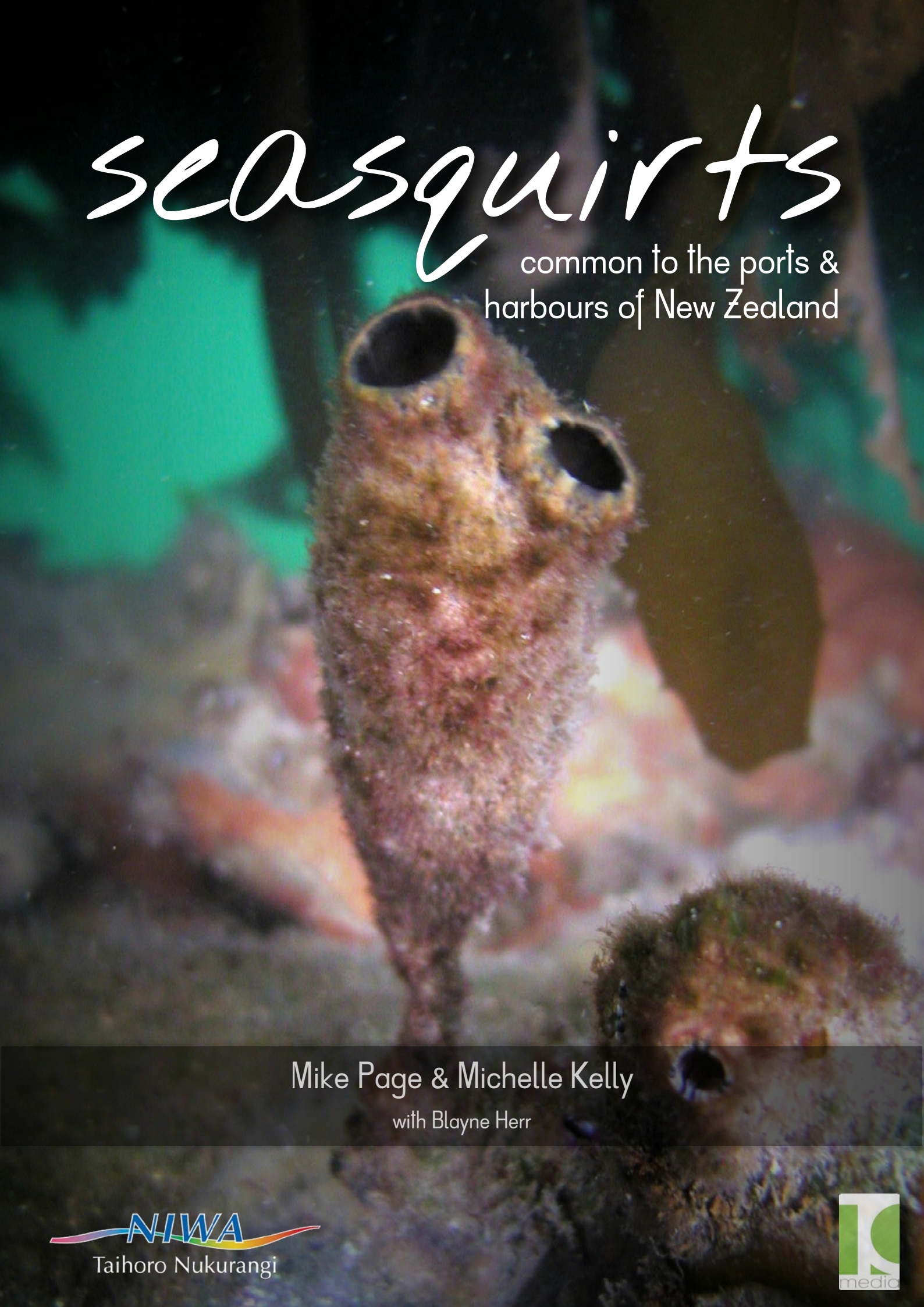

seasquirts
common to the ports &
harbours of New Zealand
Mike Page & Michelle Kelly
with Blayne Herr
NIWA
Taihoro Nukurangi
media

about seasquirts

Seasquirts (ascidians) are amongst the most common fouling animals in ports and harbours around the world. They settle and grow in great abundance on artificial substrates such as wharf piles, seawalls, ship hulls and aquaculture structures, . While most native (endemic) species are found in low numbers in intertidal and subtidal environments around New Zealand, introduced (invasive) species are usually highly successful, invading in great abundance and often in densities that preclude other species. They have abundant, highly mobile larvae that settle and grow quickly, competing with other species for food and space. The potential consequences of this biology, for the shellfish aquaculture industry in particular, are disastrous.

Seasquirts feed by filtering organic particles from water entering the inhalant siphon, and waste products, gametes and embryos are expelled through the exhalent siphon. Fertilisation may be internal or external with embryos brooded in collonial and some solitary species, followed by a very short-lived free-living larval stage before settlement.

Fish, flatworms , sea-urchins and sea-stars are the seasquirts' primary predators, although, in Chile, Japan, Korea , Europe and parts of Aboriginal Australia, some seasquirts are eaten by humans!

about this guide

The purpose of this guide is to provide a simple introduction to living seasquirts, and to distinguish between introduced and native species common to a majority of the ports and harbours around New Zealand. The species are illustrated with high-quality **images** of the animals in life, and **icons** are used to simplify identification of characters. As far as possible, we have used identifying features that can be seen with the unaided eye and a magnifying glass, and language that is non-technical. A **glossary** and **description of the icons** have been provided at the end of the guide.The guide is not definitive in that it only contains 24 species, but it is dynamic in that new species will be added as they are discovered, and the guide will be updated on NIWA's website (www.niwa.co.nz).

how to identify your seasquirt

Click on an image of a seasquirt in the **colour index** that you think looks most like your unknown species. This will bring you to the **species page** that provides information on that species. To help confirm your identification work through the **identify your seasquirt flowcharts**, using a magnifying glass to find the anatomical features where needed. As a last resort, thumb your way through the species pages looking for your animal, then confirm it by examining the characters described in the flowcharts. If you already know what the species is, click on the **taxonomic name** in the **species index** to bring you to the species page that describes the animal. If you are really keen, you can then use the **taxonomic reference** at the bottom of each species page to double check your identification. Note that seasquirts are preserved in 10% formalin after relaxation in seawater and menthol. This process may cause changes to the colour and texture of the body.

species pages

Each seasquirt **species page** illustrates and describes the characters that differentiate it from other species. The information is presented as **icons**, easy to use at a glance, conveying information without words. A **glossary of descriptive terms and icons** has been provided at the end of the guide for quick reference.

taxonomic authority
person(s) who first described this species

taxonomic name of species

species classification
see species index for arrangement

species images
Inset images show variations

image icons
highlighting whether native or introduced, solitary or colonial, and size (scale bar)

depth range
common depth range around New Zealand

bar icons
highlighting shape, surface detail, habitat, and environment

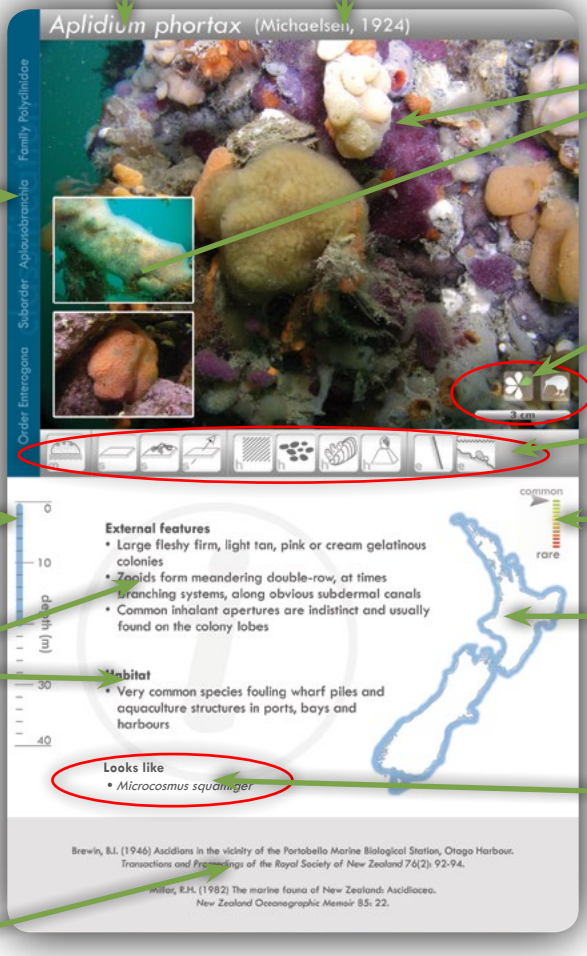
abundance

information
details on external and internal characters and habitat

distribution
section of coastline where species is most commonly found

looks like
some species are difficult to tell apart without careful identification, so check the species listed here to make sure that you have the correct species

