Maya Libiszowski
Diploma 2020

A Botanic Garden of Seaweed

in Møkkalassa, ***Oslo Fjord***

Introducing the **weightless beauty** to our common **imagination** by giving an **aesthetical appreciation** to a sustainable and industrial **commodity.**

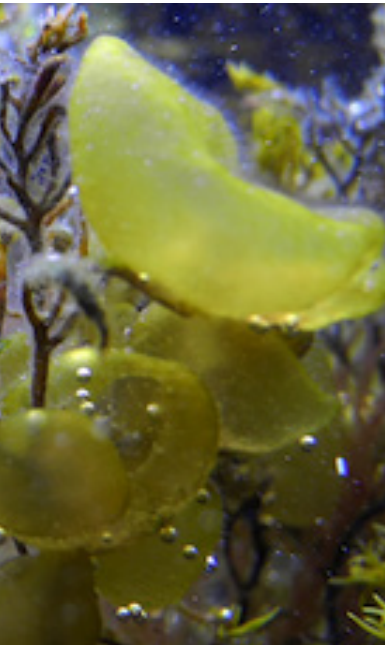
Table of Content

Michael Guiry

It is there that it performs its crucial magic of oxygenting the waters, interveens in the carbon, nitrogen, and phosphorus cycles, regulates acidification, and biosorbs pollutants.

Its rare appearances to the Norwegian's sight - either washed onshore or when low tide reveals it - maintains its exceptionality but its invisibility undermines its performance.

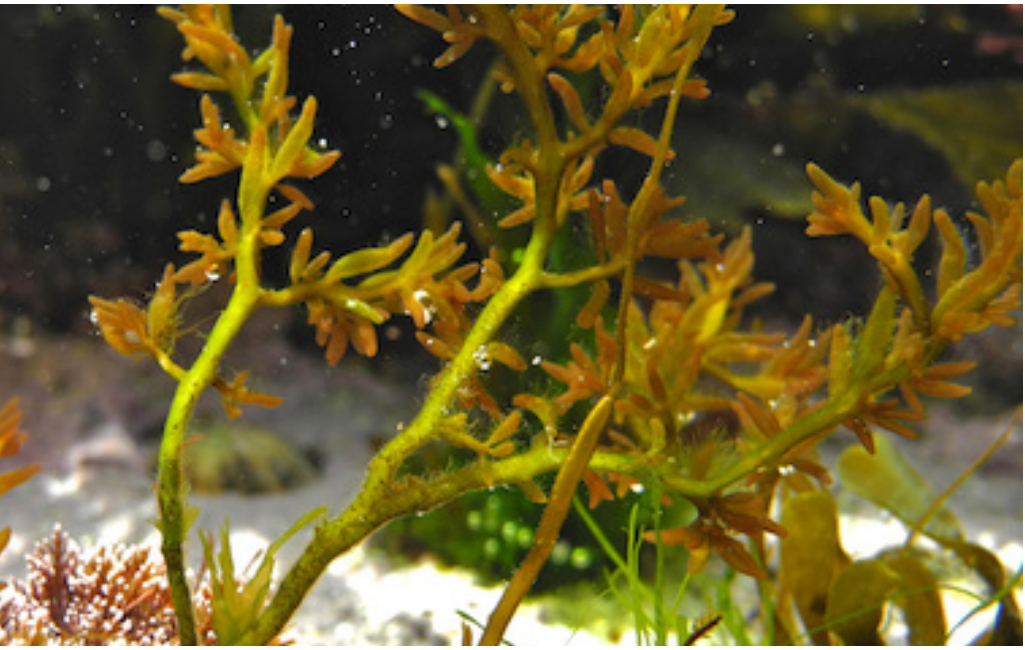
Michael Guiry



Deep dive into a different dimension

One where light, oxygen, and gravity differs from ours. One where creatures and plants are so foreign to human. One where the scape troubles the imagination.

It's in the neither here nore there area, on the border between land and underwater of the seas and the oceans of the world that Seaweed takes the stage. It dances to the rythme of the waves and the tides, grounded by its holdfasts onto the benthic surfaces.



13 000 BC to Today

A brief recount of a long history

The Seaweed-gathering Ritual at Naga

In Norway, Vikings were known to consum seaweeds for Vitamin E during their voyages.

But it isn't before the 17th, 18th, and 19th century that seaweed was harvested and processed in several locations along the coast. Often it was burnt, and ashes were used for glass, soap, and later iodine production.

During that time, farmers made use of seaweed to fertilize their crops in the summer and to feed their livestocks in the winter. It was sometimes grounded to be eaten as porridge or used as flour. These techniques slowly died out with industralization and as less labour-intensive sources appeared.

***to* by Hokkei Totoya, 1834 -1835**

This woodcut depicts seaweed gatherers in Japan around 1834; albeit a very terrestrial depiction it is a rare sight of underwater and seaweed artful representation.

Nonetheless, the first seaweed conusmers date back to the 13 000 BC in Japan. There are many references to ancient agricultural use such as by the Tongan people in Polynessia, by Hawaiians who grew and used more than 60 species, by Egypitans around 1 500 BC, and many more around the globe.

Seaweed harvest in Norway, approximately 1900

www.algea.com

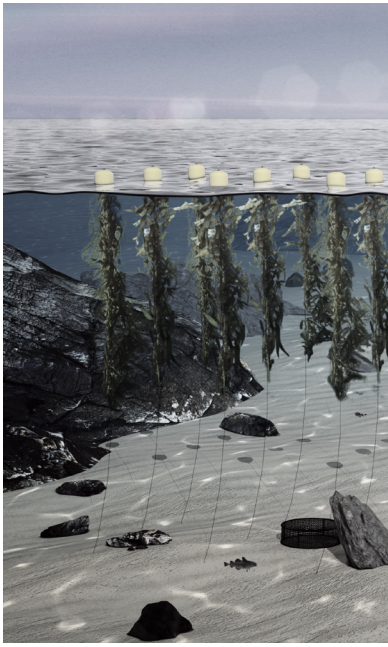
A seawe

On the turn of the 21st century, seaweed is being taken over by hordes of industries in Norway.

One major potential is seaweed based biofuel. Although it was put aside by Equinor in 2008 after the price of oil plummeted, there is interest in growing seaweed for energy.

Countless research has also been led to take advantage of seaweed's ecological services to mitigate offshore fish farming wastes.

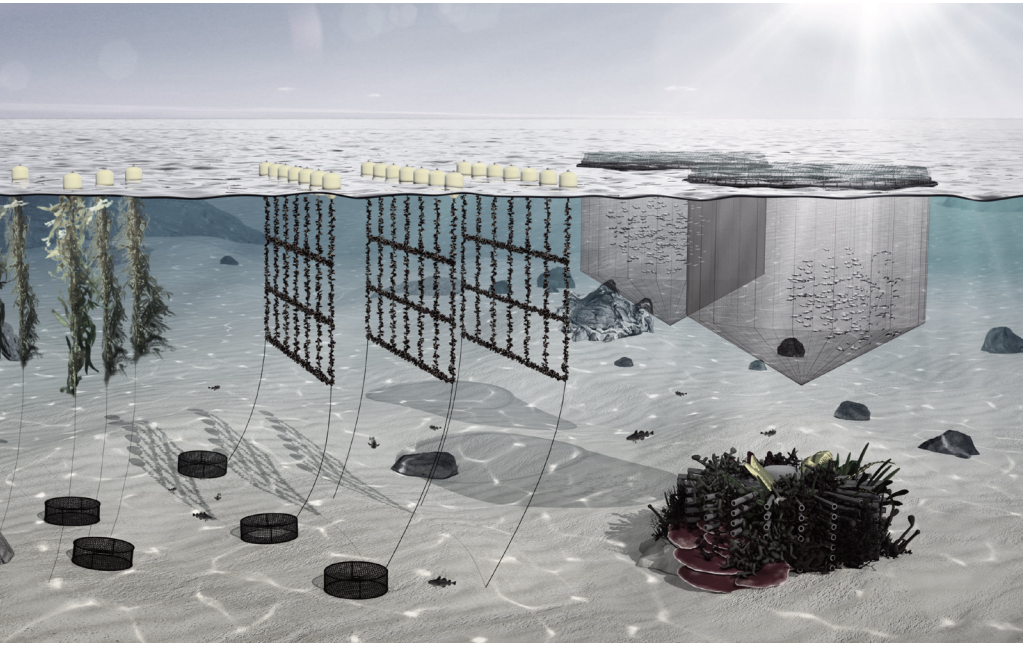
Lastly, an abundant number of studies show the health benefits and nutritional values in seaweed. Proving great potential as a sustainable food source for Norway.



www.leroyseafood.com

ed meal factory in Brønnøysund

In the 1940s, seaweed became a major additive in processed foods, largely used as food supliment, and in cosmetics. It continues to be so today.



Aquaculture Industry

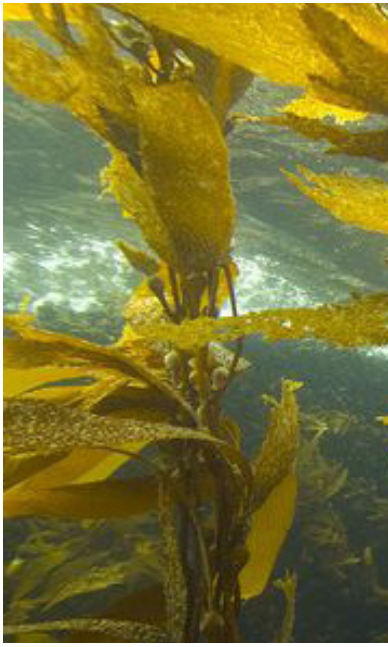
www.en.mercopress.com

These issues are particularly relevant to seaweed because it grows out of sight. It is hard to observe in its liquid environment where these fabric-like organisms are the most aesthetic.

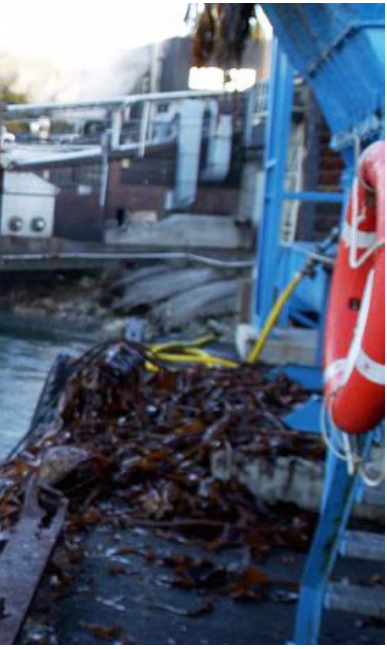
Its lyrical forms could speak for itself about this other dimension that is the underwater.

The project is a work towards intergrating seaweed in common culture by moving away from the derogatory slimy image most Europeans have of seaweed and understand seaweed for its aesthetic and spatial qualities.

Developing a lyrical myth behind these is to aestheticise the qualities of an otherwise repulsive fabric.



www.ecoticias.com



FMC Biopolymer

Nonetheless, the seaweed industry around the world is focusing on merely a handful of species, Kelp, Gracilaria, and Nori leaving behind more than 400 Norwegian grown species which are yet perfectly edible but do not fit the ideals of production.

When making a parallel with on-land agriculture's long history and rising food movements, two imminent issues surface;

On one hand the issue of the commodification of seaweed. Crops loose their aesthetic or ecological value in the eyes of people and become purely a product of consumption detached from their organic environment. On the other hand, the issue of the loss of appreciation for the diversity in species. It is a topic most widely known through the increase in awareness of seedbanks. Though hundreds of species of tomatos exist, only a few are grown nowadays which puts in jeopardy the ecological diversity of plants.

Borrowing from Japenese Poetry

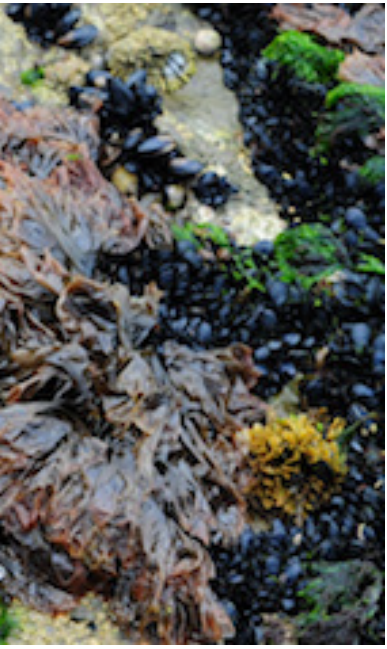
Borrowing from cultures where seaweed has been inextricable to artful representation

www.seaweed.ie

« As a mat of creepers,
Is hte sea at Iwami;
Amongst the mangled words of
Kara Point,
Upon the reefs
Grows the algae thickly;
On the rocky shoreline,
Grows the jeweled seaweed;
Soft as jeweled seaweed
Trembling, lay my girl;
Lush as thick green algae »

- Author unknown

www.seaweed.ie



« In the bay of Naniwa
Seaweed-covered
Gemstone rocks
Appear-just so
Does my love for her »

- Minamoto no Toshiyori

www.seaweed.ie

« Alas, she is no more,
whose soul was bent to mine
like the bending seaweed. »

- Manyoshu

www.youtube.com/watch?v=rqfPH2aav

« When the tide is high,
Covering the beach,
As sea-grass, perhaps,
Scarcely seen and
Greatly loverd. »

- Author unknown

vvM

Norwegian Coast Seaweed Palette

Giving an aesthetical digest to a sustainable and industrial commodity

Superphylum: Eurhodophytina
Class: Bangiophyceae
Order: Bangiales
Family: Bangiaceae

Genus: *Porphyra*
Species: *P. dioica J.Brodie & L.M.Irvine*
Common name: Black Laver

 # 001

Rodophyta - Red Algae

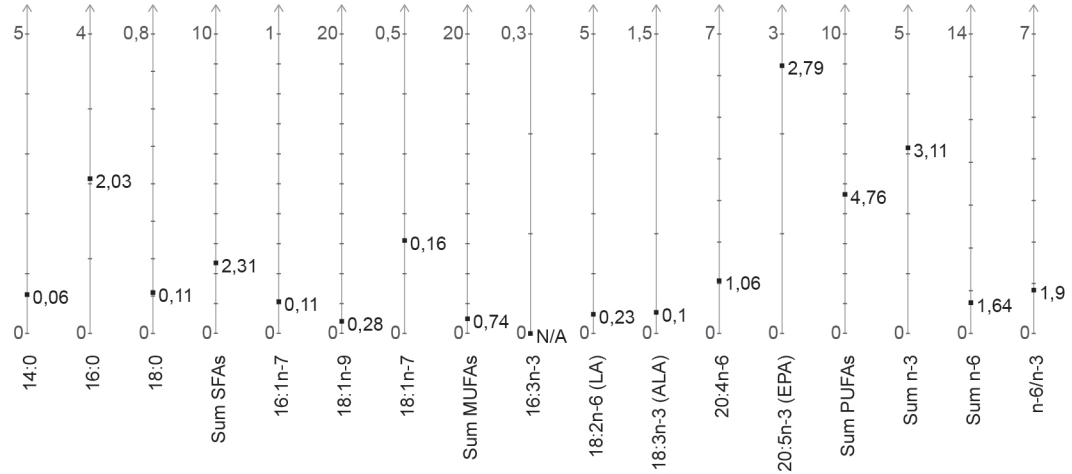


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

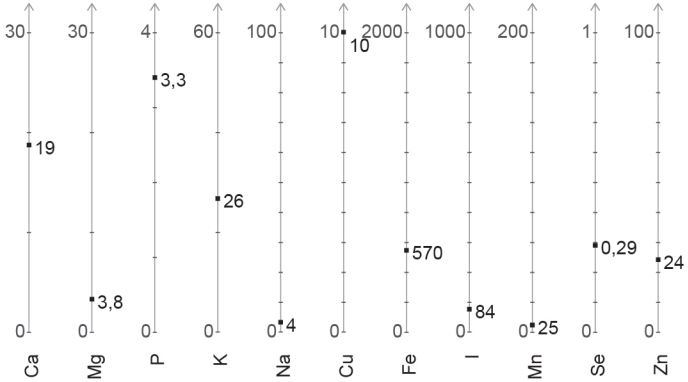


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Membranous, monostromatic, olive-green to brown-purple or blackish fronds, to 500 mm long and 200 mm wide, from short stipe and basal holdfast.

Habitat: On rock in interdidal, mainly on semi-exposed shores hanging downwards from rocks embedded in sand or affected by sand. Most common in spring and early summer; widely distributed.

 # 001

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Archaeplastida
Class: Bangiophyceae
Order: Bangiales
Family: Bangiaceae

Genus: *Porphyra*
Species: *P. purpurea A.*
Common name: Purple Laver

0 3 cm

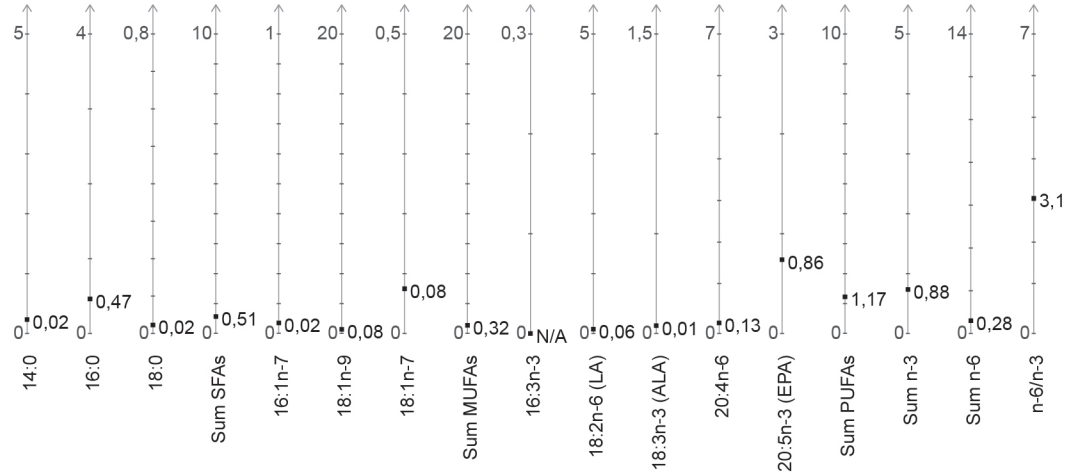


Fig. 1 - Fatty acid composition (mg g–1 algal dry weight)

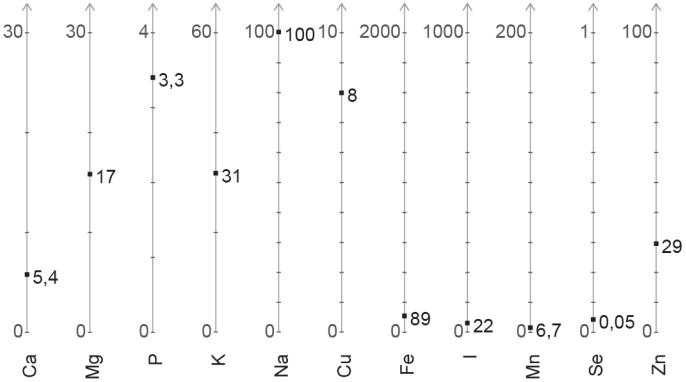
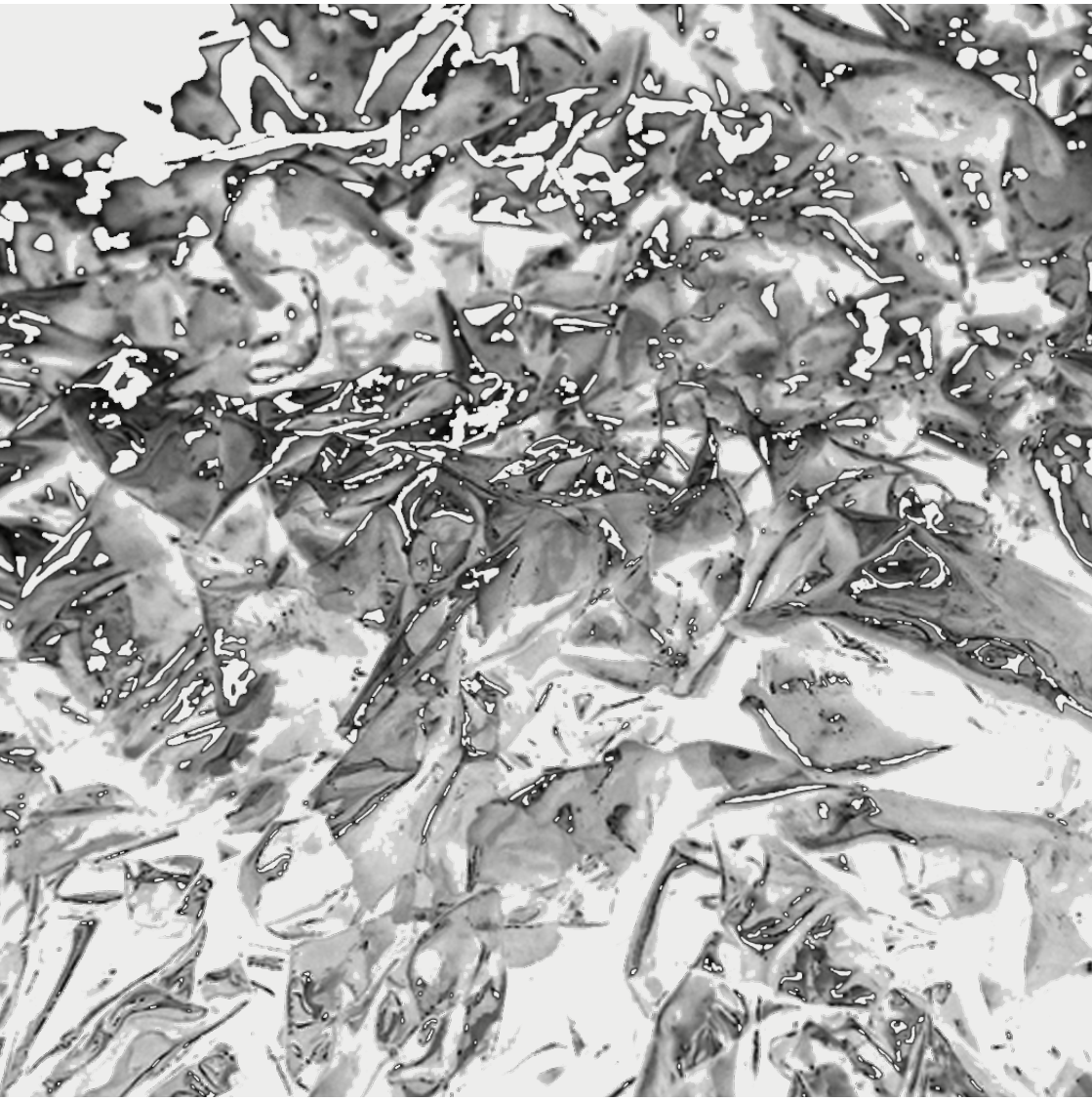


Fig. 2 - Elemental composition (g kg–1 algal dry weight)

Description: Delicate, linear, membranous, purple-brown fronds, to 200 mm long and 25 mm broad, usually simple with short stipe from basal holdfast; orange patches when reproductive.

