Seaweed Harvesting

Natural England's Advice

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Contents

Tables

Figures

Cover photo: Flat periwinkle (*Littorina obtusata*) eggs on serrated wrack (*Fucus serratus*)

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Introduction

Seaweed harvesting is an increasingly popular activity, and Natural England has been approached for advice regarding the legality and sustainability of seaweed collection, for both commercial and non-commercial purposes.

Currently there is no specific licensing system regulating seaweed harvesting. However, there is existing legislation that is relevant to this activity which is discussed below. There is limited information in the scientific literature regarding the environmental impacts of seaweed harvesting, particularly around UK shores. There is also a lack of information on the distribution, biomass and productivity of seaweed species around English coasts. Natural England issues any advice making use of the best available evidence and this guidance document aims to bring together current evidence that may inform our advice.

Marine algae have a number of important ecological functions, including:

- Habitat for a wide variety of species [2,5,14,26]
- Foraging habitat and a food source [27, 34]
- Spawning and nursery ground [16, 30]
- A refuge from predators for fish and invertebrates [16, 28]
- Role in coastal protection – dissipating wave energy and capturing sediments and nutrients [21]
- CO^2 sink [6]

If not carried out sensitively seaweed harvesting can have detrimental impacts on numerous species as well as physical processes[2]. Changes in algal community composition have been shown to occur after harvesting[2, 11, 32].The collection of detached seaweed on the shoreline can also have detrimental effects on a number of species. ‘Drift’ or ‘cast’ seaweed provides an important habitat and food source for invertebrates and higher organisms and removal has been shown to reduce the species richness of this community[8, 10].

Public rights to harvest seaweed

In order to collect seaweed from the shore and seabed in England, it is necessary to obtain permission from the relevant landowner.

The foreshore is defined as the area of land between Mean High Water (MHW) and Mean Low Water (MLW). The Crown Estate has ownership of just over half of the foreshore in England, with the remaining being owned by the Duchy of Cornwall, the Duchy of Lancaster, Ports Authorities, the National Trust, RSPB, Local Authorities and private landowners. The Crown Estate has ownership of most of the seabed out to 12 nautical miles.

Under the public right to fish in tidal waters, floating seaweed can be collected at high water. However, when the tide is out, this right does not extend to collection of seaweed from the shore. In order to collect seaweed from the shore**, the landowner's permission is always required**, this includes the collection of drift seaweed as well as attached seaweed[12].

Many coastal areas have protected status, such as Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Marine Conservation Zones (MCZs) and Sites of Special Scientific Interest (SSSIs). These are discussed in detail below. In order to collect seaweed from designated sites, either the landowner (for SSSIs) or the applicant (for SACs, SPAs and MCZs) would need to obtain permission from Natural England.

Relevant Legislation

<u>Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act 2000 and the Natural Environment and Rural Communities Act 2006</u>

If seaweed harvesting is to be carried out in a Site of Special Scientific Interest (SSSI), the landowner's permission is required. Owners and occupiers of land within a SSSI must obtain written permission from Natural England before undertaking a potentially damaging activity. Therefore the landowner would contact Natural England for consent if approached regarding seaweed harvesting within a SSSI. Most SSSIs

do not extend into the subtidal zone although there are exceptions. SSSI and other protected site boundaries can be found here:
http://magic.defra.gov.uk/

If the species to be harvested are not scheduled under the Wildlife and Countryside Act, (WCA) a licence is not required from Natural England. In England there are no seaweed species listed under Schedule 8 of the Wildlife and Countryside Act (plants which are protected). Associated species should be considered however, and there are some Biodiversity Action Plan (BAP) species that are associated with seaweeds, for example, stalked jellyfish.

