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# Final report

*Project full title*

## **Developing alternative small-scale fishery models for women in the Fly River, Western Province, Papua New Guinea**

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*prepared by* Sara Busilacchi (CSIRO)

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*co-authors/  
contributors/  
collaborators* James Butler (CSIRO), Havini Vira, Josephine Laka, Moses Kalup (OTDF), John Burton (UQ), Benjamin Brown (CDU/Blue Forests), Rio Ahmad, Iqram Muhammad (Blue Forests)

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# 1 Acknowledgments

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*Photos were provided by Josephine Laka, Iqram Muhammad and Sara Busilacchi.*

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## 2 Executive summary

Located in Western Province and bordering the Torres Strait of Australia and Papua Province of Indonesia, the Fly River region of Papua New Guinea (PNG) is remote and isolated. Poverty rates are amongst the highest in PNG, caused by complex drivers including lack of markets, weak governance, limited infrastructure, and population growth. Livelihoods are based on small-scale fisheries, which are being over-exploited due to low prices, a lack of alternative markets and an absence of fisheries management. Fishers receive low returns due to their positions as price-takers in the value chains, which are exacerbated by a lack of cooperation, driven by limited communication and traditional social strictures.

Mud crabs and tilapia are an important small-scale fisheries resource for women in the Fly River delta and Middle Fly villages, respectively. The Ok Tedi Development Foundation (OTDF) is scoping enterprises based on these species to support women's economic development, but there is a poor track record of sustainable natural resource-based businesses in the province, and little understanding of the causes or potential solutions.

The objective of this SRA was *'to scope and design alternative small-scale fishery business models for Fly River communities in the Western Province of PNG, with a focus on women's roles in mud crab and tilapia fisheries and processing'*. In November 2020 - May 2022 the project team of OTDF, CSIRO, University of Queensland and Blue Forests conducted three activities: 1) a review of business models in PNG and Melanesia and the causes of their success or failure; 2) value chain analysis of mud crab and tilapia in the Fly River delta and Middle Fly, respectively; 3) design of appropriate linked business and resource management models for women.

The review of past business models was constrained to a desk-top exercise due to COVID-19 restrictions. Few published evaluations were found, but an analysis of the 60-year history of the commercial barramundi fishery in the Fly River revealed successive cycles of financial and resource mis-management. The review highlighted the necessity for a whole-of-system approach to small-scale fishery business development, which addresses institutional, capacity and natural resource management issues simultaneously, tailored to the context of women. The review also examined the Family Farm Teams (FFT) program, Village Savings and Loans Associations (VSLAs) and the SeaNet Indonesia Sustainable Seafood Industry approach, plus outputs from the team's previous SRA FIS/2016/052 *Developing legal value chains and alternative markets for South Fly District fisheries*. These programs have been recently tested in PNG, the Solomon Islands and Papua Province, Indonesia with a focus on women, and provided pointers towards potential capacity-building and micro-financing mechanisms.

To analyse value chains 89 questionnaire interviews (85% women) were conducted with fishers in 16 villages, plus 15 key informants from the value chains, and focus group discussions with women in each village. Engagement with villages was guided by the relevant OTDF Women and Children Associations (WCAs). Mud crab and tilapia value chains are characterised by the weak status of women as individual price-takers, reflected in low returns (75 toea to 2.5 kina/crab, and 50 toea to 8.8 kina/tilapia). For mud crabs there was markup by a factor of 80 in the Asian end markets, but less for tilapia in the PNG and Indonesian markets. Value chains are vulnerable to external shocks, with sea level rise, flooding and COVID-19 having major impacts on livelihoods. Women have little

control over household finances and decision-making, but the WCAs provide a platform for collaboration and sponsorship of women's enterprises.

Using a social learning process designed to co-produce knowledge, two 2-day 'business innovation' workshops were held in the Fly River delta and Middle Fly villages with women and men. Participants assessed the value chain maps and trends in markets, produced visions for their fishery businesses by 2050, shared past experiences of local business success and failure and underlying causes, and then designed their preferred business model to achieve the vision. Community members expressed a range of economic, cultural and environmental values embedded in their aspirational business models which go beyond solely profit-driven objectives. Socio-cultural characteristics such as barter systems and traditional social networks are important sources of resilience to shocks which must be maintained.

The risks to establishing and maintaining women's fishery businesses were synthesised using a PESTLE (Political, Economic, Social, Technological, Legal and Environmental) analysis. A wide range of locally-driven and higher-level risks were identified. Economic, socio-cultural and environmental sustainability principles were then collated to address these risks, and an archetypal scaffolding was drafted based on the principles and communities' recommendations. The proposed structure combines strengths of the FFT, VSLA and SeaNet approaches within a 'hub and spoke' concept. Fishing teams, village trainers and women agents are assembled in each village as 'spokes' which avoid clan rivalries, and pool resources and catches to generate greater efficiencies and bargaining power. Spokes are governed by the VSLA committee and overseen by the local WCA. The 'hub' is a local company or individual who buys fishery products from the spokes. The structure is facilitated by OTDF and other partners (e.g. churches). Seven recommendations are made to progress this initial research:

**Recommendation 1.** Refine and trial the proposed framework in the Fly River delta and Middle Fly villages included in this study. This will require the further input of communities, and the establishment of enabling partnerships centred around OTDF.

**Recommendation 2.** Refine the business innovation workshop process to account for feedback from communities, including allowing more time and simplifying or translating unfamiliar concepts.

**Recommendation 3.** Train community members, and particularly women, in the business innovation workshop process to facilitate the scaling-out of the project's process.

**Recommendation 4.** Form an adaptive monitoring, evaluation and learning framework and process around both the development and refinement of business models, and the economic, social and environmental outcomes specific to women and their communities.

**Recommendation 5.** Conduct a detailed analysis of proposed markets for mud crabs and tilapia to better understand the trends, scale of unmet demand, and potential new market outlets.

**Recommendation 6.** Establish the status of mud crab and tilapia stocks, and their habitats, to inform potential harvest strategies and limits.

**Recommendation 7.** Disseminate and socialise the conceptual approach, methods and results of the project to Fly River communities, and across PNG through the partnerships established.

### 3 Background

Located in Western Province and bordering the Torres Strait of Australia and Papua Province of Indonesia, the Fly River region of Papua New Guinea (PNG) is remote and isolated (Figure 1). Poverty rates are amongst the highest in PNG, caused by complex drivers, including distance to major markets, weak governance, limited infrastructure and population growth. In addition, livelihoods are based on small-scale fisheries, which are being over-exploited due to low prices, a lack of alternative markets and an absence of fisheries management. Fishers illegally trade high-value marine products (shark fins, bêche-de-mer, fish bladders ('maw') from barramundi and jewfish, and mud crabs) into the growing Asian market along value chains that travel through PNG and Indonesia. However, they receive low returns due to their positions as price-takers in the value chains, which are exacerbated by a lack of cooperation, driven by limited communication and traditional social structures.

Women play an important role in fisheries value chains, but do not necessarily have control over income streams to the household, which affects diet, nutrition, health, children's education, and wellbeing (Busilacchi et al., 2018a). Consequently, promoting novel business models appropriate to women's livelihoods and fishery activities is important for enhancing family health and nutrition. The link between women's livelihoods and health is particularly important given the ongoing prevalence of multi-drug resistant tuberculosis in the region, recovery from the current impacts of the COVID-19 pandemic on food security, and the necessity to build resilience to climate change and natural disasters.

Following the Ok Tedi Mine environmental disaster in the 1990s, the Ok Tedi Development Foundation (OTDF) has been facilitating community development along the Fly River corridor, including the Fly River delta (Figure 1). This project focuses on two of the nine Community Mine Continuation Agreement (CMCA) areas in the corridor. The Kiwai-Wabada Islands (total population of 28,216) are in the river delta, where OTDF and communities are scoping a mud crab harvesting and processing venture. However, there is no formal mud crab fishery management on which to base harvesting, and the National Fisheries Authority's (NFA) Mud Crab Management Plan (2019) has not been implemented.

The Central and Lower Middle Fly villages (total population of 16,899) are also partnering with OTDF to establish a fish processing hub based on the genetically improved tilapia (GIFT), which has established an abundant wild population in the river. The initiative will focus on women's roles in catching tilapia, operating the facility and marketing the fish fillets produced. If successful, the project may divert fishing pressure away from local wild barramundi and jewfish stocks by providing an alternative source of income, while empowering women.

The PNG Government also has commitments to manage shared natural resources, cross-border trade, health and biosecurity in Western Province through bi-lateral agreements with Australia (the Torres Strait Treaty) and Indonesia (the Basic Agreement on Border Arrangements). Consequently, improving fisheries management and livelihoods in the region is a priority for the NFA. In addition, the NFA has a focus on improving livelihoods by enhancing incomes and market access, improving women's participation in small-scale fisheries, collaborating with private sector partners to mainstream research findings, enhancing livelihoods from smallholder fisheries, and capacity-building of local staff. This

capacity-building extends to fisheries staff members in the Fisheries Division of the Fly River Provincial Government. By law, NFA has delegated some of its powers to provincial governments to monitor and manage fisheries development in their jurisdictions, including small-scale fisheries interventions.

Previous projects in the region have provided foundational knowledge that underpins this SRA. In 2011-2013 CSIRO and NFA surveyed small-scale fisheries in the South Fly District, revealing the complex linkages between food insecurity, over-fishing, illegal activities, and poverty (Busilacchi et al., 2015; 2018b). In 2017- 2018 ACIAR funded CSIRO and NFA through SRA FIS/2016/052 *Developing legal value chains and alternative markets for South Fly District fisheries* to examine illegal value chains for marine products, and potential solutions to the problem (Busilacchi et al., 2018a; 2021). In 2014-2018 the ACIAR project FIS/2012/102 *Sustainable management of sharks in PNG* has identified shark species caught in the South Fly, some of which are endemic and endangered or critically endangered (Grant et al., 2021). In 2010-2016 the GEF/UNDP-funded *Arafura Timor Seas Ecosystem Action Program (ATSEA)* examined transboundary problems in the region; this is being extended in 2018-2022 to focus on the South Fly and Torres Strait. Also, the University of Queensland has conducted an Australian Research Council-funded project in 2015-2018, *The PNG-Australian Borderlands*, which examined the political economy of the transboundary region and potential strategies to break the entrenched poverty cycle (Moran & Curth-Bibb, 2020).

In April 2018, the SRA *Developing legal value chains and alternative markets for the South Fly District fisheries* project's final workshop presented its value chain analysis to stakeholders in Daru. Value chain actors mapped the complex causes of illegal and unsustainable livelihoods. Multiple solutions were recommended: a) developing enterprise models that are compatible with traditional social structures and values and which enable market information-sharing and enhanced legal returns to fishers; b) building capacity for improved fisheries and product management amongst NFA, provincial and community stakeholders, and c) identifying alternative value chains which can diversify livelihoods and thus reduce harvesting pressure on over-fished or protected species. The SRA concluded that more social and economic science is needed to design appropriate enterprise and fishery management models which can induce behavioural change, reduce illegal activities, over-exploitation and poverty, and benefit women.



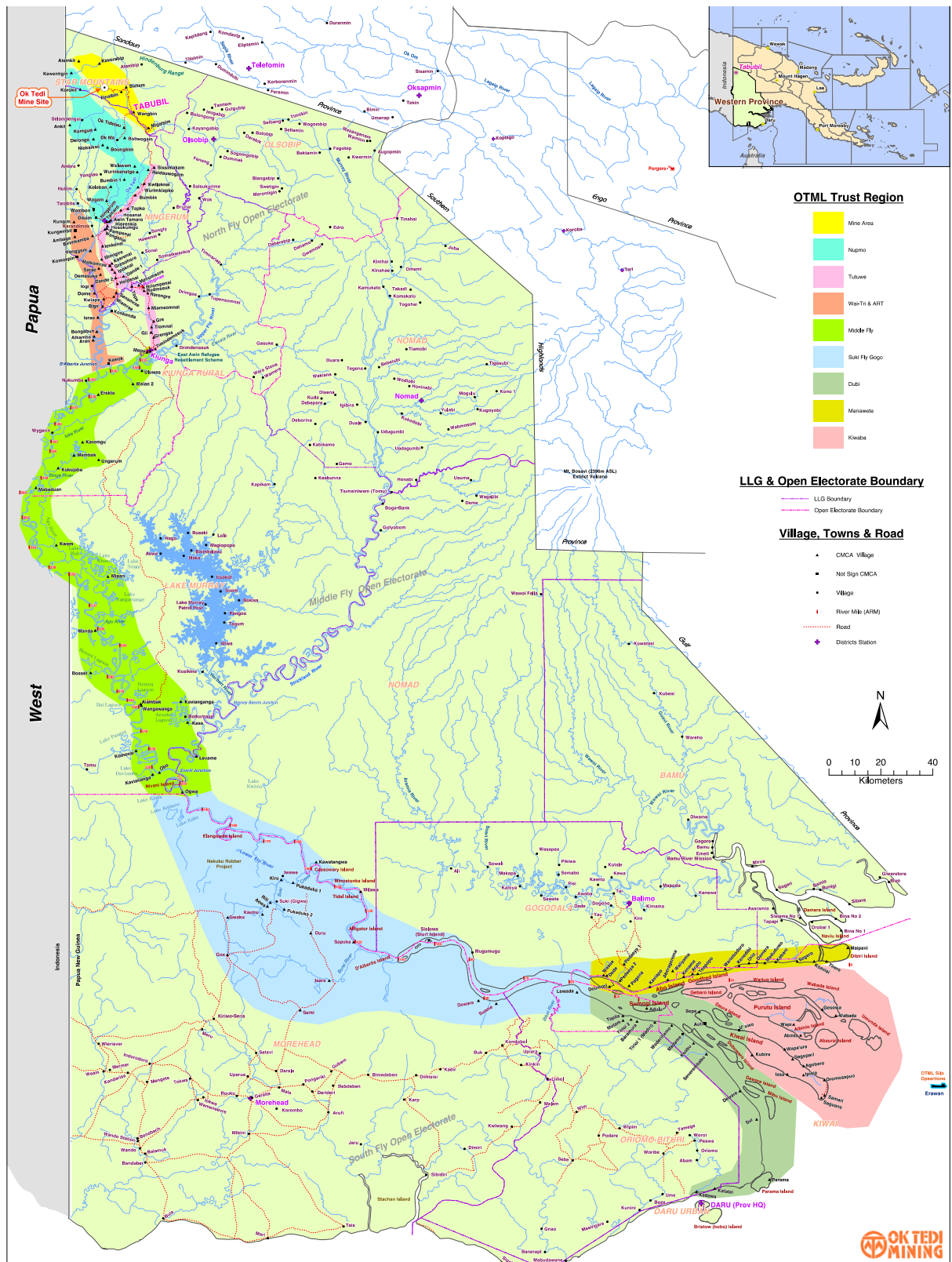


Figure 1. Map of Western Province. The CMCA areas forming the footprint of Ok Tedi Mine are highlighted in colours. The Middle Fly region (bright green) and the Kiwai-Wabada Islands in the Fly River delta (pink) are the focus of this study.

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## 4 Objectives

The primary objective of this project was *'to scope and design alternative small-scale fishery business models for Fly River communities in the Western Province of PNG, with a focus on women's roles in mud crab and tilapia fisheries and processing'*.

The three aims of the project were:

1. Review business models in PNG and Melanesia and the causes of their success or failure
2. Carry out value chain analysis of mud crab and tilapia as potential products for women's businesses in the Fly River delta (Kiwai-Wabada Islands) and Middle Fly to identify opportunities for enhanced income generation
3. Based on the results of 1) and 2), design appropriate linked business and resource management models for women that will maximize income returns and encourage sustainable enterprises and fishing.

Consequently, the three research questions posed by this SRA are:

1. What social, cultural, and political factors determine the profitability and sustainability of small-scale business models in PNG, particularly for women?
2. What are the existing value chains for mud crabs and tilapia harvested and processed in the Fly River delta and the Middle Fly villages, and how could these be better managed to improve current and future returns to women?
3. Informed by Questions 1 and 2, what form of linked business and resource management models for women are likely to succeed?

In November 2020 - May 2022 three project activities were then shaped around the research questions:

### Activity 1. Review of business models

This activity reviewed experiences with varied business models applied in PNG and Melanesia to understand the key cultural, social, and economic determinants of success and failure, with a focus on women's businesses where available.

### Activity 2. Value chain analysis of mud crabs and tilapia

This activity focused on the value chains emanating from the communities for mud crabs and tilapia, and highlighted key barriers and opportunities for women.

### Activity 3 Designing women's business models

This last activity used results from Activity 1 and 2 to conduct participatory 'business innovation' workshops with women and other stakeholders in the focal communities to explore potential business models that can maximize financial returns to women and ensure sustainable utilization of the target species.

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## 5 Methodology

A knowledge co-production approach (Norström et al., 2020) was used to address the complex issues related to fisheries value chains and livelihoods. In this approach, scientific knowledge produced by the project team, empirical and applied knowledge acquired by the OTDF team and local knowledge held by stakeholders were shared through participatory social learning processes spanning local, provincial and national levels to generate innovative ideas and solutions (Butler et al., 2015).

The tools and processes applied by the OTDF and CSIRO team were adapted to the project's aims and resources through co-design meetings and training. The OTDF team were also engaged in the parallel CSIRO Australia Pacific Climate Partnership Knowledge Broker Support Program (KBSP: <https://learnwithacfid.com/enrol/index.php?id=20>), which enabled them to join an on-line community of practice of knowledge brokers and exchange experiences and ideas about the tools they were developing, and learn about others. The skills and methods were then transferred by the OTDF researchers to their Field Base colleagues in the Fly River delta and Middle Fly during field work.

During Activity 2, a local Indonesian NGO, Blue Forests (<https://blue-forests.org/en/>) was contracted to continue the mapping of tilapia value chains where they extended into Indonesia. The Blue Forest team was trained in value chain analysis by the OTDF-CSIRO team to maintain consistency in the approach.

COVID-19 outbreaks in Australia, PNG and Indonesia coincided with the project's inception and implementation. Consequently, the survey methodologies had to be adapted to account for logistical limitations caused by governments' pandemic responses and resulting constraints to travel and face-to-face meetings.

Informed consent was sought from participants before commencing participatory activities (Appendix 1). Confidentiality, anonymity of participants' responses, and the secure storage of raw data in Australia were requirements under the CSIRO Social Science Human Research Ethics Committee approval 024/21. The study's objectives were verbally explained to participants. Emphasis was given to the study's intention to understand the current dynamics of the trade and exploitation of marine resources to enhance communities' and women's livelihoods.

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### 5.1 Activity 1 Review of business models

This activity reviewed literature of past experiences with varied business models applied in PNG and Melanesia to understand the key cultural, social, and economic determinants of success and failure, with a focus on women's businesses where available. It was originally intended to also interview key informants in Western Province, but COVID-19 made this impossible. Details of the methods and results are presented in a separate report (see Burton, 2021).

In addition, the team collated information from three other relevant initiatives: ACIAR's Family Farm Teams program (see Pamphilon & Mikhailovich, 2016; Pamphilon, 2017; Pamphilon et al., 2017), WWF's Village Savings and Loans Associations (see WWF 2017, WWF Australia & K4Dev 2021), and the SeaNet project (Lawrence & Syuhada, 2018). Finally, suggestions for alternative business models discussed at the concluding multi-

stakeholder workshop of the previous SRA, *Developing legal value chains and alternative markets for the South Fly District fisheries* (Busilacchi et al., 2018), were collated.

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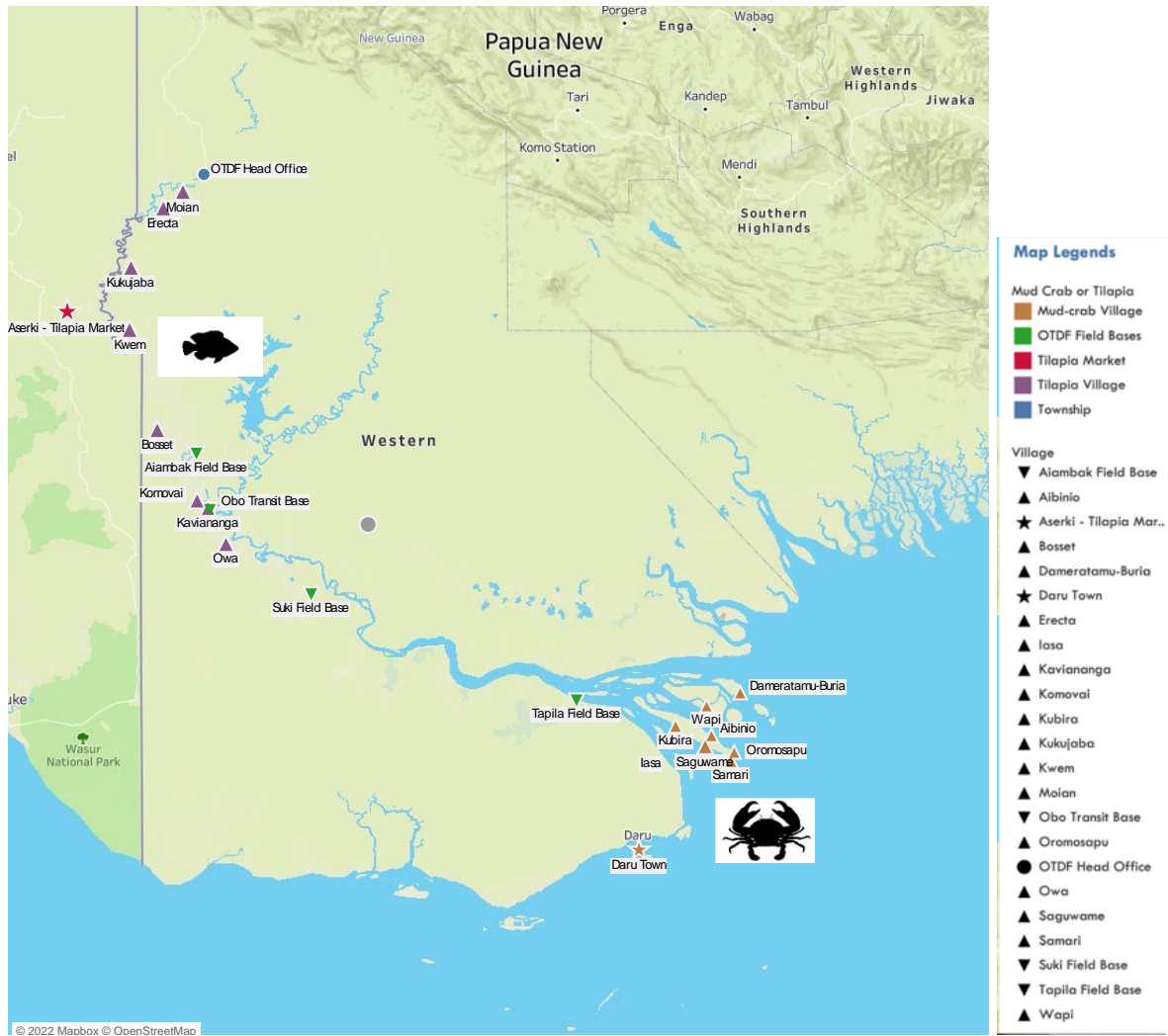
## 5.2 Activity 2 Value chain analysis of mud crabs and tilapia

Surveys were conducted in the Middle Fly villages between 16 July and 2 August 2021, and villages in the Fly River delta between 29 October and 22 November 2021 (Figure 2).



**Figure 2. The OTDF research team (left) and testing the electronic questionnaires and guidelines at the start of fieldwork (right).**

In the Middle Fly eight villages were selected as survey locations: Owa, Kaviananga, Komovai, Bosset, Kwem, Kukujaba, Erehta and Moian. In the Fly River delta another eight villages were selected: Wapi, Aibinio, Demeratamu-Buria, Oromosapuo, Samari, Kubira, Iasa and Saguame (Figure 3). Owa, Kaviananga and Komovai in the Middle Fly were visited a second time to re-interview some of the participants, because data collected were lost due to a technical problem.