Habitat: Zone-forming on rock in the upper intertidal and splash zone of semi-exposed and exposed shores. This is a winter and spring annual appearing on semi-exposed and exposed shores from November onwards and persisting until February or March.



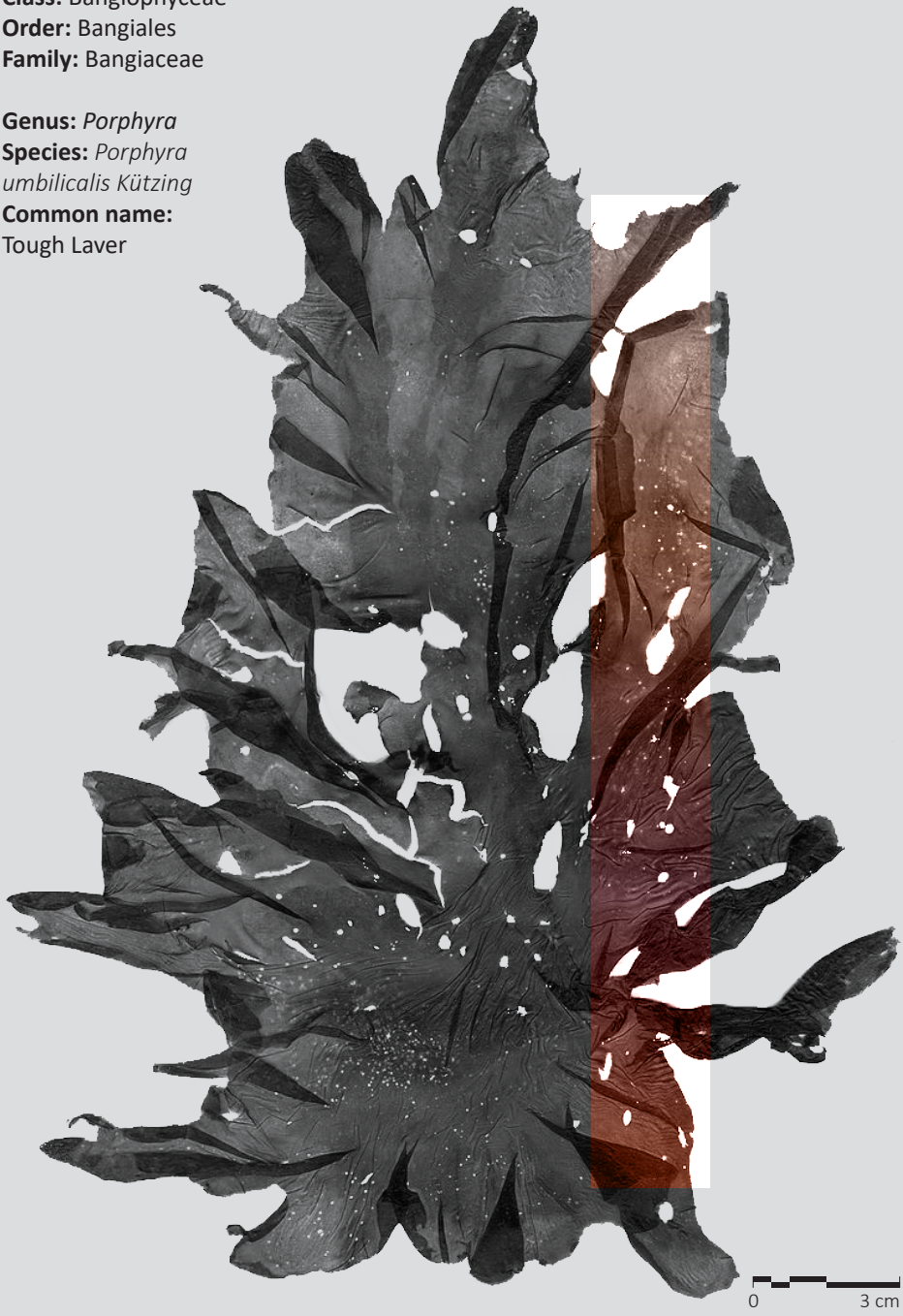
 # 002

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Rhodophyta
Class: Bangiophyceae
Order: Bangiales
Family: Bangiaceae

Genus: *Porphyra*
Species: *Porphyra umbilicalis Kützing*
Common name: Tough Laver



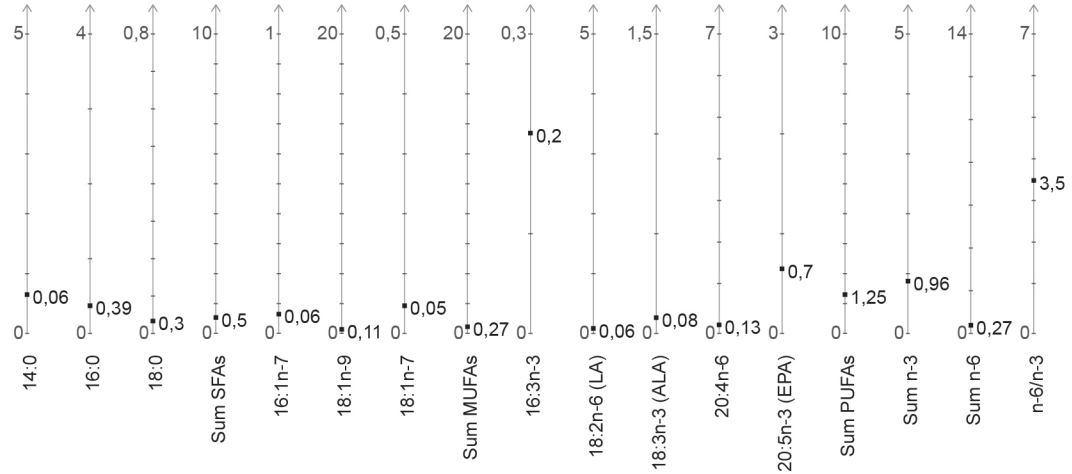


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

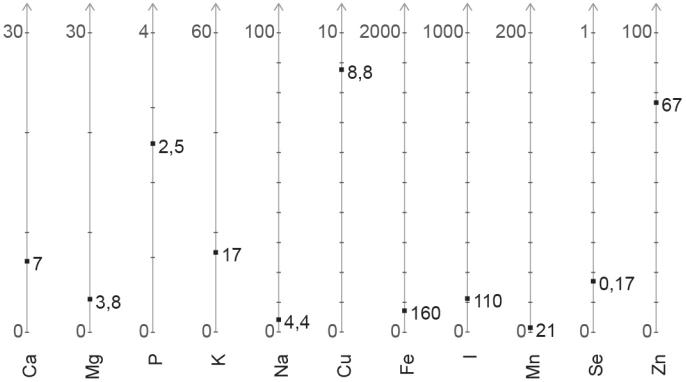
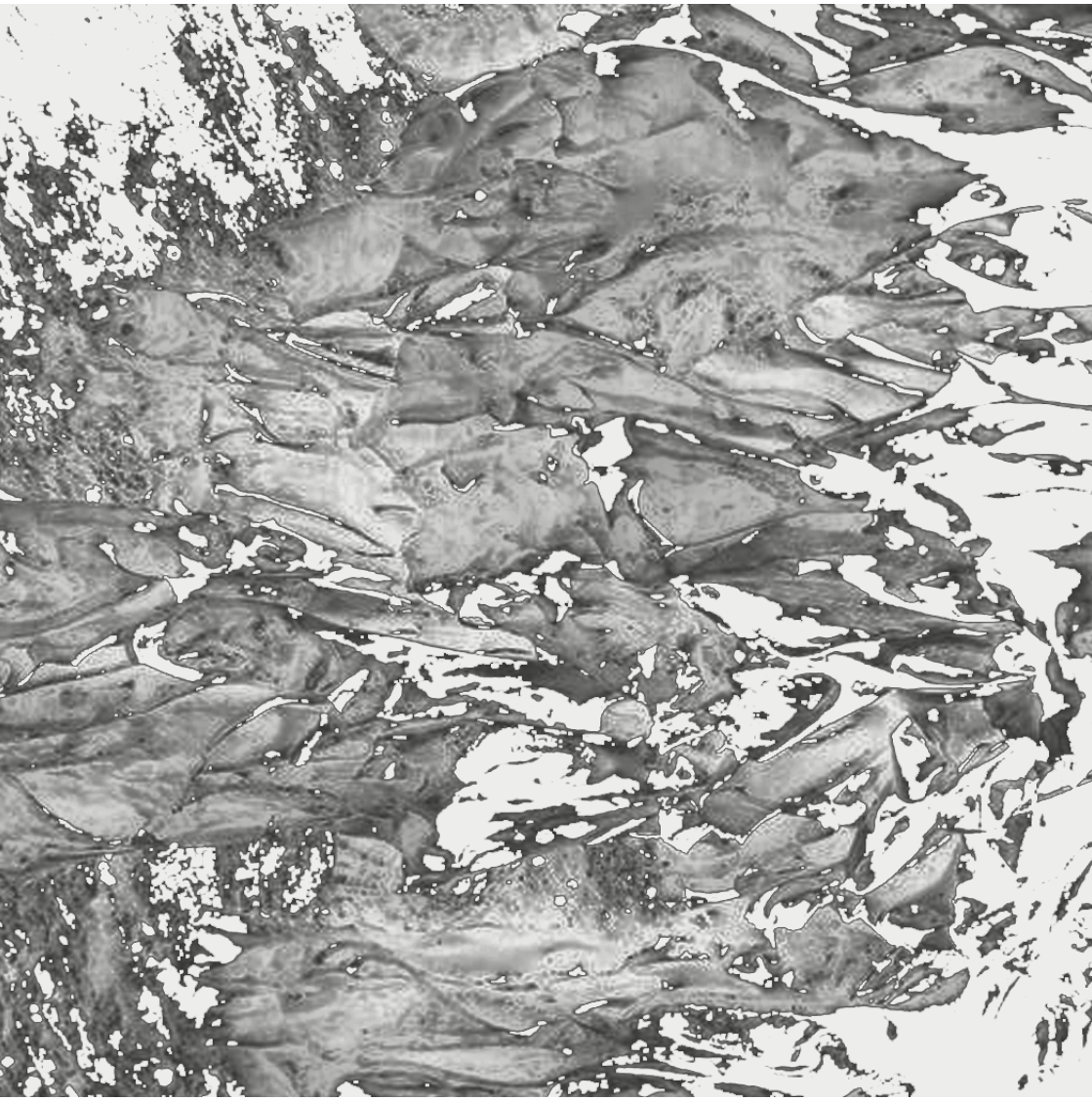


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Membranous, one layer in thickness, olive to brown-purple fronds, to 200 mm long, irregularaly lobed and split from central holdfast.

Habitat: Generally on mussels, sometimes on rock; midtidal to splash zone, generally distributed, abundant, especially on exposed coasts in spring and summer.



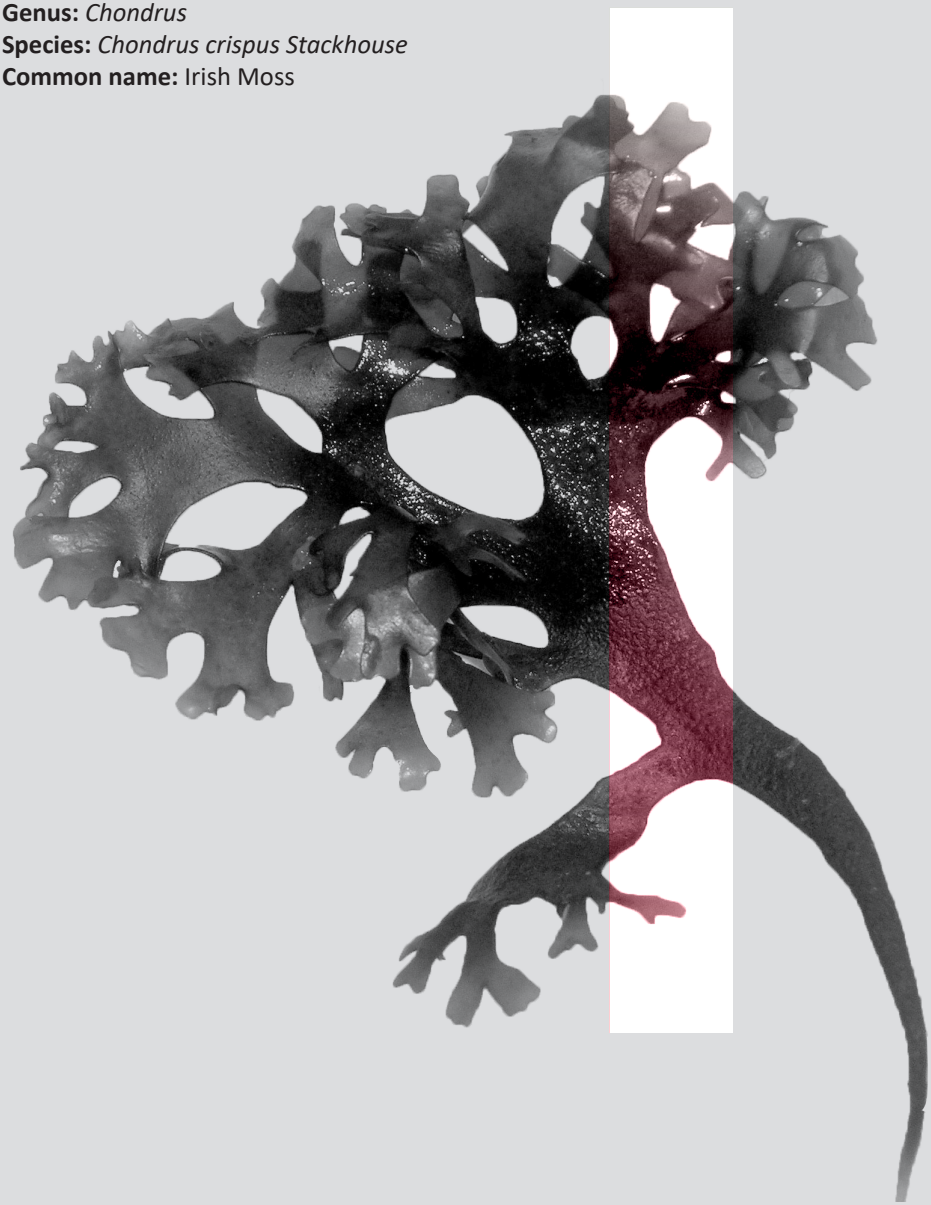
 # 003

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Eurhodophytina
Class: Florideophyceae
Order: Gigartinales
Family: Gigartinaceae

Genus: *Chondrus*
Species: *Chondrus crispus Stackhouse*
Common name: Irish Moss



0 2 cm

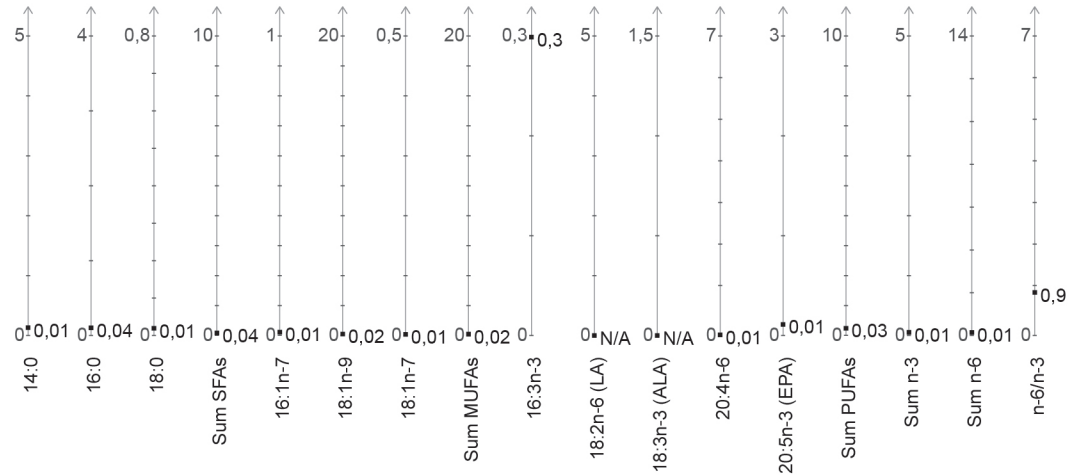


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

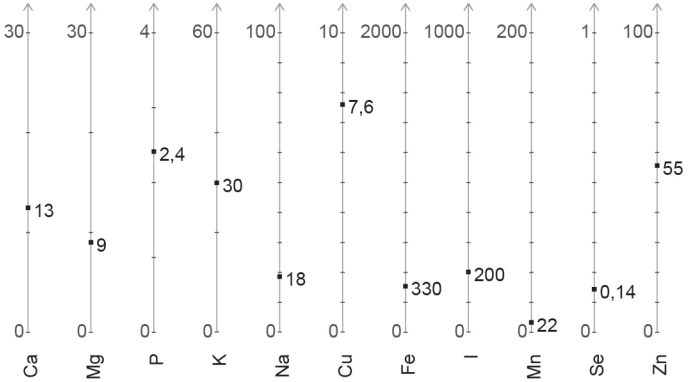
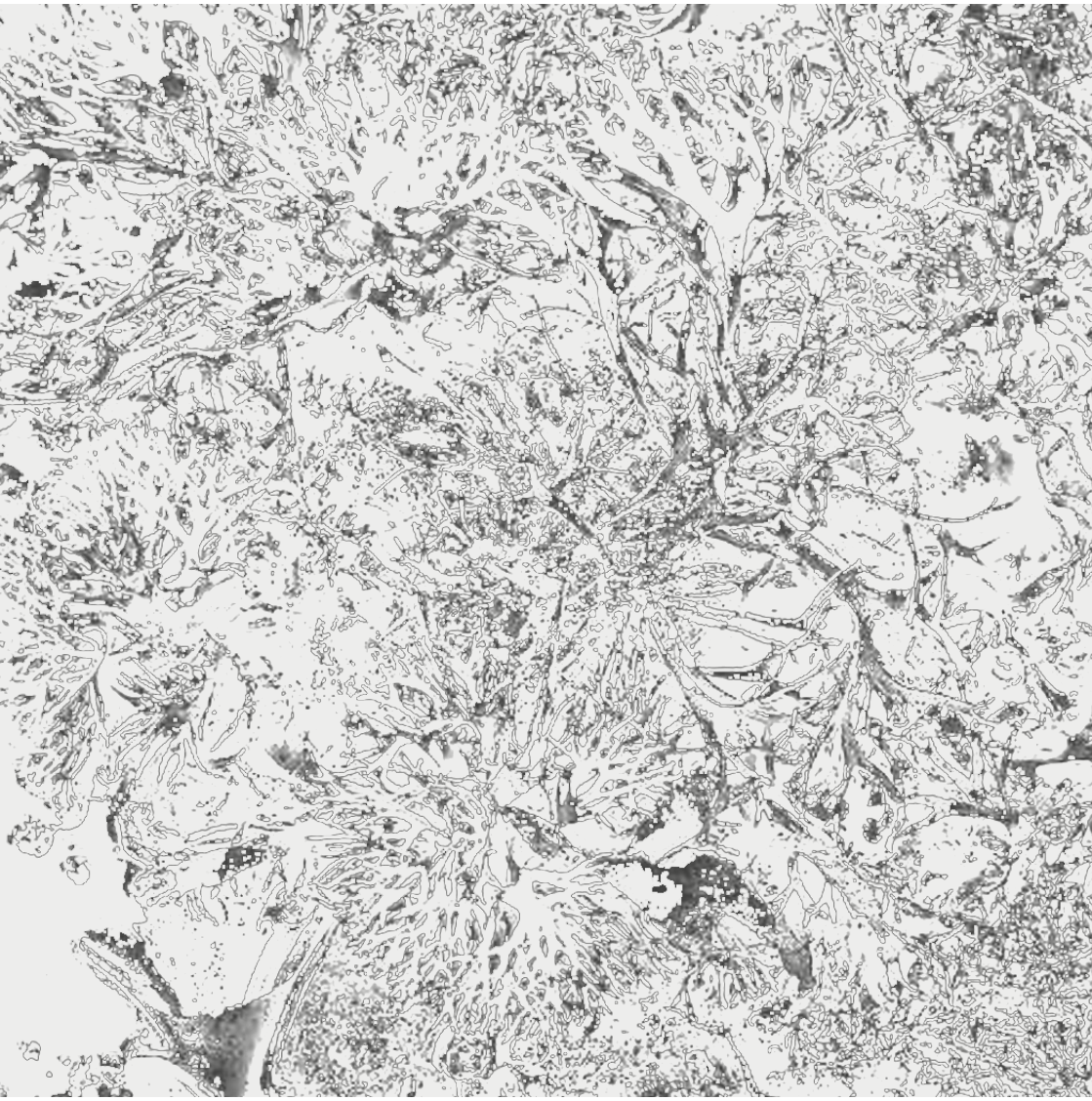


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Cartilaginous, dark purplish-red fronds, female plants sometimes iridescent at the apices under water when in good condition and turning almost completely greenish-yellow in upper-shore rock-pools, to 150 mm high. Stipe compressed, narrow, expanding gradually onto a flat, repeatedly dichotomously branched blade, in tufts from a discoid holdfast. Axils rounded, apices blunt or subacute, frond thicker in centre than margins. Very variable in breadth of segments.

