

Pre-feasibility Study for Supply Chain Development, Economic Viability and CPPL Production Centre Needs Assessment



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Author(s)	Andrew Harvey, Guuske Tiktak, Frances James, Philippe Lallemand, and Stewart Sinclair
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Name	Title	Signature	Date
Frances James	Principal Consultant		30/04/24
Tracy Murai	Technical Director		30/05/24

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Acronyms

AUD	Australian dollar
CBA	Cost-Benefit Analysis
CO	Carbon Monoxide
CPPL	Central Pacific Producers Ltd
EEZ	Exclusive Economic Zone
FAD	Fish Aggregation Device
FAO	Food and Agriculture Organization of the United Nations
HACCP	Hazard Analysis Critical Control Point
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
IRR	Internal Rate of Return
KFL	Kiribati Fish Ltd
KIFL	Kiritimati Island Fish Ltd
KV20	Kiribati 20-year Vision 2016-2036
MCIC	Ministry of Tourism, Commerce, Industry and Cooperatives
MELAD	Ministry of Environment, Land and Agricultural Development
MEP	MacAlister Elliott & Partners
MFMRD	Ministry of Fisheries and Marine Resources Development
MOU	Memorandum of understanding
MSC	Marine Stewardship Council
NPV	Net Present Value
PBP	Payback Period
PIC	Pacific Island Countries

PPP	Public-private partnership
PROP	Pacific Islands Regional Oceanscape Program
SVC	Seafood Value Chain
TOR	Terms of reference
ULT	Ultra-Low Temperature
USD	US dollar
UNFCCC	United Nations Framework Convention on Climate Change
VC	Value chain
VCA	Value chain analysis
VDS	Vessel Day Scheme
WCPFC	Western and Central Pacific Fisheries Commission

Executive Summary

This report presents findings from a rapid assessment of selected Kiritimati marine commodity value chains and a pre-feasibility assessment of a CPPL production centre, focusing on tunas, milkfish, demersal fish, and lobsters. Conducted by a team from MEP during a one-week field mission in January 2024, the report includes key stakeholder interviews, data review on marine commodity export composition, needs assessment, costing exercise for the proposed CPPL production centre, and recommendations for advancing marine commodity value chains and subsequent business development steps in Kiritimati.

Of the existing marine commodity value chains in Kiritimati, lobster and milkfish appear to offer the greatest opportunity for rapid upgrading. Adequate lobster harvest production is already in place and stocks appear to be relatively stable. Investments to improve post-harvest handling, maximize quality and improve access to export markets are likely to deliver rapid returns on investment. Similarly, adequate milkfish harvest production is already in place, and Kiritimati milkfish is already recognized in markets such as Tarawa and Fiji for its superior flavour profile. However, the majority of milkfish exports from Kiritimati currently occur in the form of personal consignments, representing a potential loss of commercial and government revenue. The development of tuna and snapper / grouper value chains meanwhile is likely to be constrained by current cargo capacity limitations.

Economic feasibility of these four value chains was assessed, together with a further 11 marine resource commodities. For each commodity, cost of production and potential revenues were estimated, economic risk associated with the investment and future income flows was evaluated, and the payback period, internal rate of return and net present value were calculated. The economic feasibility assessment confirmed that lobster and milkfish value chains have strong upgrading potential, whilst also enabling various processing pathways to be evaluated. For lobster, the export of live, chilled or frozen products requires only limited capital investment whilst having strong market potential. For milkfish, investment in deboning facilities would add value whilst introducing only marginal economic risk. There also appear to be potential to develop new marine resource commodities such as farmed giant clams. In some cases, the benefits are cumulative. For example, investment in cold chain infrastructure would deliver benefits across multiple commodities, including tunas, snappers, and milkfish. Section 3 and Annexes 3-6 present the in-depth analysis of the economic feasibility.

For each of the marine commodities and their values chains, section 2 in the report presents detailed analysis under the following headings: resource status and management; harvest sector; post-harvest transport and handling; processing and market access. Then for each, there are specific recommendations made as well as a summary schematic. As a summary, the following five recommendations apply generally in Kiritimati, irrespective of the specific commodity or value chain under upgrading.

1. Implement resource conservation and management measures.
2. Efforts to upgrade the harvest sector should prioritize the development of new resource bases.

3. Improve the availability of information and training on post-harvest handling best practices in small-scale fisheries.
4. Significant investment is required to develop processing and add value.
5. Establish market opportunities prior to investing in processing facilities.

The following general recommendations apply to the upgrading of all value chains:

- 1 **Implement resource conservation and management measures** to sustain the resource base, lock in long-term returns on investment, and mitigate the risk of “boom-and-bust” development cycles seen in many similar fisheries worldwide.
- 2 **Upgrading of the harvest sector is not a priority.** In most cases Kiribati’s fishers already employ adequate harvest methods and gears. The only exception is where there is interest in developing currently unutilised resources such as deep bottom snapper or long-line tuna fisheries, where some development support may be required.
- 3 **Improve post-harvest handling** by enhancing the availability of information and training on best practices to small scale fishers, thus helping to improve product quality and value.
- 4 **Leverage the capital and capabilities of the private sector** to meet the significant investments of capital, operational expenses, human resources, technical expertise, and market development required to accelerate the development of processing and add value.
- 5 **Establish market opportunities** prior to investing in processing facilities, including by improving the branding and promotion of Kiribati seafood.

Kiribati’s national development strategies prioritizes sustainable economic growth. Kiribati Vision 2020 aims to increase investment in value added products, create a conducive investment climate to increase foreign direct investment in the fisheries sector, and improve fishery product quality and competitiveness. With these goals in mind, achieving development goals within Kiribati’s marine commodity value chains will require integrating private sector led and community-based development. Upgrading of Kiribati’s lobster and milkfish value chains is likely to deliver the greatest returns in the short term. Meanwhile developing value chains for tuna and demersal fish will require greater investments of time and capital from both the private (e.g., processing facilities) and the public sector (e.g., transport and utilities infrastructure).

1 Introduction

1.1 Outline of the assignment

Under the Pacific Islands Regional Oceanscape Program (PROP), the Ministry of Fisheries and Marine Resources Development (MFMRD) has enlisted the services of MacAlister Elliott & Partners (MEP) for a consultancy titled “Preparation of a Needs Assessment for a Central Pacific Producers Ltd (CPPL) Fisheries Centre on Kiritimati Island and Economic Assessment of Developing Sustainable Supply Chains in the Line Islands.” In line with the assignment’s terms of reference (TOR), Phase 2 involved data collection and stakeholder engagement (Task 2.1) and Value Chain Analysis of the viability of small-scale fisheries supply chains (Task 2.2).

MFMRD are in the process of developing sustainable value chain development plans for several of Kiribati’s outer islands in line with the current fisheries regulations. The assignment’s TOR outline the need for a rapid review of marine commodity value chains within the Line Islands group, and an evaluation of their viability at the pre-feasibility stage. Specific objectives defined in the TOR include:

- Assessing the status of agreed value chains based on the best available production and export data, including with consideration to resource status, production capacity, and the efficacy of existing management measures;
- Identifying potential target markets;
- Undertaking Cost-Benefit Analysis (CBA) and risk assessment, including regulatory compliance;
- Evaluating whether existing operations and supporting infrastructure are ‘fit-for-purpose’; and
- Assessing the role of key community and government stakeholders in the development planning process and the participation of women, youth and other minority or marginalized groups in the supply and trade of marine commodities.

The TOR further outlines the need for a pre-feasibility study to examine the economic viability of CPPL operating a small-scale fisheries development and production centre to land, process and assist with fish product development and marketing. The TOR call for a market-driven approach to evaluating the viability of a CPPL production centre, and defines specific objectives that include:

- Identifying potential markets;
- Proposing strategies for market access and development; and
- Undertaking a pre-feasibility assessment of the viability of a CPPL production centre, including consideration of market, technical, financial and organisational arrangements.

1.2 Overview of this report

This report presents findings from a rapid assessment of selected Kiritimati marine commodity value chains, and a pre-feasibility assessment of a CPPL production centre. The selected marine commodities were agreed with MFMRD during the inception phase of this assignment and consisted of tunas, milkfish, demersal fish (snappers and groupers), and lobsters.

A team from MEP conducted a one-week field mission to Kiritimati in January 2024. During this mission, key stakeholders were interviewed, and available data on marine commodity export composition, volumes, values, and trends were reviewed. Additionally, a needs assessment and costing exercise for the proposed CPPL production centre were conducted, with a detailed methodology provided in Annexe 1.

This report covers the following aspects:

- Identification of key stakeholders in Kiritimati's marine commodity value chains.
- Review of the current status and trends in selected value chains.
- Overview of the factors influencing the development and viability of these value chains.
- Recommendations for advancing marine commodity value chains in Kiritimati and planning subsequent business development steps.

2 Marine Commodities and their Value Chains

The fishery value chain describes the full range of processes and activities required to bring a product from harvest to final consumers (Kaplinsky & Morris, 2000). It encompasses the state of the resource and its management, as well as the harvest, transport, processing, distribution and marketing stages. This series of consecutive, value-adding steps convert raw material inputs into consumable outputs, contributing to the bottom line of value chain actors and creating competitive advantage.

Value Chain Analysis (VCA) looks at each of these steps, and examines ways to increase efficiency, reduce costs and enhance competitiveness. VCA offers insights into upgrading opportunities - that is, improvements in product quality, design or diversification that enable producers to gain enhanced value - and potential constraints to market growth and can inform the identification of strategies to increase benefits to value chain participants. The value chain perspective is important because it uncovers the totality of risks and opportunities affecting value chain participants, and offers insights into various drivers of change, including those arising from governance, market access, and small-scale producers' competitiveness in changing markets (Jacinto & Pomeroy, 2011).

This chapter reports on findings from a rapid assessment of selected Kiritimati marine commodity value chains. This report primarily focuses on those value chain steps that occur on Kiritimati itself i.e., the resource management, harvest, transport, processing, and market access steps. Downstream issues, including consumer preferences and market trends, are not fully addressed in this pre-feasibility assessment but remain important areas of investigation that should be considered at the full feasibility assessment stage.

2.1 Tuna and tuna-like species

Kiritimati's tuna value chains are characterised by two distinct type fishery types (Figure). Large-scale purse seine and long-line vessels operating within Kiribati's exclusive economic zone (EEZ) under the Vessel Day Scheme (VDS) occasionally land catches at the port of Ronton, which are then transferred to CPPL for freezing and sale to local markets. Additionally, a small-scale troll and handline fishery targets tuna for personal consumption, local market sale, and supply to CPPL.

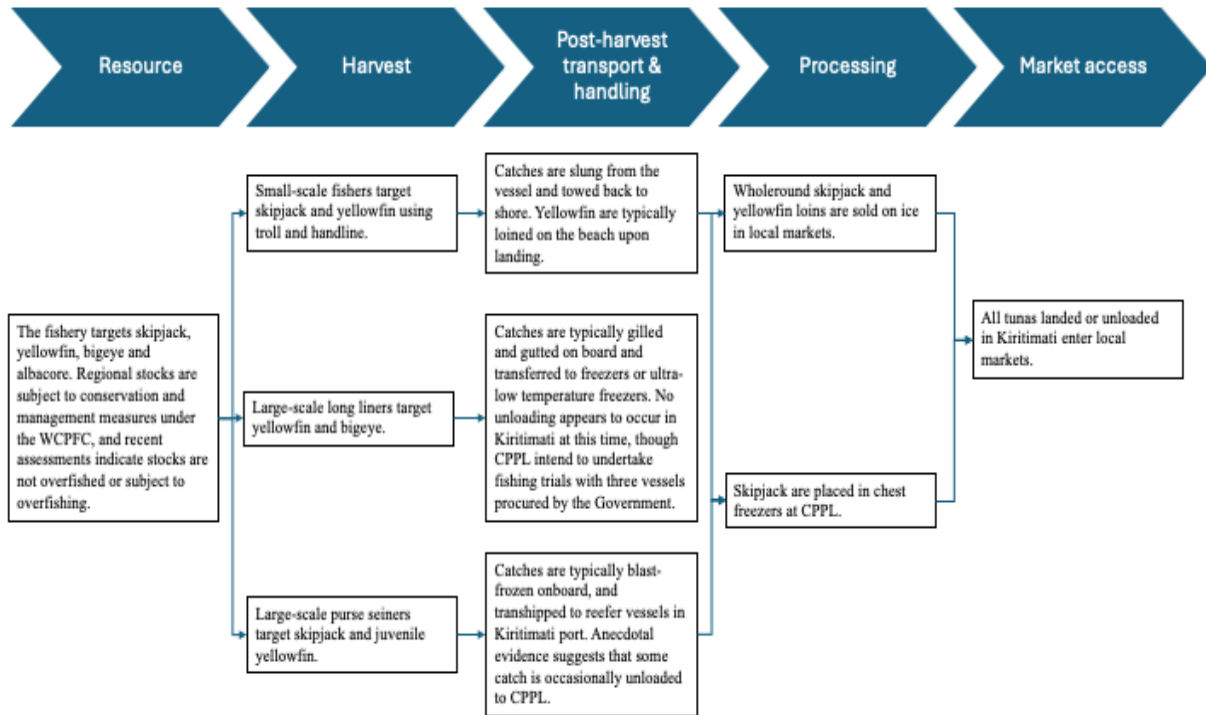


Figure 1: Schematic representation of Kiritimati's tuna value chains.

2.1.1 Resource status and management

Regional tuna stocks are assessed to be stable. The most recent Western and Central Pacific Fisheries Commission (WCPFC) stock assessments for albacore (2021), skipjack (2022), yellowfin (2023) and bigeye (2023) indicate that stocks are not overfished nor subject to overfishing. Consequently, there may be scope to expand domestic tuna fisheries. However, caution is warranted, especially for skipjack. Within the WCPFC area of competence skipjack fishing mortality has increased while spawning potential has declined since the mid to late 2000s. If these trends continue implementation of regional stock recovery and rebuilding strategies may be required, which are likely to impact the long-term viability of domestic skipjack value chains.

2.1.2 Harvest sector

Purse seine caught skipjack dominates Kiribati's tuna production. The domestic purse seine fleet has gradually increased in recent years, reaching 26 vessels in 2022, the majority of which are 1,000 GRT or larger (MFMRD, 2023). These vessels are operated through joint venture or charter arrangement with fishing partners that include Korea and China. In addition, Kiribati issues around 200 licences every year to purse seiners operated by distant water fishing nations, though this number dropped to 131 vessels in 2022. Domestic purse seine production fluctuates around 200,000 mt per year, with skipjack comprising more than 80 percent, and yellowfin and bigeye forming most of the remainder. Fishing effort is concentrated in the Gilbert Islands group. Under special access arrangements, some purse seine companies are required to land a certain portion

of their catch, usually in the form of frozen skipjack. Most of this is currently landed in Tarawa and processed by Kiribati Fish Ltd (KFL), a joint venture between the Government of Kiribati, Golden Ocean (Fiji) and Zhejiang Ocean Family (China). Some purse seine catches appear to be landed in Kiritimati for processing by CPPL, however, the consultants were not provided with data on the volume or frequency of these unloadings. There is potential for skipjack unloadings to increase in Kiritimati in the future, particularly once Kiritimati Island Fish Ltd (KIFL), a new joint venture company, has established processing facilities and the planned port developments at Poland are complete.

Longline fishing effort is concentrated around the Line and Phoenix Islands. Kiribati's EEZ is famous for longline fishing targeting premium grade tunas of yellowfin and bigeye. The domestic longline catch has increased over the past five years, totalling just over 8,000 mt in 2022, and dominated by bigeye (32%), albacore (26%) and yellowfin (30%) (MFMRD, 2023). In the past, the longline fleet was dominated by foreign operators licensed under bilateral access arrangements, with the majority from Asian countries such as Japan, Korea, and China. Closure of the fishery by Kiribati in 2017 resulted in operations ceasing for all longline companies except KFL/KIFL chartered vessels. The domestic longline fleet reached its maximum size in 2020 (47 vessels). It has since reduced to 34 vessels, largely due to the non-operation of vessels normally chartered by KFL and KIFL. In 2019 the Government purchased three longline vessels that are expected to contribute to domestic tuna production and exports through KFL. Trials are planned for CPPL to assess the viability of these vessels in waters surrounding the Line and Phoenix Islands, with a long-term aim of developing and expanding the longline fishery if trials are successful. These trials have not yet commenced. Importantly, while fishing trials will provide essential information on potential production volumes, the current state of Kiritimati's processing and export facilities mean that the trials are likely to provide only limited insight into the full economic potential of the fishery.

The small-scale fishery plays an important role in local communities for economic and food security, but data are limited. Fishers troll for skipjack and use vertical handlines to target bigeye and yellowfin. Vessels are typically less than 7 m in length, constructed from wood, and powered by 15-40 hp outboard engines. Despite its importance, challenges in acquiring sufficient and representative data mean that reported statistics for this fishery are based on very approximate estimates (MFMRD, 2023). Total annual production nationally is estimated at around 4,000 mt per year, comprising equal proportions of skipjack and yellowfin. In 2015 the total number of small-scale tuna vessels nationally was estimated at 1,911. Catch and effort data for the Kiritimati fishery were not made available to the consultants. The majority of Kiritimati's small-scale tuna production appears to enter local markets and to supply household consumption needs. In recent years there have been efforts to upgrade the small-scale fishery, including through the deployment of nearshore fish aggregation device (FAD). Data on the efficacy of nearshore FAD trials were not made available to the consultants. The development of a nearshore FAD fishery in Kiritimati has the potential to deliver economic and livelihood outcomes at the community level, whilst also generating a low-volume, high-value product with potential for brand development in export markets. However, there is also a risk of competition and conflict with the

proposed development of the longline fishery if management and zoning measures are inadequate.

2.1.3 Post-harvest handling and transport

Most purse seine and longline vessels appear to apply good handling practices. These vessels have facilities such as blast freezers, cold storage or chillers on board, and are routinely assessed for Hazard Analysis Critical Control Point (HACCP) compliance by Kiribati's competent authority. However, ongoing dissemination of information and training to domestic crew are essential to ensure that standards and compliance are maintained.

Improvements in onboard handling are required if small-scale catches are to enter formal value chains. Kiritimati's small-scale tuna fishers do not appear to use onboard ice. Instead, the tuna is slung from the vessel, towed back to shore, and loined on the beach. Such post-harvest handling techniques are unlikely to deliver the rapid cooling and maintenance of body temperature below 4°C that is essential to prevent histamine development and maintain product to a higher quality. Consideration could be given to improving the availability of information and training on best handling practices within the small-scale fishery. Due to the small size and limited hold space onboard these vessels, consideration could be given to onboard loining and chilling using ice slurry, techniques that have proven successful in similar small-scale, export-oriented tuna fisheries worldwide.

2.1.4 Processing

Minimal processing and value addition of tuna currently occurs on Kiritimati. Most small-scale catches appear to be sold fresh on ice. CPPL is the only facility on Kiritimati that currently has the capacity to process tuna at volume. While CPPL has a flake ice maker, blast freezer and cold storage, only the ice maker is currently operational. The blast freezer and cold storage are reported to have been inoperable for several years due to limited availability of compressor spare parts, refrigerants (R22 freon), and service technicians. If efforts are made to service and refurbish compressors, consideration should be given to global commitments to phase down hydrofluorocarbon (HFC) (e.g., R22) and hydrochlorofluorocarbon (HCFC) (e.g., R404a) refrigerants under the Montreal Protocol of the United Nations Framework Convention on Climate Change (UNFCCC), of which Kiribati is a signatory. With blast freezers inoperable, CPPL's current practice is to place tuna in chest freezers. CPPL landing data indicate that around 80,000-90,000 kg of oceanic fish are landed and processed annually (Figure), with the majority of this assumed to be skipjack. The data made available to the consultants appear to only account for vessels operated by CPPL and do not reflect any of the landings offloaded from purse seine vessels that are reported to occur.

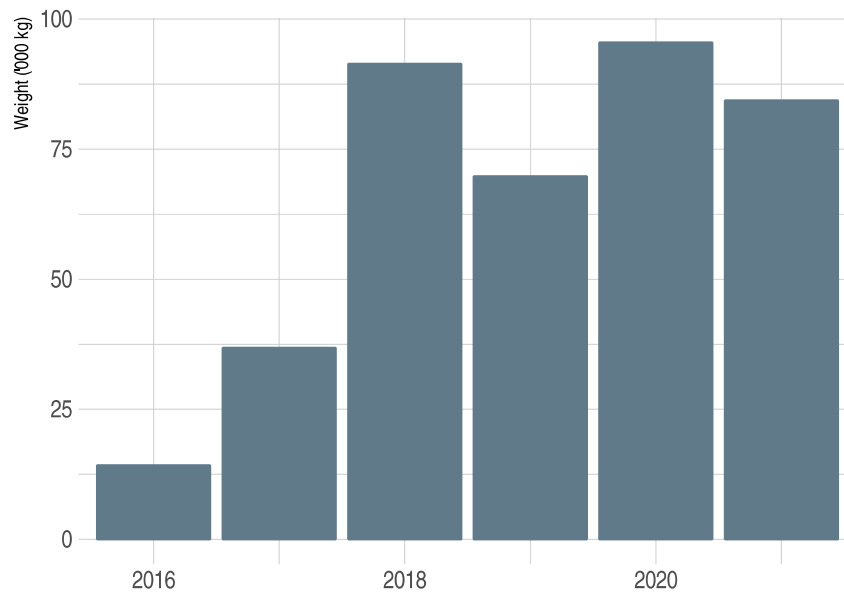


Figure 2: Annual landings of pelagic species to CPPL. Source: CPPL landing records.

Current processing facilities are inadequate for supplying export markets. Given the relative proximity to the large US and Asian tuna markets, opportunities exist on Kiritimati for tuna processing, value-addition and export. Processing could include CO injection, loining, and preparation of frozen filets or super-frozen sashimi. With the existing blast freezer and cold storage facilities inoperable, CPPL’s ability to process products for these markets is limited. Furthermore, CPPL currently lacks a climate controlled and HACCP compliant processing floor. Current production volumes are likely insufficient and too volatile to support a strong business case to address these deficiencies. However, this may change soon. Purse seine access arrangements could be structured to encourage greater skipjack unloadings once the planned port developments at Poland are complete, while yellowfin and bigeye supply are likely to increase as a result of the planned developments of the longline and coastal FAD fisheries. Undertaking fishing trials would provide the data needed to inform production estimates for the longline and coastal FAD fisheries and to prepare detailed feasibility assessments for upgrading the post-harvest sector. Improving processing facilities will require investment in capital expenditure and operating expenses, as well as human resources, technical expertise, and linkages to target markets. Leveraging private sector capabilities would help Kiritimati to address the requirements and has proven a successful strategy elsewhere in Kiribati (e.g., KFL and Pacifical signed a Memorandum Of Understanding (MOU) in 2017 for the processing and export of Marine Stewardship Council (MSC) certified tuna).

2.1.5 Market access

Kiritimati's tuna landings currently remain with local markets. Fresh yellowfin or frozen skipjack are sold within local markets for household consumption. MFMRD export and quarantine statistics indicate very low export of tuna, with less than 1,000 kg per year of the “oceanic fish” category exported to Tarawa and Fiji respectively in the form of personal consignments.

Tuna could make an important contribution to national food security, but consideration should be given to the impact on existing domestic markets. Anecdotal reports suggest that large-scale fishing vessels occasionally unload skipjack which are frozen by CPPL and sold into the local Kiritimati market at prices well below prevailing market rates. Interviews with fishers suggest that this skipjack competes with landings from small-scale fisheries and may contribute to product spoilage and loss. While the strategic introduction of frozen skipjack into the local market could help to reduce fishing effort and enhance the sustainability of vulnerable coastal fishery stocks, or to enhance food security during seasons of low coastal fishery productivity, further investigation of local market dynamics, demand and prices is needed to inform these strategies. Perhaps more importantly, value-added processing of skipjack—particularly the creation of more stable products with longer shelf lives such as through canning—would likely minimize short-term competition with and impacts on local markets.

Transport is a major constraint to export market access. Airfreight is expensive, and with Kiritimati receiving only one international flight per week there is already high competition for cargo capacity amongst passenger luggage and other export commodities. These costs and volume constraints will significantly affect the competitiveness of Kiritimati's tuna exports, and hence the feasibility of upgrading strategies. Containerisation of frozen or canned tuna may be a viable alternative once the planned port developments at Poland are complete, provided sufficient production volumes and economies of scale can be achieved. A more comprehensive forecasting and feasibility assessment should be undertaken once port development plans are finalised and data from fishing trials become available.

Opportunities exist to enhance Kiritimati (or Kiribati) seafood brand recognition. Kiritimati's long-line and small-scale tuna fisheries possess several qualities that contribute to a compelling brand profile. The island's remote location evokes images of pristine and healthy environments and healthy foods, while its artisanal fishery and short value chains contribute to brand qualities of sustainability, traceability, and social responsibility. These qualities could be harnessed to create a strong and globally recognised Kiritimati tuna brand, possibly in combination with ecolabel certification such as MSC or Fair Trade if certification costs are viable. These qualities also apply to other marine commodities from Kiritimati and throughout Kiribati. Consideration could be given to creating a Kiribati Seafood brand identity spanning multiple commodities and promoting the brand through greater participation in international seafood expos in collaboration with Ministry of Tourism, Commerce, Industry and Cooperatives (MCIC). A comprehensive feasibility assessment should be undertaken to investigate market demand and costs associated with brand development and promotion.

2.1.6 Recommendations

Prioritise management objectives for domestic tuna fisheries. Kiribati's policy and regulatory frameworks outline broad objectives for fisheries development. These include objectives specified in the National Coastal Fisheries Roadmap 2019–2036 which include empowered communities; effective coastal governance; healthy and productive coastal fisheries; and vibrant, healthy, wealthy, and responsible people. However, objectives do not appear to be prioritized, inhibiting the ability of decision makers to objectively evaluate trade-offs between competing fishery development and upgrading strategies. Kiritimati's tuna value chain faces several possible upgrading pathways. For example, developing the nearshore FAD fishery could deliver community development objectives, developing canneries to process purse seine caught skipjack could deliver food security objectives, whilst developing facilities to process long-line caught tuna loins could deliver investment and foreign trade objectives. Prioritisation of management objectives, possibly under the auspices of a coastal tuna management plan, would enable trade-offs to be evaluated and the most appropriate upgrading pathway (or combination of pathways) pursued. The Kiribati 20-year Vision 2016-2036 (KV20) places a strong emphasis on maximising economic returns from sustainable fisheries and marine resources, and the recommendations presented are made with these objectives in mind.

Implement fishing trials as a matter of urgency. The Government of Kiribati purchased three long-line vessels in 2019, and fishing trials in waters surrounding the Line and Phoenix Islands are planned. These trials should be undertaken as soon as possible. The trials will help to build crew capacity and enable logistics and human resourcing needs to be evaluated. Perhaps more importantly, they will also enable vessel production efficiency and capacity to be assessed, providing crucial data to inform production estimates and feasibility assessments. Given the large capital investment required to develop canning or loining facilities, the availability of data on production volumes is essential to guide investment planning.

Improve the availability of information and training on best handling practices for small-scale fishers. If catches from the small-scale sector are to eventually enter formal value chains, post-harvest handling practices will need to be improved. Most importantly, fish should be rapidly chilled onboard and maintained at <4°C to maintain product quality. Development strategies for the nearshore FAD fishery should incorporate training on best handling practices to ensure that cold chain integrity and HACCP compliance is maintained throughout the value chain. Consideration could also be given to enhancing traceability through improvements in catch recording and marking.

Undertake comprehensive feasibility assessments once data are available. Some key information is not currently available, including development plans for the new port and transshipment hub at Poland (likely a critical enabling infrastructure for the development of Kiritimati's tuna value chain), the results of long-line fishing trials, and production volumes from the nearshore FAD fishery. Once these data are available, comprehensive feasibility assessments should be carried out to evaluate the various upgrading pathways, including the development of canning facilities for purse seine caught skipjack or loining facilities for long-line and hand-line

caught yellowfin. These feasibility assessments will not only inform government planning, but can also aid in attracting private sector partners and investment.

Develop partnerships with the private sector. Operationalizing new processing facilities will require investment in capital expenditure and operating expenses, as well as human resources, technical expertise and linkages to target markets. The capabilities of the private sector are well positioned to assist the government in fulfilling these requirements. Consideration could be given to developing a favourable enabling environment to attract private sector investment and partnerships, building on lessons learned from joint ventures, public-private partnership (PPP), and similar arrangements elsewhere in Kiribati.

2.2 Lobster

Kiritimati’s lobster fishery is characterised by artisanal, selective harvest methods and relatively short value chains with few intermediary actors (Figure Figure 3). The value chain is dominated by two main actors: CPPL and Skylight Ltd. The main products are live lobsters, exported primarily to the US market, and frozen lobster tails, primarily for the domestic market.

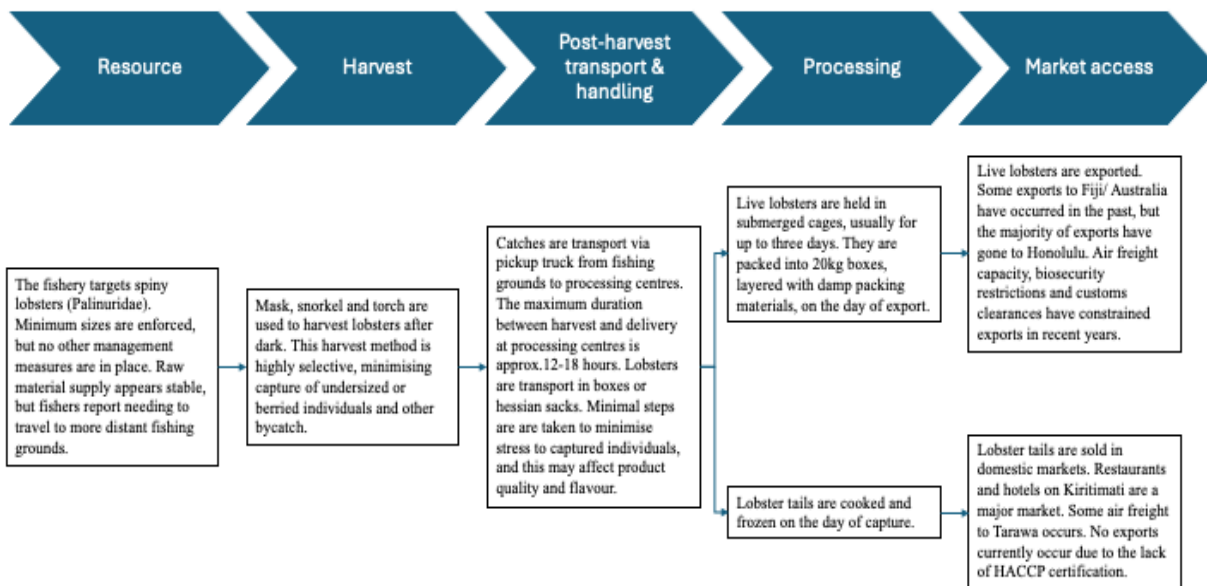


Figure 3: Schematic representation of Kiritimati’s lobster value chains.

