UBC Social Ecological Economic Development Studies (SEEDS) Student Report

Conducting a Sustainability Assessment on Fish Products with Extended Shelf-life at UBC

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The University of British Columbia Food System Project

Scenario 6: Conducting a Sustainability Assessment on Fish Products with Extended Shelf-life at UBC

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Abstract

As the world population continues to grow at an alarming rate, the environmental strains that we have stressed on the earth have placed humans in a huge crisis. Following the global warming problem, the sustainability of ecology and social and economic states is more important than ever. This paper conducts a sustainability assessment of food services and products at the University of British Columbia based on a commodity chain analysis on canned tuna and salmon.

Our hypothesis was that UBC could play a role in bridging knowledge and action for reducing food products' carbon footprint. Our research focused on the harvesting methods, processing, packaging, transportation, consumer demands, and waste disposal generated at any point along the chain of producing and consuming fish products. Our research results supported our hypothesis by showing that we could achieve the sustainability of fish by changing the views and diet habit of people through educating the general public.

1.0 Introduction

This paper is part of a progressive project initiated by the Land and Food System faculty at the University of British Columbia (UBC) as part of a collaborative effort to improve the sustainability at UBC. This report describes one, among many scenarios of problems statements shared with our fellow Agriculture Science 450 peers, who are all approaching, through various perspectives, the challenge of creating a sustainable food system at UBC. In this paper, we will first introduce our problem statement and then share our group's reflection on the 7 vision statements behind a sustainable UBC food system. Secondly, we will outline our methodology, summarize our findings, and then discuss these findings. The last sections consist of recommendations for various stakeholders, a conclusion, and an appendix.

2.0 The Problem Statement

Products with extended shelf life may seem like the perfect solution for the busy students and busy outlets rushing to prepare food to feed those hungry students, before they trickle in, a little before 8am for their first class. It offers convenient, unspoiled, and readily available, nutritious food ready at hand. Unfortunately, a great deal of processing and packaging is often required with extending the shelf-life of most products. The additional packaging, processing, and consequent waste production in turn, puts a greater strain on the use of more resources, waste, and pollution production (Pegg, 2007).

Our group was assigned a scenario that required us to conduct a sustainability assessment on food products offered by the UBC Food Services (UBCFS) which is one of the main food providers at UBC. The product we chose to assess was packaged tuna, specifically, 'pouched flake light tuna' because of its high demand and the way it is packaged for extended shelf-life. We also analyzed some aspects of canned salmon, which is used in lesser amounts than tuna at UBC, but we were drawn by the difference in packaging (a can rather than a pouch) and we wanted to see if one meets a more sustainable criterion over the other. Some comparison was also draw with AMS Food and Beverages (AMSFB) which is another food provider at UBC.

The nutrition and flavor of fish is irreplaceable. Fish in general, is the best source of omega-3 fatty acids, which are important in decreasing blood clot formations, heart disease, attributing to proper development of the brain and eye for infants, and for proper functioning of the brain in adults (Gropper, Smith & Groff, 2009; Horrocks & Yeo, 1999). Since cardiovascular disease is the leading cause of death for Western nations (Horrocks and Yeo, 1999) and brain functioning is of utmost importance for students. It is not surprising then that many nutritionists push for an increase in consumption of healthy fish with at least 2 meals a week of fish (see Figure 1). For this reason, eliminating the need for fish consumption faces many challenges.

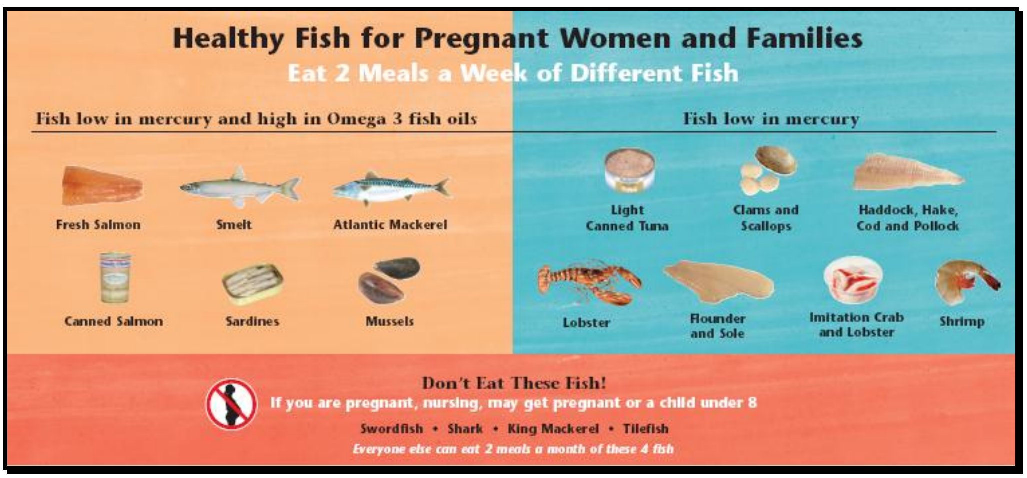

Figure 1. Part of a health education poster for encouraging the public to eat at least 2 meals a week of different fish (Maine Center of Disease Control and Prevention, 2005)

Globally, fish consumption is rising and though ocean catches has been leveling off, aquaculture production is significantly increasing to meet consumer demands (Halweil and Nierenberg; Sargent, 1997). Aquaculture has largely followed the trend of intensification in agriculture. Fish farms are seen as feedlots of the sea, crowding fish in unnaturally high densities that result in production of toxic wastes, diseases and parasites that damage the surrounding environment and also negatively affect wild populations (Weiss, 2002). Over-fishing is a huge problem and it is estimated that the global oceans has already lost more than 90% of large predatory fishes, many including codfish, skates, blue-fin tuna and rockfish (Myers and Worm, 2005). Canada's Atlantic cod shows a clear example that over-fishing is a reality. After a sudden peak of catches, stocks plummet in 1990's (Fig. 2), with a 95% drop of biomass from what it used to be, and has since failed to recover even with cessation of fishing (Frank et al., 2005).

