day on the back of a quad pumping fish feed into the dams and that was it.

IA1

Some of the other land-based aquaculture interviewees had also talked with local Aboriginal groups about possible opportunities. NCLB2 talked with the local Land Council representatives who wanted to investigate the possibility of prawn farming. He talked with them about what the work involved and they eventually decided prawn farming would not work for them, in part because the species they were interested in must be harvested at night. MNCLB4 also talked with the Aboriginal elders in his area who wanted to know more about the farming finfish to see if it suited them, but that group also did not take the idea further.

SCLB1 said the government initiatives to foster aquaculture have been too technically focussed. Demonstrating how to grow oysters or how aquaculture works in terms of ponds, fish and feed is not enough to enable them to go and start an aquaculture venture. Some of the people who gave us background information and have worked with Aboriginal coastal communities also pointed to a heavy emphasis on the technical aspects of aquaculture in some of the projects in the early 2000s under the Indigenous Fisheries Strategy, and not enough focus on working out how to manage the business side of operations.

One interviewee (code withheld for anonymity purposes) described some of the government schemes as 'false promises' because they presented aquaculture merely as a technical possibility, without addressing the various obstacles Aboriginal communities might face in trying to establish and maintain businesses in an industry such as aquaculture. This then led to a feeling of failure among the communities who said 'Oh yeah, we've been taught about it for decades, but it's never going to happen.' A couple of interviewees suggested that schemes to involve Aboriginal communities in aquaculture need to be much longer term. Local government employees SCLG1 and SCLG 2 on the South Coast noted that government support for projects that could involve Aboriginal groups with aquaculture were typically only one year or so, and this was insufficient.

I think you have to create and bring the technology with people who know how to do it, bring employment up from the bottom and education. It's going to take a generation or two but that's the way to address it... It's chemistry, it's biology, it's regulation, it's so many things. That's challenging for anybody, let alone a disadvantaged demographic.

SCLB1

IA1 had grasped many of the multifaceted challenges of land-based aquaculture, but his efforts were undone by a lack of access to finance. The significant financial barriers to aquaculture are relevant not only for Aboriginal aquaculturists, but were noted by most interviewees to be among the many other challenges, such as meeting regulatory obligations (see Section 4.1.). Interviews conducted with people of all ethnic backgrounds for this Project show that it is difficult to establish

and maintain successful businesses in aquaculture. Considering the situations of disadvantage existing in many Aboriginal communities, it seems self-evident that aquaculture businesses can only grow and survive with sustained support being focussed on all aspects of the business, including getting a balance between the social aims of Land Councils, financial viability, and technical expertise.

Minority ethnic groups

The seafood industry in Australia overall has offered work and business opportunities to many new immigrant groups (Voyer et al., 2016, Deloitte Access Economics, 2016b). John Clarke's (2013) history of oyster farming around Port Stephens and some of our interviews indicate that Greek-Australian family businesses have been prominent in wholesaling and processing for oysters. Many Greek-Australian women also worked in oyster processing associated with wholesalers in Melbourne. In NSW, the aquaculture production side, however, seems not to have provided opportunities for as wide an ethnic range of backgrounds as the wild-catch fishery or seafood processing and marketing. A previous study of Sydney Rock Oyster farmers found that most are of a White English-language background (Schroback et al., 2014a). While one of our interviewees (SC03) said that the reason his family went into oyster farming was because they were non-English speaking migrants and struggled to find economic opportunities, they did end up with derelict oyster leases that no one else wanted. Another interviewee (NCLB3) is a career aquaculture manager who was recruited 26 years ago from overseas because of his experience and qualifications. Several of our interviewees noted that in their regions there are very few people from non-English speaking backgrounds.

Women in aquaculture

Although most of the aquaculture businesses in NSW are and always have been family operations, it has usually been the male head of the family who has been considered the head of the business. One of the land-based aquaculture business owners we interviewed was a woman, and we also interviewed two women who take the lead in running their family oyster farms and working the leases.

Part of that time [partner name]'s been off-farm. So it's an industry now where women can do it really well. We've gone away from the static culture. We've gone to the floating baskets, floating trays. So I can actually do it. I did it five years by myself... But now I have someone help because we've sort of expanded to the stage where we need two people working on a regular basis doing it.

SC06

When sticks and other earlier technologies were used in oyster farming, the work was more physically strenuous. Clarke's (2013) history of oyster farming around Port Stephens notes only one woman who undertook the full range of work involved in running a farm. Clarke also writes that Aboriginal women were extensively involved in some aspects of work on oyster farms.

A previous study of the Sydney Rock Oyster sector found that 11% of farmers were women (Schroback et al., 2014a). Our interviews indicated that in terms of gender

the aquaculture industry follows an international trend in seafood value chains whereby the industry is seen as male dominated, but upon closer inspection women are thoroughly involved. Their participation includes: working in their family business (paid and unpaid); managing the family business paperwork; processing and marketing product; and the housekeeping and carer work that frees up men to focus on aquaculture work (Monfort, 2015).

One of our women interviewees had recently attended a Rural Resilience Program workshop for the wives of farmers and fishermen and found it really useful:

[We workshopped] where our business is at, where we want to go and how we need to deal with... Yeah, there was lots of sides to it. There was your business side, and then you can take away business ideas, or you could take away personal growth ideas. Then the other side was dealing with people and the skills and tools to help you do that.

MNC04

4.5.1.2 Aquaculture products in cultural life

The significance of seafood as a product associated with celebrations and major cultural events was explored through both the qualitative interviews and the social questionnaires. There was a great deal of discussion in the fieldwork interviews about the role of seafood in the cultural lives of Australians from diverse ethnic backgrounds. Seafood was mentioned as being synonymous with key celebrations on the cultural calendar, including summer holidays, Christmas and Lunar New Year. Fieldwork interviews with fish merchants conducted for the sister Wild-Catch project indicated that most put on extra staff to cope with the higher demand around holiday periods such as Christmas and Easter, and that these periods involved high turnover of sales and revenue (Voyer et al., 2016). This illustrates some of the economic flow-on benefits of the association between seafood and cultural events and celebrations.

I guess around here - and it's growing like you wouldn't believe - Christmas time, so you're inundated by people who will eat oysters once a year. All the oyster farms here, it's just going berserk.

MNC02

One way this contribution operates is through supplying valued products for a variety of cultural groups. The range of seafood being produced by NSW aquaculture has to date been fairly narrow (oysters, prawns, yabbies, and several varieties of finfish), so this contribution has correspondingly been somewhat narrow and could definitely grow if NSW aquaculture were to broaden out to cover more species.

Some Asian-background groups within NSW communities and visiting as tourists value the high quality barramundi and silver perch produced on aquaculture farms. Fresh fish of both species are sold extensively to Asian fish shops and city restaurants. One farmer producing barramundi (MNCLB3) said that the food safety aspect of the carefully regulated NSW aquaculture is a big drawcard for buyers from China, where aquaculture and other food production systems are plagued by frequent food safety scandals. Barramundi and silver perch are both sold live to

Asian restaurants in Sydney, where selecting live fish selected from a tank marks a special occasion meal for some groups.

So today is Chinese New Year, yeah? So our local Chinese restaurant owners have come out here, given us a new year's present, they've spent - had lunch and smoko with us and then I've sent them home with fresh silver perch for dinner.

MNCLB5

For Aboriginal people and Australians of Anglo-Celtic background, oysters and prawns are an important celebratory food. Imported prawns are easily available, as are non-aquaculture wild-catch prawns, but fresh oysters are virtually all cultured and domestically produced, with NSW oysters making up a large part of the market. People buy these foods to prepare at home or they eat them at restaurants and other food outlets.

Aquaculture produce is also often featured at sporting and cultural festivals. Interviewees mentioned a range of cultural events up and down the coast in which they participate. For many years one oyster farmer (MNC06) donated oysters for a local annual surfing competition. There are several dedicated oyster festivals along the coast, including at Narooma, Brisbane Waters, Greenwell Point, Karuah, Port Stephens, and the 'Oysters in the Vines' event at Hastings. Previously there was one in the Great Lakes region. Aquaculture products are also entered into produce competitions in city and regional shows such as the Sydney Royal Easter Show, the Royal Agricultural Society Fine Food Show, the Bega Agricultural Show and the Pambula Agricultural Show.

We have a local oyster association, the Sapphire Coast Wilderness Oysters association, for local farmers and through that group we do a lot of promotional events associated with other events that are happening within the community. So we run a Sydney Rock Oyster judging competition at the Pambula Agricultural Show and also amateur shucking competitions for show goers. Another oyster farmer from Tathra... organises the Sydney Rock Oyster competition for the Bega Agricultural Show and the Sapphire Coast Wilderness Oysters sponsor both of those events and also encourage and assist farmers to get their oysters to those events. We actively support farmers to get their oysters up to the Sydney Royal Agricultural Show as well from that and we're also involved in the Eden Whale Festival, which is an annual event down at Eden. We participate in the Bega Cup Carnival, which is a racing event so we sort of engage with the Bega community. Then we're also involved in the Merimbula EAT Festival where we have, oysters are sort of the main thing that the Festival has been built around. It's a local produce and local restaurant event.

SC04

4.5.2 Building and maintaining social networks in local communities

4.5.2.1 Bridging Social capital

It should be noted that our interviewees are more likely to have been actively engaged with the broader community than the average for the industry, because our original list of contacts was drawn from the farmers who had stronger connections with NSW DPI, and because these are the people who were willing to give their time to talk to us (more introverted people usually decline invitations to be interviewed). Much of this engagement is about being a 'good citizen' in a rural community, and is similar to what families from other sectors also contribute.

So we contribute to the local community by being good community members... Oh yeah, yeah, well just simple things, like the local town does a triathlon every year, okay? It's a bush triathlon. It comes past our front gate, so we are one of the marshal stations, because everybody knows where the fish farm front gate is. So we sit there for the duration of the triathlon and have the emergency phone call numbers on site... So we're community members and that's how we put back to the community.

MNCLB4

At the moment we've got in our little row of farmers, we're putting it all to - there's a local fellow who has cerebral palsy and his driveway is a dirt track sort of thing and it's just not suitable for him. So we're building him a new road with the oyster shell.

MNC01

NCLB1, who lives down a no-through road that is only used by him and his neighbours, talked about his contributions to making sure the Council maintained the road, which is frequently damaged by floods. This is a very local benefit for himself and his immediate neighbours. He also worked out with the Water Authority how to use local measurements reported on their website to estimate the levels and rates of water rising in floods so as to be able to warn people in his area when they need to move their cars.

Several interviewees also talked about reaching out to the community to give information about the aquaculture industry. This is not purely altruistic because it involves not just developing the social licence of the industry, but it also undoubtedly builds bridging social capital within communities.

We will be, apart from doing some talks at Rotaries and Apexes and the Club types just to keep the community informed of what we're doing, we do that. We talk to the local Chamber [of Commerce] organisations and local community organisations because they know we're here and they want to know what we're doing.

NCLB6

I remember once that I went to Lismore Rotary Club, they asked me to do a presentation at that and they said if you could make it for about 15, 20 minutes,

over two hours later we were still going and everyone is going, we want to have something to eat, just let's eat and talk as we go. So I ended up - but, yeah people once they become aware of - most are not aware that an oyster takes three years to grow. They all go, my god, three years? That sort of really blows people away and that includes a lot of farmers...

NCO1

I do either - the start of the season I usually have a TV spot... or a paper spot, you know. Get on and they say how's the oyster industry going? So we try to get - we just try to raise our profile within the media where we can. I think because they're there, so people know it's there, and they know, they see us at different festivals or markets and this sort of thing, you know. So that's probably our best way, I think, because the oyster industry doesn't, you know, unless you're involved in it, you really don't know anything about it.

MNCO2

I'm communicating each day to the local community. Because the community is very engaged in the development of this industry, although we're not employing 300 people yet but very engaged. We have to inform the community as well about what we're doing and developing, because of course whenever you've got a development application in for aquaculture, you need the community to understand what it is you're proposing. Because aquaculture has got a lot of - I mean, even just in Jervis Bay here there has been huge opposition to shellfish leases. You have to explain to people that shellfish aquaculture is actually going to offset all the nutrient imports the local - you were worried about algal blooms, well grow seaweed instead and you won't have as many algal blooms because the seaweed took the nutrients. So for people to understand, that actually is a benefit and an offset to human impact in the system... But you do have to - for people to accept it, they also have to understand it, which is why we're always communicating to the local community about what it is we're doing.

SCLB1

Bridging social capital includes fostering good relations with other sectors of the community such as Indigenous people. Farmer SC05 pointed out that his lease is surrounded by land owned by the local Land Council, so it is important for him to have good relations with the Aboriginal people who use the land around his lease. This includes showing them around the sheds and lease areas, sharing oysters with people who drop in, and donating oysters for weddings and other special events

Some interviewees talked about problems with bridging social capital in the past:

[Prawn farmers] were viewed with suspicion when they first came. They were the enemy to all the fishermen. What they were doing, they were going to - they were witch doctors or something in the early days, and there was some other - there were a couple of very big prawn farms started. One started very shortly

after this and they went broke, and there was a bit of economic fallout, because this is such a high-risk, capital-intensive industry, that when a big show in the early days, in the '80s, when a big project went broke, it affected a lot of people.

NCLB5

Some interviewees said earlier problems with connections to the wider community have improved through work on building social licence (connected to contributions to the wellbeing dimension of a healthy environment, see Section 4.3).

I think there were a few [oyster] farmers that did cause a stir and that definitely doesn't help. There's right ways and wrong ways about [unclear] cause a stir. I think most of them were pretty gung ho sort of guys and just pretty much abused people. But now, I think most of us are fairly well - not educated, but we know how to pick our battles and what to say. So I think that's changed the public perception and the fact that now oyster farming's bringing money into the community makes [unclear] difference. So yeah I think both ways, you know we educated the public and they see the good product we produce in our little estuaries. Most of the community is behind us and the local government and everything is supporting us...

SC05

One important contribution the aquaculture industry has made is reaching out to other users of land and water in catchments to further their understanding of how all their activities affect the health of estuaries, and how that in turn affects local industries.

We've run sort of this project... that's been about working internally with farmers to improve the environmental nature of their industry and to improve best management practice... both within estuaries and across estuaries... there were farmers from Wapengo and Pambula and Merimbula and Wonboyn that came down to Wonboyn in the day... so that exchange of ideas and appreciation of the different conditions that they're working under there and all that kind of thing is really great... We had 29 people come along... We ran a number of those things over the years... both oyster farmers and some of the catchment stakeholders and we've done them with landholders before as well... educate them about the industry, so that they realise and make the connection that what they do on the land affects the water and affects their local industry...

SCLG3

FIGURE 21. Oyster farmer and dairy farmer work together to improve fencing around a creek (photo credit: Andy Myers)



We've created a local network called Blue BioTech Shoalhaven... So we're, like, saying well the whole community can be part of this industry and like Silicon Valley provides for itself on IT, we're a coastal community. Why can't we provide for ourselves on blue technology?... We're saying - we've got a big ethanol factory that we're integrated with. We're capturing clean, food-grade CO₂ and it's a big biotech operation. We've got flavour companies, we've got - and it's also promoting the local utilities, like Shoalhaven water, because they're a very progressive and forward-thinking wastewater management company, under Council. One would need to promote and work with them on keeping the wastewater management in the region at a good level, because - I mean, they do impact the oyster industry in the river when there are overflows and things. But by working with even the regulators and Shoal Water and things and keeping them in this network, we're all in that big picture together and considering each other. So Shoalhaven Water is a part of that as well. Because we're saying, if our water is bad quality, we're not going to be selling products from here...

SCLB1

Sponsorships, donations and volunteering

One of the ways many interviewees contribute to their community is through participating in committees. Some of these are related to issues of concern for aquaculture businesses, but others are about active citizenship more broadly. Many of our interviewees have participated in Estuary Management Committees (see also Section 4.3). Other committees include: local coastal management and planning committee (SC04); Local Land Services advisory group (SC04); farmers'

market committee (NC01, SC01); surf lifesaving (SC01); school board (MNCLB3); local Australian rules football league (MNC02); local Conservatorium of Music (NCLB1); Council (MNC08); Clean Up Australia Day activities (SC01); and the Fire Brigade (SC06). In addition, several interviewees said they were currently too busy with work to be able to contribute through committee membership, although they had in the past or hoped to in the future (NCLB6, NCLB2, NCLB3, NCLB4, SC03).

In addition to committee work, most of our interviewees mentioned other kinds of volunteering and donations as part of their contribution to their community. One fish farmer (MNCLB5), who is also a keen recreational fisherman, has hosted 'ladies and kids' fishing days to facilitate broader participation in this male-dominated pastime. Other interviewees talked of donating to community groups in the form of cash or vouchers for their product to be used in raffles or auctions (MNCLB3, MNC02, MNC05, MNC06, SC01, MNCLB4).

My wife, she's involved and I really think she should run for council but don't really have the time for that. But yeah, she does a lot for the local community and people that are - you know raising money because they're sick for cancer and that sort of stuff. We donate a lot of products or put raffles and that sort of stuff. Raise money. So we try and get involved as much as we can that way... Outside the industry, I mean we - well, my wife, does a fair bit. Coaches in soccer teams and involved in that and my wife's very involved with the schools where the kids are.

SC05

Well, I mean, we're seen as one of the bigger businesses in town and always have been. So we're always approached to contribute to local events by way of sponsorship, participation, donations - those sorts of things. We do as much as we can. Like I said, the industry itself has been going through some fairly difficult times in the last few years. So we haven't been able to contribute as much as we may have in the past. But we're still able to - I've got a thing here from Camp Quality, because we gave them a couple of vouchers, which they use in a raffle... One of [the owner]'s great things that he takes pride in is that we supply all of the boats and that for the New Years' eve fireworks here, every year. We've been doing that for 20 years, I think he said, this year... But we also provide a punt at Christmas time. There's a group that sing carols throughout the [canal space], just down here... We provide them with the boat for that.

MNC08

I know that they [farm owner family] support charities. They're very - they support a lot of things... Oh, donations in cash and kind. They've supported the school when - because their kids went to school down here, as everybody did. [The farm owner]'s very, very generous. He helped the local football club sponsor the Indigenous kids and the Indigenous football. I know that we gave a donation, I think it was \$300. He went to Coffs Harbour. While he was there, he was staying at a caravan park and he got talking to some - a lady who teaches at a special school at Kempsey, and he came home and said I want you to give

them \$500. So support in the product, they donate prawns and I don't think he's ever knocked anybody back if somebody's asked for a contribution or a hand or anything. He just does it quietly. They don't make a big - they don't actively sponsor and put big banners out, but they're just in the community, which a lot of people around here do.

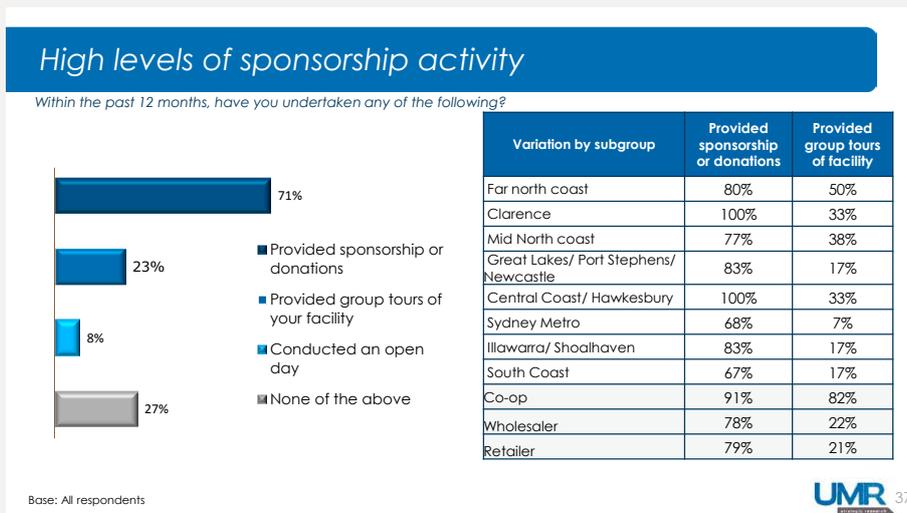
NCLB5

We have done seven charity days on site for the Westpac Rescue Helicopter and raised well in excess of \$30,000 for Westpac.

MNCLB4

The social questionnaire of fish merchants also indicated that their businesses play a role in bridging social capital through their active role in community life in the form of sponsorship and donations on behalf of the seafood industry (Figure 22).

