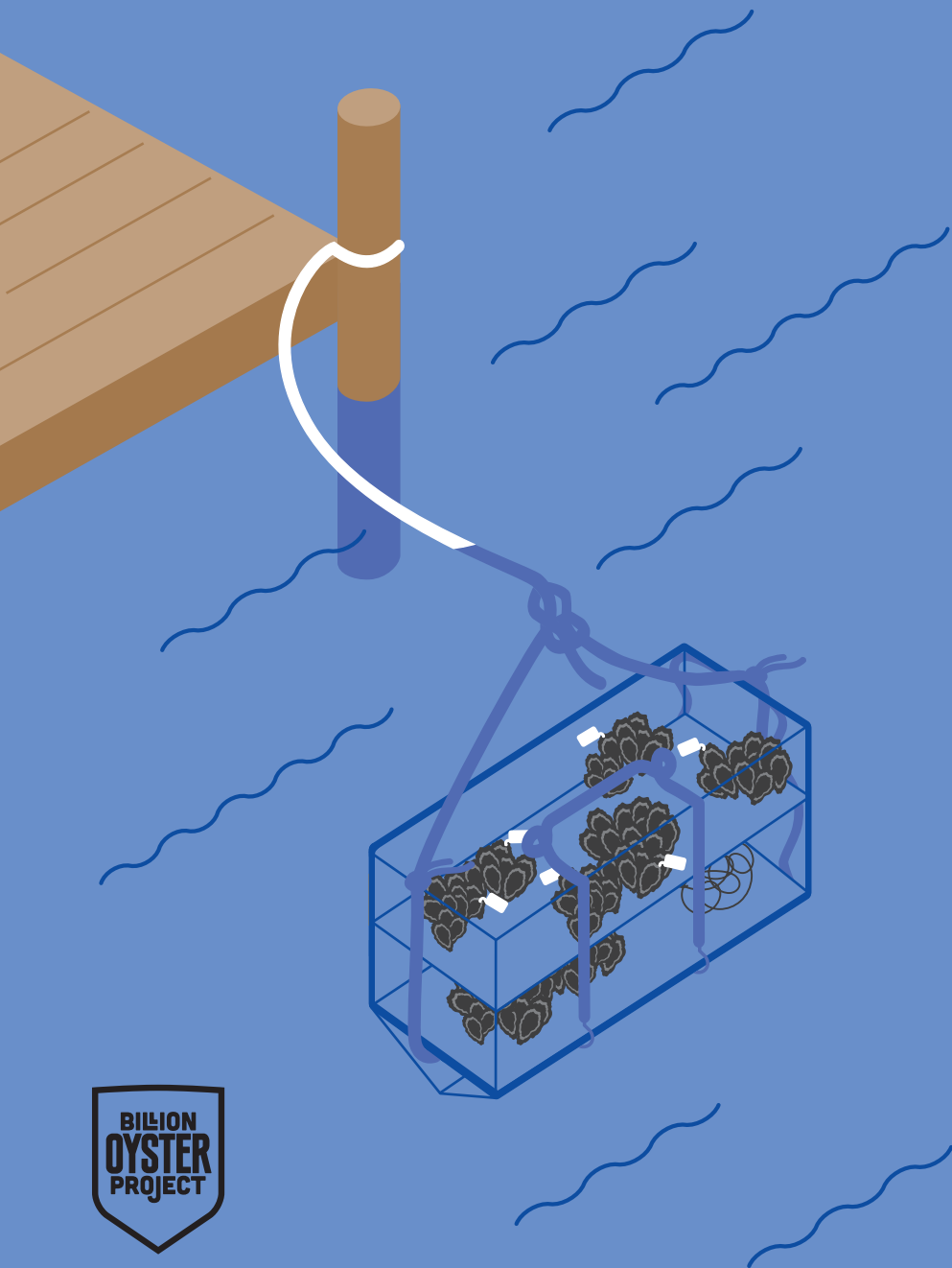


Field Science Manual: Oyster Restoration Station



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The Billion Oyster Project Curriculum and Community Enterprise for Restoration Science (BOP-CCERS) aims to improve STEM education in public schools by linking teaching and learning to ecosystem restoration and engaging students in hands-on environmental field science during their regular school day. BOP-CCERS is a research-based partnership initiative between New York Harbor Foundation, Pace University, New York City Department of Education, Columbia University Lamont-Doherty Earth Observatory, New York Academy of Sciences, University of Maryland Center for Environmental Science, New York Aquarium, The River Project, and Good Shepherd Services.

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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Sessile Species ID



Oyster Drill
Urosalpinx Cinerea

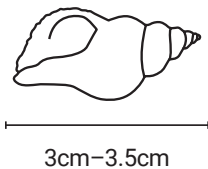
Category: Mollusks
Subcategory: Gastropods
Status: Native,
non-endemic
Phylum: Mollusca
Class: Gastropoda
Family: Muricidae
rock snails

A small pale-colored shell with sharply pointed cone and parallel ridges around shell. Predator of oysters and mussels.

Habitat: Found in shallow subtidal marine and estuarine regions in association with bivalve and barnacle beds.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Has a knobbly, sharply pointed spiraled shell, usually with 5 spiral turns or whorls. Thick, rounded ribs or costae (numbering 9-12) run from the shell opening to the pointed end of the spiral. Shell coloration is usually off-white to yellowish, sometimes with brown streaks, whilst the interior is colored purple, red-brown or yellow. The aperture is oval shaped with an open canal at the base. Size is up to 30-35 mm in length.



Blue Mussel
Mytilus Edulis

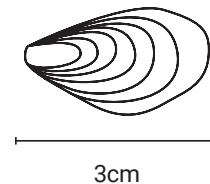
Category: Mollusks
Subcategory: Bivalves
Status: Native,
non-endemic
Phylum: Mollusca
Class: Bivalvia
Order: Mytilida
Family: Mytilidae
mussels

Blue-black with two hinged shells that open to feed, found in clumps attached to hard intertidal and shallow substrata.

