Identifying key social and economic issues in Indonesia's archipelagic waters skipjack and yellowfin tuna fisheries: A scoping study

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Abbreviations used

HS - Harvest Strategy

YFT - Yellowfin tuna

SKJ - Skipjack tuna

HL - Handline

P+L - Pole and line

PS - Purse seine

FMA/WPP - Fishery Management Zone /Wilayah Pengelolaan Perikanan

SSF - small-scale fishers

Executive Summary

This research finds that 4 core themes should form the basis of further developing the social and economic aspects of the harvest strategy for archipelagic tuna fisheries.

- ensuring the welfare of coastal and small-scale fishing communities
- ensuring food security
- improving the economic value and efficiency of tuna fisheries
- improving tuna fisheries governance

While achieving economic development goals in developing country fisheries is frequently hampered by governance limitations and trade-offs with employment and food security objectives, it is considered likely that in Indonesia, increases in the economic value of current tuna harvest can be achieved without significantly compromising social objectives. In particular it appears likely that strategies focused on increasing the value of current YFT and SKJ harvest stand to directly benefit those coastal and fishing communities who should form the target of welfare and food security objectives.

This report therefore further recommends that these 4 themes should be considered for adoption as high level objectives, around which the development of prioritised operational objectives, feasible management measures and an ongoing monitoring cycle can be established.

Recommendations relating to data collection and further research are as follows:

- Indonesia's nation-wide statistical data collection systems are a strength to be built on in relation to tuna fisheries management. A priority of research in coming months should be to collate raw data from national socio-economic surveys, ports data, and publicly available reports and extract information on SKJ and YFT tuna fisheries across FMA/WWP 713, 714, 715.

- Production of an annual "Perikanan Tuna Dalam Angka" ("Tuna Fisheries in Statistics") covering tuna fisheries at the national level, and broken down by province and FMA/WPP would be highly beneficial for all stakeholders.

- 5 broad research approaches of potential value to the development of the harvest strategy process and longer term management of archipelagic tuna fisheries have been identified.

    1. Assessing fisheries dependency in FMA/WPP 713, 714, 715 as the basis for initial socio-economic impact assessments of management strategies.
    2. Development of an input-output regional economic model to assess broad socio-economic outcomes related to employment and economic returns.
    3. Assessing the feasibility and value of effort based measures, including spatial management measures in tuna fisheries.
    4. Evaluating the social wellbeing of tuna fishing communities in Indonesia, and developing methods to track changes in wellbeing relative to changes in the fishery status and management.
    5. Assessing social-ecological linkages and key system relationships in Indonesian tuna fisheries via integrative, stakeholder inclusive models.

1. Introduction

This scoping study aims to contribute to incorporating social and economic considerations into the harvest strategy (HS) development process currently underway for yellowfin tuna (YFT) and skipjack tuna (SKJ) in Indonesia's Fishery Management Areas (FMA/WPP) 713, 714 and 715.

Drawing on the results of workshops, interviews, survey questionnaires, analysis of readily available public data and review of literature, this scoping study principally identifies:

- Key themes arising in this research.
- Recommendations for high level social and economic management objectives based on these themes, around which performance assessments of proposed management measures can potentially be structured.
- Options for further planning, socio-economic data collection, and research.

The YFT and SKJ fisheries in FMA 713, 714, 715 are substantial and complex fisheries. Accessing highly migratory fish stocks, they exist within region wide ecological and governance systems, and form a critical link in one of the most economically valuable fisheries globally (Guillotreau et. al 2016). Overall exports for the year 2015 were 206,553 tonnes for all tuna, with a value of $USD 692 million, making tunas the second most profitable fish export species in Indonesia after shrimp (KKP 2015). In addition tuna are a major source of fish protein and livelihoods in Eastern Indonesia, and domestic canned tuna supply is also substantial.

The development of a Harvest Strategy is considered to be an important step forward in ensuring the sustainability of Indonesia's tuna stocks, and the development of methods to systematically incorporate social and economic considerations into this HS is an important piece of the national and regional tuna fisheries management puzzle. Specifically, incorporating social and economic considerations into fisheries planning can assist in identifying realistic and implementable strategies, in forecasting the likely impacts of resource allocation decisions, and in identifying clear objectives that management can be assessed against over the long term (Evans et al. 2016, Brooks et al. 2015, ACIAR 2013).

This report aims to develop an overview of major issues of relevance to the HS development process and Indonesian tuna fisheries management more generally, which can contribute to the development of a framework of management objectives and a future research and assessment agenda.

It should be noted that as a scoping study, this report does not represent a fully validated set of results that have been vetted by stakeholders and expert advisors. It is a set of initial findings for further investigation and, where appropriate, adoption within the harvest strategy. More broadly it has been acknowledged within the HS process and tuna fisheries planning that an initial strategy is to be agreed upon by November 2017, and that it is considered ideal that data collection and analysis to further refine objectives and track the implementation of appropriate management measures continues beyond the current timeline. Recommendations have therefore been made with both the immediate needs of the HS development process, and the wider development of monitoring and management systems in Indonesian tuna fisheries in mind. Overall it is hoped that the information and reflections contained in this study will assist the Indonesian government and stakeholders involved in the HS development process to move forward with this important and groundbreaking work for Indonesia's fisheries.

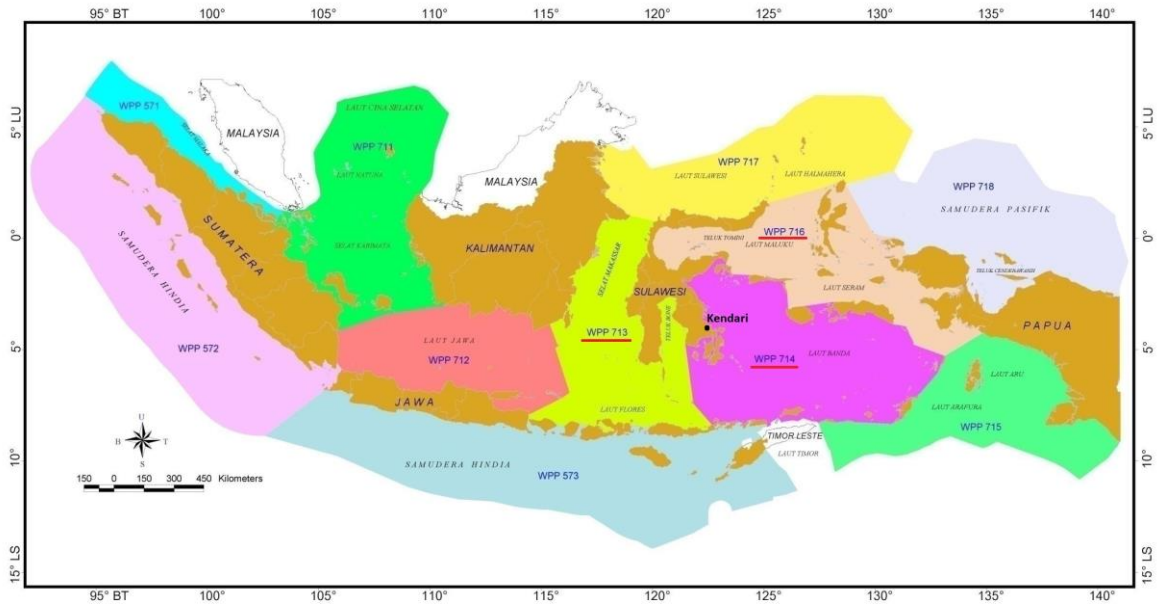


Figure 1. Indonesia's Fishery Management Areas (Source MMAF 2014A) FMA/WPP 713, 714, 715 underlined in red.

Previous work within tuna fisheries planning and the harvest strategy workshops has begun to address aspects related to social, economic and governance issues, as part of overall efforts to derive information on priority issues and potential management measures. The Indonesian National Plan of Action for Tuna for Tuna, Skipjack and Neritic Tuna (NPOA) identified ecologically sustainable management of tuna and skipjack stocks, improved governance, and implementation of market oriented measures (such as traceability systems) as three high level management objectives around which prioritised management actions and indicators of progress were established for FMA/WPP 713-15 (see MMAF 2014A). This includes production of a socio-economic report on these fisheries by 2019. In relation to harvest strategy discussions, the survey report presented at the November 2016 Stakeholder Workshop and Technical Committee meeting (see MMAF 2016) has initiated specific discussions that include identifying social and economic priorities including food security and economic development. The Indonesian Fishery Law 2004 (Amended 2009) also mandates social and economic objectives for fisheries management in Indonesia, that are to be referred to in further fisheries planning processes (Republic of Indonesia 2009).

It is also noted that among stakeholders within the HS development process, the major pressures on YFT and SKJ in FMA/WPP 713-15 are seen to be the high number of FADs, and the high level of effort in the purse seine fleet, and that measures aimed at addressing these pressures through reductions in FADs and the purse seine fleet were seen as appropriate management interventions to manage these pressures across stakeholder groups (see MMAF 2016 pp.10-11). Moreover, regulations from the Indonesian national government have recently sought to address aspects of these management challenges - specifically through announcing regulations on trans-shipping that have limited the operations of large purse seine vessels (Permen 57/2014) and through regulations and management planning for FADs (PERMEN 26/2014, see also MMAF 2014b). By providing further detail on social and economic issues in the YFT and SKJ fisheries of FMA/WPP 713, 714 and 715, this report aims to build

on these efforts, and consider the implications of further management interventions in line with these stated preferences.

1.1 Key findings

The principal finding of this study is that 4 core themes should form the basis of further developing the social and economic aspects of the harvest strategy development process. These themes are:

- ensuring the welfare of coastal and small-scale fishing communities
- ensuring food security
- improving the economic value and efficiency of tuna fisheries
- improving tuna fisheries governance

Managing fisheries for social and economic objectives

It is widely acknowledged that given the complex nature of marine fisheries inherent trade-offs exist between different management priorities, and between short term tactics and long term strategies (see Evans et al. 2016 for discussion in relation to Pacific tuna fisheries). A key purpose in identifying fishery management objectives within a harvest strategy is to make explicit these trade-offs. This allows for evidence based, informed decision making that seeks to optimise the outcomes of each goal in relationship to others, while allowing for uncertainties in the social, economic and ecological realms (see Evans et al. 2016, Sloan et. al 2014, Smith et al. 2014). Ideally this ensures that the overall health of the fishery and the benefits it provides to society are not significantly compromised over the long term by efforts to achieve any one goal.

In many marine capture fisheries economic objectives based on maximising economic returns often exist in a trade-off scenario with the social objectives of maximising food security and maintaining employment. In the absence of governance systems capable of redistributing profits fairly, either through buybacks, cost recovery systems or wider social welfare programs, pursuit of such economic goals presents as nether a feasible nor equitable management option, particularly in developing countries with large and economically marginal fishing communities (see Sumaila 2010, Cheung and Sumaila 2008).

In Indonesia however, it appears that considerable opportunities for accessing high value markets, and improving efficiencies within tuna fisheries and associated supply chains exist (Duggan et al. 2015, Sunoko and Huang 2014), and Indonesia appears well placed to position itself regionally as a producer of high quality, high value tuna products due its proximity to the Japanese market and it's abundance of YFT in particular. Given the nature of the Indonesian fleet and the specific benefits it delivers to Indonesian society, it is considered highly likely that these opportunities would, if taken advantage of, allow for increases in the economic value of tuna fisheries without significantly compromising social objectives around food security and coastal community welfare. In fact it appears likely that strategies focused on increasing the value of current YFT and SKJ harvest stand to directly benefit those coastal and fishing communities who should form the target of welfare and food security objectives, given effective governance and careful planning. This includes provision of significant social benefits to Indonesian communities at the local level that are not made available through large scale/industrial tuna fisheries development.

The 4 themes identified above represent an interlocking system of priorities that, if managed strategically, have the ability to bring significant benefits to Indonesian society across sectors

and communities, at national, regional, and local levels. Noting the primacy of biological/ecological objectives, this report further recommends that these 4 themes should be considered for adoption as high level objectives around which the development of prioritised operational objectives, feasible management measures and an ongoing monitoring cycle can be established.

Food security and the economic development of tuna fisheries have already been identified as priorities by the Indonesian government for guiding the harvest strategy development (see MMAF 2016). Fishers welfare and governance have also received some attention in harvest strategy discussions so far, though without explicit attention from the technical or research side prior to this study, and in tuna fisheries management more generally (see MMAF 2014a). Based on this progress in the HS development and the responses presented in this report, it would appear there exists a sound basis for developing these themes into a workable set of high level social and economic management objectives, and a reasonable likelihood stakeholder engagement and support should a feasible management approach related to these objectives be identified.

Socio-economic data collection

A large amount of social and economic data is already routinely collected by the Indonesian government down to the district and in some cases household level, including data specific to tuna fisheries and the consumption of tuna products, and ongoing research projects by government and non-government researchers are collecting valuable data on the social and economic aspects of tuna fisheries.

Generally speaking information on fisheries is aggregated and published at the national level through collating information collected at ports by the ministry (production, value, export destination, vessel, gear), nation-wide Socio-economic Survey (SUSENAS, annual), National Census (every 10 years ending in 0), National Agricultural Survey including a Fishing Household Subsector (every 10 years ending in 3), and Economic Census (every 10 years ending in 6). See Ismayanti (n.d.) for detailed discussion of fisheries statistics collection processes. The nation-wide labour force survey (SARKENAS, annual) would also appear to have considerable potential value for fisheries planning purposes.

Each of these sources collect data specifically in relation to tuna fisheries, however as yet very little data has been published that disaggregates tuna fisheries data from all other fisheries related data. As a result there is, with some exceptions as presented in this report, little ability to gather reports or specific data on the socio-economic characteristics of YFT and SKJ fisheries in Indonesia, or those operating in FMA/WPP 713-15.[1] Provincial BPS offices sometimes publish tuna specific information in provincial "Dalam Angka" reports, and through provincial reports based on the National Fishing Household Subsector of the National Agricultural Survey 2014 (see e.g. BPS Sultra 2016, 2014). However, accessing raw data from the national BPS and KKP offices would appear to be the most efficient way of collating public data across these fisheries.

[1] While the ministry has published national level production and export destination data specific to tuna fisheries, in many cases this is not broken down by FMA/WPP in published sources cited for this study, and for the major socio-economic data, including employment, fishers' wages and fishing fleet, only aggregated national data across all fisheries is reported. The exception here is fishing fleet data for which estimate figures for vessels over 30GT are provided. Given the reductions in purse seine effort since trans-shipping restrictions, this means that a substantial proportion (potentially a majority) of fishing vessels currently operating in the tuna fisheries in FMA/WPP 713-15 are not disaggregated from data on all other fisheries.