Marine and Coastal Access Act 2009

Section 153 of the Marine and Coastal Access Act states that 'sea fisheries resources' means any animals and plants (other than migratory/anadromous and freshwater fish) that 'habitually live in the sea, including those which are cultivated in the sea'. Seaweed is therefore considered a 'sea fisheries resource' and as such, fishing for seaweed would be regulated by Inshore Fisheries and Conservation Authorities (IFCAs) under their general duties which are as follows:

153 (2):
The IFCA district must manage the exploitation of sea fisheries resources in that district and:
a) Seek to ensure that the exploitation of sea fisheries resources is carried out in a sustainable way
b) Seek to balance the social and economic benefits of exploiting the sea fisheries resources of the district with the need to protect the marine environment from, or promote its recovery from, the effects of such exploitation.
153 (12):
Any reference in this Chapter to the 'exploitation' of sea fisheries resources is a reference to any activity relating to the exploitation of such resources whether carried out for commercial purposes or otherwise including:
a) Fishing for, taking, retaining on board, trans-shipping, landing, transporting or storing such resources
b) Selling, displaying, exposing or offering for sale or possessing such resources
c) Introducing such resources to the sea or cultivating such resources.

This would mean IFCA's can introduce byelaws and regulate fishing for seaweed.

Marine Licensing (Exempted Activities) Order 2011

Exemption 21 states that if you are removing seaweed from a beach and you are doing it on behalf of a local authority then you are exempt from requiring a marine licence.

However if you are not doing this and you are using a vehicle, vessel, marine structure or floating container for the removal of any substance or object from the sea bed then it may require a marine licence under the Marine and Coastal Access Act (2009).

http://www.legislation.gov.uk/uksi/2011/409/pdfs/uksi_20110409_en.pdf

The Conservation of Habitats and Species Regulations 2010 (as amended) and The Offshore Marine Conservation (Natural Habitats, & C.) Regulations 2007 (as amended)

If the species isn't listed under the Habitat Regulations schedules or on Annex IV of the EU Habitats Directive, then a licence isn't required to take and possess samples of the seaweed. However, if the seaweed collection is to take place within a Special Area of Conservation (SAC) or Special Protection Area (SPA), the competent authority would be required to undertake an assessment of Likely Significant Effect and subsequently an Appropriate Assessment if it cannot be ruled out that the activity may have an impact on the integrity of the site.

Some marine SACs have seaweed species listed as a 'feature' or 'sub-feature', with a conservation objective to either maintain the feature in favourable condition or recover the feature to favourable condition.

Natural Environment and Rural Communities (NERC) Act (2006)

All public authorities in England and Wales have a duty to have regard to the conservation of biodiversity in exercising their functions, and this would include ownership functions. The duty aims to raise the profile and visibility of biodiversity, to clarify existing commitments with regard to biodiversity, and to make it a natural and integral part of policy and decision making. The duty is set out in Section 40 and states that: *"Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity"*

If a license for seaweed harvesting is to be obtained from a competent or relevant authority, i.e. the Crown Estate or Local Authority, that

authority has a duty to have regard for the conservation of biodiversity when considering the application.

There are several species of algae listed as Species of Principal Importance for the conservation of biodiversity in England under Section 41 of the NERC Act 2006. These are listed in Table 1:

Table 1. Algal Species of Principal Importance (NERC 2006)

Species	Further information
Anotrichium barbatum	An extremely rare species in the UK, this red, filamentous seaweed grows to a height of 2-6cm. *http://www.marlin.ac.uk/speciesinformation.php?speciesID=2529*
Cruoria cruoriaeformis	A rare species of non-coralline crustose algae, usually found associated with maerl beds. http://www.marlin.ac.uk/speciesimportance.php?speciesID=3096
Dermocorynus montagnei* (*Grateloupia montagnei)	A non-coralline crustose alga, associated with small pebbles and occasionally on detached maerl fragments. http://www.marlin.ac.uk/speciesfullreview.php?speciesID=3141
***Lithothamnion corallioides* (maerl)**	One of the two species known as maerl. This coralline alga grows unattached to the substratum. http://www.marlin.ac.uk/speciesinformation.php?speciesID=3710
Padina pavonica	A brown seaweed, known as Peacock's Tail due to its distinctive morphology. http://www.marlin.ac.uk/speciesinformation.php?speciesID=4011
***Phymatolithon calcareum* (common maerl)**	The second and most common of the coralline algal species known as maerl. Together these two species form a unique habitat, listed on the UK's Biodiversity Action Plan. http://www.marlin.ac.uk/generalbiology.php?speciesID=4121