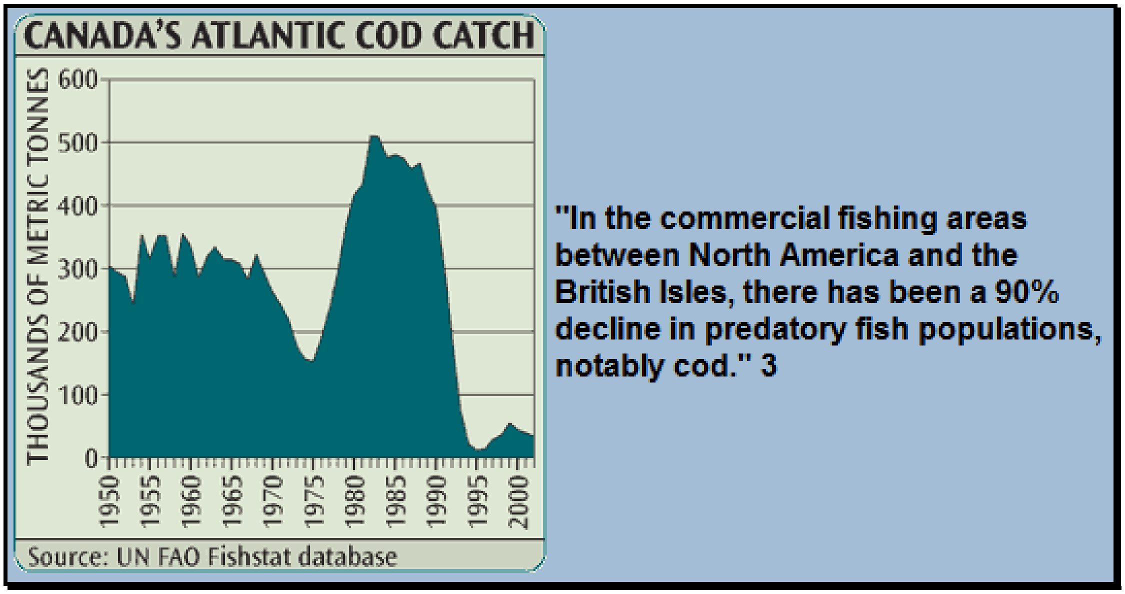

Fig. 2. Canada's Atlantic Cod catches from 1950 to 2000 (FAO, 2002).

As part of an academic institute centered at innovation, and a place for cultivating knowledge, we have the opportunity to implement change, shed light for a more sustainable future, and serve as leaders for the community. Though the outlook for wild fish may seem grim, positive change can occur with education and changes of demand. A great example was the introduction of tuna products labeled "dolphin-safe" in the late 1900's, that was hugely successful thanks to educated consumers. This pressured fisheries to abide to fishing regulations that minimizes dolphin casualties. The results are astounding, and today thousands of dolphins are saved thanks to an initiative from the consumer side (see Fig. 3).

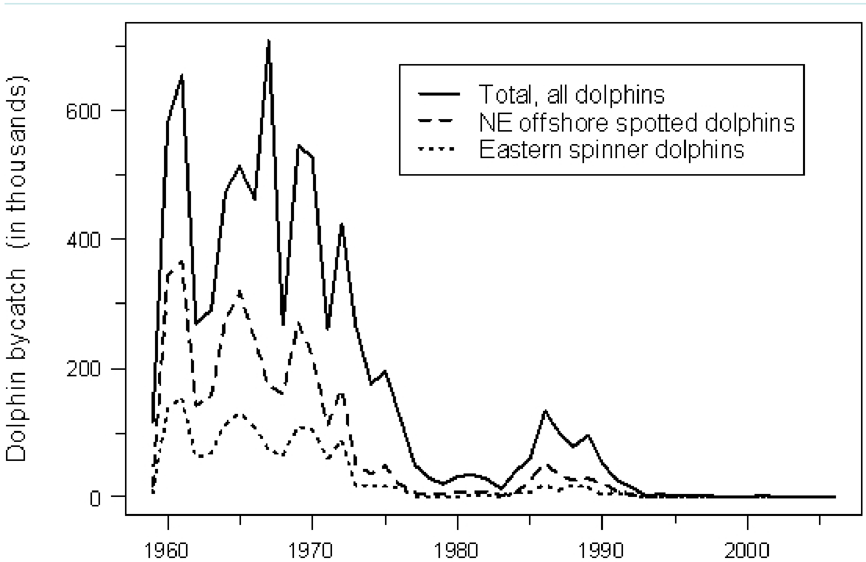

Fig. 3. Estimated annual number of dolphins killed “bycatches” in the eastern tropical Pacific purse-seine tuna fishery, total for all dolphins and seperately for the two dolphin stocks with the highest number killed (Perrin et al., 2002).

3.0 Reflection on the Vision Statement for a Sustainable Food System

There are seven guiding principles in the vision statement for creating a sustainable UBC Food System. These address: 1. Local food, 2. Waste disposal, 3. Ethnically diverse, affordable, safe and nutritious food, 4. Education, 5. Community, 6. Production by socially ecologically conscious producers, and 7. Fair prices. Our group agreed it was a good compilation of visions for the overall goal of reaching for a sustainable food system. We felt it offered a solid base for sustainability, but that it could be refined as well as benefit from a few revisions or additions.

First, we felt that the list could be prioritized, in sequential order from the most important to the least. For example, we all agreed that a local food source was an important factor but not the most essential. Many foods are seasonal and grow only in certain areas, so relying on local foods would severely limit our food abundance and selection. We also felt this was contradictory to vision# 3 in that food should be "ethnically diverse". Since everyone in our group was Asian, our ethnic food traces to the opposite side of the globe. We felt that if we were to grow rice locally in B.C. it would require even more energy inputs and hence be less sustainable for the environment. We suggest that the vision statement should better define what it takes for food to be "ethnically diverse".

As a group, we came up with three components that could be added to the vision statements. We felt that the vision statements could improve by adding somewhere the word *palatable* or *appetizing* because we believe food should taste good. In vision #2, we also think waste should be *reduced* at all points of the food system, even before consumption. Currently, vision #2 states that "waste must be recycled or composted locally" which are both methods of how to handle the waste, usually after consumption, but we believe there should be a greater emphasis on the reduction of waste, such as minimizing packaging during processing. Lastly, as part of a University project, we felt the vision statements should have a greater emphasis on education. A possible vision worth adding may be that "knowledge of food is continually passed on."

In our group everyone agreed to some degree that these vision statements are all important components of a sustainable food system. It is general enough to apply these visions to various scenarios, and that made it useful in helping us approach our own scenario for this project.

