POLICY BRIEF
21/2014
Secretariat of the Pacific Community

Adding value to fish processing by-products

Fish processing is an important activity in the Pacific, but it generates a lot of by-products that are not used in a way that maximises their economic potential.

There is opportunity to turn fish processing by-products into food, fish meal, fertiliser, pharmaceutical and other marketable products.

The problem is that fish processors operate to extract the most value from their primary products, with little attention being dedicated to extracting value from by-products. This results in missed economic return from this secondary resource due to under-investment in technologies that add value to by-products. In addition to this missed opportunity, disposal of by-products often has a direct financial and environmental cost.

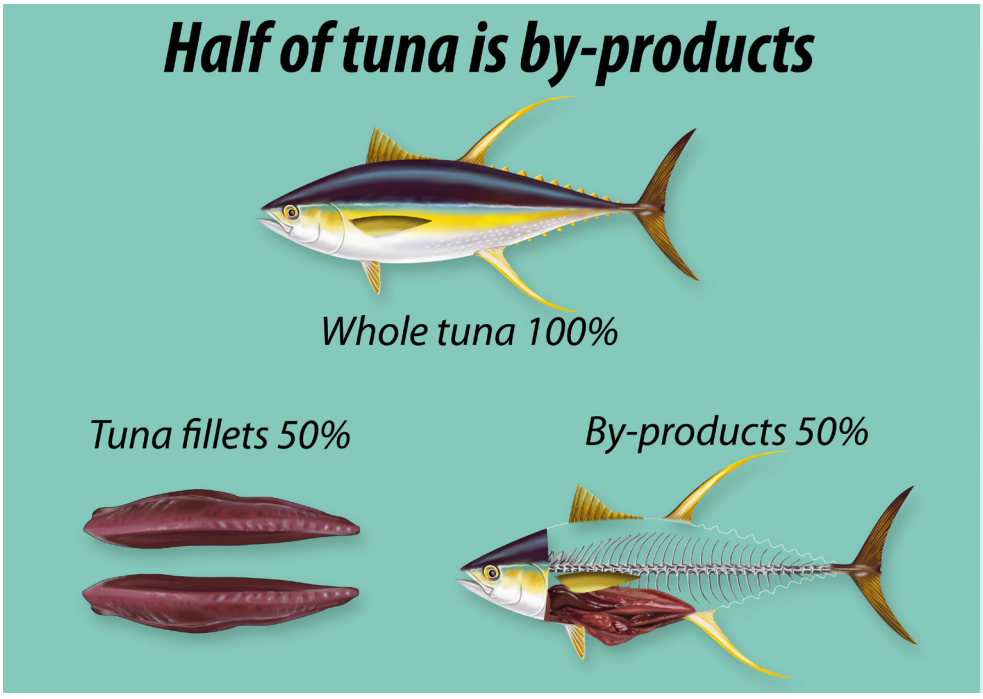
In some Pacific Island countries and territories, fish processors are already extracting value and creating employment by processing by-products, but more value can be extracted. A first step in assessing the potential to add more value to fish processing by-products is to examine how much is currently generated and how it is being used.

Policy is needed to maximise the economic value of fish processing by-products.

What are fish processing by-products?

Fish processing inevitably results in the generation of by-products, which are the raw materials that are not used in production of the primary product (Figure 1). Fish processing by-products are either dumped or sold, sometimes after they are sorted or processed into marketable form.

Although not the focus of this brief, it is noted that both the fish capture and aquaculture sectors also generate by-products and policy is needed to encourage more economical use in these industries.



What do we mean by using, under-using and wasting?

Using occurs when by-products are treated in a way that maximises their economic value.

Under-using occurs when some or all of the by-products are used, but not in a manner that maximises their potential value.

Wasting occurs when by-products are dumped.

Figure 1: Primary and by-products of the tuna fish processing sector

Who generates fish processing by-products in the Pacific?

Fish processing by-products are generated in small to industrial scales, which is demonstrated in Table 1.

Table 1. Types and volumes of fish processing by-products generated in the Pacific

Producers	Types of by-products	Volume
Industrial fish processors	Head, skin, bones, tail, fins, viscera, sexual organs, cutting scraps, cooked discards and rejects	High
Fish traders	Unsold or spoiled fish and waste from gilling-and-gutting/filleting	Moderate
Households	Parts that are not consumed, such as bones, skin and off-cuts	Low

How much fish processing by-products is generated?