Habitat: Found in the intertidal and shallow subtidal in clusters to rocky substrates or pier pilings. Individuals attach to the substrate using sticky byssal threads.

Diet: Mussels are filter feeders, ingesting bacteria, plankton and small detritus particles suspended in the water.

Morphology: A bivalve (two-shelled) mollusk with smooth outer shells with a glossy blue-black coloration. Size up to 3 cm in shell length.





Ribbed Mussel
Geukensia demissa

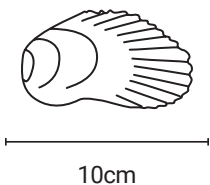
Category: Mollusks
Status: Native,
non-endemic
Class: Bivalvia
Family: Mytilidae,
Mussels

Green-brown bivalves found in muddy intertidal areas with ribs running the length of each shell.

Habitat: Found in the intertidal zone of marine and brackish waters attached to marsh plants or rocky substrates or embedded in sediment.

Diet: A filter feeder that ingests plankton and detritus from the water column.

Morphology: The ribbed mussel has two long, oval-shaped shells colored green to brown, with distinct ribs running the length of each shell. The inner shell is often tinted purple. Size up to 10 cm in shell length.



Slipper Snails
***Crepidula* Spp (Eastern Slipper Snail *C. plana* and Atlantic Slipper Snail *C. fornicata*)**

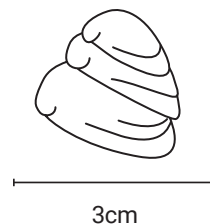
Category: Molluscs
Status: Native,
non-endemic
Class: Gastropoda
Order: Littorinimorpha
Family: Calyptraeidae,
slipper or boatsnails

Whitish single-shelled molluscs found in shallow nearshore habitats, with smooth, curved upper shells.

Habitat: Two species of small gastropod mollusk found in the low intertidal to subtidal associated with rocks, pier pilings and oyster beds.

Diet: Graze on algae and detritus found on hard substrates.

Morphology: Both species have a curved, smooth upper shell, rounder in *C. fornicata*, and a platform extending half way across the shell opening on the underside. The shell of *C. plana* is typically white to off-white, with the shell of *C. fornicata* showing darker color variations up to beige with brown markings. Size up to 30 mm in *C. plana*, up to 25 mm in *C. fornicata*.





Eastern Mudsail
Ilyanassa Obsoleta

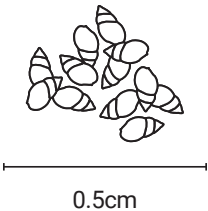
Category: Mollusks
Subcategory: Gastropods
Status: Native,
non-endemic
Phylum: Mollusca
Class: Gastropoda
Order: Neogastropoda
Family: Nassariidae,
dog whelks

Brown to black cone-shaped spiraled shell
found in large numbers in muddy habitats.

Habitat: Abundant in intertidal estuarine
areas with muddy substrates.

Diet: Feeds on algae, worms and detritus
within the muddy sediment.

Morphology: The shell is whorled and cone-
shaped with a brown to black coloration.
Shell surface is covered with beaded line
patterns and deep sutures between each
whorl. Size up to 25 mm in shell length.



Northern Rock Barnacle
Semibalanus Balanoides

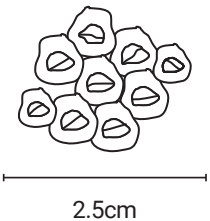
Category: Crustaceans
Subcategory: Barnacles
Status: Non-endemic
Phylum: Arthropoda
Class: Crustacea
Order: Sessilia
Family: Archaeobalanidae

Barnacles with six broad and low whitish
plates arranged in a ring around a central
diamond-shaped plate. Cemented to hard
substrata and usually found in clumps.

Habitat: Inhabits shallow intertidal and
subtidal marine areas, cemented to hard
substrata such as rocks and pier pilings.

Diet: Barnacles are filter feeders, feeding
on algae, zooplankton and detritus
particles in the water column.

Morphology: Six broad calcium carbonate
plates with a low overall profile and
diamond-shaped opening covered by a
calcium carbonate operculum. Soft parts
between plates are white or pinkish. Like all
barnacles, individuals are usually found in
clusters as they prefer to settle near other
barnacles out of the plankton. Up to 25 mm
in width.





Ivory Barnacle
Amphibalanus Eburneus

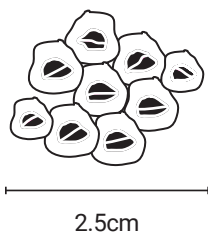
Category: Crustaceans
Subcategory: Barnacles
Status: Native, non-endemic
Phylum: Arthropoda
Class: Crustacea
Order: Sessilia
Family: Balanidae

Barnacle with whitish plates forming a steep cone, with soft parts often colored or striped. Found in clumps on hard substrata.

Habitat: Found cemented to hard substrata such as rocks and pier pilings in the intertidal and shallow subtidal, preferring brackish waters.

Diet: Barnacles are filter feeders, feeding on algae, zooplankton and detritus particles in the water column.

Morphology: The calcium carbonate plates forming the outer armor are form a steep cone. The soft parts in between plates may be striped in purple, yellow or off-white. Size is up to 25 mm in height and width.



Mud Tube Worm
Streblospio Benedicti

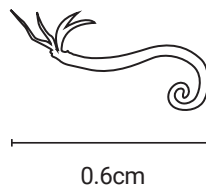
Category: Worms
Status: Native, non-endemic
Class: Polychaet
Subclass: Sedentaria
Order: Spionida
Family: Spionidae

Tube-dwelling reddish colored segmented worm up to 6 mm in length.

Habitat: In the Order Polychaeta (marine segmented worms). Lives in fine sandy and silty sediments, building tubes of sediment and mucus.

Diet: Feeds on detritus on the sediment surface.

Morphology: Head segment is cone-shaped with four eyes, one pair of tentacles and two pairs of gills. The remaining body segments each have one pair of parapodia - paddle-like appendages. Body coloration is a reddish brown, with dark green coloration around the gills. Size up to 6 mm in length.





