

# Fish Scraps to Food: New markets in Mexican artisanal fishing communities

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<http://www2.bren.ucsb.edu/~fishmeal/>

## Overview

This project assessed the feasibility and potential impacts of creating new markets for fishery wastes by producing fish meal substitutes in artisanal fishing communities. Our analysis included an evaluation of available waste material, the economic feasibility of production, and an identification of the important socioeconomic and ecological considerations.

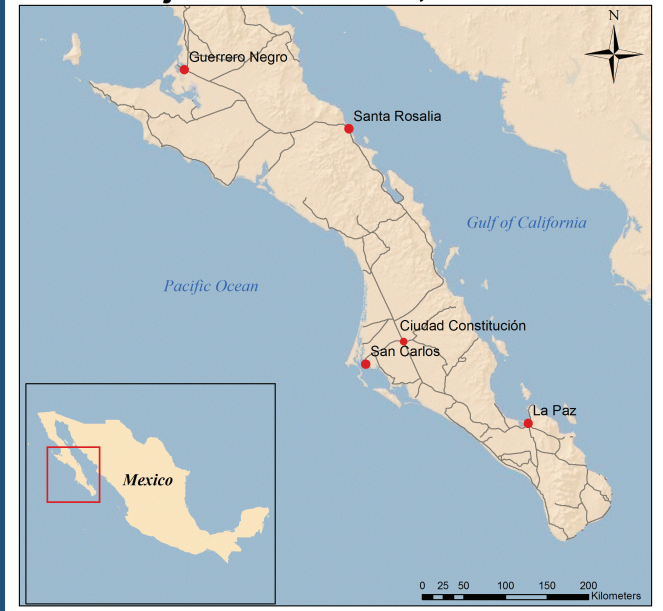
## Protein Demand

In order to meet growing demands for protein, aquaculture production has been steadily increasing globally. Fed aquaculture comprises the majority of fish aquaculture production, causing an increased reliance on aquafeeds. These marine derived feeds provide essential nutrients to farmed species. The requisite fish meal ingredient is traditionally produced from wild-caught reduction fisheries whose populations have been hit hard by these trends. It has become apparent that future aquaculture expansion will largely depend on the availability of feed ingredients.

In order to address feedstock demand, some companies are producing fish meal and other feed inputs (including liquid fish silage) from the scraps of their primary fishing operations. Up to 25% of the fish meal produced is made from these fishery or aquaculture byproducts (FAO 2012). Currently, this production primarily occurs on the industrial scale and fish byproducts from artisanal fisheries remain largely underutilized.



## Baja California Sur, Mexico



## Artisanal fishing in Baja California Sur, Mexico (B.C.S.)

In Mexico, artisanal fisheries use small boats, known locally as *pangas*, and operate close to shore with low capital investment, intensive labor, and limited capacity. In B.C.S., there are over 11,000 artisanal fishermen predominantly located in small fishing communities with low to moderate infrastructure, limited access to education, and often without electricity, refrigeration and running water (Salas et al., 2011).

While fish meal production is a complex, capital-intensive process, liquid fish silage is a simple marine protein substitute that can be produced at the artisanal scale. Globally, 90% of fishermen are active at the artisanal scale and have significant impacts on food security and poverty alleviation in their communities. Silage production using the wastes from these fisheries could create a valuable new source of marine protein while also providing additional economic opportunities for artisanal fishing communities.

## Research Question:

Is it economically feasible and ecologically sound to produce silage as an aquaculture feed ingredient from artisanal fishery scraps in B.C.S.?

**APPROACH:** To answer our question we set three objectives

**Objective 1: Examine Supply of Artisanal Fishery Waste**

We analyzed artisanal-scale landings data from the Mexican fisheries commission (CONAPESCA) to identify trends in, and approximate quantities and quality of, available waste material.

**Objective 2: Determine Economic Feasibility by Port**

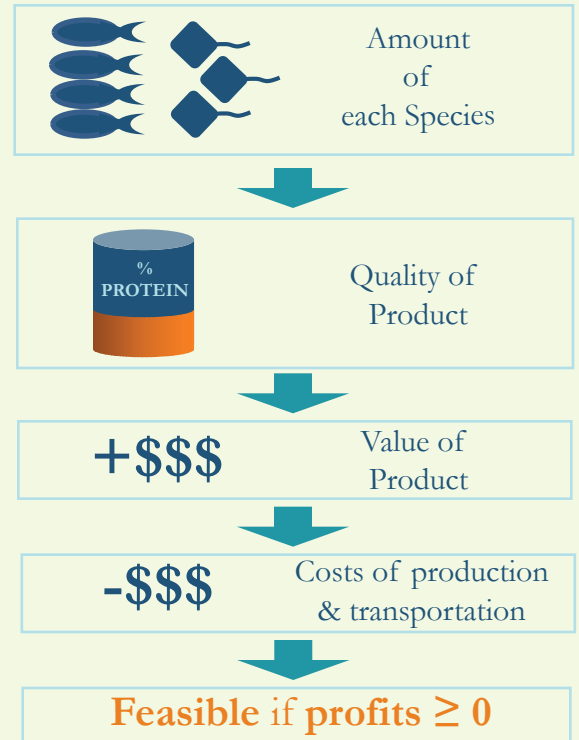
We created a model to calculate if it would be economically feasible to collect fishing scraps, produce a feed input product and transport the product to a buyer. This model was run on all ports in B.C.S. and the silage product was valued at three potential prices based on current feed inputs. The results identify for which ports production would be economically feasible.