Information on fish consumption and wellbeing indicators on poverty and the human development index are readily available at the provincial level through census and socio-economic survey data and are provided here (see Annexes 2 and 3). Information on fish consumption is broken down by species in data collection forms, and disaggregating tuna consumption from fish consumption generally would be highly beneficial.
A
Based on this the following priorities have emerged for further data collection:

- Indonesia's considerable statistical data collection systems present as a major strength to be built on in relation to tuna fisheries management. A priority of research in coming months should be to collate raw data sources (Census, SUSENAS Konsumsi module, National Agricultural Survey Fisheries Household Subsector, main ports data) and related publicly available reports (e.g. provincial "Dalam Angka" and SUSENAS reports), extracting information relevant to SKJ and YFT tuna fisheries in FMA 713, 714, 715.

- Researchers working on tuna fisheries specific socio-economic and bio-economic research should also be engaged to provide expert input, and where appropriate make their data available to the technical steering committee.

- A further priority would also be to establish production of an annual "Perikanan Tuna Dalam Angka" (Tuna Fisheries in Statistics) report in support of ongoing management efforts. This would be of high value to all stakeholders.

Future planning and research

5 broad research approaches of potential value to the development of the harvest strategy process and longer term management of archipelagic tuna fisheries have been identified.

- Assessing fisheries dependency in FMA/WPP 713, 714, 715.
- Assessing the broad social and economic impacts of different management measures within the management strategy evaluation (e.g. employment, revenue).
- Assessing the feasibility and value of effort based measures, including spatial management measures in tuna fisheries.
- Evaluating the social wellbeing of tuna fishing communities in Indonesia, and developing methods to track changes in wellbeing relative to changes in the fishery status and management.
- Assessing social-ecological linkages in Indonesian tuna fisheries via integrative models.

The specific value of each research topic is discussed in the body of the report, and it is noted that aspects of each of these focus areas could be incorporated into a fully integrated fisheries assessment process. The key finding identified here is that a spatially explicit assessment of fisheries dependency in FMA/WPP 713-15 that can allow for broad assessments of likely socio-economic impacts of management measures presents as a priority for the immediate next stages of the harvest strategy development process.

Further findings in relation to specific themes are presented in the body of the report.

2. Methods

This study adopts an "umbrella" scoping approach, attempting to span the range of social and economic issues (rather than quantify or document them in depth), an approach that has particular value in the early stages of planning and assessment (see Barclay et al 2017, Voyer at al. 2014 for broad methodological references). In particular, it allows for diverse topics that are often treated separately by specialists within particular fields of expertise to be integrated within a common framework that can orient the strategy development process. Through this, specialised investigations on particular themes can be subsequently undertaken, according to their relative level of priority, and within the context of a wider system of identified issues and interactions, rather than as isolated or standalone topics.

The report draws on interviews, workshops and survey questionnaires conducted principally over the course of 3 weeks in November 2016. Preliminary meetings with ministry staff were conducted in late August 2016, and interviews with expert advisors engaged in the harvest strategy process and with researcher partners within LIPI, IPNLF, AP2HI and UTS were held during September and October as the survey method was being refined. These primary data were augmented by a desktop survey of publicly available data, literature on YFT and SKJ fisheries in Indonesia, assessment and analysis techniques that have been applied in Indonesian fisheries previously, and the wider literature on approaches to evaluating the social and economic aspects of tuna fisheries.

The mixture of methods within a short project spans overall reflects the exploratory nature of this research, where a range of information gathering techniques were trialled in order to gather different varieties of data, and to test the appropriateness of different techniques for conducting social and economic research in tuna fisheries in the FMA/WPP 713-15.

This report presents this information via a thematic analysis, whereby the iterative development of key issues occurs firstly through literature reviews and early interviews. As the research progresses these themes are explored in more depth where appropriate, and new themes that emerge in the course of research are incorporated into surveys, interviews and workshops as considered appropriate. By the end of fieldwork a core set of issues has been defined and explored in the field, to the point required for scoping their relevance to the ongoing development of the HS.

2.1 Semi-structured interviews

Semi-structured interviews and project meetings were undertaken with a total of 41 informants during the course of this study. This included expert key informants, government fishery managers and port authorities, industry and civil society groups, tuna fishers and middlemen. In some cases these were run as small focus groups, where informants felt this was appropriate. These used an open ended qualitative interview methodology and were aimed at capturing the range of topics that informants considered relevant to a discussion of social and economic issues in the target fisheries, rather than gathering data in depth on any specific topic. Discussion initially focused on issues considered by researchers to be of potential importance based on prior knowledge of tuna fisheries and a review of relevant literature, and as discussed, evolved in light of the information provided in early interviews and survey responses. In some cases early on in the research process and particularly prior to the fieldwork in November, discussions with key informants also elicited advice as to how best to capture potential priority issues within the survey formats being developed. A list of interviewees and meetings is provided in Annex 1.

2.2 Workshops

2 workshops were undertaken in the course of this project. Broadly speaking these workshops drew on techniques and focus areas discussed in work on the social and economic aspects of tuna fisheries in Indonesia by Adhuri et. al. (2016), and wild capture fisheries in Australia by (Brooks et al 2016), Pascoe et al (2014), Voyer at al. (2014) and (Jennings et al 2014).

The first workshop was undertaken as part of the Harvest Strategy Development Stakeholder Meeting on 14th November 2016, with approximately 20 people participating, 15 of whom submitted suggested management objectives. These objectives are listed in Annex 6. This workshop used the first three questions of the online survey as the basis for open ended group discussion and elicitation relating to

- The groups and communities that participate in the fisheries with which workshop participants are involved. This was similar in nature to a stakeholder analysis.
- The contributions to coastal communities and wider Indonesian society that these fisheries make.

Participants were then requested to provide three social and/or economic management objectives that they consider to be priorities for inclusion in the harvest strategy. These were not weighted or prioritised and constitute a "long-list" of potential operational management objectives that can be used for further refinement and prioritisation in subsequent workshops.

The second workshop was a similar group discussion and elicitation process undertaken with 20 participants including employees and fishers who supply the Kendari processing facility of a tuna processing and export company based in Jakarta. This workshop progressed similarly by eliciting information about the fishery based on identifying the groups and communities who participate in the fishery, and identifying the social and economic contributions these fisheries make to coastal communities in Sulawesi Tenggara province. In this workshop participants were then requested to identify the 3 key opportunities and 3 key challenges they see operating within their fishery.

2.3 Survey questionnaires

Two questionnaires were developed for use in this study. The first was an online survey distributed amongst member companies of the Indonesian Pole and Line and Handline Tuna Fisheries Association and participants in the harvest strategy stakeholder workshop in Bogor Nov 14-16th 2016. This included a range of open ended questions aimed at gauging what respondents understandings of particular issues were, as well as a series of closed check box and multiple choice answers. This elicited 28 responses principally from government fishery managers and researchers (50%), company managers (25%), industry/civil society representative groups (14%) and non-government researchers (11%). Respondents were asked to answer these questions with reference to the fishery that was most important for their work. 44% answered in relation to Yellowfin Tuna fisheries, 44% in relation to Skipjack Tuna fisheries, and 12% answered "other" without specifying the species. 13 of the 27 respondents reported on more than one gear type for their fishery, 12 responded through focusing on one gear only, while 2 respondents did not identify which gears were operating in their fishery. Handline fisheries were included in 69% of respondents answers, purse seine fisheries in 62%, Pole and Line in 42%, while gillnet, longline, troll, ringnet and liftnet were included in a small minority of answers.

During the course of fieldwork the theme of fisheries dependency emerged as potentially significant to the ongoing HS development (see Stanford, Wiryawan et al. 2013), and a short survey instrument with principally check box and closed questions was developed and trialled in Kendari during fieldwork (see below). Some qualitative material as well as information on supply/value chains and cost structures for fishing operations was also gathered opportunistically during these survey interviews. This yielded 43 respondents including fishers (51%), processing factory workers (38%) and transport/supply/logistics workers including middlemen (12%). 50% of vessels associated with these respondents were below 5GT (district licence) while 50% were between 5 and 30GT (provincial licence), participating in Handline (38%), purse seine (35%), Pole and Line (19%) and Bagan (8%) fisheries.

2.4 Field visit to Kendari

In addition to attending the Harvest Strategy Technical Meeting and Stakeholder Workshop in early November 2016, a field visit to Kendari was undertaken from 20th to 26th November 2016. This allowed for field observations of tuna fishing operations in Kendari domestic and oceanic fishing ports, for discussions with port authorities, district and provincial government officials, workers and suppliers with processing companies in Kendari, and fishers from Kendari and Wakatobi. Information collected in Kedari is of course not presented here as being representative of other areas of the FMA/WPP 713-15, but instead is aimed at being a case study that can be illustrative of key issues and possibilities for future research across the planning unit.

2.5 Statistical data collated

Port authorities and district and provincial government authorities in Kendari generously provided production, export, price/value and vessel data for this scoping study. National level fisheries statistics were sourced from the 2015 Perikanan Dalam Angka Report (KKP 2015). Provincial level data were compiled from the National Census (BPS Sultra 2016) and the annual National Socio-economic Survey, Consumption Module (BPS 2016a and 2016b). These were used to compile the tables on food security, poverty levels and human development index across provinces in FMA/WPP 713-15.

It is beyond the scope of this study to fully assess the accuracy and limitations of each dataset. While fisheries dependency methods trialled in Padang, West Sumatra noted that government collected socio-economic and fisheries data can be inaccurate (a point often noted by government statisticians themselves, see Ismayanti [n.d.]), they also demonstrated a robust method for measuring relative levels of fisheries dependency between districts using publicly available statistics (see Stanford, Wiryawan et al 2013). In general statistics are presented in this report as illustrative of relevant issues and as examples of data for use in further investigations, rather than being presented as final robust datasets for use in decision making across FMA/WPP 713-15.

3. Results and discussion

3.1 Stakeholders and communities participating in tuna fisheries

Overall the observation is that tuna fisheries in FMA/WPP are complex socially and economically, and a wide range of groups were identified as engaged in tuna fisheries in different ways. This process is similar to a stakeholder supply chain analysis, but in the context of developing a management framework identifying different "communities" engaged in fisheries is valuable when selecting and assessing social/economic objectives (see Brooks et al. 2015, Pascoe et al 2014). The principal purpose of this exercise is to be able to define broad but readily identifiable groups of stakeholders to whom the benefits of fisheries flow, and in relation to whom the impacts of changes in the fishery can be tracked and identified. Prioritised operational management objectives can then be tied directly to the specific groups within the fishery or at different points along the supply/value chain that would likely benefit from the achievement of those objectives. Furthermore this framework can allow for engagement with those groups in the process of defining what a desirable set of objectives for that fishery would look like, if such engagement is considered desirable. The table presented below collates responses across interviews, workshops and field observations following these methods.[2]

Stakeholder/group	Community
Fishers - local	Fishers
Fishers - traditional	Fishers
Fishers - owner/operators	Fishers
Fishers - migrant (Indonesian)	Fishers
Fishers - migrant (non-Indonesian)	Fishers
Fishers - Baitfish sector	Fishers
Small-scale fishing communities	Fishers
Migrant fisher communities (e.g. Javanese, Bugis purse seine workers' families who receive remittances)	Fishers
Carrier vessel crew	Fishers
Traders for local sale (whole fish)	Traders
Traders for local sale (offcuts, scrap fish)	Traders
Middlemen/collectors supplying domestic processors	Traders
Middlemen/collectors supplying export processors	Traders
Transport workers for local sale (ojek, small trucks)	Land based services
Transport workers for regional sale (larger trucks)	Land based services
Ice suppliers	Land based services
Fuel suppliers	Land based services
Port workers	Land based services
Gear suppliers/repairs	Industry/Land based services

[2] Tables illustrating what this process resulted in for 2 fisheries in Australia is (as documented in Brooks et. al [2015] and Jennings et. al [2014]) are provided in Annex 8.

Boat suppliers/repairs	Industry/Land based services
FAD Owners	Industry
Processors - Level 1 (1st receiver - often blast freeze, process whole fish to loins)	Industry
Processors - Level 2 (Cannery, processing loins for export)	Industry
Processing factory workers	Industry
Industry associations	Industry/Management
Fishworker associations	Fishers/Management
Government (Local, District, Provincial, National)	Management
Civil society/NGOs	Management/Fishers? End users? (Requires further discussion)
Foreign buyers - retailers/wholesalers	Industry/End users
Foreign buyers - processors	Industry/End users
Consumers - local	End users
Consumers - domestic Indonesian	End users
Consumers - foreign	End users

Figure 2. Stakeholder and communities participating in or benefiting from tuna fisheries

Conclusions

- Tuna fisheries in FMA/WPP 713-15 involve a diverse range of actors across levels of governance and geographies.
- 6 main communities were identified as participating in tuna fisheries. Management objectives should ultimately be tied to benefits, which should then be tied to 5 of these communities participating in the fishery - Fishers, Traders, Land based services, Industry and End users.
- It is the role of the management community to safeguard fisheries on behalf of wider society, and work to deliver the benefits of fisheries to identified communities.

3.2 Broad-scale contributions of tuna fisheries to Indonesian society

Responses across interviews, workshops and the online survey sought to elicit views on the contributions that both large and small-scale fisheries make to Indonesian society. For the present purpose large scale represents the purse seine and long-line sectors, and small-scale the pole and line, handline and troll sectors. This has been partly informed by previous discussions in HS development workshops, separating industrial/commercial and artisanal fisheries (MMAF 2016 pp.17-18), and partly through convention. It is acknowledged that there exist many complexities in classifying Indonesia's largely undocumented small-scale tuna fishing fleet, with the existence of extensive small-scale commercial operations in archipelagic waters for example, and that there is also most likely an argument for a "medium-scale commercial" sector, which incorporates mini-purse seine and larger pole and line vessels. For the purposes of elicitation and general discussion however, the distinction between large scale and small-scale served a useful purpose.

One purpose of identifying these contributions is to be able to tie operational management objectives to specific benefits that are then connected to the specific stakeholder communities

(e.g. those identified above), as a means of tracking changes in the fishery. This could represent a further stage of the management objectives development process. The results of discussions in workshops and in key informant interviews are provided in the following table.

