

# Non-Indigenous Species Quick Reference Survey Guide



Centre for Environment  
Fisheries & Aquaculture  
Science



**Cefas**

**This non-indigenous species (NIS) quick reference guide is intended for use on existing statutory monitoring surveys to aid in the rapid identification and reporting of NIS observed during these surveys.**

**Further information on the NIS included in this guide can be found on the Non-native Species Secretariat (NNS) website <http://www.nonnativespecies.org>. Any positive NIS identification should be reported and, where possible, it is advised that scientists collect a representative sample for identification confirmation, as well as a photograph which can be contributed to the NNS website gallery. Horizon species, defined as those which are not thought to be present in the UK, are highlighted with **(H)** within the guide and should be reported immediately to Cefas and the NNS website if encountered in UK waters.**



Centre for Environment  
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Science



**Cefas**

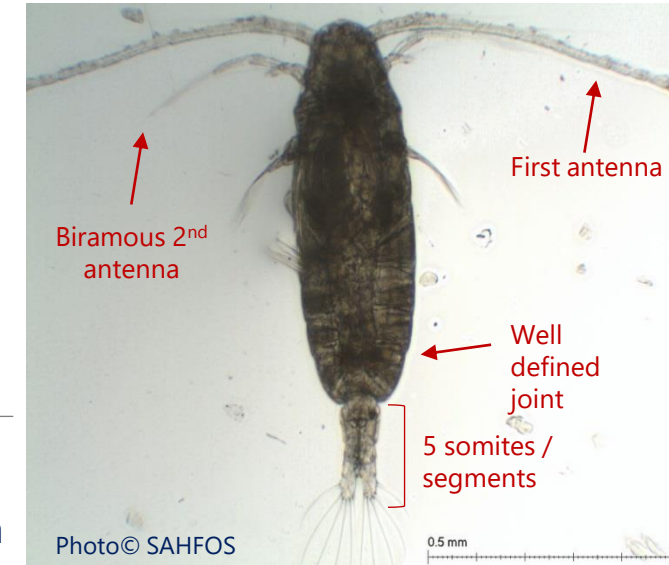
# *Acartia (Acanthacartia) tonsa* (Copepod)

# Crustacea

## Description

Between 0.5-1.5 mm in length (female 1.3-1.5 mm; male 1.0-1.1 mm) they have translucent, bilaterally symmetrical bodies, and can be differentiated from closely-related species by their long first antennae (at least half the length of their bodies) and biramous (branched) second antennae, as well as the presence of a well-defined joint between their 5<sup>th</sup> and 6<sup>th</sup> body segments. Male urosomes have 5 somites / segments (4 in females), and female swimmerets (pleopods) modified for egg brooding tend to be thicker and more filamentous.

**Synonyms** - *Acartia (Acanthacartia) giesbrechti*, *Acartia giesbrechti*, *A. gracilis*.



Photo© SAHFOS

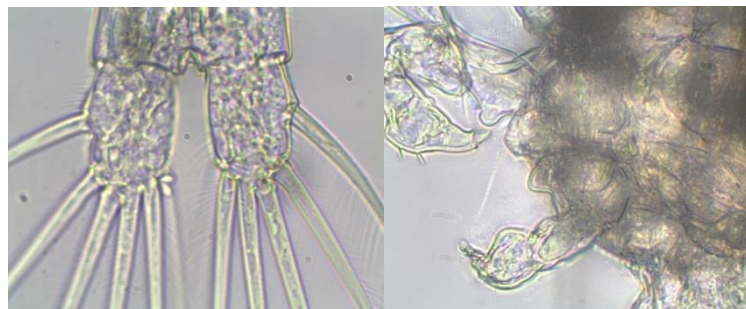
0.5 mm



Photo© A. Cooper zpkonline.com

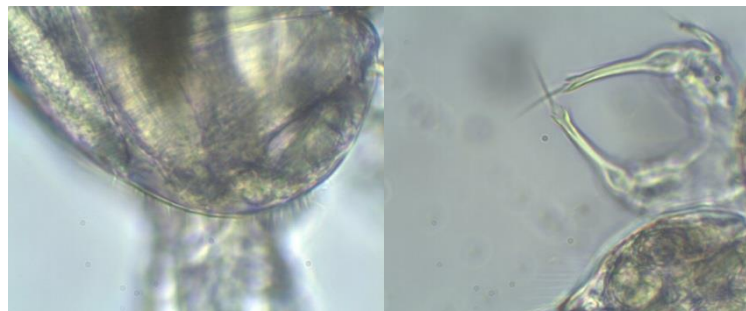
Male somites

## Key features (photos © SAHFOS)



Caudal furca

Male swimmeret



Metasome spines

Female swimmeret

## Habitat and distribution

Free-swimming planktonic copepods which can tolerate a wide range of temperatures (17-25°C) and salinities (1 ppt to 38 ppt). They are commonly found in coastal waters and brackish estuaries in depths of between 0 – 50 m, though they have been found as deep as 600 m. Prior to its introduction in Europe, *A. tonsa* only occurred in the Indo-Pacific region and it is thought that it came to Europe in ballast water in 1916 when the first European observation was reported.

## Quick Facts

**Native range:** Southwestern Pacific.

**First discovered in:** Southampton Water (1956).

**Pathway:** Ships ballast water, deliberate translocations of fish and shell fish for fisheries.

**Observed in:** Water and plankton samples.

# Agarophyton vermiculophyllum

## Red algae

### Description

A red macroalga that is cartilaginous, cylindrical, with branches 2-5 mm in diameter and up to 1 metre long. Coarsely branched, often profusely so, with lateral branches at irregular intervals. Fresh material is fleshy and robust, and dark brown in colour. Commonly found as loose-lying thalli or attached to small stones or shells. Red algae are often found in the vegetative state, and characterisation of reproductive structures may be necessary for the correct identification of *Agarophyton* species.

**Synonyms** - *Gracilaria asiatica*, *G. vermiculophylla*, *Gracilariopsis vermiculophylla*.

### Key features



### Habitat and distribution

May be found on a variety of substrata (sand, mud, rocks, man-made structures) in intertidal and shallow subtidal areas, and brackish coastal lagoons, especially those which are sheltered from strong wave action. *A. vermiculophyllum* can tolerate a wide range of salinities and temperatures. It has established on both coasts of North America and in Europe from Morocco to Sweden.

### Quick Facts

**Native range:** North west Pacific (Japan and East Asia).

**First discovered in:** Recorded in Northern Ireland (2012), England (2015) Wales (2017) but not yet in Scotland.

**Pathway:** Aquaculture, ballast water, hull fouling.

**Observed in:** Visual observations; walk over survey, camera surveys and harbour scrapings.



# *Arcuatula senhousia* (Asian date mussel)

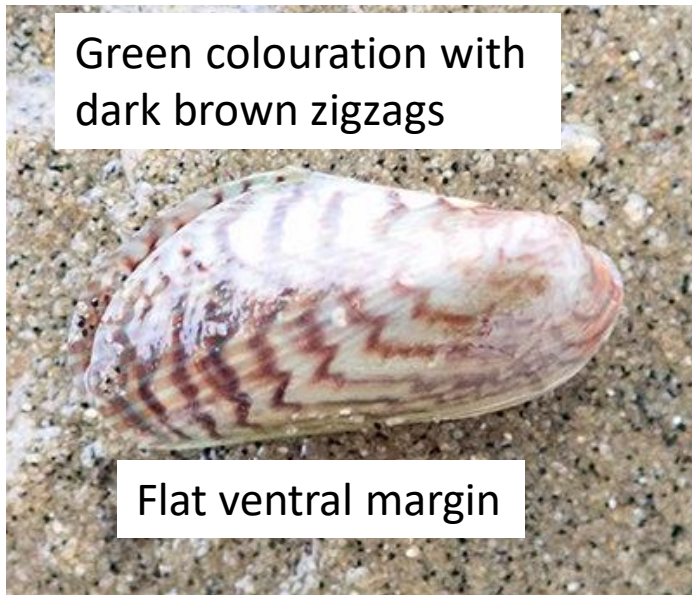
Mollusca

## Description

A small mussel (approximately 2 inches long) with a thin, fragile shell. Outline modioliform, with a straight ventral margin. The anterior and posterior areas of the shell have fine radiating ribs, with a large smooth surface in the midbody. The margin below the beaks is crenulate. Shell colour is green to blue-green, sometimes with dark brown rays and zigzags along growth lines.

**Synonyms** – *Musculista senhousia*,

## Key features



© Peter Barfield, University of Southampton

## Habitat and distribution

The mussels settle on both hard and soft substrata, forming dense mats of byssal threads mixed with shells, which can alter the substrate and water flow. The species is euryhaline, existing in salinities of 17 – 27 ppt. They are found in the littoral to subtidal zone and create very large mats. Originally from the Pacific, they have been found in the Indian Ocean, Caribbean and Northeast Atlantic.

## Quick Facts

**Native range:** Russian east coast to Singapore.

**First discovered in:** Southampton water (2016).

**Pathway:** Aquaculture, hull fouling, ballast water.

**Observed in:** Trawls, grabs and video tows.



# H *Alexandrium catenella*

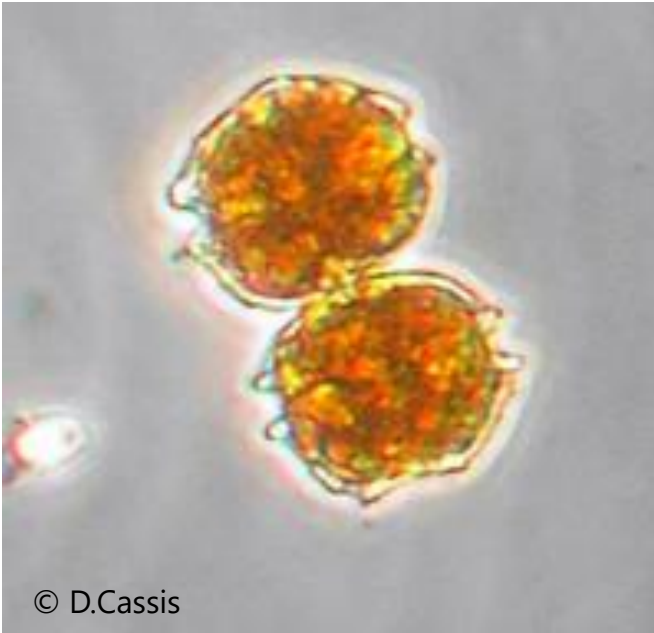
## Dinoflagellata

### Description

A chain-forming planktonic dinoflagellate. *Alexandrium catenella* is a member of the *Alexandrium tamarensis* complex and can be difficult to distinguish with certainty from the other closely-related species. The cells are 20-25 µm in length and 25-32 µm in width, and generally (although not always) found in chains of 2, 4 or 8 cells. Single cells are round, frequently wider than they are long, with deeply excavated girdles. *A. catenella* can be toxic and blooms can cause red tides.

**Synonyms** – *Alexandrium fundyense*, *Gessnerium catenella*, *G. catenellum*, *Gonyaulax catenella*, *G. washingtonensis*, *Protogonyaulax catenella*.

### Key features



### Habitat and distribution

*A. catenella* is widely found in colder, temperate waters. Many of the identifications of this species were probably a species now recognised as *A. pacificus* through DNA analysis. This applies mostly to identifications in the Mediterranean and around Australia and New Zealand. It prefers salinities of 25-38 ppt, and blooms can occur when water temperatures rise above 12°C.

### Quick Facts

**Native range:** Western American coastline.

**No observations in the UK to date** (Horizon species).

**Pathway:** Ballast water.

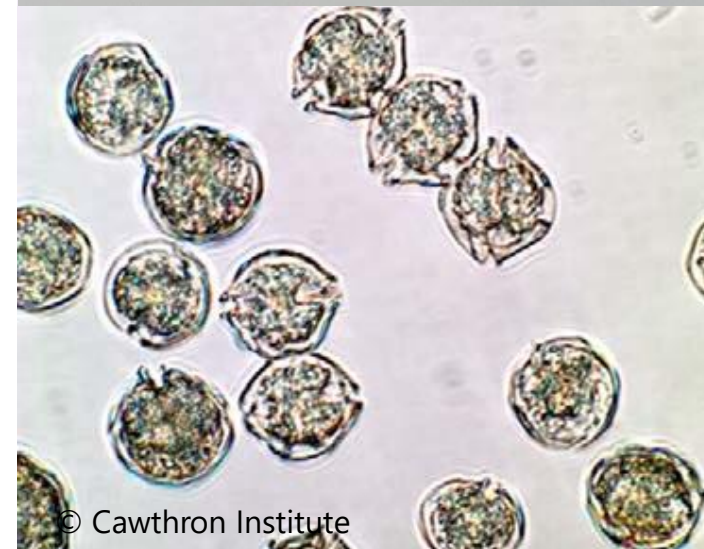
**Observed in:** Phytoplankton surveys.

© Gert Hansen



SCCAP K-1490  
*Alexandrium catenella*

10 µm



© Cawthron Institute

# *Amphibalanus amphitrite* (Striped barnacle)

# Crustacea

## Description

The shell of *Amphibalanus amphitrite* is usually conical or subcylindrical, consisting of a wall of 6 smooth white/pinkish-white plates. Its width is usually more than 1/2 its height. The plates are marked with thick vertical purple stripes narrowing from the base. It has a diamond-shaped operculum protected by a moveable lid made from four triangular plates. The flesh lining the opercular aperture has 4 purple/black bands. Adults typically range from 5.5 – 15 mm basal diameter.

**Synonyms** - *Balanus amphitrite*.

## Key features

## Habitat and distribution

*A. amphitrite* is a broadly distributed coastal and estuarine biofouling organism, occurring in open seas to estuaries, on hard natural surfaces such as rocks and oyster beds as well as on artificial structures such as ships hulls, buoys, and piers. The species has been shown to thrive in areas with physical stress or pollution. In the UK, it is found in southern England, south Wales and in Shetland, although a breeding population has not been established.

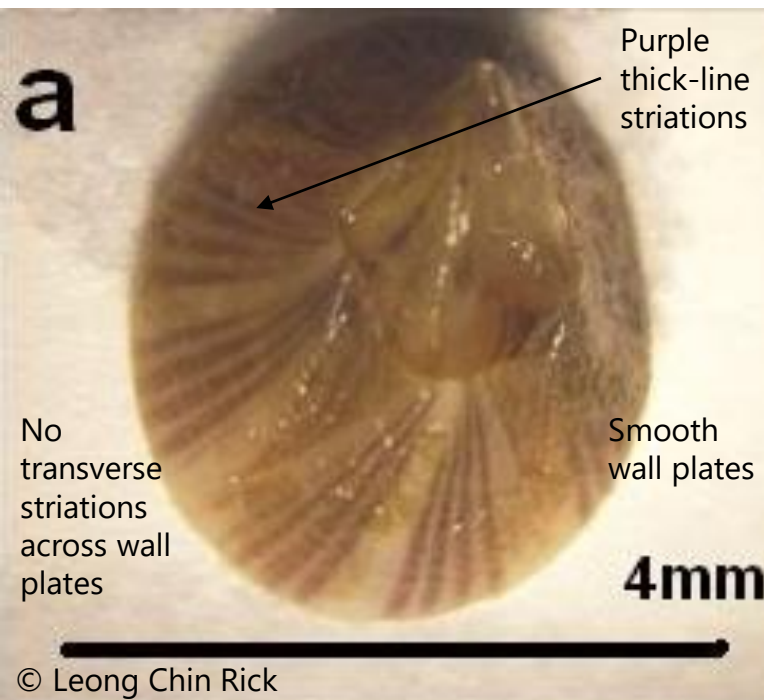
## Quick Facts

**Native range:** Indian Ocean to southwestern Pacific.

**First discovered in:** Shoreham Harbour, Sussex (1937).

**Pathway:** Adults as fouling organisms on ships' hulls or as larvae in ships' ballast water.

**Observed in:** Visual observations; walk over or camera surveys.



# H *Amphibalanus reticulatus* (Barnacle)

# Crustacea

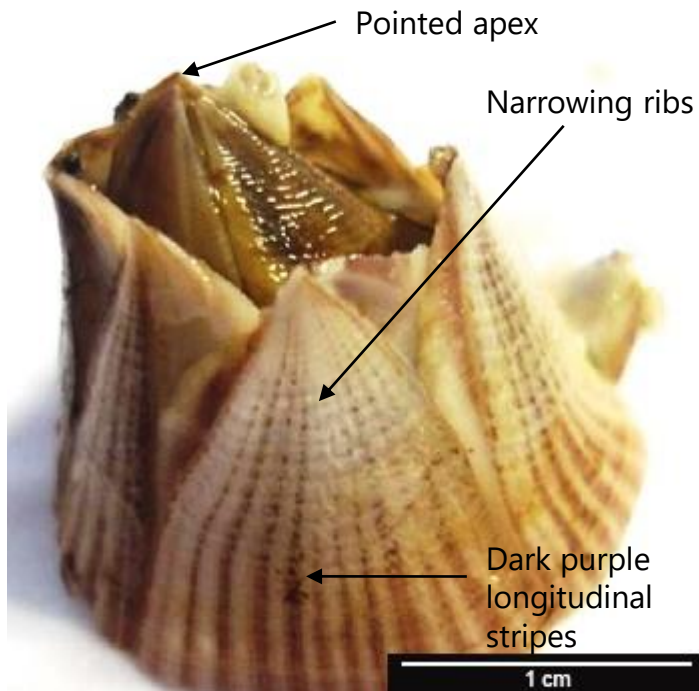
## Description

*Amphibalanus reticulatus* has a conical or sub-cylindrical shell with a toothed orifice. The width of the orifice is usually more than half its height. The plates have a smooth surface, covered in wide longitudinal spaces crossed by transverse stripes, giving a net-like appearance, with the ribs narrowing to the tops of the shell plates. It has a more pointed apex than *A. amphitrite* or *A. improvisus*. The shell is usually buff or white in colour, with dark-purple longitudinal stripes, crossed by many alternating red-and-white transverse lines. Type specimens averaged 18 mm basal diameter. **Synonyms** - *Balanus reticulatus*.