Hard Tube Worms Serpulid and Spirorbid Worms

Category: Worms
Status: Native,
non-endemic
Phylum: Annelida
Class: Polychaeta
Order: Sabellida
Family: Serpulidae,
serpulid worms
Subfamily: Spirorbidae,
spirorbid worms

Worms living inside small whitish hard tubes that are either coiled (spirorbid worms) or straight (serpulid worms).

Habitat: Found attached to hard substrata such as rocks, pier pilings and oyster shells.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Construct hard, off-white tubes of calcium carbonate that are coiled (F. Spirorbidae) or largely straight or serpentine (SF. Serpulidae). Tube length up to 30 mm in serpulids, up to 25 mm across in spirorbids .



2.5cm



Tube-Building Polychaete *Polydora Cornuta* (formerly *Polydora Ligni*)

Category: Worms
Status: Native,
origin uncertain
Class: Polychaeta
Subclass: Sedentaria
Order: Spionida
Family: Spionidae

Bristled worm with two long frontal appendages living inside muddy tubes on sediment-covered surfaces.

Habitat: Builds mud-covered detrital tubes in the intertidal and shallow subtidal waters of estuaries. Naturally prefers muddy clay substrates and can be found on settlement tiles where sediment has accumulated.

Diet: Feeds on small food particles on the sediment surface using their pair of long frontal palps.

Morphology: Segmented body around 1-2 cm long with chetae (bristles) on each segment. *P. cornuta* may be difficult to observe outside their tubes, but their palps can sometimes be seen waving out of tiny holes in the sediment.



1-2cm



Golden Star Tunicate, Star Ascidian
Botryllus Schlosseri

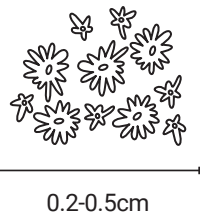
Category: Tunicates
Subcategory: Colonial ascidians
Status: Introduced,
Mediterranean
Phylum: Chordata
Subphylum: Tunicata
Class: Ascidiacea
Order: Stolidobranchia
Family: Styelidae

A colonial tunicate that grows in a gelatinous sheet, rubbery to the touch, on hard surfaces. Zooids form a star-like patterns across the surface.

Habitat: A colonial ascidian that grows as a gelatinous sheet with tiny individual modules, called zooids, embedded in a common tissue matrix. Found on hard substrata such as pier pilings, oyster cages, macroalgae and settlement tiles.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: The zooids are tear-drop shaped and very small (2-5 mm), arranged in star-shaped clusters that may contain up to 20 zooids. Coloration in this species is often striking but is also extremely variable, with the presence of star- or flower-like zooid patterning more useful for identification. Colony size is also variable, from a single zooid cluster to multiple clusters that can cover an entire settlement tile.



Chain Tunicate
Botrylloides Violaceus

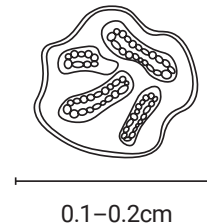
Category: Tunicates
Subcategory: Colonial ascidians
Status: Introduced,
Asian Pacific coast
Phylum: Chordata
Subphylum: Tunicata
Class: Ascidiacea
Order: Stolidobranchia
Family: Styelidae

A colonial animal that grows in a gelatinous sheet on hard surfaces, with zooids resembling meandering chains of tiny circles across the surface. Orange to brown in color, with zooids a single color.

Habitat: A colonial ascidian that grows as a gelatinous sheet with tiny individual modules, called zooids, embedded in a common tissue matrix. Found on hard substrata such as pier pilings, oyster cages, macroalgae and settlement tiles.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from Water.

Morphology: Individual zooids are a single color and oval- or tear dropshaped, 1-2 mm long and arranged in elongated clusters called systems, within a firm, often clear matrix. Systems usually contain >10 zooids and form the shape of long ovals or meandering, occasionally branching, double-rows or chains. Colony size and shape are variable.





Orange Sheath Tunicate
Botrylloides Diegensis

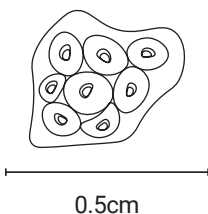
Category: Tunicates
Subcategory: Colonial ascidians
Status: Introduced,
Asian Pacific coast
Phylum: Chordata
Subphylum: Tunicata
Class: Ascidiacea
Order: Stolidobranchia
Family: Styelidae

A colonial animal that grows in a gelatinous sheet on hard surfaces, with oval-shaped zooids arranged in rows or dense clusters. Typically orange in color, with zooids two colors.

Habitat: Grows as a gelatinous sheet with tiny individual modules, called zooids, embedded in a common tissue matrix. Found on hard substrata such as pier pilings, oyster cages, macroalgae and settlement tiles.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Very similar to *B. violaceus*, particularly in color, *B. diegensis* also shows zooids that are oval in shape and arranged in rows or clusters. The individual zooids usually have two colors, with a bright ring around the oral aperture that is central to the zooid, in contrast to the position of the aperture in *B. violaceus* at the thick end of the 'tear drop' shape.



Sea Grapes
Molgula Manhattensis

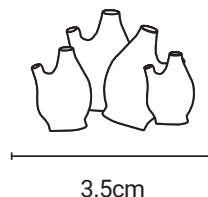
Category: Tunicates
Subcategory: Solitary ascidians
Status: Native,
non-endemic
Phylum: Chordata
Subphylum: Tunicata
Class: Ascidiacea
Order: Stolidobranchia
Family: Molgulidae

Globular grey animals with two protruding siphons, commonly heavy foulers of oyster cages.

Habitat: Found attached to hard substrata such as rocky reefs, pier pilings, ropes and other artificial structures in shallow subtidal marine and brackish waters. Often found heavily encrusting oyster cages.

Diet: *M. manhattensis* is a filter feeder on plankton and detritus.

