Policy Options to Increase the Contribution of Tuna Fisheries to National Food Security Across FFA Members

Report prepared for the Forum Fisheries Agency

October 2022





About MRAG Asia Pacific

MRAG Asia Pacific is an independent fisheries and aquatic resource consulting company dedicated to the sustainable use of natural resources through sound, integrated management practices and policies. We are part of the global MRAG group with sister companies in Europe, North America and the Asia Pacific.

2/29 Woodstock Rd	PO Box 732	P: +61 7 3371 1500
Toowong Qld 4066	Toowong Qld 4066	F: +61 7 3100 8035
Australia	Australia	E: info@mragasiapacific.com.au

This report was prepared for the Pacific Islands Forum Fisheries Agency.



This report was prepared by M. Skirtun, J. Lowe and D. Souter on behalf of MRAG Asia Pacific. The views in the report represent those of the authors and do not necessarily represent the views of the above organisations.

Suggested citation:

MRAG Asia Pacific (2022). Policy Options to Increase the Contribution of Tuna Fisheries to National Food Security Across FFA Members. Report prepared for the Forum Fisheries Agency. 75 p.

Acknowledgements

Undertaking a study of this type requires the collection of information and insights from a wide range of people and organisations. Particular thanks go staff from FFA member fisheries, industry participants, and technical experts who gave generously of their time and knowledge during interviews. Very special thanks go to the secretariat staff at SPC, FFA and PNAO for reviewing the policy options explored and their appropriateness to the Pacific context.



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Acronyms and abbreviations

AFMA	Australian Fisheries Management Authority	MFMRD	Ministry of Fisheries & Marine Resource Development (Kiribati)
ANCORS	Australian National Centre for Ocean Resources and Security	MMR	Ministry of Marine Resources (Cook Islands)
CBM	Community-based management	MPA	Marine Protected Area
DAWE	Department of Agriculture, Water & The Environment (Australia)	MT	Metric tonnes
DWFN	Distant water fishing nation	NCD	Non-communicable diseases
EEZ	Exclusive economic zone	NFA	National Fisheries Authority (PNG)
ENSO	The El Niño-Southern Oscillation	NFD	National Fishing Development Limited (Solomon Islands)
FAD	Fish aggregation device	NFMRA	Nauru Fisheries & Marine Resources Authority
FAO	UN Food and Agriculture Organisation	NORMA	National Oceanic Resource Management Authority (FSM)
FFA	Forum Fisheries Agency	RMI	The Republic of Marshall Islands
FMA	Fisheries Management Agency (Tokelau)	PIC	Pacific Island Country
FSM	The Federate States of Micronesia	PNA	Parties to the Nauru Agreement
LB FLL	Locally based foreign longline operations	PNAO	Office of the PNA
LB FPS	Locally based foreign purse seine operations	PNG	Papua New Guinea
LMMA	Locally Managed Marine Areas (Nauru)	PNMS	Palau National Marine Sanctuary
LO	Landing Obligation (European Union)	PROP	Pacific Islands Regional Oceanscape Program
MIMRA	Marshall Islands Marine Resources Authority	SIDS	Small Island Developing States
MAF	Ministry of Agriculture & Fisheries (Samoa)	SMA	Special management areas (in Tonga)
MAFE	Ministry of Agriculture, Fisheries and the Environment (Palau)	SPC	The Pacific Community
MALFFB	Ministry of Agriculture, Livestock, Forestry, Fisheries & Biosecurity (Vanuatu)	TAC	Total Allowable Catch
MFMR	Ministry of Fisheries & Marine Resources (Solomon Islands)	TFD	Tuvalu Fisheries Department

Executive Summary

BACKGROUND AND APPROACH

The desire to strengthen the contribution of tuna fisheries to food security was formally endorsed by the Pacific Islands Forum Leaders as part of the Regional Roadmap for Sustainable Pacific Fisheries in 2015. To support member countries of the Forum Fisheries Agency (FFA) in achieving the goal of increasing the supply of tuna for domestic consumption of 40,000 tonnes across the region by 2024, this study identifies and assesses various policy options that can be implemented at the country level. The study is carried out using data and information from existing literature and reports, alongside stakeholder interviews with national fisheries administrations, industry, technical experts as well as staff from secretariat bodies – i.e. SPC, FFA, PNAO.

As part of exploring policy options to increase the contribution of tuna to food security, an understanding of the key challenges to food security and the drivers and barriers to tuna consumption was first established. These are summarised below:

A4. Challenges to food security	A5. Drivers and barriers to tuna consumption
Climate change and natural disasters	Availability of tuna
Depleted coastal fish stock	Affordability of tuna
Rising cost of imports and fishing	Storage and shelf life
Reliance on imports and changes to traditional customs/diets	Technology
Supply chain challenges	Consumer preference
Food safety	
Monitoring and compliance	

POLICY OPTIONS

From there, policy options that can overcome or address the challenges and barriers were identified, assessed and 'ground-truthed' by secretariats and technical experts consulted. These options, under the three means in which they have the potential to improve food security in the Pacific, are:

3.1 Policies that increase the availability of tuna	3.2 Policies that take a livelihoods approach to improving food security	
Domestication/modernisation of the	Scaling up FAD programs	
tuna sector		
Simple post-harvest preservation	Gear and capital programs	
Simple post-harvest value-adding	Training and support services	
Reducing post-harvest losses	Supporting women's participation in the	
	sector	
Improving distribution and logistics	Using reject fish for fish meal and animal feed	
Ban on discards	3.3 Policies that increase consumption and	
	equity	
Mandatory landing	Community based management systems	
Regulating access and fish sale	Spatial closures to commercial fishing	
Taxes and subsidies	Public procurement programs	
	Education and awareness campaigns	

A final consideration of taking an integrated approach to food security is provided under section 3.4 Governance.

WHERE TOThe next step is for FFA members to review the policy options presented here and
decide for themselves which are the most suitable and practical options to apply in
their national context.

1 Introduction

Coastal fisheries have always been an important source of food security and livelihood for Pacific Island Countries (PICs), but are under increasing pressure from growing populations and climate change¹. To ensure a sustainable future for members of the Forum Fisheries Agency (FFA), Forum Leaders have formally endorsed the desire to strengthen the contribution of tuna fisheries to food security² as part of the Regional Roadmap for Sustainable Pacific Fisheries in 2015 ('the Roadmap'). The Roadmap envisages an increase in the supply of tuna for domestic consumption of 40,000 tonnes across the region by 2024. Since then, a number of studies have been commissioned by FFA to better understand how much tuna is entering local markets for domestic consumption³.

The current study fits within this broader context of work aimed at strengthening the longer-term food security position of FFA members by identifying and assessing policy options that can increase the contribution of tuna fisheries to food security across the region from baseline levels established in the previous studies³. The full Terms of Reference can be found in Annex 1.

The approach taken in this study is primarily based on a systematic review of scientific literature, stakeholder consultations and experts' review. The study was carried out across two phases with the first phase focused on understanding the background/relationship between domestic food security and regional tuna landings (e.g. domestic demand, key drivers and barriers influencing tuna consumption among member countries, etc.), as well as identifying practical policy options available to increase local landings based on regional and international experience. The second phase then analyses the key benefits and drawbacks of the identified policy options, as well as providing practical advice on the conditions under which each policy or program is likely to be most effective.

Information on the relationship between fisheries and food security in the region are drawn from relevant FFA and The Pacific Community (SPC) reports – e.g. landings from local/locally based vessels, domestic supply and consumption etc. – as well as existing studies on diet and nutrition (e.g. the SPC Public Health Division's work on nutrition and non-communicable diseases [NCD] – e.g. the NCD Roadmap Report). The systematic review of scientific literature is targeted at identifying global experiences on policies aimed at increasing the contribution of fisheries to food security⁴. The full literature review is available in Annex 2.

The repository of policies was then assessed for practicality and applicability to the Pacific context, along with other important documents from key international agencies, such as the United Nations Food and Agriculture Organization's Policy Guidance Notes on Strengthening Sector Policies for Better Food Security and Nutrition (FAO 2017)⁵ which provide recommendations on best policy practices to improve food security. All information gathered was then supplemented by consultations with fisheries administrations in FFA member countries, industry representatives, technical experts and secretariat bodies – e.g. FFA, SPC, and the Parties to the Nauru Agreement Office (PNAO).

¹ FFA and SPC (2015), Future of Fisheries: A Regional Roadmap for Sustainable Fisheries, <u>https://www.ffa.int/system/files/Roadmap_web_0.pdf</u>

² Food security exists when all people at all times have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life (World Food Summit, 1996).

³ Assessing the contribution of landings from locally based commercial tuna fishing vessels to food security (Tolvanen et al. 2019), and Assessing the contribution of landings from in-port transhipment to food security in the Pacific (Tolvanen et al. 2021)

⁴ The systemic literature review was carried out via Scopus using the key search terms: "fisheries policy" AND "improve" AND "food security" OR "nutrition security" over the time period of 10 years to 2021

⁵ Food and Agriculture Organization (2017), Strengthening Sector Policies for Better Food Security and Nutrition, Policy Guidance Series, <u>https://www.fao.org/publications/policy-guidance-series/en/</u>

Discussions with FFA member countries were centred around policies and programs with the potential to improve food security from tuna resources that have been trialled in-country and the successes or lessons learnt. Consultations with industry bodies, including operators in purse seine fishing, processing and fish trading, focused on the practical and economic feasibility of the policies impacting commercial entities. Lastly, regional bodies such as the FFA, PNAO and SPC, and technical experts were contacted to provide feedback and 'ground-truthing' on the suite of policies and programs identified, and their suitability to the Pacific context. A full list of stakeholders contacted is included in Annex 3.

This report sets out the results of the consultations and analyses. Section 2 is based on phase 1 of the study and provides background on the key challenges to food security in the region, along with the main drivers and barriers to tuna consumption. Section 3 synthesises policy options with the potential to improve food and nutrition security in the region while section 4 summarises some of the key messages and discusses the potential ways to move forward.

2 Background

To set the scene for the study, a review of relevant reports alongside consultations with fisheries administrations and industry in FFA member countries were carried out to understand the main challenges to food security across the Pacific, and the biggest drivers and barriers to higher tuna consumption. This is summarised in Table 1 below and discussed in more detail in Annexes 4 and 5.

Challenges to food security identified by member countries			
Climate change and natural	The impact of climate change and natural disasters on terrestrial and		
disasters	marine ecosystems, and their associated productive capacity, was		
	uniformly perceived as the greatest threat to food security among		
	member countries.		
Depleted coastal fisheries and	The traditional customs for reef fish consumption, coupled with		
increased reliance on FADs	population growth in urban areas, is placing increasing pressure on		
	coastal fish stocks in a number of countries, threatening future food		
	security from coastal fisheries. The introduction of FAD fishing has		
	helped alleviate some of the pressure on reef fish stocks by directing		
	artisanal fishers to fish for pelagic species on FADS. However, some		
	members expressed concerns that traditional fishing knowledge may		
	be lost through generations, as a result.		
Rising cost of imports and fishing	Global uncertainties and the economic impact of the COVID-19		
	pandemic has seen the cost of living in all FFA member countries		
	consulted rise across the board (incl. imported foods, fuel and fishing		
	gears). The rising costs undermine both the viability of small-scale		
	fishing operations and the affordability of fish available on the local		
	market, as the costs get passed onto consumers.		
Reliance on imports and changes	Imported foods (e.g. rice, noodles, canned meats, confectionary and		
to traditional customs/diets	sweetened drinks) have directed many Pacific Islanders away from the		
	traditional diet of fish, root vegetables and coconuts – threatening both		
	nutritional security as well as self-sufficiency in the face of supply chain		
	disruptions. Another challenge posed by changes to traditional customs		
	is the way food is shared, moving away from subsistence fishing and		
	communal exchanges to market systems.		

Table 1: Summary of challenges to food security in the Pacific and drivers and barriers to tuna consumption

Food safety	The lack of cold storage and understanding on proper food handling
	poses issues for food security from a human health perspective. This is
	a particular concern for countries where bycatch and small reject tunas
	enters the market from purse seine transshipment operations, where
	food safety may not be assured.
Fisheries compliance and	Related to depletion of coastal fish stocks, non-compliance, and a lack
monitoring capacity	of capacity in monitoring non-compliance of fishery regulations,
	undermines the effectiveness of sustainable coastal management and
	future food security.
Drivers and barriers to tuna consu	Imption
Availability of tuna	Limited availability of tuna is one of the largest barriers to higher tuna
	consumption among the FFA member countries consulted. The issue is
	more acute in countries without purse seine transshipment operations
	and/or large urban areas driving up demand.
Affordability of tuna	Increasing costs of fishing and limited supply/competition among
	artisanal fishers often put upward pressure on market prices of tuna,
	which can present a considerable barrier to tuna consumption. Refer to
	Annex 5 for prices of tuna and other proteins in selected FFA member
	countries.
Storage and shelf life	The lack of access to cold storage forces local fishers to make risk
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In addition to identifying challenges to food security and drivers/barriers to tuna consumption, the nutritional composition of tuna and tuna bycatch species commonly caught in of Pacific fisheries was explored in phase 1 of the study (see Annex 6). These data indicate that, by considering the nutritional composition of consumed species, PICs have the opportunity to reduce the total weight of fish required for food security while simultaneously addressing nutrient deficiencies specific to their respective countries. For example, greater access to fish rich in protein, such as tuna, may assist in alleviating the high rates of protein-energy malnutrition in communities of inland PNG, while improved access to fish high in iodine may assist in lowering the high prevalence of iodine deficiency among PICs such as Fiji, PNG, and Vanuatu (FAO, 2003a, b; Li et al., 2009; Charlton et al., 2016).

3 Synthesis of policies and programs to improve food security

This section presents policies and programs identified both from the review of scientific literature as well as consultations with stakeholders. These policies and programs have the potential to improve food security in the face of challenges and barriers identified, through one of three means. The first is through the increased availability or accessibility of tuna products, which looks at ways to promote more tuna supply on the local market and solutions around the distribution and storage. The second category of policies is focused on developing the tuna fisheries sector through a 'livelihoods approach' to improve food security. This includes options to improve the financial viability and operational setting for fishers and actors in the supply chain, which could not only increase the volume and types of tuna products available, but also increase income security and purchase power for food products. The third set of policy options which looks at increasing the consumption of tuna and tuna-like products, and/or the equity thereof, with some overarching governance thoughts provided in section 3.4.

Some policies or programs evaluated fit under more than one category. For example, while scaling up FAD deployment improves the livelihoods of small-scale fishers through reduced fishing costs and improved catch rates, the policy also increases the availability and access (i.e. affordability) to tuna products through improved supply and lower cost of operation.

A summary of the policies and programs is presented in Table 2. Each policy or program is then discussed in more detail in the sub-sections following. It is important to note that all policies and programs identified have the potential to improve food security from tuna resources, including better access. Therefore, the pros and cons do not re-iterate this and are evaluated in addition to their potential contribution to food security – for example, simple post-harvest preservation (e.g. micro-canning, drying, smoking etc.) has the benefit of improving storage of fish, managing supply influxes, reducing waste, providing additional means of livelihood to actors in the supply chain, improving distribution convenience, potential for import replacement or self-sufficiency and so forth. All of which are in addition to its potential to improve food security.

Similarly, policies related to the sustainable management of tuna resources for the benefit of future consumption are not considered in this section, as it is assumed that high-level management measures are agreed and implemented at the regional level – e.g. set via the PNA, FFA or the Western and Central Pacific Fisheries Commission (WCPFC).

Table 2: Summary of policies and programs that can improve food security, along with their associated pros and cons and recommended operational/implementation conditions.

Cat.	Policy/program	Description	Operational setting or conditions for implementation	Pros	Cons
cess of fish from tuna fisheries	Promote domestication and/or modernisation of the fisheries or related sectors and practices that increase diversification and access to tuna products	Policies include promoting fully domestic or public- private partnerships that target either the commercial fishing sector or post-harvest processing (e.g. loining, canning, salting/drying, smoking)	 This policy is particularly useful in countries where there is: a) a large urban or peri-urban population that do not have sufficient access to fish; b) some form of existing processing and distribution network or infrastructure; c) reliable and consistent supply; d) a sufficiently large (and displaced) workforce. 	 Can generate employment and other flow-on benefits to the rest of the economy Opens opportunities for local fishers to expand their operations and local entrepreneurs to engage in business activities in the fisheries sector 	 Risk that costs outweigh benefits if processing plants are built as loss leaders for fishing access discounts May be difficult to attract local crew if unemployment is low or conditions are harsh Risk that foreign partners use PICs to expand capacity under island subsidy
I. Increase the availability and/or acc	Promoting simple post- harvest methods to increase shelf life (e.g. micro-canning, bottling/jarring smoking, drying) and improving the distribution of such products at affordable prices	Rather than focusing on modernisation of large-scale post-harvest processing, this policy looks at simple small- scale methods of processing and distribution that is adaptable to fluctuating supply volumes - e.g. from commercial unloading or transshipment	 This policy is suitable for any country where this is: a) a considerable population size living in urban, peri- urban or inland areas with insufficient access to fish; b) large fluctuations in tuna supply (e.g. from commercial vessels unloading or transshipping); c) infrastructure or govt support for small-scale entrepreneurship or local business participation in processing and distribution; d) a supply chain network for materials (e.g. cans, jars) and ingredients (i.e. seasoning and sauces). 	 Preservation techniques are versatile and can be used with various food products (e.g. vegetables and other fish) Minimises waste during periods of high fish influx that can be used during bad weather events Opportunity for import replacement, canned products are mobile and shelf-stable Provides alternative income stream/livelihood means 	 Micro-canning relies on imported materials that can be susceptible to supply chain disruptions Food safety concerns if preservations are not correctly performed Commercially, only so many ventures can be supported by local demand levels
	Promoting simple value- added processes that increase the convenience of tuna products for consumers	Provide training on post- harvest fish handling and business support on value- adding processes for local fishers to make tuna more easily accessible for families or consumers that value convenience (e.g. tuna loins in vacuum bags, cooked tuna and chips etc.)	Particularly useful for countries that have transitioned towards more western-type diet and/or lifestyle, where there is a strong consumer preference for convenience. Successful implementation will require strong cold- chain infrastructure and food safety systems/protocols in place, as well as proper training for fishers, to prevent negative impacts on consumer health from poor storage or handling.	 Can generate greater revenue for fishers to sell fresh catch in loins More convenient options for tuna consumption can make it easier for people with busy lifestyles Provides healthier options to other convenient foods 	 Health and food safety risks if fishers do not handle the fish properly Often difficult to judge freshness of fish in vacuum sealed bags Can generate more plastic use/pollution if not properly addressed

Cat.	Policy/program	Description	Operational setting or conditions for implementation	Pros	Cons
I. Increase the availability and/or access of fish from tuna fisheries	Reducing post-harvest losses as a way to increase availability of fish for human consumption	 Promote efficient use of tuna resources through: a) better utilisation of bycatch species from commercial fisheries; or b) better utilisation of all parts of the fish (e.g. dark meat, heads and bones). 	Requires existing or investment in cold storage, distribution and/or processing facilities, which can be small-scale or solar powered. For recovery of dark meat from processing, this is most applicable to countries with existing domestic or joint- ventured cannery operations in place.	 Provides people with access to more fish options, potentially at low prices Catalyst for better storage and processing facilities as the market for offcuts provides financial incentives for local businesses 	 Health and food safety risk if the offcuts and bycatch are not properly handled Requires investment by the govt. or private sector in cold storage and other infrastructure
	Improving the distribution of tuna by providing logistical support, investing in cold storage or ice making machines, and setting up provincial markets	 Policies that provide logistical support can include: a) facilitating or investing in transport services between islands or provinces; b) setting up distribution centres/fish markets in areas of need; and c) investing in cold store facilities for remote regions. 	The policy is particularly interesting for countries with a mismatch between regions in supply (e.g. fishing communities in remote areas) and demand (e.g. urban centres with insufficient supply) due to distribution or logistical issues. It can also be interesting for remote areas for food security where fish supply is irregular due to weather conditions and limited access to regular seafood imports from elsewhere in the country or overseas. There may be a need for transportation of spare parts and technical expertise to service cold storage facilities. Other requirements include sustainable and affordable energy sources (e.g. solar), especially for remote areas where fuel is scarce.	 Can have flow-on benefits to other sectors with cold storage and distribution needs Provides alternative income or livelihood means for community groups who manage the cold storage units (e.g. women's groups) Can create strategic/central and safe locations for locals to buy fish and other foods More frequent and reliable distribution of food and other goods that benefit from better logistical network 	 Ice machines require regular service and are high energy consumers, which can make ice very expensive in the end. Cold storage may be used for other items, such as beer and ice cream, neither of which is very good for nutrition or health Both ice machines and cold storage are reliant on imported parts, which are subject to supply chain disruptions
	Ban on discarding small tuna and bycatch products to facilitate the supply of low- cost fish to urban centres	Banning the discarding of small or reject tuna and bycatch (beyond that required by the WCPFC) to encourage industrial fleets to offload these fish at regional ports, providing a local supply of low-cost fish.	Requires infrastructure and capacity to handle fish landed – i.e. proper storage and/or monitoring of fish quality to minimise health and safety risks to consumers. It's also advised to have monitoring and evaluation in place to assess the impact on the local community and the livelihood of artisanal fishers More suited to countries with much greater consumer demand than supply of tuna products to minimise competition with small-scale/artisanal fishers	 Can benefit from value-adding processes, i.e. provide locals with alternative means of income/livelihood Provides low cost alternatives for local consumers Minimises waste by encouraging commercial vessels to better target larger fish or key species 	 Bycatch is often overlooked and poorly treated, which can cause health and food safety risks for local consumers Can impact livelihood of artisanal fishers if the market is flooded Can impact the financial viability of commercial vessels forced to retain the bycatch and small tunas