© Christiane Maria Rocha Farrapeira

## Key features



© Christiane Maria Rocha Farrapeira

## Habitat and distribution

*A. reticulatus* is found in sheltered or exposed waters on a wide range of hard surfaces, including docks, pilings, mangroves, rocks, ships' hulls, and mollusc shells. It prefers fully saline subtidal habitats in subtropical and tropical seas, although it has been found at salinities as low as 10 ppt. Currently no records in the UK.

## Quick Facts

**Native range:** Indo-Pacific region, Japan.

**No observations in the UK to date** (Horizon species).

**Pathway:** Adults as fouling organisms on ships' hulls or as larvae in ships' ballast water.

**Observed in:** Visual observations; walk-over and camera surveys.



© Auguste Le Roux



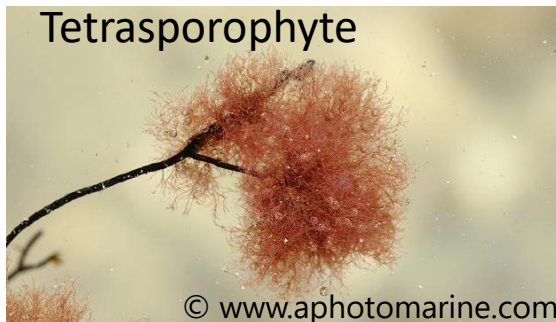
# *Asparagopsis armata* (Harpoon Weed)

## Red algae

### Description

A red macroalga with two morphologically distinct reproductive phases: The more common gametophyte is a relatively large, erect, fluffy plant, up to 30 cm high, with spirally-arranged feathery branches. The most conspicuous feature are branches that only develop barbs, giving these branches a harpoon-like appearance. Other branches have spiral, bushy branchlets. The plant is rosy pink / red; the tetrasporophyte phase forms fine woolly balls 1-2 cm in diameter which are rosy pink. This phase occurs all year round and is typically found tangled up in other seaweeds and was originally recognised as a separate genus (*Falkenbergia*). **Synonyms** - *Polysiphonia rufolanosa*, *P. vagabunda*.

### Key features



### Habitat and distribution

Gametophytes are mainly found in the low intertidal zone, extending to the first few metres of the subtidal. This form is found attached to other algae by its barbed 'harpoon' branches. This form may be found throughout the UK, but not in eastern Scotland.

The morphologically distinct tetrasporophyte has a much more restricted distribution throughout South-west England and western Ireland.

### Quick Facts

**Native range:** Southern and Western Australia.

**First discovered in:** Lundy (1949).

**Pathway:** Aquaculture, ballast water, hull fouling.

**Observed in:** Macroalgae surveys and other visual surveys.



Gametophyte of  
*Asparagopsis armata*

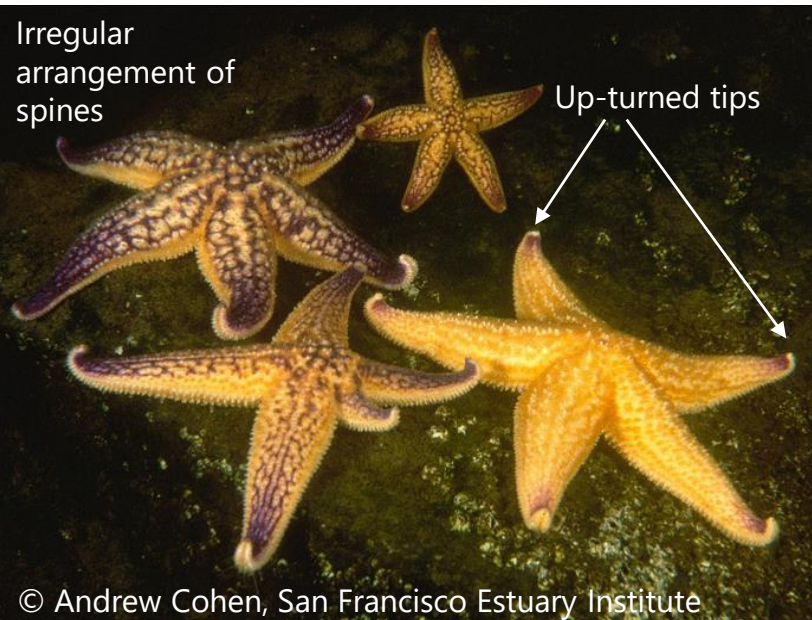
# H *Asterias amurensis* (Flatbottom sea star)

## Echinodermata

### Description

*Asterias amurensis* has 5 arms that taper to pointed, up-turned tips and join a small central disk. It is predominantly yellow, often with purple to red detail on the upper surface where numerous small spines with sharp edges are arranged irregularly along the arm edges. The underside is completely yellow and spines line the groove in which the tube feet lie, and join up at the mouth in a fan-like shape. Individuals can grow to 50 cm in diameter. **Synonyms** - *Allasterias migrata*, *A. rathbuni* var. *nortonensis*, *Asterias acervispinis*, *A. flabellifera*, *A. gracilispinis*, *A. latissima*, *A. pectinata*, *A. rubens*, *A. rubens* var. *migratum*, *Parasterias albertensis*.

### Key features



**Upturned tips** are a key identification feature when compared to similar starfish

### Habitat and distribution

Found on mud, sand or rocky areas in sheltered estuarine and marine habitats, particularly in shallow, sheltered waters. This species can tolerate a wide range of temperatures (0-25°C) and salinities (18.7-41 ppt) but prefers temperatures of 7 to 10°C.

### Quick Facts

**Native range:** North Pacific waters surrounding Japan, Russia, North China and Korea.

**Horizon species:** Not currently found in the UK but has successfully invaded the southern coast of Australia.

**Pathway:** Ships ballast water, aquaculture.

**Observed in:** Trawls, grabs/cores, camera/diver surveys, intertidal walkover surveys.



# Asterocarpa humilis (Compass sea squirt)

Chordata

## Description

Solitary sea squirt which can grow up to 4 cm in length in UK waters. The upper surface is opaque, orange-red and strongly convex when expanded. Open siphons are flared and show 4 prominent cream-white stripes, with smaller pale markings in between. The main stripes are still visible in partially closed siphons. Siphons and adjacent surface often warty.

**Synonyms** - *Asterocarpa cerea*, *Cnemidocarpa asymmetra*, *C. aucklandica*, *C. cerea*, *C. gregaria*, *Dendrodoa gregaria*, *Pandocia gregaria*, *Styela asymmetra*, *S. cerea*, *S. humilis*, *Tethyum asymmetron*.

## Key features



## Habitat and distribution

In invaded regions, it has mainly been found on man-made structures such as marinas, harbours and aquaculture facilities. It also has the potential to colonise natural low-intertidal habitats. To date it has been found in several locations on the south coast of England between Newlyn and Brighton and more recently it has been found in Holyhead Marina, North Wales and Orkney.

## Quick Facts

**Native range:** Southern Africa, Australia, New Zealand, southern South America.

**First discovered in:** Weymouth, Dorset and Salcombe, Devon (2009).

**Pathway:** Aquaculture, hull fouling.

**Observed in:** Visual observations; walk-over and camera surveys.



# Boccardia proboscidea (Mud worm)

Annelid

## Description

A polychaete worm that burrows into soft rock such as sandstone or mud and clay. Up to 29 mm in length, the worms are light green, with concentrated dark green lines on the prostomium. There are strong emergent spines in the notochetae of chaetiger 5. The gills start on chaetiger 6 and are present for most of the body length. Bidentate hooded hooks commence on chaetiger 7, accompanied by capillaries until chaetiger 9. From chaetiger 10 onwards, the neuropodia contain only hooded hooks.

**Synonyms** – *Polydora (Boccardia) proboscidea*

## Key features



## Habitat and distribution

*Boccardia proboscidea* is native to the northern Pacific, but has been found in a variety of habitats in Australia, South Africa and Argentina. The polychaete tolerates a wide range of salinities and temperatures, enabling it to survive in a range of environments. Spionid worms, including *B. proboscidea* often bore into live oysters, making them a pest species for shellfish aquaculture.

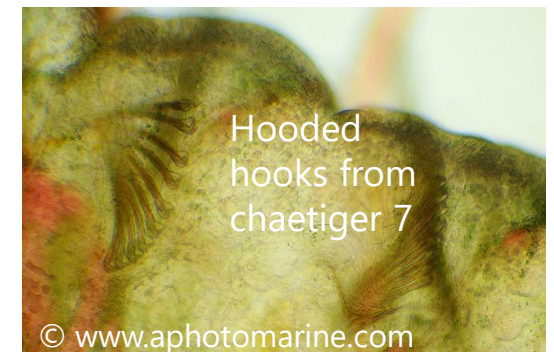
## Quick Facts

**Native range:** West coast of America and Japan.

**First discovered in:** Isle of Skye (2011).

**Pathway:** Possibly transferred with oyster aquaculture.

**Observed in:** Grab/core samples, observational surveys.



# Bonnemaisonia hamifera

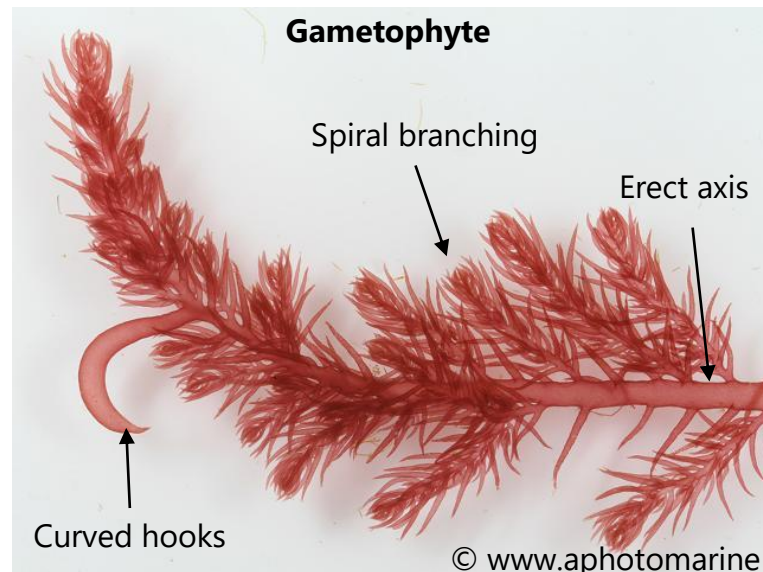
## Red algae

### Description

A branched red seaweed with two morphologically different gametophyte and tetrasporophyte phases. Gametophyte plants occur from March-June. They are brownish-red, feathery fronds with a slightly flattened axis, 1 mm wide and 350 mm long. They are attached to *Cystoseira* and other algae by hook-like modified branches. The smaller tetrasporophyte plants occur all year round, but are most obvious in October-March. Brownish-red, filamentous and in dense cotton-wool-like tufts up to 25 mm in diameter.

**Synonyms** - *Asparagopsis hamifera*, *Bonnemaisonia intricata*, *Boryna intricata*, *Ceramium intricatum*, *Herpothamnion intricatum*, *Trilliella intricata*.

### Key features



### Habitat and distribution

Found on rocks or on other seaweeds in the lower tidal pools and shallow sublittoral down to 20 m. The gametangial phase is usually found in the sublittoral or occasionally low littoral while the tetrasporangial phase is usually epiphytic in lower littoral and sublittoral to 8 m depth. It is well established in the UK, most common in the southwest, but does occur north to Shetland. It is uncommon along the east coast of England. This species spread from Cornwall to Shetland by 1949.

### Quick Facts

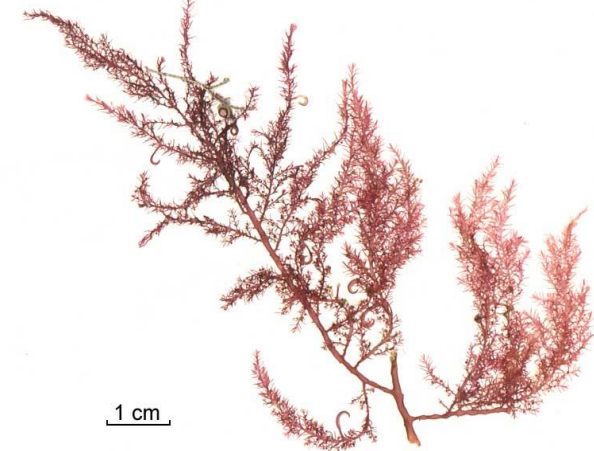
**Native range:** North West Pacific (Japan).

**First discovered in:** Falmouth, Cornwall and Studland, Dorset (1893).

**Pathway:** Possibly shipping and aquaculture. Secondary spread via drifting.

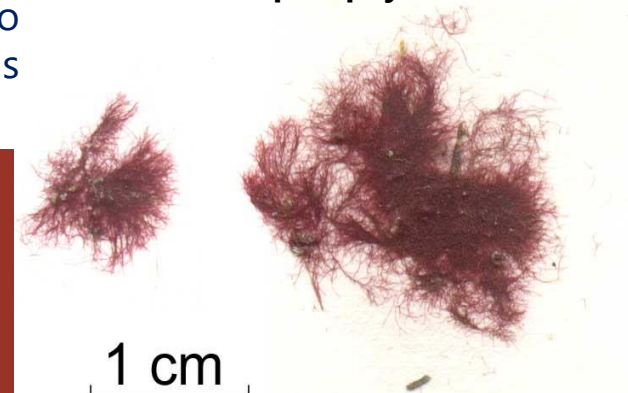
**Observed in:** Visual observations; walk-over and camera surveys.

### Gametophyte



© Picton, B.E

### Tetrasporophyte



© Picton, B.E

# *Botryocladia wrightii* (Golden membrane weed)

## Red algae

### Description

A red seaweed with thin flat branches splitting from a central hollow axis. The branches may have a radial pattern around the central axis. These main branches can have up to three orders of branches, with the ultimate branch narrowing to a point. The branches can grow to 40 cm. The algae is bright pink to deep red, with a soft, slippery texture. Cystocarps are distributed on the central axis and appear dome-shaped, without a protruding ostiole.

**Synonyms** – *Chrysomenia wrightii*, *Chylocladia wrightii*.

### Key features

Series of branches from central axis



Flat central axis

### Habitat and distribution

A subtidal species found in sheltered inlets and bays. This species is native to Japan and is likely to have been imported with oyster aquaculture. Originally found in France in 1986 and Spain in 2008, this species was first detected in the UK in 2013. *Botryocladia wrightii* had been thought to be restricted to a local spread in Falmouth but was found in the Menai Strait in 2018.