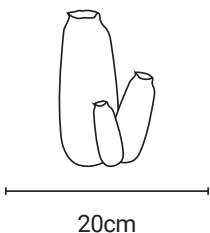
Morphology: Small, with a globular body with an inhalent and exhalant siphon on the upper side. The outer surface is usually a translucent grey to beige but is often encrusted with sediment and algae. Size up to 35 mm.





Sea Vase
Ciona intestinalis

Category: Tunicates
Subcategory: Solitary ascidians
Status: Introduced, origin uncertain
Phylum: Chordata
Subphylum: Tunicata
Class: Ascidiacea
Order: Phlebobranchia
Family: Cionidae



Translucent slender banana-shaped ascidian with small siphons at the end. Often occur in clumps.

Habitat: Found in shallow waters attached primarily to artificial hard surfaces. Can occur in large numbers.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Slender, translucent to pink/yellow colored bodies within which the branchial basket (digestive system) is usually visible. The two siphons are often tipped in yellow; incurrent siphons is longer, with 8 lobes, whereas outcurrent siphon is shorter with 6 lobes. Size variable but can be up to 20 cm in length.



Sea Squirt
Ascidella aspersa

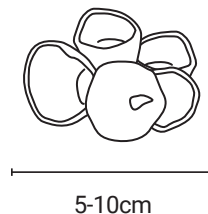
Category: Tunicates
Status: Introduced, origin uncertain
Subphylum: Tunicata
Class: Ascidiacea
Order: Phlebobranchia
Family: Ascidiidae

Solitary ascidian similar to *Molgula manhattensis* but more oval in shape with conical siphons with colored edges. Body pale in color with a lumpy outer surface.

Habitat: Found attached to hard substrata such as rocky reefs, pier pilings, ropes and other artificial structures in shallow subtidal marine and brackish waters. Often found heavily encrusting oyster cages.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Bodies are oval and often attached to substrate on one side. Two conical siphons with 6-8 lobes each; edges often colored, sometimes frilled. Translucent to pale yellow in color and with a lumpy outer surface. Size 50-100 mm in width.





Boring Sponges
Cliona Spp

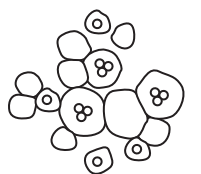
Category: Sponges
Status: Native,
non-endemic
Class: Demospongiae
Order: Clionaida
Family: Clionaidae

A very small yellow sponge that bores into oyster and mussel shells.

Habitat: Sponges are found on hard substrates such as rocks, pier pilings and algae, with their boring habit meaning that their tissues become intertwined with the substrate.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Yellow in color.



0.5cm



Red Beard Sponge
Clathria Prolifera
(formerly Microciona Prolifera)

Category: Sponges
Status: Native,
non-endemic
Class: Demospongiae
Order: Poecilosclerida
Family: Microcionidae

Reddish sponge that encrusts hard substrates in shallow waters. Irritating to skin – do not handle directly!

Habitat: Found in low intertidal to shallow subtidal waters in estuaries. Encrusts on hard substrates such as reefs and pier pilings, forming raised lobes or cups up to 200 mm tall in larger specimens and in deeper water.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Coloration is a rusty reddish orange to brown, with very small openings (oscula).



20cm



Lacy Bryozoan
Membranipora Membranacea

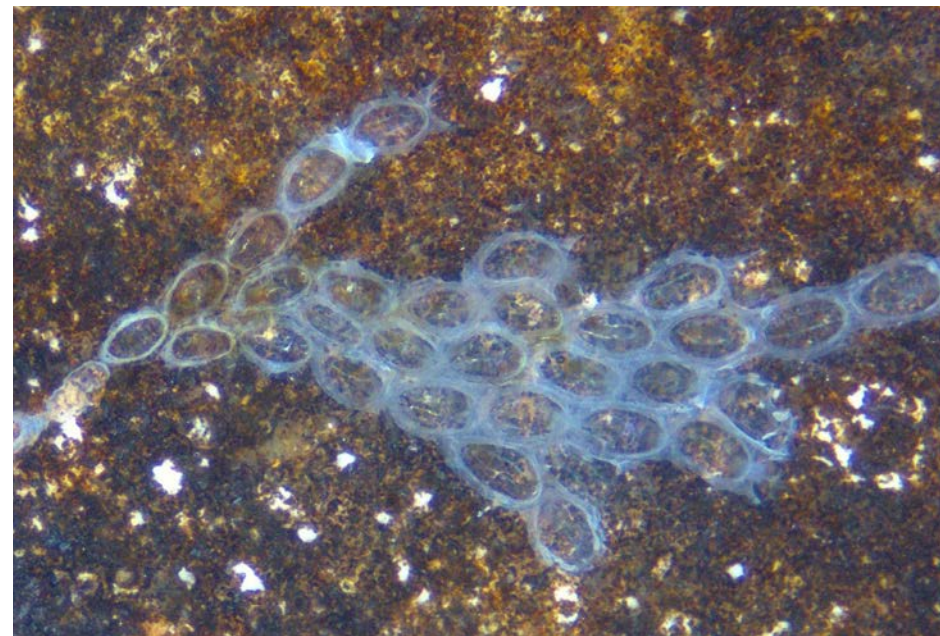
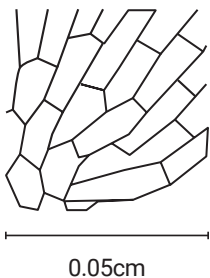
Category: Bryozoans
Status: Introduced,
US west coast, Europe
Phylum: Bryozoa
Class: Gymnolaemata
Order: Cheilostomatida
Family: Membraniporidae

Colonies form thin whitish sheets with tiny box-like zooids in a lacy pattern.

Habitat: Found encrusting a variety of subtidal surfaces, including rocks, pier pilings, shells and algae.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Colonies form thin whitish sheets of rectangular box-like units, termed zooids, which are very small (0.5 mm in length) and are arranged like bricks in a wall. Each zooid houses a fan-like feeding structure (the lophophore), which can be extended outside the zooid to capture particles in the water. Spines may be present on the zooid corners. Colony size and shape is variable according to its age and history.