Cat.	Policy/program	Description	Operational setting or conditions for implementation	Pros	Cons
/or access of fish from tuna fisheries	Mandating the landing and/or transshipment of tuna as part of licensing conditions of foreign fishing fleets	Requiring foreign or domestically flagged commercial vessels to offload or transship tuna caught. This can be at specific locations such as urban ports with a higher demand than supply of tuna, or to local canneries to improve consistency of tuna supply	 Suitable for countries with: a) existing infrastructure or facility to accommodate offloading and transshipment (e.g. appropriate port or wharf infrastructure, piloting and agent services, domestic cannery, govt. capacity to regulate transshipment etc.) b) other attributes that can attract vessels to offload or transship (i.e. being close to fishing grounds, bunkering and victualling services etc.) c) enough demand to generate financial incentives to land fish – e.g. the price paid by local canneries need to be sufficiently close to the market rate 	 Beneficial mainly for places that do not have a domestic fishery to supply the local market, or where the domestic fishery cannot keep up with consumer demand Price competition can benefit consumers and regulate the market from collusion Improves consistency of tuna supply to local canneries 	 Impact the livelihood of artisanal fishers Mandating landing is likely to result in lower-grade or quality fish being landed Can impact the financial viability of commercial vessels forced to land Periodic influxes of fish do not generate consistent long-term food security
I. Increase the availability and	Improve access to fish through establishing local co-ops and/or regulating the sale of bycatch and small or damaged tunas from commercial operations via fisheries associations	Regulating the sale of bycatch and damaged/small tunas through national fisheries associations or local co-ops, providing local fishersmen more direct control over the commercial supply, or alternative means of income (i.e. through fish trade).	Countries with existing business networks or fisheries associations can maximise gains from this type of policy. The policy would work best with commercialised or private sector co-ops where business incentives exist to ensure efficient operation.	 Improves the quality, food safety and affordability of fish if fish is received via organised or regulated means Provides alternative means of income/livelihood to local fishers Catalyst for economic activity and flow-on benefits from domestic business operations 	 Major disincentive for local fishers to continue fishing if there is more money in trading landed fish Can discourage entry to the market by those not involved in the co-op or fishing association
	Tax incentives and/or subsidies for locally based processing plants and fishing operations	Instruments used to promote domestic sale of tuna and bycatch products by locally based processing plants or fleets. These include tax incentives (e.g. exemptions), or subsidies that close the gap between export and local sale price. Reverse options include higher taxes on whole round fish landed for export.	Applicable for countries with existing canneries or locally based fishing fleets that land or process tuna in country. To ensure the program generates a net benefit to society, subsidies or tax exemptions should be given only based on tangible benefits generated by local plants or fishing operators (ad-hoc), rather than proposed or estimated benefits.	 Tax exemptions or incentives could improve business feasibility of locally based operations and boost business activity Can generate additional employment and flow-on benefits to the rest of the economy if locally based operations expand 	 Subsidies and tax exemptions come at a cost to the govt. and services provided by the govt. Higher taxes on commercial operators can add financial burden, which could deter business or encourage vessels to flag elsewhere so that they can simply catch and transship Taxes only on the fisheries or related sectors can be seen as unfair

Cat.	Policy/program	Description	Operational setting or conditions for implementation	Pros	Cons
II. Develop the tuna fisheries sector as a livelihoods approach to improving food security	Scaling up or investing in the use of nearshore and offshore fish aggregating devices (FADs), with the potential for including oceanographic sensors to monitor climate change	Deploying nearshore and offshore FADs to help improve catch rates of small- scale fishers, implemented in conjunction with the necessary training (incl. FAD maintenance/re-deployment and safety at sea) as well as meteorological weather information dissemination. Possible FAD upgrades include 1) GPS tracking; 2) acoustic sensors to measure fish aggregation; and 3) weather buoys that measure wave heights, temperature, wind and currents.	This program is appropriate for any country with small- scale/artisanal operators. Deployment of FADs should be targeted to areas that could be easily reached by fishers, but also in such way that do not attract vulnerable reef fish and ensures that the value of tuna/pelagic species caught around them exceeds the costs of materials and installation. The program should be run in conjunction with training on FAD fishing, sea-safety, as well as maintenance and recovery of damaged or lost FADs.	 Higher catch rates improve the livelihood of artisanal fishers and reduces the cost of fishing (incl. time and resources used) Promotes fishing on pelagic species and takes pressure off reef stocks Allows entry for people without traditional fishing knowledge 	 FADs can be susceptible to loss or damage, especially when deployed offshore If lost FADs are not properly retrieved, they can cause hazards to vessel navigation as well as damage to reefs Fishers who have become dependent on FADs can struggle when the FAD is lost or damaged FADs can be difficult to deploy or maintain at the village level if locals only have small canoes Additional GPS and sensors can be expensive, which would need to be funded from somewhere
	Capital, gear and fuel programs including subsidies, grants and provision of boats and equipment for artisanal fishing	 Supporting artisanal fishers, in the form of: a) provision of skiffs/canoes or skiff/canoe building programs b) tax exemptions or rebates/subsidies for capital investment (e.g. vessel, engine, gear etc.) c) subsidies on fuel d) providing well-being services such as vessel maintenance and seaworthy checks 	Suitable for most countries with artisanal operators supplying the domestic market or fish for subsistence means. It may be particularly beneficial in countries where there is high competition with the commercial fleet. Capital programs should be carefully designed to avoid fraud. For loan-based programs where assets are paid for on loan and guaranteed by the govt., the govt should hold mortgage or security over the asset in the event of default. To avoid over-inflation of asset value for rebate systems, it's recommended that the govt. has a system of procuring capital for resale rather than provide subsidy or rebate based on third party receipts.	 Capital programs that provide newer boats with better designs can improve sea-safety and catch efficiency, as well as reduce post-harvest losses. Newer or bigger boats can also allow fishers to travel further offshore, taking the pressure off coastal/reef fisheries Capital programs and associated training (e.g. building skiffs and canoes) can generate knowledge sharing among local boat building companies. This in turn can boost economic activities and other flow-on benefits 	 Can lead to over-capitalisation and put more pressure on reef stocks if not properly managed Susceptible to fraud and nepotism Can disadvantage people who have legitimate claims but not the financial records to utilise the program Might attract people to enter the fishery without the necessary knowledge or consideration of on-going operating expenses.

Cat.	Policy/program	Description	Operational setting or conditions for implementation	Pros	Cons
II. Develop the tuna fisheries sector as a livelihoods approach to improving food security	Support women's participation in small-scale tuna fishery value chains	Research has shown that women with greater control of income are more likely to spend money on food and nutritional needs of the family. As such, policies that particularly target the empowerment or involvement of women in post-harvest value chain operations can both directly and indirectly contribute to food security. Policy options include targeting women in SME support, micro-finance, training or provision of equipment.	This policy is appropriate in most country contexts, especially those that have a high unemployment rate or limited employment opportunities for women. Any program implemented should consider the compatibility of the program with traditional customs and roles of women. Research can be also done to seek the sectors or activities that could benefit most from women's involvement to improve efficiency and effectiveness of the program(s). For involving women in the post-harvest processing sector, it's also important to consider the necessary conditions or appropriateness of the post-harvesting policy/program itself (refer to above options under cat. I. Increase the availability and/or access of fish from tuna fisheries)	 Experience from micro-finance to women groups in the Pacific suggests that women tend to manage finance better due to the peer pressure from women groups to pay back loans Involving women increases the workforce available, which also boosts economic growth and development Involving women in post- harvest handling and processing can improve the supply and diversification of tuna products, and allow better distribution of labour 	 Has the potential to breakdown traditional or customary roles for women in the home if implemented incorrectly. This could lead to disputes at home. Division of labour can also raise questions or disputes on division of income from fish sold Women may be put under pressure to cheat the system or abused/targeted by relatives if they end up making too much money
	Use reject fish landed to produce fish meal, fish oil and/or fertiliser in the production of agriculture, livestock or aquaculture	Reduce waste from fishing or transshipment operations by utilising reject tuna or bycatch to produce fish meal and oil for aquaculture or livestock husbandry (e.g. pigs), and fertiliser for vegetable farming. This also has the added benefit of reducing negative impacts, such as (illegally) dumping fish inside or just outside ports/lagoons	This policy is particularly beneficial for countries that have regulations against the local sale of tuna from transshipment operations, lack of domestic demand to absorb excess tuna supply, and/or have experienced negative impacts from reject fish being dumped near ports/lagoons. Implementation of the policy will require infrastructure or facilities to handle or process reject fish into fish meal/oil, animal feed or fertiliser. In addition, if there are regulations prohibiting local sale for human consumption, there will be need for capacity to monitor and enforce such regulations	 Can capitalise on readily available resources Reduce waste, especially for fish not fit for human consumption Business opportunity for generating income security and alternative means of livelihood Can boost economic activities and flow-on benefits, such as increased food security from sources other than tuna 	 Oil content is unlikely to be high from reject fish Requires substantial investment on specialised machines and equipment to process fish into meal or oil Need a market to absorb processed products

Cat.	Policy/program	Description	Operational setting or conditions for implementation	Pros	Cons
II. Livelihoods approach cont.	Provide training programs that can improve catch, handling and storage of tuna for local operators	 Training programs can include, but not limited to: a) onboard motor use b) safety at sea c) making/repairing fishing gear d) FAD fishing and maintenance e) fish handling and post- harvest processing f) financial literacy g) using reject fish in farming, aquaculture or animal husbandry 	Suitable for all countries that have an artisanal fleet or local entrepreneurs engaged in post-harvest trading or micro-processing Training should be tailored specifically to the target audience using resources readily available in the country. It should also be delivered in a way that is engaging and digestible for the participants, and preferably in the local language There needs to be commitment to repeat training programs to ensure knowledge and skill building that can only come with repetition and practice	 Training is essential for the successful implementation of all programs Benefits can be maximised when tied with community-based management or community led initiatives 	 Effectiveness of training programs can be undermined if the right people are not selected for the training Effectiveness of training programs can be undermined if attendees do not share the knowledge with the community For some countries, the scale of training required could be large and costly
III. Increase consumption of tuna products and equity thereof	Promoting food and nutrition security through improved management of marine resources using Community-Based Management (CBM)	Policies that target equitable engagement in the management, use and distribution of marine resources (incl. tuna) for local communities. This can be tied in with protection of reef fish stocks, management of inshore FADs and women's participation in livelihood approaches to improving food security.	CBM policies are particularly useful or applicable to countries that allow for co-management of fisheries resources within their legal framework. CBM is also very beneficial for regions/communities where there is a heavy reliance on fisheries or aquaculture for food and livelihood. However, CBM is only likely to work in integrated settings where the management of other daily matters are also community based – i.e. there is existing community structure for laws and regulations Moreover, CBM is likely to work best in single communities as opposed to multiple.	 Community engaged management and monitoring of reef fisheries can be more efficient in promoting fishing on pelagic species Similarly, community managed FADs will benefit with on- ground knowledge for best use CBM of commercial assets also have the added benefit of contributing to livelihoods – e.g. centralised processing and marketing of tuna and other resources for trade and export 	 Requires supportive legal framework and customary framework for local management, supported by sufficient financial capacity. Can lead to breakdown of social structure and traditional customs if disputes surrounding money and distribution of wealth are unresolved
	Spatial closures to commercial fishing around islands/communities	Example of policy could be an extension of the inshore fishery to beyond 12nm, and de-commercialisation of fishing activities	Most suitable for countries with a large artisanal fleet that fish beyond the standard 12nm coastal zone, and can benefit from a larger buffer from commercial vessels. Spatial boundaries should be practical and aligned with the type of fishing activity and catchability in the area. This may require scientific research.	 Provides artisanal and small- scale fishers a bigger buffer to carry out their operations Can benefit commercial fishers by minimising the likelihood tangled or loss gear due to interactions with artisanal boats 	 Would create conflict with commercial domestication policies if exemptions are not correctly set up Could result in loss of economic opportunity if the zones are not utilised by local fishers. Loss of fish to local market

Cat.	Policy/program	Description	Operational setting or conditions for implementation	Pros	Cons
I. Increase consumption of tuna products and equity thereof	Public procurement programs: Using the government's purchasing power to provide regular demand for food from vulnerable producer groups, and at the same time, achieve fisheries management and national health policy goals (e.g. food and nutrition security). Target groups could incl. children, the elderly and low income or at-risk communities	Policy options range from: a) setting up federal/state purchase programs to support food nutritional goals by suppling canteens in local schools, universities and hospitals with fish sourced from small-scale operators; to b) requiring 3rd party contractors involved in the program to source a % of fish from small-scale operators As part of the program, minimum prices can be set to ensure the livelihoods of vulnerable producers, such as small-scale fishers, are supported in the process.	Requires some form of national or state procurement program in place, or where there is willingness between departments responsible (e.g. health and fisheries) to cooperate in setting up some form of national/state procurement program. Food procurement programs generally cover key govt run facilities such as public hospitals, schools, universities and prisons, and at times, food provision for certain at-risk groups and communities (e.g. social welfare or safety homes). This type of policy is particularly beneficial where the target groups (e.g. children, elderly, low-income communities) who face nutritional challenges, or where is high competition between the commercial and small-scale fishing sector	 Improved nutrition for groups in need, who may otherwise not have access to tuna products Provide small-scale fishers with an alternative means of livelihood Increase govt. demand can have other flow-on benefits (e.g. creating local market opportunities and boosting business growth) 	 Govt. run food supply programs comes with additional liability to provide safe and hygienic food If fishers are guaranteed demand for their fish, they may exercise less care in handling and storing fish which can lead to health risks Sourcing tuna from small-scale fishers may face supply constraints (i.e. limited or inconsistent supply)
	Education on the nutritional benefits of tuna and/or guidance on utilisation	 Policy options range include: a) state/national advertising campaigns that promote healthy diets from fish or tuna; b) encouraging collaboration between educators and fishers to provide better understanding on the importance of fish in healthy diets (e.g. in school educational programs); c) single day events such as World Tuna Day 	This policy option is useful for countries where this is high nutrition insecurity, or strong consumer aversion to tuna - either due concerns over content of heavy metals or simply a preference for reef fish. This policy option can also be tailored to address related issues such as pressure on depleting reef fisheries – e.g. eating tuna can help reef fish stocks recover as well as contributing to healthy diets. Awareness programs need to be targeted and well thought out to be effective – inclusive, factual and communicated well. To improve nutrition security, messages on health should be paired with food diversity and importance of a balanced diet	 Can improve nutrition security at a national level and give everyone the opportunity to make better choices on their diets Can be used to promote importance of other factors alongside health - e.g. sustainable fishing. School programs mean that the information on health and sustainability as well as traditional food cultures can be reaffirmed and passed on to the next generation and the generations following. 	 Requires commitment and funding from govts to consistently run promotional campaigns If the advertising campaigns are not politically or culturally appropriate to the audience, then the efforts can be counter- productive

Cat.	Policy/program	Description	Operational setting or conditions for implementation	Pros	Cons
IV. Governance	Integrated approach to national food and nutrition security	Implementing cross-sectoral nationwide policies that prioritise food and nutrition security. Policies can take the direction of a Food Systems Approach in which various factors and actors across food sectors are considered in a holistic way (e.g. fishing, processing, waste treatment, health, trade, energy etc.) to ensure policies are coherent in achieving shared targets. Sustainability in terms of social, economic, ecological and environmental are also included in such approach.	The policy is suited for all countries with interest in improving food and nutrition security. However, there needs to be political commitment across sectors and government departments to coordinate efforts, communication and resources. Master plans or roadmaps need to review synergies and trade-offs across government departments to optimise coordination without adding more red-tape or bureaucracy. Integrated policies should include strategic steps for implementation rather than only discussions of goals on paper. It is likely that there will be additional investment in capacity and human capital needed to ensure effective implementation of cross-sectoral policies due to increased levels of coordination between departments.	 Maximising synergies across departments can improve efficiency in achieving food and nutrition security goals Considering trade-offs in a cross-sectoral approach allows for more efficient use of resources in a more holistic perspective Simplifying and aligning goals and objectives across departments avoids non- coherent policies and programs 	 Risk of being a shelf holder Cost of delivering policies can be higher if more people need to be involved Implementation could be difficult if there are too many stand-alone govt departments, or if the departments do not have clear communication avenues Can introduce more bureaucracy if it's not planned well Need community buy-in

3.1 Policies or programs that increase the availability and/or access of fish from tuna fisheries

3.1.1 Domestication and/or modernisation of the fisheries or related sectors

The policy option of promoting the domestication and/or modernisation of fisheries or related sectors refers to strategies that support a domestic commercial fishing fleet, processing plant or other types of industry which can have a positive contribution to food security from tuna resources. Domestication and/or modernisation can be achieved through policies that target either purely domestic operations or partly domestic operations – for example, public-private partnerships or joint ventures.

Examples of policies or programs that promote domestication include, amongst others:

- prohibition or cap on number of foreign vessels licenced;
- exclusive fishing zones for domestic vessels;
- tax exemptions on fuel, capital or gear;
- discounts on fishing licence or access fees for domestic vessels;
- minimum requirements on the number of local crew onboard joint ventured vessels; and
- mandatory landing to domestic canneries by locally based foreign fleets.

As noted in Table 2, this policy also includes the promotion of practices that increase diversification and access to tuna products for the country or the region. This could include, for example:

- the provision of capital or equipment for government operated facilities (e.g. blast freezer, smoking machine etc.);
- subsidies or grants for new start-ups or existing domestic fleet and processing plants looking to upgrade their technology or capacity;
- promotion of knowledge transfer through joint venture enterprises; and
- any other programs that promote innovation and modernisation along the supply chain.

A number of the individual examples listed above are discussed further under their respective subsections to come.

Where it's been trialled

Strong examples of policy directions targeting domestication of the commercial fishing fleet can be found in Fiji and Tonga. While Fiji is a hub and base for a number of locally-based foreign vessels, there is a licence cap of 60 placed on those permitted to fish inside its EEZ. The cap of 60 was introduced in 2016, and is a reduction from the original 100 vessel limit set in 2002 (Acoura Marine 2018). Despite the fact that there are more vessels flagged to Fiji than that licenced to fish inside its EEZ (a total of 89 vessels are flagged to Fiji to date), the licence cap remains. This is mostly to support the profitable operation of the licenced vessels fishing inside the EEZ, based on results from the bioeconomic study conducted by FFA (Skirtun 2016). Similarly, there is a licence cap of 10 placed on foreign fishing vessels operating inside the Tongan EEZ, which was implemented as part of the tuna management plan in 2015. The limit on foreign licences is designed to promote the development of the domestic longline industry and is applied in conjunction with government efforts to promote joint ventures and fishing partnerships with foreign companies. Despite the push for domestically or jointly operated commercial longline ventures, there are only 5 locally flagged vessels currently operating in Tonga. Beside the policy direction on domestication of commercial fishing fleets, smaller local fishing operations have also been trialled in other FFA countries. For example, Kiribati has started to run its own mini longline operations and solar-powered supply boats.

In terms of domestication and modernisation of onshore processing facilities, there are a few more examples across the region. A successful example of private-public partnership for onshore processing is the Soltuna plant in Noro, Solomon Islands. The plant not only contributes to domestic and regional food security from canned tuna and dark meat sold in Solomon Islands and neighbouring Melanesian countries, but also generates significant economic and employment benefits. Although no financial support is provided to the Soltuna cannery by the Solomon Islands government in the form of subsidies or grants, the 3 locally-flagged Taiwanese-controlled vessels are required to supply tuna and bycatch to the Soltuna plant as part of their licencing conditions. In addition, the rest of the domestic fleet that supply the cannery, operating under National Fishing Development Limited (NFD), are provided with low cost fishing days and exclusive access to archipelagic waters. This compares to policy approach taken in PNG, where financial support, in the form of rebates, are provided to onshore processing facilities based on the volume processed. Other examples of support or policy direction that promote domestication/modernisation of onshore processing include the government provision of cold storage and smoking machines to the National Fishing Corporation of Tuvalu (NAFICOT), and establishing joint venture processing operations with a Chinese organisation in Vanuatu. The latter of which is further supported with discounted licence fees to locally-based foreign longline vessels that land domestically.

Pros

A key advantage of promoting domestication of the fisheries sectors is that it provides a means of self-sufficiency, which would ensure longer-term food security, assuming products produced are available to domestic consumers. It can also be effective in delivering substantial tuna supply for domestic consumption at affordable prices (e.g. in Vanuatu the processing plant is required to supply the local market with frozen sticks of tuna and bycatch (e.g. wahoo) at the affordable price of 500 vatu/kg or ~US\$5/kg).

In the case where commercial fishing or processing are not established industries, promoting joint venture partnerships can facilitate knowledge sharing between experienced foreign firms and domestic operators. If processing joint ventures are properly/successfully instituted, it can also have flow-on economic benefits, such as increasing local employment and boosting business opportunities and activities in supporting sectors. Finally, the sale and export of products produced by domestic enterprises has the added benefit of building up foreign exchange reserves in countries that do not use USD or AUD - i.e. from export revenue.

Cons

The main potential challenges associated with domestication programs include:

- purely domestic operations can be costly and difficult to implement given the experience required to operate commercial vessels or processing plants. In Tonga, even with government efforts in promoting domestication of commercial fishing operations in Tonga, the success has been dampened by the high costs of operation, difficulties in attracting foreign partners, low levels of local experience and diseconomies of scale;
- difficulties in finding local crew willing to work on domestic commercial vessels in countries with alternative sources of income (e.g. remittances from families overseas). The experience in RMI in the 1980s, when there was a strong policy of domestication of the fishing fleet, was that crew had to be sourced from other PICs (e.g. Kiribati) initially because there was no interest from the local population;
- risks associated with the aspirations of government policy objectives not matching commercial reality – i.e. government policy objectives for domestication need to be consistent with fishing opportunities and local business conditions (key input costs, infrastructure, etc);

- risks associated with having locals becoming front people for foreign companies or ineligible parties who seek to take advantage of the system to access government grants or other incentives;
- Joint venture processing operations have historically been used as a 'loss leader' to gain access to fishing licenses and discounted fishing access, with fish exported elsewhere. Joint venture fishing operations, with vessels reflagged to PICs, have been used to circumvent capacity limits by allowing foreign companies to acquire larger or newer vessels for their home fleet and transfer older vessels to PIC flags. This essentially means that foreign companies can continue to manage their old capital under island subsidies and upgrade/modernise their home fleet, which in turn increases their company capacity.

Conditions and ease of implementation

Given the risks surrounding the promotion of domestication/modernisation of the fisheries and related sectors, implementation of such policies should be done so with a high degree of care. If joint ventures are considered, detailed assessment of the economic and legal implications need to be reviewed to ensure that benefits generated will outweigh costs or foregone opportunities.

The success of domestication policies largely depends on political will, and the extent to which the policies are backed up by incentives and government support to drive fishery domestication. When the investment needed goes beyond small-scale, local fisheries operators and business entrepreneurs need to have not only lucrative schemes/opportunities to persuade their engagement, but also confidence in the schemes to invest considerable private resources.

With the above in mind, policies on domestication/modernisation are particularly useful in large economy countries where there is:

- a) a large urban or peri-urban population that do not have sufficient access to fish;
- b) some form of existing processing and distribution network/infrastructure;
- c) reliable and consistent supply (e.g. domestic or domestically based fleet to land fish) or demand of tuna for processing and distribution (i.e. large domestic or regional demand);
- d) sometimes it can also be necessary to have some form of displaced workforce i.e. those who are not entitled or cannot live off the land, or have moved from their home village (disconnected from wantoks) as this often provides a higher incentive to work because individuals can benefit fully from the efforts of their labour.

3.1.2 Simple post-harvest preservation

Simple post-harvest preservation or processing come in various forms, including canning, bottling, jarring, smoking, drying and so forth. Policies that promote simple post-harvest preservation can be used to target both extending the shelf-life of fish products, especially for consumption during periods of bad weather or natural disasters, and improving the distribution of such products at affordable prices as a means of import replacement or self-sufficiency. Policies and programs focused on post-harvest preservation can involve the provision of training, capital, equipment, grants or other forms of business support to specific groups/communities or the general public.

Where it's been trialled

Various programs have been trialled in the Pacific in relation to post-harvest handling and processing, from micro-canning courses under the PNA program to small-scale community initiatives in smoking and drying of fish. Some countries (e.g. Tuvalu and Kiribati) have run multiple programs to promote the safe preservation and storage of fish. The experience has largely been positive, especially in terms of smoking and drying fish because of the low reliance on imported materials such as tins. Both Tuvalu and Kiribati have reported higher supply of smoked and/or dried fish available for local consumption. In Kiribati, tuna jerky comes in different flavours and is particularly popular with the locals. For a number of countries, such as Vanuatu, smoking machines also offer an

alternative preservation method for local communities that do not have access to solar deep freezers. However, in some countries, (e.g. Tokelau, RMI and Samoa) reception of preserved fish (i.e. canned, smoked and/or dried) remains low among local consumers, as the preference is still for fresh fish.