4.0 Methodology

For this project we took a community based action research (CBAR) approach. We actively involved members of the UBCFS, the AMSFB, company representatives, and implemented past research projects, collaborated with peers and we sought information from websites, scientific papers, and past projects by AGSC450 students from years 2002-2008. Our modes of communication included personal interviews, email correspondence and phone interviews. Among our group we found that “Google documents” was a useful tool for collaborating findings.

Upon receiving our problem statement we also reviewed project statements of our peers to get a good scope of our project. Groups 29 and 30 were also assessing the sustainability of products with extended shelf life used by UBCFS so it was vital to collaborate with them in order to prevent overlap and share data. One of the first tasks was reviewing the annual grocery report for UBCFS for non-perishable goods. Since groups 29 and 30 were looking at rice and wheat respectively, we focused instead on a protein source of notable quantity, and this was canned tuna. We later expanded our research to include canned salmon to compare how some aspects of commodity chain differed.

The method we used in order to assess the sustainability was the commodity chain analysis (CCA). In past projects, Group 8 from year 2004 and Group 7 from year 2002 had also used this method. A CCA takes a systems approach in looking at all interlinking components, like the rings on a chain, from the extraction of raw materials or production to final consumption, and including the assembly of intermediate goods (Rodrigue, 2009; Grad, 2006; Jackson et al., 2006). This is useful to assess the sustainability of a single product and enables to identify weaknesses at any point along the “chain”. Our group has expanded this further to include waste disposal even after consumption since packaging often accompanies products with extended shelf-life. Also, since we are looking at wild fish products, we are looking at the harvesting of fish as the origins rather than primary production.

As part of our CCA analysis on the tuna and salmon packaged for extended shelf-life, we focused on the harvesting methods, processing, packaging, transportation, consumer demands, and waste disposal generated at any point along this chain. We began our analysis at the consumer end of the chain first, and gained relative information on demands, quantity and price by contacting Nancy Toogood and Dorothy Yip who are managers of retail operation, purchasing and project coordination for AMSFB and UBCFS, respectively. For both, we interviewed them personally, and emailed a set of questions to them. By email we also contacted Sanju Lal a representative from Neptune foods services who delivers the tuna/salmon goods for both AMSFB and UBCFS to follow the transportation of the goods. For harvesting and processing information we contacted Doug Safrika, a representative from Ocean's Fisheries who is the provider of the preserved tuna or salmon for UBC. At all stages of our project, internet research was used to supplement data we received.

5.0 Findings

Quantities

Our findings show that both food providers UBCFS and AMSFB use significantly more tuna than salmon. Something to notes is that UBCFS has chosen to use Tuna packaged in a pouch form, whereas AMSFB outlets use canned tuna. Both UBCFS and AMSFB only use salmon packaged in a can, and both obtain their products from the company, Ocean's Fisheries Ltd situated locally in Richmond, B.C. (N. Toogood, personal communications, March 19, 2009; D. Yip, pers. comm., March 11, 2009).

Table 1. Annual use (Jan 2008-Dec 2008) of fish with extended shelf life by UBCFS

Item	Size	Brand Name	Annual Quantity
Canned Salmon Pink	418G	Oceans	4
Canned Salmon Sox Wild	418G	Oceans	19
Pouched Tuna Flaked Light in Water	1.88KG	Oceans	325

Table 2. Estimated Annual use of fish with extended shelf life at AMSFS different outlets

Food Outlet	Product Name	Unit	Use Amount
Bernovlli's Bagels	Canned Tuna-Chunk Light	Each	90
	Canned Salmon Pink	Each	156
Honour Roll	Canned Tuna-Chunk Light	6 X 60.5 OZ	84
Pendulum	Canned Tuna-Chunk Light	Each	144

Harvesting of Fish

Ocean's Fisheries Ltd. only uses fish caught from wild stocks, and fish aquacultures are never used. The tuna product is called "light" because it consists of tuna species with light colouring called skipjacks and yellowfins. These species are among the most commonly caught tunas as seen in Figure 3. These tunas are caught in the Indian Ocean and South East Asia. The pink and sockeye salmon used are caught in the waters of Alaska and British Columbia (D. Safrika, personal communication, March

24, 2009).

Ocean’s Fisheries harvest fish by using purse seiners, and gillnets (D. Safrika, pers. comm., March 24, 2009). Purse seiners are boats that use large nets to encircle schools of fish, which is than drawn together into a ‘purse’. This method is used for catching tuna and some salmons like sockeye, pink and chum (BC Salmon, 2005). Another method is gillnetting. Gillnets are attached to small boats, strung close to shore and continually tended. It is mainly used to catch sockeye and chum salmons near coastal rivers and inlets (BC Salmon, 2005). Net sizes of gillnets and seines are strictly regulated by length, depth and mesh size as well as is the area where vessels can fish and the number of times they can fish (D. Safrika, personal communication, March 24, 2009). Boats are either company-owned, a joint venture or contracted with private vessels (Ocean’s, 2007.)

Oceans Fisheries tuna products are Dolphin Friendly certified by Earth Island Institute’s Mammal Project (Oceans’s, 2007). They only use tuna supplied by vessels that use dolphin-safe forms of fishing. This excludes the use of gill nets or drift nets which can entrap dolphins. The certification body also has access to the facility and records to ensure standards are upheld.

