

## What do we know about these eight introduced species?

Welcome to our survey

Firstly thank you very much for taking the time to contribute to this work. With your help, we aim to gather information about the environmental and socio-economic impacts associated with eight non-native species (NNS) listed below, particularly information which hasn't yet reached the public domain. In addition to reviewing the known impacts of these selected species, our main aim is to gather information on any potential impacts on protected marine features (MPAs), such as a reduction in the condition of protected features caused by these specific NNS. Furthermore, we wish to collate evidence of impacts on local business to better inform management decisions for all marine stakeholders.

Thank you for taking time to answer the following questions.

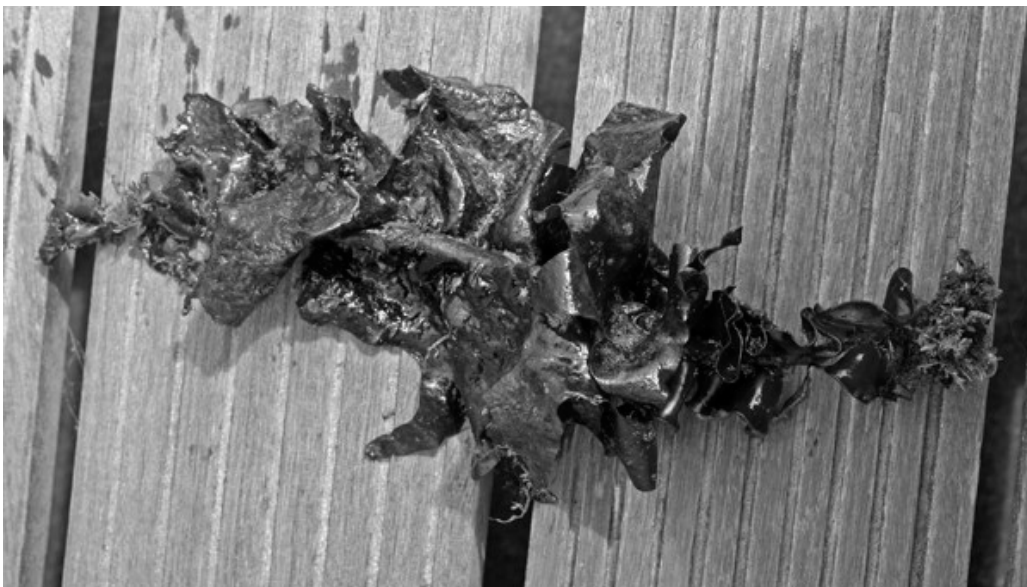
## What do we know about these eight introduced species?

\* 1. Have you seen or had any experience with *Undaria pinnatifida* (Wakame)?

Yes

No

If yes please provide a few details



Fully grown specimen of *Undaria pinnatifida* (image © Adrian Gittenberger, GiMaRIS). Large brown macroalga with a frond length of around 1 - 2 m, spore producing stage of the lifecycle (i.e. sporophyte) has a pinnately-divided blade with distinct midrib, compressed stipe and fibrous holdfast.

Pathways of spread: Hitchhiking on other aquaculture species (e.g. oysters) or on vessel hulls.

Habitat and ecology: *Undaria pinnatifida* grows on hard surfaces (i.e. rocks, artificial structures) from the lowest inter-tidal to a maximum sub-tidal depth of 8 – 10 m. This species is an annual algal, with the macroscopic sporophyll stage surviving less than 12 months. The optimum growth period is when seawater temperatures are between 5 – 13 oC.

Ecological Impacts: This species has been shown to reduce native species diversity in some locations through competition for both resources and through shading.

**What do we know about these eight introduced species?**

2. Are you aware of the presence of *U. pinnatifida* within any Marine Protected Area (MPAs)? If so could you provide details of

The MPA where species was recorded.

The date when first recorded.

The habitat(s) or feature(s) where the species was observed.

Any changes that were observed in the habitat(s) or feature(s) associated with the species presence.

Whether you believe the conservation objectives of the MPA have been affected by the presence of this species. If so please give details.

The spatial influence of the species within the MPA. Was it very localised (i.e. a few metres) or is it widespread (i.e. extending over several kilometres)?

The time-scale of influence of the species within the MPA (i.e. length of any observed changes <1 year, 2-5 years or > 5 years)

Any reports or other documents that you are aware of relating to this species.

Any other comments.

3. Are you aware of any instances where *U. pinnatifida* have produced a 'socio-economic' impact in your area? If so could you provide details of:

The location of the observed impact.

The date when first recorded and the date when impact occurred.

The business or stakeholder impacted.