key taxonomic references



colour index

Corella eumyota

Ciona spp

Molgula manhattensis

Molgula mortenseni

Diplosoma listerianum

Ascidiella aspersa

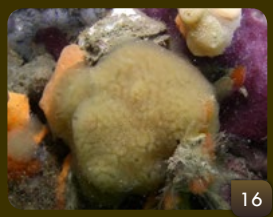
Didemnum species complex

Eudistoma elongatum

Didemnum vexillum

Pyura pachydermatina

Styela canopus

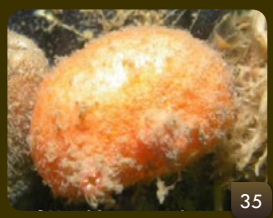


Aplidium phortax

Clavelina lepadiformis

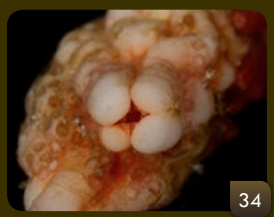
Botryllus schlosseri

Pyura species complex



Asterocarpa humilis

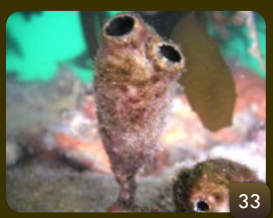
Cnemidocarpa bicornuta



Styela plicata

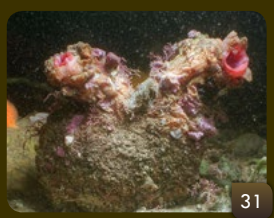
Microcosmus squamiger

Botryllus tuberatus

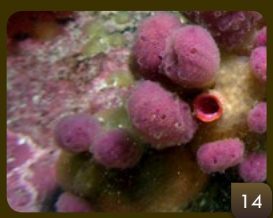


Styela clava

Botrylloides leachii

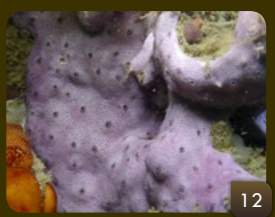


Cnemidocarpa nisiotus



Hypsistozoa fasmeriana

Botrylloides leachii



Lissoclinum notti

Pyura paeputialis

Botrylloides leachii

species index

Phylum Chordata
Subphylum Tunicata
Class Ascidiacea

Order Enterogona

Order Pleurogona

seasquirt biology

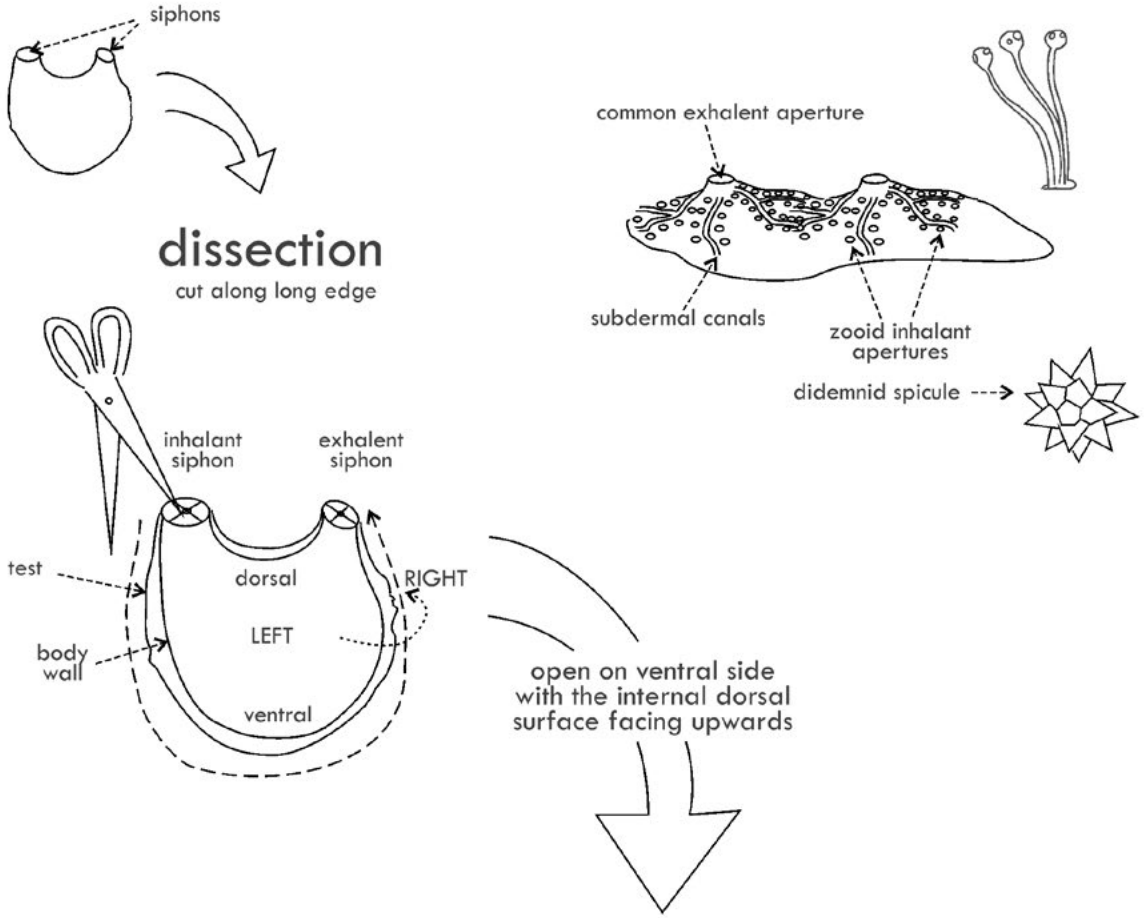
Seasquirts are animals that feed by filtering the water through their body via an **inhalant** and **exhalent siphon**. Some are **solitary** animals, and some live in groups (**colonial**), some are **stalked**, and some **encrust** the substrate. Individual animals are enclosed within a leathery or gelatinous test which can be translucent.

solitary

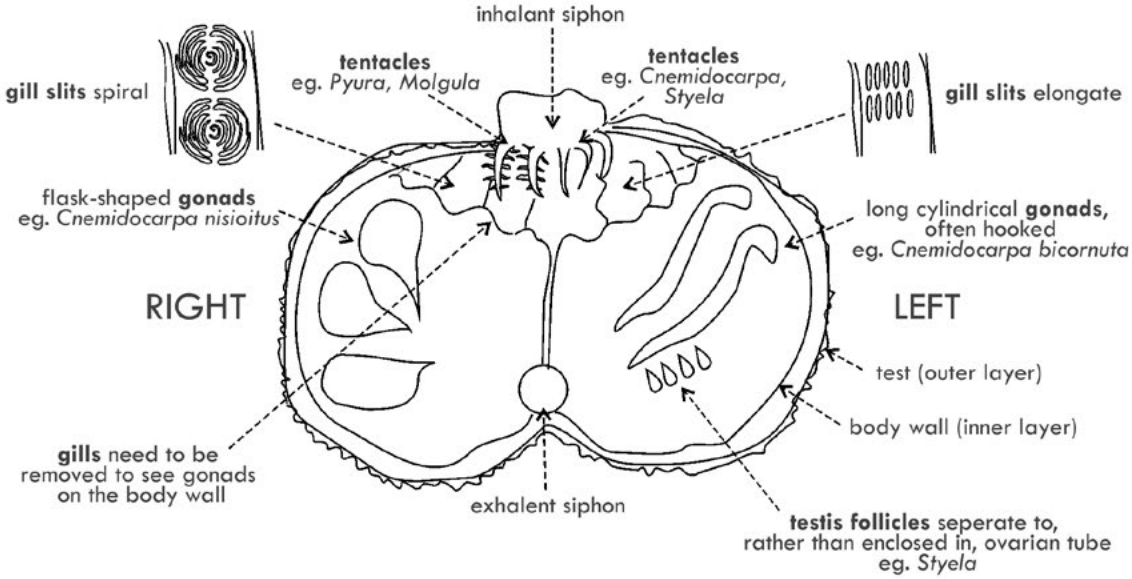
Individual animals with an inhalant siphon and an exhalent siphon, often with a thick leathery test that encloses the body of the animal.

