



A changing marine sector in Australian coastal communities: An analysis of inter and intra sectoral industry connections and employment



Ingrid van Putten^{a, b, *}, Christopher Cvitanovic^{b, c}, Elizabeth A. Fulton^{a, b}

^a CSIRO Oceans and Atmosphere, Hobart, Tasmania, 7001, Australia

^b Centre for Marine Socioecology, University of Tasmania, Battery Point, Tasmania, 7004, Australia

^c Faculty of Law, University of Tasmania, Battery Point, Tasmania, 7004, Australia

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ABSTRACT

The human population is concentrated in coastal regions around the world, and while much of this is in large urban centres, recent years have seen significant growth among smaller regional coastal centres. The economic sectors of these smaller coastal communities have historically been driven by marine based economic activities like fishing. However, there has been a decline in the fishing sector and in some communities other marine related activities – such as aquaculture, tourism, off shore oil and gas, ports, and transport (collectively called the marine sector) – are growing instead. The industry makeup of the marine sector is changing, which presents challenges to some coastal communities forced to reshape their economic activities and diversify across the portfolio of marine industries. Doing so requires intricately linked networks of businesses and services, potentially across industries, that each rely on a flow of inputs from their suppliers and downstream industries to take their product. Using Australia as a case-study, this study uses national level Input-Output (IO) data to quantify industry connections to different marine industries and assess those that may be crucial for the continued existence or future growth of the marine sector. Results show that while fishing and aquaculture are reliant on several overlapping up- and downstream industries, and some synergies exist with marine tourism, there is little overlap with other marine industries. Although marine tourism is the largest employer in small regional coastal communities across all states, employment in fishing and aquaculture is more important in small regional coastal communities than in any other type of community. These communities are most at risk of not being able to build or maintain intricate industry connections necessary for diversifying into new marine industries. The differences in the structure of the marine sector among coastal communities according to their location and size suggests that a decline in traditional marine industries will have a disproportional effect on the economic security and thus social well-being of certain communities, and highlights the need for targeted and location specific governance and policy responses to build resilience among the marine sector in coastal communities.

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1. Introduction

The assets contained in the marine environment contribute an estimated US\$24 trillion to the global economy (Hoegh-Guldberg et al., 2015), putting aside hard to quantify ecosystem services

(such as oxygen production). In Australia alone the contribution of the marine environment to the economy is estimated at over AU\$42 billion in 2009–2010 (Australian Institute of Marine Science, 2012). The economic sectors that rely on the marine environment are of particular importance in regional coastal communities where participation in this sector is traditionally high (Miller et al., 2012; van Putten et al. 2016). For example, in Australia an estimated 85% of the total population live within 50 km of the coastline (Australia Bureau of Statistics, 2004) and communities have a strong attachment to coastal living (Gurran et al., 2005; Gurran and Blakely, 2007; Ragusa, 2011). As such

* Corresponding author. CSIRO Oceans and Atmosphere, Hobart, Tasmania, 7001, Australia.

E-mail address: ingrid.vanputten@csiro.au (I. van Putten).

any changes in the structure of the marine sector is likely to have significant adverse impacts on coastal communities in terms of local employment (Gardner et al., 2006) and could thus impact the Australian way of living.

In recent times in some Australian coastal communities growth in the size and change in the characteristics of the marine sectors has become evident. Firstly, the number of industries that comprise the marine sector has expanded and now includes many other economic activities aside from fishing; such as aquaculture, marine tourism, ports and transport, energy (oil and gas, but also more recently renewable energy sources like winds and tide), and mining (e.g. salt, precious metals or diamonds, or aggregates for construction). Secondly, where these more recent marine sectors are growing they have brought with them secondary industries, like logistics companies and storage facilities, which have matured and created additional economic and employment opportunities for local coastal communities (Department of Primary Industries, 2012). For instance in Tasmania the salmonid and oyster industries were established in the early 1980s and employment in the growing and associated processing industry has since grown to 1100 and 300 respectively (Department of Primary Industries, 2012).

The growth and maturation of some components of the marine sectors stands in stark contrast to the decline of the traditional commercial fishing sector due to a general decline in landings (Skirtun et al., 2013). Fishing fleets are shrinking, or simply disappearing from some ports. The specific cause for this decline differs between jurisdictions, locations and fisheries. This has also meant that there is a spatially uneven spread in the decline of the commercial fishing fleet. Regardless of the cause, the reduction in the fishing fleets directly impacting levels of employment in the affected regional coastal communities (Tull et al., 2015). This is despite an often increased profitability per vessel for the vessels that remain in the industry and the relatively steady economic value of many fisheries when considered at the Australian level, due to price increases and new export market developments (Savage and Hobsbawn, 2015).

