Fisheries and Oceans Canada
Pêches et Océans Canada

Guide on best practices for seaweed harvesting in Quebec

Fanny Noisette

Fucus sp. assemblage at Anse-aux-Fraises in the clear waters of Anticosti Island, QC

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Roy, S., Roy, V., Smith, A. et Belley, R. 2025. Revue de la biologie et des pratiques de récolte des macroalgues de l'Atlantique Nord : suggestions de modifications et d'ajouts pour le Québec. Rapp. tech. can. sci. halieut. aquat. 3705 : ix + 72 p.
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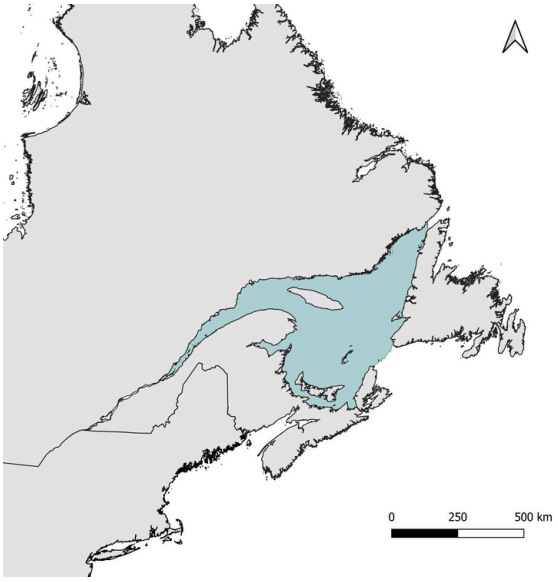
Foreword

This guide was developed for seaweed harvesters and anyone wishing to deepen their knowledge on seaweed harvesting practices. It promotes sustainable seaweed management in Quebec in the maritime zone illustrated in turquoise on the map. This guide is based on a literature review addressing seaweed harvesting conditions of multiple species harvested in Quebec and in similar climatic regions (Roy et al. 2025).



Estuary and Gulf of St. Lawrence

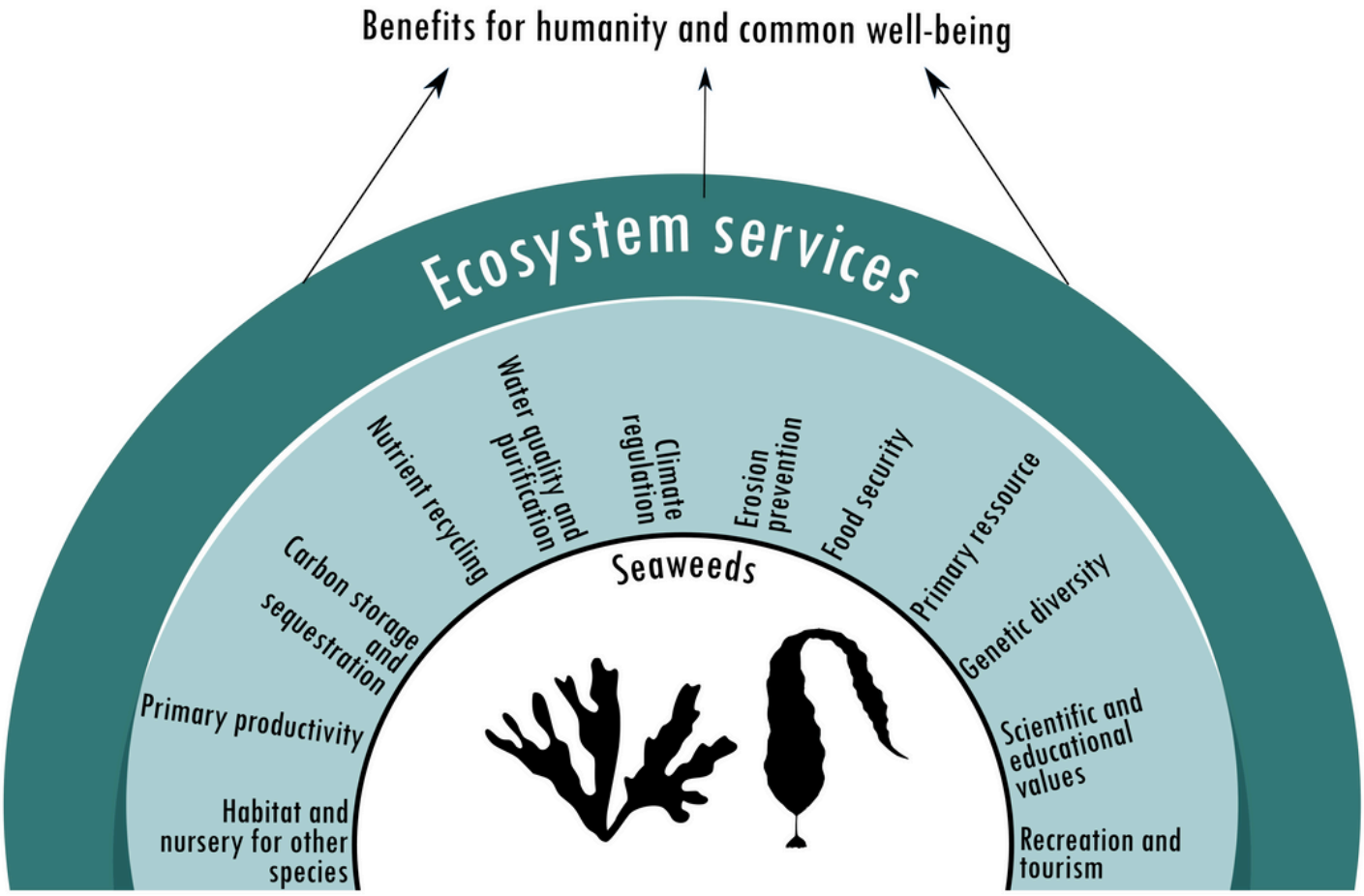
This guide aims to raise awareness on the importance of sustainable seaweed harvesting, with a focus on harvesting techniques respecting seaweed ecosystems. It is important to note that this guide is intended to serve as an informative resource promoting appropriate seaweed harvesting practices. However, it does not constitute an official regulation. The recommendations are designed to complement and not to replace existing regulations.