Large-scale fisheries (Purse seine, long-line)	**Small-scale fisheries** (P+L, HL, Troll)
Direct financial benefits through jobs/income.	Direct financial benefits through jobs/income.
Profits flowing to Indonesian companies - contribution to national GDP and regional economic development.	Profits flowing to Indonesian companies - contribution to national GDP and regional economic development. (This includes fish supply from independent SSF to processors via suppliers/middlemen).
Contributions to state revenue via domestic and export earnings.	Contributions to state revenue via domestic and export earnings.
Contribution to national/regional food security	Contribution to national/regional food security.
Direct contribution to local food security through local sale.	Direct contribution to local food security through local sale, or directly to fishing families (either subsistence livelihood or as wages in lieu of cash).
Provide employment opportunities to women	Provide employment opportunities to women
Provision of centralised infrastructure (processing, value adding) and wider market access that small-scale fishers utilise.	Provision of infrastructure (e.g. ice facilities, small ports) that creates commerce and employment in remote coastal areas.
Low proportion of owner operated vessels.	High proportion of owner operated vessels.
High usage of centralised infrastructure (either private or public owned), supporting employment and service industries in urban centres.	High levels of asset ownership (e.g. bagans, ice infrastructure) within fishing communities. High usage of dispersed port facilities, supporting employment and service industries in coastal communities.
	Maintenance of cultural identity and local institutions.
	Maintenance of community cohesion.

Figure 3. Principal benefits of large scale and small-scale tuna fisheries.

While this broad-scale thematic analysis displays many similarities in the benefits of these different sectors, there are also significant differences in the scope, the value and the spatial dimensions of these benefits.

In general, large scale/industrial fisheries were most commonly viewed as providing benefits to Indonesian society at a national and regional level and their benefits focused principally, though not uniformly, around urban centres. In some cases respondents viewed that large scale fisheries did not contribute to coastal communities positively at all, due to resource competition arising from the rapid growth in FAD based purse seine fisheries in the past. However while these conflicts and the decline in small-scale sectors were noted often during this study, the general view that large scale fisheries make no positive contribution to communities was not commonly expressed, and does not appear to be factually correct. This is most evident in the inter-relationships that exist between small-scale and large scale operators along the supply chain as discussed under Key Theme #3. This is a key point for consideration in a harvest strategy as trade-offs between sectors become more complex under conditions of interdependence. For example reducing harvest by larger scale sectors may in fact have knock on effects to small-scale operators if they lose access to processing facilities and export markets due to a decline in the large scale operators capable of guaranteeing regular supply to those facilities.

Small-scale fisheries were viewed as contributing benefits to wider Indonesian society at national and regional levels, but also directly contributing substantial benefits to coastal and local communities. A wider variety of benefits overall were identified for small-scale fisheries. Because most small-scale fishing is embedded within local communities, they were also viewed by some respondents as delivering important social benefits related to the maintenance of social cohesion at the community level, through the opportunity for to maintain local cultural traditions and community level institutions. These include political institutions such as fish-worker associations, in some cases customary bodies such as *Adat* institutions, and the ability to practice traditional marine management approaches related to spatial and seasonal management of effort.

To explore a relevant example to the HS process of how these difference in the benefits of large and small-scale fisheries can impact the development of management measures, the example of employment is worth briefly exploring here. It may well be possible to develop strategies that provide sustainable and widely accessible employment options through the economic development of tuna fisheries whether large scale or small-scale fisheries were to be prioritised. However, the spatial distribution of those benefits is critical in determining to whom these benefits flow, and how the development of Indonesian society is therefore influenced by the implementation of management measures. If the harvest strategy were to seek to maximise employment in coastal and fishing communities, it would be highly likely that this would be most readily achieved through prioritising small-scale fisheries. If employment was to be focused primarily on urban and regional centres, then large scale fisheries would be likely to most readily maximise employment in these areas.

A relevant Australian example was discussed in depth by one key informant, a director of an Australian fisheries research agency. Modelling of management options in one Australian fishery determined that with an increase in allowable gear size, the economic dynamics of the fishery would change, with an increased likelihood that operators would increase their boat size to accommodate the larger gear and take advantage of economic efficiencies. The likely outcome was that the fishing fleet over time would move to solely accessing larger port facilities that could accommodate the increased boat sizes and catch volumes. In this fishery,

the gear size restrictions had meant that historically boat sizes had remained small and the fleet large. The fleet was dispersed along the coast, accessing numerous small ports, and creating employment in small coastal towns. With fishing one of the mainstays of the local economy for coastal towns, it was predicted that the change in gear sizes would lead to the closure of the small ports, and increase urban drift away from small towns with the reduction in direct employment opportunities in the fisheries sector, as well as the decline of associated service sectors in these small towns. In order to support a social objective, that of maintaining coastal communities, the economic objective of maximising economic efficiency was in this case not pursued (Patrick Hone pers. comm. October 18th 2016).

This example is presented here as illustrative of the complexities of managing fisheries in relation to multiple social and economic objectives, and the importance of establishing a clear and agreed upon set of priorities around policy objectives. It is hoped that the above analysis can contribute usefully to this discussion amongst the stakeholder group in particular. The following sections represent a discussion of the key themes that can form the basis of a framework for prioritised operational objectives.

Conclusions

- A wide range of social and economic benefits flow from both large and small-scale tuna fisheries across sectors.
- Benefits from large scale fisheries can be characterised as "centralised" geographically. Benefits tend to be focused on large urban as well as regional centres (though not uniformly), in relation to the flow of financial benefits, employment, asset ownership and infrastructure development.
- Benefits from small-scale fisheries can be characterised as "dispersed" geographically. Benefits tend to be focused on coastal communities and regional centres (though not uniformly) in relation to the flow of economic benefits, employment, asset ownership and infrastructure development.
- Important linkages between large scale and small-scale sectors exist, particularly in relation to fish supply (small-scale to large scale), and provision of market access and infrastructure (large scale to small-scale). These linkages equate to interdependencies that mean any change in one sector is likely to influence the status and prospects of the other, and the overall economic performance of the fishery, with trade-offs likely to be complex.
- Small-scale fisheries deliver important social benefits at the local/community level.

3.3 Key theme #1: Welfare of coastal and small-scale fishing communities

Indonesia is widely acknowledged as having a high proportion of the coastal population dependent on fishing for employment, livelihoods and food needs - in particular Eastern Indonesia is recognised as being highly fishing dependant, economically less prosperous than Western and Central Indonesia, and with a large though mostly undocumented small-scale and artisanal fishing fleet (Adhuri et al 2016, BPS 2015, Budihartono et. al. 2015, Duggan et al, 2015, MMAF 2014a, FAO 2011). Tunas are the single largest group of fish harvested in Eastern Indonesia (Budihartono et. al. 2015).

Responses across interviews, workshops and surveys noted, perhaps unsurprisingly, that the welfare and livelihoods of coastal communities in particular relied directly on participation in the tuna fisheries sectors. Previous work within the harvest strategy also identified economic development at the local level as the fourth most common response when addressing priorities for the management of the fishery (MMAF 2016 p.3), reinforcing this point.

The national average for fish consumption is 13% of overall protein consumed. Publicly available socio-economic data (see Tables in Annex 2) shows that the provinces in the FMA/WPP 713-15 rely on fish as a source of protein for 22% of protein needs, and in the case of Maluku Utara (32%), Maluku (29%) and Sulawesi Tengah (26%), at over twice the national rate. Nusa Tenggara Timur and Nusa Tenggara Barat both registered significantly lower overall fish consumption than other provinces in the planning area, with roughly the national average, while all other provinces registered at least an 8% greater share of protein consumption from fish than the national average. While not uniformly available, data from the HS planning area shows tuna (a combination of YFT, SKJ and tongkol) to be the most consumed species of seafood (BPW Sultra, 2016).

Rural and urban populations didn't differ greatly in their reliance on fish for protein, with the exception of Maluku and Maluku Utara, where rural populations consumed 4-5% more fish than urban populations, in contrast to an overall average of rural populations consuming 1% more fish protein in the planning region. Fishers surveyed in Kendari port however exhibited a much higher reliance on fish for protein needs, with 64% reporting that fish makes up more than 50% of their protein intake, and 32% reported spending more than 25% of their income on fish.

All provinces in the HS planning area other than Kalimantan Selatan, Kalimantan Timur and Sulawesi Tengah are below the national average on the human development index (BPS 2016). Combined poverty levels of the provinces in the HS planning are 13% of the population relative to 11% at the national level, while NTB (26%), and West Papua (23%) are more than double the national poverty rates (source BPS 2016).

A key theme therefore emerging from this research has been a concern that the improving welfare of coastal and particularly small-scale fishing communities be taken into account within the harvest strategy. This directly reflects the first socio-economic management objective listed in the Fishery Law 2004, which states that fisheries should aim to "improve the welfare of small-scale fishers" (Government of Indonesia 2004).

A total of 25 suggestions for management objectives related to this topic were provided, the highest for any key theme identified in this study. These ranged from general statements about ensuring the welfare of fishermen, while more specific responses included: ensuring the financial wellbeing of fishermen, such as creating local jobs and sustainable incomes, reducing debt, and improving viable access to finance; improving health and education outcomes in fishing communities; maintaining community cohesion and belonging though supporting the

maintenance of traditional identities, local knowledge and institutions; and ensuring that safety at sea is improved.

Further issues of note in the context of this discussion follow below.

Employment in coastal communities

Increasing opportunities for employment was identified in 14 responses in the management objectives workshop. Generally these were not differentiated, however 4 respondents identified coastal communities as a priority for job creation, and 2 identified ensuring that jobs could be created along the supply/value chain and for as wide a proportion of the population as possible.

Employment data for tuna fisheries at the national level is not disaggregated from all other marine capture fisheries in ministry publications, however it is recommended that this process be undertaken for YFT and CKT in FMA/WPP where possible. One method for doing so could be to aggregate vessel data from port authorities, which is considered to be relatively robust as it is reported along with vessel names and licences and can therefore be verified. The following table shows employment data from vessels utilising Kendari Port during 2014, calculated from data provided by Kendari PPS authorities. It is provided as an example for how ports data can be utilised to consider the employment dynamics of different sectors within FMA/WPP 713-15, as well as some of the limitations of this data.

Vessel type	# Vessels	Total crew	Average crew per vessel
Bagan	22	163	7
Carrier	121	795	7
Gillnet	2	10	5
Hand Line	94	698	7
Light boat	18	99	6
Pole and Line	28	494	18
Purse seine	258	3889	15
Troll	84	455	5
Grand Total	**627**	**6603**	**11**

Figure 4. Vessels utilising Kendari Port, 2014 (Source PPS Kendari).

Mini-purse seine vessels account for the greatest number of jobs from vessels accessing the port by a long way, however the greatest number of crew per vessel is on P+L vessels. Furthermore, the HL fleet operating in Sulawesi Tenggara is undoubtedly vastly under-represented in this table.

Processors in Kendari reported direct relationships with 146 2-3GT handline vessels targeting mature YFT for loins, and sourced supply from approximately 1000 more vessels through middlemen in Wakatobi and Bau Bau districts. Assuming these vessels are regularly crewed by 1-2 people a simple calculation adds between 1146 and 2292 crew to the handline sector from Wakatobi and Bau Bau alone, with HL vessels also known to operate throughout Sulawesi Tenggara's eastern coastal zone. This would result in the HL sector being the second

highest, and potentially the highest employing sector currently supplying Kendari processors and local markets.

The economic impact of these jobs also needs to be considered. PS vessels in Kendari were reported to shift seasonally between fishing grounds in Sulawesi Selatan and Sulawesi Tenggara, and almost all workers on mini-purse seine vessels interviewed in Kendari were of Bugis origin from Sulawesi Selatan. The economic impact of PS jobs is thus spread over two provinces, and remittances sent out of Kendari and Sulawesi Tenggara. The benefits of the HL and to a lesser extent P+L jobs can be attributed almost entirely to Kendari and surrounding coastal regions. In addition to this, the handline sector as reported in the table above was calculated as having the highest rate of crew per GT, roughly double that of PS and P+L vessels in Sulawesi Tenggara, and when the 1-3GT handline vessels in coastal zones are added to this calculation, the ratio of jobs per GT for handline remains competitive with these other sectors.[3]

The views expressed in numerous interviews, combined with information on fishery dynamics and vessel data presented here suggest that a shift towards replacing purse seine effort with pole and line effort based could potentially result in a net gain in overall employment outcomes, and that investing in the handline sector would assist a high value fishery supporting large numbers of people in economically insecure coastal regions. Overall this mirrors research from across global small-scale fisheries indicating higher levels of employment at a lower investment cost per job when compared with industrial scale vessels (see Barclay et. al. 2013, Jacquet and Pauly 2008).

Two points bear mentioning here however. Firstly, that mini-purse seine vessels clearly also make an important contribution to local and regional employment for economically insecure coastal communities - in the above case Bugis migrant fishermen in Sulawesi Selatan. Any transition should be planned carefully to mitigate the negative social impacts of a shift away from FAD based purse seine fisheries. And secondly, a number of interview respondents noted that while supporting the small-scale handline sector is seen as a desirable end by many stakeholders, increasing the number of handline vessels may not be the optimal management intervention from either economic or biological perspectives, given the already large artisanal fleet and the low level of licensing and overall management at the local level. Instead it is considered, as is discussed in Key Theme #3, that investments in greater production and supply chain efficiency are likely to be provide optimal outcomes in the present context, when coupled with improvements in governance as discussed in Theme #4.

Alternative livelihoods

The ability to access alternative livelihoods is seen as having a critical impact on mitigating the social and economic impacts of fisheries declines and regulatory changes, and therefore on the potential feasibility of management measures (see e.g. Stanford, Wiryawan et al. 2013, Adhuri et al. 2016, Cheung and Sumaila 2008, Dawet al. 2009). Three key points emerge from literature around this theme in Indonesia and similar developing world fisheries for the present discussion.

Firstly, communities with high rates of fishing dependency are less able to move out of fishing livelihoods where they are isolated from wider economies, a relationship that typically increases with distance from urban centres (Stanford, Wiryawan et al, 2013, 2014b). Secondly, that fishers with mixed livelihoods were more willing to exit fisheries than those who

[3] Own calculation.

rely solely on fishing (Daw et al, 2012). Secondly, low income levels and debt acts to prevent fishers from exiting economically unprofitable fisheries (Adhuri et al 2016, Cinner et al, 2009). Thirdly that livelihood improvement interventions in Indonesia that have focused on enhancing skills and human capital have been more likely to provide benefits to fishers over and above increases in physical capital (Wiryawan et al 2014a, 2014b).

In questions on alternative livelihoods within the online survey, 62% of respondents cited educational barriers among fishers as a barrier to accessing alternative livelihoods, while 62% stated that a lack of adequate access to finance and capital prevented fishers from taking up alternative livelihoods, including moving into more sustainable or higher value fishing or processing operations. This indicates the potential influence of debt, poverty and/or declining returns on fishers' livelihood options in the fishery. Other responses of interest were: 39% perceived a lack of alternative livelihoods for fishers in their fishery; 42% noted that local community networks acted as a barrier to changing livelihood, with close interdependencies between fishers and family members or neighbours for credit, gear/fuel/bait supply, repairs and logistics, particularly in coastal communities and small-scale fisheries. A range of responses from fishers in Kendari are provided in Annex 4 as some initial indication of fisheries dependence levels and livelihoods related data among fishers in the planning area. These should not be considered generalisable at this stage, though do provide a useful starting point.

