



Fisheries and Oceans
Canada

Pêches et Océans
Canada

AQUATIC INVASIVE SPECIES

Identification Booklet of
Marine Species in Eastern Canada

WANTED



AQUATIC INVASIVE SPECIES

Non-native animal or plant species are of concern to biologists and environment managers throughout the world including eastern Canada. Invasive species can threaten aquatic ecosystems, occupying habitats or out-competing native species. These invasive species may show rapid population growth in the absence of natural predators and may soon become established to the point where eradication is impossible.

Aquatic invasive species can be introduced in several ways: either naturally as larvae or as fragments drifting in water currents; or through human activities, attached to boat hulls or in ballast waters for instance.

These various invaders pose threats to ecology and the economy. While regulators, scientists, and members of the aquaculture and fishing industries are the most concerned, the problem affects everyone using our waters: recreational boaters, fishers and harvesters, cottage owners, divers, etc.

The best approach for protecting our ecosystems from these invaders is to keep them out in the first place, and to do this, everybody's cooperation is essential.

This booklet contains information on major species that have invaded marine environments of eastern Canada - how to identify them and what you can do to prevent their spread and establishment.



OYSTER THIEF

(*Codium fragile* spp. *fragile*)

ORIGIN

Codium fragile, a green alga from Japan, first appeared in eastern Canada in 1989 in southern Nova Scotia. It appeared in the Gulf of St. Lawrence in 1996.



DFO S. Pereira



CHARACTERISTICS

- Shaped like a small bush, soft and velvety as a sponge to the touch;
- Colour: light to dark green;
- Thick and spongy, Y-shaped cylindrical branches, 3 to 10 mm in diameter;
- Size: up to 90 cm long;
- Weight: up to 3 kg per plant;
- When found on the beach, the branches may bleach white and resemble fat spaghetti.



DFO S. Pereira



HABITAT

Codium lives underwater in subtidal areas down to 60 feet (18 meters) and can also be found in tide pools. Its holdfast allows it to attach to rocky bottoms, reefs, wharves and pilings, and even on other algae, molluscs or crustaceans. It is often found growing on eelgrass or drifting in bays.



DFO P. Archambault

SIMILAR SPECIES

Codium can easily be distinguished from native seaweed species of the Gulf of St. Lawrence. Only the rockweed (*Fucus distichus*) has some similar characteristics such as its shrubby shape and its branching pattern. Unlike *Codium*, the rockweed's branches bear golden yellow vesicles filled with a gelatinous substance.



DFO R. Larocque

ECOLOGICAL AND ECONOMIC IMPACTS

- Replaces native species;
- Uproots eelgrass, a plant which provides shelter and reproductive and feeding habitat for fish, molluscs and crustaceans;
- Can gradually overtake and replace kelp, which is a habitat for many species such as lobster and urchin;
- When attached to shells, it prevents many molluscs from feeding, which makes them weaker and more vulnerable to predators;
- May float away with oysters and other shells to which it is attached (explaining the name of "oyster thief");
- Economic impacts on shellfish industries include loss of crop and fouling problems.



DFO S. Pereira

WHAT YOU CAN DO

- Learn to recognize *Codium fragile*;
- Follow the general guidelines at the end of this booklet.

GREEN CRAB

(*Carcinus maenas*)



DFO

ORIGIN

The Green crab is one of the ten most unwanted species in the world. This small coastal crab is native to Europe and North Africa. It was first observed in eastern Canada in the 1950's in the Bay of Fundy and entered Nova Scotia waters of the Gulf of St. Lawrence in 1994.



CHARACTERISTICS

- Adult size: up to 10 cm;
- Shell serrated and trapeze-shaped, with five obvious spines on each side and three between the eyes;
- Colour variable: green, red or yellow;
- Two claws of different size;
- Tips of its back legs are pointed, slightly flattened and are hairy;
- Aggressive, vigorous, can survive out of the water for several days.



DFO S. Pereira

HABITAT

Found in shallow water, generally on muddy, sandy or pebble bottoms or in vegetation. Prefers sheltered areas. Common in salt marshes, on sandy beaches and on rocky coasts. Can tolerate a wide range of salinities.