FIGURE 22. Fish merchant questionnaire – contributions to bridging social capital through community involvement



4.5.2.2 Bonding social capital

Interview responses to questions about building and maintaining relationships within the industry were mostly about their membership of various industry groups. Most interviewees talked about active committee membership within these groups, while one or two said they were members but did not take a leadership role within the groups. The industry groups the interviewees are currently involved with, or have been in the past, include: the NSW Farmers Association Oyster Committee (SC04, SC01, NC01, MNC05, MNC06); NSW Shellfish Committee (SC04, MNC05, MNC06); Oysters Australia (SC04, MNC08); the local Quality Assurance Program (SC04, SC05, MNC08); the Ministerial Aquaculture Advisory Committee (MNC05, MNC06, NCLB4); NSW Aquaculture Research Advisory Committee (SC05, SC01); the local Shellfish Program (MNC08, MNC06); the NSW Aquaculture Association (MNCLB5, MNCLB1); the regional VETLAB Committee (NCLB1); Silver Perch

Growers Association (MNCLB4); the Australian Prawn Farmers Association (NCLB2, NCLB4, NCLB5); the NSW Fisheries Research and Development Corporation Research Advisory Committee (NCLB2); and the Seafood Cooperative Research Centre (SC05). In addition, interviewees mentioned some regional oyster marketing organisations such as the Select Oyster Company, Sapphire Coast Wilderness Oysters, and the Australian Oyster Coast.

In addition to professional associations and committees, other forms of interaction that act to facilitate collaboration within the industry included oyster farmers sharing grading sheds and other resources (SC01, SC02).

We've made a lot of good friends through the industry. We've made heaps of contacts... It's been decades of building those relationships, and we value them. You can pick the phone up - I've got mates all up and down the coast. They're oyster farmers. It's something you don't get overnight.

MNC03-4

Interviewees also mentioned that intra-industry initiatives have been facilitated by the liaison and extension work on oyster farming done by people such as Ana Rubio (Hornsby Council), Andy Myers (OceanWatch), and Jillian Keating (South Coast Local Land Services).

Around one third of the interviewees, however, also mentioned relationship problems within the industry. The kinds of problems they raised included: a divide between newer oyster farmers and more established farmers (SC05, MNC01, MNC02); one group of people within an industry refusing to communicate with another group (SC02, SCLB1, MNCLB3); and some farmers refusing to put the work in for collaborative efforts (MNC02, SC06, SC05).

So it is difficult to get the industry together and go, okay, we're going to try and reach a common goal and achieve that. So I mean, we get involved as much as we can and try and do what we can and donate a lot of product. But other guys are like no, I'm not donating because you're just giving oysters away for free and that's going to affect my business, and they're not going to come and see me. Pretty crazy sort of stuff. So it is - yeah, it's difficult to get a bunch of farmers together to reach a common goal and try and educate people about what we're doing and protecting our waterways and that sort of stuff.

SC05

It is possible to imagine many of these kinds of problems existing in any industry, although one interviewee pointed out that the nature of the business may lead to aquaculturists being a particular type of personality not easily given to collaborating.

You're up early in the morning, you're out there when it's blowing a gale, it's raining, you're still out there. We're not fair weather sailors, it's all weather and so if you stick to the game long enough, it weeds out the people who can't put up with that sort of lifestyle, and so you get a person who's stubborn.

MNC06

4.5.2.3 Linking social capital

Sections 4.2 and .4 of this report outline the high participation rates among our interviewees in various committees that link aquaculturists to decision making that affects their industry. The committee work described in earlier in this section as bridging and bonding social capital activities also has an important linking function, especially the connecting of committees to government agencies. Indeed, it could be said that having good cohesion within an industry is an important stepping stone to effective negotiation with decision-making bodies.

One local government interviewee (SCLG3) said that the many different groups to which oyster farmers belong could be a problem for them in getting clear messages across to government, but she felt the industry-wide Oyster Strategy overcame that potential problem. Other local government interviewees (SCLG1, SCLG2) said the connections being fostered with other food-producing industries and the tourism sector also helped strengthen requests for the state government to consider issues, because the several sectors in a region could speak as one voice .

The interview material clearly shows there are aquaculturists with good connections to decision makers in local and state governments. Farmer SC01, in particular, talked of participating in leadership courses, including the Nuffield Farming Scholarships, National Seafood Industry Leadership Program, to build his skills and contacts in ways that would facilitate linking social capital. As well as links to government he talked of how these programs gave him a wider range of potentially useful contacts with oyster farmers in other states, and with business owners in the closely related sector of capture fisheries.

In addition to these positive pictures of linking social capital, however, two interviewees who had participated in government committees over a long period of time expressed frustration that government pushed its own agenda in these meetings and was not supporting the industry as well as they felt it should. Farmer NCLB4 said that his input into meetings was “falling on deaf ears”, so he left the committee. He felt lack of government support meant aquaculture had not grown as it should, considering that demand for seafood is increasing and supplies from wild-catch fisheries are declining. According to another farmer, NCLB1:

I'm sick of the rubber stamp committees you know, it's just bullshit. They get nowhere, nothing happens and 10 years later the same issue comes up and they're running a project to find out stuff and you know, it's just - we've been through it all. Go back through your notes and have a look. It's very frustrating.

NCLB1

By contrast, farmer MNCLB1, who had experience of running an aquaculture business interstate, said that he felt the government support for aquaculture in NSW was good, and for that reason he had chosen to consolidate his aquaculture interests in the state. Another farmer (NCLB5) also appreciated the support from NSW DPI through field days, showcasing the industry and farm visits for advice, but said he felt there was a lack of support from government in terms of subsidies or incentives to encourage production. Other comments about support they would

like to see from government, included extending country of origin labeling laws to restaurants and cooked food outlets (MNCLB3); protection from competition from cheaper imported product (NCLB5); and a subsidy for electricity similar to the subsidy for diesel given to farmers and capture fishers (MNCLB3).

4.5.3 Discussion

4.5.3.1 Improving social inclusion through aquaculture

The contribution of the NSW aquaculture industry to social inclusion seems to be working well in terms of providing entry-level work for people who have difficulties securing employment, in some cases apparently changing their lives through enabling them to shift from being unemployable to having ongoing employment. There seems to be some potential for improving the contribution in terms of promoting and supporting the role of women in the industry, and the role of non-English speaking migrant groups, but neither of these were raised as issues of concern in the literature or in interviews.

Increasing the contribution in terms of opportunities for Indigenous people, however, was raised in several of the interviews and background discussions, and in the literature. There has been and continues to be plenty of opportunity for Aboriginal people to work in aquaculture businesses owned by other people. Possibly there is room for improvement in this area, but our research did not uncover evidence on this point. Background discussions and the literature, however, do point to significant room for improvement in approaches to facilitating Indigenous ownership of aquaculture businesses. On the plus side, Aboriginal people have access to suitable land, extensive experience in oyster farming, relevant environmental knowledge and a strong desire to work in the coastal environment. On the minus side, the aquaculture industry is complex technically, requires large amounts of capital, and the regulatory barriers are significant. At the same time, Aboriginal communities have suffered decades of social disadvantage meaning the relevant educational qualifications, business experience, capital and entrepreneurial mindsets needed to overcome those obstacles are in short supply (Lee and Net, 2001).

Background discussions, one interviewee (SCLG1) and one report (Lee and Net, 2001) pointed to clashes between cultural objectives and financial viability in some aquaculture ventures, such as the obligation to share food with relatives taking too much product out of the commercial supply chain. Studies of various cultural groups around Oceania have similarly found that inconsistencies between cultural and business values may in some cases render businesses unviable (McCormack and Barclay, 2013). This is not to say that it is impossible to successfully balance cultural or social objectives for enterprises with commercial sustainability: the literature on co-operatives internationally shows that in some cases such balances have been achieved, enriching producer communities in various dimensions of wellbeing (Brown and Wing Wong, 2012). Background discussions indicated that achieving the balance is more likely to be difficult for enterprises run by Land Councils, and less difficult for family-run businesses.

One benefit of the various schemes that have been tried since the late 1990s to encourage greater Indigenous involvement in aquaculture is that there are plenty of lessons to be learned from that could enable more successful initiatives in the future. Some of the factors that seem to be significant include:

- > Support must be multifaceted, focusing on all of the issues facing Aboriginal aquaculturists, in addition to the technical matters of how to grow seafood, such as:
- > Building business track record and credit access from the ground up (Feary and Donaldson, 2015)
- > Developing technical knowledge through long-term educational plans (Aquaculture Action Agenda Taskforce, 2002, Feary and Donaldson, 2015, NSW DPI, 2002, 2004)
- > Considering business models that balance social/cultural aims with financial viability (Feary and Donaldson, 2015)
- > External technical and business experts brought in must be culturally competent to work effectively with Aboriginal counterparts (this point was from background discussions with people who have been involved with NSW coastal Aboriginal communities).
- > Support must be long term, ideally built into ongoing programs from the outset of planning of development, rather than being project-based or introduced once plans are drawn up. This would mean innovative rethinking of the usual government approach, while still keeping the costs feasible (Aquaculture Action Agenda Taskforce, 2002, Feary and Donaldson, 2015).
- > Deep commitment to consultation with Aboriginal groups and building long-term effective relationships is key (Aquaculture Action Agenda Taskforce, 2002, Feary and Donaldson, 2015, Lee and Net, 2001, Umwelt Australia Pty Limited, 2001, Faulkner, undated).

Recommendation 8: *Support the development of new business models for Aboriginal aquaculture based on a thorough examination of lessons learned from the past in NSW, elsewhere in Australia and internationally, founded on a commitment to long-term involvement and deep processes of consultation with stakeholders.*

Such strategies could be developed and disseminated from the Aquaculture Subcommittee that has been set up as part of the NSW Minister for Fisheries' Aboriginal Fisheries Advisory Council (AFAC), and also from various Aboriginal Reference Groups working with the NSW Government. DPI has an Indigenous staff member working in the policy area who may also be able to contribute.

4.5.3.2 Relationships with the broader community, within industry and with government

Some of the literature on aquaculture in Australia indicates problems in terms of the industry's perception by the general public. Negative perceptions of aquaculture include reduced amenity values in visual landscapes, access to waterways, noise from boats and other mechanical equipment, and smells from seafood processing. When these kinds of perceptions are higher in the public consciousness than benefits from the industry, this can indicate a lack of 'social licence to operate'. Social licence to operate is part of risk management practice, related to profitability and business survival (Quigley and Baines, 2014). Mazur et al's (2008) study found the aquaculture industry in Australia has suffered from insufficient attention to community perceptions and failure to address lack of understanding or misperceptions through communication strategies, which have then led to failed or protracted development applications, time delays, policy and procedure changes, loss of resource access and social conflict. Brooks et al. (2010) found the following issues:

- > Aquaculture developed in Australia without the community being very aware of what it is.
- > Businesses operate independently and in some geographic isolation from each other, reducing the opportunities for collaboration to improve communication.
- > Quality information on the sustainability credentials of aquaculture is not easy for the public to access.
- > There was little evidence that the industry does actively communicate with the community.

At present the industry faces many challenges in gaining community acceptance for development and expansion because of land use changes, town planning issues or concerns about the industry's sustainability (Brooks et al., 2010 p. 15).

The current study echoes some of these findings, but also indicates that there are active efforts underway to build community awareness about aquaculture that seem to be having an impact. Interviewees, especially land-based aquaculturists, certainly mentioned dealing with opposition to development applications from some sections of the community and regulatory processes as significant threats to the industry. One large new aquaculture development in NSW took years to go through the development approval process, with initial government approval overturned by a court case, requiring further government intervention to enable it to go ahead (Tweed Daily News, 2004, 2005, 2008). On the other hand, the general public questionnaire indicates very high levels of trust in the industry (71% agree they can rely on the industry to operate sustainably, 70% disagree the industry should be closed down due to environmental costs, see Figure 18). Our interviews also show that many aquaculturists actively communicate about their industry to their communities through giving talks, participating in local environmental management committees and events, hosting visits to their facilities, being interviewed in the media, talking to customers in farmers markets and at food-related festivals, and so on. In this sense the current research resonates with

another report that found in South Australia aquaculture enjoys high social acceptability because it is seen as reflecting community values in terms of being locally owned businesses (Pierce and Robinson, 2013). Our interviews indicate that local aquaculture businesses are seen as important economically and thus are part of the community identity. The general public questionnaire shows this finding very clearly, with 96% of respondents saying they prefer local seafood because it is beneficial for local economies.

Our findings thus indicate that for NSW at the current time aquaculture's social licence is possibly greater than it was in the earlier studies. It would be worthwhile investigating the effectiveness of the various communication activities the industry is undertaking and identify areas for improvement. For example, there is a new website specifically about NSW oysters (www.nswoysters.com.au), with a newsletter (<http://www.nswoysters.com.au/nsw-oyster-newsletter.html>) aimed at improving communication within the industry and the broader community. Mazur et al's (2008) study showed that women, community groups and local government are all more likely to focus on negative risks and seek regulation to mitigate them, and so communication strategies should target these groups specifically. The demographic details obtained for our questionnaire were slightly different (they did not identify local government or community group respondents), but they similarly indicate that women need more convincing than men, and people with university degrees and younger people trust the aquaculture industry less (see Figure 18).

Our interviews demonstrate a mixed picture regarding relations within the industry, and between industry and government. Previous studies have found there is insufficient coordination and collaboration within the aquaculture industry in Australia (Brooks et al., 2010, Mazur et al., 2008, Schrobback et al., 2014a, Acil Allen Consulting, 2015), with around half of the Sydney Rock Oyster farmers surveyed in Schrobback et al's (2014a) study reporting that industry bodies were ineffective in supporting their industry. Brooks et al. (2010) found that oyster industry relations were not cohesive, in part due to consolidation of leases leading to fewer businesses in each region. The interview material presented in this section, however, shows that many aquaculturists are actively pursuing intra-industry collaboration, largely through membership of industry associations.

Relations between government and industry have improved over time. The historically poor relations arising from NSW DPI's handling of the Pacific Oyster situation in the 1980s (Clarke, 2013) were not raised by any of our interviewees, even though some had been in the industry through that period. A study of the NSW oyster industry (Acil Allen Consulting, 2015) found problems with research and development (R&D) in that Government R&D is not well utilised by industry, and industry itself underinvests in R&D. However, only one interviewee, NCLB1, had negative things to say about R&D as an aspect of government relations with industry. Several interviewees expressed a desire for more government support to cope with high production costs in relation to imports, pointing out, for example, that Australian primary producers using diesel receive a rebate whereas aquaculture businesses using electricity do not. One interviewee said he had relocated to NSW from another state because of better government support of industry in NSW. Compared to the wild-catch professional fishing industry in NSW, which

has had low membership of industry associations that can represent industry in discussions with government agencies (Voyer et al., 2016), the aquaculture industry is in a much better situation. Most of our interviewees were members of more than one industry association, and the various committees raised in this section for both industry promotion and water quality management provide bridges to building relationships with government. The Shellfish Committee and Aquaculture Research Advisory Committee are intended to encourage relations between industry and government. In addition to meetings, there are services to disseminate information to the industry more broadly, including through updates via text messaging to mobile phones.

Recommendation 9: *Undertake an assessment of the effectiveness of aquaculture communication strategies including: 1) how well current efforts to improve the social licence of aquaculture are working in NSW, building on earlier studies of community perceptions of aquaculture, identifying what activities are working well as well as areas for improvement; and 2) the current state of intra-industry relations in terms of achieving effective collaboration.*

4.6 CULTURAL HERITAGE AND COMMUNITY IDENTITY

Table 30 outlines the main indicators and methods used to investigate the aquaculture industry's contributions to cultural heritage and community identity.

TABLE 30. Indicators and methods for investigating the contributions of aquaculture to cultural heritage and community identity

Contributions of the aquaculture industry		Indicators	Methods
Material	Contributions to the history of NSW coastal towns/regions	Historical role of the industry in regional growth and formation	Literature review
		Cultural heritage related to aquaculture	Qualitative interviews
Relational	Contributions to cultural heritage and community identity	Historical role of aquaculture in Indigenous communities	Literature review
		Historical involvement of diverse ethnic groups in aquaculture	Qualitative interviews
		Community identification with aquaculture heritage and notion of 'oyster towns'	
Subjective	Importance to the community of the aquaculture industry's contributions to a shared sense of community identity and local cultural heritage	Concern over decline in aquaculture	Literature review
		Participation in community events and activities led by aquaculture industry	Qualitative interviews

The qualitative interviews explored ideas around three main indicators across all three wellbeing types (material, relational, subjective):

- > The historical role of the industry in regional growth and formation of towns
- > Contributions to cultural heritage, infrastructure or artefacts as well as 'intangible' heritage such as food culture
- > Community identification with the aquaculture industry as feature of their place, for example, a sense of place as 'oyster towns'.

4.6.1 Contributions to the history of NSW coastal towns

Systematic oyster farming by White settlers first began in New South Wales in 1872 on the banks of the Georges River. John Clarke's (2013) history of oyster growing in Port Stephens notes "the tremendous contribution oyster folk made to the emergence of the coastal towns in which they settled." p 183. For an overview of some of the key stages of the history of aquaculture in NSW see Section 1.1 of this report.

Part of the cultural heritage of rural towns is built through having multiple generations of families working in an industry, building it over time. Reviews of the oyster industry have noted that there is a high level of turnover, with many farmers having entered the industry within the last five years (Acil Allen Consulting, 2015).

Nevertheless, there are still some long-term farmers in the aquaculture industry. Several of the aquaculturists we interviewed were part of multigenerational businesses, and some of the local government interviewees also discussed this as part of what the industry contributed to their community. Many of our interviewees talked about oyster farming being ‘in their blood’, others discussed the roles that key aquaculture families have played in the development of towns along the coast:

[Oyster farming]’s been around for five even six generations in – certainly in Batemans Bay and no doubt a little bit further down. That’s in the Clyde River... It’s been fostered for a long time in the region.

SCLG2

We’ve been in business for 50 plus years. We farm Sydney Rock Oysters... [The owner]’s a third generation oyster farmer. So his grandfather moved to Forster, I don’t know, 100 years ago [laughs] to manage an oyster farm here... His father then had some oysters of his own which he left to [the owner]. So there’s three generations.

MNC08

We’ve been here since what the early 1900s and we’ve had oyster leases in this place. Like my - we’ve been - we come here fishing, started fishing here in 1888 and I think my grandfather was oyster farming - I can’t - I’d have to look up when they first took the leases up, but it was early 1900s. So there’s been oyster farming in this place for a long, long time and the community has a sort of connection with it and to demonstrate that, the fact that they got their environmental levy in this place so easily back in the day...

MNC06

My father is still alive and is 87 and he’s been farming since he was 14. So he and his brothers, five brothers started an oyster company in Georges River and they functioned there together in - for probably 20 years... So I’ve come into here and took over from my father and I’ve got two sons who’ve come into the business here with me now.

MNC05

South of Batemans Bay the interviewees noted that aquaculture is a newer industry there but even so some oyster farms have been operating for two generations.

I mean I’ve been here for - I’m 53 and I started work when I was 15. I’ve been here for a long time, so more people... Yeah, know me, the oyster farmer. Yeah, I started working with dad.

SC03

I’m second generation. So my father bought the farm back in the early ‘80s I think it was. Before then, he was part time. He was a public servant working in Canberra. Then was a part time oyster farmer. Then a big farm came on the market, so they decided to up sticks and move down to the coast. We’ve been here for 34 years now. Something like that.

SC05

Land-based aquaculture started in NSW with Salmonid and aquarium industries and in the prawn and native fish industries in the 1980s, so it is much less usual to speak of multigenerational land-based farms. One of the prawn farm managers (NCLB5) we interviewed noted, however, that the farm he worked for had its third generation now working on the farm, with one of the original owner's great grandsons also interested and working during his school holidays.

4.6.1.1 Heritage, aquaculture and Indigenous coastal communities

The Aboriginal fish traps in the Brewarrina region of NSW still exist today and stand as a testament to Aboriginal knowledge of engineering and fish migration. In Victoria there are also remains archaeological evidence in the Lake Condah region of a settled Aboriginal community farming eels for food and trade in what is considered to be the earliest and possibly largest land-based aquaculture venture in Australia. Aboriginal people have also been extensively involved in aquaculture since White settlement.

It was well acknowledged that without their participation the industry would not have expanded and developed in the way that it did. Highly respected by all, the Aboriginal involvement and contribution must never be underestimated. Their total contribution, work skills and their very nature led many in the oyster business to conclude that the industry would have struggled, some say floundered, but for the efforts of these proud Aboriginal families

(Clarke, 2013, p. 52).

John Clarke's (2013) history of oyster farming around Port Stephens names some of the key Aboriginal families who have worked in oysters around the area, including the Lilley, Ridgeway, and Manton families. Oysters had long been an important food for Aboriginal people, as shown by the enormous and ancient middens of shells that dotted the coast, and in some cases still remain (many were mined as a source of lime for early settlement period construction). Aboriginal people also used oyster shells to fashion fish hooks and cutting tools. There are efforts within communities to protect the Aboriginal heritage relating to oysters in their area.