Habitat: On rocks, in pools, lower intertidal and shallow subtidal, widely distributed, abundant.



 # 004

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Eurhodophytina
Class: Florideophyceae
Order: Gigartinales
Family: Phyllophoraceae

Genus: *Mastocarpus*
Species: *Mastocarpus stellatus (Stackhouse) Guiry*
Common name: Grape pip weed

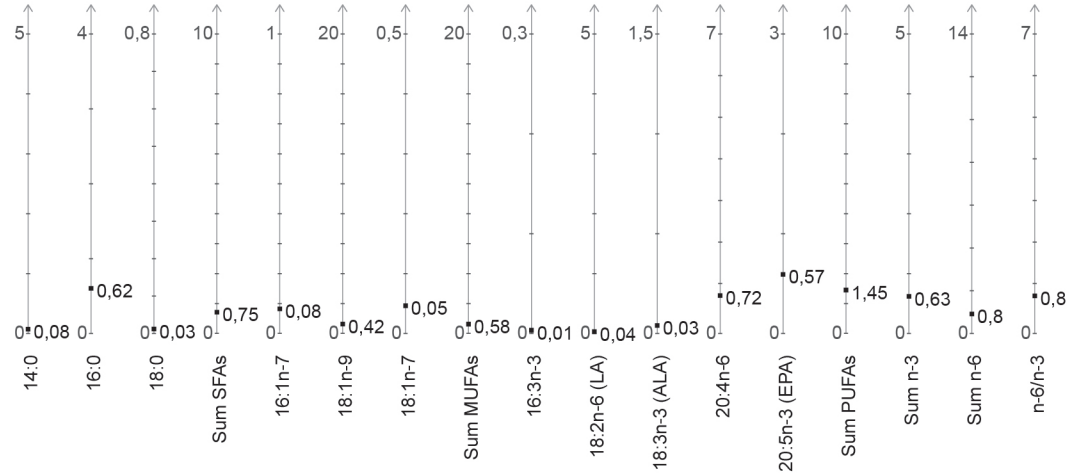


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

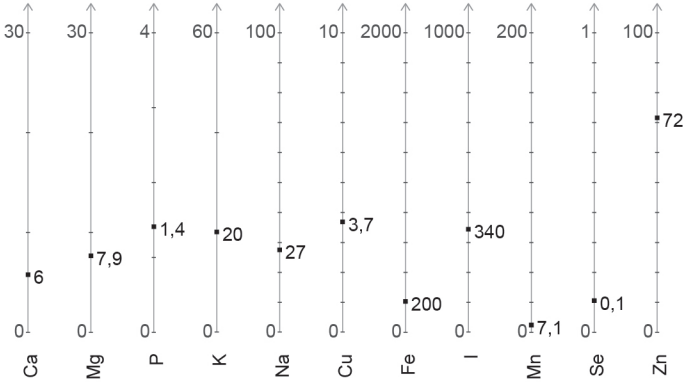


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Cartilaginous, purplish brown fronds, often in dense tufts, arising from a discoid holdfast, to 200 mm high. Narrow compressed stipe expands into strap-like blade, usually inrolled to form a channel, with thickened margins. Repeatedly dichotomously branched, axils acute. Upper part of frond with papillae to 10 mm or more long on surfaces and margins on female plants. Male plants lack papillae but are generally rare. The tetrasporophyte is a purplish-black crust Petrocelis-phase, above right.

Habitat: On rocks in lower intertidal, often in large continuous mats, widespread and abundant.

 # 005

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Eurhodophytina
Class: Florideophyceae
Order: Gigartinales
Family: Furcellariaceae

Genus: *Furcellaria*
Species: *F. lumbricalis (Hudson) J.V. Lamouroux*
Common name: Clawed fork weed

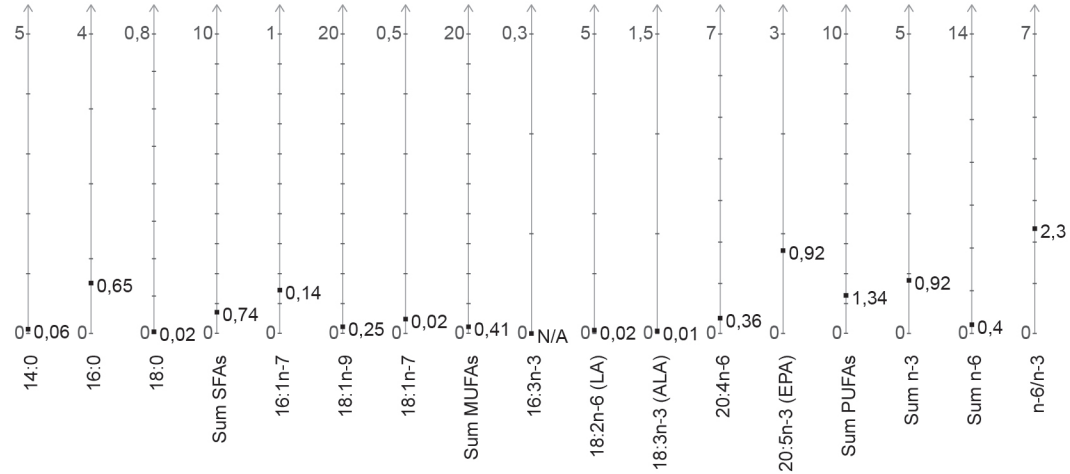


Fig. 1 - Fatty acid composition (mg g–1 algal dry weight)

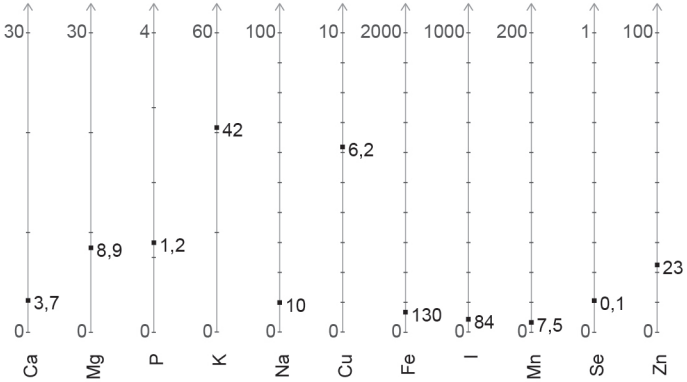
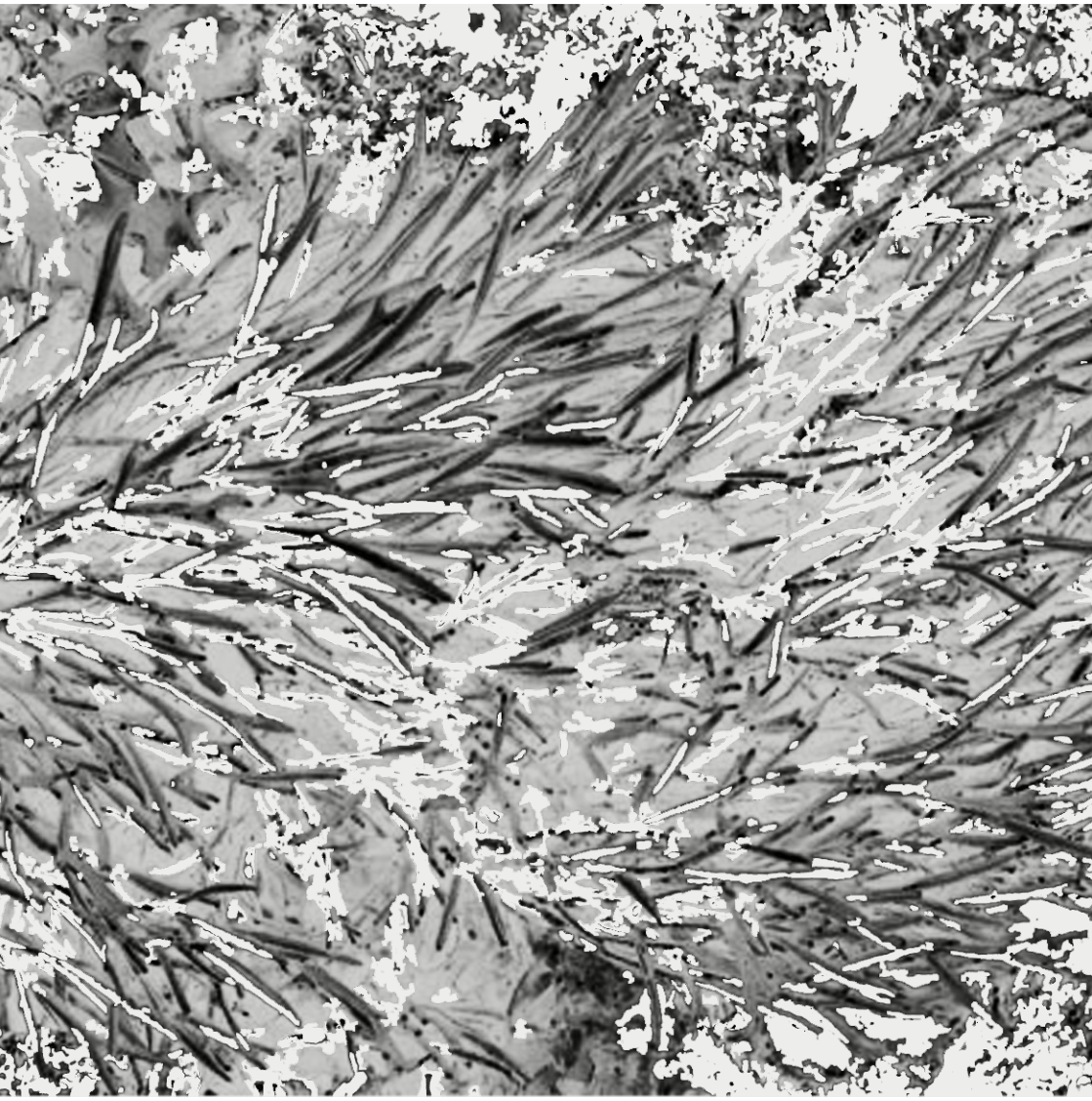


Fig. 2 - Elemental composition (g kg–1 algal dry weight)

Description: Cartilaginous, cylindrical, brownish-black fronds, repeatedly dichotomously branched with narrow axils, fastigiate, to 2 mm diam. and 300 mm long, with acute apices. Attached by much-branched rhizoids. Multiaxial, medulla of cylindrical cells interspersed with rhizoids, cortex of irregular filaments, inner cells elliptical, outer cells narrow, elongated, in radial rows.

Habitat: On rocks, lower intertidal and shallow subtidal, in pools and runnels, in open situations, often on sandy or muddy shores, tolerating lowered salinities. Widely distributed, common.



 # 006

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Eurhodophytina
Class: Florideophyceae
Order: Palmariales
Family: Palmariaceae

Genus: *Palmaria*
Species: *P. palmata (L.) Weber & Mohr*
Common name: Dulse

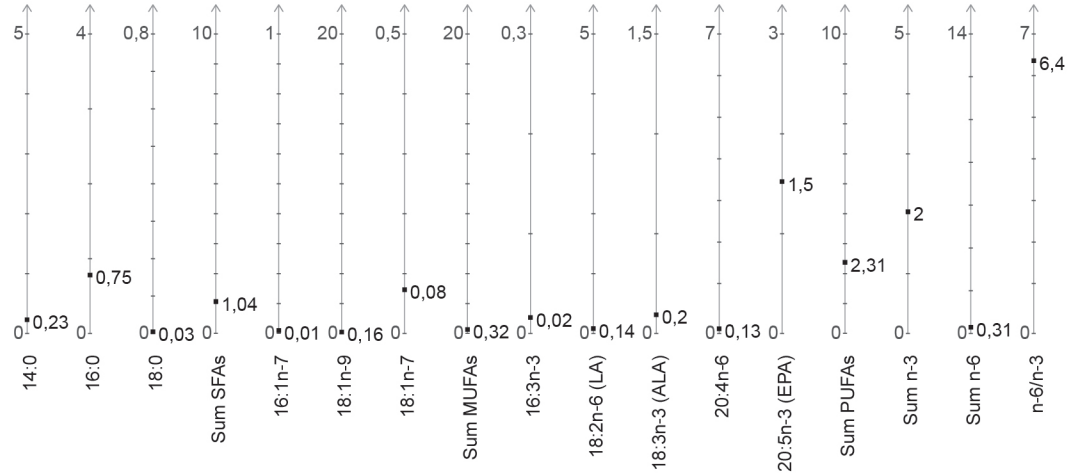


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

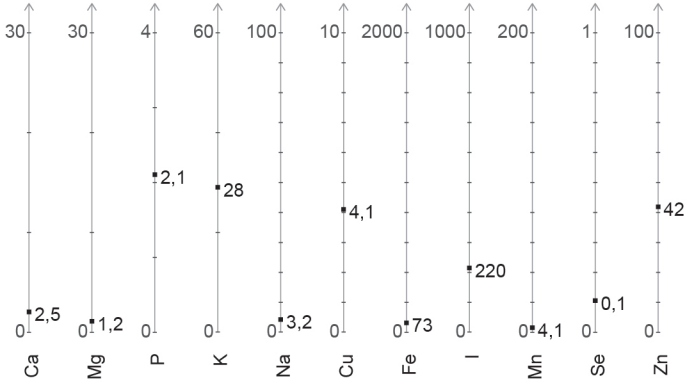


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Reddish brown, membranous or leathery, flattened fronds, 50-300 (1000) mm long, arising from a discoid base, usually with a small stipe expanding gradually to form simple or dichotomously and palmately divided fronds, often with characteristic marginal leaflets.

Habitat: On rock, mussels and epiphytic on several algae, intertidal (at all levels but particularly near low water) and shallow subtidal , especially on upper part of Laminaria hyperborea stipes (right. to a depth of about 5 m), widely distributed, abundant.

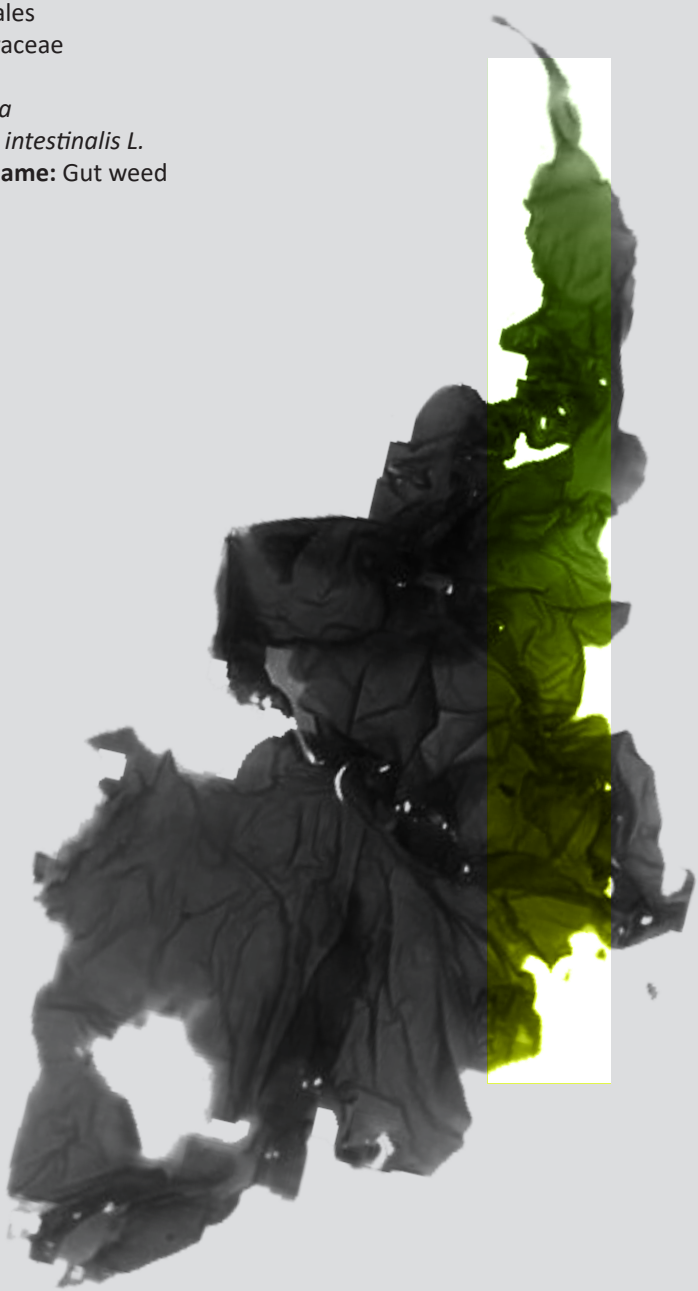
 # 007

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Chlorophytina
Class: Ulvophyceae
Order: Ulvales
Family: Ulvaceae

Genus: *Ulva*
Species: *U. intestinalis L.*
Common name: Gut weed



0 3 cm

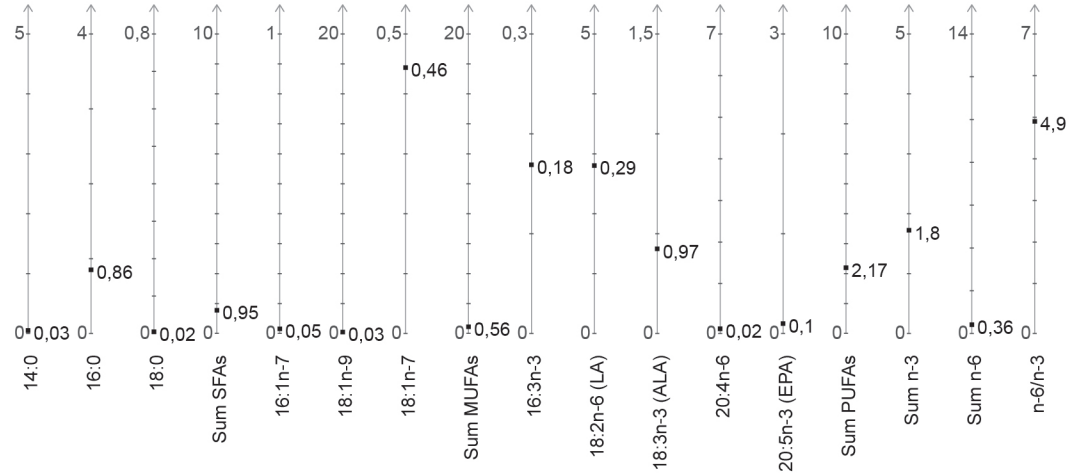


Fig. 1 - Fatty acid composition (mg g–1 algal dry weight)

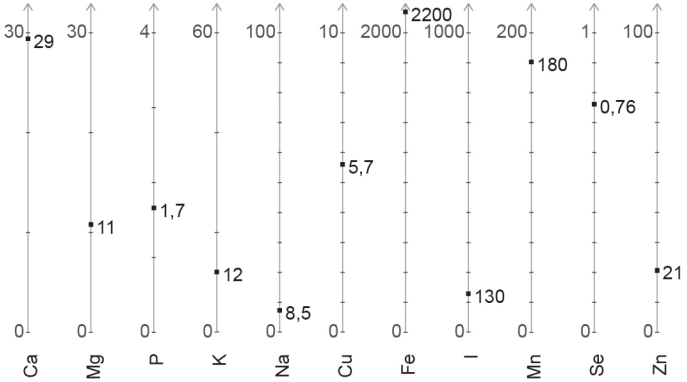


Fig. 2 - Elemental composition (g kg–1 algal dry weight)

Description: Inflated, hollow fronds with a bright grass-green colour, strongly resembling the large instestines of mammals.

Habitat: Rock pools in the upper intertidal and salt-marshes.