2.2.1 Resource status and management

Kiritimati’s lobster stocks appear to be stable, though some localised over exploitation may occur. Processors report a steady supply of raw material, and a perception that stocks are in a good condition. However, fishers report that it is increasingly difficult to find lobsters on the western coastline around Ronton, and that they are having to travel to more distant fishing grounds to sustain catches. The fishery targets spiny lobsters (family Palinuridae). The

geographic ranges of *Panulirus femoristriga*, *P. homarus*, *P. longipes*, *P. ornatus*, *P. pencillatus*, and *P. versicolor* are reported to overlap the coastal waters of Kiribati.¹ Catches are reported to be dominated by *P. pencillatus* and *P. versicolor* (MFMRD, 2017). The consultants were unable to verify the composition of any catches during this mission.

No formal stock assessments appear to be currently undertaken. Indeed, there is a lack of information on spiny lobster landings throughout the Pacific Island Countries (FAO, 2020). MFMRD has implemented a catch monitoring program, and records data on all lobsters obtained by CPPL. MFMRD enumerators record the number of males, females and berried females and the total catch weight. While these data are not sufficient for stock assessment purposes, the monitoring program could be readily expanded to provide the necessary data. Essential parameters include species and size (carapace length or weight) of individual lobsters. Catch volumes are relatively small, making it feasible to measure all individuals, though a sampling regime could be designed and implemented if production volumes are expected to increase.

No harvest strategy is currently implemented. *Panulirus* is a designated fishery under the Fisheries Act 2010, and hence requires implementation of a management plan. The Fisheries (Conservation and Management of Coastal Marine Resources) Regulations 2019 specify a minimum carapace length at harvest of 85 mm. A harvest plan has been drafted (MFMRD, 2017), is being prepared for implementation, and specifies an annual catch limit of 16,560 individuals for Kiritimati and a 2-week seasonal closure of the fishery every July. The scientific rationale for these measures is not provided, and no reference points are defined in the plan that would enable (i) catch limits to be scaled up or down based on resource status; and (ii) the harvest strategy to be monitored, evaluated and adapted. An effective harvest strategy is the foundation of a competitive fishing industry, and can be instrumental in attracting investment, securing livelihoods, and growing foreign exchange and government revenue potential. Perhaps most importantly, a harvest strategy is the primary tool via which the resource base is sustained, enabling returns on the fishery's value adding investment to be maintained. Investors in the fishery will want to be assured that assumptions around sustainable yields (in this case, 16,560 individuals per year) are justified.

The current health of Kiritimati's lobster resources, if maintained, offers a competitive market advantage. Globally, exploitation rates for spiny lobsters are high—e.g., 0.71 – 0.83 for *P. argus* in Mexico (Sosa-Cordero *et al.*, 1996), 1.43 for male and 0.8 for female *P. polyphagus* in India (Kagwade, 1994), and 0.92 – 2.30 for *P. cygnus* in Western Australia (Wright *et al.*, 2006). All commercial *Panulirus* fisheries are now considered fully exploited (Phillips *et al.*, 2013), and with little potential to increase production there has been a strong trend towards value-addition—usually by marketing live lobsters to the highest paying customers, often in distant markets. Regulations in some commercial lobster fisheries have been extreme—for example lobster (*P. marginatus*) fishing was halted in the Hawaiian Islands in mid-2000s, with subsequent impacts on

¹ <https://www.sealifebase.se>. Accessed February 2024

livelihoods and economies (Phillips *et al.*, 2013). A robust and precautionary harvest strategy would help to prevent the over-capitalisation, overfishing and subsequent resource depletion that has contribute to the “boom-and-bust” cycles that characterise many lobster fisheries worldwide. Implementing the draft harvest plan, and continuing to strengthen and refine it over time, should be a priority for this fishery.

2.2.2 Harvest sector

The artisanal harvest methods employed in the fishery are adequate, and not a priority area for upgrading. Kiritimati’s lobsters are harvested by hand, with fishers descending from the beach using a mask, snorkel and flashlight to hunt for individuals after dark. The Fisheries (Conservation and Management of Coastal Marine Resources) Regulations 2019 prohibit the use of SCUBA, hookah or other underwater breathing apparatus. These artisanal harvest methods are highly selective, ensuring that only individuals of the correct size are caught, and minimising harvest of berried females and other bycatch. In other countries where SCUBA gear is used, there are considerable health and safety concerns that have compromised the reputation of this sector. Furthermore, this artisanal, traditional, and selective method of fishing offers a compelling story that could aid product differentiation and marketing in some markets. While these harvest methods are very labour intensive, the introduction of more efficient gears, such as pots and traps, is likely to have a negative impact on job creation, sustainability, and product differentiation objectives. If upgrading in the harvest sector is to be considered, investments to improve the health and safety of fishers should be prioritised.

2.2.3 Post-harvest handling and transport

Improvements in post-harvest handling would increase product quality and value. The duration between harvest and processing is relatively short. Fishing operations typically commence at sunset and may continue until sunrise. Lobsters are then transported by pickup truck to processing centres. The maximum time between harvest and product entering the processing facilities is around 12-18 hours. However, fishers do not appear to implement any methods to minimise stress to the lobsters during this period. The body condition and health status of lobsters are particularly important when traded live. Suboptimal handling techniques not only reduce the viability of live lobsters during transport but can also affect meat flavour and quality for both live and processed lobsters. An extensive literature describes the physiological responses of lobster due to handling and emersion from water (Fotedar *et al.*, 2006; Jussila *et al.*, 1997; Lorenzon *et al.*, 2007; Paterson & Spanoghe, 1997; Speed *et al.*, 2001; Whiteley & Taylor, 1992). Dry storage of lobsters inhibits oxygen absorption and respiration, elevates levels of stress hormones, and leads to retention of toxic waste substances in the blood. These can taint meat flavour and, in some cases, result in necrosis and loss of meat. Steps could be taken during the post-harvest phase to minimise stress and hence maximise product quality. Ideally lobsters should be maintained in dark, cool, and damp conditions and protected from drying out during post-harvest handling and transport. Small adjustments could quickly be made to current post-harvest handling practices in the fishery. Priorities include (i) keeping lobsters away from direct sunlight; (ii) covering catches with hessian sacks, carpets, or other porous material; and (iii) regularly drenching with seawater during storage and transport. Transferring lobsters into

submerged cages or sprinkler tanks for 24-48 hours prior to processing or export would further aid in flushing waste products and stress hormones from the body, contributing to improved quality and flavour.

2.2.4 Processing

Two end products are currently produced: live lobster and frozen lobster tails. The two companies involved in Kiritimati's lobster fishery currently pursue very different processing strategies. CPPL produces frozen pre-cooked lobster tails for domestic markets, while Skylight exports live lobsters (though due to transport restrictions during the Covid19 pandemic and subsequent challenges obtaining customs clearances in export markets, the company has not exported since 2019). CPPL does not currently possess a HACCP certification and is consequently unable to export lobster products. Furthermore, due to challenges sourcing R22 freon and maintaining compressors, CPPL blast freezer and cold storage are not currently operational, and the company is only able to process and freeze volumes that can be accommodated in several household chest freezers. Within both companies, harvests are typically to order. CPPL places orders with fishers depending on processing needs. Skylight typically begin harvesting three days prior to scheduled flight departures with catches maintained in submerged cages until packing.

Opportunities exist for further product development and value addition. Lobster processing typically generates a large quantity of by-products (heads, shells, livers, and eggs) which account for 50-70 percent of the starting material. Opportunities may exist to develop new value-added products from materials that are typically underused or discarded as waste (i.e. residual meat, shell, haemolymph and other liquids). Options include seafood products for human consumption such as tomalley, bisque or stock from discarded lobster heads, or the production of petfood or animal feeds. Many lobster by-products are rich in high-value compounds such as proteins, chitin, lipids, minerals, and pigments. These compounds are useful for numerous applications including water treatment, agriculture, food, nutraceutical, pharmaceutical products, and biomedicine (Nguyen *et al.*, 2017). Economic recovery of these valuable components to produce value-added products could lead to new opportunities for commercialization and job creation in Kiritimati, while also increasing the value of raw material. However, some products (e.g., pharmaceuticals and biomedicines) require greater capital investment and technical expertise than others, and suitability should be evaluated carefully.

2.2.5 Market access

Market access is constrained by cargo capacity, compliance with export market requirements, and cost of production. Three main markets are served by Kiritimati's lobster fisheries: (i) export markets for live lobster; (ii) domestic markets for cooked and frozen tails; and (iii) foreign flagged vessels anchored in Kiritimati waters that purchase live lobsters for consumption onboard. Maximum annual exports are around 3,000 kg (Figure). Significant market development and value addition opportunities appear to exist, but realising their full potential will require several functional constraints to be reviewed and addressed. These include:

Transportation. Air freight places constraints on the number and size of units that can be exported. Skylight report that their maximum historical exports have been 20-30 x 20 kg boxes per flight (consisting of both live lobsters and frozen finfish). Frozen tails can be packed more densely than live lobsters, aiding freight, but this advantage may be offset by the lower market price of frozen tails relative to live lobsters. In addition, air freight capacity is often limited, with high competition from other users such as marine aquarium fish exports and passengers. Surface freight is available, with Kiribati Port Authority reporting that Kiritimati receives one container ship approximately every four months—of the c.200 containers that are loaded/unloaded, typically less than ten are refrigerated. While these reefers are used to transport perishable items to Kiritimati, it is unclear whether these containers return from Kiritimati empty or full.

Customs clearance. Export businesses report that Air Kiribati, as the ground agent for the Fiji Airways flight to Honolulu, has not allowed seafood or live fish to be loaded onto the flight, citing lack of customs clearance in Honolulu. During the field mission the consultants were not able to fully investigate this issue, which represents a significant barrier to export development.

Export quotas, fees and levies. Anecdotal reports indicate that MFMRD intends to implement an export quota fee, with prices set as a percentage of market price. Fishing represents the harvest of a public good, and it is appropriate to recover costs from the fishing industry via non-tax state revenues to e.g., cover the costs of resource management. However, when setting prices it is important to consider the full suite of development objectives, which include job creation and economic growth in addition to generating government revenues. Global experience shows that when the pricing is not fully aligned with development objectives, fees and levies can hinder growth, with businesses taking the decision that exports are not economically viable. Setting prices is notoriously challenging, often requiring costly analysis and forecasting. Other approaches, including quota auctions, have proved to be more efficient in some circumstances. Consideration should be given to evaluating the range of options that are available to the Government to recover costs and maximise non-tax revenues without undermining other development objectives or the economic viability of exports.

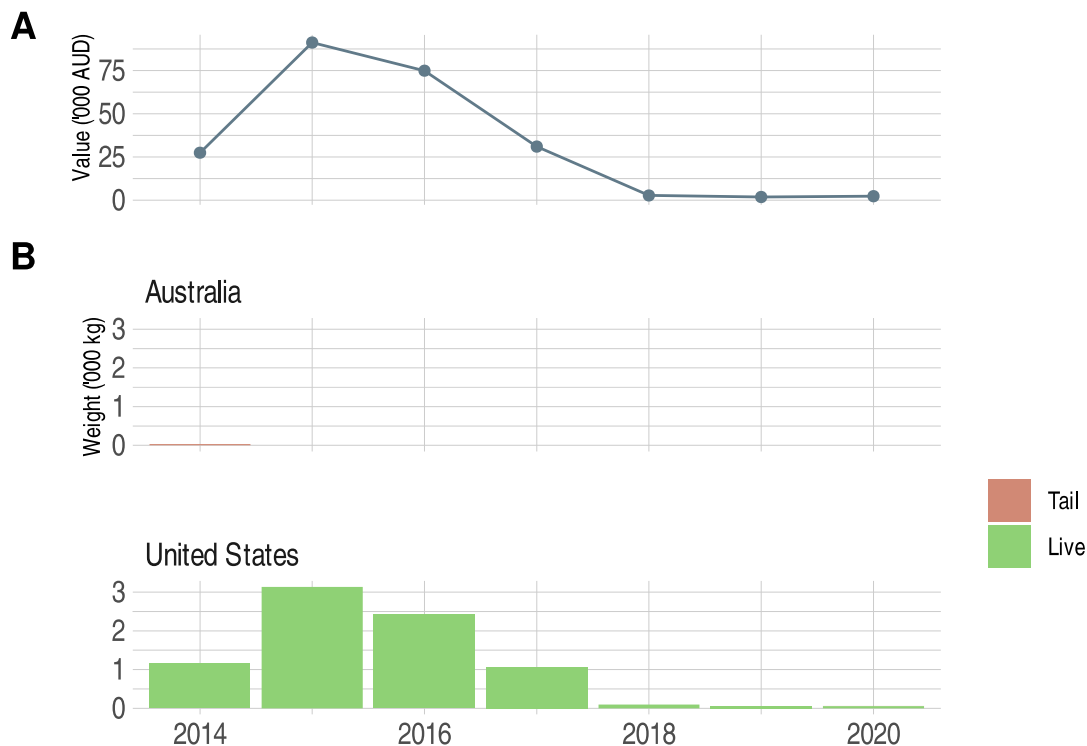


Figure 4: Value (A) and volume (B) of lobster exports from Kiritimati, with the main markets and product types shown. Source: MFMRD quarantine statistics.

2.2.6 Recommendations

Implement a harvest strategy with clearly defined reference points and harvest control rules. A harvest plan is being drafted and prepared for implementation, and this good progress should be maintained. In parallel, however, consideration should be given to identifying opportunities to improve and refine the plan, in preparation for periodic review cycles. An important priority is to ensure that transparent and well-understood mechanisms are in place to increase or decrease annual production quotas in response to changes in stock status. This would also require monitoring programs to be in place that are able to deliver all the data needed to evaluate stock status.

Improve the availability of information and training on post-harvest handling best practices. Small and low-cost adjustments to post-harvest handling practices are likely to increase the quality and value of Kiritimati’s lobster products. Two key areas for improvement should be investigated. During post-harvest transport efforts to keep lobsters cool, away from direct sunlight, and regularly inundated with seawater would minimise stress, while maintaining lobsters in sprinkler tanks or submerged cages for 24-48 hours prior to processing or export would aid in flushing stress hormones and waste products.

Undertake a detailed feasibility assessment of value addition and market development options. A number of potential value-added products could be pursued in Kiritimati, some of which would enable the recovery and use of current by-products and waste materials. These

include tomalley, bisque and the production of petfood or animal feeds. However, opportunity costs should be carefully considered, particularly in those cases where there is potential for competition between value-added products. For example, if raw material availability is constrained, such as due to harvest quotas, it is currently unclear whether simultaneous production of both live lobster and frozen lobster tails would remain viable. Similarly, the cargo constraints that currently exist in Kiritimati will impact economic performance. These issues, and their impact on the long-term feasibility and return on investments in the post-harvest sector, should be thoroughly investigated.

2.3 Milkfish

Kiritimati’s milkfish (*Chanos chanos*, local names: awatai, baneawa) fishery is characterised by artisanal harvest and processing methods (Figure). The main products are fresh whole-round milkfish, smoked fillets and brine salted fillets. These enter domestic markets on Kiritimati and are exported to Tarawa and Fiji in the form of personal consignments.

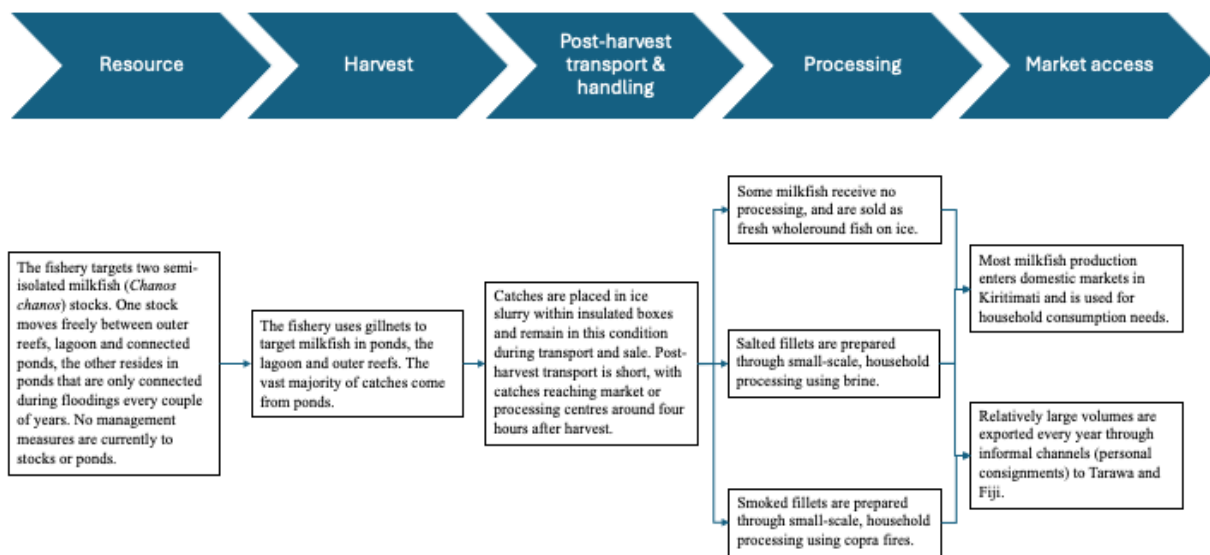


Figure 5: Schematic representation of Kiritimati’s milkfish value chains.

2.3.1 Resource status and management

Anecdotal evidence suggests that milkfish stocks are stable but may be subject to localised overexploitation. Export volumes have remained relatively stable over the past 20 years (Figure). However, reports from fishers indicate that milkfish are becoming smaller and more difficult to catch, and that fishers are having to travel further to maintain catches. Ponds nearest to settlements appear to suffer the highest rates of over-exploitation and stock depletion.

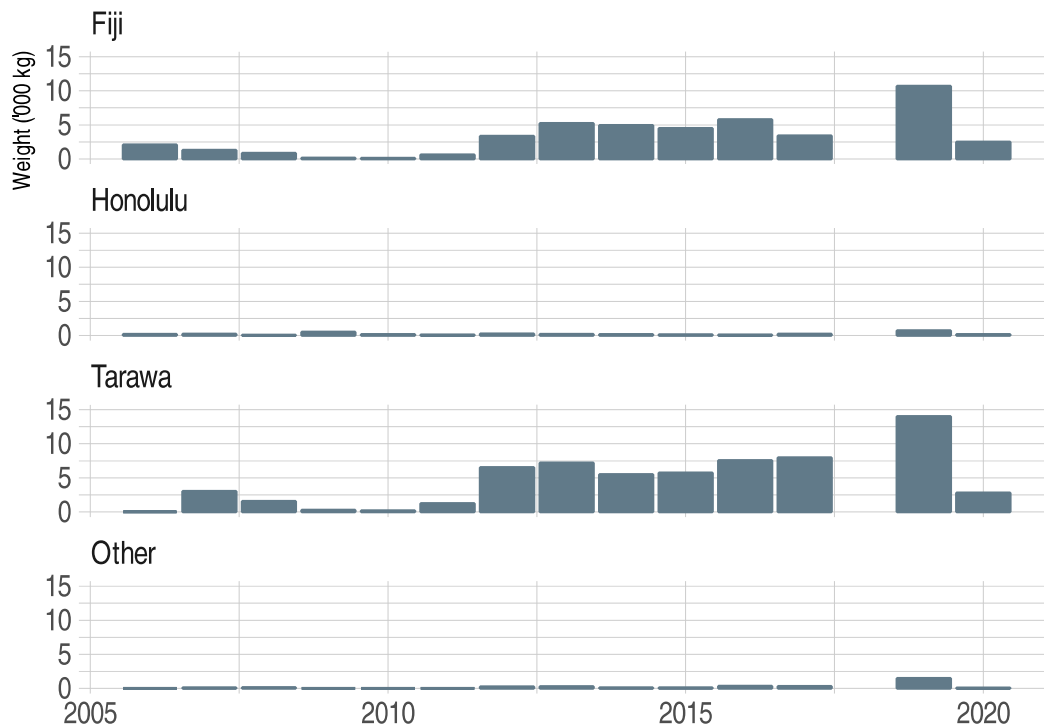


Figure 6: Milkfish volumes exported annually from Kiritimati in the form of personal consignments, disaggregated by destination market. Source: MFMRD quarantine statistics.

There is a paucity of data and investigation of Kiritimati’s milkfish. Two partially isolated milkfish stocks appear to exist. One stock comprises milkfish that can move freely between ocean and lagoon environments, and into those ponds that are connected by passages and tidal flows.² Anecdotal reports suggest that juveniles of this stock congregate in the higher reaches of the lagoon, while larger adults migrate out of the lagoon to the outer reefs. The second stock comprises milkfish that occupy inland ponds that are only connected to each other and the lagoon during times of flooding. These isolated ponds exhibit extreme variability in physiochemical characteristics including salinity (0-150 ppt), pH (7 - 10.5) and dissolved oxygen (0.61 - 9.46 mg L⁻¹) (Saenger *et al.*, 2006). There is a need for research to improve understanding of the status and dynamics of these stocks, to identify those ponds that possess physiochemical characteristics suitable for milkfish, and to monitor changes in these characteristics over time.

The lagoon and ponds represent a highly sensitive ecosystem. The present-day lagoon occupies the westernmost half of Kiritimati and is characterised by a reticulate pattern of shallow coral patches and sand bars, separated by deeper channels. At one time this reticulate lagoon

² During the British administration a system of three gates and twelve channels was constructed to artificially connect several ponds to the lagoon, including 15 ponds that have had their water environments artificially altered.

extended the full length of the atoll. Between 1,400-5,000 years ago, through either or both sea-level fall or uplift, the easternmost channels at the head of the lagoon became cut from the tides (Woodroffe & McLean, 1998). They became partially filled with sediments, captured rainwater and water from the land, and developed into ponds with unique physiochemical characteristics. The ponds are remarkable in their degree of isolation from one another, becoming temporarily connected by flooding only once every two years or more. Some are water impermeable to the extent that adjacent ponds can have very different water levels and salinities. Ponds that are fully isolated from the lagoon and tidal waters are dominated by cyanobacteria and so-called “orange jelly” algal mats composed of algal cells, bacteria, diatoms and fungal filaments (Schmitt *et al.*, 2019; Tebano, 2008). Milkfish have been observed to consume these algal mats, with observations and stomach content analysis undertaken during field surveys in March 2014³ indicating that this diet may contribute to the high fat content that make Kiritimati’s milkfish particularly prized in domestic and export markets. With these ponds having developed in isolation over thousands of years, their microbial ecosystems are likely to be highly sensitive to ecological perturbations, and there is some evidence that artificially channelling seawater to ponds completely changes their microbial ecosystem (Schmitt *et al.*, 2019). In hypersaline ponds where channels have been constructed, milkfish are observed to congregate around the low-salinity outflows where they feed on cyanobacteria blooms. A careful balance needs to be maintained. When pond temperature and salinity (>80 ppt) increase too high fish die offs have been observed. Conversely, too much seawater input risks disturbing the microbial ecosystems that contribute to the unique taste profile of Kiritimati’s milkfish, or promoting cyanobacteria blooms that, in some cases, contribute to ciguatera outbreaks (Laurent *et al.*, 2012).

No conservation and management measures are currently implemented. Milkfish are not a designated fishery under the Fisheries Act 2021. According to the Act, a designated fishery is one that, due to cultural, scientific, economic, environmental, or other relevant considerations, requires management and development measures for its effective conservation and optimum utilisation. In other words, the lack of designated fishery status means there is little imperative to create a management plan. This is surprising given that milkfish constitutes a major proportion of Kiritimati’s fishery production. Three models of pond management exist on Kiritimati. Some ponds are managed as conservation areas under the authority of Ministry of Environment, Land and Agricultural Development (MELAD), with fishers subject to a licence fee of AU\$ 10 per trip. Other ponds are managed as fishing areas by MFMRD, with fishers subject to a per kg landing fee. The remaining ponds are apparently open access. In all cases, no licence conditions appear to be applied and no physical management of ponds or their channels and sluices appears to take place.

³ <https://tautai.com/the-orange-jelly-ponds-of-kiritimati/>

2.3.2 Harvest sector

Data on catch and effort are limited. Detailed resource surveys were undertaken some 20 years ago (Awira *et al.*, 2008), but do not appear to have been subsequently updated. These surveys indicated that milkfish account for 65 percent of Kiritimati's total fishery production by volume, with the majority of catches (95 percent) coming from the lagoon or ponds. The Kiritimati Integrated Fishery Plan 2014-2017 reports that government-controlled ponds produce an average annual harvest of 15 mt worth around AU\$ 40,000, though the basis of these estimates is unclear. The Plan further appears to mistakenly report that milkfish production is an aquaculture activity—in actuality this a wild-caught fishery, and no farming activities (e.g., restocking, stock enhancement, input addition, etc.) appear to currently take place. Data on production volumes, number of fishers and fishing effort do not appear to be routinely collected, making it challenging to estimate total production potential with any degree of accuracy.

Fishing methods are adequate but may conflict with other resource users in some locations. Fishers use gillnets that are deployed manually by walking out from the shore. Similar fishing techniques are used in ponds, the lagoon and on the outer reefs. Importantly, gillnets within the lagoon may conflict with other resource users, most notably the recreational fishery through bycatch of bonefish. Interviews with fishers indicated that they typically catch around 100 kg of milkfish from ponds during a four-hour fishing trip. While management efforts could be made to minimise conflict by constraining gillnets to defined fishing zones within the lagoon (or prohibiting gillnet fisheries within the lagoon entirely), fishing methods are otherwise adequate and do not constitute a priority area for upgrading or improvement at this time.

2.3.3 Post-harvest handling and transport

Post-harvest handling practices appear adequate, but food safety testing could be increased. Fishing trips are typically short in duration, with fish arriving to markets within around four hours of capture. Milkfish are placed into an ice slurry within insulated boxes immediately after harvest and are maintained in this condition during transport and sale. The source of ice is unclear, but is likely homemade in domestic freezers, and may or may not use food safe water. The availability of information and training on best handling practices could be reviewed to ensure it is adequate to maintain standards. Testing of products that are currently destined for domestic markets could be undertaken more frequently to ensure they are free from pathogenic bacteria, indicator organisms and ciguatoxins. Post-harvest handling does not appear to be a priority area for upgrading and improvement at this time but will become more pressing if export pathways are developed.

2.3.4 Processing

Processing and value-addition is predominately artisanal, with considerable opportunity for diversification and upgrading. Milkfish are typically sold into local markets either as iced fresh whole round fish, smoked fillets or brine salted fillets. Brine salted is preferred by consumers, and processors strive to fulfil this demand despite the greater processing effort involved. The process for both smoked and salted fillets is somewhat similar, with milkfish filleted in private houses and then either smoked over a copra fire or salted in buckets. It is unclear where the water

used in processing is sourced, and whether it is food safe (FAO & WHO, 2023). Opportunities exist to improve the efficiency of value addition processing through greater economies of scale and industrialisation. Opportunities also exist for further product diversification and value addition, including deboning and the processing of frozen fillets.

2.3.5 Market access

Export markets hold considerable potential, but their values are currently not being realised. Historically Kiribati has investigated a variety of markets for milkfish, including as bait for tuna long-line and pole-and-line fisheries (Gopalakrishnan, 1978; Gopalakrishnan, 1977). The economic performance of bait markets appears to have been relatively limited. In contrast, a considerable export market appears to exist, with Kiritimati's milkfish prized for its high fat content and flavour. It should be noted that the Pacific region has several major low-cost milkfish producers, and competing in distant markets may prove challenging. However, Kiritimati's milkfish poses several competitive advantages in nearby markets, including its prized flavour profile and lower transportation costs compared to more distant producers. Indeed, considerable volumes are already exported to Tarawa and Fiji, albeit in the form of personal consignments (Figure). Personal consignments are not subject to the usual business licencing and export fees applied in Kiribati, and hence these volumes would appear to represent a considerable loss of non-tax revenue potential to the government. Strategies could be explored to increase the collection of government revenues from these exports, while simultaneously creating incentives for business development on Kiritimati to fulfil this demand. While the current airfreight capacity limitations may have some impact on business feasibility, the planned port developments at Poland should enable containerisation and greater volume of exports in the not-too-distant future.

2.3.6 Recommendations

Establish a Kiritimati milkfish development strategy. The strategy should address the critical question of whether Kiritimati will pursue intensive or extensive production models. Intensive production typically requires inputs in the form of feeds, fertilisers, pesticides, etc. There is a risk that such inputs could disrupt the microbial ecosystems that contribute to the high fat content and unique selling point Kiritimati's milkfish, while also increasing prevalence of off-flavours (Azis *et al.*, 2015), ultimately leading to a lower value product. Detailed cost-benefit and feasibility assessment should be undertaken to select optimal development pathways (see below). This assessment could inform the preparation of a development strategy that addresses key considerations such as environmental impact, monitoring and management requirements and licence conditions, which in turn would help to guide private sector investment and development.

Undertake a detailed feasibility assessment to identify milkfish upgrading pathways. Consideration should be given to all stages of the value chain, including stock management, pond maintenance, capital investments, value addition options, market potential, transportation, and production volumes. Public and private sector roles should be identified, and evaluation made of the costs, benefits and trade-offs of intensive versus extensive production models, including with pragmatic consideration of associated risks. A comprehensive feasibility assessment would

inform both the government's development strategies as well as private sector investment planning.

Review and strengthen cost recovery mechanisms. Several cost recovery mechanisms are available, including licence fees associated with pond access and management rights, and export levies. Importantly, the high volume of exports that currently occur in the form of personal consignments appears to represent a significant loss of revenue potential to the government. Consideration could be given to introducing levies on these consignments, which if priced correctly would help to incentivise and stimulate the development of a milkfish processing industry in Kiritimati. Consideration could also be given to the numerous open access ponds that currently lie outside MFMRD and MELAD licencing jurisdiction. With appropriate licence fees and licence conditions, these ponds could be suitable for development through private sector or community-based investment and enterprise.