The process through which the impact occurred (e.g. increased maintenance costs).

Any known costs (financial or otherwise) associated with the impact.

The time-scale of the impact (i.e. length of observed impact <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments.

## What do we know about these eight introduced species?

\* 4. Have you seen or had any experience with *Ficopomatus enigmaticus* (Trumpet tube worm)?

Yes

No

If yes please provide a few details



Close-up of *Ficopomatus enigmaticus* tubes, showing flanges and flaring openings on some tubes (image © Leslie Harris, NHMLAC). This reef building polychaete is the only member of the genus inhabiting temperate waters and is characterised by a symmetrical body, operculum and collar chaetae which are coarsely serrated and simple in structure.

Pathways for spread: Vectors for spread are hull fouling, ship ballast (either in the water or sediment), and aquaculture (as a hitchhiker during stock transfer).

Habitat and ecology: This species typically inhabits brackish water environments (salinity 10 – 30 ppt optimum), particularly in sheltered regions such as estuaries, inland saline lagoons and inshore marine environments, such as ports and harbours. The larvae typically settle on hard substrates and in environments with calm conditions and shallow waters, this species can build individual reefs up to 7 m in diameter.

Ecological impacts: *Ficopomatus enigmaticus* has a high growth rate, high fecundity and high larval retention in semi-enclosed, brackish waters. The presence of this species will lead to physico-chemical changes in the environment, including altering the hydrodynamic flow regime of an area, leading to increased sediment deposition, the development of anoxic sediments and the hyper-accumulation of nutrients and organic materials.

**What do we know about these eight introduced species?**

5. Are you aware of the presence of *F. enigmaticus* within any Marine Protected Area (MPAs)? If so could you provide details of:

The MPA where species was recorded.

The date when first recorded.

The habitat(s) or feature(s) where the species was observed.

Any changes that were observed in the habitat(s) or feature(s) associated with the species presence.

Whether you believe the conservation objectives of the MPA have been affected by the presence of this species. If so please give details.

The spatial influence of the species within the MPA. Was it very localised (i.e. a few metres) or is it widespread (i.e. does it extend over several kilometres)?

The time-scale of influence of the species within the MPA (i.e. length of any observed changes <1 year, 2-5 years or > 5 years).

Please provide links to suitable reports.

Any other comments.

6. Are you aware of any instances where *F. enigmaticus* have produced a 'socio-economic' impact in your area? If so could you provide details of:

The location of the observed impact.

The date when first recorded and the date when impact occurred.

The business or stakeholder impacted.

The process through which the impact occurred (e.g. increased maintenance costs).

Any known costs (financial or otherwise) associated with the impact.

The time-scale of the impact (i.e. length of observed impact <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments.