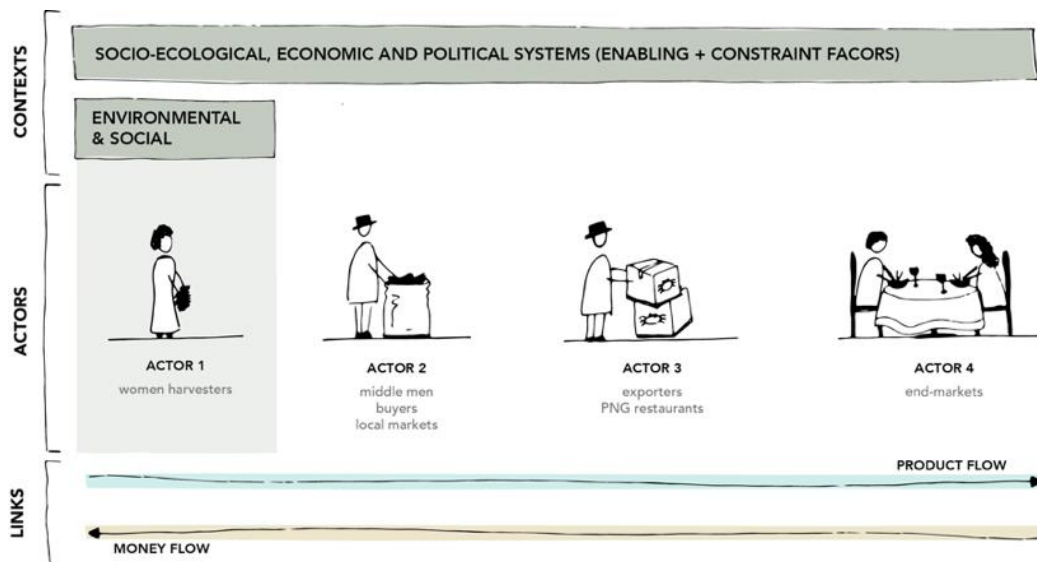
**Figure 3. Surveyed villages in the Middle Fly (tilapia) and Fly River delta (mud crabs), plus other relevant locations mentioned in the report.**

In Papua Province, Indonesia, the Blue Forests team conducted fieldwork between 22 and 31 December 2021 (Figure 4). Following the value chains initially mapped by the OTDF team, they visited the three entry points on the PNG border, concluding in the markets of Tanah Merah, Merauke and Oksibil.



**Figure 4. The Blue Forests team interviewing actors in the Indonesian tilapia value chain.**

The vertical and horizontal dimensions of the value chains of mud crabs and tilapia were analysed following the methodology in Busilacchi et al. (2021), Bolwig et al. (2010) and Riisgaard et al. (2010). In this approach, an analysis of the ‘vertical’ flows of the products, finance, information and knowledge between different actors in the value chain are complemented with a ‘horizontal’ analysis of the socio-ecological, economic and political context (Figure 5).



**Figure 5. The actors (vertical) and context (horizontal) dimensions of value chains**

The value chain analysis (VCA) used mixed methods which combined quantitative and qualitative data to allow triangulation and comparison of results. Data and information were collected through individual interviews using a questionnaire, Key Informant interviews (KIs), Focus Group Discussions (FGDs) and direct observations (Appendix 2).

Questionnaire interviews were carried out with 89 fishers in the villages, of which 76 (85%) were women. KIs who were involved in the value chains were also approached in Kiunga, Daru and the villages, and additional KIs were identified from their interviews through snow-balling. In total, 15 KIs were interviewed, of which three were women and nine were men (Appendix 3). Sixteen FGDs were also conducted (i.e. one in each village) with women who were involved in OTDF Women and Children Associations (WCAs), following engagement with the presidents of the associations for the Middle and Fly River delta areas.

During the questionnaire interviews 10 indicators of living standards, education and health were also enumerated (see Part 2, Appendix 2) to calculate the Multi-dimensional Poverty Index (MPI) (Alkire & Santos, 2010). The MPI enables an estimation of poverty levels in communities and provides baseline information for future monitoring. MPI can range from 0 to 1 (extreme poverty). In PNG remoter, poorer communities have MPI scores typically ranging between 0.4 and 0.5, while locations nearer health infrastructure score between 0.2 and 0.4 (J. Burton, personal comm). Due to technical problems, insufficient data were collected to calculate MPIs for the Middle Fly villages.

In Papua Province, questionnaires were carried out with eight men, and KI interviews with two men. One FGD was held with two men (Appendix 3).

The OTDF team used the Smap software v22.02 to collect and store data, while the Blue Forest team used the Kobo Toolbox (KoBo Inc.).

### 5.3 Activity 3 Designing women’s business models

In Activity 3, results from the first two activities were used to co-design business models appropriate for women and communities using a participatory social learning process (Figure 6). ‘Business innovation’ workshops were designed to encourage learning by following four steps and questions centred on the challenge of improving women’s business models for fisheries: ‘what is?’, ‘what should be?’, ‘what could be?’ and ‘what can be?’ (following Brown, 2008; Butler et al., 2015). By holding the workshops over 2 days it was hoped that there would be sufficient time to encourage discussion and knowledge co-production amongst participants (Appendix 4). Sessions considered current value chains, weaknesses and opportunities (‘what is?’), an agreed vision for businesses incorporating communities’ values (‘what should be?’), alternative business models (‘what could be?’), and the design and implementation of strategies to achieve the vision and values (‘what can be?’).

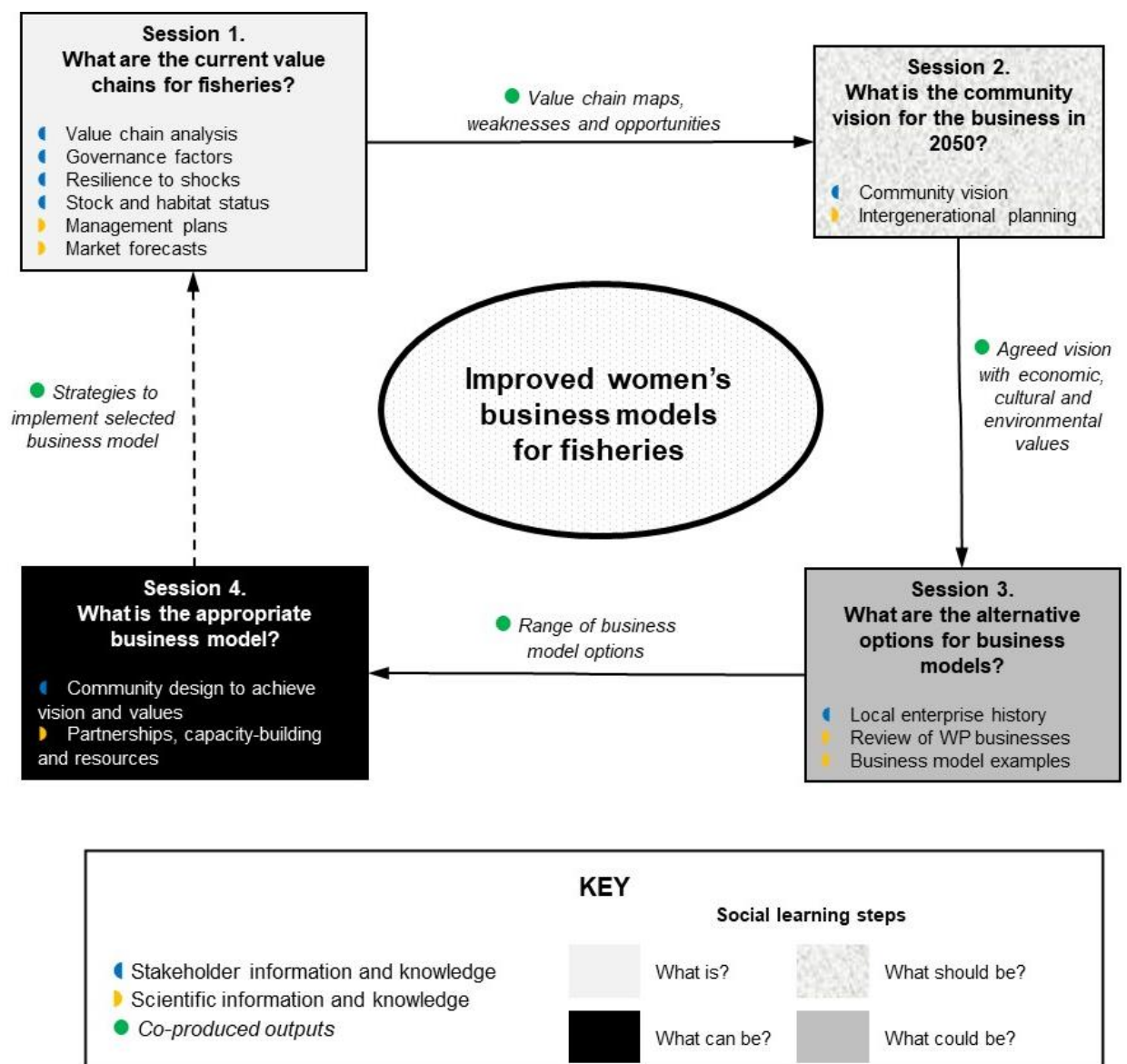


Figure 6. The social learning and knowledge co-production process applied in the ‘business innovation’ workshops, based on four learning steps centred on the issue of improving women’s business models for fisheries.

Two 2-day workshops were organized with stakeholders at the community level in the Middle Fly and Fly River delta and held on 30 and 31 March, and 5 and 6 April 2022, respectively (Figure 7). Participants were selected by the presidents of the relevant WCAs, and many had also been questionnaire interviewees and KIs in Activity 2. The Middle Fly workshop was attended by 10 women and 15 men, including fishers, middlemen and youth representatives, and the Fly River delta workshop was attended by 10 women and 15 men (Appendix 5). The OTDF research team facilitated the workshops with the help of OTDF Field Base staff.



**Figure 7. Middle Fly community workshop participants (left) at Kaviananga village, and Fly River delta community workshop participants (right) at the Tapila Field Base.**

A 1-day multi-stakeholder workshop was organized with community representatives from the prior workshops and other stakeholders, and held in Kiunga on 14 April 2022 (Figure 8). The workshop was designed to disseminate initial results and discuss the business models proposed by the communities (Appendix 6). Twenty-three participants took part, of whom 10 were women and 13 were men; three attended on-line. As well as female representatives from the community workshops, participants included officers from the provincial and district governments' fisheries departments, INLOC Group, Ok Tedi Mine Ltd., the Australian High Commission and the ACIAR PNG Country Office (Appendix 7). The OTDF and CSIRO research team facilitated the workshop.



**Figure 8. Multi-stakeholder workshop participants at the Cassowary Hotel, Kiunga.**



## 6 Achievements against activities and outputs/milestones

### *Objective 1: Review business models in PNG and Melanesia and the causes of their success or failure*

no.	activity	outputs/ milestones	completion date	comments
1.1	Review of business models in PNG and Melanesia, with particular reference to women	Report (Burton, 2021)	June 2021	Objective 1's approach was changed due to COVID-19. Originally key informant interviews had been proposed in the Fly River corridor, but these were not possible. Instead, a desk top analysis of literature was carried out.

### *Objective 2: Carry out value chain analysis (VCA) of mud crabs and tilapia as potential products for women's businesses to identify opportunities for enhanced income generation*

no.	activity	outputs/ milestones	completion date	comments
2.1	VCA methodology co-design	Methodology for VCA co-designed and materials for data collection produced (i.e. questionnaires, questionnaire guides, field guides, training material, cloud storage and electronic data forms)	June 2021	Delays were experienced due to the impact of COVID-19 on the movements and availability of people
2.2	Training on VCA and data collection	OTDF and Blue Forest research teams gained new knowledge on VCA	June 2021	COVID-19 limited training to on-line activities. Delays were experienced due to the impact of COVID-19
2.3	Fieldwork for data collection	Data and information collected and stored	January 2022	COVID-19 disrupted and delayed field trips and data collection
2.4	VCA data analysis	Value chain maps for tilapia and mud crabs produced with an analysis of key barriers and opportunities for women.  Report of value chains in Indonesia produced by Blue Forests (Muhammad & Ahmad, 2022).  Presentations of value chains in the Middle and Fly River delta produced by OTDF.	March 2022	

**Objective 3: Based on the results of 1) and 2), design appropriate linked business and resource management models for women that will maximize income returns and encourage sustainable enterprises and fishing**

<b>no.</b>	<b>activity</b>	<b>outputs/ milestones</b>	<b>completion date</b>	<b>comments</b>
3.1	Co-design of the participatory social learning process	Methodology for participatory process co-designed and materials for workshop produced	March 2022	
3.2	Community workshops	Agreed business models meeting core social, environmental and economic values, and resilience to shocks	April 2022	
3.3	Multi-stakeholder workshop	Partnerships initiated, and next steps agreed	April 2022	
3.5	Final report	Activity summary and final recommendations	August 2022	

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## 7 Key results and discussion

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### 7.1 Key results

#### 7.1.1 Activity 1 Review of business models

The Executive Summary of John Burton's (2021) report is presented here. Chapter 1 examines what is meant by a 'Theory of Change' in terms of community development projects, and looks at relevant PNG cases where a theory of change is either formally stated or is made explicit by the aims of the policy or development initiative.

Chapter 2 goes wider than Western Province to examine women's economic participation in PNG's rural economy as a whole. It does so from a wide range of viewpoints: from basic research on the gender relations of household work, through formal institutional support for women primary producers during the 1980s, 1990s and 2000s to 2018's Women in Agriculture and Fisheries Policy Dialogue at the APEC meetings in Port Moresby.

Chapter 3 looks at the history of an existing commercial fishery in several Fly River communities, the barramundi fishery, over the past 60 years. The fishery has stopped and started several times for reasons attributable at different times to overfishing, El Niño droughts, and lack of management capacity.

Chapter 4 attempts a finer breakdown of the poor track record of the Fly River barramundi fishery using the framework of a PESTLE (Political, Economic, Social, Technological, Legal and Environmental) analysis and a rating scheme to summarise the capacity of the fishery to survive challenges under each category. Following this, a first attempt is made to translate the PESTLE risks of the fishery into guidance for potential women's fishing businesses in the Fly River. Two key points are made from the analysis:

- In order to be sustainable, women's businesses must withstand exactly the same risks as men's businesses, but they face greater handicaps. Human resource skills that women can bring to their fishing ventures are likely to be poorer than men's, women's businesses may be starting from scratch, and historically interventions and extension programs (e.g. those run by NFA) have struggled to have impact.
- A whole-of-system approach to support is needed, which simultaneously addresses institutional, capacity and natural resource management issues, plus a specific focus on appropriate assistance to women.

Seven recommendations are then given for this SRA and future work:

Recommendation 1: Refresh the socio-economic baseline for the target communities. The first step is to collate what data is already available for the communities. Further thought can be given to what needs to be added, or what (preferably rapid) methodology is feasible and appropriate as the project proceeds.

Recommendation 2: Undertake a PESTLE analysis for the target groups of women. This can only be done when this SRA has provided more detail for the target groups of women and their business proposals.

Recommendation 3: A focus on markets. The supply chain arrangements between primary producers and distant markets are the key determinants of the success or failure

of rural enterprises. This area of focus should result in an account of how women fishers will establish sustainable and fair access to buyers.

Recommendation 4: A focus on payment systems. Not explored in this report, payment systems are an area of rapid change in the rural Pacific. Banks in PNG have been active in mobile banking for some years and the project should monitor developments in PNG micropayment systems to look for possible solutions for women to receive and send small amounts of money without leaving the village.

Recommendation 5: Examine the linkages between institutions and women's business. Of the institutional programs supporting women's economic participation, many have not had a national reach and sufficient funding is rarely allocated for them. Nonetheless, the project should endeavour to establish connections with all/any of the national and provincial entities operating the area of primary production (e.g. Women in Agriculture Development Unit, Women in Agriculture and Fisheries Policy Dialogue).

Recommendation 6: Examine each component of the project for its gender effectiveness. A gender lens must be used to examine each component of the current project for its effectiveness in reducing gender inequity, such that it is not enough to include women, each component must yield a practical outcome that benefits the women.

Recommendation 7: Undertake an ex-post evaluation. An ex-post evaluation should be planned that has the aim of measuring the extent to which the project has succeeded in fulfilling its aims, which are to raise family incomes generally, and raise the disposable income available to women, in particular. Outcomes must be measured.

To complement Burton's (2021) review, the key facets of the following programs and approaches were also collated:

**Family Farm Teams (FFT) program:** The aim of the FFT program is to provide one female and one male family head from a household with a series of workshops and family activities that will encourage them to work as a family team and to plan together the further development of their agricultural activities. The program can also be used with full family teams (adults, young adults and youth). The FFT program helps men and women to look at the work done by women, men and youth and to work towards making it equal and shared. A core facet of FFT is financial and savings training, which raises business and planning literacy. Through the training and follow-up materials the economic development of women and youth is being improved by increasing agricultural engagement, improving nutrition, and elevating financial management skills. Local teams of 'village educators' are also trained to be peer-to-peer educators through a series of workshops, thus enabling scaling out amongst families. The FFT approach will also be scaled up and out through partnerships with churches and their agricultural programs in rural and remote communities. In 2021-2022 the FFT was introduced to Western Province, and training has taken place in the Pahoturi and Binaturi areas of the South Fly District.

**Village Savings and Loan Associations:** The Village Savings and Loan Association (VSLA) model has proved successful in many African countries, where it was originally established by CARE International in 1991 (Ksoll et al., 2016; Fort & Koczberski, 2020). Savings associations are self-managed groups of 15 to 25 people who meet regularly to save their money in a safe space, access micro-finance loans, and obtain emergency

insurance. Groups hold annual elections and the roles and responsibilities of the management committee are clearly defined and highly decentralized. This is to encourage the participation of all members in the operations of the group and to protect the group from being dominated by a single individual. Members save through the purchase of shares, and the price of a share is decided by the group. At each meeting, every member must purchase between 1 and 5 shares. The share price is set by the group at the beginning of the cycle and is fixed for the entire cycle.

Key to the model is peer accountability which engenders trust, and VSLA's are accessible to even the least literate and least influential member of the group. VSLA's members often support each other to set up small businesses, negotiate fair prices in the marketplace, advocate for gender equality in their communities, and pursue public office. In Africa the VSLA model has played an important role supporting an estimated 8 million group members, the majority of whom are women, to increase access to and control over their resources, and to gain influence over decisions in their homes and beyond.

The VSLA approach was trailed by WWF in Madang Province, PNG, and Western Province in the Solomon Islands, starting in 2017 under the project *Improving Livelihoods of Coastal Communities in PNG and Solomon Islands through Sustainable Fisheries and Financial Inclusion*. The WWF model differed from the original model by including sustainable fishing practices and community-based fisheries management rules within the constitution of each VSLA. It also provided an opportunity to further the involvement of women in decision-making about fisheries, and to diversify livelihoods beyond fisheries-based incomes due to the growing pressure on coastal fish stocks.

In the WWF example 10 to 25 people save regularly and borrow from the group fund. Loans are repaid with interest over a period of 1-3 months. On a date chosen by the members, usually after about a year, all the financial assets are divided among the members in proportion to each one's savings. The groups normally re-form immediately and start a new cycle of savings and lending. Evaluations of the VSLA model have been positive, with evidence of diversified and increased household incomes, plus women's and youth's empowerment. However, there is some evidence that the imperative for members to generate sufficient surplus income to buy shares each month may exacerbate over-fishing if fisheries management rules are not upheld.

**SeaNet Indonesia Sustainable Seafood Industry approach:** In 2016-2018 the *Building a Sustainable Seafood Industry to Support Coastal Communities in the Arafura Sea* program delivered a pilot demonstration of an extension service to small scale Indonesian fishers in Papua Province, and also Maluku Province. Delivered by SeaNet Indonesia through TierraMar in partnership with the Coral Triangle Centre, the project established Learning Groups in fishing communities. Through the groups, fishers learned about best practice to improve both their economic returns and to encourage sustainable harvesting of marine resources. They also learned about enhancing the value of seafood-based products post-harvest, with a focus on improving financial returns for women engaged in product processing and sales. This latter objective encompassed training in modern business and marketing skills, including financial management. Group members would then return to their communities and act as peer-to-peer educators, scaling out the skills.

In Papua Province, mud crab fishers were engaged in Merauke to empower small-scale women fishers, who mostly conduct the fishing, handling and marketing. Before the project, fisherwomen were harvesting mud crab by cutting down mangrove roots to expose crab holes, and then pulling the crab out using an iron rod. With SeaNet training

the women's group learned how to manage household and business finances, including building a simple business plan. The team demonstrated how to integrate sustainable crab fishing into their business plan. Crab pots were introduced that avoided the need to cut mangrove roots, increasing the catch by 87% and reduced fishing time from 6-8 hours to 4-6 hours per day, leaving time for other household or business activities. The new method also reduced fisherwomens' dependency on tides, since using the iron rod is only possible at low tide.

**ACIAR SRA *Developing legal value chains and alternative markets for the South Fly District fisheries – 'hub and spoke' model***: Based on discussions held with participants during this previous ACIAR project, a hybrid 'hub and spoke' structure was derived that might overcome the barrier of distrust between clans, and build greater bargaining power in the market for fishers selling to middlemen. In this model, the 'spokes' are family teams who work together to fish. Instead of selling their products individually, fish are pooled by the teams to be sold to a 'hub', which is a local business. Within the village is a leader or agent who can work as an intermediary and middleman, bargaining with the hub and other actors higher up the value chain to secure better prices for the fishers, and therefore overcoming power asymmetries between fishers and middlemen. The agent is overseen by an advisory committee, which could also operate a VSLA for fisher teams, and provide capacity-building support in terms of convening learning groups and/or village trainers.

## 7.1.2 Activity 2 – Value chain analysis of mud crabs and tilapia

### Mud crab value chains in the Fly River delta

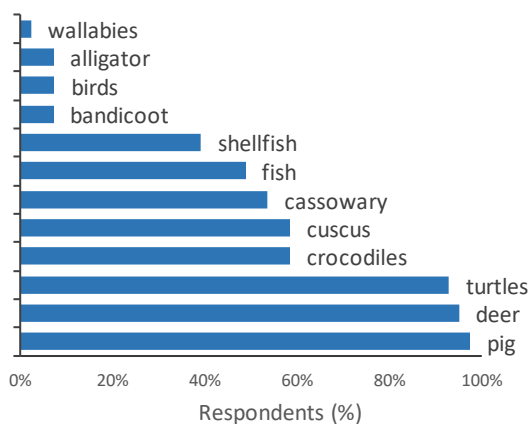
#### Vertical dimension

Mud crab (*Scylla serrata*) is one of the resources most commonly caught by women in the Fly River delta (Figure 9). However, all women interviewed reported a decrease in the number of mud crabs in the last 10 years, and that they harvested female crabs. When asked for a reason for the decrease, they could not provide one. Only one respondent associated increased fishing pressure with the decline, but workshop participants later attributed the decrease with mangrove clearing and sea-level rise. Villages such as Iasa, Saguane, Oromosapu and Kubira are already impacted by sea-level rise, and they are planning a relocation or have already relocated the settlements. Also, the land shortage created by rising waters has generated land disputes, as villages have to relocate inland, encroaching on other clans' land.



**Figure 9. Mud crabs caught and cooked by women in the Fly River delta.**

Mud crabs are an important component of women's resource base that provides food for their families and generates income. Communities also harvest deer, pigs, cassowary, cuscus, turtles, bandicoots, crocodiles, birds, wallabies, shells, and marine and freshwater fish (Figure 10) which are mainly used for subsistence consumption due to the lack of suitable markets, but some are smoked for local sale.



**Figure 10. Wildlife harvested in the Fly River delta villages (left; n = 41 respondents), and deer meat being smoked before being sold (right).**

Mud crab harvesting is a year-round activity in which women spend on average 3 hours/day for around 15 days/month. Women in the Pacific have been estimated to work an average of 7.7 hours/day (UN Escap, 2019). Applying this figure to the delta, women may therefore spend 20% of their working time catching crabs. Most crabs are caught in the mangroves (40%) and mudflats (48%) which women reach by canoe or on foot.

Women access three markets of Daru, Tapila and Kawiapo four times/year when transport is available. Women also sell crabs at local markets. In Daru they can sell also to two licensed buyers for the Asian markets via Port Moresby. Final prices may be 160 Kina/crab, a markup factor of at least 80 times from the initial fishers' sale price (Figure 11). Women in Aibinio and Dameratamu-Buria have access to middlemen ('mobile teams') from a nearby fishing company in Buria (Abea Meke Marine Resources Ltd.). Six mobile teams travel to the different areas along the Fly River to collect fish maws, but they also buy crabs for local consumption (Figure 11).