Pambula Lake in particular has an amazing set of Aboriginal oyster middens, possibly the best example in Australia of oyster middens. So that's certainly something that the Pambula oyster industry are very proud of and are working with National Parks to try and preserve. Because we're finding that they're being impacted at the moment by jet skis, water skis and wake boarding, just that environmental erosion. So we're sort of working with National Parks at the moment to try and see what we can do with that.

SC04

Talk to some of the Yuin people, who are traditional First Nation people who - that means they're water based in terms of their food and all their traditional - if you have a look at some of the middens - inland middens that just shows you they did thousands of years ago. It's fascinating the history and hopefully

that doesn't get lost too much. That's - for thousands of years they used to come down the coast and then - this was explained to me - travelled up the - there was these junctions where they would... There's massive middens there and they've been doing that - as you say - for thousands of years until they've... They would be the - I think the experts in aquaculture...

SCLG1

Other interviewees explained how they felt Aboriginal people's heritage with coastal Country, including oysters, helped with the work of oyster farming, for example,

Because if you think about it the Aboriginals have been probably doing this longer than we have.

SC06

According to local government interviewees on the South Coast (SCLG1 & SCLG 2), Aboriginal food culture around oysters has also been celebrated in some of the promotional work around local food and tourism on the South Coast, with recipes featured in the television program *River Cottage Australia*.

Previous studies of the importance of coastal areas for Aboriginal groups have shown that cultural connection and community identity through caring for and using the resources on Country are foundational to their heritage. In addition to the heritage, communal and personal identity benefits from producing and sharing food from the natural environment, these activities also give Aboriginal people benefits in other dimensions of wellbeing – providing nutritious food for low-income communities (economic and health benefits) and enabling people to maintain and pass on their knowledge about Country (educational benefits) (Feary and Donaldson, 2015).

4.6.2 Importance of aquaculture to cultural heritage and community identity

Cultural heritage is the legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations

(UNESCO, 2016).

Cultural heritage refers to the ways of living developed by a community that are passed on through generations, including customs, practices, places, objects, buildings, and tools. It includes both tangible and intangible things. Cultural heritage helps inform the way a community sees itself and helps to build a sense of common purpose and values.

Aquaculture as an industry has not physically shaped coastal towns in the way other industries have, such as fishing with wharves and co-operatives and visible working fishing boats in the centre of town. In some areas, however, such as around Port Stephens, where the oyster industry has a long history and a very large presence in the waterways, the oystering equipment in the water and on shore has become part of the local landscape. Some places along the coast have been known as oyster towns.

So oysters are really the only thing that it's sort of known for really and Karuah is sort of an oyster - a little oyster growing area.

MNCLB1

The fact that you can see the oyster leases, they're kind of part of the river. They're very much a visual part particularly if you're on the river or around the river in certain areas. They're quite a visual kind of component and a very traditional part of the community interaction with the river... But certainly with the oysters there were certain families that you associated with oysters and they were sort of well-established family groups that you knew were the oyster families. So it was really part of that, that Tweed identity.

NCLG2

FIGURE 23. Oyster Farm Rd in Lemon Tree Passage (photo credit: Andy Myers)



In other parts of the coast oyster farms are located in less visible waterways and so have not been a part of the visual sense of place. Even when the actual farms are not easily visible, however, knowledge that they exist as part of the town means they can be identified as a key part of the community.

So oystering is probably not out there in the flashing lights, I suppose, about being an oyster industry on the Hastings River... because you can't see it in town. We're hidden away a bit. If you don't come on the river you don't really know there's an oyster industry here.

MNC02

I think that people in this community see that as part of their - part of what they - where they come from. They know there's an oyster industry in the background. They know that it's part of the area, they're likely to pull you up in the street and ask you how the game's going. They're interested in how the game is going... [It's] part of their backyard... Yeah it's an integral part of the community and they [hear] plenty about it and they're accepting of it, you know?... I think mainly just through media and through local governments, what they generate in the way of newsletters and what not, all the events and stuff they have. They make sure they get the word out there.

MNC06

So we also create a lot of opportunity just through that networking and word of mouth that - it means that the community feels that they are part of the aquaculture journey and are a part of aquaculture, even if they're sitting in an accountant's office. They actually understand that they're part of that bigger story.

SCLB1

Land-based aquaculture farms tend to be even further away from public view, in areas out of town and not directly on the waterways. Many of the fish, prawn and yabby farms also have their main markets in capital cities rather than in the local towns, so in that way they are also less in the community view. The fact that the land-based farms have started only since the 1980s means their history is not as long as that of the oyster farms. Several of the land-based farm managers we spoke to, however, said the families that owned the farms had become prominent in their small communities over the decades and so may be building community identity even without their infrastructure being in the public eye or their product prominent in local shops.

4.6.2.1 Contribution to community identity through food and the natural environment

Aquaculture's contribution to community identity was visible in the interviews in two main ways. One was through being local food producers, including the connections they have with tourism. The other is that community identity has been built through environmental stewardship activities led by aquaculturists and associated with aquaculture (see Sections 4.4 and 4.5). Often both ways of building community identity are at play:

I think the South Coast and oysters are - people correlate coming down the South Coast with oysters, that - whether it's just chipping them off the rocks or buying them for Christmas. There's a lot of nostalgia towards oyster farming in our region. So it's - yeah I think it's key to the region's identity... fresh oysters.

SC01

Locally, I think there's a certain amount of community pride if we produce a good product. You know, I think people say that we have an oyster industry and so because we have an oyster industry, we have a healthy river. I think that goes together.

MNC02

So just to give you a little bit of context I suppose about the Tweed, we're really lucky in that the catchment of the Tweed River is actually within the local government boundaries. So we see ourselves as quite a nice contained catchment as well as a local government area. So it gives us that sort of identity in that we have control - control, that's probably not the best word but from catchment management perspective, we've got from the top of the catchment right down through into the estuary and offshore.

NCLG2

These types of community identity are actively fostered by aquaculturists themselves, and also by tourism promotion organisations. For example, local government interviewees from the South Coast talked of how tourism promotion campaigns build an image of place for an external audience of visitors, but then it is taken on and 'owned' as community's identity by locals.

We're the heart of Australia's Oyster Coast... the way that tourism works in this region it actually has an impact on the rest of the population. People then get to own the space. I remember many years ago there was a threat of a charcoal plant coming to the region. At the time...[laughs] It was branded as Nature Coast and it was really amazing how thousands of people - literally one third of the population of Eurobodalla walked on a march on one day in order to own the space as Nature Coast and they've not let go of that. People see themselves as unspoilt, natural et cetera. All those things - the oysters - as soon as they own a particular piece of the area they're really passionate about it... If it any time - we just shudder if someone says the - there's been an outfall of - I don't know - maybe the sewage is - or there's been a lot of rain and it causes x, y, z. You go Oh my goodness. Everybody gets actually... then think that Oh my goodness our oysters.

SCLG1

The combination of different sectors created in images of a region can add strength to the community identity.

When you can turn up at an event with oysters and cheese then that's - there's your identity from a food base. Rather than just a surfboard or a bucket of sand, - we've got beautiful beaches but we're more than beaches. That allows us - that gives us a lot of credibility in order to make those statements as a region.

SCLG2

Aquaculturists also talked of actively building a sense of community around their activities in ways that benefit their businesses, but also have benefits for the environment and for other residents in their areas. These benefits includes building awareness about water quality issues and participating in events that showcase local produce.

I just think because the oyster industry is putting a fair bit of effort into building that social licence it actually, yeah, is definitely building into that community identity as well. I think that, again, a lot of tourism, a lot of cafés and

restaurants really sell on the back of having a healthy, vibrant, well-awarded oyster industry... we had that there were lots of individual farmers who were out doing community events and things just to make sure that people were aware that there was an oyster industry and that we need to look after that water... So we need to work really proactively with the community and I think we're doing it really well down here at the moment.

SC04

We did participate last year in a very successful gate-to-plate, which was a showcase of local produce held in Yamba, and we actively participated in that. It was a social interaction, I suppose, and letting people know that along with a lot of other people, there's some sleeping giants out here. People weren't aware of our product and how good farmed prawns can be... So it showcased the region. I don't know how many hundred people went through it...

NCLB5

The Wonboyn tour that we had the other day actually, they had a number of the councillors and the council staff come along. They had sort of a seafood feast for them to eat at lunchtime and showed them a number of the catchment issues while we were out there too. So just, yeah, they're quite good at doing those things more locally and I think that helps to build the image and sort of stamp the community as an important place for oyster industry and the oyster industry as an important part of the local community.

SCLG3

Narooma - the Oyster Festival. That's an annual event... People are proud - you're proud on the weekend to welcome hopefully lots of people from the outside to have a look at the event...

SCLG1-2

4.6.3 Discussion

Along with fishing, forestry and farming, the oyster industry has been one of the key primary production industries that shaped European settlement of the NSW coast from the late 1800s and throughout the 20th century. In the waterways around Port Stephens, oyster farming was a huge part of regional development, and the physical infrastructure became part of the landscape of this area, for example, oyster growing equipment in the water, punts plying the waterways, and sheds on shore. In other locations oyster farming was conducted in waterways less visible to the general public. Other land-based aquaculture has also been located in places away from public view, and the contribution of these kinds of aquaculture is not to the physical and visual heritage of towns. Rather, the families and active businesses contribute to heritage through the social fabric of the towns. This is particularly the case for multigenerational aquaculture farms. Aboriginal communities have also played an important role in the history of aquaculture in NSW through being the first aquaculturists, helping European oyster farming to become established, and forming a key component of the oyster farming workforce. Some work has been

conducted by NSW DPI and aquaculturists to preserve images and documents, including through the Aquaculture Research Advisory Committee (ARAC).⁴

Recommendation 10: *Include the aquaculture industry, especially multigenerational farms and Aboriginal involvement in aquaculture, in local public history activities, in preserving oral histories, documents and pictures, and in memorialising events and monuments.*

Interviewees indicated two interrelated ways that aquaculture contributes to a sense of place and a community's identification with it. One way is through images of fresh local seafood and a beautiful natural environment promoted largely for the tourist market, but which local people then take on and own as part of their sense of place. We might say that aquaculture is, or is becoming, part of the 'intangible heritage' of food production in those communities, it is part of a 'food community' (UNESCO, 2016, Ecotrust Canada, 2013). This reflects a broad cultural trend towards food localism, connecting with a culture of place through food, as is visible in farmers' markets and festivals that celebrate local produce. The other way is through aquaculturists being concerned about catchments as ecological regions that affect their businesses; aquaculturists then become leaders in community efforts to look after the environment. In both cases we can see in NSW aquaculture something similar to the findings of a study in South Australia, which concluded that the aquaculture industry contributed in regional towns to increased 'community spirit' and 'community pride' (Pierce and Robinson, 2013).

Recommendation 11: *Build on ongoing efforts promoting aquaculture as part of local food cultures, local economies and local environmental stewardship.*

⁴ For example, see a collection of historic photos of NSW aquaculture on the ARAC website: <http://www.dpi.nsw.gov.au/fishing/aquaculture/committees/arac> (accessed 21 November 2016).

4.7 LEISURE AND RECREATION

Many of the quality of life frameworks examined through the literature review for this Project emphasised the importance of leisure and recreation, or work-life balance, to community and individual wellbeing. This includes opportunities for fun, play, sport and participation in the arts and cultural events. Table 31 outlines the main indicators and methods used to investigate the aquaculture industry's contributions to leisure and recreation.

TABLE 31. Indicators and methods used to investigate the contributions of aquaculture to leisure and recreation

Contributions of aquaculture industry		Indicators	Methods
Material	Contributions of the aquaculture industry to community recreation – visitors and locals	Utilization of aquaculture product through food retail and hospitality sector	Qualitative interviews Social questionnaires – fish merchants, tourism operators, general public
		Utilization of aquaculture product or facilities in tourism	
		Recreational fishers using fish aggregating tendencies of oyster farms and sea cages	
Relational	Connections between the aquaculture industry and recreational users	Market channels for local aquaculture product	Qualitative interviews
		Accessibility of aquaculture facilities for locals, tourists and recreational fishers	
Subjective	Importance users put on local seafood and infrastructure for recreational boating, kayaking and fishing	Importance of fresh local seafood for special occasions locals and holiday-makers	Social questionnaire – general public
		Importance of aquaculture sites for recreational fishing, kayaking and boating	Social questionnaire – fish merchants Qualitative interviews

The greatest contribution the NSW aquaculture industry makes to this dimension of community wellbeing is through the production of foods that are enjoyed on holiday or other special occasions. The interconnections between tourism and aquaculture were discussed at length in Section 4.1. Preferences for local seafood were discussed in Section 4.2. In this section we consider the contribution of locally produced seafood in a different light, considering the enjoyment of food as part of people's recreation and leisure activities.

Other contributions the aquaculture industry makes to this dimension include providing:

- > Spots of interest for tourists to visit – to come and see how the aquaculture is done, to come to the shed to buy oysters from the farmer, to go past on a river tour or to go visit on kayaks
- > Good recreational fishing spots around shellfish leases or sea cages (fish aggregate around these)
- > Aquaculture stock enhancement programs for freshwater and native species.

4.7.1 Supply of food for leisure and recreation

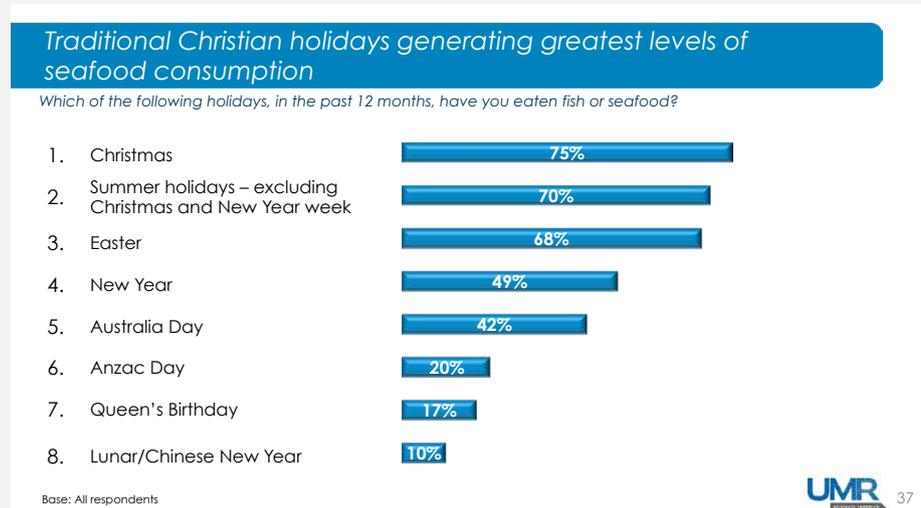
The general public questionnaire specifically asked about whether people expect to eat locally produced seafood when on holiday at the coast (89% agreed), and whether it is important to them to eat local seafood when on holiday at the coast (76% agreed) (Figure 24). The questionnaire responses of fish merchants and tourism operators supported these results, with them also agreeing it is important to their customers to eat local seafood (see Appendix 2).

FIGURE 24. General public questionnaire – expectations, importance and interest in aquaculture while on holiday



The general public questionnaire also revealed that NSW coastal residents have a strong association between major celebrations like Christmas and Easter and seafood consumption (Figure 25). The Christmas and summer holiday period can be viewed as the 'seafood season', with 75% of respondents indicating that they consumed seafood the previous Christmas and 70% the previous summer holiday period (excluding the Christmas and New Year week). Easter is also strongly associated with seafood – 68% of respondents indicated they had consumed seafood the previous Easter. There was very little variation in these figures across the eight study areas. The exception to this was the Sydney and Far North study areas, which showed significantly less incidences of consumption of seafood over Easter than the other regions (59% and 45% respectively) (see Appendix 2).

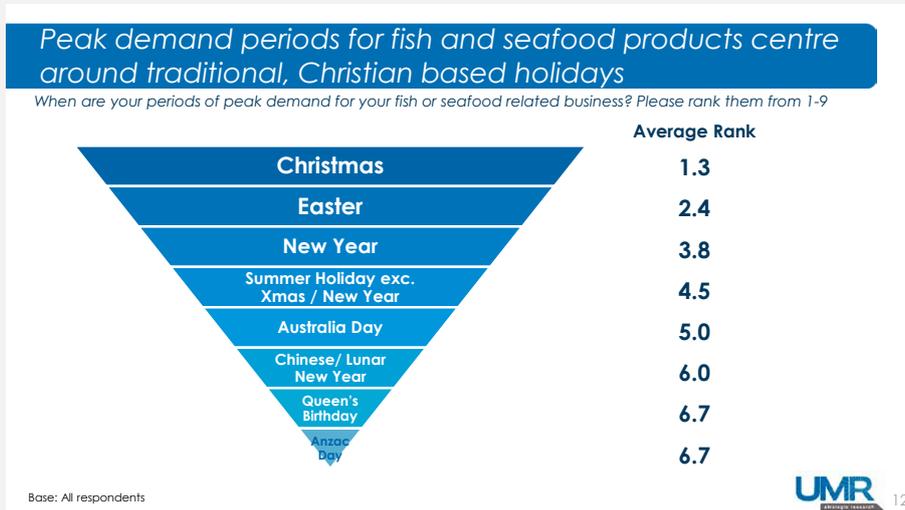
FIGURE 25. General public questionnaire – seafood consumption and celebrations



These holiday periods, not surprisingly, are also the peak demand periods for NSW fish merchants (retailers and wholesalers). Christmas was consistently rated as the number one demand period for seafood sales across all the types of businesses surveyed (Figure 26). Whilst traditional Christianity-based holidays dominated, festivals of importance to other cultural groups within the community, such as Lunar New Year⁵, were also significant periods of seafood sales for NSW fish merchants. It should be noted that in terms of demand for Sydney Fish Market, Lunar New Year is close to Christmas and Easter, so the average ranks spread across merchants from along the coast do not represent the situation for each merchant (Figure 26).

⁵ Lunar New Year is often called Chinese New Year in Australia, but since Vietnamese, Korean and other Asian groups also celebrate Lunar New Year as the most significant festive event of the year, it is more accurate to call it Lunar New Year.

FIGURE 26. Fish merchant questionnaire – peak seafood demand periods



4.7.2 Supplying food for leisure and recreation

Interviewees talked about their aquaculture product being mostly used for special occasions, in part because it is relatively high cost compared to imported seafood. This was certainly the case for oysters and prawns, which have long been used by people of Anglo-Celtic backgrounds for celebratory meals, including Christmas. Interviewees MNC05 and MNC06 were interviewed together. This was their perspective on the role of oysters in coastal holidays:

A lot of the tourists come here because we're here. They come here for the oysters a lot of them. They come here over that Christmas - that summer period for the oysters because they're so fresh. They get them fresh and they can't do any better than that.

MNC06

I don't think they travel up the coast saying we're going to stay in Forster because of the oysters.

MNC05

No, but it's part of the reason.

MNC06

It's definitely a bonus... We've got the ocean and the lake, they're a bonus and on top of that we've got really great oysters.

MNC05

It should be noted that other aquaculturists, such as SC06, did say that some of their customers came to their area specifically for the oysters.

Land-based farmers talked about their silver perch going to Asian restaurants, presumably for meals to be enjoyed by groups of people, and yabbies being sought

after by both by city restaurants and people on holiday from the city. In this sense aquaculture product is being used in leisure and recreation around shared and/or celebratory meals when people are at home and when they go on holiday. The following quote shows how aquaculture product and facilities may be enjoyed both by locals and tourist as part of their leisure activities:

There's the Richmond Oysters and that's a great facility for the community. It's somewhere that you can go on the sheltered waters and they sell direct from the shop front there. So it's open to the public.

NCLG3

4.7.3 Tours, recreational fishing, boating and kayaking

Around a third of the aquaculturists interviewed noted the contribution their industry makes to the enjoyment of recreational fishers. Mainly they discussed the habitat and food that shellfish farms provide for other fish and make their leases good places for recreational fishing. Land-based farmer NCLB2 noted that his effluent drain was a favourite local fishing spot.

Now without our infrastructure out there, they wouldn't have anywhere near the fish to catch. It creates a safe haven, yeah ecosystems for the fish which then creates recreational fishing, which then - the spin off from that is far and wide and worth millions to the community.

MNC05

It actually provides a really good fish habitat. So what's happening is a lot of people come - like to go fishing around aquaculture leases because they know that's where the fish tend to go. So that draws in a lot of people as well. So that gives people - the alternative is just going around the lake finding things they say. Especially if you're working a lease and you're turning the bags and there's like the little bag fish go out, a lot of fish will swim with you. Or the seagulls or birds. You have a lot of bird activity.