 # 008

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Chlorophytina
Class: Ulvophyceae
Order: Ulvales
Family: Ulvaceae

Genus: *Ulva*
Species: *U. lactuca L.*
Common name: Sea lettuce

0 3 cm

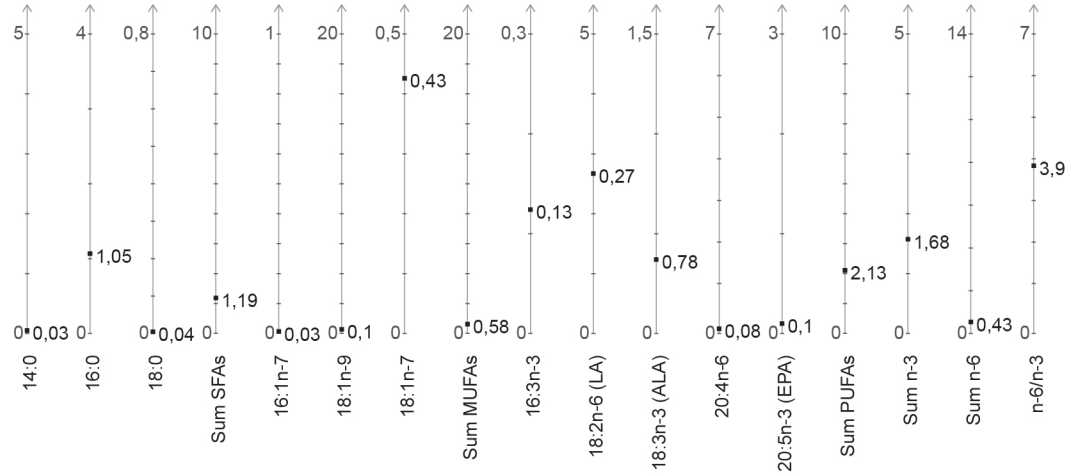


Fig. 1 - Fatty acid composition (mg g–1 algal dry weight)

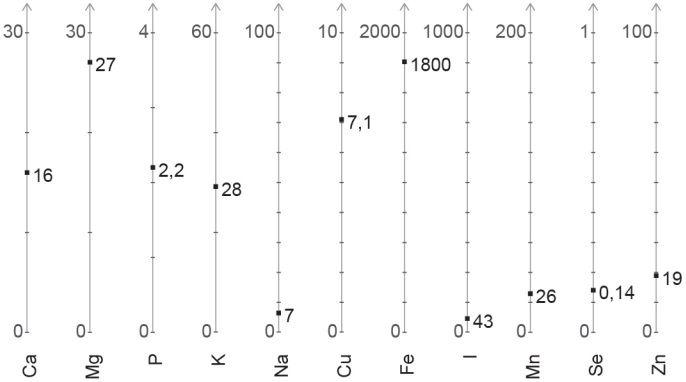


Fig. 2 - Elemental composition (g kg–1 algal dry weight)

Description: Thallus sheet-like, light green, rather delicate and translucent, to 250 mm long. Persists throughout the year.

Habitat: On rock and in lower-shore rock pools, and in the shallow subtidal.

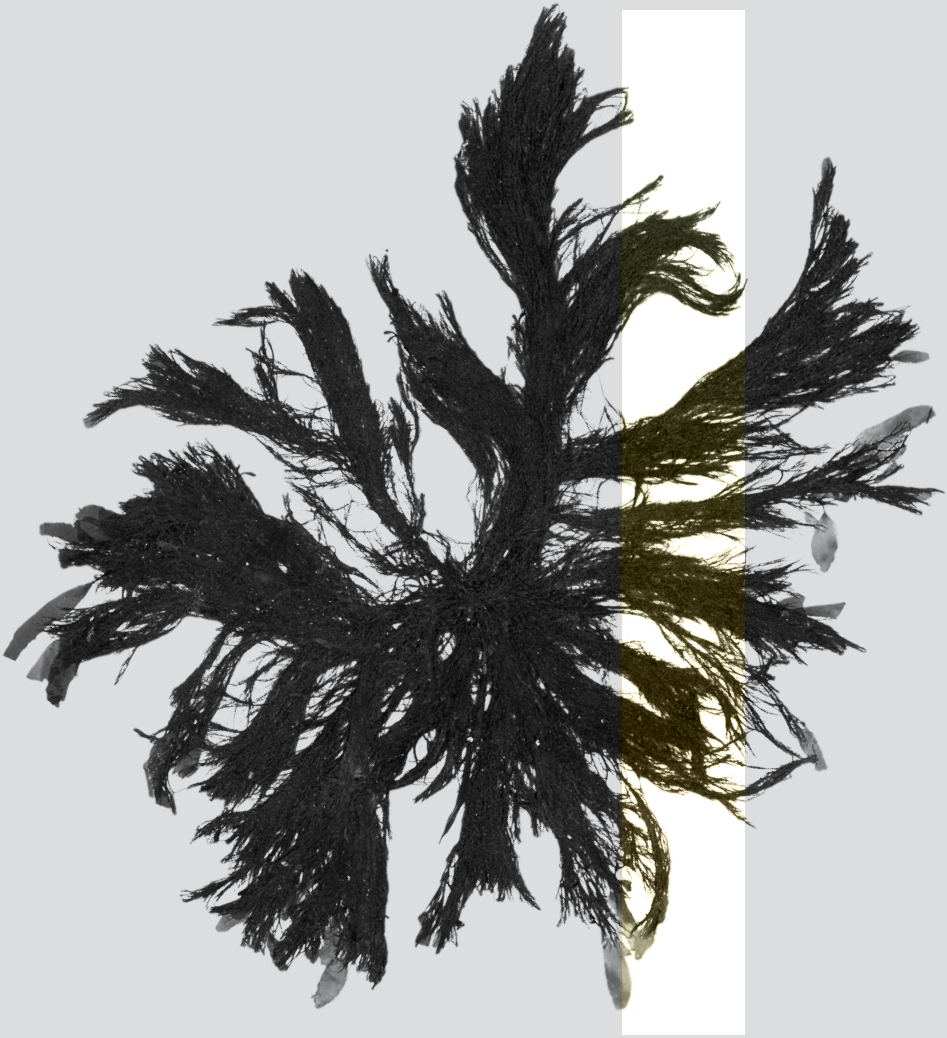
 # 009

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Chlorophytina
Class: Ulvophyceae
Order: Cladophorales
Family: Cladophoraceae

Genus: *Cladophora*
Species: *C. rupestris (L.) Kützing*
Common name: Common green branched weed



0 3 cm

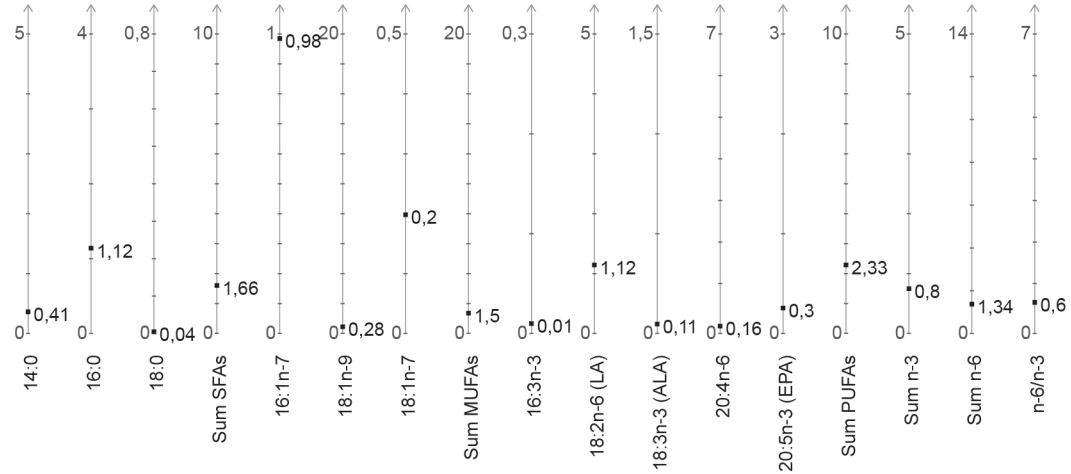


Fig. 1 - Fatty acid composition (mg g–1 algal dry weight)

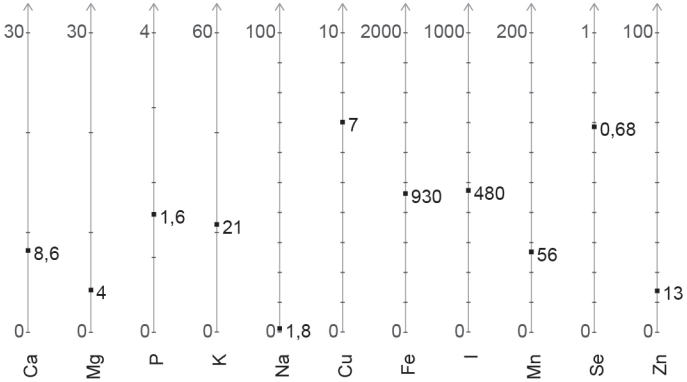
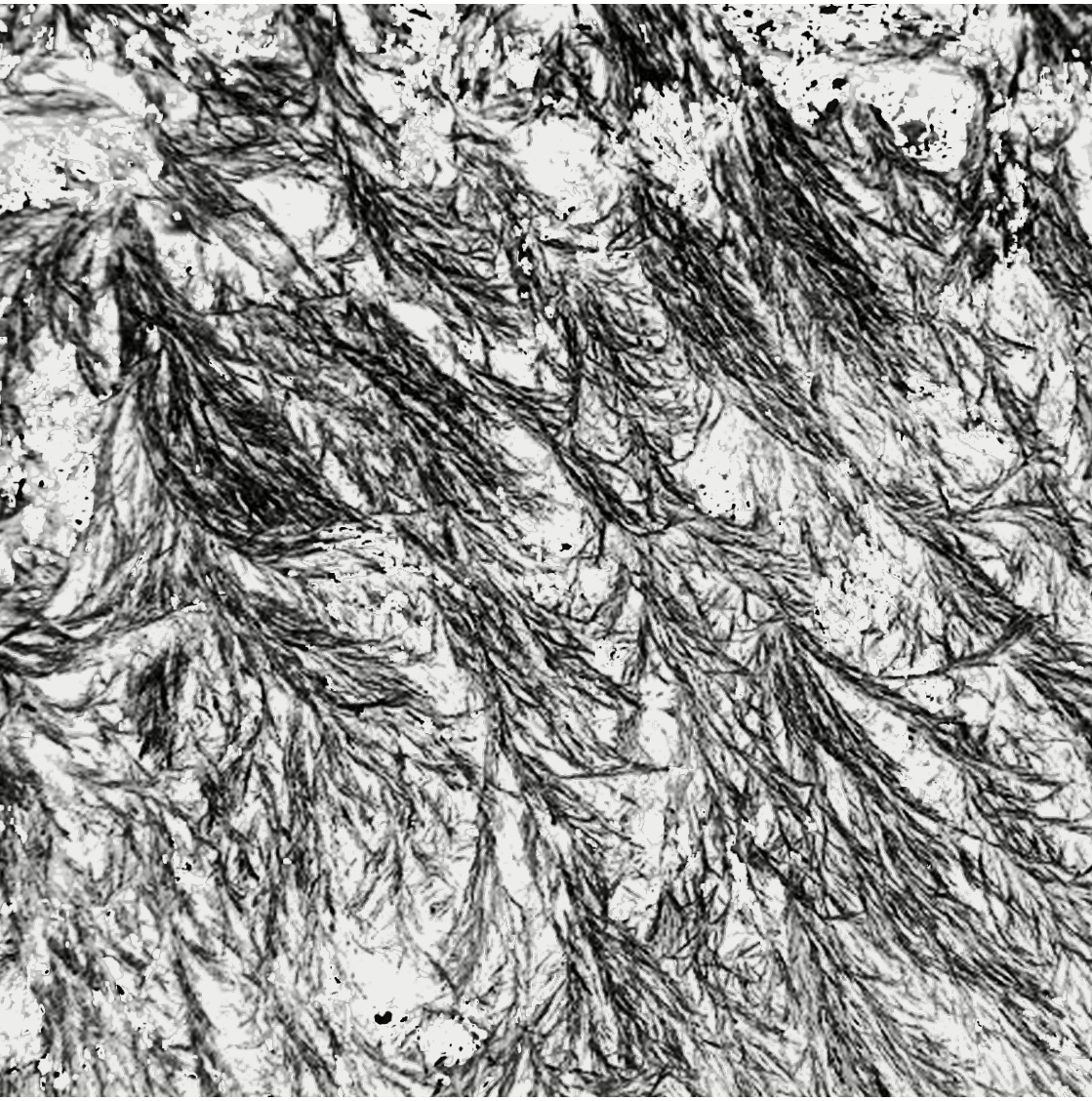


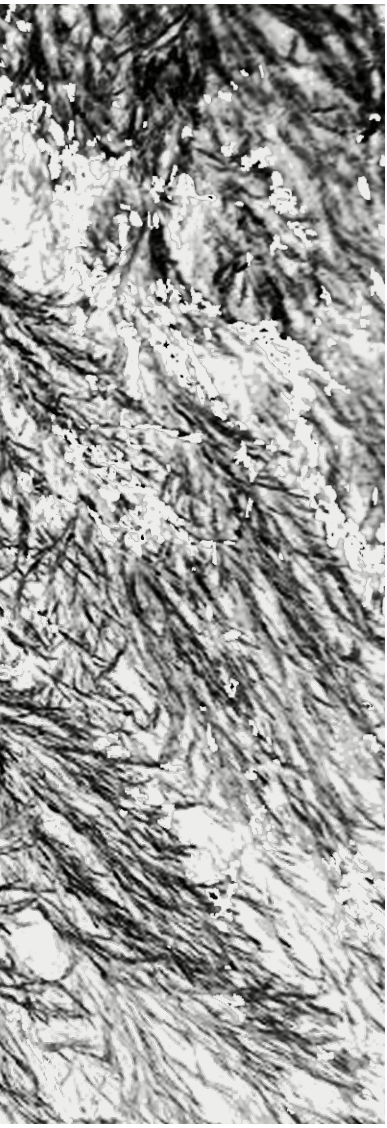
Fig. 2 - Elemental composition (g kg–1 algal dry weight)

Description: Thallus dark green (sometimes bluish), stiff, entwined, to 200 mm in length, composed of profusely, irregularly branched filaments apparent to the unaided eye. Attached by a rhizoidal holdfast. Persists throughout the year.

Habitat: On rock and in pools from mid-tide downwards, often growing under Fucus vesiculosusor Ascophyllum nodosum but such plants are generally smaller and darker. Common and widespread.



 # 010



Superphylum: Heterokonta
Class: Phaeophyceae
Order: Fucales
Family: Fucaceae

Genus: *Fucus*
Species: *F. serratus L.*
Common name:
Serrated Wrack

 # 011

Phaeophyceae - Brown Algae

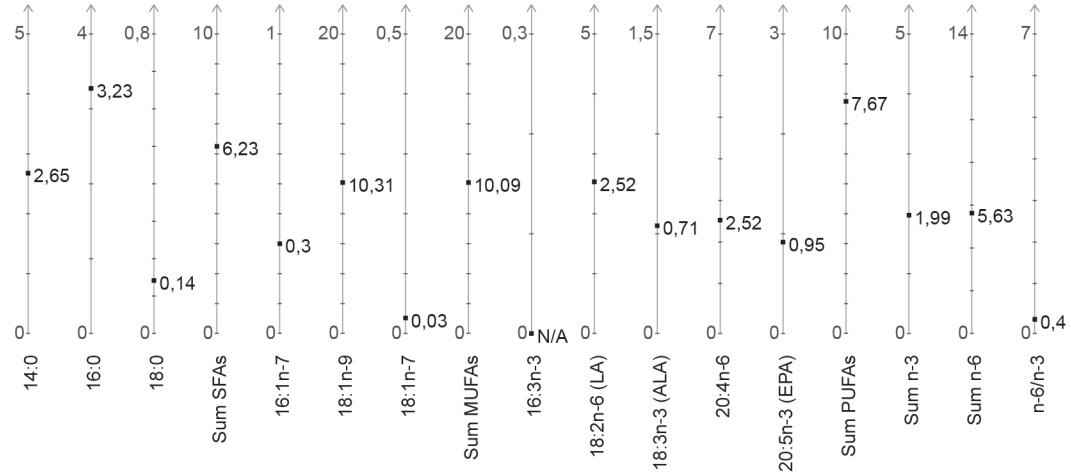


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

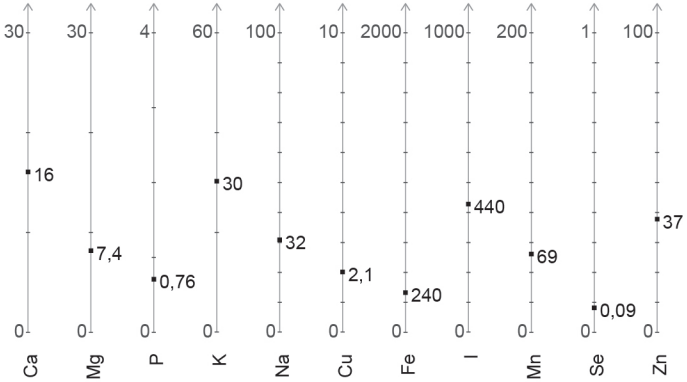


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Dichotmously branched fronds arising from a small disc via a short stipe; distinct midrib. Plants to 300 mm with terminal, compressed receptacles with warty conceptacles. This is the «Serrated wrack» of the lower shore in the north-eastern Atlantic. It is easily recognised by its saw-toothed frond, and a lack of swollen receptacles.

Habitat: Zone forming on sheltered and semi-exposed shores from about MTL down to about MLWN where it meets the kelp zone.

 # 011

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Heterokonta
Class: Phaeophyceae
Order: Fucales
Family: Fucaceae

Genus: *Fucus*
Species: *F. vesiculosus L.*
Common name: Bladder wrack

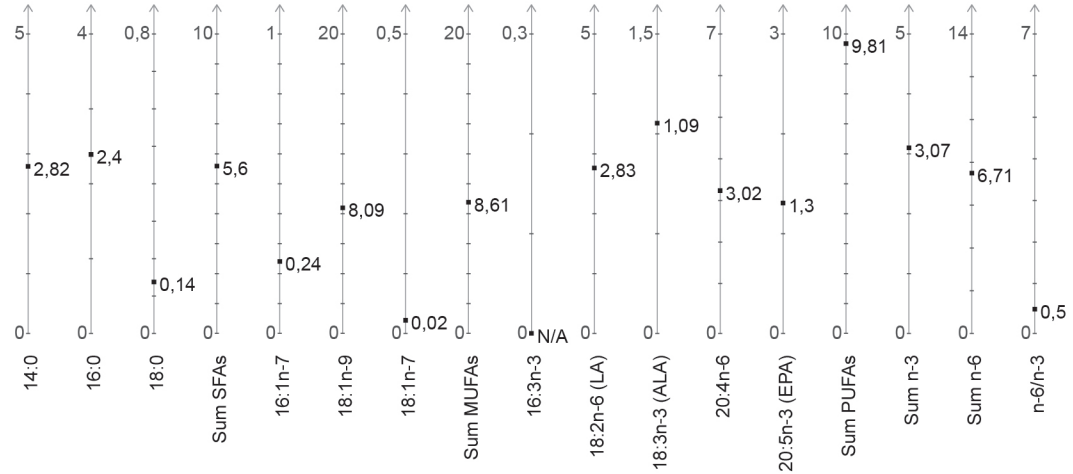


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

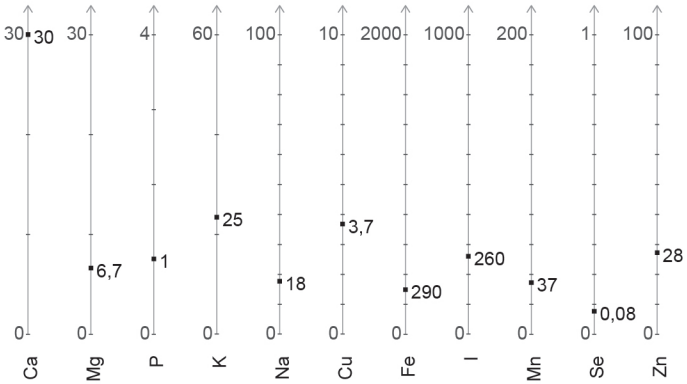


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Mid-shore wrack easily recognised by its paired bladders occurring on either side of a prominent midrib. The frond is generally not strongly spiralled and the receptacles do not have a sterile rim (Fucus spiralis and F. guiryi), and the frond does not have a serrated margin (Fucus serratus). Fucus vesiculosus is attached by a small, strongly attached disc which gives rise to a short stipe. The reproductive receptacles are swollen area at the tips of fronds that have many flask-shaped cavities called conceptacles.

