



Private provision of public information in tuna fisheries



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ABSTRACT

Private enumeration of landings data and traceability is an emerging phenomena in developing world tuna fisheries. The general goal of these systems is to facilitate compliance with mandatory market requirements such as the European Union's Illegal, Unreported and Unregulated fisheries regulation, as well as support aspirations for voluntary requirements such as the Marine Stewardship Council. The long-term success of these systems appears to be dependent on their ability to complement and extend government data and information systems. Developing and maintaining the credibility of these voluntary private enumeration and traceability systems requires strong market incentives as well as strong state support and assurance. If this credibility can be maintained private fisheries information systems may provide a promising basis for innovative stock assessment and management approaches relevant for complex developing world fisheries such as tuna.

1. Introduction

Ensuring the long-term sustainability of transboundary fisheries resources such as oceanic tunas starts with the availability of data and information on the status of stocks, as well as information on who catches fish, where, and how. Oceanic tuna fisheries are particularly complex given the highly diverse range of industrial to artisanal fisheries and the vast spaces and multiple jurisdictions involved. Management of these fisheries is further complicated by the lack of information on coastal tuna fisheries due to their remoteness and dispersion in regions like South and Southeast Asia, West Africa and the Caribbean [1–3]. Despite this complexity, public and private demands for information about these fisheries continues to grow. Public demands are made by states seeking to fulfil the requirements of regional fisheries management organisations (RFMOs) who in turn formulate conservation and management measures see [4,5]. Private demands are made by NGOs and buyers in export markets in response to their concerns about overfishing, fraudulent trade, and more recently, issues surrounding bonded and indentured labour [6–9]. These growing demands and poor information systems call for a new round of innovation in data collection, organisation, processing, and disclosure.

Despite the emergence of private informational demands, the state

remains the informational backbone of tuna fisheries management. Member states of many RFMOs are obligated to provide data and information on annual catches, active vessels, operational catch and effort data see [5,10]. These data and information feed into the databases of designated scientific and enforcement committees and organisations which support RFMO decisions on conservation and management measures [11]. Information required to comply with market requirements such as the European Union's illegal, unreported and unregulated (IUU) regulation is also a responsibility of export states, who have to ensure that licencing and catch certificates are coordinated through an EU-recognised competent authority [12]. Eco-certification schemes, such as the Marine Stewardship Council (MSC), also rely on various sources of information including state-coordinated information for assessing the sustainability of fish stocks and wider ecosystem health.

The willingness and capacity of states to invest in the provision of information related to oceanic and coastal tuna fisheries appears limited. Many tropical coastal states have been criticised for their weak and ineffective data management and information systems feeding into regional management [13–16]. Major tropical producing and processing countries like Indonesia, Philippines, Thailand, Papua New Guinea, Sri Lanka and Trinidad and Tobago have received warnings from the EU on failing to meet the IUU regulation with respect to poor

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transparency around fishing effort, regulation, data management, and traceability [17,18]. Although steps have been made in some of these fisheries towards compliance with the EU IUU legislation and the MSC standard, increased coverage and more accurate information remains a key point of improvement [19]. These information requirements are all the more critical in small-scale and coastal fisheries in many tropical countries where estimates on total fishery landings remain largely guesswork [15,20]. For example, in Indonesia estimates of under-reporting range from 38% of national landings to 57% of Eastern Indonesian landings [21], amounting to approximately 5% of total regional landings in the WCFC area [22].¹ The result is that regional management of tuna fisheries is undermined, as well as the capacity of fishers and other private sector actors to comply with requirements for entering export markets.

Faced with the limitations of state-based fishery information systems, the private provision of fisheries information is emerging, including the enumeration of tuna landings and investments in traceability systems. The rationale of these companies and NGOs is to improve the transparency of tuna fisheries and in doing so enable states to perform more effectively in RFMO negotiations, feed into more robust management systems, as well as meet trade related regulations such as the IUU rule of the EU, and/or compliance with MSC standards. In taking up responsibility for the private provision of public information, these groups appear to be bringing landings enumeration and traceability, as different information flows, together. But in doing so, these private initiatives may be encroaching on the role and responsibilities of states.