Women stressed the difficulty, if not impossibility of accessing the markets due to a lack of transportation and associated costs. Petrol prices in the villages are high and unaffordable for women. Prices vary between 7 kina/litre in villages close to Daru and other markets and 10-12 kina/litres in villages further away. A one-way motorised canoe trip to Daru from the delta can cost between 70 and 100 kina/person. Transport in the area can also be affected by weather and sea conditions which can be dangerous, especially during the trade wind season of June-August. KIs also confirmed the logistical difficulties for people in the communities. While 78% of the respondents had a canoe, only 5% owned an outboard motor which could allow long-distance travel. Most travel is done on canoes with sails, which is extremely slow. Only a small number of people reported being able to use motorized transport.

Wastage of mud crabs is high due to mortalities caused by the lack of handling and storing skills and facilities (Figure 11). One respondent reported losing on average 20% of their crabs to mortality before sale.

Other than their time, no other expenses are involved in catching crabs. Nor do women have expenses when selling the crabs to neighbouring villages or to middlemen who visit the villages. Women reported selling crabs for an average of 2.5 kina/crab and selling on average 56 crabs/trip for a total of 143 kina/trip. By comparison, the few women who have access to a motorized boat to reach the markets sell crabs for an average of 3 kina/crab, but the net profit is only 0.75 toea/crab. These women usually sell 63 crabs for a total income of 190 kina/trip, equating to 48 kina/trip after expenses. Women prioritize household necessities when they spend money earned from mud crabs (Figure 12).



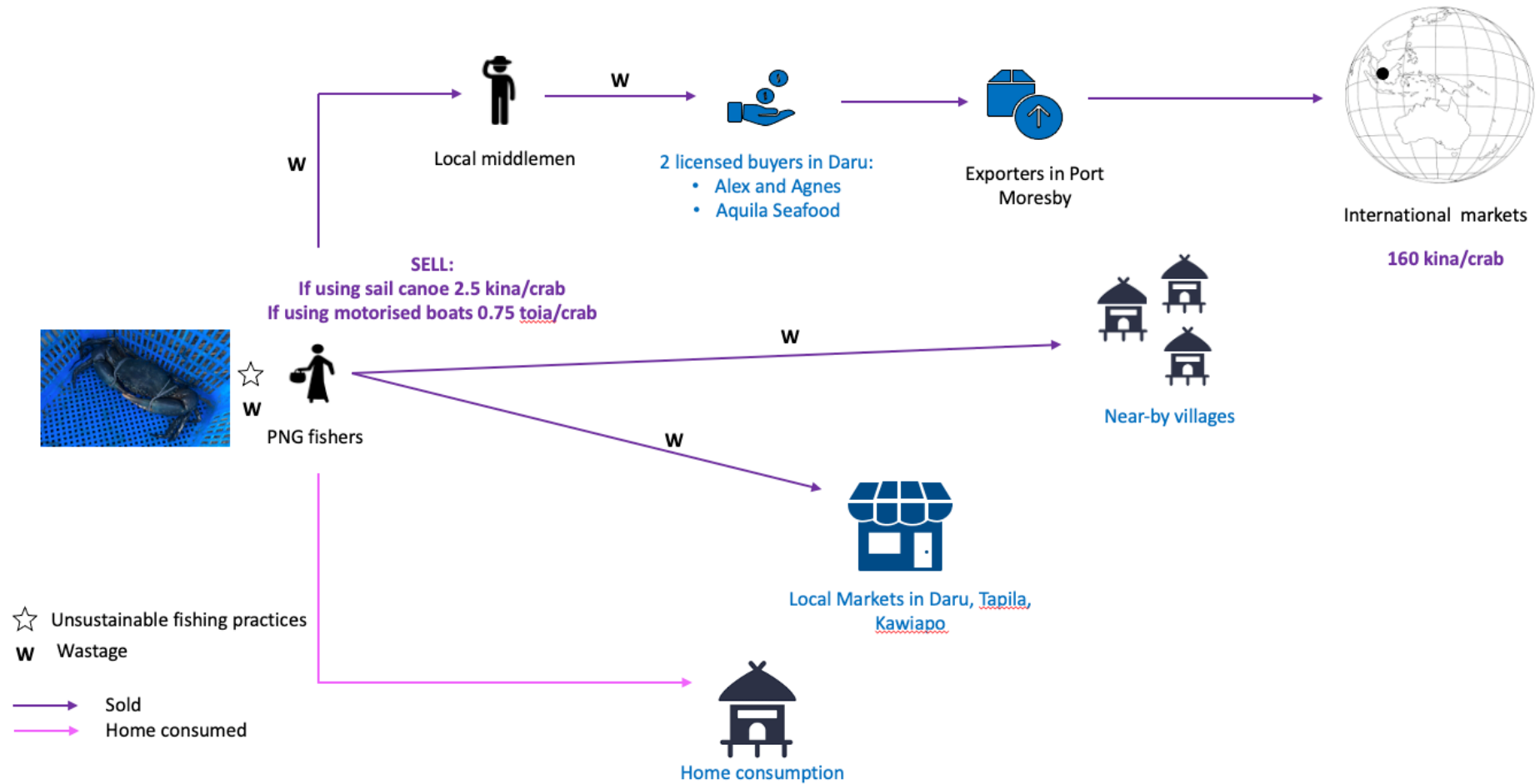
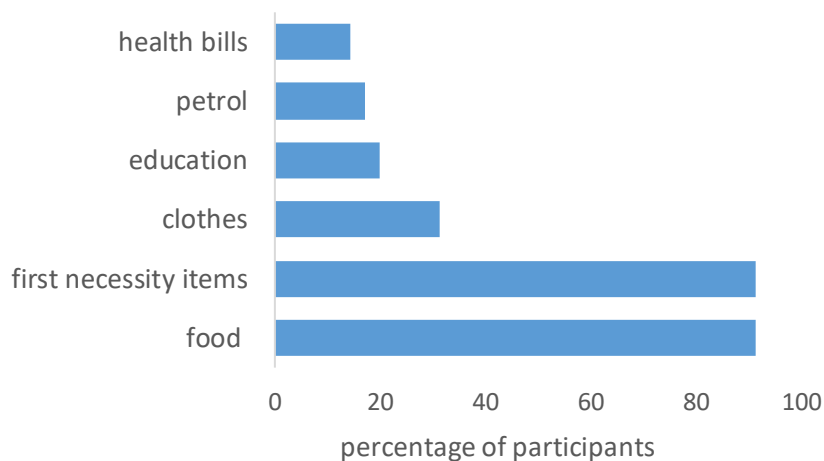


Figure 11. Value chains for mud crabs in the Fly River delta.



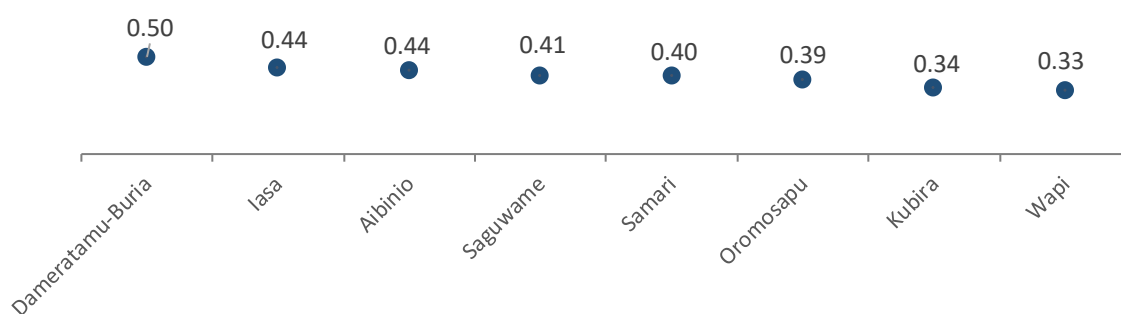
**Figure 12. Women's primary items of expenditure from mud crab income in the Fly River delta villages (n = 41 respondents).**

#### *Horizontal dimension*

Selling mud crabs is only one of several income sources in the Fly River delta villages. Fishing, especially for fish maws from croakers, jewfish, and barramundi, is the main activity in the villages, along with Ok Tedi Mine compensation payments, which are paid twice a year. Fishing for fish maw is the most remunerative activity, generating 70% of income. Fishing is also the activity most important for households' general wellbeing, and is essential for their food security and income. Hunting and vegetable gardens also provided income for 83% of the respondents. A small percentage also sold sago (17%) or had salaried employment (12%). Employment is only available in Dameratamu-Buria village via the Abea Meke Fishing Company which buys and processes fish maws.

Women reported not knowing their households' weekly earnings, which the men manage. They also reported not having any source of steady weekly income. Income-generating activities are only available opportunistically when women go to Daru or other markets for other reasons, or travel to other villages.

The Fly River delta villages had MPI scores between 0.33 and 0.5 (Figure 13). Most of the villages suffer acute poverty, with Kubira and Wapi the only ones with reasonable MPI scores below 0.4. Despite the presence of the Abea Meke Fishing Company, Buria has the highest level of poverty, possibly because the village relocated to be nearer to the company and services are absent in the new settlement (Figure 14). Aibinio is also located close to the Abea Meke Fishing Company and also experiences extreme poverty. By contrast Wapi, which relocated to be nearer another seafood operation owned by Vietnamese nationals (Purutu Seafood Company, Figure 15) had the lowest MPI, with a score equivalent to the least poor in PNG. However, it should be noted that these data are based on only 41 respondents across the eight villages.



**Figure 13. The Multidimensional Poverty Index (MPI) of the Fly River delta villages. Scores between 0.2 and 0.4 are moderately poor, while those above 0.4 suffer acute poverty.**



**Figure 14. Abea Meke Fishing Company (left), and the relocated village of Buria, now settled in front of the company (right).**



**Figure 15. Purutu Seafood Company (left) and the relocated village of Wapi, now settled close by (right).**

There is a general lack of awareness of the formal regulations governing mud crabs and marine resources, including the NFA's recently introduced National Mud Crab Management Plan. Participants in the community workshop and informal conversations stressed that the lack of awareness stems from a limited flow of information from authorities to communities. KIs in the provincial and district governments confirmed the lack of information made available to the communities and related it to logistical challenges, transport costs and a poor cell phone network. People mentioned that this also applies to communication with OTDF and their projects.

OTDF has established nine WCAs which are allocated 10% of the Ok Tedi Development Fund package to implement projects that empower women and youth. Each association has a president who is elected every 4 years to oversee its operations, and an executive board with a secretary and a treasurer. A chairwoman represents each village. Currently, WCAs do not have any involvement in managing natural resources. However, KIs indicated that some WCAs are interested in investing in projects that would boost

economic activities for women, including a new fishing company in the Fly River delta (Kiwaba Enterprise Ltd.) which aims to focus on mud crab marketing.

In most cases, respondents said that women have no restrictions on going fishing or making decisions about their trading activities, and share decisions about fishing with their husbands. Women also make their own decisions on spending any money they earn. However, KIs highlighted that nonetheless women do not have a voice in decision-making within the community and household.

KIs also stressed how kinship relations are very important for women. Women usually socialize and relate only within their families, especially once married. Any involvement in village social activities or interaction outside the family is usually controlled and approved by the husband or head of the house. Church groups, fellowships and WCAs are the only platforms where women work together toward a common goal. One KI who is involved in a WCA stated: *"Generally women are looked down upon, they have no voice, no authority and no power in the village. That is the reason why OTDF decided to empower women creating the Women and Children's Network. Women have to learn to work together to help all women, youth and children."*

### **Tilapia value chains in the Middle Fly**

#### *Vertical dimension*

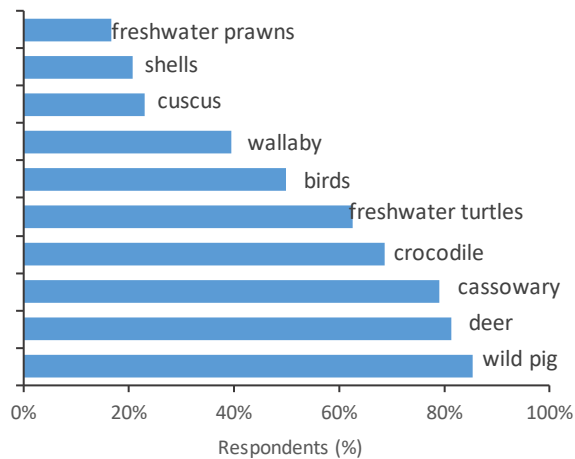
The GIFT tilapia (*Oreochromis niloticus*) was introduced to PNG in 1999 for aquaculture due to its ability to grow 60% faster than its founder species. Having escaped fish farms it is now found in many rivers and lakes in PNG, especially in Western Province and the Highlands. It can survive in many habitats at very high densities and is omnivorous, and consequently is extremely adaptable and resilient.

A study conducted in the South Fly District in 2012-2013 found that tilapia was the most common fish sold in Daru market (Busilacchi et al., 2015). In the Middle Fly, women rather than men usually catch and sell tilapia (Figure 16).



**Figure 16. Tilapia sold at the local market in Kaviananga (left), and cooked tilapia is a staple food for people in the Middle Fly (right).**

All respondents reported a steady increase in the abundance of tilapia since its introduction. Some respondents and participants at the community workshop also reported a concomitant decrease in the numbers of other species commonly caught in the river, and participants gave a list of species no longer found (Appendix 8). Other wildlife commonly caught and either kept for subsistence or sold were wild pigs, deer, cassowary, crocodiles and birds (e.g. birds of paradise, ducks, bush fowl). Women usually process the harvested animals (Figure 17).



**Figure 17. Wildlife harvested in the Middle Fly villages (left; n = 48 respondents), and women processing deer meat (right).**

All 48 respondents reported catching tilapia, which are caught all year round. Women in the Middle Fly spend 1 hour a day on average for around 16 days/month, equating to 12% of their monthly working time. Fish are caught from canoes in swamps and lakes (44% of respondents), and sometimes in rivers and creeks (12%).

Tilapia is a primary staple food for families, and all respondents reported catching them for household consumption. Equally, all respondents sold tilapia to generate income. Tilapia has gained social and cultural value, with half of respondents stating that the fish is used during feasts and church gatherings. The community workshops highlighted that the barter system is still very strong in all the communities along the Fly River, and is regarded as a mechanism to strengthen social networks and kinships. Tilapia is often bartered to access goods and food not available in the communities.

Markets for the tilapia, often sold with common carp, differ depending on the regional location of the village (i.e. Upper, Central and Lower Middle Fly). Consequently, the value chains are numerous and complex (Figure 18). People in Moian and Erehta villages (Upper Middle Fly) have access to the Kiunga market to sell their catch. Some also reach more distant markets at Ningerum, Rumginae or Tabubil. Fishers usually store the caught tilapia in cages made from mosquito nets to keep them alive, as there is no refrigeration. Most of the tilapia are tied to strings for transportation to the market. Fishers and middlemen pay for a boat to transport the tilapia to Kiunga when they have enough, usually once a week. Fish mortality is high during transport, but dead tilapia are sold if they are still fresh. People in those villages are now building ponds with the intent to stock and rear tilapia and carp (Figure 19). Many respondents (70%) process (by smoking) the tilapia before transporting them, which reduces the rate of wastage. Participants in the community workshop highlighted that Kiunga is the only market accessible to them, and they feel vulnerable to external shocks. During COVID-19, when the markets were closed, the trade in the communities stopped, with a significant impact on their livelihoods.

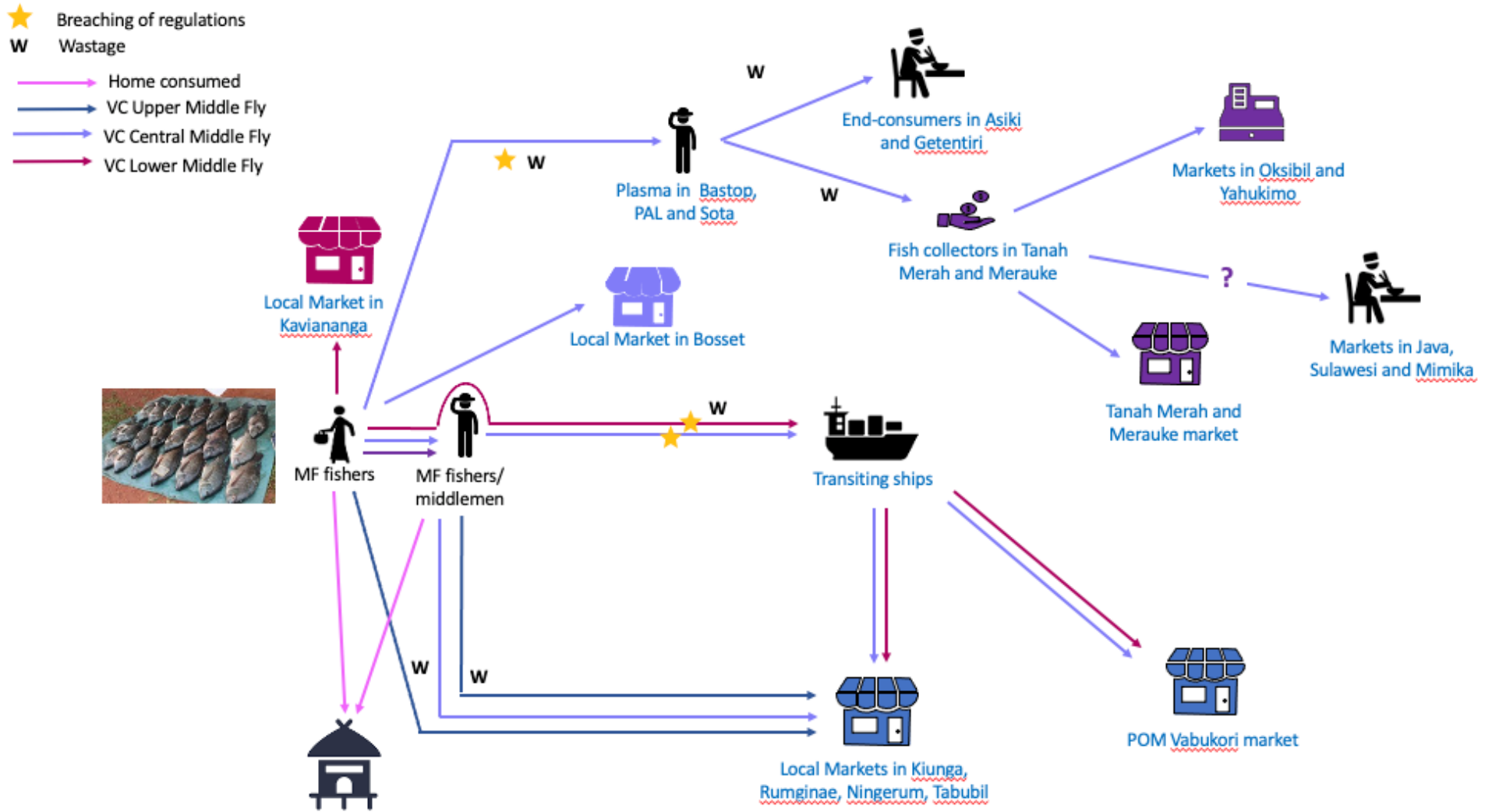


Figure 18. Tilapia value chains in the Middle Fly (MF) villages.



**Figure 19. Completed (left) and under-construction tilapia ponds (right) in the Middle Fly.**

People in Kukujaba, Kuem and Bosset villages (Central Middle Fly) have access to several markets: the Indonesian markets at the border (78% of respondents), the village market in Bosset (33%), the passing freight ships and other boats which stop on their way to Kiunga or Port Moresby (17%), and middlemen who usually sell in Kiunga or Indonesia (33%). Once caught, tilapia are kept alive in cages along the waterways in the villages as there is no refrigeration. They are then tied into pairs and transported alive or smoked (Figure 20).



**Figure 20. Cages are made with mosquito nets to keep tilapia alive (left), and tilapia are tied in pairs to be transported to the Indonesian markets (right).**

Fishers from Kwem mainly deliver to the markets in Indonesia. The cross-border trade of tilapia started in 2012 and has expanded since. Today, there are three border markets in Indonesia that PNG fishers and middlemen access: Bastop, PAL (an oil palm company) and Sota, which are accessible by outboard motor-powered boat (Figure 21). The first two are visited by people from the Central Middle Fly villages, while the latter is visited opportunistically. The Indonesian Army patrols Bastop, while PAL is within an oil palm plantation on customary land. Both are situated along waterways to facilitate transportation from PNG.

Women usually go to the border with their husbands and family to sell tilapia and other products. Several PNG and Indonesian quarantine, export and customs regulations are breached once the product crosses the border. Export and quarantine of fish and their products in PNG are regulated under the National Agriculture Quarantine and Inspection Authority (NAQIA) Act 1997. Exporters in PNG are required to obtain the quarantine import conditions of the importing country before seeking certification from NAQIA. An animal health certificate is then issued for export clearance upon payment of a fee. Fish

and fish products also need an export clearance from PNG Customs and an export permit from the NFA. Similarly, a Health and Safety certificate from PNG is needed to export marine products to Indonesia. This is provided after a letter of origin from the Department of Marine Affairs and Fisheries has been obtained.

The trade is vulnerable to external shocks. During COVID-19, food security in the villages became very unstable, and fishers/middlemen had to increase their visits to Indonesia. However, the PNG Army was sent to patrol the borders as part of the government's pandemic response, and people had to bribe them to continue their trade, which elevated their costs.

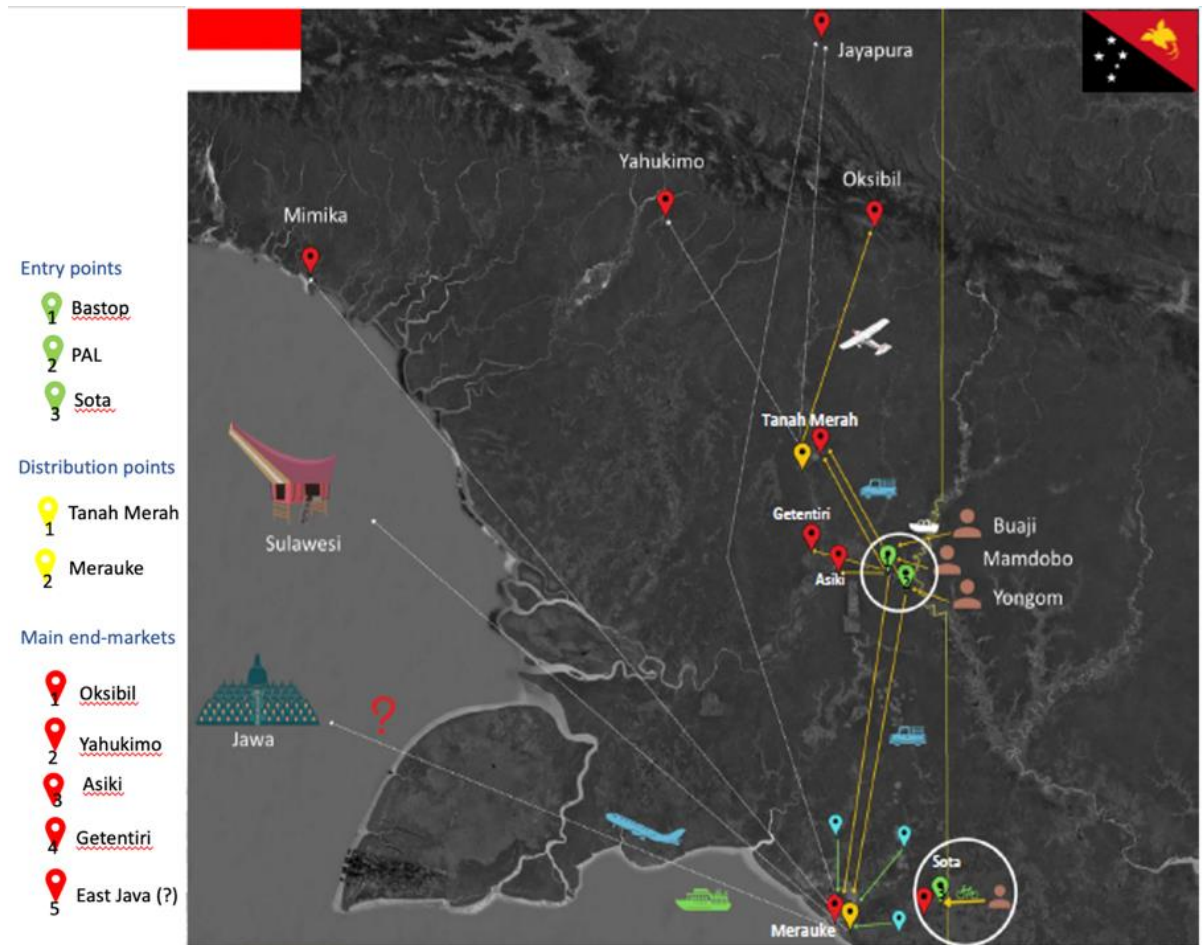
Indonesian middlemen buying from the PNG people in these locations are ex-oil palm workers called 'Plasma'. Plasmas are based in Asiki and visit Bastop and PAL two or three times a week. Other products sold to Plasmas are crocodile skins, fish maw and wild pig and deer meat. The mortality rate of tilapia during travel to Indonesia is very high. Indonesian middlemen discard dead fish for which PNG fishers are not paid. Plasmas then transport the tilapia on trucks with ice to keep the fish fresh to the towns of Tanah Merah, Merauke, Asiki and Getentiri. Most tilapia are sold in Tana Merah, where four fish collectors buy the fish to send to Oksibil and Yahukimo in the Highlands by plane, and also Jayapura. In the last quarter of 2021, 18.5 tonnes of tilapia had been transported to Oksibil alone. KIs stated that most of this had originated in PNG.