Other examples of simple post-harvest processing that have been trialled include micro- bottling and jarring programs run in the Solomon Islands and Vanuatu, and earth oven-smoked fish by local entrepreneurs in PNG.

It should be noted that since the start of the pandemic, many countries have paused a lot of the training programs, but most are looking to re-initiate some kind of post-harvest processing training soon.

Pros

Simple post-harvest preservation techniques are particularly useful to store influxes of fish, resulting from transshipment activities or a good artisanal fishing season, in the absence of cold storage. The removal of fish influx also helps to alleviate any price competition for artisanal fishers from a jump in supply on the local market. At a food system level, simple post-harvest preservation minimises wastage during periods with high supply, and allows the fish to be used during periods of bad fishing weather or natural disasters, providing a means of climate adaptation.

Simple post-harvest preservation techniques such as micro-canning, bottling or jarring are also versatile and can be used for other products, (e.g. bycatch, reef fish, milkfish, eel, tilapia, noddy birds, beche-de-mer, vegetables and even breadfruit). These micro-preparations, along with smoking and drying, allow people to experiment with different flavours and sauces and present a way to add value to low-grade or reject products. Beyond food security, simple post-harvest preservation can also offer an alternative means of livelihood for local entrepreneurs and women communities to target the tourist market with dried tuna jerky or premium raw pack tuna products. In particular, raw packing – the practice of canning fish raw and cooking in its own juices – yields a much higher Omega 3 content than traditional canning⁶.

Due to the shelf-stable and mobile nature of the preserved fish products, they are convenient for distribution to regions that lack access to tuna, such as inland communities or urban areas where demand outstrips supply. Lastly, the investment cost for micro- preservation techniques is relatively low and can usually be cost recovered within a short time-frame.

Cons

The biggest potential risk to preservation techniques is food safety. This is particularly the case with micro-canning, bottling or jarring. Adjustments to the seamer, cooking temperature and time varies with the contents of each can or jar, as well as ambient temperature and humidity levels on the day. The adjustments require technical expertise, and if not done right, can create health risks in the form of botulism. Botulism is a rare but serious condition caused by *Clostridium botulinum* toxins that attacks the nervous system and causes difficulty breathing, muscle paralysis, and in extreme cases, even death (CDC 2022⁷). *Clostridium botulinum* is a spore-forming bacterium that is not harmful in itself but can produce highly poisonous toxins when deprived of oxygen, such as in closed cans or bottles (NHS 2022⁸). When cans or bottles are poorly sealed, the food preserved within can be contaminated by the bacteria in the surrounding environment. Alternatively, if the cooking temperature or time is not set correctly to kill any existing *Clostridium botulinum* that may have contaminated the food during preparations prior canning or bottling, the bacteria can grow from its

⁶ Based on lab testings for FoodStream carried out by Symbio Laboratories which resulted in a range of 790 to 850mg of Omega 3 total per 100g of raw packed skipjack tuna. This compares with commercial packs of skipjack tuna which has a range of 100 to 300mg per 100g.

⁷ https://www.cdc.gov/foodsafety/communication/home-canning-and-botulism.html

⁸ https://www.nhs.uk/conditions/botulism/

spore form during storage and create the dangerous toxin. Unlike most other bacterial, yeast or fungal contamination, botulism can be difficult to detect based on smell, taste or visual deterioration (CDC 2022⁷). In the United States, there has been over 300 laboratory confirmed foodborne botulism cases reported between 2001 to 2017, of which 17 cases resulted in death – including the one death from the homemade potato salad case in Ohio in 2015 (Lúquez et al 2021).

Depending on the type of post-harvest processing method, there may also be dependence on importation of materials that are susceptible to supply chain disruptions (e.g. tins for canning, vacuum seal bags etc.). However, other processes such as drying tuna jerky, smoking fish, or preservation using re-usable bottles and jars are much less restricted and/or more economically feasible.

Conditions and ease of implementation

Given the serious consequences related to improper home-canning, the most important condition of implementation is the provision of education and training correct handling and preparation for micro-canning, bottling and jarring. This includes the use of the appropriate jars and bottles, designed for re-use – for example, Ball or Kilner brand jars with the 2-piece lid system that allows for proper air-tight sealing (**Error! Reference source not found.**⁹). For example, the PNA micro-canning program¹⁰, which ran in all PNA countries with the exception of FSM and Tuvalu, has strictly followed the Australian Technical and Further Education (TAFE) standards to ensure food safe preparations.



Furthermore, formal guidelines should be provided for small-scale commercial operations on hygiene and food safety standards to minimise risks to public health. One side note on small-scale commercial enterprises is that there may be a demand ceiling for how many ventures can be set up in a single locality for all to profit. It could, therefore, be useful for policies to promote or support diversification on various types of small-scale ventures within one area. This could be done through community groups, and fishers or women's associations.

In general, policies that promote simple post-harvest preservation initiatives are suitable for any country where there is:

Figure 1: Ball mason jar with 2-piece lid system. Source: Amazon

- a) an excess supply of tuna and/or bycatch species that cannot be consumed immediately;
- b) high fluctuations in supply of tuna (e.g. due to seasonal variations or from commercial vessels unloading or transshipping);
- a) a considerable population size living in urban, peri-urban or in-land areas with insufficient access to fish; and

⁹ https://www.amazon.com/Ball-Mason-Jars-Pint-Dishwasher/dp/B07TC8ZFK8

¹⁰ Originally conducted using cans, the PNAO is planning to roll out additional training programs using re-usable jars.

c) infrastructure or government support for small-scale entrepreneurship or local business participation.

On ease of implementation, the investment cost for micro-preservation is comparatively low compared to other policy options. The start-up cost for a micro-canning and jarring operation, including an inventory of 500 cans, retort, seamer and freight is around US\$2,000, which equates to a payback period of around 2 weeks (FoodStream 2019)¹¹. This has since increased due to supply chain disruptions, but capital recovery period is estimated to still remain less than 2 months (pers. comm. FoodStream). Other simple post-harvest techniques such as smoking and drying techniques are even more economically feasible as they require very little capital investment and equipment.

3.1.3 Simple post-harvest value-adding processing

Similar to the previous policy option, this type of policy looks at promoting or assisting local entrepreneurs, including fishers and women groups, in simple post-harvest techniques that improve the convenience of tuna products for consumers. Improving convenience can overcome barriers to consumption (Annex 5), as well as provide an additional means of income security for the fisher and/or other actors in the supply chain. Simple post-harvest value-added processing includes the loining, filleting, vacuum sealing, making ready-to-eat products such as sashimi, poke bowls or fish and chips (i.e. sold from the same or in close proximity to fish retail stores/market outlet). Policy programs around post-harvest value-adding can involve the provision of training, capital, equipment, grants or other forms of business support to individuals, specific groups/communities or the general public.

Where it's been trialled

While there were no specific government run policy or programs highlighted during the stakeholder consultations for the Pacific region, examples of private sector initiatives have been observed in RMI, Samoa and the Cook Islands. In RMI, fishers who sell their catch from eskies at the local service station have been known to sell tuna loins and fish skeletons separately to different groups of consumers on Mondays. Additionally, tuna steaks in vacuum sealed bags are available in large supermarkets in RMI, but the price per pound is much higher than that sold by local fishers at the service stations. There is also a smaller supermarket, Misko, that sells sashimi tuna, but again at a much higher price. In Samoa, the Alia fishers who supply the local market with tuna and other pelagic species have recently started running fish and chips retail points as a way to sell off their catch faster. In the Cook Islands, consumers are able to buy cuts of various fish from the local fish shops, but there is also an informal market where customers can obtain free fish skeletons from recreational fishers filleting on the beach.

Pros

The main benefit of selling convenient and ready-to-eat options is that it makes tuna consumption easier for people with busy lifestyles, which addresses one of the barriers to tuna consumption identified in Annex 5: consumer preference. In addition, for countries or communities without a strong culture of eating tuna or particular bycatch species, convenient or ready-to-eat forms of fish can remove some hesitance or make it easier to try small amounts of the fish in question.

For fishers, selling loins separately is great business for larger fish (i.e. around 20 - 30kg) as it presents an opportunity to generate more income from the same fish. At the same time, it has the potential to reduce waste if the fish heads and skeletons are sold separately to consumers who specifically want them as opposed to people who purchase whole fish but only want the flesh. During the interviews, it was confirmed on various occasions that there is a market for fish heads,

¹¹ Based on a model PNAO and FoodStream developed in Tarawa, which assumes 30% gross margin on 220g cans of fish – simple payback was achieved after producing about 2000 cans.

skeletons and offcuts in most PICs. Finally, improving convenience promotes healthier diets as it provides consumers with healthier options compared to other forms of convenient foods.

Cons

The biggest challenge to improving convenience of fresh tuna products is the health risk associated with unsanitary preparations. This is particularly an issue with tuna steaks or loins inside vacuum sealed bags as it is difficult to judge the freshness of the fish. Therefore, it is critical that any program is implemented in conjunction with appropriate training on sanitary fish handling and storage. Depending on the method of packaging (e.g. plastic wrap or vacuum seal bags), moving to convenience foods can also generate more plastic use and potential pollution if it is not properly addressed.

Conditions and ease of implementation

The implementation of policy programs supporting local businesses or entrepreneurs in providing convenient tuna products are expected to be relatively easy considering the low level of investment needed. The most critical condition for implementation is the provision of appropriate training on sanitary handling, cleaning and storage of fish to prevent any health and food safety risks. For example, fishers in PICs have been observed to store ice separate to the catch (i.e. in the plastic bag the ice came in) to make the ice last longer, but this does not cool the fish properly.

3.1.4 Reducing post-harvest losses

Reducing post-harvest losses as a way to increase the availability of fish for human consumption is a relatively widely practiced policy approach globally (e.g. in Vietnam¹², Bangladesh¹³, Africa¹⁴).

Post-harvest losses can result from inadequate utilisation of all parts of the fish or the discard of non-target species. The former ranges from fish heads and skeletons, which are often discarded by recreational fishers in the Cook Islands, to the bloodlines or dark parts of tuna that is usually a waste product used to produce fish meal or animal feed in canneries in Asia. Bell et al. (2015) discusses the strong preference and demand for dark meats in the Pacific, and policy options to improve affordability of tuna by ensuring that canneries in the Pacific keep and distribute canned dark meat in the region at low prices like that done by Soltuna in Solomon Islands.

While non-target species are not discarded by the domestic longline industry in Fiji, interviews indicated that the demand for certain bycatch species is still very low because many locals are unaware of how to prepare and cook them. Based on the above, food security in FFA member countries can be improved by policies that promote efficient use of tuna resources through:

- a) better utilisation of bycatch species from commercial fisheries
- b) better utilisation of all parts of the fish (e.g. fish heads and skeletons, and dark meat)

The latter could be targeted via small-scale canneries or requirements to joint ventures companies with vertically integrated fishing operations to return canned dark tuna meat preferred by Pacific Islanders to the region rather than selling it to other markets (Bell et al. 2015).

Where it's been trialled

To date, there have not been any specific government-run policies to address post-harvest losses for points a) and b) above. Similar to the promotion of simple post-harvest value-adding processing, the sale of dark meat tuna in the Pacific has been mostly industry driven. Consultations with TriMarine, the company that owns 51% of Soltuna, confirmed that there is a business case for the retention of

¹² <u>http://www.seafdec.or.th/home/news/229-seafdec-enhance-the-capacity-on-fish-handling-and-post-harvest-losses-in-viet-nam</u>

¹³ http://fpmu.gov.bd/agridrupal/sites/default/files/Nowsad Alam-PR5-08.pdf

¹⁴ <u>https://www.fao.org/3/i5141e/i5141e.pdf</u>

canned dark meat for domestic sale in Melanesian countries due to the higher value that can be achieved compared to using the product for fish meal or animal feed. However, not all processing facilities in the Pacific are taking advantage of the market for dark meat (i.e. those with only loining facilities).

Pros

The biggest pro of reducing post-harvest losses is the increased availability of fish for human consumption. Secondly, from a food systems approach, the utilisation of bycatch and waste products of fish can generate benefits for all actors within the system, from processors to consumers – i.e. provide additional income avenues to processors and fish vendors, while providing consumers with affordable or low cost alternatives. Policies that target reducing post-harvest losses can be combined with those from the previous section (3.1.3) to support businesses to provide convenient products as well as utilising the offcuts for different groups of consumers.

Cons

Depending on the policy approach taken, Government investment may be needed for the provision of cold stores and other infrastructure – i.e. a small-scale cannery to process offcuts of tuna or bycatch species. Given that prime cuts (e.g. loins and steaks) of tuna have the greatest value to the supplier or processer, proper fish handling of offcuts might be overlooked. This can generate health risks for offcut consumption.

Conditions and ease of implementation

The condition and ease of implementation will vary with the policy program. Simple measures that help connect different groups of consumers can be implemented through existing marketplaces with the provision of food safety training to fishers, and if necessary, investment in cold storage. Similarly, implementation of policies/agreements that require existing commercial processing facilities to return or utilise dark meat in the production of canned goods fit for human consumption do not require much investment and is relatively straightforward to implement.

To promote the recovery of dark meat and other offcuts in the absence of existing commercial processing facilities, government support may be needed to help companies set up some form of small-scale distribution and/or processing operation. In particular, training on proper handling and storage is important to minimise health risks to all consumer groups.

3.1.5 Improving distribution and logistical support

Distribution and logistics cover a wide range of factors, from transport to cold storage, to marketplace or distribution centres that can gather consumers and suppliers. As discussed in Annexes 4 and 5, storage and logistics often pose significant challenges to food security and tuna consumption in the Pacific. As such, policies that can improve distribution and logistics are expected to bring about considerable benefits/positive impacts to the consumption of tuna in the region.

Policies that provide distribution logistical support can include:

- a) facilitating or investing in transport services between islands or provinces within a PIC;
- b) setting up distribution centres/fish markets in areas of need; and
- c) investing in cold store facilities for remote regions or major distribution centres

The last point refers to both the installation of (solar) deep freezers as well as the ice making machines.

Where it's been trialled

Many FFA member countries have set up fish centres or provincial markets to help facilitate the sale of reef and pelagic species, and this is often done in combination with the installation of deep freezers and/or ice machines. For instance, Kiribati has successfully set up 22 fish centres around the

outer islands, all equipped with deep freezers and ice machines. These centres not only provide a place for fishers to sell their catch, but also a safe place for local fishers to store fish for sale during bad weather. The latter has been very important, in terms of both supporting food security as well as livelihoods for artisanal fishers.

Similarly, the Tuvalu Fisheries Department (TFD) has distributed at least 2 freezers to each of its 9 islands; the Ministry of Agriculture and Fisheries (MAF) in Samoa has installed ice machines in rural areas where artisanal fishing fleets are based; in Vanuatu, more than 200 solar deep freezers have been installed at provincial markets across the country; MMR (Cook Is) has provided ice machines and blast freezers in selected ports based on fishers' request; and there are 4 fish markets established on outer islands of RMI, each equipped with their own cold store and ice machines to facilitate with the sale of fish on the islands.

The overall experience with deep freezer programs has been largely positive/successful across the FFA membership in increasing food security from tuna resources, with only minor issues raised in relation to the maintenance of batteries on solar freezers. Ice machines on the other hand, have been on average less successful, with countries including Kiribati reporting frequent malfunctions which require parts to be imported and expert technicians to service the machines. In RMI, MIMRA has a team that services ice machines and cold stores, but capacity is limited so the machines are only used on and off between maintenance problems. Power supply compatibility was another issue that was mentioned, with efforts to install an ice machine for the Fishermen of Funafuti Association (FOFA) in Tuvalu being delayed due to power supply incompatibility between a 3-phase system ice machine and the 2-phase power supply on the island. The only country that has reported a relatively hassle-free ice machine program is Samoa. Only minor administrative issues related to the lease of the machines to fishers were raised. This may be in part the result of training on handling and maintenance of the machines that was carried out alongside the program.

In general, deep freezers and ice machines have high power consumption which can cause issues. Solar powered programs for ice machines have been helpful in addressing the high fuel consumption in Kiribati compared to traditional ice machines. Having contracts with service providers has also meant that minor issues from the solar power systems can be managed and fixed quickly.

On transportation, RMI is the only country in the FFA membership that reported organised transportation of fish between outer islands and populous/urban areas (i.e. Majuro and Kwajalein Atoll) is coordinated by the government. The process starts with the notification of collection a day or two ahead of time, as many of the outer islands lack cold storage facilities and the fact that cold stores are not needed given the ample supply of fish. Fisheries authority vessels then collect the fish from the outer islands on the pre-coordinated day, with payment provided to the fishers on the spot. The fish is then distributed to markets in Majuro and Kwajalein Atoll for sale. Prior to COVID, larger vessels would visit the outer islands to pick up fish around 4-5 times per month with another smaller boat visiting every other week. Since the pandemic, the visits have been less frequent.

Pros

The main benefits to better distribution, logistical and storage systems include:

- improvement in fish quality and the reduction in public health risks related to the consumption of poorly handled and/or stored fish;
- improving viability and efficiency of artisanal fishing operations by allowing fishers to maximise catch and manage seasonality (e.g. artisanal fishers can fish more during productive periods where catch per unit of effort (CPUE) is higher; sell stored fish during periods of bad weather);
- supporting entrepreneurs provide simple value-added products that increase convenience to the end consumer and utilise more parts of the fish. This benefit is extended to other

food groups where cold storage is shared across other products – e.g. seafood other than tuna/pelagic fish, meats, dairy products and other consumable goods.

 closing the gap between supply and demand – this provides benefit both to those communities where there is an abundance of tuna and other pelagics, in terms of income generated in supplying fish, and those communities where demand is higher than that can be met by the local supply (e.g. urban centres or inland areas). Improved transportation between remote areas/outer islands and populous centres also has the added benefit of providing a means of transportation for other goods and services. The latter includes technical services such as repair and maintenance for equipment including ice machines and deep freezers.

Cons

The main challenges include:

- deep freezers and ice machines require considerable energy, and in the case of ice machines, also a considerable amount of fresh water in the case of freshwater ice machines. The consumption of energy and water puts pressure and competition for other energy/water needs of the communities. While solar power provides a solution on energy consumption, increasing the availability of fresh water takes far more investment – for example desalination plants;
- deep freezers and ice machines may be used to store cold items that are not necessarily good for the community or benefit food and nutrition security (e.g. beer and ice cream);
- in countries where there is limited competition among suppliers, the installation of deep freezers may place further market power in the hands of local fishers for example, storing larger tunas for sale during church events and national celebrations at inflated prices instead of selling their catch fresh on the daily market;
- ice machines are prone to breakdown that require maintenance and parts. The latter of which must be imported, and subject to delays; and
- an increase in the amount of waste generated from transport (incl. marine oils, fish waste, plastics etc.), which can pollute the surrounding environment if not properly handled.

Conditions and ease of implementation

Policies that aim to improve logistics and distribution of tuna and tuna-like products are particularly interesting for countries with a mismatch between regions in supply (e.g. fishing communities in remote areas) and demand (e.g. urban centres with insufficient supply) due to distribution or logistical issues. It may also be interesting for remote communities where fish supply is irregular due to weather conditions or seasonality, and have limited access to regular seafood imports from elsewhere in the country or overseas. The same applies to (urban) areas where there are fluctuations in supply due to, for example, landing and transshipment operations by locally-based purse seine and longline fleets.

Cold storage investments should be made in conjunction with improved logistical network in order to leverage from better transport connections for spare parts and technical service for the deep freezers and/or ice machines. Other requirements include sustainable and affordable energy sources (e.g. solar), especially for remote areas where fuel is scarce.

The ease of implementation varies depending on the extent of the capital investments needed and the source of investment. For example, ice machines and/or cold storage could be co-funded under public-private initiatives with commercial entities such as fishing associations or joint venture processing facilities. This will maximise usage and benefits generated, but also establish a commercial interest in maintaining the cold storage facilities that can be much more efficient than government managed. Alternatively, there is also the potential for micro-financing between sectors within a community-based management system.

3.1.6 Ban on discarding small tuna and bycatch products

While a ban on the discard of target tuna species from purse seine vessels that are fit for human consumption is enforced by relevant WCPFC CMMs (2021-01; 2009-02), there is no prohibition of discarding small tunas for the longline fisheries, nor non-tuna bycatch species from either sector. By enforcing a requirement to retain and land small tunas and bycatch species, FFA members could encourage industrial fleets to offload fish at regional ports and provide the local communities a source of low-cost fish.

Where it's been trialled

There are no current examples of a requirement to retain and land all catch in the Pacific region, including Australia and New Zealand (Karp et al. 2019, Borges et al. 2016). A ban on discards was introduced in the European Union in 2015 under the Landing Obligations (LO) policy, which aimed to reduce unwanted catches in fisheries within its waters¹⁵. However, the LO includes 4 exemptions to the obligation to land – one of which (the *de minimis* exemption) allows the discarding of species where there is scientific evidence to support that increases in selectivity is 'very difficult' to achieve, or there is 'disproportionate costs' associated with handling of unwanted catches. Whether the policy has been a successful one is difficult to say. Borges (2021) argues that the upward adjustments in Total Allowable Catches (TACs) introduced to help with the transition, and the lack of complementary at-sea monitoring systems, have likely led to increases in unwanted catch and discards, in opposition to the LO objectives.

Pros

The main benefit of banning discards is making more tuna and bycatch products available in urban centres at affordable prices. Additional benefits can be derived with ways to add value to the fish, for example, through simple post-harvest processing (section 3.1.3). This also provides actors in the supply chain with income security and alternative livelihood. Finally, banning discards can encourage commercial operators improve fishing methods or gear to target larger fish which has positive implications on the long term sustainability of the fishery.

Cons

Key concerns associated with a landing requirement are:

- competition with artisanal fishers flooding the market with low-cost fish can undercut fishing efforts of artisanal fishers and has the possibility of pushing artisanal fishers to permanently leave the industry if the competition is prolonged;
- impacts on the viability of commercial operators the policy can impact their business
 viability as it not only requires them to retain lower valued catch and reduces space on
 board for target species, but also creates more work. Where landing requirements are not
 applied uniformly between countries, there may be commercial incentives to license to
 coastal States without landing requirements and/or reflag vessels away from States with
 landing requirements;
- health and food safety risks given that bycatch and discard species are of low value to commercial operators, especially purse seine vessels, they can often by overlooked and poorly handled in terms of storage during transshipment or unloading operations; and
- enforcement given the limited observer coverage on longline vessels, enforcing and monitoring a policy that bans discarding is likely to be difficult.

Conditions and ease of implementation

The most important condition for implementing a ban on discards is having the necessary infrastructure and capacity to handle fish landed. For example, enough space at ports for vessels to

¹⁵ https://oceans-and-fisheries.ec.europa.eu/fisheries/rules/discarding-fisheries_en

unload the reject fish, cold storage and transportation to maintain quality of fish landed, and monitoring capacity to ensure vessel compliance as well as fish quality in order to minimise health and safety risks to consumers. It's also important to have some form of monitoring and evaluation in place to assess the impact on the local community and the livelihood of artisanal fishers from the implementation of such policy.