Conclusions

Overall these discussions on the welfare of coastal and small-scale fishing communities are intended to highlight the critical importance of this theme within any HS development, and provide information of value for targeting policies towards this end. While further research is required to substantiate these observations and fill out the relative benefits and costs of focusing management on this priority, the following initial observations are put forward.

- Coastal communities are likely to be the most vulnerable to impacts from changes in tuna fisheries management, exhibiting higher fisheries dependency, lower wellbeing, and being more isolated from wider economies and alternative livelihood options than urban communities.
- It is likely that changes in the management of small-scale and artisanal fisheries will have a higher impact on coastal communities than changes in the management of larger scale PS and P+L fisheries.
- Investments in small-scale fisheries and non-destructive fishing practices may be able to replace employment losses from other sectors in the event of reduced allocations to larger scale fisheries, and under optimal conditions may potentially increase overall employment levels in tuna fisheries.
- In the absence of government intervention through buyouts, investments in local social and human capital (i.e. education, local institutions that provide flexibility and wider networks) as well as debt and poverty alleviation programs among fishers and associated service/logistics industries are likely to aid in mitigating some of the impacts of any losses in employment among sectors, and likely provide benefits for improving the value of coastal fisheries production for those who remain in the fishery.

3.4 Key theme #2: Food security

Food security was identified as a substantial contribution of tuna fisheries in the planning area, and a key priority for the planning process to address (MMAF 2016). As previously noted, large scale fisheries were viewed in this study as making contributions to food security principally at a regional level (as in they contributed to food security in regional centres of Indonesia where catch was landed, and distributed from there to other regional centres – e.g. from Kendari to Makassar), while small-scale fisheries contributed to both regional and local level food security (through landings at large ports in terms of regional food security, and through the many scattered small ports throughout Eastern Indonesia).

A large proportion of Indonesia's tuna is exported either fresh, frozen or from domestic canneries (Sunoko and Huang 2014). In the apparent absence of official statistics, responses in the online survey reported that most production was oriented towards processing operations, with responses ranging between 5% and 20% of tuna production oriented towards local markets, while the rest was transported to processing plants. Often this was reported as being entirely for export, though there is a domestic market for lower grade canned tuna.

It was noted in some interviews that tuna is underutilised as a food source in Indonesia outside the planning area. Given the abundance of the resource, research addressing the possibilities for increasing domestic consumption of higher value tuna, particularly in the major urban areas in Java and Bali would appear to be beneficial from a health and wellbeing perspective, and potentially an economic perspective.

In Eastern Indonesia however, tuna makes an important food security contribution. As noted previously:

- 'Combined tunas' are the most harvested species by volume in Eastern Indonesia
- Fish accounts for 22% of protein consumption across FMA/WPP 713-15, including provinces among the highest for fish consumption in the country (Maluku Utara, Maluku).
- In some provinces tuna is reported as the largest single species consumed.
- Fishers report a much higher reliance on fish protein, often reporting over 50% of protein consumption.

This consumption includes substantial quantities of YFT and SKJ that are sold through the local market. Interviewees reported that for YFT, mature fish that are not of sufficient quality to be sold to processors and exporters are generally sold to the local market, or to canneries supplying both domestic and export markets. SKJ were widely reported in the online survey as being sold through local markets and observed in Kendari market, while substantial quantities of sub-adult YFT and big eye tuna are also sold to local markets. Neritic tuna, in particular tongkol (frigate tunas) also make a major contribution to regional and local food security, and are caught regularly by mini purse seine fisheries along with SKJ, with YFT and bigeye considered bycatch. Despite being reported in national export statistics along with other tunas, the rate of export volumes of any individual tuna species including tongkol was not able to be determined from publicly available production data.

Data from port authorities in Kendari indicated the following production levels for 2010-2014, and provide a relative indication of the harvest of species from one port in the HS planning unit.

Species	Production in Kendari Port, 2010-2014 (%)
Skipjack	43
Tongkol	38
Yellowfin Tuna	19

Figure 5. Production of tuna species in Kendari Port, 2010-2014 (%). Source PPS Kendari.

The management of tongkol and other neritic species was not raised as a concern from a stock biology perspective within this study, and there appears to be little attention to it from a research or management perspective, though its' critical role in local food security would warrant further attention. There appears to be debate as to the implications of stock trends for YFT at the regional level, which remain within the green zone but appear to be tracking towards overfished/overfishing status (see WCPFC 2014). One interviewee pointed out that if stock studies reveal sub-regional stocks of YFT then the argument for reducing purse seining around FADs becomes stronger, as does the argument in favour of national and bi-lateral management of stocks. In such a case, the effects of sub adult YFT catch are likely to be higher where stocks are more restricted, and the effects of management below the RFMO level, such as sub-regional and sub-national harvest strategies, are likely to be more effective. This is potentially an important point, as the migratory nature of tuna stocks is often cited as a barrier to any one actor in the governance system choosing to initiate sustainability measures.

Despite the role in FAD based tuna fisheries for catch of tongkol, and literature suggesting that FADs are used across the Pacific to enhance food security when used as aids for inshore subsistence oriented fisheries (e.g. Bell et al. 2015), there was a commonly reported perception in the online survey that the use of FADs had not contributed to enhancing food security. Only 20% of respondents in the online survey observed that FADs have enhanced or play an important role food security for coastal communities.

This may be explained by the fact that respondents were considering these answers in terms of YFT and SKJ fisheries specifically, for which FAD fisheries appear to play a less substantial role in local food security than for tongkol. Just as likely is that purse seine based FAD fisheries are known to result in growth and recruitment overfishing (see Monintja and Mathews 2000 for Indonesian example). This echoes the common view among HL and P+L fishers in Kendari, and a number of other informants, that the rapid increase in FADs and purse seiners since c.2000 had contributed to increased resource competition and a decline in stocks, resulting in erosions of fish availability.

Research investigating the interactions of FADs, stock dynamics and food security would appear to be of high value, with Evans et al. (2016) identifying FAD fisheries as a key source of uncertainty in SKJ management in the Western Pacific.

This could include investigating:

- Whether and to what extent food security status and the socio-economic viability of fishing operations across sectors has shifted in relation to historical increases in FAD based fisheries and proportional changes in gear associated with this increase.
- Modelling the potential effects of stock changes resulting from the continuation of FAD fisheries on food security over the longer term.

- Modelling the potential effects of reducing FAD numbers and overall effort in FAD based fisheries on food security.

In the management objectives workshop, a total of 9 responses addressed food security. These responses were generally not differentiated, simply stating food security/protein supply as a priority, other than: one respondent identified that spatial allocation measures between sectors should be used to ensure food security is not compromised; one identified ensuring that local food security and fish quality should not be adversely impacted by exporting of catch to foreign markets; two respondents identified ensuring food security for rural/coastal and disadvantaged communities as a priority; one respondent identified increasing the availability of nutrients through fish supply as a priority. This last response alludes at the health benefits of ensuring a fish based diet is accessible amongst the general public, and particularly in economically and food insecure areas.[4]

In relation to the development of the management objectives framework, further socio-economic work on food security would ideally focus on developing a greater level of detail in relation to this high level management objectives - for example:

- Identifying clearly which communities access which varieties of tuna as a source of food, and from which fisheries (e.g. fisher communities, coastal communities, provincial urban communities, major urban centres - fresh whole, fresh loined, canned, smoked - SKJ/YFT/Tongkol)
- From what fisheries and through what means these different groups access supply (P+L, HL, PS, LL, FAD/Non-FAD - local markets [fresh], bought canned in local area, markets in urban centres [fresh], bought canned in urban centre)
- How food security status and the benefits gained from accessing tuna (whether as a food supply or as a source of income) alter from community to community.

This could allow for analysis of how different sectors of the population will be affected by different management strategies in relation to accessing tuna as a food source, and for appropriate allocation of resources in poverty alleviation, alternative livelihoods and food security projects that may sit parallel to harvest strategy implementation.

Conclusions

- Tuna plays an important role in food security in Eastern Indonesia, but is likely underutilised as a food source across the country. Where feasible, increasing domestic tuna consumption would appear to be of considerable benefit as a source of nutrition, and for opening up further cost-effective markets for tuna among growing urban populations.
- Small-scale fisheries provide substantial food security benefits directly to coastal communities in Eastern Indonesia through supply to local markets and in the form of fish as wages, as well as contributing to regional food security.

[4] It should also be noted that in economically insecure coastal fishing communities in the Phillippines, recent research has shown that fish are frequently traded in order to buy rice as a staple, rather than consumed directly, and that availability of income was viewed as equally important as availability of fish for securing food supply. This highlights the complexity of delivering food security - increased availability of fish may be required for direct protein sources but increased availability of economically viable fisheries may also be important for ensuring people can trade for other staple food items. See Fabinyi et al. (2016).

- Purse seine vessels provide food security benefits in regional centres and at local levels in Eastern Indonesia through sale of skipjack and tongkol catches, and to a lesser degree through YFT catches.
- Short-term food security benefits associated with PS fisheries should be weighed against the potential for long-term over-exploitation by PS of FAD associated schools. Further research on this topic should be considered a priority.
- P+L and handline fisheries associated with FADs are likely to be associated with less risks of this nature, given adequate management.
- Sub-adult YFT and big eye tuna play a role in local and possibly regional food security. It is not clear from available data at what volumes or the overall share of food supply through local markets.

4.5 Key theme #3: The economic value and efficiency of tuna fisheries

24 responses related to improving the economic value of tuna fisheries were identified in the management objectives workshop, the second most of any key theme.

In general, the integration of formal economic methods into fisheries planning processes is further developed than social methods (Pascoe et al. 2014), and a number of fisheries worldwide are now managed according to economic objectives (Cheung and Sumaila 2008, Grafton et al. 2010, Kompas et al. 2010). There are at least 2 factors underpinning the case for managing fisheries according to economic principles that are valuable for considering management objectives in Indonesian tuna fisheries.

Firstly, in marine capture fisheries the point at which economic returns are maximised relative to costs (i.e. the most economically efficient level of production) is typically at a lower level of production than that required to attain maximum biological yield (usually called Maximum Sustained Yield or MSY). To put it simply, in order to maximise profit, economics tells us we must fish at an effort less than that required to attain MSY (see e.g. Grafton et al. 2010, Gordon 1954). Secondly, the efficiency of production is also of course in part determined by the value of the target species, and focusing on higher value species or markets is likely to yield a greater economic return for the same effort. The principles of fisheries economics therefore encourage fishing at lower rates of exploitation, while targeting higher value species.

It should also be noted that achieving economic objectives based on maximising economic returns require specific circumstances in order to be effective. In particular, it is increasingly noted that in developing countries with large populations of small-scale fishers, such objectives can stand in a direct trade-off with important social goals of providing livelihoods, food and employment, and that a high level of management and overall governance capacity is required to mitigate the effects of these trade-offs, and implement measures capable of effectively reducing effort and maintaining it at an economically optimal level of production (see Sumaila 2010, Cheung and Sumaila 2008).

This is important as creating employment opportunities was viewed as an important objective by 13 workshop respondents, in addition to the previously identified goal of ensuring the welfare of coastal and SSF communities. Nonetheless, economic principles still have considerable value for optimising economic returns *in relation* to other objectives where managing a fishery to maximum economic yield is perhaps not advisable, and it would seem Indonesia is reasonably well placed over the longer term to engage in such a process.

It is clear that effort has been decreased following the moratorium on large purse seine vessels under the trans-shipping restrictions. Acknowledging the need to develop these efforts into a longer term plan as an aspect of the harvest strategy, another strategy now presents itself as worth pursuing alongside effort management - working to access higher value markets while improving the efficiency of supply chains. If implemented effectively, this could, ideally, improve effort to revenue ratios, so as to deliver increasing profits without having to fish more, while maintaining the fishery within biologically sustainable limits.

Supporting the general observations made above, responses related to 3 separate objectives as stated in the Fishery Law of 2004, with a major focus on increasing the value and competitiveness of tuna fisheries. Improve productivity, quality, value added and competitiveness of tuna fisheries received 21 responses; Increase foreign exchange (3 responses); Improve raw material supplies for fish processing industries (1 response).

Generally speaking then, the approach that would appear to have merit in the Indonesian situation would be to attempt to limit catch or effort at similar levels to what is currently occurring, with any increases in production carefully planned, and in the immediate term seeking to increase the value of present catch through increasing efficiencies in the fishery supply chain, and accessing higher value markets. Before addressing this strategy however, it is worthwhile considering the development of the fishery in the last 10-15 years.

Effort management, FADs and economic efficiency

It was noted that FADs increase the efficiency of fishing, as they greatly reduce the time required to find schools. In the online survey 54% of respondents noted that FADs had significantly reduced costs. This echoes research that pole and line fisheries in Maluku Utara had experienced more than a 40% increase in catchability with the increase in FADs in the 1990s, which 'increased CPUE by 41%, landings of fish per ton of live bait increased by 24%, the consumption of diesel oil for tuna catches reduced by 46%, and profits increased from Rp 10 to 60 million by boat per year' (Monintja and Marten 2000).

So the question arises that if FADs increase efficiency, and efficiency is a management objective, how have we arrived at a situation of excess effort in the Indonesian tuna fleet? Another way of looking at this would be to ask the question, how does the increased efficiency that FADs offers influence fishing effort?

A study of FADs in the Spanish purse seine fleet targeting YFT in the Indian Ocean provides some important insights into this issue (see Murillas-Maza et. al 2013). When buoyed FADs were introduced to the fishery in the 1990s, researchers and managers expected that due to increased efficiencies in time and fuel required to catch tuna that the socio-economic viability of the fishery would increase. For each load of fish, profits would be higher as costs relative to revenue would decrease, leading to higher wages for fishers and higher profits for companies. What researchers in fact found was that after the introduction of buoyed FADs, both the biological and socio-economic viability of the fishery had decreased. The reason for this was that the strategy that fishers employed in response to increased efficiency was different to what researchers expected - instead of maintaining effort at a similar level in order to take advantage of the increased profits from catching the same amount of fish at a more efficient rate, companies instead provided incentives for boats to use FADs, so that the efficiency gains could be instead used to increase production. This led to:

- An increase in effort, eroding any cost advantages from FADs.
- A decrease in fishers' wages as profits did not improve while hours worked increased.
- An oversupply of fish in the market placing downward pressure on prices.
- Increased conflicts with longline fleets.
- A decline in the resource.

In the absence of voluntary or regulatory controls on the level of effort in the fishery, the benefits that FADs could bring were steadily eroded, with the result that the fishery became socio-economically and biologically unviable.