SC06

Oyster farmer SC04 noted that in addition to shellfish leases providing food and habitat for fish, the fact that oysters are being grown for food in the area gives recreational fishers peace of mind that the fish from that area will be safe to eat, because the water quality will be good. Other interviewees noted that recreational fishers are very interested in fish farming and like to talk about it, including with land-based aquaculturists (NCLB1), and that yabby farming provides a source bait for recreational fishers (MNCLB1, MNCLB5).

Relationships between oyster farmers and recreational fishers, however, are not always cordial; many of our interviewees mentioned that boaters sometimes damage equipment on the oyster leases. The NSW Shellfish Committee is developing a communication strategy and education program to be rolled out through Maritime Services and DPI recreational fisheries managers to address this problem.

Sometimes the rec fishermen do damage our equipment and things like that, but what do you do [laughs]? Sometimes it can be quite frequent, around the holidays. You get people from out of town that don't know the water or anything and sometimes they'll drive their boat straight through the middle of it and... causes quite a bit of a mess for me.

MNC01

Most - you've got a percentage of people who have enormous respect for the industry and our infrastructure and do give a damn, but there's a group - an ever growing percentage who don't give a stuff. They'll drive over anything they like if they think they're going to get an extra flathead to do it.

MNC03

In addition to enjoying the eating of aquaculture product in meals as part of leisure and recreation, many people enjoy visiting where the product is farmed and buying direct from the farmer, or eating it fresh at the farm.

The tourism mob say, if you want to see oyster farming, come down Point Road, Tuncurry... So we quite often get them to come in. They come in and they ask questions or they get a couple of a dozen oysters straight from the farm.

MNC05

FIGURE 27. Sign to attract customers to buy oysters direct from the farmer (photo credit: Andy Myers)



The outlets, certainly in Batemans - well they've got it all the way down and that is they'll build their wharf - they'll have their farms, but inevitably they'll also have like a boatshed that they then sell direct from, so it's farm gate sales. They become good areas I know for picnicking, certainly on the Clyde River. There's the kayaking... One of the local kayak businesses does tours of... the oyster farms... leases in collaboration with the oyster growers. You get this thing that includes some tasting... champagne and oysters. We send - we usually get our journalists if they're doing a kayak at the moment, because it's a hero experience, it'll be okay, you can eat it but you can also go up to the farm. They'll give you the oysters and then shuck it in front of you and you get to eat it there and then on the spot.

SCLG1-2

In some places along the coast where there are tour boats working the rivers, oyster farms are included as points of interest on the tours. For example, during fieldwork Nicki Mazur observed that several of the tour boats operating around Port Macquarie point out oyster farms, and one tour boat features oyster farms as a highlight of their tour.

Yeah, there's Camden Cruises, they are actually - they've only been around for about two years, I'd say, but they quite often drive up the river and there's oyster leases everywhere and sometimes they'll be going past when we're working up there and lifting things out with a crane and all of that sort of stuff. So there's always a few photos and things like that... I think a lot of people see it and they decide to go and buy a dozen oysters later that afternoon.

MNC01

FIGURE 28. Signs showing oyster businesses along a river (photo credit: Andy Myers)



There is also tourist interest in visiting land-based farms. One fish farm had so many people turning up wanting to view their farm they started offering tours and meals as part of their business.

We're in a really isolated spot. We're not on a main road. The reason why we went ahead and built the restaurant and the tourist centre was because every time we'd turn around someone was knocking on our door wanting to have a look at what we did... People basically I suppose heard about us through word of mouth. Prior to having the tourist centre here we'd always get people popping in to have a look at what we did which really meant that you had to either be rude or tell people that you couldn't show them through or waste an hour that you don't have.

MNCLB3

The other land-based aquaculturists we interviewed did not encourage tourists or members of the public to visit, for safety reasons.

No one really wants the public to come out here and hang around. It's sort of, you know you're dealing with machinery and electricity and slippery banks. I get a few of these old [recreational] fishermen that come out and get the weed to go after their blackfish... and I'm just waiting for the day that they break a hip or something and sue me.

NCLB4

Also because of bio security as well we just can't have people walk in. We don't know what diseases they can bring. We're very conscious of that. It's invitee only.

MNCLB5

This indicates there is possibly unmet demand in terms of aquaculture being a point of interest for tourists visiting coastal areas.

Some interviewees also talked about infrastructure around rivers provided by or for the oyster industry that is also used by recreational fishers, boaters and kayakers

People come down and fish off the wall here, all the time, because it's nice and concreted...

MNC08

But what we've found over the years is, there's a lot more people in our estuary that use kayaks or canoes. So they're not motor driven vessels. So they actually love to launch them on our little very shallow sloping - it's like a little rock boat ramp. A lot of them do it on that because there's a little beach, there's a little table nearby. So they actually launch there... So they've got the benefit of that. So if wouldn't have put that say oyster boat ramp in, they wouldn't have that.

SC06

There's been improvements to the parking area just at the Wapengo sheds even though that's not a designated public boat ramp it tends to get used and the oyster farmers allow the public to launch across their lease there. So yeah, they sort of work pretty actively in maintaining those facilities for the public and for their own use as well.

SC04

4.7.4 Discussion

Aquaculture's contribution to leisure and recreation is largely in the form of providing food for special occasion meals – at restaurants, for celebrations at home or at restaurants, and when on holiday. This is closely related to the 'resilient local economy' wellbeing dimension that connects the tourism and hospitality sectors to the 'community health' in terms of NSW residents' strong preference for locally produced seafood, especially while on holiday. The material aspects of this contribution are in terms of the food itself. Subjective aspects are in terms of the importance consumers place on having access to food produced by aquaculture for special meals and being able to fish around shellfish leases and visit aquaculture facilities for recreational purposes. The relational aspects are in terms of the market channels that give people access to locally produced seafood.

The other main contributions to leisure and recreation that aquaculture makes are around providing locations and facilities for people to enjoy fishing, picnicking, boating and/or learning about aquaculture. This contribution has a material aspect, and also relational aspects with interactions between producers and visitors occurring through these activities. The tourism and aquaculture sectors have mutual interests in clean waterways connected to people's recreational enjoyment of coastal landscapes. This finding echoes the results of one New Zealand study that found 19% of people surveyed experienced a positive impact from the industry due to the presence of aquaculture improving the recreational activities of fishing and diving (Robertson and Comfort, 2014). Our findings also indicate that the recreational fishing community could be a part of the broader public support for aquaculture and be particularly interested in any new opportunities to interact with it. The general public questionnaire indicated that among the general public 63% of respondents were interested in visiting an aquaculture facility while on holiday, but among recreational fishers the interest rate was 73% (see Appendix 2).

Recommendation 12: *Build awareness of the recreation benefits of aquaculture infrastructure, as well as about taking care not to damage equipment when boating in the area.*

Recommendation 13: *Improve availability and visibility of local aquaculture product in coastal regions for the enjoyment of holiday makers. This could include collaborations between producers, tourism operators, tourism promotion organisations, hospitality and food retail businesses to make sure there are places to get fresh local seafood.*

4.8 Assessing the strength and importance of industry contributions to wellbeing

This research Project has established an approach to evaluating aquaculture industry contributions to community wellbeing, investigated each of the key component areas, and measured some of them. As a mixture of economic and social indices, there is no “right” weighting for the perceived importance of each of the contributions to community wellbeing. In this section we propose a method for investigating the values for each attribute held by different stakeholders.

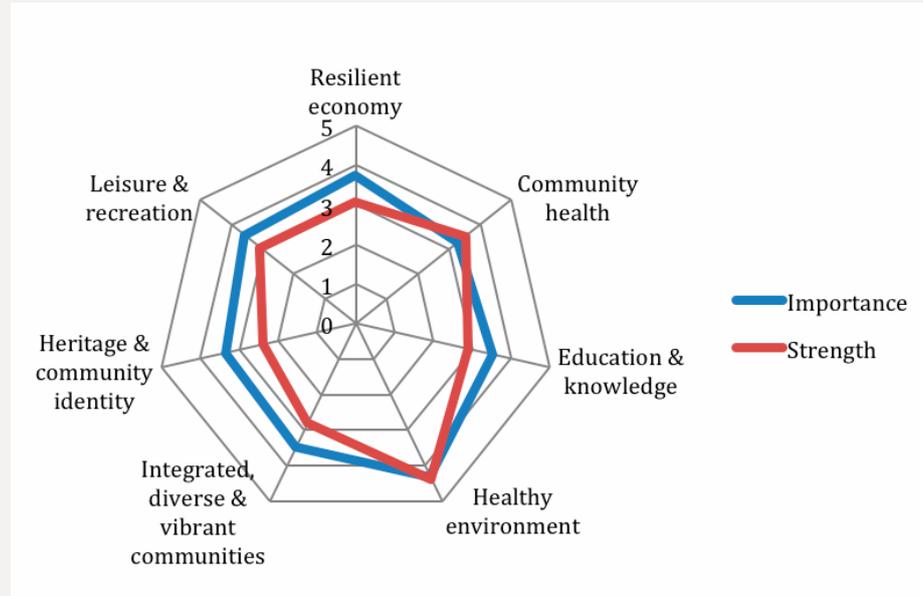
We present a new tool for assessing stakeholder perceptions of the strength and importance of industry contributions to community wellbeing. The tool was trialled at a workshop of our preliminary findings held with the project Steering Committee. If the tool is to be used further as part of ongoing monitoring of social and economic contributions, it should be tested with larger groups of industry and government stakeholders, and also with community representatives. A comparative analysis would be useful to enable the different perspectives held by industry, government and the community to be identified in an open context. The comparisons are communicative and can assist each of the parties to realise differences in worldview and also different priorities related to the roles of each of the sectors. There are also issues of exposure, with government and industry and the general public not having many opportunities to exchange their respective perspectives.

This trial run provided some useful pointers for which of the contributions are at highest risk, and for similarities and differences between the perceptions of the value and strength of industry contributions to community wellbeing. With further development the tool could be a beneficial part of an ongoing methodology for monitoring the social and economic contributions the aquaculture industry makes to its communities.

4.8.1 Stakeholder workshop

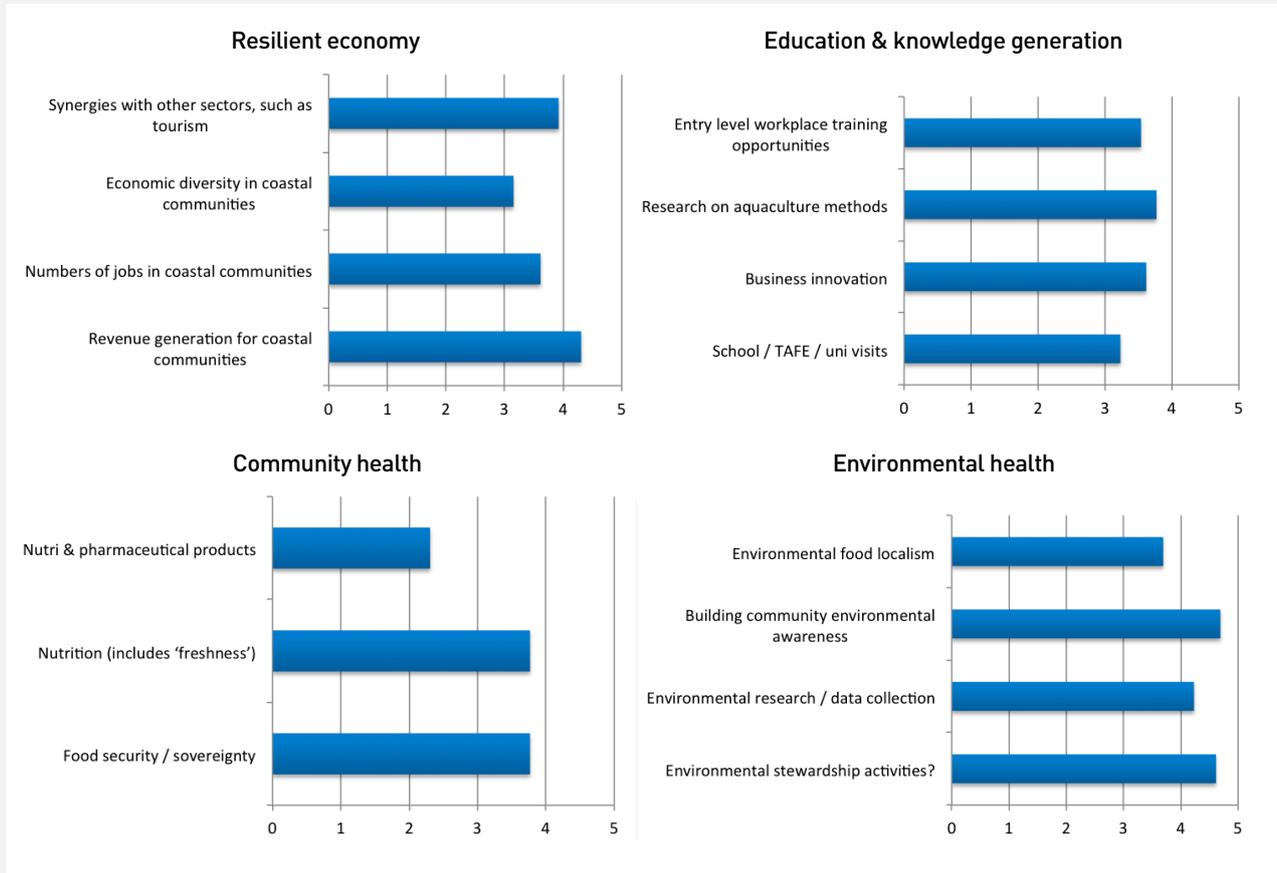
A workshop was conducted on 22 July 2016 including five industry representatives, two DPI staff, the researchers from this project and several others, including a representative from Oceanwatch, the Sydney Fish Market and FRDC (21 participants in total). The project results were summarised for the attendees, and the workshop participants were asked to give each dimension of wellbeing a score out of five in order to rate both the importance of the industry’s contributions to each dimension of wellbeing, and the strength of those contributions. The individual ratings were averaged to provide an overall assessment of strength and importance of the contributions (Figures 29, 30 and 31). See Appendix 6 for the full set of questions used.

FIGURE 29. Stakeholder assessments of strength and importance of industry contributions to dimensions of wellbeing



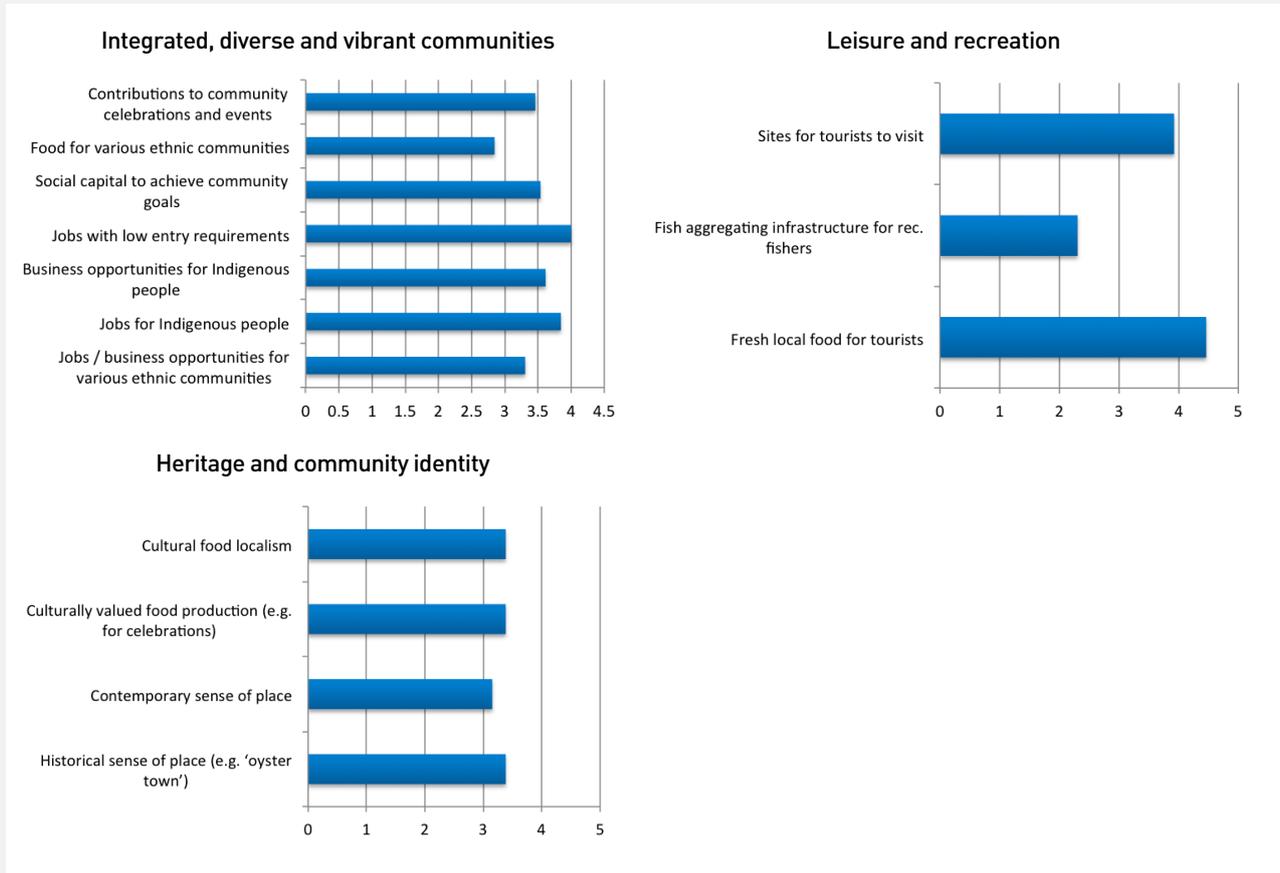
Note: See Appendix 6 for the questions used. For importance this shows aggregate scores for groups of questions on component parts of each dimension. For strength participants were asked a single global question for each dimension.

FIGURE 30. Stakeholder assessments of importance of component parts of aquaculture’s contribution to dimensions of wellbeing (1)



Note: The numbers in these graphs are the average scores participants gave those components of contributions in the workshop. The important topic of food safety was accidentally left off the list of questions used on the day, but is an important category to consider in this sort of analysis.

FIGURE 31. Stakeholder assessments of the importance of component parts of aquaculture contributions to community wellbeing (2)



Note: The numbers in these graphs are the average scores participants gave those components of contributions in the workshop.

4.8.2 Discussion

The radar graph (Figure 29) indicates that this group of stakeholders believe that the industry's contribution to environmental health is both very important and very strong. This supports the findings of the study that the main area to work on in this dimension is improving community understanding of the performance of the aquaculture industry in terms of environmentally sustainable practices. The graph then shows several areas where the strength of the industry contribution is less than its perceived importance, indicating there is room to strengthen these contributions. The biggest gap of this type is for heritage and community identity, followed by a resilient local economy, integrated, diverse and vibrant communities, education and knowledge generation, and leisure and recreation. Overall, however, it is interesting to note that all dimensions were scored moderate to high for strength and importance, which may reflect the interests of the workshop participants.

Because each of the domains of wellbeing has several distinct component parts, it is difficult for participants in this kind of exercise to give a global figure for the domain. For example, within the leisure and tourism domain, the importance of providing fresh local seafood for holiday makers may be seen as much greater than providing fish attracting infrastructure for recreational fishers. To accommodate this, the questions for 'importance' for the workshop exercise were broken down into their component parts, and these were then compiled for an overall domain contribution for the radar graph (Figure 29). Total scores given by participants for each of the component parts of the domains are shown at Figures 30 and 31. These results reinforce the findings of the research. For example, entry-level jobs and employment for Indigenous people were both felt to be more important contributions to the domain of an integrated, diverse and vibrant community than the contribution made by aquaculture to supporting ethnic diversity.

This tool needs further trialling before it could be used to generate reliable information about stakeholder perceptions of the strength and importance of industry contributions to wellbeing. One important limitation was the omission of food safety from the community health questions. In further refining the tool the contributions to domains could also be broken into component parts for the strength of contributions. Focus group discussion on the strength and importance of the component parts of the contributions could elicit useful information about these perceptions. It would also be useful to include standard deviations for responses to show where there is and is not consensus among stakeholder groups about the importance and strength of industry contributions. Finally, because we trialled this tool in a mixed stakeholder group that included researchers, industry representatives, liaison and extension officers, and government aquaculture managers, it would be interesting to conduct the assessment separately to see where different stakeholder groups have varying perceptions of the strength and importance of industry contributions. Other types of stakeholders could be included, such as environmental conservation groups and community representatives.