Stéphanie Roy

Kelp beds at low tide, Anse-au-Lard, Rimouski, QC

Importance of seaweeds

Seaweed ecosystems provide numerous services to humanity, also called ecosystem services, such as oxygen production, carbon dioxide fixation, as well as various marine species, using them as nurseries and refuges from predators. To preserve these services, it is crucial to maintain the integrity of these ecosystems during harvesting. Sustainable harvesting requires particular attention to harvesting techniques, which must be adapted to the biology of seaweeds. These techniques will be explained in more detail below. Prevailing conditions at harvest sites must also be considered. For example, if the harvest site is located near a coastal erosion zone, subject to a particularly high rate of herbivory or exposed to strong dislodgement following a storm, it is recommended to limit the harvest as much as possible at the site until the situation stabilizes to preserve ecosystem services.



List of commercial species in Quebec

Brown seaweeds

- **Sea colander** (*Agarum clathratum*)
- **Sugar kelp** (*Saccharina latissima*)
- ***Hedophyllum nigripes***
- **Oarweed** (*Laminaria digitata*)
- **Winged kelp** (*Alaria esculenta*)
- ***Saccorhiza dermatodea***
- **Knotted wrack** (*Ascophyllum nodosum*)
- **Fucus** (*Fucus* spp.)
- **Sea lace** (*Chorda filum*)
- ***Chordaria flagelliformis***

Dominates the coast of the Estuary and Gulf of St. Lawrence

Air vesicles keeping an upright position in the water

Red seaweeds

- **Irish moss** (*Chondrus crispus*)
- **Dulse** (*Palmaria palmata*)
- ***Devaleraea ramentacea***
- **Nori** (*Porphyra* spp.)

Specialized pigments allowing them to colonise the deep waters

Often attached to a living support (e.g. kelp stipe)