This short communication explores the extent to which private provision of enumeration and traceability data can complement public data to strengthen tuna fisheries management. In doing four critical areas of further research and development are identified which are likely to underpin the future application and expansion of private attempts to collect information in support of sustainable tuna fisheries and trade. The information drawn upon is 'panoptic' in scope – meaning broad observations from a range of sources to understand an emerging phenomenon are drawn upon. Primary and secondary sources include ongoing field-work conducted in Indonesia and the Philippines started in 2012, a review of secondary academic sources, and the grey literature on enumeration, traceability and Fishery Improvement Projects.

2. Private initiatives providing public information

2.1. Private enumeration

Private firms and NGOs are increasingly involved in establishing and running what might be termed 'pro-active' voluntary programmes for the enumeration of fisheries landing data, including catch composition (target and non-target species including endangered, threatened and protected species), landings number and weight, sizes of fish, and fishing effort (e.g. vessel size, gear type and fishing location). These proactive programmes differ from 'reactive' programmes in that they are established by fishing, processing and/or trading companies without any guidance from governments, i.e., they are private. They therefore differ from the fisheries that have been encouraged and guided by governments to voluntarily deliver data, most commonly in the step-wise implementation of individual quota systems, as seen in Canada and New Zealand [23]. Proactive enumeration programmes are more likely to emerge in countries where the coverage of state data collection is limited in terms of both coverage and accuracy, and where private actors are striving to meet export and/or MSC standards, or

other standards such as FairTrade [24]. Notably, these proactive programmes also still deliver data to state agencies to undertake stock assessments and management and therefore need to engage with government and inter-government agencies.

Proactive private data collection is becoming a common feature of fishery improvement projects (FIPs). FIPs are often implemented under the guidance of an NGO partner and (often but not always) with funding from philanthropic foundations and/or importers and retailers from the EU and US [25–27]. A common part of many FIPs, in line with requirements for MSC certification, is the development of data collection systems that include landings enumeration and spatially allocation through vessel monitoring [27]. In many FIPs, improved data collection focuses on improving local or national government capacity to support private interests such as MSC (Table 1). For example, the International Pole and Line Foundation (IPLNF) has established the Fisheries Information System (FIS) in the Ministry of Fisheries and Agriculture on behalf of their retail members, Marks and Spencer, Sainsburys and World Wise Foods [28]. The IPLNF system aims to ensure compliance with international catch and vessel reporting, including catch statistics, license information, catch certification, and fish purchase and transfer. In other cases, attempts are made to establish data collection systems, including on board observer programmes, with industry associations. An example of this is WWF's support to the Vietnam Tuna Association to develop an observer programme in response to private ambitions for MSC certification [29].

Other tuna buyers involved in FIPs have taken a more direct role in establishing enumeration programmes. In Indonesia and the Philippines, for instance, US and EU importers have established their own programmes for hand line tuna fisheries in response to inadequate government coverage [19]. In Indonesia Anova Foods established and partners with the now independent NGO Masyarakat dan Perikanan Indonesia (MDPI) to establish a protocol and enumeration system for tuna landing in multiple private ports and beaches across the eastern part of the country [19]. In addition, MDPI is also developing vessel monitoring systems for small hand line vessels to comply with IUU requirements and assess spatial allocation of tuna fishing effort. Data is then uploaded to the online government controlled cloud-based iFish database (www.ifish.id), designed to accept data from multiple public and private sources, and made available for Indonesian and government stock assessment scientists. MDPI is looking to expand their enumeration programme to include vessel monitoring systems that can collect real time information on the location and activities of fishing vessels. In the Philippines BlueYou (Meliomar), without the any government or NGO support, have established their own data collection system in the sites where they source fish in Mindoro and Lagonoy Gulf [30]. In both cases these enumeration programmes have developed data collection protocols that are compliant with the WCPFC data protocols, in terms of specific data collected (landings by species, size and area, effort) through sampling a specific proportion of the fishery. Data are also passed through government databases to RFMO level databases for regional stock assessment.