> The problem is not the use of FADs versus catching free school... In the absence of control mechanisms, it seems that FAD-based fishing reinforced the strategy of fishing as much as possible, but now with the aid of a more efficient tool which can be used in high numbers (Murillas-Maza et. al 2013).

This appears to be the situation facing Indonesia's archipelagic waters over the last 10-15 years, where a rapid increase in FAD deployment has been accompanied by an influx of vessels into the fleet and increases in effort. Observations from interviewees suggested, that since around 2000 increased resource competition from FAD based purse seines and a perceived decline in stocks has been reflected in increased time and costs required to catch tuna. P+L fishers and processing companies for example reported that since the 1998 economic crisis the P+L and large HL fleet in Kendari has reduced to 30% of its capacity, due in part to these factors. Choosing instead to source supply from higher value small handline fisheries, those handline fishers supplying processors in Kendari themselves reported that the distances required to find fish had steadily increased over the same period. Historical information on catch broadly speaking supports these observations, with substantial rise in production since 2000, from 800,000 tonnes for tunas to roughly 1.2 million tonnes in 2013 (CEA 2016). Overall this would suggest that with the rise in production and increased competition for resources, evidence exists to suggest that economic overfishing has been occurring in at least certain sectors of Indonesia's tuna fisheries. Economic overfishing occurs when effort exceeds that required to attain MSY, a point beyond which increased production does not lead to increases in profits, and fishers must fish more and more in order to obtain the same returns.

The key insight from this discussion of FAD management then, is that any efforts to maximise the economic value and efficiency of archipelagic tuna fisheries must also be accompanied by active intervention by the state to manage effort and FAD numbers, so that the gains in efficiency and value are not eroded by another influx of effort into the fishery, as could occur under open access conditions.

Accessing higher value markets

Data on the volume and value of fresh and frozen tuna exports from Indonesia by destination are valuable for further consideration of this aspect of the harvest strategy discussions. As discussed by Guillotreau et al (2016) two leading markets for tuna exist globally - the high value sashimi market in Japan, principally made up of large tunas including YFT, and the lower value canning market for SKJ (including a range of other tuna species including YFT), with Thailand the leading processing hub for this market. In 2010 Indonesian exports of tuna to Japan made up 30% of volume (ranked 1st) and roughly 60% of value (ranked 1st), while exports to Thailand made up 10% of volume (ranked 3rd) and roughly 20% of value (ranked 4th). By 2014 export volumes to Thailand had jumped to 1st in the rankings, accounting for roughly 30% of volume, yet still only accounted for roughly 15% of total value (3rd in rankings), in spite of increasing its absolute value by 87%. Export volumes to Japan meanwhile had slightly dropped and overall share had dropped sharply with the rapid increases in total exports to just below 20%. However by value it maintained its top ranking, at just over 20% of total value.

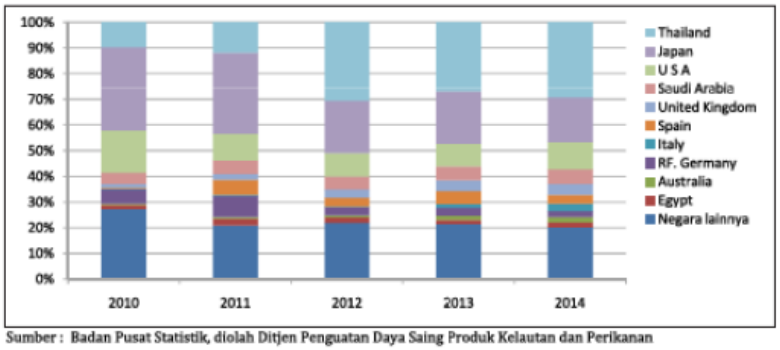
Tabel 9.9. Volume Ekspor Komoditas Tuna, Cakalang dan Tongkol Indonesia Menurut Negara Tujuan, 2010 - 2014
Table 9.9. The Export Volume of Tuna/Skipjack/Eastern Little Tuna by Country of Destination, 2010 - 2014

Satuan: Ton
Unit: Tons

NEGARA TUJUAN *DESTINATION*	TAHUN - YEAR					Kenaikan rata-rata (%) *Increasing average (%)*	
	2010	2011	2012	2013	2014	2010-2014	2013-2014
Total	**122.450**	**141.774**	**201.160**	**209.072**	**206.553**	**15,10**	**-1,20**
Thailand	11.812	16.780	61.422	56.091	60.459	76,80	7,79
Japan	39.743	44.604	40.829	42.770	35.823	-1,93	-16,24
U S A	20.013	15.062	18.294	18.549	21.980	4,15	18,50
Saudi Arabia	5.441	7.205	10.274	11.007	11.605	21,89	5,43
United Kingdom	1.716	3.364	6.450	8.947	9.078	56,99	1,47
Spain	543	8.175	6.954	10.435	6.577	351,12	-36,97
Italy	449	776	796	3.121	6.403	118,19	105,17
RF. Germany	6.727	11.515	6.079	6.448	4.544	0,12	-29,53
Australia	609	740	1.716	3.243	4.531	70,54	39,73
Egypt	1.870	3.926	4.204	3.599	3.970	28,25	10,29
Negara lainnya	33.527	29.627	44.142	44.863	41.585	7,92	-7,31

Sumber : Badan Pusat Statistik, diolah Ditjen Penguatan Daya Saing Produk Kelautan dan Perikanan

Grafik 9.10. Kontribusi Volume Ekspor Komoditas Tuna, Cakalang dan Tongkol Indonesia Menurut Negara Tujuan, 2010 - 2014
Graph 9.10. The Share Export Volume of Tuna/Skipjack/Eastern Little Tuna by Country of Destination, 2010 - 2014



Sumber : Badan Pusat Statistik, diolah Ditjen Penguatan Daya Saing Produk Kelautan dan Perikanan

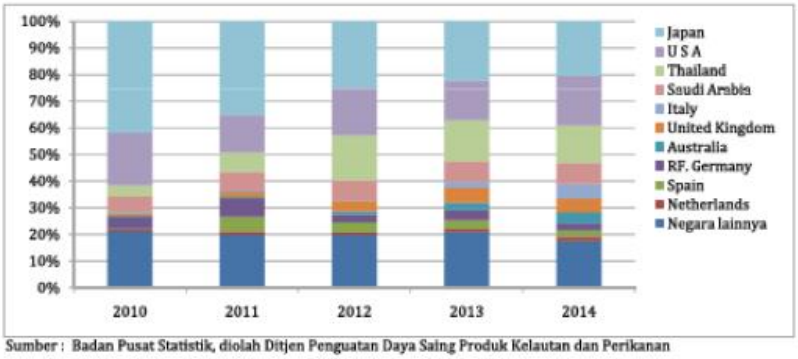
Tabel 9.10. Nilai Ekspor Komoditas Tuna, Cakalang dan Tongkol Indonesia Menurut Negara Tujuan, 2010 - 2014
Table 9.10. The Export Value of Tuna/Skipjack/Eastern Little Tuna by Country of Destination, 2010 - 2014

Satuan: US$ 1.000
Unit: US$ 1.000

NEGARA TUJUAN *DESTINATION*	TAHUN - YEAR					Kenaikan rata-rata (%) *Increasing average (%)*	
	2010	2011	2012	2013	2014	2010-2014	2013-2014
Total	**383.230**	**498.591**	**749.992**	**764.791**	**692.281**	**18,25**	**-9,48**
Japan	159.928	174.060	187.921	170.414	141.901	-2,31	-16,73
U S A	75.763	71.374	132.647	113.765	128.297	19,65	12,77
Thailand	16.294	36.619	127.579	116.758	97.678	87,08	-16,34
Saudi Arabia	22.220	33.318	53.505	58.922	55.165	28,57	-6,38
Italy	1.433	2.787	3.453	18.002	37.417	161,91	107,85
United Kingdom	4.198	10.604	29.176	42.275	35.691	89,26	-15,57
Australia	2.079	2.888	9.851	20.770	27.656	105,99	33,15
RF. Germany	15.939	33.532	21.895	29.495	19.070	18,76	-35,34
Spain	1.521	28.497	28.102	25.606	16.849	432,36	-34,20
Netherlands	2.498	5.607	5.631	7.482	10.536	49,64	40,83
Negara lainnya	81.358	99.305	150.233	161.305	122.023	14,09	-24,35

Sumber : Badan Pusat Statistik, diolah Ditjen Penguatan Daya Saing Produk Kelautan dan Perikanan

Grafik 9.11. Kontribusi Nilai Ekspor Komoditas Tuna, Cakalang dan Tongkol Indonesia Menurut Negara Tujuan, 2010 - 2014
Graph 9.11. The Share Export Value of Tuna/Skipjack/Eastern Little Tuna by Country of Destination, 2010 - 2014



Sumber : Badan Pusat Statistik, diolah Ditjen Penguatan Daya Saing Produk Kelautan dan Perikanan

Figure 6. Volume and value of tuna fisheries exports, 2010-2014 (Source KKP 2015)

This is a crude analysis that likely ignores many significant factors, but it does provide a valuable example of the benefits of accessing high value markets, and of analysis that could be undertaken in a more detailed economic study of fisheries in FMA/WPP 713-15. Even with a massive increase in volumes and in value, exports to Thailand were not able to increase overall share of export value or surpass the value of exports to Japan, despite Japanese exports dropping in volume and in value.

Indonesia would appear well placed to continue to take advantage of higher value export markets over the longer term (Sunoko and Huang 2014, McElroy 1989, Marten et al. 1982). Through efforts focused on small-scale and non-destructive fishing practices, increases in the value of tuna exports may be possible without necessarily increasing overall tuna production. This was discussed as potentially occurring in two ways, firstly through increasing the quality of tuna, for example in order to access the Japanese sashimi market, in addition to growing sashimi markets outside Japan (e.g. US, EU). Given the abundance of YFT in Indonesia's waters, and its relative proximity to Japan, this would appear to be a strategy worth investigating.

Currently YFT loins produced by handline fishermen in Wakatobi, for example, are exported to the EU and USA as steaks and sashimi for the highest quality products, and to a range of other markets in developing country markets for lower quality product. Increasing the quality of the product to access the Japanese sashimi market would likely attract a significant price premium (Guillotreau et al 2016). Secondly, supporting current eco-labelling efforts in order to produce verifiably sustainable tuna. While this does sometimes lead to price premiums over and above regular markets (Barclay 2013), significant benefits around access to new markets and brand trust and loyalty are consistently seen (Guillotreau et. al. 2016). Given this, it is worthwhile exploring experiences elsewhere of attempts to connect artisanal and small-scale fisheries with credible sustainability credentials in particular to high value export markets.

Barclay (2013) discusses in depth the arguments in favour of implementing a model of fisheries development focused on small-scale fisheries in the Pacific, shifting away from reliance on large scale/industrial fisheries development. The example Barclay cites as a success story is the Maldives fishery (pp.24-28). Artisanal tuna fisheries have existed for centuries in the Maldives, and since the 1970s this fishery has supplied SKJ to canneries for exports, and sashimi tunas to the Japanese market, as well to local markets including a domestic tourist market. Any local artisanal fisher is eligible to fish in Maldives waters, and industrial fisheries have never been granted access to the Maldives, with the exception of some larger pole and line vessels. Anchored FADs are also used under a careful management regime which has allowed artisanal fishers to take advantage of the cost and effort efficiencies associated with FADs.

A number of success factors in this fishery stand out for Indonesia's current discussion on archipelagic waters fisheries. Firstly, the success of the Maldives fishery relied on a mix of strategies and gears, with SKJ and YFT targeted at various times, and based on separate export and domestic markets. Secondly, the fishery excluded all large scale and destructive fishing activities that were capable of overfishing stocks at a rapid rate. Thirdly, a workable and effective system of managing the artisanal fleet was developed, including licensing, monitoring, regulating and reporting. Fourthly, artisanal fishers were insulated from external price fluctuations by selling to a government owned company that managed processing and export, and guaranteed a fixed price.

While the last point appears not to be feasible in the context of Indonesia's vast and already highly developed fishery, Barclay points out that the markets associated with eco-labelling and sustainably sourced tuna may provide similar price stability (2013), if not always providing a price premium (Guillotreau et al. 2016). This is of particular relevance given ongoing efforts to attain MSC certification for pole and line and handline fisheries in Indonesia (see Duggan et. al 2015), and the stated goal of the NPOA to address market demands for higher quality and sustainable tuna in the FMA/WPP 7013-15 (MMAF 2014a).

Improving efficiencies in a long supply chain

An important theme that emerged in interviews - and one that represents perhaps one of the unique challenges that Indonesia faces as a seafood exporter - is the length of the internal supply chain.

While in some cases the supply chain is relatively short, where local fishers unload at a nearby port, with catch being transported directly to an export cannery, in other cases, and it seems particularly for handline YFT, the situation is more complex. Handline fishers in Wakatobi for example catch YFT which they loin and ice at sea, sell to middlemen in Wakatobi at a range of beach landing sites, who then box it and transport it 200km to a processor in Kendari, who then sells it to an exporter in Kendari, who prepares tuna steaks for final export to the EU. Through these networks processors interviewed in this study periodically access the catch of perhaps as many as 1000 HL fishermen. Similar processes exist for YFT handliners in Banda Islands, however their loins are transported almost 2000km to Surabaya ad Jakarta for final processing and export.

Key issues related to improving the value and marketability of Indonesian tuna products across the supply chain that arose in interviews and workshops are as follows.

- Increased availability of ice.
- Improved knowledge among fishers and processors of fish handling techniques to improve quality of product and meet health and safety standards.
- Improvements in infrastructure along the supply chain for fish storage and transport.
- Increase the diversity of processed fish products.
- Improve the marketing of tuna.
- Improve the supply and efficiency of baitfish to P+L operations.

As the last point alludes to, a key link in the overall supply chain of tuna fisheries in the FMA/WPP 713-15 is bait fisheries supplying the pole and line sector. In light of the recent lack of tuna supply to large scale processing plants following the reduction in large purse seine fishing, the ability of the pole and line sector to make up a sufficient amount of the shortfall to keep processing factories was reported as being principally hampered by the unreliability of bait supply, and in some cases bait depletions. It is noted that efforts to produce baitfish via aquaculture are attempting to address this problem, however in the context of efficiencies it was also pointed out that possibilities for increasing the bait-to-catch ratio also exist (see Lewis 2015, Gillet 2014). Substantial work on bait fisheries for pole and line operations in Larantuka has been undertaken, including development of a harvest strategy and fishery indicators by WWF, which may prove a valuable local reference. A point that is raised in research is that while many fisheries report shortages of bait in Indonesia, in many cases this is not due to overfishing, but instead due to natural variability, bait handling techniques, and in some cases conflicts with human consumption. These may be areas where

government management can assist to improve resource allocation in the case of conflicts with other uses, and through training and education to improve handling techniques.