Improve pond management. Baseline surveys could be undertaken to inform management targets and limits for temperature, salinity, pH and other physiochemical characteristics of individual ponds. Regular processes should be established for the repair and maintenance of channels, sluices and other pond infrastructure. Importantly, artificial stocking and the addition of inputs such as feeds and pesticides should probably be avoided until comprehensive environmental impact management systems are in place. Ponds are likely to be highly sensitive to environmental perturbations and, if disrupted, it may be difficult to recover the microbial ecosystems that contribute to the high fat content and prized flavour profile that are a unique selling point of Kiritimati's milkfish.

2.4 Demersal fish snappers and groupers

Kiritimati’s demersal fishery is characterised by artisanal harvest methods that target shallow water species (Figure 7). Very little processing and value addition currently occurs, and fish are generally sold as fresh or frozen whole-round for household consumption or to hotels and restaurants. A small proportion of production leaves Kiritimati in the form of commercial exports or personal consignments.

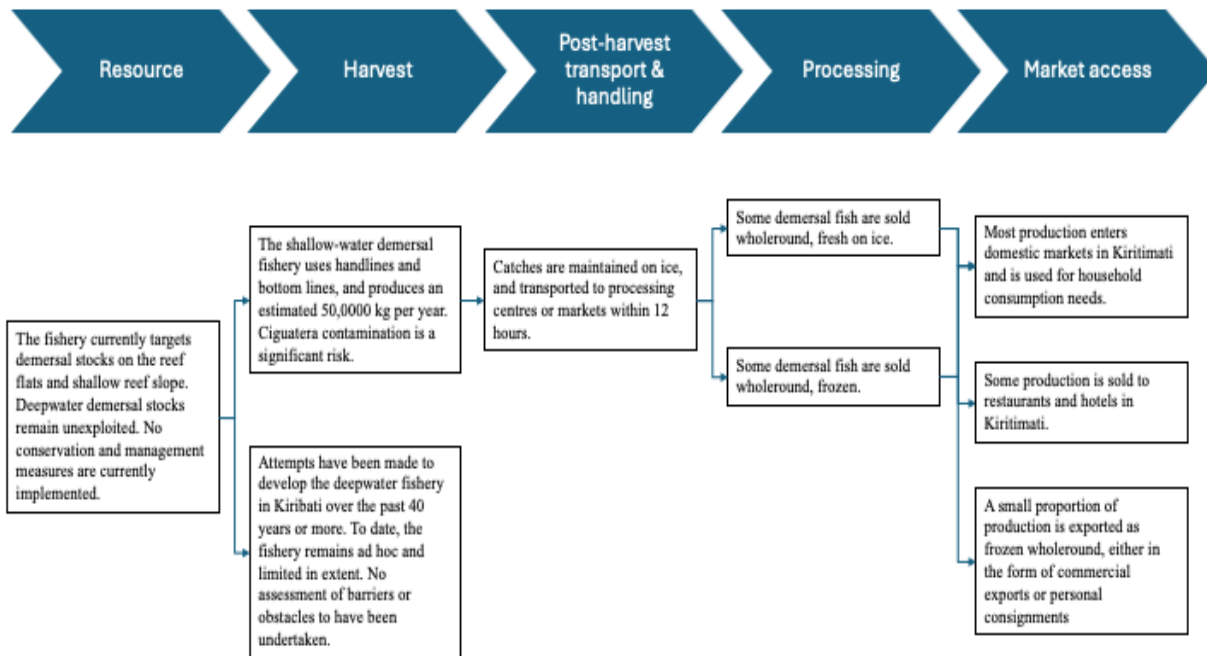


Figure 7: Schematic representation of Kiritimati’s demersal fish value chains.

2.4.1 Resource status and management

Shallow-water demersal stocks appear to be subject to moderate fishing pressure. These stocks are characterised by snappers, groupers and similar species that inhabit the reef flat and shallow reef slope down to approximately 50 m. Processors report a steady supply of raw material, meanwhile, fishers report having to travel to more distant fishing grounds to maintain catches. A comprehensive survey of over 100 Kiritimati households conducted in 2013 revealed a widespread perception that fish are becoming smaller and harder to catch (Watson *et al.*, 2016). Underwater visual census conducted in 2005 across several Pacific atolls revealed that fish assemblages in Kiritimati were markedly different than those on uninhabited and lightly fished atolls, with fewer commercially important species, lower tropic levels dominating fish biomass, and larger sizes at maturation (DeMartini *et al.*, 2008).

While Kiritimati’s deep-water demersal stocks are currently unexploited, most deepwater fisheries in the region have followed a “boom and bust” cycle. Deepwater stocks are typically found at depths of 100 - 250 m (McCoy, 2010; Preston *et al.*, 1999), with more than 200 species recorded regionally (Dalzell & Preston, 1992). Throughout the Pacific, new deepwater demersal fisheries have typically experienced high catch rates of large individuals (McCoy, 2010). However, business plans projected on these initial high catch rates often reveal themselves to be unfeasible

once fisheries settle to a sustainable equilibrium, at which point catch rates may be as low as one-third of those on the virgin fishery (Adams & Chapman, 2004).

Robust management measures are an essential prerequisite to upgrading and expanding Kiritimati’s demersal fisheries. Proactive rather than reactive management would reduce the risk of overcapitalisation and overexploitation, helping to enhance stakeholder certainty in the fishery and sustain returns on investment. Conducting traditional stock assessments for these species is challenging and expensive, requiring intensive monitoring, the collection of detailed catch and effort data time-series for multiple species, and ultimately estimates to be made of stock size (SPC, 2014a). The costs of this data collection would likely exceed the value of the fishery (Williams & Nicol, 2013). Alternative approaches could be considered, such as using a risk-based approach to select indicator species, determining fishing mortality via a length-based spawning potential ratio approach or similar, and determining reference points and decision rules. SPC has undertaken considerable review and development of regionally-appropriate monitoring and management measures (SPC, 2014b), and these lessons learned and expertise should be drawn on if Kiritimati’s deepwater demersal fisheries are to be upgraded.

2.4.2 Harvest sector

Harvest methods in the shallow water fishery are adequate, and not a priority area for upgrading. Fishers use handlines and bottom lines to target fish on the reef flats and shallow reef slopes. While catch and effort data are limited, CPPL’s landing records indicate that total annual production for the fishery generally exceeds 30,000 kg. Interviews with fishers suggest that gillnets are not currently used within the fishery. Gillnets are likely to bring elevated risk of environmental impact, as a result of both greater bycatch rates and increased interaction with benthic habitats, and their use should be avoided in the fishery unless stringent monitoring and management measures are implemented.

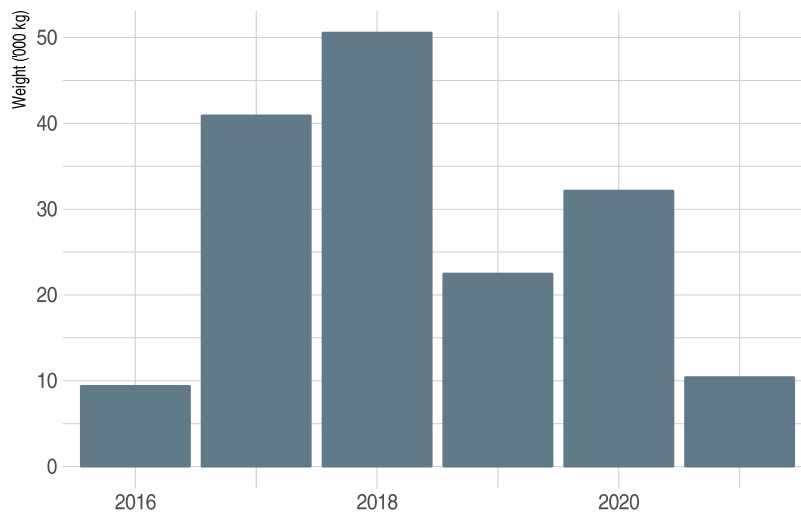


Figure 8: Annual landings of shallow-water demersal species to CPPL. Source: CPPL landing records

Efforts to develop the deepwater demersal fishery go back decades. Accessing these resources is challenging, requiring vessels that can operate safely in the exposed waters outside the lagoon, unfamiliar fishing techniques, and suitable gears. Retail stores in Kiritimati currently sell monofilament lines of up to 100 m in length, which are insufficient for the deepwater fishery. Successful deep bottom fishing trials were carried out in Kiribati by FAO (Day & Savins, 1986) and SPC (Chapman, 2003) in the early 1980s. However, the fishery has not developed to any extent, and today fishing occurs only on an ad hoc basis by small-scale fishers. Prior to any renewed efforts to develop the fishery in Kiritimati, this history should be examined carefully to identify the barriers and constraints to growth. Two contributing factors are likely to be market access, as well as the lack of any competitive advantage relative to shallow demersal fisheries—not least due to the additional cost and effort involved.

Ciguatera represents a significant risk to the shallow water demersal fishery. Fishers report that algal blooms often occur around Kiritimati, particularly along the southern coastline, and bring incidents of ciguatera fish poisoning. This risk would need to be managed carefully if the fishery is developed, to prevent contaminated seafood from entering the value chain. Environmental monitoring and remote sensing could provide an early warning of algal blooms and ciguatera risk. Increased seafood testing would minimise the chances of contaminated seafood being consumed. Communication and advisory services could be enhanced to improve the dissemination of information on ciguatera outbreaks and risks to fishers.

2.4.3 Post-harvest handling and transport

Post-harvest handling practices are adequate. The duration between harvest and processing or markets is typically around 12 hours. Fishers maintain catches on ice throughout this period. The consultants were unable to ascertain the source of ice or water used. Ice is likely homemade, and water may or may not be food-safe. Consideration could be given to enhancing the availability of information and training on best handling practices to fishers. If export markets are to be developed, a HACCP plan should be prepared to ensure compliance during post-harvest handling and transport.

2.4.4 Processing

Very little processing or value addition currently occurs. Snappers and groupers are typically sold whole round, either fresh on ice or frozen. While Skylight currently possesses HACCP certification and is therefore able to process for export markets, CPPL does not. Furthermore, as noted previously, CPPL's blast freezer and cold storage are currently inoperable, and processing volumes are constrained by the capacity of several household chest freezers. If this fishery is to be developed, the processing sector is a priority area for upgrading. Improvements required would include: (i) refurbishing CPPL's processing floor to comply with HACCP standards; (ii) training and support to accelerate CPPL's HACCP certification process (including upgrading laboratory facilities to enable testing for ciguatera, microbes and other contamination); (iii) upgrading and refurbishing facilities, including blast freezers and cold storage; and (iv) training and technical assistance on value-adding processes such as filleting and vacuum packing. However, no data are currently available on production volumes in the fishery, and it is not clear that there is a robust

business case for these investments. A detailed feasibility assessment should be undertaken to evaluate the business case and prioritise development options. Given that similar facilities and processes are required, the development of the tuna value chain would likely offer a better initial return on investment in Kiribati, with the potential to develop demersal fisheries at a later date as part of a diversification strategy.

2.4.5 Market access

Current production is directed entirely towards local markets. Products are destined for household consumption and to supply local restaurants and hotels. While Skylight has exported frozen snappers and groupers in the past, transport restrictions during the Covid19 pandemic and subsequent challenges obtaining customs clearances in export markets mean the company has not exported since 2020. At their peak, exports reached around 8,000 kg per year (Figure **Error! Reference source not found.**). In addition, a further 4,000 kg or so are exported in the form of personal consignments (Figure **Error! Reference source not found.**).

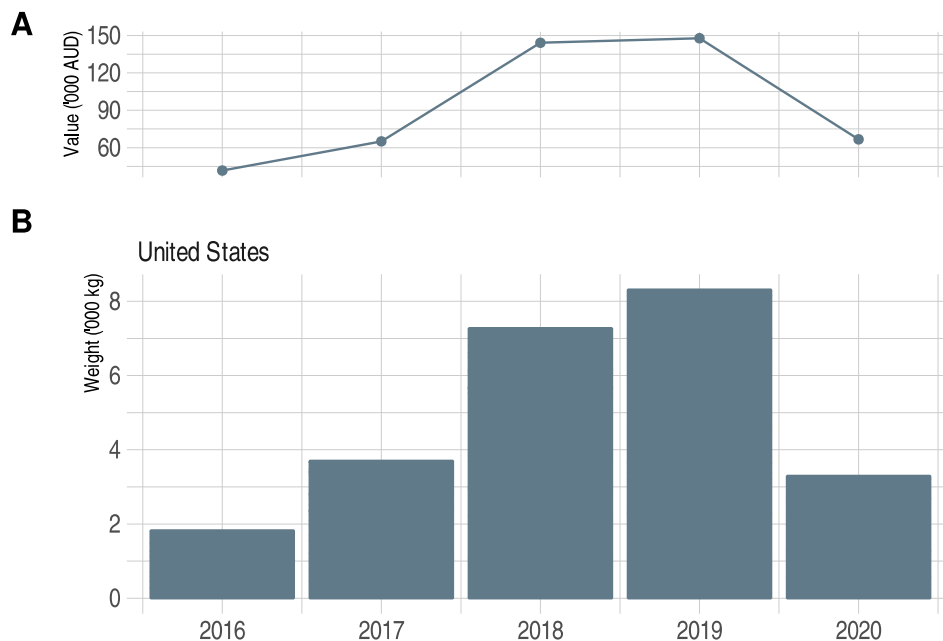


Figure 9: Value (A) and volume (B) of shallow-water demersal exports from Kiribati, with the main markets and product types shown. Source: MFMRD export statistics.

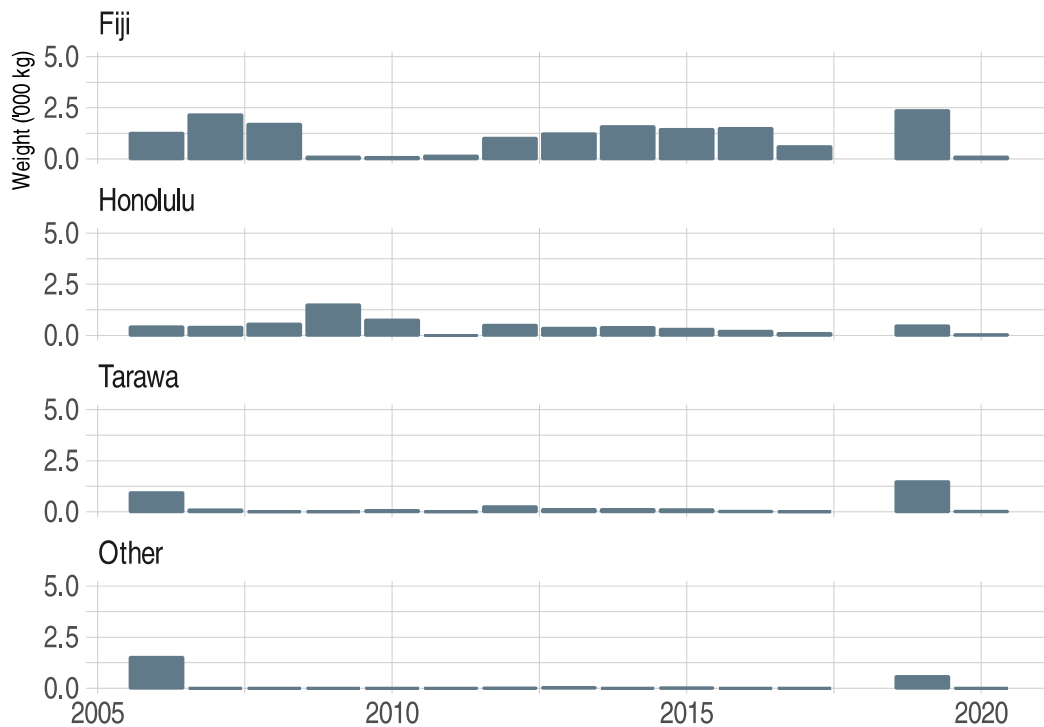


Figure 10: Shallow-water demersal volumes exported annually from Kiritimati in the form of personal consignments, disaggregated by destination market. Source: MFMRD quarantine statistics.

Some opportunities may exist for value-addition and development of export markets. Much like for tuna (described above), Kiritimati’s demersal fisheries offer a compelling story that could help to differentiate products in export markets around brand qualities of sustainable, ethical and high-quality seafood. Market demand should be evaluated carefully before value chain investments (including the development of the deepwater fishery) are pursued. Throughout the Pacific region there is a track record of demersal fishery export activities failing due to insufficient examination of market conditions (McCoy, 2010). Issues include (i) costs and logistical challenges of getting fish to market; (ii) species preferences by specific markets; (iii) competition from other sources of supply with the same or similar species; and (iv) seasonal market demand — for example in Hawaii, the destination of most of Kiritimati’s commercial exports, the greatest demand occurs in December and January with prices falling by 50 percent or more at other times of the year (McCoy, 2010).

Cargo capacity is a significant constraint to the development of Kiritimati’s demersal fisheries. Current air freight capacity and competition for space impact export volumes and hence the feasibility of upgrading Kiritimati’s demersal fishery. Consequently, the additional cost and effort required to develop the deepwater demersal fishery is likely not justified at current export volumes. While the planned port developments at Poland may go some way to alleviating these constraints, port development plans should be carefully reviewed to improve export volume estimates, and a detailed feasibility assessment carried out to prioritise the development of the demersal fishery against other development options, including the development of the domestic tuna fishery.

2.4.6 Recommendations

Upgrading of the demersal fishery alone is unlikely to deliver long-term return on investment. While a detailed feasibility assessment should be undertaken to confirm this, it is unlikely that Kiritimati's fishery can sustain the production volumes needed to support investments in the post-harvest sector. Sustainable supply and long-term returns are more likely to be realised from the tuna fishery, and upgrading should probably prioritise this option. The demersal fishery is likely to provide supplemental benefits, rather than to be a driver of investment and growth. Development of this fishery could be pursued as part of a diversification strategy, once a successful tuna value chain is established, and would benefit from being able to use much of the same facilities and infrastructure.

Implement a robust management framework before developing the fishery. A well-designed harvest strategy, with clearly defined reference points and decision rules would ensure that catches are maintained at a sustainable level and help to secure long-term returns on investment. This issue is even more pressing if the deepwater fishery is developed. Initial production volumes on these virgin stocks are likely to be high, and experience in other Pacific nations suggests that ambitious business plans often cannot be maintained once fisheries reach a sustainable equilibrium. Establishing a robust management framework at an early stage of development would aid investment planning and enhance stakeholder confidence.

Undertake a comprehensive feasibility assessment to prioritise development options. This preliminary feasibility assessment suggests that it is unlikely that the demersal fishery alone can satisfy Kiritimati's development objectives. Instead, the demersal fishery may form part of a diversification strategy, once upgrading of other more profitable fisheries has progressed. These preliminary findings should be confirmed through a more comprehensive feasibility and market assessment.

3 Economic feasibility of marine commodity value chains

3.1 VCA Model

A value chain analysis (VCA) model was developed to identified potential and existing marine life and fisheries product segments in Kiritimati. The identification of the potential product segments draws from Greer & Failler (2022) and personal communications⁴ with the client. For the final version of the pre-feasibility report there will be a more comprehensive VCA.

This project reviewed current market trends to identify potential ‘strategic segments’ of the industry trading fishery and marine life products. The segmentation focuses on both demand (Consumer Markets) and supply (the availability – product types and ancillary services -provided to those markets). Overall, the segmentation proposed here has the main objective of identifying the potential most attractive segments, under constraints of market access requirements, competitive edge, and segments’ growth potential. Market conditions (such as the existence of substitutes, rivals, new entrants, suppliers, buyers, trending markets, and minimum efficient production size capacity) determine the attractiveness of each segment.

This analysis focuses on the premise that the Line Islands producers are following Porter’s methodology for the application of Five Forces as summarized in the figure below (Figure 11).



Figure 11: Porter’s Five Forces Schematic. Source: Pringle & Huisman (2011) and Porter (2008)

⁴ Beero Tioti, Project Manager | PROP Project, Ministry of Fisheries & Marine Resources Development

Products are classified as *processed*, *chilled*, or *live*. “*Processed*” means the preservation of fishery products through freezing, canning, drying, and processing to extend shelf life, add value, and any product transformation that might appeal to consumers. It includes the preservation of tuna through ULT⁵, allowing the tuna to be used for a higher-value product such as sashimi. “*Chilled*” means fresh and chilled products with short shelf lives. “*Live*” means preserving the sea creature by any mean to keep it alive by storing it in, for example, in salt water or in any moist and adequate environment.

The consumer market is classified into the following: *basic needs/ food security*, *branded/ labelled products*, *premium markets*, or *ornamental*. “*Basic*” refers to markets for products that are supplied to meet subsistence needs and basic demands for animal protein with minimal added value in addition to that needed for preservation through freezing, canning, drying, or smoking. “*Branded*” refers to higher-value branded retail markets demanding unique, environmentally friendly, and more appealing products commanding higher value. “*Premium*” refers to high-value markets for fresh, exotic, and sought-after products commanding a premium price. “*Ornamental*” refers to markets for aesthetically pleasing and decorative non-food products. The results of our analysis are shown in Figure below where 15 segments were identified with various potential.

⁵Tuna meat deteriorates above -60°C and loses its taste and red colour. Ultra low temperature (ULT) freezers, also known as "minus 80 freezers", store contents at -80 to -86°C (-112 to -123°F). -50° to -60°C.

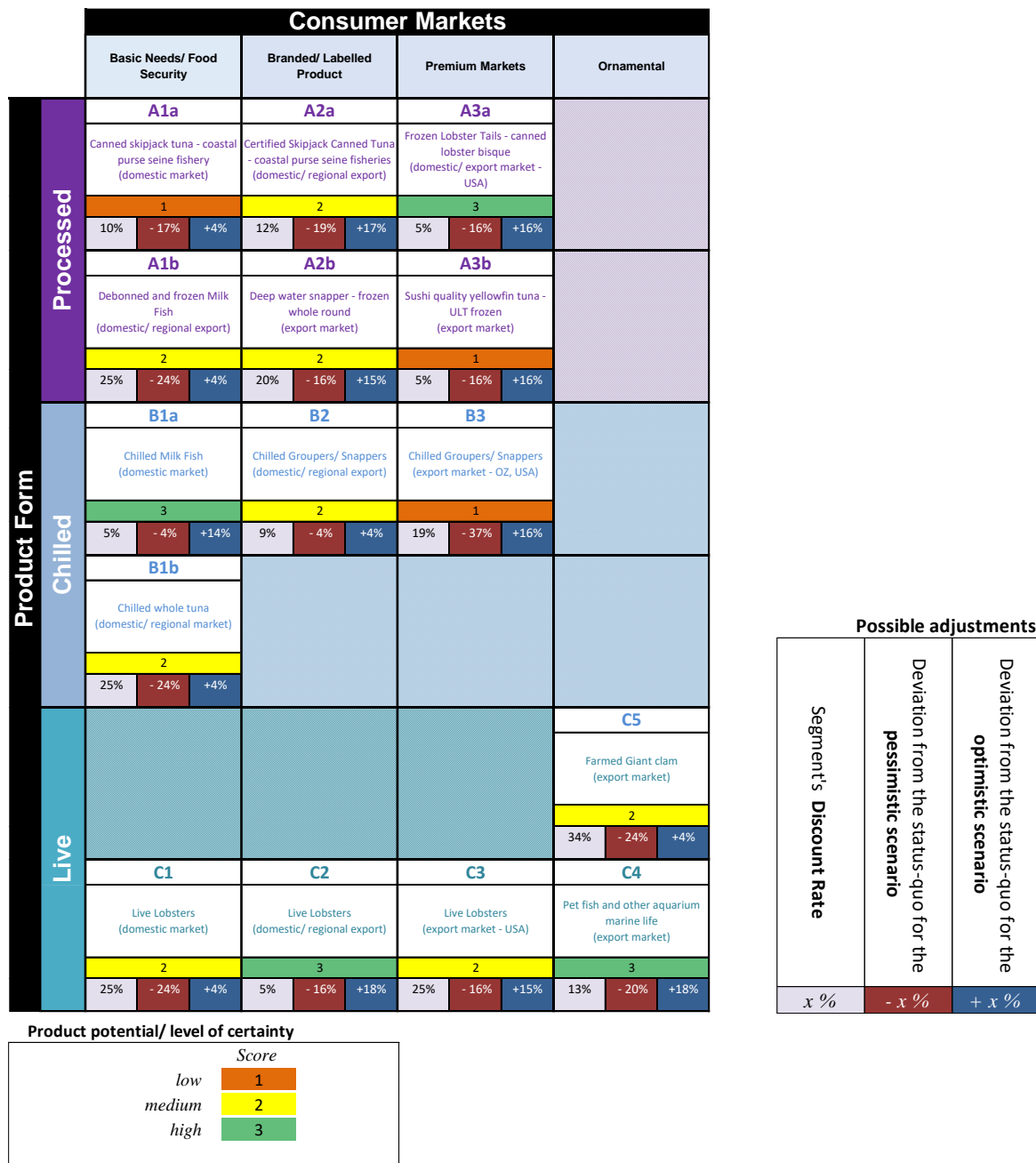


Figure 12: Proposed Segmentation of Kiritimati Marine Life and Fishery Products

Figure indicates the potential of each segment; with a value of 1 (orange colour) representing a low segment's potential while a value of 2 (yellow colour) and 3 (green colour) represent a medium and high potential respectively. For each segment, this analysis has determined the underlying discount rate to be used in the calculation of the Net Present Value (NPV) and the deviation to the status-quo or average when determining the pessimist (in marron) and *optimistic* (navy blue) scenarios or outcomes for each segment. Using these parameters allowed us to weigh in our confidence with the potential outcomes related to each segment and capture some measure or risk and uncertainty: for example, a higher discount rate (above 15%) will capture our perception

of higher risk of investing in a relatively new segment (percentage on the greyish background) while a higher deviation percentage, above (positive percentage on a navy blue background) or below (negative percentage on a marron background) the average will reflect a higher variability or uncertainty in the segment's potential, skewed upward or downward, corresponding to optimist or pessimist scenario respectively.

3.1.1 Financial Indicators

Several criteria can be used to rank the fishery products options such as the Net Present Value (NPV), the Internal Rate of Return (IRR) and the pay-back period associated with each.

Following the VCA model in Lallemand (2018), the NPV, IRR and pay-back period for each 15 potential fishery product segmentation were estimated. The VCA was conducted for the 15 segments by identifying each actor along the value chain and contrasting current and estimated costs and economic rent (or profit) at each level of the value chain.

3.1.2 Economic data

To run the VCA model we first analysed the data provided by CPPL and MFMRD augmented by data we extracted from alternate sources found on the internet⁶ or from past projects.

For each actor along the seafood value chain (fishers/ harvesters, processors/ distributors) and for each segment, we prorated the cost data available to the percentage a specific species accounted for in the chain in term of revenue. Values on the cost categories were originally given without discriminating between species, although we were given the relative production weight and value of each important group of species (see Annexe 5 below).

3.1.3 Preliminary VCA Results

In this section we present the VCA's preliminary results in 3 tables and the corresponding box charts; the tables/ charts summarise the 3 financial indicators, that is 1) the pay-back period, 2) the NPV and 3) the IRR.

For each financial indicator, the VCA outputs are contrasted for all 15 segments and their corresponding simulated economic activity over a period of 10 years.

Each segment's VCA is characterised by its own discount rate and by a set of deviations or delta parameters defined to express, in percentage, the potential deviation from the status-quo and labelled as pessimistic and optimistic scenarios. The discount rate is only used in the NPV calculation, while the optimistic and pessimistic scenarios representing the deviation upward or downward from the average or status-quo's scenario are used for all 3 indicators.

⁶ For example, some of the local seafood prices not elsewhere available were obtained from the following website <https://www.selinawamucii.com/insights/prices/kiribati/>

The discount rate used in the NPV calculation is used as a proxy to measure any financial or economic risk associated with the investment and the future income flows of a particular segment; it can be interpreted as the measure of the opportunity cost of not investing in alternative and less risky economic/ financial endeavour; the higher the discount rate, the higher the perception of financial risk for a particular segment and therefore with this risk, the expected economic returns tend to be discounted heavily. The lower the discount rate, which is usually close to the bond rate, the less the risk perception in the segment and therefore investing in it could be compared to investing in the alternative relatively “safe” bond market at the same rate. In other words, the risk perception of the likelihood and severity of financial loss can be expressed with the appropriate discount rate.

On the other hand, uncertainty refers to a lack of definite knowledge, a lack of confidence. Therefore, the pessimistic and optimistic scenarios are meant to capture uncertainty in the segment’s future economic returns. A particular segment might exhibit skewed uncertainty towards either a positive or negative perception on the future returns, that is why we set up our model to allow for individual absolute positive and negative deviations from the base case scenario that we labelled as the “status-quo”. The status-quo can be viewed as the mean and the optimistic and pessimistic scenarios as the positive (upward) and negative (downward) deviations from the mean. These deviations will be different for each segment and might be different in absolute value for the same segment as well indicating a skew towards positive or negative perception of the future returns. The positive deviation from the status-quo as the optimistic scenario’s upper delta and the negative deviation from the status-quo as the pessimistic scenario’s lower delta.

Detailed financial and economic information on each segment’s VCA can be found in Annexe 6 below.

VCA’s Pay-back period

The first series of table and chart compares the pay-back period between segment, that is the time expressed in number of years, given the estimated annual net-revenue, it would take to pay-back the initial investment. It is noted that the pay-back period is a simple division between the initial investment and the sum of the future nominal net-revenue i.e. not discounted, that is the pay-back period n_i for the i^{th} segment is:

$$n_i = \frac{I_i}{\pi_i}$$

Where, I_i is the initial investment of the i^{th} segment, π_i is the estimated annual net revenue i.e., profit or loss for the i^{th} segment. We assume here that the flow of net revenues generated annually is constant over time. A negative net-revenue i.e., a loss, would imply that the initial investment can never be repaid, which was not observed here. It should be acknowledged that our assumptions simplify the complex reality. It is possible that a segment might initially experience negative returns (in the short-term), which could be offset by positive returns in the medium to long term. This consideration supports the overall desirability of the investment over the entire evaluation period (10 years).

Table 1: Comparison of payback periods by proposed product segment for Kiritimati expressed in number of years based on projected production/ year and for the 3 scenarios, optimistic, pessimistic and status-quo and showing for each segment, the discount rate and ± delta variation (upper/ lower delta) from the status-quo.