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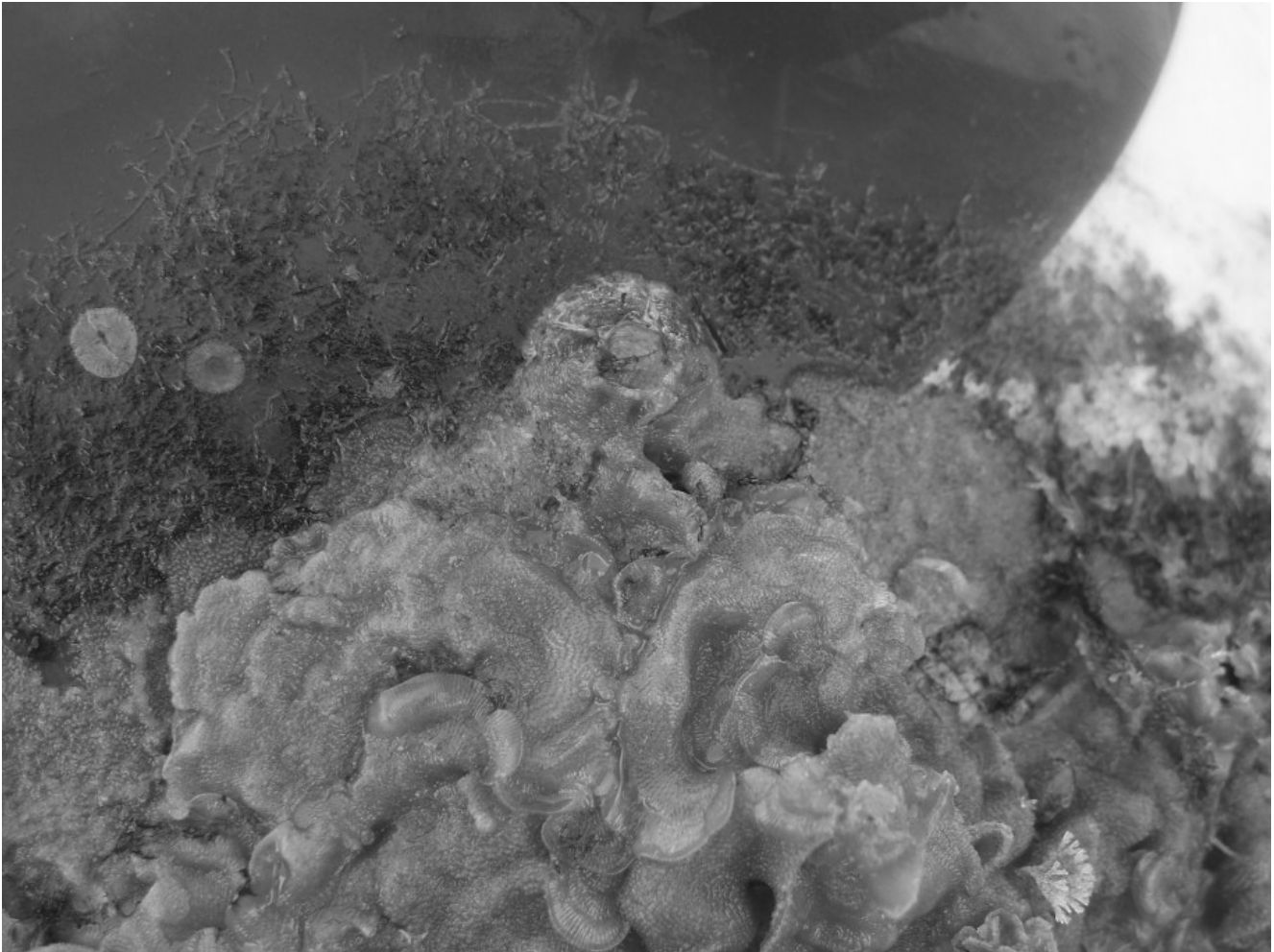
\* 7. Have you seen or had any experience with *Schizoporella japonica* (Bryozoan)?

Yes

No

If yes please provide a few details





Orange encrusting bryozoan, *Schizoporella japonica* on mooring buoy (image © Jirina Stehlikova, SAMS). Bright orange-red, calcified, encrusting bryozoan; forming extensive sheets that grow into foliose lobes.

Pathways for spread: *S. japonica* introductions have been reported in association with aquaculture activities such as oyster transport in addition to ship and boat hull fouling.

Habitat and ecology: Discovered initially in Holyhead marina in north Wales in 2010, and then in Stromness and Kirkwall marinas in Orkney. It has now spread around the Scottish coast, and has been found in marinas in Plymouth. Worldwide it is usually found in harbours and marinas, on hard substrates such as pilings and hulls; or intertidally on rocks, boulders and on shellfish such as oysters and mussels. It is tolerant of salinities between 18 to 34 ppt and temperatures between 7 to 19°C.

Ecological impacts: *S. japonica* is a competitor for space and is known to inhibit the growth of adjacent species.

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8. Are you aware of the presence of *S. japonica* within any Marine Protected Area (MPAs)? If so could you provide details of:

The MPA where species was recorded.

The date when first recorded.

The habitat(s) or feature(s) where the species was observed.

Any changes that were observed in the habitat(s) or feature(s) associated with the species presence.

Whether you believe the conservation objectives of the MPA have been affected by the presence of this species. If so please give details.

The spatial influence of the species within the MPA. Was it very localised (i.e. a few metres) or is it widespread (i.e. does it extend over several kilometres)?

The time-scale of influence of the species within the MPA (i.e. length of any observed changes <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments

9. Are you aware of any instances where *S. japonica* have produced a 'socio-economic' impact in your area? If so could you provide details of:

The location of the observed impact.

The date when first recorded and the date when impact occurred.

The business or stakeholder impacted.

The process through which the impact occurred (e.g. increased maintenance costs).

Any known costs (financial or otherwise) associated with the impact.

The time-scale of the impact (i.e. length of observed impact <1 year, 2-5 years or > 5 years)

Any reports or other documents that you are aware of relating to this species.

Any other comments.

## What do we know about these eight introduced species?

\* 10. Have you seen or had any experience with *Sargassum muticum* (Wireweed)?

YES

No

If yes please provide a few details



*Sargassum muticum* (image © Elizabeth Cook, SAMS). Large brown macroalgae with thallus of up to 10 m in length. Fibrous, circular holdfast up to 1.5 cm in diameter, supports a main axis which is typically solitary.

