Undaria pinnatifida

Taxon	Family /Order/ Class/ Phylum
Undaria pinnatifida (Harvey) Suringar 1873	Alariaceae / Laminariales / Phaeophyceae / Ochrophyta

COMMON NAMES (English only)
Wakame
Japanese kelp

SYNONYMS
Alaria pinnatifida Harvey 1860
Alaria amplexicaulis Martens 1866
Ulopteryx pinnatifida (Harvey) Kjellman 1885

SHORT DESCRIPTION
This marine brown alga grows on hard substrates and reaches up to 3 m in length (sporophyte stage).

Close up of *Undaria pinnatifida*

Photo: Sandrine Ruitton, France

BIOLOGY/ECOLOGY

Dispersal mechanisms
Ametophytes with water currents.

Reproduction
The species has a heteromorphic, diplohaplontic annual life cycle with a large sporophyte and microscopic female and male gametophytes. In Europe the sporophyte is usually less than 1 m in the Mediterranean Sea. Some introduced populations show more than one generation during a year. Vegetative reproduction by fragmentation is unknown.

Known predators/herbivores
A high number of species prey upon the algae, e.g. harpacticoid copepods, amphipods, sea urchins and fish. Further, bacteria and phycomycetes attack the plant.

Resistant stages (seeds, spores etc.)
The gametophytes may undergo a dormancy period. Especially at low light, they are capable of surviving adverse conditions as thick-walled resting stages.

HABITAT

Native (EUNIS code)
A3: Sublittoral rock and other hard substrata. It grows at hard bottom habitats from approx. 1-15 m depth.

Habitat occupied in invaded range (EUNIS code)
A3: Sublittoral rock and other hard substrata. Hard bottom habitats from ca. 1-18 m depth. Seems to prefer artificial substrates.

Habitat requirements
Growth of sporophytes was documented in NE Japan from 4-25 °C where plants appear in winter and disappear in summer. Optimum growth for young sporophytes is 20°C. Microscopic gametophytes may survive -1 to 30°C. Light requirements for sporophyte photosynthesis vary seasonally (120-500 µE m^{-2} s^{-1} or less). Gametophytes are able to survive in darkness > 6 months. Salinities above 27 PSU are necessary for growth of sporophytes and gametophyte development. Zoospores attach above 19 PSU.

DISTRIBUTION

Native Range

Northwestern Pacific shores, i.e. coasts of Japan, (excluding northern and eastern Hokkaido), Korea, northeastern China, southeast Russia.

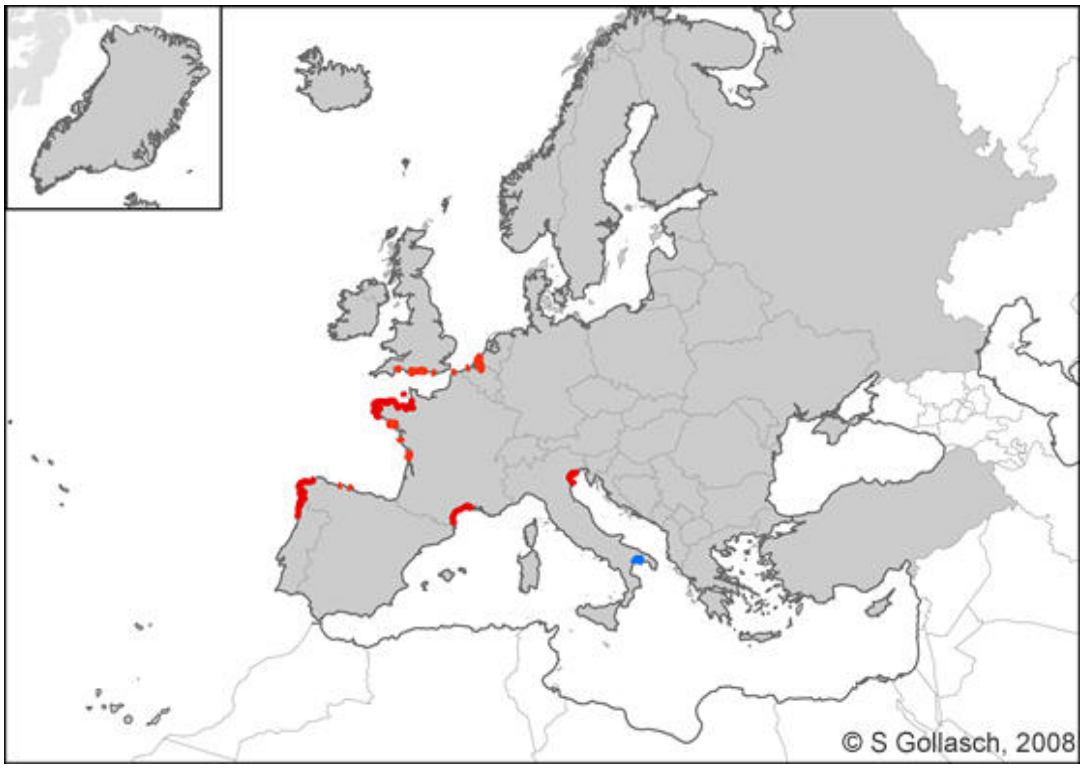
Known Introduced Range

Its first record outside the native range was in the French Mediterranean coast. From here it was intentionally transferred to three sites in Brittany in 1983 for farming, and more sites were tested thereafter. In 1987 reproducing individuals were found on mussel lines near the Ouessant seaweed farm. Natural recruitment was observed in St. Malo and in the Rance estuary. In northern Spain it was reported from Ria Ariosa in 1990, later it was found along the N Spanish Atlantic coast down to the Portuguese border. Some records are known from Portuguese estuaries. First finding in southern United Kingdom was in 1994, thereafter on the Channel Islands. In 1999 the species was reported from Zeebrugge, Belgium and in the Netherlands (near Yerseke and near Strijenham). These findings are the northernmost in Europe. Records from the Mediterranean Sea are sporadic (e.g. in the Venice lagoon).

Trend

Spreading.

MAP (European distribution)



Legend

	Known in country		Known in CGRS square		Known in sea
	Key distribution area		Infrequent		Unestablished
	Uncertain establishment				

INTRODUCTION PATHWAY

Unintentional introduction with oyster imports from Japan to the French Mediterranean coast. From here it was intentionally transferred to Brittany. Records in or near ports indicate that secondary dispersal may have been caused by vessels.

IMPACT

Ecosystem Impact

In some regions it is the dominant seaweed and several co-occurring species decrease when it becomes abundant.

Health and Social Impact

Unknown.

Economic Impact

It prefers artificial substrates and due to its fouling behaviour, frequent cleaning of aquaculture equipment and boats is required. In the Netherlands it grows mainly on *Crassostrea gigas*, but also on mussels. Being slippery, it causes problems for fishermen harvesting oysters. During mass developments further detrimental impacts may occur, which may impair aquaculture harvests.

MANAGEMENT

Prevention

Hulls of ships should only be cleaned out of the water and detached organisms should be disposed out of the reach of the sea. *U. pinnatifida* should not be used as a display organism in public aquaria. Even if the water is treated, a risk remains that fertile parts may reach the sea. Scientific experiments within field conditions should not be undertaken where the alga has not yet been found.

Mechanical

One problem with eradication efforts is that the microscopic gametophytes are very tolerant and not visible to the naked eye. In several cases attempts at manual eradications were unsuccessful or showed a limited efficacy.

Chemical

Trials with herbicides and antifouling paints showed that some toxins are efficient at preventing zoospore germination or at causing gametophyte mortality.

Biological

Unknown.

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