The policy is more suited to countries with a large gap between demand and supply of tuna products to ensure minimal impact on small-scale/artisanal fishers from competition and for the policy to generate maximum benefits to consumers who may otherwise not be able to afford the fish.

3.1.7 Mandatory landing or formalising bycatch supply

Similar to banning discards, policies that mandate or encourage the landing of tuna and bycatch species from foreign or domestically-flagged commercial vessels have the aim of increasing the supply of tuna products on the local market at affordable prices. Mandatory landing of tuna and bycatch from commercial vessels can be targeted to specific locations, such as urban ports with a large gap between demand and supply, i.e. areas of high population density but low supply of reef fish, or to local processing facilities to improve consistency of tuna supply. The latter includes government run or joint venture operated canneries or loining plants that can formalise the supply of bycatch on the local market.

Where it's been trialled

There is a small handful of FFA member countries that have implemented some form of landing obligation as part of licensing conditions for commercial vessels. These include Kiribati, Tonga, Vanuatu, Solomon Islands and PNG. While the mandate differs across countries, they are all aimed at increasing the supply of tuna domestically.

In Kiribati, the landing of bycatch and reject tuna from purse seine transshipment is regulated through licensing conditions that are negotiated on a case-by-case basis (Tolvanen et al. 2019). The fish landed are made available for local sale at very low prices through two government owned or joint-venture operated fish retail shops in south Tarawa – Central Pacific Producers Limited and Kiribati Fisheries Limited (Tolvanen et al. 2021). The price for bycatch and reject tunas sold through the two outlets is set at A\$1/kg. This compares to A\$4/kg for fresh tuna supplied by the local fishers. However, as noted by MFMRD staff interviewed, the quality of the fish is often poor and have caused health problems in the past. In addition, the fish landed from transshipping vessels do not reach other markets and the lower price often creates competition with local fishers. The increased competition on local fishers has led to a number of small-scale operators ceasing operations in south Tarawa (pers. comm. E. Lelemai via SPC Community-based Fisheries Dialogue). Adding a preservation step in the value-chain can help address the issue and shift the competition towards imported canned fish.

In Vanuatu, the landing of target species and bycatch from commercial longline vessels are regulated through licencing conditions, which distinguish between foreign fishing licences and locally-based foreign fishing licences. Locally-based foreign fishing licences are required to land catch to the public-private joint venture processing facility, Sino-Van Fisheries Limited, which began operations in October 2019 (Figure 2). While target species are processed for export (mostly fresh and frozen tuna with plans for canning), smaller tunas and bycatch species (e.g. wahoo) are sold on the local market in the form of frozen tuna/bycatch sticks. The price of frozen tuna/bycatch sticks are set at 500 vatu/kg or ~US\$5/kg, compared to fresh tuna sold by local fishers at 800 vatu/kg or ~US\$8/kg.



Figure 2: The fish processing plant in Vanuatu operated under joint-venture arrangements between the Vanuatu government and China National Fisheries Corporation (CBFC). Source: Vanuatu Department of Fisheries¹⁶

Similarly, Tonga regulates landing from its locally based foreign longline fleet as part of their licencing conditions. There is no processing facility in Tonga, but locally based vessels are required to supply the domestic market with a minimum of 3MT of tuna/bycatch per vessel unloading (once per 1-2 months). Since COVID restrictions came into force in March 2020, the minimum required landing has been increased to 7MT per unloading. Fish sale is managed by the government with proceeds going back to the vessels (Tolvanen et al. 2019). The fish is sold at ~ 50-80% below the market price, at 7 pa'anga/kg or around US\$3/kg. This compares to the local supply, which ranges from 10–15 pa'anga/kg with good quality tuna selling up to 20–25pa'anga/kg.

Both the experiences in Vanuatu and Tonga have been very positive. The provision of more affordable options for tuna and pelagic species has been welcomed by the local community. In Tonga's case, a long queue of people waiting to buy fish can be observed on days that bycatch is landed for local sale. Despite some initial impacts and dissatisfaction from local fishers, the market was able to adjust and align over time in both countries. This is mostly because there is sufficient demand in both countries to absorb the increase in supply of tuna and tuna-like products. In Vanuatu, it was also highlighted during the stakeholder interviews that the products are differentiated and attract different consumers – i.e. fresh tuna landed by local fishers can be sold at a premium because it is considered a higher quality product. Moreover, the increased supply of tuna products and capacity to process and store the supply has meant that the Vanuatu government was able to arrange for the distribution of frozen tuna/bycatch sticks during the aftermath of Cyclone Harold in 2020, instead of canned fish as that has been done in the past.

In Solomon Islands, the landing policy, mandated through licencing conditions, only applies to domestically-flagged purse seine vessels to supply tuna to the processing plant in Noro. Bycatch and reject tuna from transshipment operations is not regulated and occurs through informal means by locals who paddle out in small canoes or dinghies to purse seine vessels transshipping in the port of Honiara. Similarly, the landing requirements in PNG refer only to domestic canneries rather than on the local market. Nevertheless, purse seine vessels unloading to processing plants in Lae supply on average 3-6MT of bycatch per unload to locals who line up to purchase cheap fish. There are usually 3 vessels that come to unload per week.

¹⁶ <u>https://fisheries.gov.vu/index.php/fishnews/96-fish-processing-plant-operating-in-october.html</u>

Pros

Mandatory landing provides an efficient way to increase the supply of tuna available for domestic consumption or processing. It can be particularly beneficial in places that do not have a domestic fishery to supply the local market, or the domestic fishery cannot keep up with consumer demand. Moreover, increased competition has the benefit of reducing price paid for local consumers and avoiding the development of monopolies. Finally, increased volumes of tuna and bycatch supplied to the domestic market at low prices presents opportunities for local entrepreneurs and/or small businesses to carry out simple post-harvest processing (section 3.1.3) or provide services to vessels coming into port for landing or transshipment – for example, agency, observer or stevedoring services.

Cons

Disadvantages associated with mandatory/formalised landing of bycatch include:

- impacts on the livelihoods of artisanal fishers similar to the policy of banning discards, the main concern is increased competition with local fishers. If local fishers leave the industry due to inability to compete on price, this has flow-on impacts on future food security. Price competition through the flooding of tuna/bycatch on the local market is especially damaging if it is very seasonal. If the volume of commercial supply is managed such that the market can still absorb catches from artisanal fishers (as is the case with Vanuatu and Tonga) the impacts can be better managed. This is likely to be easier for longline operations compared to purse seine landings;
- impacts on the informal sector for example, the locals who line up to purchase cheap bycatch and reject tuna from purse seine vessels unloading in Lae are usually women, who then on-sell the tuna at local markets. If the government formalises the landing of tuna bycatch through official means (e.g. fishing associations or government-run retail stores), the income opportunity for locals engaged in the informal market will be removed;
- health risks while formalised means of distributing and storing reject tuna/bycatch from commercial vessels by government operated entities or local fishing associations are expected to yield fish of higher quality or lower health risks compared to informal processes, this is not always the case. Despite the fact that purse seine bycatch sales in Kiribati are managed through government-run retail stores, there has been complaints of health incidents that have occurred; and
- impacts on viability of commercial operators mandatory landing of tuna and bycatch for low prices is likely to impact financial viability. Therefore, the volume of fish mandated for landing should be considered carefully. Excess burden on commercial vessels may see vessels leaving the country and negatively impact the flow-on benefits generated in supporting sectors (e.g. local businesses supplying gear, food, fuel, agency services etc. to commercial vessels).

Conditions and ease of implementation

The most important condition for implementation is having the necessary infrastructure to handle the fish landed (e.g. appropriate port or wharf infrastructure, piloting services, government capacity to regulate transshipment etc.). For example, bilateral fishing agreements in PNG all come with a mandate of landing at least 5% of catch from purse seine vessels to the domestic canneries. However, there is not always the adequate infrastructure to receive catch – e.g. wharf space.

The second most important condition is having the necessary attributes that can attract vessels to offload or transship (i.e. being close to fishing grounds, having bunkering and victualling services, or canneries that are able to pay a realistic price for the raw materials). Mandating landing by governments in countries without sufficient attributes may push domestically-based foreign vessels to leave and base their operations elsewhere.

The policy is more suited to countries with a large gap between demand and supply of tuna products to ensure minimal impact on small-scale/artisanal fishers. In this regard, the impact on small-scale fishers from mandatory landing of tuna and bycatch to the local market may be easier managed for longline fleets compared to purse seine fleets.

3.1.8 Regulating access and sale of fish through local co-ops or fishing associations

Given the amount of bycatch and damaged/small tunas available from both purse seine (estimated at 1% of total catch) and longline (estimated at 10-15%) operations¹⁷, policies that regulate access and distribution of bycatch and reject tuna through national fisheries associations or local co-ops have the potential to make significant impact on national food security. In addition, involving local fishers in the value chain for the sale of fish landed from commercial vessels is likely to minimise the negative impacts on their livelihood (by allowing direct control over the commercial supply, and an alternative means of income - i.e. through fish trade). Moreover, policies that formalise the handling of bycatch from the commercial fishing fleets can be applied in conjunction with those that reduce wastage and/or add value through simple or more complex processing discussed in sections 3.1.1 through to 3.1.4.

Where it's been trialled

The best examples of policies or regulations that formalise the treatment of bycatch through national cooperatives in the Pacific can be found in Kiribati, Solomon Islands and Vanuatu. As described earlier, the landing of bycatch from purse seine transshipments is mandated through licensing conditions in Kiribati. The sale of bycatch from transshipment operations is then sold through the two government owned or joint-venture operated fish retail shops in south Tarawa (Tolvanen et al. 2021). In the Solomon Islands, bycatch landing for locally-flagged foreign-controlled vessels is processed through the Soltuna processing plant in Noro, in which the government holds a 49% share in¹⁸. Similarly, the Vanuatu government holds 49% share in the loining plant, Sino-Van in Black Sands, Port Vila which is the designated processing facility for bycatch landed from vessels licenced under locally-based foreign fishing licences. Finally, there were plans in place in Tuvalu for the government owned NAFICOT to start processing bycatch from purse seine transshipments, with investments of freezers, driers and smoking machines made just prior to the start of the COVID pandemic in 2020. However, due to restrictions on transshipment at sea between March 2020 and April 2022, the plans have been put on hold.

Pros

The main benefits from formalised treatment of bycatch through national organisations or local coops include:

- improving the quality of bycatch and small tunas to provide consumers given storage and distribution would be regulated through commercial means. Nevertheless, the benefit of improved quality is very much dependent on the execution of the companies involved – e.g. in Kiribati, despite the formalisation of bycatch handling there have been instances where the quality of fish was not maintained and resulted in consumer complaints;
- indirectly increasing the price of the commercial catch made available, alleviating price competition faced by artisanal fishers to some extent. Given that formalised treatment of bycatch could involve processing and shelf-life extension to bycatch products, this also

¹⁷ Purse seine bycatch estimate is taken from Tolvanen et al. (2019) and catch estimate of non-target species and small tunas for longline operations is provided from the Fijian longline industry interviewed.

¹⁸ The 49% government share in Soltuna is comprised of the Solomon Islands National Provident Fund (31.4%), Investment Corporation of Solomon Islands Limited (9.3%) and the Provincial Executive of the Western Province (7.8%).

means that the local market would not need to be flooded with increased supply of raw fish during peak periods of transshipment/landing;

- generation of employment opportunities e.g. 20 locals were trained in processing techniques at NAFICOT in preparation of handling bycatch from purse seine transshipments prior to the implementation of COVID restrictions. Similarly, whilst not all employees at Soltuna or Sino-Van handle bycatch, the processing/handling of bycatch does account for a small portion of employment at these plants; and
- generation of financial returns for the public enterprises, which in turn, has positive flow-on impacts on the rest of the economy. This is especially the case if the cooperatives can become a nucleus/core operation that provides additional benefits such as cold storage and ice maker facilities for local fishers.

Cons

The main disadvantages from the formalised handling of bycatch include:

- potential for small-scale fishers not involved in the state-owned enterprise or local fishing associations handling the bycatch to 'miss out' (e.g. reef fishers who face also competition from pelagic species);
- discouraging individual entrepreneurs from participating in the industry (e.g. if bycatch is handled by larger organisations that are either set up through the state supported monopolies or fishing associations);
- if small-scale fishers are heavily involved in the formalised handling of bycatch, this can be a major disincentive for them to continue fishing, especially if there is more money to be made from re-selling fish from the commercial vessels. This shift in fishing behaviour has been observed in Samoa with the Alia fishers re-selling catch landed by the domestically based commercial longline fleet.

Conditions and ease of implementation

Regulating access and sale of fish through national or local cooperatives would require the necessary infrastructure (i.e. wharf capacity, cold storage, transport, processing facility etc.) to receive and handle catch. This is especially the case for bycatch from purse seine transshipment operations which could be left on the wet deck for extended periods of time after it has been separated from the target species. While interest was expressed from FFA members to incorporate the provision of higher quality of bycatch or tunas from transshipment operations as part of licensing conditions, interviews with industry participants suggest that the process would come at significantly higher costs to vessels due to disruptions to normal operations. A possible avenue for maintaining the quality of tuna and bycatch from purse seine transshipments would be to have transport organised by the cooperative or business that can coincide with the transshipments.

Experience in the Pacific indicates that a commercial cooperative is likely to be better option to coordinate the sale of fish than a government-funded entity. This can be a small processing facility or distribution centre run by a commercial fishing association or public-private enterprise. Moreover, the operation can be used as a nucleus activity that can help sustain other local operations – for example, provide a centralised cold storage for local entrepreneurs.

For bycatch from longline operations, it's important to provide some value for the fish to the vessels because, for the most part, the fish has more commercial value than the bycatch/discards from purse seine operations. Finally, despite the potential involvement of local fishers in the formalised treatment and handling of bycatch, it's nevertheless important to monitor and evaluate the impact on the local community with the introduction of such policy to minimise any unforeseen negative impacts. As with other policy options that look to increase tuna supply from commercial vessels, the policy is suited to countries with a large enough demand capacity and the presence of a commercial fishing fleet to source bycatch and reject tuna from.

3.1.9 Tax incentives and/or subsidies for locally based processing plants and fishing operations

Taxes and subsidies are economic instruments that can be used to promote domestic sale of tuna and bycatch products by locally based processing plants or fishing fleets. Taxes can be levied on products landed or processed for export to make selling domestically more attractive. Alternatively, taxes can be removed on tuna and bycatch products destined for domestic sale, thereby increasing the profit margin on domestic distribution. In addition, subsidies or rebates can be given to either processing plants to encourage processing onshore (which not only provides employment but also increase volume of processed goods available) or fishing fleets to supply/land tuna to the local market and/or cannery.

Where it's been trialled

The most common form of tax incentives trialled in the Pacific in promoting increased domestic supply of tuna is export taxes. For example, a 5% export levy is currently in place for tuna products in Vanuatu. Similarly, to encourage onshore processing, PNG had a 15% export tax on whole round tuna in the 1980s to 1990s that was increased from an initial 2.5% (Barclay and Cartwright 2007). In Fiji, a number of tax incentives has been trialled for the fisheries sector, including:

- a FJ\$350/MT fish levy on tuna transshipped but not landed for processing that was introduced in 2011 and which was later increased to FJ\$450/MT mid-2017;
- a 60% deduction to export income for persons engaged in the agriculture, fisheries, or forestry sector for the period from 2021 to 2024¹⁹; and
- a 15% duty that is currently in place on fish landed from foreign vessels for domestic sale (without processing).

In most cases, export taxes have been implemented with the aim of encouraging fishing fleets to increase the supply of tuna either for domestic consumption or onshore processing. However, past experiences show that they have rarely worked as intended. In PNG's case, the 15% tax on whole round tuna exports was too prohibiting for the foreign fishing industry operating in PNG at the time, and resulted in many fishing fleets leaving in the mid- to late-1980s (Barclay and Cartwright 2007). It wasn't until amendments to the fisheries policy in the mid-1990s, which included the removal of the export duty, that development of the domestic processing sector began in earnest. More recently, PNG introduced a processing rebate system (RBS) at the start of 2018 to encourage greater onshore processing. The RBS, which provides a flat fee for each metric ton of tuna processed in PNG plants, has seen total processed volume increasing from around 85,000MT in 2017 to over 117,000MT by 2021, with an additional 4,000 jobs created. The RBS replaced the previous system of providing discounted fishing access to PNG-flagged and locally based foreign vessels, after reviews confirmed much of the fish taken under discounted access was not landed in PNG.

The experience with export taxes is similar in Fiji. Fiji was a popular hub for foreign fishing vessels up until the fish levy was increased to FJ\$450/MT in 2017. The number of foreign vessels visiting Fiji prior to 2018 was around 300 to 400 per year, however, since the levy increased this dropped to around only 100. To counter this negative outcome, and also the large declines in economic activity as a result of the COVID pandemic, Fiji removed the fish levy in 2020 and introduced more favourable tax incentives including the 60% income deduction for the primary sectors in 2021. This has subsequently led to a slow increase in the number of foreign vessels returning to Suva, but numbers remain well below that prior to 2018. Finally, Vanuatu is looking at reducing the current 5% export levy on the basis that the levy is deterring vessels from transshipping and landing in-country.

¹⁹ <u>https://www.investmentfiji.org.fj/investment-incentives/fisheries</u>

Besides taxes on exports, a number of FFA member countries also have policies in place that provide tax exemptions, primarily on fuel and/or gear, for local commercial and/or artisanal vessels. Duty free fuel is available in Fiji and Australia. For Fiji, locally-based longline companies are able to purchase fuel net of taxes while domestic fishing vessels in Australia, along with a number of other industries, are eligible for tax exemptions on fuel in the form of off-road diesel rebates.

Pros

Tax incentives that reduce operating costs allow fishers to fish beyond their financial break-even point (e.g. tax exemptions on fuel, gear, and capital). While this may mean that the fishery is fished beyond the natural economic limit, for small-scale fishers who do not have economies of scale, tax exemptions or subsidies are ways to boost operations and achieve social goals like increasing catch landed for domestic food security.

For foreign fishing operations, removing export taxes can boost business activities and attract vessels to land or transship in-country. In turn, this can make more bycatch available for local sale. Subsidy or rebate programs for fish landed and/or processed can also provide incentives to vertically integrated processing and fishing companies to increase production domestically. This will not only make more tuna products available to the local market (e.g. canned dark meat) but also has the added benefit of other economic flow-on impacts such as employment and business growth in supporting industries such as packaging, storage and logistics.

Cons

According to economic theory, taxes and subsidies are generally considered inefficient because they distort the free market. However, they may be necessary to correct certain market failures, such as the exclusion of positive social externalities generated (e.g. domestic food security) when businesses make market-based decisions founded on profit.

Notwithstanding the potential social benefits, the biggest disadvantage of taxes is that they can reduce business activities or deter boats from using the PIC port for their operations. In particular, taxes only on the fishery sector can be seen as unfair if other primary sectors (e.g. forestry and agriculture) are not treated equally. For vertically integrated companies, higher taxes on one sector can lead to transfer pricing to another. Implementing policies that provide tax exemptions or subsidies come at a cost to the government, but also the society as the government revenue cannot then be spent elsewhere – such as health and education. Finally, without comprehensive (and potentially costly) monitoring arrangements, export taxes can provide an incentive for fishers to under-report actual catches and exports.

Conditions and ease of implementation

The general experience with increased taxes in the Pacific is that they tend to depress economic activities. If the objective is to moderate a certain activity – e.g. reducing sugar consumption by taxing sugar, which has proven effective in the Solomon Islands, then taxes can work well. However, if the aim is to boost economic activity, it is likely that the reverse would be more effective – i.e. tax exemptions or subsidies. However, tax exemption and subsidies are both expenses (or forgone revenue) for the government that will need to be somehow funded. Therefore, care needs to be taken in understanding the impact of such measures to ensure that the expenses are well spent. In general, before implementing any taxation or subsidy instruments, research should be taken to estimate the cost and benefits from their implementation. In addition, taxes and subsidies should be considered in context with all other fees and payments made by the fishing or processing industry – e.g. licencing, transport and shipping, export certification, packaging costs etc. Governments should avoid putting unnecessary burden on fishers and exporters.

With the above in mind, policy options that use taxes and subsidies to promote increased foreign landing for consumption or processing are only applicable for countries with existing infrastructure
in place (e.g. canneries, cold storage, transport network, wharf capacity etc.). Given past experiences with discounts and subsidies, it is advisable that subsidies or rebates are provided post-hoc (rather than ex-ante) and only where there is a tangible benefit. Lastly, a more general note is that the region only has capacity for so many canneries to be viably supplied by foreign fishing fleets. If strategically placed, production hubs can more efficiently benefit the whole region.

3.2 Develop the tuna fisheries sector as a livelihoods approach to improve food security

3.2.1 Scaling up FAD deployment and use (with potential for oceanographic sensors)

Fish Aggregating Devices (FADs) can take various forms and be deployed in different ways. Simple FADs can be constructed from nothing more than banana leaves and coconut/bamboo branches while more sophisticated FADs can have electronic sensors that range from GPS tracking, sonar to detect the biomass of fish, as well as weather and wave monitoring that provide information on wave height, currents and wind speed (see Figure 3). FADs can be deployed as anchored to the sea floor or drifting (i.e. free floating), making their deployment possible both inshore and offshore environments.



Figure 3: A simple FAD made of bamboo in Solomon Islands (left, photo credit: Wade Fairley²⁰) and more sophisticated FAD sonar buoys used in the commercial purse seine industry (right, photo credit: Francisco Blaha²¹)

The key purpose of FADs is to aggregate fish and make it easier and more efficient for fishers to catch fish. Policy options that look at scaling up the deployment of FADs are considered under the livelihoods approach here as they fundamentally improve the earning capacity and financial viability of small-scale fishers through higher catch rates. However, scaling up the deployment of FADs also has positive flow-on impacts on availability and access (e.g. affordability) to tuna and tuna-like products by making it easier and cheaper for fishers to catch fish²².

²⁰ <u>https://coastfish.spc.int/en/publications/technical-manuals/fads</u>

²¹ <u>http://www.franciscoblaha.info/blog/2019/3/3/economic-benefits-of-fad-set-limits-throughout-the-supply-chain</u>

²² Assuming that the supply of pelagic species would increase under more FADs deployed, and lead to increased competition on the local market which results in lower prices for consumers

Where it's been trialled

Inshore and offshore FAD deployment has been trialled in every FFA member country interviewed under the SPC program funded by FAO. The experience has been varied with successes in some countries and challenges in others. In most countries the program has been largely successful, with higher reported catch in Tuvalu, Samoa, RMI and the Cook Islands. In Samoa, for example, FADs have been particularly successful in combination with vertical longline trials, with fishers reporting considerably higher catch rates with lower fuel use (i.e. only 40 litres per trip with vertical longlining compared to 160 litres under traditional trolling). The only additional cost of vertical longlining is the use of bait as opposed to lure under trolling. In RMI, FAD use is particularly popular around Christmas time when fish is in high demand.