With further refining, this tool has the potential to triangulate with questionnaire and interview data for the ongoing monitoring of the aquaculture industry's contributions to community wellbeing. If conducted annually or biannually it would show trends in perceptions of these contributions over time.

5. CONCLUSION

The objectives of this Project were to identify the range of social and economic contributions of the NSW aquaculture industry to local communities in order to improve social and economic evaluation methods and thereby improve future assessments of the industry's sustainability and viability.

The origins of this Project came from within the aquaculture industry and its feeling that the valuation of industry by government should not just be about dollars and cents, and current assessments significantly undervalue the extent and depth of a range of societal contributions made in coastal rural communities in regional NSW. The research finds there is a suite of wellbeing contributions to rural and regional communities flowing from aquaculture operations. The challenge is to keep these societal flows sustainable and viable, with the development of the industry conducted with awareness of its role in maintaining wellbeing among its members as well as the wider community. The failure to recognise these contributions risks serious damage to the industry's and their communities' wellbeing.

NSW Government agencies are under legislative obligations in the *NSW Fisheries Management Act 1994*, *Fisheries Management (Aquaculture) Regulation 2012* and *State Environmental Planning Policy 62 – Sustainable Aquaculture* to adhere to the principles of Ecologically Sustainable Development. This legislation addresses economic and environmental integration, including inter-generational equity, but omits intra-generational equity – one of the key ESD principles. This gap has in turn led to poor processes and tools for including the social aspects of sustainability, such as community wellbeing, in planning and development processes for aquaculture.

The Project has systematically identified a range of contributions and benefits flowing from the aquaculture industry. It has also highlighted potential threats to these contributions. This exercise provides a useful framework from which regulators can frame social and economic impact assessment processes, as well as a tool by which policies can be assessed against in order to investigate the extent to which they comply with all ESD components. It also provides indication of where industry bodies can focus communication strategies to best effect. This is of value in the NSW context, but is also likely to be applicable to other jurisdictions around the country and globally.

The following section outlines how these findings can be further translated into tangible outcomes that support, maintain and grow these contributions. It does so by outlining the three top challenges that will require industry and NSW Government cooperation and effort to address.

5.1 Maintaining diversity and flexibility in regional economies

Regional economies need diversity in order to be resilient. Having a range of different sectors in an economy provides mutual benefits in terms of generating connections between businesses and collectively making support industries viable. Different types of industries also provide different types of employment

opportunities, helping to ensure there are economic opportunities for all sectors of society. Aquaculture is a key part of the economic diversity and flexibility of coastal towns in NSW.

The different market options available, including local supply chains, bait markets and links with tourism and hospitality businesses, could be the subject of future research into the links between aquaculture, hospitality and tourism. This would allow aquaculturists to make informed choices about the best possible ways they can maximise profits and grow the industry's overall contributions to resilient local economies.

Our data clearly demonstrate that aquaculture and other sectors such as tourism are not an 'either/or' proposition – each has a socially and economically important role to play in NSW communities, especially in regional areas. Furthermore these sectors are in fact interdependent. Fresh, locally produced food and environmentally protected waterways are key attractions for the tourism industry, and tourists are an important market for aquaculturists. Tourism (including recreational fishing tourism) and aquaculture are thus not mutually exclusive; they support each other. Management exercises and planning strategies should seek to develop and enhance areas of common ground rather than buying into simplistic arguments which call for one sector's contribution to be 'weighed up' against another. A key component of encouraging more inclusive debates lies in building all forms of social capital to enhance bonds within the industry, between the industry and the wider community, and between industry and government.

5.2 Accountability and transparency

This research reinforces findings of other research showing that community support for the aquaculture industry rests in large part on perceptions of the sustainability of aquaculture as a food production system, and of the trustworthiness of the companies involved in aquaculture and the government agencies regulating it. NSW consumers are keen to embrace their local industries but are inhibited by not being able to discern whether the products they buy are local, and confusion about whether the industry is environmentally friendly and sustainable. This is partly a problem of internal industry practices, the solution of which requires enhanced traceability, marketing and labelling around local products. These problems are also due the general public not being aware of how to access clear, independently verifiable information about the environmental credentials of NSW aquaculture. It is crucial that information about environmental health and sustainability comes from a trusted independent source. The current Threat And Risk Assessment (TARA) process initiated by the NSW Marine Estate Management Authority uses an ecosystem-wide approach to assessing the key threats and risks to environmental, social and economic benefits derived across the entire marine estate (NSW Marine Estate Management Authority, 2016). It involves government agencies, independent experts and stakeholder consultation, and when completed should provide a greater understanding of the extent to which the NSW aquaculture industry is meeting its sustainability objectives. Further investigations could be conducted by the NSW Government or industry groups to assess whether these results are seen as 'trustworthy' by the wider community, why this might be, and the influence this

might on community attitudes. This information needs to be delivered in a way that recognises that the sustainability of our fisheries and the health of our oceans is a responsibility shared not only by aquaculturists but also by professional and recreational fishers, Aboriginal cultural fishers, and land-based activities that cause pollution and habitat damage.

5.3 Considering culture

Aquaculture is not always thought of as a culturally important activity, but our research indicates that historically it has strongly supported cultural expression and growth, and it continues to do so in some sections of modern Australia. This is particularly strong amongst Indigenous Australians where opportunities to embrace culture through working with natural resources on their Country can also bring with it benefits to health, employment, education and overall wellbeing. While efforts since the late 1990s to promote Indigenous aquaculture have not resulted in widespread Indigenous ownership or management of aquaculture businesses, there is now a great opportunity to increase the contribution in this area by building on lessons learned from these earlier initiatives.

The cultural importance of fresh, local, high quality seafood to many other ethnic groups within the community was also highlighted in the Project for its significant potential to develop and enhance new and emerging markets, including in China. Seafood is an integral part of what many Australian and international visitors enjoy about spending time at the coast. There is scope to further enhance this enjoyment through ensuring there is sufficient supply of local seafood in coastal areas, and public awareness of where it can be bought. There are also further opportunities to celebrate the contributions of the industry to convivial and celebratory meals and holiday memories, through greater attention to aquaculture as part of community heritage.

6. IMPLICATIONS

The Project results have a range of implications relevant to the aquaculture industry, local communities, managers, policy makers and other sectoral interest groups, including tourism bodies and recreational fishing groups. Primarily the results indicate that these key stakeholders need to think differently about assessing the 'worth' of the aquaculture industry in ways that include wider community wellbeing objectives. We find that the industry does contribute to a wide range of wellbeing values in their regions. Aquaculture management information processes and policy initiatives should explicitly consider and discuss impacts on community wellbeing, and the Project has delivered a framework for these discussions.

We highlight areas where networks could be enhanced to grow industry contributions to wellbeing, especially by building on the tourism potential of the seafood industry. We also suggest that public responses to aquaculture development applications that seek to exclude the industry in favour of tourism are counterproductive, given the inter-dependence and complementarity of the two sectors.

7. RECOMMENDATIONS

The principal recommendation (Recommendation 1) for this project involves greater consideration of community wellbeing in NSW Government reporting and socio-economic impact assessment processes. Subsequent recommendations were assigned a level of priority (High, Medium or Low) by the project team (Table 32).

TABLE 32. Recommendations arising from Project findings

Recommended Action	Responsibility	Priority
Recommendation 1: Undertake ongoing monitoring of the social and economic benefits arising from aquaculture in NSW coastal communities, to enable evidence-based policy development in support of the industry, and to help build the general public's awareness about those benefits.	DPI	High
Recommendation 2: Deepen collaboration between aquaculture and other regional food producers, tourism and hospitality operators and regional tourism promotion agencies all along the NSW coast, building on work already being done.	Industry, tourism & hospitality sector, regional tourism & business development agencies	High
Recommendation 3: Collect data on the numbers and types of jobs in aquaculture by region and for Aboriginal people as part of ongoing monitoring of the social and economic contributions to NSW coastal communities.	DPI, Industry	High
Recommendation 4: Using the results of the current study and ongoing monitoring of social and economic contributions, undertake promotional activities in both regional localities and metropolitan centres to build awareness of the social and economic features of the industry as well as the high quality of NSW aquaculture products. This could include location of origin labelling, including for restaurants.	Industry associations	High
Recommendation 5: Collect information about the number and types of education and knowledge activities undertaken in the aquaculture industry as part of the ongoing monitoring of its social and economic contributions. Build awareness that the industry contributes to its communities in this way.	DPI, Industry	Medium
Recommendation 6: Develop an easily accessible and thoroughly credible web-based source of information about the environmental credentials of NSW aquaculture, and build public awareness that this information exists. This could be based on existing DPI web-based information.	DPI	High
Recommendation 7: Raise public awareness of the importance of water quality in estuarine regions, which would increase pressure on other sectors using those catchments to avoid causing pollution. This could build on standards for water quality and its protection in the Oyster Industry Sustainable Aquaculture Strategy (NSW DPI, 2016b).	DPI, Industry, OceanWatch, Local Land Services, Local Councils	High
Recommendation 8: Support the development of new business models for Aboriginal aquaculture based on a thorough examination of lessons learned from the past in NSW, elsewhere in Australia and internationally, founded on a commitment to long-term involvement and deep processes of consultation with stakeholders.	DPI, Land Councils, other relevant government departments such as Education	High

Recommended Action	Responsibility	Priority
Recommendation 9: Undertake an assessment of the effectiveness of aquaculture communication strategies including: 1) how well current efforts to improve the social licence of aquaculture are working in NSW, building on earlier studies of community perceptions of aquaculture, identifying what activities are working well as well as areas for improvement; and 2) the current state of intra-industry relations in terms of achieving effective collaboration.	DPI, Industry associations	Medium
Recommendation 10: Include the aquaculture industry, especially multigenerational farms and Aboriginal involvement in aquaculture in local public history activities, in preserving oral histories, documents and pictures, and in memorialising events and monuments.	Local public history institutions, community members, industry	Medium
Recommendation 11: Build on ongoing efforts promoting aquaculture as part of local food cultures, local economies and local environmental stewardship.	Industry, tourism & hospitality sector, regional tourism & business development agencies	Medium
Recommendation 12: Build awareness of the recreation benefits of aquaculture infrastructure, as well as about taking care not to damage equipment when boating in the area.	Industry, recreational fishing organisations, DPI	Medium
Recommendation 13: Improve availability and visibility of local aquaculture product in coastal regions for the enjoyment of holiday makers. This could include collaborations between producers, tourism operators, tourism promotion organisations, hospitality and food retail businesses to make sure there are places to buy fresh local seafood.	Industry, tourism & hospitality sector, regional tourism & business development agencies	High

7.1 Ongoing methodological approach to monitoring contributions

The methodology employed by this Project can be adapted and rationalised to provide a cost-effective long-term approach to monitoring the aquaculture industry's contributions to wellbeing over time. We recommend that the framework of social wellbeing be maintained and a monitoring program implemented. This program involves two main time-related components:

- > Annually or biannually:
 - Qualitative assessment of the strength and importance of industry contributions conducted by workshops with representatives from industry, government and the wider community as per Section 4.8. The workshops should involve a preliminary briefing of the key concepts outlined in this document.
 - Indexing of production and price data using DPI and price statistics to monitor trends over time especially relating to non-SFM sales.
- > Every five to ten years:
 - Qualitative study to ascertain that the same areas of wellbeing are relevant, and provide context for quantitative assessments.
 - Quantitative assessments through social and economic questionnaires of aquaculturists, the general public, fish merchants and tourism bodies.

Table 15 (Section 4) outlines the main indicators that should be used in any ongoing assessment in order to ensure that they can be measured against the baseline data provided in this report.

7.2 Applying the methodological approach in other jurisdictions

The indicators and methods outlined in Table 15 are likely to be generally transferable to other jurisdictions in Australia and even overseas. However, for areas outside NSW it is recommended that a preliminary round of qualitative fieldwork be conducted to validate the applicability of the approach outlined in this report. In other words, the seven dimensions of wellbeing identified here should be checked for their relevance for other communities, and to ascertain whether additional dimensions are required. In addition, the preliminary round of fieldwork should validate the kinds of contributions that local fishing and aquaculture industries make to these dimensions of wellbeing in the wider community. The economic methods may also need revising for other regions, due to the availability of different economic data and other contextual issues. For example, a recent valuation of the economic contributions of the professional fishing industry in Queensland was unable to use the regional economics methods used in this report, due to ABS data being less detailed in Queensland (Pascoe et al., 2016).

8. EXTENSION AND ADOPTION

The extension plan for this Project has three interrelated objectives: improve knowledge about the social and economic contributions of the aquaculture industry in NSW; make that knowledge accessible for organisations wishing to use it; and enable better triple bottom line policy-making. The audiences for the Project are thus aquaculturists themselves, industry associations in aquaculture and related sectors, and government agencies.

Communication about the Project was promoted in several different ways: Steering Committee teleconferences and emails; researchers attended two field days on the North and South Coasts in 2015 to talk about the Project; DPI and OceanWatch newsletters notified aquaculturists that data collection had begun; face-to-face contact with aquaculturists and local government representatives during fieldwork interviews; and DPI staff discussed the Project at aquaculture-related committees such as the Aquaculture Research Advisory Committee and the Shellfish Committee.

Key messages are outlined in the Executive Summary of this report. In addition, participants in the Steering Committee workshop at which findings were presented in July 2016 identified the following key messages from the Project:

- > Oysters are valuable to the social and economic fabric of NSW.
- > Aquaculture is integral to regional economies.
- > Expansion of aquaculture can increase community wellbeing.
- > Marketing and community engagement is important to aquaculture being able to expand.
- > Consumers want locally produced and Australian seafood.
- > It is important to recognise diversity in communities and economies, rather than pitting sector against sector.

Following FRDC acceptance of the Final Report from this Project, the following activities are planned to disseminate the findings, and enable them to be taken up by stakeholders.

TABLE 33. Extension and adoption activities

Activity	Responsibility	Timeline
Make Final Report available in PDF format and searchable via internet search engines.	FRDC DPI (website) Research team (UTS website) NSW oyster industry (website)	Within two months of acceptance of the Final Report
Produce PDF plain language brochure of the Executive Summary and web address for the Final Report. Disseminate via email, SMS, newsletters, presentation at meetings of Associations and Committees and to relevant decision-making bodies, media release.	Research team (production of brochure, UTS website, media release) DPI (website, email/ newsletter/SMS dissemination to all aquaculture permit holders, present at industry Associations and Committees, including the NSW Aquaculture Steering Committee, present to Minister for Primary Industries, media release) OceanWatch (bimonthly NSW oyster industry electronic newsletter, possibly including a short talking video on key findings)	Within two months of acceptance of the Final Report
Present at regional aquaculture industry events in NSW	Research team	Within one year of acceptance of Final Report
Conference presentations. For example: Seafood Directions 2017; NSW and National Oyster Conference 2017; MARE People and the Sea 2017; Institute for International Fisheries Economics and Trade 2018.	Research team	Within one year of acceptance of the Final Report (longer for some conferences)
Scientific journal publications. For example: <i>Marine Policy</i> , <i>Ocean and Coastal Management</i> ; <i>Aquaculture</i>	Research team	Submission within one year of acceptance of the Final Report (publication takes longer)

8.1 Project coverage

As far as we are aware there has been no media coverage of the Project so far.

9. REFERENCES

- ABS 2013. *Measures of Australia's Progress, 2013* [Online]. Canberra: Australian Bureau of Statistics (ABS). Available: <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1370.0~2013~Main%20Features~Homepage~1> [Accessed 19/11 2015].
- ABS undated. *Data by Region* [Online]. Canberra: Australian Bureau of Statistics (ABS). Available: <http://stat.abs.gov.au/itt/r.jsp?databyregion> - / [Accessed 11 September 2016].
- ACIL ALLEN CONSULTING 2015. *NSW Oyster Industry Strategy*. NSW Oyster Strategy Working Group.
- AQUACULTURE ACTION AGENDA TASKFORCE 2002. *Aquaculture Industry Action Agenda: National Aquaculture Development Committee's Report to Government and Industry*. Canberra: Department of Agriculture, Fisheries and Forestry, Australia.
- AUSTRALIAN INSTITUTE OF HEALTH AND WELFARE 2015. *Aboriginal and Torres Strait Islander Health Performance Framework 2014 report: New South Wales*. Canberra: AIHW. Available: <http://www.aihw.gov.au/indigenous-data/health-performance-framework/> [Accessed 20 November 2016]
- BAZELEY, P. & JACKSON, K. 2013. *Qualitative Data Analysis with NVivo*, Thousand Oaks, California, Sage.
- BRITTON, E. & COULTHARD, S. 2013. Assessing the Social Wellbeing of Northern Ireland's Fishing Society using a Three-Dimensional Approach. *Marine Policy*, 37, 28-36.
- BROOKS, K., MARSHALL, J. A., FROMM, J. G. & BENNISON, S. G. 2010. *Integration of Socio-Economic Sustainability Criteria into a Reporting Framework for the Australian Aquaculture Industry*. Canberra: FRDC Report No. 2007/010.
- BROOKS, K. J. 2007. Social Capital: Analysing the Effect of a Political Perspective on the Perceived Role of Government in Community Prosperity. *Rural Society*, 17, 231-247.
- BROWN, A. & WING WONG, C. 2012. Accounting and Accountability of Eastern Highlands Indigenous Cooperative Reporting. *Social and Environmental Accountability Journal*, 32, 79-93.
- CAMPBELL, L. M., BOUCQUEY, N., STOLL, J., COPPOLA, H., & SMITH, M. D. 2014. From Vegetable Box to Seafood Cooler: Applying the Community-Supported Agriculture Model to Fisheries. *Society & Natural Resources*, 27, 88-106.
- CDI PINNACLE MANAGEMENT PTY LTD 2010. *Australian Oyster Industry Benchmarking Program Development. Project No. 2009/701*. Australian Seafood Cooperative Research Centre.
- CLARKE, J. 2013. *Oysterman: The World's Biggest Oyster Farm*, NSW, John Clarke.
- COMMONWEALTH OF AUSTRALIA 2016. *Closing the Gap Prime Minister's Report 2016*. Canberra: Department of the Prime Minister and Cabinet.

- COULTHARD, S. 2012. What Does the Debate around Social Wellbeing Have to Offer Sustainable Fisheries? *Current Opinion in Environmental Sustainability*, 4, 358-363.
- COULTHARD, S., JOHNSON, D. & MCGREGOR, J. A. 2011. Poverty, Sustainability and Human Wellbeing: A Social Wellbeing Approach to the Global Fisheries Crisis. *Global Environmental Change*, 21, 453-463.
- DELOITTE ACCESS ECONOMICS 2016a. *A Redeveloped Sydney Fish Market: Enhancing Its Wider Economic and Social Impacts*. Deloitte.
- DELOITTE ACCESS ECONOMICS 2016b. The economic and social impact of Sydney Fish Market. Deloitte.
- DOMINION CONSULTING 2001. *An Assessment of Economic and Social Issues in the NSW Estuary General Fisheries Management Strategy*. NSW Department of Primary Industries.
- ECONSEARCH 2013. *Economic Indicators for the South Australian Abalone Fishery, 2011/12*. PIRSA Fisheries and Aquaculture.
- ECONSEARCH 2014a. *Economic Indicators for the Professional Fisheries of South Australia: Summary Report 2012/13*. Adelaide: PIRSA Fisheries and Aquaculture.
- ECONSEARCH 2014b. *The Economic Impact of Aquaculture on the South Australian State and Regional Economies, 2012/13*. Adelaide: Report prepared for Primary Industries and Regions South Australia (PIRSA), Fisheries and Aquaculture.
- ECOTRUST CANADA 2013. *Understanding Values in Canada's North Pacific briefing*. T. Buck Suzuki Environmental Foundation.
- FAULKNER, A. undated. *Submission to the National Aquaculture Development Strategy for Indigenous Communities in Australia*. Indigenous Environmental Research Centre, Southern Cross University.
- FEARY, S. & DONALDSON, S. 2015. *Sea Countries of New South Wales: A Benefits and Threats Analysis of Aboriginal People's Connections with the Marine Estate*. NSW Marine Estate Management Authority.
- FISHERIES AND AQUACULTURE DEPARTMENT FAO 2016. *National Aquaculture Sector Overview: Australia*. Food and Agriculture Organization of the United Nations.
- FOOD STANDARDS AUSTRALIA NEW ZEALAND. 2011. *FSANZ Advice on Fish Consumption* [Online]. Canberra: Food Standards Australia New Zealand. Available: <http://www.foodstandards.gov.au> [Accessed 19/11 2015].
- FOXTON, F. & JONES, R. 2011. *Social Capital Indicators Review*. United Kingdom: Office for National Statistics.
- FUDGE, M., ANDERSON, & LEWIS, T. 2012. *Establishing Regional Indicators of Social Sustainability in the Tasmanian Aquaculture Industry – A Pilot Study* (FRDC 2010/219). Canberra: Fisheries Research and Development Corporation (FRDC).
- GARNHAM, N. 1999. Amartya Sen's "Capabilities" Approach to the Evaluation of Welfare: Its Application to Communications. In: CALABRESE, A. & BURGELMAN, J.-C. (eds.) *Communication, Citizenship, and Social Policy: Rethinking the Limits of the Welfare State*. Lanham: Rowman & Littlefield.