UK Biodiversity Action Plan (2007)

Following the 1992 Rio Convention on Biological Diversity, the UK became the first country to create a national biodiversity action plan (BAP). The Biodiversity Action Plan was last updated in 2007. There are a number of BAP habitats and species that could be impacted by seaweed collection, including:

- Estuarine rocky habitats
- Fragile sponge and anthozoan communities on subtidal rocky habitats
- Intertidal underboulder communities
- Maerl beds
- Sabellaria alveolata reefs
- Sabellaria spinulosa reefs
- Seagrass beds
- *Padina pavonica* (Peacock's tail)
- *Anotrichium barbatum* (Bearded red seaweed)
- *Haliclystus auricula* (Stalked jellyfish)
- *Lucernariopsis campanulata* (Stalked jellyfish)
- *Lucernariopsis cruxmelitensis* (Stalked jellyfish)

Stalked jellyfish are commonly associated with marine algae, such as Chondrus crispus (Fig. 1)

Fig. 1 Stalked jellyfish on *Chondrus crispus*

Harvesting seaweed sustainably

Natural England advises against the use of mechanical harvesting methods as these are likely to have a detrimental impact on the marine environment. Harvesting by hand, using scissors, will have a lesser impact.

Natural England recommends that for any commercial harvesting activity, data should be obtained on standing crop biomass of the species to be harvested, as well as percentage coverage, reproductive season and growth season information. The following factors should also be considered when evaluating potential impacts of any seaweed harvesting operation:

- Associated species and nursery function
- Loss of important habitat for associated species
- Specific vulnerabilities
- Collection methods and equipment
- Frequency of harvesting
- Effect of repeated harvesting on the species – loss of stocking algae
- Effect of harvesting on community composition
- Loss of seaweed functions (i.e. wave dissipation)
- Access issues (trampling and disturbance to wildlife)
- Following any quotas and recording biomass taken (species, date and location)

Fig. 2 Netted dog-whelk eggs on *Chondrus crispus*

Care should be taken to avoid ‘bycatch’, for example, brittlestars, stalked jellyfish, bryozoans, molluscs or their eggs (Fig 2).

Seaweed Harvesting Code of Conduct

Natural England has worked closely with the Crown Estate, Cornwall and Devon Inshore Fisheries and Conservation Authorities (IFCAs), National Trust and Cornwall Wildlife Trust to produce a code of conduct for seaweed harvesting. We advise that anyone harvesting seaweed in England should adhere to this code, whether harvesting is for commercial purposes or not. The code of conduct is available as a separate document.

1	Always consult Natural England and your local Inshore Fisheries and Conservation Authority (IFCA) before harvesting seaweed and obtain permission from the landowner.
2	Harvest seaweed only by hand – mechanical methods should not be used.
3	Do not use vehicles on the foreshore.
4	Avoid disturbing wildlife such as seabirds and seals by keeping an appropriate distance away.
5	Avoid or minimise trampling on non-target organisms and avoid taking ‘bycatch’ such as stalked jellyfish, brittlestars, bryozoans and blue-rayed limpets.
6	Collect less than one third of an individual plant to allow for regrowth.
7	Cut fronds (leaves) well above the point of growth (e.g. the meristem for kelps) and always leave the holdfast attached.
8	Harvest sparsely, taking only a small percentage of standing stock.*
9	Rotate harvesting areas to allow ample time for recovery. Harvested areas should be left for up to several years, depending on the species, before harvesting again.*
10	Harvest seaweeds during the active growth season to allow for quicker recovery.*
11	Harvest seaweeds after reproduction has occurred if possible and ensure a substantial proportion of mature plants remain.*
12	Take extra care when harvesting invasive non-native seaweeds to ensure that seaweeds or spores are not transferred to other areas. Follow ‘Check, Clean, Dry’ biosecurity principles, checking, cleaning and drying all equipment and clothing when moving between sites to ensure that invasive species, pests and diseases are not spread to new areas. ** (https://secure.fera.defra.gov.uk/nonnativespecies/checkcleandry/#)
13	Do not collect drift seaweed from the entire length of strandlines – harvest sparsely as this constitutes an important habitat.