colonial

Groups of small animals (zooids) embedded in a gelatinous test as a colony. Zooids can be arranged in systems, sharing common exhalent canals and apertures. Other types can have zooids opening independantly or on stalks connected to a common basal test.



composite schematic of a solitary seasquirt

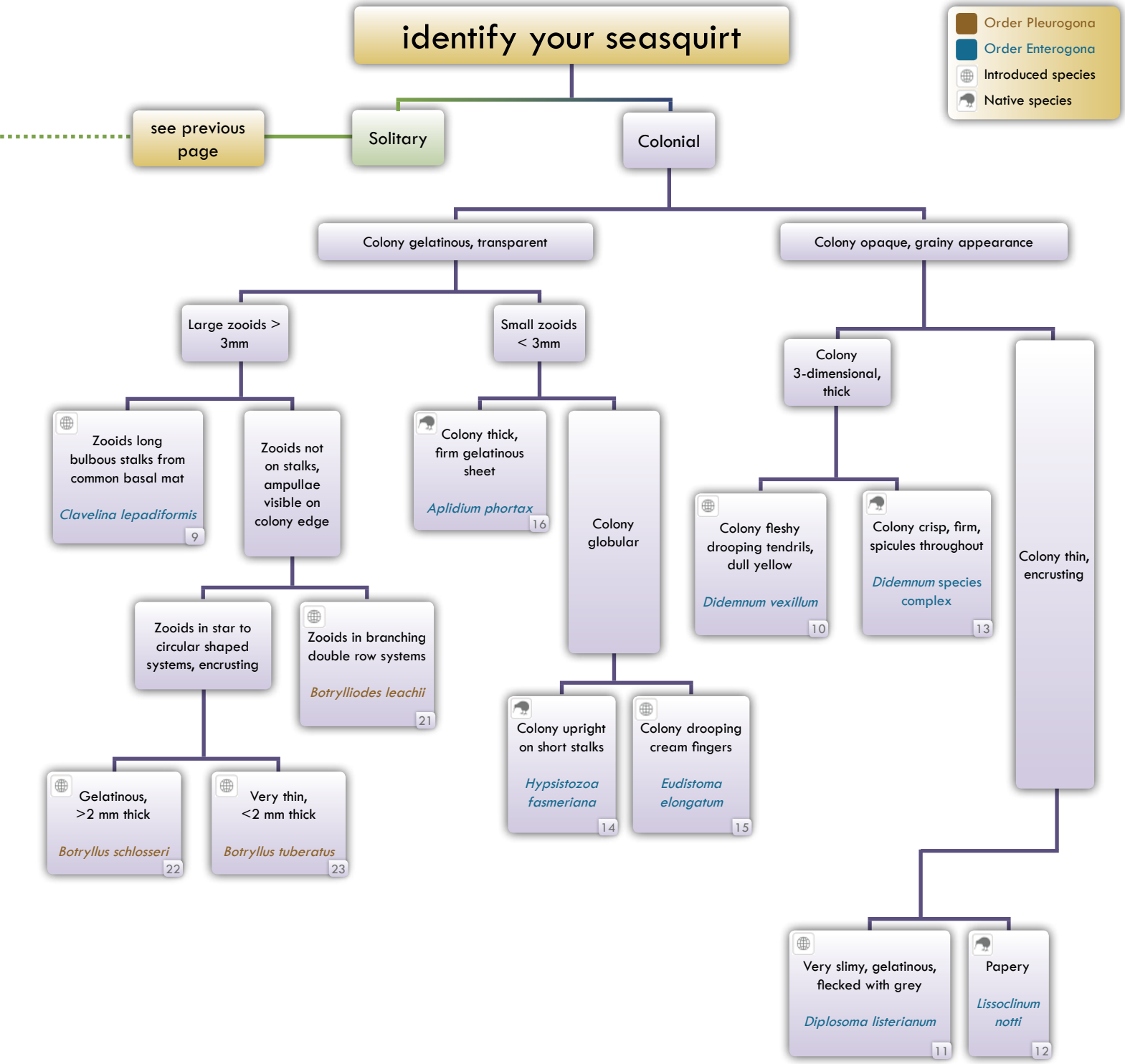


Order Pleurogona
Order Enterogona
Introduced species
Native species

identify your seasquirt

- Solitary
  - Stalked
    - Stalk long smooth, siphons 1/3 body length apart — *Pyura pachydermatina* — 26
    - Stalk short deep longitudinal folds, siphons close together — *Styela clava* — 33
  - Unstalked
    - Test translucent, slightly see-through
      - Test smooth
        - Test cartilaginous, tough yet flexible — *Corella eumyota* — 20
        - Test soft
          - Yellow pigment spots on siphon rim — *Ciona intestinalis* — 18
          - Orange pigment spots on siphon rim — *Ciona savigny* — 19
      - Test rough with warty processes — *Ascidiella aspersa* — 17
    - Test not translucent, opaque
      - Tentacles branched
        - Gill slits spiral, small globular individuals, test with no ridges
          - Test white, papery, translucent — *Molgula manhattensis* — 24
          - Test coated in fine sand — *Molgula mortenseni* — 25
        - Gill slits elongate
          - Numerous gonads in paired blocks on each side of body
            - Test thick, cartilaginous (tough yet flexible), sandy — *Pyura paeputialis* — 28
            - Test leathery, tough, wrinkled — *Pyura* species complex — 29
          - Gonads in a few large blocks, left gonad crosses over the gut loop
            - Test irregular with ridges and swellings, elongate — *Microcosmus squamiger* — 27
      - Tentacles NOT branched
        - Test white or gray
          - Test inflexible, cream thick, warty and pleated — *Styela plicata* — 34
          - Test flexible
            - Body small, oval, siphons with warty processes — *Asterocarpa humilis* — 35
            - Body upright, siphons close together — *Styela canopus* — 32
        - Test brown, wrinkled, leathery
          - Body ovoid, siphons about ½ a body length apart — *Cnemidocarpa nisiotus* — 31
          - Body elongate, with a saddle between siphons — *Cnemidocarpa bicornuta* — 30

- Colonial — see next page


identify your seasquirt
Order Pleurogona
Order Enterogona
Introduced species
Native species
see previous page
Solitary
Colonial
Colony gelatinous, transparent
Colony opaque, grainy appearance
Large zooids > 3mm
Small zooids < 3mm
Colony 3-dimensional, thick
Colony thin, encrusting
Zooids long bulbous stalks from common basal mat
Clavelina lepadiformis
9
Zooids not on stalks, ampullae visible on colony edge
Colony thick, firm gelatinous sheet
Aplidium phortax
16
Colony globular
Colony fleshy drooping tendrils, dull yellow
Didemnum vexillum
10
Colony crisp, firm, spicules throughout
Didemnum species complex
13
Zooids in star to circular shaped systems, encrusting
Zooids in branching double row systems
Botrylliodes leachii
21
Colony upright on short stalks
Hypsistozoa fasmeriana
14
Colony drooping cream fingers
Eudistoma elongatum
15
Gelatinous, >2 mm thick
Botryllus schlosseri
22
Very thin, <2 mm thick
Botryllus tuberatus
23
Very slimy, gelatinous, flecked with grey
Diplosoma listerianum
11
Papery
Lissoclinum notti
12

Clavelina lepadiformis (Müller, 1776)

Order Enterogona Suborder Aplousobranchia Family Clavelinidae

External features

- Colonies of this species have a distinctive medusiod shape
- Zooids are joined by a thin common basal test and protrude as individual bodies each opening separately to the outside
- Branchial sac and gut are clearly visible through the transparent test
- Endostyle and tentacles pigmented either white or yellow, giving it a 'light bulb' appearance