2.2. Traceability

While enumeration data may contribute to information needed for stock assessments and assessments of catch and effort allocation, it generally cannot address the wider range of informational needs for transparency in production and trade. For example, the fraudulent labelling of tuna species in both cans and in sushi bars [7] is not improved by monitoring tuna upon landing. The range of new provenance and credence requirements being made by tuna buyers, including country of origin or environmental and social sustainability, are also not guaranteed by enumeration alone. The verification and communication of these claims is instead facilitated through value chain traceability, defined as a system of structuring information associated with products for purposes of business management and

¹ The calculation of 5% is based on dividing 35% of an estimated volume by Indonesia based on 2009–10 data, by the total volume produced by the WCPFC area (2.4million tonnes) in that period [22].

Table 1
Examples of public-private data improvement in handline, pole and line and longline tuna fishery improvement projects.

Fishery improvement project	Data improvement strategy	NGO and Private sector involvement	Goal	Source
Vietnam Handline and Longline Yellowfin Tuna	<ul style="list-style-type: none"> ● Improve government landings enumeration ● Develop on board observer capacity 	WWF; VinaTuna; Ministry of Agriculture and Rural Development; Department of Agriculture and Rural Development; Department of Capture Fisheries and Resource Protection; Research Institute of Marine Fisheries; International exporters/suppliers, local processors and fishermen	Marine Stewardship Council certification	[29,49]
Philippines yellowfin tuna - handline	<ul style="list-style-type: none"> ● Establish national vessel registration scheme with BFAR ● Extend use of fish catch reports (FCR) implementation ● Define management structures with BFAR to interpret FCR information and create mechanisms for intervention by 2017 ● Improved data landings enumeration and traceability 	WWF Philippines; Artesmar; Blueyou Consulting; Bureau of Fisheries and Aquatic Resources	Marine Stewardship Council certification	[30,50]
Eastern Indonesian handline tuna	<ul style="list-style-type: none"> ● Dynamic online fisheries Information System (FIS) ● Logbook data 	Masyarakat dan Perikanan Indonesia Foundation (MDPI); Anova Foods US; Ministry of Marine Affairs and Fisheries, Indonesia; International Pole and Line Foundation; WWF Indonesia Asosiasi Perikanan Pole and Line dan Handline Indonesia (AP2HI).	Combat IUU fishing; Marine Stewardship Council certification	[19,51]
Maldives pole and Line tuna		International Pole and Line Foundation (IPLNF); Ministry of Fisheries and Agriculture (MoFA); Marks & Spencer, Sainsburys and World Wise Foods	Marine Stewardship Council re-certification	[52]

product logistics, ensuring the legality of traded products, managing the reputational risk of buyers like retailers, and communicating these internally within the supply chain and optionally outwards to consumers [31]. Traceability is not a sustainability approach, nor does it necessarily demand greater transparency beyond the value chain. However, as state and civil society demands for more transparent production of fisheries increases, like in other food sectors see [32], traceability systems provide additional information upon which decisions around legality verification, retailer reputational risk management and consumer communication can be made.

To address the demands for greater transparency, a range of traceability providers have emerged, many of whom are funded by marine conservation foundations.² These systems have emerged for seafood specifically in response to demands by states and the market to improve on existing charges of seafood fraud, as well as providing assurance that fish is not sourced from IUU fisheries [32], nor that it is associated with indentured and bonded labour [9,33,34]. There are numerous traceability models emerging, many with aspirations to provide online publicly available information on fisheries, many with different levels of data transparency (Table 2). States are also experimenting with developing traceability standards, such as the state of Alaska, but have yet to develop or offer their own traceability systems to aggregate producer and value chain information. Generic proprietary pay-for-service systems, such as Traceall and TraceRegister are implemented up the supply chains by major (often retail) buyers. The information collected by these systems, however, is only available for these buyers and used largely as a means of coordinating call-backs related to food safety. Alternatively, proprietary (internal) company-led systems providing static and generic consumer facing information on where a fish is caught (e.g. Pacifical, JohnWest) are also emerging. NGO-led systems, such as the ThisFish system developed by EcoTrust Canada, provide consumer-facing traceability information on where fish are caught, by who and using what methods. The growing field of traceability providers, coupled with millions of dollars in funding and new requirements of importing states e.g. [35], has led to questions about how in fact traceability can transform seafood governance, especially in developing countries where the majority of the world's traded seafood comes from [31,36].