14	Keep records of volumes of each species of seaweed harvested, along with date and location.
15	Limit harvesting in erosion prone coastal areas (i.e. dunes) where kelp forests dissipate wave energy.
16	Please be aware that foreshores can be hazardous. Do not put yourself at risk of injury by collecting seaweed in adverse conditions and be aware of tides.

**Consult Natural England for further information/ advice*

*** For information on how to identify non-native seaweeds, please see the GBNNSS website:* www.nonnativespecies.org.

Harvesting or clearance of drift seaweed

'Drift' or 'cast' seaweed provides an important habitat and food source for invertebrates and higher organisms and removal has been shown to reduce the species richness of this community[8,10]. Natural England therefore advises against complete clearance of drift seaweed from strandlines and would recommend leaving larger proportions in place during winter months, when overwintering birds may depend on it as a food source.

Non-native seaweed species

Non-native species are those that have established themselves outside their natural range either past or present, with the assistance of man, either intentionally or unintentionally. The arrival of non-native seaweeds is often associated with aquaculture and shipping. Non-natives can sometimes have a negative effect on native marine life and commercial activities. Further information on non-native species can be found on the Natural England website: http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/threats/nonnativespecies.aspx).

There are several species of non-native seaweeds that are now commonly found on our shores. Some examples are given in Table 2. Natural England does not necessarily recommend the harvesting or clearance of non-native species as this can sometimes exacerbate the problem, for example if spores break off or are transported to other areas allowing the species to spread.

If non-native species are to be harvested, 'Check, Clean, Dry' biosecurity principles should be used when moving between sites to ensure that invasive species, pests and diseases are not spread to new areas. Any equipment and clothing should be thoroughly checked for spores etc, cleaned and dried after use. More information is available on the GBNNSS website.

Table 2. Established non-native seaweed species in the UK (*Information from the* GB Non-Native Species Secretariat)

Species	Native range	Route of entry to the UK	Negative Impacts
Sargassum muticum **(Wire weed)**	China, Japan, Korea, Russia	Aquaculture	Outcompetition of native seaweed species. Fouling of fishing gear and man-made structures. Blooms in shallow water and can inhibit recreational activities.
Undaria pinnatifida **(Japanese kelp or wakame)**	China, Japan, Korea	Aquaculture	Competition with native seaweed species. Ability to form dense rafts of algae, posing an entanglement risk. Fouling of man-made structures.
Asparagopsis armata **(Harpoon weed)**	New Zealand and Australia	Aquaculture	Ability to dominate seaweed communities. Can form harmful algal blooms, which pose a threat to native marine life.

Species specific considerations for seaweed harvesting

Some general advice on the sustainable harvesting of a number of species of edible seaweeds is given below (Tables 3, 4 and 5). This advice is not exhaustive and is based on the best evidence currently available.

Brown seaweeds

Studies suggest that a number of cold water brown seaweeds are already showing vulnerability to climate change and rising ocean temperatures. Contractions in species range, reduced reproduction and reduced genetic diversity in marginal populations have been observed[19,24,29,35]. Other studies however suggest that as of yet no clear patterns can be discerned[17].

