BC Centre for Disease Control
An agency of the Provincial Health Services Authority

Environmental Health Services

Food Issue

Notes from the Field

Marine plant harvesting, licensing and safety as a food product

Request received from:	Regional Health Authority
Date of request:	October 31, 2013
Issue (brief description):	Dried bull kelp product found being sold at farmers' market. What licensing requirements are there for harvesting and processing; and what food safety concerns exist? [Nereocystis luetkeana]

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Summary of search information:

1. Internet sources: FAO library
2. Ovid (define your search terms): FoodNetBase texts; Agricola [macrocystis or macroalgae, n=1299] and [food safety, n=16,583] resulted in 11 abstracts.
3. Other: spoke to biologists

Background information

Macroscopic algae forms are known as seaweeds and sea vegetables.[1] They are eaten in many parts of the world, and at least 20 varieties are known to be consumed by indigenous Canadian people.[1] Seaweeds and sea vegetables are nutritious, but can be difficult to digest, due to complex polysaccharides. For this reason, many cultures ferment seaweed products before drying the product for later consumption.[1]

Records do exist that confirm Pacific coast Indians did ingest various species of kelp (*Alaria* spp., *Costaria costata*, *Hedophyllum sessile*, *Laminaria* spp., *Lessoniopsis littoralis*, *Macrocystis pyrifera*, Nereocystis *luetkeand*, *Pterygophora* sp.) and other sea vegetables such as rockweed (*Fucus* spp.), dulse (Palmaria *palmata*), and sea lettuce (*Ulva lactuca*). Giant kelp (*Macrocystis*) was eaten with herring spawn on it. For further details on traditional preparation of these foods, consult this link http://www.fao.org/wairdocs/other/ai215e/AI215E06.htm .

Elsewhere in the world, kelp and sea vegetables are consumed fresh (sea lettuce, reported in Scotland, India, Siberia, North and South America); as dried products, most significantly in Japanese culture as "nori" (cultured *Porphyra*) ,"kombu" (compressed *Laminaria*), and "wakame" (dried *Undaria*); in breads (Scotland, Brittany) and in soups (Chile).[2] On the Pacific coast, *Nereocystis luetkeana* has been marketed in a desalted, dried and candied format known as "seatron" for confectionaries. [2]

Giant bull kelp is extensively harvested in North America as a source of alginate.[3] Alginate is used as a gelling and gumming agent in foods, and has many other uses as when dried it can absorb 200X its weight in water (http://en.wikipedia.org/wiki/Alginic_acid). In California, total production of alginate was in excess of 100,000 tonnes in the mid-80's.[3] The use of *Macrocystis* and *Nereocystis* as human food is minor in North America. Slices are prepared and pickled, but no known commercial products of this kind were being marketed at the time of this report (1986).[3] Phycocolloids (agars, carrageenan, furcellaran) are derived from red algae and are also more commonly named as agars, vegetable gums, mucilages and thickeners.[2]

What are the risks associated with sea weed and sea vegetable products?

Hazards associated with consuming seaweed products are primarily "chemical", specifically concerns over various types of heavy metal consumption. Although toxins do not appear to be associated directly with macroscopic algae (seaweeds and sea vegetables) some microscopic algae species are able to produce toxins that may lead to illness, for example, saxitoxins produced by the dinoflagellate algae, *Alexandrium*.[4]

There is evidence that heavy metals present in the environment can be absorbed by algae and kelp, and can bioaccumulate in species feeding on them, such as abalone.[5,6] Studies of kelp and algae fed to mice and rats have found some toxicity may be present, dependant on the levels of heavy metals and other compounds in the kelp.[5,7] However, in one Korean study, examination of the total intakes of mercury, lead and cadmium in seaweed products would only represent 0.2 to 6.7% of tolerable weekly intakes, and they concluded that even with a high consumption of seaweed, there would be a low probably of health risks from consuming these products.[8]