Conopeum Spp (*C. tenuissium* and *C. seurati* are very similar)

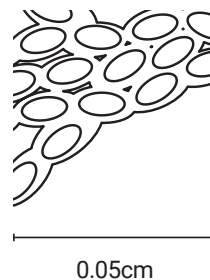
Status: Introduced,
US Gulf Coast
Class: Gymnolaemata
Order: Cheilostomatida
Superfamily: Membraniporoidea
Family: Electridae

Encrusting colonies form whitish sheets, with oval-shaped zooids.

Habitat: Found encrusting hard surfaces such as rocks and mollusc shells.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Colonies form thin whitish sheets with tiny, oval-shaped zooids. Zooid size is around 0.5 mm in length and 0.25 mm in width. Where colonies have been disturbed by predators (e.g. nudibranchs), they may form up to 8 spines on the zooid periphery. Colony shape often resembles branching patterns across the substrate.





Bugula Neritina

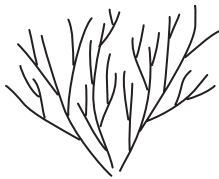
Status: Introduced,
origin uncertain
Class: Gymnolaemata
Order: Cheilostomatida
Superfamily: Buguloidea
Family: Bugulidae

Upright, tree-like bushy colonies, purple to brown.

Habitat: Found attached to hard substrates such as pier pilings and rocks as well as algae and shells.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Colonies are upright, bushy and tree-like. Branches are two zooids wide, with bifurcations every four zooids in length. Zooids are 0.2-0.3 mm in width and 0.75-1.2 mm long and may also contain spherical whitish reproductive structures termed ovicells. When present, ovicells are usually abundant and concentrated towards the older, central part of the colony. Colonies often resemble algae but can be distinguished by looking for the modular structure. Coloration is purple to brown.



0.075-0.12cm



Hydroids

Category: Cnidarians
Status: Native,
non-endemic
Class: Hydrozoa
Subclass: Hydroidolina

Tiny translucent colonies that may be feather-like, tree-like or form runners over the surface.

Habitat: A very large and complex group of cnidarian species that have a colonial life stage attached to substrata such as rocks, pier pilings, shells, algae, seagrass and other structures.

Diet: Capture microscopic algae, zooplankton and detritus in the water.

Morphology: These animals have very small modular units, termed polyps, which may be arranged as elongate threads across a surface or as tree-like arborescent structures projecting vertically from the surface. Each polyp possesses stinging cells, termed nematocysts, to enable them to capture small prey. Colony size is usually small, up to a few cm across.



0.5-1cm



Tubular Hydroids
Ectopleura Crocea

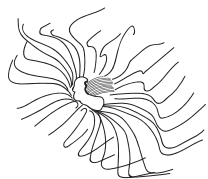
Category: Hydroids
Status: Native,
non-endemic
Phylum: Cnidaria
Class: Hydrozoa
Order: Anthoathecata
Family: Tubulariidae

Slender-stalked colonial hydroids with pink-colored zooids and numerous whitish oral tentacles.

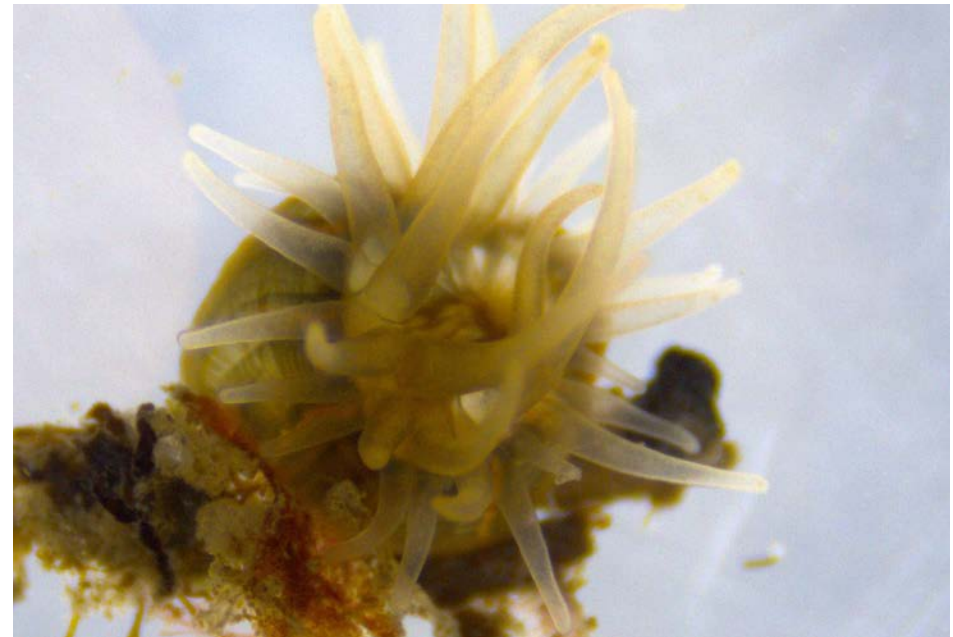
Habitat: Found attached to hard substrates such as pier pilings and rocks in intertidal and subtidal brackish waters.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: The individual zooids (hydranths) have a rosy-pink center surrounded by 20–25 whitish, thread-like oral tentacles. The stalks connecting hydranths to the basal connective runners (stolons) are slender and smooth, with no branching. Basal stolons can form a tangled mat on the substrate, trapping microalgae, detritus and sediment. Size of individual zooids up to 0.5 cm across; length of stalks up to 12.5 cm; colony sizes up to ~10–15 cm across.