Table 3. Considerations for harvesting brown seaweed species

Seaweed Species	Common name	Species ecology	Sustainable harvesting advice
Himanthalia elongata	Thongweed/ sea spaghetti	Usually annual Unusual morphology, reproductive fronds make up 93% of the seaweed's biomass[3] Reproductive fronds grow throughout the winter and spring, before summer reproduction. Fronds then disintegrate[22]	Harvest in summer after the reproductive season if possible. Reproductive structures are visible as dark circles on fronds. If harvesting occurs during the reproductive season then harvest only one of the two main fronds.
Laminaria digitata	Kelp/ oarweed	Perennial Growth is from the meristem at the base of the fronds, rather than the tips. Growth is fastest throughout spring and summer[36] Two reproductive peaks; in early summer and late summer/autumn[36] Alternation of generations with two morphologically distinct phases. Familiar form of *L.digitata* is the large sporophyte[7]	Cut by hand, avoiding the meristem at the base of the fronds. Collect only the upper parts of the frond and harvest areas sparsely, as kelp forests have a function in wave dissipation, shoreline protection and habitat provision. Harvest during early spring, before the

			summer reproductive peak.
Laminaria hyperborea	Kelp/ oarweed	Perennial Growth is from the meristem at the base of the fronds, rather than the tips. Growth is again fastest in spring and summer, but completely ceases at the end of summer until the next year[36] Alternation of generations with two morphologically distinct phases. Familiar form of *L.hyperborea* is the large sporophyte[7] Habitat for at least 238 species of macrofauna[5]. This is in addition to the large mobile mammals, such as grey and common seals.	Cut by hand, avoiding the meristem at the base of the fronds. Collect only the upper parts of the fronds and harvest areas sparsely. Harvest during the first half of the year when growth is most rapid[31] Avoid harvesting during and after the spring/summer reproductive period.
Saccharina Lattisima	Sugar kelp	Perennial Growth is from the meristem at the base of the fronds, rather than the tips. Growth is fastest throughout spring and summer[36] Reproduction starts during autumn and continues until early spring[1] Alternation of generations with two morphologically distinct phases. Familiar form of *S.lattisima* is the large sporophyte[7]	Cut by hand, avoiding the meristem at the base of the fronds. Harvest during spring and summer, avoiding the autumn/winter reproductive season.
Alaria esculenta	Dabberlocks	Perennial Growth is from the meristem at the base of the fronds, rather than the tips. Reproduction occurs during the autumn and winter. Reproductive sporophylls are located in clusters at the top of the stipe, just below the fronds[7] Alternation of generations with two morphologically distinct phases. Familiar form of *A.esculenta* is the large sporophyte[7]	Cut by hand, avoiding the meristem and sporophylls at the base of the fronds. Avoid harvesting during autumn and winter, when the seaweed is reproductively active.

Fucus vesiculosis	Bladder wrack	Short-lived perennial species Appearance varies markedly in different environments. Most common form has a large number of distinct air vesicles in the frond[7] Reproduction peaks in the spring and summer[15] Life cycle is direct, with sporophytes producing gametes[7]	Cut fronds at 30cm or more from the base[15]. Avoid harvesting during the spring/summer reproductive period. Number of reproductive receptacles on the seaweed increases greatly as it ages and regrowth potential decreases. Solely harvesting large mature individuals is not advised[15]
Fucus serratus	Serrated wrack	Short lived perennial species, with one distinct form[7] Reproduction peaks in the autumn/winter, although can vary greatly with locality[15] Life cycle is direct, with sporophytes producing gametes[7]	Cut fronds at 30cm or more from the base[15]. Avoid harvesting during the autumn/winter reproductive season. Number of reproductive receptacles on the seaweed increases greatly as it ages. Solely harvesting large mature individuals is not advised[15]
Ascophyllum nodosum	Knotted wrack	Long lived perennial species Reproduction peaks during spring[13] Life cycle is direct, with sporophytes producing gametes[7] This seaweed supports a very diverse species group, particularly when older individuals link up to form a complex habitat[33]	Collect only the upper parts of the seaweed, preserving some of the older more complex habitat. Avoid harvesting during the spring reproductive peak. Harvest only from small areas, with areas of un-harvested *Ascophyllum* breaking them up. This may help avoid the negative effects of harvesting on associated fauna[2]. Leave two years between harvesting an area, preferably recovery time should be longer[9]

