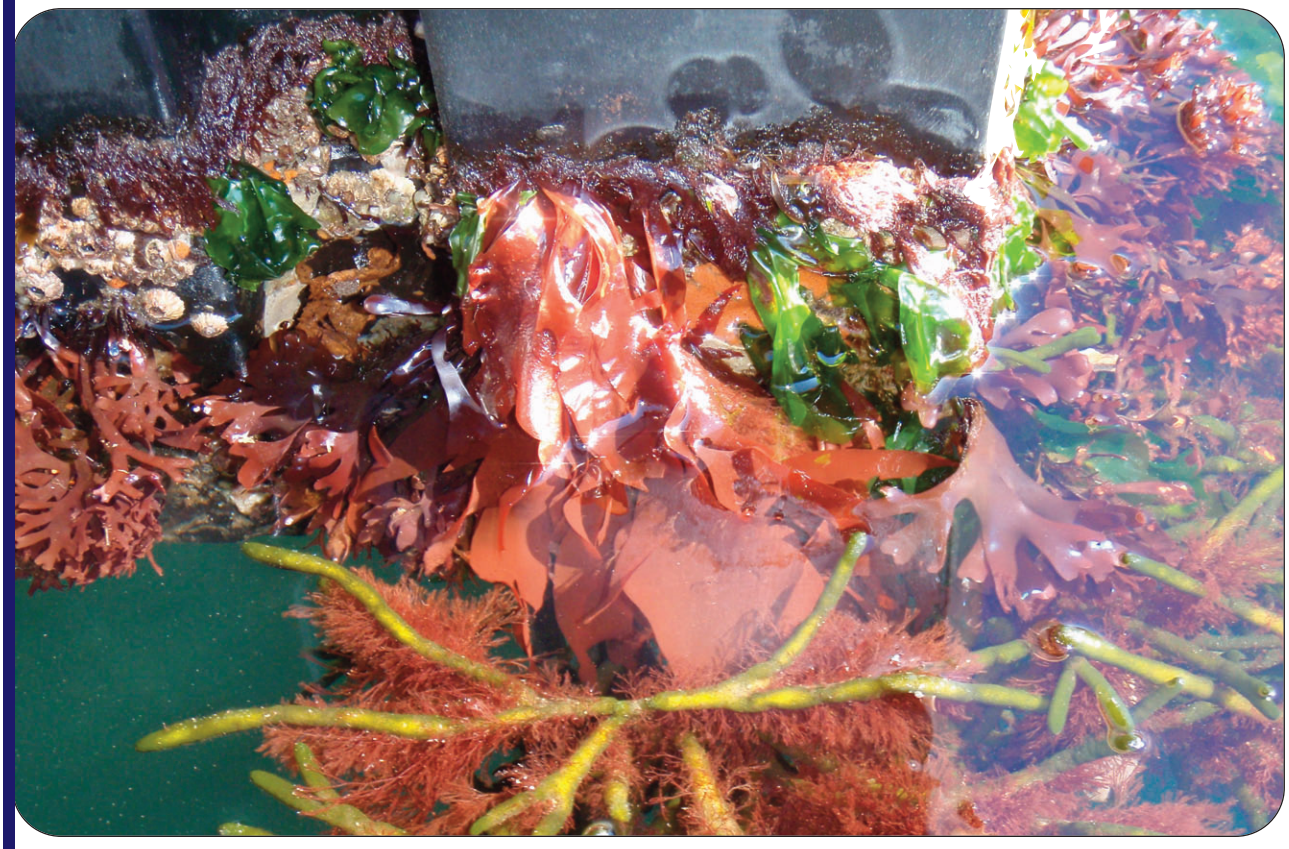
Non-Native Seaweed in Massachusetts

Guidance from the Massachusetts Office of Coastal Zone Management, May 2013

Massachusetts is home to a diverse and widespread group of seaweeds, comprised of marine plants and plant-like species, including algae. Algae differ from vascular plants such as eelgrass; they are more primitive and lack specialized features such as seeds and flowers. While some groups, like the red and the green algae (Rhodophyta and Chlorophyta), are currently considered to be in the plant kingdom, others, like the brown algae (Phaeophyceae), are classified separately due to the types of pigments they contain and how they collect and store energy. Seaweed plays an important role in the ecosystem, providing food and habitat for a wide variety of marine organisms. While the majority of seaweed species found in Massachusetts are native, some have been introduced to the area by human means, such as shipping and aquaculture.