Payback period	segment by product type	Optimistic Scenario	Pessimistic Scenario	Status Quo	Discount Rate	Optimist Scenario upper delta	Pessimistic Scenario Lower delta
1 - Basic Needs/ Food Security	A1a - Canned skipjack tuna - coastal purse seine fishery (domestic market)	6.96	10.05	8.14	8%	+17%	-19%
	A1b - Debonned and frozen Milk Fish (domestic/ regional export)	7.30	9.77	8.40	5%	+15%	-14%
	B1a - Chilled Milk Fish (domestic market)	7.17	10.12	8.60	5%	+20%	-15%
	B1b - Chilled whole tuna (domestic/ regional market)	5.56	7.68	6.45	5%	+16%	-16%
	C1 - Live Lobsters (domestic market)	1.21	1.64	1.40	5%	+15%	-15%
2 - Branded/ Labelled Product	A2a - Certified Skipjack Canned Tuna - coastal purse seine fisheries (domestic/ regional export)	6.74	9.74	8.09	9%	+20%	-17%
	A2b - Deep water snapper - frozen whole round (export market)	3.69	4.84	3.87	9%	+5%	-20%
	B2 - Chilled Groupers/ Snappers (domestic/ regional export)	3.55	6.59	4.61	6%	+10%	-12%
	C2 - Live Lobsters (domestic/ regional export)	7.90	9.87	8.69	5%	+20%	-10%
3 - Premium Markets	A3a - Frozen Lobster Tails - canned lobster bisque (domestic/ export market - USA)	6.84	9.12	8.21	7%	+15%	-20%
	A3b - Sushi quality yellowfin tuna - ULT frozen (export market)	6.01	8.63	6.91	7%	+30%	-30%
	B3 - Chilled Groupers/ Snappers (export market - OZ, USA)	6.05	9.94	6.96	8%	+15%	-30%
	C3 - Live Lobsters (export market - USA)	6.83	11.38	8.20	6%	+20%	-28%
4 - Ornamental	C4 - Pet fish and other aquarium marine life (export market)	3.46	5.18	4.15	5%	+20%	-20%
	C5 - Farmed Giant clam (export market)	3.45	5.18	4.14	5%	+20%	-20%

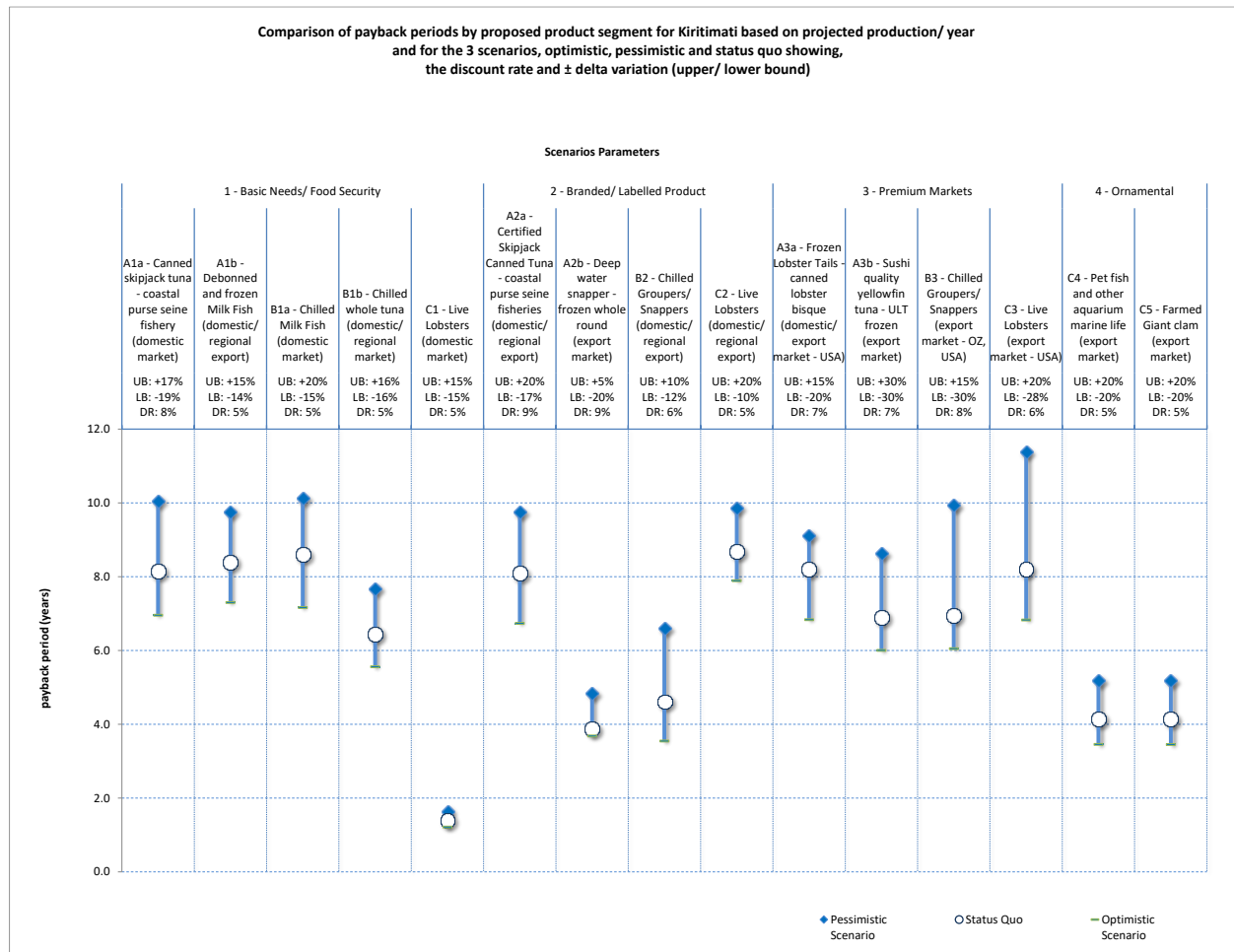


Figure 13: Graphical representation comparing the payback periods by proposed products segment for Kiritimati's based on projected production/ year and under 3 scenarios, optimistic, pessimistic and status quo.

VCA's Net Present Value (NPV)

The second series of table and chart compares the Net Present Value from each segment. The NPV's calculation for the i^{th} segment follows the formula:

$$NPV_i = \sum_{t=1}^T \sum_{j=1}^{N_i} \frac{(p_{ij} - c_{ij}) \cdot q_{ij}}{(1+r)^t} - \sum_{j=1}^{N_i} \sum_{k=1}^{K_{ij}} n_{ijk} \cdot I_{ijk}$$

where,

T is the number of years on which to calculate the NPV along the i^{th} segment's VC which can vary between 1 and 10 years as defined by the user during the simulation,

N_i is the number of actors along the i^{th} segment's VC (here we assumed 2 types of actors only, first ,harvesters then, processors/ distributors),

p_{ij} is the price per kg received by the j^{th} actor for the i^{th} segment,

c_{ij} is the cost per kg paid by the j^{th} actor for the i^{th} segment,

q_{ij} is the catch or volume in kg produced by the j^{th} actor for the i^{th} segment,

r is the discount rate as defined by the user for the simulation for each segment's VC,

I_{ijk} is the k^{th} investment of the j^{th} actor for the i^{th} segment,

K_{ijk} is the number of different capital investment I_{ijk} from the j^{th} actor for the i^{th} segment,

n_{ijk} corresponds to the number of time the j^{th} actor's k^{th} capital investment I_{ijk} needs to be renewed during T number of years for the i^{th} segment.

The formula can be simplified further such as,

$$NPV_i = \sum_{t=1}^T \sum_{j=1}^{N_i} \frac{\pi_{ij} \cdot q_{ij}}{(1+r)^t} - \sum_{j=1}^{N_i} \sum_{k=1}^{K_{ij}} n_{ijk} \cdot I_{ijk}$$

where,

π_{ij} is the unit profit (or loss if <0) per kg produced by the j^{th} actor for the i^{th} segment,

We note that NPV_i can be positive or negative depending on if the sum of the flow of discounted future net revenues is less than the initial investment.

Table 2: Comparison of NPVs by proposed product segment for Kiritimati expressed in Australian dollars (AUD) based on projected production/ year and for the 3 scenarios, optimistic, pessimistic and status-quo and showing for each segment, the discount rate and \pm delta variation (upper/ lower delta) from the status-quo

NPV over 10 years	segment by product type	Optimistic Scenario	Pessimistic Scenario	Status Quo	Discount Rate	Optimist Scenario upper delta	Pessimistic Scenario Lower delta
1 - Basic Needs/ Food Security	A1a - Canned skipjack tuna - coastal purse seine fishery (domestic market)	-20,574	-191,158	-101,127	8%	+17%	-19%
	A1b - Debonned and frozen Milk Fish (domestic/ regional export)	32,903	-120,387	-46,385	5%	+15%	-14%
	B1a - Chilled Milk Fish (domestic market)	42,027	-128,364	-55,339	5%	+20%	-15%
	B1b - Chilled whole tuna (domestic/ regional market)	185,195	2,639	93,917	5%	+16%	-16%
	C1 - Live Lobsters (domestic market)	1,350,832	932,666	1,141,749	5%	+15%	-15%
2 - Branded/ Labelled Product	A2a - Certified Skipjack Canned Tuna - coastal purse seine fisheries (domestic/ regional export)	-35,132	-251,303	-151,982	9%	+20%	-17%
	A2b - Deep water snapper - frozen whole round (export market)	501,353	220,895	445,261	9%	+5%	-20%
	B2 - Chilled Groupers/ Snappers (domestic/ regional export)	740,661	49,631	395,146	6%	+10%	-12%
	C2 - Live Lobsters (domestic/ regional export)	-36,778	-137,857	-82,723	5%	+20%	-10%
3 - Premium Markets	A3a - Frozen Lobster Tails - canned lobster bisque (domestic/ export market - USA)	32,586	-38,596	-14,869	7%	+15%	-20%
	A3b - Sushi quality yellowfin tuna - ULT frozen (export market)	114,740	-126,094	11,525	7%	+30%	-30%
	B3 - Chilled Groupers/ Snappers (export market - OZ, USA)	66,248	-198,125	-21,876	8%	+15%	-30%
	C3 - Live Lobsters (export market - USA)	52,508	-239,123	-69,005	6%	+20%	-28%
4 - Ornamental	C4 - Pet fish and other aquarium marine life (export market)	4,813,625	1,909,084	3,361,354	5%	+20%	-20%
	C5 - Farmed Giant clam (export market)	202,836	80,558	141,697	5%	+20%	-20%

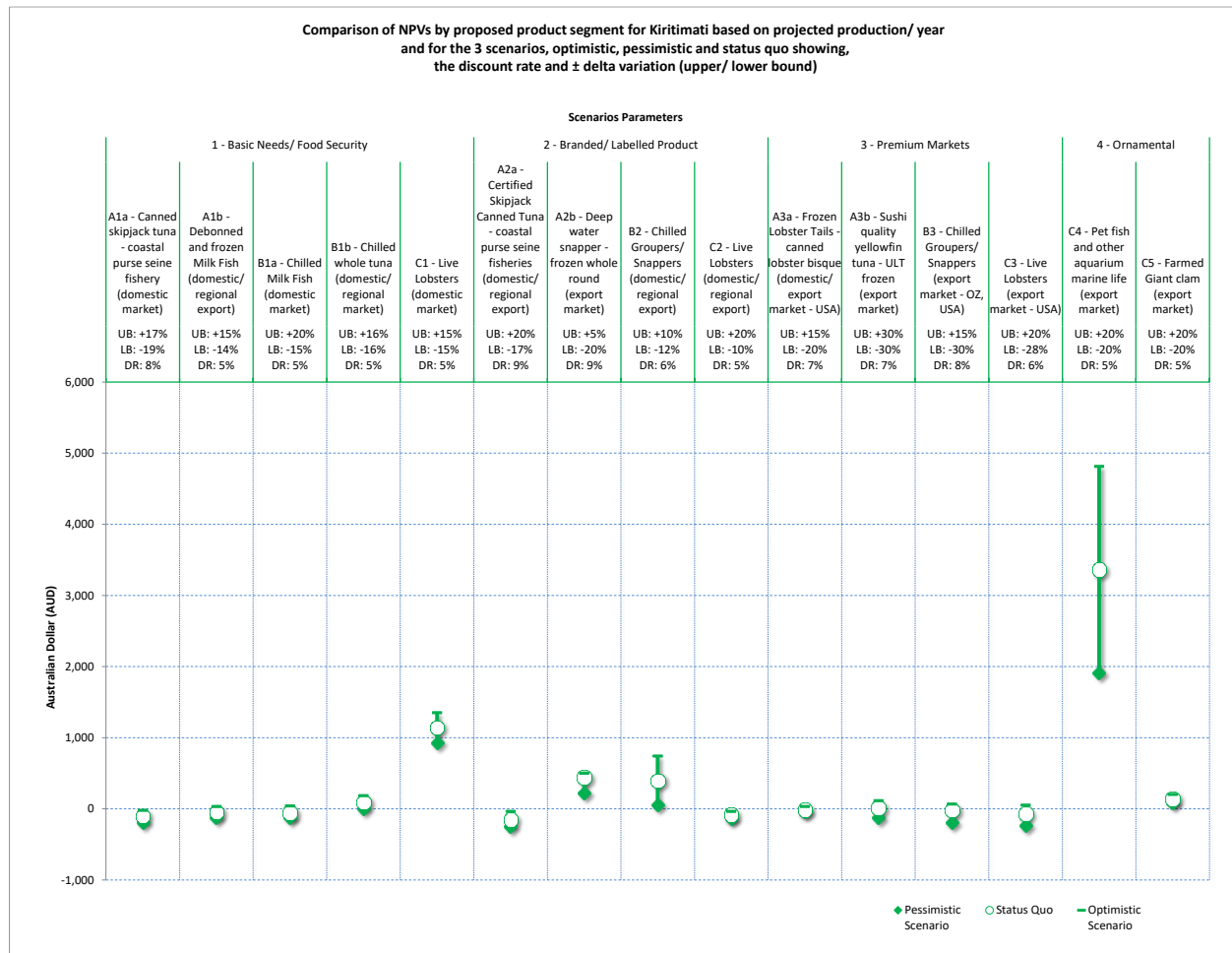


Figure 14: Graphical representation comparing NPVs by proposed products segment for Kiritimati's expressed in Australian Dollars (AUD) and based on projected production/ year and under 3 scenarios, optimistic, pessimistic and status quo

VCA's Internal Rate of Return (IRR)

The third series of table and chart captures the Internal rate of returns of each segment.

r_i^* , the IRR for segment i is determined through an iterative process following the formula:

$$\sum_{t=1}^T \sum_{j=1}^{N_i} \frac{(p_{ij} - c_{ij}) \cdot q_{ij}}{(1 + r_i^*)^t} - \sum_{j=1}^{N_i} \sum_{k=1}^{K_{ij}} n_{ijk} \cdot I_{ijk} = \sum_{t=1}^T \sum_{j=1}^{N_i} \frac{\pi_{ij} \cdot q_{ij}}{(1 + r_i^*)^t} - \sum_{j=1}^{N_i} \sum_{k=1}^{K_{ij}} n_{ijk} \cdot I_{ijk} = 0$$

where,

r_i^* is the Internal rate of return of the i^{th} segment being determined iteratively and numerically.

T is the number of years on which to calculate the NPV along the i^{th} segment's VC which can vary between 1 and 10 years as defined by the user during the simulation,

N_i is the number of actors along the i^{th} segment's VC,

p_{ij} is the price per kg received by the j^{th} actor for the i^{th} segment,

c_{ij} is the cost per kg paid by the j^{th} actor for the i^{th} segment,

q_{ij} is the catch or volume in kg produced by the j^{th} actor for the i^{th} segment,

r is the discount rate as defined by the user for the simulation of all the segment's VC,

I_{ijk} is the k^{th} investment of the j^{th} actor for the i^{th} segment,

K_{ijk} is the number of different capital investment I_{ijk} from the j^{th} actor for the i^{th} segment,

n_{ijk} corresponds to the number of time the j^{th} actor's k^{th} capital investment I_{ijk} needs to be renewed during T number of years for the i^{th} segment.

π_{ij} is the unit profit (or loss if <0) per kg produced by the j^{th} actor for the i^{th} segment,

Table 3: Comparison of IRRs by proposed product segment for Kiritimati expressed in percentage (%) based on projected production/ year and for the 3 scenarios, optimistic, pessimistic and status-quo and showing for each segment, the discount rate and \pm delta variation (upper/ lower delta) from the status-quo

IRR over 10 years	segment by product type	Optimistic Scenario	Pessimistic Scenario	Status Quo	Discount Rate	Optimist Scenario upper delta	Pessimistic Scenario Lower delta
1 - Basic Needs/ Food Security	A1a - Canned skipjack tuna - coastal purse seine fishery (domestic market)	7%	0%	4%	8%	+17%	-19%
	A1b - Debonned and frozen Milk Fish (domestic/ regional export)	6%	0%	3%	5%	+15%	-14%
	B1a - Chilled Milk Fish (domestic market)	7%	0%	3%	5%	+20%	-15%
	B1b - Chilled whole tuna (domestic/ regional market)	12%	5%	9%	5%	+16%	-16%
	C1 - Live Lobsters (domestic market)	82%	60%	71%	5%	+15%	-15%
2 - Branded/ Labelled Product	A2a - Certified Skipjack Canned Tuna - coastal purse seine fisheries (domestic/ regional export)	8%	0%	4%	9%	+20%	-17%
	A2b - Deep water snapper - frozen whole round (export market)	24%	16%	22%	9%	+5%	-20%
	B2 - Chilled Groupers/ Snappers (domestic/ regional export)	5%	0%	3%	6%	+10%	-12%
	C2 - Live Lobsters (domestic/ regional export)	8%	2%	4%	5%	+20%	-10%
3 - Premium Markets	A3a - Frozen Lobster Tails - canned lobster bisque (domestic/ export market - USA)	11%	3%	7%	7%	+15%	-20%
	A3b - Sushi quality yellowfin tuna - ULT frozen (export market)	25%	8%	17%	7%	+30%	-30%
	B3 - Chilled Groupers/ Snappers (export market - OZ, USA)	10%	0%	7%	8%	+15%	-30%
	C3 - Live Lobsters (export market - USA)	8%	-2%	4%	6%	+20%	-28%
4 - Ornamental	C4 - Pet fish and other aquarium marine life (export market)	26%	14%	20%	5%	+20%	-20%
	C5 - Farmed Giant clam (export market)	26%	14%	20%	5%	+20%	-20%

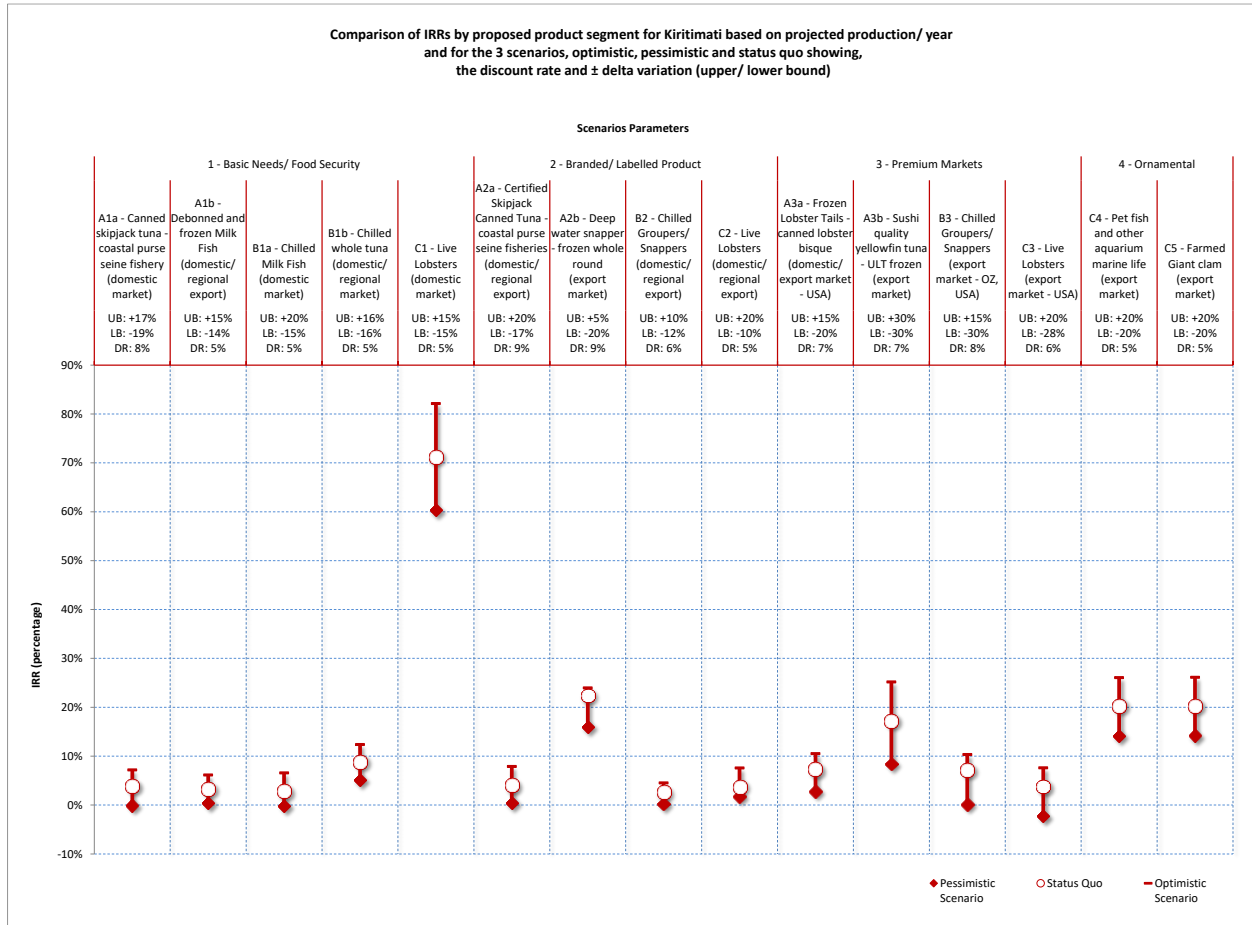


Figure 15: Graphical representation comparing IRRs by proposed products segment for Kiritimati's expressed in percentage (%) and based on projected production/ year and under 3 scenarios, optimistic, pessimistic and status quo

4 Recommendations

4.1 General recommendations

The following five recommendations apply generally in Kiritimati, irrespective of the specific commodity or value chain under upgrading.

1. Implement resource conservation and management measures.

While stakeholders report occasional localized depletions, in general Kiritimati's fishery stocks appear to be in a good condition. However, there is risk that upgrading value chains will create incentives that lead to competition, over-capitalization, and resource over-exploitation. Such trends are overly common amongst global fisheries, often leading to "boom-and-bust" development cycles. Clearly defined management objectives and the implementation of conservation and management measures is essential to sustain the resource base and lock in long-term returns on investment.

2. Efforts to upgrade the harvest sector should prioritize the development of new resource bases.

In general Kiritimati's fishers employ adequate harvest methods and gears. While there may be opportunities to increase labour efficiency in some fisheries (e.g., through the adoption of lobster pots and traps), such improvements could ultimately undermine job creation, sustainability, and market development objectives. Indeed, the artisanal nature of Kiritimati's small-scale fisheries is an asset that could the development of a sustainable, equitable and ethical seafood brand identify. As such, the value in upgrading the harvest sector appears to be marginal. The only exception is where there is interest in developing currently unutilised resources, including deep water snapper and long-line tuna fisheries. In these cases, development support may be required to procure equipment and deliver training.

3. Improve the availability of information and training on post-harvest handling best practices in small-scale fisheries.

Within the large-scale sector post-harvest handling practices are generally adequate, and HACCP compliance is regularly assessed by Kiribati's competent authority. In the small-scale sector however, improvements in post-harvest handling are required if catches are to enter formal value chains. Examples include the need to rapidly chill tuna and to minimize stress to live lobsters to maintain product quality.

4. Significant investment is required to develop processing and add value.

Very little value addition currently occurs in Kiritimati. Existing infrastructure (e.g., CPPL blast freezer and cold storage) is poorly maintained and not compliant with HACCP standards (an essential prerequisite to developing export markets). While several value addition pathways are available to Kiritimati (see below), they will all require significant investment of capital, operational expenses, human resources, technical expertise, and market development. Leveraging private sector capabilities and investment, for example via partnership agreements or joint ventures, could help to accelerate the operationalization of new facilities.

5. Establish market opportunities prior to investing in processing facilities.

The development of a Kiritimati (or Kiribati) seafood brand identify could help to position exports in the market, drawing on qualities such as sustainability, traceability, and social responsibility. Promotion at international seafood expos would further help to build brand recognition. However, global seafood markets are dynamic. Maintaining market share requires a good understanding of consumer preferences, as well as an ability to adapt rapidly to emerging trends. Globally state-owned enterprises have often struggled to remain competitive in these markets, in part due to rigid and bureaucratic management structures that hinder innovation and responsiveness. Leveraging private sector capabilities and investment could again be beneficial here, minimising the public cost of market development while facilitating pragmatic business and investment planning.

4.2 Upgrading recommendations

In addition to the above five general recommendations, the report makes the additional specific recommendations.

1. National development strategies prioritise sustainable economic growth.

KV20 aims to increase investment in value added products, create a conducive investment climate to increase Foreign Direct Investment (FDI) in the fisheries sector, and improve fishery product quality and competitiveness. KV20 sets specific targets to, by 2036, increase private sector contribution to GDP to 65%, increase the number of established foreign investments to 100, and increase the value of exports by 39%.

2. Achieving development goals will require integrating private sector led and community-based development.

Today much of the food processing in Kiribati is labour intensive. As described by Cauchy et al. (Cauchi *et al.*, 2021), “it is as if in a country known for its pasta production, such as Italy, households are expected to sow, cultivate and harvest their own wheat, manually grind it into flour, turn it into pasta and then cook it themselves.” Strategic positioning of private sector investment has the potential to not only enhance the competitiveness of Kiritimati’s marine commodity exports, but also enhance the performance of and deliver benefits to small-scale producers.

3. Upgrading of Kiritimati’s lobster and milkfish value chains is likely to deliver the greatest returns in the short term.

Both fisheries generate high value products, have existing export markets that are underexploited, and require relatively small capital investment in value addition. Lobster fisheries would benefit from improvements in resource management and post-harvest handling, including sprinkler tanks or holding cages to improve the quality and taste of live exports. Milkfish fisheries would benefit from improved pond management, capturing the value that is currently lost through “personal consignment” exports, and value addition processing such as deboning. Furthermore, both fisheries have the potential to contribute to both export trade and domestic food security

objectives. Detailed feasibility assessments should be undertaken for each of these fisheries individually.

4. Developing value chains for tuna and demersal fish will require greater investments of time and capital.

Establishing a deep-water snapper fishery will necessitate procuring vessels and gears and developing skills in new and unfamiliar fishing techniques. While tuna raw material is more readily available, high capital investments and technical expertise will be needed to operationalise canning or loining facilities. Transportation remains a significant bottleneck. The viability of Kiritimati's tuna value chains will remain significantly constrained until port facilities are adequate and regular shipping lines established to enable tuna products to be containerised for transport to Tarawa and export markets. Efforts should be made to engage with the port development process to ensure plans reflect these current and future needs. Production volume estimates, possible generated through fishing trials, would aid in defining these specifications as well as informing detailed feasibility assessments for these upgrades.

5. Well-designed cost recovery mechanisms are essential to lock in benefits.

Leveraging private sector investment and capabilities will help to operationalise value chain upgrades quickly and effectively. However, sustaining benefits will require resource conservation and management measures to be implemented, bringing a cost to the public purse. Proportional, transparent, and well-structured cost recovery mechanisms would help to minimise burden on state budgets and should be considered when detailed feasibility assessments are carried out.

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Annexe 1 Methodology

To achieve the objectives outlined in the terms of reference, strategies and methodologies were developed in collaboration with the PROP team during the inception phase of the assignment. The MEP team of experts conducted a one-week mission to Kiritimati from January 17th to January 24th, 2024.

Semi-structured interviews were conducted with key stakeholders (see Annexe 2), representing the private sector, national and sub-national government agencies, and development partners. These interviews aimed to gain insights into stakeholder perceptions regarding the status of marine resources, activities in the harvest and post-harvest sectors, types and quantities of marine commodity production and trade, relevant regulatory frameworks, and the constraints and opportunities pertaining to market access.

Historical data on the composition and quantity of marine commodity exports were obtained from MFMRD. Additionally, data on the composition and quantity of personal consignments of marine resources exported from Kiritimati were acquired from MFMRD's quarantine division. These datasets were analysed to discern long-term trends in export weights and values for various commodities.

Site visits were conducted to key locations and facilities, including private sector operators, Ronton Port, Cassidy Airport, and site to identify and evaluate potential locations for a cargo facility. Preliminary discussions were held with the Kiribati Airport Authority to review proposed options and identify potential constraints.

Annexe 2 Stakeholders

Stakeholder	Interests
Island Council	Responsible for the operation of some public infrastructure (e.g., ice, fuel, etc.); implementation of bylaws (including those related to fishery management and processing); community support; and implementation of business licences.
Marine aquarium fish operators	Direct user of the proposed facility
Fishers	
Skylight Ltd	Direct user of the proposed facility
MELAD	Responsible for environmental impact assessments and the issuance of land permits
Kiribati Airport Authority	Responsible for the operation and maintenance of the Cassidy Airport property, including issues related to aviation security.
Kiribati Port Authority	Responsible for the operation of Ronton marine port and holds information on surface freight trends.
Ministry of Commerce	Responsibilities include industry development, trade promotion, and promotion of product quality and standards
MFMRD	Responsibilities include monitoring and inspection of marine commodity exports.
CPPL	Direct user of the proposed facility
Air Kiribati Ltd	Responsibilities include ground handling and security screening of airfreight
MLPID	Responsibilities include development of the Line Islands and Phoenix Islands

Annexe 3 Conversion factors by species and by type of processing

We use the conversion factor as shown in Table below to express the final product once processed in its green-weight equivalent. For example, to produce 1 ton of canned tuna, one will need 1,000 X 1.875 kg of whole tuna or 1.875 tons.