In contrast, MFMRD reported that FADs deployed are frequently lost, sometimes only after a few days. Similarly, FADs in Nauru often become damaged or lost as a result of fishers anchoring on the FADs. In Kiribati, poor management of FADs are sometimes associated with the migration of trained personnel moving to other islands.

Pros

The main benefits of FAD deployment include:

- increasing artisanal catch rates and the supply of tuna and tuna-like products on the local market - increased catch rates allow fishers to improve operating efficiency compared to other forms of fishing, such as trolling – including a reduction in fuel use and search cost, measured in time;
- improved safety of fishing at sea for example, a secondary objective of the FAD program implemented in Tokelau is to improve sea safety by discouraging fishers from chasing surface school fish further out than necessary. In PNG, the number of fishers lost at sea has decreased with the introduction of inshore FADs;
- taking pressure off reef stocks by making it less financially attractive for fishers to fish on reef species; and
- improved efficiency and safety of operations for local fishers by fitting FADs with add-ons such as weather buoys, temperature sensors, GPS tracking and acoustics (i.e. to provide better information on density of fish accumulated, currents and wave heights etc).

Cons

Disadvantages of FAD deployment programs can include:

- loss or damage if care is not taken, or if deployed in open waters that are subject to heavy weather conditions and/or currents. Lost or damaged FADs can be time consuming and costly to maintain and replace for the responsible authority, as well as creating marine hazards for vessels travelling through the area;
- depending on the level of sophistication, FADs can be quite expensive to acquire and fit out. FADs with GPS trackers and/or weather buoys can cost anywhere between US\$10,000 to over US\$150,000, varying according to the type of equipment and information collection capacity (pers. comm. I. Bertram and W. Sokimi, SPC). SPC is working on reducing the cost to US\$100 for simple GPS units with coordinated procurements;
- generation of a reliance on FADs for local fishers and erosion knowledge on traditional fishing techniques over time;
- a requirement for larger boats to deploy than those used by fishers in small villages or communities.

Conditions and ease of implementation

It is essential that FAD deployment programs are carried out in conjunction with appropriate training on the proper use and maintenance of FADs in order to prevent or minimise FAD damage or loss. In

addition, it is important that training on safety at sea, as well as meteorological forecasting/weather information dissemination, are also provided as part of the program.

Wider community awareness programs on the geographic locations of FADs, such as that communicated via radio in FSM, can be beneficial in reducing accidental damage to FADs by recreational and local fishers. It is recommended that local communities be involved in selecting the best locations for FAD deployment so as to maximise use of FADs (such as that done in the Solomon Islands and Vanuatu).

In general, this policy is appropriate for any country with small-scale/artisanal operators. Deployment of FADs should be targeted to areas that would be easily reached by fishers, but also in such way that does not attract vulnerable reef fish and ensures that the value of tuna caught around them well exceeds the costs of materials and installation. Past experience suggests that FADs deployed in sheltered areas are less susceptible to damage and loss compared to those deployed offshore or in open waters.

Given that one of the biggest challenges to FAD deployment programs is succession planning (i.e. maintenance and re-deployment in the event of damage or loss), effective program implementation should also entail considerations around who should be responsible for the management of FADs post-deployment. A scientific study carried out by Pittman et. al. (2020) explored FAD management systems for the Eastern Caribbean under 3 scenarios: (i) privately operated, (ii) community managed and (iii) top-down governance. The results suggest that private-individual governance is likely to result in the most conflict and potential sabotage, and can even undermine the traditional forms of cooperation within the fishing community. While community-based management is expected to avoid conflict, it is unlikely to provide adequate incentives for deploying and maintaining FADs. Finally top-down governance is expected to result in the least incentive for fishers to manage or take care of the FADs. The authors highlight options that allow co-management of FADs between government and community groups as appropriate means of FAD management.

In the Solomon Islands and PNG, the commercial purse seine fishing industry are engaged in the setting and maintenance of industrial FADs that are accessible to artisanal fishers. For the Solomon Islands, industrial FADs are deployed and maintained outside 3nm by NFD as part of their licensing conditions. In PNG, the locally-based commercial fishing industry are permitted to set anchored FADs within archipelagic waters beyond 12nm, which can also be accessed by artisanal fishers. The option of involving the commercial fishing industry in management and maintenance of FADs, either as part of their commercial operation or as a paid service for FADs that are set in coastal zones, could potentially solve any capacity issue in succession plans, and bring uninterrupted benefits to local communities.

3.2.2 Gear, capital and fuel programs and subsidies for domestic operators

For small-scale fishers in PICs, start-up investment costs and high operating expenses can pose a considerable impediment to establishing new operations, or scaling-up existing ones. Financial support provided to artisanal fishers aimed at improving productivity and financial viability of fishing and related activities is expected to not only contribute to improved food security through increased supply of tuna, but also strengthen the livelihoods of the small-scale operators involved along the supply chain. Policy options that provide financial support to local fishers include, but are not limited to:

- a) provision of skiffs/canoes or skiff/canoe building programs
- b) tax exemptions or rebates for capital investment (e.g. vessel, engine, gear etc.)
- c) subsidies or rebates on fuel
- d) providing complementary well-being services such as maintenance and sea-worthy checks on small vessels

Where it's been trialled

A number of FFA members have implemented subsidies or support programs in one form or another, including Kiribati, Tuvalu, Cook Islands, PNG and Vanuatu.

Most of the countries that have trialled financial support programs have targeted the provision of vessels (e.g. canoes/skiffs) and gear (e.g. outboard motors, spare parts) for free or at a highly subsidised rate, focusing in particular on remote communities on outer islands. While there may be support programs available to urban areas, they tend to be limited by a quota or to only a selection of items/services. For example, MFMRD in Kiribati have programs that supply skiffs and canoes or offer subsidies on engine and gear to fishers on outer islands, but fishers in south Tarawa are offered only free vessel maintenance and training (e.g. on sea safety and FAD use).

In Vanuatu, the capital program '70/30' offers local fishers fibreglass vessels fully equipped with all the necessary gear (incl. echo sounders, solar engines etc.) for an out-of-pocket cost of around US\$5,000 (which constitutes 30% of the actual cost with the government covering the other 70%). In the Cook Islands, artisanal fishers can apply to the 'Small grants program' which offers grants up to NZ\$2,000 on fishing capital upgrades (e.g. gears, fishing technology etc.). The grants are offered on a competitive basis and each fisher may apply for a grant every 3 years to ensure equitable access to the grant. Under the Provincial Development Program, which ran between 2012 and 2014, communities in PNG were provided motorised boats and various gear and equipment (e.g. generator, fishing gear, cool box etc.) free of charge. However, due to the high cost of the program, it has since been replaced with the Microbank program which allocates K5 million each year to be loaned out to local fishers at interest rates that are considerably lower than commercial banks. The fund is designed to assist fishers with the purchase and/or upgrade of fishing gear and equipment (e.g. speed boats, generators, freezers etc.) Similarly, Nauru also had a number of capital programs that provide free capital and gear to local fishers, but due to the popularity of the programs, it has now been limited to only boat trailers and onboard motors.

Fuel subsidies is another area of support that is commonly provided, similar to tax exemptions on fuel discussed under section 3.1.9. However, the premise of tax exemptions is to allow fishers or companies in the fishing industry to purchase fuel exclusive of the tax or levy that is usually charged by the government. Under fuel subsidy programs, the subsidy provided can be greater than just the tax that is typically levied. In the Pacific, the Cook Islands introduced a program in 2017 to provide direct subsidies on fuel purchased to artisanal fishers for fishing to help with the increasing cost of fishing. Eligible artisanal fishers must record their fishing trips and catches on the SPC TAILS app in order to qualify for the subsidy. A similar fuel subsidy program for local fishers in Vanuatu was discontinued after fishers were found to be cheating the system and using the fuel for other purposes.

There have also been programs run that focus on increasing the capability of local communities to build their own fishing vessels. For example, SPC ran a canoe building program under FAO funding for Nauru and Tuvalu in recent years. The program provided communities greater access to fisheries resources and also allowed fishers to better manage costs amidst the global increases in oil prices. The canoe building program in Nauru has received very positive responses, with communities requesting more training. The idea of increasing vessel building capacity is not new. FAO has run multiple programs since the late '80s that teach communities in PICs to build their own vessels, including in Kiribati, Vanuatu and Fiji.

While past vessel building programs have been limited to mostly small vessels such as wooden canoes, the TFD started a program building fibreglass boats for local fishers in 2021. Despite some initial doubts on technical capacity, the first fibreglass skiff was successfully built domestically in Tuvalu in 2022. Currently, the program is gaining a lot of attention from local fishers because of its durability, but also increased safety at sea.

Pros

The biggest benefit of providing financial support to local fishers is improving the business viability of their operations, which in turn, increases fish supply and food security. Providing financial support for start-up investments reduces barriers to entry for a new generation of artisanal fishers and/or community members, creates meaningful work and boosts economic activity. Capital support programs have been by far the some of the most popular programs trialled based on community feedback.

Another benefit of capital programs is that they promote newer boat purchases with better designs, which can improve sea-safety and efficiency of catching. Newer boats also allow fishers to fish further offshore and take pressure off reef fisheries. Vessel building programs and associated training, such as that trialled in Tuvalu, can generate knowledge sharing among local companies.

Cons

Providing free or discounted capital and gear can overcapitalise the local fishery and potentially cause further depletion of reef fish stocks if vessels, gear and fuel are used for fishing on the reefs. Financially attractive programs are often susceptible to fraud and deception – for example, when vessel buyers collude with vendors to inflate the cost of vessel purchase for personal gain. Another common avenue of abuse to financial support systems is nepotism among officials running the schemes.

On fuel subsidy programs, there is the added risk of increasing the overall fuel demand and driving up prices for all users in the community.

Depending on the administrative requirements in applying for financial support, the procedure can disadvantage people with little financial literacy or a lack of credit record. Lastly, large reductions in start-up capital investments might encourage more participants without the necessary knowledge/aptitude for fishing to enter into the fishery, and without considering the ongoing costs of operation.

Conditions and ease of implementation

As is with all policies and programs discussed so far, financial support schemes should be implemented alongside appropriate training – e.g. safety at sea, fishing on FADs etc. For vessel building and capital support programs, it's important to have infrastructure and services in place to maintain and ensure vessels are seaworthy (such as that in place in Kiribati).

To prevent abuse of schemes that provide free or discounted capital, it's necessary for the government to oversee the transaction, or have some form of security over the asset if the asset is paid for on loan. For example, the government could be engaged in the bulk purchasing of skiffs and re-selling to local fishers at a discounted price, or hold ownership over the boat if the government is the guarantor on the loan for the purchase of fishing capital. There have been incidents in the past where the government guaranteed capital loans and was held responsible for the repayments to the bank but was not able to secure the asset when the borrower defaulted on the loan.

In general, financial support programs are suitable for most countries with artisanal or subsistence fishers, provided that mechanisms are put in place to prevent fraudulent claims or other means of abusing the system. It may be particularly beneficial in countries where there is high competition with the commercial fleet.

3.2.3 Training programs and support services for fishing and sea safety

Appropriate training is essential to successfully implement all policy options discussed in this report - from improving catch efficiency and sea-safety for fishers, through to handling and storage of tuna in on-shore processes. Training programs can include, but are not limited to:

- a) onboard motor use
- b) safety at sea
- c) making/repairing fishing gear
- d) FAD fishing and maintenance
- e) fish handling and post-harvest processing
- f) using reject fish in aquaculture or animal husbandry
- g) financial literacy and management

Where it's been trialled

Most FFA member countries have experience in the delivery of local training programs. For example, members that participated in the FAD and vessel building programs have all conducted some form of training to help fishers familiarise with offshore fishing and sea safety protocols. Countries (e.g. Kiribati) also provide training to local fishers on onboard motor use and fish handling, which has been positively received. Similarly in Samoa, education and training programs that promote better fish handling (e.g. gutting and icing, proper storage to maintain fish quality) have been run for the local Alia fishers.

A small handful of fish processors in the region, including Soltuna and PAFCO Fiji, have rolled out financial literacy and management training with the support and materials provided by FFA and the International Finance Corporation. The program was aimed at improving budgeting skills of plant workers, and in turn, reducing absentees (i.e. sick days). The training focused on managing household expenses (incl. loan repayments) and creating savings plans, which were tracked for a period of time and reviewed. The courses also included modules on how to access credit and maintain healthy financial relationships. The latter covers household equality and financial abuse as a form of domestic violence. The programs yielded positive results for the canneries with small, but noticeable, reduction in absentees.

Pros

Training is essential for successful implementation of any policy or program. If the training provided is effective, then the benefits generated should reflect the objectives set out by the training – e.g. improved sea-safety, increased fishing efficiency from FADs, better fish handling, financial management and food safety etc.

Cons

Challenges to effective training can include:

- limits on numbers, particularly for training not held in-country it then becomes important for the attendees to share knowledge and/or information with others, however there may be incentives for not doing so (e.g. to maintain a competitive edge);
- selection of participants can often be influenced by factors other than merit;
- budgetary constraints for countries with a large number of participants in the catching and/or processing sector, the scale of training required could be beyond that able to be viably supported by Government.

Conditions and ease of implementation

The provision of training to support food security policies appropriate in the local context is relevant to all FFA members. Important considerations in delivering effective training programs include:

- ensuring a transparent and equitable selection process for participants;
- ensuring an effective means of distributing knowledge to those who are not able to attend;
- providing an appropriate ratio of trainers to trainees that is conducive to effective learning;
- repetition continual and/or repeated training is helpful to improve and 'bed down' existing skills, and master new ones;

- providing logistical support around training programs, in terms of both the physical location and time during working hours.
- ensuring training materials are tailored and delivered in an engaging way (incl. in the native language of the participants).

3.2.4 Supporting women's participation in small-scale tuna fisheries value chain

Research has shown that women with greater control of income are more likely to spend money on food and nutritional needs of the family (Gibson et al. 2020). Therefore, policies that particularly target the empowerment or involvement of women in the fisheries post-harvest sector through a livelihoods approach will indirectly contribute to food and nutritional security. Policy options that offer support to individual or small-scale entrepreneurs (e.g. micro-finance, training or provision of equipment) can be adjusted with gender targets or objectives.

Where it's been trialled

At the higher level, women's participation in the tuna value chain is promoted through policies around domestication and modernisation of fishing and processing sectors in 3.1.1 – for instance, supporting the establishment and operation of onshore processing facilities, who are major employers of women. In Kiribati, programs are often tailored or run through women associations, including training on post-harvest preparations (e.g. micro-canning, smoking etc.). In Fiji, an initiative between the Fijian-owned company, SeaQuest, and FFA has made it possible for the first all-female operated tuna longline vessel SEAKA II to begin expedition (Vucukula 2022²³).

Pros

Experience from micro-finance to women groups in the Pacific suggests that women tend to manage finance better due to the peer pressure from other members of the group – e.g. to pay back loans in a timely manner. For certain supply chain activities, such as processing, marketing and selling of fish, there is an alignment with the traditional roles of women in the Pacific, which makes the engagement of women in those industries easier.

Aside from indirectly contributing to food and nutrition security with the economic empowerment of women, increasing overall employment (of women) means a bigger workforce and a higher Production Possibility Frontier (PPF) for the country. The latter is a catalyst for economic development and growth. Providing policy support for the employment of women in post-harvest handling and processing can also be linked to improved supply and diversification of tuna products, presenting welfare gains in variety similar to that from globalisation and trade.

Finally, the economic empowerment of women is often associated with financial freedom or autonomy, which can lead to social change such as reduced violence against women (Jatfors 2017²⁴). However, research has shown that the interrelation between economic empowerment and violence against women is not linear but follows an inverted U-shape, with increase in violence against women where women's economic power is in transition because men are more likely to feel threatened, particularly in instances where only the woman worked and/or where the woman is earning more than her partner (Fraser 2012²⁵, Jatfors 2017, Stöckl et al. 2021).

Cons

Policies that target the participation and economic empowerment of women have the potential to breakdown traditional or customary roles for women in the home (i.e. incompatible culturally or otherwise if implemented incorrectly). This could lead to disputes and even violence towards

²³ https://www.fijitimes.com/a-world-first-first-all-female-deck-crew-for-fiji/

²⁴ <u>https://www.unescap.org/sites/default/files/Session%203%20-%20Anna-Karin%20Jatfors.pdf</u>

²⁵ <u>https://gsdrc.org/publications/economic-empowerment-and-violence-against-women-and-girls-vawg/</u>

women, especially in terms of the distribution of income if the fish is caught by men but sold/processed by women. Despite potential for long-term social progress, it is likely to take time for societal and customary views to adjust.

Conditions and ease of implementation

This policy is appropriate in most country contexts whereby an artisanal or commercial fishery exists, and particularly in countries that have a high unemployment rate or limited employment opportunities for women. The feasibility or appropriateness of a female-dominant post-harvest processing sector is the same as that under the policy option 3.1.2.

Policies or programs supporting women will be better targeted if they are in a field of comparative advantage or cultural acceptance – e.g. processing, marketing and/or trading. Lastly, any program implementation should be done so alongside necessary training and support. This includes training on basic financial literacy.

3.2.5 Using reject fish landed to produce fish meal, fish oil and/or fertiliser in the production of agriculture, livestock or aquaculture

Similar to policy option 3.1.4 which targets the reduction in post-harvest losses for human consumption, this policy looks at ways to utilise post-harvest waste through other means that then provide indirect contributions to food security and/or alternative livelihoods for actors in the fisheries sector. This includes reducing waste from fishing or transshipment operations by utilising reject tuna or bycatch to produce fish meal and oil for aquaculture or livestock husbandry (e.g. pigs), and/or fertiliser for vegetable farming.

Where it's been trialled

Despite the availability of reject fish and bycatch from fishing and transshipment in the Pacific, examples of using waste fish for alternative means are limited. There is a small-scale processor in RMI, Kendall Micronesia Inc., that turns waste fish into pellets for aquaculture which is then used in the country's milkfish farming sector. The output from milkfish farming supports both domestic food security as well as providing livelihoods and employment to locals through exports targeted for the Hawaiian market.

The other example is a fish silage program ran by SPC in New Caledonia in the late 2000s which provided training and guidance to locals on turning fish waste into fertiliser for agriculture and food supplement for animals (Blanc 2009²⁶). The program attracted interests around the region. However, for reasons unknown, the program did not take off elsewhere.

Pros

The main benefit of fish waste utilisation programs is that they allow for the productive use of a previous waste product, while at the same time growing alternate (e.g. fertilizer production) and/or traditional (e.g. farming) livelihoods. It can be a business opportunity for commercial/larger-scale production in countries that experience high volumes of surplus fish from transshipment operations. Like all commercial business opportunities, there are flow-on economic benefits in terms of employment, income security and business activity in the upstream and downstream sectors. Depending on the usage of outputs produced from waste fish, policies that promote waste utilisation can indirectly improve food security from agricultural, animal husbandry and aquaculture. Finally, it can also reduce scope for (illegal) dumping of fish associated with transhipment operations.

²⁶ <u>https://coastfish.spc.int/en/features/128-how-to-make-fish-silage-2</u>

Cons

The limitations to policies that promote the utilisation of waste fish in the production of fish meal/oil or fertiliser are mostly related to the commercial aspects of production. For example, commercial grade fish meal/oil often require a certain level of oil or protein content that may not be met by the reject tuna or bycatch available. While the content present may suffice for local small-scale farming, it can pose a barrier to producing export grade fish meal/oil. An addition drawback is the need for investment in capital and machinery to process the fish. If the supply of surplus fish from fishing or transshipment is not guaranteed and/or consistent, it becomes difficult to justify the investment by local entrepreneurs.

Conditions and ease of implementation

A key condition of implementation is having the necessary infrastructure and capacity to receive reject fish at wharf/port similar to that discussed in 3.1.6 and 3.1.7.

In general, this policy is particularly suited to countries that have a) access to large volumes of reject fish (e.g. from purse seine transshipment operations); and b) regulations against the local sale of tuna from transshipment for human consumption. To prevent leakage of discard fish being transferred for human consumption in countries that prohibits local sales, there should be capacity to monitor and enforce such regulations.

Larger countries with other industries that produce waste materials which can be utilised in the production of fish feed or fertiliser (e.g. flour mills) can benefit from coordination and economies of scale. Similarly, policies supporting fish feed or fertiliser production are likely to be more useful in countries with aquaculture and agriculture industries – e.g. milk fish. Otherwise, business support should be provided to SMEs in finding the right market to export processed products, including guidance in navigating the required paperwork (e.g. export/sanitary certification etc.).

3.3 Increase the consumption of tuna and tuna-like products, and/or the equity of access to tuna consumption

3.3.1 Promoting tuna consumption and fisheries management through Community-based coastal resource management

Community-based management (CBM) is the involvement of local communities in the day-to-day management of resources on which they rely for food and livelihood. While CBM in the Pacific has typically been limited to coastal fisheries, the management of coastal and offshore fisheries cannot be seen as stand-alone channels in achieving food security or conservation goals. As discussed in section 3.2.1, CBM can play an important role in assisting with the monitoring and maintenance of FAD programs but more importantly, the success of FAD programs depends on the management and enforcement of coastal fishing regulations at the community level. CBM can also encourage tuna consumption (particularly as an alternative to reef fish), equitable distribution through traditional customs of meal sharing, as well as women's participation in livelihoods as means to improve food security.

Where it's been trialled

While various forms of CBM exist across the FFA membership – from RMI to Tokelau, to Solomon Islands, Tonga, Nauru, Kiribati and Vanuatu – they have primarily been limited to coastal resources (i.e. have not been utilised to encourage tuna consumption). A good example of successful CBM is Tokelau, which is unique in that the inshore fisheries around all 3 atolls are completely managed by elders on each island, up to 25nm. The success of CBM in Tokelau is primarily owing to the fact that it has always been in place, disrupted by Western-style management only for a short period of time

during the British colonial rule (Government of Tokelau 2022²⁷). Another critical element of its success is that CBM in Tokelau is integrated through every aspect of day-to-day life such that the management of marine resources does not represent a division in governance. The traditional CBM of marine resources in Tokelau, with food security set as the principal objective for inshore fisheries management, has ensured not only ample supply of aquatic food but also stewardship over coastal reefs and its marine resources.

Although not implemented to the same extent, similar successes with CBM are found in Tonga, Vanuatu, Solomon Islands and RMI. In Tonga, special management areas (SMAs) are set up where the fisheries ministry works with coastal communities, assisting in the setting rules and regulations to manage the marine resources in their coastal zones. At the current time, SMAs have only been trialled in single community groups. However, there are plans to upscale and extend the program to joint communities (e.g. landlocked communities in partnership with coastal), but it requires the amendments in the national legislation, which are still in process. There is also interest in setting up community-based co-management of regions between adjacent islands under bilateral arrangements. In the Solomon Islands, CBM for coastal fisheries have been trialled in a number of remote communities under the 'Pathways'²⁸ program, giving the communities the responsibility of managing their own resources. This has been met with positive responses with others also requesting to manage their own resources. Through the program²⁸, some communities in the Solomon Islands have more awareness of how to manage resources and are seeing the return of different species of fish since the implementation of CBM for fisheries (Collins et al. 2019).