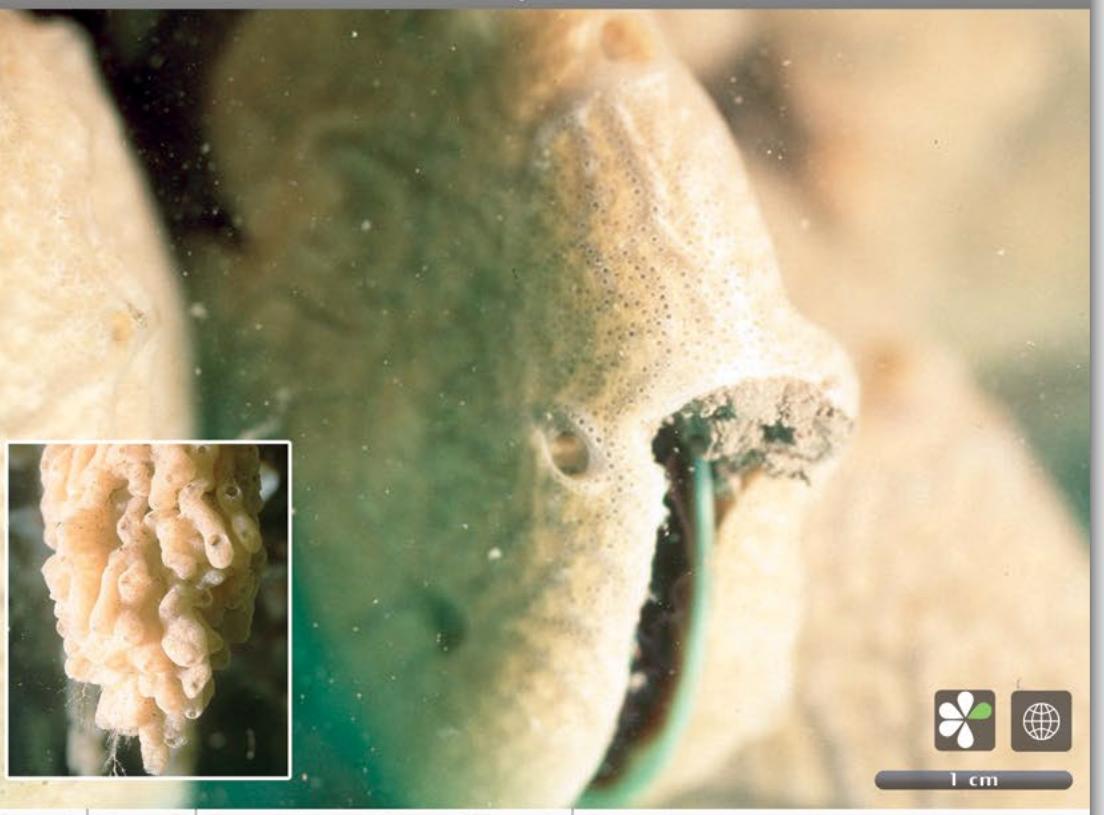
Habitat

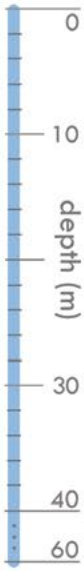
- Fouls the underside of floating moorings

Hayward, P.J.; Ryland, J.S. (Ed.) (1990) 1. Introduction to protozoans and arthropods. *The marine fauna of the British Isles and North-West Europe*. Clarendon Press, Oxford: 627 pp.

Didemnum vexillum Kott, 2002

Order Enterogona | Suborder Aplousobranchia | Family Didemnidae





External features

The test of most *Didemnum* species is crowded with minute calcite star-shaped structures called spicules. High abundance of spicules can give many species of this genus an opaque appearance.

- Spicules are sparse throughout most of the test; making it more gelatinous than other *Didemnum* species
- Colonies form extensive sheets on vertical surfaces
- Cylindrical or frond-like outgrowths can often extend off the main colony, sometimes forming dripping tendrils that may be meters long
- May encrust algae, hydrozoans, tube-worms and mussels
- Pale yellow to cream coloured
- Gelatinous to touch
- Common exhalent openings are obvious at the end of lobes and a fine open network of canals can be seen below the surface

Habitat

- Can be locally abundant, fouling boat hulls, the undersides of floating structures, marine farm lines and sea cages

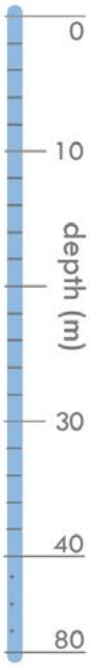
Looks like

- *Didemnum* species complex (see page 13)
- Encrusting sponges

Kott, P. (2002) A complex didemnid ascidian from Whangamata, New Zealand. *Journal of the Marine Biological Association of the United Kingdom*. 82: 625-628.

Diplosoma listerianum (Milne Edwards, 1841)

Order Enterogona | Suborder Aplousobranchia | Family Didemnidae



External features

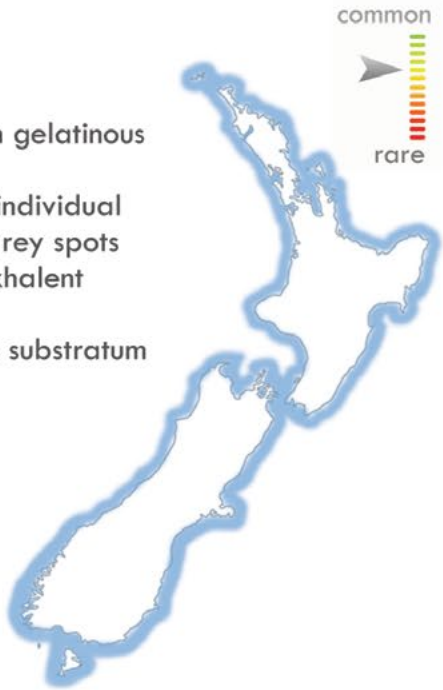
- Colonial seasquirt that forms extensive thin gelatinous sheets
- Test is transparent and the small (<2 mm) individual animals (zooids) can be seen as white or grey spots densely crowded around large common exhalent apertures
- Colonies easily removed by hand from the substratum as a slimy film

Habitat

- Encrusts a variety of submerged surfaces including shellfish, algae and barnacles

Looks like

- *Botrylliodes leachii* (see page 21)