Pollutants such as petroleum products would almost certainly adversely affect the quality of edible seaweeds and the extraction of phycocolloids, whilst high colon bacteria might produce a health hazard in seaweeds used for food and fodder(http://www.fao.org/docrep/005/ac860e/AC860E06.htm). In areas of sewage enrichment, kelp plants have shown localized rotting, affecting the quality of the product.[3]

Pathogens can be associated with sea weeds and sea vegetables. At least one case of *Vibrio* has occurred in BC, this case was reported in a hungry kayaker, who ate some sea lettuce (*Ulva)* while on paddling on the open sea. As mentioned above, sea weeds and sea vegetables could potentially be contaminated with bacterial and viral pathogens from exposure to sewage. Once products are dried, however, most bacterial pathogens will die off. Viruses, however, even in small amounts have potential to cause illness.

Previous guidance on marine plant harvesting and processing from British Columbia

A marine plant harvest licence and a marine plant processing licence are required in BC, and may be obtained from the Ministry of Agriculture.
http://www.agf.gov.bc.ca/fisheries/commercial/commercial_mp.htm

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Requirements for a marine plant processing plant can be found on the Ministry of Agriculture constructional and operational plant requirements checklist or as described in the *BC Fish Inspection Act* and *Fish Inspection Regulation*.

Although inventories of sea kelp have been conducted by the province of BC in the 1970's and 1980's, no testing for heavy metals was conducted on this resource, so the extent of heavy metal contamination is unknown. Conversations with two biologists on assessing risks of heavy metal contamination in BC sea plants was contradictory. One felt that examining sediments for heavy metals would not be a good indicator of potential heavy metal contamination in sea plants, as the plant itself does not grow in the soil, but on substrates such as rocks. The other biologist felt that as the plant decomposed, residual material would compost into sea bed, and therefore would be a reasonable indicator of heavy metal contamination.

The Canadian Shellfish Sanitation Program (CSSP) does provide some guidance for harvesting and collection of shellfish that may be applied to this situation. The CSSP guidance prohibits collection of shellfish within a 300 metre radius of intermittent sewage discharge areas or industrial outfalls (Section 2.3.6).[9]

Guidance on marine plant harvesting and processing (elsewhere in the world)

None was found related to human food safety.

Recommendations from BCCDC

Although very little could be found in the literature describing potential hazards of marine plants, some common sense recommendations were noted for harvesting and processing of this product.

- Marine plants sold in farmers' markets or elsewhere must comply with all provincial and federal requirements, including
  - Obtaining a marine plant harvesting licence
  - Obtaining a marine plant processing licence
  - Labelling requirements
- Marine plants intended to be dried should not be harvested from areas where
  - Sewage outflows or combined sewerage/storm water outflows exist to limit exposure of plant materials to enteric pathogens. Harvest sites should be at least 300 metres away from open sewage or storm water outflows.
  - Industrial activities are known to have occurred that may have contaminated the area with toxic heavy metals or pollution sources (persistent organic pollutants).
  - Closures for shellfish harvesting for marine biotoxin or sanitary closures are in effect. This information will assist the operator in fulfilling this recommendation:

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  - Fisheries and Oceans Canada is responsible for enacting the opening and closing of shellfish areas.
  - The official site for Marine Biotoxin Updates remains the DFO Website at: http://www.pac.dfo-mpo.gc.ca/fm-gp/contamination/biotox/index-eng.htm
  - You may apply to receive fishery notices by email from DFO at the following link: http://www-ops2.pac.dfo-mpo.gc.ca/fns_reg/index.cfm

- Further, marine plants intended to be sold fresh (such as *Ulva*), should comply with the above and in addition should not be harvested from areas where
  - *Vibrio parahaemolyticus* closures exist for shellfish
- If results could be found describing concentrations of heavy metals, persistant organic pollutants or endocrine disrupting products such as hormones and antibiotics in marine sediments, these could be assessed as surrogates for the presence/absence of heavy metals in harvest marine plants. Further research should be undertaken to try and source these out.
- Processing of marine plants should occur in an inspected facility, and sea plants should be washed with potable water before drying or selling fresh.

References

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