Potential Impacts of Non-Native Species

To date at least 17 species of non-native marine algae have been documented in Massachusetts (Table 1), although this number does not include the many species whose origins and taxonomy are not resolved (CZM 2013a, Green et al. 2012, Low et al. 2011, Mathieson et al. 2008a,b,c,d, Nettleton 2008, Pappal 2010). Ecological impacts of non-native seaweeds generally include competition for resources, shading, and displacement of native seaweeds (Scaffelke and Hewitt 2007, Williams and Smith 2007). Aesthetic and recreational impacts can occur when non-native seaweeds wash ashore on beaches and form large, unsightly clumps, which may result in noxious odors (Pederson et al. 2005). See *Managing Seaweed Accumulations on Recreational Beaches: Guidance from the*



A mixture of native and non-native seaweed attached to a floating dock.

PHOTO: ADRIENNE PAPPAL

Table 1: Non-native seaweed documented in Massachusetts

Phylum/Class	Species	Citation
Chlorophyta (Green Algae)	*Codium fragile* ssp. *fragile*	Mathieson et al. 2008b
Phaeophyceae (Brown Algae)	*Melanosiphon intestinalis*	Mathieson et al. 2008b,c
	Ulonema rhizophorum	Mathieson et al. 2008a
	Colpomenia peregrina	Green et al. 2012
Rhodophyta (Red Algae)	*Antithamnion pectinatum*	Mathieson et al. 2008c
	Bonnemaisonia hamifera	Mathieson et al. 2008b
	Dumontia contorta	Mathieson et al. 2008a,c
	Gracilaria vermiculophylla	Gulbransen et al. 2012
	Grateloupia turuturu	Mathieson et al. 2008b,d
	Heterosiphonia japonica	CZM 2013a, Low et al. 2011
	Lomentaria clavellosa	Mathieson et al. 2008b
	Lomentaria orcadensis	Mathieson et al. 2008b
	Neosiphonia harveyi	Mathieson et al. 2008b
	Porphyra katadae	Mathieson et al. 2008b,c
	Porphyra yezoensis f. narawaensis	Nettleton 2008
	Porphyra yezoensis f. yezoensis	Mathieson et al. 2008a,b,c
	Rhodymenia delicatula	Mathieson et al. 2008c

Massachusetts Office of Coastal Zone Management (CZM 2013b) for more information.

The most widespread non-native seaweed species in Massachusetts is arguably the red filamentous algae *Neosiphonia harveyi*, followed by the green algae *Codium fragile* ssp. *fragile* (CZM 2013a, Pederson et al. 2005). More recent invaders include the red algae *Grateloupia turuturu*, first documented in Massachusetts in 2007, *Heterosiphonia japonica*, first discovered in 2010, and *Colpomenia peregrina*, first found in 2011 (CZM 2013a, Green et al. 2012, Low et al. 2011, Mathieson et al. 2008d, Schneider 2010).

Codium fragile ssp. *fragile*

Codium fragile ssp. *fragile* (previously known as *Codium fragile* ssp. *tomentosoides*) was most likely introduced to Massachusetts as a hitchhiker on oysters transplanted from Long Island Sound in the mid 20th century and then drifted through the Cape Cod Canal to other areas (Carlton and Scanlon 1985, Mathieson et al. 2003, Wood 1962). It can displace native seaweeds particularly after disturbances such as winter storms or heavy grazing reduces native species presence, leading to habitat impacts (Levin et al. 2002). *Codium fragile* ssp. *fragile* has become widespread in Massachusetts; long-term studies suggest that there has been a general 20-27 fold increase in the Gulf of Maine over a 10-22 year period (Levin et al. 2002, Mathieson et al. 2008c).