Non-flagellated sexual cells limiting their dispersal

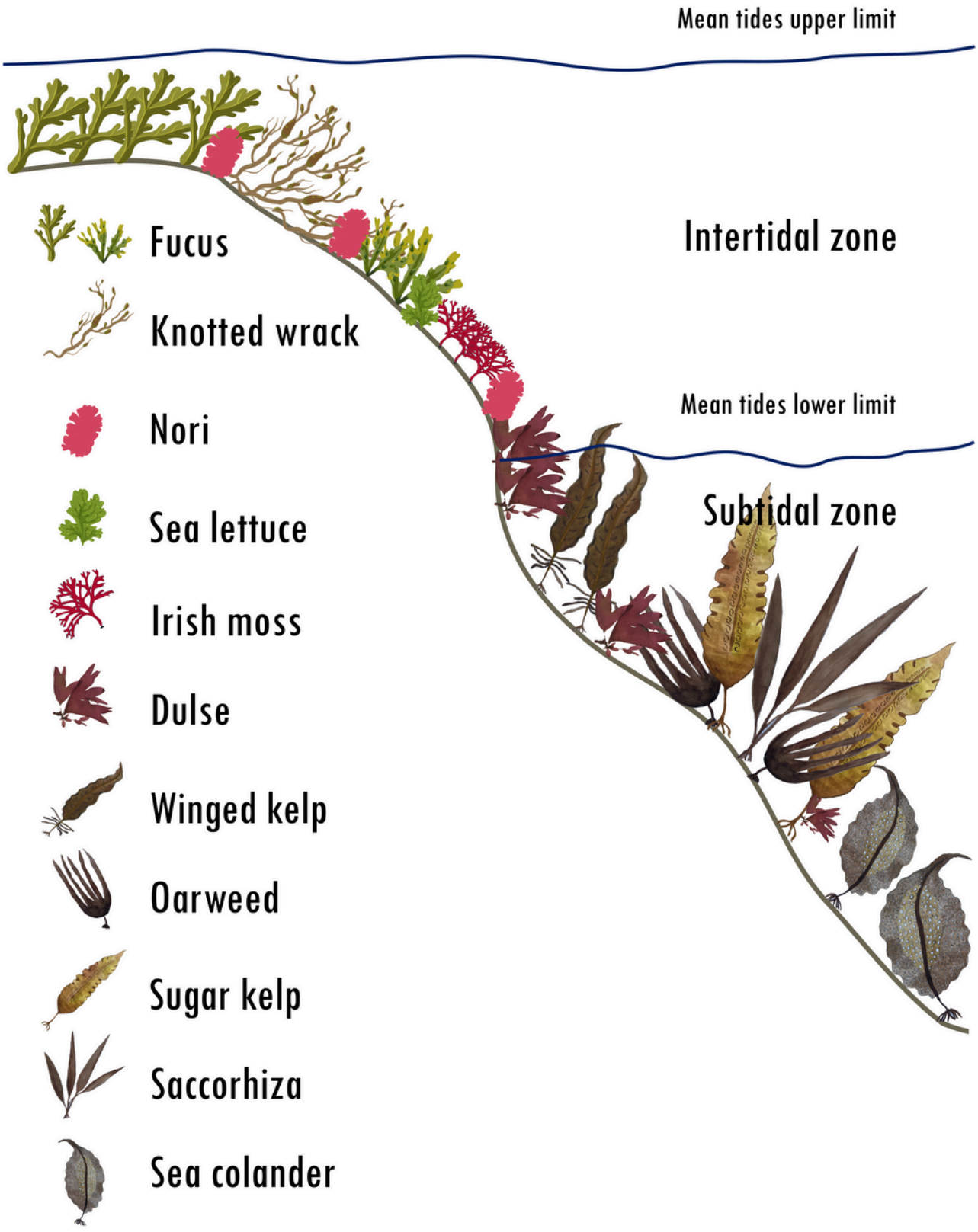
Green seaweeds

- **Sea lettuce** (*Ulva* spp.)

Can proliferate quickly

Can be a pollution indicator when in very large quantity

Vertical distribution – where to find the species?



Not all species described in this guide are shown in this figure.

General practices for sustainable harvest

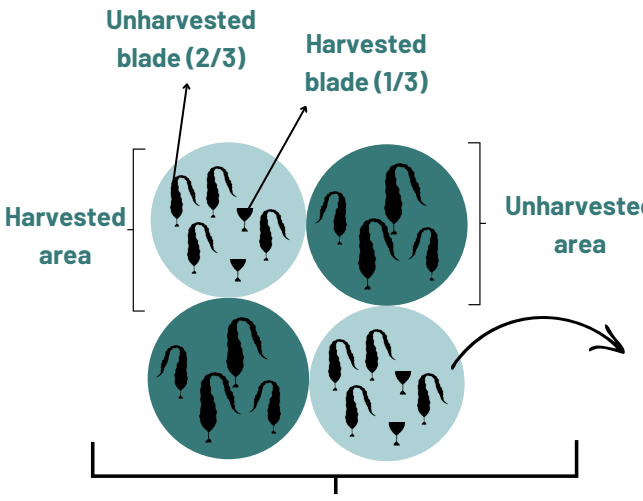
For all seaweed species, harvest suggestions go as follow:

Harvest site (in order of importance)