Merauke is a much bigger market. Tilapia from PNG are mixed with those caught locally, and it is difficult to trace their onward value chains as a result. One KI stated that PNG tilapia could be recognized by their bigger size and muddy aroma. Tilapia from Merauke are sent to Java, with 25 tonnes delivered in 2021, plus Sulawesi and Mimika in Papua. The tilapia are processed in Java, and skins are used to make shoes and sandals. Plasmas also sell tilapia directly to palm oil company employees in Asiki and Getentiri.

Fishers from Bosset, which is the farthest village from markets, rely on the local village market. They usually smoke the product to preserve it before selling it.

Fishers in Kaviananga, Komovai and Owa villages (Lower Middle Fly) do not have access to markets. Apart from some sales in the local Kaviananga market, women in the villages largely sell their fish to transiting freight ships going to Kiunga or Port Moresby, or to middlemen who live in the villages. Women also barter fish for goods with the ships' workers. These operations breach the ship companies' policies. People are aware of this, but the lack of alternative legal livelihood options leaves them with little choice. The trade, however, is vulnerable to shocks such as flooding and droughts, which disrupt shipping traffic and thus income.





**Figure 21. Entry points and Indonesian nodes of the tilapia value chains from the Middle Fly.**

For Lower Middle Fly fishers, no expenses are involved in catching tilapia because they use canoes with paddles for their activities. Fishers/middlemen in the villages buy the tilapia for 1 kina/tilapia (Figure 22).

In the Upper Middle Fly, most fishers directly sell their catch to the Kiunga market. Fishers buy passenger and freight fares in one of the chartered motorized boats to transport their tilapia. Fares change depending on the distance: people from Erehta spend on average 100 kina/return trip, including freight, while people from Moian spend 60 kina/return trip. The sale price of tilapia in the market depends on several factors. Smoked tilapia is sold on average for 5.5 kina/fish, while fresh fish are sold for 13.5 kina/fish. Size is also an important factor, with large fresh tilapia fetching as high as 20 kina/fish, and small ones sold for around 5 kina/fish. Demand also influences price. With low demand, fishers are forced to sell all tilapia for 5 kina and sometimes give them away towards the end of a business day.

People take on average 50 tilapia/trip, which is mostly fresh. Assuming an average price of 10 kina/fish, fishers make an average of 500 kina/trip. Adjusting for expenses, the net profit for fishers in Erehta is 400 kina/trip (or 8 kina/fish), and for fishers in Moian is 440 kina/trip (or 8.8 kina/fish; Figure 22).

For the Central Middle Fly, different villages rely on different value chains depending on their distance from Kiunga and the border with Indonesia. People from Kukujaba village mainly sell tilapia to the middleman, with no expenses. Tilapia are bought for an average of 2 kina/fish. An average of 36 tilapia are sold each time, giving an average return of 73

kina/trip. Women sell their tilapia twice a month, giving a monthly income of 146 kina. Once in Port Moresby, tilapia prices vary depending on size (5 to 15 kina/fish; Figure 22).

The trade with Indonesia has the most complex value chain. The trade is conducted mainly by fishers from Kwem, who are closer to the border. A return trip in a motorized canoe is 25 kina (or 100,000 Indonesian Rupia), which is often subsidized by the Plasmas. Expenses can be lower if several families share the costs of a trip. A string of two tilapia is sold by fishers in Bastop or PAL for 2.5 kina (10,000 Indonesia Rupiah), or 1.25 kina/fish. Family groups sell on average 72 tilapia for 90 kina/trip. Once travel expenses are accounted for the net profit per trip is about 77 kina (or 1 kina/fish). Family groups go to the border up to three times a week, yielding an income of up to 231 kina/week (Figure 22).

In Indonesia, tilapia prices for end-consumers are around 12 kina/fish in Oksibil and Yahukimo, and 6 kina/fish for retailers who buy fish in Merauke.

People from Bosset do not have easy access to any external markets, and sell their tilapia at the local market for an average of 1.5 kina/fish, generally once a week.

In the Lower Middle Fly, Kaviananga fishers mainly sell for 1 kina/fish at the village market. They usually bring to the market an average of 25 fish each once a week for a total of 25 kina/trip. Komovai fishers also bring their catch to the Kaviananga market, at a cost of 17 kina/motorized canoe trip. Smoked tilapia at the market are sold again for 1 kina/fish. Women usually bring an average of 37 fish, yielding a net profit of 20 kina/trip (or 0.5 toea/fish). Fishers travel to Kaviananga usually once a week (Figure 22).

Fishers from Owa mainly access the freight ships. Fish are sold for 1 kina/fish, and 47 tilapia are sold on average for 47 kina/trip. People paddle with their canoes to reach the ship, so no expenses are incurred. The fishers sell to the ships on average twice a month, giving a monthly income of 94 kina.

Women prioritize household and family expenses when they spend their income from tilapia sales. Women in the Lower Middle Fly spend most of their income on necessities such as kitchenware and clothes, followed by food. Food is the priority for women in Central Middle Fly, with a smaller percentage spending money on soaps and salt. Also, family groups going to the Bastop and PAL often spend all their profits at the market stalls there. The main goods bought are betel nut, lime, food, drinks and petrol. Women in the Upper Middle Fly spend all of their tilapia income on food.

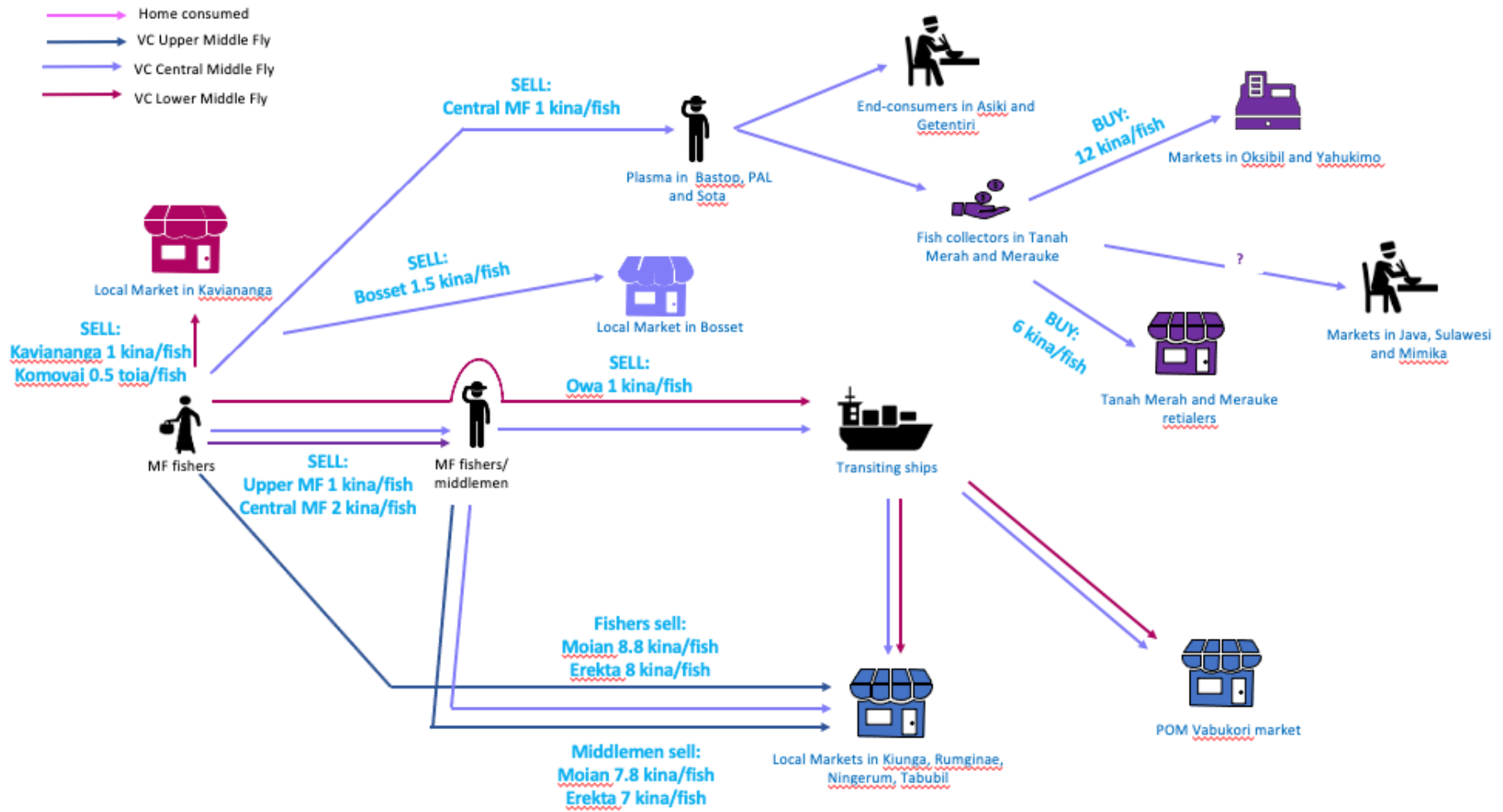


Figure 22. Prices along the tilapia value chains in the Middle Fly (MF). The sale prices for PNG fishers are net of expenses.

### *Horizontal dimension*

Selling tilapia is only one of the income-generating activities in the Middle Fly. The main activity is hunting, usually to trade wildlife products with Indonesia. Products from wildlife are most suitable for trade with Indonesia because they are dried and do not require refrigeration. Crocodile hides are amongst the most important products, along with deer horns, penis, and tendons. Fishing for barramundi for their maw to sell to the Plasma is also important. One of the respondents stated that *“fishing is our livelihood, our life and the main source of survival”*.

CMCA compensation payments are paid twice a year and provide a regular income source. Eighty percent of respondents also made an income from their vegetable gardens. A small percentage of respondents had their own small businesses, mainly reselling store goods in the villages, or as middlemen for people in the villages. However, fishing for fish maw and tilapia is the most remunerative activity for people in the Lower, Central, and Upper Middle Fly.

Women in the lower Middle Fly reported not knowing the amount earned by the household weekly. By contrast, women in the Central and Upper Middle Fly reported an average household income of 160 kina/week. Income greatly varies among households, ranging from 25 kina/week to 300 kina/week. On average, 50% of that income is contributed by women (range 20% to 100%). People in the lower Middle Fly did not save money, but those in the Central and Upper Middle Fly save an average of 60 kina/week. Except for widows, women respondents made decisions about household finances with their husbands.

Participants in the community workshop reported that fishers and middlemen from the villages have no bargaining power with other actors in the value chains, and are price-takers. If available, current markets are often the only option for village-level actors. Following Magee & Galinsky's (2008) definition of power among units that exchange resources, villagers have little agency in social relations with other actors because middlemen can obtain the resource elsewhere, while villagers cannot otherwise sell their resource.

People from the villages in the Central Middle Fly visiting Indonesia are from the Buaji, Mandobo and Yongom language groups which span the border. Families are often spread between the two countries, and people use this connection to justify the trade as part of their traditional activities. Plasmas are Indonesians who transmigrated from Java to work in the oil palm plantations. With the expansion of the tilapia trade, competition among Plasmas has resulted in patron-client relations in the value chains, whereby the Plasma provides petrol and fishing nets to the fishers he engages. In return, the fishers only sell to that Plasma. There are also complex relationships among the actors involved in the tilapia value chain within Indonesia. Plasmas at the Bastop pay a bribe of 1,000 Indonesian Rupia/string (24 toea) to the border patrol officers to conduct their activities. Plasmas also pay a small fee to the landowners of the land where the PAL market is. The PNG Army also has the power to ask for bribes to conduct the cross-border trade when patrolling the area.

Another cultural issue emerged which has implications for business development. The traditional clans of family networks are the primary unit of political and social loyalty (Hogbin, 1973). These units have distinctive characteristics that unite the members and distinguish them from others. Traditionally relations between clans could be strengthened

(e.g. through trade or marriage), but often they were characterized by competition and hostility. KIs revealed that rivalry between clans is still very strong within the Middle Fly communities. This trait impedes cross-clan cooperation because trust is undermined by suspicion and fear of potential power-grabbing. One KI in Kiunga stated that “*cooperatives do not work in the region because people fight one another to be the big man*”. Another KI in Daru explained how one of the local seafood companies in the area introduced fishing games to exploit the trait of inter-clan competitiveness to increase catches, offering prizes to the fishing parties returning with the biggest catch.

### **7.1.3 Activity 3 – Designing women’s business models**

#### ***Fly River delta community workshop - mud crabs***

##### Session 1: What are the current value chains for fisheries?

The OTDF facilitators first presented the mud crab value chain maps from Activity 2. They asked participants to reflect on the horizontal elements of the value chains, including cultural and social factors, opportunities and challenges, vulnerability to shocks, and the status of the mud crab resource. These were drawn onto print-outs of the value chain maps using post-it notes (Appendix 9). Results from this session augmented the preceding VCA results for Activity 2. A video presentation was given by the CSIRO team on trends in demand for mud crabs, with a focus on the rapid growth of the Asian market.

##### Session 2: What is the community vision for the business in 2050?

Participants worked in groups to develop their visions for mud crab businesses in 2050. They were asked to think about and express not only their economic objectives, but also their environmental and cultural values, and the overall wellbeing of their communities.

Participants from Iasa, Samari, and Sagapari villages did not articulate a business vision for their communities, but instead focussed on services and infrastructure that would improve the communities’ wellbeing such as aid posts, schools, classrooms, communication towers and meeting halls (Figure 23). These villages are distant from the existing seafood companies and do not have any significant trade in mud crabs, which explained their focus on infrastructure planning rather than businesses.

By contrast, participants from Aibinio saw a future with healthy mangrove forests to breed and catch mud crabs, a crab processing factory, and a trade store (Figure 24). This village is the site of the planned seafood factory, Kiwaba Enterprises Ltd., which also intends to trade in mud crabs. This might have helped those groups of women to envisage a future supported by a sustainable and healthy business supporting a well-organized village. The vision also considered sea walls to combat ongoing sea level rise impacts.

Wapi and Buria villages, which have recently relocated to fishing camps around existing seafood companies have been profoundly impacted and lack any services, which is reflected in acute levels of poverty (see Figures 13, 14 and 15). The visions for these two villages depicted thriving communities in which the wealth generated by the companies trickles down to improve people’s living standards and wellbeing. Both visions also showed healthy environments such as mangrove forests and large fish (Figure 25).



Figure 23. An example of a community vision for 2050 focussing on services and infrastructure, in this case Sagapari in the Kiwai Islands.



Figure 24. The community vision for 2050 in Aibinio village, Kiwai Islands, including a crab factory, crab breeding habitat and sea walls.



Figure 25. The community vision for 2050 in Buria village, showing the existing seafood company.



Following presentation of the groups' visions, the facilitators held a discussion to tease out the values demonstrated within the diagrams. Capital, tools to conduct the business, financial and business knowledge and skills and the right licensing and permits to conduct a successful business were all considered economic values for participants (Table 1). The barter system, initiation ceremonies, kinship relationships and healthy crab, fish and mangrove resources were considered important cultural values. The latter overlapped with environmental values.

**Table 1. Summary of the economic, cultural and environmental values expressed within the business visions for Fly River delta villages in 2050**

Values category	Values expressed
Economic	<ul style="list-style-type: none"> <li>• Capital</li> <li>• Reliable transport</li> <li>• Human capital to manage money and finances</li> <li>• Training</li> <li>• Skills</li> <li>• Knowledge</li> <li>• Tools to manage finances (e.g. budgeting)</li> <li>• Compliance with government laws</li> <li>• Appropriate licences and permits</li> </ul>
Cultural	<ul style="list-style-type: none"> <li>• Barter system</li> <li>• Initiation ceremonies</li> <li>• Kinship relationships</li> <li>• Land and sea resources (i.e. healthy crab, fish and mangrove resources)</li> <li>• Hunting and gardening</li> <li>• Hand craft production</li> </ul>
Environmental	<ul style="list-style-type: none"> <li>• Land and sea resources (i.e. healthy crab, fish and mangrove resources)</li> <li>• Local food supplies</li> <li>• Tides</li> <li>• Materials for housing, hand crafts</li> </ul>

The session concluded by considering potential future shocks and how they would affect the visions and mud crab businesses, and sources of resilience within the communities. Shocks identified included climate change (e.g. sea level rise and drought), pandemics such as COVID-19, population growth and increasing sea and land disputes. Sea level rise is already affecting communities, with several relocating inland. Seeking better transport infrastructure and access to services is another driver for relocation. However, over time relocation is expected to create disputes as migrants encroach on other clans' lands.

Participants described the strong cultural norms and traditions that have always made communities resilient to shocks. Key facets listed were:

- *Social networks and connections among different villages and within clans:* transportation by boat, which often requires cooperation between several families, strengthens these bonds;
- *Information sharing:* the verbal transmission of information amongst families and villages is strong. For example, a verbal notice is circulated by women when a crab middleman is visiting a village;
- *Barter system:* this enables exchange of goods when cash is not available;
- *Churches:* although a more recent influence, churches maintain social cohesion and provide services such as education.

One participant said in summary that “*where there is fellowship, there is peace and harmony*”. It was also mentioned that more reliable transport infrastructure would build people's resilience, since it is a primary limitation for communities.

### Session 3: What are the alternative options for business models?

Participants were first asked to discuss local histories of business models that they were aware of. Participants prepared a list and gave reasons for their success or failure. The only successful business in the region was the Vietnamese-owned Puruta Seafood Company (Table 2). The proponents were considered to have followed the appropriate process by requesting land from landowners, preparing a proposal for NFA and applying for necessary permits. As a result, they were now creating employment for local people, and also providing a credit service. The main reasons cited for the failure of all the other businesses were transport problems, lack of training and skills, mis-management and dishonesty.

**Table 2. Fly River delta businesses listed by participants, their success or failure and reasons given**

Business name	Successful?	Causes
Iasa market tables: lollies, smokes, noodles, biscuits	No	Transport and fuel problems
Mission Fishing (fish storage)	No	No freezer maintenance leading to breakdown; transport problems due to distance and weather
Wapi Canteen	No	Insufficient customers due to transport limitations
Fuel supply business	No	Mis-management
Gesowa Fishing	No	Canteen broke down; lack of management skills; dishonesty
Sewing businesses	No	No training or business skills
Puruta Seafood Company, Wapi	Yes	Engagement with local landowners, permits and licences obtained, credit service

John Burton then presented by video a summary of his report from Activity 1, including the history of the barramundi fishery, and those national initiatives underway to promote women's involvement in agriculture and development. Also by video, the CSIRO team presented the additional examples of business models and capacity-building programs: FFT, VSLAs and the SeaNet approach. The 'hub and spoke' model was also outlined.

#### Session 4: What is the appropriate business model?

Participants were asked to consider and describe an appropriate business model for their mud crab fisheries, considering the value chains from Session 1 and their values and factors that build resilience discussed in Session 2. To overcome the challenge of translating the concept of a 'business model' the examples from Session 3 were used, and in particular, the VSLAs, SeaNet and 'hub and spoke' approaches. Due to time constraints the participants did not fully incorporate the value and resilience factors into their business models, but focussed on the institutional structure and partnerships necessary to increase returns from value chains and improve resource management (Figure 26).

Iasa village suggested the formation of women's crab fishing groups that would be managed by a legislated committee and sell to a fishery company that would be established locally. The grouping of families would avoid inter-clan rivalry, generate greater volume and hence value in selling to the company, and the committee would maintain fishery rules and provide a savings club, including training. Crab fishing would be limited to the use of traditional methods, mainly 'biri' basket traps baited with waste fish. Aibinio also suggested the formation of women's crab fishing groups, overseen by a fishing committee consisting of men and women members and providing savings and training services. OTDF would act as a broker between the partners, and facilitate marketing with a local buyer, potentially Maru Marine Ltd. based in Daru.

Samari also suggested the formation of women's fishing teams that would be organised by a village hub including a committee, and this would negotiate and sell in bulk to a proposed company, 'Mowea', generating higher returns to fishers. In turn Mowea would sell to exporters. These partnerships would be facilitated by OTDF. Wapi formed a similar model of community fishing teams selling to a grassroots fishing company that would form the hub, but with an Advisory Committee that would represent each clan group equally, and establish and enforce a crab management plan within the rules of the committee. They also sought a partnership with WWF to act as a broker and provide training and capacity-building support on financial skills-building and fisheries management.

Participants also provided a list of their needs to develop and implement their suggested models. Assets and capital were most frequently mentioned (4), followed by planning/timeframe (3), capacity-building (2) and management advice (2).

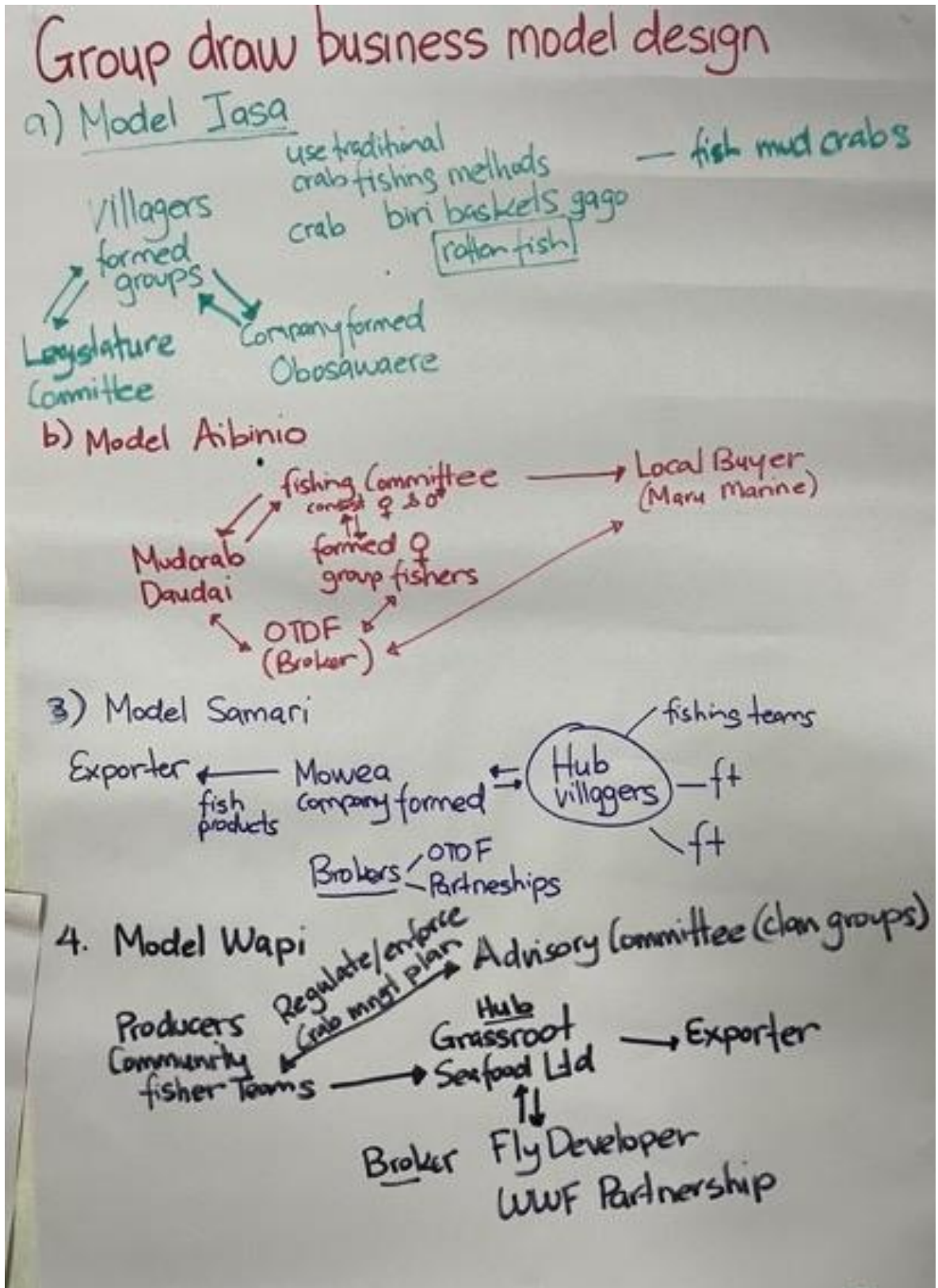


Figure 26. Business models proposed by Iasa, Aibinio, Samari and Wapi villages for mud crabs in the Fly River delta.