Codium fragile ssp. *fragile*

PHOTO: FISHERIES AND OCEANS CANADA

Neosiphonia harveyi

The increase in *C. fragile* has also helped facilitate the spread of the red filamentous algae *Neosiphonia harveyi*, which can grow on *C. fragile* and other seaweeds. *Neosiphonia harveyi* has increased

Neosiphonia harveyi

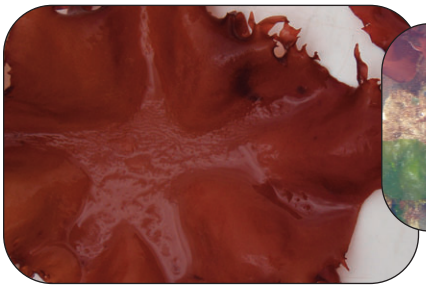
PHOTO: UNIVERSITY OF CONNECTICUT

PHOTO: IGNACIO BÁRBARA

six-fold since 1966 and is now one of the most widely distributed seaweed species in the Gulf of Maine and the Northeast (Mathieson et al. 2003, Mathieson et al. 2008a,c). Interestingly, *N. harveyi* was misidentified as the native *Polysiphonia harveyi* for nearly 150 years until recent genetic work suggested otherwise (Mathieson et al. 2003, Mathieson et al. 2008b,c, McIvor 2000). This highlights the difficulty in positively identifying non-native species in general and seaweeds in particular.

Grateloupia turuturu

Grateloupia turuturu, a red alga native to Asia, was first reported in Rhode Island waters (as *G. doryphora*) in 1994 (Harlin and Villalard-Bohnsack 2001). Since that time, *G. turuturu* has continued to expand northward and was first recorded in Massachusetts in 2007 (Mathieson et al. 2008d). This species can grow rapidly, producing large blades capable of covering other seaweed species in the intertidal and subtidal (Harlin and Villalard-Bohnsack 2001). *Grateloupia turuturu* has a limited distribution in Massachusetts currently, but given its broad environmental tolerances, it is expected to continue to spread (CZM 2013a, Mathieson et al. 2008d).

