MarLIN
Marine Information Network
Information on the species and habitats around the coasts and sea of the British Isles

Toothed wrack (*Fucus serratus*)

MarLIN – Marine Life Information Network
Biology and Sensitivity Key Information Review

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A report from:
The Marine Life Information Network, Marine Biological Association of the United Kingdom.

Please note. This MarESA report is a dated version of the online review. Please refer to the website for the most up-to-date version [https://www.marlin.ac.uk/species/detail/1326]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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***Fucus serratus* patch on a rocky shore.**
Photographer: Judith Oakley
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See online review for distribution map

Distribution data supplied by the Ocean Biogeographic Information System (OBIS). To interrogate UK data visit the NBN Atlas.

Researched by	Angus Jackson	**Refereed by**	Dr Graham Scott
Authority	Linnaeus, 1753		
Other common names	-	**Synonyms**	-

Summary

Description

Fucus serratus, the toothed wrack, is a robust, olive-brown shrubby seaweed that grows in high densities low on the seashore. The fronds are about 2 cm wide, splitting in two repeatedly. The fronds bear no air bladders. The whole plant typically grows to about 60 cm long. The fronds have a serrated edge and grow from a short stalk.

Recorded distribution in Britain and Ireland

All British and Irish coasts.

Global distribution

Northern Portugal and the Atlantic coast of France; British Isles, North Sea coasts and into the western Baltic; Scandinavia up to Novaya Zemlya; Iceland and the Gulf of St. Lawrence in the western north Atlantic.

Habitat

Fucus serratus is found on hard substrata on the lower shore in more sheltered areas of coastline.

Depth range

Not relevant

Identifying features

- Fronds are flat and straplike with a well developed mid-rib.
- Fronds edged with sharp, forward-pointing serrations.
- The frond bears no air bladders.
- The frond surface has numerous pin-pricks with clusters of tiny white hairs.
- Receptacles form slightly thickened patches about 4 cm long surrounded by a sterile border at the terminal end of the frond.

Additional information

Also known as serrated or saw wrack. Ripe male plants can be distinguished by their orange colour.

Listed by

Further information sources

Search on:

G G NBN WoRMS

Biology review

Taxonomy

Phylum	Ochrophyta	Brown and yellow-green seaweeds
Class	Phaeophyceae	
Order	Fucales	
Family	Fucaceae	
Genus	Fucus	
Authority	Linnaeus, 1753	
Recent Synonyms	-	

Biology

Typical abundance	High density
Male size range	50-70cm
Male size at maturity	
Female size range	Large(>50cm)
Female size at maturity	
Growth form	Shrub
Growth rate	0.2-0.1cm/day
Body flexibility	
Mobility	Not relevant
Characteristic feeding method	Autotroph
Diet/food source	
Typically feeds on	Not relevant
Sociability	No information
Environmental position	Epifloral
Dependency	Independent.
Supports	Substratum the hydroid, *Dynamena pumila*, the bryozoans *Flustrellidra hispida*, *Alcyonidium hirsutum*, *Alcyonidium polyoum*, *Electra pilosa*, and the polychaete *Spirorbis spirorbis*.
Is the species harmful?	No

Biology information

During most of the year plant densities range between 10-14/0.25 square metres. When recruitment is occurring then densities may rise to 18-22/0.25 square metres. Surface cover by this species may reach over 95 percent during the summer. This decreases and becomes more patchy during winter and autumn. *Fucus serratus* typically grows up to 70 cm but has been recorded at over 2 m in length in very sheltered environments. Growth rate refers to maximal growth rate under optimal conditions. Growth rate varies considerably depending on environmental conditions. Growth rate ranges from 4-12 cm per annum. There are two size classes: germlings less than 10 cm (30-40 percent of the population); and adult plants greater than 40 cm. The germlings developing from eggs are initially microscopic and become visible to the naked eye after about two

weeks. There is no clear mode in between but individuals of intermediate size are always present. *Fucus serratus* supports a wide variety of epiphytes with over 90 species having been recorded. Growth of microalgae on the frond surface can cause shading and reduced photosynthesis, anoxia at the frond surface and may interfere with reproduction. Mobile herbivores may benefit *Fucus serratus* through removal of this algal film. Other dominant macrofaunal species found on *Fucus serratus* include *Lacuna pallidula*, *Littorina mariae*, *Amphithoe rubricata*, *Idotea granulosa* and epiflora include *Rhydomenia palmata* and *Elachista fucicola*.