### ***Middle Fly community workshop – tilapia***

#### Session 1: What are the current value chains for fisheries?

Following the same 2-day workshop process, in Session 1 the OTDF team presented the tilapia value chain maps and asked participants to give a deeper insight into how they are embedded in the cultural and social context of the communities, opportunities and challenges in the value chains, vulnerability to shocks, and the status of the tilapia resource (Appendix 10). Results from these discussions have augmented the VCA in Activity 2.

#### Session 2: What is the community vision for the business in 2050?

In Session 2, participants were divided into groups and asked to construct their visions for their communities and tilapia fishery businesses in 2050. The groups reorganised themselves into Lower Middle Fly and Upper Middle Fly villages, because issues and conditions in these village clusters differed in terms of proximity to markets and the border with Indonesia.

The Lower Middle Fly participants envisioned the tilapia business being developed through the establishment of fishponds integrated with agriculture, which is feasible because livelihoods include agricultural activities, unlike the Fly River delta (Figure 27). This diversity was considered to enhance the villages' resilience to shocks. Participants also envisaged a fish processing plant in the village, and Indonesia as the main market for their products, which would require construction of a border post and highway. The economic development would support the funding of functioning services and infrastructure such as health, schools and electricity, which are currently lacking.

The Upper Middle Fly participants proposed a similar vision (Figure 28), but instead of a processing plant they wanted to establish a tilapia buying point. Fishponds have already been built in the villages because women can't easily fish for tilapia when flooding occurs. Relocation caused by flooding is a primary concern for these communities, and they receive the highest rates of compensation due to the accumulation of Ok Tedi Mine-related sedimentation in the area, which exacerbates flooding problems. Hence the vision was centred on a new village location on the opposite bank of the Fly River. A highway connects the communities to Kiunga, their primary market. Two commonalities between the visions were the diversification of livelihoods and the consolidation of products and processing. Both communities discussed how betel nut and mustard, which are important sources of income for some households, could be promoted and linked to the Kiunga market where demand is very high.

The values and their different characterizations within the visions had to be carefully facilitated because the concept was abstract and new for the participants. They easily described the economic values as those products which can be commercialized and are the focus of businesses presented in the visions (Table 3). Cultural norms and traditions have an important role in business design: the barter system, hunting and gathering, initiation and wedding ceremonies are central to the communities' organization and wellbeing and should be integrated within future livelihoods. Environmental values were all associated with protecting and maintaining the habitats underpinning the tilapia resource, and other resources that contribute to communities' livelihoods.

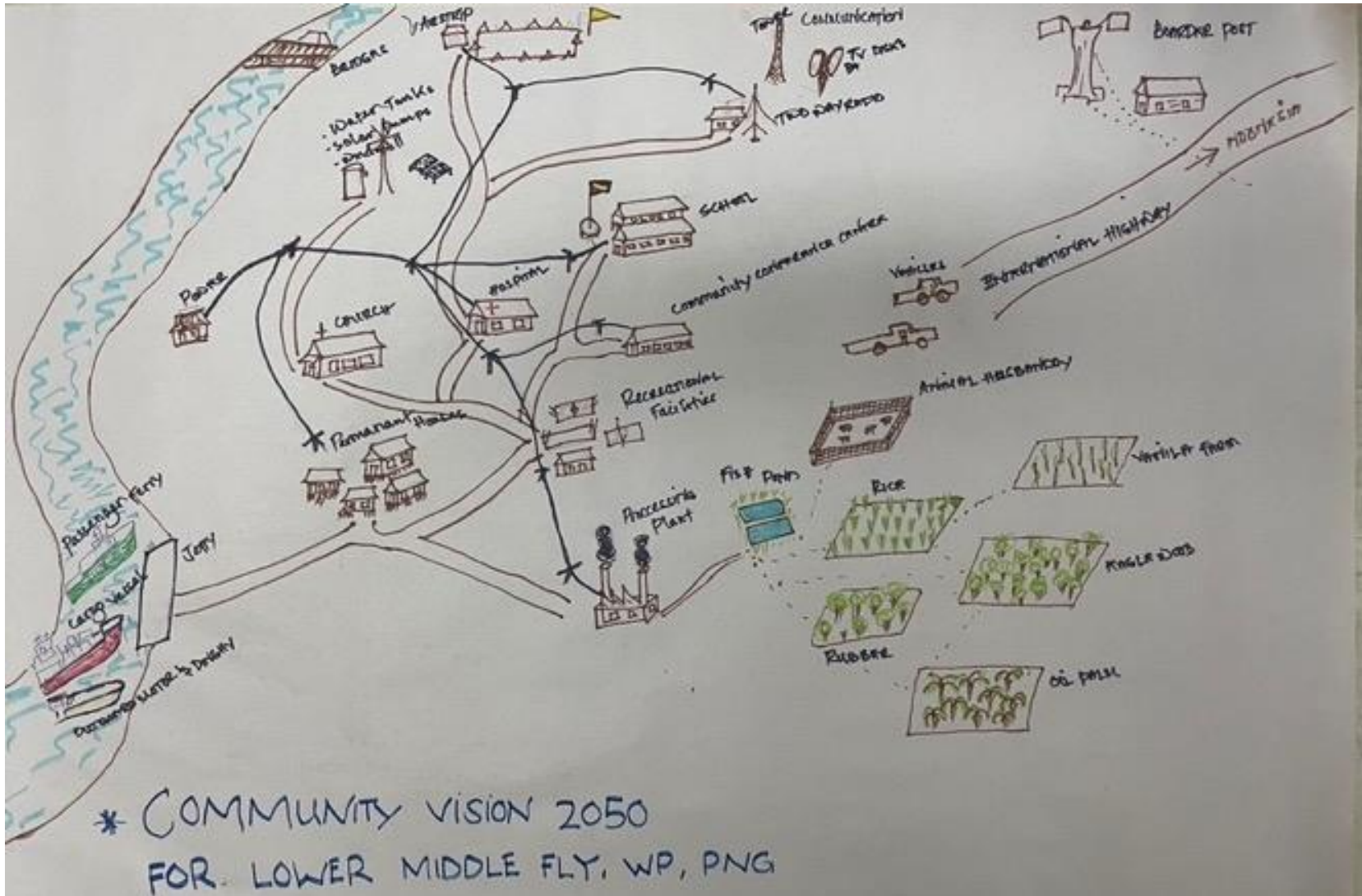


Figure 27. The community vision for 2050 in the Lower Middle Fly villages



Figure 28. The community vision for 2050 in the Upper Middle Fly

**Table 3. Summary of the economic, cultural and environmental values expressed within the Middle Fly business visions for tilapia in 2050**

Values category	Values expressed
Economic	Income from: <ul style="list-style-type: none"> <li>• Tilapia fishponds</li> <li>• Cocoa</li> <li>• Rubber</li> <li>• Rice</li> <li>• Eaglewood</li> <li>• Vanilla</li> <li>• Betel nut and mustard</li> <li>• Oil palm</li> <li>• Animal production</li> </ul>
Cultural	<ul style="list-style-type: none"> <li>• Fishing</li> <li>• Barter system</li> <li>• Initiation ceremonies</li> <li>• Wedding ceremonies</li> <li>• Making canoes and building houses</li> <li>• Hunting and gathering</li> <li>• Hand craft production</li> <li>• Gardening</li> </ul>
Environmental	<ul style="list-style-type: none"> <li>• Healthy forest</li> <li>• Healthy land</li> <li>• Clean water</li> <li>• Marine resources</li> <li>• Stable climate</li> </ul>

According to participants, access to markets will be the primary factor that determines the resilience of tilapia businesses in the communities. Access would generate income to people in the communities, which would be spent on improving living conditions, food security, essential services and ultimately overall wellbeing. Participants also suggested that collaboration would strengthen women fishers' power in the value chains, and enhance access to markets by sharing transport and pooling other resources. Participants understood that they could no longer work individually in any fisheries business. They also mentioned that reliable transport would build value chains' resilience to minimise disruption to the tilapia fishery and marketing.

Session 3: What are the alternative options for business models?

In Session 3, presentations were given by video from John Burton and the CSIRO team. Participants then discussed local business models' history and experiences (Table 4). There were no examples of long term success. Historically, there had been trials based on crops including rice, eaglewood, vanilla and rubber. Poultry, crocodile skins and prawn culture had also been trialed. A petrol supply business had also been attempted. Common to most previous attempts were a lack of financial literacy or management skills, no extension services to follow up initial activities, and a lack of an established market.



COVID-19 had impacted a recent crocodile skin enterprise, and ongoing environmental impacts from Ok Tedi Mine limited the feasibility of this initiative and the prawn fishery.

**Table 4. Middle Fly businesses listed by participants, their success or failure and reasons given**

Business name	Successful?	Causes
Rubber cultivation	No	No interest from local participants; no transport; no market; land ownership disputes; bush fires; poor coordination
Crocodile skins	Short term	Initially there was a market and people were interested, but the COVID-19 shock, poor transport, financial constraints, land disputes and build up polluting sediments had undermined the model
Vanilla	No	No market, no extension services, lack of interest
Poultry	No	No market, no food supply, no training or extensions services
Eaglewood	No	Logistical problems, no extension services, impacts of pollution from Ok Tedi mine, lack of management skills
Prawns	No	Pollution impacts on prawn stocks; low prices; no management expertise; no market
Petrol supply	No	No regular payments; low financial literacy

#### Session 4: What is the appropriate business model?

For Session 4 the two clusters divided up the tasks: one focused on the business model, and the other on needs for business development. The concept of a business model had to be first explained by the facilitators using the examples given in Session 3.

Contextual issues were a focus for the business model group. The main prerequisites were clear land ownership, community awareness-raising programs and consultation with other stakeholders, including government bodies, which are often absent. In addition, a management plan to access funding and resources was necessary, plus financial training, reliable transport, easy access to markets and extension support. Communication was also imperative to encourage the flow of information between communities and other stakeholders, including OTDF. The capacity group reinforced and expanded this list. Skills-building was essential for women, more reliable transportation with accessible fuel, partnerships that can support villagers, especially in the initial stages, a central hub to consolidate activities, and rules and regulations to govern fishing and marketing activities. Unlike the mud crab workshop, participants did not develop detailed diagrams of business models.

### **Multi-stakeholder workshop**

The 1-day workshop involved four sessions (Appendix 6). The first three were devoted to the presentation and discussion of findings from the community workshops by women representatives. This created lively conversations, and started a dialogue among different participating bodies and organisations to explore opportunities for potential future partnerships (Figure 29). However, particularly due to the absence of some important stakeholders such as the NFA, it was not possible to develop an action plan for implementation. A final workshop in Port Moresby is being planned by OTDF for August 2022 to reconvene potential future partners with international and national government agencies.



**Figure 29. Women representatives from the Fly River delta presenting their proposed business models to the multi-stakeholder workshop.**

## 7.2 Business innovation workshop evaluations

At the end of each community business innovation workshop a participatory evaluation exercise was carried out, which asked the following four questions: 1) What were the strengths of the approach? 2) What were the weaknesses of the approach? 3) How could the approach be improved? and 4) Has the workshop changed your thinking?

For the Fly River delta workshop, the strengths of the approach related to how the process would help improve livelihoods (Table 5). In terms of weaknesses, the most common answer was that 2 days were not enough, while others mentioned that the issues were too hard to understand, perhaps because the workshop was the first of its kind, and that more materials were needed. These issues were reiterated for the next question, with four participants requesting more time, perhaps 1 week, and two requesting a simplification of the concepts. Others also requested more training in how to use the workshop method themselves. In terms of how the process had changed their thinking, 10 agreed that it had, and only one disagreed.

**Table 5. Participants' reflections on the process for the Fly River delta workshop**

Question	Comments
1) What were the strengths of the approach?	<ul style="list-style-type: none"> <li>• Good approach to help with improving livelihoods/living (8)</li> <li>• I learned many things that would help me start a business (2)</li> <li>• Enabled me to devise a management plan (1)</li> <li>• The workshop gave me a new direction (1)</li> <li>• It helped me understand business models (1)</li> <li>• It is the first of its kind for us (1)</li> <li>• It really opened my mind to what I have (1)</li> <li>• It really touched our feelings (1)</li> <li>• I have learned a new skill (1)</li> </ul>
2) What were the weaknesses of the approach?	<ul style="list-style-type: none"> <li>• Two days are not enough – more time (3)</li> <li>• Hard to understand (3)</li> <li>• It is the first of its kind for us (2)</li> <li>• Need more materials (1)</li> </ul>
3) How could the approach be improved?	<ul style="list-style-type: none"> <li>• Need more time – perhaps 1 week (4)</li> <li>• Simplify the concepts (2)</li> <li>• We need more training in how to use the method (2)</li> <li>• We need to help one another to tackle the issues (1)</li> </ul>
4) Has the workshop changed your thinking?	<ul style="list-style-type: none"> <li>• Yes, it changed my mind/thinking and gave me new ideas (10)</li> <li>• I have a better understanding about setting up business models (2)</li> <li>• Good training for me (1)</li> <li>• It's a good study plan for business models (1)</li> <li>• I was strengthened by the workshop (1)</li> <li>• Not really (1)</li> </ul>

Similarly, for the Middle Fly workshop the key strength of the approach was that it encouraged people to ‘think big’, and it ‘opened up their minds’ (Table 6). Others mentioned that it was a ‘good and active’ process, it promoted learning from past business models, and generated ideas and personal growth. One participant highlighted the strength of combining women and men in discussions about women’s business models. In terms of weaknesses, the most common answer was that the process was hard to understand, followed by the need to apply the results, and that more time was needed for the workshops. Better explanation of conceptual jargon was also mentioned. The workshop approach could be improved by allowing more time, by following up with testing of the ideas, and also further training. There was strong evidence that the workshop had changed participants’ thinking and triggered new ideas. One participant explicitly mentioned that the workshop had enabled them to help women set up their businesses.

**Table 6. Participants’ reflections on the process for the Middle Fly workshop**

Question	Comments
1) What were the strengths of the approach?	<ul style="list-style-type: none"> <li>• It helps me to think big and opened up my mind (7)</li> <li>• Good and active process (3)</li> <li>• Learning from mistakes of past business models (3)</li> <li>• Generated new ideas and personal growth (3)</li> <li>• Gives me strength to run a fishing operation (3)</li> <li>• Combined both women and men (1)</li> <li>• Smooth and free (1)</li> <li>• Clear and good facilitation (1)</li> </ul>
2) What were the weaknesses of the approach?	<ul style="list-style-type: none"> <li>• Hard to understand (9)</li> <li>• Need to apply the results (4)</li> <li>• Two days are not enough – more time (3)</li> <li>• Conceptual jargon needs better explanation (2)</li> <li>• Insufficient consultation with the leaders and people (2)</li> <li>• Not much contribution from participants (1)</li> <li>• Too slow (1)</li> <li>• Generated fear about the future (1)</li> </ul>
3) How could the approach be improved?	<ul style="list-style-type: none"> <li>• More time (2)</li> <li>• It must be more real by applying and testing the ideas (2)</li> <li>• Encourage participants to freely share ideas (1)</li> <li>• More discussion, communication and sharing (1)</li> <li>• Need training in the approach (1)</li> </ul>
4) Has the workshop changed your thinking?	<ul style="list-style-type: none"> <li>• Yes, it changed my mind/thinking and gave me new ideas (12)</li> <li>• It made me a business-minded person (2)</li> <li>• I have a clear picture of business models (1)</li> <li>• I can now help women set up their businesses (1)</li> </ul>

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## 7.3 Synthesis

In this section we synthesise the SRA's findings to derive recommendations that will steer the future development of women's fishery enterprises. First, as recommended by Burton's (2021) review, we applied a PESTLE analysis to distil the primary risks to establishing women's businesses based on mud crabs and tilapia. Following this, we compiled key sustainability principles that could address the risks highlighted by the PESTLE analysis, covering economic, socio-cultural and environmental aspects derived from Activity 1 and other relevant sources. Finally, we applied the principles to account for the PESTLE analysis' risks, and sketched an archetypal scaffolding based on workshop participants' ideas that could be refined and tested in the Fly River delta and Middle Fly villages engaged by this project.

### *PESTLE analysis*

PESTLE breaks down risks to a development initiative into Political, Economic, Social, Technological, Legal and Environmental components. We address each in terms of women's small-scale fishery businesses:

**Political:** Current political support for the empowerment of women is strong at a national level with numerous initiatives underway (see Burton, 2021). These are mirrored and supported by development programs, including ACIAR's FFT program which is being extended to Western Province. Regionally, OTDF is also prioritising women's advancement through the WCAs, and 10% of the Ok Tedi Development Fund is being ring-fenced for development projects that promote women and youth welfare. Hence the wider political environment, and resources connected to it, appear to be conducive to any initiative's progress. However, the long-term future of Ok Tedi Mine, and therefore the existence of OTDF poses some risk to this enabling environment remaining so positive.

**Economic:** The primary economic issues revealed by this study concern the value chains for mud crabs and tilapia, and women fishers' positions in them. From a vertical perspective, both value chains are characterised by comparatively weak status of women as individual price-takers, reflected in low returns (75 toea to 2.5 kina/crab, and 50 toea to 8.8 kina/tilapia) and high workloads necessary to generate this income (20% of work time for mud crabs, 12% for tilapia). The markup from this first point of sale to the final market price further highlights this weakness, particularly for mud crabs with a factor of 80 increase. In addition, women fishers are usually restricted to very few markets and/or middlemen, which is often determined by the systemic transport, communications, and infrastructural constraints typical of the Fly River. The community workshops also highlighted the necessity for capital investment, which is often unavailable either from banks or micro-finance mechanisms. More broadly, the mud crab market is driven by increasing demand in the Asia region, while the tilapia market is more locally and regionally-driven, with growing demand evident along multiple value chains in the Middle Fly. In summary, the primary barrier and risk to women's fishery businesses is their weak economic position in the value chains, and the impediments posed by transport and infrastructural access to markets, but the growth in demand for mud crabs and tilapia presents an opportunity.

**Social:** The social risks are complex. Within households, women have little power in terms of decision-making over resource use and expenditure of income, and their economic empowerment through fishery businesses may generate friction with men. It

has been emphasised that collaboration between fishers is necessary to strengthen their bargaining power and relationships with middlemen, yet cooperation across clans is problematic. This tension may be exacerbated by wider land disputes generated by relocation, in turn driven by advancing sea level rise and flooding. The horizontal characteristics of the tilapia value chains also involve movement of people and products across the Indonesian border, necessitating potentially risky interactions with the Indonesian and PNG military and other formal and informal regulatory mechanisms. In addition, kinship ties across the border have formed dependencies between fishers and middlemen which may be disrupted by the empowerment of women with unknown social effects. Combined, these social issues pose potentially significant risks to the establishment of women's businesses and must be anticipated and mitigated.

**Technological:** A lack of financial, management and business skills were identified as a significant shortcoming by the community workshops, and were also a contributory factor in the failure of previous businesses, including the Fly River barramundi fishery. Also, there is a general lack of skills and facilities for the post-catch processing of mud crabs and tilapia, with high levels of wastage in the value chain, and therefore inefficiencies. Technical knowledge of fishery management and conservation also appeared to be limited, with all surveyed fishers being unaware of the NFA's National Mud Crab Management Plan, and female crabs being harvested. For tilapia there is no knowledge of the resource, its habitat needs or status, although the resilience of the species may obviate this information in the short term. In terms of technical skills for harvesting and storing the target species, current methods appear to be low cost and efficient (i.e. catching mud crabs on foot, or using canoes and mosquito nets for tilapia). However, the use of baited traps for mud crabs could enhance efficiency and protect mangroves, as demonstrated by the SeaNet approach. Combined, these technical and capacity issues are significant.

**Legal:** Much of the tilapia trade into Indonesia and along the Fly River in freight ships contravenes several regulations, but since these are only superficially enforced the legal issues are not a major risk at present. However, should the fishery businesses build to a critical mass with large quantities being sold into these value chains, legal compliance would have to be secured, or alternatively, regulations relaxed to enable the trade to thrive. Further down the value chains, processing companies (e.g. Abea Meke Fishing Company and the Purutu Seafood Company in the Fly River delta) will have to obtain export permits from the relevant authorities, which will depend on the capacity of the regulatory agencies to process and manage a significant up-scaling of applications and permits. Similarly, with an increase in fishing pressure and trade activities there will be a need for greater fishery management and enforcement investment, which is currently limited at the district, provincial and national levels.

**Environmental:** As discussed above, the status of the target species and their supporting habitats is largely unknown, although Fly River delta workshop participants stated that mud crab stocks were declining, potentially due to the loss of mangroves caused by sea level rise. Flooding linked to sedimentation in the Middle Fly was also identified as a limitation to tilapia fishing. More broadly, the impact of sea level rise and flooding on villages and their limited infrastructure has had a disruptive impact on women fishers and their livelihoods, with knock-on effects such as relocation, land disputes and exacerbated poverty. Other environmental shocks including COVID-19 have had debilitating impacts on the Middle Fly tilapia value chains, and on other nascent businesses. Overall, the

challenges posed by the extreme environment of the Fly River region are only likely to intensify as climate change advances, and human pressure on the fisheries and their habitats grows.

### ***Sustainability principles***

Principles were grouped into economic, socio-cultural and environmental factors (Figure 30). Primary economic principles involve the enhancement of fishers' returns in value chains by strengthening their bargaining power through collaboration and pooling of products and resources, and shortening value chains (i.e. by by-passing middlemen). VSLAs also provide a solution to the problem of providing start-up capital for businesses, and an avenue for saving income and empowering women entrepreneurs.

Socio-cultural principles are diverse, largely due to the complexity of the social, political and legal context in the Fly River region and PNG, as reflected in the multiple risks identified in the PESTLE analysis above. Legalisation of trading would reduce the vulnerable and disempowered positions of women in the tilapia value chains. As demonstrated by the FFT and SeaNet programs, training at the household level would build financial and business skills, and village educators could scale out this capacity. Working with, rather than across traditional social structures and institutions would minimise risks of clan rivalry, and promote communication and resilience to shocks to value chains. The WCAs established by OTDF also provide a political and economic vehicle through which to empower women and access resources for investment into fishery businesses, while engagement with national programs for women's enterprises potentially also provide resources and political support.

Environmental principles include the integration of sustainable fishery management practices into the constitutions of VSLAs, which would promote best practice and self-regulation in the absence of well-resourced government fisheries agencies. Village educators can act as extension officers, socialising sustainable practices.