Industrial fish processing operations generate significant volumes of by-products. Only 40 to 60 per cent of the fish is used in the primary product (Figure 1), with the remainder being wasted or under-used. Figure 2 shows the by-products produced by tuna processing operations by percentage of total fish weight. It is estimated that tuna canning and tuna loining (filleting) operations in the Pacific generate approximately 120,000 tonnes of by-products annually, of which some is wasted and some transformed into low-value bulk products, such as fish meal.

Fish traders, including retailers, generate an unknown quantity of by-products, however there is opportunity to use this as it is generated in centralised locations.

Households consume approximately 80 per cent of a whole fish by weight; however, the remaining 20 per cent is usually fed to livestock or it is buried in household gardens to enrich the soil. Therefore, the volume of by-products generated by households is minimal.

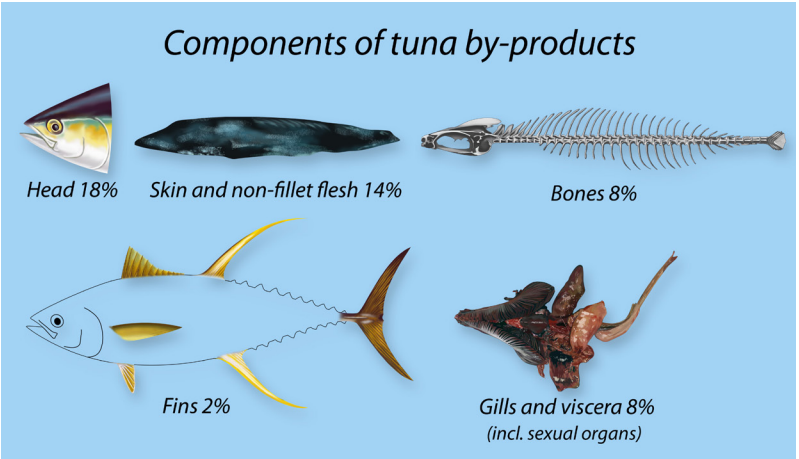


Figure 2: Components of tuna processing by-products by percentage of total fish weight

Uses of fish processing by-products

The larger producers of by-products typically treat them in one of three ways: by selling them on local markets as low-cost protein, by processing them into low-value products such as fish meal, or by dumping them.

There are examples of small-businesses that have been developed based on availability of fish-processing by-products (Figure 3 and text box on the right).

Simple technologies can be used to transform the low volumes of by products generated by small-scale fishers and households into usable form, such as fertiliser.

Table 2 lists some of the potential applications, products and uses of fish processing by-products.

Table 2. Potential uses of fish processing by-products

Applications	Products	Uses
Agricultural	Fertiliser (silage), compost, pesticide	– Soil improvement – Pest control
Energy	Biofuel, oxidiser	– Energy generation
Animal feed	Meal, oil, protein, silage, minerals	– Feed – Food supplements
Nutrition (supplements)	Oil, protein, minerals, amino acids	– Food supplements – Sports nutrition
Human food	Whole or parts of fish, mince, pulp, gelatin, fish stock, fish sauce, liver oil	– Unprocessed food – Processed food
Pharmaceutical	Omega 3, calcium, chondroitin, collagen, bioactive peptides	– Nutraceutical – Cosmetics – Biotechnology

Figure 3: Small-scale operation converting tuna processing by-products into fertiliser. Photo credit: BioAgri-NC.

Small-scale case study:

BioAgri-NC – a producer of fish fertiliser

New Caledonia's tuna loining industry generates approximately 1,000 tonnes of by-products each year, which is usually wasted at an annual financial cost of some USD 100,000 plus an undetermined environmental cost.

BioAgri-NC, a family owned and run business, identified the opportunity offered by consistent and plentiful local supply of tuna processing by-products and set up a facility to produce fish fertiliser (Figure 3). The raw materials (tuna heads and carcasses) are ground, liquefied, strained and bottled in a small facility. BioAgri-NC's organic fertiliser is marketed widely throughout New Caledonia.

Industrial case study:

StarKist Samoa Inc. – a producer of fish meal

StarKist Samoa Inc. processes approximately 130,000 MT of raw material annually and produces an undetermined, but presumably significant volume of by-products. StarKist sorts by-products to supply markets for human consumption (e.g. fish heads) and pet-food (e.g. red meat), while the remaining by-products are mass transformed for the production of fish meal and oil.

The fish meal and oil is primarily exported, but a small amount is supplied to local aquaculture farms that use it as the protein component in fish feed. The availability of protein-rich fish meal has enabled aquaculture farmers to reduce their operating costs by substituting imported fish feed with domestically-produced feed.