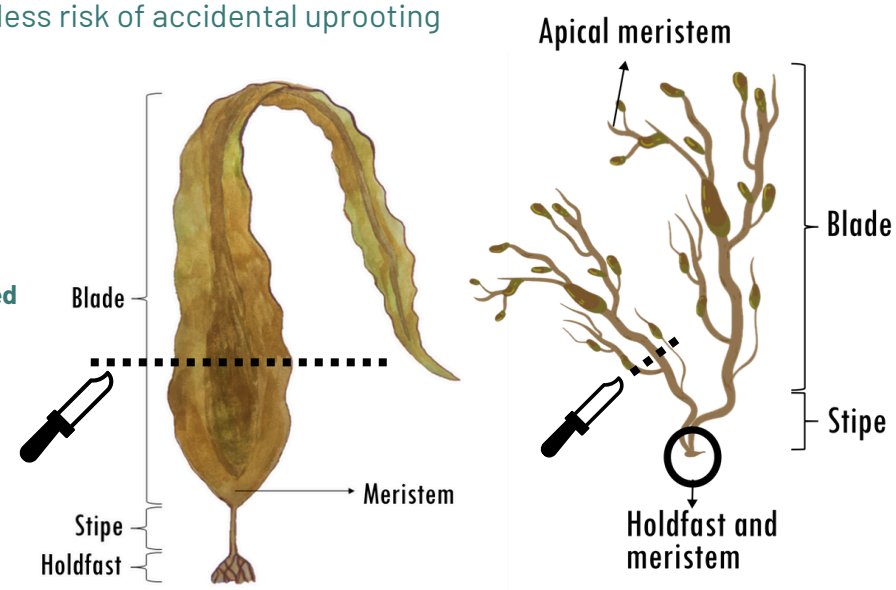
- **Harvest a maximum of 33% of the biomass per species per site (one blade out of three)**
  Conservation of the biomass and associated benefits
- **Favour harvesting during the growth phase and avoid harvesting during reproduction**
  Maintains biomass through rapid regrowth following harvest and better population renewal through more efficient reproduction
- **Leave the holdfast attached to the substrate. If problematic, uprooting of holdfasts of a maximum of 10% of the harvested biomass per species may be acceptable**
  Maximum loss to conserve benefits and promote effective regrowth
- **Apply fallow periods**
  Allows the population to return to the pre-harvest state
- **Maintain an unharvested zone (buffer zone) between each harvested area, ensuring that each zone is of similar size (mosaic harvest)**
  Allows more efficient recolonization due to proximity to an unexploited zone
- **Avoid harvesting fertile individuals**
  Ensures better population renewal through efficient reproduction
- **Avoid harvesting juveniles**
  More effective population regeneration

Harvested individual (in order of importance)

- **Cut above the meristem**
  Leaving the meristem in place allows for faster regrowth of the blade
- **Avoid harvesting reproductive structures (leave at least an intact branch)**
  Ensures better population renewal through efficient reproduction
- **Use sharp object**
  Less damaging to the seaweed and less risk of accidental uprooting



Mosaic harvest and buffer zone



Morphology of sugar kelp and knotted wrack

Sea colander (*Agarum clathratum*)

Other names: *Agarum cibrosum*
Life expectancy: Several years
Age of maturity: n.a.
Reproduction period: Autumn, winter
Fertile individual: Presence of a dull beige area on the blade
Growth period: Spring, summer
Meristem: Basal area of the blade

One of the few species to be less grazed by the green sea urchin due to chemical compounds that decrease its edibility.

Brown algae

Christian Nozais

Anticosti Island, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits

Cut at a minimum of 10 cm above the stipe and blade junction
Leaving the meristem in place allows for faster regrowth of the blade

Favour harvesting during growth from May to July
Maintains biomass through rapid regrowth

Avoid harvesting during reproduction from September to February
More efficient reproduction leads to better population renewal

Fallow period of 2 years
Population recovery to the pre-harvest state

Sugar kelp (*Saccharina latissima*)

Other names: Sweet kombu, *Saccharina longicruris*, *Laminaria saccharina*, *Laminaria longicruris*
Life expectancy: 2 to 5 years
Age of maturity: 8 to 15 months
Reproduction period: Autumn
Fertile individual: Presence of a dark brown area in the center of the blade
Growth period: Spring, summer
Meristem: Basal area of the blade

The blade can be more or less undulated depending on the wave exposure, where sheltered environments have more undulated blades than exposed environments.

Christian Nozais

Brown algae

Anticosti Island, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits
Cut at a minimum of 20 cm above the stipe and blade junction
Leaving the meristem in place allows for faster regrowth of the blade
Favour harvesting during growth from May to July
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction in September and October
More efficient reproduction leads to better population renewal
Fallow period of 2 years
Population recovery to the pre-harvest state
Harvest within a 15 m diameter area and leave 15 m between harvested areas
Allows for more effective recolonization due to proximity to an unharvested area

Hedophyllum nigripes

Other names: -
Life expectancy: Several years
Age of maturity: n.a.
Reproduction period: n.a. (Possibly similar to other kelp species, like *L. digitata*)
Fertile individual: Presence of dark brown areas on the blade
Growth period: n.a. (Possibly similar to other kelp species, like *L. digitata*)
Meristem: Basal area of the blade

Hansneset, Spitsbergen, Norway
Modified from Dankworth et al. 2020

Can easily be misidentified as *L. digitata*, because they are morphologically similar. It is possible to differentiate the two species by the presence of mucus on the stipe compared to *L. digitata*.