### Quick Facts

**Native range:** North West Pacific (Japan).

**First discovered in:** Falmouth, Cornwall (2013).

**Pathway:** Possibly shipping and aquaculture. Secondary spread via drifting.

**Observed in:** Visual observations; walk-over and camera surveys.



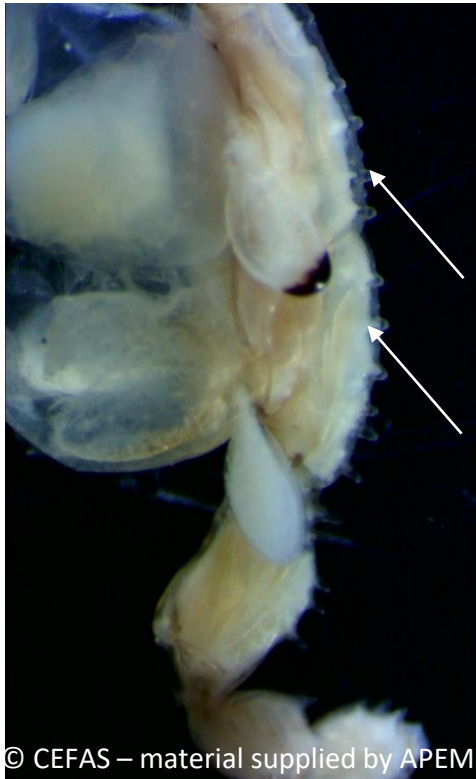
# Caprella mutica (Japanese skeleton shrimp)

# Crustacea

## Description

*Caprella mutica* is a large caprellid amphipod (larger than native caprellids) which has a slender body and cylindrical shape. Males can grow up to 45 mm in length with females smaller (15 mm). The head is bulbous with long antennae (one of which is often larger than the other). Fine hairs can be observed on the first two body segments and large spines on the third to seventh body segments in males. The second body segment is characteristically longer than any others. Females have orange spots on their brood pouch. Individuals are usually bright orange to red in colour. **Synonym** - *Caprella macho*.

## Key features



Series of dorsal spines on the posterior

## Habitat and distribution

*C. mutica* is found on a range of natural substrata such as hydroids and algae as well as artificial substrata including buoys, mooring ropes, boat hulls, mussel farms and floating pontoons. It is often found in association with the large brown seaweed *Sargassum muticum*. There are established populations in the North Sea, English channel, west coast of Scotland, and the Irish Sea. It has been found in high concentrations in Marine Protected Areas designated for their biogenic reefs. Particularly high densities of *C. mutica* may be observed during the summer months.

## Quick Facts

**Native range:** Eastern Asia, near Japan.

**First discovered in:** Fish farm in Oban, Scotland (2000).

**Pathway:** Likely to be associated with shipping (ballast water and on hulls) and aquaculture.

**Observed in:** Visual observations; walk over and camera surveys.



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# *Caulacanthus okamurae* (Okamura's pom-pom weed)

## Red algae

### Description

Relatively easy to identify due to the 'pom-pom' appearance and springy texture. The plant forms hemispherical tufts up to 4 cm in diameter. Close-up the fronds are thin, with numerous branches forming a mass of tangled fronds. The branching pattern is irregular and sometimes forked. These fronds are cartilaginous and tough, giving the pom-pom a tough springy texture. The colour is bright red. This macroalgae often forms irregular mats of pom poms which may be mixed in with other red algae of a similar form.

**Synonyms** – *Feldmannophycus okamurae*.

### Key features

### Habitat and distribution

*Caulacanthus okamurae* grows on firm surfaces, including rock, mussels and man-made structures. It is often observed on rocky, exposed shores in the intertidal zone.

Originally recognised as a similar species, *Caulacanthus ustulatus*, which has a more southerly distribution (SE France), specimens from further north (Brittany and England) were recently recognised as a distinct species – *C. okamurae*. It is now regularly found on the south and western coasts of England and Wales.

### Quick Facts

**Native range:** Japan

**First discovered in:** Plymouth Sound in 2004

**Pathway:** Aquaculture, ballast water, hull fouling.

**Observed in:** Macroalgae surveys and other visual surveys.



© www.glaucus.org.uk



© Matt Slater (Cornwall Wildlife Trust)



# H *Caulerpa racemosa* (Sea grapes)

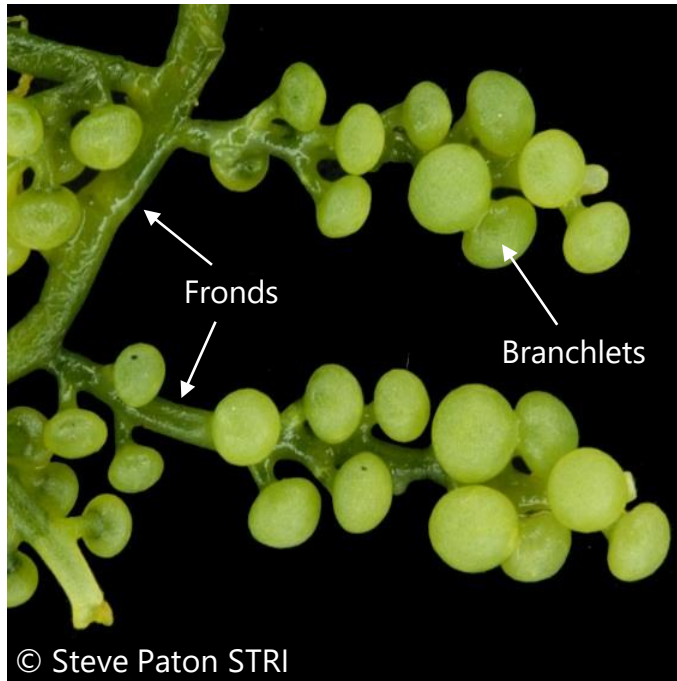
## Green algae

### Description

A green seaweed with short, erect branches (<15 cm) arising from a horizontal stolon attached to the sediment at intervals by descending rhizomes. The branches bear sack-shaped branchlets which are radially or distichously arranged. Branchlets can be spherical, club-shaped or disk-shaped. Sea grapes can often form dense mats.

**Synonyms** - *Caulerpa clavifera*, *C. clavifera* var. *uvifera*, *C. feldmannii*, *C. obtusa*, *C. racemosa* var. *clavifera*, *C. racemosa* var. *disticha*, *C. racemosa* var. *mucronata*, *C. racemosa* var. *uvifera*, *C. uvifera*, *Chauvinia clavifera*, *C. clavifera* var. *uvifera*, *Fucus clavifer*, *F. racemosus*, *F. uvifer*.

### Key features



© Steve Paton STRI

### Habitat and distribution

Occurs on most types of substrata from shallow muddy bays to clear water reef environments, from near the surface to depths of 85 m (usually 10-35 m). It can colonize seagrass meadows and areas already occupied by other seaweeds. There are currently no UK records although it has been recorded in the Mediterranean from Spain to Turkey. It is a very popular plant in the UK's marine aquarium trade and the risk of accidental release means it is highlighted as a horizon species.

### Quick Facts

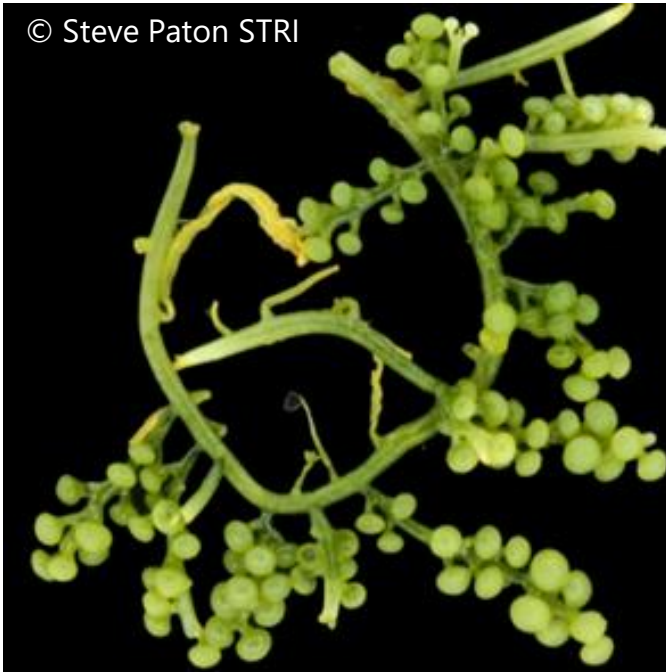
**Native range:** South-western Australia.

**No observations in the UK to date** (Horizon species).

**Possible pathway:** Ballast water, ship's hulls fouling, release from aquaria.

**Observed in:** Visual observations; walk-over and camera surveys.

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# H *Caulerpa taxifolia* (Caulerpa / killer alga)

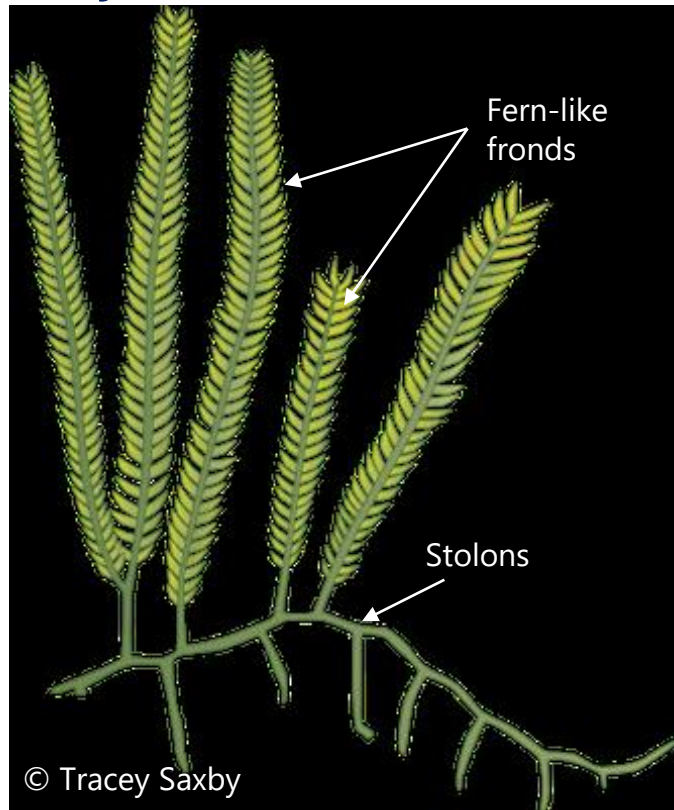
## Green algae

### Description

A bright green macroalgae with upright fern-like fronds which are compressed laterally, serrate and feathery, arising from creeping stolons. The frond diameter is 6-8 mm and the length varies from 3-15 cm in shallow water to 40-60 cm in deeper waters, up to a maximum of 2.8 metres in length.

**Synonym** – *Caulerpa pennata*, *Fucus taxifolius*.

### Key features



### Habitat and distribution

*C. taxifolia* is found subtidally to depths of 35 m on sheltered and exposed coasts and in seagrass meadows. It can attach to a variety of substrates including sandy and muddy bottoms, rock and artificial substrates. It is native to tropical waters, occurring in the Caribbean, Red Sea, East African coast, northern Indian Ocean, southern China Sea, Japan, Hawaii, Fiji, New Caledonia and tropical/sub-tropical Australia. The invasive strain can tolerate low temperatures and survive out of water, in moist conditions, for up to 10 days. It was first recorded in Europe adjacent to the Oceanographic Museum of Monaco in 1984 where it had been cultured in aquaria.

### Quick Facts

**Native range:** Tropical regions including Caribbean sea, Indian and Pacific Oceans.

**No observations in the UK to date** (Horizon species).

**Pathway:** Aquaria, spread through fishing and marine traffic.

**Observed in:** Visual observations, walk-over and camera surveys.



# H *Celtodoryx ciocalyptoides*

## Porifera

### Description

A quince yellow to golden yellow sponge with a massive globular, encrusting form with a cauliflower-shaped surface (but can occasionally be smooth). Texture is very soft, with no visible oscules and releases large amounts of mucus when damaged. Colonies range in size from  $< 20 \text{ cm}^2$  to  $25 \text{ m}^2$  with a thickness of a few to 50 cm. Surface areas of 10-30 cm are common, but may be considerably larger, as specimens with a surface area of up to  $25 \text{ m}^2$  have been reported off Tholen Island in the eastern region of the Oosterschelde, SW Netherlands. Consistency is soft and easily damaged. A microscope is required for complete identification. **Synonyms** – *Celtodoryx girardae*, *Cornulum ciocalyptoides*.



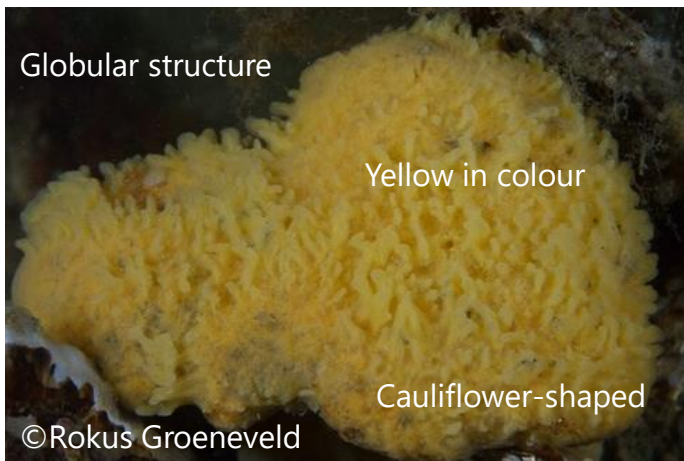
© R. Doornberg



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Rokus Groeneveld ©

### Key features



Globular structure

Yellow in colour

Cauliflower-shaped

©Rokus Groeneveld

### Habitat and distribution

Occurs on rocky substrates, mussel shells and soft bottoms of the shallow subtidal zone in estuarine and fully marine habitats. The species has been found to tolerate strongly eutrophicated waters. The maximum depth recorded for the species in the NW Pacific is 16 m and 38 m in the NE Atlantic. *C. ciocalyptoides* has been identified as an introduced species in the North Sea, the Oosterschelde and the Gulf of Morbihan.

### Quick Facts

**Native range:** North West Pacific Ocean: Korea and China.

**No observations in the UK to date** (Horizon species).

**Pathway:** Aquaculture most likely candidate for introduction.

**Observed in:** Visual observations, camera surveys, trawl samples.

# Cephalothrix simula (Ribbon worm)

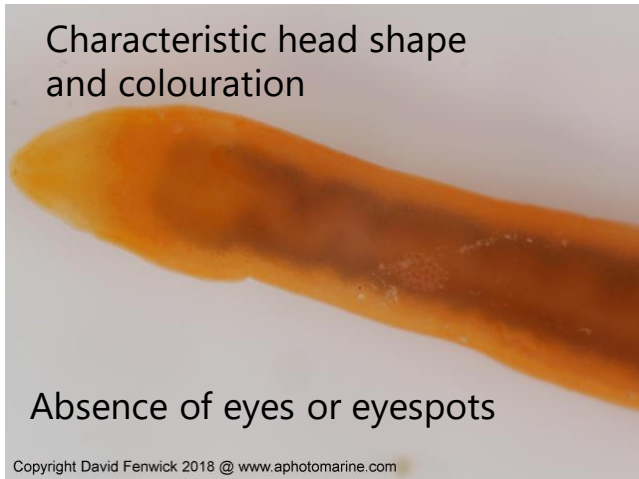
## Nemertea

### Description

A nemertean worm which has been found to contain high levels of tetrodotoxin, a toxin commonly associated with Pufferfish poison. These worms can establish populations in oyster cultures, therefore representing a potential food safety risk. Nemerteans in general are difficult to identify and require detailed anatomical investigations to identify to species level. *C. simula* does have some characteristics which would suggest its identity: the head is narrowed and arrowhead-shaped, the colouration of darker orange in the area of the foregut and the lack of eyes or eyespots.