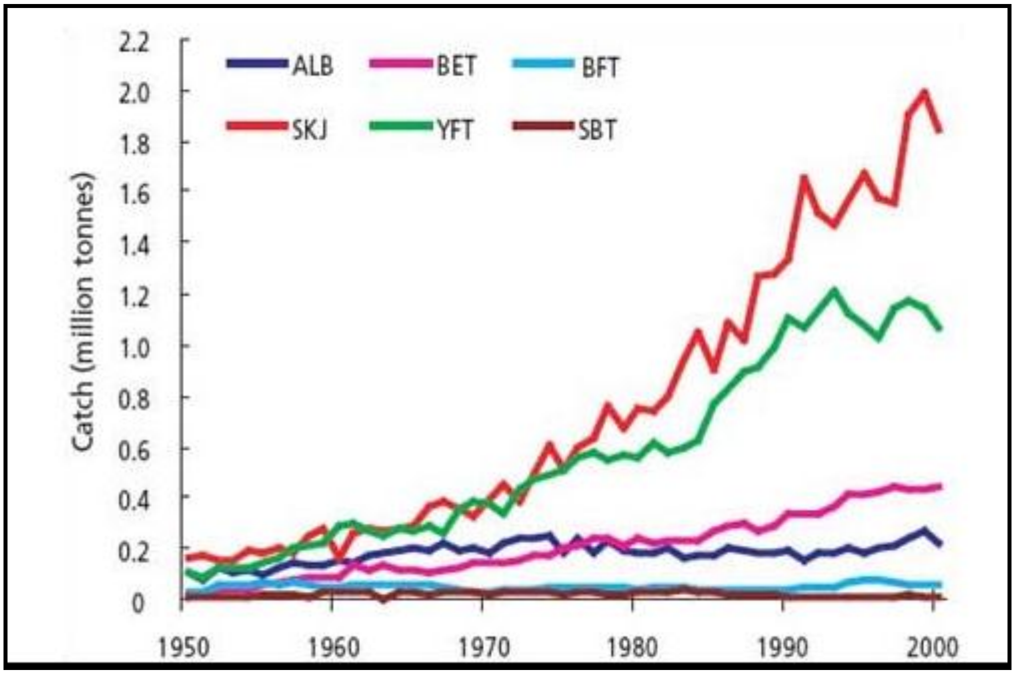

Fig. 4. Combined world catches of major species of tunas (Miyake et al., 2004). Note: ALB=Albacore, BET=Bigeye, BFT=Blue fin, SKJ=Skipjack, YFT=Yellow fin, and SBT=Southern Blue fin

Processing & Packaging of Canned Fish

Canned or pouched fish appears to be the most popular form to extend the life of fish. The shelf life of canned fish is generally 2 to 5 years. This section outlines step-by-step the procedure of how fish are processed and then packaged into a can or pouch. This is also outlined in Figure 5.

After Ocean's fleets catch their tuna and salmon off the coasts of BC, they quickly freeze them to preserve freshness (Ocean's, 2007). "Vessel debriefing" is the term used to unload the fish from the ships. Sizing takes place soon after to separate the fish according to weight and size. After the removal of the viscera, if the fish is not processed immediately, they will be stored in cold storage where temperature and storage period will be monitored.

Processing starts with thawing the fish in large thawing tanks that contain hot water. In terms of economic sustainability, both freezing and thawing will take a considerable amount of electrical or coal energy to maintain freezing and boiling temperatures. Cleaning of the fish consists of removing the gills, gutting, de-heading and cutting (Bumble Bee Foods, 2009). These steps are not only essential for making sure the fish is of high quality but they are also economically and socially sustainable because human labor is needed to perform these procedures properly. By providing jobs for the public instead of using other methods such as machines and computers, the company is using a renewable source of energy while supporting the development of social networks amongst the community and contributing to the labor market.

From this point, the fish is loaded onto racks for pre-cooking by various techniques such as pressure cooking at 240^{o}F for 2 hours, steamed for 2 to 4 hours or baked in an oven at 250-350^{o}F for 1 to 4 hours depending on the size of the fish pieces (Polar Seafood Processing, 2009). Cooking is an important step to remove body oil that constitutes to the bitterness and strong flavours, and making it easy for loining or the stripping of the skin and bones (Daniels and Hebard, 2007). Cooling of the fish in temperature-controlled rooms is the next step after cooking. This is to prevent food safety issues that might arise if the fish is not cooled to 4-0^{o}C within 2 hours; histamine poisoning is one of the main concerns during fish processing (Daniels and Hebard, 2007). Once the fish is cooled, loining takes place to separate the edible parts of the meat from the skin and bones.

Fish is a low acid food and, when improperly processed, there is an increased chance for botulism poisoning (Commercial Fishing and Shellfish Technologies

Publications [CFASTP], 2005). Botulism poisoning, one of the most severe food poisonings known, is caused by a toxin produced by the bacterium, *Clostridium botulinum* (CFASTP, 2005). This microorganism often is found in mud samples taken from seafood producing waters, so finding it in fish is a constant risk (CFASTP, 2005). It is important that the heating procedures for canned or pouched fish are carefully monitored in order to properly eliminate *C. botulinum* (CFASTP, 2005). By the application of heat, microorganisms, that shorten the shelf-life of foods by degradation, are killed (Durance, 2007

The heat is applied in many ways during the process. First, potential pathogens are killed during pre-cooking stages, and then when the cans are filled with fish flesh, hot medium such as salt water is added. Another factor that affects the preservation of canned fish is sealing the cans hermetically (Durance, 2007). This step is done under vacuum condition with a double seam to prevent further bacteria entry that can cause spoilage or render safety (Durance, 2007). Hermetically sealed cans also prevent the entry of extra oxygen which is a necessary substrate for lipid oxidization (Durance, 2007). After packaging the tuna into cans or pouches, retorting cooking further ensures safety by eliminating all pathogens and spoilage bacteria. Next, the product is commercially sterilized by killing all viable microorganisms and inactivating their spores. Batch retorts are used with pre-determined conditions that can sufficiently fulfill this regulation so that food could be stored under normal non-refrigerated conditions without bacterial proliferation (Durance, 2007). In general, a lethality Fo (unit of sterilization, time at 121.1˚C) of 10 to 15 minutes is needed for canned fish (Myrseth, 1985).

After thermal processing, cans and pouches are cooled under pressure, and dried in air or with the assistance of air blowers, and held in "bright-stacks" prior to labeling and packing, or labeled and packed directly off the line (D. Safrika, Personal Communications, March 24, 2009). After each processing, the plant generates a large amount of fish waste (D. Safrika, Personal Communications, March 24, 2009). Oftentimes, these unused fish materials are either sent to a reduction facility where they are made into fertilizer or animal feed. Other plant materials are recycled (D. Safrika, Personal Communications, March 24, 2009).