Of specific interest to the supply chain efficiency is the utilisation of industrial scale infrastructure, and leveraging of the market access this brings by smaller scale fishers - one of the contributions of large-scale fisheries noted in earlier sections.

The example of using large collector vessels for these purposes is valuable to consider, as it provides a snapshot of strategies fishers and processors have adopted in order to increase efficiencies along the supply chain Informants in this study widely noted that transferring catch to collector vessels allows pole and line fishers to spend greater time fishing during peak fishing times without having to return to their home port to unload. By placing a collector vessel near to fishing grounds, fishers are able to reduce fuel and time costs associated with returning to port to unload catch during peak fishing periods, which sometimes only lasted a few days at a time. Currently, the regulation restricting trans-shipping means that when carrier vessels do accompany pole and line vessels to fishing grounds, they wait in the nearest local port as per regulations, where previously they would accompany the pole and line vessel at the fishing ground. Once unloaded in the small port the carrier vessel will then return to the home port to deliver the catch to processors.

One company that developed the use of large collector vessels into a specific business model was interviewed for this study, and this provides a valuable example as to how efficiencies along the supply chain can be achieved. PT Ocean Mitramas is a firm that until the ministerial regulations on trans-shipment and foreign built vessels were introduced, operated 7 large former Japanese longliners up to 628GT, collecting from 200 PLASMA run traditional pole and line vessels of between 5 and 30GT, operating in Larantuka, Selayur, Ternate, Bitung and Sorong. Collector vessels acted as "floating cold storage" for these pole and line PLASMAs, travelling to these different parts of Eastern Indonesia seasonally, with catch being shipped directly to processing facilities in Bitung, Jakarta or Surabaya. This arrangement reportedly saved the P+L vessels up to 50% in fuel costs, and allowed them to fish constantly during peak seasons due to the high storage capacity of the collector vessels, increasing their production substantially. For Ocean Mitramas, the direct arrangement with the vessels allowed them to avoid price competition in ports while still buying at a slight discount, with associated efficiency gains of being able to freeze and transport 300 tons of fish direct from fishing grounds to processing plants. In addition, this model was proposed as an efficient means of monitoring production levels from the small-scale fisheries, as all catch could be documented centrally within the collecting vessels. The argument was further made that there was an in built incentive for collector vessels to document catch accurately, to be able to maintain their reputation in the market and to continue collecting under their licence. For government it meant only one point of monitoring at the company level in order to track the catch of 200 artisanal vessels that would otherwise escape audit.

The Ocean Mitramas case highlights the view expressed by a number of interviewees that a shift towards harvest based on greater reliance on small-scale or artisanal fleets in Eastern Indonesia likely requires improved linkages to wider transport and storage networks that can in many cases be best provided by larger scale operators. With adequate regulatory and policy support, opportunities to increase efficiencies through strategic interdependencies between large and small-scale sectors exist. In the case of Ocean Mitramas, this situation also revealed potential management efficiencies that could be gained from encouraging such private sector engagement with small-scale artisanal fisheries.

Conclusions

- Indonesia appears to be suffering from economic overfishing, where increasing effort does not lead to increases in profits from fishing.
- Indonesia appears to be well placed geographically to access high value YFT sashimi and YFT/ SKJ "eco-labelling" export markets over the long term.
- Focusing on increasing the value of current catch through supporting small-scale and artisanal fleets has the potential to increase financial benefits flowing to economically marginal coastal communities in Eastern Indonesia, assisting in the attainment of both social and economic management objectives.
- Based on previous discussion of the difficulties of marginalised SSF moving up the supply chain due to debt and educational limitations, targeted programs aimed at supporting SSF to access the benefits of a shift towards high value markets would appear necessary to ensure that the benefits of this strategy are shared across the supply chain, and that economic objectives are balanced against social objectives related to SSF welfare.
- The zoning of archipelagic waters to favour small-scale and non-destructive fishing methods has produced sustained economic benefits in smaller archipelagic nations, and deserves considered attention as a management measure, should a shift towards sustainable, high value stocks be prioritised. This would however require active management of fleets (licensing, monitoring, enforcement, catch reporting), and in the case of Indonesia specifically, the development of strategic linkages between large-scale transport and processing networks and widely distributed small-scale operators.
- An increase in the small-scale fleet may not be optimal given the nature of current supply chains and governance systems in Eastern Indonesia. Opportunities to increase the efficiency of tuna production across the supply chain may instead present as a better use of resources.
- Overall, efforts to increase the value of Indonesia's fisheries would likely need to be accompanied by continued efforts to manage FAD based fisheries and overall fishing effort to be effective. Without management intervention the likelihood of economic efficiencies and returns from high value markets being eroded from increases in effort would appear high.

4.6 Key theme #4: Strengthen tuna fisheries governance

It is increasingly recognised that sound fisheries governance processes are critical for ensuring that managers and fishers alike can respond effectively to fisheries declines, achieve equitable and sustainable benefits from fisheries, and maintain social licence and wider community support (see e.g. Erikkson et al. 2016, Bailey, Miller et. Al. 2016, Hartoto, Adrianto et al 2009, Cheung and Sumaila 2008, Andrew et.al 2007).

10 workshop participants provided responses that identified specific management or governance related objectives, covering a wide range of aspects of this topic - for reference they are provided in Annex 7. Overall, the clarity of governance processes, policy positions and strategies, and the proper enforcement of regulations are viewed as important factors in the long-term sustainability of the SKJ and YFT fisheries in FMA/WPP 713-15.

To take one example, it has been noted in recent commentary that while resent restrictions on trans-shipping and wider trawl bans are generally seen as a positive initiative from the point of view of environmental sustainability, it also stood in contrast to the Ministry's stated position of increasing fisheries exports by 2019 (CEA 2016). Articulating a clear plan through the HS and other policy processes for how export goals could be best achieved within biologically safe limits was therefore seen as a potentially highly positive development for businesses seeking to invest in the industry over the long term. Further capacity building and knowledge sharing among government, industry and fishers alike was therefore seen as highly desirable by a range of respondents in this study (see also Bailey, Miller et. Al. 2016, ACIAR 2013).

The following general observations arose in the course of research into this subject. Optimal policy making, regulatory processes and monitoring, surveillance and control (MSE) is seen as having the ability to:

- Support the creation of incentives for fishers to maintain a sustainable level of fishing, supporting the achievement of biological, social and economic objectives.
- Incentivise the provision of information to fisheries management authorities, improving management effectiveness and efficiency.
- Create a stable and dependable business and investment environment, supporting the achievement of economic objectives.
- Support sustainable employment and livelihoods, supporting the achievement of social objectives.

Sub-optimal policy making, regulatory processes and monitoring, surveillance and enforcement (MSE) is seen as having the ability to:

- Exacerbate overfishing in some sectors, impacting negatively on biological, economic and social objectives (maintain stock health, improve economic returns, create steady employment, minimise conflicts).
- Incentivise fishers to under or misreport catch to fisheries management authorities, reducing management effectiveness and efficiency.
- Create uncertainty and confusion impacting negatively on economic objectives (business sustainability/profitability, investment levels, raw materials supply).
- Create rapid and unexpected changes in employment and livelihood availability, impacting negatively on social objectives (steady jobs/income, improve welfare).

Co-operative management of tuna fisheries

Recent literature suggests that co-operative management at a range of levels has the potential to assist in addressing tuna fisheries management challenges in the Western Pacific and particularly in Indonesia, where a growing role for the private sector in bringing Indonesian tuna fisheries management in concert with regional fisheries management standards is evident (Bailey, Miller et al. 2016).

57% of respondents in the online survey reported the involvement of either local fish-worker associations or industry representative associations in the development of fisheries policy. Likewise 50% of respondents reported that *Sasi* or customary marine management institutions were operational in their fisheries and 48% reported that fishers were already practicing informal area base effort management as an informal management mechanism (see also Duggan et. Al. 2015). Interviewees also noted that some local Adat groups in Papua Barat played a role in granting *Kapal Andon* licences,[5] and formal co-management of coastal resources with local fish worker associations and supporting fishers to participate in market oriented sustainability initiatives have each been identified as potentially fruitful areas for co-operation (Bailey, Miller et. Al 2016, Adhuri et al. 2016, Pomeroy et Al. 2012).

Co-management with industry was reported as an opportunity to be built upon. As mentioned previously industry bodies and processing companies have direct interest in developing market based initiatives, and seek a stable investment environment. Industry led initiatives aimed at increasing economic efficiency along the supply chain, such as through collecting and trans-shipping where appropriate also form a potential area for management co-operation, with management efficiencies also likely to be available in these cases.

A further element raised in relation to co-management was striking a balance between centralised management and regional autonomy (see also CEA 2015). Generally speaking regional autonomy was seen as a valuable aspect of Indonesia's recent political development. However for highly migratory species such as tuna, the ability to co-operate between levels of government to allow for effective management where necessary was seen as desirable.

Currently all vessels below 5GT are licensed at the district level, with 5-30GT licensed at the provincial level and above 30GT licensed at the national level. Ensuring that district level licensing is effectively tracked and data shared with provincial level and national level authorities was considered of particular importance given the high numbers of <5GT HL vessels in coastal waters.

Conflicts between sectors

Conflicts between different sectors were regularly reported, and by far the most common response related to conflicts over FAD management. In the online survey 20 of 28 respondents reported at least one conflict between different sectors, gears or groups in their fishery, 50% of these included discussion of FAD related conflicts, while 25% of these explicitly related conflicts between small-scale and large-scale gears. Overall 70% of respondents reported that FADs had increased conflicts in their fishery.

[5] *Kapal Andon* is the term used to describe a boat fishing outside it's home waters. An *Andon* licence can be granted to a boat for 1 month to fish in areas outside the province in which it is registered under it's normal license. In most cases these *Andon* are licensed by local or district government authorities.

Other relevant conflicts reported here include between foreign/migrant fishermen and local fishermen (3 responses); conflicts related to fishers not abiding by government regulations (4 responses); conflicts over baitfish consumption for human consumption versus use for commercial fisheries (1 response); conflicts between bagan owners and coastal communities (1 response).

Responses in this study tend to confirm a wide range of literature from tuna fisheries and Indonesian coastal fisheries that highlights links between social and inter-sectoral conflicts in fisheries and resource decline (see, Hoshino et al. 2016, Murillas-Maza et al. 2014, Pomeroy et al. 2012, 2007). For this reason, transparent allocations of resources have the ability over the longer term to address social and biological problems within fisheries, a theme that was raised as a management objective relating to governance, as well as in key informant interviews.

Conclusions

- Improving governance processes and management capacity in Indonesia represents a critical link in the tuna management chain, supporting all aspects of fisheries sustainability.
- Key opportunities to further enhance co-operative governance exist, particularly in relation to industry co-management, community level institutions and between levels of government.
- Reducing conflicts between communities and sectors is viewed as an important governance related objective, and is closely tied to addressing resource decline.
- Clear allocations of resource access based on spatial zoning have the potential to address conflicts.

4.7 Zoning and allocations between sectors

It is not the purpose of this study to assess the merits of specific management strategies or resource allocation options, and this report recognises that all options should not be ruled either in or out until they have been fully assessed with appropriate expert assistance. However from the perspective of social and economic issues, a number of valuable points were raised by some key informants relating to spatial management of effort at two levels - locally and at the archipelagic waters level.

In the Indonesian context, spatial management of effort at the local level, such as through inshore fishing zones or fishing "paddocks" to which different communities or operators have access appears to have merit on the following grounds.

- Dispersal of effort across the fishery, where there is incentive for fishers to concentrate effort at the most economically efficient points – e.g. near to ports, fish aggregation sites (e.g. breeding areas).
- Prevention of fisheries conflicts between local and *Andon* fishers, different gear types, and small-scale and large scale sectors.
- Through granting a certain amount of guaranteed effort "rights" at the community level, bottom-up resource management is supported, whereby local fish worker associations or customary institutions (e.g. *Adat* bodies if appropriate) can become formal co-management partners in the fishery. By providing a secure and non-alienable right for communities to fish for their needs, it encourages communities to take active stewardship of the resources in their local area.

This approach would build on experiences of trials of local level Territorial Use Rights for Fishers (TURFs) in YFT tuna fisheries in Lombok that appear promising in relation to conflict management, though not necessarily an overall solution for managing catch levels (see Packer 2013). TURFs have however been used in small-scale fisheries and fisheries dependant archipelagos with some notable success, such as the Chilean Loco snail fishery (see San Martin 2010) and Shetland Islands fisheries utilising community quotas (see Anderson 2008).

Following this line of thinking, a wider spatial management measure that could be considered is the creation of an “archipelagic fishing zone” for small-scale and non-destructive fishing techniques, as discussed in relation to the Maldives example (Barclay 2013). This could encompass all or significant parts of the FMA/WPP 713-15. Benefits of this approach could include:

- Ensuring resource access for coastal communities, addressing food security and local employment objectives.
- Relative clarity for management and enforcement if clearly demarcated and supported by a VMS system.
- Clearly demarcates areas where fish are sustainably produced, supporting the development of economically valuable export markets focused on high value, YFT and SKJ.
- Reduce conflicts between sectors.

For each of these examples, consideration of an overarching effort based management system has also been discussed as potentially having merit as a broad approach. Examples of success stories here that could be valuable to consider are the Australian Northern Prawn Trawl Fishery (Kompas 2010) and the Vessel Day Scheme for the Pacific SKJ and YFT fishery (Hanich 2010). Moreover, current bio-economic modelling yet to be published appears to be

addressing this theme, attempting to identify the feasibility of a vessel day scheme, and the likely resource rents that would accrue from such a management approach. This project is in included in Annex 5.

In general it was observed that regardless of the management strategy adopted, clearly articulated policies on the export of tuna and sustainable allocations through a harvest strategy would contribute to creating certainty for industry, small-scale fishers, and markets willing to pay price premiums for sustainably sourced tuna. Clarity/simplicity and the ability to validate management effectiveness were reported as two key criteria for any management strategy adopted.

Conclusions

- Effort based management presents as a potentially feasible overarching management approach for Indonesia's archipelagic waters.
- The creation of local spatial zonings presents as a potentially feasible allocation measure for Indonesia's archipelagic waters from social perspective.
- The creation of an "archipelagic fishing zone" for small-scale and non-destructive fishing techniques presents as potentially feasible allocation measure for Indonesia's archipelagic waters from social and economic perspectives.
- Addressing governance requirements and reductions in purse seine effort will likely be required for these measure to deliver identified benefits.

5. Future planning, research and analysis

The recommendations provided below are presented as suggested or potential options for consideration in the next stages of the HS process, and for tuna fisheries management initiatives more generally. These are not representative of stakeholder priorities, but instead represent the author's own general recommendations based on the discussions and research carried out in the course of this study.