Brown algae

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of the biomass and associated benefits
Cut at a minimum of 20 cm above the stipe and blade junction
Leaving the meristem in place allows for faster blade regrowth
Favour harvesting during growth from May to July
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction in September and October
More efficient reproduction leads to better population renewal
Fallow period of 2 years
Population recovery to the pre-harvest state
Harvest within a 15 m diameter area and leave 15 m between harvested areas
Allows for more effective recolonization due to proximity to an unharvested area

Oarweed (*Laminaria digitata*)

Other names: Digitate kelp, horsetail kelp, tangle
Life expectancy: 3 to 5 years
Age of maturity: 18 to 20 months
Reproduction period: Autumn
Fertile individual: Presence of dark brown areas on the blade
Growth period: Spring, summer
Meristem: Basal area of the blade

Can easily be misidentified with *H. nigripes*, because they are morphologically similar. It is possible to differentiate the species by the absence of mucus on the stipe compared to *H. nigripes*.

Fanny Noisette

Brown algae

Anticosti Island, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of the biomass and associated benefits
Cut at a minimum of 20 cm above the stipe and blade junction
Leaving the meristem in place allows for faster blade regrowth
Favour harvesting during growth from May to July
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction in September and October
More efficient reproduction leads to better population renewal
Fallow period of 2 years
Population recovery to the pre-harvest state
Harvest within a 15 m diameter area and leave 15 m between harvested areas
Allows for more effective recolonization due to proximity to an unharvested area

Winged kelp (*Alaria esculenta*)

Other names: Atlantic wakame, dabberlocks
Life expectancy: 5 to 10 years
Age of maturity: 8 to 14 months
Reproduction period: Summer
Fertile individual: Presence of dark brown areas on the sporophylls
Growth period: Spring, summer
Meristem: Basal area of the blade

Reproductive structures called sporophylls are located beneath its blade, unlike other kelp species that bear them directly on their blades.

Brown algae

Stéphanie Roy

Saint-Fabien-sur-Mer, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of the biomass and associated benefits

Cut at a minimum of 20 cm above the stipe and blade junction
Leaving the meristem in place allows for faster blade regrowth

Favour harvesting during growth in May and June
Maintains biomass through rapid regrowth

Avoid harvesting during reproduction in July and August
More efficient reproduction leads to better population renewal

Fallow period of 2 years
Population recovery to the pre-harvest state

Saccorhiza dermatodea

Other names: -
Life expectancy: Approximately one year
Age of maturity: Less than a year
Reproduction period: Autumn
Fertile individual: Presence of a dark area on the blade
Growth period: Spring, summer
Meristem: Basal area of the blade

The blade can sometimes split lengthwise and look like *L. digitata* and *H. nigripes*. It can be distinguished by its flattened stipe towards the blade as opposed to the other two species that have cylindrical stipes.

Eve Tremblay-Morel

Brown algae

Anticosti Island, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of the biomass and associated benefits
Cut at a minimum of 20 cm above the stipe and blade junction
Leaving the meristem in place allows for faster blade regrowth
Favour harvesting during growth from May to July
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction in September and October
More efficient reproduction leads to better population renewal

Knotted wrack (*Ascophyllum nodosum*)

Other names: -
Life expectancy: 3 to 15 years (blade), 40 years (holdfast)
Age of maturity: 5 years
Reproduction period: Spring, summer
Fertile individual: Presence of yellow or green receptacles at the tip of the blade
Growth period: Summer
Meristem: Holdfast and apical area of the blade

Very slow renewal rate, so it is particularly important to use fallow periods and buffer zones (see below).

Brown algae

Eve Tremblay-Morel

Anticosti Island, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits
Cut at a minimum of 30 cm above the holdfast
Leaving the meristem in place allows for faster regrowth of the blade
Leave at least one branch
Preserve part of the reproductive structures to allow for faster regrowth
Favour harvesting during growth period from July to September
Maintain biomass through rapid regrowth
Avoid harvesting during the reproduction period in May and June
More effective reproduction leads to better population renewal
Fallow period of 3 years
Population recovery to pre-harvest state
Harvest within a 15 m diameter area and leave 15 m between harvested areas
Allows for more effective recolonization due to proximity to an unharvested area

Fucus
(*Fucus* spp.)

Other names: Bladderwrack
Life expectancy: 2 to 5 years
Age of maturity: 1 to 2 years
Reproduction period: Spring, summer
Fertile individual: Presence of yellow or green receptacles at the tip of the blade
Growth period: Summer
Meristem: Holdfast and apical area of the blade

The species and subspecies present in Quebec are : *Fucus vesiculosus*, *Fucus distichus*, *Fucus distichus subsp. edentatus*, *Fucus distichus* subsp. *evanescens* and *Fucus spiralis*.