SIMILAR SPECIES

The Green crab is sometimes mistaken for native Rock crabs, Lady crabs or Mud crabs. Rock crab is larger (up to 15 cm), its peach-colored shell is wide and ovoid, with nine smooth notches on either side of the eyes. Lady crab is also large, has five notches like a Green crab but the hind legs are oval. Mud crab is smaller than the Green crab and usually has either white or black claw tips.



DFO R. Larocque

ECOLOGICAL AND ECONOMIC IMPACTS

- Changes balance between species in the ecosystems;
- Can destroy shellfish beds;
- Destroys eelgrass beds, which are essential habitats;
- Reduces invertebrate and fish diversity;
- This voracious predator threatens shellfish aquaculture;
- Impacts the eel fishery by damaging the catch.



DFO R. Daigle

WHAT YOU CAN DO

- Learn how to recognize Green crab;
- Follow the general guidelines at the end of this booklet.

ASIAN SHORE CRAB

(*Hemigrapsus sanguineus*)



©Molly Jacobson

ORIGIN

The Asian shore crab is a small crab native to East Asia. Now established in both Europe and North America, it was first observed in the United States in 1988 in New Jersey. It has since proliferated along the US east coast and is now found from North Carolina to Maine. In Canada, it was first observed in Nova Scotia during the spring of 2020.



CHARACTERISTICS

- Shell width up to 4,4 cm;
- Three spines on each side of the shell, just behind the eyes;
- Square shaped shell mottled with reddish, greenish or dark purple areas on its back;
- Alternating light and dark bands on the legs;
- Bulb-like structure in the recess of the male claws, at the base of the movable finger.



MPPO S. Kingsbury



Ansel Ommen, Bugwood.org

HABITAT

Asian shore crab usually live in habitats down to 4 m deep, on rocky bottoms located in the tidal zone. During the winter season, it moves in deeper water, in the areas still submerged. In North America, it has been observed around rock piers, bulkheads and wooden pilings, as well as in submerged and floating aquaculture gear (cages and larval collectors). It also uses sandy and pebble beaches, mussel or seagrass beds and salt marshes.

SIMILAR SPECIES

Asian shore crab should not be confused with the European Green crab which looks similar. Adult Green crab can be up to 10 cm wide, twice the size of Asian shore crab. They can also be recognized by the spines on each side of their shells, just behind the eyes, Green crab having five spines and Asian shore crab only three.



ECOLOGICAL AND ECONOMIC IMPACTS

- As omnivores, Asian shore crabs feed on molluscs (mussels, oysters, clams and snails), crustaceans, annelid worms and algae. Through predation and competition for food and space, they displace native species (barnacles, snails, crabs, bivalves).
- Asian shore crabs can reach densities up to 300 individuals per square metre. Given their population density and voracious appetites, they have caused significant ecological impacts on intertidal communities (fishes, molluscs, crustaceans) on the US East Coast.
- To this day there is no evidence that they are having any significant impact on the aquaculture industry.



WHAT YOU CAN DO

- Learn how to recognize the Asian shore crab;
- Report any sighting to Fisheries and Oceans Canada, take photos and note: date, location (GPS coordinates) and number of crabs (when possible);
- Follow the general guidelines at the end of this booklet.

CHINESE MITTEN CRAB

(*Eriocheir sinensis*)

ORIGIN

The Chinese mitten crab, native to the Yellow sea between China and Korea, is one of the ten most unwanted species in the world. It was first reported in the Great Lakes in 1965 where it occasionally shows up in Lakes Ontario and Erie. It appeared in the St. Lawrence River in 2004.



Smithsonian Environmental
Research Center G. Ruiz



CHARACTERISTICS

- Adult size: 3 to 8 cm;
- Colour: greenish brown;
- Shell with a notch between the eyes and four spines on either sides;
- Two claws of the same size with white tips and dense fluffy hair (the adults seem to be wearing mittens);
- Legs twice as long as the carapace width.