Habitat preferences

Physiographic preferences	Open coast, Sea loch / Sea lough, Ria / Voe, Estuary
Biological zone preferences	
Substratum / habitat preferences	Bedrock, Cobbles, Large to very large boulders, Small boulders
Tidal strength preferences	Moderately Strong 1 to 3 knots (0.5-1.5 m/sec.), Strong 3 to 6 knots (1.5-3 m/sec.), Very Weak (negligible), Weak < 1 knot (<0.5 m/sec.)
Wave exposure preferences	Extremely sheltered, Moderately exposed, Sheltered, Very sheltered
Salinity preferences	Full (30-40 psu), Reduced (18-30 psu), Variable (18-40 psu)
Depth range	Not relevant
Other preferences	No text entered
Migration Pattern	Non-migratory / resident

Habitat Information

Depth in metres is considered not relevant because the species is intertidal. More exposed coasts have a lower proportion of adult individuals in the population. In more sheltered areas *Fucus serratus* may grow on substrata such as cobbles.

Life history

Adult characteristics

Reproductive type	Gonochoristic (dioecious)
Reproductive frequency	Annual protracted
Fecundity (number of eggs)	>1,000,000
Generation time	Insufficient information
Age at maturity	Insufficient information
Season	May - November
Life span	2-5 years

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Not relevant
Duration of larval stage	No information

Larval dispersal potential	Greater than 10 km
Larval settlement period	

Life history information

Dickinson, (1963) notes that fruiting fronds can be found almost throughout the year with fertile plants most in evidence during the winter months. However, most other work suggests that reproduction commences in late spring/early summer and continues through summer and autumn, peaking in August - October. Eggs and sperm are released into the water and fertilisation occurs in the water column. The eggs produce a sperm attractant called fucoserratin that is active within 0.5mm. The zygote then develops into a minute plant that can then settle onto the substratum. Post reproductive fronds are shed contributing to loss of surface cover. Many plants may be lost during winter due to storms and heavy wave action. Germlings have a high mortality, up to 83 % being recorded lost in 77 days on the Isle of Man. Reproduction occurs earlier and growth is faster on sheltered shores. Egg release is protracted. The largest number of receptacles recorded from a single plant is over 4,600. Eggs are broadcast into the water column to be carried by the current to settle and develop wherever they fall. Eggs attach firmly to the substratum within a few hours. Many eggs are eaten by browsing molluscs.

Sensitivity review

This MarLIN sensitivity assessment has been superseded by the MarESA approach to sensitivity assessment. MarLIN assessments used an approach that has now been modified to reflect the most recent conservation imperatives and terminology and are due to be updated by 2016/17.

Physical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Substratum Loss	High	High	Moderate	High

Fucus serratus is permanently attached to the substratum. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. If the entire population of *Fucus serratus* is removed, other species may come to dominate. Re-establishment of the seaweed may depend on the ability to out-compete other species and this may be dependent on suitable environmental conditions.

Smothering	High	High	Moderate	Low

Intolerance to smothering will depend on the state of the tide. If the factor occurs when the tide is out and the alga is lying flat on the substratum then all the frond will be covered and photosynthesis prevented. If smothering occurs whilst the alga is underwater and upright then not all the photosynthetic surfaces of adult plants will be covered. Germlings are likely to be smothered and killed and will be the most intolerant stage of *Fucus serratus* life history. A further form of smothering can occur through heavy growth of epibionts such as *Flustrellidra hispida* on the frond surfaces. This growth may reduce photosynthesis and increase anoxia at the frond surface. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. If the entire population of *Fucus serratus* is removed, other species may come to dominate. Re-establishment of the seaweed may depend on the ability to outcompete other species and this may be dependent on suitable environmental conditions.

Increase in suspended sediment	Low	Very high	Very Low	Low

Siltation will only have an effect during the time that the seaweed is covered with water. Increased siltation may cover the frond surface with a layer of sediment reducing photosynthesis and growth rate. Once conditions return to 'normal' then it probably won't take long for the population to resume a normal size and growth rate.

Decrease in suspended sediment

Dessication	Intermediate	High	Low	High

Seaweeds cannot prevent desiccation, they can only tolerate it. Seaweeds have a critical water content. Desiccation past this point causes irreversible damage. The critical point for *Fucus serratus* is 40 percent water content. A reduction in water content to 40 percent can occur after 2 hours exposure to sunshine. *Fucus spiralis*, a similar species to *Fucus serratus*, transplanted further up the shore to the *Pelvetia canaliculata* zone (greater desiccation) die within 4-8 weeks (Schonbeck & Norton, 1978). Other species better able to tolerate

desiccation will competitively displace *Fucus serratus* following increases in desiccation. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. If the entire population of *Fucus serratus* is removed, other species may come to dominate. Re-establishment of the seaweed may depend on the ability to outcompete other species and this may be dependent on suitable environmental conditions.