SUBSTITUTED PRODUCT	Soybean meal	Fishmeal (low)	Fishmeal (high)
RELATIVE PRICE	\$	\$\$	\$\$\$

**Objective 3: Identify Key Socioeconomic and Ecological Considerations**

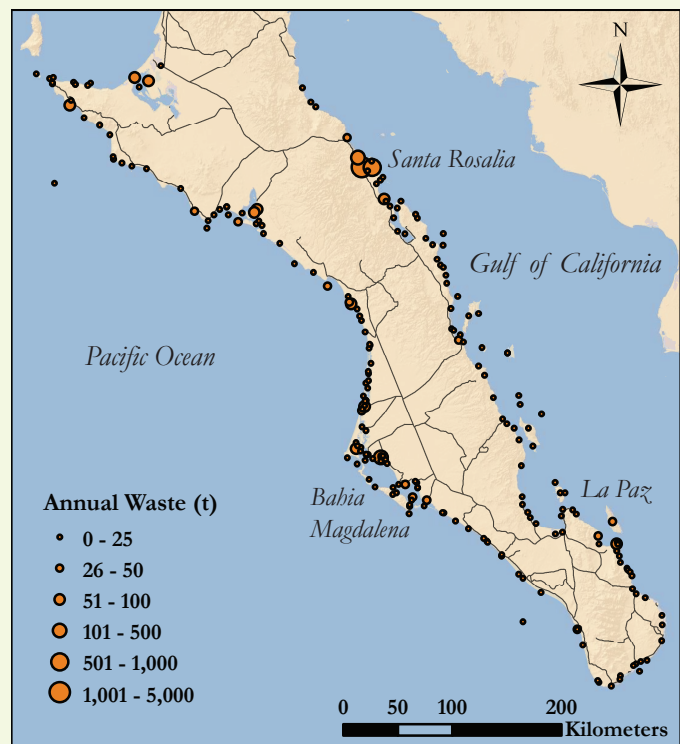
We conducted a qualitative analysis of the potential barriers, catalysts, benefits, and ecological consequences of creating new markets for artisanal fishery wastes.

**Conceptual model**



**RESULTS**

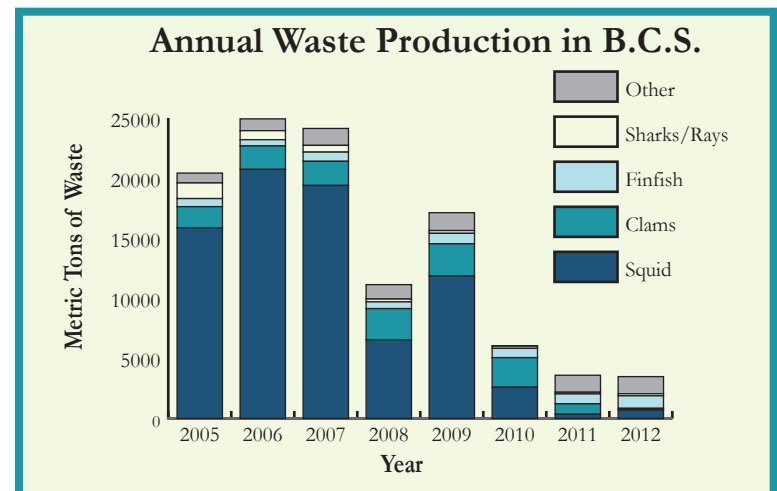
**Objective 1: Examine Supply of Artisanal Fishery**



**Distribution and availability of waste**

Waste is relatively evenly distributed around the state, but a few areas of high yield exist, including Santa Rosalia and Bahia Magdalena. Santa Rosalia produced the highest amounts of waste and is the major landing port for squid in B.C.S.