Pathway for spread: Primary introductions of *Sargassum muticum* have been linked to the stock movements of the Pacific oyster *Crassostrea gigas* for aquaculture purposes, both to the Pacific coast of North America and to Europe and via the entanglement of plants around submerged vessel structures or attachment to vessel hulls.

Habitat and ecology: *Sargassum muticum* is predominantly found in inshore marine environments, where it occurs from the inter-tidal zone, typically in rock pools, down to a depth of 20 m. It has also been found to occur in estuaries and lagoons, however, it has been suggested that *S. muticum* will be unable to reproduce if salinity is consistently <15 ppt and may be unable to compete effectively if salinity is <25 ppt. It is generally found in sheltered locations protected from wave action, where it prefers to attach to hard substratum, including boulders, stones, wood, mooring lines and harbour wharves.

Ecological Impact: Significant habitat modification has resulted from the extensive colonisation of areas by *Sargassum muticum*, leading to changes in resident infaunal communities. Studies on the impact of this species on seagrass beds have been conflicting, but more recent investigations have found that this alga can become established in sea grass beds by colonising the sea grass matrix itself rather than the unsuitable underlying sandy substratum.

**What do we know about these eight introduced species?**

11. Are you aware of the presence of *S. muticum* within any Marine Protected Area (MPAs)? If so could you provide details of:

The MPA where species was recorded.

The date when first recorded.

The habitat(s) or feature(s) where the species was observed.

Any changes that were observed in the habitat(s) or feature(s) associated with the species presence.

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The time-scale of influence of the species within the MPA (i.e. length of any observed changes <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments.

12. Are you aware of any instances where *S. muticum* have produced a 'socio-economic' impact in your area? If so could you provide details of:

The location of the observed impact.

The date when first recorded and the date when impact occurred.

The business or stakeholder impacted.

The process through which the impact occurred (e.g. increased maintenance costs).

Any known costs (financial or otherwise) associated with the impact.

The time-scale of the impact (i.e. length of observed impact <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments.

## What do we know about these eight introduced species?

\* 13. Have you seen or had any experience with *Hemigrapsus sanguineus* (Asian shore crab)?

YES

No

If yes please provide a few details



Asian shore crab (image *Hemigrapsus sanguineus* © Martin Burke). A small crab with a square carapace (shell) up to 4.5 cm, variable in colour from orange-brown to greenish-black.

Pathways for spread: Asian shore crab larvae are primarily carried through ships' ballast water and subsequently extended its range through natural larval dispersal by water currents. Hull fouling and oyster transportation are also possible vectors for this species.

Habitat and ecology: The Asian shore crab inhabits estuarine and marine habitats and occurs 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.

Environmental impact: Significant reductions in common shore crab abundance and mussel density have been reported where the Asian shore crab has achieved high densities in mainland Europe, and similar effects across the broader community may be expected. Recruits and juveniles of other invertebrates including snails, barnacles and polychaetes may also be threatened due to increased predation.

**What do we know about these eight introduced species?**

14. Are you aware of the presence of *H. sanguineus* within any Marine Protected Area (MPAs)? If so could you provide details of:

The MPA where species was recorded.

The date when first recorded.

The habitat(s) or feature(s) where the species was observed.

Any changes that were observed in the habitat(s) or feature(s) associated with the species presence.

Whether you believe the conservation objectives of the MPA have been affected by the presence of this species. If so please give details.

The spatial influence of the species within the MPA. Is it very localised (i.e. a few metres) or is it widespread (i.e. does it extend over several kilometres)?

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Any reports or other documents that you are aware of relating to this species.

Any other comments.



15. Are you aware of any instances where *H. sanguineus* have produced a 'socio-economic' impact in your area? If so could you provide details of:

The location of the observed impact.

The date when first recorded and the date when impact occurred.

The business or stakeholder impacted.

The process through which the impact occurred (e.g. increased maintenance costs).

Any known costs (financial or otherwise) associated with the impact.

The time-scale of the impact (i.e. length of observed impact <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments.