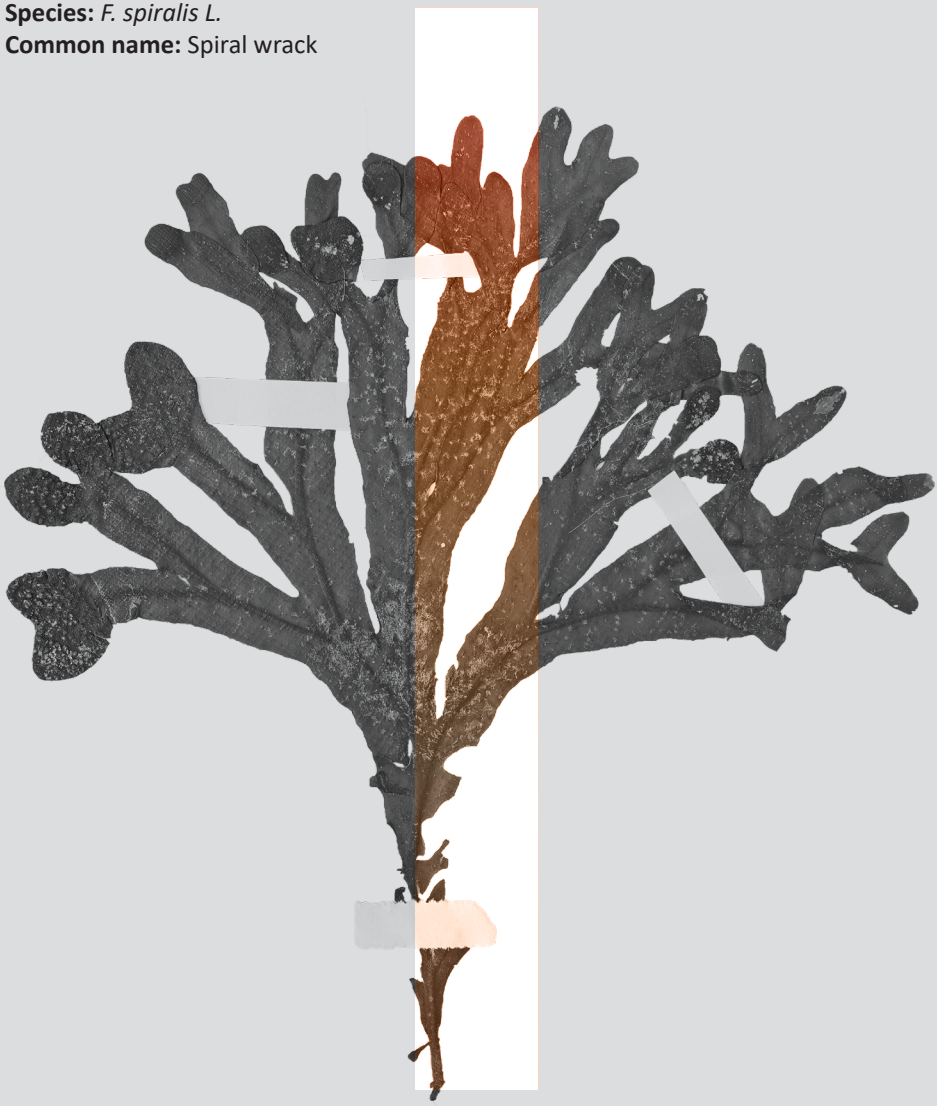
 # 012

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Heterokonta
Class: Phaeophyceae
Order: Fucales
Family: Fucaceae

Genus: *Fucus*
Species: *F. spiralis L.*
Common name: Spiral wrack



0 4 cm

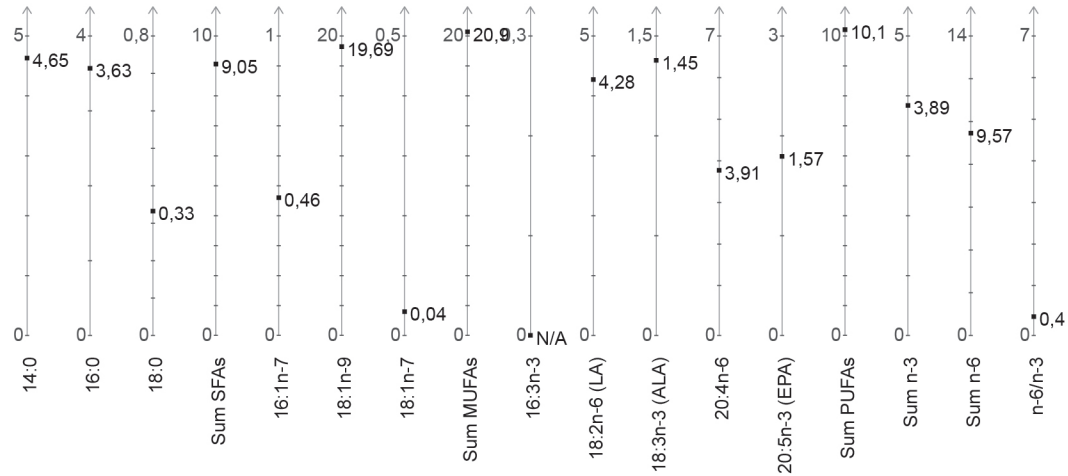


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

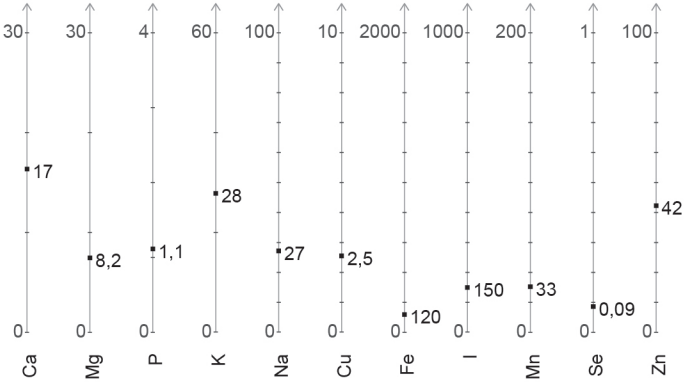
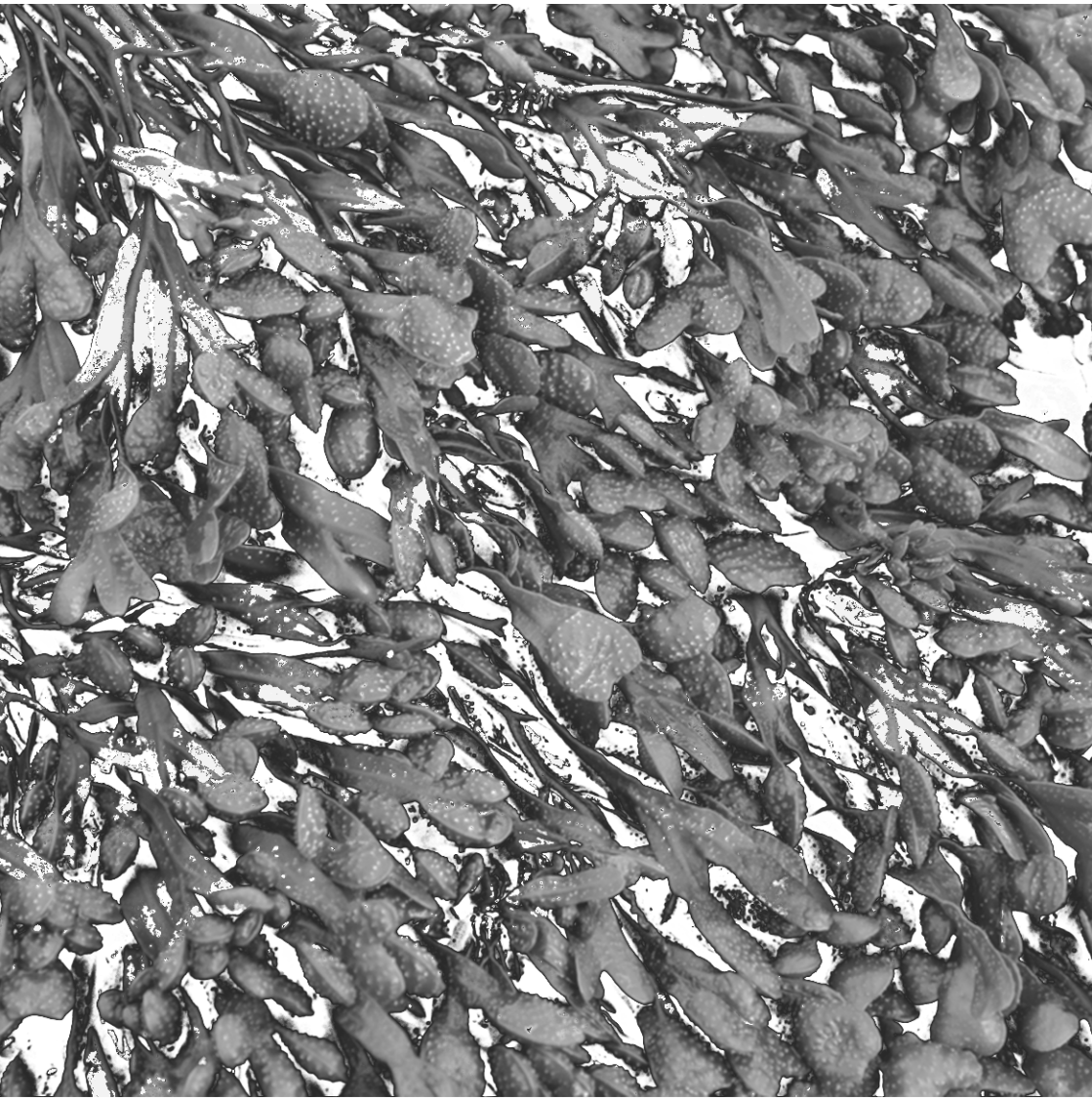


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Spiralled Wrack, Fucus spiralis, is the uppermost species of Fucus that occurs on the shore. The frond lacks bladders (Fucus vesiculosus) and does not have a serrated edge (Fucus serratus); it is sometimes spiralled. This species has recently had another, common species segregated from it, Fucus guiryi. For characters to distinguish the two species, go to the description of this entity.



 # 013

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Heterokonta
Class: Phaeophyceae
Order: Fucales
Family: Fucaceae

Genus: *Pelvetia*
Species: *P. canaliculata (L.) Decaisne & Thuret*
Common name: Channel wrack

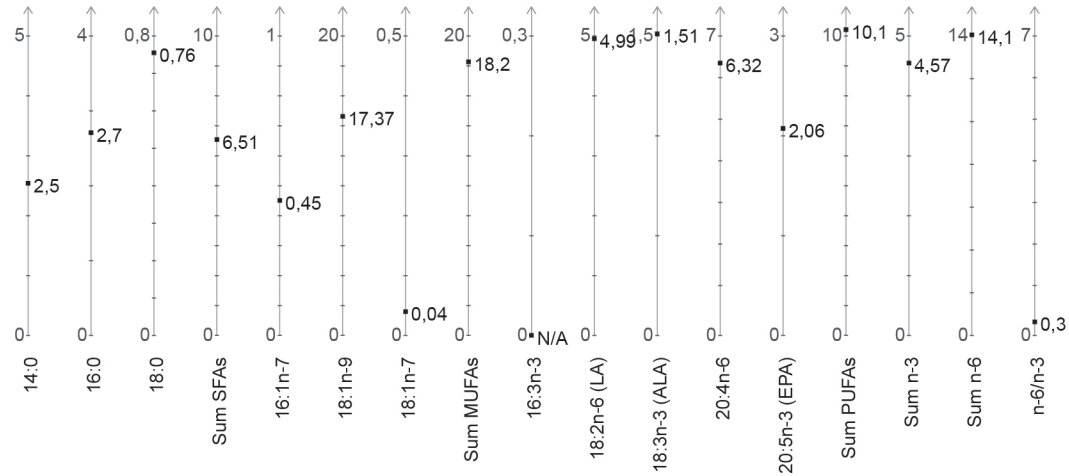


Fig. 1 - Fatty acid composition (mg g–1 algal dry weight)

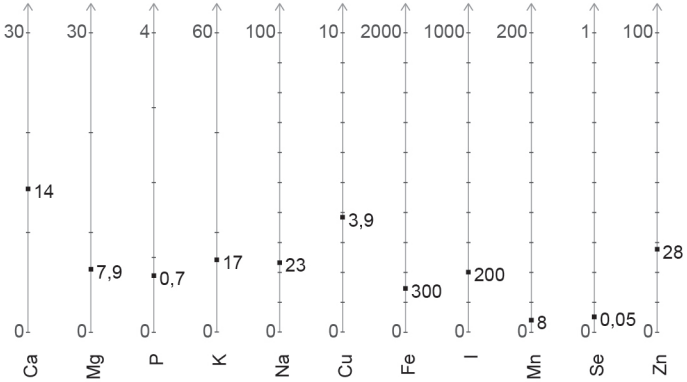


Fig. 2 - Elemental composition (g kg–1 algal dry weight)

Description: Plants 80-120 mm long, yellow-brown in colour, turning black when dry, and often so dry that the fronds disintegrate when trodden upon; regularly dichotomously branched with a disctinct channel on the underside (the side nearest the rock), which holds moisture and apparently helps the wrack to survive at very high levels on the shore.

Habitat: Occurring very high on the shore, generally above MHWN, on wave-exposed and sheltered shores, but absent from very exposed roacky shores. Some free-living ecotypes (var. libera) occur in salt-marshes.

 # 014

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Heterokonta
Class: Phaeophyceae
Order: Fucales
Family: Sargassaceae

Genus: *Halidrys*
Species: *H. siliquosa (L.) Lyngbye*
Common name: Sea oak

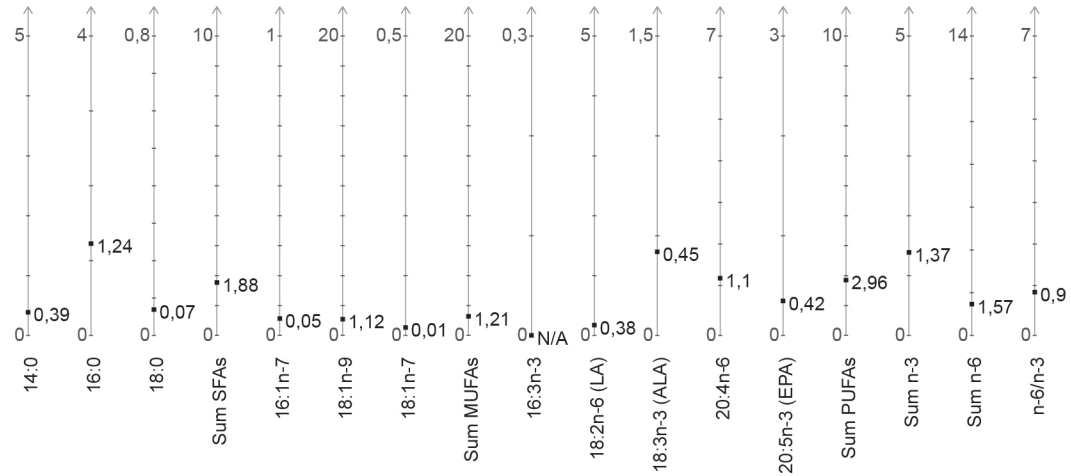


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

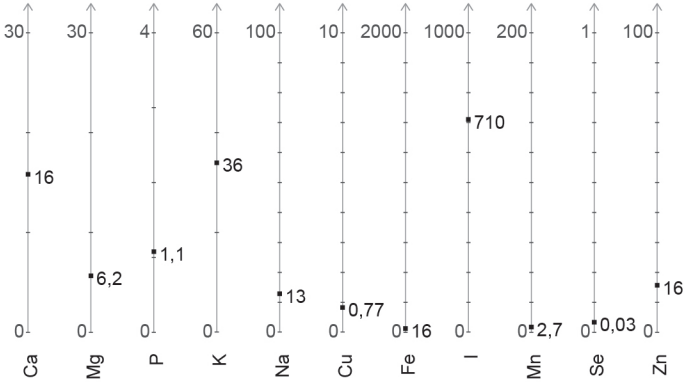
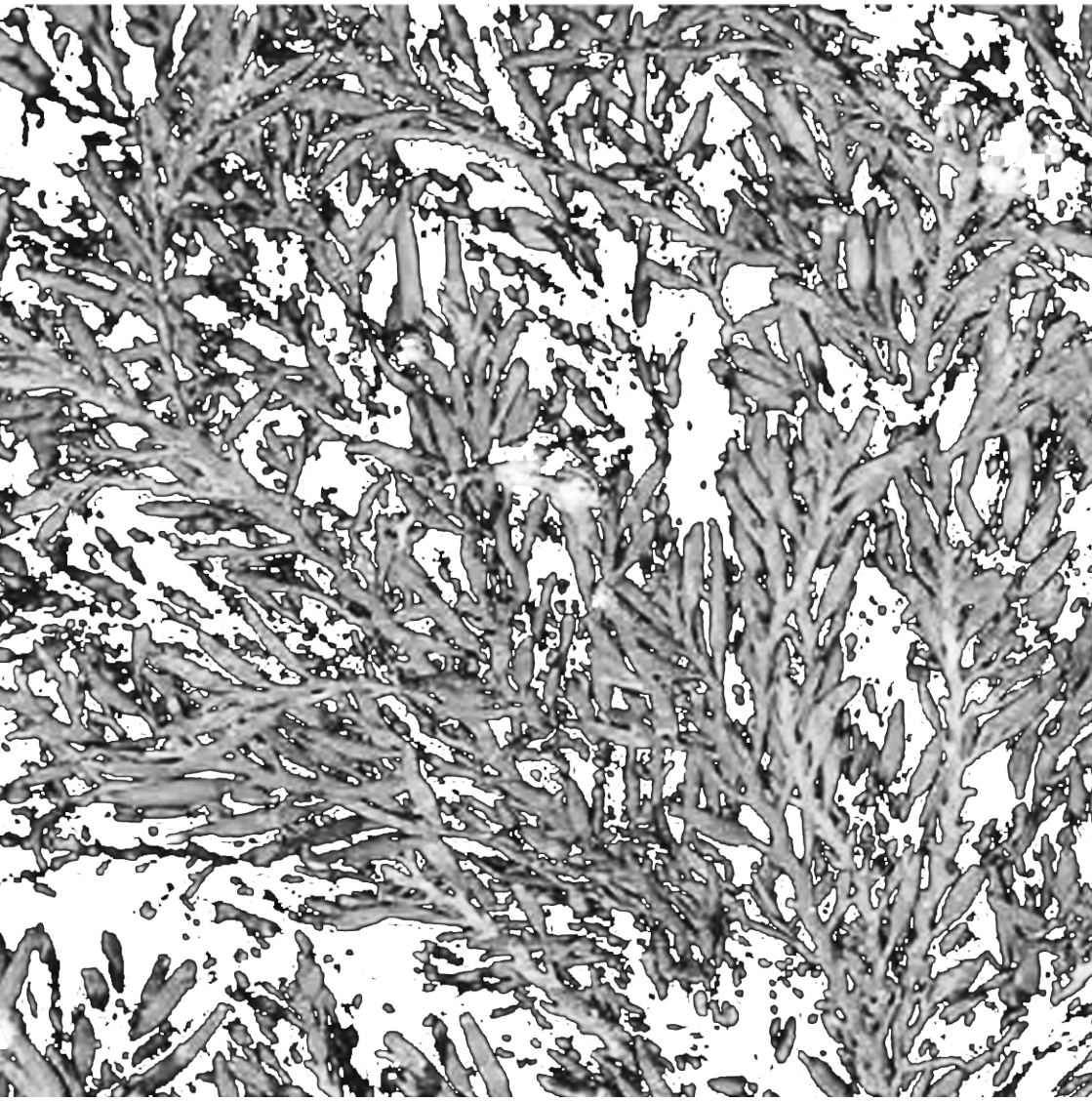


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Thallus 30-130 cm long, tawney to yellow-brown ochre, tough and leathery; attached by a large, discoid holdfast, giving rise to compressed, irregularly alternately branched fronds, with several orders of close branching in the same plane. Pod-shaped, segmented, air bladders, are produced replacing some lateral branches.

Habitat: Found most commonly in large, mid-intertidal pools, often dominating in the very large, sunny pools, but more often forming occasional stands. Occasionally forming extensive forests in the shallow subtidal to about 10 m, generally in current-exposed situations. Widespread and common.



 # 015

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Heterokonta
Class: Phaeophyceae
Order: Fucales
Family: Himanthaliaceae

Genus: *Himanthalia*
Species: *H. elongata (L.) S.F. Gray*
Common name: Thong weed

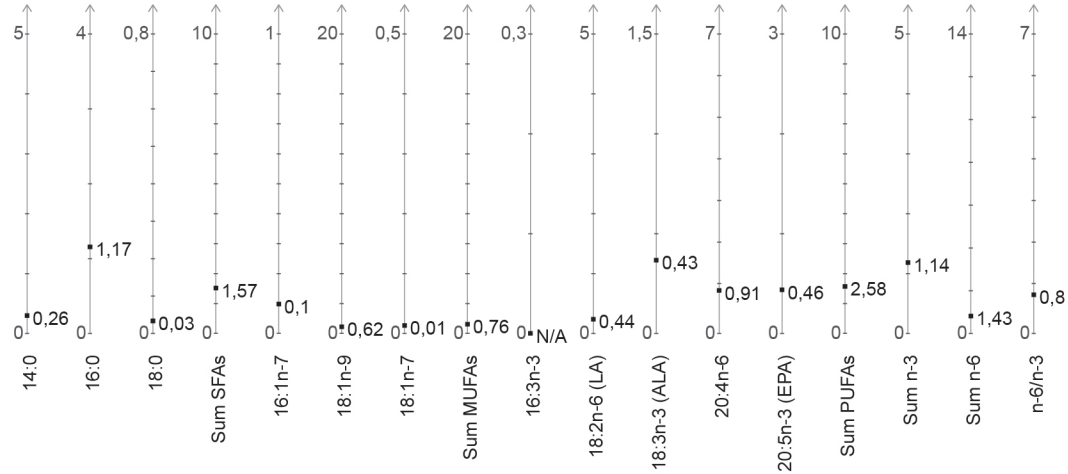


Fig. 1 - Fatty acid composition (mg g–1 algal dry weight)

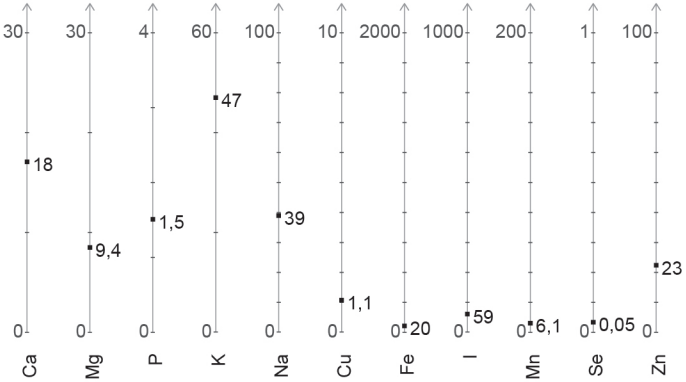


Fig. 2 - Elemental composition (g kg–1 algal dry weight)

Description: Thallus consisting of a button-shaped vegetative thallus to 30 mm wide and 25 mm high, and a long, narrow, strap-like, sparingly branched, light yellow-brown reproductive receptacle to 2 m in length and up to 10 mm in width, on which the conceptacles are borne.