MPNF G. Bourget

HABITAT

It can be found down to a depth of ten meters, in fresh or brackish waters in estuaries, lakes, rivers and wetlands. It can tolerate a wide range of temperatures and salinities and can easily survive in disturbed and polluted environments. It is a catadromous species that lives in freshwater and reproduces in saltwater.

SIMILAR SPECIES

No native species have hairy claws.

ECOLOGICAL AND ECONOMIC IMPACTS

- Accelerates river bank erosion by burrowing;
- Population expansion may occur in the St. Lawrence River which has appropriate environmental conditions;
- May compete with and prey on native species.



DFG, Ohio State, USA

WHAT YOU CAN DO

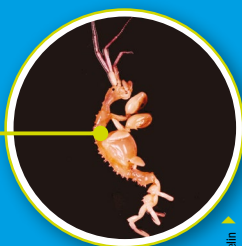
- Learn how to recognize Chinese mitten crab;
- Follow the guidelines at the end of this booklet.

JAPANESE SKELETON SHRIMP

(*Caprella mutica*)

ORIGIN

Caprella mutica is an amphipod crustacean (such as beach fleas) from eastern Asia. It was first reported in eastern Canada in the 1990's in the Bay of Fundy, and in the Gulf of St. Lawrence (Prince Edward Island) in 2000.



DFO T. Gosselin



CHARACTERISTICS

- Maximum size: males 3.5 cm and females 1.5 cm;
- Colour: variable from pale orange to red;
- Long cylindrical body, males with a long two-segmented neck;
- Males very hairy on neck and claws;
- Females carry eggs in a ventral (belly) pouch, which is covered with dark red spots.



SAMS T. Nickell

HABITAT

Common on man-made structures such as ropes, buoys, artificial reefs, breakwaters and mussel aquaculture socks. Often very abundant.

Like many invasive species *Caprella mutica* reproduces rapidly, has a varied diet and tolerates a wide range of temperatures and salinities.

SIMILAR SPECIES

There are several native caprellid species that resemble *Caprella mutica*. However, these species grow mainly on natural substrates and are not hairy.

ECOLOGICAL AND ECONOMIC IMPACTS

- Infests man-made structures such as buoys and mussel aquaculture socks, sometimes reaching numbers of 100,000 individuals per square meter;
- May compete with mussels for food and space.



MAPAQ B. Thomas

WHAT YOU CAN DO

- Learn to recognize *Caprella mutica*;
- Follow the general guidelines at the end of this booklet.

COFFIN BOX

(*Membranipora membranacea*)

ORIGIN

This European invertebrate, which is a bryozoan, was first found in eastern Canada, Nova-Scotia, in the early 1990's and in the Gulf of St. Lawrence, Quebec, in 2003.



DFO S. Perera



CHARACTERISTICS

- Tiny filter feeders (zooids);
- Forms white-colored encrusting colonies;
- The colony has a rough texture;
- Colonies are round and made up of many small rectangular "cells".



DFO I. BÉrube

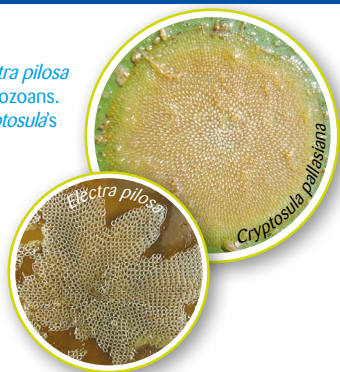
HABITAT

This species can be found in shallow subtidal waters from the surface down to a depth of ten meters, on kelp and other seaweed, rocks, boat hulls, and other surfaces and organisms. Grows best in areas with strong currents or good tidal water exchanges.

SIMILAR SPECIES

Membranipora can be mistaken for *Electra pilosa* and *Cryptosula pallasiana*, two native bryozoans.

Electra's colonies are star-shaped and *Cryptosula's* are thicker and orange-colored.