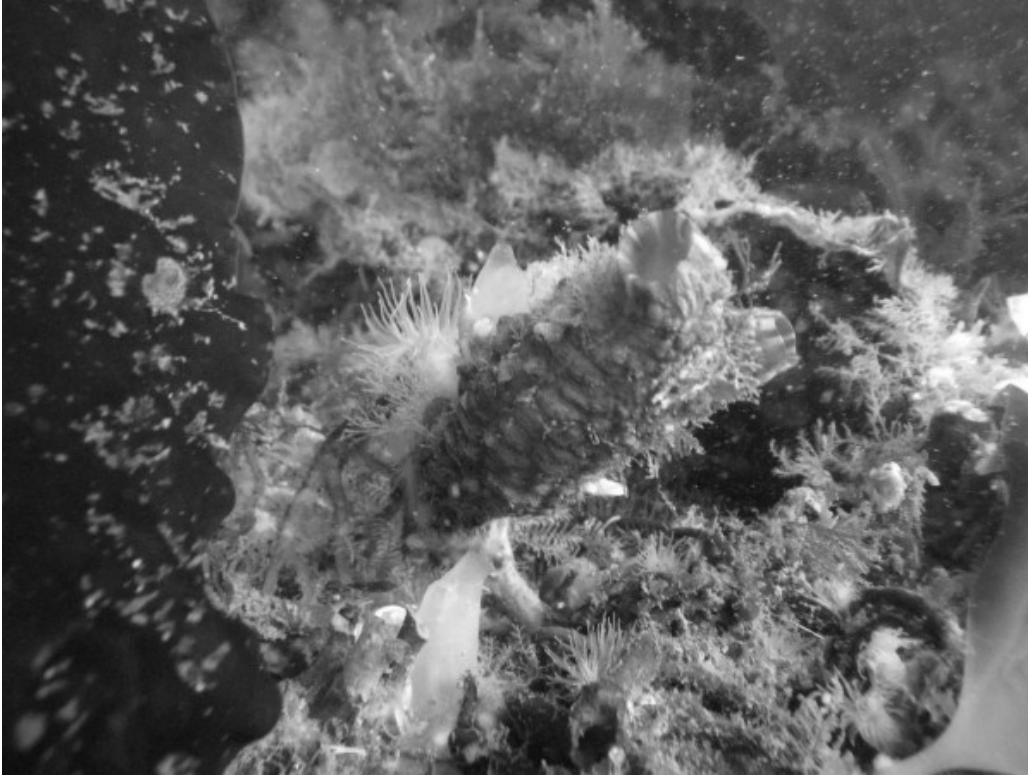
## What do we know about these eight introduced species?

\* 16. Have you seen or had any experience with *Styela clava* (leathery sea squirt)?

YES

No

If yes please provide a few details



The clubbed tunicate *Styela clava* (image © Christine Beveridge, SAMS). A brown, non-colonial (unitary or 'solitary') sea squirt up to 20 cm tall.

Pathways for spread: *Styela clava* is thought to have been originally introduced through the hull fouling of naval vessels that visited Korea and were subsequently repaired in the UK. A separate introduction in Europe may have taken place with the importation of *Crassostrea gigas* oysters from west coast of USA in 1970s.

Habitat and ecology: *S. clava*, attaches to solid surfaces in shallow water, especially in harbours and marinas but also on wrecks and natural rock bottoms. *S. clava* can establish populations within temperatures ranging from -2 to 23°C but can only reproduce at temperatures >14°C. Adults can tolerate salinities over 10 ppt whilst larvae can tolerate salinities over 18 ppt. Adults can survive out of water for up to 3 days.

Environmental Impact *Styela clava* is a relatively large organism that can reach high densities, sometimes being the dominant species in shallow sheltered habitats. The species might thus have a negative effect on the abundance and habitat occupancy of other shallow-water suspension feeding sessile invertebrates. However, it is not clear whether this would cause the local extinction of any species.

**What do we know about these eight introduced species?**

17. Are you aware of the presence of *S. clava* within any Marine Protected Area (MPAs)? If so could you provide details of:

The MPA where species was recorded.

The date when first recorded.

The habitat(s) or feature(s) where the species was observed.

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Any reports or other documents that you are aware of relating to this species.

Any other comments.

18. Are you aware of any instances where *S. clava* have produced a 'socio-economic' impact in your area?

If so could you provide details of:

The location of the observed impact.

The date when first recorded and the date when impact occurred.

The business or stakeholder impacted.

The process through which the impact occurred (e.g. increased maintenance costs).