Table 4: List of species of interest found in Kiritimati with their potential product types and their corresponding conversion factor⁷, source: FAO, (2000)

Ndx	Species	Type of processing	Conversion Factor
1	Flying fish	Dried	1.12
2	Flying fish	Whole fresh	1.00
3	Grouper	Chilled whole (Gilled & Guttled)	1.10
4	Grouper	Frozen whole (Gilled & Guttled)	1.10
5	Grouper	Whole fresh	1.00
6	Lobster	Canned head meat	1.50
7	Lobster	Frozen tail (Fresh)	3.00
8	Lobster	Frozen whole (Cooked)	1.00
9	Lobster	Frozen whole (Fresh)	1.00
10	Lobster	Live	1.00
11	Lobster	Whole fresh	1.00
12	Milk fish	Chilled whole (Gilled & Guttled)	1.10
13	Milk fish	Dried	1.12
14	Milk fish	Fillet/Deboning	2.00

⁷ Based on the third FAO Fisheries publication containing listings of the factors used by national authorities for the conversion of the landed weight of fishery products to the live weight equivalent.

Ndx	Species	Type of processing	Conversion Factor
15	Milk fish	Frozen whole (Gilled & Gutted)	1.00
16	Milk fish	Smoked	1.00
17	Milk fish	Whole fresh	1.00
18	Other reef fish (Long-nose emperor, trevally)	Chilled whole (Gilled & Gutted)	1.20
19	Other reef fish (Long-nose emperor, trevally)	Frozen fillet	2.50
20	Other reef fish (Long-nose emperor, trevally)	Frozen whole (Gilled & Gutted)	1.20
21	Other reef fish (Long-nose emperor, trevally)	Whole fresh	1.00
22	Snapper	Whole fresh	1.00
23	Tuna	Chilled whole (Gilled & Gutted)	1.20
24	Tuna	Frozen sashimi blocks	1.50
25	Tuna	Frozen whole (Gilled & Gutted)	1.00
26	Tuna	Tuna fillet (Chilled and Frozen)	2.20
27	Tuna	Tuna jerky (packet of 100g)	3.50
28	Tuna	Tuna loin (sourced from purse seine, local fishers)	2.00
29	Tuna	Whole fresh	1.00
30	Tuna	Canned tuna	1.875

Annexe 4 Kiribati seafood prices of selected product

The following tables (Table) gathers information on prices for selected seafood products found in Kiribati and collected from the interweb.

Table 5: Market prices (retail and wholesale) of selected seafood product sold in Kiribati.
 Source: <https://www.selinawamucii.com/insights/prices/kiribati>

Tuna	<p>The retail price range in Australian Dollar for tuna is between AUD 5.83 and AUD 8.02 per kilogram or between AUD 2.65 and AUD 3.64 per pound(lb) in Tarawa and Betio Village.</p> <p>In 2024, the approximate wholesale price range for Kiribati tuna is between US 2.72 and US 3.73 per kilogram or between US 1.23 and US 1.69 per pound(lb).</p> <p>https://www.selinawamucii.com/insights/prices/kiribati/tuna/?utm_source=kiribati+live-fish&utm_medium=button&utm_campaign=price_finder_tool</p>
Lobster	<p>The retail price range in Australian Dollar for lobster is between AUD 6.15 and AUD 31.49 per kilogram or between AUD 2.79 and AUD 14.28 per pound(lb) in Tarawa and Betio Village.</p> <p>In 2024, the approximate wholesale price range for Kiribati lobster is between US 2.86 and US 14.66 per kilogram or between US 1.30 and US 6.65 per pound(lb).</p> <p>https://www.selinawamucii.com/insights/prices/kiribati/lobster/?utm_source=kiribati+tuna&utm_medium=button&utm_campaign=price_finder_tool</p>
Ornamental Fish	<p>The retail price range in Australian Dollar for live ornamental fish is between AUD 7.22 and AUD 21.67 per kilogram or between AUD 3.28 and AUD 9.83 per pound(lb) in Tarawa and Betio Village</p> <p>In 2024, the approximate wholesale price range for Kiribati live ornamental fish is between US 3.36 and US 10.08 per kilogram or between US 1.52 and US 4.57 per pound(lb).</p> <p>https://www.selinawamucii.com/insights/prices/kiribati/live-ornamental-fish/?utm_source=kiribati+lobster&utm_medium=button&utm_campaign=price_finder_tool</p>

Live Tuna	<p>The retail price range in Australian Dollar for live tuna is between AUD 6.61 and AUD 9.18 per kilogram or between AUD 3.00 and AUD 4.16 per pound(lb) in Tarawa and Betio Village.</p> <p>In 2024, the approximate wholesale price range for Kiribati live tuna is between US 3.08 and US 4.27 per kilogram or between US 1.39 and US 1.94 per pound(lb).</p> <p>https://www.selinawamucii.com/insights/prices/kiribati/live-tuna/?utm_source=kiribati+live-ornamental-fish&utm_medium=button&utm_campaign=price_finder_tool</p>
Octopus	<p>The retail price range in Australian Dollar for octopus is between AUD 18.53 and AUD 36.31 per kilogram or between AUD 8.40 and AUD 16.47 per pound(lb) in Tarawa and Betio Village.</p> <p>In 2024, the approximate wholesale price range for Kiribati octopus is between US 8.62 and US 16.90 per kilogram or between US 3.91 and US 7.66 per pound(lb).</p> <p>https://www.selinawamucii.com/insights/prices/kiribati/octopus/?utm_source=kiribati+live-tuna&utm_medium=button&utm_campaign=price_finder_tool</p>
Sea Cucumber	<p>The retail price range in Australian Dollar for sea cucumber is between AUD 21.18 and AUD 67.63 per kilogram or between AUD 9.61 and AUD 30.67 per pound(lb) in Tarawa and Betio Village.</p> <p>In 2024, the approximate wholesale price range for Kiribati sea cucumber is between US 9.86 and US 31.48 per kilogram or between US 4.47 and US 14.28 per pound(lb).</p> <p>https://www.selinawamucii.com/insights/prices/kiribati/sea-cucumber/?utm_source=kiribati+octopus&utm_medium=button&utm_campaign=price_finder_tool</p>
Sea Cucumbers	<p>The retail price range in Australian Dollar for sea cucumbers is between AUD 11.69 and AUD 18.26 per kilogram or between AUD 5.30 and AUD 8.28 per pound(lb) in Tarawa and Betio Village.</p> <p>In 2024, the approximate wholesale price range for Kiribati sea cucumbers is between US 5.44 and US 8.50 per kilogram or between US 2.47 and US 3.85 per pound(lb).</p> <p>https://www.selinawamucii.com/insights/prices/kiribati/sea-cucumbers/?utm_source=kiribati+sea-cucumber&utm_medium=button&utm_campaign=price_finder_tool</p>

Other Fish	<p>The retail price range in Australian Dollar for fish is between AUD 3.30 and AUD 11.77 per kilogram or between AUD 1.50 and AUD 5.34 per pound(lb) in Tarawa and Betio Village.</p> <p>In 2024, the approximate wholesale price range for Kiribati fish is between US 1.54 and US 5.48 per kilogram or between US 0.70 and US 2.48 per pound(lb).</p> <p>https://www.selinawamucii.com/insights/prices/kiribati/fish/?utm_source=kiribati+kelp&utm_medium=button&utm_campaign=price_finder_tool</p>
Other Fish Filet	<p>The retail price range in Australian Dollar for fish fillet is between AUD 6.31 and AUD 11.14 per kilogram or between AUD 2.86 and AUD 5.05 per pound(lb) in Tarawa and Betio Village.</p> <p>In 2024, the approximate wholesale price range for Kiribati fish fillet is between US 2.94 and US 5.18 per kilogram or between US 1.33 and US 2.35 per pound(lb).</p> <p>https://www.selinawamucii.com/insights/prices/kiribati/fish-fillet/?utm_source=kiribati+fish&utm_medium=button&utm_campaign=price_finder_tool</p>

The information on prices thus collected is summarised in the table below.

Table 6: Summary of market prices (retail and wholesale) of selected seafood product sold in Kiribati expressed in AUD/ kg and USD/ Kg.
 Source: <https://www.selinawamucii.com/insights/prices/kiribati>

Species	Retail (low) AUD/ kg	Retail (high) AUD/ kg	Wholesale (low) USD/ kg	Wholesale (high) USD/ kg	Wholesale (low) AUD/ kg	Wholesale (high) AUD/ kg
Other Fish	3.3	11.77	1.54	5.48	2.40	8.55
Other Fish Filet	6.31	11.14	2.94	5.18	4.59	8.08
Live Tuna	6.61	9.18	3.08	4.27	4.81	6.66
Lobster	6.15	31.49	2.86	14.66	4.46	22.88
Octopus	18.53	36.31	8.62	16.9	13.45	26.37
Ornamental Fish	7.22	21.67	3.36	10.08	5.24	15.73
Sea Cucumber	21.18	67.63	9.86	31.48	15.39	49.12
Sea Cucumbers	11.69	18.26	5.44	8.5	8.49	13.26
Tuna	5.83	8.02	2.72	3.73	4.24	5.82

Table 7: Ex-vessel and market prices of selected seafood product collected in Kiritimati from CPPL and Fishers

Species	type	Source type	target	Price type	Price (AUD/ kg)	Source
Lobster	Canned head meat	CPPL	Domestic Market	domestic price	80.00	CPPL
Tuna	Tuna jerky (packet of 100g)	CPPL	Domestic Market	domestic price	80.00	CPPL
Lobster	Frozen tail (Fresh)	CPPL	Export Market	export price	30.00	CPPL
Lobster	Frozen tail (Fresh)	CPPL	Domestic Market	domestic price	20.00	CPPL
Lobster	Frozen whole (Cooked)	CPPL	Domestic Market	domestic price	16.00	CPPL
Lobster	Frozen whole (Fresh)	CPPL	Domestic Market	domestic price	16.00	CPPL
Lobster	Live	CPPL	Domestic Market	domestic price	16.00	CPPL
Tuna	Frozen sashimi blocks	KIFL	Export Market	export price	14.00	KIFL
Flying fish	Dried	Local fishers	Domestic Market	ex-vessel price	13.33	Ekeimoa
Flying fish	Whole fresh	Local fishers	Domestic Market	ex-vessel price	13.33	Gilima Enterprise
Lobster	Whole fresh	Local fishers	CPPL	ex-vessel price	11.00	CPPL
Flying fish	Whole fresh	Local fishers	Domestic Market	ex-vessel price	10.67	Ekeimoa
Milk fish	Dried	Local fishers	Domestic Market	ex-vessel price	9.71	Ekeimoa
Milk fish	Dried	CPPL	Domestic Market	domestic price	8.57	CPPL
Milk fish	Fillet/Deboning	CPPL	Domestic Market	domestic price	8.57	CPPL
Milk fish	Smoked	CPPL	Domestic Market	domestic price	8.57	CPPL

Species	type	Source type	target	Price type	Price (AUD/kg)	Source
Milk fish	Whole fresh	Local fishers	Domestic Market	ex-vessel price	8.57	Kiriphin
Tuna	Tuna loin (sourced from purse seine, local fishers)	CPPL	Domestic Market	domestic price	8.50	CPPL
Milk fish	Chilled whole (Gilled & Gutted)	CPPL	Domestic Market	domestic price	7.14	CPPL
Milk fish	Frozen whole (Gilled & Gutted)	CPPL	Domestic Market	domestic price	7.14	CPPL
Milk fish	Whole fresh	KIFL	Domestic Market	domestic price	7.00	KIFL
Tuna	Tuna fillet (Chilled and Frozen)	CPPL	Domestic Market	domestic price	6.61	CPPL
Tuna	Chilled whole (Gilled & Gutted)	CPPL	Domestic Market	domestic price	5.51	CPPL
Tuna	Frozen whole (Gilled & Gutted)	CPPL	Domestic Market	domestic price	5.51	CPPL
Milk fish	Whole fresh	Local fishers	Domestic Market	ex-vessel price	5.29	Ekeimoa
Milk fish	Whole fresh	Local fishers	CPPL	ex-vessel price	4.50	CPPL
Other reef fish (Long-nose emperor, trevally)	Chilled whole (Gilled & Gutted)	CPPL	Domestic Market	domestic price	4.41	CPPL
Other reef fish (Long-nose emperor, trevally)	Frozen whole (Gilled & Gutted)	CPPL	Domestic Market	domestic price	4.41	CPPL
Tuna	Whole fresh	Local fishers	CPPL	ex-vessel price	4.41	CPPL
Tuna	Whole fresh	Local fishers	Domestic Market	ex-vessel price	4.41	Gilima Enterprise

Species	type	Source type	target	Price type	Price (AUD/kg)	Source
Grouper	Whole fresh	Local fishers	CPPL	ex-vessel price	3.31	CPPL
Other reef fish (Long-nose emperor, trevally)	Whole fresh	Local fishers	CPPL	ex-vessel price	3.31	CPPL
Other reef fish (Long-nose emperor, trevally)	Whole fresh	Local fishers	Domestic Market	ex-vessel price	3.31	Ekeimoa
Other reef fish (Long-nose emperor, trevally)	Whole fresh	Local fishers	Domestic Market	ex-vessel price	3.31	Gilima Enterprise
Other reef fish (Long-nose emperor, trevally)	Whole fresh	Local fishers	Domestic Market	ex-vessel price	3.31	Kiriphin
Snapper	Whole fresh	Local fishers	CPPL	ex-vessel price	3.31	CPPL
Tuna	Whole fresh	Local fishers	Domestic Market	ex-vessel price	3.31	Ekeimoa
Grouper	Chilled whole (Gilled & Gutted)	CPPL	Domestic Market	domestic price	2.50	CPPL
Grouper	Frozen whole (Gilled & Gutted)	CPPL	Domestic Market	domestic price	2.50	CPPL
Other reef fish (Long-nose emperor, trevally)	Frozen fillet	CPPL	Domestic Market	domestic price	2.00	CPPL
Milk fish	Whole fresh	Local fishers	Domestic Market	ex-vessel price	1.22	Tuteke

Annexe 5 Revenue and cost data used in the VCA model

The following tables below summarise the revenue and cost data used in the VCA model and corresponding to CCPL data on fish Landings by fishers and fish handling and processing by CPPL in 2021.

A5.1 Seafood Harvest Sector

The following data came from Fishers mostly contracted by CPPL

Table 8: Landings of Ocean Fish (a.k.a. Tuna) and Reef Fish (a.k.a. Snapper) supplied to CPPL by fishers in 2021

Landings Kg	month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output (Kg)													
Ocean Fish	1,549.	2,356.	3,310.	1,196.	633.0	1,620.	1,823.	7,342.	4,525.	4,011.	3,525.	2,855.	34,751.
Reef Fish	362.5	1,095.	1,044.	1,293.	395.8	-	80.32	-	5.79	-	-	14.78	4,292.1
Total weight	1,912.	3,452.	4,354.	2,489.	1,028.	1,620.	1,904.	7,342.	4,531.	4,011.	3,525.	2,870.	39,043.

Table 9: Ex-vessel prices of Ocean Fish (a.k.a. Tuna) and Reef Fish (a.k.a. Snapper) supplied to CPPL by fishers in 2021

ex-vessel prices AUD/ kg	month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Price (AUD/ kg)													
Ocean Fish Price (AUD/ kg)	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Reef Fish Price (AUD/ kg)	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	0.74	1.26
Weighted average Price (AUD/ kg)	1.56	1.56	1.55	1.53	1.53	1.65	1.63	1.65	1.65	1.65	1.65	1.65	1.61

Table 10: Revenue from Ocean fish (a.k.a. Tuna) and Reef Fish (a.k.a. Snapper) supplied to CPPL by fishers in 2021

Revenues AUD	month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Revenue (AUD)													
Ocean Fish Revenue (AUD)	2,560.14	3,892.19	5,467.61	1,975.97	1,045.61	2,677.29	3,012.57	12,128.66	7,474.83	6,625.25	5,822.36	4,717.19	57,399.64
Reef Fish Revenue (AUD)	479.03	1,447.91	1,379.53	1,708.61	523.12	-	106.13	-	7.66	-	-	19.54	5,671.51
Gross Revenue (AUD)	3,039.17	5,340.09	6,847.14	3,684.58	1,568.72	2,677.29	3,118.70	12,128.66	7,482.49	6,625.25	5,822.36	4,736.72	63,071.15

Table 11: Species (Tuna and Snapper) Share of Catch and Revenue by fishers in 2021

Species Share of Catch & Rev	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Category Output share (%)													
% Ocean Fish	72.00%	71.86%	68.59%	64.57%	62.90%	100.00%	94.92%	100.00%	99.88%	100.00%	100.00%	99.49%	87.12%
% Reef Fish	28.00%	28.14%	31.41%	35.43%	37.10%		5.08%		0.12%			0.51%	12.88%
Revenue share (%)													

Ocean Fish Revenue share (%)	73.31 %	72.24 %	69.20 %	65.03 %	64.04 %	100.00 %	95.62 %	100.00 %	99.91 %	100.00 %	100.00 %	99.58 %	87.43 %
Reef Fish Revenue share (%)	26.69 %	27.76 %	30.80 %	34.97 %	35.96 %		4.38%		0.09%			0.42%	12.57 %

Table 12: Operating Cost (AUD) for Tuna Species provided by fishers in 2021

Recap

Category	Month													AU D Per kg
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	
Operating Cost (AUD)														-
Ocean Fish Costs (AUD)														-
Bait	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fishing Line	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel	1,179.69	1,554.48	2,518.10	1,672.01	638.76	1,472.85	872.64	2,795.85	3,352.26	2,838.38	3,611.25	3,098.68	25,604.95	0.74
Hook	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ice	387.07	433.43	560.53	397.99	125.90	216.00	183.59	1,056.00	983.07	576.00	816.00	812.57	6,548.15	0.19
Oil	-	-	-	-	115.90	224.75	137.98	422.92	511.53	433.01	554.14	509.52	2,909.75	0.08
Sinker	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trolling	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wire	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ocean Fish Total Expenses (AUD)	1,566.77	1,987.90	3,078.63	2,070.01	880.55	1,913.60	1,194.21	4,274.77	4,846.86	3,847.39	4,981.39	4,420.78	35,062.85	1.01

Table 13: Operating Cost (AUD) by Snapper Species provided by fishers in 2021

Recap

Category	Month												Annual	AU D Per kg	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Op Cost (AUD)														-	
Reef Fish Costs (AUD)															
Bait	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fishing Line	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel	429.5 1	597.4 2	1,120. 73	899.0 7	358.7 4	-	39.96	-	3.17	-	-	13.07	3,461. 66	0.8 1	
Hook	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ice	140.9 3	166.5 7	249.4 7	214.0 1	70.71	-	8.41	-	0.93	-	-	3.43	854.45	0.2 0	
Oil	-	-	-	-	65.09	-	6.32	-	0.48	-	-	2.15	74.04	0.0 2	
Sinker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Trolling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Reef Fish Total Expenses (AUD)	570.4 3	764.0 0	1,370. 20	1,113. 07	494.5 4	-	54.69	-	4.58	-	-	18.64	4,390. 15	1.0 2	
Total Expenses (AUD)	2,137. 20	2,751. 90	4,448. 83	3,183. 08	1,375. 09	1,913. 60	1,248. 90	4,274. 77	4,851. 44	3,847. 39	4,981. 39	4,439. 42	39,453. .00	1.0 1	

Table 14: Revenue (AUD) and Output (kg) by species (Tuna and Snapper) provided by fishers in 2021

Recap

Category	Month													Annual	AU D Per kg
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Rev (AUD)															-
Ocean Fish															
Revenue (AUD)	2,560.14	3,892.19	5,467.61	1,975.97	1,045.61	2,677.29	3,012.57	12,128.66	7,474.83	6,625.25	5,822.36	4,717.19	57,399.64	1.65	
Reef Fish															
Revenue (AUD)	479.03	1,447.91	1,379.53	1,708.61	523.12	-	106.13	-	7.66	-	-	19.54	5,671.51	1.32	
Gross															
Revenue (AUD)	3,039.17	5,340.09	6,847.14	3,684.58	1,568.72	2,677.29	3,118.70	12,128.66	7,482.49	6,625.25	5,822.36	4,736.72	63,071.15	1.62	
Output (Kg)															
Ocean Fish (kg)	1,549.97	2,356.43	3,310.23	1,196.30	633.04	1,620.90	1,823.89	7,342.99	4,525.45	4,011.09	3,525.00	2,855.90	34,751.19		
Reef Fish (kg)	362.52	1,095.75	1,044.00	1,293.04	395.88	-	80.32	-	5.79	-	-	14.78	4,292.10		
Total weight (kg)	1,912.49	3,452.18	4,354.23	2,489.35	1,028.92	1,620.90	1,904.20	7,342.99	4,531.24	4,011.09	3,525.00	2,870.69	39,043.28		

	Net per Kg (AUD/ kg)
Ocean Fish (kg)	0.64
Reef Fish (kg)	0.30
All fish combined	0.60

A5.2 Seafood Processing Sector (CPPL)

The following data were collected from CPPL and were used to calibrate the cost and revenue parameters in the VCA model for several relevant segments.

Table 15: Processor Operating Cost by category (AUD) provided by CPPL in 2021

Expenses	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Cost Category/ Cost Center													
Admin	444.5 4	690.3 3	786.9 3	2,672. 66	1,073. 66	691.8 4	1,248. 79	707.2 3	644.3 2	604.7 4	622.0 4	728.3 6	10,915. 44
KIC Insurance	75.00	80.00	100.0 0	110.0 0	150.0 0	150.0 0	225.0 0	150.0 0	150.0 0	135.0 0	150.0 0	135.0 0	1,610.0 0
Licence	-	-	-	1,972. 50	-	-	200.0 0	-	-	-	-	-	2,172.5 0
Taxes	369.5 4	610.3 3	686.9 3	590.1 6	923.6 6	541.8 4	823.7 9	557.2 3	494.3 2	469.7 4	472.0 4	593.3 6	7,132.9 4
Equipment	914.2 0	-	-	-	-	-	-	-	-	-	-	-	914.20
Fishing Gear	914.2 0	-	-	-	-	-	-	-	-	-	-	-	914.20
Finance	4,071. 52	2,237. 90	5,062. 67	3,071. 54	2,162. 95	2,926. 50	8,304. 19	3,905. 01	3,369. 28	3,000. 46	2,887. 50	4,339. 68	45,339. 20
Bank Loan	-	-	-	-	-	-	1,676. 21	-	-	-	-	-	1,676.2 1
DBK Loan	1,109. 40	814.0 0	792.2 9	920.1 0	792.0 0	1,014. 00	1,521. 00	1,014. 00	1,014. 00	1,014. 00	640.0 0	1,339. 80	11,984. 59
KPF Contribution	964.7 2	-	2,321. 33	1,029. 84	-	-	3,013. 18	1,473. 76	1,045. 98	911.2 6	919.5 0	784.9 8	12,464. 55
KPF Loan	1,231. 80	1,065. 80	1,235. 60	1,121. 60	1,005. 10	1,140. 60	1,719. 30	1,040. 00	977.6 0	1,075. 20	957.2 0	1,487. 70	14,057. 50

Expenses	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Cost Category/ Cost Center													
Petty Cash	765.6 0	358.1 0	713.4 5	- -	365.8 5	771.9 0	374.5 0	377.2 5	331.7 0	- -	370.8 0	727.2 0	5,156.3 5
Labour	15,15 8.95	12,58 1.85	4,544. 71	6,199. 30	15,37 6.25	2,694. 25	30,01 8.97	2,437. 06	3,203. 46	1,684. 55	1,023. 13	7,680. 22	102,60 2.70
Allowance	-	997.1 5	223.4 0	464.0 0	446.8 0	121.8 5	567.1 0	-	1,080. 85	520.4 5	-	180.0 0	4,601.6 0
Bonus	10,30 4.00	-	-	-	-	-	-	-	-	-	-	5,026. 05	15,330. 05
Crewing	-	5,050. 00	2,826. 60	3,012. 50	11,98 4.55	700.0 0	15,89 1.62	1,308. 96	-	-	-	555.0 0	41,329. 23
Entertainment	738.5 0	-	-	-	-	-	-	-	-	-	-	893.6 0	1,632.1 0
House Rent	87.70	38.15	87.70	87.70	87.70	87.70	131.5 5	87.70	87.70	87.70	78.93	105.2 4	1,055.4 7
Leave Grant	3,501. 30	6,000. 00	-	2,000. 00	-	-	11,00 0.00	-	-	-	-	-	22,501. 30
Local Imprest (DSA)	-	-	-	-	490.0 0	1,230. 00	-	-	-	-	-	-	1,720.0 0
Salaries	32.75	496.5 5	1,407. 01	635.1 0	2,112. 20	-	2,428. 70	1,040. 40	2,034. 91	1,076. 40	944.2 0	920.3 3	13,128. 55
Seafare	-	-	-	-	255.0 0	554.7 0	-	-	-	-	-	-	809.70
Wages	494.7 0	-	-	-	-	-	-	-	-	-	-	-	494.70
Operating	594.6 0	2,487. 10	2,363. 20	2,201. 82	1,423. 60	2,196. 70	4,104. 40	4,202. 00	1,170. 40	3,557. 25	1,470. 50	1,160. 50	26,932. 07
Agency	-	-	-	257.1 7	-	-	-	-	-	-	-	-	257.17

Expenses	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Cost Category/ Cost Center													
Fishing Expenses	594.60	2,317.10	1,305.20	1,420.65	803.30	1,946.70	3,781.40	4,202.00	1,170.40	2,687.25	658.00	1,160.50	22,047.10
Rental	-	-	-	-	430.30	-	-	-	-	-	-	-	430.30
Repairs & Maintenance	-	170.00	1,058.00	524.00	190.00	250.00	323.00	-	-	870.00	812.50	-	4,197.50
Supply	3,373.15	1,334.70	4,457.45	-	1,417.10	856.59	2,533.50	5,323.40	4,248.50	1,239.60	1,691.50	356.40	26,831.89
Fish Purchase	-	988.00	2,159.60	-	-	517.00	754.00	4,005.20	3,755.40	-	-	-	12,179.20
Lobster Purchase	2,161.15	287.30	2,240.25	-	379.10	220.00	1,779.50	1,318.20	493.10	1,239.60	673.20	356.40	11,147.80
Milk Fish Purchase	1,212.00	-	-	-	1,038.00	-	-	-	-	-	824.10	-	3,074.10
Octopus Purchase	-	59.40	57.60	-	-	119.59	-	-	-	-	194.20	-	430.79
Utility	4,273.60	3,382.77	6,954.70	6,919.35	4,475.77	3,531.92	693.87	1,222.67	-	4,391.30	5,547.77	5,355.43	46,749.15
Electricity	895.29	-	1,472.79	1,471.80	1,151.70	1,498.86	-	557.14	-	-	-	-	7,047.58
Fuel	2,750.20	2,750.20	4,807.60	4,744.65	2,691.40	1,382.60	-	-	-	3,763.80	4,919.80	4,069.00	31,879.25
Telecommunication	628.11	632.57	674.31	702.90	632.67	650.46	693.87	665.53	-	627.50	627.97	1,286.43	7,822.32
Office	-	-	-	-	-	-	417.50	-	-	191.25	-	1,540.00	2,148.75
Office Equipment	-	-	-	-	-	-	-	-	-	-	-	1,540.00	1,540.00

Expenses	Month												Annual	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Cost Category/ Cost Center														
Office Supplies	-	-	-	-	-	-	-	-	-	-	191.25	-	-	191.25
Other Expenses	-	-	-	-	-	-	417.50	-	-	-	-	-	-	417.50
Monthly total	28,830.56	22,714.65	24,169.66	21,064.67	25,929.33	12,897.80	47,321.22	17,797.37	12,635.96	14,669.15	13,242.44	21,160.59	262,433.40	

Annexe 6 VCA's results by segment

In this section we present the VCA's preliminary results by product segment.

Methodology

Data Collection and Organization

Data for each segment were entered into Microsoft Excel, with separate tables capturing the costs and revenues associated with harvesting, processing, and distributing. These entries are preliminary, as updated or additional data may become available to better inform the models.

Table Structure and Pivot Tables

Fifteen tables were created to gather the "raw" data, each using the same template to facilitate the subsequent creation of PivotTables in Excel. According to Microsoft, PivotTables provide an interactive way to quickly summarize large amounts of data. They enable detailed analysis of numerical data and help answer unanticipated questions about the data.

Process Overview

Data Entry: Raw data on costs and revenues for each segment were entered into Excel tables.

Standardization: All tables followed a consistent template to ensure uniformity and ease of analysis.

PivotTables Creation: The standardized data were then used to create PivotTables. These PivotTables helped in logically and succinctly summarizing the data, allowing for an interactive and detailed analysis.

Preliminary Results: The preliminary results were generated, showcasing the cost and revenue parameters for the various segments deemed relevant.

This methodology ensures that the data is organized in a way that facilitates comprehensive analysis, allowing for adjustments as more data becomes available.

A6.1 Canned skipjack tuna - coastal purse seine fishery (domestic market) - Segment A1a.