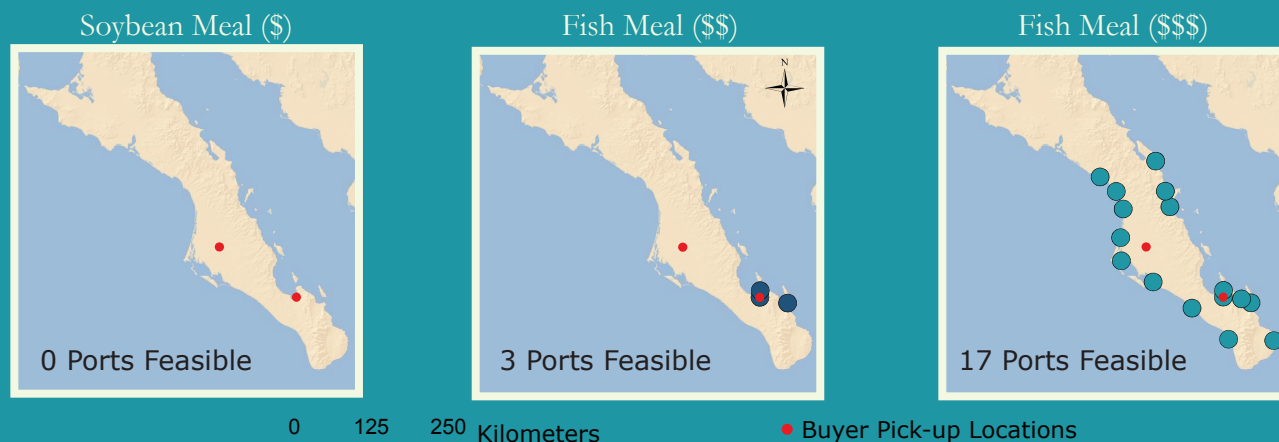
Total landings were highly variable between 2005 and 2012, ranging from almost 80,000 metric tons in 2007 to less than 50,000 metric tons in more recent years. Concurrently, a dramatic decline in waste was observed in the data series. From 2005 to 2007, between 20,000 and 25,000 metric tons of waste were produced, representing approximately one third of the recorded live weight in each year. Since 2010, waste has dropped below 7,000 metric tons with only 3,484 metric tons in 2012. This decline was primarily the result of low landings from the squid fishery and a more complete utilization of squid, sharks, and rays for human consumption.



**Figure 1:** Annual waste availability declines in recent years due to lower squid landings and greater efficiencies in overall processing

## Objective 2: Determining Economic Feasibility by Port

### Economic Feasibility for Three Substitute Product Valuations



Based on our model, it was never profitable to produce protein products from waste as a substitute for soybean meal (no feasible ports). Of 157 ports assessed, only three ports can produce and transport silage to buyers at either of the two pickup locations if the product is valued at a lower fish meal price. Operation is economically viable for 17 ports if the product is valued at the higher price for fish meal. When silage is valued at the higher fish meal price, it can be transported from farther away, resulting in higher revenues and more feasible ports overall.

Three ports were identified as economically feasible under both fish meal valuations: La Paz, Pichilingue, and Punta Arenas. The population size, fishing fleet size, and infrastructure vary considerably between these locations. Furthermore, the amount of waste at each port has declined in recent years. If this trend continues, the availability of waste may be too low to make production practical.

Port	Population Size	Ave Annual Waste 2005-2010 (metric tons)	Ave Annual Waste 2011-2012 (metric tons)
La Paz	215,178	20	13
Pichilingue	6	11	3
Punta Arenas	121	70	4

Table 1: Population size and waste availability for three ports where silage production is economically feasible

## Objective 3: Identifying Socioeconomic & Ecological Considerations

### Socioeconomic Considerations

Site-specific socioeconomic characteristics will affect success

- **Economic Need**
  - Alternative income opportunities
  - Willingness to participate
- **Social Capital**
  - Level of cooperative effort
- **Fishing Community Structure**
  - Production viability
- **Local Demand**
  - Buyers
  - Local uses



### Ecological Concerns



Increased value of sensitive fisheries may result in:

- Increased number of fishermen
- Current fishermen fishing more
- Switching target species
- Diverting catches away from direct human consumption to silage production
- Use of less selective fishing gear

# CONCLUSION

Waste from artisanal fisheries represents an underutilized resource with the potential to help fill a growing demand for marine protein. With the supply of conventional fish meal limited, processing of this waste into a protein ingredient in feeds is increasingly viable. This economic opportunity is particularly significant to Baja California Sur, where the artisanal fishing sector is of critical importance to local economies. However, declines in the amount of waste and uncertainties in demand for silage in B.C.S limit the scope and magnitude of this opportunity. In addition, socioeconomic factors can present barriers to implementation and perverse incentives may generate significant ecological damage.

## ALTERNATIVE USES

### Agriculture in B.C.S.



**Aquaculture:** Silage can be made into aquaculture feeds onsite by fish farmers at the artisanal scale, bypassing feed producers. Water availability in B.C.S. limits terrestrial aquaculture but this feed source could support the further development of local small-scale marine aquaculture.

**Livestock:** Silage can be directly fed to pigs and chickens, as well as used strategically to supplement livestock diets when grazing and feed sources are limited. These options can increase food security in communities.

**Agriculture:** Silage can be applied directly to fields as a fertilizer. This use can improve food production in communities or support existing agricultural operations throughout the state.



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### References:

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Salas, Silvia, Ratana Chuenpagdee, Anthony Charles, and Juan Carlos Seijo. 2011. Coastal Fisheries of Latin America and the Caribbean. Rome: Food and Agriculture Organization of the United Nations.