Management objectives:

- *Adoption of appropriate high level/conceptual objectives for incorporation into the Harvest Strategy*. The 4 key themes identified in section 3 are suggested for adoption.

- *Identification of operational management objectives that address each high-level objective, and prioritisation of those operational objectives*. It is suggested that each of the objectives listed in the Fishery Law 2004 could act as operational management objectives linked to high level/conceptual objectives.

- *Linking key communities and benefits with operational objectives*. Techniques specific to social and economic objectives as described in Brooks et al. 2015, Pascoe et al. 2015, and Jennings et al. 2014 are suggested as methodological references to guide this process. Communities and benefits identified in section 3.1 and 3.2 are suggested for adoption.

Statistics and data inputs

- *Collation of SKJ and YFT fishery specific data in the FMA/WPP 713-15* Suggested scope: landings, production, export, vessels by gear/sector, ex-vessel prices, value. Further information available about the value chain would be valuable.

- *Collation of raw data from BPS national Census and SUSENAS Konsumsi survey*. Suggested scope: fish consumption/expenditure and basic welfare indicators (health expenditure, education levels/expenditure, asset ownership, income). Tables including fish consumption, human development and poverty indicators at the provincial level have been provided in Annex 2 and 3 for the HS planning unit. It is not anticipated that this is an adequate basis for a full impact assessment, however this is the most recently published information available, and provides a useful starting point.

- *Engagement with fisheries socio-economics unit within MMAF and wider academic community in Indonesia*. A list of current social and economic research projects ongoing in the HS planning area is provided in Annex 5 with information on statistical data on fishing operations and socio-economics.

Assessing management options

- *Mapping fisheries dependency and broad-scale wellbeing in FMA 713, 714, 715*. This is suggested as a basis for assessing social/economic impacts of management strategies. This would ideally be based on the spatially explicit technique developed by Stanford, Wiryawan et al., (2013) using detailed census and socio-economic data. Development of a fisheries dependency survey tool for use with fishers in the main tuna ports in FMA/WPP 713-15 could be valuable over coming months to develop a dataset against which province wide socio-economic data can be validated.

- *Development of an input-output economic model*. Suggested value: simulating the economic outcomes of management strategies vis-à-vis employment and economic returns. Undertaking analysis of inter-linkages between regions within the planning area and between the planning area and the wider economy following Resosudarmo et al. (2008) could be of value for assessing the geographical flow of economic benefits (e.g. accounting for migrant fishers remittances, catch from one WPP being processed in another WPP or outside the planning area).

- *Assessing the feasibility of a total allowable effort system*. This would ideally include assessing the merits (and challenges) of allocating spatially explicit effort zones to community and commercial operators under a TAE system.

- *Assessing the feasibility of an "Archipelagic Fishing Zone" restricted to small-scale and non-destructive fishing methods*. This would ideally include an assessment of the potential social, economic and management benefits (and challenges) of such a measure.

Broader data collection, research and assessment work of value to Indonesian tuna fisheries

- *Producing a "Perikanan Tuna di Dalam Angka" - Tuna Fisheries in Statistics using fisheries ministry and statistical bureau data*. This would aim to collate all relevant Ministry and BPS data on tuna production, export, consumption, management, and socio-economic indicators of key tuna fishing communities in a publicly available document that can be updated annually. This would be a valuable resource for managers, policy makers, industry and analysts.

- *Developing a bio-economic model of Indonesian YFT and SKJ fisheries*. This would build on the regional input-output model to develop a more detailed understanding of the flow of economic benefits in relation to changes in the fishery and fisheries management.

- *Assessing the social wellbeing of communities participating in tuna fisheries*. This approach would aim to develop an integrative method for assessing the value of Indonesian tuna fisheries in both economic (i.e. financial) and social/cultural terms, and for tracking changes in fisheries management against changes in social wellbeing indicators to assess the effectiveness of fisheries management to deliver benefits to target communities.

- *Assessing social-ecological linkages in Indonesian tuna fisheries*. This would aim to assess critical system relationships between ecological, social, economic and governance

elements, and provide integrative tools for simulating management scenarios through the use of simple conceptual models and participatory methods. This represents an integrative, system wide approach that is capable of: incorporating quantitative and qualitative methods; can be developed with the input and participation of stakeholders; can be focused on specific issues within the system to assess their critical elements, and their impact on the wider fishery.

Due to the nature of this study as an initial "scoping" exercise, and the need to address the technical aspects of a national level harvest strategy development process, a number of issues arose in this research that have not been explored in depth this report. These are considered of value for consideration within ongoing social and economic research on tuna fisheries management more generally, and in some cases, in more detailed studies at the sub-national level of the impacts and implementation of chosen harvest strategies. These include:

- The role of informal management practices among fishers, including fishing strategies employed in response to changing variables (environmental, economic, regulatory).
- The influence of subsidies in tuna fisheries management.
- The role and contribution of women in tuna fisheries, and the impacts of gender relations on household income and food security in SSF.
- The impact of persistent debt and wage instability/insecurity on the wellbeing of SFF.
- The influence of social and cultural institutions at the local level on the flow of economic benefits from tuna fisheries, including; debt patronage relations between SSF and suppliers; non-nuclear family units and resource sharing within ethnically distinct communities; the role of migrant fishers in tuna fisheries.
- Human rights and tuna fisheries, including the use of foreign labour on large vessels.

5. Annexes

ANNEX 1 - Interviews, extended meetings and visits undertaken.

1. Pak Duto Nugroho, Fisheries Scientist, Ministry of Marine Affairs and Fisheries, Jakarta
2. Pak Fayakun Satria, Fisheries Scientist, Ministry of Marine Affairs and Fisheries, Jakarta
3. Pak Muhammad Natsir, Fisheries Scientist, Ministry of Marine Affairs and Fisheries, Jakarta.
4. Pak Rifky Hardijanto, Director, BPSMKDP, Indonesian Government.
5. Pak Deni, BPSMKDP, Indonesian Government.
6. Pak Ari, BPSMKDP, Indonesian Government.
7. Tony Lewis, International Pole and Line Foundation.
8. Craig Proctor, Fisheries Scientist, Commonwealth Scientific and Industrial Research Organisation, Australia.
9. Dr Ingrid van Putten, Fisheries Economist, Commonwealth Scientific and Industrial Research Organisation, Australia.
10. Dr Patrick Hone, Executive Director, Fisheries Research and Development Corporation, Australia.
11. A/Prof. Budy Resosudarmo, Arndt-Corden Division of Economics, Crawford School of Public Policy, Australian National University.
12. Andrew Bassford, Chief Executive Officer, Marine Change.
13. Sari Tolvanen, Director, Marine Change.
14. Lalu Hizbulloh, Masyarakat dan Perikanan Indonesia.
15. Momo Kochen, Masyarakat dan Perikanan Indonesia.
16. Peter Trott, Traceability consultant, Fishlistics Consulting, Hobart.
17. Widhya Nugroho, PhD candidate (Bio-economic modelling of tuna fisheries), BESTTuna Program, University of Wageningen, Netherlands.
18. Shinta Winyarta, PhD candidate (Bio-economic modelling of tuna fisheries), BESTTuna Program, University of Wageningen, Netherlands.
19. Dr Riyani Miranti, Indonesia Program Director, National Centre for Social and Economic Modelling, University of Canberra, Australia.
20. Andrew Harvey, Indonesia Country Manager, International Pole and Line Foundation.
21. Martin Purves, Managing Director, International Pole and Line Foundation.
22. Prof Lasara, Biology Department, Universitas Halo-uleo, Kendari.
23. Pak Julius, Managing Director, PT Ocean Mitramas, Jakarta.
24. Pak Frits, Kepala, Pelabuhan Perikanan Samudera Kendari, Ministry of Marine Affairs and Fisheries, Kendari.
25. Pak Recky Pangemaman, Pelabuhan Perikanan Samudera Kendari, Ministry of Marine Affairs and Fisheries, Kendari.
26. Pak David, Lucky Doll Fish Company, Kendari, Sulawesi Tenggara.
27. Pak Kijo, Kepala Dinas, Ministry of Marine Affairs and Fisheries, Kendari.
28. Pak Tegu, Manager, PT Cilacap, Kendari.
29. Pak Basuki, Manager, PT Sultra Tuna, Kendari.
30. Pak Sugianta, World Wide Fund for Nature, Kendari, Sulawesi Tenggara.
31. Pak Aris, PT Dharma Samudera, Kendari.
32. Pak Muliadi, PT Dharma Samudera, Kendari.
33. Pak Arian, PT Dharma Samudera, Kendari.
34. Ibu Marni, PT Dharma Samudera, Kendari.
35. Ibu Mawar, PT Dharma Samudera, Kendari.
36. Pak Tambat, PT Dharma Samudera, Kendari.
37. Pak Junaidi, Supplier, Wakatobi, Sulawesi Tenggara.
38. Par Rinto, Fisherman, Wakatobi, Sulawesi Tenggara.
39. Pak Anas, Fisherman, Wakatobi, Sulawesi Tenggara.
40. Pak Herman, Fisherman, Wakatobi, Sulawesi Tenggara.
41. Pak Sofian, Fisherman, Kampung Butung, Kendari, Sulawesi Tenggara.

ANNEX 2 - Fish consumption in FMA/WPP 713-15, derived from BPS (2016a, 2016b).

Province		Daily average consumption of protein (grams)	Daily average consumption of protein from (seafood)	Protein from seafood as a % of total consumption
Maluku Utara	Urban	49.14	13.34	27%
	Rural	45.62	15.33	34%
	Urban + Rural	**46.57**	**14.79**	**32%**
Maluku	Urban	54.98	14.53	26%
	Rural	46.83	14.3	31%
	Urban + Rural	**50.07**	**14.39**	**29%**
Papua Barat	Urban	53.97	13.61	25%
	Rural	47.52	11.15	23%
	Urban + Rural	**50.00**	**12.10**	**24%**
Sulawesi Utara	Urban	63.54	13.17	21%
	Rural	54.40	12.64	23%
	Urban + Rural	**58.86**	**12.88**	**22%**
Gorontalo	Urban	61.35	14.36	23%
	Rural	51.96	11.55	22%
	Urban + Rural	**55.34**	**12.56**	**23%**
Sulawesi Tengah	Urban	56.97	12.1	21%
	Rural	52.12	11.36	22%
	Urban + Rural	**53.36**	**11.55**	**22%**
Sulawesi Tenggara	Urban	62.43	16.53	26%
	Rural	54.65	13.9	25%
	Urban + Rural	**56.97**	**14.69**	**26%**
Sulawesi Selatan	Urban	62.14	13.02	21%
	Rural	53.72	10.99	20%
	Urban + Rural	**56.96**	**11.77**	**21%**
Sulawesi Barat	Urban	60.79	15.99	26%
	Rural	54.65	12.50	23%
	Urban + Rural	**55.91**	**13.22**	**24%**
Nusa Tenggara Barat	Urban	57.27	6.93	12%
	Rural	55.78	7.96	14%
	Urban + Rural	**56.43**	**7.52**	**13%**
Nusa Tenggara Timur	Urban	54.96	8.8	16%
	Rural	47.97	4.96	10%
	Urban + Rural	**49.40**	**5.74**	**12%**
Kalimantan Selatan	Urban	62.34	8.81	14%
	Rural	58.97	10.77	18%
	Urban + Rural	**60.43**	**9.92**	**16%**
Kalimantan Timur	Urban	57.80	9.81	17%
	Rural	51.82	9.07	18%
	Urban + Rural	**55.67**	**9.55**	**17%**
Average across 13 provinces	Urban	58.28	12.38	21%
	Rural	52.00	11.27	22%
	Urban + Rural	**54.31**	**11.59**	**21%**
National Average	Urban	59.14	7.03	12%
	Rural	54.05	7.32	14%
	Urban + Rural	**56.67**	**7.17**	**13%**

Figure 7. Consumption of seafood as a percentage of protein consumption by province.

Province		Monthly Average Expenditure on food items (rupiah)	Expenditure on seafood from monthly average expenditure on food (rupiah)	Expenditure on seafood as a % of monthly average expenditure on food
Maluku Utara	**Urban**	466434	58201	12%
	Rural	394030	53139	13%
	Urban + Rural	**413580**	**54506**	**13%**
Maluku	**Urban**	511198	59395	12%
	Rural	378718	50128	13%
	Urban + Rural	**431484**	**53819**	**12%**
Papua Barat	**Urban**	578480	69059	12%
	Rural	422748	47815	11%
	Urban + Rural	**482624**	**55983**	**12%**
Sulawesi Utara	**Urban**	545514	61419	11%
	Rural	431923	53782	12%
	Urban + Rural	**484938**	**57346**	**12%**
Gorontalo	**Urban**	458799	59357	13%
	Rural	337137	42272	13%
	Urban + Rural	**380934**	**48423**	**13%**
Sulawesi Tengah	**Urban**	509944	48840	10%
	Rural	389502	42388	11%
	Urban + Rural	**420182**	**44051**	**10%**
Sulawesi Tenggara	**Urban**	439024	58312	13%
	Rural	343145	46604	14%
	Urban + Rural	**371733**	**50095**	**13%**
Sulawesi Selatan	**Urban**	505254	56002	11%
	Rural	346180	43094	12%
	Urban + Rural	**407389**	**48061**	**12%**
Sulawesi Barat	**Urban**	413761	59320	14%
	Rural	343144	41841	12%
	Urban + Rural	**357586**	**45415**	12%
Nusa Tenggara Barat	**Urban**	442889	31401	7%
	Rural	385012	34205	9%
	Urban + Rural	**410112**	**32989**	**8%**
Nusa Tenggara Timur	**Urban**	426418	39722	9%
	Rural	283013	21644	7%
	Urban + Rural	**312312**	**25338**	**8%**
Kalimantan Selatan	**Urban**	576703	54831	10%
	Rural	496275	58594	12%
	Urban + Rural	**531127**	**56963**	**11%**
Kalimantan Timur	**Urban**	509281	59332	12%
	Rural	549413	55461	10%
	Urban + Rural	**587920**	**57951**	**10%**
Average across 13 provinces	**Urban**	491053.8	55014.69	11%
	Rural	392326.2	45459	12%
	Urban + Rural	**430147.8**	**48533.85**	**11%**
National Average	**Urban**	520631	35799	7%
	Rural	397100	31313	8%
	Urban + Rural	**460639**	**33620**	**7%**

Figure 8. Consumption of seafood as a percentage of monthly average expenditure by province.

ANNEX 3 - Poverty and human development index in FMA/WPP 713-15 2011-2015, derived from BPS Sultra (2016).