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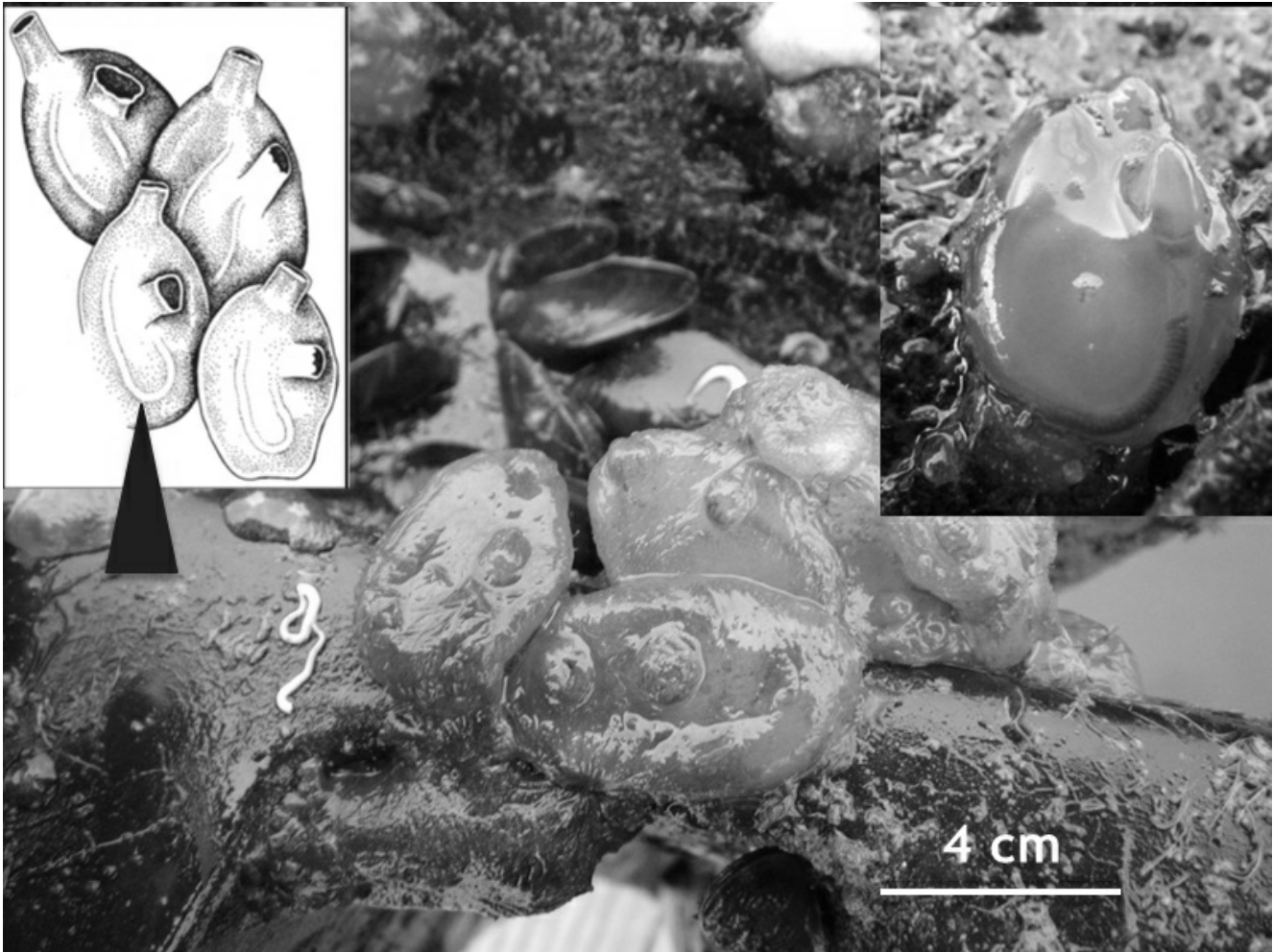
## What do we know about these eight introduced species?

\* 19. Have you seen or had any experience with *Corella eumyota*?

YES

No

If yes please provide a few details



*Corella eumyota* (image © Chris Beveridge, SAMS). Smooth, slightly translucent solitary tunicate. Typically 2-4 cm in length as an adult, but can grow up to 8 cm. Generally lies flat against the substrate attached along its right-hand side. Siphons frequently have orange tinge, some individuals can be entirely orange.

Pathways for spread: Hull fouling and aquaculture transfers may provide suitable vectors for species movement.

Habitat and ecology: *Corella eumyota* is typically found in the low intertidal and shallow subtidal in sheltered locations.

Environmental impact: Potential to out-compete native species occupying similar habitats (e.g., native ascidian *Ascidiella aspersa*). This species has exhibited rapid growth rates in introduced habitats, quickly establishing dense monocultures on the submerged surfaces of artificial structures.

**What do we know about these eight introduced species?**

20. Are you aware of the presence of *C. eumyota* within any Marine Protected Area (MPAs)? If so could you provide details of:

The MPA where species was recorded.

The date when first recorded.

The habitat(s) or feature(s) where the species was observed.

Any changes that were observed in the habitat(s) or feature(s) associated with the species presence.