**Synonyms** – *Procephalothrix simula*, *Procephalothrix simulus*

### Key features



### Habitat and distribution

*Cephalothrix simula* is normally found in the intertidal zone amongst rocks or buried in mud or sand. The native range of *C. simula* is the Northwest Pacific but specimens have recently been found in the western Mediterranean and in northern Europe along the coast of the Netherlands.

### Quick Facts

**Native range:** Uncertain, likely from the Southern Hemisphere, possibly Australia.

**First discovered in:** Cornwall (2018).

**Pathway:** Possibly oyster aquaculture transfers.

**Observed in:** Tidepool observational surveys.



# H *Ciona savignyi* (Pacific transparent sea squirt)

Chordata

## Description

A solitary sea squirt with an upright smooth cylindrical tunic which can reach up to 15 cm in length. The squirt is attached to the substratum by the base, with the body standing erect. The tunic is transparent, white or yellowish-green. There are 5-7 conspicuous muscle strands on each side of the body visible within through the tunic. There are two siphons, oral and atrial. The oral siphon has 8 lobes with a yellow margin and reddish-orange spots. The atrial siphon has 6 lobes with a yellow margin and reddish-orange spots. In addition, there are white spots scattered throughout the body wall.

**Synonyms** – *Ciona aspersa*

## Key features

Orange spots on siphons



White pigment spots on tunic

## Habitat and distribution

Normally found in harbours and marinas, *Ciona savignyi* attaches to man-made structures but has occasionally been recorded from rocky substrates. It has a subtidal distribution, with a wide tolerance of salinities (18 – 40 ppt). Native to Japan, it has been found on both sides of the Pacific from California to Alaska and also in New Zealand.

## Quick Facts

**Native range:** Japanese waters.

**No observations in the UK to date** (Horizon species).

**Pathway:** Aquaculture, hull fouling.

**Observed in:** Visual observations; walk-over and camera surveys.



© Melissa Frey / NEMESIS database

# Corella eumyota (Orange-tipped sea squirt)

Chordata

## Description

A small (2-4 cm) solitary sea squirt with a smooth, normally semi-translucent tunic. Older individuals have an orange tinge, with the colour particularly concentrated around the siphons. The C-shaped gut runs close to the lower margin and is visible through the tunic. The gut contents resemble a tightly wound spring, making this a distinctive feature to aid identification. The squirt is normally found attached to the substratum along one side of its body, as opposed to more common erect sea squirts.

**Synonyms** – *Corella benedeni*, *Corella dohrni*, *Corella novarae*

## Key features

Orange colour,  
particularly around siphons



C-shaped gut

## Habitat and distribution

Normally found in harbours and marinas attached to man-made structures where it can occur in high densities. *C. eumyota* has been found attached to coarse sediments including cobbles, boulders and dead mollusc shells. The species is native to the Southern Hemisphere countries of Chile, South Africa, Australia and New Zealand. In recent years it has been found in harbour surveys along the Atlantic coast of Portugal, Spain and France.

## Quick Facts

**Native range:** Southern circumpolar waters.

**First discovered in:** Brighton marina (2004).

**Pathway:** Vessel hull fouling.

**Observed in:** Observational surveys, trawls.



# Crassostrea sp. (Portuguese oysters)

## Mollusca

### Description

*Crassostrea angulata* and *Magallana gigas* are closely-related species, which can be distinguished genetically, but are almost impossible to distinguish morphologically: *C. angulata* has a rough irregular shell in a teardrop shape. The left valve is deeply cupped with 6-7 bold ribs, the right flat or slightly convex. The shape of *M. gigas* is variable but is usually an elongated oval or teardrop form. Umbones are prominent and the left valve is deeply cupped with prominent growth stages which are raised and frilled, forming flat scales, while the right valve is flat or weakly convex. *C. angulata* is usually off-white to yellow or can be bluish/grey with purple patches, while *M. gigas* is off-white, yellowish or grey with dark purple patches. Individuals of both species can grow up to 30 cm long. **Synonyms** – Too numerous to list.

*Crassostrea angulata*



© Jan Johan ter Poorten

### Key features

*Magallana gigas*



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### Habitat and distribution

Attaches to hard substrates in intertidal / shallow subtidal zones of estuaries and coastal waters. In muddy/sandy areas the oysters can create reefs by cementing their shells together. Farmed populations are widespread across Europe and occur throughout the UK, from which escapees have established populations in SE and SW England and Wales. Extensive beds of naturally-recruited oysters now exist in some southern estuaries of England.

### Quick Facts

**Native range:** Japan and NE Asia.

**First discovered in:** River Blackwater, Essex (1926).

**Pathway:** Imported to UK from Canada for commercial aquaculture, dispersal through larval drift.

**Observed in:** Visual observations, camera surveys.

*Magallana gigas*



© John Bishop, MBA

# Crepidula fornicata (Slipper limpet)

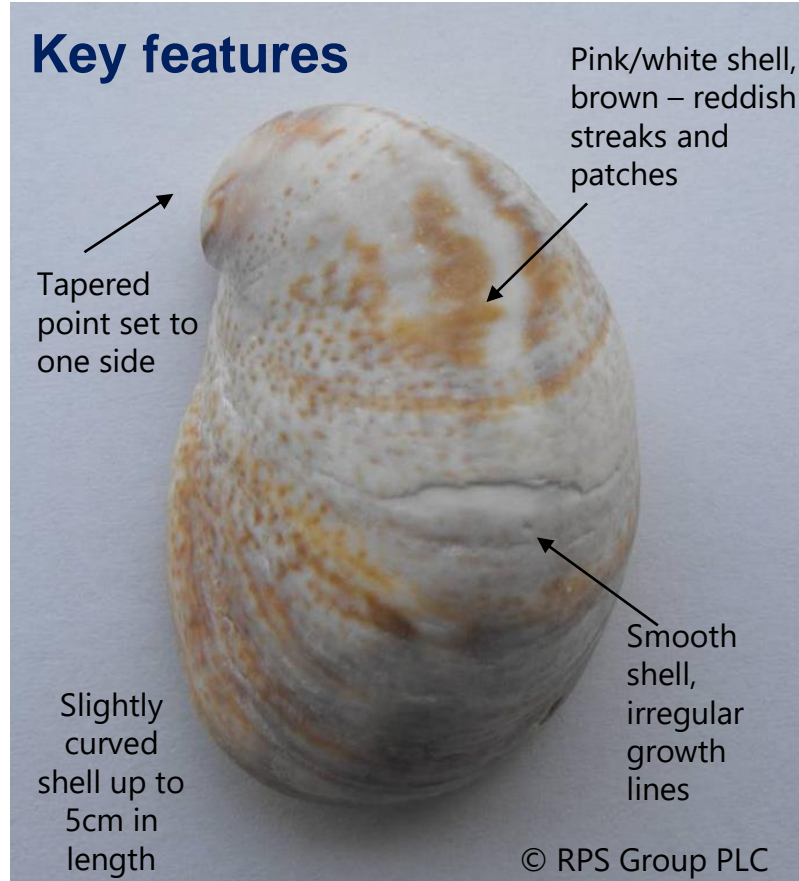
## Mollusca

### Description

Shell is oval with an elongate cap-shape and up to 5 cm in length. The large shell opening on the ventral side has a flat white shelf, extending for half its length. Apex is curled around and tucked in on one side. Shell is smooth, white, cream, yellow or pinkish in colour with streaks or blotches of red or brown. Commonly found in curved chains or stacks made up of several individuals.

**Synonyms** - *Crepidula riisei*, *C. virginica*, *C. densata*, *Crypta nauturum*, *Patella fornicata*.

### Key features



### Habitat and distribution

Adults live on the seabed, reaching highest densities in wave-protected muddy areas. Often attach to shells of hard-shelled invertebrates (alive or dead) including scallops, crabs, mussels. Established on the southern coasts of England and Wales and spreading northward. Present on the east coast (up to Spurn Head) and west coast (up to Cardigan Bay) of England and in Scotland.

### Quick Facts

**Native range:** From Point Escuminac, Canada along the eastern coast of America down to the Caribbean.

**First discovered in:** Liverpool Bay (1872) but this population has since died out.

**Pathway:** Most likely to have been imported with American oysters (*Crassostrea virginica*).

**Observed in:** Trawls, grabs and video tows.





# *Diadumene lineata* (Orange-striped sea anemone)

## Cnidaria

### Description

The orange striped sea anemone usually has a base slightly wider than the column. The column is smooth with a diameter reaching up to 25 mm and a height of up to 40 mm, however British specimens are normally half this size with a height of between 10-20 mm. They can have up to 100 long tentacles, irregularly arranged. The column is usually olive-green or brown/grey in colour (it can occasionally be pinkish) with prominent orange, yellow or white longitudinal stripes.

**Synonyms** – *Aiptasiomorpha (Diadumene) luciae*, *Diadumene luciae*, *Haliplanella luciae*, *Haliplanella luciae*, *Haliplanella liciae*, *H. lineata*, *H. lucia*, *H. luciae*, *H. luciae*, *Sagartia davisii*, *S. lineata*, *S. luciae*.

### Key features



### Habitat and distribution

*Diadumene lineata* is found in sheltered bays, harbours and estuaries. It is an intertidal species, but can sometimes be found in the sublittoral. It attaches to hard substrates such as man-made structures, rocks and mollusc shells. It is tolerant of temperature and salinity variations. Found all over the UK.

### Quick Facts

**Native range:** North West Pacific: Japan.

**First discovered in:** Stone Quarry, Abereddy, late 18<sup>th</sup> century.

**Pathway:** Fouling on ship hulls and/or by aquaculture.

**Observed in:** Visual observations; walk-over and camera surveys.



# *Didemnum vexillum* (Carpet sea squirt)

Chordata

## Description

Pale orange or cream colonies forming extensive, thin (2-5 mm) sheets or long pendulous outgrowths. Firm, leathery texture, with a marbled appearance. Numerous small pores in the surface close when colony is disturbed, revealing tiny whitish spots.

**Synonyms** - *Didemnum vestitum*, *D. vestum*.

## Key features



## Habitat and distribution

Mainly recorded in marinas and adjacent shallow artificial structures in the UK. It can inhabit cobble / gravel seabed down to 80 m depth. Found in tide pools, in seagrass beds and on bivalve aquaculture installations. *D. vexillum* has so far been recorded in a total of ten marinas in the UK: North Wales (1), Devon (2), Solent (5), Clyde (1) and Whitstable (1).

## Quick Facts

**Native range:** Probably North West Pacific and likely to have spread from Japan.

**First discovered in:** Autumn 2008 from a marina in North Wales and one in Plymouth.

**Pathway:** Hulls of leisure craft, ballast water and movement of aquaculture stock.

**Observed in:** Video tows, intertidal surveys, maintenance of structures.





# *Dyspanopeus sayi* (Say mud crab)

# Crustacea

## Description

The carapace which is roughly hexagonal and convex in shape and olive-green in colour. Its carapace can reach a width of 30 mm. The carapace is smooth, with five antero-lateral teeth, but the first two teeth are reduced and separated by a wide but shallow sinus. The tips of the claws are black and this colouration extends back from the lower pincer in a characteristic pattern. The shell has a light covering of hair, especially to the front and sides. The claws are unequal in size, with the right one being shorter and wider than the left. **Synonyms** - *Neopanope sayi*, *Panopeus sayi*.

## Key features

Black tips on claws

Brown/ olive carapace



© Museo di Storia Naturale di Venezia

## Habitat and distribution

The species has been observed in Swansea Docks since 1960. *Dyspanopeus sayi* lives predominantly on muddy substrates where it is a predator of bivalve molluscs. In its native environment, it hides among colonies of polychaete worms to avoid being preyed on by the Atlantic Blue Crab.

## Quick Facts

**Native range:** Atlantic coast of North America.

**First discovered in:** Swansea Docks (1960).

**Pathway:** Unknown.

**Observed in:** Camera surveys, grab samples, walk over surveys.



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© Cyric, Nature Watch NZ

Characteristic black lobe on lower pincer

# *Ensis leei* (American jack knife clam)

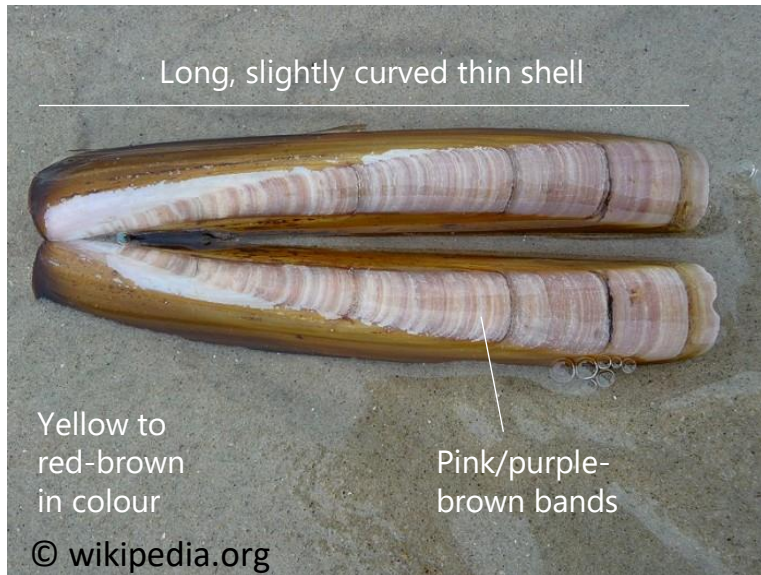
Mollusca

## Description

A long thin bivalve which is slightly curved in shape and can reach 20 cm in length and 3 cm in width, although usually does not exceed 10 cm. The shell is yellow to red-brown in colour and is covered in pink to purple-brown bands. One end of the shell is never fully closed. The shell is much more curved than other species of *Ensis*, but retains straight anterior and posterior ends. The anterior hinge has few very small teeth and an elastic ligament. **Synonyms** – *E. americanus*, *E. arcuatus* var. *directus*, *Ensis directus*, *Solen directus*, *Solen ensis* var. *americanus*.



## Key features



## Habitat and distribution

The species is common in soft sandy and muddy sediments of the intertidal or subtidal zones on the east coast of England between the Humber and east Kent. Individuals have also been reported along the south coast of England and Milford Haven, South Wales. It was first found in the UK in the 1980s. Its expansion is principally due to natural dispersal. It is gregarious and has wide environmental tolerances.



## Quick Facts

**Native range:** Atlantic coast from Labrador to Florida.

**First discovered in:** Holme Beach, Norfolk (1989).

**Pathway:** Ballast water of a ship crossing the Atlantic.

**Observed in:** Camera surveys, grab sampling and walk over surveys.



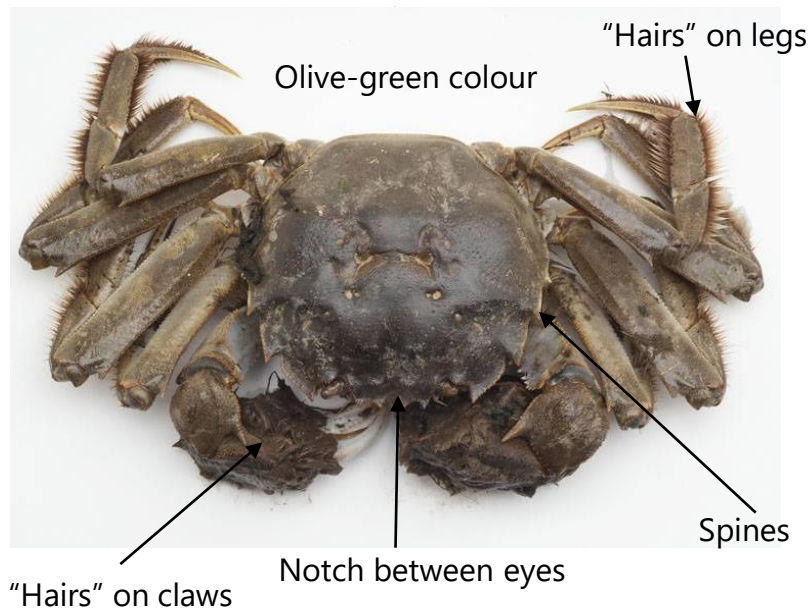
# *Eriocheir sinensis* (Chinese mitten crab)

## Crustacea

### Description

A relatively large crab with a maximum body length of 56 mm. The carapace is relatively square in shape, narrowing towards the head where there are 4 spines on each side and a notch between the eyes. This species is olive-green in colour with paler legs which are twice the length of the body, with white tips on the claws. There is a dense mat of hair present on the claws which is the species' most distinguishing feature. The leading edges of the legs are also hairy. **Synonyms** - *Eriocheir sinensis* f. *acutifrons*, *E. sinensis* f. *rostratus*, *E. sinensis* f. *rotundifrons*, *E. sinensis* f. *trilobata*, *Grapsus nankin*.