CANNED SALMON FLOW CHART

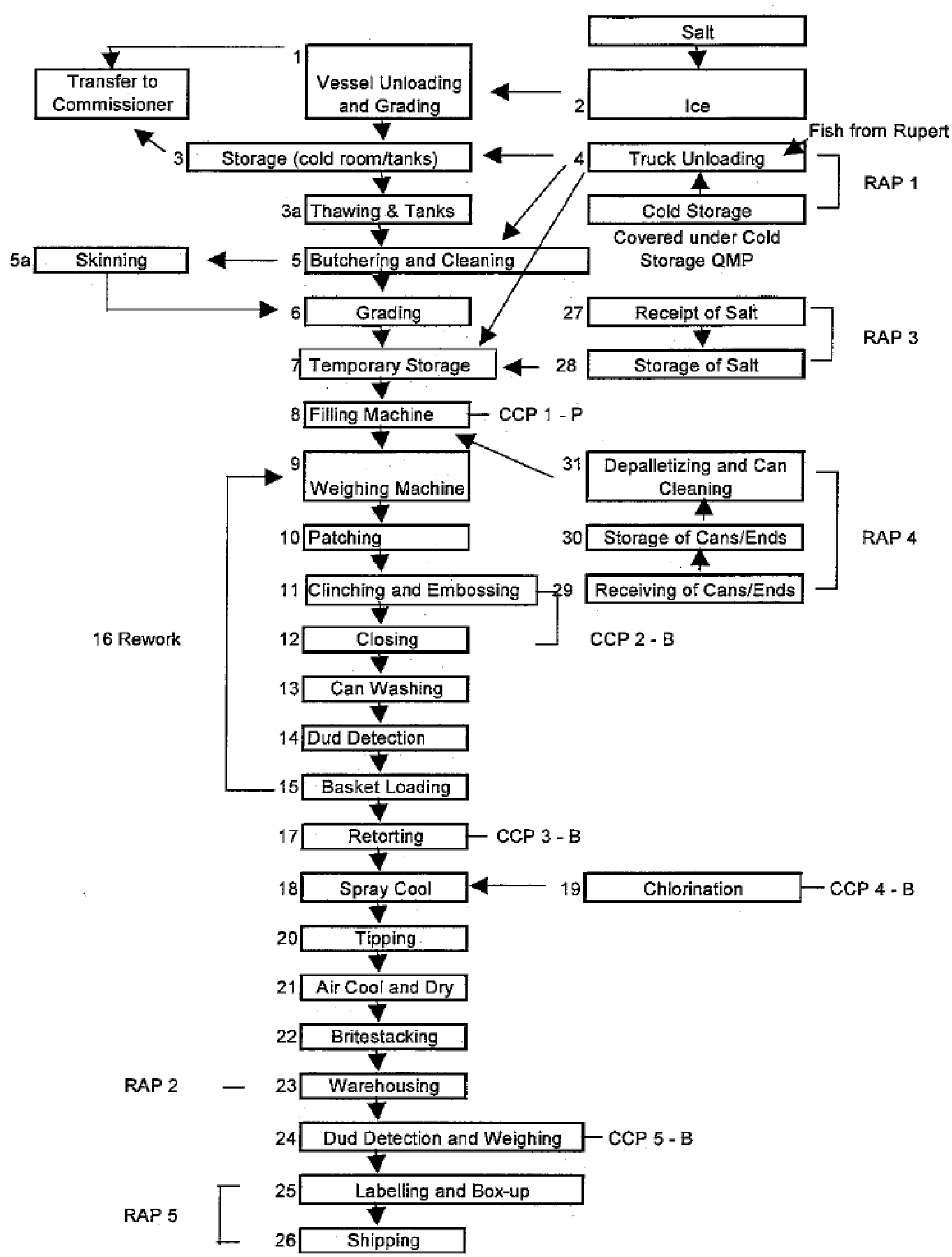

Fig. 5. Processing and packaging flow chart of canned fish (D. Safrika, Personal Communications, March 24, 2009).

Processing & Packaging of Pouched Fish

The Tuna used by UBCFS is packaged in what is called a retort pouch. The pouch lining is configured of a 12.5-μm polyester/12.5-μm aluminum foil/80-μm cast polypropylene (Bindu, and Gopal, 2008). The preparatory work that follows before the fish is pouched is must the same as the canning process (National Fisheries Institute, 2009). The main differences that the process is carried out in Asia where the pouch material is also made in (D. Safrika, Personal Communications, March 24, 2009). Further comparison of Pouched versus Canned packaging is explained in the Discussions.

Transportation & UBC Waste management

Currently, Neptune Food Service is the food supplier and distributor for the AMS Food and Beverages, and UBC Food Services on campus. It is the largest food service distributor which offers a full range of food service products in Canada. The company is known in the industry as a "broad line" or "multi-line" supplier and wholesaler. It is also been the leading firm in the food distribution business in B.C. for over 25 years, and it is strongly committed maintaining that leadership position for the future (Neptune, 2009). According to our estimation, the travel distance between UBCFS and the Neptune warehouse is about 31.1km. In order for UBCFS to select the food supplier, they contact several food distributors within B.C. The successful bidder will obtain the contract, based on service and pricing. The food supplier constantly provides two shipments to UBCFS per week.

UBC Waste Management provides both waste management services and waste reduction for all on-campus restaurants and cafes. A large scale “in-vessel” composting facility was built in September, 2004 at UBC Vancouver campus (University of British Columbia [UBC], 2009). The "in-vessel" composting facility enables the waste management team to efficiently decompose organic waste in large amounts (UBC, 2009). The facility greatly reduces the amount of waste materials which would be originally sent to landfills. UBC collects about 1,900 tonnes of compostable waste each year, including food waste, paper products, and yard waste (UBC, 2009). It is considered as a sustainable model in managing solid waste and composting organic materials. In addition, several waste materials such as cans, plastic cutlery and glasses cannot be composted. These items can only be recycled and processed by other waste companies.

6.0 Discussion

Since Ocean's Fisheries Ltd. does not source from aquacultures, this may be seen as creditable since aquacultures are known to cause significant ecological damage from fish wastes and negative health on nearby, surrounding marine life (Weiss, 2002). However, looking at it another way, we may be over-fishing and disrupting the ecological balance of many species that depend on the fish we are harvesting.

Fishing methods and regulations seem to be sustainable in that it limits negative effects of other marine wildlife. But it is difficult to really say with affirmation that current practices of harvesting are sustainable because we cannot get a perfect estimate of populations in the wild. In Figure 6, it shows that world catches of fish are increasing, for skipjack tuna but yellowfin seem to be leveling off. Could this mean fishing for skipjack tuna is not being regulated enough and are being overfished or are possibly, populations in the wild increasing? These are questions requiring timely, data analysis, and scientific research that goes beyond our limitations for this paper.