- GEORGE, D. & NEW, R. 2013. *Australian Fisheries Surveys Report 2012: Financial and Economic Performance of the Eastern Tuna and Billfish Fishery, the Commonwealth Trawl Sector and the Gillnet, Hook and Trap Sector*. Canberra: ABARES.
- GERMOV, J., WILLIAMS, L. & FREIJ, M. 2010. Portrayal of the Slow Food Movement in the Australian Print Media. Conviviality, Localism and Romanticism. *Journal of Sociology*, 45, 89-106.
- GLASER, B. G. & STRAUSS, A. L. 1967. *The Discovery of Grounded Theory: Strategies for Qualitative Research* Chicago, Aldine Pub. Co.
- GOUGH, I. & MCGREGOR, J. A. 2007. *Wellbeing in Developing Countries: From Theory to Research*, Cambridge University Press.
- GUY, J. A., MCILGORM, A. & WATERMAN, P. 2014. Aquaculture in Regional Australia: Responding to Trade Externalities. A Northern NSW Case Study. *Journal of Economic and Social Policy*, 16, Article 6.
- HARRINGTON, C., CURTIS, A. & BLACK, R. 2008. Locating Communities in Natural Resource Management. *Journal of Environmental Policy & Planning*, 10, 199-215.
- HARRISON, J. 2010. *A Socio-Economic Evaluation of the Commercial Fishing Industry in the Ballina, Clarence and Coffs Harbour Regions*. Maclean: Fisheries Research and Development Corporation Project No. 2009/054.
- HASHAM, N. 2013. Fears Fish Farm Could Cause Shark and Pollution Problems Dismissed. *Sydney Morning Herald*, 24 January.
- HIMES-CORNELL, A., HOELTING, K., MAGUIRE, C., MUNGER-LITTLE, L., LEE, J., FISK, J., FELTHOVEN, R., GELLER, C. & LITTLE, P. 2013. Community Profiles of North Pacific Fisheries - Alaska. *NOAA Technical Memorandum NMFS-AFSC-259*. Seattle: US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.
- INDUSTRY & INVESTMENT NSW 2009. *NSW Land Based Sustainable Aquaculture Strategy*. Sydney: Department of Premier's and Cabinet Department of Planning, Industry & Investment NSW, Department of Environment Climate Change and Water, Land and Property Management Authority, Department of Local Government, NSW Food Authority, December.
- JACOBSEN, K. I., LESTER, S. E. & HALPERN, B. S. 2014. A Global Synthesis of the Economic Multiplier Effects of Marine Sectors. *Marine Policy*, 44, 273-278.
- JOYCE, A., RUBIO, A. & WINBERG, P. 2009. *Environmental and Socio-Economic Considerations for Aquaculture in Jervis Bay, NSW*. Canberra Fisheries Research and Development Corporation Project No. 2009/328.11.
- KASPERSKI, S. & HIMES-CORNELL, A. 2014. Indicators of Fishing Engagement and Reliance of Alaskan Fishing Communities. In: AFSC (ed.) *AFSC Quarterly Report Feature*. Alaskan Fisheries Science Centre.
- KINGSLEY, J., TOWNSEND, M., HENDERSON-WILSON, C. & BOLAM, B. 2013. Developing an Exploratory Framework Linking Australian Aboriginal Peoples' Connection to Country and Concepts of Wellbeing. *International Journal of Environmental Research and Public Health*, 10, 678.

- LANGLEY, S. 2013. Convenience the Key Driver for Australia's Food Health Choices. *Australian Food News*, 18 November.
- LEE, C. L. & NET, S. 2001. *A National Aquaculture Development Strategy for Indigenous Communities in Australia*. Canberra: Department of Agriculture Fisheries and Forestry Australia, Fisheries Western Australia.
- LONG, J. 2015a. Concerns on Aquaculture Revealed in New Survey. *South Coast Register*, 12 May.
- LONG, J. 2015b. Mixed Reception for Aquaculture Leases. *South Coast Register*, 3 February.
- LOVE, G. & LANGENKAMP, D. 2003. *Australian Aquaculture: Industry Profiles for Selected Species. ABARE eReport 03.8*. Canberra: Australian Bureau of Agricultural and Resource Economics.
- MAZUR, N., ASLIN, H., AND BYRON, I. 2005. *Community Perceptions of Aquaculture: Final Report. Social Sciences Program*. Canberra: Australian Government Bureau of Rural Sciences.
- MAZUR, N., CURTIS, A. & BODSWORTH, A. 2014. *Let's Talk Fish: Assisting Industry to Influence Conversations about the Sustainability of Wild-Catch Fishing*. Canberra: FRDC Final Report Project No. 2012-301.
- MAZUR, N. A. & CURTIS, A. L. 2008. Understanding Community Perceptions of Aquaculture: Lessons from Australia. *Aquaculture International Journal of the European Aquaculture Society*, 6, 6, 601-621.
- MCCORMACK, F. & BARCLAY, K. (eds.) 2013. *Engaging with Capitalism: Cases from Oceania*, Bingley, UK: Emerald.
- MCENTEE, J. 2010. Contemporary and Traditional Localism: A Conceptualisation of Rural Local Food. *Local Environment*, 15, 785-803.
- MCGREGOR, A., COULTHARD, S. & CAMFIELD, L. 2015. Measuring what matters. The role of well-being methods in development policy and practice. *Development Progress Project Note 04*. London: Overseas Development Institute.
- MCMICHAEL, A., SCHOLLES, R., HEFNY, M., PEREIRA, E., PALM, C. & FOALE, S. 2005. Linking Ecosystem Services and Human Well-being. In: Capistrano, Doris, Samper K., Cristián, Lee, Marcus J., and Raudsepp-Hearne, Ciara, (eds.) *Ecosystems and Human Well-being: Multi-scale Assessments*. Millenium Ecosystem Assessment Series, 4. Island Press, Washington DC, USA, pp. 43-60.
- MONFORT, M. C. 2015. The Role of Women in the Seafood Industry. *GLOBEFISH Research Programme, Vol. 119*. Rome: FAO.
- MURPHY, S. & KRUGER, A. 2008. Clean and Green. *Landline*. ABC TV.
- NEW ZEALAND QUALITY OF LIFE PROJECT 2007. Quality of Life 07 in Twelve of New Zealand's Cities. Christchurch: Christchurch City Council.
- NIMMO, F., CAPPELL, R. & GRANT, A. 2009. *Literature Review of Evidence that Fish Farming Impacts on Tourism*. Report prepared by Royal Haskoning for Scottish Aquaculture Research Forum.

- NORMAN, H. 2012. *From Activism to Enterprise: A Political History of the NSW Aboriginal Land Rights Act, 1983*. Doctor of Philosophy thesis, University of Sydney.
- NORMAN, H. 2015. *'What Do We want?' A Political History of Aboriginal Land Rights in New South Wales*, Canberra, Aboriginal Studies Press.
- NSW DPI 2002. *Indigenous Fisheries Strategy and Implementation Plan* [Online]. Sydney: NSW Government Department of Primary Industries (NSW DPI). Available: <http://www.dpi.nsw.gov.au/fishing/aboriginal-fishing/strategy/nsw-ifs/nsw-ifs> [Accessed 8 August 2016].
- NSW DPI 2004. NSW Fisheries Indigenous Fisheries Strategy 2002–2004. In: FISHERIES (ed.). New South Wales: NSW Government Department of Primary Industries (DPI).
- NSW DPI 2007. *Aquaculture Update - Aboriginal Reference Group. Nelson Bay*: Fisheries Management.
- NSW DPI 2009. *NSW Land Based Sustainable Aquaculture Strategy*. NSW Department of Primary Industries (DPI).
- NSW DPI 2012. *Commercial Fisheries*. Port Stephens: NSW Department of Primary Industries (DPI).
- NSW DPI 2014. *Commercial Shellfish Aquaculture Leases Jervis Bay, NSW. Response to Submissions Report*. Taylors Beach: NSW Department of Primary Industries,.
- NSW DPI 2015a. *Aquaculture Production Report 2013-2014*. NSW Department of Primary Industries (DPI).
- NSW DPI 2015b. *Aquaculture in New South Wales Facts & Figures 2015*. Port Stephens: NSW Department of Primary Industries (DPI).
- NSW DPI 2016a. *Aquaculture Production Report 2016*. Port Stephens: NSW Department of Primary Industries (DPI).
- NSW DPI 2016b. *NSW Oyster Industry Sustainable Aquaculture Strategy. 3rd edition*. Nelson Bay: NSW Government Department of Primary Industries (DPI).
- NSW DPI. undated. *Commercial Fisheries* [Online]. Sydney: NSW Government, Department of Primary Industries (DPI). Available: <http://www.dpi.nsw.gov.au/fishing/commercial> [Accessed 12 September 2016].
- NSW MARINE ESTATE MANAGEMENT AUTHORITY 2016. *Hawkesbury Shelf Marine Bioregion Assessment - Suggested Management Initiatives. Discussion paper*. NSW Government.
- NUSSBAUM, M. 2000. *Women and Human Development: The Capabilities Approach*, Cambridge, Cambridge University Press.
- NUSSBAUM, M. 2003. Capabilities as Fundamental Entitlements: Sen and Social Justice. *Feminist Economics*, 9.
- NUSSBAUM, M. C., SEN, A. & WORLD INSTITUTE FOR DEVELOPMENT ECONOMICS RESEARCH (eds.) 1993. *The Quality of Life*, New York: Clarendon Press.
- OECD 2013. *How's Life? 2013: Measuring Well-being*, Paris, OECD Publishing.

- OGBURN, D. M. 2011. *The NSW Oyster Industry: A Risk Indicator of Sustainable Coastal Policy and Practice*. PhD thesis, ANU.
- OYSTERS AUSTRALIA. 2013. *Website: Oysters Australia* [Online]. Available: <http://www.seafoodcrc.com/core-participants/the-oyster-consortium.html> [Accessed 11 September 2016].
- PARTRIDGE, E., CHONG, J., HERRIMAN, J., DALY, J. & LEDERWASCH, A. 2011. *City of Sydney Indicator Framework*. Institute for Sustainable Futures, University of Technology Sydney, City of Sydney.
- PASCOE, S., INNES, J., TOBIN, R., STOECKI, N., PAREDES, S. & DAUTH, K. 2016. *Beyond GVP: The Value of Inshore Commercial Fisheries to Fishers and Consumers in Regional Communities on Queensland's East Coast. Final Report* (FRDC 2013-301). Canberra: Fisheries Research and Development Corporation.
- PENNICOTT WILDERNESS JOURNEYS undated. *Tasmanian Seafood Seduction* [Online]. Available: https://www.seafoodseduction.com.au/?_ga=1.156039100.663575964.1469578539 [Accessed 11 September 2016].
- PIERCE, J. & ROBINSON, G. 2013. Oysters Thrive in the Right Environment: The Social Sustainability of Oyster Farming in the Eyre Peninsula, South Australia. *Marine Policy*, 37, 77-85.
- POWELL, R. A., JENSEN, R. & HORWOOD L. 1988. *The Effects of Policy Change on South-East Trawl Fishing Communities. Report to the Steering Committee on Long-Term Management of the South East Trawl fishery*. Canberra: University of New England and Department of Primary Industries and Energy.
- PRODUCTIVITY COMMISSION 2004. *Assessing Environmental Regulatory Arrangements for Aquaculture*. Canberra: Australian Productivity Commission.
- QUIGLEY, R. & BAINES, J. 2014. *How to Improve Your Social Licence to Operate: A New Zealand Industry Perspective*. Auckland: Report prepared for Aquaculture Unit, Ministry of Primary Industries.
- ROBERTSON, A. & COMFORT, V. 2014. *Public Perceptions of New Zealand's Aquaculture Industry*. Auckland: Report prepared by Colmar-Brunton for the New Zealand Ministry of Primary Industries.
- ROHEIM, C. A., DURHAM, C. A., KING, R., JOHNSON, A., MCCLUSKEY, J., PARDOE, I., FLORES, J. & ZHAO, H. 2007. *Rhode Island Consumers' Preferences for Locally-Produced Food: Report on Results from a 2006 Survey, Funded by the USDA/CSREES National Research Initiative Program*. University of Rhode Island, Oregon State University, University of Minnesota, and Washington State University.
- ROWLAND, S. J. 2004. Overview of the History, Fishery, Biology and Aquaculture of Murray Cod (*Maccullochella peelii peelii*). *Management of Murray Cod in the Murray-Darling Basin - Canberra Workshop*.
- RUBIO, A., WINBERG, P., KIRKENDALE, L., WARNER, R. & DAVIS, A. 2013. *Ensuring that the Australian Oyster Industry Adapts to a Changing Climate. A Natural Resource and Industry Spatial Information Portal for Knowledge Action and Informed Adaptation*

Frameworks, Oyster Information Portal. Fisheries Research and Development Corporation.

RURAL DIRECTIONS PTY LTD 2012. *Oyster Industry Benchmarking Snap Shot 2010–11: Industry Edition*. A Report for Oysters Australia, the Australian Seafood CRC and the Fisheries Research and Development Corporations.

RURAL DIRECTIONS PTY LTD 2013a. *The Oyster Snapshot. Overview of Services*. In: Report for Oysters Australia, the Australian Seafood CRC and The Fisheries Research and Development Corporation. Oysters Australia, the Australian Seafood CRC and The Fisheries Research and Development Corporation. Available: <http://www.ruraldirections.com/pages/industry-development/industry-benchmarking.php> [Accessed 20 November 2016]

RURAL DIRECTIONS PTY LTD 2013b. *Australian Oyster Industry SnapShot: Summary for wider industry and stakeholders*. A Report for Oysters Australia, the Australian Seafood CRC and The Fisheries Research and Development Corporation. Oysters Australia, the Australian Seafood CRC and The Fisheries Research and Development Corporation. Available: <http://www.ruraldirections.com/pages/industry-development/industry-benchmarking.php> [Accessed 20 November 2016]

SCHROBBACK, P. 2014. *Economic Analyses of Australia's Sydney Rock Oyster Industry*. PhD thesis, Queensland University of Technology.

SCHROBBACK, P., COGLAN, L. & PASCOE, S. 2014. Socio-Economic Determinants for Industry Development: The Case of Australia's Sydney Rock Oyster Industry. *Aquatic Living Resources*, 27 167–175.

SCHROBBACK, P., PASCOE, S. & COGLAN, L. 2014a. History, Status and Future of Australia's Native Sydney Rock Oyster Industry. *Journal of Aquatic Living Resources*, 27, 153–165.

SCHROBBACK, P., PASCOE, S. & COGLAN, L. 2014b. Impacts of Introduced Aquaculture Species on Markets for Native Marine Aquaculture Products: The Case of Edible Oysters in Australia. *Aquaculture Economics & Management*, 18 248–272.

SCHROBBACK, P., PASCOE, S. & COGLAN, L. 2014c. Shape Up or Ship Out: Can We Enhance Productivity in Coastal Aquaculture to Compete with Other Uses? *PLoS ONE*, 9, e115912.

SEN, A. 1999. *Development as Freedom* Oxford, Oxford University Press.

SEN, A., MUELLBAUER, J. & HAWTHORN, G. 1987. *The Standard of Living*, Cambridge, Cambridge University Press.

SMITH, C. L. & CLAY, P. M. 2010. Measuring Subjective and Objective Well-being: Analyses from Five Marine Commercial Fisheries. *Human Organization*, 69, 158–168.

SMYTH, D. c. 1993. *A Voice in All Places: Aboriginal and Torres Strait Islander Interests in Australia's Coastal Zone – Consultancy report*, Canberra, Coastal Zone Inquiry (Australia).

- SOUTH COAST REGISTER. 2013. Mussel Farm Concerns to be Considered. *South Coast Register*, 22 July.
- STIGLITZ, J. E., SEN, A. & FITOUSSI, J.-P. 2009. *Mismeasuring Our Lives: Why GDP Doesn't Add Up*. The report by the Commission on the Measurement of Economic Performance and Social Progress, New York, New Press.
- SUTHERLAND, D. 2011. *Garroowa Coastal Sea Country Report: Port Stephens, Great Lakes Marine Park*. Newcastle: Worimi Knowledgeholders Aboriginal Corporation.
- SWEENEY RESEARCH 2014. *Marine Estate Community Survey - Final report*. Report for the NSW Marine Estate Management Authority.
- TAMBLYN, C. A. & POWELL, R. A. 1988. *Input and Output Study of the North Coast Agriculture and Fisheries Industries*. Wollongbar: NSW Dept. of Agriculture.
- THOMPSON, S. J. & GIFFORD, S. M. 2000. Trying to Keep a Balance: The Meaning of Health and Diabetes in an Urban Aboriginal Community. *Social Science and Medicine*, 51, 1457-1472.
- TWEED DAILY NEWS 2004. Bug-ger Off. *Tweed Daily News*, 23 December.
- TWEED DAILY NEWS 2005. Lobster Farm Concerns Remain. *Tweed Daily News*, 13 January.
- TWEED DAILY NEWS 2008. Crayfish Farm in Pipeline. *Tweed Daily News*, 16 September.
- U.S. DEPT. OF HEALTH AND HUMAN SERVICES 2005. *Dietary Guidelines for Americans*. USDA (ed.) Washington, D.C.
- UMWELT AUSTRALIA PTY LIMITED 2001. *NSW Estuary General Fishery Management Strategy. Assessment of Impacts on Heritage and Indigenous Issues*. NSW Fisheries.
- UMWELT ENVIRONMENTAL CONSULTANTS 2005. *NSW Commercial Abalone Draft Fishery Management Strategy: Assessment of Impacts on Heritage and Indigenous Issues*. The Ecology Lab.
- UNESCO 2016. *Tangible Cultural Heritage* [Online]. United Nations Educational Scientific and Cultural Organization (UNESCO). Available: <http://www.unesco.org/new/en/cairo/culture/tangible-cultural-heritage/> [Accessed 25 August 2016].
- VAN PUTTEN, I., CVITANOVIC, C. & FULTON, E. A. 2016. A Changing Marine Sector in Australian Coastal Communities: An Analysis of Inter and Intra Sectoral Industry Connections and Employment. *Ocean & Coastal Management*, 131, 1-12.
- VOYER, M. 2013. *Assessing the Social Acceptability of Marine Protected Areas (MPAs) – A Comparison between Port Stephens-Great Lakes Marine Park (PSGLMP) and Batemans Marine Park (BMP) in NSW*. PhD thesis, Faculty of Science, University of Technology Sydney.
- VOYER, M., BARCLAY, K., MCILGORM, A. & MAZUR, N. 2016. *Social and Economic Evaluation of NSW Coastal Professional Wild-Catch Fisheries (FRDC 2014/301)*. Canberra: Fisheries Research and Development Corporation (FRDC).

- VOYER, M., GLADSTONE, W. & GOODALL, H. 2014. Understanding Marine Park Opposition: The Relationship between Social Impacts, Environmental Knowledge and Motivation to Fish. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 24, 441-462.
- WATTS, E.-M. 2016a. Fears Raised by Port Stephens Fish Farm Proposal. *Port Stephens Examiner*, 7 June.
- WATTS, E.-M. 2016b. Love Sea Food Festival Activities Continue in Port Stephens this Weekend. *Port Stephens Examiner*, 19 August.
- WILKINSON, J. 2004. *NSW Fishing Industry: Changes and Challenges in the Twenty-First Century. Briefing Paper No 11/04*. Sydney: NSW Parliamentary Library Research Service.
- WRIGHT, A. 2013a. Aquaculture Lease Might Be Thin Edge of a Larger Wedge. *South Coast Register*, 13 November.
- WRIGHT, A. 2013b. Lease Mussels in on Sailing Club Safety. *South Coast Register*, 25 October.
- WRIGHT, A. 2015. Callala Residents Call for a Greater Say on Aquaculture. *South Coast Register*, 10 March.

