**Fish scraps to food: new markets in Mexican artisanal fishing communities**

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**Overview**

The study assessed the feasibility of producing aquaculture feed ingredients from the byproducts of small-scale artisanal fisheries in Baja California Sur, Mexico as a means to create ecologically sustainable economic opportunities.

**Background**

Over 90% of the fisheries in BCS are artisanal, operating on a small scale with limited technology. Artisanal fishing communities are often remote and impoverished, lacking economic opportunities outside of the fishing sector.

**Quantitative Results**

**Objective 1: Examine supply of artisanal fishery waste**

- **Distribution of waste**
  - Waste is produced in over 200 artisanal fishing communities in BCS. Squid Rosas and Concentrated High Value Waste are major contributors.

- **Declining waste production**
  - Squid makes up over 50% of the annual fishery waste produced in BCS. Since 2005, the availability of squid waste has declined due to lower squid landings and changing processing practices.

- **Objective 2: Determine economic feasibility by port**
  - It is economically feasible for some ports to produce silage and transport it to a buyer in southern BCS if silage is sold at a price comparable to fish meal but not soybean meal.
  - Additional, communities with a consistent supply of high quality waste are more likely to be feasible. Transportation costs greatly impact on feasibility.

**Qualitative Results**

**Objective 3: Identify social and ecological considerations**

- **Ecological Impacts**
  - Increasing the value of these sensitive fisheries through profitable silage production may result in:
    - Increased fishing effort
    - Increased bycatch, concentrate fishing effort, and divert fish away from direct human consumption.
  - Therefore, silage production is likely to cause negative ecological impacts unless implemented in areas with well-managed fisheries.

**Research Question**

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

**Objectives and Methods**

- **Objective 1: Examine supply of artisanal fishery waste**
  - We analyzed eight years of artisanal catch data to:
    1. Estimate the quantity and quality of available waste.
    2. Investigate spatial and temporal trends in waste production.

- **Objective 2: Determine economic feasibility by port**
  - Ports deemed economically feasible are clustered in southern BCS because of their close proximity to buyer pick-up locations, which results in lower transportation costs and higher profits. When silage is valued at a higher fish meal price, ports bring in more revenue and can transport silage from farther away, which results in more economically feasible ports overall.

**Alternative Uses of Fish Scraps**

Aquaculture: Silage can be made into aquaculture feeds onsite by fish farmers at the artisanal scale, bypassing feed producers.

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.

Agriculture: Silage can also be applied directly to fields as a fertilizer to supplement food production in communities.

**Conclusions**

- The amount of fishery waste in BCS is variable and has declined from 2005 to 2012.
- This decline was primarily the result of low landings from the squid fishery and changing processing practices.
- Silage production from fish scraps is economically feasible if the product is valued as a substitute for fish meal but not soybean meal.
- Adding value to fishery byproducts may generate perverse incentives that increase bycatch, concentrate fishing effort, and divert fish away from direct human consumption.
- In locations where silage sale to a feed producer is not feasible, alternative local uses of fish scraps in aquaculture, livestock, or agriculture may be possible.

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