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The impact of industrial tuna fishing on small-scale fishers and economies in the Pacific

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ABSTRACT

Industrial fishing for tuna is a major revenue earner in the Pacific Islands region. Capturing more benefits from this fishery is a key priority of Pacific Island country governments and people. Many Pacific countries have done this by allowing transhipping — the transfer of fish from industrial purse-seine fishing vessels to carrier vessels in port. This paper investigates one such port, Funafuti in Tuvalu. Using a unique dataset, the analysis (for the first time) demonstrates that there are a number of negative impacts on small-scale fishers associated with allowing transhipping in port. These negative impacts include lost employment days, reduced catches and, potentially, fresh fish availability and lower incomes within the artisanal fishery. The analysis also demonstrates that there are benefits associated with transhipping, such as spending in local businesses and bycatch off-loads. This paper provides a number of considerations for governments to optimise the benefits from transhipping and minimise costs.

1. Introduction

Fish and fisheries contribute significantly to the economies, livelihoods, food security and income of Pacific Island countries [1]. Fisheries contribute between 0.6% and 10% of the gross domestic product (GDP) of many Pacific Island countries and account for USD 820 million in exports across the region [2]. In 2015, purse-seine and longline vessels of member countries of the Pacific Islands Forum Fisheries Agency (FFA) contributed USD 276 million to the countries' GDPs [3]. Offshore, locally based, industrial tuna vessels employ about 23,000 people in FFA member countries (authors calculations from data in [2] and [4]) and globally 56% of the world's tuna comes from the Pacific [5]. Small-scale subsistence and semi-commercial fishing is no less important as it provides most of the catch and protein in Pacific island countries [2,6]. Among Pacific island countries, 27% of households participate in fishing activities and 8% of households rely on fishing as a primary source of income. Current fish consumption is significant in the Pacific region averaging between 20 kg and 110 kg/person/year [7], with many Pacific Island countries expected to face a local production shortage of fish by 2030 [6].

The distribution and types of benefits from each fishing sub-sector may be very different, with small scale fisheries potentially only capturing a small fraction of the benefits of oceanic resources. Barclay and Cartwright [8] state that the 'most prominent desire' among small-scale fishers and Pacific Islanders is to capture more of the wealth created by their domestic pelagic resources, according to the principles of social equity and sustainability. Currently, most of this value comes from access and license fees. In 2014, USD 349 million in license fees were paid by distant water fishing operators to Pacific Island nations [2].

Some Pacific Island countries have captured additional benefits from distant water fishing nations through the development of local businesses and services in transhipping ports in countries such as Tuvalu, Marshall Islands and Solomon Islands [8]. These income sources contribute significantly to national economies and often make up a critical component of government budgets. Industrial operations, on the other hand, may impact important local small-scale fisheries. It is conceivable that local fishers are losing out as a result of these attempts to capture more value domestically as the benefits of the operations do not directly accrue to small scale fishers.

The United Nations Fish Stocks Agreement, requires signatories to consider the interests of artisanal and subsistence fishers, and avoid the adverse impacts of industrial fishing on these fishers [9]. Yet, Pacific Island coastal communities have become increasingly concerned about the impact of industrial fishing on the depletion of fish stocks on which they depend [10].

The potential for interactions between small-scale artisanal fishers

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and industrial fishing is increasing. With climate change degrading coral reef ecosystems, coastal fishers must move farther off shore and increasing rely on oceanic species for their catch [11]. As a result, Bell *et al.* [11] estimate that oceanic tuna will need to provide 25% of all fish consumption in the Pacific by 2035. The stated policy aim of Pacific Island countries and territories is to increase the amount of tuna available for domestic consumption by 40 000 t in 10 years [12].

The importance of interactions between small-scale fishers and industrial vessels has been noted by Shomura *et al.* [13], who remarked that knowledge of the interactions is essential for rational fisheries management, a statement that remains true more than 25 years later. The interactions literature is dominated by the analysis of biological and fish stock interactions, largely noting the reduction in the availability of fish for small-scale fishers [13–15]. There are also some studies documenting accidents and incidents at sea, but these are often poorly reported [16]. Behavioural and land-based interactions, however, are poorly understood [17,18]. Understanding and managing interactions within the oceanic fishery will be critical in achieving the Sustainable Development Goal (SDG) related to oceans (SDG 14), and the priorities in Pacific regional documents that guide Pacific Island countries' fisheries policies [19]. The Regional Roadmap for Sustainable Pacific Fisheries [20] states that the goals of coastal fisheries are to ensure resilience, protect livelihoods and empower communities. For oceanic fisheries, ensuring sustainability while extracting the greatest value, employment and food security outcomes are central [21]. The overarching goal of the Pacific region's "New Song for Coastal Fisheries" [22] is 'improved wellbeing for coastal communities'. Policies designed to contribute to these outcomes will be inefficient and potentially less effective without a good understanding of the trade-offs associated with fishers' behaviour [23].