DFO | L. Bérubé

ECOLOGICAL AND ECONOMIC IMPACTS

- Forms a crust on algae, blocking light needed for photosynthesis and making the algal body stiff and brittle, causing it to break when exposed to waves;
- Disturbs kelp ecosystems, and promotes establishment of invasive plants, such as *Codium*;
- Proliferation in the Gulf of Maine has already destroyed entire kelp forests.



DFO | L. Gendron

WHAT YOU CAN DO

- Learn to recognize *Membranipora*;
- Follow the general guidelines at the end of this booklet.

INVASIVE TUNICATES

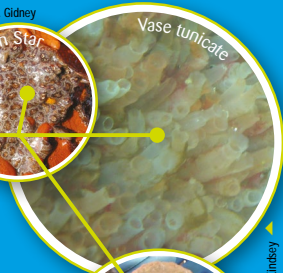
Tunicates, or sea squirts, are small marine animals that spend most of their lives attached to an underwater substrate. They are named “tunicate” for their thick skin resembling a tunic. They feed by filtering seawater through their siphons.

Several invasive species of tunicates threaten our waters. They are found on the Atlantic and Pacific coasts and can be spread by ocean currents as well as by human activities.



R. Gidney

Golden Star



Vase tunicate



Dicotylidium

DFO C. McKindsey

D. Blackwood

HABITAT

Tunicates are typically found in sheltered areas, attached to rocks, eelgrass, seaweeds, other animals or on man-made structures such as boat hulls, buoys, ropes, anchors, floating docks, aquaculture gear and wharf pilings.



M. Desraspes



DFO Newfoundland and Labrador Region

DFO C. McKindsey

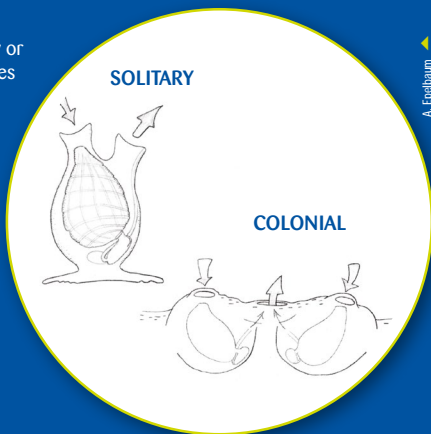


SOLITARY OR COLONIAL

Tunicates can be either solitary or colonial. Several colonial species form gelatinous mats that may cover almost anything underwater.

The colonies are made up of many individual organisms, called zooids, embedded in a common matrix.

For certain species, colonies can form folds and lobes that hang down in the water.



ECOLOGICAL AND ECONOMIC IMPACTS

- May outcompete other organisms for food and space, thereby altering the natural community dynamics;
- Threaten aquaculture, fishing and other coastal and offshore activities;
- Increase the weight of the aquaculture cultivation gear, causing work to be more demanding;
- Increase the operating costs for shellfish producers and processors.



WHAT YOU CAN DO

- Learn how to recognize the invasive tunicates;
- Follow the general guidelines at the end of this booklet.

VASE TUNICATE (*Ciona intestinalis*)

CLUBBED TUNICATE

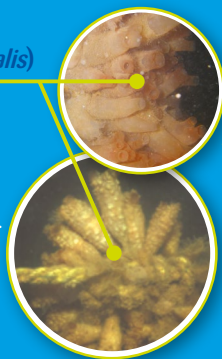
(*Styela clava*)

ORIGINS

Vase and Clubbed are the two invasive solitary tunicates.

Vase tunicate, a northern European species, has been intermittently documented in eastern Canada for the past 100 years. Large populations of the species have been found in Nova Scotia since 1997 and in Prince Edward Island since 2004.

The **Clubbed tunicate**, from the Western Pacific, is one of the worst invasive alien species in the world. It has been reported in the Gulf of St. Lawrence in Prince Edward Island since 1997.



DFO S. Pereira

DFO F. Hazel



CHARACTERISTICS

VASE TUNICATE

DFO B. Vercaemer



- Body cylindrical, unstalked, translucent, soft and smooth;
- May reach 15 cm in length;
- Colour variable: from light greenish-yellow to orange or pink;
- Develops individually but can form dense aggregations.