Tuna and salmon are both carnivorous fish, frequently eating smaller fish. To be sustainable it is often suggested we eat lower down the food chain, such as the omnivorous tilapia fish (Haliweil & Nierenberg, 2008). Tilapia farming in Canada is just starting to gain momentum. The drawback is that tilapia is a tropical, warm-water fish grow best at temperatures of 24˚ C (Rakocy, 1989). This means rearing them requires closed, heated on land containment systems (which could become very energetically demanding). The benefit is that there is no risk of the fish escaping and becoming a problem for natives species. The benefit is that they are fast growing, reaching market weight of 300g in less than 10months, and can have several broods a year compared to one for cold water fish (Canadian Aquaculture Industry Alliance, 2008). But before we can actually recommend tilapia, over salmon or tuna, we would first suggest that more study be conducted at looking into the ecological footprint of raising tilapia in our climates.

The process of canning tuna or any other canning practices could be an economically and environmentally unsustainable practice. This is because the process of commercial canning requires a large capital investment in facilities for production, transportation, and storage. The materials needed to fabricate the cans must be imported from a foreign country (e.g. United States or China) (Food Market Exchange, 2003). Due to the rising fuel costs combined with the weight of can metal, it has made canning increasingly less cost-effective (Jun, Cox & Huang, 2006). In addition, large amounts of fossil fuel used during transportation of the tin aluminum cans from a distant can manufacturer to the site of processing further add to environmental damage. Therefore, growing awareness of environmental problems during recent years has led to increased demand for environmental information about seafood products. To combat this problem, Ocean's Fisheries Ltd were using cans that were made by Ball Packaging, a local can manufacture in Richmond that was closed to their Richmond facility plant (D. Safrika, personal communication, March 24, 2009). Buying local from local can producers is an economically and environmentally sustainable practice because it greatly reduces the costs and energy consumed in transportation of the cans. Also, it decreases carbon emissions and carbon footprint. In fact, Ocean's Fisheries Ltd. have completed their carbon footprint analysis in an attempt to reduce their carbon footprint. However, the analysis was completed on per pound of fish processed calculation (D. Safrika, personal communication, March 24, 2009). The company did not compare individual products such as salmon vs. tuna but rather the total carbon footprint of their company and the total volume of fish produced (D. Safrika, personal communication, March 24, 2009). Therefore it would be difficult to give the carbon footprint of any particular product. Nevertheless, we saw that the tuna industry can boost the economy as well because many jobs can be generated at the fisheries, processing plants, transportation, even at UBC where hundreds of people are employed to serve faculty and students. Manual labour consists of working with sharp equipment and heated materials within the processing plants which can pose a hazard for workers. These complications can affect the social sustainability of the system, but we believe that with proper training programs, strict safety requirements and work-safe involvements, these problems could be minimized.

Also, canning and retort cooking of canned tuna requires significant heat treatment to eliminate pathogens and bacteria that cause spoilage because heat needs to penetrate the surface and then to the center of can to ensure no viable pathogens survived in the cold spot of the can. As the findings suggested, the critical time and temperature of canned tuna for retort cooking is 121.1˚C for 10 to 15 minutes, not including, the time for pre-cooking 250-350˚F for 1-4 hrs or steamed for 2-4 hrs and cooling at 4-0˚C for 2 hours. Thus, by adding all this time and heat needed to produce the product, one could imagine how much fossil fuel and energy we would have to burn and how much carbon emission we would release to our ozone. This is such a devastating uneconomical and un-environmental friendly practice.

In addition, fish waste disposal practice is also an issue the Ocean's company has to deal with (D. Safrika, personal communication, March 24, 2009). Currently, Ocean's Fisheries Ltd. are recycling all their plant materials and sending their unused fish materials to a reduction facility where they are made either into fertilizer or animal feed which is an environmentally friendly practice (D. Safrika, personal communication, March 24, 2009). Perhaps, the company could take an alternate approach by employing the Enerfish process (Biofleet, 2008). That is converting fish waste into biodiesel.

Food Packaging Options for Tuna: Flexible Retort Pouch vs. Aluminum Tin Can

It is difficult to compare packaging costs without also including the costs of shipping containers, depreciation coasts of packaging machinery, labour requirements and energy cost of achieving commercial sterility. Canning is one of the most common packaging methods for preserving food products and it requires a large capital investment in facilities for production, transportation, and storage. Also, materials for can packaging is imported into the country, and with the combination of fossil fuel used for transport as well as the weight of the can material, it is less cost effective for the processing company

(Jun et al., 2006). Moreover, canning requires extensive heating and cooking time to eliminate all pathogens and spoilage bacteria, as well as considerable processing expertise to maximize palatability (Durance, 2007; Jun et al., 2006). On the other hand, flexible pouches are more economical to ship and dispose of than rigid cans. The retort pouch–packed product needs significantly less heat than cans to achieve commercial sterility, with cooking time and energy costs reduced by half (Jun et al., 2006). Heat penetrates the food much more quickly when it only has to reach the inside of a half inch-thick mass rather than the much thicker mass in around can (Jun et al., 2006). Unlike canned foods, the pouched foods will not be overcooked and softened into mush, ensuring better texture and taste (Jun et al., 2006). In addition, retort pouching packing is environmentally friendly because it produces less waste and uses less fossil fuel. Lastly, retort pouch eliminates many work-related injuries due to a reduction in packaging material accidents. Nonetheless, food processors are still reluctant to remove a functioning can line to replace it with retort packaging due to its high capital costs.

7.0 Recommendations

Through the extensive research on processed tuna using the food commodity chain analysis tool, we have formulated recommendations for the UBC students, the UBC food outlets and for future LFS students. These recommendations placed upon UBC as a whole is not limited to the campus, but can be utilized in other communities.

Changing the views of the consumer

By educating the general public, the students of UBC can help reduce the demand of tuna and create a leveling off of the demand quota. The less people are interested in purchasing, the less processors will produce. In order to promote awareness on the practices of fish production, we recommend visual aids (e.g. posters) as a great way to draw attention. Even though there is a chance for a rise in "poster pollution", posters are one of the most efficient methods to get information across. As a way to decrease poster accumulation around the campus, the development of a quick fact brochure is another method of promotion (refer to Appendix 1 for an example). This brochure would include food alternatives to tuna, advantages of these alternatives and simple recipes that can be utilized by the UBC food services and the rest of the campus community.