APPENDICES

Appendix 1. Literature review of quality of life indicators of community and individual wellbeing

Reference	Quality of Life Indicators
Quality of Life Indicators (NSW Marine Estate Management Authority, 2016)	<ul style="list-style-type: none"> > Health: the length and quality of people's lives > Education: e.g. school enrolment, education expenditure, graduation rates, years of schooling. > Personal activities: How people spend their time and the nature of their personal activities, including Paid employment, unpaid domestic work, Commuting time, Leisure time – quantity and quality, participation in cultural events and housing. > Political voice and governance: Encompasses the ability to participate as full citizens, have a say in the framing of policies, dissent without fear. Indicators include level of trust in public institutions and levels of political participation, presence of free press. > Social connections (social capital): e.g. membership in associations, levels of civic and political engagement, membership and voluntary work in organisations/religious groups, relationships with family members and neighbours and means of getting news and information. > Environmental conditions effects on human health directly and indirectly, environmental services such as clean water/recreation areas, environmental amenities > Personal insecurity: things that put at risk the individual crime, accidents, natural disasters – impact of bereavement and fear on subjective wellbeing. Economic insecurity: uncertainty about future material conditions through risks such as unemployment, illness and old age
Nussbaum's core capabilities (Stiglitz et al., 2009)	<ul style="list-style-type: none"> > Life: being able to live to the end of a human life of normal length (i.e. not dying prematurely) > Bodily health: being able to have good health, including reproductive health, to be adequately nourished, to have adequate shelter > Bodily integrity: to be able to move freely from place to place, secure from violence, having opportunities for sexual satisfaction and for choice in matters of reproduction > Sense: imagination and thought: to be able to use senses/thoughts/imagination in a way that is informed and cultivated by adequate education. Use in connection to experiencing producing works and events of one's own choosing, protected by guarantees of freedom of expression/religion etc > Emotions: being able to have attachments to things/people without fear or anxiety. Supporting forms of human association that can be shown to be crucial in their development. > Practical reason: being able to engage in critical reflection about the planning of one's life (entails protection for liberty of conscience/religion). > Affiliation: to be able to live with and toward others, show concern for others, to engage in social interaction (Protecting this capability means protecting institutions that constitute and nourish such forms of affiliation, and also protecting the freedom of assembly and political speech.) and being free of discrimination and humiliation > Other species: living with concern for non human world > Play: be able to laugh, play and enjoy recreational activities > Control over ones environment: being able to participate in political choices that govern ones life, including protections of free speech, and being able to hold property and having property and employment rights on an equal basis with others

<p>City of Sydney Community Wellbeing Indicator framework (Nussbaum et al., 1993, Nussbaum, 2000, Nussbaum, 2003)</p>	<p>Healthy, safe and inclusive communities</p> <ul style="list-style-type: none"> > Personal health and wellbeing > Community connectedness > Early childhood > Personal and community safety > Lifelong learning > Service availability > Housing > Income and wealth <p>Culturally rich and vibrant communities:</p> <ul style="list-style-type: none"> > Arts and cultural activities, > Creative industries, Cultural diversity, Leisure and recreation <p>Democratic and engaged communities:</p> <ul style="list-style-type: none"> > Community engagement, > citizenship, > Elections, <p>Representation and democracy</p> <p>Dynamic resilient local economies:</p> <ul style="list-style-type: none"> > economic activity, > diversity and prosperity, > employment and education of city residents > productivity and innovation <p>Sustainable environments:</p> <ul style="list-style-type: none"> > Open space, > Transport, > Air and noise, > Energy and greenhouse, > Urban ecology, > Water, > Consumption, waste and resource recovery.
<p>New Zealand Quality of Life Project (Partridge et al., 2011)</p>	<ul style="list-style-type: none"> > People > Knowledge and skills > Economic standard of living > Housing > Health, > Safety > Social connectedness

OECD Betterlife Index (New Zealand Quality of Life Project, 2007)	<ul style="list-style-type: none">> Income and wealth> Availability and quality of jobs> Housing> Physical and mental health> Education and skills> Work-life balance> Civic engagement> Social connections> Quality of the natural environment> Living in a secure environment> Subjective wellbeing/life satisfaction
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Appendix 2. Results of social questionnaires conducted by UMR

Submitted to FRDC as a separate document. Can be supplied upon request to author: Kate.Barclay@uts.edu.au

Appendix 3. The NSW aquaculture economic questionnaire

This report summarises the methods and results of the economic questionnaire of NSW aquaculturists for this project. The questionnaire was distributed by mail to 50 selected aquaculture businesses of the total 514 permit holders in the 2013–14 financial year. The purpose of the survey was to collect data on costs and income in order to determine the contribution of aquaculture businesses to regional economies via regional economic modelling. The project proposal committed to producing an analysis of three regions along the NSW coast (North Coast, Mid North and Central Coasts and South Coast).

Aquaculture operator questionnaire

The economic survey had a total of 27 responses (54%) from the 50 aquaculture businesses approached. Of these, 21 were completed validly, the others omitting essential business information. As the replies were anonymous it was not possible to follow up the incomplete surveys.

Some indication of the representativeness of those businesses replying to the survey can be seen in comparing the revenue from these businesses with the total GVP. The responding 21 businesses had revenue of \$9.16m (19.23%) from a total GVP, excluding inland areas, of \$47.6m. The 21 replies are approximately 4.7% of 450 permit holders.

A sample of businesses is normally assumed to be representative of the businesses in the different aquaculture sectors. However, the results are from a diverse range of businesses and as such, averages should be interpreted with caution. The 4.7% of the businesses that replied provide 19.23% of the coast aquaculture GVP. The survey looks to have captured businesses that are unlikely to be representative of all permit holders, however the extent of any bias is unknown. The responding businesses have a higher level of activity and there is likely an unknown degree of respondent bias arising from more active businesses replying to the survey.

Appraising economic viability

Aquaculture enterprise viability can be estimated through accounting data collected in a questionnaire. This gives an accounting view of a firm's individual performance, but is not good for measuring performance across different businesses in the aquaculture industry or comparing aquaculture with other industries. Economists adjust accounting data to gain more useful industry economic performance measures.

The limited survey response required business types to be combined forming Oyster and Non-oyster business categories. When grouped together on this basis the business numbers in each sample class were sufficiently above the level where individual business's confidentiality may be compromised.

The residual of Total Revenue less Operating Costs is Operating Profit and shows a gross level of operating profitability. The financial returns to capital on an all equity basis can then be measured. Economic returns differ from the financial returns by

including opportunity costs to enable comparison of economic rates of return with other industries.

Depreciation and the opportunity cost of capital are deducted to give economic profit or loss (OECD, 2013). Depreciation was calculated on a straight line basis using information provided in the questionnaire on the current market values, the original or replacement cost and the age of capital items attributable to each aquaculture business.

In the study a 7% opportunity cost of capital was included in costs and an estimate of the opportunity cost of labour, including unpaid labour, was made. The opportunity cost of capital follows ABARES value applied in fisheries surveys, a rate of 7% per year (George and New, 2013). This exceeds the real interest rate that could be earned on an investment elsewhere and takes some account of investment risk in the aquaculture sector. Guy et al. (2014) applied a discount rate of 8% believing that higher risk adjusted rates than this can detrimentally impact the assessment of commercial viability.

Profitability results

We report the business revenue by aquaculture grouping in Table 1.

TABLE 1: Respondent numbers, average business revenue and range of revenues for the Oyster and Non-oyster business groups

Vessel category	Respondent numbers	Average revenue (\$)	Coefficient of variation
Oysters	15	391,614	1.35
Non Oysters	6	491,811	1.22
Total	21	443,661	

The variety of businesses categories and activity levels among aquaculture producers are evident and seen in the coefficient of variation (standard deviation/mean), which indicates considerable spread in gross revenues in the businesses responding.

Accounting measures

The survey accounting revenues and cost results are reported in Table 2.

TABLE 2: Accounting revenues and costs for a representative aquaculture in the Oyster and Non-oyster business groups

Revenue or Cost	Oysters \$	Percentage of Total Revenue	Non-oysters \$	Percentage of Total Revenue
Gross Revenue	391,614	100%	491,811	100%
Total Variable Costs (TVC)	280,055	72%	281,976	57%
Total Fixed Costs (TFC)	25,830	7%	62,992	13%
Total Costs (TVC+TFC)	305,885	78%	344,968	70%
Gross Operating Profit	85,729	22%	146,843	30%

The results report that total variable costs, such as fuel, boat repairs, aquaculture gear repairs, freight costs and wages to employees are 71.5% and 57.3% of gross revenue in the two activity groups Oyster and Non-oyster respectively.

Indirect or fixed costs, such as boat and vehicle registrations, insurance, aquaculture management charges, rates, bank and business administration expenses were 6.6%, 12.8% of revenue respectively, making total cash costs 78.1% and 70.1% of total revenue. Operating profit in each of the two activity groups is estimated as 21.9% and 29.9% of gross revenue respectively. However conclusions on long run viability are difficult to draw from accounting data alone. Certain economic adjustments have to be made to determine more meaningful profitability results such as an economic rate of return.

Economic results

The economic survey results include adjustments to give the economic depreciation, the imputed cost of labour and opportunity cost of capital and are reported in Tables 3a and b.

TABLE 3A: Revenue, costs, profit and rate of return on capital at full equity in NSW aquaculture businesses in the financial year 2013-2014, by activity group

	Revenue or Cost	Oysters	Coeff. of variation	Non Oysters	Coeff. of variation
(1)	Gross revenue	391,614	1.35	491,811	1.12
	Fuel/oil	12,008	1.71	16,439	1.16
	Repairs and maintenance	11,949	1.03	26,355	1.36
	Clothing	1,565	1.35	425	1.70
	Hire Cost	1,208	1.64	5,017	2.47
	Labour Paid	157,333	2.30	87,559	1.36
	labour-self wages	52,925	0.81	29,342	1.10

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(2)	Labour Unpaid	761	1.97	2,536	1.29
	Freight/packaging	9,383	1.48	18,143	1.42
	On-grower purchases	28,806	1.71	12,429	2.16
	Fish food	-	0.00	69,000	1.78
	EPA/lab testing/field consummables	1,382	1.17	5,496	1.57
	Other	2,734	1.54	9,236	1.69
(3)	Total Variable Costs	280,055	1.45	281,976	1.27
	Business License/permits	12,372	1.20	5,776	0.85
	Vehicle registration & insurances	9,022	0.81	6,153	1.03
	Mooring/slippage fee	430	3.69	-	0.00
	Accounting fee	3,437	1.17	3,392	1.08
	Legal costs	470	2.52	-	0.00
	Phone	2,901	1.04	2,597	0.63
	Stationery	1,274	1.47	2,988	1.97
	Electricity/gas	2,851	1.30	46,326	1.31
	Bank charges	1,304	1.72	539	0.81
(4)	Interest	5,465	1.94	3,095	2.65
	Travel cost	1,392	1.43	1,347	1.23
	Membership levies	853	1.94	933	1.63
	Marketing and promotions	1,055	1.99	214	2.65
(5)	Leasing fee	3,070	1.91	156	2.65
	Other	1,327	2.69	1,405	2.33
(6)	Total Fixed Costs	25,830	1.04	62,992	1.12
(7)	Total Cash Costs (3+6)	305,885	1.41	344,968	1.21
	Farm Gross Margin (1-3)	111,559	1.23	209,835	1.02
(2)	Unpaid labour	761	1.97	2,536	1.29
	Gross operating surplus (1-7+2)	86,489	1.33	149,379	1.03
(8)	Farm cash Income (1-7)	85,729	1.34	146,843	1.07
(9)	Depreciation economic	26,586	0.79	64,503	0.86
(10)	Farm Business Profit (8-9)	59,904	1.66	84,876	1.60
(11)	Profit at full equity (10+4+5)	68,438	1.56	88,127	1.59
(12)	Farm capital	516,523	0.85	1,222,715	0.66
	Licence value	291,000	0.91	215,314	0.60
(13)	Total Capital	807,523	0.84	1,438,029	0.51
	Rate of return on boat capital (11/12*100)	8.0%	1.40	9.8%	1.65

TABLE 3B: Net economic returns of NSW aquaculture businesses in the financial year 2013-2014, by activity group

	Revenue or Cost	Oysters	Coeff. of variation	Non Oysters	Coeff. of variation
	Farm cash Income (1-7)	85,729	1.34	146,843	1.07
(2)	Unpaid Labour	761	1.97	2,536	1.29
	Opportunity costs of capital (7%)	56,527	0.84	100,662	0.51
	Depreciation	34,562	0.79	64,503	0.86
	Plus interest, leasing and management fees	8,535	1.52	3,251	2.65
	Interest	5,465	1.94	3,095	2.65
	Leasing fee	3,070	1.91	156	2.65
(14)	Net economic returns	8,700	9.45	-11,975	-13.02
(13)	Total capital	807,523	0.84	1,438,029	0.51
	Economic rate of return on capital (14/13*100)	1.1%		-0.8%	

Note: in Tables 3 a and b the coefficient of variation is the standard error/mean and indicates the variation in the results.

The results indicated that the financial profitability gives return to full equity in Table 3a of 8% for the Oyster group and 9.8% for the Non-oyster group. However, once a range of opportunity costs and adjustments are made the economic profitability is 1.1% for oyster businesses and -0.8% for non-oyster businesses.

Non-oyster businesses are just below a zero rate of return, which indicates they are just below covering opportunity costs and earning a normal return to capital (0%). Oyster businesses had an apparent small 1% economic surplus over all economic costs. The results indicate that both business categories are earning at an equivalent to other industries and so leaving and entry of businesses would be minimal. Should these have been negative than farmers would consider leaving the industry and if positive others may be attracted into the industry.

Limitations of the analysis

The main limitation of the study relates to the limited number of response rates. The survey had 27 complete responses from 50 selected commercial aquaculture permit holders, of which 21 responses were deemed useable. The coastal area study regions have adequate business sampled from each, giving the 3 final study regions.

These results are representative of the small sample of 21 businesses that replied to the survey, but are unlikely to be representative of all businesses in the industry. The responding 21 businesses (4.7% of 450 permit holder numbers) had a revenue of \$9.16m (19.23%) from total industry GVP, excluding inland areas, of \$47.6m. These data suggest that the businesses that replied were more active than the average non-responding business.

The calculation of oyster farm capital has assets in building, ponds and equipment, but the land is often leased from the government depending on the type and location of the farm. The values have been estimated conservatively and may under-represent the value of holding a NSW aquaculture licence.

In calculating both the accounting profitability and economic results, it was necessary to adjust for depreciation. Survey respondents were asked to provide depreciation data in their survey response, however many omitted this information or provided an accounting value, which may result in much of the assets value being written off in the first few years of ownership. Accounting depreciation can fail to take into consideration the true value of the asset being consumed annually and can be distorted by the tax system. We calculate an economic estimate of depreciation based on information provided by respondents regarding original cost, residual value and asset age.

Unpaid labour is an important input in many aquaculture businesses, but was mainly applied by family members in the businesses surveyed. Labour costs are imputed from questions in the survey on paid and unpaid days worked by the aquaculture producers and their family on the farm. Award wages for miscellaneous employment were used to calculate an imputed value of labour. The basis of imputation was for an annual average wage of \$35,963 (\$691.60 per week) imputed on a daily basis from ABS data (ABS 2013). The number of unpaid hours per year per aquaculture business was assigned a value. Given the lifestyle nature of many aquaculture businesses, unpaid labour estimates may be underestimated.

Finally the data provided covers the 2013-2014 financial year only and inferences from this one year for other time periods may potentially under-represent the degree of inter-annual variation found between years.

Investment in the industry

Capital investment in the aquaculture industry takes place in several investment areas. The standard process of investing in land sites is made problematic due to many farms being on aquaculture leases which are crown land. However, some farms are not on leases. Most farms have buildings, ranging from lockups and sheds to protect equipment, to more substantial buildings for product handling and packing. This diversity makes land and building investment value difficult to measure. There are shorter term capital investments in other infrastructure for farm equipment farm vehicles and smaller machinery. Farmers were asked to estimate the historical cost and the replace cost of these asset classes. The state-wide estimates of the investments tied up in the three coastal aquaculture areas was estimated to be \$94m historical cost with a \$124m replacement cost. However this estimate should be treated with caution given the measurement issues discussed above.

TABLE 4. The estimated capital values for different asset classes on oyster and non-oyster farms

Non-Oyster farms	Sum of land/ building value (\$)	Replacement cost (\$)	Average age of assets (years)
Land and buildings	25,943,310	17,640,000	22
Infrastructure and equipment	10,355,000	15,369,825	7
Vehicle and machinery	7,690,900	19,250,000	11
Total	43,989,210	52,259,825	14
Oyster farms	-	-	-
Land and buildings	14,025,000	19,075,00	14
Infrastructure and equipment	32,575,000	42,000,000	16
Vehicle and machinery	3,420,000	11,350,000	7
Total	50,020,000	72,425,000	12
Grand Total	94,009,210	124,684,825	13

Note: These figures were derived from extrapolations of the survey replies, so please treat with caution.

There was some evidence of new investment among the businesses that responded, some in new types of farm, but most investment appeared to be in smaller operational and equipment items presumably arising from the need for replacement. The debt levels among those surveyed appeared to be low with 10 out of the sampled 21 business having debt interest payments averaging \$5,000 per annum (average of \$50-60k loans). The businesses sampled are generally not taking on large amounts of debt.

References

- ABS. 2013 *Employee Earnings and Hours, Australia*, 63060D0005_201205, May 2012.
- GEORGE, D. & NEW, R. 2013. *Australian Fisheries Surveys Report 2012: Financial and Economic Performance of the Eastern Tuna and Billfish Fishery, The Commonwealth Trawl Sector and the Gillnet, Hook and Trap Sector*. Canberra: ABARES.
- GUY, J. A., MCILGORM, A. & WATERMAN, P. 2014. Aquaculture in Regional Australia: Responding to Trade Externalities. A Northern NSW Case Study. *Journal of Economic and Social Policy*, 16, Article 6.
- OECD 2013. *How's Life? 2013: Measuring Well-being*, Paris, OECD Publishing.

Appendix 4. Regional economic impacts of aquaculture and secondary sector in NSW

This appendix examines the regional economic modelling for aquaculture production in NSW.

Background – Regional Expenditure flows

The business data from the questionnaire of aquaculture businesses was combined with the coastal aquaculture revenue estimate of \$47.7m to determine regional revenues and associated input costs in each region.

The three areas for the regional economic analysis cover aquaculture production for the North Coast, Mid North and Central Coasts and South Coast regions in NSW, divided into regions as per the Australian Bureau of Statistics (ABS). We used a mixture of level 3 and 4 Statistical Local Areas (SLAs) (for further details see Appendix 5):

- > The Richmond, Tweed and Clarence Rivers (North Coast)
- > Port Macquarie south to Port Stephens (Mid North and Central Coasts)
- > Jervis Bay south to the Victorian border (South Coast)

Regional economic modelling for regions requires that we account for income and expenditure flows between the various study regions, as well as those flows leaving the state of NSW, and it was necessary to adjust the regional level revenues to reflect any such movements. The adjustments have been made as per Table 1 below using the information on expenditures between regions gathered in the economic questionnaire.

TABLE 1. Income and expenditure flows exiting NSW from each study area

	Total apportioned revenue	Net flow adjustments	Adjusted revenue
North	10,455,418	-796,043	9,659,375
Mid north	22,426,099	-606,512	21,819,587
South	14,577,069	-980,114	13,596,955
	47,458,586	-2,382,669	45,075,917

In Table 1 a total of approximately \$2.38 million was spent outside of NSW, the majority of this going to Queensland and Victoria from the three regions of NSW (middle column).

Another \$0.75m of net expenditures flowed between areas within NSW. There was a net movement of \$213,000 from the Mid North and Central Coasts region to the North Coast and then a net movement from the South Coast to the Mid North and Central Coasts area of \$544, 000 reflecting different purchases. These net expenditure flows represent the balance between the areas.

The type of spending by businesses outside of 100km in NSW and outside of NSW is presented for 20 businesses sampled in Table 2.

TABLE 2. A cross section of annual and capital items purchased by 20 aquaculture businesses in the 2013-14 period over 100km or from outside NSW

Expenditure item	Annual expenditure		Capital expenditure		Grand Total
	Outside NSW	Over 100 km	Outside NSW	Over 100 km	Grand Total
Fish food	324,525	1,800			326,325
Oyster Spat			37,033	40,818	77,851
Oyster trays	11,875		20,000	34,597	66,472
Posts		10,000	50,784		60,784
Fuel/oil	51,231	6,609			57,840
Car/Bikes		2,782		39,000	41,782
Truck/Bobcat				40,000	40,000
Oyster bags	9,000	14,413		9,000	32,413
Electricity/ Telephone	2,946	25,526			28,472
Outboard			1,500	23,800	25,300
Mussel Floats and Socking	4,000		13,500		17,500
Admin/Insurance		15,105		616	15,721
Fish fry	2,000			15,000	15,000
Oyster Mesh, Foam	2,700	12,899			14,899
Tanks/cylinders	4,996		8,500	3,000	14,200
Packing and freight	1,123	7,448			12,444
Small hardware		4,780		937	6,840
Conveyor			6,500		6,500
Gas/welding/ compressor		4,954			4,954
Rope		2,900			2,900
Grand Total	414,396	89,703	137,817	206,767	848,683
Percentage of grand total	48.8%	10.6%	16.2%	24.4%	100.0%

Table 2 reports that fish food is the major expenditure from outside of NSW. Oyster spat is another interstate sourced item as are capital items such as trays, posts, conveyors and specialized floats and equipment. The greater than 100km expenditure within NSW included purchases of vehicles and illustrates the distance of some of the aquaculture businesses from service providers and farm operators and the need to be as self sufficient as possible through hiring or purchasing of essential equipment.