In RMI, the community-based program 'Reimaanlok', which translates to "looking forward towards the future" is a focused on conservation. The coastal division of MIMRA works with local communities in setting up marine protected areas (MPAs) to manage/protect coastal resources. The goal is to manage 50% of RMI's coastal resources by 2030. The program combines the cultural insights of local leaders with scientific research on the local environment. To date 'Reimaanlok' has helped at least 16 communities complete their MPA management plans with another 20 or more coastal fish resource sites assessed and ready to implement their plans to manage their own coastal resources (The World Bank 2021²⁹).

One of the latest FFA members to implement CBM for marine resources is Nauru. The new Coastal Fisheries and Aquaculture Act 2020 introduced provisions for locally managed marine areas (LMMA), which provides the 14 districts of Nauru the opportunity to submit a management plan to manage the reefs in the coastal zone within their district to NFMRA and cabinet for approval. However, the implementation of LMMAs has not been without its challenges. So far, only one community management plan has been submitted. However, the plan was rejected by cabinet on the grounds that the plan excluded people from other districts from fishing in their coastal zone, which is not permitted under national law as the districts that do not have coastlines would be disadvantaged.

Pros

The use of CBM promotes inclusive, equitable and transparent management of coastal marine resources with community buy-in that may not be achieved with centralised management. This includes the sustainable management of reefs (e.g. through Marine Protection Areas) and advocacy for fishing on pelagic species (e.g. through FAD programs). CBM can be coupled with education campaigns on the nutritional benefits of tuna and lesser known pelagic species as well as methods of preparation. Moreover, CBM can offer livelihood means to improving food security through the

²⁷ <u>https://www.tokelau.org.nz/About+Us/History.html</u>, accessed September 2022

²⁸ A collaboration between researchers and regional and national networks and agencies, led by ANCORS in partnership with WorldFish, SPC and national fisheries administration in participating countries <u>https://www.uow.edu.au/ancors/ourresearch/cbfm/</u>

²⁹ <u>https://www.worldbank.org/en/news/feature/2021/11/17/-reimaanlok-the-future-of-community-led-ocean-conservation-in-marshall-islands</u>

commercialisation of assets which can be hugely beneficial to the local community if managed well – centralised processing, marketing and trading. In terms of small-scale commercialisation of fish storage and/or processing, policies that engages in CBM can be implemented in line with those discussed in sections 3.1.2, 3.1.4, 3.1.5, 3.2.1, 3.2.3 and 3.2.4.

Cons

Limitations of CBM in the context of food security include:

- it may not work well for land-locked communities e.g. in Nauru, access issues became major barriers to the successful implementation of CBM for certain communities;
- there is the need for capacity at fisheries agencies to run CBM programs, which may not be possible without external support (e.g. Collins et al. 2019);
- CBM can be effective managing access to, and promoting equitable distribution of, coastal fisheries resources, but has limited influence over the broader health of highly migratory tuna stocks which require effective region-wide management.

Conditions and ease of implementation

CBM policies are particularly beneficial for countries/communities where there is a heavy reliance on subsistence fisheries for livelihood, However, for CBM to work, there needs to be a legal framework in place that allows for co-management of fisheries resources, as well as an existing social structure to generate community buy-in and compliance (e.g. traditional forms of authority and respect, for chiefs or leaders).

Experience indicates that CBM is also most effective if implementation is:

- integrated in other aspects of daily life, as is the case with Tokelau; and
- based on community/customary boundaries, rather than geographic ones.

In theory, once established, the CBM should work more or less autonomously, without the need for external financial support. However, from experiences in the region, setting up or facilitating CBM can be a costly exercise and requires a lot of capacity at the national fisheries administration level at least in the short/medium term. This is partly as a result of the need for training and information, to ensure that coastal fisheries are managed based on science as well as customs.

3.3.2 Spatial closures to commercial fishing around islands/communities

Broadly, spatial closure approaches seek to improve access to tuna and other resources for PIC communities by reducing competition with commercial fishers. In this way, areas around islands/communities are reserved for artisanal/subsistence fishers.

Where it's been trialled

Examples of spatial closures aimed at limiting competition between commercial and subsistence fishers can be found in many FFA countries, including Tokelau, the Cook Islands, PNG and Palau. In Tokelau, commercial fishing is prohibited within the inshore zone (i.e. 25nm from the coastline), with food security set as the primary objective for management of the zone. Requirements are also in place to ensure full assessments on the netted impacts are to be carried out should any fishery commercialisation be considered in the future.

For the Cook Islands, the commercial fishing exclusion zone was recently extended from 24nm to 50nm under the Marae Moana Act 2017. Part of the justification for the extension is to protect the life cycle of marine species, and improve the status of fish stocks and their availability for community fishing (Marae Moana 2022³⁰). The extension of the exclusion zone has been beneficial for small-scale fishers in that there is now less competition within 50nm. However, catch rate data for

³⁰ <u>https://www.maraemoana.gov.ck/about-marae-moana/what-is-marae-moana/</u>

artisanal tuna fishing has not been examined by the Ministry of Marine Resources (MMR) to see whether the extension has helped improve the availability of tuna for domestic consumption.

The most extreme example of a spatial closure in the Pacific can be found in Palau, where the introduction of the Palau National Marine Sanctuary (PNMS) saw 80% of its EEZ closed to any form of extractive activity, including fishing along with deep-sea mining and oil exploration (Gunia 2022^{31}). Plans for the PNMS were announced by President Tommy Remengesau Jr at the UN General Assembly in September 2014³², but the marine sanctuary only formally came into effect in January 2020 under the Marine Sanctuary Act. The new Act was backed by the traditional leaders of Palau and the council of chiefs (Ligaiula 2022³³). The ambition of the PNMS is to safeguard biodiversity and ecosystems, as well as contribute to the fight against climate change by preventing stores of seafloor carbon from being released from activities like trawling or resource extraction (Gunia 2022³¹). However, the PNMS – an exclusion zone bigger than the size of California – has not been met without criticisms. The Ministry of Fisheries, Agriculture, and Environment (MAFE) has reported that US\$1.8 million has been lost from banning fishing (Gunia 2022³¹). Moreover, the closing of Palau's EEZ to commercial fishing has compromised the goal of the PNMS to reduce pressure on coastal reefs - with increased consumption of reef fish (e.g. grouper, snapper and parrotfish) as a result of major commercial tuna fishing companies shutting down their operations in Palau (Carreon 2020³⁴). Since the departure of fishing companies, including Palau International Traders Corporation (PITI), supermarkets and seafood restaurants in the country have stopped stocking tuna or offering it on their menus, due to the lack of supply, and instead forced to turn to reef fish or imported fish like salmon and basa (Carreon 2020³⁴). The current President of Palau, Surangel Whipps Jr., who took office a year after the PNMS was enacted, reportedly wants to reduce the size of the PNMS to around 30% of the EEZ in order to find a better balance between protection and production (Gunia 2022³¹).

Pros

The main arguments for spatial closures to commercial fishing around islands/communities are based on environmental and social benefits – including reducing competition and conflict between commercial and artisanal/subsistence fishers. For commercial fishers, there is also the benefit of a decreased likelihood of getting their gear tangled up by artisanal fishers when inshore zones are shared. For most FFA countries with restrictions on commercial fishing in inshore areas, small-scale fishers are protected from competition while allowing the country to still benefit from licencing and access arrangements with industrial fishing vessels working offshore.

Cons

Potential disadvantages to spatial closures to commercial fishers in inshore waters identified during consultations included:

- lost economic opportunities e.g. extending the exclusion zone to fishing beyond the access capability of small-scale vessels limits potential returns from industrial fishing access. A number of interviewees noted that artisanal canoes and skiffs are typically not able to travel beyond around 12nm from shore; and
- impacts on the domestic commercial fleet in the Cook Islands, for example, the extension of the fishing exclusion zone to 50nm under Marae Moana has considerably impacted the operating cost (i.e. fuel and time) for the only domestic longline company as a result of the extra distance that must be travelled before the vessels are allowed to fish. Consequently,

³⁴ https://www.theguardian.com/world/2020/feb/27/palaus-marine-sanctuary-backfires-leading-to-increasedconsumption-of-reef-fish

 ³¹ <u>https://islandsbusiness.com/features/palaus-controversial-plan-to-take-climate-justice-into-its-own-hands/</u>
³² <u>https://www.un.org/en/ga/69/meetings/gadebate/pdf/PW_en.pdf</u>

³³ <u>https://pina.com.fj/2022/04/12/former-palau-leader-fears-marine-sanctuary-act-could-be-ditched/</u>

market price for tuna sold by the company has also increased since the exclusion zone extension.

Conditions and ease of implementation

The key implementation condition identified by stakeholders consulted is that the zonal boundaries should be practical and aligned with the types of local fishing activity and catchability in the area (e.g. 12nm for artisanal fishers). In PNG and Solomon Islands, having a smaller inshore decommercialised zone also allows artisanal fishers to then benefit from FADs deployed and maintained by the commercial purse seine industry, set at the 12nm line in PNG and outside 3nm in the Solomon Islands. Another area for consideration is the practical part of monitoring and compliance with the establishment of zonal policies. This includes the capacity at national fisheries administrations to monitor, both electronically and physically (i.e. patrol) the zones to ensure the policy is adhered to.

3.3.3 Public procurement programs

Public or national procurement is a commonly used tool to purse social, economic and environmental objectives (FAO 2018a). The concept is to use the government's purchasing/market power to provide regular demand for goods and services from certain providers or suppliers to meet specified objectives. For instance, the government can source tuna products from vulnerable producers (e.g. small-scale fishers) as a means of providing livelihood and income security, and at the same time, achieve resource management and/or national health policy goals (e.g. food and nutrition security). Target groups for health policies could include children, elderly citizens, and pregnant women, as well as people in low income and at-risk communities.

Policy options under public food procurement programs include:

- a) setting up federal/state purchase programs to support food and nutrition goals by suppling canteens in schools, hospitals, universities, prisons, the military and other public establishments, with the option of targeting fish sourced from local operators; and
- b) requiring 3rd party contractors involved in national food procurement programs to source a certain percentage of fish from small-scale operators

As part of the program, minimum prices can be set to ensure the livelihoods of small-scale fishers are supported in the process.

Where it's been trialled

Public or national procurement programs are widespread across the globe, with the procurement of goods and services accounting for 50% of more of total government expenditure in developing countries and around 29% in high-income countries (World Bank 2015). In Europe, this strategy was first implemented in the 19th century as a way of improving employment conditions and securing a minimum wage for workers (FAO 2018a). Today, the European Union uses government food procurement to promote environmental goals by targeting foods that generate lower greenhouse emissions and favouring short supply chains (European Commission 2016).

In supporting SMEs, the US has one of the largest and most comprehensive schemes, instituted in 1953 under the Small Business Act (FAO 2018a). Under the Farm to School Programme, the government makes purchases from local producers and suppliers for school lunches in support of the domestic farming sector, and with the aim of increasing consumption of fresh foods at schools (FAO 2018a). In India, the Public Distribution System seeks to promote food security in the country by procuring grains and distributing them to poor households through food subsidies and in-kind transfers (Bhattacharya et al., 2017). In the same vein, the government of Brazil created the Food Purchase Programme, which aims to procure food from smallholder farmers for food assistance strategies (FAO 2018a). Numerous additional examples of public food procurement initiatives that

aim to generate positive impacts on smallholder livelihoods, local economies and food security can be found in Latin America and Africa (FAO 2018a).

Pros

The biggest advantage of public food procurement policies is the ability to address multiple government objectives. For example, in the fisheries sector public food procurement policies can not only provide small-scale fishers with an alternative means of livelihood/revenue, but also reduce the risks and uncertainties involved in market participation, all the while making progress towards national health and nutrition goals (FAO 2018a).

Increasing government demand for fisheries products can boost business and growth (i.e. from investment made possible through income security) for both fishers and other actors in the upstream and downstream supply chain. This includes women, who are often involved in the processing and trading/marketing of fisheries products. Over the longer term, food procurement policies can help build up the fishing and processing sectors from small to large scale, which contributes to self-sufficiency and future food security.

Cons

Potential drawbacks to public food procurement policies/approaches include:

- the need for strong coordination across various government departments which may not always be straightforward;
- the need to establish and resource systems and processes to manage procurement and distribution;
- fair access and competition for small-scale fishers may be undermined if procurement procedures (e.g. tender processes) are not properly designed; and
- potential exposure to legal liability for Governments in ensuring safe and hygienic food (requiring strict quality assurance procedures).

Consistency in volume of supply may also be difficult to achieve when sourcing solely from smallscale producers. The government may need to work on a balance between small-scale and commercial suppliers to ensure the necessary volume is delivered on a regular basis.

Conditions and ease of implementation

Public food procurement policies are particularly beneficial in addressing food and nutritional security challenges for vulnerable groups (e.g. children, elderly, medically ill), or where is high competition between the commercial and small scale fishing sectors. The main condition for implementing policies on food procurement is to have some form of national or state procurement program in place, or a willingness by government departments (e.g. health and fisheries) to cooperate in setting up some form of national/state procurement program. Food procurement programs generally cover key government operated facilities such as public hospitals, nursing homes, schools, universities, prisons, and at times, food provision for certain at risk groups and communities (e.g. social welfare or safety homes).

Other conditions required for implementation include:

- the need for a strict quality assurance process around food safety and quality;
- the need for a system in place to ensuring timely delivery of required volumes of pelagic fish to minimise disruptions in food supply;
- the need to ensure the composition of food baskets is balanced and based on scientific research.

Additional guidance on the successful implementation of public food procurement policies is available in FAO Policy Guidance Note 11: Public Food Procurement (available at https://www.fao.org/documents/card/en/c/CA2281EN/).

3.3.4 Education and awareness programs on the nutritional benefits of aquatic food and/or guidance on utilisation

To create meaningful changes in consumer purchasing and dietary behaviour and/or perception of tuna products, educational campaigns may be needed. Previous reviews on the impact of nutrition education interventions on dietary habits have shown promising results for all indicators assessed, from the consumption of food to nutrition knowledge, dietary habits, physical activity, and quality of life (e.g. Lua and Elena 2012).

Education on the nutritional benefits of tuna and tuna-like products was identified as one policy option that can bring about positive long term change to tuna consumption in PICs. The type of policy options ranges from:

- a) state/national advertising campaigns that promote healthy diets from fish or tuna
- b) encouraging collaboration between educators and fishers to provide a better understanding on the importance of fish in healthy diets (e.g. in school educational programs)
- c) building consumer awareness on how to cook and prepare bycatch species (e.g. cooking shows or recipes by celebrity chefs)
- d) single day promotional events such as World Tuna Day

Where it's been trialled

Awareness campaigns have been trialled in the Pacific in various forms, from single day events like World Tuna Day to longer term well-being campaigns promoting the consumption of fish for healthy diets. RMI and FSM have both reported high turnout and very positive feedback on World Tuna Day events, which often includes fishing tournaments, cooking demonstrations, food stalls, interactions with schools etc. In Vanuatu, longer term awareness campaigns promoting the benefits of tuna/fish consumption have also been successful against their objectives, including fighting against the high risks of NCD through healthier diets, and increasing the appeal of pelagic species to encourage fishers away from depleted reef stocks. In particular, there has been a boost in fishing activities among rural communities where the campaigns have been targeted, with fishing vessel purchases increasing noticeably. Similar well-being campaigns have also been trialled in Kiribati (i.e. "Fish for life") and Samoa (albeit there is a stronger emphasis on the consumption of reef fish compared to tuna in the health awareness campaign in Samoa).

Outside the Pacific, educational campaigns that target healthier diets can be found in a diverse number of countries around the world, from the US to Korea, Japan and Israel. In the US, dietary educational intervention varies depending on the state. Campaigns are delivered in a variety of forms – including in the classroom education, promotional programs in the cafeteria, online resources (e.g. BAM! Body and Mind,) and hands-on opportunities under the "Farm to School" program engaging students through gardening, cooking lessons, or farm field trips (CDC 2022³⁵). In Japan, education intervention is mandated under the Basic Act on Dietary Education (Shokuiku) 2005 – whereby the responsibility of delivering the basic plan for the promotion of health and nutrition is detailed for the national and municipal governments, food-related businesses as well as schools and childcare centres³⁶.

³⁵ https://www.cdc.gov/healthyschools/nutrition/school nutrition education.htm

³⁶ <u>https://www.japaneselawtranslation.go.jp/en/laws/view/3419/en</u>

Pros

Well-targeted education campaigns can be expected to increase consumption of healthy foods (including tuna), with flow-on benefits including reducing NCDs and improving nutrition security at the provincial and/or national level. In addition, dietary education campaigns can be run to incorporate other noteworthy messages related to food consumption, such as the importance of sustainable fishing and reducing food waste. School programs that focus on educating the younger generation can build knowledge at an early age that results in lasting behavioural changes – which estimated to require around 40 to 50 hours of education (Institute of Medicine 2014).

Cons

The main cons to education campaigns are that they requires commitment and funding from the government to promote it in a meaningful way (i.e. around 40 to 50 hours of classroom interactions), as well as potentially investment in supply chains to accommodate expected increases in tuna demand. Campaigns must be factual, accurate and politically or culturally appropriate to the audience, otherwise efforts could be counter-productive. For example, the 'Shokuiku' policy in Japan, which also promoted the consumption of domestically produced food and support for local farmers, came under criticisms amidst food safety concerns in the aftermath of the Fukushima nuclear disaster (Reiher 2012).

Conditions and ease of implementation

Policy options focused on promoting the consumption of tuna through educational intervention can be very useful for countries where there is high nutrition insecurity, or strong consumer aversion to tuna – e.g. due to lack of knowledge on the methods of preparation, or simply a preference for reef fish. Depending on the circumstances, educational campaigns should be tailored to address related issues, such as reducing fishing pressure and/or advocating for sustainability on depleting reef stocks.

Awareness or advertising campaigns need to be factual, engaging and inclusive for all backgrounds, genders, and cultures. Research has shown that for school-based nutrition education to be effective in changing attitudes, knowledge and practices, it needs to be carried out over a period of 40 to 50 hours (Institute of Medicine 2014) which is likely to require considerable government funding. Finally, any messages around nutrition should ideally be paired with food diversity (Farmery et al. 2020) – increasing not only the consumption of tuna but also fruits and vegetables.

3.4 Governance

3.4.1 Integrated approach to national food and nutrition security

While individual policy options from sections 3.1 through to 3.3 may yield certain desired outcomes, effectively increasing food security across the country requires an integrated approach across multiple sectors. An integrated whole-of-government approach targeting food and/or nutrition security looks at implementing a range of policies, to promote higher volumes of nutritious foods being available to local consumers.

Where it's been trialled

The best known example of an integrated approach to food security in the Pacific is in Vanuatu. Food security objectives are explicitly included in national policies, and the government has set up a Food Council which operates across multiple sectors, incl. health, agriculture and fisheries to coordinate food policy. In addition, the Ministry of Agriculture, Livestock, Forestry, Fisheries & Biosecurity (MALFFB) has implemented a range of policies that support food security from tuna resources, such as lower licence fees to commercial longline vessel that land tuna domestically, an export levy of 5% on fish exports, joint venture operations to process bycatch for local consumption, installation of

solar deep freezers and establishment of provincial fish markets, promoting small-scale processing (e.g. smoking fish and bottling programs), providing capital support for artisanal operations by funding 70% of the upfront cost in the purchase of fibreglass vessels and distributing over 100 FADs around the country under the SPC FAD program. Vanuatu has been assessed as being at high risk of NCD from processed foods and as a result, awareness campaigns are in place to promote the consumption of pelagic fish for a healthier diet, especially in rural communities. A secondary objective of the awareness campaign is to move artisanal fishers away from fishing on coastal and reef fish. All of the above is done in conjunction with community-based fisheries management programs that set out MPAs to limit allowable zones for reef fishing and encourage local fishers to shift to fishing on FADs. Part of Vanuatu's success in taking an integrated cross-sectoral approach to promoting stronger food security from tuna resources is the fact that MALFFB combines a wider range of departments than most other countries in the Pacific.

However, having a larger number of smaller departments does not prevent taking an integrated approach to food security. In FSM and the Cook Islands, progress has been made towards more centralised policies to promote food security. In FSM, the Fisheries Investment Policy is a national policy designed to better align key players in the whole value chain from fishing, to unloading, exporting, compliance and so forth in order to maximise benefits from their tuna resource in terms of both food and income security. The policy includes 11 strategies and provides guidance on how to translate the strategies into economic development – e.g. value-adding facilities, storage, processing – all of which can provide alternative means of employment. In the Cook Islands, the National Food and Nutrition Policy is implemented by the Ministry of Health and promotes the consumption of fish among other healthy foods (albeit progress on implementation has slowed since COVID).

Pros

The benefit to having an integrated whole-of-government approach to food security from tuna resources is increased efficiency and synergy in policies implemented across various departments in achieving the same goal. It also allows the trade-offs to be considered and balanced to minimise counter-productive measures being implemented across individual sectors.

Cons

The biggest risk to integrated whole-of-government policies is ineffective communication and coordination across government departments. There is usually more cost involved in delivering integrated policies as a result of higher transaction costs (i.e. coordination and communication), often exacerbated by difficulties in balancing trade-offs and reaching consensus. Further, overarching policies spread over several government departments can introduce another level of bureaucracy if not properly planned, creating additional barriers to implementation. In addition, cross-sectoral policies tend to be discussed at a higher level, limiting community buy-in and support.

Conditions and ease of implementation

The most important condition for implementing an integrated whole-of-government policy approach is to ensure that the policy actively pursued through planned coordination and communication between government departments involved. A possible option to ensure effective cross-sector coordination is to establish a standalone entity that focus on harmonising food security efforts across departments – e.g. a food council. The organisation would also be responsible for reviewing and synergising existing working relations between government sectors to optimise coordination without adding more bureaucracy, also noting that nutritional security cannot come from tuna alone, but the consumption of a diverse variety of healthy foods (e.g. vegetables and fruits).

Other things to consider when implementing an integrated whole-of-government policy on food security is the incorporation of a holistic "food systems approach" – which encompasses the entire range of interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products (FAO 2018b). For more information on food

systems approach, refer to the FAO brief on Sustainable food systems: Concept and framework, available at: <u>https://www.fao.org/3/ca2079en/CA2079EN.pdf</u>.

On ease of implementation, this depends on the scale of coordination needed and the number of government departments involved. For countries like Tokelau, an integrated approach to food security is already embedded in the traditional ways of management and no additional resources are required to coordinate efforts. However, for larger countries with many government departments in managing affairs related to food security and/or sizeable urban areas and jurisdictions, the additional cost and commitment needed to implement an integrated policy approach can be extensive.

4 Where to from here?

A number of policy options to improve food security is identified in this report, from both literature and trials undertaken in the Pacific. Some common conditions for successful implementation include providing appropriate training; taking an integrated approach – whether that is through crosssectoral policy alignment or integrating CBM of fisheries as part of the traditional customs in place for communities; having capacity to monitor, enforce and evaluate policies trialled; and where possible, allow for commercialisation to enhance the efficiency of succession strategies. The latter refers to promoting local SMEs or private entities to take over the programs trialled or provide supporting services to the suggested programs as an auxiliary service to their core business. While governments have a role in promoting or trialling programs, it is rarely feasible to have the resources or capacity to continue running all programs trialled.