12.5cm



Frilled Anemone
Metridium Dianthum (formerly M. Senile)

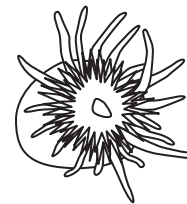
Category: Cnidarians
Status: Native,
non-endemic
Class: Anthozoa
Order: Actinaria
Family: Metridiidae

Solitary polyp attached to substrate with creamy yellow to brown coloration and many tentacles.

Habitat: Found on hard substrata such as rocks and pier pilings in the intertidal and shallow subtidal. The most common anemone on the northeast coast.

Diet: Feed on live and dead animals from zooplankton through to fish.

Morphology: Numerous, fine tentacles (up to 1000) in large, adult forms, with a lobed oral disk. Juveniles and smaller individuals have around 20-50 fine unbanded tentacles. Column is smooth and creamy yellow to brown. Size up to 10 cm tall by 8 wide in the subtidal, but smaller in the intertidal and along the shore.



10cm



Northern Red Anemone
Urticina felina

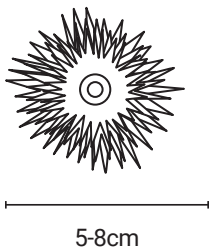
Status: Native,
non-endemic
Class: Anthozoa
Order: Actinaria
Family: Actiniidae

Solitary polyp attached to substrate with reddish coloration and short, banded tentacles.

Habitat: Found on lower intertidal shores on hard substrata such as rocks and pier pilings, as well as in gravel or shell debris.

Diet: Feed on live and dead animals from zooplankton through to fish.

Morphology: Column smooth and stout, around half as high as wide. Coloration varies from pinkish to deep wine red to purple, with short, blunt, banded tentacles. Overall width is 5-8 cm in intertidal individuals, larger (up to 10 cm wide) in deeper waters.



Orange Bryozoan
Watersipora Subtorquata

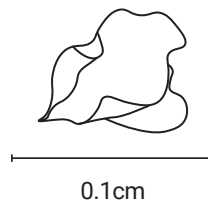
Category: Bryozoans
Status: Introduced,
origin uncertain
Phylum: Bryozoa
Class: Gymnolaemata
Order: Cheilostomatia
Family: Watersiporidae

Colonies may be encrusting or lobed with red-orange zooids.

Habitat: Found encrusting hard surfaces such as rocks, pier pilings and shells as single-layered sheets. More upright, lobed forms may be found in calm waters.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water.

Morphology: Colonies form encrusting sheets on hard substrata such as rocks and pier pilings but may be more three-dimensional in large colonies in calm waters. Zooid size is around 1 mm long by 0.5 mm wide. Colonies are a reddish-orange color, with black zooid and operculum outlines. Dead zooids are black to grey.





Brown Bushy Bryozoan
Bugula Neritina

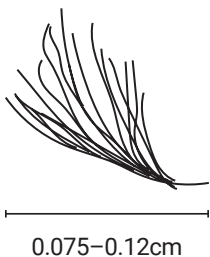
Category: Bryozoans
Status: Introduced,
origin uncertain
Phylum: Bryozoa
Class: Gymnolaemata
Order: Cheilostomatida
Family: Bugulidae

Upright, tree-like bushy colonies, purple to brown in color.

Habitat: Found attached to hard substrates such as pier pilings and rocks as well as algae and shells.

Diet: Filter feeders, ingesting microscopic algae, zooplankton and detritus particles from the water

Morphology: Colonies are upright, bushy and tree-like. Branches are two zooids wide, with bifurcations every four zooids in length. Zooids are 0.2-0.3 mm in width and 0.75-1.2 mm long and may also contain spherical whitish reproductive structures termed ovicells (see image below right). When present, ovicells are usually abundant and concentrated towards the older, central part of the colony. Colonies often resemble algae but can be distinguished by looking for the modular structure. Coloration is purple to brown.



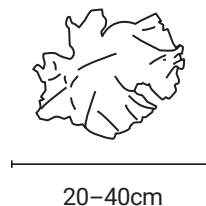
Sea Lettuce
Ulva Spp. (Commonly
Ulva Lactuca)

Category: Algae (green)
Status: Native,
non-endemic
Kingdom: Plantae
Phylum: Chlorophyta
Class: Ulvophyceae
Order: Ulvales
Family: Ulvaceae

Green algae growing in thin sheets with ruffled edges.

Habitat: Grows in shallow marine and brackish waters, commonly in nutrient-rich areas. Can be found free-floating or attached to substrates such as rocks and pilings as well as on sandy bottoms.

Morphology: Has a similar appearance to wilted lettuce, with thalli growing as thin sheets with ruffled edges. Color is an intense green, size from around 20 to 40 cm across. Often found in clumps.





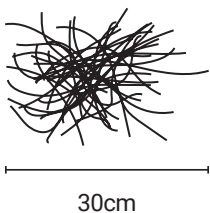
Hollow Green Weed
***Enteromorpha* Spp.**

Category: Algae (green)
Status: Native,
non-endemic
Kingdom: Plantae
Phylum: Chlorophyta
Class: Ulvophyceae
Order: Ulvales
Family: Ulvaceae

Grass-green algae growing as thin, hollow threads.

Habitat: Grows in shallow marine and brackish waters worldwide. Typically grows in clumps on wood, rocks and other plants.

Morphology: Tubular, sometimes branched, bright grass-green algae. Often found in clumps. Tubes are hollow, with air bubbles visible in larger specimens. Tube width variable, from <1 mm to greater than 10 mm, with tube length up to 300 mm. Branched species tend to have more slender and shorter in size.



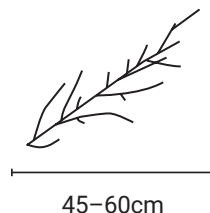
Sour Weeds
***Desmarestia* Spp.**

Category: Algae (brown)
Status: Native,
non-endemic
Kingdom: Chromista
Phylum: Ochrophyta
Class: Phaeophyceae
Order: Desmarestiales
Family: Desmarestaceae

Branching brown algae with wispy, fine tufts or spines off main branches.