### Key features



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### Habitat and distribution

Juveniles live in lower estuaries and marine habitats but as they develop into adults, they migrate upstream into more freshwater / brackish environments. Adults live in burrows in muddy river banks, but aquatic vegetation and marshes could provide an alternative habitat. They migrate to higher salinity environments to reproduce. *E. sinensis* is established in the Thames, Medway and Ouse and has been observed in several other estuaries in England and Wales.

### Quick Facts

**Native range:** Eastern Asia (China, Japan and Taiwan).

**First discovered in:** Thames Estuary (1935).

**Pathway:** Ballast water, fouling on ships' hulls and possibly transported with mariculture.

**Observed in:** Visual observations; walk over and camera surveys.



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# *Ficopomatus enigmaticus* (Trumpet tubeworm)

Annelid

## Description

A Serpulid worm which occurs in dense colonies of upright, white, intertwined chalky tubes, 2 mm in diameter, with flared collars at intervals. The base attaches to solid surfaces such as rocks and pebbles. The tubes house worms with a crown of banded, feathery feeding tentacles. When the body is retracted, an operculum with characteristically dark spines plugs the tube entrance.

**Synonyms** - *Mercierella enigmatica*, *Phycopomatus enigmaticus*.

## Key features



## Habitat and distribution

*F. enigmaticus* is a warm water species which is confined to sheltered coastal brackish-water areas such as estuaries. It is usually found at less than 2 m deep, and is able to tolerate wide fluctuations in salinity. It is now found in all ports between Pembrokeshire and the Thames Estuary, as well as at Barrow-in-Furness. It can form large colonies or biogenic reefs.

## Quick Facts

**Native range:** Uncertain, likely from the Southern Hemisphere, possibly Australia.

**First discovered in:** London Docks (1922).

**Pathway:** Vessel hulls, ballast water, aquaculture.

**Observed in:** Grab/core samples, observational surveys.



# *Grateloupia turuturu* (Devil's tongue weed)

## Red algae

### Description

A red macroalga with thin deep red to purple lance-shaped blades of up to 1 metre long. The shape of the blades varies somewhat, and may be forked, and may have bladelets (pinnae) at the base. The margin of the blade is almost always undulate. It has a very small area of attachment and a very short stem before the blade widens. It has a slippery texture but the slimy sensation does not transfer to the fingers. It does not have kidney shaped blade extensions observed in the similar native species *Kallymenia reniformis*. May grow singly or in clumps. **Synonyms** - *Halymenia sinensis*.

### Key features



### Habitat and distribution

Grows on firm surfaces (including man-made structures, most frequently marina pontoons) in sheltered coastal areas from the lower intertidal down to a depth of about 7 m. Can tolerate lowered salinities. It is a native of the Northwest Pacific. It has become established along the south east coast of England and in Pembrokeshire. European observations were misclassified as *G. doryphora* until recently.

### Quick Facts

**Native range:** Japan and Korea.

**First discovered in:** The Solent (1973).

**Pathway:** Aquaculture, ballast water, hull fouling.

**Observed in:** Macroalgae surveys and other visual surveys.



© Hideki Haga

# *Hemigrapsus sanguineus* (Asian/Japanese shore crab)

# Crustacea

## Description

A small crab with a square carapace up to 4.5 cm in width varying in colour from orange-brown to greenish-black with banded legs. It has three distinct 'teeth' on each side of the carapace and banding on the walking legs. Large males have a fleshy bulb at the pincer base. Teeth on the carapace are more acute than those of the closely-related species *H. takanoi*. Both species have a crest below each eye, which looks like a horizontal ridge under the eyes. In *H. sanguineus* this is undivided, while in *H. takanoi* this is divided into three unequal parts.

**Synonyms** - *Grapsus (Grapsus) sanguineus*, *Heterograpsus maculatus*.

## Key features



Three distinct teeth

Greenish-brown in colour

© Jack Sewell and Becky Seeley, MBA

## Habitat and distribution

The species inhabits estuarine and marine habitats within the intertidal or shallow subtidal zones. It is typically found on more exposed rocky shores but also occurs in soft sediments under the shelter of rocks or shells, artificial structures, mussel beds and oyster reefs. Specimens have been reported from rockpools in Jersey and Guernsey since 2009. First recorded in South Wales and Kent in 2014.

## Quick Facts

**Native range:** North West Pacific.

**First discovered in:** Barry, South Wales (2014), NW coast of Guernsey (2009).

**Pathway:** Larva carried in ship ballast water, adults on hulls and via aquaculture.

**Observed in:** Visual observations; walk over and camera surveys.



Fleshy bulb

Undivided crest

© Nancy Flocke, VLIZ



© USGS Science Centre for Coastal and Marine Geology



# *Hemigrapsus takanoi* (Brush clawed shore crab) and *Hemigrapsus penicillatus* (Japanese shore crab)

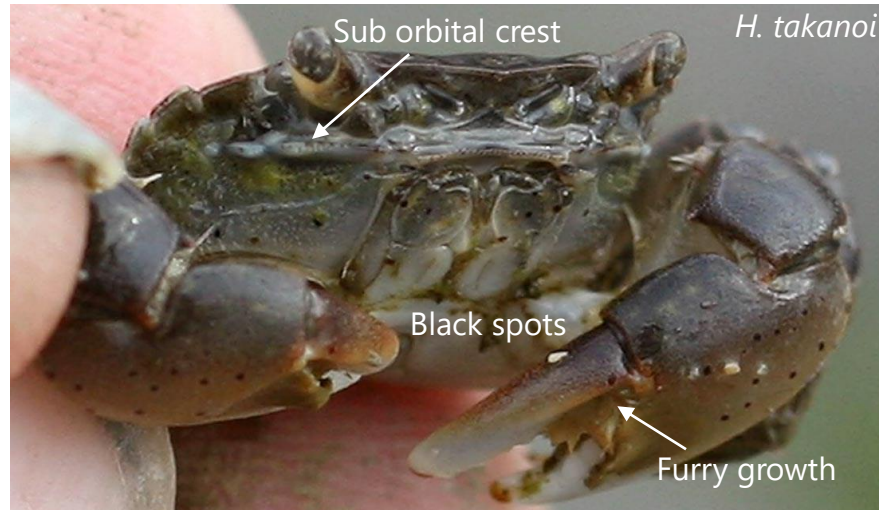
## Crustacea

### Description

Two virtually indistinguishable small crabs only recognised as separate species in 2005. Square carapace up to 5 cm wide, varying in colour from dark grey-green to brown-orange and with banded legs. They have three distinct 'teeth' on either side of the carapace, and males have a yellow-brown furry growth at the base of the pincers (which is slightly larger in *H. takanoi*). Both may have small black spots on the body and limbs, which are generally smaller on *H. takanoi*, and on these species they are absent from the abdominal segments. Both species are similar in appearance to the closely related non-native *H. sanguineus*. All three species have a crest below each eye, but in *H. sanguineus* this is undivided, while in *H. takanoi* and *H. penicillatus* it is divided into three unequal parts.

**Synonyms** – *Hemigrapsus tanakoi*; *Brachynotus brevidigitatus*, *Grapsus (Eriocheir) penicillatus*

### Key features



© Arjan Gittenberger/GiMaRIS-2009

### Habitat and distribution

Both species inhabit shallow coastal waters and estuaries. *H. takanoi* was originally identified as *H. penicillatus* in Europe and is widespread from Biscay to Germany, and has recently been found in Kent, Essex and Glamorgan. Previous European records of *H. penicillatus* are likely *H. takanoi*.

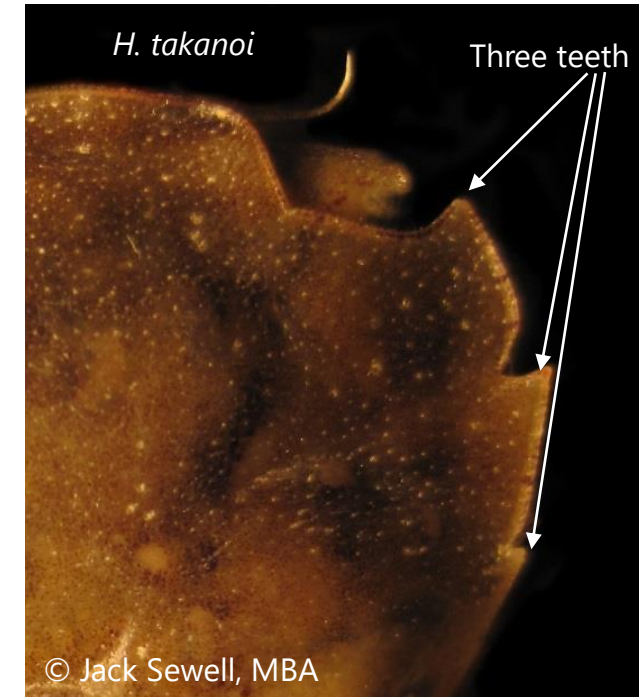
### Quick Facts

**Native range:** North West Pacific.

**First discovered in:** Medway and Colne estuaries in 2014 (*H. takanoi*). *Hemigrapsus penicillatus* yet to be observed in the UK.

**Pathway:** Ballast water, hull fouling, aquaculture.

**Observed in:** Trawl, camera and walk over surveys.



© Jack Sewell, MBA



© Christine Wood, MBA

# *Hesperibalanus fallax* (Barnacle)

# Crustacea

## Description

*Hesperibalanus fallax* is a small barnacle reaching 12 mm in diameter, typically epibiotic and found in shallow seas. The shell is comprised of 6 pore-less shell plates and a pore-less calcareous base. The shell plates are generally white with reddish-purple patches. The lateral projections on the shell plates are sloped, giving the orifice a toothed look. The opercular membrane is yellow (light to deep yellow) and bears four brown or black bands. Less coloured specimens may be mistaken for the native species *Balanus crenatus*. *H. fallax* has solid walls, whereas there are pores in the plates of *B. crenatus*.

**Synonyms** – *Solidobalanus fallax*.

## Key features



© www.aphotomarine.com

## Habitat and distribution

Found on molluscs, crustaceans, false corals, seaweeds, discarded plastics and other man-made items such as lobster pots. It does not settle on rocks. It has extended its range northwards from tropical Africa into European waters and is now found on the south west coasts of England and Wales.

## Quick Facts

**Native range:** Atlantic coast of tropical Africa.

**First observed in:** West English Channel (off Plymouth) in 1994.

**Pathway:** Adults as fouling organisms on ships' hulls or as larvae in ships' ballast water.

**Observed in:** Visual observations; walk over or camera surveys, and on biota from trawl catches.



© John Bishop, MBA



© John Bishop, MBA

# Heterosigma akashiwo

Alga

## Description

An ichthyotoxic planktonic raphidophyte. *Heterosigma* cells rotate during swimming. Cells of *H. akashiwo* are slightly longer than wide, measuring 11-25  $\mu\text{m}$  in length. In Lugol fixed samples, *H. akashiwo* can be difficult to identify, as the cells disintegrate, forming a 'raspberry' shape.

**Synonyms** - *Chattonella akashiwo*, *C. inlandica*, *Entomosigma akashiwo*, *Heterosigma carterae*, *H. inlandica*, *Olisthodiscus carterae*.

## Key features



Live cell © Jacob Larsen

## Habitat and distribution

Now found worldwide. Can tolerate a wide range of conditions, through a salinity range of 2 to >50 ppt, although blooms tend to occur in coastal waters at salinities of 20-25 ppt, and a temperature range of 5°C to 30°C.

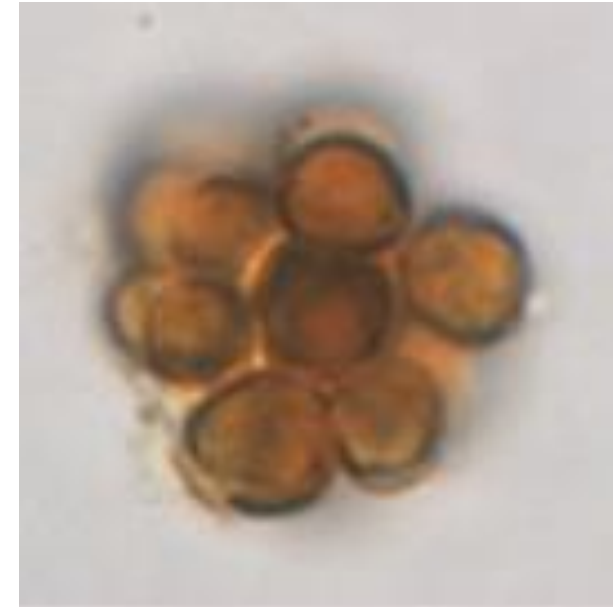
## Quick Facts

**Native range:** Japan.

**First discovered in:** Scotland in the 1980s.

**Pathway:** Ballast water.

**Observed in:** Plankton samples, watering sampling.



© Jacob Larsen

# H *Homarus americanus* (American lobster)

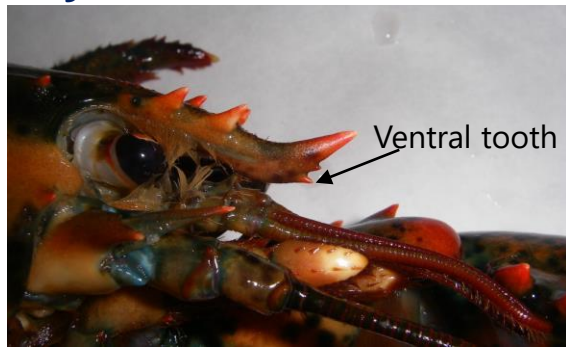
## Crustacea

### Description

This species is very similar to the European lobster, with slightly more robust features. It may obtain a body length of 50 cm or more but is typically less than 25 cm. It usually has a green/brown colour with orange, red, dark green or black speckling, with an orange underside to the claws, whereas European lobsters are blue with cream coloured undersides to the claws. There is a ventral tooth on the rostrum which is not present in the European lobster, and this is the principle identification feature.

**Synonyms** – None listed on WoRMS database.

### Key features



All images © Paul Stebbing

### Habitat and distribution

The species inhabits inshore and offshore waters from the lower intertidal down to a depth of >500 m. They may be encountered in a variety of habitats but prefer rocky habitats which offer more cover. Adults have been sporadically recovered from UK coastal waters, mainly in the English Channel but no firm evidence of established (breeding) populations has been found. There was a large (ceremonial) release of several hundred animals off Brighton in 2015.

### Quick Facts

**Native range:** Atlantic coast of North America from New Jersey to Labrador.

**First reported in:** The Solent (1988).

**Pathway:** Escapes and deliberate releases of live adults imported for human consumption. No reports of breeding in UK waters.

**Observed in:** Trawl and camera surveys.



# H *Megabalanus coccopoma* (Titan acorn barnacle)

# Crustacea

## Description

A very large barnacle which can grow to over 5 cm in diameter and height, and has a conspicuous pinkish-red colour. There are six triangular plates which form a steep-sided cone. These plates are smooth and fused together, and separated by narrow purple or white radii. The aperture at the top is relatively small and circular or oval in shape.

**Synonyms** – None listed on WoRMS database.

## Key features



© Marco Faasse

## Habitat and distribution

A tropical barnacle native to the Pacific coast of South and Central America. It is gregarious and attaches to hard substrates in coastal areas down to 100 m. It has spread northwards along the Pacific coast of North America, and to the southern Atlantic, US, Japan, Australia. In Europe its distribution is currently limited to the southern North Sea along the Belgian and French coast.