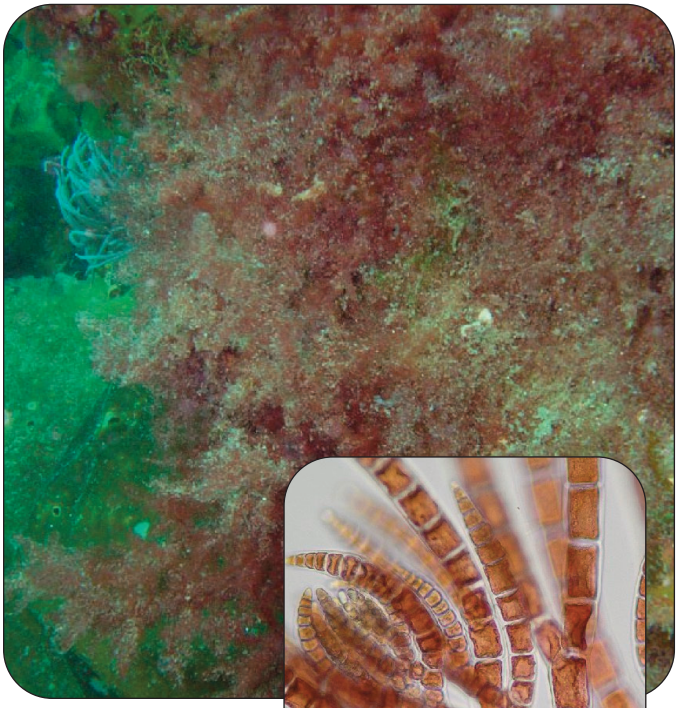


Grateloupia turuturu

PHOTOS: ADRIENNE PAPPAL

Heterosiphonia japonica

Heterosiphonia japonica is a red filamentous species of algae. Native to Asia, this species was first recorded in France in 1984, and is now widespread across Europe, likely introduced there from the western Pacific as a hitchhiker on oysters for aquaculture (Sjøtun et al. 2008). *Heterosiphonia japonica* was first found on the outer coast of Rhode Island in 2009, then discovered in Massachusetts in 2010 (CZM 2013a, Low et al. 2011, Schneider 2010). In the spring and summer of 2012, this species in particular received much attention and press reports of masses washing up on beaches. As *H. japonica* (like many of the red filamentous algae) is difficult to identify (requires magnification), all of these reports have not been substantiated. However, recent collections indicate this species is expanding its distribution along the coast of Massachusetts and elsewhere (Savoie and Saunders 2013). Research is currently being conducted to determine the extent and impact of this species in Massachusetts.



PHOTOS: IGNACIO BÁRBARA

Heterosiphonia japonica

Colpomenia peregrina

Colpomenia peregrina is a relatively new invader to Massachusetts waters, first reported in 2011 (Green et al. 2012). It forms a hollow mass or bubble as it grows and is visually similar to the native species *Leathesia marina*. First recorded in the Northwest Atlantic in Nova Scotia in 1960, it has made its way south with populations recently recorded in Maine, New Hampshire, and Massachusetts (Green et al. 2012). It is unclear at this time what impacts this species will have in Massachusetts waters, but its tendency to grow on native seaweeds, shellfish, and other species could lead to shading and other competitive impacts (Green et al. 2012).

PHOTOS: LINDSAY GREEN

Colpomenia peregrina

Seaweed Identification

Identification of non-native seaweeds can be tricky. The majority of the filamentous algae, for example, require microscopic examination of the cellular and reproductive structures for identification, while others may require genetic work.

Here is a list of resources that may assist in the identification of seaweeds:

- Algaebase, www.algaebase.org/.
- Kingsbury JM. 1969. *Seaweeds of Cape Cod and the Islands*. Chatham (MA): The Chatham Press Inc. 212 p.
- Sears JR. 1998. *NEAS Keys to the Benthic Marine Algae of the Northeastern Coast of North America from Long Island Sound to the Strait of Belle Isle*. Dartmouth (MA): University of Massachusetts. 163 p.
- Stewart Van Patten M. 2006. *Seaweeds of Long Island Sound*. Groton (CT): Connecticut Sea Grant College Program. 104 p.
- Villard-Bohnsack M. 2003. *Illustrated Key to the Seaweeds of New England*, 2nd Ed. Kingston (RI): The Rhode Island Natural History Survey. 149 p.

Non-Native Seaweed Management

Most non-native seaweeds that become successfully established in a new location possess a suite of traits that allow them to grow and spread rapidly. These traits include being able to survive in a number of habitats and environmental conditions and being able to reproduce rapidly through a wide number of means, such as spores and fragments. Given these characteristics, it is extremely difficult to control a non-native seaweed species once it is established in the marine environment. However, there are things that can be done to prevent and reduce the number of introduced seaweed species in Massachusetts. Here is a list of activities the average person can do to reduce the threat:

- Inspect your boat when you take it out of the water and remove any attached organisms and seaweeds from the hull and other areas; dispose of them in the trash.
- Never release unused bait or bait packaging materials into the water. Put unused bait in a

plastic bag or container and place it in the trash.

- Clean equipment between visits to different water bodies.
- Do not release seafood or seafood products into the water; put seafood waste in the trash (including shells).
- Buy local seafood.
- Choose native species for aquariums.
- Do not release aquarium species into local waterbodies or storm drains.
- Contact your state and federal legislators about the importance of strong measures for prevention of non-native species.

For More Information

For more information on non-native marine species, including seaweeds, see the Massachusetts Office of Coastal Zone Management, Aquatic Invasive Species Program, at **www.mass.gov/czm/invasives**.

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www.mass.gov/czm/invasives

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