Increase in emergence regime Intermediate High Low Moderate

Fucus spiralis, a similar species to *Fucus serratus*, transplanted further up the shore to the *Pelvetia canaliculata* zone (longer emergence) die within 4-8 weeks. Other species better able to tolerate desiccation will competitively displace *Fucus serratus* following increases in emergence. Decreases in emergence will put the species in competition with species that typically remain submerged (e.g. laminarians) although in some locations of reduced salinity (the Belt Sea) the *Fucus serratus* population remains continually submerged. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. If the entire population of *Fucus serratus* is removed, other species may come to dominate. Re-establishment of the seaweed may depend on the ability to outcompete other species and this may be dependent on suitable environmental conditions.

Decrease in emergence regime

Increase in water flow rate Intermediate High Low Moderate

Increases in water flow rate may cause some of the population to be torn off the substratum. Decreases in water flow rate are unlikely to have any effect. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. Recruitment may occur through reproduction of the remaining population or from other populations. As some of the population remains it is unlikely that other species will come to dominate. Removal of some of the adult canopy will allow the understorey germling back to grow faster. Recovery will probably have occurred after a year.

Decrease in water flow rate

Increase in temperature Tolerant Not relevant Not sensitive High

Decreases in temperature are unlikely to have any effect. The species distribution extends north to Novaya Zemlya where water temperatures are much colder. *Fucus distichus*, a similar species can survive for several months at -40 °C. The species distribution also extends further south than the British Isles into warmer waters. Increases of up to 5°C above British and Irish temperatures is not likely to have a detrimental effect. Growth of *Fucus serratus* is optimal at 20 °C so British and Irish populations are more likely to benefit from increases in temperature. *Fucus serratus* cannot survive continual exposure to temperatures above 28°C for a week.

Decrease in temperature

Increase in turbidity Low Very high Very Low Moderate

Turbidity is only relevant when *Fucus serratus* is covered with water. Seaweed photosynthesis declines on emersion and recommences when recovered with water. Once conditions return

to 'normal' then it will probably not take long for the population to resume a normal size and growth rate.

Decrease in turbidity

Increase in wave exposure	High	High	Moderate	Moderate

Fucus serratus only occurs on coasts with moderate exposure or less. Increases above this level of wave action will cause damage to individual plants, breaking fronds and removing entire plants from the substratum. *Fucus serratus* is more intolerant of wave exposure than *Fucus vesiculosus*. On more exposed coasts there are fewer adult individuals in the population. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. If the entire population of *Fucus serratus* is removed, other species may come to dominate. Re-establishment of the seaweed may depend on the ability to outcompete other species and this may be dependent on suitable environmental conditions.

Decrease in wave exposure

Noise	Tolerant	Not relevant	Not sensitive	High

Seaweeds have no known mechanism for detection of noise vibrations.

Visual Presence	Tolerant	Not relevant	Not sensitive	High

Seaweeds have no known mechanism for visual perception.

Abrasion & physical disturbance	Intermediate	High	Low	High

Although the species is highly flexible, abrasion is likely to cause damage to and removal of fronds and even removal of entire plants from the substratum. Human trampling has been shown to significantly reduce the cover of fucoids on a shore (Holt *et al*., 1997) Cracks and crevices are ideal places for germlings to develop and these sites may be protected from abrasion. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. Recruitment may occur through reproduction of the remaining population of from other populations. As some of the population remains it is unlikely that other species will come to dominate. Removal of some of the adult canopy will allow the understorey germling back to grow faster. Recovery will probably have occurred after a year.

Displacement	High	High	Moderate	High

Fucus serratus is permanently attached to the substratum. If removed, the attachment cannot be reformed. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. If the entire population of *Fucus serratus* is removed, other species may come to dominate. Re-establishment of the seaweed may depend on the ability to out-compete other species and this may be dependent on suitable environmental conditions.

Chemical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence

Synthetic compound contamination High High Moderate Not relevant

Different life stages of *Fucus serratus* differ in their intolerance to synthetic chemicals. Scalan & Wilkinson (1987) found that spematozoa and newly fertilized eggs of *Fucus serratus* were the most intolerant of biocides, while adult plants were only just significantly affected at 5 ml/l of the biocides Dodigen v181-1, Dodigen v 2861-1 and ML-910. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. If the entire population of *Fucus serratus* is removed, other species may come to dominate. Re-establishment of the seaweed may depend on the ability to outcompete other species and this may be dependent on suitable environmental conditions.