CLUBBED TUNICATE

DFO



- Body firm and wrinkled with little bumps, shaped like a water-filled wineskin. Presence of a solid stalk. Leathery texture;
- Measures up to 18 cm, the stalk accounting for one third of its length;
- Colour brown;
- Solitary, but may grow in very dense clumps;

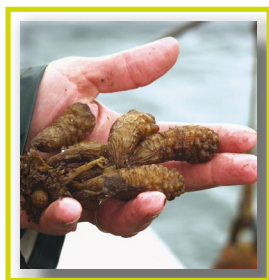
VASE TUNICATE

DFO A. Demers



CLUBBED TUNICATE

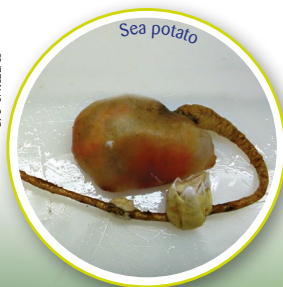
DFO N. Simard



SIMILAR SPECIES

Among native species, sea potatoes and sea peaches are other tunicates, but they are solitary or found in small groups. The sea potato is shaped like a rattle and has a stalk that can reach 13 cm. The sea peach's body is firm and rounded and its skin is rough.

DFO C. NozEres



DFO C. McKindsey



DFO C. NozEres



EUROPEAN SEA SQUIRT

(*Ascidrella aspersa*)

ORIGIN

This European tunicate was first introduced in New England in the 1980's and can now be found in most of the Gulf of Maine. It was first detected on the south shore of Nova Scotia in 2012.



DFO B. Vercaemer



CHARACTERISTICS

- Body egg shaped, semi-translucent. Firm, slightly bumpy surface;
- May reach 5 cm in length;
- Color grayish with pinkish hue;
- Solitary but can develop dense aggregations.



DFO B. Vercaemer



DFO B. Vercaemer



DFO B. Vercaemer

SIMILAR SPECIES

Sea grapes, sea potatoes and sea peaches are native solitary tunicates, but they are shaped differently and may be found individually or in small clumps. For example, sea grapes are spherical with two siphons close together at the top.

Among invasive species, European sea squirts may be mistaken for vase or clubbed tunicates but their shape, tunic surface and color are different. In addition, the European sea squirt has one siphon on top and one on the side (at approximately one third of its body length).

DFO R. Bernier



DFO R. Bernier



DFO C. NozEres

DFO C. NozEres



DFO C. McKindsey



GOLDEN STAR TUNICATE

(*Botryllus schlosseri*)

VIOLET TUNICATE

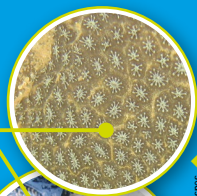
(*Botrylloides violaceus*)

ORIGINS

Golden Star and Violet are two invasive colonial tunicates.

Golden Star tunicate is widely distributed throughout the world. It has been reported in eastern Canada and in the Gulf of St. Lawrence for several decades.

The **Violet tunicate** originates from Asia. It was first observed in eastern Canada, Nova Scotia, in the 1990's and in the Gulf of St. Lawrence, Prince Edward Island, in 2002.



M. Desraspes

H Gartner



CHARACTERISTICS

GOLDEN STAR TUNICATE

DFOI. BÉrudit



- Colour variable: orange, yellow, red, greenish grey, violet, dark grey or black;
- Dense colonies of several microscopic individuals, called zooids;
- Zooids that make up the colony are daisy shaped.

VIOLET TUNICATE

DFOI. BÉrudit



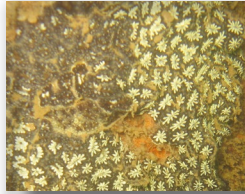
- Colour variable: whitish, yellow, orange, reddish-brown, violet;
- Dense colonies of several microscopic individuals, called zooids;
- Zooids arranged in a network of curving tracks.

GOLDEN STAR TUNICATE

▼ DFO Newfoundland and Labrador Region



▼ M. Desraspes



VIOLET TUNICATE

▼ DFO S. Pereira



▼ PEI-D'ARID



SIMILAR SPECIES

Can be mistaken for sponges, but sponges have a soft porous texture rather than a gelatinous one.