Regional economic impacts for the aquaculture sector

This approach measures the economic benefits at the farm gate or point of first sale, as opposed to subsequent economic activity in the processing, wholesale and retailing of seafood, which are the secondary sector, which is addressed later. For the primary production sector, a production approach can be used to measure the benefits that go the whole NSW economy from the aquaculture activity and then the indirect benefits to the community from the inputs sourced from the community, in producing the farm production. The results of the economic survey are used to estimate the level of inputs used in the aquaculture process, with this data being inserted into a regional economic model of the NSW economy. The report of the regional economic modelling by Western Research Institute (WRI) is reported in Appendix 5. The available regional data can support an analysis down to 3 coastal areas of NSW as described in Table 4.

The economic impacts of commercial aquaculture on the respective regions

The WRI study used a standard regional economics approach incorporating input-output modelling as described in the methods section and WRI report (Appendix 5). From the sales revenue obtained by industry there is an initial expenditure on inputs in the general economy of \$31.06m which produces an amount of economic output across the economy \$113.5m. The total estimates are made up of the initial stimulus, plus the flow-ons as reported in Table 3.

TABLE 3. The initial and flow-on economic impacts of commercial aquaculture on the total for NSW

Expenditure by region - NSW (\$m) \$31.06m	Output (\$m)	Value added (\$m)	Household income (\$m)	Employment (no.)
Initial	47.44	30.66	13.83	550
Flow-on	66.04	34.23	16.18	198.1
Total Impact	113.48	64.89	30.00	748.1
Type II multiplier	2.39	2.12	2.17	1.36

The direct initial output is \$47.44m and the indirect flow-on is an output of \$66.04m (Gross Regional Product – GRP) giving the state total of \$113.48m. Aquaculture in NSW has a direct \$30.66m of value added, has an indirect flow-on in the economy of \$34.23m making a total of \$64.89m across the NSW economy. The value added is the output, less the intermediate consumption (i.e. the cost of materials, supplies and services used to produce final goods or services). Similarly there is a total of \$30m generated in household incomes. The initial direct Full Time Equivalent (FTE) employment is 550 jobs and there are then 198 indirect FTE jobs in supplying inputs for aquaculture businesses making a total employment of 748 jobs.

The total impact can be related as a ratio of the initial impacts and is referred to a Type II multiplier. For example, for output \$113.48m/\$47.44m gives a Type II output multiplier of 2.39. The value added Type II added value and income multipliers are

2.12 and 2.17 respectively and the Type II employment multiplier is 1.36 for all of NSW. These indicate the dimensions of multiplication in the general economy associated with aquaculture production. The regional results for all regions are presented in Table 5, summarised from the WRI report in Appendix 5.

The output can be measured for different areas, such as for the three coastal areas in this study and then for the whole NSW economy. In Table 4 the results of the regional economic analysis are presented for each of the study areas along the NSW coast. The total NSW results cover all three areas and account for economic activity between areas, not calculated in each region, or by adding those regions (the all regions column).

TABLE 4: The economic impacts of commercial aquaculture on the respective regions

	North Coast	Mid North and Central Coast	South Coast	All Regions	NSW
Initial expenditure (\$m)	7.82	14.15	9.08	31.06	31.06
Output (\$m)	21.54	40.25	25.38	87.17	113.48
Value added (\$m)	10.6	25.36	15.66	51.62	64.89
Household income (\$m)	4.37	11.63	6.88	22.88	30
Employment (no. FTE)	143.60	361.20	182.10	686.90	748.10

At the regional level, results from the economic modelling in Table 4 showed the greatest increase in GRP in the Mid North and Central Coasts region (\$25.36m), followed by the South Coast (\$15.66m) and North Coast (\$10.6m), with a total increase in GRP for all regions of \$51.62 million, and for all of NSW \$64.89.

Household income had the highest impacts in the Mid North and Central Coasts (\$11.63m) followed by the South Coast (\$6.88m). The largest employment impacts were seen in the Mid North and Central Coasts (361), South Coast (182) and the North Coast (143) regions, with a total of approximately 686 FTE achieved across all regions.

In Table 5 the initial and flow-on outputs, value added, household income and employment are reported for each of the three study areas, total regions and NSW. The Mid North and Central Coasts region has significantly higher regional economic activity than the other regions.

TABLE 5: An overview of the output, value added, household income and employment in the three areas, all areas and all NSW

Annual expenditure	Output	Value Added	Income	Employment
Expenditure \$7.82m	(\$m)	(\$m)	(\$m)	No. of FTE
Initial (\$m)	10.4	5.14	2.14	110
Flow-on (\$m)	11.14	5.45	1.97	33.6
Total	21.54	10.6	4.37	143.6
Annual expenditure	Output	Value Added	Income	Employment
Expenditure \$7.82m	(\$m)	(\$m)	(\$m)	No. of FTE
Initial (\$m)	22.28	15.67	7.18	297
Flow-on (\$m)	17.98	9.69	4.45	64.2
Total	40.25	25.36	11.63	361.2
Annual expenditure	Output	Value Added	Income	Employment
Expenditure \$7.82m	(\$m)	(\$m)	(\$m)	No. of FTE
Initial (\$m)	14.48	9.84	4.24	143
Flow-on (\$m)	10.89	5.82	2.64	39.1
Total	25.38	15.66	6.88	182.1
Annual expenditure	Output	Value Added	Income	Employment
Expenditure \$7.82m	(\$m)	(\$m)	(\$m)	No. of FTE
Initial (\$m)	47.16	30.66	13.83	550
Flow-on (\$m)	40.02	20.97	9.06	136.9
Total	87.17	51.62	22.88	686.9
Annual expenditure	Output	Value Added	Income	Employment
Expenditure \$7.82m	(\$m)	(\$m)	(\$m)	No. of FTE
Initial (\$m)	47.44	30.66	13.83	550
Flow-on (\$m)	66.04	34.23	16.18	198.1
Total	113.48	64.89	30	748.1

Table 6 reports the Type II ratios, which are the multipliers and are given by the ratios of total output/initial output in a given region. The ratio shows how the economy in each region responds to the additional stimulus from commercial aquaculture. Ratios are shown for added value, household income and employment. The higher the ratio the more induced effect there is from a regional economy relative to the stimulus.

TABLE 6: An overview of the Type II multiplier ratios for output, value added, household income and employment in the three study areas

Output	Initial (\$m)	Total (\$m)	Type II ratio
Far North	10.4	21.54	2.07
Mid North	22.28	40.25	1.81
South	14.48	25.38	1.75
Total regions	47.16	87.17	1.85
NSW	47.44	113.48	2.39

Income	Initial (\$m)	Total (\$m)	Type II ratio
Far North	2.41	4.37	1.81
Mid North	7.18	11.63	1.62
South	4.24	6.88	1.62
Total regions	13.83	22.88	1.65
NSW	13.83	30	2.17

Value Added	Initial (\$m)	Total (\$m)	Type II ratio
Far North	5.14	10.6	2.06
Mid North	15.67	25.36	1.62
South	9.84	15.66	1.59
Total regions	30.66	51.62	1.68
NSW	30.66	64.89	2.12

Employment No.	Initial (\$m)	Total (\$m)	Type II ratio
Far North	110	143.6	1.31
Mid North	297	361.2	1.22
South	143	182.1	1.27
Total regions	550	686.9	1.25
NSW	550	748.1	1.36

For each of the four measures, the highest multiplier occurs for the NSW version, which benefits from the inter-connectedness between the economy in the three areas. The output, value added, income and employment multipliers are slightly higher in the North Coast region, reflecting the economy in that area.

Discussion of the aquaculture production sector results for all NSW

The economic significance of an industry, such as commercial aquaculture, can be measured in terms of direct and indirect effects. The direct effects from the initial expenditure are a measure of the value of output of the industry itself, the number of people employed and the income they receive. The indirect effects, or flow-ons reflect induced indirect responses in the economy.⁶

The multipliers indicate the size of those impacts relative to the level of sales to final demand. The Type II ratios reflect the relationship between the total impact (direct and indirect) to the direct effect. The calculation of multipliers from aquaculture will only include the linkage effects that occur back through the supply of inputs to fishermen and not any effects downstream toward the consumer. In the next section we examine the impacts from the secondary sector seafood activity.

⁶ Flow-ons can be divided into production induced and consumption induced effects in the economy. Production induced effects are the industry's purchase of goods and services from other industries. Consumption induced effects arise from the spending of household income received as payment for labour.

Estimates of the regional impacts of the secondary sector in aquaculture

The secondary sector includes post farm gate sales activities and functions such as product receivers, processors, wholesalers and retailers. There is little published data on these supply chains in NSW aquaculture. Retail prices are known for oyster species in places like the Sydney Fish Markets, but many aquaculture products also end up in the retail and restaurant trade – the food industry. To estimate the secondary sector for aquaculture we are going to assume it is similar to the overall NSW seafood sector including capture fisheries, as we calculated for the sister project on wild-catch fisheries (Voyer et al. 2016). In that study we drew on previous site-, and port-specific estimates, to provide a state-wide estimate.

There are previous regional economics studies of the wild-catch and seafood sector in areas of NSW (Tamblyn and Powell, 1988, Powell et al., 1988, Harrison, 2010). Regional studies have been completed in other states (Econsearch, 2014b). There are two scenarios in the past NSW site-specific regional seafood studies noted above. One is where fish are landed and have little processing (Tamblyn and Powell, 1988, Powell et al., 1988) and the second is where fish are further processed as in the Northern Rivers region (Harrison, 2010). In estimating the state-wide secondary sector estimates, we use the ratio of primary to secondary output in the past studies to generate an imputed output value for the secondary sector. These ratios were 0.99 of the primary output value (Tamblyn and Powell, 1988, Powell et al., 1988) and 1.29 (Harrison, 2010) where there was fish processing in the Clarence region. The secondary sector for aquaculture uses the lower figures as reported in Table 7.

TABLE 7: Adjustment factors used to impute values of the secondary sector from the primary sector estimates

All NSW	Output (\$m)	Added Value (\$m)	Income (\$)	Employment (\$m)
Primary to secondary adjustment factor	0.99	1.06	1.31	1.35

The estimated lower and higher secondary sector estimates are presented in Table 8.

TABLE 8: The regional aquaculture sector with retail and processing estimates (low and high)

Expenditure by region - NSW (\$m) \$31.06m	Output (\$m)	Value added (\$m)	Household income (\$)	Employment (no.)
Aquaculture	113.5	64.9	30.0	748.1
Retail and processing estimate	112.3	68.8	39.3	1,009.9
Total estimate	225.8	133.7	69.3	1,758.0

The secondary sector estimates in Table 8 show that for the year 2013–14 the state-wide estimates of both the aquaculture growing and secondary sector are between an output of \$226m, \$134m added value, \$69.3m in household income and the sectors employ a total of 1,758 full time jobs across NSW. This would translate into many more part time and casual jobs among as seen across the aquaculture and secondary seafood retailing industries in NSW.

The accepted estimates likely exceed those of DPI that the NSW seafood industry, including aquaculture and oyster farmers generates over \$500m of economic activity each year and employs more than 4000 people (NSW DPI, undated).

The sister project on wild-catch fisheries estimated that professional fishing and the secondary seafood sector had a likely output in 2012–13 of \$436m–\$501m with an estimated 3,291 and 3,857 full time jobs across NSW (Voyer et al. 2016). The current aquaculture study indicates that aquaculture and the associated secondary seafood sector have a likely output in 2013–14 of \$225.8m with an estimated 1,758 full time jobs across NSW.

In the light of these studies we can adjust the NSW DPI estimate of the industry to say that the NSW seafood industry, including aquaculture and oyster farmers generates over \$650m of economic activity each year and involves more than 5000 FTE jobs. Furthermore, since many aquaculture and fishing businesses are lifestyle in nature and family-run, with many part time workers, the total number of people working in the seafood sector would be much more than 5000.

References

- ECONSEARCH 2015. *The Economic Impact of Aquaculture on the South Australian State and Regional Economies, 2012/13. A report to PIRSA Fisheries and Aquaculture by EconSearch Consulting*. Adelaide: PIRSA Fisheries and Aquaculture.
- HARRISON, J. 2010. *A Socio-Economic Evaluation of the Commercial Fishing Industry in the Ballina, Clarence and Coffs Harbour regions*. Maclean: Fisheries Research and Development Corporation Project No. 2009/054.
- NSW DPI. 2016. *Aquaculture in New South Wales – Facts and Figures 2015*. New South Wales, Department of Primary Industries.
- NSW DPI undated. *Commercial Fisheries* [Online]. Sydney: NSW Government, Department of Primary Industries (DPI). Available: <http://www.dpi.nsw.gov.au/fishing/commercial> [Accessed 12 September 2016].
- POWELL, R. A., JENSEN, R. & HORWOOD L. 1988. *The Effects of Policy Change on South-East Trawl Fishing Communities. Report to the Steering Committee on Long-Term Management of the South East Trawl Fishery*. Canberra: University of New England and Department of Primary Industries and Energy.
- TAMBLYN, C. A. & POWELL, R.A. 1988. *Input and Output study of the North Coast Agriculture and Fisheries Industries*. Wollongbar: NSW Dept. of Agriculture.
- VOYER, M., BARCLAY, K., MCILGORM, A. & MAZUR, N. 2016. *Social and Economic Evaluation of NSW Coastal Professional Wild-Catch Fisheries (FRDC 2014/301)*. Canberra: Fisheries Research and Development Corporation (FRDC).

Appendix 5. Economic evaluation of NSW coastal aquaculture: report by Western Research Institute (WRI).

Submitted to FRDC as a separate document. Can be supplied upon request to the author: Kate.Barclay@uts.edu.au

Appendix 6. Stakeholder workshop on the importance and strength of industry contributions to community wellbeing

Rate from 1 to 5 the importance of the contributions the aquaculture industry provides.

1. Not important at all
2. Somewhat important, lesser importance than the other contributions
3. Moderately important, other contributions are of greater importance
4. Very important, but not the most critical
5. Critical

Think in terms of the 'ideal' situation, not the current position.

Aquaculture contributions		
Dimension of wellbeing	How important is aquaculture for:	Importance (1-5)
A resilient economy	Revenue generation in coastal communities?	
	Numbers of jobs in coastal communities?	
	Economic diversity in coastal communities?	
	Synergies with other sectors, such as tourism?	
Health	Food security/sovereignty?	
	Food safety?	
	Nutrition (includes 'freshness')?	
	Nutri- & pharmaceutical products?	
Education & knowledge generation	School/TAFE/university visits?	
	Business innovation?	
	Research on aquaculture methods?	
	Workplace training opportunities for low entry labour?	
Healthy environment	Environmental stewardship activities?	
	Environmental research/data collection?	
	Building community environmental awareness?	
	Environmental food localism?	
Integrated diverse & vibrant communities	Jobs/business opportunities for various ethnic communities?	
	Jobs for Indigenous people?	
	Business opportunities for Indigenous people?	
	Jobs with low entry requirements?	
	Social capital to achieve community goals?	
	Food for various ethnic communities?	
	Contributions to community celebrations and events?	
	Cultural food localism?	
Heritage & community identity	Historical sense of place? (eg, 'oyster town')	
	Contemporary sense of place?	
	Culturally valued food production? (eg, for celebrations)	
Leisure & recreation	Fresh local food for tourists?	
	Fish aggregating infrastructure for rec. fishers?	
	Sites for tourists to visit?	

Based on the research presented today and what you know about the industry, rate the strength of the contributions of aquaculture to each dimension of wellbeing, in the current situation.

Rating	This contribution is:
5	Extremely strong and is at or near its maximum potential
4	Very strong with some potential for further development
3	Moderately strong with potential for future development
2	Underdeveloped with significant potential for growth
1	Weak and not meeting its potential

Dimension of wellbeing	Contributions	Strength of contribution (1-5)	Key threats
A resilient economy	Revenue, employment, relationships with service, post harvest, tourism sectors		
Community health	Fresh, local, nutritious and/or culturally valued food		
Education and knowledge generation	Workplace training, aquaculture education & research, business innovation		
A healthy environment	Stewardship activities, environment research & data collection, building community awareness, food localism		
Integrated diverse and vibrant communities	Community celebrations, jobs & business opportunities for various ethnic groups, jobs for disadvantaged people, food for various ethnic communities, cultural localism		
Cultural heritage and community identity	Historical and/or contemporary sense of place, culturally valued food production		
Leisure, recreation and cultural life	Fresh local food for tourists, sites for rec. fishers & tourists		

Key threats identified by stakeholder workshop participants

Dimension of wellbeing	Key threats
A resilient economy	<ul style="list-style-type: none"> > Employment opportunities need to be more advertised (x2); > main threats in increasing production are availability of hatchery seed, access to increased production area for aquaculture, and diversification of aquaculture products; > environmental change, disease, negative public perception of the industry (x2), lack of succession planning; production issues reducing profitability; > various perceptions of what “sustainable seafood” is; > sector competition; > lack of awareness of the potential contribution the industry could make to tourism; > NIMBYism (x2); > industry retraction; > urbanisation pressure (x2); > inability to expand / cultivate new areas, under-production; > NGOs.
Community health	<ul style="list-style-type: none"> > Williamtown groundwater pollution; > people already know of the health benefits of eating seafood; > disease – negative public perception; > urbanisation; > visual impact of aquaculture farms; > lack of availability; > environmental concerns; > pollution / climate change; > out-of-season or overpriced; > often seen as easier to send to larger city markets rather than service local need.

Education & knowledge generation	<ul style="list-style-type: none"> > TAFE closing down; > they already exist but we can boost some of the good things that are happening; > without information / education consumers may develop wrong picture about the industry; > lack of support for R&D that drives innovation; > should not be seen as a job to do because can't get a job anywhere else; > lack of access to capability; > industry growth; > profitability of business; > under-resourced, low capital resources to fund innovation / research; > all ends of the spectrum exist, from nil, to on-the-job, to PhDs and postdocs; > slow change in production methods due to cost / old farmers, limited technology to interest new generations;
A healthy environment	<ul style="list-style-type: none"> > Historical practices raised; > need to tell story better, it is already happening; > spills, run-off from land-based practices that affect estuaries and 'uneducated' opinion may blame source on aquaculture practices; > failure to manage catchments; > role of the media in pushing down consumption; > external impacts on safety of product; > public perception of poor performance; > lack of awareness of stewardship practices; > cost; > stewardship is strong but community awareness and food localism could be improved; > adopt technology, share data.

<p>Integrated, diverse and vibrant communities</p>	<ul style="list-style-type: none"> > Current local opposition to yellowtail kingfish farms; > need more education / dissemination to promote opportunities for disadvantaged people; > focus on seafood consumption for celebrations may drive down purchasing outside of these times; > lack of variety available; > lack of connections to these communities; > little being done by the industry in this space; > profitability of business; > not a very well developed area; > in decline, events used to be quite big; > labour costs high; > technology in future may reduce job opportunities.
<p>Cultural heritage and community identity</p>	<ul style="list-style-type: none"> > Historical mismanagement, e.g. introduction of Pacific oysters, derelict lease infrastructure; > Tasmania an example of where this is done well; > industrialisation and corporatisation; > higher profits to sell product outside local region; > lack of awareness of Indigenous connection to aquatic biological resources and associated rights; > NIMBYism; > loss of identity through use of internet / facebook etc.; > depends on the different locations' history with aquaculture; > in decline compared to the past due to low industry productivity / profitability.

Leisure, recreation and community life	<ul style="list-style-type: none">> Look for innovative ways of promoting industry, e.g. oyster farm tours (they exist in Merimbula and other areas);> conflict with tourism industry;> too many tourists may damage fragile ecosystem that farm resides in or may damage or pilfer product;> external environmental impacts e.g. land clearing, loss of habitat;> appears to be patchy, not widespread and uncoordinated;> pollution (x 2) or sickness from suppliers;> varies depending on level of tourism in the area;> technology / surveillance will allow greater access to tourism and recreational users.
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