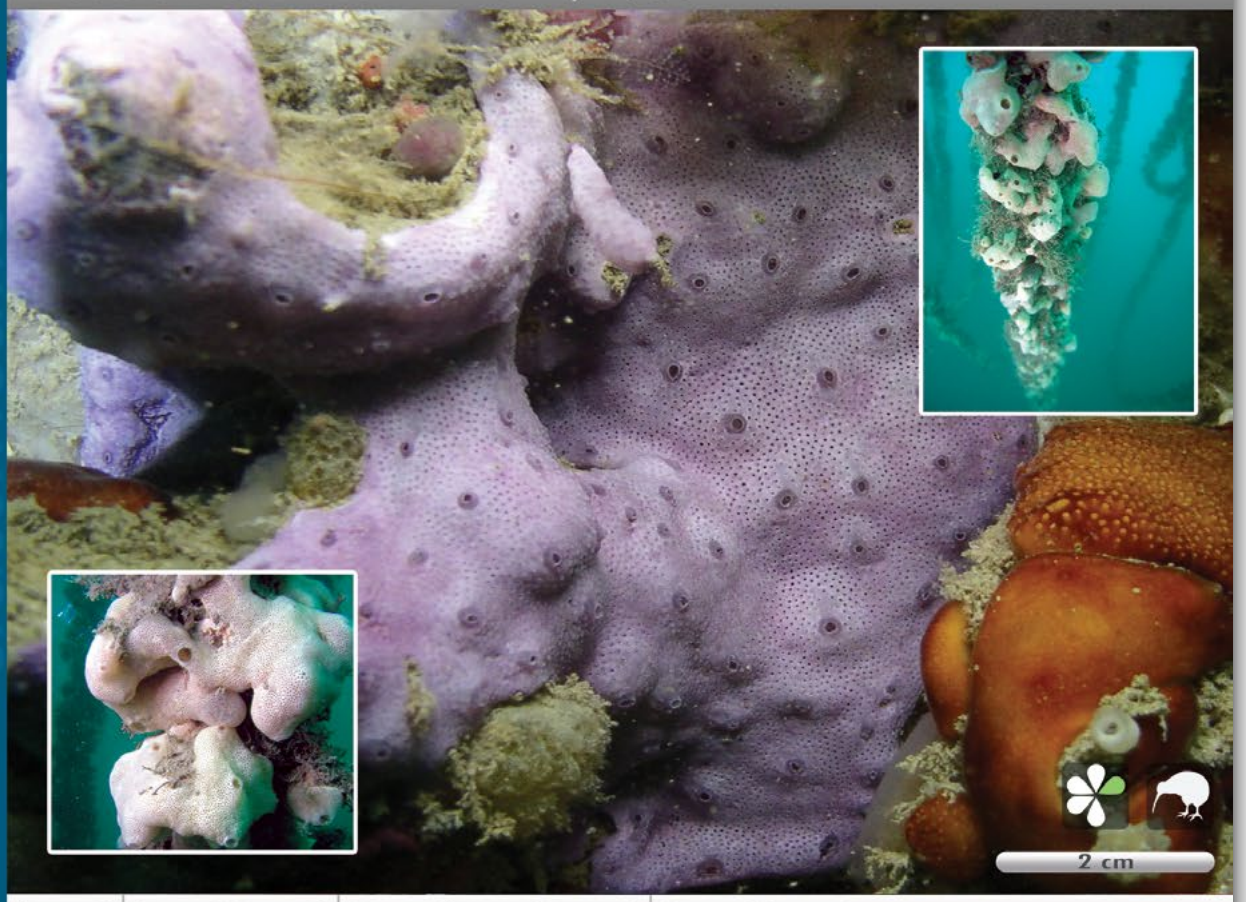


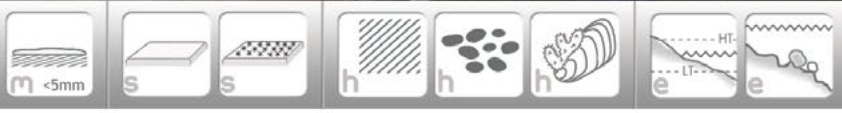
Brewin, B.I. (1946) Ascidians in the vicinity of the Portobello Marine Biological Station, Otago Harbour. *Transactions and Proceedings of the Royal Society of New Zealand* 76(2): 100-101.

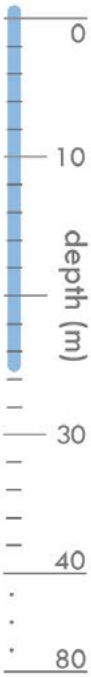
Kott, P. (2001) The Australian ascidiacea Pt 4, Didemnidae. *Memoirs of the Queensland Museum*. 47(1): 339-341.

Lissoclinum notti Brewin, 1958

Order Enterogona | Suborder Aplousobranchia | Family Didemnidae

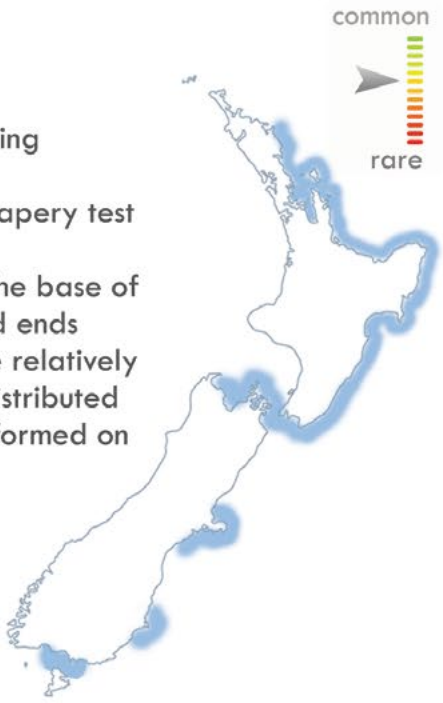






External features

- Colonies characteristically very thin, encrusting <2 mm, easily torn and fragile
- Opaque cream, brown or violet coloured papery test which is easily torn
- Spicules in 2 layers; at the surface and at the base of the colony, and have distinctive burr-shaped ends
- Zooids not in marked systems, but there are relatively large common exhalent apertures evenly distributed throughout the colony or on apex of lobes formed on encrusted organisms



Habitat

- Common on shallow subtidal reefs, wharf piles and aquaculture structures

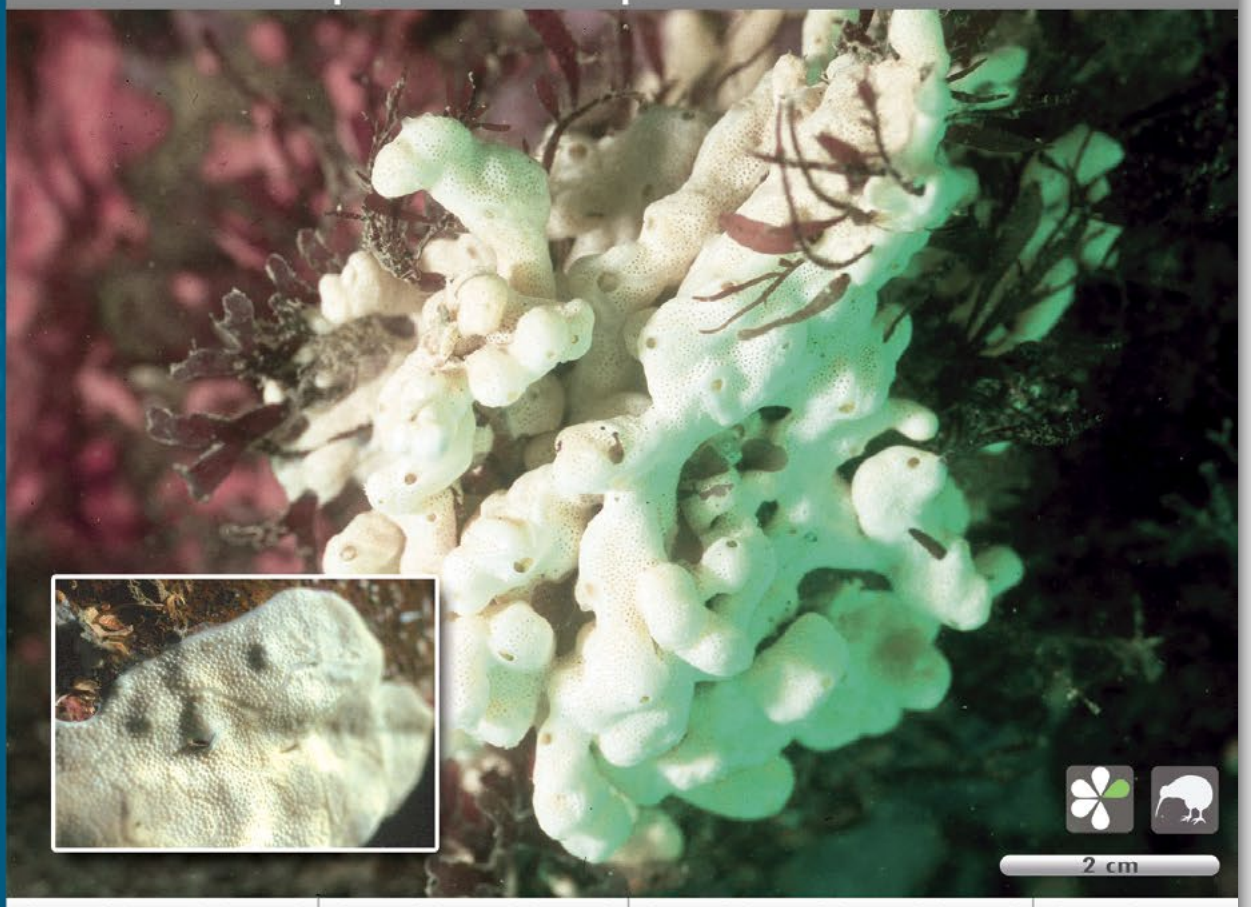
Looks like

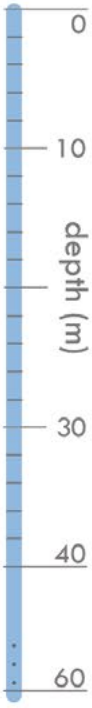
- *Didemnum* species complex (see page 13)
- *Didemnum vexillum* (see page 10)

Brewin, B.I. (1958) Ascidians of New Zealand. Part XII. Ascidians of the Hauraki Gulf. Part III. *Transactions and Proceedings of the Royal Society of New Zealand* 85(3): 457-458.