Habitat: On gently sloping rocks at MLWN, particularly on semi-wave-exposed shore (below), on which they may form a distinct zone at low water. Sparse populations sometimes develop in sheltered lagoons and the plants are more yellow and less flattened.

 # 016

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Heterokonta
Class: Phaeophyceae
Order: Fucales
Family: Fucaceae

Genus: *Ascophyllum*
Species: *A. nodosum (L.) Le Jolis*
Common name: Egg wrack

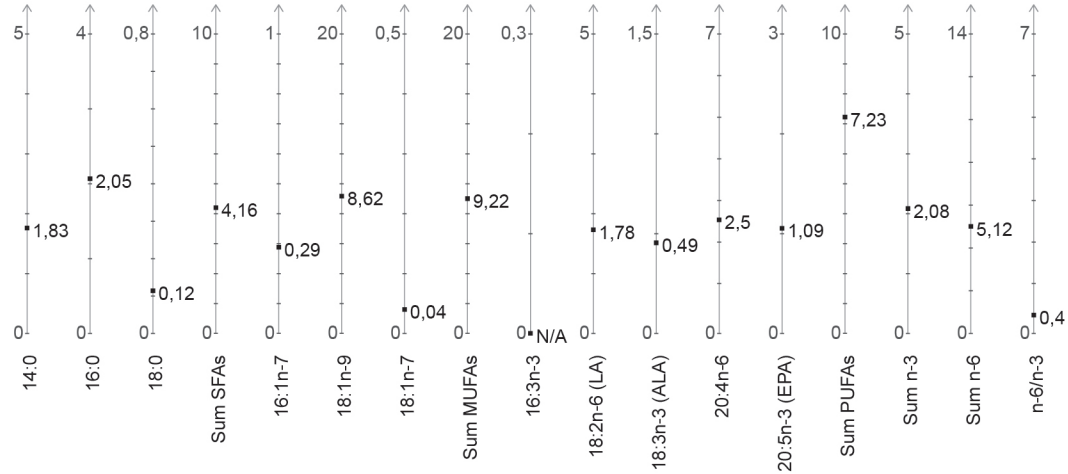


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

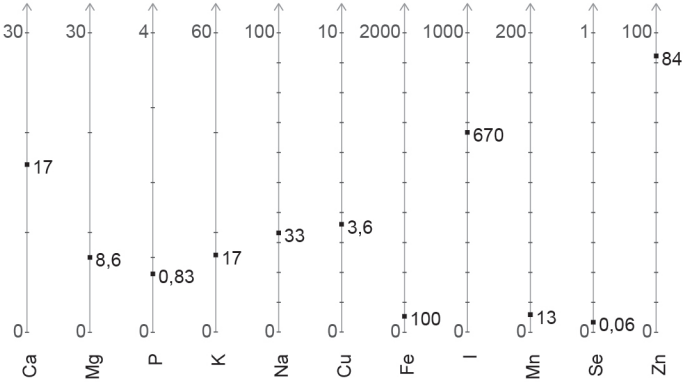
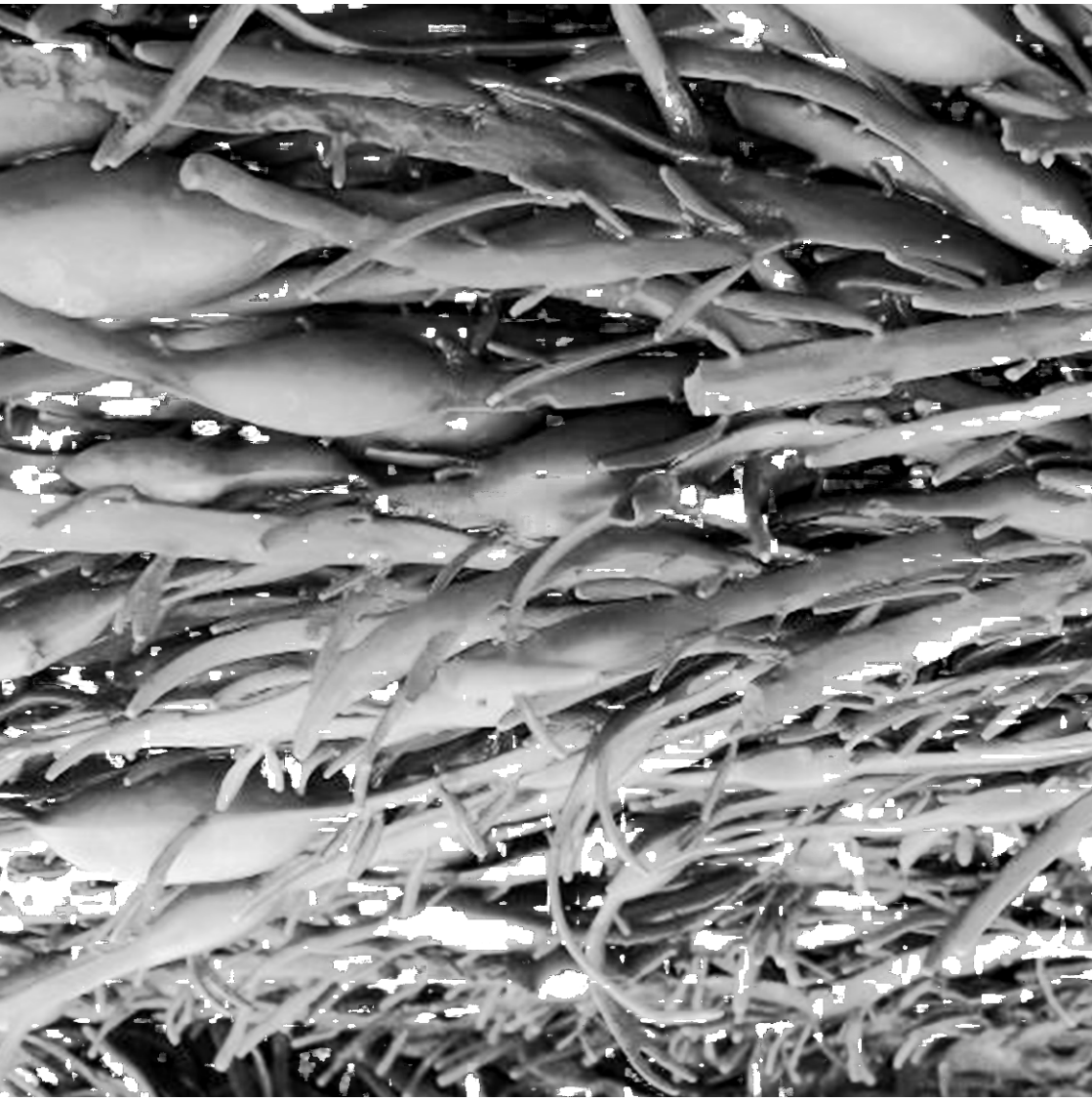
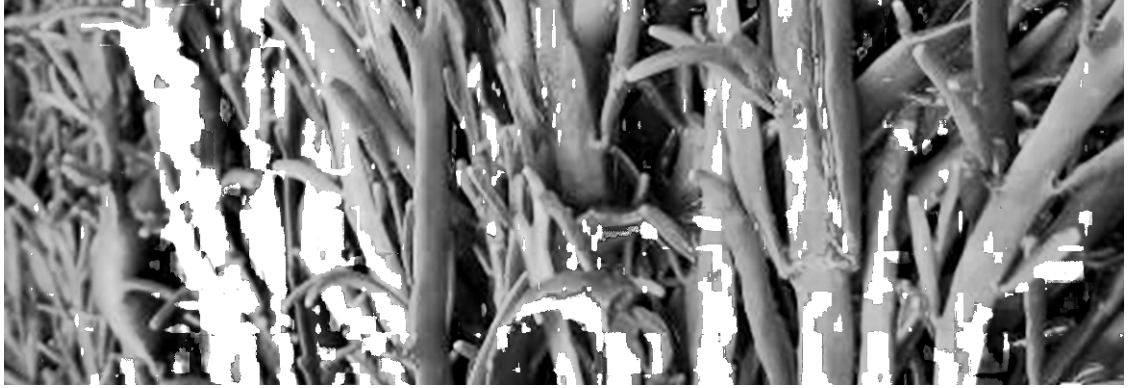


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Ascophyllum nodosum is a brown seaweed closely related to Fucus. It forms a single bladders centrally in long, strap-like fronds. The fronds hang downwards, gently draping sheltered intertidal rocks. A number of fronds grow from each basal holfast, and the plant generally regenerates new fronds from the base when one of the larger fronds are damaged, so that the stands you see on the shore may be very persistant indeed. Reproduction takes place in beautiful yellow receptacles in sprin. These develop in reponse to short days in the autumn, mature during the winter, and are at their most prolific in spring.

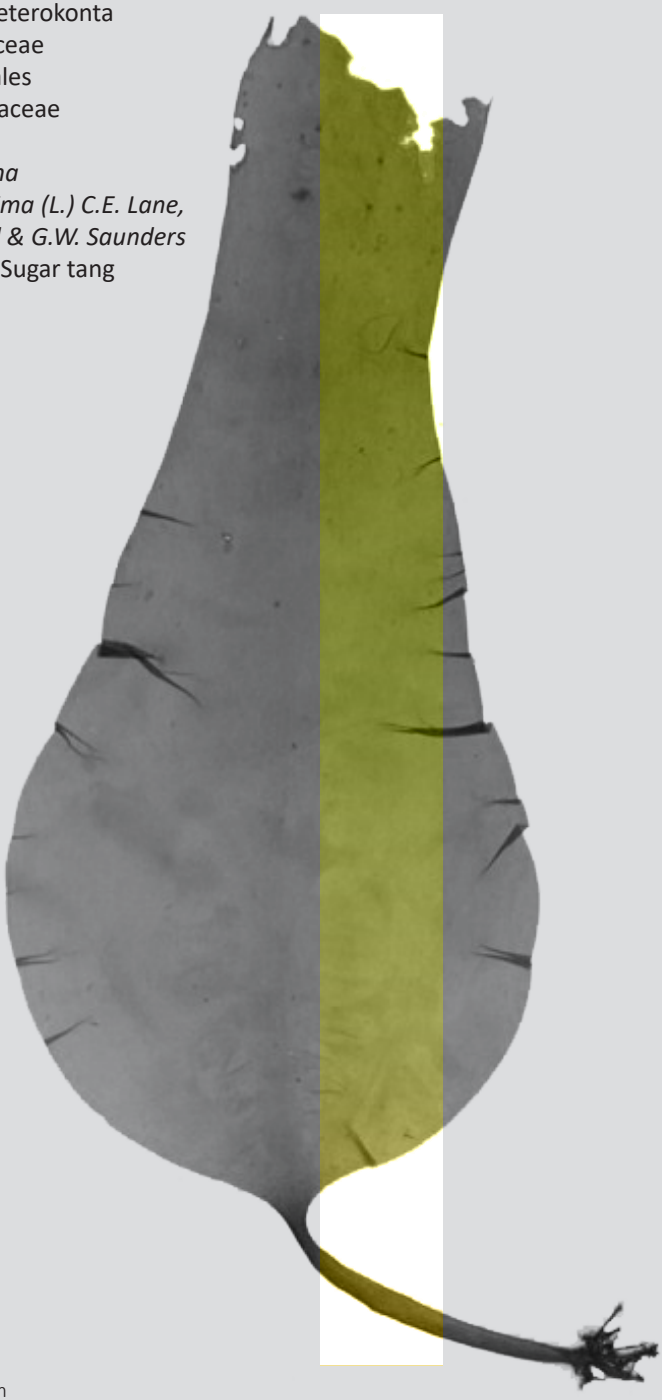


 # 017



Superphylum: Heterokonta
Class: Phaeophyceae
Order: Laminariales
Family: Laminariaceae

Genus: *Saccharina*
Species: *S. latissima (L.) C.E. Lane, C. Mayes, Druehl & G.W. Saunders*
Common name: Sugar tang



0 3 cm

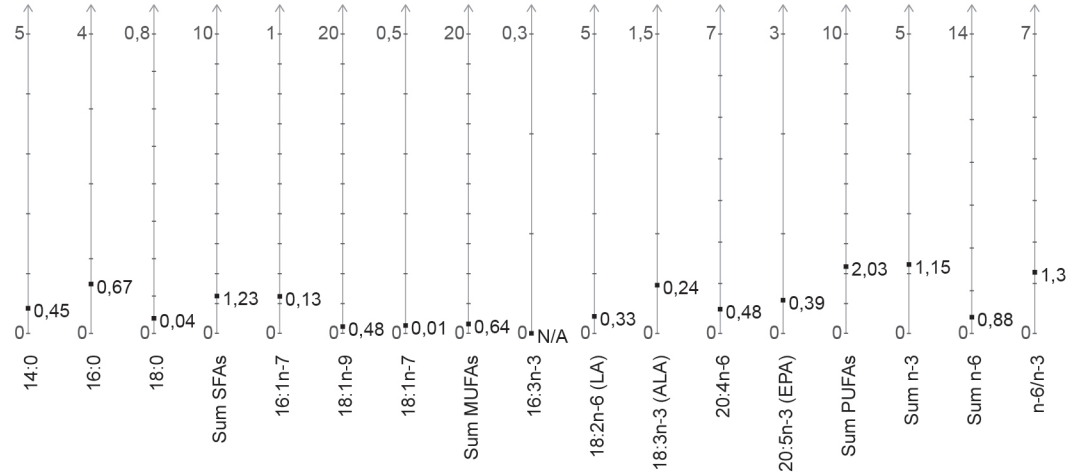


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

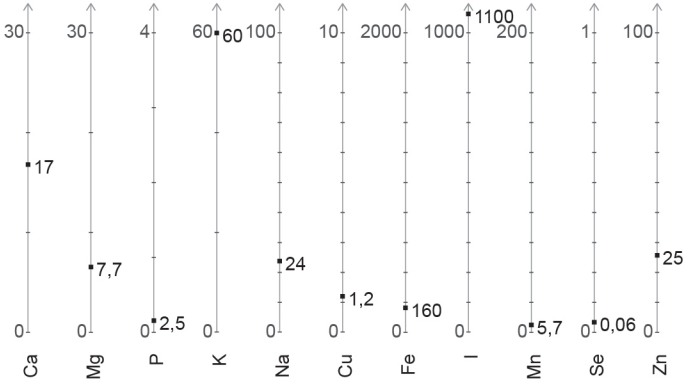
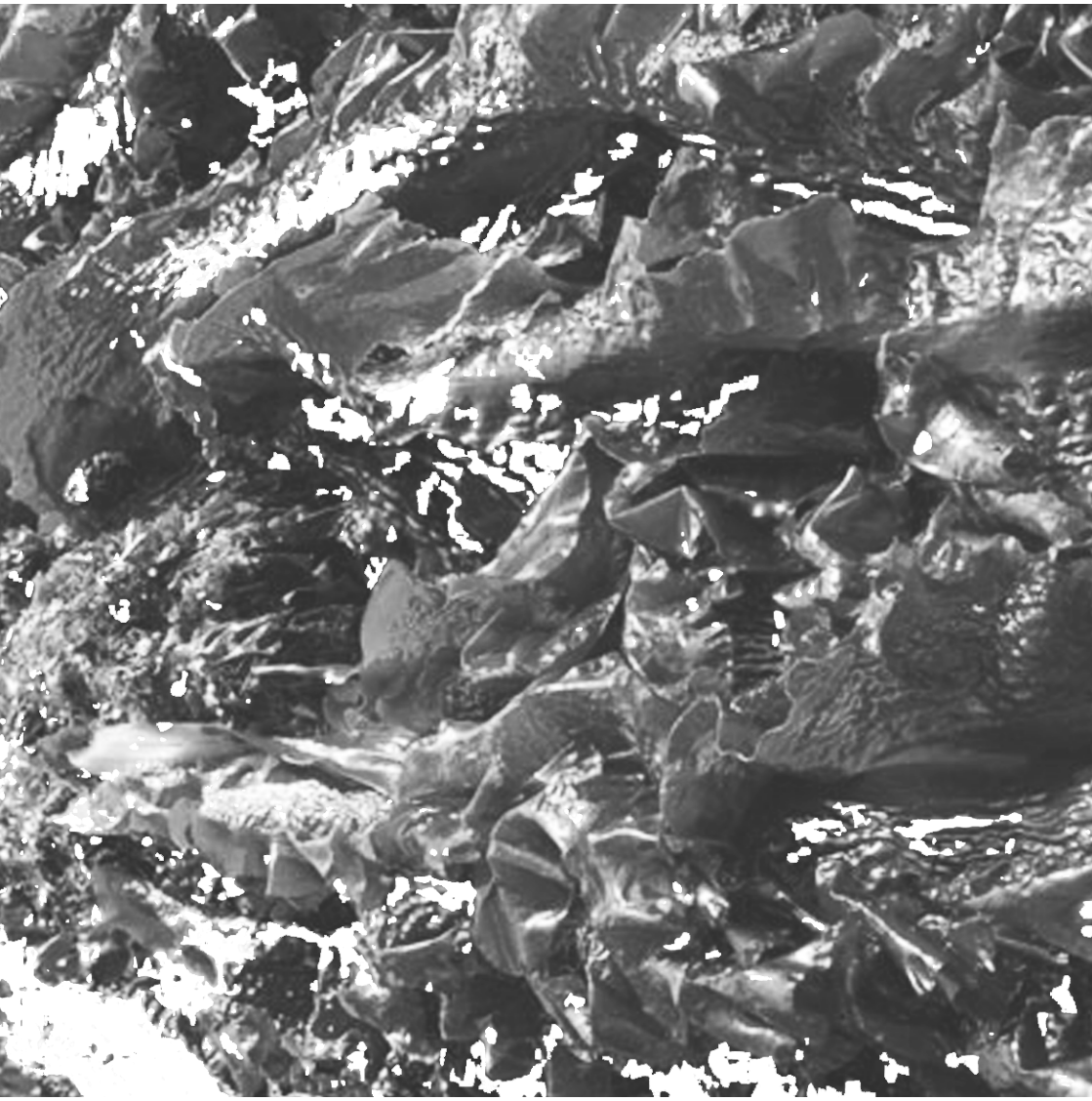


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Yellow brown, to 3 m in length; with a claw-like holdfast, a small, smooth, flexible stipe, and an undivided laminate blade to 3 m long with parallel, ruffled sides and a elongated, tongue-like appearance. The frond is characterstically dimpled with regular bullations (depressions).

Habitat: Intertidal pools and occasional in the shallow subtidal, becoming more abundant at low water in sheltered localities with fast-moving water, such as rapids systems. In the subtidal, it is characteristic of intermittently disturbed areas.