Whether you believe the conservation objectives of the MPA have been affected by the presence of this species. If so please give details.

The spatial influence of the species within the MPA. Is it very localised (i.e. a few metres) or is it widespread (i.e. does it extend over several kilometres)?

The time-scale of influence of the species within the MPA (i.e. length of any observed changes <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments.

21. Are you aware of any instances where *C. eumyota* have produced a 'socio-economic' impact in your area? If so could you provide details of:

The location of the observed impact.

The date when first recorded and the date when impact occurred.

The business or stakeholder impacted.

The process through which the impact occurred (e.g. increased maintenance costs).

Any known costs (financial or otherwise) associated with the impact.

The time-scale of the impact (i.e. length of observed impact <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments.

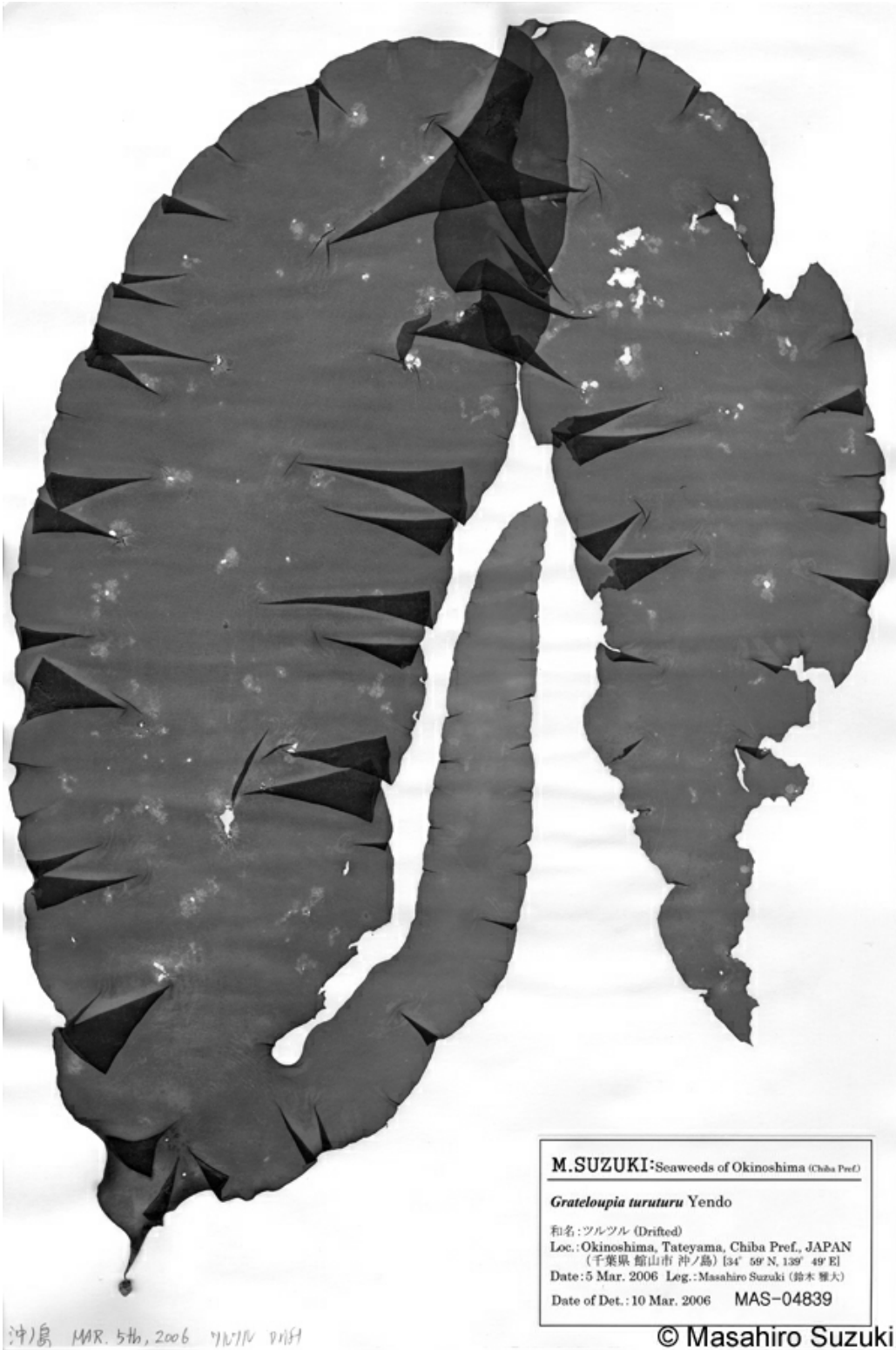
## What do we know about these eight introduced species?