Heavy metal contamination Low High Low Not relevant

Fucoid algae readily accumulate heavy metals within their tissues. The effect of heavy metals on the growth rate of adult *Fucus serratus* plants has been studied by Stromgren (1979b;1980a & b). Copper significantly reduces the growth rate of vegetative apices at 25 µg/l over 10 days (Stromgren, 1979b). Zinc, lead, cadmium & mercury significantly reduce growth rate at 1400 µg/l , 810ug/l, 450ug/l and 5ug/l respectively (Stromgren, 1980a & b). The benchmark concentrations of heavy metals may therefore reduce growth rate, so intolerance is reported as low, although early life stages of the species may be more intolerant.

Hydrocarbon contamination Intermediate High Low High

Adult plants are tolerant of exposure to spills of crude oil although very young germlings are intolerant of relatively low concentrations of 'water soluble' extractions of crude oils. Exposure of eggs to these extractions (at 1.5 micrograms/ml for 96 hours) interferes with adhesion during settling) and (at 0.1micrograms/ml) prevents further development (Johnston, 1977). *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. Recruitment may occur through reproduction of the remaining population or from other populations. As some of the population remains it is unlikely that other species will come to dominate. Removal of some of the adult canopy will allow the understorey germling back to grow faster. Recovery will probably have occurred after a year.

Radionuclide contamination Not relevant

Insufficient information

Changes in nutrient levels Intermediate High Low Moderate

When in high densities, the seaweed competes for space light and nutrients. Nutrient availability is the most important factor controlling germling growth. Plants under low nutrient regimes achieve smaller sizes and may be out competed. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. Recruitment may occur through reproduction of the remaining population of from other populations. As some of the population remains it is unlikely that other species will come to dominate. Removal of some of the adult canopy will allow the understorey germling back to grow faster. Recovery will probably have occurred after a year.

Increase in salinity Low Very high Very Low High

Being intertidal and subject to precipitation, *Fucus serratus* is exposed to a range of salinities. The species is able to compensate for these changes in salinity by adjusting internal ion concentrations. Salinity affects the photosynthetic rate and hence growth rate of seaweed. For *Fucus serratus*, growth rate is maximal at a salinity of 20 psu. Above and below this growth rate declines. If salinity is suddenly increased for brief periods then the rate of net photosynthesis increases before decreasing. Salinity can also affect respiration rates. Once conditions return to 'normal' then it probably won't take long for the population to resume a normal size and growth rate.

Decrease in salinity

Changes in oxygenation	Low	Very high	Very Low	Low

Cole *et al.* (1999) suggest possible adverse effects on marine species below 4 mg/l and probable adverse effects below 2mg/l. There is no information about *Fucus serratus* tolerance to changes in oxygenation. Once conditions return to 'normal' then it probably won't take long for the population to resume a normal size and growth rate.

Biological Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Introduction of microbial pathogens/parasites				Not relevant

Insufficient information

Introduction of non-native species				Not relevant

Insufficient information

Extraction of this species	Intermediate	High	Low	High

Fucus serratus is one of several harvested and exploited algal species. *Fucus serratus* is highly fecund, is iteroparous, surviving and breeding for protracted periods over 3-4 years. The eggs are broadcast into the water column allowing a potentially large dispersal distance. The species is found on all British and Irish coasts so there are few mechanisms isolating populations. Recruitment may occur through reproduction of the remaining population of from other populations. As some of the population remains it is unlikely that other species will come to dominate. Removal of some of the adult canopy will allow the understorey germling back to grow faster. Recovery will probably have occurred after a year.

Extraction of other species	Tolerant	Not relevant	Not sensitive	Low

Fucus serratus has no known obligate relationships.

Additional information

Importance review

Policy/legislation

- no data -

Status

National (GB) importance	-	**Global red list (IUCN) category**	-

Non-native

Native	-		
Origin	-	**Date Arrived**	-

Importance information

The seaweed is collected, dried and used as a soil additive. Various fucalean algae are used in the production of alginates. These are used widely in the pharmaceutical and cosmetics industries. The dense beds of *Fucus serratus* provide shelter for a very wide variety of species and also provide considerable substratum for epiphytic species. National status for *Fucus serratus* is not available but is almost certainly widespread.

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