Didemnum species complex

Order Enterogona Suborder Aplousobranchia Family Didemnidae





A 'species complex' is a group of closely related species that cannot be easily distinguished in the field due to their physical similarity. They often appear to vary only by the smallest details.

External features

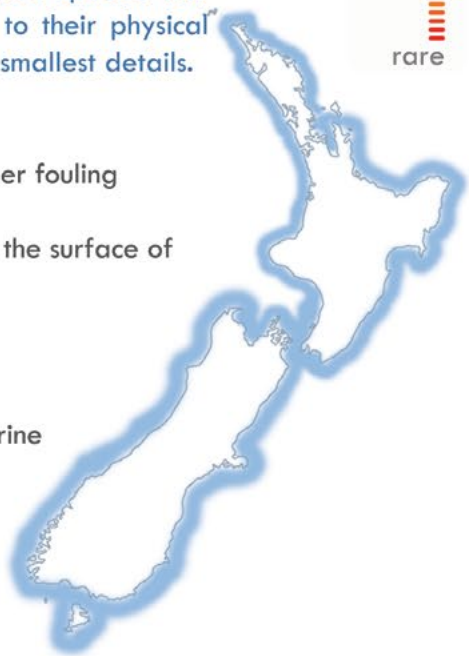
- Shape varies from lobes when overgrowing other fouling organisms, to thin encrustations
- Opaque due to a heavy coating of spicules on the surface of the test

Habitat

- Boat hulls, undersides of floating structures, marine farm lines, sea cages and wharf piles

Looks like

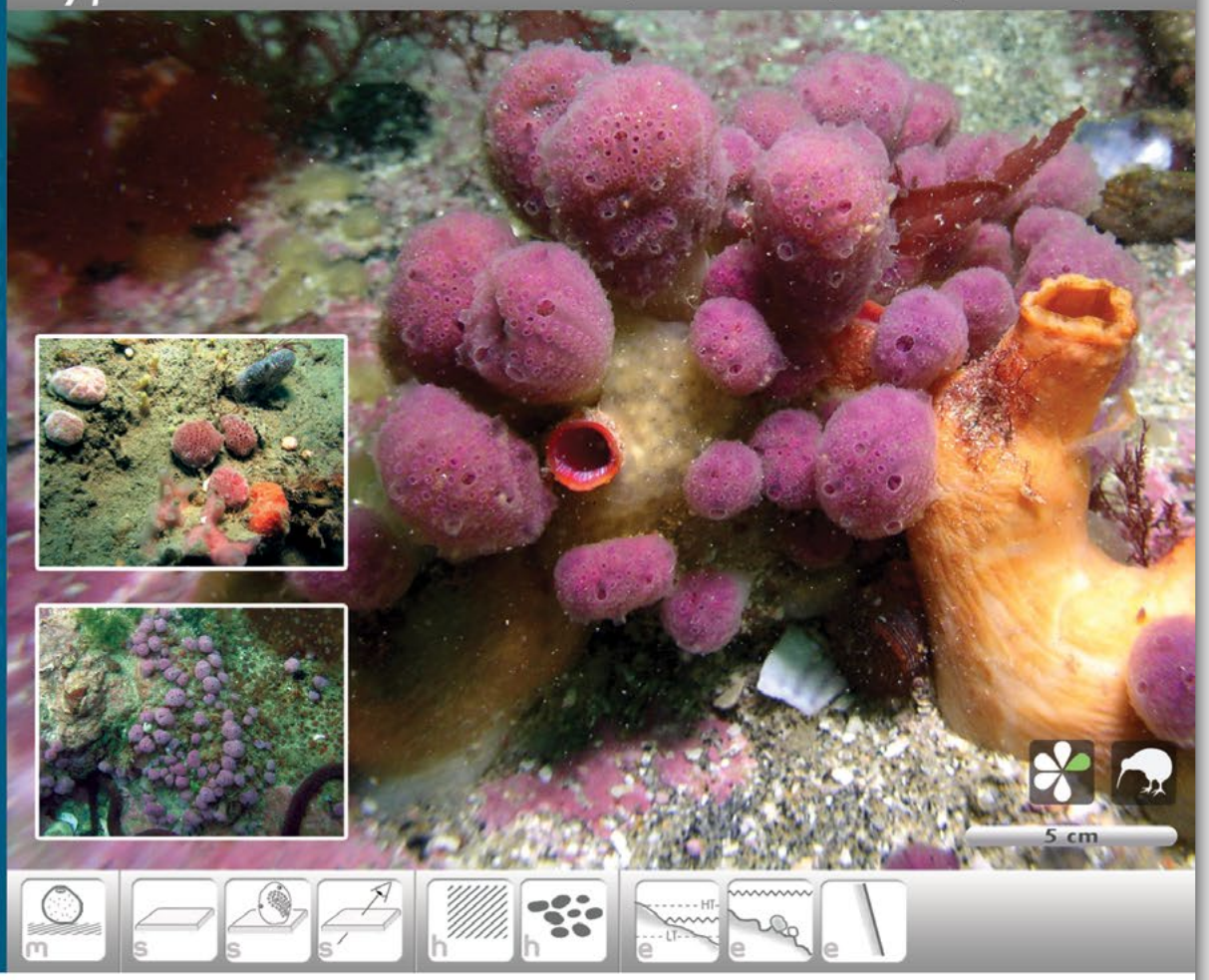
- *Didemnum vexillum* (see page 10)
- *Lissoclinum notti* (see page 12)



Kott, P. (2001) The Australian ascidiacea Pt 4, Didemnidae. *Memoirs of the Queensland Museum*. 47(1): 1-410.

Hypsistozoa fasmeriana (Michaelsen, 1924)

Order Enterogona | Suborder Aplousobranchia | Family Holozoidae

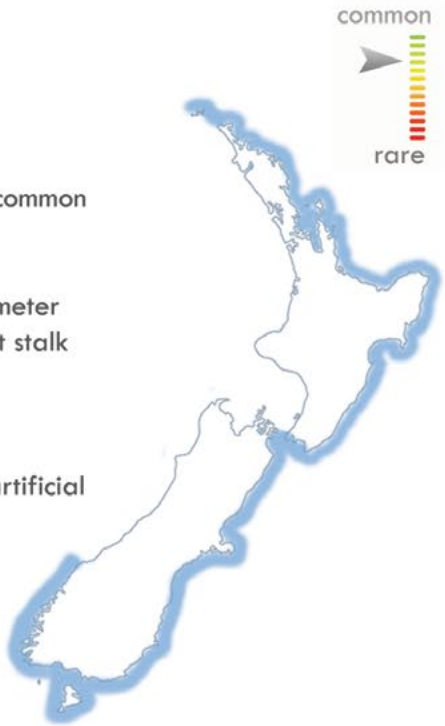


External features

- Button mushroom-shaped
- Soft and gelatinous to touch
- Zooids in parallel systems and numerous large common exhalent apertures
- Usually violet to fuscia pink
- Can occur in patchy groups of up to 30 cm diameter
- Colonies are attached individually or by a short stalk

Habitat

- Most common on shallow coastal reefs and on artificial structures in open harbours with high tidal flow
- Can be found down to 20 m depth in areas of moderate exposure

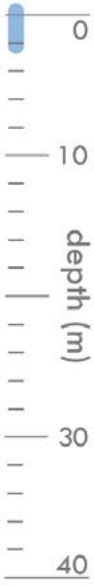


Brewin, B.I. (1946) Ascidians in the vicinity of the Portobello Marine Biological Station, Otago Harbour. *Transactions and Proceedings of the Royal Society of New Zealand* 76(2): 103 -105.