The next step from here is to allow FFA members to review the policy options presented in this study and decide for themselves which are the most suitable and practical to apply in their national context. It is worth noting that a follow up program, under which interested members can obtain support from the FFA Secretariat to identify, develop and implement appropriate national policies and programs drawing on the findings from this report is currently being developed.

At a regional level, it could be interesting for members to come together and identify synergies that could see realisation of the 40,000MT increase in tuna consumption set out under the Roadmap. This could include coordinating the distribution of processed bycatch or dark tuna meat across the region, including devising locations/hubs strategic for the distribution of tuna and/or capital and equipment.

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Annex 1: Terms of Reference

IDENTIFY AND ASSESS POLICY OPTIONS TO INCREASE THE CONTRIBUTION OF TUNA FISHERIES TO NATIONAL FOOD SECURITY ACROSS FFA MEMBERS

A. Background

FFA Members have expressed a desire to increase the volume of tuna caught in their waters that enters local markets and is available for domestic consumption in order to increase food security and the availability of healthy food options to their people. This desire is reflected in the Regional Roadmap for Sustainable Pacific Fisheries endorsed by Forum Leaders in 2015 which envisages an increase in the supply of tuna for domestic consumption of 40,000 tonnes across the region by 2024.

With data on the supply of tuna for domestic consumption previously limited a number of studies were conducted in recent years in order to assess how much tuna enters local markets for domestic consumption. These studies cover three areas:

- i. Canned (mainly dark meat) tuna which is produced by local and overseas canneries and supplied to Pacific Island Countries.³⁷
- ii. Landings from local and locally based purse seine, pole and line, and longline fishing vessels which are provided for local consumption, rather than being processed and/or exported; as well as fresh and frozen fish products supplied from processing plants.³⁸
- iii. Purse seine and longline by-catch landed from foreign vessels during transhipment operations this makes an important contribution in a number of urban centres, but the trade is mainly 'informal' which creates difficulties in collecting data.³⁹

In addition, some data on catches from small-scale artisanal fishing operations is available although accurate data from this sector in most FFA member countries remains elusive. SPC is the regional organisation with responsibility for data collection from this important fishery.

The results from the above outlined studies indicate that to achieve the Roadmap target a significant increase in the amount of tuna being supplied to local markets will be required.

B. Objective

To identify and assess policy options that will achieve an increase in the contribution of tuna fisheries to food security at the national level across FFA Members.

C. Terms of Reference

The activities expected of the Consultant(s) shall include, but not necessarily be limited to the following:

³⁷ J. D. Bell, M. K. Sharp, E. Havice, M. Batty, K. E. Charlton, J. Russell, W. Adams, K. Azmi, A. Romeo, C. C. C. Wabnitz, N. L. Andrew, L. Rodwell, S. Gu'urau & R. Gillett, 'Realising the food security benefits of canned fish for Pacific Island countries' (2019) 100 Marine Policy 183-191.

³⁸ S. Tolvanen, K. Thomas, T. Lewis and M. McCoy, 2019, *Assessing the contribution of landings from locally based commercial tuna fishing vessels to food security*, FFA Report.

³⁹ S. Tolvanen, K. Thomas and T. Lewis, 2021, *Assessing the contribution of landings from in-port transhipment to food security in the Pacific*, FFA Report.

- i. Explore the relationship between food security and regional tuna fisheries and how increased domestic supply of tuna from these fisheries can contribute to increasing food security for FFA members at the national level.
- ii. Conduct a review of current approaches and policies with regard to the supply of tuna to FFA members domestic markets.
- iii. Obtain the views of stakeholders in FFA Members government and industry on the various policy options and their applicability at the national level.
- iv. Obtain the views of SPC on the various policy options for small scale fisheries.
- v. Review and assess policy options for increasing the supply of tuna to domestic markets highlighting the implications, both positive and negative, for commercial fishing fleets and small scale and artisanal fisheries and other stakeholders as applicable.
- vi. Provide recommendations on national policy options for Members and the national circumstances in which these polices are appropriate noting the diverse environment across FFA members.

D. Operational arrangement

The consultant will report to the Director of Fisheries Development, FFA. The Fisheries Development Adviser will be the first point of contact for any enquiries. The consultant shall liaise closely and take into account advice and recommendations made in relation to the Consultancy and other matters related thereto.

E. Assistance to be provided by FFA

- 1. As far as possible, provision of necessary documents, on a confidential basis if necessary, to the consultant upon request.
- 2. Liaison with relevant stakeholders as required, including official notification to advise of the nature of the project and requesting cooperation.

Annex 2: Scopus literature reviewed

Table 3: Articles deemed relevant to the study on policy options to improve food security in the Pacific region*

Title	Authors	Year	Topic area/description	Region	Source title	Link
Marine fishing management towards sustainability in Sierra Leone	Massaquoi, B., Roberts, N.J., Tian, G.	2021	Uses original data on local market access, profit and waste for marine fish, and presents worldwide case studies and a new transferable framework to assist national authorities and managers to increase food security and improve management of resources	Africa	International Journal of Sustainable Development and Planning	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85118603482&doi=10.18280 %2fijsdp.160514&partnerID= 40&md5=8de383a2e8332ccc b11b5b8ee08d451e
Identifying policy best- practices to support the contribution of aquatic foods to food and nutrition security	Farmery, A.K., White, A., Allison, E.H.	2021	Reviews "best practice" policies to support food security goals from fisheries and aquaculture sectors	Oceania	Foods	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85110649389&doi=10.3390% 2ffoods10071589&partnerID= 40&md5=6323e9b85d27c0cb 462307389f55bb3e
Blind spots in visions of a "blue economy" could undermine the ocean's contribution to eliminating hunger and malnutrition	Farmery, A.K., Allison, E.H., Andrew, N.L., Troell, M., Voyer, M., Campbell, B., Eriksson, H., Fabinyi, M., Song, A.M., Steenbergen, D.	2021	Discusses the "blind spots" of blue food growth - i.e. equitable distribution of benefits - using a food systems approach	Global	One Earth	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85099820428&doi=10.1016% 2fj.oneear.2020.12.002∂ nerID=40&md5=4583647f5c4 abc8163a9f8fb56fd2654
Dietary diversity and fish consumption of mothers and their children in fisher households in Komodo District, eastern Indonesia	Gibson, E., Stacey, N., Sunderland, T.C.H., Adhuri, D.S.	2020	Reports findings from an exploration of the interplaying factors leading to food and nutrition insecurity in three marine-dependent coastal communities in eastern Indonesia	Asia	PLoS ONE	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85082731424&doi=10.1371% 2fjournal.pone.0230777∂ nerID=40&md5=6936afe25ab 66b9b3760905c6c617130

Title	Authors	Year	Topic area/description	Region	Source title	Link
Linking agroecosystems producing farmed seafood with food security and health status to better address the nutritional challenges in Bangladesh	De Roos, B., Roos, N., Mamun, AA., Ahmed, T., Sneddon, A.A., Murray, F., Grieve, E., Little, D.C.	2019	Review connections between aquaculture agroecosystems, local and national fish production, fish consumption patterns and nutrition and health outcomes in Bangladesh. Provides arguments for policies addressing the specific challenges of risk management of coastal communities	Asia	Public Health Nutrition	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85072071281&doi=10.1017% 2fS1368980019002295&partn erID=40&md5=c483b9fa6a54 4fd8111178d7eca6ed32
Relationship between the Russian fishing fleet and domestic ports as the core for performing its state mission	Vasiliev, A.M., Komlichenko, V.V., Lisunova, E.A.	2019	Provides rationale for the implementation of the Food Security Doctrine of the Russian Federation, and describes changes in the activities of the fishing fleet in the Northern fishery basin that were caused by the process	Europe	IOP Conference Series: Earth and Environmental Science	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85071840502&doi=10.1088% 2f1755- 1315%2f302%2f1%2f012141 &partnerID=40&md5=60561c 32e82a540d55591603400d6a 91
Operationalising access to oceanic fisheries resources by small-scale fishers to improve food security in the Pacific Islands	Bell, J.D., Albert, J., Amos, G., Arthur, C., Blanc, M., Bromhead, D., Heron, S.F., Hobday, A.J., Hunt, A., Itano, D., James, P.A.S., Lehodey, P., Liu, G., Nicol, S., Potemra, J., Reygondeau, G., Rubani, J., Scutt Phillips, J., Senina, I., Sokimi, W.	2018	Looks at the use of nearshore fish aggregating devices (FADs) in the Pacific in improving small-scale fishers catch takings of tuna and other large pelagic fish and pinpointing locations where FADs are likely to make the greatest contributions to nutrition of coastal communities	Oceania	Marine Policy	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85034617877&doi=10.1016% 2fj.marpol.2017.11.008∂ nerID=40&md5=91173b82aa 0872595d851e6ab2930fd2
How can climate predictions improve sustainability of coastal fisheries in Pacific Small-Island Developing States?	Dunstan, P.K., Moore, B.R., Bell, J.D., Holbrook, N.J., Oliver, E.C.J., Risbey, J., Foster, S.D., Hanich, Q., Hobday, A.J., Bennett, N.J.	2018	Describes how climate predictions can be used to make decisions on short time scales that should be of direct benefit to sustainable management of small-scale fisheries, contributing to livelihoods and food security	Oceania	Marine Policy	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85030715702&doi=10.1016% 2fj.marpol.2017.09.033∂ nerID=40&md5=de8b8d1e79 6f5423a18ae823a7f3ec26

Title	Authors	Year	Topic area/description	Region	Source title	Link
The role of fish and fisheries in recovering from natural hazards: Lessons learned from Vanuatu	Eriksson, H., Albert, J., Albert, S., Warren, R., Pakoa, K., Andrew, N.	2017	Seeks to better understand the role of fish for Pacific Island communities during disasters and in disaster recovery by evaluating community impacts and responses after natural disasters in Vanuatu	Oceania	Environmental Science and Policy	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85021307320&doi=10.1016% 2fj.envsci.2017.06.012&partn erID=40&md5=4e7c14dab0d9 5a1f782f13b0deb522c0
Fisheries, food, and health in the USA: The importance of aligning fisheries and health policies	Love, D.C., Pinto da Silva, P., Olson, J., Fry, J.P., Clay, P.M.	2017	Looks at how aligning fisheries and health policies contributes to improving food security in the United States	North America	Agriculture and Food Security	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 85019980685&doi=10.1186% 2fs40066-017-0093- 9&partnerID=40&md5=f2c43 1d2d12ffa1a82d57428923e30 6f
Fishery management, development and food security in the Western and Central Pacific in the context of climate change	Weng, K.C., Glazier, E., Nicol, S.J., Hobday, A.J.	2015	Review on the context of fishery development in the (WCPO), and the importance of regional capacity building to ensure that PICs are poised to respond to the coming challenges of climate change, food security and economic development	Oceania	Deep-Sea Research Part II: Topical Studies in Oceanography	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 84924326221&doi=10.1016% 2fj.dsr2.2014.10.025&partner ID=40&md5=0cfa2e90b61a57 d2674a1e2586bf46fd
Alternative policies to agricultural export taxes that are less market distorting	Liefert, W.M., Westcott, P.C.	2015	Examines the market effects of a conventional export tax, as well as three alternative policies that are less market distorting that aims to purse food security	North America	U.S. Agricultural Exports: Trade and Tax Issues	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 84955073472&partnerID=40 &md5=29a6325dd93e10637f e4a97633a749c1

Title	Authors	Year	Topic area/description	Region	Source title	Link
Diversifying the use of tuna to improve food security and public health in Pacific Island countries and territories	Authors Bell, J.D., Allain, V., Allison, E.H., Andréfouët, S., Andrew, N.L., Batty, M.J., Blanc, M., Dambacher, J.M., Hampton, J., Hanich, Q., Harley, S., Lorrain, A., McCoy, M., McTurk, N., Nicol S. Pilling G. Point	2015	Looks at the gap in domestic supply of tuna in PICs needed for food and nutrition security in the WCPO	Region Oceania	Source title Marine Policy	https://www.scopus.com/inw ard/record.uri?eid=2-s2.0- 84909606160&doi=10.1016% 2fj.marpol.2014.10.005∂ nerID=40&md5=fa1214bb3ba ac80c36931ba09988911c
	D., Sharp, M.K., Vivili, P., Williams, P.					

* The Scopus literature reviewed was carried out using the search terms: "fisheries policy" AND "improve" AND "food security" OR "nutrition security" over the time period of 10 years to 2021. The search yielded 62 results, of which 13 were deemed relevant (as shown in Table 3). The relevant articles formed the basis for snowball sampling on additional literature that are referenced in the reference list but not included in the table above.

Annex 3: Stakeholders who participated in the study

Name	Position	Organisation	Country	Sector
Ms Fiona Hill	Senior Fisheries Manager for International Tuna	AFMA	Australia	Fisheries Administration
Ms Kate Martin	Tropical Tuna Officer	AFMA	Australia	Fisheries Administration
Mr Mat Kertesz	Assistant Director, Regional Fisheries	DAWE	Australia	Fisheries Policy
Ms Alexis Wolfgramm	Senior Fisheries Officer	MMR	Cook Islands	Fisheries Administration
Mr Youky Susaia Jr	Acting Director	NORMA	FSM	Fisheries Administration
Mr Jamel James	Acting Assisting Director	NORMA	FSM	Fisheries Administration
Ms Angie Tretnoff	Senior Economist	NORMA	FSM	Fisheries Administration
Ms Fangie Poll	Assistant Economist	NORMA	FSM	Fisheries Administration
Dr Tooreka Temari	Head of Coastal Fisheries	MFMRD	Kiribati	Fisheries Administration
Ms Tereere Tioti	Licensing and Compliance	MFMRD	Kiribati	Fisheries Administration
Ms Berry Muller	Deputy Director for Oceanic	MIMRA	RMI	Fisheries Administration
Mr Beau Bigler	Chief Fisheries Officer (Oceanic)	MIMRA	RMI	Fisheries Administration
Ms Lyla Lemari	Competent Authority Officer	MIMRA	RMI	Fisheries Administration
Ms Jasmina Jones	Legal Officer	NFMRA	Nauru	Fisheries Administration
Mr Lui Bell Jr	Senior Fisheries Officer	MAF	Samoa	Fisheries Administration
Mr Eddie Honiwala	Director for Offshore Fisheries	MFMR	Solomon Islands	Fisheries Administration
Mr Feleti Tulafono	Director	FMA	Tokelau	Fisheries Administration
Mr Stan Crothers	Fisheries Advisor	FMA	Tokelau	Fisheries Administration
Ms Lesley Gould	Fisheries Technical Advisor	FMA	Tokelau	Fisheries Administration
Dr Tuikolongahau Halafihi	Chief Executive Officer	Fisheries Ministry	Tonga	Fisheries Administration
Mr Siola'a Malimali	Fisheries Scientist	Fisheries Ministry	Tonga	Fisheries Administration
Mr Tala Simeti	Fisheries Economist	TFD	Tuvalu	Fisheries Administration
Mr Moses Amos	Director General	MALFFB	Vanuatu	Fisheries Administration
Mr Gerry Katai	Fisheries Manager	NFA	PNG	Fisheries Administration

Table 4: List of stakeholders that participated in the study

Policy Options to Increase the Contribution of Tuna Fisheries to National Food Security

Name	Position	Organisation	Country	Sector
Mr Benthly Sabub	Fisheries Manager	NFA	PNG	Fisheries Administration
Mr Noan Pakop	Fisheries Manager	NFA	PNG	Fisheries Administration
Mr Thomas Usu	Fisheries Manager	NFA	PNG	Fisheries Administration
Mr Maurice Brownjohn	Commercial Manager	PNAO	RMI	Regional secretariat
Mr Ian Bertram	Principal Fisheries Adviser (Coastal)	SPC	New Caledonia	Regional secretariat
Mr William Sokimi	Fisheries Development Officer (Coastal)	SPC	New Caledonia	Regional secretariat
Mr Watisoni Lalavanua	Community Based Fisheries Management Officer (Coastal)	SPC	New Caledonia	Regional secretariat
Mr Phil Roberts	Managing Director	TriMarine	Singapore	Industry
Mr Ray Clarke	Vice President of Environmental Development and Government Affairs	South Pacific Tuna Corporation	United States	Industry
Mr Fong Lee	Sustainability Manager	FCF	Taiwan	Industry
Mr Harry Chen	Project Manager	FCF	Taiwan	Industry
Mr Donald Papaol	Executive Manager	Fishing Industry Association (PNG)	PNG	Industry
Mr Anare Raiwalui	Executive Officer	Fiji Fishing Industry Association	Fiji	Industry
Mr XueJun Du	Managing Director	Golden Ocean Fish	Fiji	Industry
Ms Radika Kumar	General Manager	Solander Pacific	Fiji	Industry
Dr Anna Farmery	Postdoctoral Research Fellow at ANCORS	University of Wollongong	Australia	Research
Mr Chris Bourne	Accredited trainer (micro- canning)	Foodstream	Australia	Technical expert

Annex 4: Challenges to food security in the Pacific

Climate change and natural disasters

The impacts on terrestrial and marine ecosystems from climate change and natural disasters were universally perceived as the greatest threat to food security among FFA member countries consulted. More frequent incidents of drought, water scarcity and high alkalinity in soil have made it difficult for a number of countries to sustain crop growth and other means to food security. Atoll countries and those without supply of fresh water from rivers are particularly vulnerable as they are dependent on rainfall for subsistence farming and human consumption. In Nauru, La Niña events often result in extended droughts, which can last up to a period of 36 months, due to the delayed onset of the wet season and drier than normal wet seasons (MCIE 2014). During extended drought events, severe water shortages can mean the community are required to wait for weeks before they receive water delivered by truck. This requires extreme water conservation by locals and often leads to the use of brackish water from the inland lagoon for everything other than consumption. However, contaminants in the brackish water can be transferred onto food items like vegetables during washing, which has an impact on food safety and human health.

At the same time, changes in the distribution and availability of regional fish stocks associated with longer-term climate change have been highlighted by many FFA members as a key concern to food security. Under climate scenario projections to 2080, all FFA members in the Southern Longline fishery are expected to experience a decrease in South Pacific Albacore stocks in their EEZs, with Tonga, Niue, Fiji, Vanuatu, the Cook Islands, Tokelau and Tuvalu being some of the worst affected (Chang et al. 2021). For tropical tunas – i.e. skipjack, yellowfin and bigeye tunas – FFA members in the western part of the Pacific are projected to be most negatively impacted under climate change scenarios to 2050, as the distribution of tunas is expected shift to the east of the Pacific Ocean (Bell et al. 2021). The shift in migration of tuna stocks will impact FFA members not only in terms of future food security and livelihoods of actors in the domestic fisheries sector, but also income security at the national level as licence revenue makes up a large percentage of government revenue (Bell et al. 2021).

In addition to influencing the distribution and migration of tuna stocks, climate change is transforming coral reefs, threatening the future supply of essential dietary nutrients from small-scale fisheries, and thus food security, in PICs. Even for Tokelau, a unique case in the Pacific where no present challenges to food security were identified, climate change was highlighted as the biggest foreseeable threat to future food security. Ecosystem changes have already been witnessed for the inshore coastal zones, including ocean acidification and coral bleaching (COP23⁴⁰).

Finally, food security in small island developing states (SIDS) is often threatened by disaster events, such as tsunamis, volcanic activities and cyclones, the latter of which are predicted to increase in intensity as a result of ongoing anthropogenic global warming (Knutson et al., 2010). In addition to damages to crops and farming production associate with cyclones, a number of FFA members are also subject to volcanic activities and earthquakes, including Solomon Islands, PNG, Fiji, Vanuatu and Tonga, which not only causes displacement of people and food production, but also risks tsunamis and hazards related to volcanic ash. This is evident in the recent volcano eruption in Tonga, which displaced many of the small-scale fishers and significantly reduced the supply of fish and other produce available on the local market, among other devastating impacts.

⁴⁰ https://cop23.com.fj/tokelau/

Depleted coastal fisheries and increased reliance on FADs

The traditional customs for reef fish consumption, coupled with population growth in urban areas, has meant that depleted reef fish stocks are a problem common to many FFA member countries (Veitayaki and Ledua 2016; UN Press 2005; European Commission 2005). To combat the disparity in fish supply between outer islands of RMI where reef stocks remain abundant, and high demand in urban areas where stocks are under stronger fishing pressure, the Marshall Islands Marine Resources Authority (MIMRA) has set up vessel transport to collect reef fish caught on outer islands for distribution and sale in Majuro and Kwajalein Atoll. This took place around 4-5 times a month prior to the pandemic.

While anchored and drifting FADs have offered some relief to coastal reefs and provide local fishers with alternative means of catch, the increased reliance on FADs was mentioned as a potential challenge to food security in some instances. For example, local fishers in the Solomon Islands have traditionally fished on free school tuna but have now predominantly switched to FAD fishing. This has the risk of discontinuing knowledge on traditional fishing methods being passed down, which can reduce future food security if lost FADs are not replaced in a timely manner.

Rising costs of imports and fishing

Global uncertainties and the economic impact of the COVID-19 pandemic has seen the cost of living in all FFA member countries consulted rise across the board. This extends from imported foods to fuel and the cost of equipment and gear. Much of the increase in the price of imported commodities can be attributed to increases in shipping cost, which rose more than 6.5 fold between December 2019 and the peak in September 2021 due to global supply chain disruptions (see Figure 4, Statistica 2022⁴¹). Since then, average shipping rates have fallen, but remain higher than pre-June 2021 levels. PICs, in particular, have been hit hard by disruptions in the supply chain with many of the trade routes scaled back, rerouted, or ceased (Pacific Trade Invest Australia 2021). With global supply chains not expected to stabilise until the first half of 2024, PICs are likely to continue to face challenges to imports and trade in the short to medium term (Carl Mark Advisors 2022).



Figure 4: Global container freight rate index from January 2019 to May 2022. Source: Statistica41

⁴¹ Statistica, Global container freight rate index from January 2019 to May 2022, accessed 12 July 2022, available at <u>https://www.statista.com/statistics/1250636/global-container-freight-index/</u>. The source tracks the freight costs of 40-inch

Notwithstanding the overall rising cost to imports, fuel remains the biggest driver behind the increase in fishing expenses cited across the FFA membership, with prices almost doubling in places like Nauru – from AU\$1.15-1.20/ltr prior to the pandemic, to around AU\$2.20/ltr in 2022. This has, in part, translated to an increase in tuna price on the local market from AU\$7-8/kg to AU\$12-15/kg over the same period.

On a more general note, operating costs are reported to be on average higher for local commercial fishing fleets in PICs compared to that operated by distant water fishing nations (DWFNs), irrespective of the flag state. This is owing to higher costs for labour and imported equipment and materials, even prior to the pandemic, as well as lower productivity and economies of scale. The Fijian commercial longline industry, who contributes a minimum of 2,000 MT of fresh pelagic fish to the domestic market annually, reported an increase of 130% in duty-free fuel prices over the course of one year – from US\$650/MT in 2021 to almost US\$1,500 in 2022. This is in conjunction with a 45% increase in the price of bait, from US\$1,190/MT to US\$1,600/MT, and 50% increase in imported gear and 35% increase in cost of local supply. The implication of the stark increases in key operating expense items such as fuel, (which used to account for 40% of operating costs for longline vessels, but now constitutes around 60-65% of total cost) is that a number of vessels are tying up from operating. For artisanal fishers, the rising costs of operations is likely to be even more heavily felt as they usually do not have access to bulk or wholesale prices on fuel, bait, gear and other supplies.