The scientific literature indicates that there are some impacts on the availability of oceanic pelagic resources to small-scale fishers as a result of industrial vessels fishing in local waters, particularly when they are close to shore [14,15,24–27]. Leroy *et al.* [15] commented that 'industrial purse-seine fisheries may impact upon artisanal and subsistence fishers by reducing local fish availability', and SPC [26] found that industrial vessels 'largely catch similar sized fish to the artisanal fleet', suggesting that the two fisheries fish the same portion of the stock. However, SPC [26] do not suggest that industrial vessels directly impact the catch of artisanal or subsistence fishers.

Anecdotal evidence supports the conclusions from the literature and suggests that many fishers believe that industrial fishing is depleting stocks of coastal recourses (authors' discussions with a range of Pacific Island communities). In Tuvalu, data collectors, Fisheries Department staff, and fishers have all described the same pattern: the presence of industrial vessels means that fewer artisanal fishers go fishing and catches are reduced. Abernethy *et al.* [17] describes our understanding of small-scale fishers' behaviour as 'at best rudimentary', yet this underpins fishers' day- to-day decisions, and without a basic understanding of the behavioural dynamics, policy will be inefficiently designed and likely to fail. Muallil *et al.* [18] also call for a greater understanding of the factors impacting a fisher's willingness to exit a fishery. Developing data-driven evidence and understanding the behavioural drivers of artisanal fishers and the impacts of their behaviour is important, and policy-makers need to fully understand these trade-offs when making decisions.

This paper looks to address this gap in the literature with an initial analysis of the impact of transhipping on the willingness of fishers to go fishing in Funafuti, a small but important transhipping port. We go onto use this modelled relationship to estimate potential losses with the artisanal fishery as a result of transhipping activity.

Tuvalu is a Pacific Island nation in the central Pacific, consisting of nine atolls, and is one of eight members of the Parties to the Nauru Agreement (Fig. 1). Together, the member countries of the Parties to the Nauru Agreement control the largest tuna purse-seine fishery in the world, via the implementation of collective management arrangements [11].

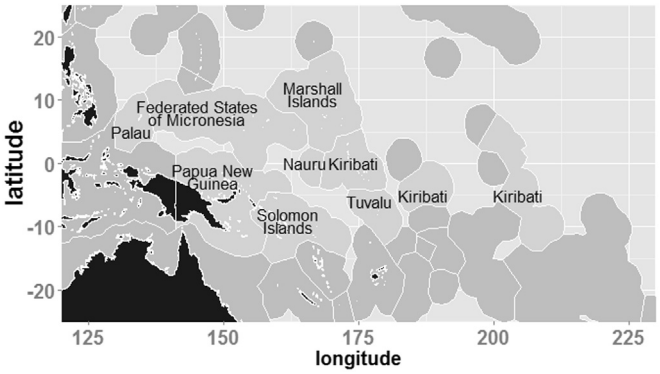

Fig. 1. : Location of Tuvalu relative to other member countries of the Parties to the Nauru Agreement.

The difficulty in quantifying interactions between artisanal and industrial fisheries is largely due to poor artisanal catch data [15]. At the Pacific Community (SPC) Head of Fisheries meeting in 2011 Tuvalu placed a high priority on understanding the potential for interaction between regional tuna fisheries and local artisanal fishing [24]. As a result, SPC provided support for artisanal catch monitoring in Tuvalu in 2013 to address critical data deficiencies and allow improved investigation into the interactions. This dataset provides a unique opportunity to investigate the interactions between artisanal and industrial vessels from a social and biological perspective. We use this and other datasets from Tuvalu to reveal the impact of industrial vessels on the willingness of artisanal fishers to go fishing. This revealed preference technique is a new approach to the problem of interactions between the two important sub-sectors of the tuna fishery.

Broadly, this paper considers three aspects of the interaction between industrial and artisanal fishing: 1) Does the presence or absence of industrial fishing vessels in the port of Funafuti affect a fisher's willingness to go fishing? 2) If so, what are the impacts on key livelihood indicators such as employment, income and the availability of locally produced fish? 3) To fully understand the trade-offs facing decision-makers we estimate the benefits of allowing transhipping in port and compare these to the modelled impacts in the artisanal fishery.

2. Materials and Methods

2.1. Data

Three complimentary datasets were analysed: artisanal landing survey data, individual artisanal logsheet data and commercial vessel monitoring system (VMS) data. Artisanal landing survey and individual logsheet data collection ceased in Tuvalu in 2016 in favour of a creel-based survey methodology due to changing objectives associated with data collection. Data are therefore available from 2013 to 2016, although 2016 is incomplete. The VMS data used for the impact analysis was for the period 2012 to 2016. The VMS system receives and records the position, course and speed of every vessel every two hours. We were also provided with transhipment data from 2014 and 2015, which aided in some of our calculations and allowed us to corroborate some of our findings.

The number of artisanal vessels fishing each day is calculated from landing site activity logs. These are collected by fisheries officers who report the number of boats returning to each landing site from a fishing trip each day. The number of vessels observed is a snapshot of how many vessels are actually fishing each day. To obtain the total daily fishing activity, the data were grouped into discrete time blocks. This allows us to scale the daily observed fishing activity to total daily fishing activity. The greatest number of boats observed returning from a fishing trip were between 04:00 and 12:00; after 12:00, the entries were