perennia
ideas • innovation • success

NOVA SCOTIA SPECIES SPOTLIGHT: **SEA CUCUMBER** (*Cucumaria frondosa*)

FISHERY

The sea cucumber fishery in NS takes place on the Scotian Shelf in Northwest Atlantic Fisheries Organization (NAFO) areas 4VXW, in inshore and offshore areas, from May 1st to March 31st. It is mainly a commercial fishery, and Food, Social and Ceremonial or recreational fisheries are not currently permitted. The Maritimes fishery is in an exploratory stage.

In 2022, the total allowable catch (TAC) in these areas was 2,300 t.

Sea cucumber is also fished in SW New Brunswick, the Gulf of St. Lawrence, and in 3Ps off Newfoundland.

Sea cucumber is fished using dredges of a design distinct from sea scallops.

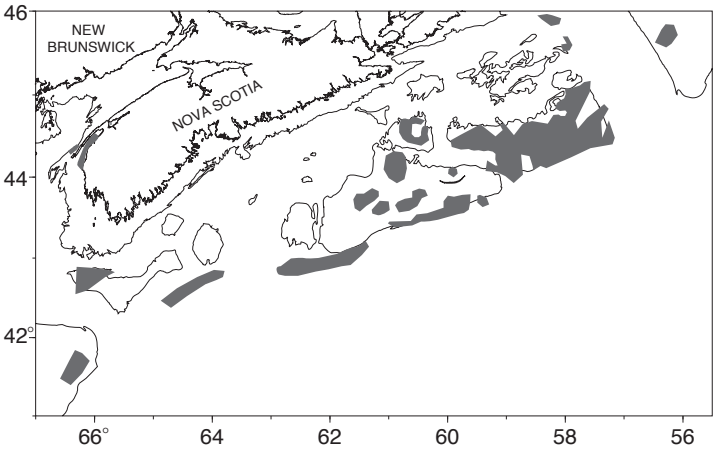

Figure. Sea cucumber fishing areas on the Scotian Shelf

BIOLOGY

Sea cucumber is an invertebrate echinoderm of the class Holothuroidea. They are closely related to sea urchins and sea stars. A variety of sea cucumber species are targeted by commercial fishing, including 52 in Asia, 36 in the Pacific, but it is believed there are over 1000s species globally.

Sea cucumbers are cylindrical in shape, measuring from 25 to 50 cm in length, and weigh up to 600 g. They possess five tube feet for mobility, and their mouth (or aquapharyngeal bulb/tentacles/flower) contains 10 structures that are used for feeding.

Sea cucumbers are benthic, slow-moving, and aggregate in small beds. They prefer rocky, gravel, or sandy bottoms, and are typically distributed between 20 and 100 m depths, but have been collected from depths as low as 800 m.

They filter phytoplankton, unlike other sea cucumber species that feed on sediment. They are predated by fish and crustaceans, but predominately by sea stars, namely the Purple sunstar.

LIFE CYCLE

Spawning takes place from March – May. Males release spermatozoa into the water column first, followed by females who release from 10,000 – 100,000 oocytes.

Fertilized oocytes measure 0.5 to 0.8 mm in diameter, then spend 1 to 2 months in the water column feeding on plankton before settling on the ocean bottom.

Sea cucumbers are considered slow growers. Male and female sea cucumbers exist at nearly a 1:1 ratio and reach sexual maturity by 3 years of age when 8 to 10 cm in length. They are estimated to reach 12 cm in length from 4.5 to 5 years of age. They reach commercial size (25 to 30 cm) by approximately 10 years of age.

MANAGEMENT AND CONSERVATION

The Scotian shelf sea cucumber fishery does not yet have an established integrated fishing management plan. However, efforts to implement such a management plan following the precautionary approach are being taken. Currently, the fishery is managed through conservation harvesting plans with temporal and spatial fishing restrictions and a TAC.

perennia
ideas • innovation • success

NOVA SCOTIA SPECIES SPOTLIGHT: **SEA CUCUMBER** (*Cucumaria frondosa*)

SEAFOOD LABELLING

	Terminology	Description
Common Name	**English**: Sea cucumber **French**: Concombre de mer, Holothurie	Accepted common name(s) for *C. frondosa*
Other Names	Trepang / Beche-de-mer	Traditional names for the dried body wall of sea cucumbers globally
Production Method	Wild	Harvested from the ocean
Product Forms	Dressed (Football/Cocoon Cut)	Tentacles and anus removed, eviscerated
	Split (Butterfly Cut)	Tentacles removed, split, eviscerated

PROCESSING/HANDLING

Process Yields

Viscera = **5 - 10%**

Dried Body Wall = **5 - 10%**

Primary Products
Dried Body Wall, Whole (Frozen)

By-Products
Viscera, tentacles (flower)

Post-Harvest Primary Processing Flow
Receiving » Thawing (Optional) » Washing » Cutting » Evisceration » Cooking » Drying » Packaging » Storage » Transportation

Traditional sea cucumber processing may involve salting prior to cooking or smoking after cooking and before drying. Both processes assist in removing moisture from sea cucumber.