Brown algae

Fanny Noisette

Anticosti Island, QC

Specific sustainable harvesting practices

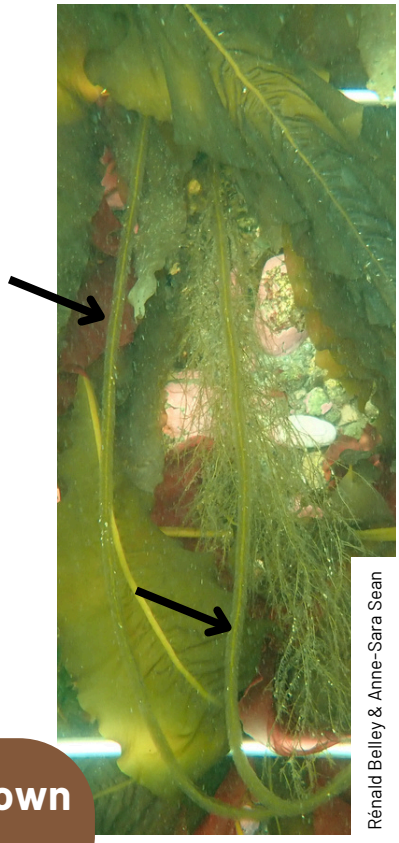
Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits
Cut at a minimum of 15 cm above the holdfast
Leaving the meristem in place allows for faster regrowth of the blade
Leave at least one branch
Preserve part of the reproductive structures to allow for faster regrowth
Favour harvesting during growth period from July to September
Maintain biomass through rapid regrowth
Avoid harvesting during the reproduction period in May and June
More effective reproduction leads to better population renewal
Fallow period of 3 years
Population recovery to pre-harvest state
Harvest within a 15 m diameter area and leave 15 m between harvested areas
Allows for more effective recolonization due to proximity to an unharvested area

Sea lace (*Chorda filum*)

Other names: -
Life expectancy: Approximately one year
Age of maturity: Less than a year
Reproduction period: Autumn
Fertile individual: Presence of dark spots all along the blade
Growth period: Spring, summer
Meristem: Apical area of the blade (adult) and basal area of the blade (juvenile)

The meristem is located in the apical zone of the blade, making it impossible to harvest adults without also harvesting the meristem.

Small hairs are located along the entire blade, with a particularly high hair density on the meristem.



Rénald Belley & Anne-Sara Sean

Brown algae

***C. filum* among other seaweeds such as *A. esculenta* and *Porphyra* spp.**

Baie-Sainte-Catherine, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits
Favour harvesting during growth from May to July
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction in September and October
More efficient reproduction leads to better population renewal

Chordaria flagelliformis

Other names: -
Life expectancy: Approximately 1 year
Age of maturity: Less than a year
Reproduction period: n.a. Possibly similar to other annual species
Fertile individual: n.a.
Growth period: Spring, summer
Meristem: n.a.

Information on the life cycle is scarce. Research should be conducted to better understand the life cycle of this commercial species.

Stéphanie Roy

Brown algae

Rimouski, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits
Cut at a minimum of 15 cm above the holdfast
Leaving the meristem in place allows for faster regrowth of the blade
Leave at least one branch
Preserve part of the reproductive structures to allow for faster regrowth
Favour harvesting during growth from May to July
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction in September and October
More efficient reproduction leads to better population renewal

Irish moss (*Chondrus crispus*)

Other names: Carrageen moss
Life expectancy: 2 to 4 years
Age of maturity: n.a.
Reproduction period: Summer, autumn
Fertile individual: Presence bulging areas on the blade
Growth period: Spring, summer
Meristem: Apical and marginal area of the blade

Can be mistaken for *Mastocarpus stellatus*, which has a similar morphology, but its stipe curls along its entire length, unlike *C. crispus*.

Eve Tremblay-Morel

Red algae

Anticosti Island, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Preserve biomass and its associated benefits

Cut above the holdfast, leaving a portion of the blade
Leaving the meristem intact allows for faster blade regrowth

Leave at least one branch
Preserve part of the reproductive structures to enable quicker regrowth

Favour harvesting during the growth period in May and June
Maintain biomass through rapid regrowth

Avoid harvesting during the reproduction period from July to October
More effective reproduction leads to better population renewal

Fallow period of 3 years
Population recovery to pre-harvest state

Harvest within a 3 m diameter area and leave 3 m between harvested areas
Allows for more effective recolonization due to proximity to an unharvested area

Dulse (*Palmaria palmata*)

Other names: -
Life expectancy: Several years
Age of maturity: 9 to 12 months (male), a few days (female)
Reproduction period: Autumn, winter
Fertile individual: Presence of a dark, almost black, area in the center of the blade
Growth period: Spring, summer
Meristem: Apical and marginal area of the blade

Due to the differences in their maturation rates, females will be fertilized by males from earlier generations.

