10. Seafood and Aquaculture

P51. Life Cycle Assessment of Ecuadorian processed tuna

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Objective

Ecuador is an important player in the global tuna fishing and processing industry: the Ecuadorian industrial tuna fleet represents 17% of the global tuna purse seiner fleet, and it is the second largest tuna processing country after Thailand. The fishing and processing operations of one of the largest vertically integrated tuna processing firms in Ecuador were evaluated regarding their environmental impacts, and assumed representative of the Ecuadorian tuna processing industry. Results were compared with those of other international fish processing and other sources of animal protein for human consumption. Directions are finally identified towards reducing environmental impacts of both the tuna fishery and processing industry.

Method

Detailed operational fishery and processing data was collected from a representative Ecuadorian tuna processing firm, and the life cycle assessment framework applied to it for identification of hotspots. Two functional units were used: 1 tonne of final product (for canned, pouched, vacuum bagged and ‘average’ products) and 1 tonne of “fish in product”, which includes all process losses and normalises the final product:raw fish ratios among the different processing routes analysed. The ReCiPe impact assessment method was used, including all midpoint and endpoint impact categories. Impacts were allocated by mass between tuna products and residues (which are rendered into residual fishmeal). The system boundary included the construction, use, maintenance and end-of-life of the tuna fishery until the landing port, and those of the construction, use and maintenance of the processing plant, from fish landing until the storage of final products. Primary data were collected only for use and maintenance of both fishing vessels and processing plants.

Main result

In the period 2012-2013, the studied sub-fleet featured a fuel use intensity of 835 L per landed tonne (Fig. 1), which was 235% higher than reported values for all tuna landings in the Pacific Ocean in 2009. Reasons for such underperformance may include inter-annual variations in tuna catchability and the fact that fuels are generally subsidised in Ecuador, and thus skippers perhaps do not apply sufficient fuel-saving strategies. The main contributors to impacts associated with tuna processing were the provision of tinplate cans (58.0% of the ReCiPe single score) and fuel use by the fishery (22.6%). Ecuadorian tuna products feature environmental impacts generally higher than those of other fish processing industries worldwide, yet lower than those of many alternative sources of fish and land animal protein (Table 1).

Implications

Efforts to reduce environmental impacts of Ecuadorian tuna processing should focus on the fuel performance of the providing fleet, and on the container technology. Increased use of larger tinplate cans, aluminium cans, or other non-metal container technologies (e.g. pouches, retort cups) would decrease environmental impacts of tuna processing. The sources of relative inefficiency observed for the Ecuadorian tuna fleet should be thoroughly investigated. Possible solutions could involve applying fuel saving strategies.

Keywords: canning; Ecuador; fuel use intensity; tuna

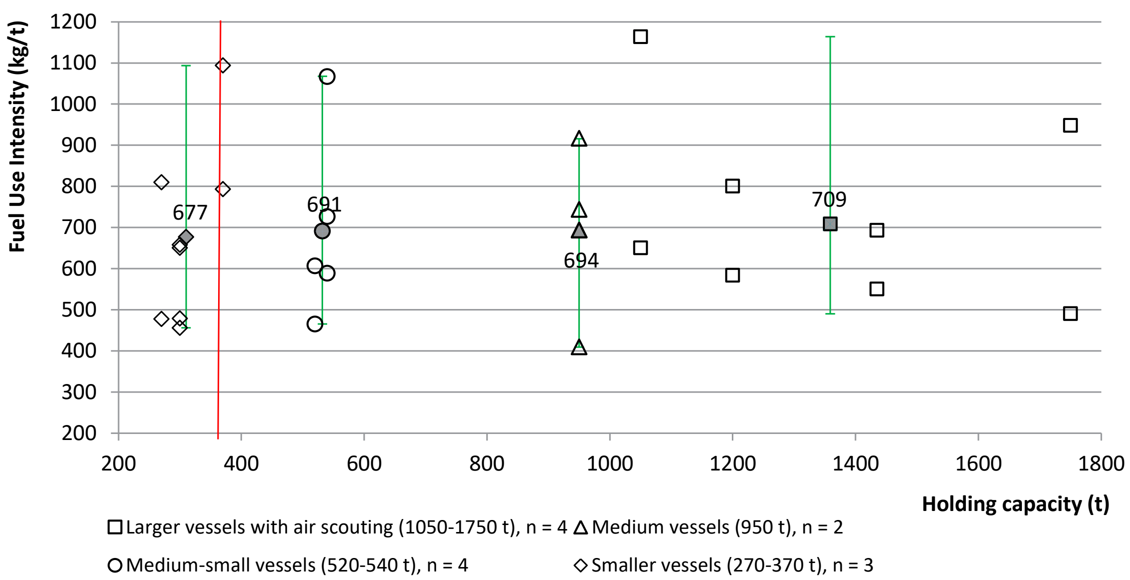

Fig. 1. Fuel-use intensity of four segments of the tuna fleet (sample n = 13 purse seiners with 25 FUI/year/vessel data points) for the period 2012-2013. Grey-fill symbols represent landings-weighted fuel use intensity per segment; the vertical line represents the lower limit of the upper class of the official Inter-American Tropical Tuna Commission industrial tuna purse-seiners classification, and error bars represent the range of FUIs within each segment. Density of marine diesel: 0.832 kg/L

Table 1. Comparison of climate change impacts (kg CO_2 eq) per kg product and kg protein of Ecuadorian tuna products and other animal products from global supply chains. Sources listed in Avadí et al. (2015)

Product	Protein content (%)	Impact per kg product	Impact per kg protein
Ecuador: Canned tuna in vegetable oil	26.5	3.7	14.0
Ecuador: Pouched loins	28.2-29.2	2.7	9.3-9.7
Ecuador: Bagged (frozen) loins	22.0-24.4	3.1	12.9-14.3
Peru: Canned anchoveta in vegetable oil	21.3	1.7	8.1
Peru: Fresh cultured tilapia	18.3	1.9-4.1	10.4-22.4
Peru: Fresh cultured trout	18.4	2.8-3.4	15.2-18.5
Portugal: Canned tuna in olive oil	26.5	7.7	29.1
Portugal: Frozen tuna	22.0-24.4	1.0	4.1-4.5
Spain: Canned tuna in tomato sauce	20.8	2.5	12.1
International: Various animal protein sources, without packaging (Nijdam et al., 2012)			
Beef (studies = 15, products = 26)	20	9-129	45-640
Pork (studies = 8, products = 11)	20	4-11	20-55
Poultry (studies = 4, products = 5)	20	2-6	10-30
Eggs (studies = 4, products = 5)	13	2-6	15-42
Milk (studies = 12, studies = 14)	3.5	1-2	28-43
Cheese (based on milk studies)	25	6-22	28-68
Seafood from fisheries (studies = 9, products = 18)	16-20	1-86	4-540
Seafood from aquaculture (studies = 7, products = 11)	17-20	3-15	4-75

Notes: Protein content values from the USDA National Nutrient Database for Standard Reference Release 27 http://ndb.nal.usda.gov/ndb/foods (except for Peru; values based on measurements).

References:

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