Post-Harvest Processes Impacting Quality

- Improper cleaning (presence of foreign material, incomplete evisceration)
- Handling (mortalities, miscuts, damage to skin)
- Temperature abuse (delays in chilling, processing)
- Product inspection (improper grading/identification of product out of specification)
- Processing (grading, cooking time, drying time)

CHEMICAL COMPOSITION

Proportion (g / 100 g)		
	Whole[1]	**Viscera[2]**
Moisture	90.5	82.1
Protein	5.5	8.6
Fat	0.8	4.7
Carbohydrate	3.5	2.4
Ash	1.5	2.1

[1]Zhong, Khan, and Shahidi, 2007; [2]Lui et al., 2021

Sea cucumbers contain many bioactive and functional compounds, including collagen, glycosaminoglycans, saponins, and omega-3 fatty acids.

STORAGE

After harvest, sea cucumbers should be chilled, preferably in sea water, and protected from sunlight. Water used to store sea cucumbers should be replaced often or recirculated through a filtration system to maintain oxygenation and overall water quality. Direct contact with ice may cause localized freezing and damage to the skin.

Dried sea cucumbers should be stored in an atmosphere of low humidity, otherwise they may take on moisture available in the air, and risk the growth of moulds.

perennia
ideas • innovation • success

NOVA SCOTIA SPECIES SPOTLIGHT: **SEA CUCUMBER** (*Cucumaria frondosa*)

KEY FOOD SAFETY AND QUALITY CONCERNS

Autolysis, or self-digestion, may occur due to delays in chilling and processing. Evidence of autolysis includes discolouration or unevenness of colouration, and pitting of the skin.

Quality attributes include individual piece size body wall thickness, shape, colouration (skin and meat), skin appearance, freshness, moisture content. Colouration and skin appearance may be affected by use of freshwater during cooking, or overcooking. Skin is easily damaged by handling after cooking, prior to drying.

Two cooking steps are traditionally used during the preparation dried sea cucumber. A second cooking step after an initial drying step can help drive out more moisture and provides the opportunity for reshaping of the product before fully dried. If a product is still flexible after drying, but no further weight loss is occurring during drying, a second cook is recommended.

Even though *Cucumaria frondosa* are dendrochirotes and feed using their tentacles, they may ingest matter on the ocean bottom, including rocks and sand that can be found within internal structures. Proper evisceration and clean should remove these foreign materials.

REFERENCES

DFO. 1997. Scotian shelf sea cucumber. Stock status report 96/125E. Fisheries and Oceans Canada. **https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/40642276.pdf**

DFO. 2019. Sea cucumber Newfoundland and Labrador region 3Ps. Fisheries and Oceans Canada. **https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/sea_cucumber-holothuries/2019/index-eng.html**

DFO. 2021. Guidance for setting reference points for the sea cucumber (Cucumaria frondosa) fishery in the Maritimes region, and status of the SWNB sea cucumber fishery 2019. Science Advisory Report 2021/007. **https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/40979404.pdf?_gl=1*171fbmm*_ga*ODYxNzQ3NTjE2NTE1MTM4NDY .*_ga_7CCSB32R7T*MTY3MTczMTM2Ni4xLjEuMTY3MTczNjUwMy4wLjAuMA.**

DFO. 2022. 2022 to 23 Scotian shelf sea cucumber (4Vs, 4W, and 4X). Fisheries and Oceans Canada. **https://www.dfo-mpo.gc.ca/fisheries-peches/decisions/fm-2022-gp/atl-29-eng.html**

Liu, Y., Dave, D., Trenholm, S., Ramakrishnan, V.V., and Murphy, W. 2021. Effect of drying on nutritional composition of Atlantic sea cucumber (Cucumaria frondosa) viscera derived from Newfoundland fisheries. Processes. 9, 703. **https://doi.org/10.3390/pr9040703**

Purcell, S.W. 2014. Processing sea cucumbers into beche-de-mer: A manual for Pacific Island fishers. Southern Cross University, Lismore, and the Secretariat of the Pacific Community, Noumea. 44 p.

Slater, M. J. (2015): Use and Exploitation of Sea Cucumbers / N. Brown and S. Eddy (editors), In: Echinoderm Aquaculture, Echinoderm Aquaculture, New Jersey, Wiley Blackwell, 384 p., ISBN: 978-0-470-9603.

Toral-Granda, V., Lovatelli, A., and Vasconcellos, M. 2008. Sea cucumbers. A global review of fisheries and trade. FAO Fisheries and Aquaculture Technical Paper. No. 516. Rome, FAO. **https://www.fao.org/3/i0375e/i0375e.pdf**

Zhong, Y., Khan, M.K.A., and Shahidi, F. 2007. Compositional characteristics and antioxidant properties of fresh and processed sea cucumber (Cucumaria frondosa). Journal of Agricultural and Food Chemistry. 55(4), 1188-1192.