Stéphanie Roy

Red algae

Rimouski, QC

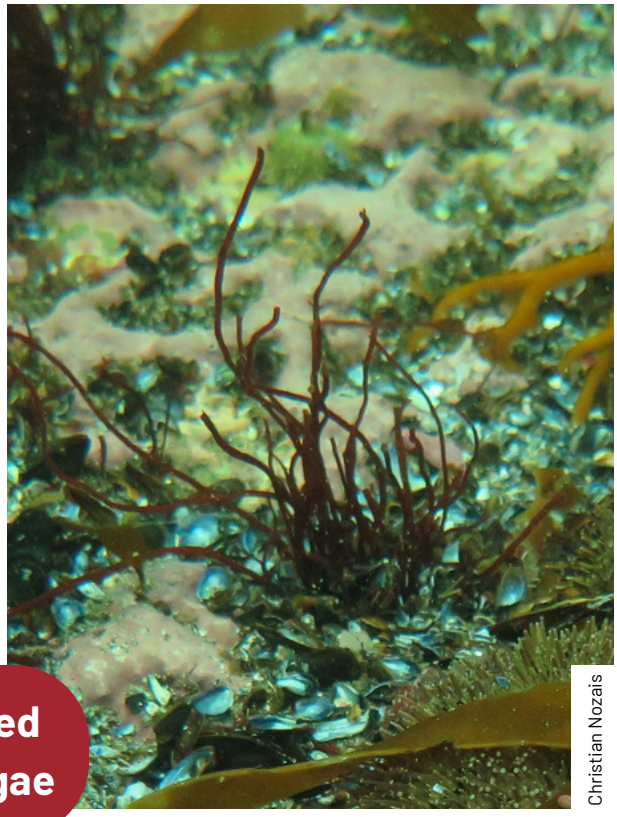
Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits
Cut above the holdfast, leaving a portion of the blade
Leaving the meristem in place allows for faster regrowth of the blade
Leave at least one branch
Preserve part of the reproductive structures to enable quicker regrowth
Favour harvesting during growth from May to July
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction from September to February
More efficient reproduction leads to better population renewal
Sallow time of 2 or 3 years
Population recovery to the pre-harvest state

Devaleraea ramentacea

Other names: -
Life expectancy: Several years
Age of maturity: n.a.
Reproduction period: n.a. (Possibly similar to species from the same family, like *P. palmata*)
Fertile individual: Presence of dark areas on the blade
Growth period: n.a. (Possibly similar to species from the same family, like *P. palmata*)
Meristem: n.a.

There is very little information available on this species. However, it belongs to the same order as *P. palmata*, so its biology and ecology are likely similar.



Christian Nozais

Red algae

Anticosti Island, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits
Cut above the holdfast, leaving a portion of the blade
Leaving the meristem in place allows for faster regrowth of the blade
Leave at least one branch
Preserve part of the reproductive structures to enable quicker regrowth
Favour harvesting during growth from May to July
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction from September to February
More efficient reproduction leads to better population renewal
Fallow period of 2 or 3 years
Population recovery to the pre-harvest state

Nori (*Porphyra* spp.)

Other names: -
Other genera with a similar life cycle and morphology: *Wildemania* sp., *Pyropia* sp.
Life expectancy: Approximately one year
Age of maturity: 45 days
Reproduction period: Spring, autumn
Fertile individual: Presence of a dark or yellow border on the outer edge of the blade
Growth period: Spring, summer
Meristem: Basal area of the blade

When reproduction is over, a thin white border is visible on the outer edge of the blade (like on the photo).