### ***Archetypal scaffolding***

The scaffold was sketched around the initial 'hub and spoke' framework discussed and adapted by the business innovation workshop participants, augmented by the VSLA and WCA governance structures (Figure 31). At the village level, the 'spoke' would be formed around existing clans to promote collaboration, communication and the pooling of products and resources. A VSLA would be established to oversee each spoke, and its members would include women fishing teams or FFTs within a household, village trainers or educators, and a female business agent. The agent would substitute for existing middlemen and shorten the value chain, creating a stronger bargaining position with a local buyer or 'hub', and therefore generating higher returns for the fishers through the VSLA. The WCA would provide an umbrella institution promoting women's enterprise across spokes. The establishment and functioning of the model would be facilitated by OTDF and other partners such as churches. Funds generated by the VSLA and other investors would be managed through the VSLA to provide micro-finance for women's business start-ups and other inputs (e.g. motorised boat transport). The village educators would provide financial and business skills training among the VSLA members, and to other potential members within the village. The VSLA would include sustainable fishery management principles within its constitution, to which fishers would have to adhere as a condition of membership. The socialising of sustainable fishery practices, improved processing and capture techniques would be another function of the village educators.

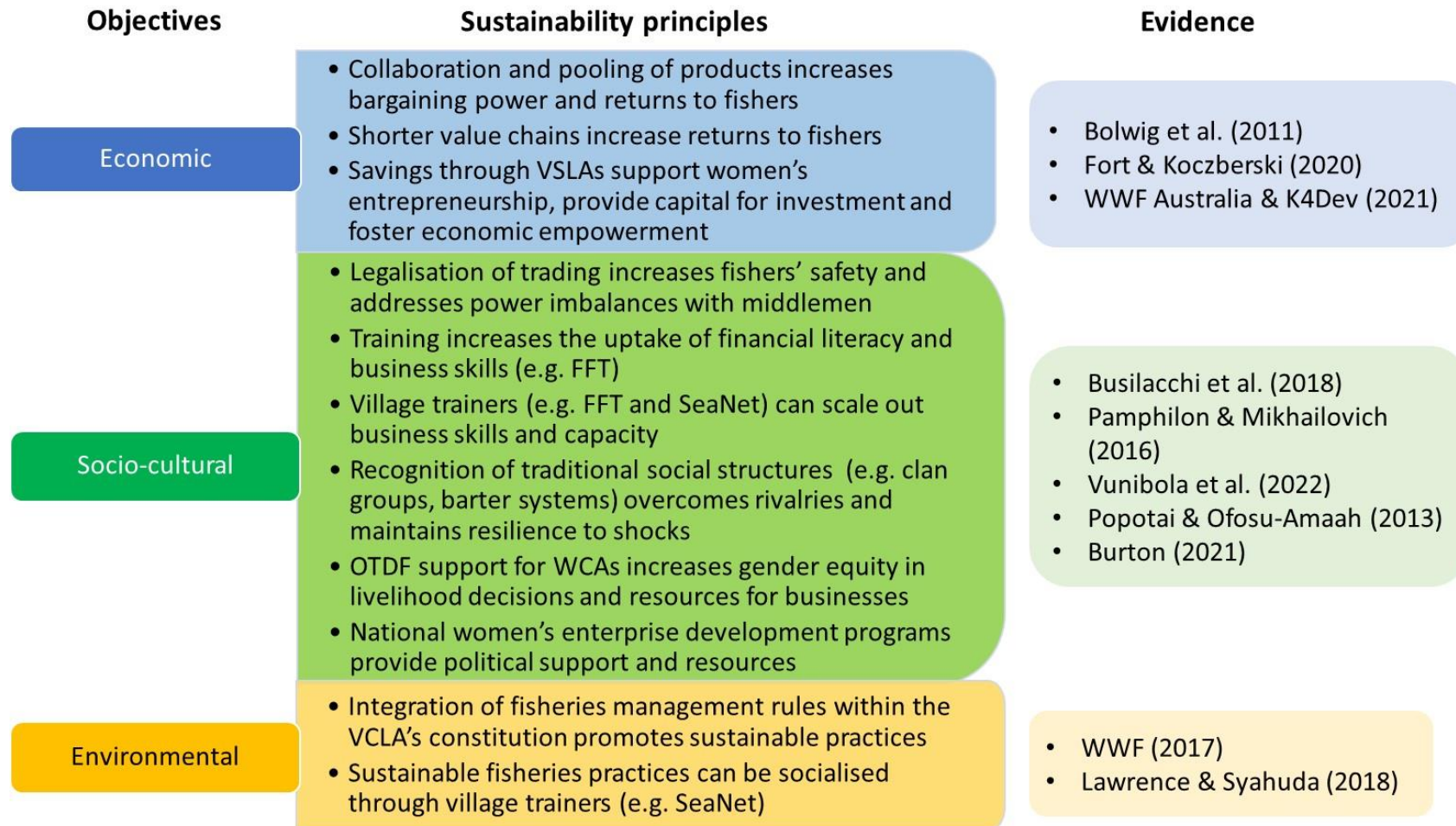


Figure 30. The principles potentially promoting the economic, socio-cultural and environmental sustainability of women’s fishery businesses



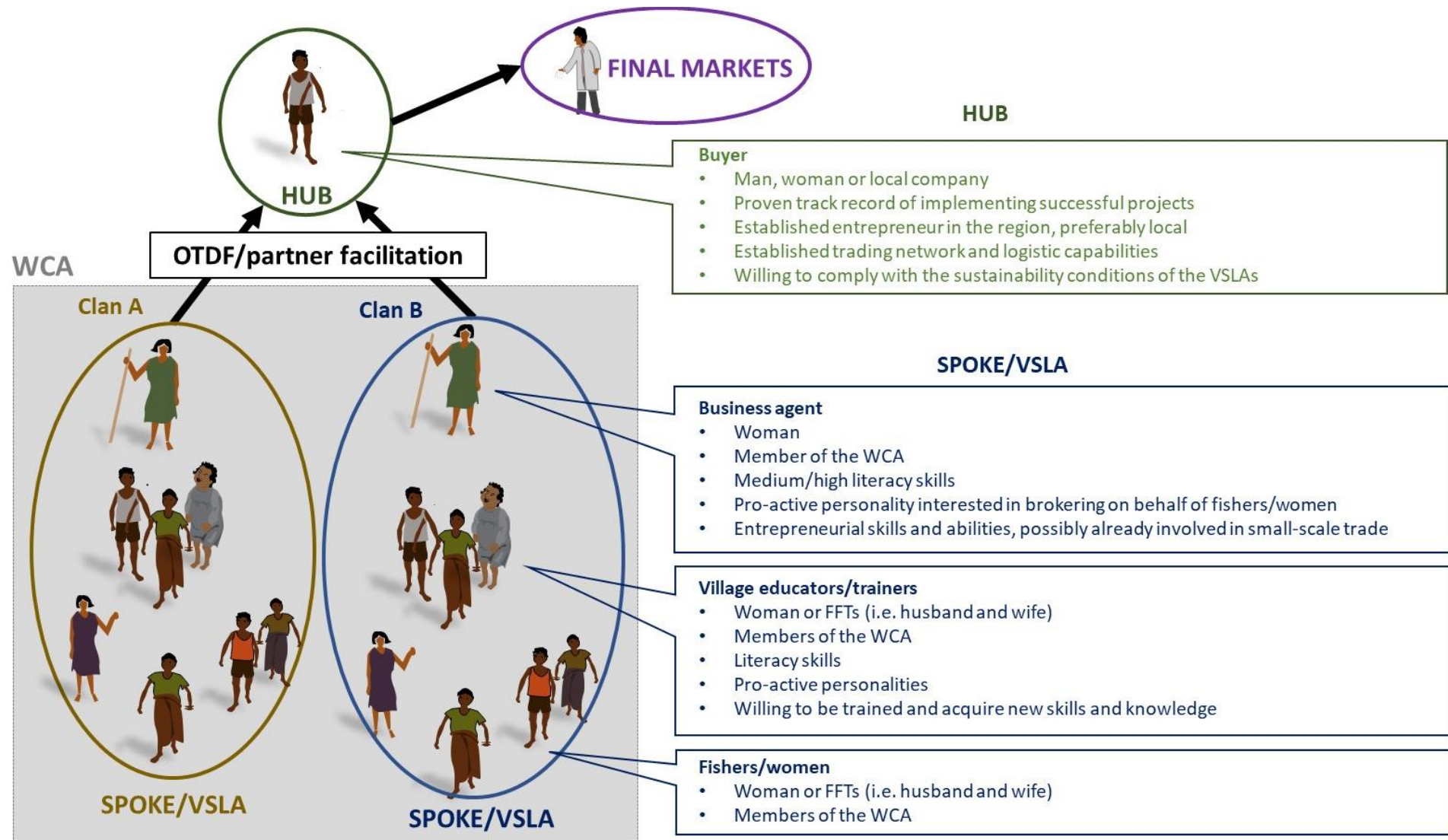


Figure 31. Archetypal scaffolding for small-scale fishery-based businesses in the Fly River delta and Middle Fly villages

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## 8 Impacts

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### 8.1 Scientific impacts – now and in 5 years

#### 8.1.1 Present impacts

This research has developed tools (e.g. VCA) and processes (e.g. business innovation workshops) which facilitate the co-production of knowledge and development of innovative solutions to the complex challenge of designing women's fishery businesses. The VCA method is well-established, but building on the project team's previous applications in Western Province has been further refined to explore horizontal dimensions of informal cross-border trade, in this case for the tilapia value chains into Indonesia. The community-based workshop process, which was based on social learning steps and principles, was also innovative and evaluations suggested that it generated transformational thinking amongst participants.

The detailed results of the project are also of scientific significance. Burton's (2021) review of the Fly River barramundi fishery's 60-year history, and reflections from workshop participants about the causes of previous business successes and failures demonstrated the systemic problems facing mainstream business practice in Western Province. These results led to the preliminary design of an alternative framework that might overcome such pervasive issues, and re-frame the concept of 'business' to be more culturally-appropriate, particularly for women and small-scale fisheries. This framework focuses not only on economic values and objectives, but also on cultural and environmental values as both desired outcomes and essential components of their function and resilience.

The calculations of women's financial returns from mud crab and tilapia fishing, and the MPI assessments for the Fly River delta villages also provide useful objective baselines against which future interventions can be evaluated. However, it should be noted that these were based on modest sample sizes of questionnaire interviews.

#### 8.1.2 Impacts in 5 years

The project's methodological approach is contributing to the global shift from a focus on top-down, technical solutions to development, towards the co-production of knowledge and innovation with multiple stakeholders. In this case the theme of women's businesses, fisheries and the incorporation of multiple values and objectives is a unique perspective, and is likely to have growing scientific impact over the next 5 years.

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### 8.2 Capacity impacts – now and in 5 years

#### 8.2.1 Present impacts

The OTDF and Blue Forests teams have built their capacity to adapt and apply knowledge co-production processes to the development issues they commonly face during their projects. The OTDF team's skills were also augmented by their participation and contribution to CSIRO Knowledge Broker Support Program (KBSP). They exchanged their experience of VCA with the KBSP community of practice established in PNG and the Solomon Islands, and in turn learned about tools such as governance mapping,

ecosystem services valuation, scenario planning and Theory of Change. The skills built within both teams will enable them to introduce the tools and approaches to their colleagues within Western Province and Papua Province, and to apply the skills to other development research, project design and implementation. Despite the restrictions on face-to-face working due to the COVID-19 pandemic, two-way learning also occurred between the OTDF, Blue Forests and CSIRO team members. On-line team meetings enabled exchange of ideas and co-design of the methods, and reflection on what worked and what didn't, which built the whole team's research capacity.

### **8.2.2 Impacts in 5 years**

It is anticipated that the OTDF and Blue Forests teams will adaptively embed the knowledge co-production processes in their practice over the coming years. In addition, knowledge co-production between OTDF, the CMCA communities and other partners will help OTDF to become leaders in development practice and innovation in PNG. As such they will be able to design, implement and evaluate projects and interventions that do not just recreate development models transposed from other regions and partners, but are locally-driven and context-specific.

By engaging communities, and in particular women fishers and other value chain actors through trials of alternative business models, their financial and business skills will be enhanced. Socio-cultural characteristics which maintain resilience to value chain shocks will also be bolstered. In parallel, the capacity of communities to sustainably manage their mud crab and tilapia fishery resources will be expanded, and partnerships with fishery agencies will be strengthened.

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## **8.3 Community impacts – now and in 5 years**

### **8.3.1 Present impacts**

Other than evaluation of the community workshops, there was no intent to assess the impact of the SRA on women fishers and their households. However, the workshops clearly raised participants' awareness of their fisheries, value chains, shocks, sources of resilience, past business successes and failures, and the multiple values desired from any alternatives. Many participants thought the workshop process had changed their thinking and exposed them to new ideas. Some even stated that they were now able to help establish women's businesses, and wished to be trained in the workshop method to apply it themselves. Unfortunately, the intended outcomes from the multi-stakeholder were not achieved due to absence of key agencies. However, first steps were taken to building a suite of potential Western Province partners and their awareness of communities' wishes in terms of mud crab and tilapia fisheries and alternative business models.

### **8.3.2 Impacts in 5 years**

The medium-term impact of the project's participatory approach, and subsequent implementation by OTDF and other partners, will be an increased likelihood of impact on women's livelihoods in the Fly River delta and Middle Fly villages. If successful, the business models and the processes used for their development can be scaled-out across the province and scaled-up to be used nationally. Linkages and synergies with other ACIAR investments such as the FFT program, and national programs supporting women's enterprise development will further build this impact.

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## 9 Communication and dissemination activities

The participatory approach necessitated the involvement of women, communities and other stakeholders in the project from its inception, maintaining communication about the project. The OTDF team is planning further community visits at the end of the project to discuss and socialise its outcomes, and to plan next steps. OTDF will also hold meetings in Port Moresby to disseminate outcomes and discuss implementation and scaling-out pathways with potential partners at the national and international level.

OTDF and the ACIAR PNG Country Office have also disseminated information about the project to national newspapers:

- <https://www.thenational.com.pg/community-considering-market-options-for-mud-crabs-fish/>
- [Fisheries opportunities for women - Post Courier](#)

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## 10 Conclusions and recommendations

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### 10.1 Conclusions

This project sought to scope and design alternative small-scale fishery business models for Fly River communities in the Western Province of PNG, with a focus on women's roles in mud crab and tilapia fisheries. A review of business models in PNG and Western Province found little published information, and the COVID-19 pandemic limited the ability to interview local key informants about past experiences. However, the Fly River barramundi fishery exemplifies the boom-and-bust nature of some mainstream fisheries business models in the province, and the systemic capacity and resource management constraints that undermined its sustainability. Similar themes were revealed by the community workshops' reflection on local small-scale businesses, with financial skills, severe shortcomings in transport, communications and logistics, a lack of capital investment, extension services, and shocks such as floods and COVID-19 contributing to most businesses' failure.

However, a review of the FFT program, VSLAs and the SeaNet project provide some pointers about alternative approaches to building women's business skills and financial literacy, plus fishery management and processing practices that could overcome some of these constraints and risks. In addition, it is clear that a whole-of-system approach to support is needed, which simultaneously addresses institutional, capacity and natural resource management issues, with a specific focus on appropriate assistance to women.

Surveys, FGDs and business innovation workshops with women fishers, their communities and other value chain actors suggest that the value chains are diverse, but women have weak positions and low returns from the trade. Information about the status of the mud crab and tilapia resources and their supporting habitats is lacking, and in the case of mud crabs the stock may be declining due to overfishing and mangrove loss. The PESTLE analysis identifies a wide range of locally-driven and higher-level risks to the development of women's fishery businesses, despite the likely growing demand for mud crab and tilapia.

The business models co-designed with communities and women aim to overcome many of the locally-driven risks, limitations and pressures on sustainable small-scale fisheries enterprises by shortening value chains through VSLAs, and simultaneously building skills and capacities through village trainers. Community members also expressed a range of economic, cultural and environmental values to be incorporated and harnessed by business models, which indicate that their aspirations for enterprises go beyond profit objectives alone. The synthesised archetypal scaffolding is based on the 'hub and spoke' model which explicitly integrates these values within traditional clan structures and social networks, thereby building resilience to shocks.

These initial findings and the framework should now be further refined by the communities, facilitated by OTDF. Additional partners who can provide resources and linkages, and therefore mitigate some of the higher-level political, economic and technological risks should be involved in this on-going co-design. Finally, some trials should be established in the target villages to establish and test the models within a clear adaptive learning framework, underpinned by careful monitoring, evaluation and learning of outcomes. Some data gathered by this project (e.g. MPIs in the Fly River delta villages,

average household incomes, fishers' sale prices for mud crabs and tilapia) can form a baseline against which to measure economic outcomes.

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## 10.2 Recommendations

**Recommendation 1.** Refine and trial the proposed framework in the Fly River delta and Middle Fly villages included in this study. This will require the further input of communities, and the establishment of enabling partnerships centred around OTDF.

**Recommendation 2.** Refine the business innovation workshop process to account for feedback from communities, including allowing more time and simplifying or translating unfamiliar concepts (e.g. business model, values).

**Recommendation 3.** Train community members, and particularly women, in the business innovation workshop process to facilitate the scaling-out of the project's approach. In doing so, the method can be adapted and simplified as necessary.

**Recommendation 4.** Form an adaptive monitoring, evaluation and learning framework and process around both the development and refinement of business models, and the economic, social and environmental outcomes specific to women and their communities. Some data collected by this SRA can contribute to identifying and monitoring baseline economic indicators.

**Recommendation 5.** Conduct a detailed analysis of proposed markets for mud crabs and tilapia to better understand the trends, scale of unmet demand, and potential new market outlets.

**Recommendation 6.** Establish the status of mud crab and tilapia stocks, and their habitats, to inform potential harvest strategies and limits.

**Recommendation 7.** Disseminate and socialise the conceptual approach, methods and results of the project to Fly River communities, and across PNG through the partnerships established.

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## 11.2 List of publications produced by the project

- Burton, J. (2021). *Review of women's village business enterprises in PNG focussing on Western Province*. Report. The University of Queensland and ACIAR
- Muhammad, I. & Ahmad, R. (2022). *Value chain analysis of tilapia Papua, 2021*. Blue Forests report to CSIRO and ACIAR.



## 12 Appendices

### Appendix 1 – Consent information sheet



#### Developing alternative small-scale fishery models for women in the Fly River, Western Province, Papua New Guinea

##### Information Sheet

- Introduce yourself

##### About the project

You are invited to participate in a research project conducted by OTDF with the collaboration of CSIRO and funded by ACIAR.

This visit is the first step of a larger project that aims to establish sustainable long-term businesses for women based on tilapia and/or mud crabs. Based on previous failures, we want to understand **why** previous businesses did not work and **what is needed** for future businesses to succeed.

**Economically, environmentally and socially sustainable** businesses are needed to ensure the long-term well-being of the people living in the CMCA villages.

We will bring back the results from this first visit toward the end of the year to plan with the communities the next steps in developing successful businesses for women toward the end of the year.

During this visit, we want to find out the commercial options for tilapia and mud crabs available to women and how much money they bring to you compared to other sources of income. We also want to discuss with you what are the problems and issues associated with these businesses and markets and how do you think they can be improved.

Thanks for your time.

##### What is involved?

- This **interview or group discussion** might take between 30 minutes and 1 hour to complete.
- Participation in this **interview/group discussion** is for collecting background information only.
- **Discussions: we will be taking notes throughout the discussion. We will not identify individual contributions, just document the general discussion and key points.**
- **Discussions: we would like to hear from everyone even if opinions are different. All comments are valuable.**

##### Participation and withdrawal

- It is up to you whether you decide to participate or not.

- Participation is voluntary and you are free to stop participating or withdraw information at any time.

#### **Risks**

- Participation in this research should involve no physical or emotional distress.
- If you feel uncomfortable talking about certain information, you are free not to answer.
- Please discuss any concerns or risks with members of the project team so we can try to find ways to minimise any risks.

#### **Confidentiality**

- You will not be directly identifiable in any reports, publications or discussion of results.

#### **Use of the information you provide**

- Information may be written up in reports, research publications and other formats such as information sheets. Information may also be verbally presented as part of project and stakeholder engagement meetings.
- You will not be identifiable in the reporting of results.

#### **Ethical review process**

- This project adheres to the guidelines of the ethical review process of CSIRO, Australia. You may wish to discuss your participation in this study with members of the project team. Contact details are given in the information sheets provided.

For further information or queries please contact:

Havini Vira  
Ok Tedi Development Foundation  
Kiunga  
Email: [Havini.Vira@otdfpng.org](mailto:Havini.Vira@otdfpng.org)  
Phone: +675 (0) 73604073

James Butler  
CSIRO Land & Water  
Brisbane  
Email: [james.butler@csiro.au](mailto:james.butler@csiro.au)  
Phone: +61 (0) 437030120

## Appendix 2 – Questionnaires and questionnaire guides

### INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
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Identify each survey with a code using your initials, the first two letters of the Village name and interview number in that village in progressive numbering (e.g. Sara Busilacchi Sui Village third interview = SBSU3). Label each page of the survey with this code in case any pages get mixed up or lost.

**Observer** = team member doing the interview; **Participant** = person who is actively involved in the value chain and who is interviewed by the observer

Observer's name:
Name of the participant ( <i>to be kept confidential</i> ):
<p><b>Observer:</b></p> <p><input type="checkbox"/> Give an overview of the project and the interview (from the information sheet)</p> <p><input type="checkbox"/> Explain that the participant can withdraw at any time</p> <p><input type="checkbox"/> Explain that there are no risks involved. In case of doubts participant can discuss with team members</p> <p><input type="checkbox"/> Explain that the information discussed is <b>kept confidential</b></p> <p><b>Consent of participant: (Please tick relevant box)</b></p> <p><input type="checkbox"/> I am happy to give information (proceed with asking the questions)</p> <p><input type="checkbox"/> I am not happy to give information (do not proceed with asking questions)</p>

#### PART ONE: GENERAL INFORMATION ON PARTICIPANT

**Age:** \_\_\_\_\_ **Gender:** F  M  other

**What is your marital status?** married  divorced  widowed  never married  other

**Where were you born?** this village  this province  another province in PNG  overseas

**If migrated, why did you move?** work  mine impact  marriage  education/health   
came back to my village

**Are you part of any association, co-operative or community group?** yes  no  **Which?** \_\_\_\_\_

#### PART TWO. INFORMATION ON PARTICIPANT'S HOUSEHOLD FOR ESTIMATION OF THE **POVERTY INDEX**

**How many people live in your household?** <6yo  6yo to 18yo  men  women

**Has your household ever lost a member younger than 18yo?** yes  no

**How many people between 6yo and 18yo go to school regularly**

**Have any members of your household finished grade 5?** yes  no

**How many days in the last week has your household eaten protein in your meal (e.g. meat, fish, chicken, eggs)?**  
 1  2  3  4  5  6  7

**What is your house made of?**  all bush material  bush material with metal roof  mixed material with metal roof  all permanent material  other

**How do you get water?** piped to house  creek or well  rainwater tank attached to house   
communal tank  sago swamp  other

**What do you use to cook?** electricity  firewood  gas  other

### INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
----------------	--------------------

Does the house have working electricity? fixed power  generator  working solar  none

Does the house have one of the following? pit toilet  septic tank  none  other

Is the toilet shared with other families? yes  no

Household assets (only in working condition)

Household possessions	Number
fish nets	
fishing traps or spears	
genset	
Boat	
phone (mobile or fixed)	
OBM	
Solar fridge	
esky	
kabota	
Generator fridge	
Solar panel	

### PART THREE. INFORMATION ON PARTICIPANT'S INVOLVEMENT IN THE FISHERIES OF MUD CRAB

Do you catch mud crabs?  Yes, continue  No, go to PART FOUR (if the participant only trade and does not catch mud crab)

Think to all the activities you do when you go **catching MUD CRABS**; from when you leave the house to when you eat them or sell them:

Why do you catch mud crabs? (tick all that apply)

food  income  social  cultural events  other

From your answers, which is the **main reason** you catch mud crabs? (tick one)

food  income  social  cultural events  other

Where do you catch mud crabs? (tick all that apply)

mangrove  mud flats  along the coast  other

What is the proportion you catch in each of these places? (give a percentage)

mangrove  mud flats  along the coast  other (specify)

Which is the place where you catch **most of your** mud crabs? (tick one)

mangrove  mud flats  along the coast  other

INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
----------------	--------------------

When you go catching mud crabs in the place where you catch **most of your** mud crabs

a. How do you get to this place? (tick all that apply)	<input type="checkbox"/> boat without motor <input type="checkbox"/> boat with motor <input type="checkbox"/> canoe <input type="checkbox"/> foot <input type="checkbox"/> other
b. Which fishing gears do you use? (tick all that apply)	<input type="checkbox"/> hand spear <input type="checkbox"/> <del>poison</del> <input type="checkbox"/> hands <input type="checkbox"/> trap <input type="checkbox"/> stick <input type="checkbox"/> other
c. How many hours do you take to get to this place? (tick one)	<input type="checkbox"/> <1 <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> >5
d. In a day, how many hours do you spend catching crabs once you arrive to the place? (tick one)	<input type="checkbox"/> <1 <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> >5
e. In a week, how many days do you go fishing here? (if less than weekly tick N/A & go to g)	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> N/A
f. How many weeks each month do you fish here? (tick one)	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4
g. Which months do you fish here? (tick all that apply)	<input type="checkbox"/> January <input type="checkbox"/> February <input type="checkbox"/> March <input type="checkbox"/> April <input type="checkbox"/> May <input type="checkbox"/> June <input type="checkbox"/> July <input type="checkbox"/> August <input type="checkbox"/> September <input type="checkbox"/> October <input type="checkbox"/> November <input type="checkbox"/> December <input type="checkbox"/> all months <input type="checkbox"/> random months
h. Who do you go fishing with? (tick all that apply)	<input type="checkbox"/> alone <input type="checkbox"/> own household <input type="checkbox"/> relatives <input type="checkbox"/> other women in village <input type="checkbox"/> other

How many mud crabs do you usually catch at this place?