Table 16: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Canned skipjack tuna - coastal purse seine fishery (domestic market)

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/year)	Annual Output (kg/year)
Harvest											
Recap	10	16,400	164,000	7,404	74,045	1.481	8,250	82,500	1.650	5,000	50,000
Recap	10	16,400	164,000	7,404	74,045	1.481	8,250	82,500	1.650	5,000	50,000
Investment	10	16,400	164,000	2,360	23,596	0.472					
Equipment	10	16,000	160,000	2,302	23,021	0.460					
Gears	10	400	4,000	58	576	0.012					
Operating Cost	10			5,045	50,448	1.009					
Fishing Line	10										
Fuel	10			3,684	36,840	0.737					
Hook	10										
Ice	10			942	9,421	0.188					
Oil	10			419	4,187	0.084					
Sinker	10										
Trolling	10										
Wire	10										
Repairs & Maintenance	10										
Landings	10						8,250	82,500	1.650	5,000	50,000
Skipjack	10						8,250	82,500	1.650	5,000	50,000
Processing											
Recap	1	410,971	410,971	137,307	137,307	5.163	199,468	199,468	7.500	26,596	26,596
Recap	1	410,971	410,971	137,307	137,307	5.163	199,468	199,468	7.500	26,596	26,596
Investment	1	401,829	401,829	57,815	57,815	2.174					
Building & machinery	1	401,829	401,829	57,815	57,815	2.174					
Operating Cost	1			11,625	11,625	0.437					
Agency	1			111	111	0.004					
Fishing Expenses	1			9,517	9,517	0.358					
Rental	1			186	186	0.007					
Repairs & Maintenance	1			1,812	1,812	0.068					
Equipment	1	9,142	9,142	1,315	1,315	0.049					
Fishing Gear	1	9,142	9,142	1,315	1,315	0.049					
Admin	1			4,712	4,712	0.177					
KIC Insurance	1			695	695	0.026					
Licence	1			938	938	0.035					
Taxes	1			3,079	3,079	0.116					
Finance	1			2,226	2,226	0.084					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			2,226	2,226	0.084					
Labour	1			44,288	44,288	1.665					
Allowance	1			1,986	1,986	0.075					
Bonus	1			6,617	6,617	0.249					
Crewing	1			18,053	18,053	0.679					
Entertainment	1			704	704	0.026					
House Rent	1			456	456	0.017					
Leave Grant	1			9,713	9,713	0.365					
Local Imprest (DSA)	1			742	742	0.028					
Salaries	1			5,667	5,667	0.213					
Seafare	1			350	350	0.013					
Supply of raw material	1			82,500	82,500	3.102					
Fish Purchase	1			82,500	82,500	3.102					
Utility	1			20,179	20,179	0.759					
Electricity	1			3,042	3,042	0.114					
Fuel	1			13,761	13,761	0.517					
Telecommunication	1			3,376	3,376	0.127					
Office	1			928	928	0.035					
Office Equipment	1			665	665	0.025					
Office Supplies	1			83	83	0.003					
Other Expenses	1			180	180	0.007					
Output Production	1						199,468	199,468	7.500	26,596	26,596
Canned Skipjack	1						199,468	199,468	7.500	26,596	26,596

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	0%	4%	7%
NPV over 10 years	-191,158	-101,127	-20,574
Payback period	10 years	8 years	7 years

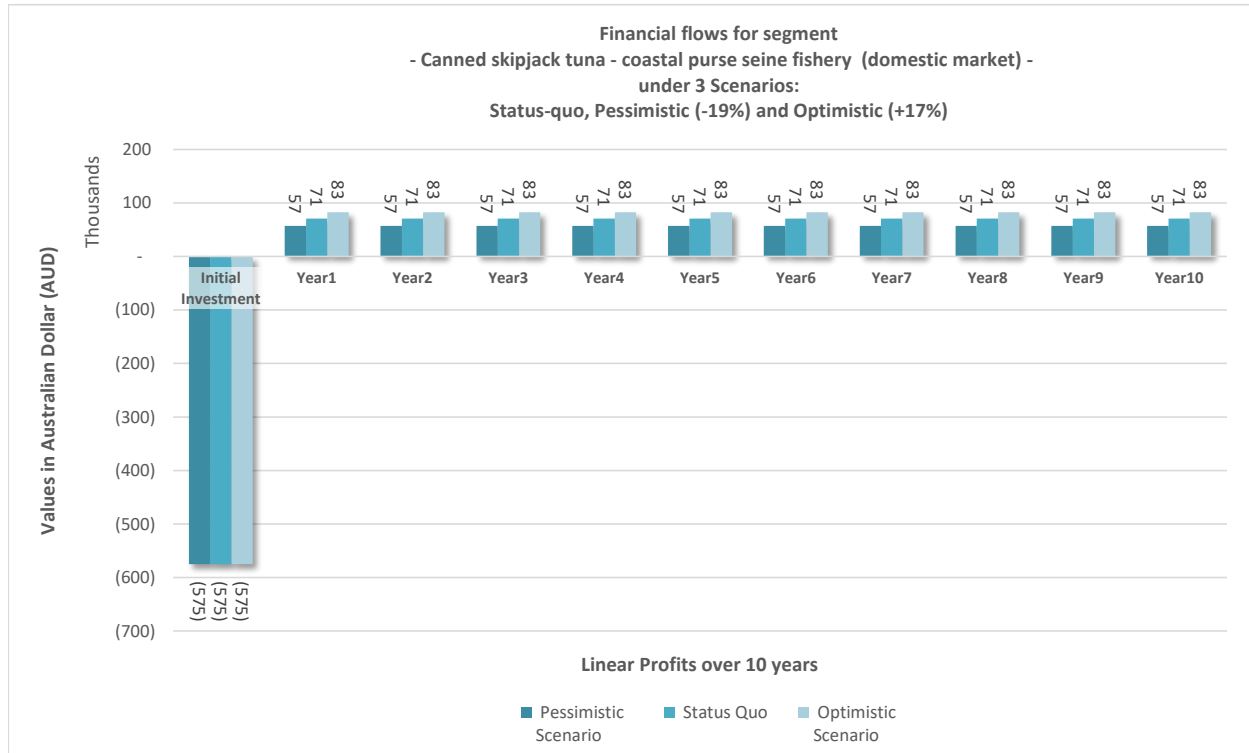


Figure 16: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Canned skipjack tuna - coastal purse seine fishery (domestic market)

A6.2 Debonned and frozen Milk Fish (domestic/ regional export) - Segment A1b.

Table 17: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Debonned and frozen Milk Fish (domestic/ regional export)

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/ year)	Annual Output (kg/ year)
Harvest											
Recap	10	16,400	164,000	889	8,885	1.481	2,940	29,400	4.900	600	6,000
Investment	10	16,400	164,000	283	2,832	0.472					
Equipment	10	16,000	160,000	276	2,762	0.460					
Gears	10	400	4,000	7	69	0.012					
Operating Cost	10			605	6,054	1.009					
Fishing Line	10										
Fuel	10			442	4,421	0.737					
Hook	10										
Ice	10			113	1,131	0.188					
Oil	10			50	502	0.084					
Sinker	10										
Trolling	10										
Wire	10										
Repairs & Maintenance	10										
Landings	10						2,940	29,400	4.900	600	6,000
Milk Fish	10						2,940	29,400	4.900	600	6,000
Processing											
Recap	1	410,971	410,971	3,660	3,660	0.610	51,600	51,600	8.600	6,000	6,000
Investment	1	401,829	401,829	6,938	6,938	1.156					
Building & machinery	1	401,829	401,829	6,938	6,938	1.156					
Operating Cost	1			372	372	0.062					
Agency	1			4	4	0.001					
Fishing Expenses	1			305	305	0.051					
Rental	1			6	6	0.001					
Repairs & Maintenance	1			58	58	0.010					
Equipment	1	9,142	9,142	158	158	0.026					
Fishing Gear	1	9,142	9,142	158	158	0.026					
Admin	1			151	151	0.025					
KIC Insurance	1			22	22	0.004					
Licence	1			30	30	0.005					
Taxes	1			99	99	0.016					
Finance	1			71	71	0.012					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			71	71	0.012					
Labour	1			1,417	1,417	0.236					
Allowance	1			64	64	0.011					
Bonus	1			212	212	0.035					
Crewing	1			578	578	0.096					
Entertainment	1			23	23	0.004					
House Rent	1			15	15	0.002					
Leave Grant	1			311	311	0.052					
Local Imprest (DSA)	1			24	24	0.004					
Salaries	1			181	181	0.030					
Seafare	1			11	11	0.002					
Supply of raw material	1			29,400	29,400	4.900					
Fish Purchase	1			29,400	29,400	4.900					
Utility	1			646	646	0.108					
Electricity	1			97	97	0.016					
Fuel	1			440	440	0.073					
Telecommunication	1			108	108	0.018					
Office	1			30	30	0.005					
Office Equipment	1			21	21	0.004					
Office Supplies	1			3	3	0.000					
Other Expenses	1			6	6	0.001					
Output Production	1						51,600	51,600	8.600	6,000	6,000
Frozen Whole Milk Fish	1						51,600	51,600	8.600	6,000	6,000

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	0%	3%	6%
NPV over 10 years	-120,387	-46,385	32,903
Payback period	10 years	8 years	7 years

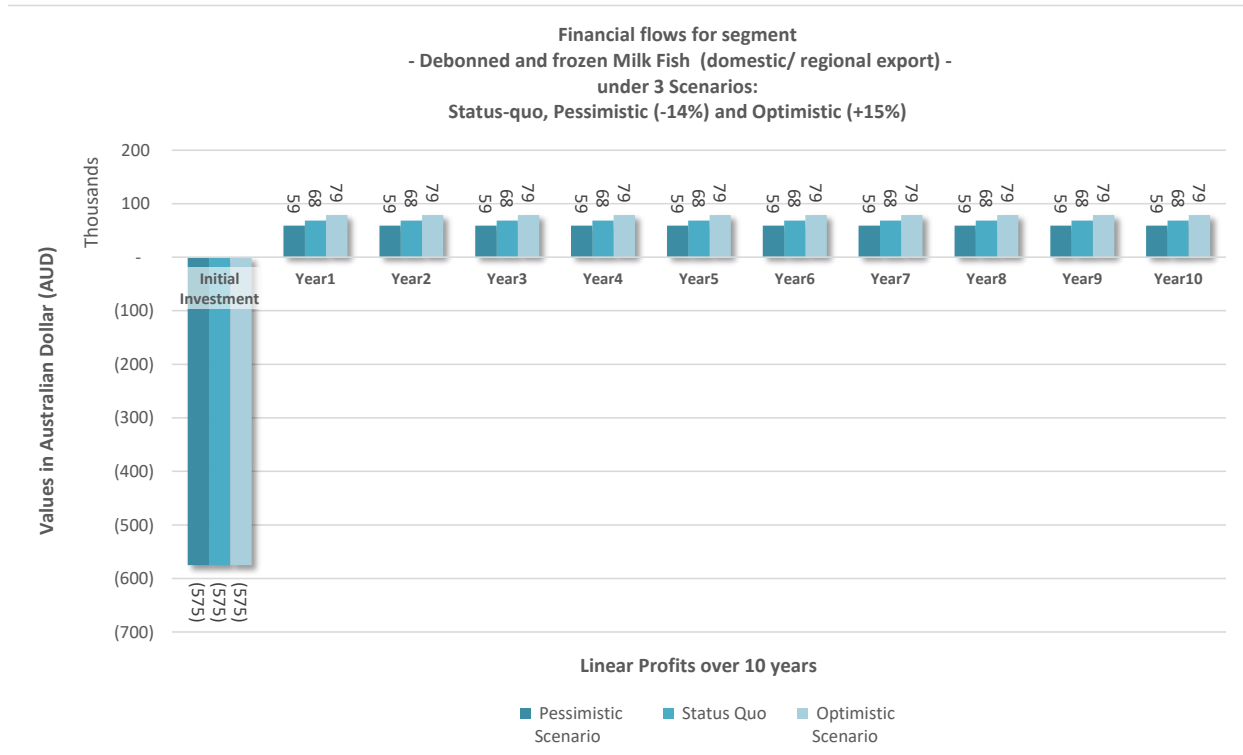


Figure 17: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Debboned and frozen Milk Fish (domestic/ regional export)

A6.3 Chilled Milk Fish (domestic market) - Segment B1a.

Table 18: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Chilled Milk Fish (domestic market)

Australian Dollar (AUD) ▼

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)							Output in kg		
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/ year)	Annual Output (kg/ year)
Harvest											
Recap	8	16,400	131,200	1,387	11,092	1.387	4,900	39,200	4.900	1,000	8,000
Recap	8	16,400	131,200	1,387	11,092	1.387	4,900	39,200	4.900	1,000	8,000
Investment	8	16,400	131,200	378	3,020	0.378					
Equipment	8	16,000	128,000	368	2,947	0.368					
Gears	8	400	3,200	9	74	0.009					
Operating Cost	8			1,009	8,072	1.009					
Fishing Line	8										
Fuel	8			737	5,894	0.737					
Hook	8										
Ice	8			188	1,507	0.188					
Oil	8			84	670	0.084					
Sinker	8										
Trolling	8										
Wire	8										
Repairs & Maintenance	8										
Landings	8						4,900	39,200	4.900	1,000	8,000
Milk Fish	8						4,900	39,200	4.900	1,000	8,000
Processing											
Recap	1	410,971	410,971	5,061	5,061	0.696	40,000	40,000	5.500	7,273	7,273
Recap	1	410,971	410,971	5,061	5,061	0.696	40,000	40,000	5.500	7,273	7,273
Investment	1	401,829	401,829	9,250	9,250	1.272					
Building & machinery	1	401,829	401,829	9,250	9,250	1.272					
Operating Cost	1			496	496	0.068					
Agency	1			5	5	0.001					
Fishing Expenses	1			406	406	0.056					
Rental	1			8	8	0.001					
Repairs & Maintenance	1			77	77	0.011					
Equipment	1	9,142	9,142	210	210	0.029					
Fishing Gear	1	9,142	9,142	210	210	0.029					
Admin	1			201	201	0.028					
KIC Insurance	1			30	30	0.004					
Licence	1			40	40	0.006					
Taxes	1			131	131	0.018					
Finance	1			95	95	0.013					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			95	95	0.013					
Labour	1			1,890	1,890	0.260					
Allowance	1			85	85	0.012					
Bonus	1			282	282	0.039					
Crewing	1			770	770	0.106					
Entertainment	1			30	30	0.004					
House Rent	1			19	19	0.003					
Leave Grant	1			414	414	0.057					
Local Imprest (DSA)	1			32	32	0.004					
Salaries	1			242	242	0.033					
Seafare	1			15	15	0.002					
Supply of raw material	1			39,200	39,200	5.390					
Fish Purchase	1			39,200	39,200	5.390					
Utility	1			861	861	0.118					
Electricity	1			130	130	0.018					
Fuel	1			587	587	0.081					
Telecommunication	1			144	144	0.020					
Office	1			40	40	0.005					
Office Equipment	1			28	28	0.004					
Office Supplies	1			4	4	0.000					
Other Expenses	1			8	8	0.001					
Output Production	1						40,000	40,000	5.500	7,273	7,273
Chilled Whole Milk Fish	1						40,000	40,000	5.500	7,273	7,273

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	0%	3%	7%
NPV over 10 years	-128,364	-55,339	42,027
Payback period	10 years	9 years	7 years

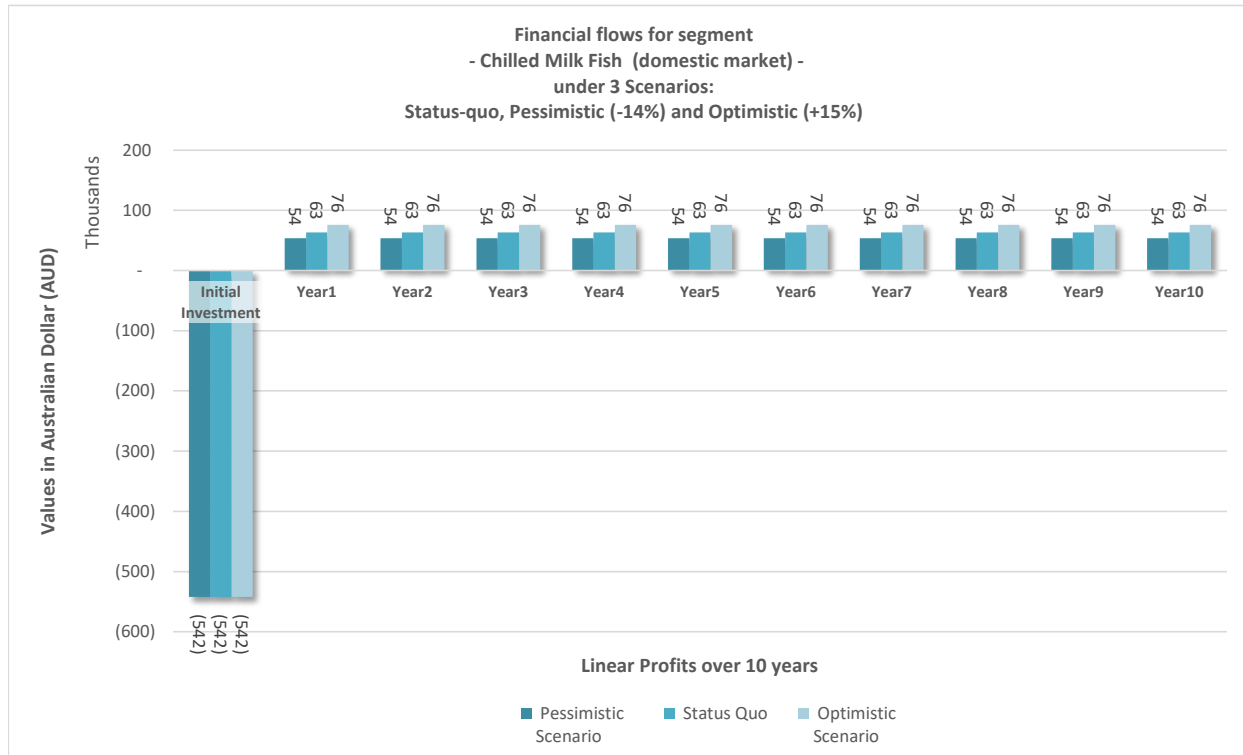


Figure 18: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Chilled Milk Fish (domestic market)

A6.4 Chilled whole tuna (domestic/ regional market) - Segment B1b.

Table 19: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Chilled whole tuna (domestic/ regional market)

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/ year)	Annual Output (kg/ year)
Harvest											
Recap	8	16,400	131,200	1,387	11,092	1.387	4,900	39,200	4.900	1,000	8,000
Recap	8	16,400	131,200	1,387	11,092	1.387	4,900	39,200	4.900	1,000	8,000
Investment	8	16,400	131,200	378	3,020	0.378					
Equipment	8	16,000	128,000	368	2,947	0.368					
Gears	8	400	3,200	9	74	0.009					
Operating Cost	8			1,009	8,072	1.009					
Fishing Line	8										
Fuel	8			737	5,894	0.737					
Hook	8										
Ice	8			188	1,507	0.188					
Oil	8			84	670	0.084					
Sinker	8										
Trolling	8										
Wire	8										
Repairs & Maintenance	8										
Landings	8						4,900	39,200	4.900	1,000	8,000
Milk Fish	8						4,900	39,200	4.900	1,000	8,000
Processing											
Recap	1	410,971	410,971	5,061	5,061	0.696	40,000	40,000	5.500	7,273	7,273
Recap	1	410,971	410,971	5,061	5,061	0.696	40,000	40,000	5.500	7,273	7,273
Investment	1	401,829	401,829	9,250	9,250	1.272					
Building & machinery	1	401,829	401,829	9,250	9,250	1.272					
Operating Cost	1			496	496	0.068					
Agency	1			5	5	0.001					
Fishing Expenses	1			406	406	0.056					
Rental	1			8	8	0.001					
Repairs & Maintenance	1			77	77	0.011					
Equipment	1	9,142	9,142	210	210	0.029					
Fishing Gear	1	9,142	9,142	210	210	0.029					
Admin	1			201	201	0.028					
KIC Insurance	1			30	30	0.004					
Licence	1			40	40	0.006					
Taxes	1			131	131	0.018					
Finance	1			95	95	0.013					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			95	95	0.013					
Labour	1			1,890	1,890	0.260					
Allowance	1			85	85	0.012					
Bonus	1			282	282	0.039					
Crewing	1			770	770	0.106					
Entertainment	1			30	30	0.004					
House Rent	1			19	19	0.003					
Leave Grant	1			414	414	0.057					
Local Imprest (DSA)	1			32	32	0.004					
Salaries	1			242	242	0.033					
Seafare	1			15	15	0.002					
Supply of raw material	1			39,200	39,200	5.390					
Fish Purchase	1			39,200	39,200	5.390					
Utility	1			861	861	0.118					
Electricity	1			130	130	0.018					
Fuel	1			587	587	0.081					
Telecommunication	1			144	144	0.020					
Office	1			40	40	0.005					
Office Equipment	1			28	28	0.004					
Office Supplies	1			4	4	0.000					
Other Expenses	1			8	8	0.001					
Output Production	1						40,000	40,000	5.500	7,273	7,273
Chilled Whole Milk Fish	1						40,000	40,000	5.500	7,273	7,273

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	5%	9%	12%
NPV over 10 years	2,639	93,917	185,195
Payback period	8 years	6 years	6 years

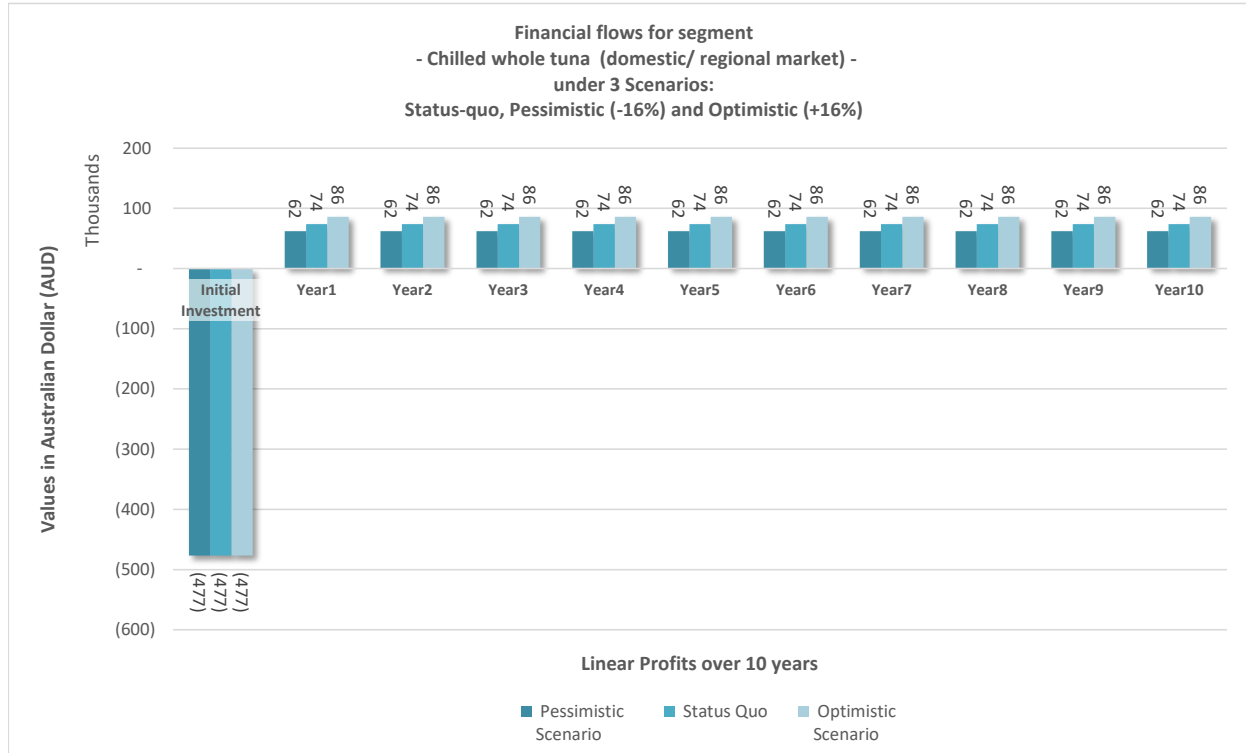


Figure 19: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Chilled whole tuna (domestic/ regional market)

A6.5 Live Lobsters (domestic market) - Segment C1.

Table 20: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Live Lobsters (domestic market)

Australian Dollar (AUD) ▼

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)							Output in kg		
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/year)	Annual Output (kg/year)
Harvest											
Recap	4	16,400	65,600	11,977	47,910	1.198	16,500	66,000	1.650	10,000	40,000
Recap	4	16,400	65,600	11,977	47,910	1.198	16,500	66,000	1.650	10,000	40,000
Investment	4	16,400	65,600	1,888	7,551	0.189					
Equipment	4	16,000	64,000	1,842	7,367	0.184					
Gears	4	400	1,600	46	184	0.005					
Operating Cost	4			10,090	40,359	1.009					
Fishing Line	4										
Fuel	4			7,368	29,472	0.737					
Hook	4										
Ice	4			1,884	7,537	0.188					
Oil	4			837	3,349	0.084					
Sinker	4										
Trolling	4										
Wire	4										
Repairs & Maintenance	4										
Landings	4						16,500	66,000	1.650	10,000	40,000
Skipjack	4						16,500	66,000	1.650	10,000	40,000
Processing											
Recap	1	186,540	186,540	157,576	157,576	3.939	320,000	320,000	8.000	40,000	40,000
Recap	1	186,540	186,540	157,576	157,576	3.939	320,000	320,000	8.000	40,000	40,000
Investment	1	182,390	182,390	20,994	20,994	0.525					
Building & machinery	1	182,390	182,390	20,994	20,994	0.525					
Operating Cost	1			14,071	14,071	0.352					
Agency	1			134	134	0.003					
Fishing Expenses	1			11,519	11,519	0.288					
Rental	1			225	225	0.006					
Repairs & Maintenance	1			2,193	2,193	0.055					
Equipment	1	4,150	4,150	478	478	0.012					
Fishing Gear	1	4,150	4,150	478	478	0.012					
Admin	1			5,703	5,703	0.143					
KIC Insurance	1			841	841	0.021					
Licence	1			1,135	1,135	0.028					
Taxes	1			3,727	3,727	0.093					
Finance	1			2,694	2,694	0.067					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			2,694	2,694	0.067					
Labour	1			53,606	53,606	1.340					
Allowance	1			2,404	2,404	0.060					
Bonus	1			8,009	8,009	0.200					
Crewing	1			21,852	21,852	0.546					
Entertainment	1			853	853	0.021					
House Rent	1			551	551	0.014					
Leave Grant	1			11,756	11,756	0.294					
Local Imprest (DSA)	1			899	899	0.022					
Salaries	1			6,859	6,859	0.171					
Seafare	1			423	423	0.011					
Supply of raw material	1			66,000	66,000	1.650					
Fish Purchase	1			66,000	66,000	1.650					
Utility	1			24,425	24,425	0.611					
Electricity	1			3,682	3,682	0.092					
Fuel	1			16,656	16,656	0.416					
Telecommunication	1			4,087	4,087	0.102					
Office	1			1,123	1,123	0.028					
Office Equipment	1			805	805	0.020					
Office Supplies	1			100	100	0.002					
Other Expenses	1			218	218	0.005					
Output Production	1						320,000	320,000	8.000	40,000	40,000
Canned Skipjack	1						320,000	320,000	8.000	40,000	40,000

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	60%	71%	82%
NPV over 10 years	932,666	1,141,749	1,350,832
Payback period	2 years	1 years	1 years



Figure 20: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Live Lobsters (domestic market)

A6.6 Certified Skipjack Canned Tuna - coastal purse seine fisheries (domestic/ regional export) - Segment A2a.

Table 21: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Certified Skipjack Canned Tuna - coastal purse seine fisheries (domestic/ regional export)

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)							Output in kg		
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/ year)	Annual Output (kg/ year)
Harvest											
Recap	8	16,400	131,200	16,638	133,105	1.387	19,800	158,400	1.650	12,000	96,000
Investment	8	16,400	131,200	4,530	36,244	0.378					
Equipment	8	16,000	128,000	4,420	35,360	0.368					
Gears	8	400	3,200	110	884	0.009					
Operating Cost	8			12,108	96,861	1.009					
Fishing Line	8										
Fuel	8			8,842	70,734	0.737					
Hook	8										
Ice	8			2,261	18,089	0.188					
Oil	8			1,005	8,038	0.084					
Sinker	8										
Trolling	8										
Wire	8										
Repairs & Maintenance	8										
Landings	8						19,800	158,400	1.650	12,000	96,000
SkipJack	8						19,800	158,400	1.650	12,000	96,000
Processing											
Recap	1	605,028	605,028	368,300	368,300	7.213	434,043	434,043	8.500	51,064	51,064
Investment	1	601,829	601,829	111,005	111,005	2.174					
Building & machinery	1	401,829	401,829	111,005	111,005	2.174					
Certification	1	200,000	200,000								
Operating Cost	1			24,552	24,552	0.481					
Agency	1			234	234	0.005					
Fishing Expenses	1			20,099	20,099	0.394					
Rental	1			392	392	0.008					
Repairs & Maintenance	1			3,827	3,827	0.075					
Equipment	1	3,200	3,200	884	884	0.017					
Fishing Gear	1	3,200	3,200	884	884	0.017					
Admin	1			9,951	9,951	0.195					
KIC Insurance	1			1,468	1,468	0.029					
Licence	1			1,981	1,981	0.039					
Taxes	1			6,503	6,503	0.127					
Finance	1			4,701	4,701	0.092					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			4,701	4,701	0.092					
Labour	1			93,537	93,537	1.832					
Allowance	1			4,195	4,195	0.082					
Bonus	1			13,975	13,975	0.274					
Crewing	1			38,128	38,128	0.747					
Entertainment	1			1,488	1,488	0.029					
House Rent	1			962	962	0.019					
Leave Grant	1			20,513	20,513	0.402					
Local Imprest (DSA)	1			1,568	1,568	0.031					
Salaries	1			11,968	11,968	0.234					
Seafare	1			738	738	0.014					
Supply of raw material	1			158,400	158,400	3.102					
Fish Purchase	1			158,400	158,400	3.102					
Utility	1			42,618	42,618	0.835					
Electricity	1			6,425	6,425	0.126					
Fuel	1			29,062	29,062	0.569					
Telecommunication	1			7,131	7,131	0.140					
Office	1			1,959	1,959	0.038					
Office Equipment	1			1,404	1,404	0.027					
Office Supplies	1			174	174	0.003					
Other Expenses	1			381	381	0.007					
Output Production	1						434,043	434,043	8.500	51,064	51,064
Canned Skipjack	1						434,043	434,043	8.500	51,064	51,064
Marketing	1			18,800	18,800	0.541					
Certification	1			18,800	18,800	0.541					

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	0%	4%	8%
NPV over 10 years	-251,303	-151,982	-35,132
Payback period	10 years	8 years	7 years

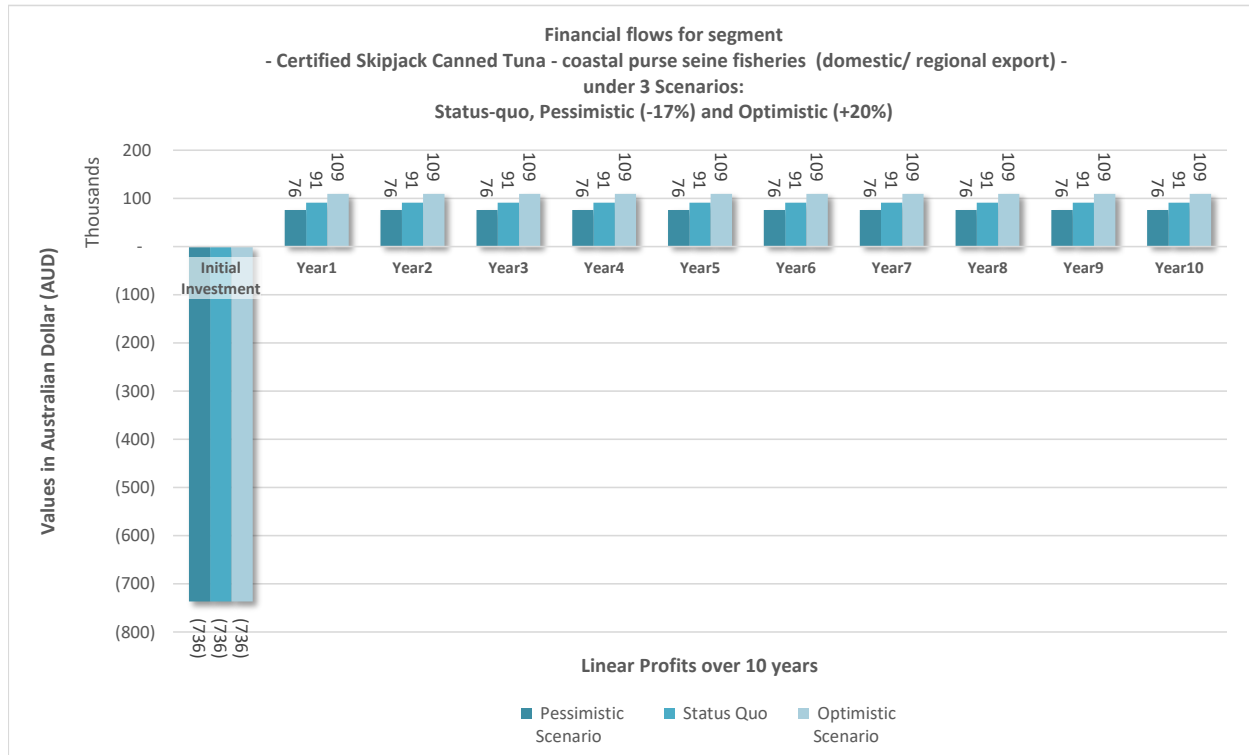


Figure 21: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Certified Skipjack Canned Tuna - coastal purse seine fisheries (domestic/ regional export)

A6.7 Deep water snapper - frozen whole round (export market) - Segment A2b.