Red algae

Rénald Belley & Anne-Sara Sean

Baie-Sainte-Catherine, QC

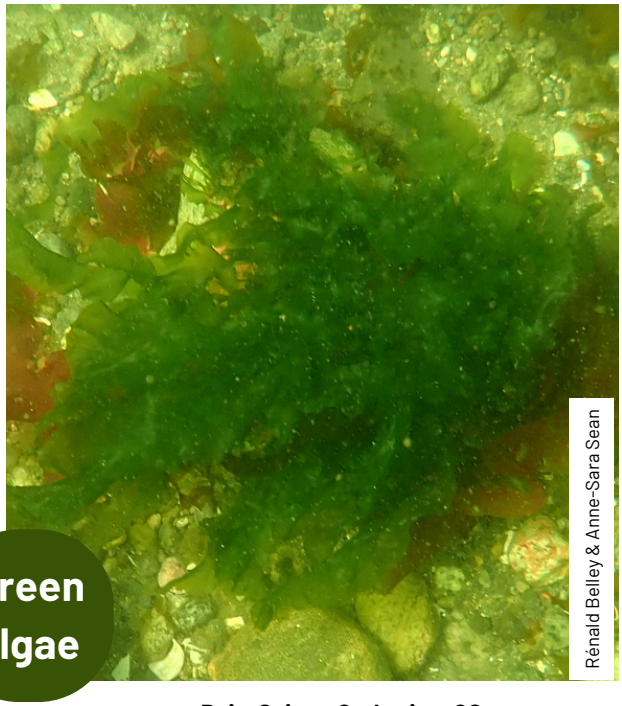
Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits
Cut above the holdfast, leaving a portion of the blade
Leaving the meristem in place allows for faster regrowth of the blade
Favour harvesting during growth in July
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction in May, June, August and September
More efficient reproduction leads to better population renewal

Sea lettuce (*Ulva* spp.)

Other names: *Enteromorpha* sp., *Ulva* sp.
Life expectancy: Approximately one year
Age of maturity: A few weeks
Reproduction period: Summer
Fertile individual: Presence of a yellow-brown border on the outer edge of the blade
Growth period: Spring, summer
Meristem: Mitotic points on the blade

Opportunist species, with rapid growth, sometimes considered a nuisance species.



Baie-Sainte-Catherine, QC

Specific sustainable harvesting practices

Harvest a maximum of 33% of the biomass (one blade out of three)
Conservation of biomass and associated benefits
Cut above the holdfast, leaving a portion of the blade
Leaving the meristem in place allows for faster regrowth of the blade
Favour harvesting during growth in May and June
Maintains biomass through rapid regrowth
Avoid harvesting during reproduction in July and August
More efficient reproduction leads to better population renewal

Summary of specific sustainable harvesting practices for 15 commercially valuable seaweeds in the Quebec region

Brown seaweeds | Red seaweeds | Green seaweeds | n.a. : not applicable

	Harvest site						Individual harvested	
Latin name	Vernacular name	Maximum harvest	Preferred harvest period	Period to avoid	Suggested fallow	Buffer zone	Cutting height	Leave a branch
 *Agarum clathratum*	Sea colander	33%	May to July	September to February	2 years	To consider	10 cm above the stipe and blade junction	n.a.
 *Hedophyllum nigripes*	-	33%	May to July*	September and October*	2 years	Yes (15 m)	20 cm above the stipe and blade junction	n.a.
 *Laminaria digitata*	Oarweed	33%	May to July	September and October	2 years	Yes (15 m)	20 cm above the stipe and blade junction	n.a.
 *Saccharina latissima*	Sugar kelp	33%	May to July	September and October	2 years	Yes (15 m)	20 cm above the stipe and blade junction	n.a.
 *Alaria esculenta*	Winged kelp	33%	May and June	July and August	2 years	To consider	20 cm above the stipe and blade junction	n.a.
 *Saccorhiza dermetodea*	-	33%	May and July	September and October	None	To consider	20 cm above the stipe and blade junction	n.a.
 *Ascophyllum nodosum*	Knotted wrack	33%	July to September	May and June	3 years	Yes (15 m)	30 cm above the holdfast	Yes
 *Fucus* spp.	Fucus	33%	July to September	May and June	3 years	Yes (15 m)	15 cm above the holdfast	Yes
 *Chorda filum*	Sea lace	33%	May to July	September and October	None	To consider	None	n.a.
 *Chordaria flagelliformis*	-	33%	May to July	September and October	None	To consider	15 cm above the holdfast	Yes

Brown seaweeds | Red seaweeds | Green seaweeds | n.a. : not applicable

	Harvest site						Individual harvested	
Latin name	Vernacular name	Maximum harvest	Preferred harvest period	Period to avoid	Suggested fallow	Buffer zone	Cutting height	Leave a branch
 *Chondrus crispus*	Irish moss	33%	May and June	July to October	3 years	Yes (3 m)	Above the holdfast with a portion of the blade	Yes
 *Palmaria palmata*	Dulse	33%	May to July	September to February	2-3 years	To consider	Above the holdfast with a portion of the blade	Yes
 *Devaleraea ramentacea*	-	33%	May to July*	September to February*	2-3 years	To consider	Above the holdfast with a portion of the blade	Yes
 *Porphyra* spp.	Nori	33%	July	May, June, August and September	None	To consider	Above the holdfast with a portion of the blade	n.a.
 *Ulva* spp.	Sea lettuce	33%	May and June	July and August	None	To consider	Above the holdfast with a portion of the blade	n.a.

*Growth and reproduction periods are not available, but could be similar to the ones from similar species.

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