Habitat: A genus of algae that has a global distribution in temperate to polar rocky intertidal to shallow subtidal habitats. Common species in the area are *D. aculeata* (spiny sour weed) and *D. viridis* (soft sour weed).

Morphology: Main branches stiff (spiny sour weed *D. aculeata*) or soft (soft sour weed *D. viridis*), alternating on the central axis. *Desmarestia aculeata* has tufty filaments projecting from main branches in spring and short, spiny branches in summer. *Desmarestia viridis* has soft, fine filaments projecting from main branches throughout the year. Both species smell sour. Whole plant size to 450 mm (*D. aculeata*) and 600 mm.








Protocol 1: Site Conditions


Meta Data

| |
|-----------------------------|
| Name of member(s): |
| Name of site or water body: |
| Coordinates: |
| Date of monitoring: |
| Time of monitoring: |
| Notes/other observations: |

Meteorological Conditions

| | | | | | | | | | |
|---|----------------------------------|-------|---------------|--------|------|-----|------|------|--------------|
|  | Weather conditions (circle one): | Sunny | Partly cloudy | Cloudy | Rain | Fog | Snow | Hail | Thunderstorm |
|  | Air temperature (°C): | | | | | | | | |
|  | Wind speed (mph): | | | | | | | | |
|  | Wind direction (circle one): | N | NW | W | SW | S | SE | E | NE |
|  | Humidity (%): | | | | | | | | |

Recent Rainfall

| | | | |
|---|-------------------------------------|-----|----|
|  | Has it rained in the past 7 days? | YES | NO |
| | Has it rained in the past 72 hours? | YES | NO |
| | Has it rained in the past 24 hours? | YES | NO |

Tide Conditions

| |
|--|
| Use free app such as "Tides Near Me" or NOAA |
|--|



Tide observations:

| | | | | | | | |
|---|-----------------------------|-------------------------------|------------------------|-----------------------------|----|--------------------------|----|
|  | Reference point (location): | | | | | | |
|  | Tide times and heights: | Closest high tide time: | Closest low tide time: | Closest high tide height: | ft | Closest low tide height: | ft |
|  | Tidal current (circle one): | Flood current (incoming tide) | Slack water | Ebb current (outgoing tide) | | | |

Protocol 1: Site Conditions


Water Conditions

Take a photograph of the water with your camera in landscape orientation

| | | | | | | | | | | |
|---|--|--|------------|-----------|-----------------|------------|-------------|------------|----|--|
|  | Surface movement | | Direction: | | Speed (ft/sec): | | | | | |
|  | Describe the water color: | | Light blue | Dark blue | Light green | Dark green | Light brown | Dark brown | | |
|  | Oil sheen present? | | YES | | | | | | NO | |
|  | Is there anything floating in the water? | | YES | | | | | | NO | |

| | | | | | | | |
|-------------|--------------|--------------|-------|-------|-------|---------|-------|
| Extent/type | Hard plastic | Soft plastic | Metal | Paper | Glass | Organic | Other |
| None | | | | | | | |
| Sporadic | | | | | | | |
| Common | | | | | | | |
| Extensive | | | | | | | |

Outfall Pipes

| | | | | | | |
|---|---|--|---------|--------------|---------------|-----------|
|  | Are there any marked combined sewer overflow (CSO) pipes? | | YES | | NO | |
| If Y, what is the location? | | | | | | |
| If Y, is there any flow through the pipe? | | | | | | |
| How much? | | | YES | | NO | |
| | | | Trickle | Light stream | Steady stream | Full flow |
| Are there any unmarked or other outfall pipes? | | | | | | |
| If Y, what is the location? | | | | | | |
| If Y, what is the approximate diameter of the pipe (cm)? | | | | | | |
| If Y, is there any flow through the pipe? | | | | | | |
| How much? | | | YES | | NO | |
| | | | Trickle | Light stream | Steady stream | Full flow |

Land Conditions

Take a photograph of the water with your camera in landscape orientation



Choose shoreline type:

Bulkhead/wall

Fixed pier

Floating dock

Rocky shoreline

Dirt or sand

Other



Estimate percent surface cover for the adjacent shoreline (about 100 x 100 feet)

☐

% Impervious surface (concrete/asphalt paths, roads, buildings etc.)

☐

% Pervious surface (dirt, gravel etc.)

☐

% Vegetated surface (grass, shrubs, trees)

☐

% Sum should equal 100%.



Is there any garbage on the adjacent shoreline?

YES

NO

| Extent/type | Hard plastic | Soft plastic | Metal | Paper | Glass | Organic | Other |
|-------------|--------------|--------------|-------|-------|-------|---------|-------|
| None | | | | | | | |
| Sporadic | | | | | | | |
| Common | | | | | | | |
| Extensive | | | | | | | |

Protocol 2: Oyster Measurements

Meta Data

Name of member(s):

Name of site or water body:

Coordinates:

Date of monitoring:

Time of monitoring:

Notes/other observations:



Depth of Oyster Cage

Submerged depth of cage (meters):



Condition of Oyster Cage

Bioaccumulation on cage (circle one):

None/clean: No macroalgae or animals present

Light: Macroalgae or minimal animals present that do not encroach on mesh openings

Medium: Some encrusting macroalgae/animals reducing size of mesh opening up to 50%

Heavy: Encrusting macroalgae/animals reducing mesh opening by more than 50%

Describe any damage to the cage:

Measuring Oyster Growth

After you measure all the live oysters on all ten tagged substrate shells complete the following:

| Population totals | Min. size: | Max. size: | Avg. size: | Total alive: |
|--|------------|------------|------------|--------------|
| If you have completed a previous expedition, write in that data below and calculate delta. Then calculate growth and mortality rate. | | | | |
| Previous expedition | Min. size: | Max. size: | Avg. size: | Total alive: |
| Delta (% change) | | | | |
| Growth rate (%) | | | | |
| Mortality rate (%) | | | | |