Changing our diets

There are many alternatives to tuna which can even contain more nutritional value than tuna. In choosing the other food alternatives we can reduce the large scale tuna production and consequently decrease the environmental impacts involved in the processing and production of tuna. Food alternatives such as tofu, flaxseed, tempeh are excellent food stuffs that can easily replace tuna by providing similar amounts of essential fatty acids and protein. For example, flaxseed is an excellent alternative that is also a source of fiber and antioxidants, and does not contain cholesterol (Sorgen, 2003). Flaxseed has been associated with lowering overall cholesterol, stabilizing blood sugar levels, and lowering the risk of certain cancers (Sorgen, 2003) and it can be produced in sustainable means (Canadian Grain Commission, 2009). Tofu is another example of a fish alternative that has been increasing in popularity. Common in the vegetarian and vegan diet, it provides high amounts of protein, B vitamins and iron with no cholesterol and low in sodium (United States Department of Agriculture, 2009). Though tofu is a great alternative, consumers must be aware that there are unsustainable practices in producing soybeans for tofu. The increasing demand for soybean production has lead to the monoculture of soybeans and decreasing overall land biodiversity (Wood, Stedman-Edwards, Mang, World Wildlife Fund, 2000).

We suggest that AMS Food and Beverages and UBC Food Services need to purchase more ecological sustainable foods in comparison with canned tuna. Although there is an advocate from the Vancouver Aquarium with their Oceanwise program that promotes the use of sustainable fish in the food services, it is still not a fully sustainable choice compared to decreasing fish consumption overall. UBCFS and AMS Food and Beverages have a part in the sustainability of our campus by the support and promotion at their outlets with other tuna alternatives such as tofu wraps as well as provide reasoning for these changes. Students will be exposed to more food choices combined with information on the impact of tuna production from the brochure. This change can allow us to move one step closer to a more sustainable campus and subsequently, sustainability on a global basis.

8.0 Conclusion

Using a commodity chain analysis (CCA) and community based action research approach, our group was able to assess the sustainability of consuming packaged tuna and salmon products provided by UBCFS and AMSFB. One of our findings is that taking a CCA approach does not give a clear answer to what is sustainable or not. When comparing multiple links within a food system, two products may rate more favorably in some aspects yet poorly in others. For example, we cannot give a clear answer to whether we should eat tuna, salmon, or even tilapia as each has there benefits and disadvantages to sustainability.

Tuna was the most common fish consumed and we predict that consumption may never really decline due to number of factors such as nutritional properties, taste preferences or the amount of jobs this industry can provide. Therefore it is really difficult to say that eliminating tuna is the answer, yet at the same time we do not want the tuna to suffer the same fate as the Atlantic cod, which was once a abundant fish, before it was fished to its depletion and in turn caused the collapse of many fishing operations (Fudge and Rose, 2008). We hope that the UBC community can continue to be a model for making innovative and sustainable food choices. Implementing "Dolphin-safe" products in Totem Park and Place Vanier cafeterias were giant steps for UBC to move towards consuming sustainable seafood, but through public education and awareness, we believe there is a chance that UBC students and faculty members would comprehend why tuna consumption should be lessened. We understand that the texture and taste of tuna cannot be replaced; however, our wish is for consumer surveys and further research into other food choices that could potentially substitute its nutrition content and at the same time be accepted by the UBC population.

9.0 Appendix

Interview via phone with Nancy Toogood, manager of AMS Food and Beverage Department

General:

1. **What are your reasons for using fish? (ex. consumer demand, convenience?)**

This really depended on customer's requests and we try to keep a wide variety of choices for students and faculty members.

2. What type of foods do you make from the packaged fish?

Mostly tuna salads and sandwiches, smoked salmon on bagel.

Waste:

3. At the end of a day, how much unsold fish products do you have? What do you do with it?

For Honor Roll, they cut enough pieces of the fish for the day, there won't be left over since they are raw. The salad or mixed products will be kept in the fridge up to three days.

Carbon footprints:

4. Do you use other types of fish besides tuna or salmon? If so, what type?

We use other types of seafood for salads and sushi such as shrimp, fake crab, real crab, shrimp.

5. Have you considered using whole, fresh fish instead? If yes, why? If no, why do you think it would/wouldn't be feasible for your business?

We don't usually use whole, fresh fish because most of the staff is students working 10-12 hours per week. We don't allow them to handle raw foods because they aren't trained in food safety, therefore only the full-time staff does these processes. So we try not to use raw means in the menus but the Moon is probably the only one that handles more raw meats than the other outlets.

6. If the recipe asks for fish products, have you thought of *changing it* to make it a "lighter carbon footprint" product instead?

Again, it depends on consumer demand. If people like anchovy sandwiches, we would make this switch but unfortunately this doesn't happen even if we want to switch to a more sustainable fish source.

Economics:

7. What percentage of your profit is based on tuna/salmon menu items?

This is impossible to calculate based on the number of tuna/salmon dishes sold every day. AMS food outlets are actually not so much for profit since any profit goes back into AMS to provide other things for students, so we always need to consider the costs of our operations while providing a wide variety of nutritious menus for everyone. Thus the Agsc 450 projects really helps us a lot to make changes for the better.

Interview via email with Doug Safrika, Director of Quality Assurance.

Fish Harvesting:

1. Where are the fish above caught, and does Oceans fisheries get any from farmed sources?

The salmon are caught in Alaska and British Columbia. The tuna is caught mostly in the Indian Ocean and south east Asia. We do not handle farmed fish.

2. How do they catch the fish?

The tuna is caught with a purse seiner which encloses the net around the schools of fish and closes into a purse. The salmon is caught with purse seiners and gillnetters. The B.C. Salmon marketing council has more information on these forms of fishing at http://www.bcsalmon.ca/bcsmc/ffact3.htm

3. What regulations do they place on their fisherman to ensure fishing practices meet

Ocean's standards of dolphin friendly?