Province	2011	2012	2013	2014	2015
Maluku Utara	10.00	8.05	7.64	7.41	6.22
Maluku	22.45	20.76	19.27	18.44	19.36
Papua Barat	28.53	27.04	27.14	26.26	25.73
Sulawesi Utara	8.46	7.63	8.50	8.26	8.98
Gorontalo	18.02	17.22	18.00	17.41	18.16
Sulawesi Tengah	16.04	14.94	14.32	13.61	14.07
Sulawesi Tenggara	14.61	13.05	13.73	12.77	13.74
Sulawesi Selatan	10.27	9.82	10.32	9.54	10.12
Sulawesi Barat	13.64	13.01	12.23	12.05	11.90
Nusa Tenggara Barat	19.67	18.02	17.25	17.05	16.54
Nusa Tenggara Timur	20.43	20.41	20.24	19.60	22.58
Kalimantan Selatan	5.35	5.01	4.76	4.81	4.72
Kalimantan Timur	6.63	6.38	6.38	6.31	6.10
National	**12.36**	**11.66**	**11.46**	**10.96**	**11.13**

Figure 9. Number of Poor People by Province (percent), 2011-2015.

Province	2011	2012	2013	2014	2015
Maluku Utara	63.19	63.93	64.78	65.18	65.91
Maluku	64.75	65.43	66.09	66.74	67.05
Papua Barat	59.90	60.30	60.91	61.28	61.73
Sulawesi Utara	68.31	69.04	69.49	69.96	70.39
Gorontalo	63.48	64.16	64.70	65.17	65.86
Sulawesi Tengah	64.27	65.00	65.79	66.43	66.76
Sulawesi Tenggara	66.52	67.07	67.55	68.07	68.75
Sulawesi Selatan	66.65	67.26	67.92	68.49	69.15
Sulawesi Barat	60.63	61.01	61.53	62.24	62.96
Nusa Tenggara Barat	62.14	62.98	63.76	64.31	65.19
Nusa Tenggara Timur	60.24	60.81	61.68	62.26	62.67
Kalimantan Selatan	65.89	66.68	67.17	67.63	68.38
Kalimantan Timur	72.02	72.62	73.21	73.82	74.17
National	**67.09**	**67.70**	**68.31**	**68.90**	**69.55**

Figure 10. Human development index by province 2011-2015.

ANNEX 4 - Field survey data from Kendari Fisheries Dependency trial survey – Fishers' welfare related data

This is presented principally as an example of field data that could be collected from port sites relatively efficiently. N=43

Average monthly wage of fishers	2.1 Million Rp
Average monthly household expenses	1.7 million rp
% of fishers who are sole earners in their household	63
% of respondents for whom fishing related work is their principal source of income	49
% of respondents who earn more than 25% of their income from fishing related work	95
% of respondents spending more than 25% of monthly household income spent on fish	32
% of fishers with more than 50% of protein needs coming from fish	64
% of respondents with education above SMP (middle school)	42
% of respondents reporting access to some form of health care	85 (ship first aid not differentiated from access to a shore based clinic - future surveys would ideally specify access to a clinic or hospital)

Figure 11. Welfare related data from fishers surveys in Kendari Port, November 2016.

ANNEX 5 - Social and economic research on tuna fisheries in FMA/WPP 713-15 reported during interviews/meetings.

Activity	Data collected	Area	Organisation	Status
Operational costs data collection	Operational costs for Handline YFT (fuel, bait, distance, catch, sale price)	Wakatobi, Sulawesi Tenggara	World Wide Fund for Nature	Completed (2008-2012)
Socio-economic and bio-economic research	Socio-economic information, detailed vessel data, perceptions of fishery status	Kendari Port, Sulawesi Tenggara	DGCF (MMAF)/CSIRO	Data collection finished, results to be published
Bio-economic modelling of FADs (2 PhD projects)	Operational data (Costs, bait used, production, distance travelled, FAD positioning)	Bitung, Sulawesi Utara	BESTTuna, University of Wageningen, Netherlands	Ongoing
Bio-economic modelling of financial incentives for tuna fisheries management (including resource rent calculations for effort based "Vessel Day Scheme")	Unclear, focus on Indonesian FAD based tuna species so likely similar to above BESTTuna research.	Unclear, focus on Indonesian FAD based tuna species	BESTTuna, University of Wageningen, Netherlands	Ongoing until December 2017
Governance assessment focusing on wellbeing of tuna fishing communities	Tbd - establish key indicators of community wellbeing and methods to track changes over time	Tbd - Likely Kendari, Sulawesi Tenggara and Sorong, West Papua	University of Technology Sydney, Indonesian Institute of Science (LIPI)	Pending contract, due to commence mid-2017
Develop a bio-economic model of the benefits of fisheries reform and recovery in Indonesia.	Unclear - in planning phase to establish Indonesia specific model based on global datasets.	Unclear - key species if SKJ. Considered high likelihood of archipelagic waters focus.	University of Santa Barbara California.	Planning project duration mid 2016-mid 2017
Socio-economic study and traceability needs assessment	Socio-economic data (Income, demographics, education, access to healthcare)	Bitung, Sulawesi Utara	USAID/MDPI/Marine Change	Field surveys completed late 2016
Fisheries dependence surveys	Socio-economic data (Income, expenditure, demographics, education, access to healthcare, alternative livelihoods)	Kendari, possibly other locations tbd.	AP2HI	Pilot complete late 2016 through this research. Proposed ongoing as part of AP2HI activities.

Figure 12. Socio-economic and bio-economic research reported in FMA/WPP 713, 714, 715 during research.

ANNEX 6 - Management objectives identified in HS stakeholder workshop

SOCIAL-ECONOMIC OBJECTIVES BASED ON UU NO. 31, 2004	OBJECTIVE
#1 - Improve welfare of coastal communities and small-scale fishers'	Improving fishers skills and training (example: fish handling, boat operations) (Also included in Objective #5)
	Increase incentives on the more sustainable fishing practice - handline without FAD.
	Increase welfare of fishermen
	Fulltime fishermen earn at least the minimum monthly provincial wage
	Improving fishing communities financially
	To protect socio-cultural aspects of the fisheries (preserve local wisdom)
	Fishing community's traditional identity and sense of belonging is maintained.
	The level of education of fishers' children should be higher than their parents (improve literacy).
	Increasing education levels for fishers' children
	Improving the standard of living of fishermen →welfare
	Ensure welfare of coastal communities
	Improving welfare
	Safety at sea improved
	Increasing income from fisheries
	Increases the income of fishermen
	Fishermen free from debt
	Providing welfare to fishermen and crew with a minimum income equal to the minimum wage in the region they work
	Fishermen have access to insurance and bank finance
	The fishermen have bargaining position to the middleman
#2 - Improve foreign exchange	Provide foreign exchange through exporting tuna seafood
	Expand further into international market
	Improving profits from fisheries
#3 - Improve state revenue	Increasing tax and government revenue
	Increases the income of local and also central government
#4 - Increase employment opportunities	Increase the availability of job opportunities
	To create a viable income for as wide a proportion of the population as possible
	The availability of job opportunities for coastal communities
	Provide job opportunities in coastal communities (Also counted in Objective #1)
	To ensure economic returns for all part of supply chain to which support increased sustainable investment
	Improving the quality of human involved in fisheries (skills)
	Absorption of labour force
	Sustainability of business →absorption of labour force and business
	Job security
	More job involved including supply of raw material and machinery
	Local job (Also included in Objective #1)
	Increasing the job opportunities (Also included in Objective #1)
	Increasing local income (Also included in Objective #1)
#5 - Protein supply/food security	Food availability for communities
	The availability of protein source
	Provide fish (FCT) for protein source (food security) for Indonesian people
	To ensure food security for rural/disadvantaged communities
	Increasing the nutrient
	Food security

	Food security and quality of local communities is not adversely affected by export of catch to international markets
	Food security
#6 - Increase productivity, quality, value added, competitiveness	Promoting/ensuring profitability/long term economic sustainability
	Improved infrastructure
	Overfishing is not happening
	Increase competitive advantage
	Improved access to financing/capital
	Improved market access
	Improve value of the product - better handling to improve quality (ice, cold storage)
	Sustainability of business technically (improving the fishing efficiency—closer to fishing ground)
	Increasing the role of bank (making it easier to get credit from bank)
	Improving the value added of tuna product →improving the profit
	Develop catch innovations
	Improve marketing
	Increase the diversity of fish processing products
	100% profit thinking
	Ensure business sustainability
	Increasing attention to technology and market demand
	Improving the market access
	Improve market access
	Fishermen have good knowledge of good fish handling and safety
	Increasing value added
	Enhancing tuna added value product for small-scale and large industry
#7 - To improve raw material supplies for fish processing industries	Raw material for fishing industry is available
Additional category - Management and Governance	Management of fish resources should be better in terms of the ability to provide calculations about the potential, the allowable catch number and type of fisheries that is allowed to operate
	Improving the fisherman's institution (Also included in #1)
	Healthy competition between fisher group in regard to government assistance
	Enunciate clear policy regarding value adding and export of oceanic tuna resources
	Secure protein supply to coastal fishing communities through assured economic allocation of resources (spatial allocation) (Also included in #6)
	Minimise negative interactions between small-scale and industrial fisheries
	Involvement of all stakeholders in the fisheries management and then continue it with defining each roles clearly
	The fisheries conflict is at minimum level
	Taking the benefit of local wisdom in the decision making
	Transparent value/profit share

Figure 13. Potential management objectives identified by stakeholders for Indonesia's SJT and YFT fisheries.

ANNEX 7 - Examples of prioritised social and economic objectives hierarchies from two Australian wild capture fisheries.

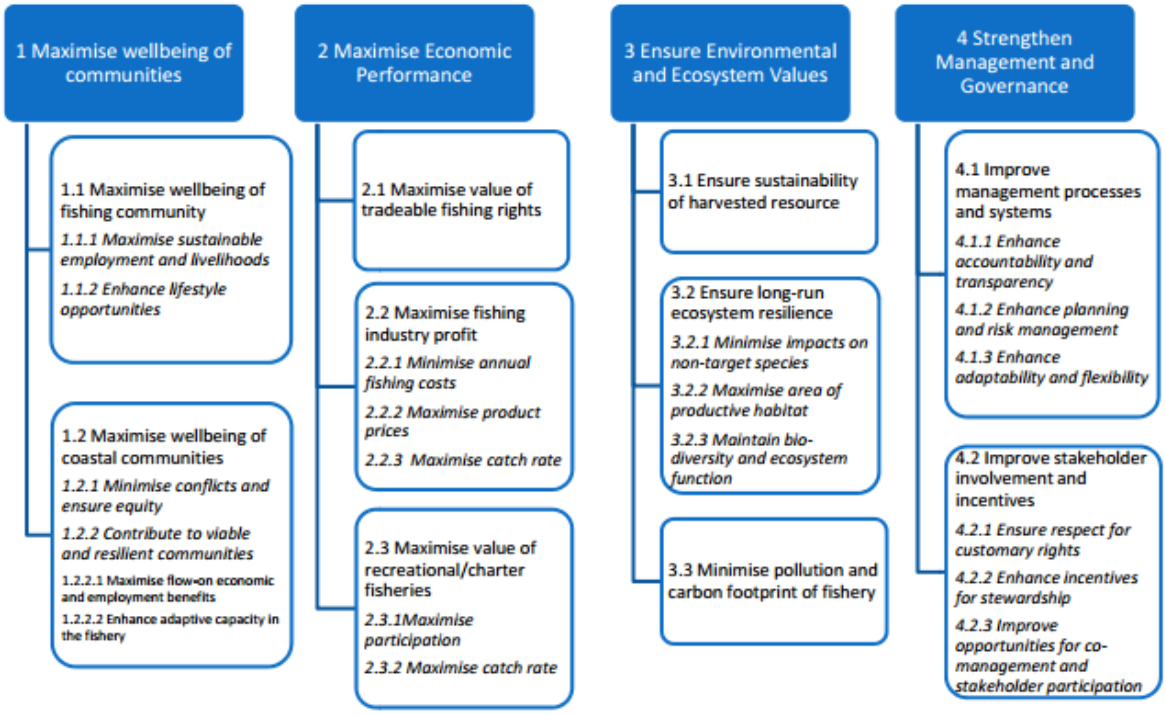


Figure 14. A prioritised set of fishery wide objectives for 4 wild capture fisheries in SE Australia (from Jennings et. al 2014 p.6)

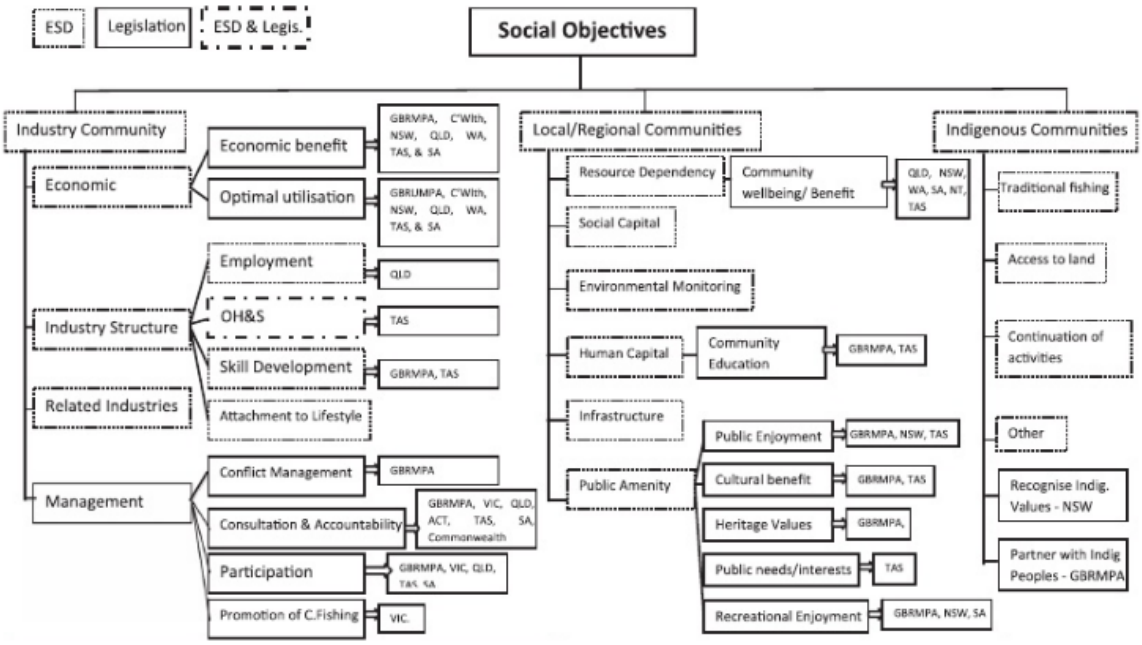


Figure 15. A prioritised set of socio-economic objectives for an Australian wild capture fishery (from Brooks et. al 2015 p. 113)

References

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