Millar, R.H. (1982) The marine fauna of New Zealand: Ascidiacea. *New Zealand Oceanographic Memoir* 85: 14-15.

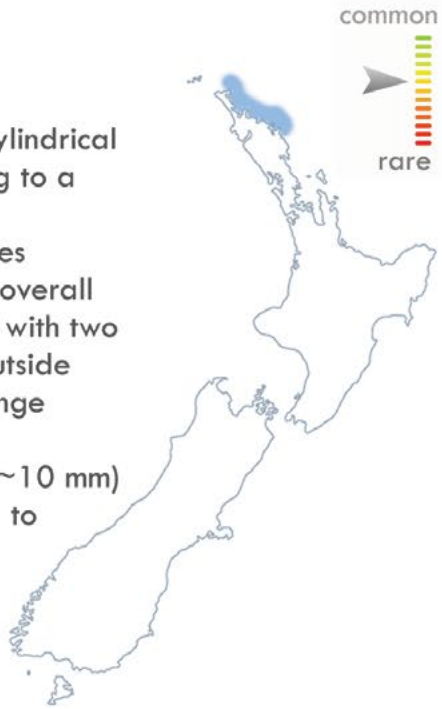
Eudistoma elongatum (Herdman, 1886)

Order Enterogona | Suborder Aplousobranchia | Family Polycitoridae



External features

- Easily distinguished when mature by long cylindrical cream coloured pendulous colonies tapering to a smooth stalk
- Sometimes with short wart-like side processes
- Test is smooth and gelatinous to touch, firm overall
- Zooids appear as light brown specks, each with two tiny apertures opening separately to the outside
- When reproductive the zooids become orange with developing embryos
- Colonies regress and over-winter as small (~10 mm) cream buds, regrowing the following spring to larger colonies



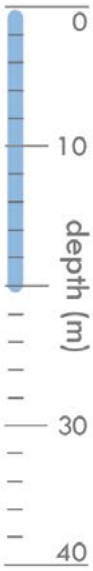
Habitat

- Species occur locally in high abundance in sheltered embayments, growing on oyster racks, mangrove roots, rocky shoreline and on shells embedded in mud

Kott, P. (1990) The Australian ascidiacea Pt 2, Aplousobranchia. *Memoirs of the Queensland Museum*. 29(1): 205-206.

Aplidium phortax (Michaelsen, 1924)

Order Enterogona Suborder Aplousobranchia Family Polyclinidae

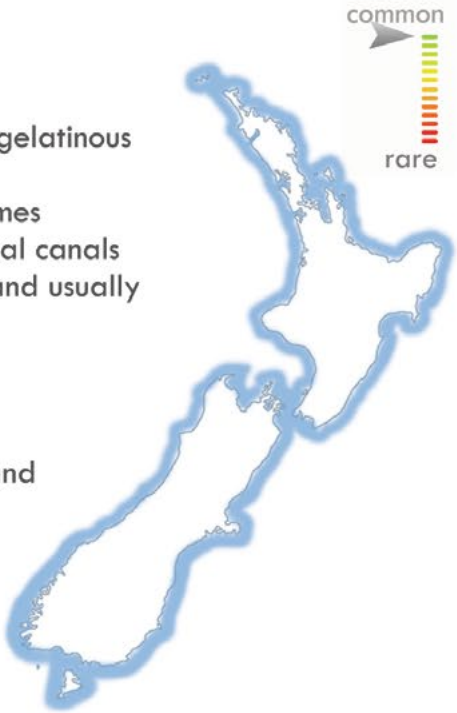


External features

- Large fleshy firm, light tan, pink or cream gelatinous colonies
- Zooids form meandering double-row, at times branching systems, along obvious subdermal canals
- Common inhalant apertures are indistinct and usually found on the colony lobes

Habitat

- Very common species fouling wharf piles and aquaculture structures in ports, bays and harbours



Brewin, B.I. (1946) Ascidians in the vicinity of the Portobello Marine Biological Station, Otago Harbour. *Transactions and Proceedings of the Royal Society of New Zealand* 76(2): 92-94.

Millar, R.H. (1982) The marine fauna of New Zealand: Ascidiacea. *New Zealand Oceanographic Memoir* 85: 22.

Ascidiella aspersa (Müller, 1776)

Order Pleurogona Suborder Phlebobranchia Family Ascidiidae

External features
- Ovoid body with an inhalant siphon at the top of the animal, and an exhalent siphon one third to halfway down one side
- Test thin, translucent and covered in small bumps (papillae)

Internal features
- Gill slits elongate
- Gills not folded
- Tentacles smooth

Habitat
- Shallow subtidal rock, wharf piles and submerged structures, found in both marine and estuarine environments

Looks like
- *Corella eumyota* (see page 20)
- *Ciona intestinalis* (see page 18)

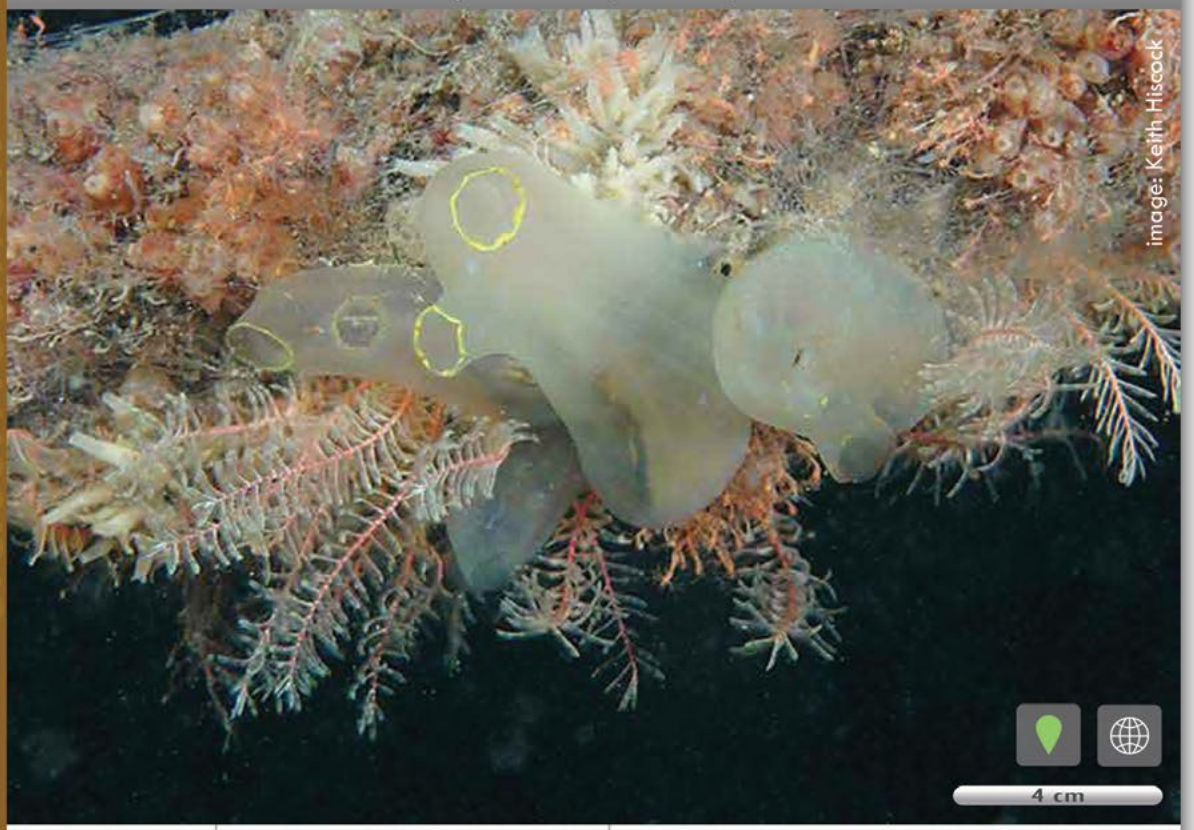
Brewin, B.I. (1946) Ascidians in the vicinity of the Portobello Marine Biological Station, Otago Harbour. *Transactions and Proceedings of the Royal Society of New Zealand 76(2)*: 106 -108.

Kott, P. (1985) The Australian Ascidiacea I. Phlebobranchia and Stolidobranchia. Memoirs of the Queensland Museum. 23: 22-24.