Efforts are also underway to understand the rationales for these systems e.g. [12,37], as well as how the uptake of traceability can lead to positive change in seafood supply chains. One of the central questions that has emerged from these studies focuses on the current lack of traceability standards, the underdeveloped sense of who should pay for traceability systems versus who the likely benefactors will be, and the impact of philanthropic funding from US marine conservation groups which currently subsidizes market uptake. Work on bringing together funders, providers and supply chain case study actors is underway [37]. However, as outlined by Bailey et al. [38], critical questions on the suitability of western traceability systems for developing country producers, whether democratization of seafood supply chain information empowers or disempowers producers, and the extent to which traceability information can assist in fisheries management or can modify consumer purchasing practices have yet to be fully answered.

3. Implications for future tuna fisheries sustainability

The assumption made by private actors is that the improved provision of tuna and tuna fisheries related information can contribute to state attempts to comply with international informational demands,

² For example, the Gordon and Betty Moore Foundation pledged \$1.3 million in 2015 to the Global Food Traceability Centre, Walton Family Foundation granted over \$8 million to seafood marketplace incentives (including traceability) in 2014, and in 2012, Oceans 5 provided an undisclosed amount of funding to Oceana, WWF, Marine Fish Conservation Network and Greenpeace to improve seafood traceability.

Table 2
Examples of different seafood traceability systems.

System owner	Characteristics	Examples	Source
Seafood companies	Systems designed and run by companies catching, processing, or trading seafood.	John West, Pacifical, Ocean Naturals	https://www.john-west.co.uk/discover-the-story-behind-your-can ; http://www.pacifical.com/traceability.html ; http://oceannaturals.com/my-tuna/
Traceability providers	Companies designing and selling services for traceability to (sea)food related companies (e.g. processors, wholesalers, retailers).	TraceRegister, Traceall, Frequencez, BackTracker, ShellCatch,	http://www.traceregister.com/ ; http://www.traceallglobal.com/ ; http://frequentz.com/ ; http://backtrackerinc.com/ ; http://www.shellcatch.com/
Non-government organisations	Non-for profit organisations designing and providing services to fishers and (sea)food related companies (e.g. processors, wholesalers, retailers).	ThisFish	www.thisfish.info

Table 3
Assumed benefits to stakeholders derived from private enumeration and traceability.