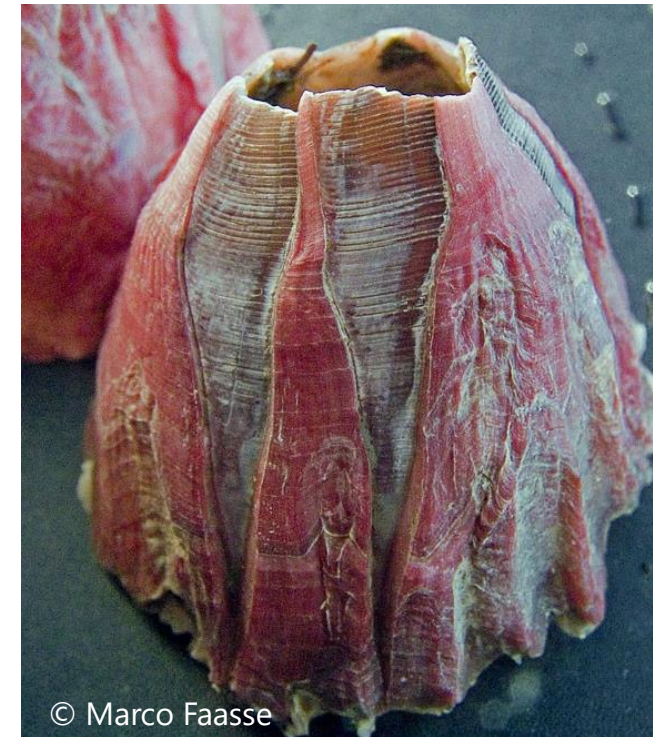
## Quick Facts

**Native range:** Pacific coast from Mexico to Ecuador.

**No observations in the UK to date** (Horizon species).

**Pathway:** Adults as fouling organisms on hulls or larvae in ballast water.

**Observed in:** Visual observations; walk over or camera surveys.



© Marco Faasse



© Marco Faasse

# H *Megabalanus tintinnabulum* (Giant purple barnacle)

# Crustacea

## Description

A very large barnacle which can grow to over 5 cm in diameter and height. The plates are almost smooth or very finely ribbed. The orifice is relatively small compared to the base (less than half the diameter). The margin of the orifice is very strongly toothed. The plates are usually coloured deep red with occasional white lines. The tergum is white while the scutum is reddish – purple.

**Synonyms** – *Balanus tintinnabulum*

## Key features

Purple rays

Narrow orifice



Plates finely ribbed

## Habitat and distribution

A tropical barnacle native to the eastern Pacific. It has now spread to the western Pacific and the Atlantic and Indian Oceans. *M. tintinnabulum* occurs in the intertidal and shallow subtidal down to 100m. A highly gregarious species, it settles quickly on man-made structures or disturbed substrates, making it a prolific fouling barnacle.

## Quick Facts

**Native range:** Eastern Pacific

**First discovered in:** Cornwall (1970s).

**Pathway:** Adults as fouling organisms on hulls or larvae in ballast water.

**Observed in:** Visual observations; walk over / camera surveys.



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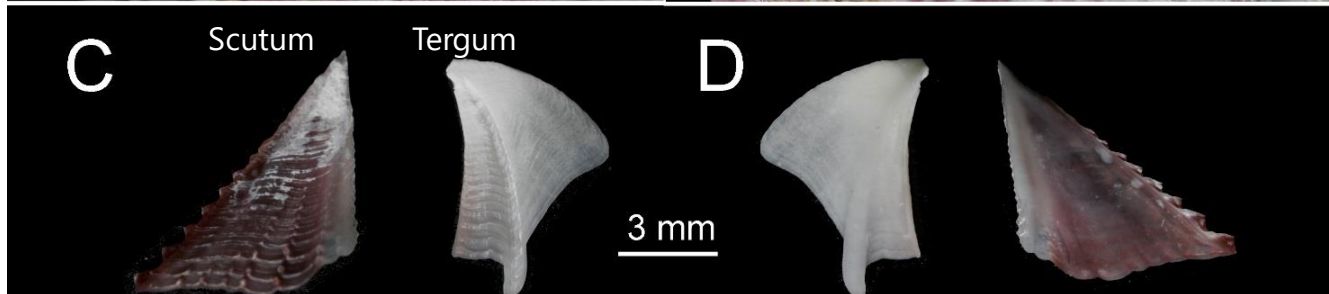
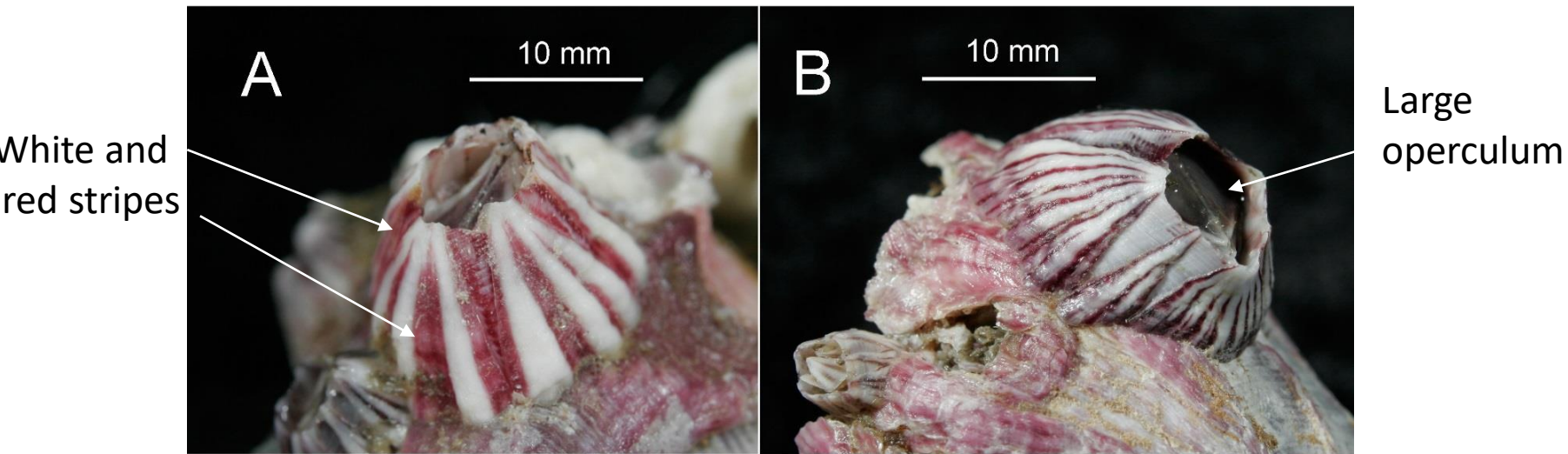
# H *Megabalanus zebra*

# Crustacea

## Description

A relatively large barnacle of up to 30mm in diameter at the base with an orifice 1/3 to 2/3 the size of the basal diameter, conic or tubulo-conic in shape. Shell plates are reddish or bluish purple with white ribs, which are more pronounced on smaller specimens. The tergae and scutae (opercular plates) are of a similar size. The inner surface of the shell plates are a rich dark brown, a feature which separates *M. zebra* from other similar species. **Synonyms** – none listed on WoRMS database.

## Key features



## Habitat and distribution

A warm water species native to the Atlantic coast of Africa and the Indian Ocean. It has also been reported in Australia. Colonises hard surfaces including man-made structures.

## Quick Facts

**Native range:** Atlantic Ocean: west coast of Africa; Indian Ocean: Bombay, Thailand.

**No observations in the UK to date** (Horizon species).

**Pathway:** Adults as fouling organisms on ships' hulls or as larvae in ships' ballast water.

**Observed in:** Visual observations; walk over or camera surveys.

# H *Mizuhopecten yessoensis* (Japanese scallop)

## Mollusca

### Description

A large scallop of up to 20 cm in width. Exterior of right valve whitish, with 21-23 radial ribs. It has prominent auricles (wings) flanking the hinge. The upper valve is flattened and the lower valve more convex. The exterior of valves show a variable mix of brown or purple with white. Interior is whitish, furrowed, with a single adductor muscle scar. *M. yessoensis* closely resembles *Patinopecten caurinus*, but differs by having a reticulated structure on the spaces between the ribs.

**Synonyms** - *Patinopecten yessoensis*, *Placopecten yessoensis*, *Pecten yessoensis*, *P. brandti*.

### Key features



### Habitat and distribution

Occurs in sheltered subtidal waters to a depth of 50 m on sand and gravel substrates where salinities exceed 26 ppt. Its native range is the North West Pacific. It has been introduced to western Canada, France, Denmark and Morocco for aquaculture but these attempts were unsuccessful and did not result in the establishment of self-sustaining populations.

### Quick Facts

**Native range:** North West Pacific from Tokyo Bay, Japan and the northern part of the Korean Peninsula to southern Sakhalin and the Kurile Islands, Russia.

**No observations in the UK to date** (Horizon species).

**Pathway:** Aquaculture introductions, ballast water.

**Observed in:** Trawls, grabs and video tows.





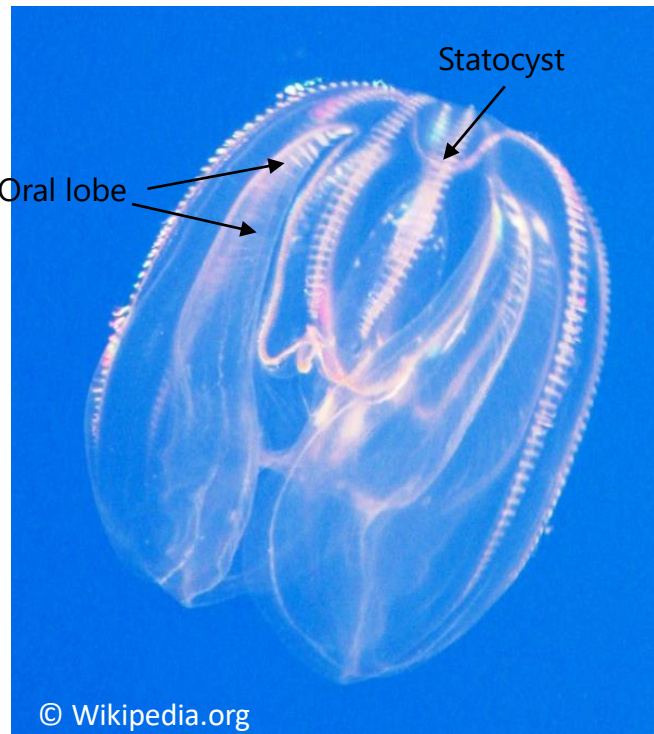
# *Mnemiopsis leidyi* (American comb jelly)

# Ctenophore

## Description

*Mnemiopsis leidyi* has an oval, slightly flattened, lobed body without obvious tentacles which may be up to 120 mm long, but is more commonly 10-40 mm. It is translucent or slightly milky with eight rows of ciliated combs (four long and four short) which are iridescent by day and may glow green at night. It is similar in appearance to *Bolinopsis infundibulum* but in *B. infundibulum*, the upper terminations of the oral lobes are midway between the mouth and the statocyst, whereas in *M. leidyi* the oral lobe reaches up to near to the statocyst. **Synonym** – *Mnemiopsis mccradyi*

## Key features



## Habitat and distribution

A pelagic species which inhabits shallow estuaries and coastal waters and can tolerate a wide range of salinities. Most abundant in the late Summer when it may form blooms of up to 1000 animals per m<sup>3</sup>. Arrived in the Black Sea in 1982 where it has caused significant problems, and has since spread to the Caspian, Baltic and North Seas.

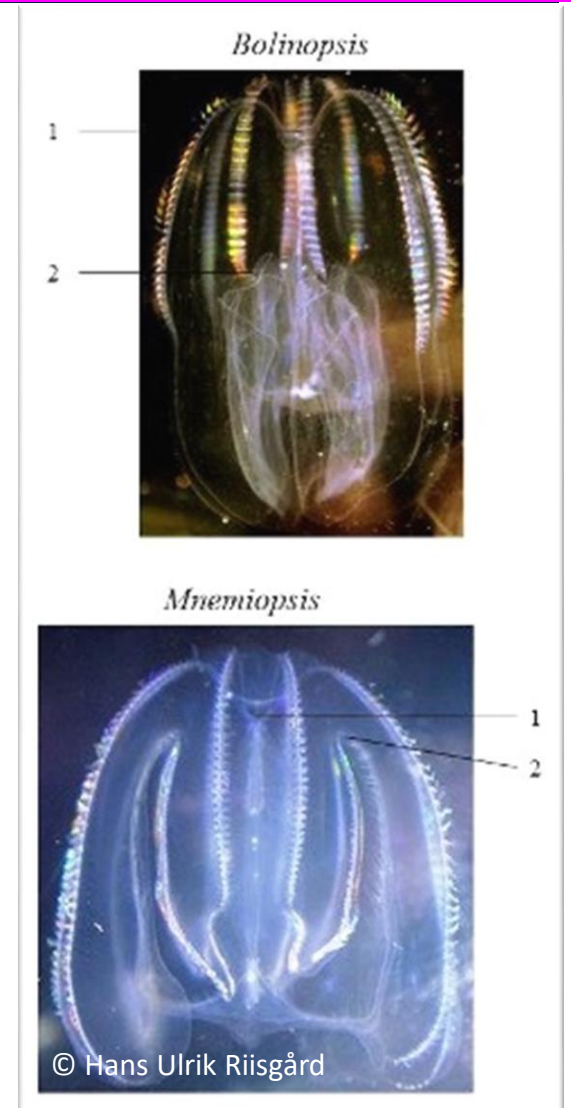
## Quick Facts

**Native range:** Atlantic coasts of North and South America from Massachusetts to southern Argentina.

**First reported in:** Ouse Estuary (2016).

**Pathway:** Ballast water.

**Observed in:** Visual observations or plankton sampling. Fragile and may break up on collection.



Difference in the position of the oral lobes (2) relative to the statocyst (1) between *Bolinopsis infundibulum* and *Mnemiopsis leidyi*

# H *Mulinia lateralis* (Dwarf surf clam)

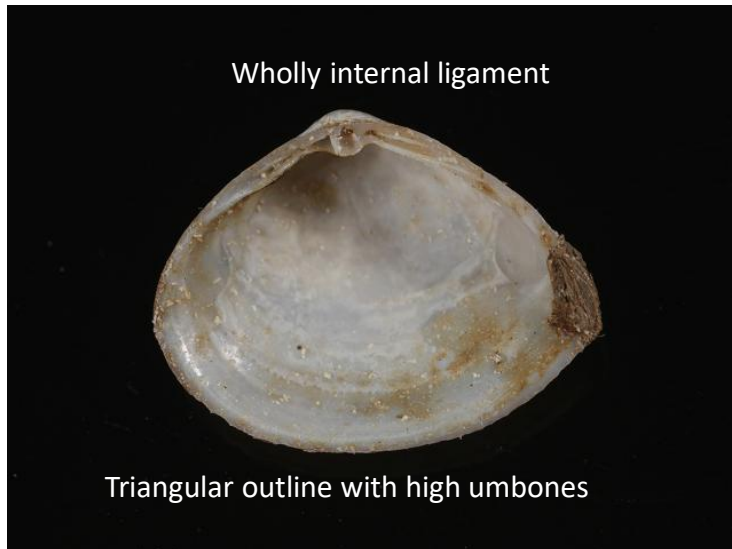
## Mollusca

### Description

A small triangular bivalve with a distinct radial ridge in the posterior portion of each valve. This shell has higher umbones and an overall narrower triangular shape than the native *Macra stultorum* with which it may be confused. Closed shells can be easily separated from similar *Macra* or *Spisula* species by the wholly internal ligament which is not visible from above.

**Synonyms** – *Macra lateralis*, *Macra rostrata*

### Key features



© www.aphotomarine.com

### Habitat and distribution

*Mulinia lateralis* is able to tolerate a very large range of salinities (5 to 80 ppt) but appears to be mainly an estuarine species. The species is very gregarious and quick to colonise after defaunation events and can tolerate poor quality water. It is native to the eastern Atlantic from the Gulf of St. Lawrence to the Gulf of Mexico, but has recently spread to Northern Europe.