Reliance on imports and changes to traditional customs/diets

For many FFA member countries, traditional diets of fish, coconuts and root vegetables (e.g. cassava, taro, breadfruit and sweet potato) have been replaced by imports of rice, canned meats, instance noodles, cereals, confectionary and sweetened drinks (Charlton et al. 2016, Bell and Taylor 2015). The heavy reliance on imported foods poses a threat to not only food and nutrition security but also self-sufficiency. Supply chain disruptions seen during the COVID pandemic have seen shortages on essential items in Nauru, for example, including rice and other staples.

Another challenge to food security arising from changes to traditional customs is the way food is shared. For example, in Tokelau where the economy is largely based on subsistence agriculture and fishing, food is shared within the community and there is little use for market exchanges or money (Foster et al. 2018). However, for countries like Tuvalu, the traditional sharing of catch is being eroded in urban areas like Funafuti. While communities on outer islands still abide by traditional customs of sharing fish, the main atoll where majority of the population resides operates on the market system in which everything needs to be paid for. The limited supply of fish, along with increasing prices on all consumer goods in recent years, have meant that not everyone has adequate access to fish.

In countries like Samoa, which received WST\$606 million in foreign remittances in 2021 – equivalent to 28% of Gross National Income (SBS 2021⁴²), incentives to carry out traditional farm or food production practices have diminished over time. Having alternative sources of income, coupled with limited farming and harvesting capacity, has meant that the general population relies heavily on imported goods and have little self-sufficiency when it comes to food security. This is also the case with a number of other FFA countries that have affiliations or trade routes with larger countries like the US, Australia and New Zealand.

The shift towards western diet is especially evident in some of the northern FFA member countries, but also the Cook Islands. In RMI, the preference for imported and processed foods poses serious challenges to nutrition security, even though food security was not identified as a main issue at the

containers via eight major routes, including spot rates and short-term contract rates. The values are an average of the five business days of the last full week in each month.

⁴² Samoa Bureau of Statistics, National Accounts Aggregates Annual Analysis 2021, <u>https://www.sbs.gov.ws/economics</u>

present time. The availability of junk food, sugar drinks and alcohol, in particular, can compromise health and nutrition when prioritised over healthy alternatives like fish and vegetables. A final note in the shift from traditional customs and lifestyle is the issue of emigration which was raised during consultations with the National Oceanic Resource Management Authority (NORMA) in FSM. The increased departure of people to the US in seek of better opportunities, especially since the start of the pandemic, is a key limitation to the domestic labour force available to meet development aspirations in increasing tuna production for local consumption.

Supply chain challenges: storage and logistics

For PICs, cold chains and logistics have always faced its own set of challenges. Transportation between islands or regions was raised as a key impediment to food security for a number of FFA members. The issue tends to be between outer islands or key ports, where fish stocks/supply are more abundant, and populous urban centres where demand for fish is higher than supply. This is the case with south Tarawa in Kiribati and Rarotonga in Cook Islands. In PNG, transportation between key fishing ports (e.g. Lae and Madang) and urban areas (i.e. Port Moresby), as well as the central highlands remains a challenge. Countries like RMI have in place ministry-facilitated fish transportation as discussed in section 3.1.5, while others rely on public or privately-run passenger vessels to move eskies of fish between islands and town centres, as is done in the Solomon Islands. In the Cook Islands, inter-island transport is run by one company, but services are irregular and vessels have run aground on many occasions causing prolonged disruptions. The transportation issue in the Cook Islands was further exacerbated during the COVID-19 pandemic, as inter-island flights were also reduced. The lack of reliable inter-island transport in the Cook Islands mean that there is limited competition for tuna supply on the more populous island of Rarotonga. Improved logistics between islands would provide more opportunities to source fish from fishers in coastal communities outside urban centres, which not only improves food security but also the livelihoods of artisanal fishers.

Maintaining cold storage is the other key supply chain challenge for many FFA members, and this is often highlighted in conjunction with other factors. For example, the Ministry of Fisheries & Marine Resource Development (MFMRD) in Kiribati attributed difficulties in maintaining the cold chain for local fishers supplying Tarawa to the high cost of ice. While there have been initiatives in setting up solar powered cold storage and ice machines, it has come with its own set of challenges such as frequent breakdowns and the need for imported parts and specialist technicians to service the machines.

In other FFA member countries like the Solomon Islands, land rights and related issues have often undermined efforts to build large cold storage facilities and logistical networks. For the Cook Islands, ice machine and blast freezer facilities at harbours have been constrained by power issues in the past. With the implementation of reliable solar power supply on many islands, the only constraint for cold storage installation now is the lack of available funding. For the islands with installed freezers, the availability of cold storage has helped support small-scale fishers to expand operations into value-added products like frozen fillets that are transported to Rarotonga on the intermittent barges operating.

Lack of cold storage facilities is especially accentuated for countries experiencing high seasonality in fishing. For example, the limited deep freezer facilities in Samoa makes it difficult for Alia fishers to store fish for extended periods of time. As a result, supply of tuna in Samoa is highly dependent on seasonality and the locally-based foreign longline fleet.

Finally, port infrastructure was another key challenge to food security highlighted during the stakeholder consultations. For countries like Nauru, Samoa and the Cook Islands, the absence of a suitable port to receive fish from commercial (purse seine) fleets is one of the key factors limiting supply of tuna and other pelagic species on the domestic market.

Food safety

Challenges in cold chains are often associated with food safety concerns. In countries where there is insufficient cold storage, or low fish handling awareness, consumer health is at risk from poorly stored fish. Tuna and other pelagic species, including mackerels, bonito, mahi mahi, swordfish and marlins, are susceptible to Scombroid or histamine food poisoning which is caused by bacterial enzyme activity in dead fish (QLD government 2021⁴³). There has been accounts of the syndrome reported in local hospitals in Solomon Islands, however, it is generally considered an underreported form of food poisoning (Farmery et al. 2020).

The lack of cold storage or the high cost of ice can often lead to local fishers in many FFA countries selling fish either unchilled, over the counter or hung from fish trees/skirts, or placing the fish next to bags of unopened ice. The latter is usually done to preserve or extend the useful life of the ice, but the practice leads to the fish not being properly chilled and continue to deteriorate in quality. Moreover, fishers can often continue to sell fish well after it's no longer safe for human consumption, even if ice is correctly used for storage. Fisheries administrations in various FFA member countries have confirmed consumer complaints or reports of food poisoning made to them from poorly kept fish purchased on the local market.

In countries where bycatch and small reject tunas enters the market from purse seine transshipment operations, food safety concerns are particularly an issue as the quality and handling of these fish are often compromised. Insights from industry representatives have identified the long duration of fish left on the wet deck of purse seine vessels during the transshipment process, which can take several hours, as the primary cause for the poor quality because there is no distinction in well storage or treatment of bycatch and targeted tuna species when the fish is first caught. Organised and timely transport of the fish to local cold storage facilities can mitigate food safety risks identified for fish coming from transshipment operations.

Fisheries compliance and monitoring capacity

The last major challenge identified for food security in the Pacific is sustainability of vulnerable coastal fisheries due to non-compliance. Many FFA countries have regulations in place to restrict coastal fishing alongside the programs that encourage fishing on pelagic species, such as the FAD deployment program. However, regulations on coastal fisheries have not always been met by compliance from local fishers, and this was a problem reported by several FFA member countries interviewed. The vast coastlines and low levels of enforcement and resource capacity, especially in areas without Community-based management (CBM) regimes, can mean that non-compliance often goes undetected. In light of rising fuel costs, non-compliance for coastal fisheries could be further exacerbated as it is usually cheaper to fish closer to shore for motorised vessels.

Related to the issue of resource capacity is also the challenge of monitoring and evaluation. For example, NORMA raised the lack of capacity to evaluate policy effectiveness post implementation as a key challenge to the better utilisation of policies/strategies to improve food security from tuna products.

⁴³ <u>https://www.qld.gov.au/health/staying-healthy/food-pantry/food-safety-for-consumers/food-warnings-and-advice/seafood/scrombroid-histamine-food-poisioning</u>

Annex 5: Drivers and barriers to tuna consumption in the Pacific

Availability of tuna

One of the biggest barriers to higher tuna consumption in the FFA member countries consulted is the availability of tuna. The problem is generally more acute for countries which are not members of the Parties of the Nauru Agreement (PNA), but there are exceptions. In countries like Samoa and Tonga, where are no reported barriers to consumer preference or logistics and supply chains, the biggest limiting factor to tuna consumption is supply. A combination of seasonality and capacity constraints mean that the domestic fleets struggle to close the gap between local demand and supply. Moreover, despite mandatory unloading requirements by locally based foreign longline (LB FLL) fleets in Samoa, Tonga and Vanuatu demand for tuna outstrips supply.

While most PNA countries have sufficient supply of tuna bycatch from transshipment operations, where domestic consumption is limited by demand or preference, Nauru stands as an exception. Given the absence of a sheltered port for transhipment or landing, tuna supply in Nauru is limited to that supplied by local fishers who employ trolling to catch pelagic species. Declining catch rates influenced by commercial fishing and climate variability, as well as interference by resident dolphins in the area, have meant that it is becoming increasingly difficult for local fishers to supply the domestic market.

For countries with domestically based canneries, such as PNG, Solomon Islands and Fiji, availability of tuna on the local market is enhanced through the distribution of canned fish. Bell et al. (2016) estimated a total of 8,900 MT of canned tuna, or 24,000 MT of whole fish equivalent entering the local market across the three countries.

Affordability of tuna

Price is often quoted as the other key deterrent to domestic tuna consumption. While most FFA countries participating in the study did not indicate a price difference between pelagic species and reef fish sold on the local market, prices for tuna caught by small-scale fishers are usually observed to be higher than tuna and bycatch coming from commercial vessels or other imported proteins. This is owing to the fact that the tuna caught by small-scale fishers tends to be fresher and of better quality compared to bycatch from commercial vessels, especially those from transshipment operations (Table 5).

Location	Price of local (fresh) tuna	Price of tuna from commercial fleets	Price of chicken
Tarawa ⁴⁴	AU\$4/kg (US\$2.88/kg)	AU\$1/kg (US\$0.72/kg)	
Funafuti	AU\$4-5/kg (US\$2.88-3.60/kg)	Free/traded for goods	
Majuro	~US\$30/kg for tuna steak, or US\$5.50-6.05/kg for whole fish	Traded for goods	US\$1.49/lbs or \$3.30/kg
Nuku'alofa	PT\$10-25/kg (US\$4.40-11/kg)	PT\$7/kg (~US\$3/kg)	
Efate Island	VUV\$800/kg (~US\$8/kg)	VUV\$500/kg (~US\$5/kg) for frozen tuna sticks	
Apia ⁴⁵	WST\$17.65-29.40 (US\$ 6.80-11.30/kg)	WST\$10/kg (~US\$3.80/kg)	
Rarotonga ⁴⁶	NZ\$30-50/kg (~US\$20-34/kg)	NZ\$30-50/kg (~US\$20-34/kg)	NZ\$12/g (~US\$8.20/kg)

Table 5: Comparison of price for tuna and other proteins (proxied by chicken) in selected FFA member countries*

⁴⁴ Conversion based on medium term average exchange rate of 1 AUD = 0.72 USD

⁴⁵ Conversion based on medium term average exchange rate of 1 WST = 0.385 USD

⁴⁶ Conversion based on medium term average exchange rate of 1 AUD = 0.68 USD

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Location	Price of local (fresh) tuna	Price of tuna from commercial fleets	Price of chicken
Suva ⁴⁷	FJ\$12-17/kg (~US\$5.64-8.33/kg)	FJ\$8/kg (US\$3.76)	FJ\$10/kg (US\$4.70/kg)
Lae ⁴⁸	PGK\$12-20/kg (~US\$3.50-5.80/kg)	PGK\$1.35-3.35/kg (US\$0.40-1.00/kg)	PGK\$20-27/kg (US\$5.80-7.75/kg)
Nauru	AU\$12-15/kg (US\$8.65-10.80/kg)	Not available	AU\$5.25/kg (US\$3.78/kg)

* Price of local (fresh) tuna refers to that charged for catch from domestic fishing operators, who are generally small-scale or artisanal with the exception of Fiji and the Cook Islands. The variation in the price of tuna from commercial fleets comes from differences in both species and method of catch. For purse seine transshipment ports (i.e. Tarawa, Funafuti, Majuro and PNG ports), the price of tuna/bycatch from commercial fleets refers to those frozen in brine. For Nuku'alofa, Apia, Suva and areas around Port Vila in Vanuatu, prices reflect blast frozen bycatch or small tunas caught by longline operators. Prices for both fresh and in-brine tuna in PNG are based on small skipjacks ~1.5-2.5kgs.

Competition also influences affordability, with tuna price typically being higher in countries without transshipments or landings from foreign commercial fleets. For example, in the Cook Islands, the price of tuna has increased to NZ\$30-50/kg (~US\$20-34/kg), driven in part by rising operating cost for the domestic longline operator under the 50nm Marae Moana exclusion zone to commercial fishing, as well as the lack of competition due to intermittent transport of artisanal landings from outer islands. The option to export premium tuna to New Zealand also plays into the increased cost of the local tuna supply.

Collusion among local fishers was also reported in a couple of instances by FFA members where domestic supply or external competition is limited. Local fishers may intentionally control or limit tuna and fish supply for one of two reasons: 1) to maintain high prices for their catch, and 2) to ensure that all fish are sold at the end of the day. While collusion can improve revenues for local fishers, collusive behaviour is not conducive to improving domestic food security from marine resources.

Storage and shelf life

Without proper cold storage, the quality of fresh tuna and other pelagic species caught by local fishing operators can be maintained for around 4 days on ice. The absence of longer term cold storage facilities means that supply can be 'lumpy' because fishers are forced to market catches before they spoil, and also means that fish markets can only be set up close to coastal areas, limiting distribution of fish to inland provinces and communities. Poor storage poses health risks to consumers without good knowledge on how to identify fish freshness and can influence demand.

Technology

Technology, especially in terms of social media platforms that connect people, has been identified as a key driver for tuna consumption. In FSM, artisanal and game fishers have taken an entrepreneur approach to advertising their catch through the use of Facebook Marketplace. The online platform has helped connect buyers with fishers and improve access to fish beyond the local markets. The availability of alternative advertising platforms has also meant that fishers no longer need to bring their catch to markets in urban areas but set up markets in their own villages out of town for people to visit. This has facilitated the growth in access to fish for rural communities nearby. The only drawback to the development of technology is issues created around licensing. In FSM, fishers are

⁴⁷ Bycatch and small tunas from the domestic commercial longline industry, which constitutes around 10% of total catch, is sold to wholesalers at an average price of FJ\$3-4/kg (US\$1.41-1.88/kg) pre-pandemic and FJ\$5-6/kg (US\$2.35-2.82/kg) currently – retail prices have on average a 30% mark up. USD conversions are based on an average exchange rate of 0.47 FJD/USD

⁴⁸ Conversion based on medium term average exchange rate of 1 PGK = 0.29 USD
required to have a licence to sell fish but platforms like Facebook Marketplace are not officially monitored and bypasses the licence requirements to sell fish.

Consumer preference

Consumer preference varied greatly across FFA member countries interviewed, including preferences for pelagic species versus reef fish, fresh tuna versus frozen-in-brine or canned tuna, or other imported proteins. A number of countries reported an aversion to tuna in brine from purse seine operations. For example, in RMI locals reportedly only paddle out at the beginning of transshipments to barter for bycatch and tuna because purse seine vessels tend to fish their last set/s close to port, and the fish from that set would normally sit on top of the wells instead of deep in the wells like the earlier sets. As such, the catch from the last set is usually not frozen in the brine water.

Similarly, in Tuvalu there is no enforcement from the fisheries agency to prevent locals with a boat from paddling out to transshipping vessels to ask for fish, and local stevedores are often given 10 sacks of fish per day as a perk of their job. However, no tuna in brine are sold on the local market with fish from transshipment usually shared with friends and families, with the excess used as bait.

In other countries like Kiribati, consumer preference against tuna in brine is not a key deterrent. While some people prefer reef fish or fresh tuna, the local population are happy to consume whatever fish that's available. Tuna is a key product consumed in Kiribati and people know many ways of preparing tuna to eat.

In general, bias against fresh tuna is less evident. Larger pelagics such as yellowfin, bigeye, and other gamefish species such as swordfish and mahi mahi, are particularly popular for special events – e.g. birthdays, Christmas, church events. Traditional recipes for raw tuna in coconut milk also exist across the FFA membership under different names – for example, Oka I'a in Samoa, Ota'ika in Tonga, Kokoda in Fiji, Solomon Islands and PNG, coconut fish in Nauru and Ika Mata in the Cook Islands. Similarly, variations of tuna poke recipes can be found in many northern FFA member countries like Palau, FSM and RMI. Nevertheless, there are countries who report a stronger consumer preference for reef fish compared to tuna (e.g. RMI, Solomon Islands and Vanuatu).

The availability of other foods, especially in FFA member countries with stronger trade routes with the US, Australia and New Zealand, also has an impact on consumer preference for tuna consumption. For example, in RMI demand is influenced by the availability and price of other foods including imported chicken and canned tuna, which are comparatively cheaper than whole tuna sold in eskies at petrol stations, or tuna steaks available in supermarkets. For example, a large can of tuna (6.5 oz) from the US sells for US\$2.00 in the local supermarkets, which can feed a family of 2-3 when eaten with rice. Meanwhile, one piece of tuna steak would cost US\$3-4 in the same supermarket and is only enough for 1 or 2 people.

The trend in consumer preference for other imported proteins is also evident in other FFA countries. Even for a small country like Tokelau, there has been a shift towards preference for imported chicken and other meats among the younger generation. In Kiribati, chicken is often preferred over fresh tuna due to the difference in relative unit cost between the two proteins.

A final factor influencing consumer preference is convenience. As previously mentioned, whole tunas caught by local fishers are available in RMI at local petrol stations. However, locals are often deterred from purchasing whole fish because of the process required to transport the fish home, which can leave odours in the car, and prepare a large fish that is often not all consumed in one sitting. The hassle of handling whole fish leaves many everyday consumers in RMI opting for more ready-to-eat products like poke bowls or canned tuna from the supermarkets. Similar trends are also witnessed in countries like Samoa, where fried tuna and chips options have become a popular avenue for the Alia fishers to sell their catch more quickly.

Annex 6: Nutritional profiles of tuna and pelagic species

While the Regional Roadmap for Sustainable Pacific Fisheries envisages that an increase in the supply of tuna for domestic consumption of 40,000 tonnes across the region by 2024 would improve food security, it should be understood that i) food security can only be achieved by meeting the nutritional requirements of individuals and ii) not all fish are nutritionally equal. Accordingly, the consumption of certain species can lead to greater nutritional benefit to the end consumer. For example, pelagic fish are generally higher in protein, selenium, and omega 3s when compared to the same edible portion weight of coral reef fish, chicken (breast), pork (ground), or beef (ribeye) (Robinson et al., 2022). Moreover, the consumption of certain fish may assist in combating the high prevalence of obesity and non-communicable diseases across Pacific nations, such as heart disease and diabetes. Below we show the relative nutritional composition of the most common tuna and tuna bycatch species landed in Pacific tuna fisheries which contribute to food security (species based on Tolvanen et al., 2019, 2021; Figure 5).



Figure 5: Bayesian predicted median micronutrient concentrations of common tuna and tuna bycatch species caught by Pacific tuna fisheries (+/- 95% uncertainty intervals). The red, dashed line represents the commonly cited average protein composition of fish consumed among Pacific nations (Bell et al., 2009). The blue dashed lines show the average concentration of each macronutrient among the species plotted. Data source: Fishbase nutrient analysis tool based on the model of Hicks et al., 2019.

From Figure 5, it is evident that by optimising individuals' diets based on the nutritional composition of consumed species rather than the weight of consumption, a smaller quantity of fish would be required to obtain the same nutritional outcomes. Elevated levels of protein in bigeye, albacore, yellowfin, skipjack, wahoo, frigate tuna, and mackerel scad compared to the commonly cited average of 20% protein composition across the diverse suite of fish consumed in Pacific nations (e.g.,

Bell et al., 2009), is a case in point. By consuming only these high-protein species (i.e., bigeye, albacore, yellowfin, skipjack, wahoo, frigate tuna, and mackerel scad), Pacific nations could reduce the required weight of fish by 2-4%, while achieving similar levels of protein consumption evident in average species composition Pacific Islander diets. While this is obviously not likely to be practical, even if bigeye, albacore, yellowfin, skipjack, wahoo, frigate tuna, and mackerel scad were to comprise 70% of the total weight of fish consumed, this has the potential to reduce the weight of fish required by 1.4% - 2.8% while achieving similar levels of protein intake across the population. This is particularly relevant for communities of inland PNG which suffer from high rates of protein-energy malnutrition (Charlton et al., 2016) that may be alleviated in-part through greater access to fish rich in protein, such as tuna.

Protein intake levels in other PICs are currently considered sufficient to meet the nutritional requirements of individuals (Charlton et al., 2016). Nevertheless, by considering the nutritional composition of consumed species, PICs have the potential to reduce the weight of fish required to be retained to achieve future food security for their burgeoning populations, while simultaneously optimising patterns of domestic fish consumption according to the nutritional deficits evident in the respective population. For example, improved access to fish high in iodine may assist in lowering the high prevalence of iodine deficiency among PICs such as Fiji, PNG, and Vanuatu (FAO, 2003a, b; Li et al., 2009; Charlton et al., 2016).

The relevant questions for each Pacific nation are therefore:

- 1) what nutritional deficiencies need to be improved to achieve future food security?
- 2) Is the supply of species rich in the critical micronutrients required to improve food security sufficient to allow for a reduction in the total weight of fish required? Or is it more appropriate to retain a larger quantity of less nutritious species?
- 3) Will the increased consumption of species rich in critical micronutrients, or fish more generally, be economically and logistically feasible for the population? (e.g., origin, access, taste, price)

Most PNA countries have sufficient supply of tuna and tuna bycatch from transshipment, albeit their consumption is limited by consumer preference/demand and the lack of adequate infrastructure to transport this catch throughout the country, including to areas where the dependence on fish for protein is particularly high (e.g., where farming is not viable and to rural areas where there are limited alternative sources of protein, such an imported meats; Bell et al., 2009; Cinner, 2005). If these issues can be overcome, it appears that PNA countries have the greatest potential to benefit from considering the nutritional value of consumed fish species rather than just the weight of consumption, when designing programmes and policies aimed at ensuring future food security. On the other hand, despite mandated landing requirements evident in some non-PNA countries, interviewed respondents generally reported that the domestic demand for tuna outstrips supply. Increasing the supply of highly nutritious tuna may therefore be less feasible in non-PNA countries and a weight-of-consumption approach across a diverse suite of species may be better suited to achieving food security while also allowing for the majority of the valuable tuna resources to be exported.