 # 018

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Heterokonta
Class: Phaeophyceae
Order: Laminariales
Family: Laminariaceae

Genus: *Laminaria*
Species: *L. digitata (Hudson) J.V. Lamouroux*
Common name: Sea gridle

0 4 cm

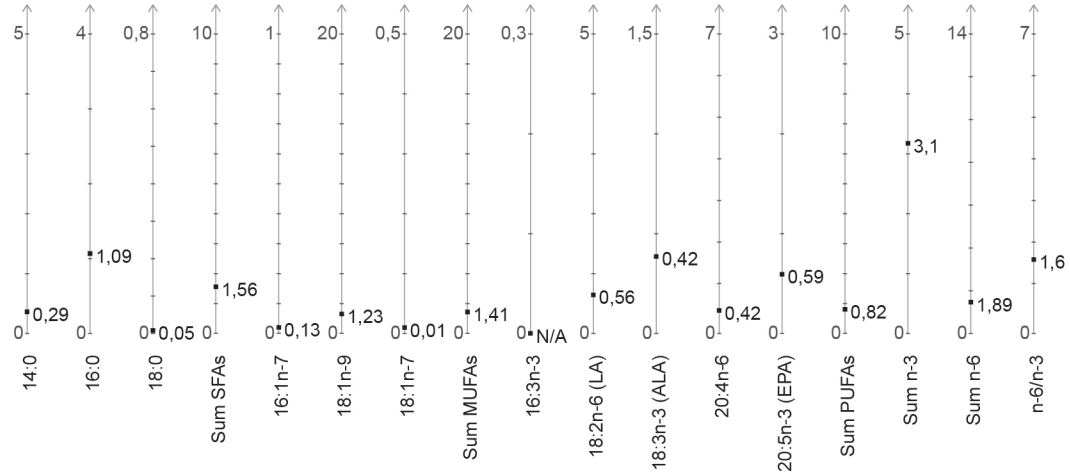


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

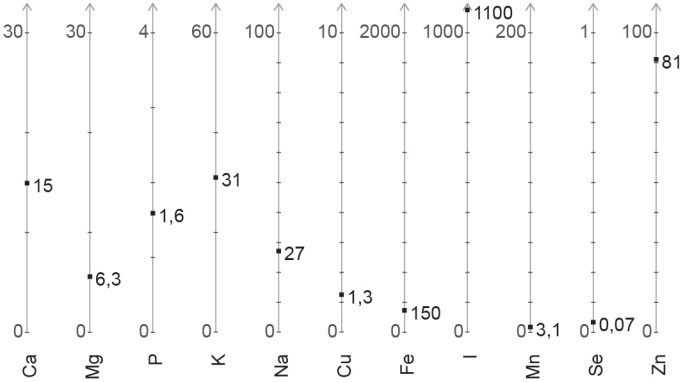
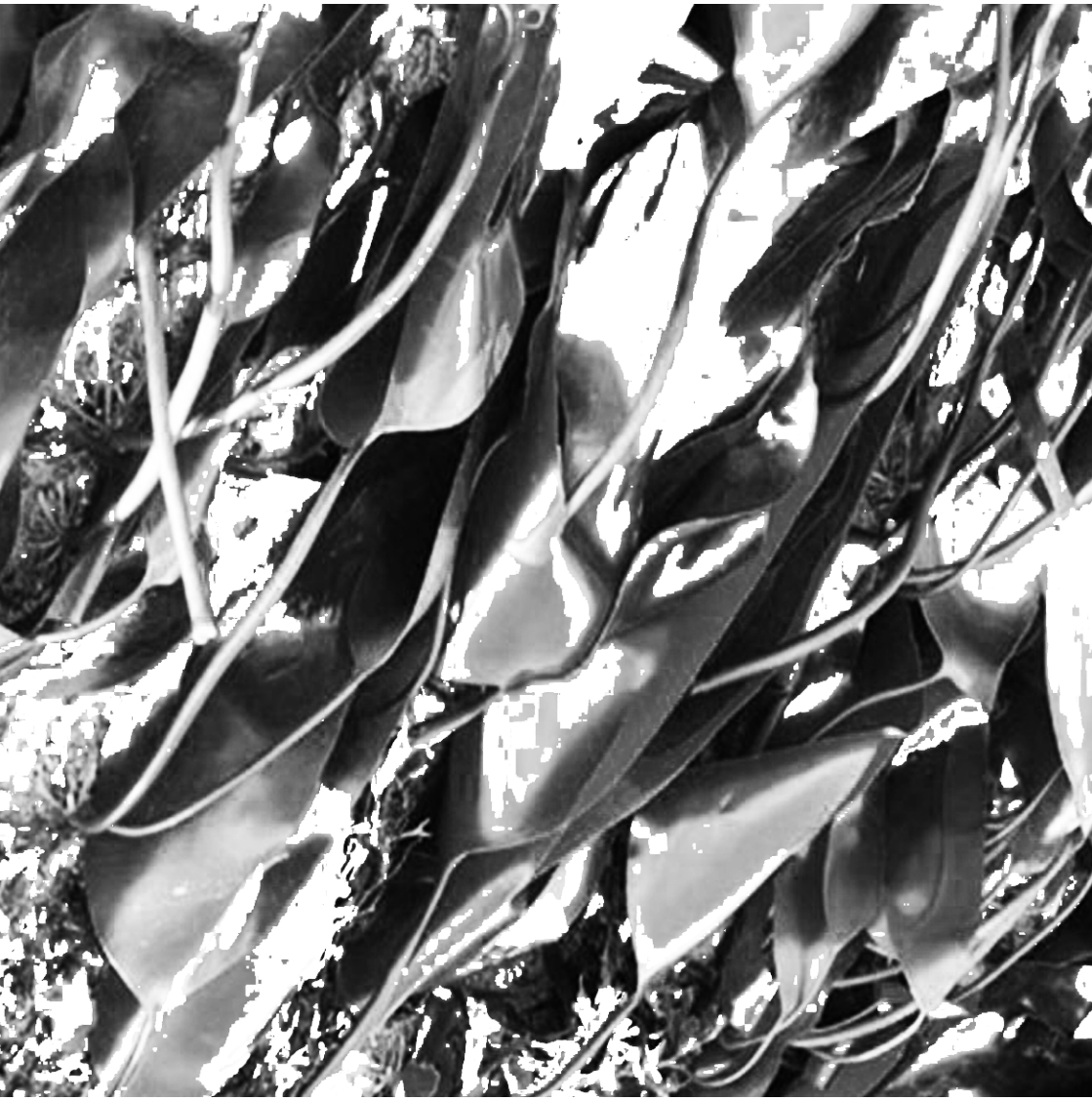


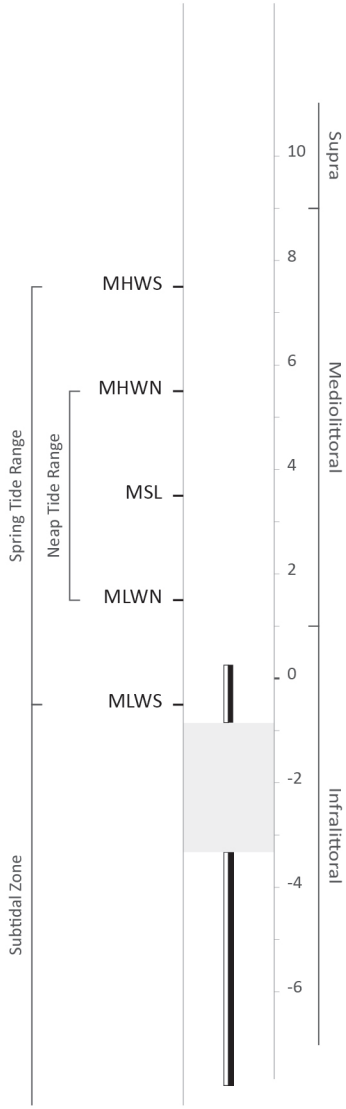
Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Dark brown, to 2 m in length; with a claw-like holdfast, a smooth, flexible stipe, and a laminate blade to 1.5 m long split into finger-like segments.

Habitat: Very common in the lower intertidal and shallow subtidal growing on rock in Britain and Ireland. May form extensive meadows at low water from Robin Hood's Bay, Yorkshire). Underwater plants are more golden in colour in sunlight.



 # 019

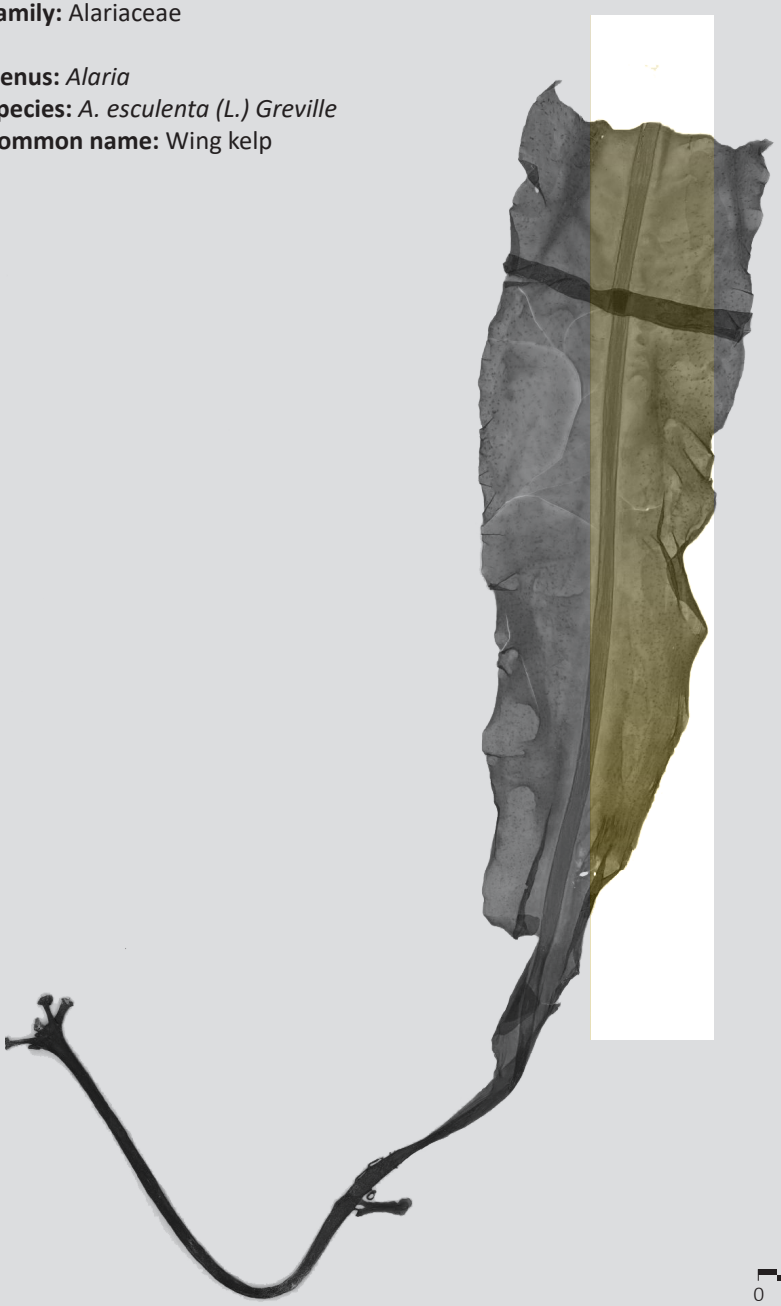


Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Heterokonta
Class: Phaeophyceae
Order: Laminariales
Family: Alariaceae

Genus: *Alaria*
Species: *A. esculenta (L.) Greville*
Common name: Wing kelp



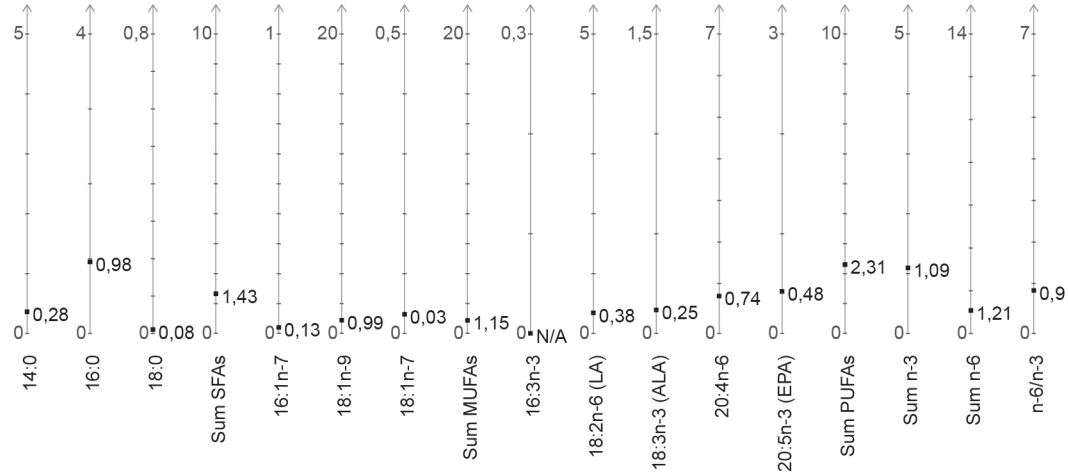


Fig. 1 - Fatty acid composition (mg g−1 algal dry weight)

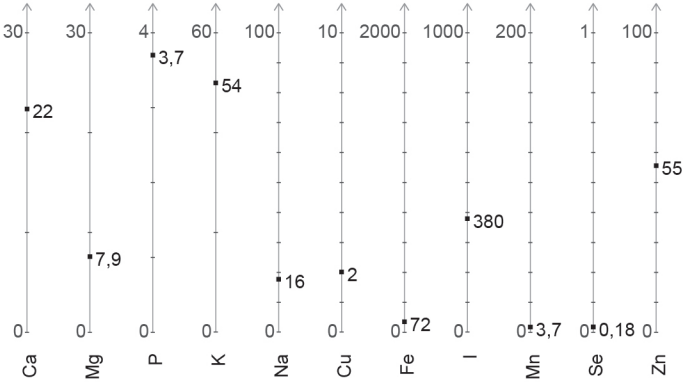


Fig. 2 - Elemental composition (g kg−1 algal dry weight)

Description: Plants with olive or yellow-brown fronds to 4 m long and 25 cm wide, more often about 1 m and 7.5 cm wide. Attached by a root-like holdfast at the base from which a narrow flexible stipe arises which continues into the leafy part of the plant as a distinct mid-rib, generally with a yellow-brown colour. The reproductive structures, apparent as dark-brown areas, are confined to unbranched leafy appendages borne on the stipe, usually in two rows.

Habitat: Generally growing on rock in wave-exposed places, often forming a band at low water and in the shallow subtidal, but also occurring in tidal pools in the lower shore.

 # 020

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

Superphylum: Heterokonta
Class: Phaeophyceae
Order: Ectocarpales
Family: Chordariaceae

Genus: *Chordaria*
Species: *C. flagelliformis (O.F. Müller) C. Agardh*
Common name: Slimy whip weed

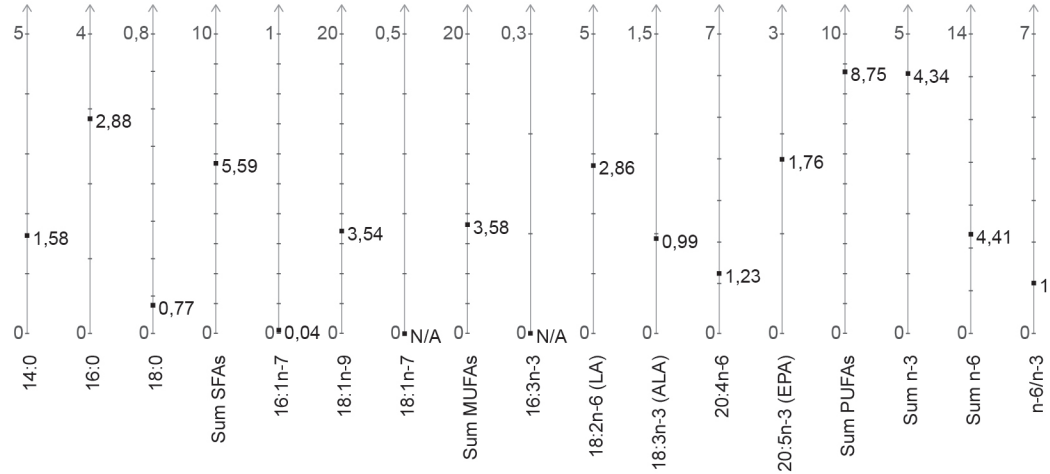


Fig. 1 - Fatty acid composition (mg g–1 algal dry weight)

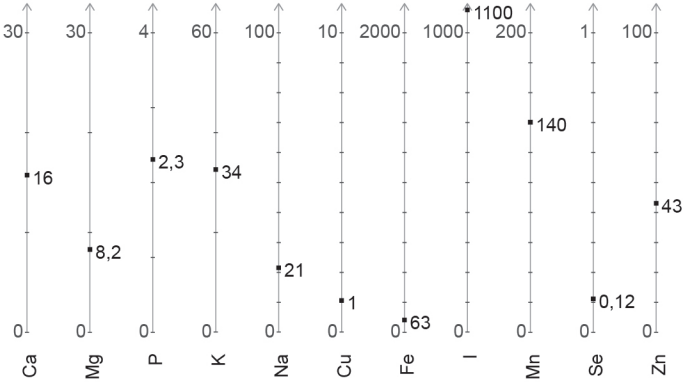


Fig. 2 - Elemental composition (g kg–1 algal dry weight)

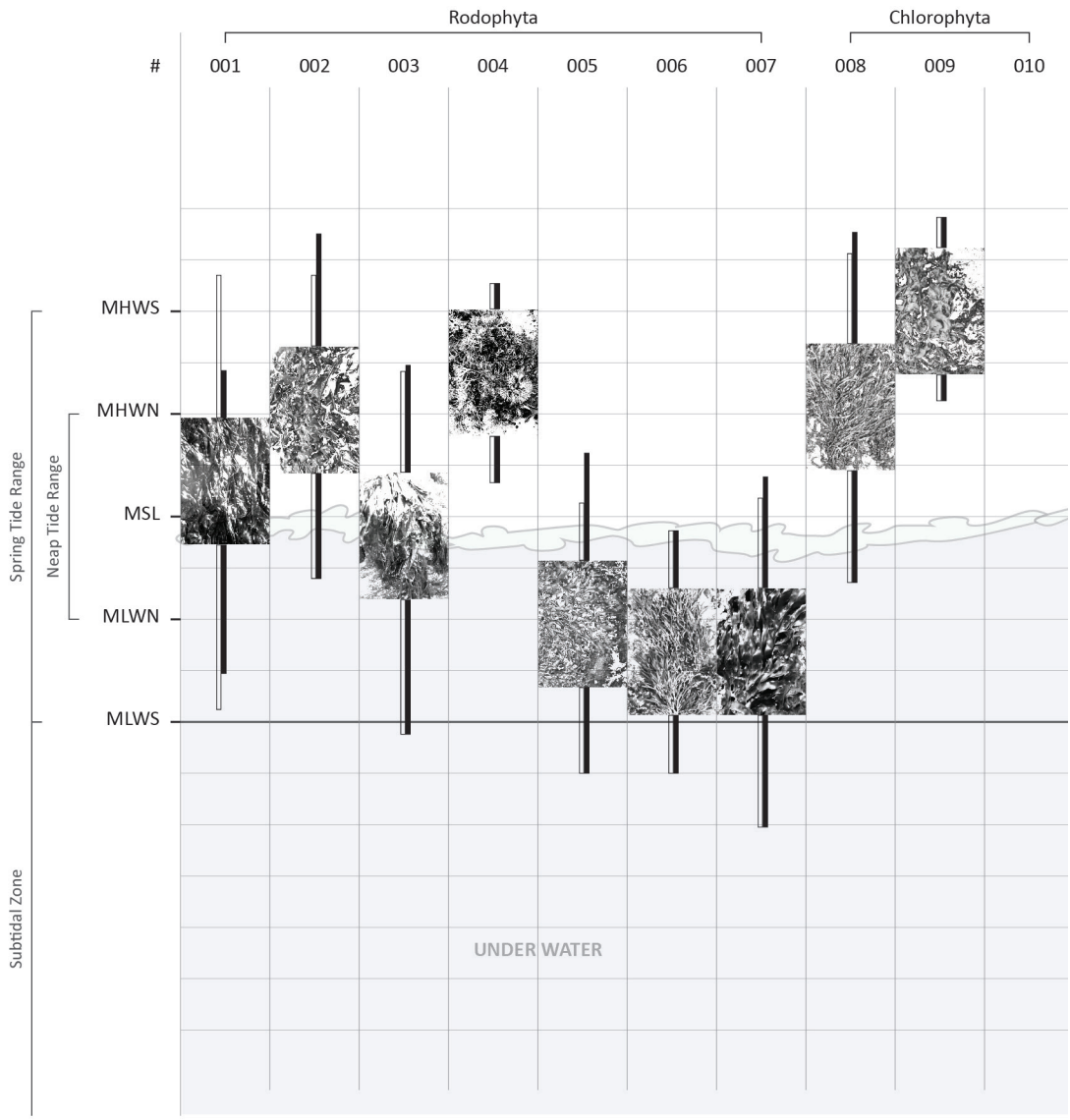
 # 021

Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring

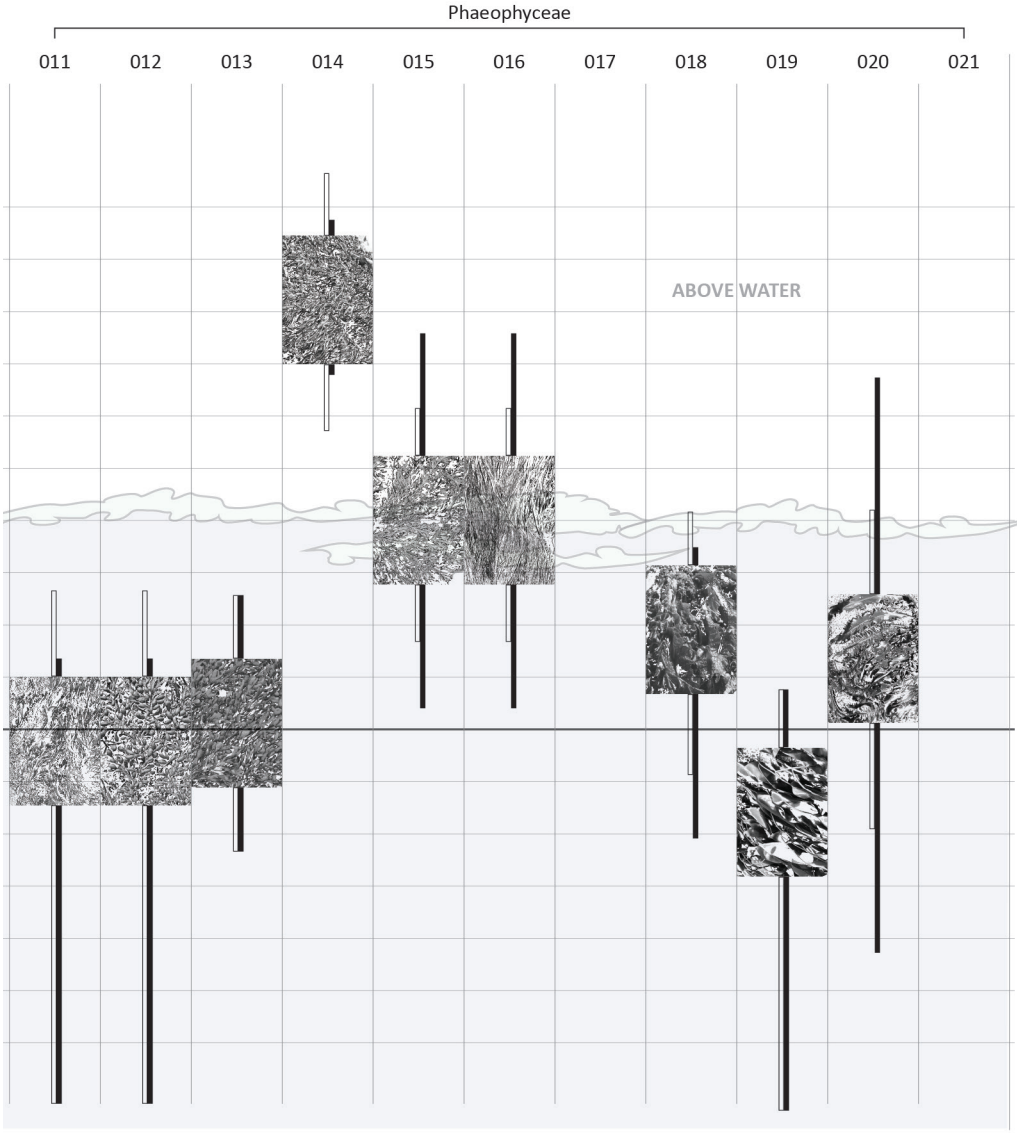
Intertidal Distribution

Many factors determine the distribution of seaweed within the boundaries of the shore



Exposed
Protected

MLWS - Mean High Water Spring
MHWN - Mean High Water Neap
MSL - Mean Sea Level
MHWN - Mean Low Water Neap
MSL - Mean Low Water Spring


Phaeophyceae
011
012
013
014
015
016
017
018
019
020
021
ABOVE WATER
10
8
6
4
2
0
-2
-4
-6
Supra
Mediolittoral
Infralittoral

Habitats

001 / On rock in interdidal, mainly on semi-exposed shores hanging downwards from rocks embedded in sand or affected by sand. Most common in spring and early summer; widely distributed.