\* 22. Have you seen or had any experience with *Grateloupia tututuru* (Devil's tongue weed)?

YES

No

If yes please provide a few details



沖島 MAR. 5th, 2006 7N11W drift

M.SUZUKI: Seaweeds of Okinoshima (Chiba Pref.)

*Grateloupia turuturu* Yendo

和名: ツルツル (Drifted)

Loc.: Okinoshima, Tateyama, Chiba Pref., JAPAN  
(千葉県 館山市 沖ノ島) [34° 59' N, 139° 49' E]

Date: 5 Mar. 2006 Leg.: Masahiro Suzuki (鈴木 雅大)

Date of Det.: 10 Mar. 2006 MAS-04839

© Masahiro Suzuki



*Grateloupia tututuru* (image © Masahiro Suzuki) . A red algae with flat blades approximately 10 – 70 cm long and 2 – 15 cm broad. This species is pink to dark red in colour and soft and gelatinous in texture. Found attached to substratum by small disc-shaped holdfast and short 'stem'. The margins of the blades are either entire or with narrow extensions from their margins.

Pathway for Spread: Initial sightings of this species have typically occurred in the vicinity of shellfish farms throughout Europe, suggesting initial introduction via commercial shellfish imports. Secondary transfer of established populations is likely via hull fouling and ballast water.

Habitat and ecology: In the North Atlantic this species occurs on protected and semi-exposed open coastal sites, coastal embayments and harbours with high tidal currents. The plant grows on rocky substrata in the low intertidal, including rock pools and the shallow subtidal zone down to a depth of approximately 3 m. This species is tolerant to nutrient enrichment and variable temperature (4 – 29 °C) and salinity regimes (22 – 37 ppt).

Environmental impact: The large size and rapid reproductive ability via sporic and vegetative means, has enabled this species to out-compete many native macroalgae in the low intertidal and shallow subtidal zones. This species can also alter trophic patterns and cause habitat loss. Many of the tolerances of this species exceed those of native macroalgae, such as *Chondrus crispus*, *Mastocarpus stellatus* and *Palmaria palmata*.

**What do we know about these eight introduced species?**

23. Are you aware of the presence of *G. tututuru* within any Marine Protected Area (MPAs)? If so could you provide details of:

The MPA where species was recorded.

The date when first recorded.

The habitat(s) or feature(s) where the species was observed.

Any changes that were observed in the habitat(s) or feature(s) associated with the species presence.

Whether you believe the conservation objectives of the MPA have been affected by the presence of this species. If so please give details.

The spatial influence of the species within the MPA. Is it very localised (i.e. a few metres) or is it widespread (i.e. does it extend over several kilometres)?

The time-scale of influence of the species within the MPA (i.e. length of any observed changes <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments.

24. Are you aware of any instances where *G. tututuru* have produced a 'socio-economic' impact in your area? If so could you provide details of:

The location of the observed impact.

The date when first recorded and the date when impact occurred.

The business or stakeholder impacted.

The process through which the impact occurred (e.g. increased maintenance costs).

Any known costs (financial or otherwise) associated with the impact.

The time-scale of the impact (i.e. length of observed impact <1 year, 2-5 years or > 5 years).

Any reports or other documents that you are aware of relating to this species.

Any other comments.

## What do we know about these eight introduced species?

\* 25. In order to allow us to contact you in the future with regards to this work, would it be possible for you to please provide us with your contact details (this information will only be used in connection with this work)

**Name**

**Company**

**Email Address**

**Phone Number**

26. If you are aware of any individual(s) who could contribute to this work please provide details bellow or forward the link.

## Thank you for taking the time to contribute to this work.

All information provided will be remain anonymous.

If you have any queries regarding this work, please do not hesitate to contact our team.

<sup>1</sup>Elizabeth Cook (E: [Elizabeth.Cook@sams.ac.uk](mailto:Elizabeth.Cook@sams.ac.uk); T: 01631 559243)

<sup>2</sup>Adrian Macleod (E: [Adrian.Macleod@sams.ac.uk](mailto:Adrian.Macleod@sams.ac.uk); T: 01631 559450)

1: The Scottish Association for Marine Science; 2: SAMS Research services Ltd.

This survey has been created by staff at SAMS and SRSL under contract to Natural England and Natural Resources Wales.

27. If you have any additional comments concerning these eight NNS, or about this survey in general, please include them below.

[https://www.surveymonkey.com/r/NNS\\_consultation](https://www.surveymonkey.com/r/NNS_consultation)