Table 22: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Deep water snapper - frozen whole round (export market)

Australian Dollar (AUD) ▼

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/year)	Annual Output (kg/year)
Harvest											
Recap	4	16,400	65,600	3,593	14,373	1.198	3,780	15,120	1.260	3,000	12,000
Recap	4	16,400	65,600	3,593	14,373	1.198	3,780	15,120	1.260	3,000	12,000
Investment	4	16,400	65,600	566	2,265	0.189					
Equipment	4	16,000	64,000	552	2,210	0.184					
Gears	4	400	1,600	14	55	0.005					
Operating Cost	4			3,027	12,108	1.009					
Fishing Line	4										
Fuel	4			2,210	8,842	0.737					
Hook	4										
Ice	4			565	2,261	0.188					
Oil	4			251	1,005	0.084					
Sinker	4										
Trolling	4										
Wire	4										
Repairs & Maintenance	4										
Landings	4						3,780	15,120	1.260	3,000	12,000
Deep water fish	4						3,780	15,120	1.260	3,000	12,000
Processing											
Recap	1	610,971	610,971	65,943	65,943	5.495	240,000	240,000	20.000	12,000	12,000
Recap	1	610,971	610,971	65,943	65,943	5.495	240,000	240,000	20.000	12,000	12,000
Investment	1	601,829	601,829	20,782	20,782	1.732					
Building & machinery	1	601,829	601,829	20,782	20,782	1.732					
Operating Cost	1			4,221	4,221	0.352					
Agency	1			40	40	0.003					
Fishing Expenses	1			3,456	3,456	0.288					
Rental	1			67	67	0.006					
Repairs & Maintenance	1			658	658	0.055					
Equipment	1	9,142	9,142	316	316	0.026					
Fishing Gear	1	9,142	9,142	316	316	0.026					
Admin	1			1,711	1,711	0.143					
KIC Insurance	1			252	252	0.021					
Licence	1			341	341	0.028					
Taxes	1			1,118	1,118	0.093					
Finance	1			808	808	0.067					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			808	808	0.067					
Labour	1			16,082	16,082	1.340					
Allowance	1			721	721	0.060					
Bonus	1			2,403	2,403	0.200					
Crewing	1			6,555	6,555	0.546					
Entertainment	1			256	256	0.021					
House Rent	1			165	165	0.014					
Leave Grant	1			3,527	3,527	0.294					
Local Imprest (DSA)	1			270	270	0.022					
Salaries	1			2,058	2,058	0.171					
Seafare	1			127	127	0.011					
Supply of raw material	1			15,120	15,120	1.260					
Fish Purchase	1			15,120	15,120	1.260					
Utility	1			7,327	7,327	0.611					
Electricity	1			1,105	1,105	0.092					
Fuel	1			4,997	4,997	0.416					
Telecommunication	1			1,226	1,226	0.102					
Office	1			337	337	0.028					
Office Equipment	1			241	241	0.020					
Office Supplies	1			30	30	0.002					
Other Expenses	1			65	65	0.005					
Output Production	1						240,000	240,000	20.000	12,000	12,000
Frozen deep water fish	1						240,000	240,000	20.000	12,000	12,000
Logistic	1			34,531	34,531	2.878					
Transport	1			34,531	34,531	2.878					
Marketing	1			50,000	50,000	1.439					
Certification	1			50,000	50,000	1.439					

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	16%	22%	24%
NPV over 10 years	220,895	445,261	501,353
Payback period	5 years	4 years	4 years

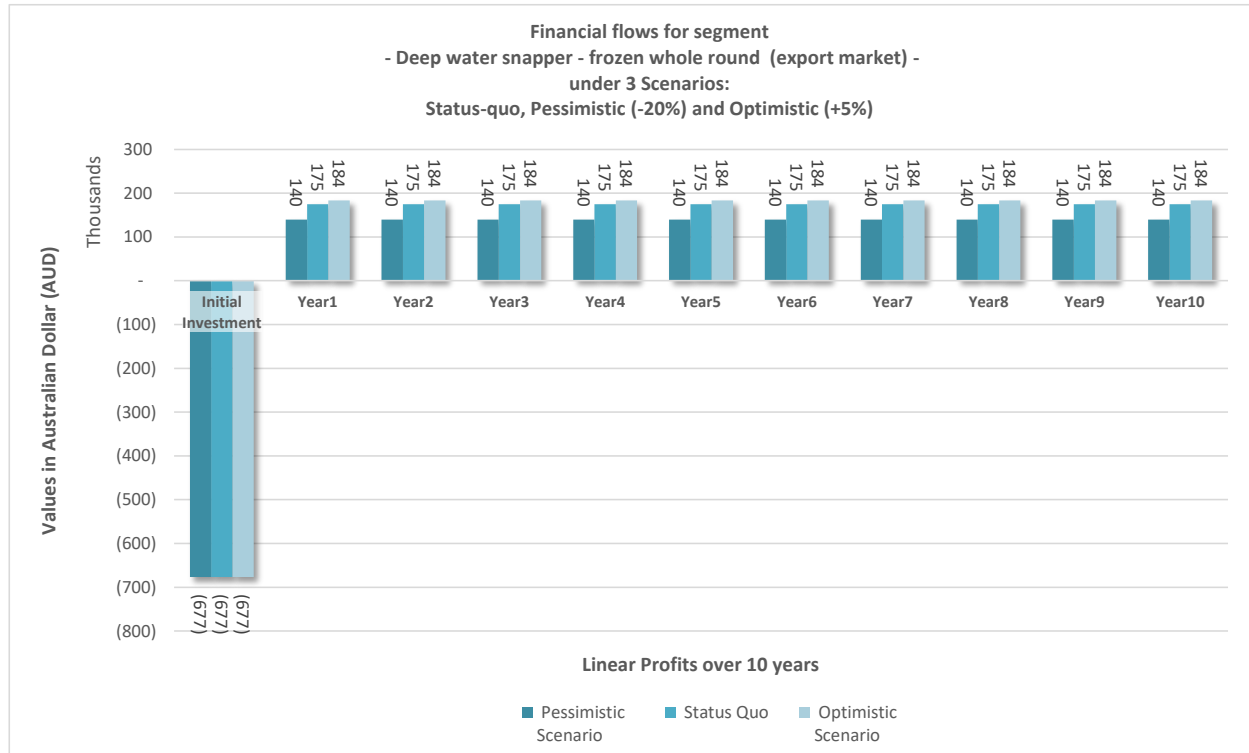


Figure 22: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Deep water snapper - frozen whole round (export market)

A6.8 Chilled Groupers/ Snappers (domestic/ regional export) - Segment B2.

Table 23: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Chilled Groupers/ Snappers (domestic/ regional export)

Australian Dollar (AUD) ▼

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/ year)	Annual Output (kg/ year)
Harvest											
Recap	8	16,400	131,200	2,773	22,184	1.387	2,520	20,160	1.260	2,000	16,000
Recap	8	16,400	131,200	2,773	22,184	1.387	2,520	20,160	1.260	2,000	16,000
Investment	8	16,400	131,200	755	6,041	0.378					
Equipment	8	16,000	128,000	737	5,893	0.368					
Gears	8	400	3,200	18	147	0.009					
Operating Cost	8			2,018	16,143	1.009					
Fishing Line	8										
Fuel	8			1,474	11,789	0.737					
Hook	8										
Ice	8			377	3,015	0.188					
Oil	8			167	1,340	0.084					
Sinker	8										
Trolling	8										
Wire	8										
Repairs & Maintenance	8										
Landings	8						2,520	20,160	1.260	2,000	16,000
Deep water fish	8						2,520	20,160	1.260	2,000	16,000
Processing											
Recap	1	410,971	410,971	23,552	23,552	1.472	88,000	88,000	5.500	16,000	16,000
Recap	1	410,971	410,971	23,552	23,552	1.472	88,000	88,000	5.500	16,000	16,000
Investment	1	401,829	401,829	18,501	18,501	1.156					
Building & machinery	1	401,829	401,829	18,501	18,501	1.156					
Operating Cost	1			2,480	2,480	0.155					
Agency	1			24	24	0.001					
Fishing Expenses	1			2,030	2,030	0.127					
Rental	1			40	40	0.002					
Repairs & Maintenance	1			387	387	0.024					
Equipment	1	9,142	9,142	421	421	0.026					
Fishing Gear	1	9,142	9,142	421	421	0.026					
Admin	1			1,005	1,005	0.063					
KIC Insurance	1			148	148	0.009					
Licence	1			200	200	0.013					
Taxes	1			657	657	0.041					
Finance	1			475	475	0.030					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			475	475	0.030					
Labour	1			9,448	9,448	0.591					
Allowance	1			424	424	0.026					
Bonus	1			1,412	1,412	0.088					
Crewing	1			3,851	3,851	0.241					
Entertainment	1			150	150	0.009					
House Rent	1			97	97	0.006					
Leave Grant	1			2,072	2,072	0.130					
Local Imprest (DSA)	1			158	158	0.010					
Salaries	1			1,209	1,209	0.076					
Seafare	1			75	75	0.005					
Supply of raw material	1			20,160	20,160	1.260					
Fish Purchase	1			20,160	20,160	1.260					
Utility	1			4,305	4,305	0.269					
Electricity	1			649	649	0.041					
Fuel	1			2,936	2,936	0.183					
Telecommunication	1			720	720	0.045					
Office	1			198	198	0.012					
Office Equipment	1			142	142	0.009					
Office Supplies	1			18	18	0.001					
Other Expenses	1			38	38	0.002					
Output Production	1						88,000	88,000	5.500	16,000	16,000
Chilled Whole Grouper	1						88,000	88,000	5.500	16,000	16,000

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	0%	3%	5%
NPV over 10 years	-137,857	-82,723	-36,778
Payback period	10 years	9 years	8 years

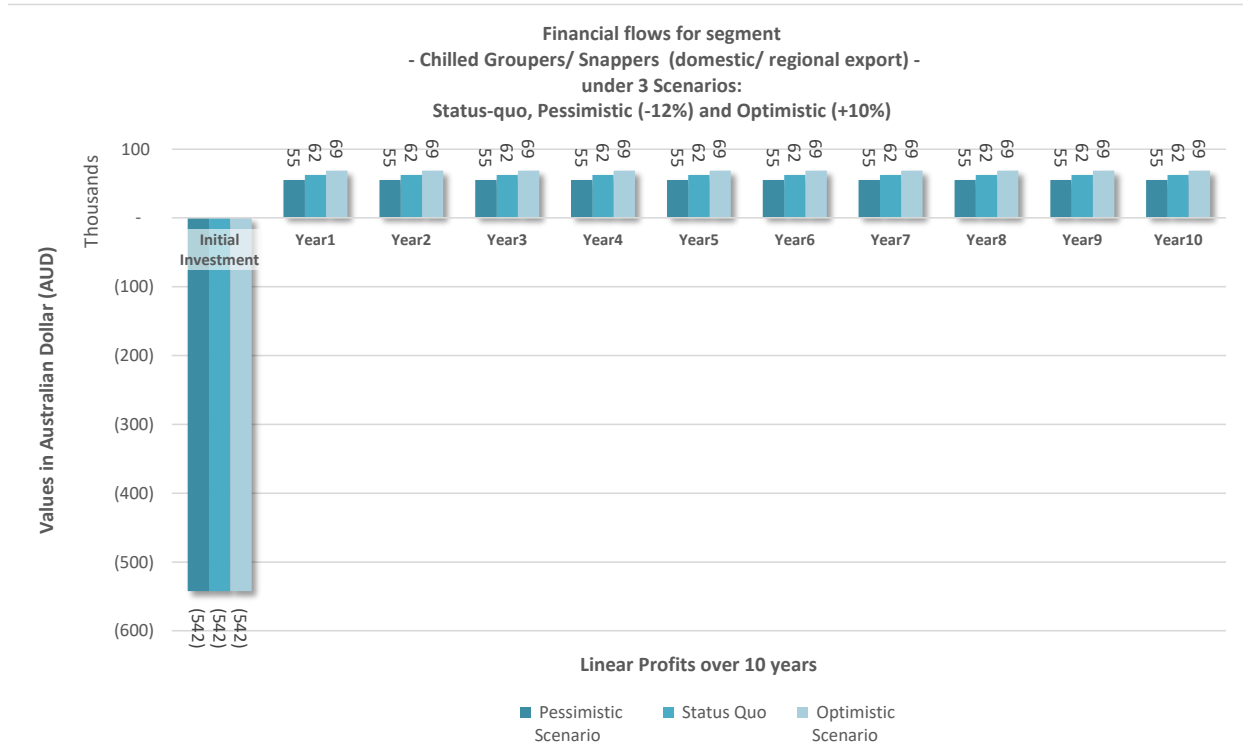


Figure 23: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Chilled Groupers/ Snappers (domestic/ regional export)

A6.9 Live Lobsters (domestic/ regional export) - Segment C2.

Table 24: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Live Lobsters (domestic/ regional export)

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/year)	Annual Output (kg/year)
Harvest											
Recap	4	16,400	65,600	11,977	47,910	1.198	16,500	66,000	1.650	10,000	40,000
Recap	4	16,400	65,600	11,977	47,910	1.198	16,500	66,000	1.650	10,000	40,000
Investment	4	16,400	65,600	1,888	7,551	0.189					
Equipment	4	16,000	64,000	1,842	7,367	0.184					
Gears	4	400	1,600	46	184	0.005					
Operating Cost	4			10,090	40,359	1.009					
Fishing Line	4										
Fuel	4			7,368	29,472	0.737					
Hook	4										
Ice	4			1,884	7,537	0.188					
Oil	4			837	3,349	0.084					
Sinker	4										
Trolling	4										
Wire	4										
Repairs & Maintenance	4										
Landings	4						16,500	66,000	1.650	10,000	40,000
Skipjack	4						16,500	66,000	1.650	10,000	40,000
Processing											
Recap	1	186,540	186,540	157,576	157,576	7.406	170,213	170,213	8.000	21,277	21,277
Recap	1	186,540	186,540	157,576	157,576	7.406	170,213	170,213	8.000	21,277	21,277
Investment	1	182,390	182,390	20,994	20,994	0.987					
Building & machinery	1	182,390	182,390	20,994	20,994	0.987					
Operating Cost	1			14,071	14,071	0.661					
Agency	1			134	134	0.006					
Fishing Expenses	1			11,519	11,519	0.541					
Rental	1			225	225	0.011					
Repairs & Maintenance	1			2,193	2,193	0.103					
Equipment	1	4,150	4,150	478	478	0.022					
Fishing Gear	1	4,150	4,150	478	478	0.022					
Admin	1			5,703	5,703	0.268					
KIC Insurance	1			841	841	0.040					
Licence	1			1,135	1,135	0.053					
Taxes	1			3,727	3,727	0.175					
Finance	1			2,694	2,694	0.127					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			2,694	2,694	0.127					
Labour	1			53,606	53,606	2.520					
Allowance	1			2,404	2,404	0.113					
Bonus	1			8,009	8,009	0.376					
Crewing	1			21,852	21,852	1.027					
Entertainment	1			853	853	0.040					
House Rent	1			551	551	0.026					
Leave Grant	1			11,756	11,756	0.553					
Local Imprest (DSA)	1			899	899	0.042					
Salaries	1			6,859	6,859	0.322					
Seafare	1			423	423	0.020					
Supply of raw material	1			66,000	66,000	3.102					
Fish Purchase	1			66,000	66,000	3.102					
Utility	1			24,425	24,425	1.148					
Electricity	1			3,682	3,682	0.173					
Fuel	1			16,656	16,656	0.783					
Telecommunication	1			4,087	4,087	0.192					
Office	1			1,123	1,123	0.053					
Office Equipment	1			805	805	0.038					
Office Supplies	1			100	100	0.005					
Other Expenses	1			218	218	0.010					
Output Production	1						170,213	170,213	8.000	21,277	21,277
Canned Skipjack	1						170,213	170,213	8.000	21,277	21,277

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	2%	4%	8%
NPV over 10 years	-38,596	-14,869	32,586
Payback period	9 years	8 years	7 years

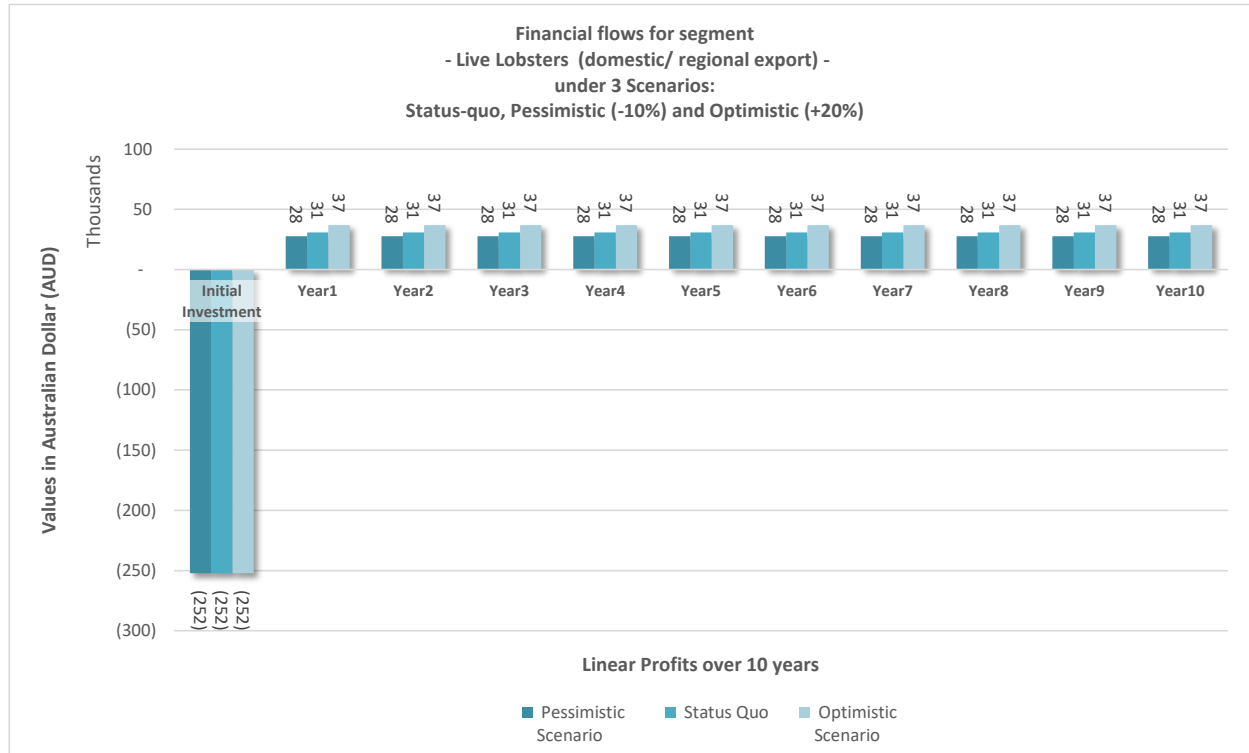


Figure 24: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Live Lobsters (domestic/ regional export)

A6.10 Frozen Lobster Tails - canned lobster bisque (domestic/ export market - USA) - Segment A3a.

Table 25: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Frozen Lobster Tails - canned lobster bisque (domestic/ export market - USA)

Main Centre/ Activity	over 10 years		Values in Australian Dollar (AUD)							Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/ year)	Annual Output (kg/ year)
Harvest											
Recap	4	16,400	65,600	1,458	5,833	1.439	11,143	44,572	11.000	1,013	4,052
Recap	4	16,400	65,600	1,458	5,833	1.439	11,143	44,572	11.000	1,013	4,052
Investment	4	16,400	65,600	191	765	0.189					
Equipment	4	16,000	64,000	187	746	0.184					
Gears	4	400	1,600	5	19	0.005					
Operating Cost	4			15,779	63,117	15.577					
Diving Equipment	4			8,000	32,000	7.897					
Fuel	4			746	2,986	0.737					
Cooler/ Ice box	4			400	1,600	0.395					
Ice	4			6,548	26,193	6.464					
Oil	4			85	339	0.084					
Sinker	4										
Trolling	4										
Wire	4										
Repairs & Maintenance	4										
Landings	4						11,143	44,572	11.000	1,013	4,052
Lobster	4						11,143	44,572	11.000	1,013	4,052
Processing											
Recap	1	610,971	610,971	21,810	21,810	16.148	81,040	81,040	60.000	1,351	1,351
Recap	1	610,971	610,971	21,810	21,810	16.148	81,040	81,040	60.000	1,351	1,351
Investment	1	601,829	601,829	7,017	7,017	5.195					
Building & machinery	1	601,829	601,829	7,017	7,017	5.195					
Operating Cost	1			1,305	1,305	0.966					
Agency	1			12	12	0.009					
Fishing Expenses	1			1,068	1,068	0.791					
Rental	1			21	21	0.015					
Repairs & Maintenance	1			203	203	0.151					
Equipment	1	9,142	9,142	107	107	0.079					
Fishing Gear	1	9,142	9,142	107	107	0.079					
Admin	1			529	529	0.392					
KIC Insurance	1			78	78	0.058					
Licence	1			105	105	0.078					
Taxes	1			346	346	0.256					
Finance	1			250	250	0.185					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			250	250	0.185					
Labour	1			4,971	4,971	3.680					
Allowance	1			223	223	0.165					
Bonus	1			743	743	0.550					
Crewing	1			2,026	2,026	1.500					
Entertainment	1			79	79	0.059					
House Rent	1			51	51	0.038					
Leave Grant	1			1,090	1,090	0.807					
Local Imprest (DSA)	1			83	83	0.062					
Salaries	1			636	636	0.471					
Seafare	1			39	39	0.029					
Supply of raw material	1			44,572	44,572	33.000					
Fish Purchase	1			44,572	44,572	33.000					
Utility	1			2,265	2,265	1.677					
Electricity	1			341	341	0.253					
Fuel	1			1,544	1,544	1.144					
Telecommunication	1			379	379	0.281					
Office	1			104	104	0.077					
Office Equipment	1			75	75	0.055					
Office Supplies	1			9	9	0.007					
Other Expenses	1			20	20	0.015					
Output Production	1						81,040	81,040	60.000	1,351	1,351
Frozen Lobster tails	1						81,040	81,040	60.000	1,351	1,351
Logistic	1			11,660	11,660	8.633					
Transport	1			11,660	11,660	8.633					
Marketing	1			5,830	5,830	4.316					
Certification	1			5,830	5,830	4.316					

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	3%	7%	11%
NPV over 10 years	-126,094	11,525	114,740
Payback period	9 years	7 years	6 years

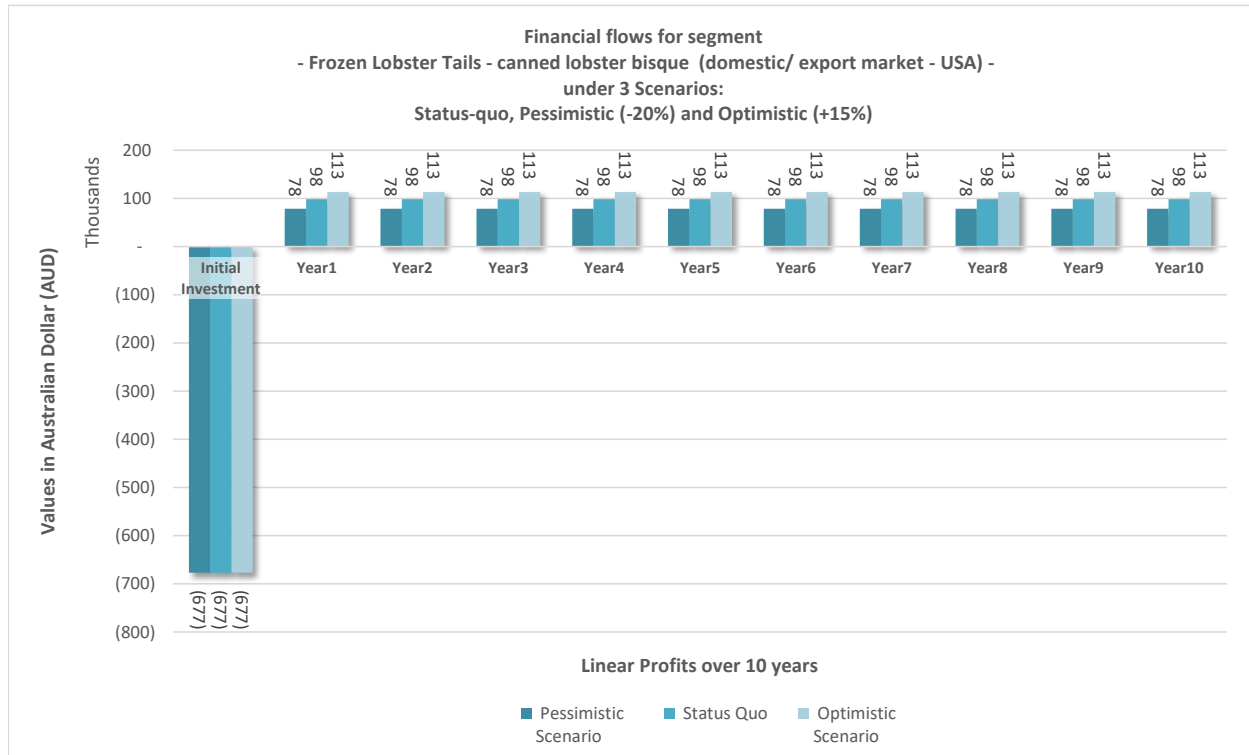


Figure 25: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Frozen Lobster Tails - canned lobster bisque (domestic/ export market - USA)

A6.11 Sushi quality yellowfin tuna - ULT frozen (export market) - Segment A3b.