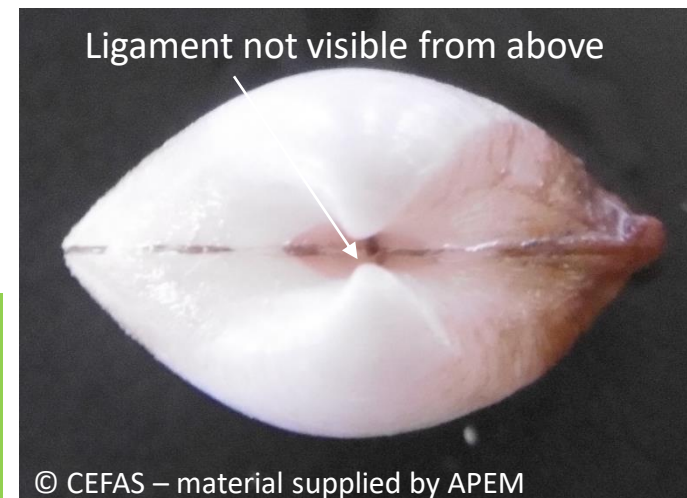
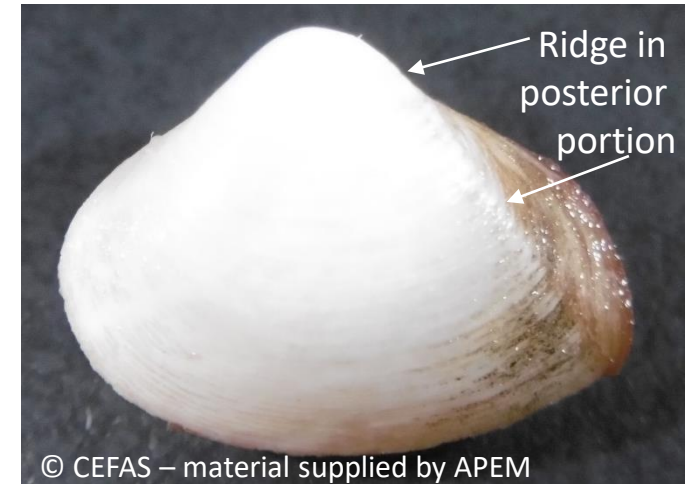
### Quick Facts

**Native range:** Eastern Atlantic.

**No observations in the UK to date** (Horizon species).

**Pathway:** Aquaculture introductions, ballast water.

**Observed in:** Trawls, grabs and video tows.



# H *Ocenebrellus inornatus* (Japanese oyster drill)

Mollusca

## Description

Shell height up to 60 mm, shell may be beige or brown but can also be orange or striped. Shell morphology can vary significantly, often making it difficult to distinguish from the native oyster drill (*Ocenebra erinacea*). The shell has a flat upper projecting shelf with a deep suture between whorls extending to the spire apex. There may be four to eleven flared vertical ridges (costae) occurring irregularly on the whorls. Siphonal canal is open along its length. *Ocenebra erinacea* has eight to nine costae which are generally not as raised. **Synonyms** – Too numerous to list.

## Key features



Image © Linda Schroeder

## Habitat and distribution

First recorded in Europe (Atlantic coast of France) in 1995, and is now found in the Netherlands, Portugal and Denmark. Inhabits the intertidal and shallow subtidal in estuaries and coastal waters down to 6 m depth, on substrates of gravel / shell / sand / mud, often associated with oyster beds.

## Quick Facts

**Native range:** North West Pacific: northern China, Korea and Japan.

**No observations in the UK to date** (Horizon species).

**Pathway:** Aquaculture.

**Observed in:** Visual observations, walkover surveys, camera surveys.



Image © Claudio Galli

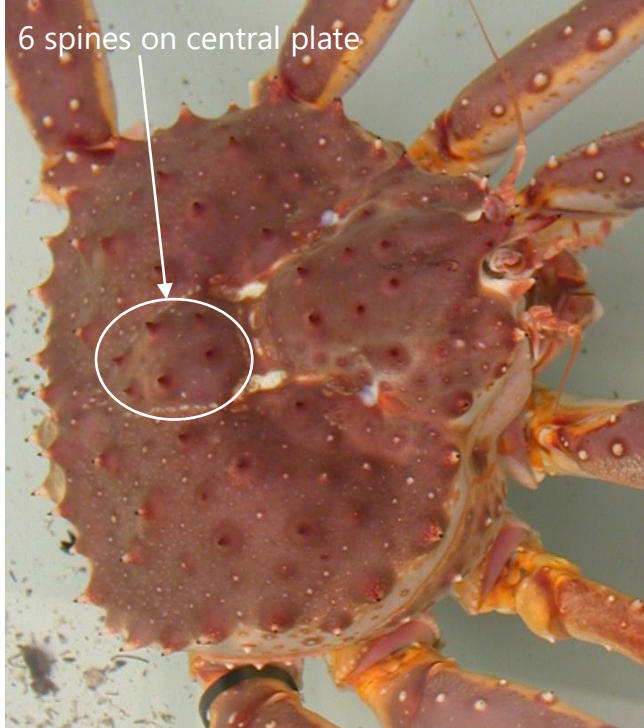
# H *Paralithodes camtschaticus* (Red king crab)

## Crustacea

### Description

A very large, long-legged crab which can grow up to 220 mm (carapace length) and weigh over 10 kg. It is red to purple in colour, and its exoskeleton is strongly calcified and covered in short spines. The right pincer is usually larger than the left. It has three pairs of walking legs, which are longer than the pincers. The fifth (posterior) pair of limbs is reduced and usually hidden in the gill chamber. The central posterior plate of the carapace has three pairs of spines compared to other *Paralithodes* species which only have two. **Synonyms** – *Lithodes japonicus*, *L. spinosissimus*, *Maja camtschatica*, *Paralithodes rostrifalcatus*, *P. camtschatica*.

### Key features



### Habitat and distribution

A cold water species. Adult king crabs tend to be found on sandy and muddy substrates in deep water (300m) but there is a shoreward migration in Winter and early Spring. They are gregarious at times. Juveniles use shallower areas of more complex substrate. They are established in the Barents Sea and have been recorded as far south as Bergen. A solitary specimen was also found in the Mediterranean in 2009.

### Quick Facts

**Native range:** North Pacific, Okhotsk and Japan Sea, Bering Sea.  
**Introduced to:** Barents Sea in the 1960s where it has since established, but yet to be reported in UK waters.  
**Pathway:** Intentional introduction, natural spread, ballast water.  
**Observed in:** Trawl and camera surveys.



All images © Lis Lindal Jørgensen, IMR, Norway

# H *Polysiphonia subtilissima*

## Red algae

### Description

A prostrate red / brown macroalga which can grow up to 12 cm tall but is generally less than 4 cm. Individuals occur in dense tufts. It has a delicate appearance and a soft flaccid texture, with slender, heavily-branched fronds and a holdfast of prostrate branches which attach using rhizoids. In UK waters a similar red alga (*Chondria* spp.) is present which has coarser fronds with less regular branching. **Synonyms** - *Polysiphonia angustissima*, *Polysiphonia subtilissima* var. *westpointensis*.

### Key features



### Habitat and distribution

This species is a warm water epiphyte found mostly in intertidal / estuarine areas, but has been found in freshwater habitats. It ranges from intertidal to shallow subtidal. Its epiphytic nature allows it to withstand strong tides, so it can be found in areas of high tidal action. Now found worldwide, along coastlines in all ocean basins, excluding Antarctica but has not been reported in the UK. It has been found upriver (in fresh water) in North America.

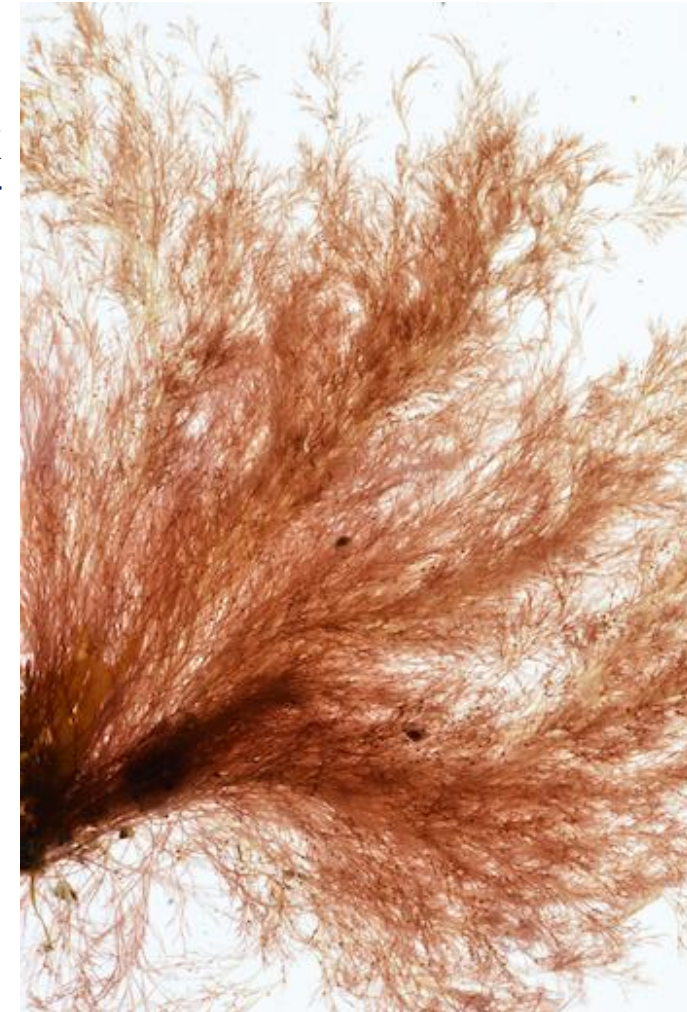
### Quick Facts

**Native range:** Northwest Pacific.

**No observations in the UK to date** (Horizon species).

**Pathway:** Ship biofouling, possibly through ballast water.

**Observed in:** Macroalgae surveys and other visual surveys.



© Michael Guiry

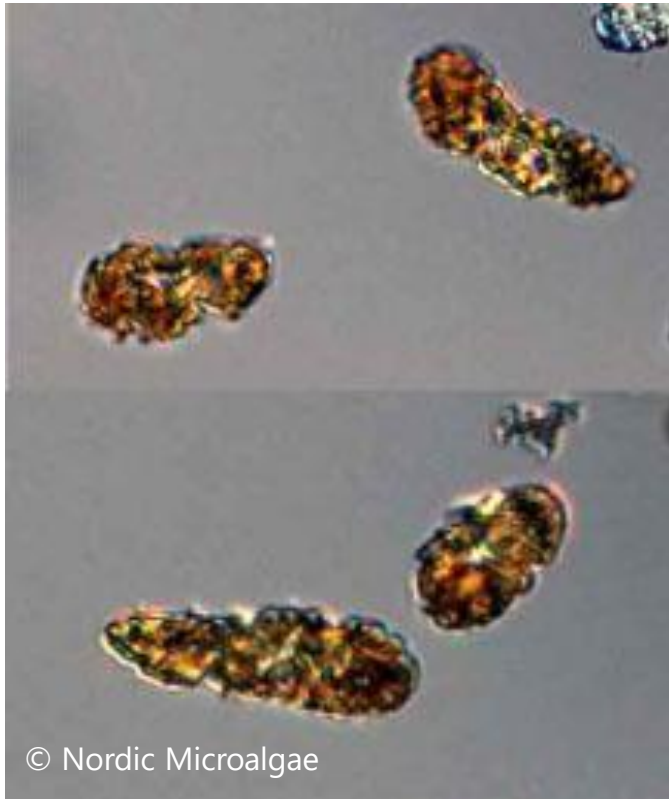
# H *Pseudochattonella verruculosa*

Alga

## Description

A heterokont planktonic alga with two flagella of different lengths. It is pear-shaped and has a number of warty protrusions around the periphery of the cell, mucocysts, which eject in response to changes in environmental conditions. Cells 12-45  $\mu\text{m}$  in diameter. Chloroplasts are pale-yellow to yellow-brown, relatively small, 2-3  $\mu\text{m}$  long and 1-2.5  $\mu\text{m}$  wide, each with a single embedded pyrenoid, located in the ectoplasm. **Synonyms** – *Chattonella verruculosa*, *Verrucophora verruculosa*.

## Key features



## Habitat and distribution

Similar cells have now been found in the North Sea, around Denmark and Sweden, in New Zealand, and off the eastern coast of North America. Mostly found in tidal estuaries, bays and brackish lagoons. *P. verruculosa* tolerates a salinity range of 15-35 ppt and temperature range of 12-22  $^{\circ}\text{C}$ .

## Quick Facts

**Native range:** Japan, North West Pacific.

**No observations in the UK to date** (Horizon species).

**Pathway:** Ballast water.

**Observed in:** Phytoplankton surveys.



© Cawthron Institute



© Cawthron Institute

# *Pseudodiaptomus marinus* (Copepod)

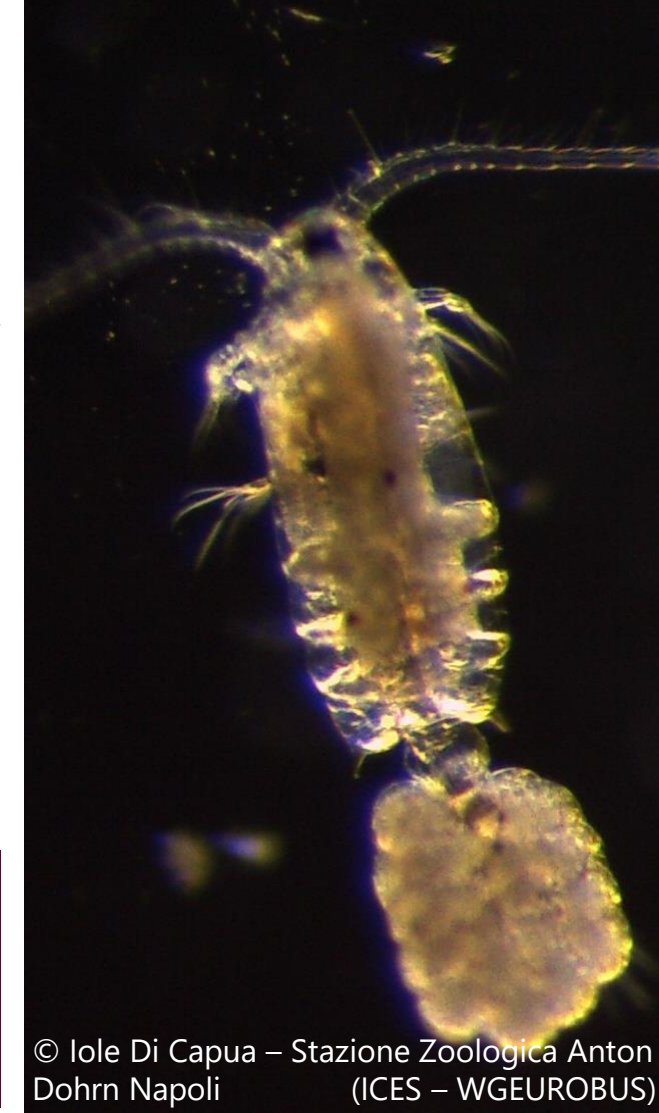
## Crustacea

### Description

A copepod between 1.3 – 1.8 mm in length (female 1.3-1.5 mm; male 1.3-1.8 mm) they have translucent, bilaterally symmetrical bodies, and can be differentiated from closely-related species by the appearance of the biramous exopod on pereopod 5 in males: the exopod is three segmented, with a distinctive sickle-shaped third article and forked process extending from the first article.

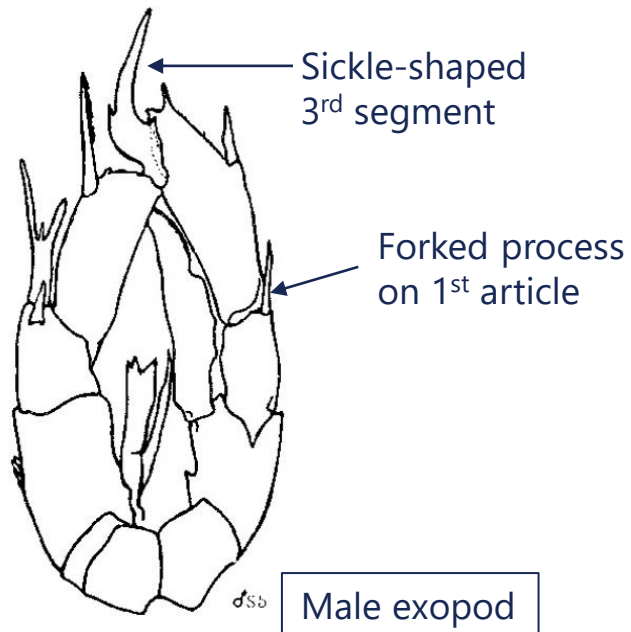
**Synonyms** – none.