The participant catches (number)   (cross the right window)

Do you catch female mud crabs at this place?  yes     no

Have the quantities of mud crabs you catch at this place changed in the last 10 years?  no     yes

If yes, why? too much fishing  mine pollution  changes in the environment  other

How much do you usually spend when you go catching crabs at this place? (if there are no expenses put K.0)

The participant spends (number)    (cross the right window)

What do you do with the mud crabs that you catch? (tick all that apply)

keep to eat     share with families     barter     share at feasts     sell     other

PART FOUR. INFORMATION ON PARTICIPANT'S INVOLVEMENT IN BUYING MUD CRAB

If you **DO NOT** buy mud crab go to PART FIVE. If you **BUY** mud crabs, continue:

Do you have people working for you?  no     yes

If yes, how many?

### INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
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**Who do you buy mud crabs from?** *(Tick all that apply).*

- fishers in the village  
  fishers in other villages  
  middlemen  
  other

**Who do you buy most of your mud crabs from?** *(tick one)*

- fishers in the village  
  fishers in other villages  
  middlemen  
  other

**What is the proportion you buy from each of these sellers?**

fishers in the village   
 fishers in other villages   
 middlemen   
 other

**When you buy mud crabs from your main seller**

How do you get to the seller? <i>(tick all that apply)</i>	<input type="checkbox"/> they come to my house <input type="checkbox"/> walk there <input type="checkbox"/> boat <input type="checkbox"/> canoe <input type="checkbox"/> other
How often do you buy mud crabs from them? <i>(tick one)</i>	number: _____ times a: <input type="checkbox"/> week <input type="checkbox"/> month <input type="checkbox"/> year

**How much do you usually spend (kina) to pick up the mud crabs from your main sellers?** *(if there are no expenses put K.0)*

The participant spends (number)  kina  
 rupee  
 Australian dollars *(cross the right window)*

**How much mud crabs do you usually buy from your main sellers?**

The participant buys (number)  kg  
 crabs *(cross the right window)*

**How much do you usually buy crabs for?**

The participant buys the mud crabs for (number)  kina  
 rupee  
 Australian dollars  
 every (number)  kg  
 crabs *(cross the right window)*

**Do prices of mud crabs change?**  no  yes  
**If yes, why?** different sellers  change in crab quantities  other

#### PART FIVE. INFORMATION ON PARTICIPANT'S INVOLVEMENT IN SELLING MUD CRAB

**If you DO NOT sell mud crabs, go to PART SIX. If you SELL mud crabs, continue:**

**Who do you sell mud crabs to?** *(Tick all that apply).*

- people in the village  
  people in other villages  
  at market  
  at roadside  
  middlemen  
 exporters  
 other

**Who do you sell most of your mud crabs to?** *(tick one)*

people in the village  
  people in other villages  
  at market  
  at roadside  
  middlemen  
 exporters  
 other

### INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
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**When you sell mud crabs to your main buyers**

How do you get to the buyers? <i>(tick all that apply)</i>	<input type="checkbox"/> they come to my house <input type="checkbox"/> walk there <input type="checkbox"/> boat <input type="checkbox"/> canoe <input type="checkbox"/> other
How often do you sell mud crabs to them? <i>(tick one)</i>	number: _____ times a: <input type="checkbox"/> week <input type="checkbox"/> month <input type="checkbox"/> year
Do you process the mud crabs before selling it?	<input type="checkbox"/> no <input type="checkbox"/> yes <i>(specify)</i>

**How much do you usually spend (kina) to take the mud crabs to your main buyers? (if there are no expenses put K.O)**

The participant spends (number)    *(cross the right window)*

**How much mud crabs do you usually sell to your main buyers?**

The participant sells (number)   *(cross the right window)*

**How much do you usually sell mud crabs for?**

The participant sells the mud crabs for (number)     
 every (number)   *(cross the right window)*

**Do prices of mud crabs change?**  no     yes    **If yes, why?** different buyers     change in demand   
 other

**Can you bargain prices?**  yes     no    **If no, why?** I do not have anywhere else to sell     I owe money to buyers   
buyers     the provided me with fishing gears or other things     other

**What do you mainly use the money for? (tick one)**

food     children's education     health bills     gambling/alcohol     other

### PART SIX. INFORMATION ON PARTICIPANT'S INVOLVEMENT IN THE FISHERIES OF TILAPIA

**Do you catch tilapia?**  Yes, continue     No, go to **PART SEVEN** *(if the participant only trade and does not catch tilapia)*

*Think to all the activities you do when you go fishing TILAPIA; from when you leave the house to when you eat them or sell them:*

**If you DO CATCH tilapia, why do you catch tilapia (tick all that apply):**

food     income     social     cultural events     other

**From your answers, which is the main reason you catch tilapia? (tick one)**

food     income     social     cultural events     other

**Where do you catch tilapia? (tick all that apply)**

swamps     rivers     lakes     other

### INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
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What is the proportion you catch in each of these places? (*give a percentage*)

swamps       rivers       lakes       other

Which is the place where you catch **most of your** tilapia? (*tick one*)

swamps       rivers       lakes       other (*specify*)

When you go fishing tilapia in the place where you catch **most of your** tilapia

a. How do you get to this place? ( <i>tick all that apply</i> )	<input type="checkbox"/> boat with motor <input type="checkbox"/> paddle in canoe <input type="checkbox"/> canoe with <del>kabota</del> <input type="checkbox"/> foot <input type="checkbox"/> other
b. Which fishing gears do you use? ( <i>tick all that apply</i> )	<input type="checkbox"/> hand spear <input type="checkbox"/> <del>poison</del> <input type="checkbox"/> hands <input type="checkbox"/> trap <input type="checkbox"/> handline <input type="checkbox"/> dragnet <input type="checkbox"/> gillnet <input type="checkbox"/> other
c. How many hours do you take to get to this place? ( <i>tick one</i> )	<input type="checkbox"/> <1 <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> >5
d. In a day, how many hours do you spend harvesting tilapia once you arrive to the place? ( <i>tick one</i> )	<input type="checkbox"/> <1 <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> >5
e. In a week, how many days do you go fishing here? ( <i>if less than weekly tick N/A &amp; go to g</i> )	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> N/A
f. How many weeks each month do you fish here? ( <i>tick one</i> )	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4
g. Which months do you fish here? ( <i>tick all that apply</i> )	<input type="checkbox"/> January <input type="checkbox"/> February <input type="checkbox"/> March <input type="checkbox"/> April <input type="checkbox"/> May <input type="checkbox"/> June <input type="checkbox"/> July <input type="checkbox"/> August <input type="checkbox"/> September <input type="checkbox"/> October <input type="checkbox"/> November <input type="checkbox"/> December <input type="checkbox"/> all months <input type="checkbox"/> random months
h. Who do you go fishing with? ( <i>tick all that apply</i> )	<input type="checkbox"/> alone <input type="checkbox"/> own household <input type="checkbox"/> relatives <input type="checkbox"/> other women in village <input type="checkbox"/> other

How many **tilapia** do you usually catch at this place?

The participant catches (*number*)                   (*cross the right window*)

Have the quantities of tilapia you harvest at this place changed in the last 10 years?  no     yes

If yes, why?    too much fishing     mine pollution     changes in the environment     other

How much do you usually spend (kina) when you go fishing tilapia at this place? (*if there are no expenses put K.0*)

The participant spends (*number*)                   (*cross the right window*)

Do you put tilapia in cages after you catch them?  no     yes

What do you do with the tilapia after you catch them or take them from the cages? (*tick all that apply*)

keep to eat     share with families     barter     share at feasts     sell     other

#### PART SEVEN. INFORMATION ON PARTICIPANT'S INVOLVEMENT IN BUYING TILAPIA

If you **DO NOT** buy tilapia go to PART EIGHT. If you **BUY** tilapia, continue:



### INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
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Do you have people working for you?  no  yes

If yes, how many?

Who do you buy tilapia from? (Tick all that apply).

- fishers in the village  fishers in other villages  middlemen  people from the ships  other

Who do you buy **most of your** tilapia from? (tick one)

- fishers in the village  fishers in other villages  middlemen  people from the ships  other

What is the proportion you buy from each of these sellers?

- fishers in the village  fishers in other villages  middlemen  people from the ships  other

When you buy tilapia from **your main** seller

How do you get to the seller? (tick all that apply)	<input type="checkbox"/> they come to my house <input type="checkbox"/> walk there <input type="checkbox"/> boat <input type="checkbox"/> canoe <input type="checkbox"/> other
How often do you buy tilapia from them? (tick one)	number: _____ times a: <input type="checkbox"/> week <input type="checkbox"/> month <input type="checkbox"/> year

How much do you usually spend (kina) to pick up the tilapia from **your main** buyers? (if there are no expenses put K.0)

The participant spends (number)  kina  rupee  Australian dollars (cross the right window)

How much tilapia do you usually buy from **your main** buyers?

The participant buys (number)  kg  tilapia (cross the right window)

How much do you usually buy tilapia for?

The participant buys the mud crabs for (number)  kina  rupee  Australian dollars  
 every (number)  kg  tilapia (cross the right window)

Do prices of tilapia change?  no  yes If yes, why? different buyers  change in tilapia quantities  other

#### PART EIGHT. INFORMATION ON PARTICIPANT'S INVOLVEMENT IN SELLING OF TILAPIA

If you **DO NOT** sell tilapia, go to PART NINE. If you **SELL** tilapia, continue:

who do you sell tilapia to? (Tick all that apply).

- people in the village  people in other villages  at market  at roadside  middlemen  people from the ships  Indonesian buyers  at market  other

Who do you sell **most of your** tilapia to? (tick one)

- people in the village  people in other villages  at market  at roadside  middlemen  people from the ships  Indonesian buyers  at market  other

What is the proportion you sell to each of these buyers?

### INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
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people in the village  people in other villages  at market  at roadside   
 middlemen  people from the ships  Indonesian buyers  at market   
 other

**When you sell tilapia to your main buyers**

How do you get to the buyers? ( <i>tick all that apply</i> )	<input type="checkbox"/> they come to my house <input type="checkbox"/> walk there <input type="checkbox"/> boat <input type="checkbox"/> canoe <input type="checkbox"/> other
How often do you sell tilapia to them? ( <i>tick one</i> )	number: _____ times a: <input type="checkbox"/> week <input type="checkbox"/> month <input type="checkbox"/> year
Do you process the tilapia before selling it?	No <input type="checkbox"/> Yes

**How much do you usually spend (kina) to take the tilapia to your main buyers? (*if there are no expenses put K.0*)**

The participant spends (number)  kina    rupee    Australian dollars (*cross the right window*)

**How much tilapia do you usually sell to your main buyers?**

The participant sells (number)  kg    tilapia    strings (*cross the right window*)

**How much do you usually sell tilapia for?**

The participant sells the mud crabs for (number)  kina    rupee    Australian dollars  
 every (number)  kg    tilapia    strings (*cross the right window*)

**Do prices of tilapia change?**  No    Yes (specify) **If yes, why?** different buyers  change in demand  
 other

**Can you bargain prices?**  yes    no   **If no, why?** I do not have anywhere else to sell  I owe money to buyers   
buyers  the provided me with fishing gears or other things  other

**What do you mainly use the money for? (*tick one*)**

- food    children's education    health bills    first necessity items (salt, soap)    gambling/alcohol  
 other (*specify*)

**PART NINE. INFORMATION ON USE OF OTHER SPECIES BY PARTICIPANT**

**Apart from mud crabs and/or tilapia do you catch, hunt or harvest anything else?**

No    Yes   **If yes, which?**

Wildlife product	Market
1.	
2.	
3.	
4.	
5.	

### INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
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#### PART EIGHT. INFORMATION ON PARTICIPANT'S HOUSEHOLD AND LIVELIHOODS

What activities **do YOU do** that bring food or money to your home?

Livelihood activity	Participate
Fishing	<input type="checkbox"/> yes <input type="checkbox"/> no
Fish trading	<input type="checkbox"/> yes <input type="checkbox"/> no
Aquaculture	<input type="checkbox"/> yes <input type="checkbox"/> no
Hunting	<input type="checkbox"/> yes <input type="checkbox"/> no
Farming (includes household gardens, livestock)	<input type="checkbox"/> yes <input type="checkbox"/> no
Salaried employment	<input type="checkbox"/> yes <input type="checkbox"/> no
Tourism	<input type="checkbox"/> yes <input type="checkbox"/> no
Small business	<input type="checkbox"/> yes <input type="checkbox"/> no
Compensation	<input type="checkbox"/> yes <input type="checkbox"/> no
Remittances	<input type="checkbox"/> yes <input type="checkbox"/> no
Handicrafts	<input type="checkbox"/> yes <input type="checkbox"/> no
Other	<input type="checkbox"/> yes <input type="checkbox"/> no

From the list above, which activity is **the most** important for YOU?

From the list above, which activity is **the second most** important for YOU?

From the list above, which activity is **YOUR most stable** source of income?

From the list above, which activity earns **YOU the most** money overall?

If you could not fish would your household be affected?  no  yes

What is **the main** source of income for **YOUR HOUSEHOLD**?

What does **YOUR HOUSEHOLD** normally earn in a week  kina  rupee  Australian dollars  
 week  don't known

Is the majority of the earning from fishing or from other activities?  fishing  other activities

How much does your household receive in compensation every year?

***Personally***, what do **YOU** normally earn in a week? kina rupee Australian dollars / week

How much of this is from fisheries sources? kina rupee Australian dollars / week

Are you able to save money each week?  yes, how much? kina rupee Australian dollars / week  
 no

Have **YOU** taken any loans or borrowed cash and/or goods in the past 12 months?  yes  no, skip next question

Was the loan or borrowed cash/goods for fishing activities?  yes  no

<b>Lending source</b> <i>(if no, go to next lender. If yes, complete next two columns)</i>	<b>If yes, what?</b> <i>(tick one)</i>	<b>If yes, who made the decision to borrow from [LENDER]?</b> <i>(tick one)</i>
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### INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
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<b>Village shop</b> <input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> cash <input type="checkbox"/> goods <input type="checkbox"/> cash & goods	<input type="checkbox"/> only you <input type="checkbox"/> mainly you <input type="checkbox"/> you and someone else equally <input type="checkbox"/> mainly someone else <input type="checkbox"/> <u>only</u> someone else
<b>Friends or relatives</b> <input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> cash <input type="checkbox"/> goods <input type="checkbox"/> cash & goods	<input type="checkbox"/> only you <input type="checkbox"/> mainly you <input type="checkbox"/> you and someone else equally <input type="checkbox"/> mainly someone else <input type="checkbox"/> <u>only</u> someone else
<b>Group-based micro-finance or lending (e.g., co-ops)</b> <input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> cash <input type="checkbox"/> goods <input type="checkbox"/> cash & goods	<input type="checkbox"/> only you <input type="checkbox"/> mainly you <input type="checkbox"/> you and someone else equally <input type="checkbox"/> mainly someone else <input type="checkbox"/> <u>only</u> someone else
<b>Money lender</b> <input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> cash <input type="checkbox"/> goods <input type="checkbox"/> cash & goods	<input type="checkbox"/> only you <input type="checkbox"/> mainly you <input type="checkbox"/> you and someone else equally <input type="checkbox"/> mainly someone else <input type="checkbox"/> <u>only</u> someone else
<b>Formal lender (bank/financial institution)</b> <input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> cash <input type="checkbox"/> goods <input type="checkbox"/> cash & goods	<input type="checkbox"/> only you <input type="checkbox"/> mainly you <input type="checkbox"/> you and someone else equally <input type="checkbox"/> mainly someone else <input type="checkbox"/> <u>only</u> someone else
<b><u>Non governmental organization (NGO)</u></b> <input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> cash <input type="checkbox"/> goods <input type="checkbox"/> cash & goods	<input type="checkbox"/> only you <input type="checkbox"/> mainly you <input type="checkbox"/> you and someone else equally <input type="checkbox"/> mainly someone else <input type="checkbox"/> <u>only</u> someone else

Did you want to borrow goods or get a loan in the last year but did not?    yes    no

#### PART TEN. INFORMATION ON RELATIONS THAT CAN AFFECT PARTICIPANT

**Are you involved in making decisions about marine resource use or managing marine resources?**

*For example, have you been to any meetings about marine resources? If yes, how? (Check one box after deciding level of participation: "passive" if attends meetings but does not talk and "active" if talks at meetings)*

not involved    passive    active    leadership role

**Are you able to go fishing as often as you would like?**    yes    no

**If not, why?** I have other work to do    I have to look after my family    my husband tells me when to go    I do not have transport    other

**Who makes decisions about your fishing activities?**    only you    mainly you  
 you and someone else equally    mainly someone else    only someone else

**If someone else is involved, who?**

husband    another member in the family    non-relative

INDIVIDUAL INTERVIEW – QUESTIONNAIRE

Observer code:	Location and date:
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**Who decides what seafood to sell and what to consume in the home?**  only you  mainly you  
 you and someone else equally  mainly someone else  only someone else

**If someone else is involved, who (relationship e.g., spouse)?**

husband  another member in the family  non-relative

**Who makes decisions about how the money *YOU* earn is spent?**  only you  mainly you  you  
and someone else equally  mainly someone else  only someone else

**If someone else is involved, who (relationship e.g., spouse)?**

husband  another member in the family  non-relative

## KEY INFORMANT INTERVIEW – GUIDE

Observer code:	Location and date:
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**REMEMBER:** This question guide gives only a broad indication of questions to ask. However, you have to come up with your questions during each interview with Key Informants (KI). The kind of questions you will ask each KI will depend on

1. their role, position and specific knowledge;
2. how the discussion with the KI develops;
3. the information the KI provides;
4. the kind of involvement/input they can give to implement the project.

You can ask further questions on any interesting comments made by the participant. Is there anything you would like to know more? Can you explore further something the KI said? You can also repeat parts of the discussion that you think needs further in-depth discussion and ask participants to explain further.

Some of the issues that are important to understand are:

1. Any information (including legislation) on current markets and trade for fisheries products.
2. Any information (including legislation) on cross-border activities.
3. Any information (including legislation) on the trade with the ships.
4. Any opinion on potential fisheries market opportunities.
5. Any information (including legislation) on present and past fisheries cooperatives and other business models.
6. Any information on the cultural characteristics that might hinder the successful development of coops and characteristics that can help develop alternative business models.
7. Any opinion on business models that can work in the communities.

**To start the interview, you should ease the KI into the interview by asking generic questions**

1. Where do you work?
2. What is your position?
3. How long have you been in this position?

Continue by summarising what you have found during your trip to the villages in the Middle Fly. Be very concise but mention the limited opportunities for women and the communities to sell their fisheries products. Mention also that often the only options people have are selling to the ships or Indonesian buyers. Continue then with the first part of the interview:

### Current markets for fisheries products

- Now that you heard from me... What can you tell me about the markets for tilapia and/or mud crabs available to communities in the Middle Fly?
- Are existing markets economically viable? Why yes or why not?
- Do you know if women have the same access to these markets as men do?
- Do you know if there are regulations for the management of the trade of fisheries products? Are they enforced?

### Cross-border activities

- Do you know that one of the main markets for fisheries products available to people in the communities are the Indonesian traders? What do you know about this trade?
- Could you tell me which laws regulate the cross-border trade of marine resources?
- In which way they are breached when people cross the border to sell their products?

### Trade through the shipping companies

- Do you know that one of the main markets for fisheries products available to people in the communities is the ships along the Fly River? What do you know about this trade?

- Could you tell me which laws regulate the passage of the ships and their contact with people in the villages?
- In which way they are breached when people in the villages sell to people on the ship?

**Potential fisheries market opportunities**

- What barriers do people in the communities encounter that do not allow them to be involved in more economically viable markets?
- Do women face additional or different barriers?
- What is needed for people to be able to access more viable markets?
- Would women need something different to access the same markets?

**Present and past fisheries cooperatives and other business models**

- Do you think fisheries coops are a good business model for the communities in the Western Province?
- Do you know if there are fisheries coops in the Middle Fly? How many? Can you give me the contact details of some so that I can follow up?
- Do women participate in any coops or fisheries businesses? Do you have the contact of any women involved in the fisheries business?
- Do you know if they are active and economically viable? Why, yes? Why not?
- If they are not working well, can you explain why?

**Cultural characteristics that might hinder the successful development of coops and characteristics that can help develop alternative business models.**

- Do you think there are cultural characteristics and traditions which make it difficult for coops to work well? Can you explain?
- Do you think there are cultural characteristics and traditions which can help develop appropriate business models?
- Are the cultural reasons why women are not involved in the business?
- Are there different roles women and men perform in the business?

**Potential business models which can work in the communities**

- In your opinion, is there a business model that is more likely to be successful in the villages?
- Which characteristics should it have to be successful?
- Do you think that the same business model can work for both men and women? Why yes or why not?

**Closing question**

- Ask KI if there is anything they want to add.
- Ask KI if they know anyone else worth interviewing.
- Thank KI for the time taken during the interview.

**FOCUS GROUP DISCUSSION with WOMEN – GUIDE**

**PRINT AND FILL PAGE 1 FOR EACH SINGLE INTERVIEW YOU DO**

Observer code:	Location and date:
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Facilitator's name:
Observer's name:
Assistants' name:
<b>Facilitator:</b> <input type="checkbox"/> Give an overview of the project and the interview (from the information sheet) <input type="checkbox"/> Explain that the participants can withdraw at any time <input type="checkbox"/> Explain that there are no risks involved. In case of doubts participant can discuss with team members <input type="checkbox"/> Explain that the information discussed is <b>kept confidential</b> <input type="checkbox"/> Ask permission to use voice recorder and take photographs
<b>Consent of participants:</b> Ask participants to raise their hand if they are happy to participate to the focus group. If any of the participants does not raise their hand, explain to them politely that due to our ethics requirements they cannot take part to the focus groups and ask them to leave. Once only people who agree to be interviewed are left, tick the box below.  <input type="checkbox"/> We are happy to give information (proceed with the discussion)



Observer code:	Location and date:
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### **Current issues with value chains and constrains/issues**

*The facilitator can personalise this brief intro depending on her/his style:*

*thank the participants for their presence. Acknowledge that the time spent in the focus group has been from the daily activities. Tell them that they have been chosen as they are actively involved in the harve trade of mud crabs/tilapia and their contribution to the discussion is very valuable to make real change happen.*

*Explain to the women why they have been asked to participate to the focus group. You can start by tell them that the project's goal is to work with them and other women in the villages to develop business opportunities based on mud crabs or tilapia (depending from the village) which can be socially, econom and environmantly sustainable in the long-term, contrary to many other interventions that have been implemented in the past. If we really want to achieve this goal, the first step is to understand why previ fisheries projects and interventions failed. It is also important to understand the challenges that the wo the village daily face when harvesting and selling mud crabs and tilapia so that these challenges/proble be addressed in future interventions.*

*If you do not know the women in the communities, briefly introduce yourself (name - and role if you wa then ask the facilitation team and the women to do the same. Finally, start the discussion:*

### **Questions that can prompt discussion:**

Ask the women to think about when they leave their houses to go harvesting mud crab/tilapia (depend which community you are in): *If you have butcher paper, you can ask them to draw the fishing areas ar villages and to do a mental map which can help them to summarise their interactions with the places tl usually visit. It also makes the activity more engaging.*

- *What are the main problems/challenges you face daily (1) to go to and come back from the fishing t (2) to access the fishing grounds and (3) to conduct the fishing activities? If women use different fish grounds and face different problems/challenges list them all. You can use another piece of butcher p list all the different fishing grounds and their associated problems/challenges.*

*If they do not mention it, ask:*

- *Have your fishing activities changed because of climate change? (particularly for mud crabs/tilapia)*
- *Can you describe how did they changed?*

*If the women have identified some problems, ask:*

- *Have you or the community ever tried to address the problems you just described? List the problem mentioned earlier one by one and ask them to describe how the problems have been addressed.*
- *What were the results?*

## FOCUS GROUP DISCUSSION with WOMEN – GUIDE

### PRINT AND FILL PAGE 1 FOR EACH SINGLE INTERVIEW YOU DO

Observer code:	Location and date:
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Ok, now think about when you leave the house to go selling your mud crabs/tilapia: (*again, you can use butcher paper and ask the women to draw a mental map using the steps explained above*).