In regional coastal communities where a decline has been observed and where other economic activities have not increased, the associated loss of economic security and productivity has undermined the long term prosperity and resilience of these communities, placing them on the verge of economic tipping points (Miller et al., 2012). The risk posed to these regional coastal communities by the changing structure and composition of the marine sector is deepened further by the already obvious climate pressures in the marine environment (Burrows et al., 2011). Quite apart from the stress put on coastal infrastructure by climate change driven sea level rise and extreme events (Lewsey et al., 2004; Brown et al., 2014), some less obvious effects may arise from biological impacts on marine species abundance (Simpson et al., 2011), change to their distribution (Last et al., 2011; Nye et al., 2009; Perry et al., 2005), changing physiology (Neuheimer et al., 2011) and phenology (Dufour et al., 2010). These climate driven physical and biological impacts can have negative consequences for directly dependent industries (such as fisheries) and consequently also on downstream sectors (Grafton, 2010; Dell et al., 2015). For instance, range contraction of a commercial species can mean reduced local abundance and lower commercial catches with flow on effects on local processing businesses (Hobday et al., 2008). This can be further exacerbated if regulatory policy automatically assumes a fisheries induced stock reduction, rather than a climate driven relocation, and forces specific management responses rather than allowing for spatial shifts in targeting (for those boats able to do so). However, climate impact in the marine environment can also have positive economic

outcomes. For instance, range expanding recreational species can mean increased business for charter fishers and local tackle shops (van Putten et al., 2014a). Changes in the economic role of commercial fisheries due to several social and economic processes, in conjunction with any climate impacts, are already evident in some regional coastal communities and have presented a strong imperative to explore alternative economic opportunities nationally in Australia (and also on a global level) (e.g. Fabinyi, 2010; Carter and Garaway, 2014; Porter et al., 2015).

In light of the above physical, biological and socio-economic challenges some coastal communities are already experiencing, and other communities may increasingly be facing, they will be forced to change and reshape their economic activities to ensure future growth and prosperity. Due to their location near the ocean, some of these new economic activities are likely to be in the other marine sectors. Consequently, coastal communities that are impacted by a shrinking fishing sector, may increasingly diversify into other marine industries like tourism (Green, 2000; Miller et al., 2012), or aquaculture (which is often seen as a natural livelihood diversification given it also deals with marine food production), or extractive industries such as energy or mining. Switches of this kind can be problematic for these communities, particularly during the transitional period when they are not familiar with the activity patterns associated with these new ventures. For example, income streams generated by marine tourism are usually seasonal and highly impacted by external factors such as the exchange rate of the Australian dollar (Coakes et al., 2001), international affairs and extreme events or pandemics (Jones et al., 2010). Alternatively, communities that turn to the growing aquaculture industry (Naylor et al., 2000) can face long development lead times and be susceptible to their own climate related impacts and challenges – such as excessive fresh water flows (extreme events), which affect oyster growers (e.g. Knowles, 2014).

While the nature of change experienced in the marine sector will be context specific and dependent on local factors, the future economic security of coastal communities is contingent on the extent to which any increase in economic activity translates to so-called economic maturation. This occurs when the local market is large enough to support local suppliers, which then leads to the emergence of service sector suppliers and economic transformation at the regional level (e.g. O'Connor, 2004). Economic maturation of this kind, however, requires intricately linked networks of industries, businesses, and services that each rely on the flow of inputs from their suppliers and downstream industries to take their product (Carvalho, 2012). Accordingly, understanding the composition, structure and strength of the networks linkages among marine industries in coastal communities is critical for understanding how policy interventions can best support economic growth and the prosperity of coastal communities (Driffield et al., 2002).

The aim of this study is to identify key industry linkages for different marine industries (collectively referred to as the marine sector) that rely on the *marine* environment using Australian national level Input Output (IO). The IO data provides an intuitive way by which the different sectors that make up an economy can be understood (e.g. Allen Consulting Group, 2004). In this study we also characterised the marine sector in terms of sectoral employment (Wan et al., 2013) at regional coastal community level, and spatially evaluate the impact of a change in the structure of the marine sector across Australia. In the next section we provide an overview of IO analysis and the ways in which we have applied it to the Australian marine sector. We then present the results of marine sectoral employment characteristics for Australian coastal communities and relate this to industry

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