Protocol 2: Oyster Measurements

Copy from tag

| | | |
|--|-------------------------|---------|
| Tag number: | Set date: | Source: |
| Weight (g): | Number of live oysters: | |
| Photograph both sides of the shell: outer (convex, rough) and inner (concave, smooth). Make sure the tag is visible. | | |

Measurement (mm)

| | | |
|-----|-----|-----|
| 1. | 13. | 25. |
| 2. | 14. | 26. |
| 3. | 15. | 27. |
| 4. | 16. | 28. |
| 5. | 17. | 29. |
| 6. | 18. | 30. |
| 7. | 19. | 31. |
| 8. | 20. | 32. |
| 9. | 21. | 33. |
| 10. | 22. | 34. |
| 11. | 23. | 35. |
| 12. | 24. | 36. |

Copy from tag

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|--|-------------------------|---------|
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| 3. | 15. | 27. |
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| 5. | 17. | 29. |
| 6. | 18. | 30. |
| 7. | 19. | 31. |
| 8. | 20. | 32. |
| 9. | 21. | 33. |
| 10. | 22. | 34. |
| 11. | 23. | 35. |
| 12. | 24. | 36. |

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| 8. | 20. | 32. |
| 9. | 21. | 33. |
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| 11. | 23. | 35. |
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| 11. | 23. | 35. |
| 12. | 24. | 36. |

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| 6. | 18. | 30. |
| 7. | 19. | 31. |
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| 9. | 21. | 33. |
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| 5. | 17. | 29. |
| 6. | 18. | 30. |
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| 8. | 20. | 32. |
| 9. | 21. | 33. |
| 10. | 22. | 34. |
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| 12. | 24. | 36. |

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| Weight (g): | Number of live oysters: | |
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| | | |
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| 5. | 17. | 29. |
| 6. | 18. | 30. |
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| 8. | 20. | 32. |
| 9. | 21. | 33. |
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| 11. | 23. | 35. |
| 12. | 24. | 36. |

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| 7. | 19. | 31. |
| 8. | 20. | 32. |
| 9. | 21. | 33. |
| 10. | 22. | 34. |
| 11. | 23. | 35. |
| 12. | 24. | 36. |

Copy from tag

| | | |
|--|-------------------------|---------|
| Tag number: | Set date: | Source: |
| Weight (g): | Number of live oysters: | |
| Photograph both sides of the shell: outer (convex, rough) and inner (concave, smooth). Make sure the tag is visible. | | |

Measurement (mm)

| | | |
|-----|-----|-----|
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| 2. | 14. | 26. |
| 3. | 15. | 27. |
| 4. | 16. | 28. |
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| 6. | 18. | 30. |
| 7. | 19. | 31. |
| 8. | 20. | 32. |
| 9. | 21. | 33. |
| 10. | 22. | 34. |
| 11. | 23. | 35. |
| 12. | 24. | 36. |

Protocol 3: Mobile Trap

Meta Data

Name of member(s):

Name of site or water body.

Coordinates:

Date of monitoring:

Time of monitoring:

Notes/other observations:

Mobile Organisms

Monitor the mobile trap near the shoreline, so you can return the organisms to the harbor as soon as possible.

[illegible][illegible]

Protocol 4: Settlement Tiles

Meta Data

Name of member(s):

Name of site or water body:

Coordinates:

Date of monitoring:

Time of monitoring:

Notes/other observations:

Settlement tile number:

| Grid point | Common name | Grid point | Common name |
|------------|-------------|------------|-------------|
| 1. | | 1. | |
| 2. | | 2. | |
| 3. | | 3. | |
| 4. | | 4. | |
| 5. | | 5. | |
| 6. | | 6. | |
| 7. | | 7. | |

Settlement tile number:

| | | | |
|-----|--|-----|--|
| 8. | | 8. | |
| 9. | | 9. | |
| 10. | | 10. | |
| 11. | | 11. | |
| 12. | | 12. | |
| 13. | | 13. | |
| 14. | | 14. | |
| 15. | | 15. | |
| 16. | | 16. | |
| 17. | | 17. | |
| 18. | | 18. | |
| 19. | | 19. | |
| 20. | | 20. | |
| 21. | | 21. | |
| 22. | | 22. | |
| 23. | | 23. | |
| 24. | | 24. | |
| 25. | | 25. | |

Protocol 4: Settlement Tiles

Settlement tile number:

| Grid point | Common name | Settlement tile number: | |
|------------|-------------|-------------------------|-------------|
| | | Grid point | Common name |
| 1. | | 1. | |
| 2. | | 2. | |
| 3. | | 3. | |
| 4. | | 4. | |
| 5. | | 5. | |
| 6. | | 6. | |
| 7. | | 7. | |
| 8. | | 8. | |
| 9. | | 9. | |
| 10. | | 10. | |
| 11. | | 11. | |
| 12. | | 12. | |
| 13. | | 13. | |
| 14. | | 14. | |
| 15. | | 15. | |

| | | | |
|-----|--|-----|--|
| 16. | | 16. | |
| 17. | | 17. | |
| 18. | | 18. | |
| 19. | | 19. | |
| 20. | | 20. | |
| 21. | | 21. | |
| 22. | | 22. | |
| 23. | | 23. | |
| 24. | | 24. | |
| 25. | | 25. | |

Protocol 5: Water Quality

Meta Data

Name of member(s):

Name of site or water body:

Coordinates:






Date of monitoring:




Time of monitoring:

Notes/other observations:

Water Quality Parameters

Depth of water sample (m):

| Parameter | Method (tool or test name) | Results (complete two or three measurements for each parameter) | | | Average | Units (must be the same for all results) |
|---|----------------------------|---|--|--|---------|--|
|  Water temperature | | | | | | |
|  DO | | | | | | |
|  Salinity | | | | | | |
|  pH | | | | | | |
|  Ammonia | | | | | | |

| | | | | | | |
|---|--|--|--|--|--|--|
|  Nitrate | | | | | | |
|  Phosphate | | | | | | |
|  Turbidity | | | | | | |
| Other | | | | | | |

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