Requirements for using fish processing by-products

The processing of by-products is done by one of the following: (a) transforming, without sorting, a mass of material into a specific product like fish meal; (b) sorting, where classes of by-products are grouped to extract specific components, such as liver oil and proteins; or (c) a combination of sorting and mass transformation.

Proposals to establish a new industry need to meet the following criteria:

- ✓ Consistent quantity and geographical concentration of by-products;
- ✓ Suitable type and quality of by-products for their proposed application;
- ✓ Suitable infrastructure to maintain quality and facilitate market access;
- ✓ Ability to comply with sanitary standards;
- ✓ Financial capacity to invest in value adding technology; and
- ✓ Availability of research and development to support decision-making for development.

Factors affecting the full use of fish processing by-products

i. ***Economic*** **–** large volumes are required to achieve economies of scale (especially in the case of low-value products), while there are high investment costs for producing high-value products (Figure 4);

ii. ***Technical*** **–** expertise are required to use advanced technology in the production of high-value products;

iii. ***Social*** **–** the use of fish processing by-products must not have adverse implications on food security; and

iv. ***Policy*** **–** supportive regulations and legislation are required to facilitate private sector investment.

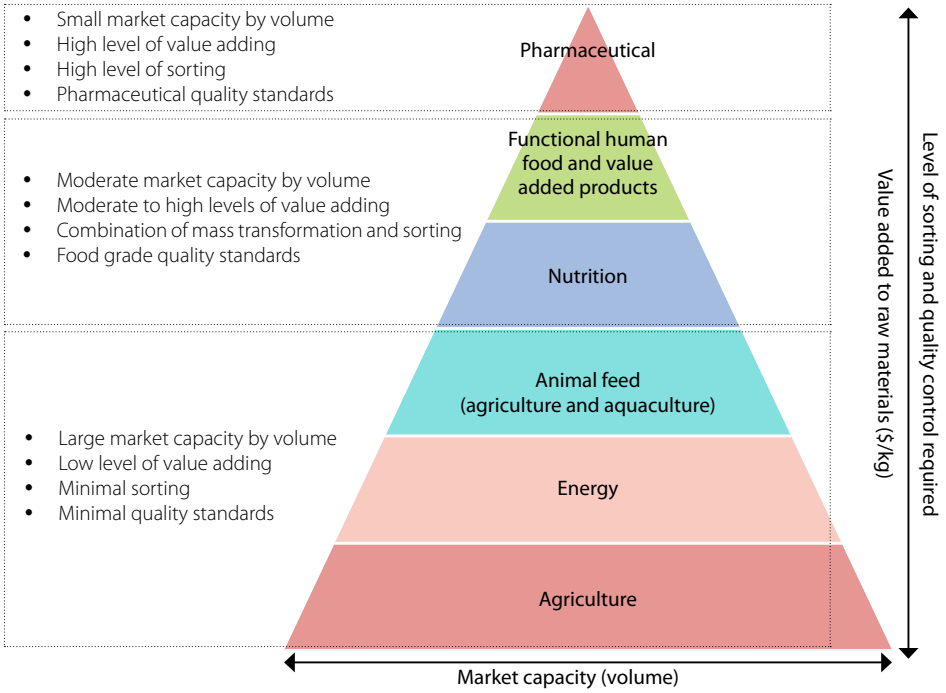


Figure 4: Potential markets and capacity for fish processing by-products, and the corresponding levels of value added to the raw materials

Recommendation and policy implications

Fish processing by-products have many applications in the countries and territories of the Pacific, but their use is dependent on the volume and type of by-products and the capacity of individual nations and companies producing the by-products. Particular attention needs to be paid to the special requirements of transforming by-products into food for human consumption – these include improved sanitary standards and distribution channels for market development.

Policy should encourage large generators of fish processing by-products to extract more value

As a first step, SPC member countries and territories are encouraged to:

- Take stock of the type, volume and location of the by-products generated and identify their current use; and
- Where there are sufficiently large and geographically concentrated by-products, identify the options to extract more value from this resource.

The role of governments is to improve the use of fish processing by-products by:

- **Identifying strategies to reduce the amount of wasted and under-used by-products;**
- **Encouraging cooperation between generators of by-products to create volumes that make new industries viable;**
- **Trial aquaculture feed produced from fish processing by-products;**
- **Promote the use of fish cleaning and cutting stations to concentrate fish by-products;**
- **Develop a mobile pilot processing plant for testing and demonstrating different technologies; and**
- **Provide technical support to industry for improving the use of by-products.**

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