002 / Zone-forming on rock in the upper intertidal and splash zone of semi-exposed and exposed shores. This is a winter and spring annual appearing on semi-exposed and exposed shores from November onwards and persisting until February or March.

003 / Generally on mussels, sometimes on rock; midtidal to splash zone, generally distributed, abundant, especially on exposed coasts in spring and summer.

004 / On rocks, in pools, lower intertidal and shallow subtidal, widely distributed, abundant.

005 / On rocks in lower intertidal, often in large continuous mats, widespread and abundant.

006 / On rocks, lower intertidal and shallow subtidal, in pools and runnels, in open situations, often on sandy or muddy shores, tolerating lowered salinities. Widely distributed, common.

007 / On rock, mussels and epiphytic on several algae, intertidal (at all levels but particularly near low water) and shallow subtidal , especially on upper part of Laminaria hyperborea stipes (right. to a depth of about 5 m), widely distributed, abundant.

008 / Rock pools in the upper intertidal and salt-marshes.

009 / On rock and in lower-shore rock pools, and in the shallow subtidal.

010 /

011 / Zone forming on sheltered and semi-exposed shores from about MTL down to about MLWN where it meets the kelp zone.

012 / Zone forming on sheltered and semi-exposed shores from about MTL down to about MLWN where it meets the kelp zone.

013 / Intertidal, where it co-occurs with Fucus spiralis

and Fucus vesiculosus on the same shore, average distributional shore height typically in between these two species.

014 / Occurring very high on the shore, generally above MHWN, on wave-exposed and sheltered shores, but absent from very exposed roacky shores. Some free-living ecotypes (var. libera) occur in salt-marshes.

015 / Found most commonly in large, mid-intertidal pools, often dominating in the very large, sunny pools, but more often forming occasional stands. Occasionally forming extensive forests in the shallow subtidal to about 10 m, generally in current-exposed situations. Widespread and common.

016 / Found most commonly in large, mid-intertidal pools, often dominating in the very large, sunny pools, but more often forming occasional stands. Occasionally forming extensive forests in the shallow subtidal to about 10 m, generally in current-exposed situations. Widespread and common.

017 /

018 / Intertidal pools and occasional in the shallow subtidal, becoming more abundant at low water in sheltered localities with fast-moving water, such as rapids systems. In the subtidal, it is characteristic of intermittently disturbed areas.

019 / Very common in the lower intertidal and shallow subtidal growing on rock in Britain and Ireland. May form extensive meadows at low water. Underwater plants are more golden in colour in sunlight.

020 / Generally growing on rock in wave-exposed places, often forming a band at low water and in the shallow subtidal, but also occurring in tidal pools in the lower shore.

021 /

Behind a History of Women

Seaweed sees many links through out history with that of women

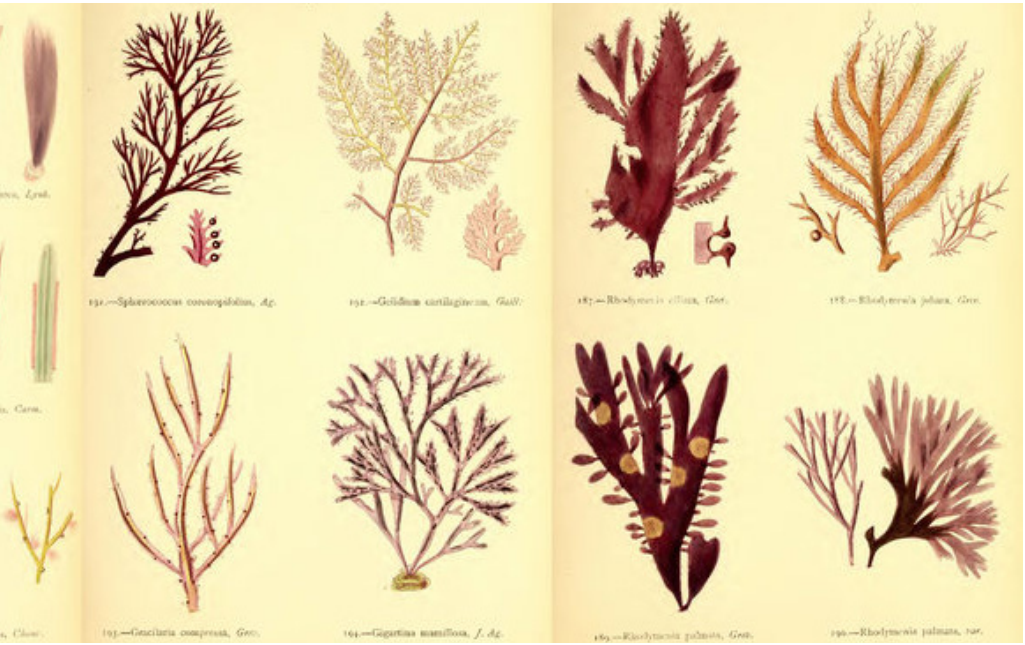
Lofoten Seaweed Company

In Victorian times it became a wide spread hobby for women of upper class to collect seaweed in albums that blend an artful representation and a scientific collection. It was also a feminist statement as they challenged dress codes at a time when women were not encouraged to wear pants or even uncover their ankles.

British Sea-Weeds, Margaret Gatty

Female success stories of grassroot - pun intended - business models in the food industry have taken over the market.

Namely the famous Lofoten Seaweed in Norway exporting to all hip farmers markets around Oslo or the older sister Mara Seaweed based in Edinburgh which is now selling to big companies like Blue Apron are few of many examples.



David Tu Sun Song

In Japenese culture seaweed is not just a ‘sea vegetabe’. In ancient Haikus it was common to use seaweed «as an imagery and metaphor to express meanings from «love» to «compassion», «truth» and «sensuality» (Bast, 2014). Often written by men, these allegories were often used to depict female traits.

« Alas, she is no more, whose soul was bent to mine like the bending seaweed »

- Manyoshu

Haenyeo or Sea-women in Korean is a tradition of the Jeju province where women apnea gatherers collect among other sea creatures, seaweed to sell on local markets. The culture was inscribed in 2016 on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity. The industry dates back to the 500 AD and become female dominated by the 18th century.

The reliance of families on the mothers income challenged the Confucius traditions and transformed these societies in semi-matriarchal where it became custom for fathers to stay at home to care for the children.

« As a mat of creepers,
is the sea at Iwami;
Amongst the mangled words of
Kara Point,
Upon the reefs
Grows the algae thickly;
On the rocky shorline,
Grows the jeweled seaweed
Trembling, lay my girl;
Lush as thick (miru) green algae »

- Unknown

« In the bay of Naniwa
Seaweed-covered
Gemstone rocks
Appear-just so
Does my love for her »

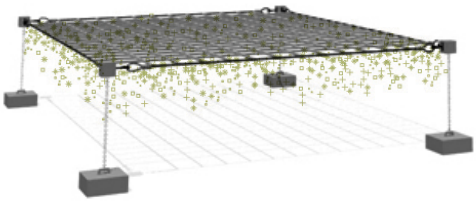
- Minamoto no Toshiyori

«As the jeweled seaweed,
She, trembling, laid her down »

- Unknown

Forms Borrowed from Aquaculture

A set of structures used in the cultivation of seaweed which could make the bones of an aquatic park

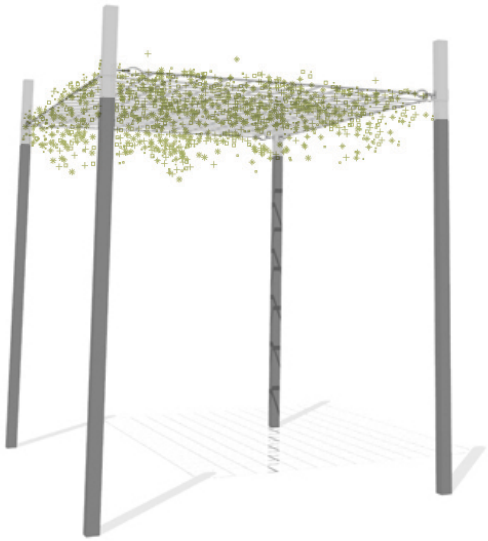


Benthic rack

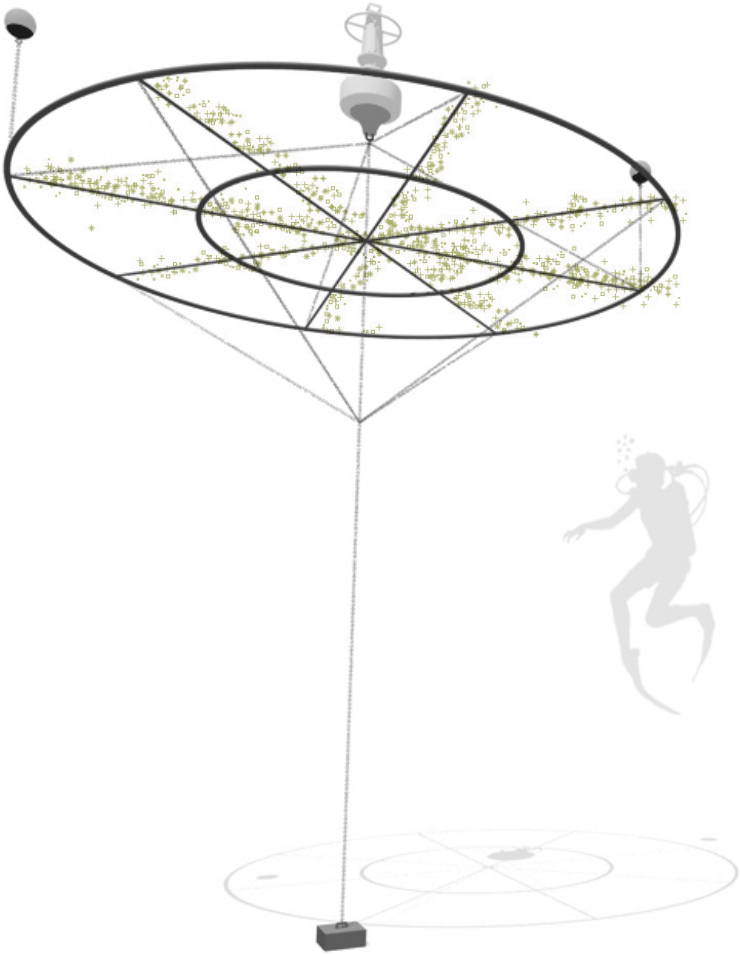
Sea curtain

Sea garland

Sea column



Surface rack



Sea centerpiece

An Under Water Garden

To dive into the world of buoyancy

www.browndailyherald.com

A submerged interstection between a botanical garden, a vegetable garden, and a formal garden.

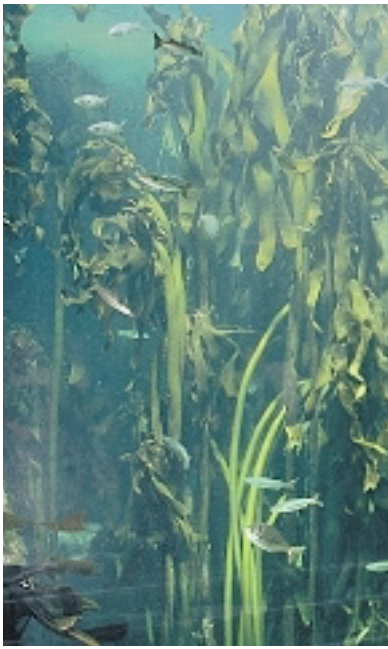
www.travelblog.com

Le Potager du Roi, Versailles

London Botanical Garden

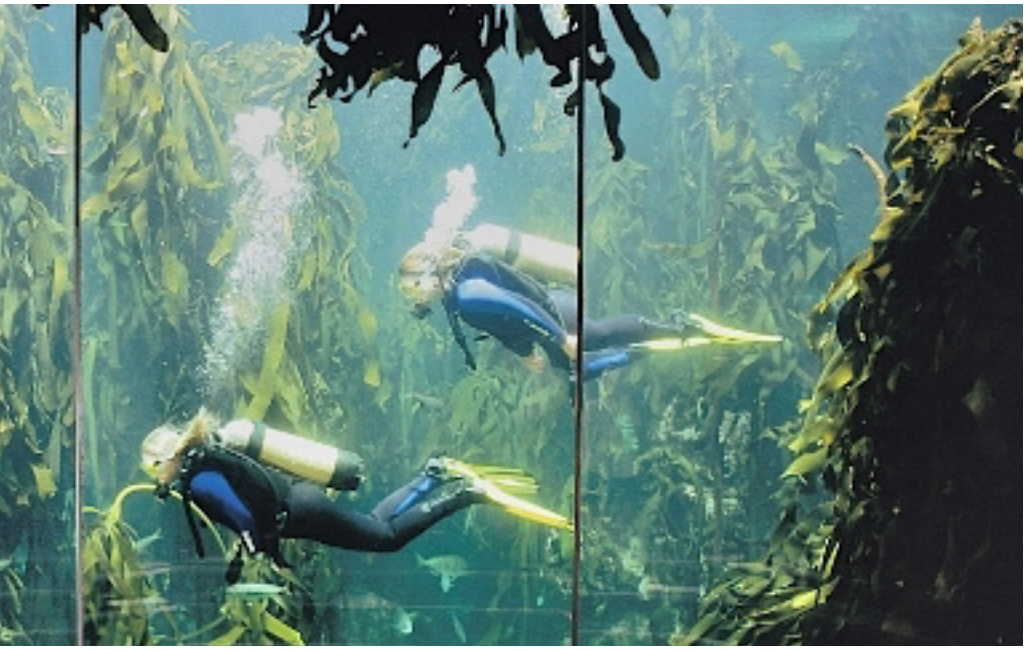
wsg.washington.edu

Where visitors are invited to experience seaweed by diving into the world of buoyancy where the greenery of a different world moves to the rhythm of tides and currents.



www.hiperly.com

Surface Grid



Underwater Jungle

References

Articles

Biancarosa, I. , Belghit, I. , Bruckner, C. G., Liland, N. S., Waagbø, R. , Amlund, H. , Heesch, S. and Lock, E. (2018), Chemical characterization of 21 species of marine macroalgae common in Norwegian waters: benefits of and limitations to their potential use in food and feed. J. Sci. Food Agric, 98: 2035-2042.

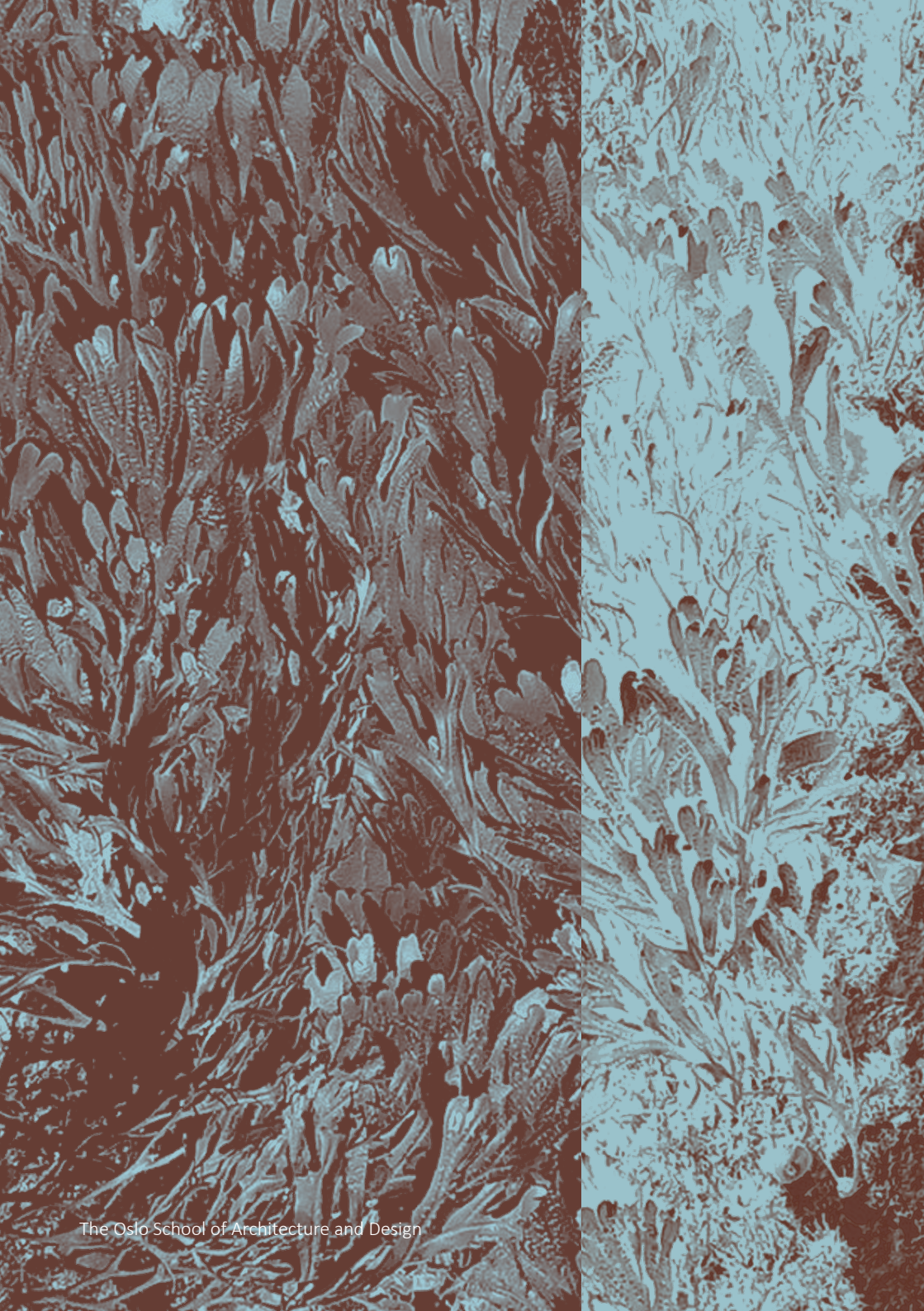
Bast, Felix. (2014). Seaweeds in Japanese Culture: An analysis of medieval Waka poetry. The Phycologist. 86. 24-27. 2014.

Book

J. D. Fish, S. Fish. *A Student's Guide to the Seashore.* institute of Biological, Environmental and Rural Schiences. Aberystwyth University. 2011.

Website

M.D. Guiry. The Seaweed Site: information on marine algae. www.seaweed.ie. 2010- 2019.


The Oslo School of Architecture and Design