Stakeholder group	Benefits traceability	Benefits enumeration
1. Fishers	<ul style="list-style-type: none"> ● Better able to meet documentation and chain of custody requirements for market access for MSC and/or Fairtrade certification ● Market intelligence on where fish is sold, by who and how ● Communication with downstream actors 	<ul style="list-style-type: none"> ● Communication with scientists, regulators and environmental NGO's ● Checks/controls on catch and effort ● Potential to meet requirements of MSC and Fairtrade certification ● Information available which may help to make informed decisions on future fishing activities
2. Processors	<ul style="list-style-type: none"> ● Platform enables transparency of activities for marketing purposes (e.g. can be used to link product to participation in a FIP) ● Fulfil documentation requirements of export markets ● Added-value of analysis of companies and market ● Reduction of reputational risk associated with sector ● Decreases losses due to potential recalls ● Compliance to various international food safety and environmental standards 	<ul style="list-style-type: none"> ● Transparency check about where the fish comes from? ● Improved view on historic sourcing of fish and hence on future focus ● Verification on 'sustainability' of the fishery (e.g. low interaction with ETPs, low bycatch) ● Potential to market active participation in a FIP or sustainability approach
3. Retailers	<ul style="list-style-type: none"> ● Transparency about where their fish is coming from ● Claim value on providing information on products sold ● Reduce reputational risk associated with mislabelling 	<ul style="list-style-type: none"> ● Building visibility of small scale fisheries with government ● Transparency check about where the fish comes from? ● Information on resource status claims
4. Consumers	<ul style="list-style-type: none"> ● Clear information on source of fish, conscience free consumerism ● Potential for communication with fishers if traceability is 'consumer facing' ● Educated on fishing practices and global trade 	<ul style="list-style-type: none"> ● Reduce reputational risk associated with overharvesting practices ● Information available for communicating source, amounts and pressures of/on fish resources
5. Managers	<ul style="list-style-type: none"> ● Data available on key fisheries indicators for stock assessment ● Inclusion of small scale fisheries enables more informed decisions over benefits and allocation 	<ul style="list-style-type: none"> ● Data available on key fisheries indicators for stock assessment ● Inclusion of small scale fisheries enables more informed decisions over benefits and allocation
6. Government	<ul style="list-style-type: none"> ● Economic indicators can be included in management decisions ● Data flows available to feed into national and regional databases ● Meet international obligations set by RFMOs ● Better facilitation of fishers to meet IUU regulations for export markets ● Improved information on trade and non-fishery related benefits of otherwise unreported fisheries ● Decision making made under less uncertainty ● Strengthening of trust relationships with import countries for improved trade relations e.g. US Trusted Trader accreditation 	<ul style="list-style-type: none"> ● Data flows available to feed into national and regional databases ● Meet international obligations set by RFMOs ● Better facilitation of fishers to meet IUU regulations for export markets ● Improved information on trade and non-fishery related benefits of otherwise unreported fisheries ● Decision making made under less uncertainty

which in turn opens (or maintains) business opportunities for exporting tuna to export markets like the EU and US. As outlined in Table 3, there are also a range of potential benefits to private actors all along the value chain. However, it remains unclear whether the data that these private initiatives generate are being taken up into state databases, are considered by resource managers and policy makers or 'sustainable' given the ongoing investment that will be required to maintain them over the long term. This in turn leads to four key questions for assessing the future of such private-public information partnerships.

First, does the introduction of private enumeration and traceability data generate information that is accurate, representative, timely and accessible? Private companies are first and foremost interested in the specific sites and fisheries from which their fish is sourced and have less interest in the statistical coverage of these fisheries. Though privately enumerated data can contribute to the precision of relevant fishery indicators (e.g. standing biomass, fishing effort, reproductive capacity of stocks and ecosystem effects of bycatch), and comply to a large extent with RFMO data requirements, they may be biased if these samples are not representative of the whole fishery [39]. However, such

bias may be overstated given private data collection will likely remain additional rather than a replacement for ongoing state efforts to collect data. The accuracy and timeliness of private data collected may also increase over time with the application of data collection technologies. Automated government databases that take up privately enumerated data such as iFish uses cloud-based internet technologies to capture and store data, and is already operational in dispersed hand line tuna and blue swimming crab fisheries. Feeding privately enumerated, and increasingly automated data into cloud-based systems has already been shown to make information available and accessible almost the moment they are collected e.g. [40,41]. In doing so such systems can increase the representation and accuracy of data from the small scale sector that is currently excluded from national and regional statistics.

Second, what levels of assurance will states need to engage with these private initiatives? While companies may be willing to invest in the provision of fishery and trade information to governments, it is less clear if and how governments trust and value this information. If states wish to facilitate and benefit from a private information collection strategy, attention will need to be given to data standards and

accreditation. For instance, fishing associations or NGOs such as the IPLNF, see [42] could be provided a 'data steward' status for both enumeration and traceability. This status could be governed by rules of conduct in collecting and storing data, with misconduct (e.g. fraud or systemic mismanagement) dealt with by revoking data provider status, or even export licences and/or fishing licences. Such measures would have to be considered in the context of the fishery in question, given severe penalties in many small scale fisheries may lead to a disproportionate burden on local livelihoods. Conversely, so called 'good data behaviour' may also be credited by the state with lower tax rates on catch, and/or by international buyers with preferential market access.