Table 26: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Sushi quality yellowfin tuna - ULT frozen (export market)

Australian Dollar (AUD) ▼

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/year)	Annual Output (kg/year)
Harvest											
Recap	4	36,400	145,600	7,140	28,559	1.428	22,050	88,200	4.410	5,000	20,000
Recap	4	36,400	145,600	7,140	28,559	1.428	22,050	88,200	4.410	5,000	20,000
Investment	4	36,400	145,600	2,095	8,380	0.419					
Equipment	4	36,000	144,000	2,072	8,287	0.414					
Gears	4	400	1,600	23	92	0.005					
Operating Cost	4			5,045	20,179	1.009					
Fishing Line	4										
Fuel	4			3,684	14,736	0.737					
Hook	4										
Ice	4			942	3,769	0.188					
Oil	4			419	1,675	0.084					
Sinker	4										
Trolling	4										
Wire	4										
Repairs & Maintenance	4										
Landings	4						22,050	88,200	4.410	5,000	20,000
Yellowfin Tuna	4						22,050	88,200	4.410	5,000	20,000
Processing											
Recap	1	610,971	610,971	128,996	128,996	7.740	233,333	233,333	14.000	16,667	16,667
Recap	1	610,971	610,971	128,996	128,996	7.740	233,333	233,333	14.000	16,667	16,667
Investment	1	601,829	601,829	34,636	34,636	2.078					
Building & machinery	1	601,829	601,829	34,636	34,636	2.078					
Operating Cost	1			7,036	7,036	0.422					
Agency	1			67	67	0.004					
Fishing Expenses	1			5,759	5,759	0.346					
Rental	1			112	112	0.007					
Repairs & Maintenance	1			1,097	1,097	0.066					
Equipment	1	9,142	9,142	526	526	0.032					
Fishing Gear	1	9,142	9,142	526	526	0.032					
Admin	1			2,851	2,851	0.171					
KIC Insurance	1			421	421	0.025					
Licence	1			568	568	0.034					
Taxes	1			1,863	1,863	0.112					
Finance	1			1,347	1,347	0.081					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			1,347	1,347	0.081					
Labour	1			26,803	26,803	1.608					
Allowance	1			1,202	1,202	0.072					
Bonus	1			4,005	4,005	0.240					
Crewing	1			10,926	10,926	0.656					
Entertainment	1			426	426	0.026					
House Rent	1			276	276	0.017					
Leave Grant	1			5,878	5,878	0.353					
Local Imprest (DSA)	1			449	449	0.027					
Salaries	1			3,430	3,430	0.206					
Seafare	1			212	212	0.013					
Supply of raw material	4			88,200	352,800	5.292					
Fish Purchase	4			88,200	352,800	5.292					
Utility	1			12,212	12,212	0.733					
Electricity	1			1,841	1,841	0.110					
Fuel	1			8,328	8,328	0.500					
Telecommunication	1			2,043	2,043	0.123					
Office	1			561	561	0.034					
Office Equipment	1			402	402	0.024					
Office Supplies	1			50	50	0.003					
Other Expenses	1			109	109	0.007					
Output Production	1						233,333	233,333	14.000	16,667	16,667
ULT Yellowfin Tuna	1						233,333	233,333	14.000	16,667	16,667
Logistic	1			57,552	57,552	3.453					
Transport	1			57,552	57,552	3.453					
Marketing	1			28,776	28,776	1.727					
Certification	1			28,776	28,776	1.727					

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	8%	17%	25%
NPV over 10 years	49,631	395,146	740,661
Payback period	7 years	5 years	4 years

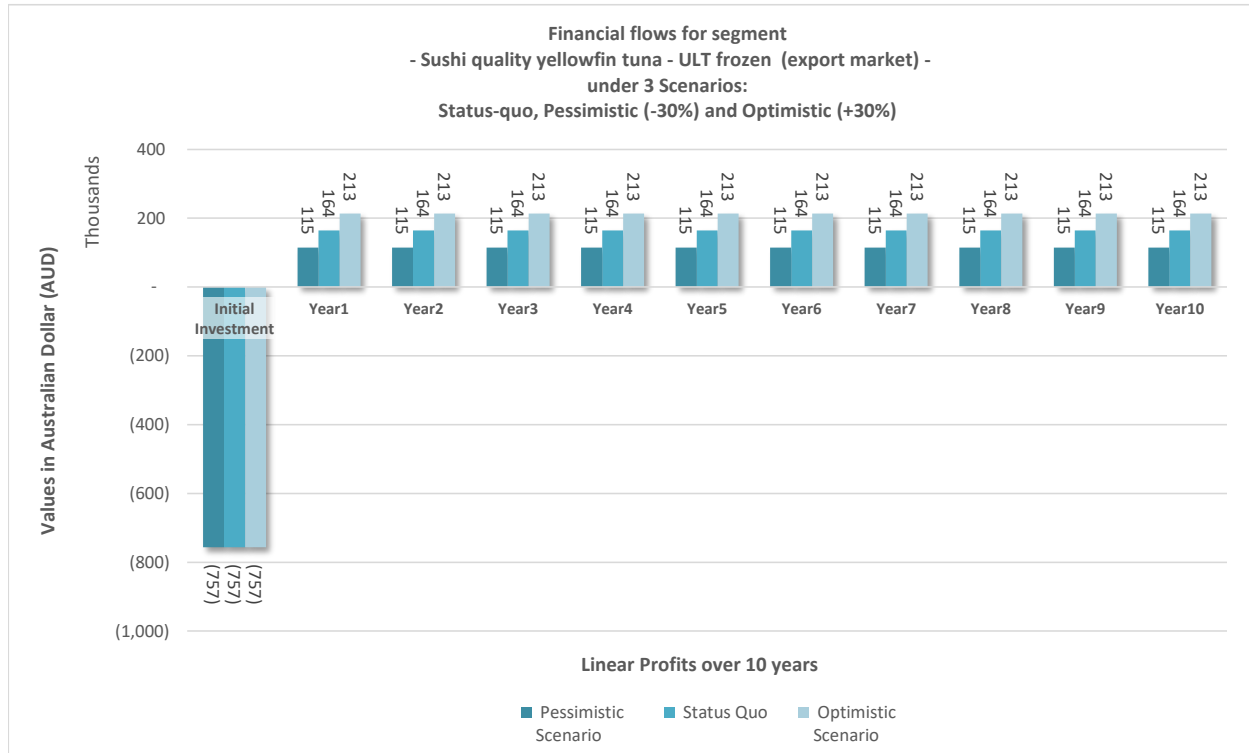


Figure 26: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Sushi quality yellowfin tuna - ULT frozen (export market)

A6.12 Chilled Groupers/ Snappers (export market - OZ, USA) - Segment B3.

Table 27: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Chilled Groupers/ Snappers (export market - OZ, USA)

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/year)	Annual Output (kg/year)
Harvest											
Recap	6	16,400	98,400	1,421	8,528	1.292	1,386	8,316	1.260	1,100	6,600
Recap	6	16,400	98,400	1,421	8,528	1.292	1,386	8,316	1.260	1,100	6,600
Investment	6	16,400	98,400	311	1,869	0.283					
Equipment	6	16,000	96,000	304	1,823	0.276					
Gears	6	400	2,400	8	46	0.007					
Operating Cost	6			1,110	6,659	1.009					
Fishing Line	6										
Fuel	6			810	4,863	0.737					
Hook	6										
Ice	6			207	1,244	0.188					
Oil	6			92	553	0.084					
Sinker	6										
Trolling	6										
Wire	6										
Repairs & Maintenance	6										
Landings	6						1,386	8,316	1.260	1,100	6,600
Skipjack	6						1,386	8,316	1.260	1,100	6,600
Processing											
Recap	1	510,971	510,971	32,234	32,234	5.372	120,000	120,000	20.000	6,000	6,000
Recap	1	510,971	510,971	32,234	32,234	5.372	120,000	120,000	20.000	6,000	6,000
Investment	1	501,829	501,829	9,531	9,531	1.588					
Building & machinery	1	501,829	501,829	9,531	9,531	1.588					
Operating Cost	1			2,322	2,322	0.387					
Agency	1			22	22	0.004					
Fishing Expenses	1			1,901	1,901	0.317					
Rental	1			37	37	0.006					
Repairs & Maintenance	1			362	362	0.060					
Equipment	1	9,142	9,142	174	174	0.029					
Fishing Gear	1	9,142	9,142	174	174	0.029					
Admin	1			941	941	0.157					
KIC Insurance	1			139	139	0.023					
Licence	1			187	187	0.031					
Taxes	1			615	615	0.102					
Finance	1			445	445	0.074					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			445	445	0.074					
Labour	1			8,845	8,845	1.474					
Allowance	1			397	397	0.066					
Bonus	1			1,322	1,322	0.220					
Crewing	1			3,606	3,606	0.601					
Entertainment	1			141	141	0.023					
House Rent	1			91	91	0.015					
Leave Grant	1			1,940	1,940	0.323					
Local Imprest (DSA)	1			148	148	0.025					
Salaries	1			1,132	1,132	0.189					
Seafare	1			70	70	0.012					
Supply of raw material	1			8,316	8,316	1.386					
Fish Purchase	1			8,316	8,316	1.386					
Utility	1			4,030	4,030	0.672					
Electricity	1			608	608	0.101					
Fuel	1			2,748	2,748	0.458					
Telecommunication	1			674	674	0.112					
Office	1			185	185	0.031					
Office Equipment	1			133	133	0.022					
Office Supplies	1			16	16	0.003					
Other Expenses	1			36	36	0.006					
Output Production	1						120,000	120,000	20.000	6,000	6,000
Canned Skipjack	1						120,000	120,000	20.000	6,000	6,000
Logistic	1			15,194	15,194	2.532					
Transport	1			15,194	15,194	2.532					
Marketing	1			7,597	7,597	1.266					
Certification	1			7,597	7,597	1.266					

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	0%	7%	10%
NPV over 10 years	-198,125	-21,876	66,248
Payback period	10 years	7 years	6 years

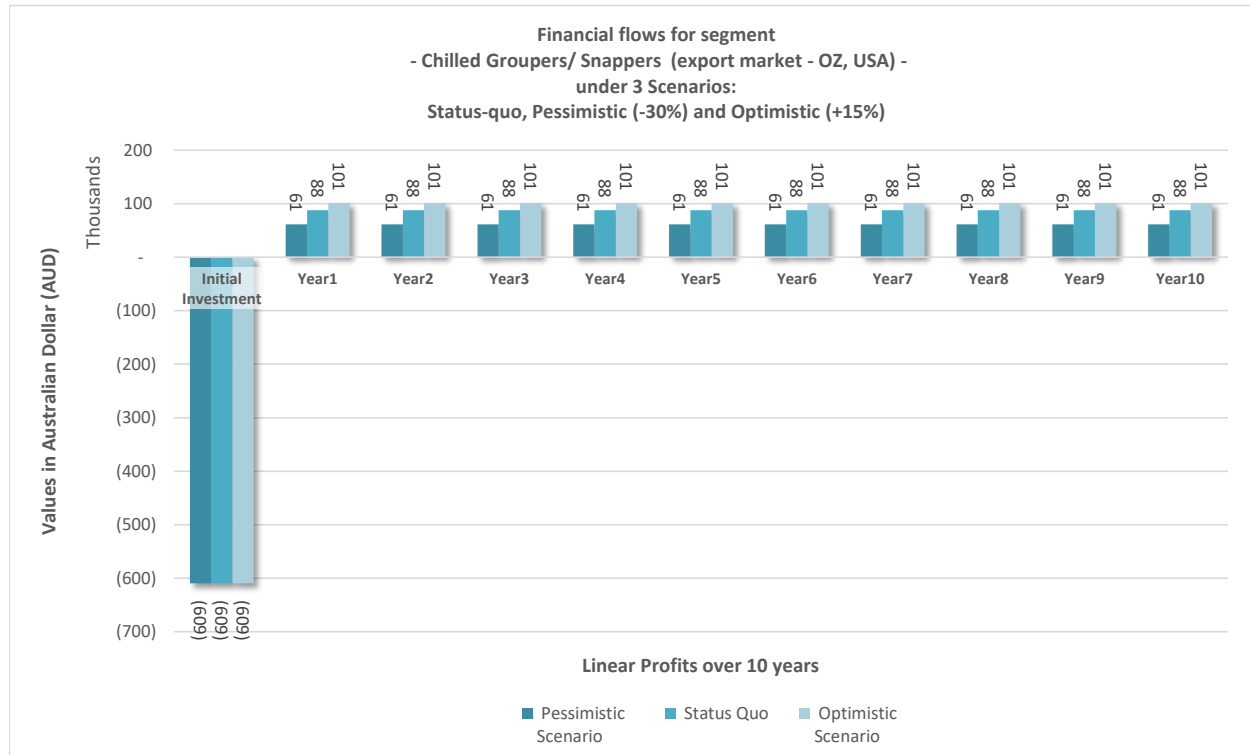


Figure 27: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Chilled Groupers/ Snappers (export market - OZ, USA)

A6.13 Live Lobsters (export market - USA) - Segment C3.

Table 28: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Live Lobsters (export market - USA)

Australian Dollar (AUD) ▼

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/year)	Annual Output (kg/year)
Harvest											
Recap	4	16,400	65,600	864	3,455	1.439	6,600	26,400	11,000	600	2,400
Recap	4	16,400	65,600	864	3,455	1.439	6,600	26,400	11,000	600	2,400
Investment	4	16,400	65,600	113	453	0.189					
Equipment	4	16,000	64,000	110	442	0.184					
Gears	4	400	1,600	3	11	0.005					
Operating Cost	4			750	3,002	1.251					
Diving Equipment	4			138	552	0.230					
Fuel	4			442	1,768	0.737					
Cooler/ Ice box	4			7	28	0.012					
Ice	4			113	452	0.188					
Oil	4			50	201	0.084					
Sinker	4										
Trolling	4										
Wire	4										
Repairs & Maintenance	4										
Landings	4						6,600	26,400	11,000	600	2,400
Lobster	4						6,600	26,400	11,000	600	2,400
Processing											
Recap	1	610,971	610,971	12,397	12,397	5.165	72,000	72,000	30,000	2,400	2,400
Recap	1	610,971	610,971	12,397	12,397	5.165	72,000	72,000	30,000	2,400	2,400
Investment	1	601,829	601,829	4,156	4,156	1.732					
Building & machinery	1	601,829	601,829	4,156	4,156	1.732					
Operating Cost	1			773	773	0.322					
Agency	1			7	7	0.003					
Fishing Expenses	1			633	633	0.264					
Rental	1			12	12	0.005					
Repairs & Maintenance	1			120	120	0.050					
Equipment	1	9,142	9,142	63	63	0.026					
Fishing Gear	1	9,142	9,142	63	63	0.026					
Admin	1			313	313	0.131					
KIC Insurance	1			46	46	0.019					
Licence	1			62	62	0.026					
Taxes	1			205	205	0.085					
Finance	1			148	148	0.062					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			148	148	0.062					
Labour	1			2,944	2,944	1.227					
Allowance	1			132	132	0.055					
Bonus	1			440	440	0.183					
Crewing	1			1,200	1,200	0.500					
Entertainment	1			47	47	0.020					
House Rent	1			30	30	0.013					
Leave Grant	1			646	646	0.269					
Local Imprest (DSA)	1			49	49	0.021					
Salaries	1			377	377	0.157					
Seafare	1			23	23	0.010					
Supply of raw material	1			26,400	26,400	11.000					
Fish Purchase	1			26,400	26,400	11.000					
Utility	1			1,342	1,342	0.559					
Electricity	1			202	202	0.084					
Fuel	1			915	915	0.381					
Telecommunication	1			224	224	0.094					
Office	1			62	62	0.026					
Office Equipment	1			44	44	0.018					
Office Supplies	1			5	5	0.002					
Other Expenses	1			12	12	0.005					
Output Production	1						72,000	72,000	30,000	2,400	2,400
Canned Skipjack	1						72,000	72,000	30,000	2,400	2,400
Logistic	1			6,906	6,906	2.878					
Transport	1			6,906	6,906	2.878					
Marketing	1			3,453	3,453	1.439					
Certification	1			3,453	3,453	1.439					

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	-2%	4%	8%
NPV over 10 years	-239,123	-69,005	52,508
Payback period	11 years	8 years	7 years

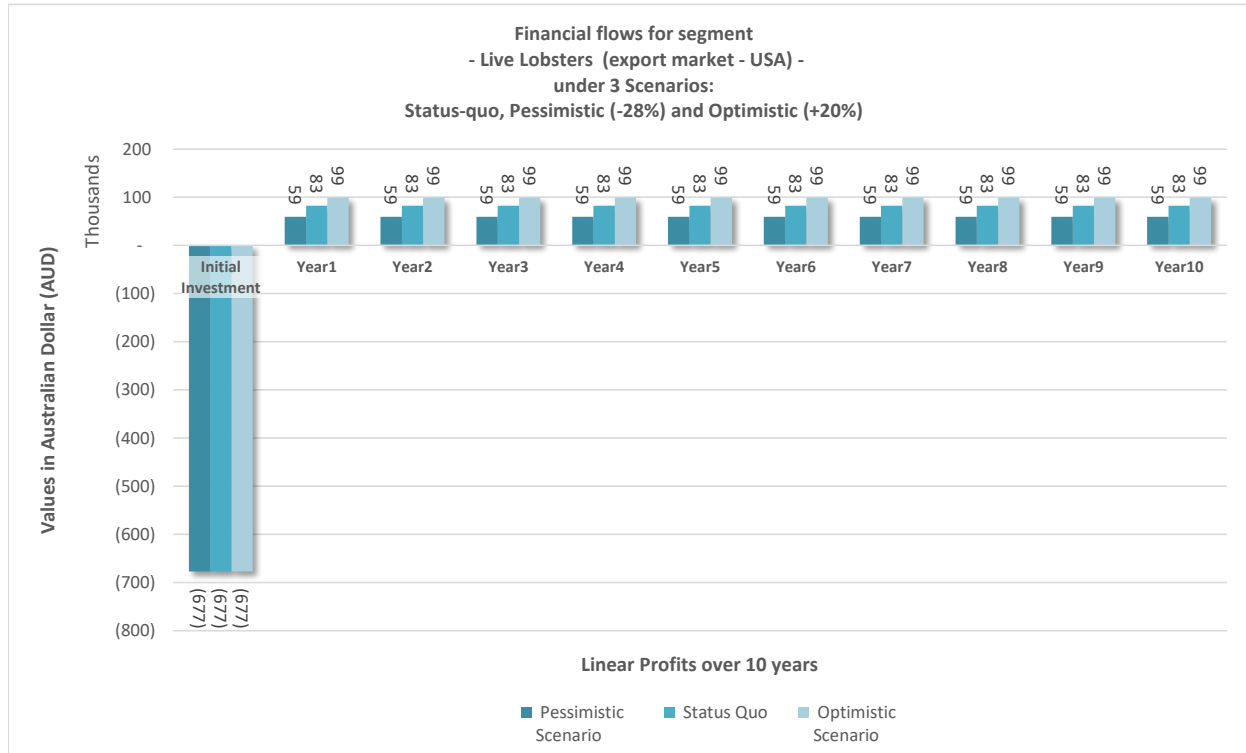


Figure 28: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Live Lobsters (export market - USA)

A6.14 Pet fish and other aquarium marine life (export market) - Segment C4.

Table 29: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Pet fish and other aquarium marine life (export market)

Australian Dollar (AUD)		Values in Australian Dollar (AUD)								Output in kg		
Main Centre/ Activity	over 10 years	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/ year)	Annual Output (kg/ year)
	Harvest											
Recap	39	20,000	780,000	12,243	477,458	765.157	16,000	624,000	1,000.000	16	624	
Investment	39	20,000	780,000	2,000	78,000	125.000						
Equipment	39	16,000	624,000	1,600	62,400	100.000						
Gears	39	4,000	156,000	400	15,600	25.000						
Operating Cost	39			10,243	399,458	640.157						
Fuel	39			5,000	195,000	312.500						
Ice	39			168	6,548	10.494						
Oil	39			75	2,910	4.663						
Repairs & Maintenance	39			1,000	39,000	62.500						
Licence	39			1,000	39,000	62.500						
Diving Equipment	39			2,000	78,000	125.000						
Packaging (cartons, bags)	39			1,000	39,000	62.500						
Landings	39											
Pet Fish	39						16,000	624,000	1,000.000	16	624	
TBA	39						16,000	624,000	1,000.000	16	624	
TBA	39											
Processing												
Recap	13	240,000	3,120,000	1,810,936	23,542,163	2,902.140	1,872,000	24,336,000	3,000.000	624	8,112	
Investment	13	200,000	2,600,000	20,000	260,000	32.051						
Building & machinery	13	200,000	2,600,000	20,000	260,000	32.051						
Operating Cost	13			205,200	2,667,600	328.846						
Repairs & Maintenance	13			5,000	65,000	8.013						
Rental	13			5,200	67,600	8.333						
Packaging (cartons, bags)	13			195,000	2,535,000	312.500						
Equipment	13	40,000	520,000	4,000	52,000	6.410						
Pumps, equipment, etc..	13	40,000	520,000	4,000	52,000	6.410						
Admin	13			10,916	141,903	17.493						
KIC Insurance	13			1,610	20,930	2.580						
Licence	13			2,173	28,243	3.482						
Taxes	13			7,133	92,730	11.431						
Finance	13			26,000	338,000	41.667						
Petty Cash	13			26,000	338,000	41.667						
Labour	13			554,220	7,204,860	888.173						
Allowance	13			52,000	676,000	83.333						
Bonus	13			39,000	507,000	62.500						
Entertainment	13			6,500	84,500	10.417						
House Rent	13			13,000	169,000	20.833						
Leave Grant	13			130,000	1,690,000	208.333						
Local Imprest (DSA)	13			1,720	22,360	2.756						
Salaries	13			182,000	2,366,000	291.667						
Packers	13			130,000	1,690,000	208.333						
Supply of raw material	13			624,000	8,112,000	1,000.000						
Pet Fish Purchase	13			624,000	8,112,000	1,000.000						
Utility	13			143,000	1,859,000	229.167						
Fuel	13			26,000	338,000	41.667						
Electricity	13			52,000	676,000	83.333						
Telecommunication	13			65,000	845,000	104.167						
Office	13			28,600	371,800	45.833						
Office Equipment	13			19,500	253,500	31.250						
Office Supplies	13			2,600	33,800	4.167						
Other Expenses	13			6,500	84,500	10.417						
Output Production	13						1,872,000	24,336,000	3,000.000	624	8,112	
Pet Fish	13						1,872,000	24,336,000	3,000.000	624	8,112	
Logistic	13			130,000	1,690,000	208.333						
Transport	13			130,000	1,690,000	208.333						
Marketing	13			65,000	845,000	104.167						
Trade Certification	13			65,000	845,000	104.167						

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	14%	20%	26%
NPV over 10 years	1,909,084	3,361,354	4,813,625
Payback period	5 years	4 years	3 years

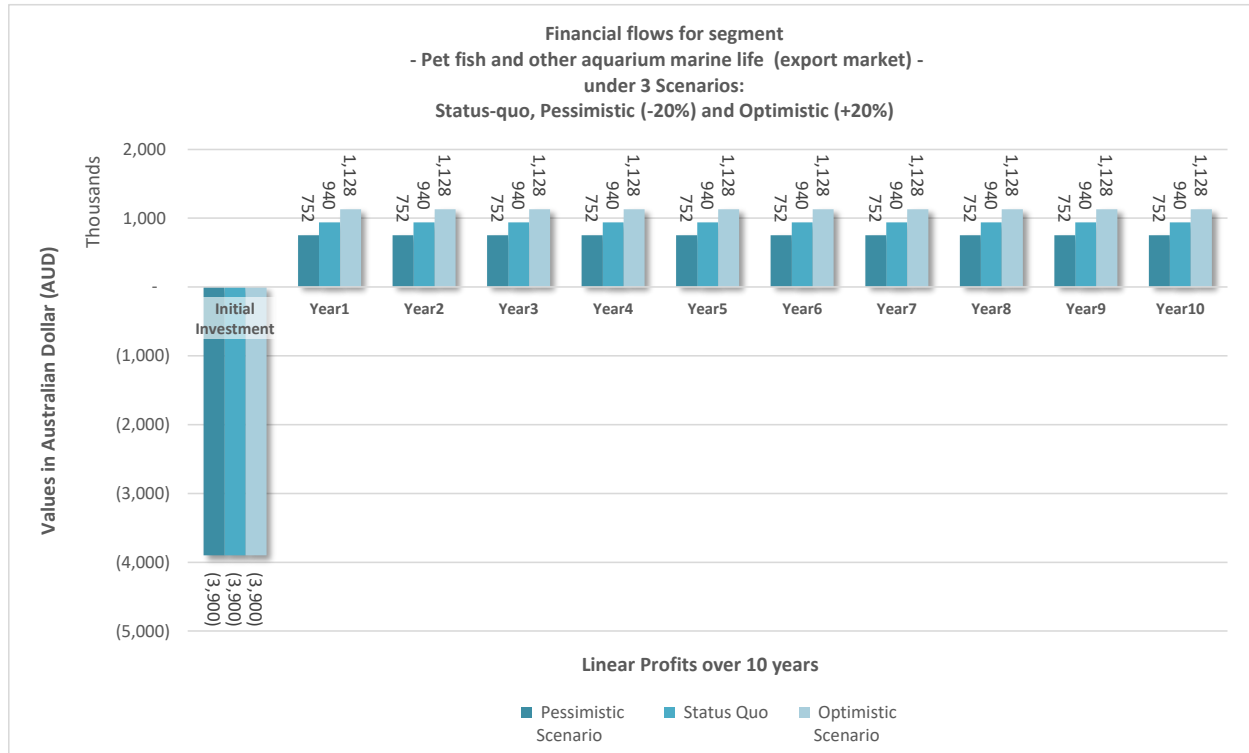


Figure 29: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Pet fish and other aquarium marine life (export market)

A6.15 Farmed Giant clam (export market) - Segment C5.

Table 30: Pivot table summarising initial Investments, annual running costs and outputs for the main actors, Harvesters/ Fishers and Processors/ Distributors for the product segment, Farmed Giant clam (export market)

Australian Dollar (AUD) ▼

Main Centre/ Activity	over 10 years	Values in Australian Dollar (AUD)								Output in kg	
	Nbr of Units	Investment per unit over project dur.	Total Investment over project dur.	Annual cost per unit	Total Annual Cost	Value of cost per kg	Annual Revenue per unit	Total Annual revenue	Value of output per kg	Annual Output per unit (kg/ year)	Annual Output (kg/ year)
Harvest											
Recap	10	4,400	44,000	4,231	42,310	1,952.953	4,333	43,329	2,000.000	2	22
Recap	10	4,400	44,000	4,231	42,310	1,952.953	4,333	43,329	2,000.000	2	22
Investment	10	4,400	44,000	440	4,400	203.097					
Equipment	10	4,000	40,000	400	4,000	184.634					
Gears	10	400	4,000	40	400	18.463					
Operating Cost	10			3,291	32,910	1,519.063					
Diving Equipment	10			2,000	20,000	923.169					
Fuel	10			1,000	10,000	461.585					
Hook	10										
Cooler/ Ice Box	10										
Oil	10			291	2,910	134.309					
Sinker	10										
Trolling	10										
Wire	10										
Repairs & Maintenance	10										
Landings	10						4,333	43,329	2,000.000	2	22
Giant Clams Juvenile (T.Maxima)	10						4,333	43,329	2,000.000	2	22
Licences/ Permits	10			500	5,000	230.792					
Licence	10			500	5,000	230.792					
Processing											
Recap	1	120,000	120,000	340,559	340,559	3,143.934	379,129	379,129	3,500.000	108	108
Recap	1	120,000	120,000	340,559	340,559	3,143.934	379,129	379,129	3,500.000	108	108
Investment	1	100,000	100,000	40,183	40,183	370.956					
Building & machinery	1	100,000	100,000	40,183	40,183	370.956					
Operating Cost	1			34,885	34,885	322.048					
Agency	1			257	257	2.374					
Packaging (cartons, bags)	1			30,000	30,000	276.951					
Rental	1			430	430	3.972					
Repairs & Maintenance	1			4,198	4,198	38.751					
Equipment	1	20,000	20,000	914	914	8.440					
Pumps, equipment, etc..	1	20,000	20,000	914	914	8.440					
Admin	1			10,916	10,916	100.770					
KIC Insurance	1			1,610	1,610	14.863					
Licence	1			2,173	2,173	20.056					
Taxes	1			7,133	7,133	65.850					
Finance	1			5,156	5,156	47.603					
Bank Loan	1										
DBK Loan	1										
KPF Contribution	1										
KPF Loan	1										
Petty Cash	1			5,156	5,156	47.603					
Labour	1			119,476	119,476	1,102.963					
Allowance	1			4,602	4,602	42.481					
Bonus	1			15,330	15,330	141.525					
Crewing	1			41,825	41,825	386.112					
Entertainment	1			1,632	1,632	15.067					
House Rent	1			1,055	1,055	9.744					
Leave Grant	1			22,502	22,502	207.729					
Local Imprest (DSA)	1			1,720	1,720	15.879					
Salaries	1			30,000	30,000	276.951					
Seafare	1			810	810	7.475					
Supply of raw material	1			43,329	43,329	400.000					
Giant Clams Juvenile purchase	1			43,329	43,329	400.000					
Utility	1			68,000	68,000	627.755					
Electricity	1			30,000	30,000	276.951					
Fuel	1			30,000	30,000	276.951					
Telecommunication	1			8,000	8,000	73.854					
Office	1			2,700	2,700	24.926					
Office Equipment	1			1,500	1,500	13.848					
Office Supplies	1			200	200	1.846					
Other Expenses	1			1,000	1,000	9.232					
Output Production	1						379,129	379,129	3,500.000	108	108
Giant Clams (T. Maxima)	1						379,129	379,129	3,500.000	108	108
Logistic	1			10,000	10,000	92.317					
Transport	1			10,000	10,000	92.317					
Marketing	1			5,000	5,000	46.158					
Trade Certification	1			5,000	5,000	46.158					

Segment's Financial indicators under 3 Scenarios (Status quo, Pessimistic and Optimistic)

Financial Indicator	Pessimistic Scenario	Status Quo	Optimistic Scenario
IRR over 10 years	14%	20%	26%
NPV over 10 years	80,558	141,697	202,836
Payback period	5 years	4 years	3 years

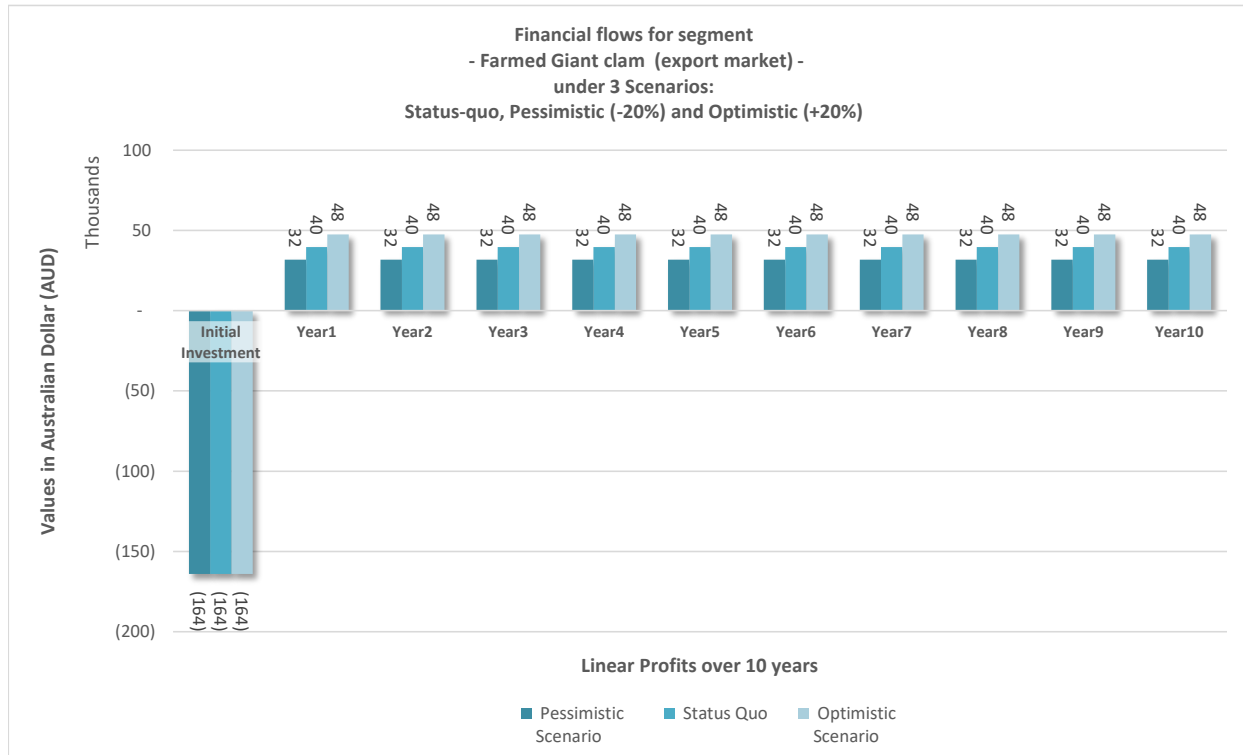


Figure 30: Recap of the 3 financial indicators and trend in the financial flows i.e., initial investment and estimated future stream of net revenues under the 3 scenarios (Status quo, Pessimistic and Optimistic) for the segment Farmed Giant clam (export market)