- What are the main problems you daily face (1) to go to and come back from your main market, (2) to access the markets and (3) to sell your products? *If women access different markets and face different problems/challenges, list them all. You can use another piece of butcher paper to list all the different markets and their associated problems/challenges.*

*If the women do not know what to say, you can prompt them by asking them:*

- How do culture / gender / power dynamics / government regulations (if any) or logistics affect your capacity to access to and use existing markets and income-generating activities?

*If the women have identified some problems, ask:*

- Have you or the community ever tried to address the problems you just described? *List the problems they mentioned earlier one by one and ask them to describe how the problems have been addressed.*
- What were the results?

Now let's focus on the future, and let's talk about sustainable business models for new markets (*this terminology might be a bit too complex? /how can we simplify?*) that you think can make you earn more.

- Can you describe any markets for mud crabs/tilapia that you think can make you earn more?
- Have you or other women in the village tried to reach these markets in the past? What did you do?
- What were the results?
- What would you need to access to and use these markets?

*For both facilitator and observer: use follow-up questions to further investigate any interesting comments made by the participants. Is there anything you would like to know more about? You can also repeat parts of the discussion that you think needs further in-depth discussion and ask participants to explain further.*

- Ask the participants if there is anything they want to add.

*Finish by thanking participants for their time.*

**Appendix 3 – Number of individual questionnaire, Key Informant and Focus Group Discussion participants**

<b>Region</b>	<b>Method</b>	<b>Participants</b>
Middle Fly	Individual questionnaire interviews	48 (36 women, 12 men)
	Key Informant interviews	10 (1 woman, 9 men)
	Focus Group Discussions	8 (one FGD with women in each community)
Fly River delta	Individual questionnaire interviews	41 (40 women, 1 man)
	Key Informant interviews	5 (2 women, 3 men)
	Focus Group Discussions	8 (one FGD with women in each community)
Papua Province (Indonesia)	Individual questionnaire interviews	8 (8 men)
	Key Informant interviews	2 (2 men)
	Focus Group Discussions	One FGD with 2 men

### Appendix 4 - Community workshop process

Session	Time	Activities (who)	Materials	Outputs
<b>Day 1</b>				
<b>Introductions</b>	9:00 – 10:00 1 hour	Project introduction, participant introductions, research ethics and verbal consent (OTDF)	<ul style="list-style-type: none"> <li>- Participant sheet</li> <li>- Laptop, projector and screen</li> <li>- Project presentation</li> </ul>	1. Participant sheet completed
<b>1. What are the current value chains for fisheries?</b>	10:00 – 1:00 3 hours	<ol style="list-style-type: none"> <li>1. Presentation of value chain results and maps (OTDF)</li> <li>2. Discussion about cultural and social context, opportunities and challenges (all)</li> <li>3. Discussion about resilience to shocks (all)</li> <li>4. Presentation about market trends (OTDF Business Dev Team, CSIRO pre-recorded)</li> <li>5. Presentation on Mud Crab Management Plan (NFA/District Fisheries Officers)</li> <li>6. Discussion about stocks and habitat status (all)</li> </ol>	<ul style="list-style-type: none"> <li>- Laptop, projector and screen</li> <li>- Value chain maps printed on A0 paper</li> <li>- Value chain maps hand-outs printed on A4 paper</li> <li>- Pre-recorded CSIRO presentation</li> </ul>	<ol style="list-style-type: none"> <li>1. Annotated value chain maps with opportunities and weaknesses</li> <li>2. Flip chart notes about stocks and habitat trends</li> </ol>
Lunch	1:00 – 2:00			
<b>2. What is the community vision for the business in 2050?</b>	2:00 – 4:30 2 ½ hours	<ol style="list-style-type: none"> <li>1. Groups drawing their vision for 2050 (all)</li> <li>2. Groups present their visions (all)</li> <li>3. Discussion and listing of values in visions: a) economic, b) cultural and c) environmental (all)</li> <li>4. Discussion of factors that build value chain resilience to shocks (all)</li> </ol>	<ul style="list-style-type: none"> <li>- Illustration slides to help guide participants</li> <li>- Flip chart paper and coloured pens</li> </ul>	<ol style="list-style-type: none"> <li>1. Vision diagrams</li> <li>2. Agreed list of core values a) economic, b) cultural and c) environmental on flip chart paper on wall</li> <li>3. Identification of factors building resilience to shocks on flip chart paper on wall</li> </ol>
<b>Day 2</b>				
<b>3. What are the alternative options for business models?</b>	9:00 – 12:00 3 hours	<ol style="list-style-type: none"> <li>1. Local history and experience of business models (all)</li> <li>2. Primary results from John Burton's report (John Burton pre-recorded video)</li> <li>3. Presentation of alternative models: WWF Village Savings Associations; SeaNet approach, hub and spoke model, Family Farm Teams (CSIRO pre-recorded video)</li> <li>4. Lessons learned presentation (OTDF Bus Dev Team)</li> </ol>	<ul style="list-style-type: none"> <li>- Laptop, projector and screen</li> <li>- Pre-recorded UQ and CSIRO presentations</li> </ul>	1. Range of business model options

<b>Lunch</b>	1 – 2 pm			
<b>4. What is the appropriate business model?</b>	12:00 – 1:00 2:00 - 4:00 3 hours	<ol style="list-style-type: none"> <li>1. Revisiting the agreed list of core values from Session 2: economic, cultural, environmental (OTDF)</li> <li>2. Revisiting factors building resilience to shocks from Session 2 (OTDF)</li> <li>3. Groups draw business model design, showing where values are met, and resilience created – OTDF show example first (all)</li> <li>4. Groups present back their designs</li> </ol>	<ul style="list-style-type: none"> <li>- List of core values on wall</li> <li>- List of factors building resilience to shocks on wall</li> <li>- Flip chart paper and pens</li> <li>- Example of diagrams and groups drawing on powerpoint</li> </ul>	<ol style="list-style-type: none"> <li>1. Range of business models meeting core values, and resilience to shocks <u>(Designs combined before multistakeholder workshops)</u></li> </ol>
<b>Next steps</b>	4:00 – 5:00 1 hour	<ol style="list-style-type: none"> <li>1. Discuss needs to implement models (e.g. resources, training, partnerships) (all)</li> <li>2. Planning for multi-stakeholder workshop in Kiunga (all)</li> <li>3. Workshop evaluation (four questions excluding next steps): 1) Strengths of the approach 2) Weaknesses of the approach 3) How could approach be improved 4) Has the workshop changed your thinking?</li> </ol>	<ul style="list-style-type: none"> <li>- Flip chart paper and pens</li> <li>- Evaluation questions for open discussion</li> </ul>	<ol style="list-style-type: none"> <li>1. List of resource needs</li> <li>2. Plan for implementation</li> <li>3. Evaluation results on flip chart paper (4 questions)</li> </ol>

## Appendix 5 - Community workshop participants

### Fly River delta workshop

Village	Name	Gender	Position
Buria	Morea Allen	M	
Buria	Jessie Maikau	F	
Wapi	Ipusa Buruga	F	
Wapi	Gugu Agua	M	
Aibinio	Molly David	F	
Aibinio	Pahe David	F	Kiwaba Women President
Aibinio	Kadasa Damaro	M	
Agobaro	Komane Sipi	F	Kiwaba Women V/President
Saguane	Lillian James	M	Church Leader
Saguane	Gisawo Jimmy	M	
Iasa	Gegera Peter	M	
Iasa	Sibaio Nauma	F	Women Chairlady
Iasa	Wakaka Duma	F	Treasurer
Samari	Rose Bama	F	
Samari	Naroa Enau	M	VPC Chairman
Kubira	Sarah Gaibiri	F	Community Leader
Kubira	Keapi Akuru	F	Community Leader
Kubira	Sagira Simoro	M	Church Leader

### Middle Fly workshop

Village	Participant	Gender	Position
Owa	Locks Andrew	M	Fisher middleman
Owa	Paiks Michael	M	
Owa	Namora Wandewa	F	
Owa	Seni Poloa	M	Local Trustee Observer
Kaviananga	Aqua Kelai	M	
Kaviananga	Hazel Mandula	F	
Kaviananga	Joel Kasawa	M	
Kaviananga	Kurina Aioge	F	MF Women Association Treasurer
Kaviananga	Marowai Barley	F	Women Chairlady Observer
Kaviananga	Helen Abilo	F	Observer
Kaviananga	Masola Abilo	M	VPC Kaviananga Observer
Kaviananga	George Nambai	M	MF MRCMCA Observer
Komovai	Sailas Waimona	M	
Komovai	Nela Ben	F	Local Trustee
Levame	Caleb Giawari	M	A/VPC Chairman
Levame	Jeremy Giawasi	M	
Levame	Georgina Yakola	F	
Kuem	Robin Peter	M	VPC Chairman
Kuem	Leah Gabriel	F	
Erekta	Paulus Clemes	M	
Erekta	Lyn Bap	F	MF Women Vice President
Erekta	Micah Bap	M	Youth Rep
Moian	Helen Richard	F	
Moian	Gaitanus Kambayong	M	
Moian	Richmond Joanis	M	

### Appendix 6 – Multi-stakeholder workshop process

Session	Time	Activities (who)	Materials	Outputs
<b>Introductions</b>	9:00 – 10:00 1 hour	Project introduction, participant introductions, consent (OTDF)	<ul style="list-style-type: none"> <li>- Participant sheet</li> <li>- Consent slide</li> <li>- Project presentation</li> </ul>	Attendance sheet completed
<b>1. What are the current value chains for fisheries?</b>	10:00 – 11:30 1 ½ hours	<ol style="list-style-type: none"> <li>1. Presentation of value chain results and maps – tilapia (OTDF-CSIRO-community reps)</li> <li>2. Presentation of value chain results and maps – mud crabs (OTDF-CSIRO-community reps)</li> <li>3. Discussion (all)</li> </ol>	<ul style="list-style-type: none"> <li>- Laptop, projector and screen</li> <li>- Community value chain maps printed on A0 paper</li> <li>- Value chain maps hand-outs printed on A4 paper</li> </ul>	
<b>2. Lessons learned from business development in Western Province and PNG</b>	12:00 – 1:00 1 hour	<ol style="list-style-type: none"> <li>1. Lessons learned (NFA)</li> <li>2. Lessons learned (FRPG Fisheries)</li> <li>3. Primary results from John Burton's report (John Burton pre-recorded video)</li> <li>4. Presentation of alternative models: WWF Village Savings Associations; SeaNet approach, hub and spoke model, Family Farm Teams (CSIRO)</li> <li>5. Discussion (all)</li> </ol>	<ul style="list-style-type: none"> <li>- Laptop, projector and screen</li> <li>- Pre-recorded UQ presentation</li> </ul>	
Lunch	1:00 – 2:00			
<b>3. What are the communities' proposed business models?</b>	2:00 – 3:30 1 ½ hours	<ol style="list-style-type: none"> <li>3. Tilapia community group present preferred business design and explanation (Middle Fly community reps)</li> <li>4. Mud crab community group present preferred business design and explanation (South Fly community reps)</li> <li>5. Discussion and feedback from stakeholders (all)</li> </ol>	<ul style="list-style-type: none"> <li>- Communities' diagrams of preferred business models, showing their economic, environmental and cultural values and resilience features</li> </ul>	
<b>4. How do we implement the business models?</b>	3:30 – 5:00 1 ½ hours	<ol style="list-style-type: none"> <li>1. Tilapia community group present their necessary next steps (Middle Fly community reps)</li> <li>2. Mud crab community group present their necessary next steps (South Fly community reps)</li> <li>3. Deciding on next steps and resources (all)</li> <li>4. Workshop evaluation (4 questions)</li> </ol>	<ul style="list-style-type: none"> <li>- Flip chart paper and pens</li> <li>- Evaluation questions for open discussion</li> </ul>	<ol style="list-style-type: none"> <li>1. List of resource needs</li> <li>2. Plan for implementation</li> <li>3. Evaluation results on flip chart paper (4 questions)</li> </ol>

### **Appendix 7 - Multi-stakeholder workshop participants**

<b>Organisation</b>	<b>Name</b>	<b>Gender</b>	<b>Position</b>
Provincial Fisheries	Kloney Odori	M	Fisheries Manager
District Fisheries	Wuam Elemunop	M	District Fisheries Officer
National Agency Functions	Elias Anden	M	Manager
Ok Tedi Mine Ltd.	Markson Yarao	M	Environment Riverine Management
INLOC Group	Rowan McIntyre	M	Aquaculture and Fisheries specialist
INLOC Group	Scott Taylor	M	PNG Operations Manager
Trust	Noah Tenep	M	Middle Fly Chairman
Trust	Amos Kubai	M	Kiwaba Chairman
Women & Children Association	Charlotte Mathew	F	Middle Fly President
Women & Children Association	Pahe David	F	Kiwaba President
Women & Children Association	Kurina Aioge	F	Middle Fly Treasurer
Women & Children Association	Lyn Bap	F	Middle Fly Vice President
OTDF	Andrew Mari	M	PSSD Manager
OTDF	Moses Kalup	M	M&E
OTDF	Lesley Timothy	F	Economic Development
OTDF	Moses Waiviro	M	GPS LDP
OTDF	Bala Tedumo	M	Community Development
OTDF	Veao Nami	F	Program Services Operation
OTDF	Elijah Elijah	M	Media
OTDF	Dan Dasa	M	IT
OTDF	Josephine Laka	F	Co-facilitator
CSIRO	Sara Busilacchi	F	Co-facilitator
Field work assistant	Annabella Ben	F	Komovai WSICG Leader
<b>Attending virtually</b>			
Australia High Commission	James Marshall	M	Program Manager
DCPP South Fly	Ireire Olewale	F	
ACIAR PNG Country Office	Aaron English	M	Communications Officer

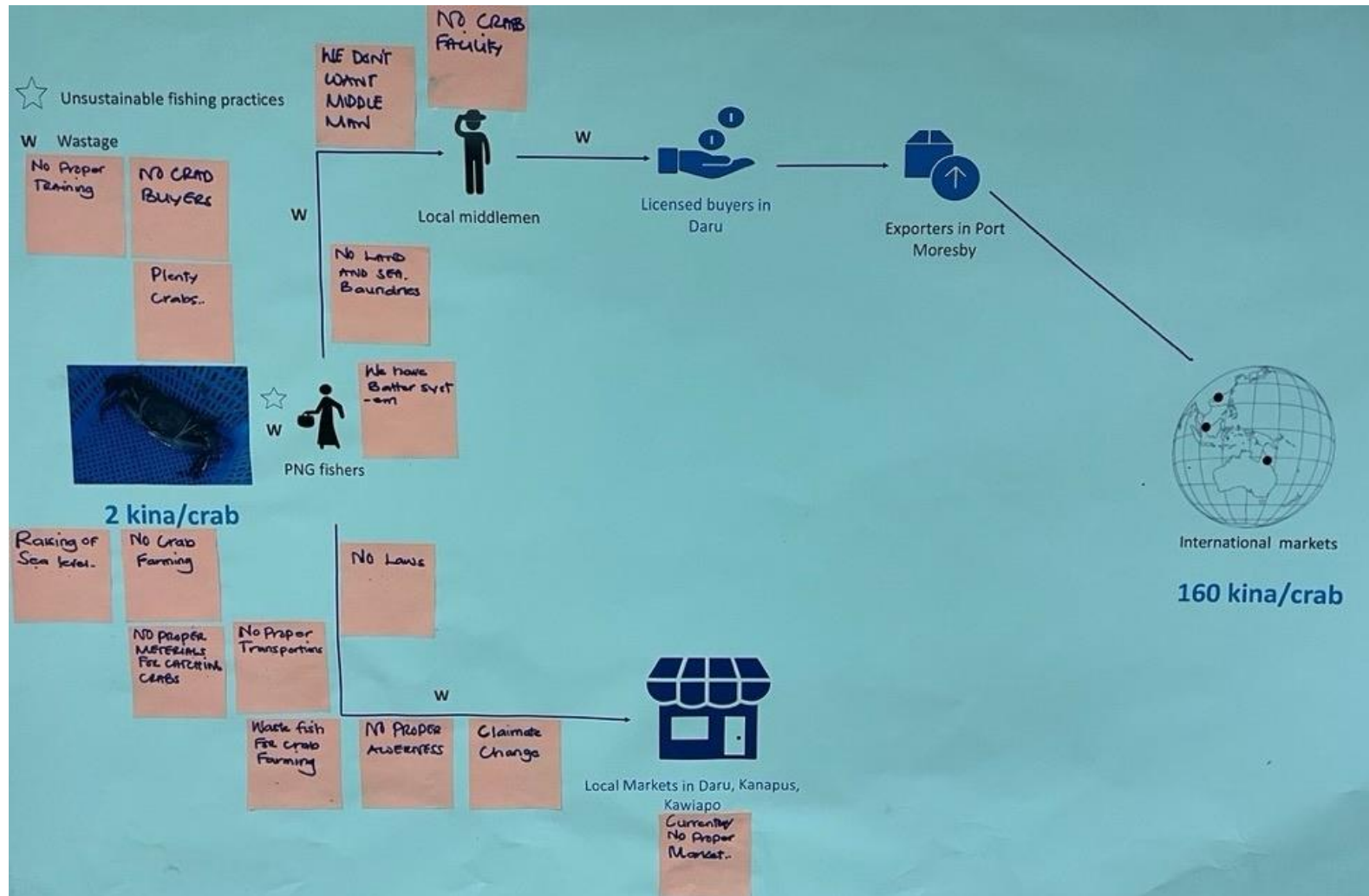


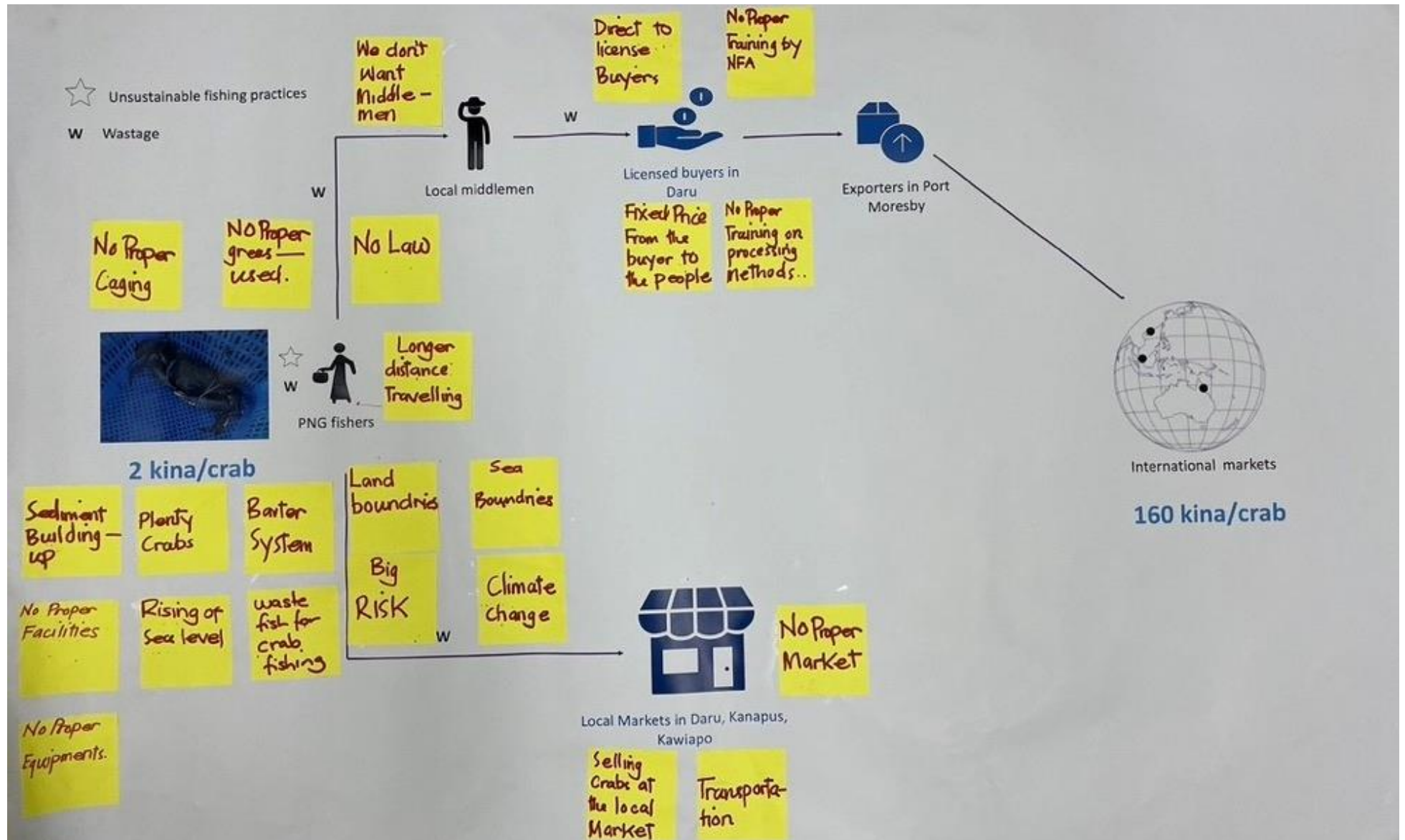
**Appendix 8 – Aquatic species that have disappeared from the Middle Fly since the introduction of tilapia, as listed by Middle Fly community workshop participants**

- Names of species which are not around or found any more here in our lakes.
- ① Estuary – stingray – NDO \*\*
  - ② Saratoga – vizu \*\*
  - ③ ~~Eel~~ Eel fish – mboma \*\*
  - ④ Papuansis – Gazi \*\*
  - ⑤ ~~Thres~~ Thryssa rastrosa – gazi \*\*
  - ⑥ Strong losser – Mad fish – Guvuga (labuki) \*\*
  - ⑦ Equinus – Ngaita \*\*
  - ⑧ Meraukensis – tobaga \*\*
  - ⑨ obbesi – yovi \*\*
  - ⑩ ~~Kra~~ Krefftii – Zale \*\* at times –
  - ⑪ Wernerii – ~~poti~~ potokakesi \*\*
  - ⑫ Rainbow fish – Kafo \*\*
  - ⑬ Ambassis agramus – bagibagi \*\*
  - ⑭ Parambassis gulliveri – gindadevi \*\*
  - ⑮ Amniataba offinis – bobi \*\* at times
  - ⑯ Hephæstus habbema – amowasi \*\*
  - ⑰ Hephæstus species – Kumasi \*\*
  - ⑱ Glossamia aprion – Pokoi \*\*
  - ⑲ Water Snakes – lavu

**Appendix 9 – Fly River delta community workshop – Session 1 annotated value chain maps**

What are the current value chains for mud crabs, the cultural and social context, opportunities, challenges and exposure to shocks?





**Appendix 10 – Middle Fly community workshop Session 1 annotated value chain maps**

What are the current value chains for tilapia, the cultural and social context, opportunities, challenges and exposure to shocks?