Third, can government analysis and communication of fisheries information further incentivize private data collection? As argued in various cases of adaptive management e.g. [43], greater transparency and literacy on stock status can create incentives for private data collection beyond market access and MSC compliance. If fishers are involved in capturing and processing the information that underlies management decisions they are assumed to be more responsive to calls for collecting the data on which these decisions are made [44,45]. In turn, they may be more willing to invest in the ongoing collection of such data in a given site. However, to foster such positive feedback between data, learning, decision making and investment, fishers need to be able to understand the information produced, recognise the consequences of their own actions on this information, and ultimately see value in using the information in future actions [46]. To strengthen the sustainability of private data collection systems greater attention by the state to not only communicating information, but also supporting improved literacy of fisheries information may be an important step to take. If fishers and traders see the importance of such information, it may also influence their willingness to invest in longer term data collection rather than shifting their interests elsewhere in response to short term declines in catch.

Finally, what potential is there for integrating both enumeration and traceability data, and in what ways and with which goals in mind? The notion of linking these two data streams appears attractive given the multi-faceted nature of assessing seafood sustainability. Linking traceability to enumeration on fish landings may to some extent cover the problems around maintaining data collection, as processors generally have longer term commitments to specific tuna fisheries. Both data streams start at the point where fish are landed in classical enumeration systems or could start earlier at sea in forms of automated data collection systems. Requirements for specific types of data may differ between traceability and enumeration – e.g. data on the size of fish and non-target species needed for stock and ecological assessments compared to volumes and product quality for traceability in meeting food safety goals. However, such data requirements converge when the goal of traceability is expanded to include ecological sustainability requirements. Bringing these data flows together then may enable more integrative assessments that meet the goals of both public and private actors. This could occur by linking the ecological status of stocks with trade volumes to assess total production e.g. [47,48], or by providing a more accurate picture of exploitation in regions with little on the ground regulatory oversight. Combining these data sets may also create possibilities to integrate validation systems. For example, where traceability data validates or highlight inconsistencies in enumeration data, or vice versa.

Addressing these questions and successfully integrating private data into public databases would be a major innovation from what is currently practiced in oceanic and coastal fisheries. Investing in these innovations may serve to strengthen the overall capacity of governments to meet mandates for both national and regional fisheries assessment. The incorporation of private data may even allow for the reversal of punitive approaches to fisheries assessment practiced through EU IUU regulation and MSC certification alike. Instead of forcing fishers and fisheries to demonstrate they are not engaged in IUU fishing, more pre-emptive information, based on a combination of

credible private enumeration and traceability information could instead facilitate more pro-active assurance models for Legal, Reported and Regulated (LRR) fish and seafood catch entering the market. If this can be achieved, it may be possible that private sector goals of compliance with regulatory and voluntary export market requirements can be met, providing them a return on their investment in private information provision.

4. Conclusions

The private provision of public information has opened up a new round of innovation for sustainable tuna fisheries. Current developments over a range of sites and situations demonstrate opportunities for further research and development of both enumeration and traceability systems. The promotion of private information provision can extend the coverage of enumeration and traceability over fisheries (or geographically marginal parts of fisheries) to fisheries that otherwise would not be adequately included into state data collection. But it is also clear that if private actors cannot deliver timely and accurate information they will risk losing credibility in both the markets they seek to comply with, and with the governments they seek to support.

If private information provision is to expand beyond the relatively niche position it currently holds stronger state appears necessary. While the market can provide an initial incentive for private investment in data collection it is likely to be only partial in nature. It is ultimately national governments that must provide a clear framework for scaling up these private initiatives by providing a clear set of protocols for their integration into national and regional databases. An important first step will be developing a verification programme for private information providers, as well as clear data management agreements to protect relevant private interests. However, the balance between regulatory and market incentives will also need to be better understood if these voluntary systems are to be scaled up. It is here that the combination of information from both enumeration and traceability may be able to reinforce each other. By developing integrated enumeration-traceability systems it appears likely that private actors will continue to invest in the overall transparency of the fisheries they are supporting to be compliant to both state regulation and eco-certification like the MSC. If such systems can be developed and scaled up for small scale fisheries, private information provision may present itself as a viable long term solution for supporting the assessment and management of complex developing world fisheries such as those for oceanic tunas.

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