Live adult female with egg sacs attached



© Iole Di Capua – Stazione Zoologica Anton Dohrn Napoli (ICES – WGEUROBUS)

### Key features



### Habitat and distribution

Characteristic of coastal waters and estuaries, *P. marinus* have a very wide tolerance of salinities (4 – 44 ppt) and water temperatures (8 - 37° C). Adults are often found clinging to hard surfaces. The species mate in the water column but when carrying eggs are normally found close to the seafloor. *P. marinus* was originally described from Japanese waters, but has spread to the west coast of America and the Northeast Atlantic.

### Quick Facts

**Native range:** Western Pacific.

**First discovered in:** Southern North Sea (2011).

**Pathway:** Ships ballast water.

**Observed in:** Water and plankton samples.

# H *Rapana venosa* (Asian Rapa Whelk)

Mollusca

## Description

A large gastropod mollusc up to 18 cm long, larger than any native marine snails. The shell is heavy, strongly sculptured with knobby and rounded decoration. The spire is short, less than half the length of the aperture. External colouration is usually grey with dark veins. The shell opening is large and oval with small teeth on the outer lip and a short, open siphonal canal. The large heavy shell, grey on the outside and brilliant orange on the inside makes this species very distinctive.

**Synonyms** – *Purpura venosa*, *Rapana thomasiana*, *R. pontica*, *R. pechiliensis*, *R. marginata*.

## Key features



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## Habitat and distribution

It is usually found on or within soft sediment, and sometimes on hard surfaces at depths of 3-20 m, with larger animals preferring softer substrata. It congregates on hard surfaces (including man-made structures) for spawning during late Spring / Summer. Well established in the Black Sea. Occasional records from UK waters, but the nearest established population is in Brittany.

## Quick Facts

**Native range:** Sea of Japan, Yellow Sea, Bohai Sea, East China Sea.

**First report in:** UK waters in 2005 (Central North Sea).

**Pathway:** Aquaculture, ballast water, seafood trade.

**Observed in:** Camera surveys and other observational surveys, trawl surveys.





# **H** *Rhopilema nomadica* (Nomad jellyfish)

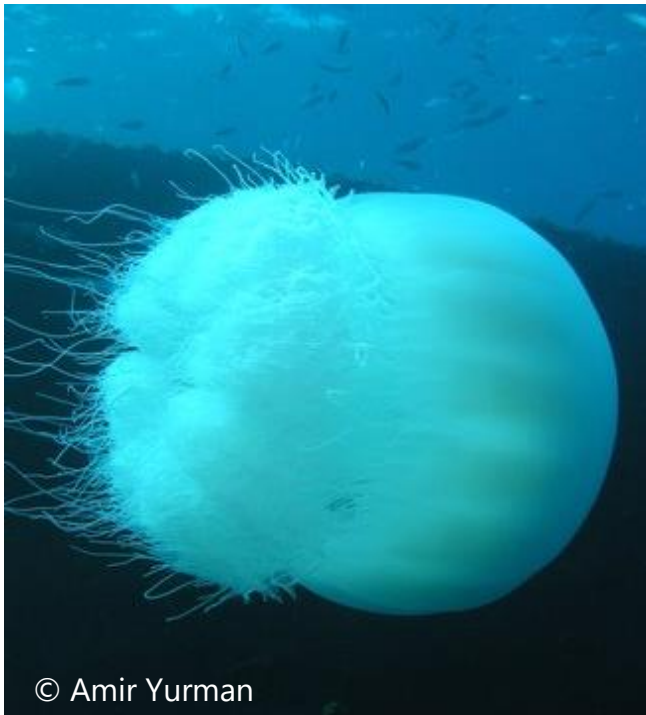
Cnidaria

## Description

This relatively solid, large jellyfish is light blue in colour with tiny granules on the bell. The bell is rounded and can range from 10 to 90 cm in diameter, but is usually 40–60 cm. Hanging from the centre are eight large mouth-arms divided at mid-length into two ramifications with numerous long filaments. May form dense aggregations in coastal areas during the summer. It is most similar to the Barrel jellyfish (*Rhizostoma octopus*) but its size, shape and coloration makes it easily distinguishable from native species. It can deliver a painful sting.

**Synonyms** - None listed on WoRMS.

## Key features



© Amir Yurman

## Habitat and distribution

A warm water epipelagic species native to the east coast of Africa and the Red Sea. It entered the Mediterranean through the Suez canal in the late 1970s and has spread as far as Greece. Blooms in the eastern Mediterranean have caused disruption to fishing, water sports and have even blocked power station intakes. It is considered likely that it will spread further west along the North African coast.

## Quick Facts

**Native range:** East Africa, Red Sea.

**No observations in the UK to date** (Horizon species).

**Pathway:** Suez canal, then natural spread within the Mediterranean.

**Observed in:** Intertidal surveys, trawl samples.



© wikipedia.org

# *Schizoporella japonica* (Orange ripple bryozoan)

## Bryozoan

### Description

Forms bright orange rigid calcified but fragile encrusting colonies up to 20 cm across. Colonies form a sheet often with rounded lobes, sometimes with erect portions formed by back-to-back growth. Individuals are rectangular or polygonal and 0.75 mm in length, and are separated by a deep groove. The orifice is broader than long, semi-circular on the distal end, with a broad sinus at the other end. Individuals sometimes have one or two avicularia to the side of the orifice, and may also have a larger frontal avicularium. Ovicells are round and sit on the frontal walls of the individuals.

**Synonyms** – None listed on WoRMS.

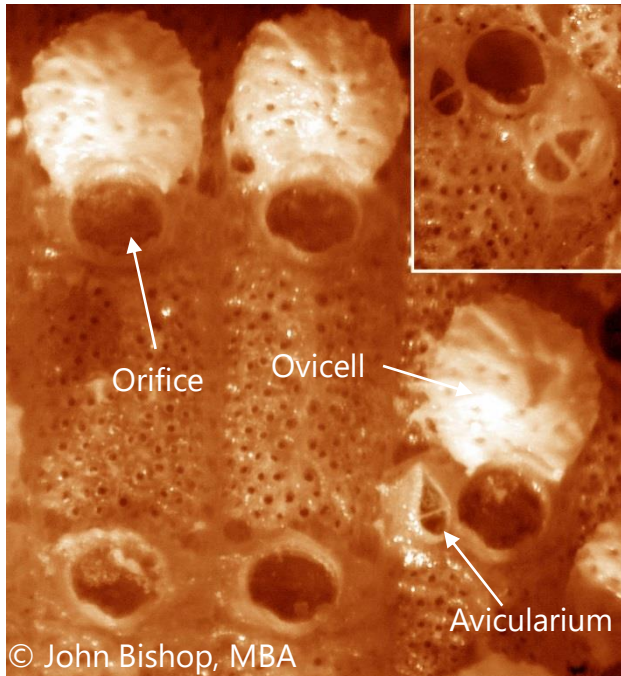


© John Bishop, MBA



© Christine Wood, MBA

### Key features



Orifice

Ovicell

Avicularium

© John Bishop, MBA

### Habitat and distribution

Native to the North Pacific, it was first recorded in the UK in North Wales in 2010. It has since spread around the Scottish coast and has also been observed in Plymouth. It is usually found in harbours and marinas, on hard substrates such as pilings and hulls, or intertidally on rocks, boulders and on bivalve shells.

### Quick Facts

**Native range:** North West Pacific from China to Japan.

**First discovered in:** Holyhead Marina (2010).

**Pathway:** Hull fouling, aquaculture.

**Observed in:** Visual surveys (camera, walkover) particularly in marinas.

# *Sargassum muticum* (Wireweed)

## Brown algae

### Description

*Sargassum muticum* is a large olive-brown seaweed with fronds normally 1 metre in length, but in favourable conditions can grow to 8.5 metres long. A tough, wiry main stem about 2 mm in diameter bears a series of secondary branches, giving it a characteristic 'washing line' appearance when held out of water. The branches have small, flattened, toothed oval leaflets and spherical gas bladders.

**Synonyms** – *Sargassum (Bactrophyucus) muticum*, *Sargassum kjellmanianum* f. *muticum*

### Key features



### Habitat and distribution

Grows intertidally and subtidally, particularly in rockpools and in shallow water, on hard surfaces in shallow coastal waters and in estuaries. Originally from the North West Pacific, it is now established around the coast of continental Europe, from the Mediterranean to the Baltic as well as the Atlantic coast of North America. In the UK it is distributed widely along the coasts of south and west England, Wales, Northern Ireland and western Scotland.

### Quick Facts

**Native range:** North West Pacific: Japan, Russia, Korea and China.

**First discovered in:** Isle of Wight (1971).

**Pathway:** Aquaculture, hull fouling.

**Observed in:** Macroalgae surveys.



# *Styela clava* (Leathery sea squirt)

Chordata

## Description

A brown, solitary sea squirt up to 20 cm tall, attached by a small flat holdfast at the base of a narrow stalk, and with two siphons close together at the free end. The surface is tough and leathery, with folds and swellings. The siphons show brown stripes when open.

**Synonyms** - *Botryorchis clava*, *Styela barnharti*, *S. mammiculata*, *Tethyum clava*.

## Key features



## Habitat and distribution

The leathery sea squirt is established from the Clyde (Scotland) around the south coast of England to the Humber, the northern limits appearing relatively stable. Attached to solid surfaces in shallow water, especially in harbours and marinas but also on wrecks and natural rock bottoms. Very well established in the UK, and present on the Atlantic coast of Europe from northern Denmark to southern Portugal. Also introduced on both seaboards of North America, in Australia, and in New Zealand.

## Quick Facts

**Native range:** North West Pacific: Japan, Korea, Russia and China.

**First discovered in:** Plymouth Sound (Devon) and Lynher Estuary (1953).

**Pathway:** Vessel hulls possibly returning from Korean war to Plymouth naval dockyard.

**Observed in:** Observational surveys, trawls.



# *Telmatogeton japonicus* (Marine splash midge)

Insecta

## Description

*Telmatogeton japonicus* may be observed either as larvae, pupae (and empty pupa cases) or adults. It is difficult to identify chironomid larvae to species and there are four morphologically distinct larval instars. Pupae are about 7 mm long and have eight apparent abdominal segments. The thorax and terminal disc are golden to golden-brown. Adults are 4 mm long with a brownish-black body with a slightly frosted appearance. Wings are a smoky colour and legs are brown. Microscopic examination is required for positive identification. Larval tubes may be quite conspicuous, in the splash zone of man-made offshore structures amongst algal growth.

**Synonyms** – None listed on WoRMS.

## Key features



## Habitat and distribution

In European waters larvae and pupae live in tubes on hard surfaces within the splash zone where they graze on algae. They can form dense colonies on offshore man-made structures (e.g. wind farms) where predators are absent, but have also been observed on rocky shorelines. Adults only live for a few days. Probably arrived on ships' hulls and are now widespread in Northern Europe.

## Quick Facts

**Native range:** Japan, Australasia and possibly Hawaii.

**First discovered in:** St. Kilda, Outer Hebrides, 2010.

**Pathway:** Vessel hulls, natural dispersal.

**Observed in:** Biological surveys of the splash zone, particularly at offshore structures such as wind farm pilings

Larva (missing part of abdomen)



© Torbjorn Ekrem

Pupa



# *Undaria pinnatifida* (Japanese kelp, Wakame)

## Brown algae

### Description

A large golden-brown kelp reaching 1-3 metres in length. It has a branched holdfast just above which there is a ribbonlike reproductive frill with wavy edges. The blade is broad, flattened and lance-like in shape with a distinctive flattened midrib. The margins of the blade are wavy and ribbon-like at the base. There are similar species in UK waters but none has the combination of the branched (rather than knobby) holdfast, reproductive frills and flattened midrib.

**Synonyms** – Too numerous to list.

### Key features



### Habitat and distribution

Grows on hard surfaces (natural or man-made) from the low intertidal to a depth of 18 m. It can be found on sheltered or exposed coasts. It was introduced to France in 1971 and has since spread to the south coast of the UK and the Channel Islands.

### Quick Facts

**Native range:** Temperate regions of Japan, China and Korea.

**First discovered in:** The Solent (1994).

**Pathway:** Aquaculture, ballast water, hull fouling.

**Observed in:** Macroalgae surveys and other visual surveys.



# *Urosalpinx cinerea* (American oyster drill)

## Mollusca

### Description

*Urosalpinx cinerea* a tall yellowish, orange or grey spiral shell up to 40 mm long with up to 8 turns. It has rounded vertical ribs (10-12 in the final turn) and numerous finer concentric spiral ridges. The shell opening is oval with a short open canal at the base. An orange / yellow plate covers the opening when the animal withdraws. The native Sting Winkle (*Ocenebra erinacea*) is similar but has a closed siphonal canal in older specimens, the margins of the opening are folded over, and it has a rougher shell with uneven sculpturing. **Synonyms** – *Fusus cinereus*, *Urosalpinx cinerea* var. *follyensis*

### Key features



### Habitat and distribution

Prefers muddy substrates in lower intertidal and shallow subtidal areas in estuaries and coastal waters. Often associated with bivalve mollusc beds, upon which it feeds. Its distribution in the UK is limited to Kent and Essex as natural dispersal is slow. Populations were seriously affected by tributyl tin pollution during the 1980s.

### Quick Facts

**Native range:** Atlantic coast of North America (Cape Cod to Florida).

**First discovered in:** Essex oyster grounds (1927).

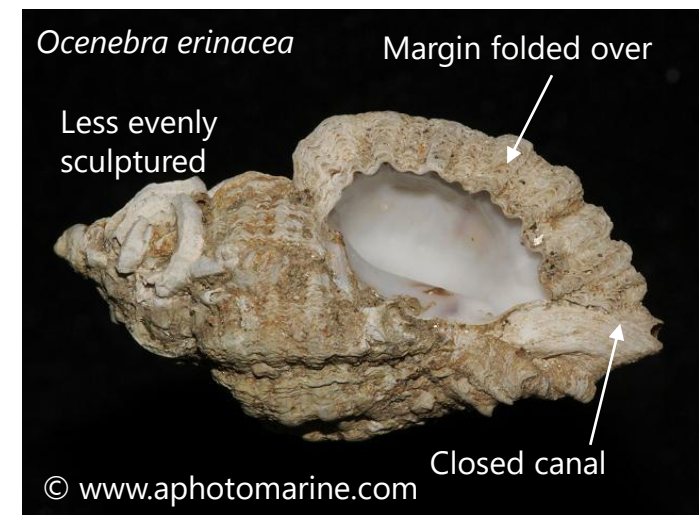
**Pathway:** Aquaculture.

**Observed in:** Visual observations; walkover surveys, camera surveys.

### American Oyster Drill



### Native Sting Winkle



# *Watersipora subatra* (Red ripple bryozoan)

## Bryozoan

### Description

Rigid but fragile encrusting colonies up to several cm across, formed of 1 mm-long individuals arranged as a sheet. Colonies often form rounded lobes, sometimes with erect portions formed by back-to-back growth. Colour is orange-red around the growing edges, with inner (older) parts of the colonies sometimes turning darker (maroon to black). Individuals are elongated, with a rounded dark blackish spot at the end (the operculum).

**Synonyms** – *Watersipora edmondsoni*.



### Key features



© John Bishop, MBA

### Habitat and distribution

Attaches to solid surfaces (particularly man-made surfaces) in lower intertidal and shallow subtidal areas. May also be found on mussels and in France, it has been observed on boulders in lower intertidal areas. It was first recorded in Plymouth in 2008 and has since been observed in a number of marinas along the south coast of England.

### Quick Facts

**Native range:** Unknown, but is becoming common in various regions around the world on temperate coasts.

**First discovered in:** Plymouth (2008).

**Pathway:** Aquaculture, hull fouling.

**Observed in:** Visual observations (visual and camera surveys) especially in marinas.