▼ DFO C. McKindsey



▼ DFO R. Larocque

DIDEMNUM

(*Didemnum vexillum*)

DIPLOSOMA

(*Diplosoma listerianum*)

ORIGIN

Didemnum and *Diplosoma* are two invasive colonial tunicate species.

Didemnum is native to the Pacific. It has not yet been observed in eastern Canada, although it is present nearby on the eastern coast of the United States.

Diplosoma is primarily seen in tropical and temperate waters. This species probably originates from northern Europe and has spread along the American east coast. This tunicate was first observed in eastern Canada on the Magdalen Islands in 2008.



SABS J. Martin

M. Desraspes



CHARACTERISTICS

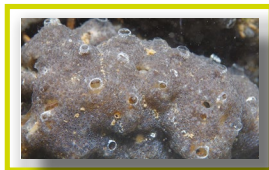
DIDEMNUM

USGS P. Valentine - D. Blackwood



- Dense colonies that resemble pancake batter;
- Colour variable: white, cream, yellow or light brown;
- Forms carpets or hanging lobes.

DIPLOSOMA



R. Groeneveld

- Dense colonies that are soft, gelatinous and translucent;
- Forms fragile crusts which are hard to remove without tearing;
- Colour: darkish grey;
- Openings sometimes spotted with white dots.

DIDEMNUM

P. Barter



DFO I. BÉrubé



DIPLOSOMA

M. Desraspes



SIMILAR SPECIES

- *Didemnum* can be mistaken for other invasive tunicates such as the violet tunicate, but *Didemnum* do not come in red or orange.
- *Diplosoma* and *Didemnum* may resemble certain types of sponges, but their texture is gelatinous rather than sponge.
- *Diplosoma* may also be mistaken for *Alcyonidium*, but this native bryozoan does not have the characteristic openings of tunicates.

DFO C. McKindsey

DFO I. BÉrubé



Alcyonidium



Sponge

DFO R. Larocque

WHAT YOU CAN DO

HOW TO PREVENT THE INTRODUCTION AND SPREAD OF INVASIVE SPECIES

Everyone using aquatic habitats can help prevent the introduction and spread of invasive species.

PREVENTIVE MEASURES

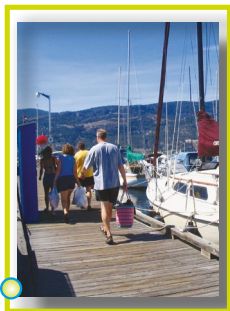
General

- Learn about these species and how to recognize them using this booklet and by accessing the Fisheries and Oceans Canada website: dfo-mpo.gc.ca/aquatic-invasive-species;
- Do not move organisms from one area to another;
- Never release live bait, aquarium fish or plants into open water or sewer.



When taking your boat out of the water

- Inspect and remove fouling plants and animals from boat, motor, anchor, trailer and equipment with freshwater or spray with pure vinegar (protect your eyes);
- Clean hull and dispose of removed material far from the water;
- Drain water from your motor, bilge and wells. If possible, let equipment dry completely;
- Use environment-friendly antifouling paint or products on your boat hull.



PREVENTIVE MEASURES

Shellfish harvesting

- Clean shellfish where they were collected;
- Move as little water as possible with the shellfish;
- Spread any leftover water on the lawn;
- “De-sand” shellfish in the original water or in a bucket with water that will be thrown onto the lawn.



DFO D. Chamard

Diving and other water sports

- Rinse equipment with fresh water after every trip;
- Let equipment dry completely.

WHAT TO DO IF YOU FIND INVASIVE SPECIES

1. Try to identify them;
2. Follow the recommendations at the end of each species' page;
3. Take photos, note the location (GPS coordinates are nice) and observation date;
4. Report any sighting to Fisheries and Oceans Canada (contact information on the back cover of this booklet).

CLEAN DRAIN DRY



HELP STOP AQUATIC INVADERS



Fisheries and Oceans Canada
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