The dolphin friendly program is monitored by Earth Island Institute. Earth Island was established in 1982 and is involved in numerous environmental programs. They certify that the fish we are buying is dolphin friendly. Their web site is http://www.earthisland.org/index.php/aboutUs/story/

4. Are there other regulations to minimize damaging effects to the environment or wildlife when harvesting fish?

There are numerous regulations world wide to minimize damage to the environment or wildlife when fishing. In British Columbia dragging is limited to areas where there are no sensitive underwater sea life such as corals, sponges, etc which would be damaged by the dragging of the nets. All draggers are required to have an observer on board to verify incidental catch. Seine net mesh size and gillnet mesh size are strictly controlled as are the areas where vessels can fish and the times they can fish.

Processing

1. What are the basic steps Ocean's uses for canning and pouching tuna/salmon?

I have attached a flow chart of our canning process. Some of our product is canned at our Richmond cannery and some is canned for us in Alaskan by co-packers.

2. Is salmon also sold in a pouch package? If not, why?

At this time we do not sell salmon in a pouch package. The demand for such a product has been very limited.

3. Can you offer any energy estimate that is required for processing the fish in a day?

We have completed our carbon footprint. The carbon footprint was completed on a per pound of fish processed calculation. We did not compare individual products such as salmon vs. tuna but rather the total carbon footprint of our company and the total volume of fish produced. Therefore it would be difficult to give the carbon footprint any particular product.

4. Is the canned and pouched packaging outsourced from another company? Is so, which company and would it possible for us to contact them as well?

The cans we use in our Richmond facility are made by Ball Packaging in Richmond. The ends for the can are made by a Ball Packaging plant in the USA. The tuna pouches are packed with a co-packer in Asia near where the fish is caught and all the pouches are made in Asia.

5. Have you incorporated any sustainable practices in the processing of fish products? (ex. Energy efficient machinery, or change in raw materials used for packaging)

We have established a green committee within the company Programs that have come from that committee, and are now being implemented, include:

a) Monitors and restrictors on the speed of the fish boats to reduce fuel usage.

b) Change in net designs to reduce the drag effect from the nets and thereby to save fuel.

c) Recycling of plant materials.

d) Encouraging employees to car pool. (Our facility is rather isolated and buses are not a realistic option for most employees.)

e) Reduced air travel.

f) Use of packaging with a reduced carbon footprint.

g) Transfer of all company manuals, procedures, and records to an electronic format to avoid unnecessary use of paper.

h) Encouraging employees to use electronic formats in their communications if possible.

The green committee is an ongoing committee and we are continually evaluating our progress.

6. How are unused fish materials and other waste along the line disposed of?

Unused fish materials are either sent to a reduction facility where they are made into fertilizer or animal feed.

Transportation

1. Do you provide direct transportation of goods to UBC or rely on another company to deliver? If another company is used, which ones and why?

Numerous other transportation companies would be used.

Easy Ways to Supplement your Diet with Omega 3:

- sprinkle some flaxseed in your salad, cereal or pasta
- blend a tofu based smoothie with your favourite berries...don't judge if you haven't tried it!
- easily replace tuna for tempeh in tacos and wraps.
- snack on some walnuts
- eat green leafy salads, but cut back on the salad dressing as it is high in Omega 6.
- Choose meat and eggs from free-range animals with access to pasture

Brought to you by

Group 28

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As part of a the UBC Food Systems Project, 2009

Alternatives to fish:

Good Sources of Protein and Omega 3

Part a of Movement towards Sustainability

What are Omega 3 Essential Fatty Acids?

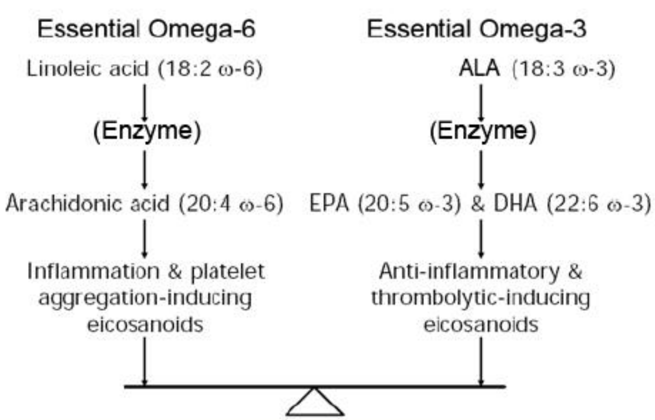
There are 3 types of Omega 3 Fatty acids:
Alpha-linolenic acid (ALA)
Eicosapentaenoic acid (EPA)
docosahexaenoic acid (DHA)

They are essential because our body is unable to produce it so we need it in our diets. Below are answers to common myths about Omega-3

Myth #1: We need more Omega 3
NO, what we need is **not** just more Omega 3, but a **balance** of essential Omega 6 and 3. Omega 6 is found in vegetable oils (corn, sunflower, safflower) common in processed foods.

Myth #2: The only way to get Omega 3 is from fish or fish oils.
NOT QUITE. Only EPA and DHA are found predominantly in fish. But, ALA is found in many types of plants products: flaxseed, walnuts, Soy products, canola oil, beans/peas and green leafy vegetables.

What most people don't' understand is
Our bodies can make EPA and DHA, from ALA (See below):



Since we can make EPA & DHA from ALA..

...and ALA can easily be obtained from plant sources...

We do not need to eat fish
for our Omega 3 needs!*
There are Alternatives out there!

*Provided that we maintain a proper balance of Omega 6 and 3, so enzymes are not all busy converting Omega 6. Recommended Omega 6: Omega 3 ratios should be no more than 10:1

More Reasons to Choose Alternatives Over Fish:

- Some fish may have high levels of mercury (A risk for pregnant woman and young children)
- Prevent depletion of wild fish stocks, and ecologic damage from aquacultures
- Less energy required to preserve, and process.
- Little to no cholesterol compared to tuna
- As good or better source of omega-3
- Can be farmed sustainable
- Try something new in your diet!

How Some Alternatives Compare:

Tofu (100g Protein: 8 g Omega-3: 0.36g)
- excellent source of protein
- cholesterol free
- excellent product for vegetarians
- good source of B vitamins and iron
- low in sodium

Flaxseed (1 oz. Protein: 5 g Omega 3: 3.51 g)
- rich source of essential fatty acid
- good source of dietary fibre
- high in phytochemicals (eg. antioxidants)
- high in B vitamins

Tempeh (4 oz. Protein: 20.63g
- good source of iron
- source of polyunsaturated and monounsaturated fats
- cholesterol free
- soy-based product
- high in protein

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