Green seaweeds

Ulva species are the most commonly harvested green seaweeds. However, distinguishing between them is very difficult. There are at least 5 blade forming seaweeds, such as *Ulva lactuca* (sea lettuce) and 8 branching tubular seaweeds found in Britain and Ireland [4]. The advice given here is primarily for the blade forming *Ulva* species.

Table 4. Considerations for harvesting green seaweed species

Seaweed Species	Common name	Species ecology	Sustainable harvesting advice
Ulva spp.	Sea lettuce	Pseudo perennial, with the base, but not the fronds, surviving from year to year[7] Rapid growth in spring and summer, when reproduction also peaks[25] Reproduction can be both sexual and asexual. Sporophyte and gametophyte form are morphologically very similar[7] *Ulva* species can rapidly form algal blooms in favourable conditions, sometimes known as 'green tides'. These can be damaging to both other marine organisms and the wider ecosystem[37]	Harvest during the rapid growth phase in spring and summer, leaving the holdfast and some of the fronds intact.

Red seaweeds

Table 5. Considerations for harvesting red seaweed species

Seaweed Species	Common name	Species ecology	Sustainable harvesting advice
Palmaria palmata	Dulse	Perennial Alternation of generations. Familiar form of dulse is the large sporophyte or the male gametophyte. Female gametophytes are very small and once fertilized are taken over by the sporophyte [4]	Ensure the holdfast and some of the blade is left intact for re-growth.

Chondrus crispus	Carrageen/ Irish moss	Normally perennial Rapid growth during spring and summer[20] Reproduction occurs during the autumn and winter[20] Alternation of generations, with a diploid sporophyte and separate gametophytes for each sex[7]	Harvest only a small proportion of the largest blades[20]. Harvest during the spring/summer rapid growth period. Avoid harvesting during the autumn and winter when reproduction is ongoing and recovery is much slower[20]
Mastocarpus stellatus	False Irish moss	Perennial Alternation of generations with morphologically very distinct phases. Familiar forms are the gametophytes, with the sporophyte originally thought to be a different species[4]	Ensure the holdfast and some of the blade is left intact for re-growth.
Porphyra species	Laver	Perennial Five common species around the UK, but more are still being discovered[4] Alternation of generations. Familiar form is the large gametophyte, whilst the sporophyte is microscopic and was previously thought to be a separate species[4]	Ensure basal portion remains intact for re-growth. Cut well above the base. Do not strip entire plant from rocks[23]
Corallina officinalis		Calcareous seaweed which grows to only 12cm Unusual appearance, more like that of coral. Distinctive pink colour, due to the white lime in the base and the seaweed's reddish pigment[7] Perennial base, with new fronds growing each year. Fronds can regrow from the base[18] Alternation of generations with morphologically very similar gametophytes and sporophytes[4]	Ensure the crustose base is left intact for re-growth.
Asparagopsis armata	Harpoon weed (Introduced species)	Introduced species, which is now well distributed in south west England. This species is also found on the west coast of Ireland and in Shetland[4] Alternation of generations, with	Follow the 'Check, Clean, Dry' biosecurity principles when moving between sites to ensure that invasive species, pests and diseases are not spread to new

	two morphologically distinct phases. The gametophyte has many feathery fronds and is up to 30 cm long, with large barbed growths of 1cm length. The sporophyte phase consists of tiny filamentous balls ('Falkenbergia'), up to 20mm in diameter[4] Sexual and asexual reproduction occurs.	areas. Any equipment and clothing should be thoroughly checked for spores etc, cleaned and dried after use.

Brown, green and red seaweeds on a sheltered rocky shore

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