Millar, R.H. (1982) The marine fauna of New Zealand: Ascidiacea. *New Zealand Oceanographic Memoir* 85: 57.

Ciona intestinalis (Linnaeus, 1767)

Order Enterogona Suborder Phlebobranchia Family Cionidae



Two *Ciona* spp are know to co-occur in New Zealand ports and harbours. *Ciona intestinalis* has lemon yellow pigment spots on the siphon rim while *Ciona savigny* has orange pigment spots on the siphon rim.

External features

- Body elongate, tapering towards two closely spaced siphons
- Test soft, flexible, gelatinous, with light green pigment at the anterior end
- Lemon yellow pigment spots on siphon rim

Internal features

- Gill slits elongate
- Gills not folded
- Tentacles smooth
- Six broad longitudinal muscle bands on each side of the body wall

Habitat

- Often found in high abundance on aquaculture structures, wharf piles and pontoons

Looks like

- *Ciona savigny* (see page 19)

Brewin, B.I. (1950) Ascidians of New Zealand. Part IV. Ascidians in the vicinity of Christchurch. *Transactions and Proceedings of the Royal Society of New Zealand* 78(2-3): 347.

Ciona savigny Herdman, 1882

Order Enterogona | Suborder Phlebobranchia | Family Cionidae

Two *Ciona* spp are know to co-occur in New Zealand ports and harbours. *Ciona savigny* has orange pigment spots on the siphon rim while *Ciona intestinalis* has lemon yellow pigment spots on the siphon rim.

External features

- Body elongate, tapering towards two closely spaced siphons
- Test soft, flexible, gelatinous, with light green pigment at the anterior end
- Orange pigment spots on siphon rim
- Yellow or white pigment flecks on body wall

Internal features

- Gill slits elongate
- Gills not folded
- Tentacles smooth
- Six broad longitudinal muscle bands on each side of the body wall

Habitat

- Often found in high abundance on aquaculture structures, wharf piles and pontoons

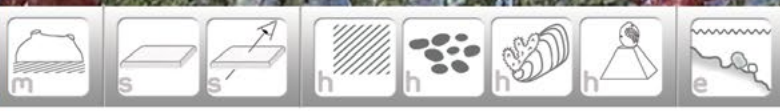
Looks like

- *Ciona intestinalis* (see page 18)

Brewin, B.I. (1950) Ascidians of New Zealand. Part IV. Ascidians in the vicinity of Christchurch. *Transactions and Proceedings of the Royal Society of New Zealand* 78(2-3): 347.

Corella eumyota Traustedt, 1882

Order Pleurogona Suborder Phlebobranchia Family Corellidae



External features

- Body oval to elongate, laterally compressed
- Attached to the substrate on its right side
- Inhalent siphon at top of animal, exhalent siphon ⅓ of the way down the side of the body
- Test transparent, smooth and cartilaginous
- Gut and gonads often visible through the test
- Individuals are often found in groups

Internal features

- Gill slits spiral
- Gills not folded
- Tentacles smooth

Habitat

- Prefers calm protected waters
- Found in shallow subtidal environments attached to wharf piles, ropes and other submerged structures

Looks like

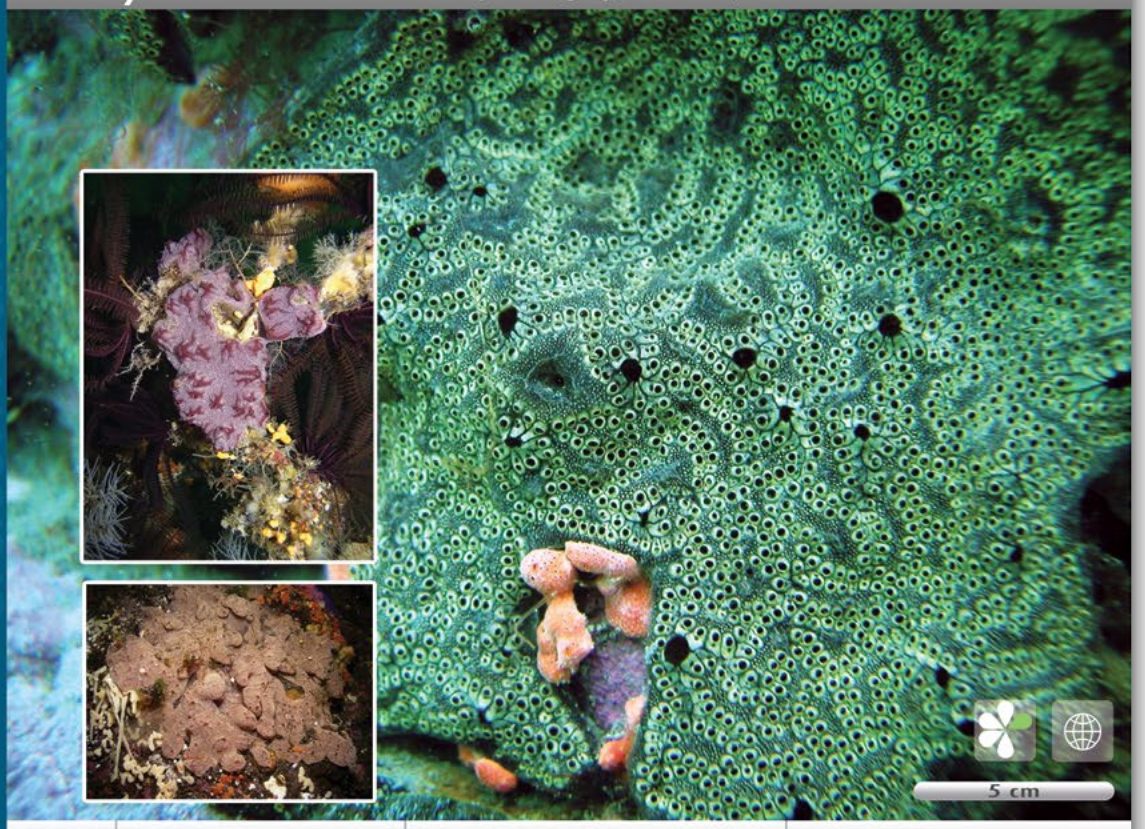
- *Ascidiella aspersa* (see page 17)
- *Molgula* spp. (see pages 24-25)

Millar, R.H. (1962) Further descriptions of South African ascidians. *Annals of the South African Museum* 46(7): 113-221.

Kott, P. *et al.* (2009) Tunicata, in Gordon, D.P. (ed) *New Zealand Inventory of Biodiversity Volume 1,* Canterbury University Press: 409-430.

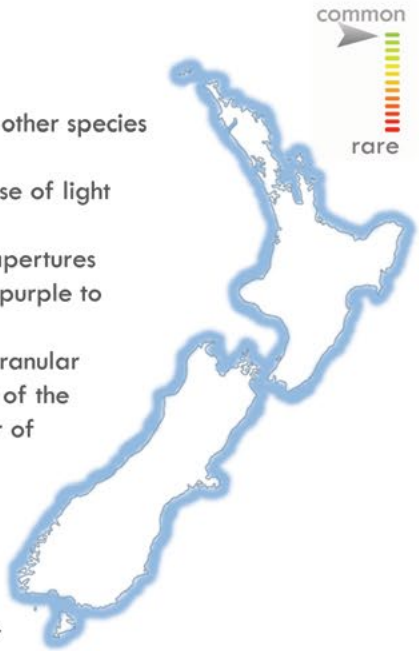
Botrylloides leachii (Savigny, 1816)

Order Pleurogona Suborder Stolidobranchia Family Botryllidae



External features

- Encrusting colonies, 3-5mm thick, overgrowing other species giving colonies a lobate appearance
- Parallel systems of zooids often obvious because of light pigmentation around branchial apertures
- Systems connect to numerous common cloacal apertures
- Colour highly variable, ranging from typically purple to orange and cream
- Test is transparent, soft and gelatinous, small granular bodies (ampullae) are visible near the surface of the test between the zooid systems and the border of the colony



Habitat

- Encrusts moorings, jetties and wharf piles
- Very common in ports and harbours throughout New Zealand, this species was probably introduced by early sailing ships

Looks like:

- *Botryllus schlosseri* (see page 22)

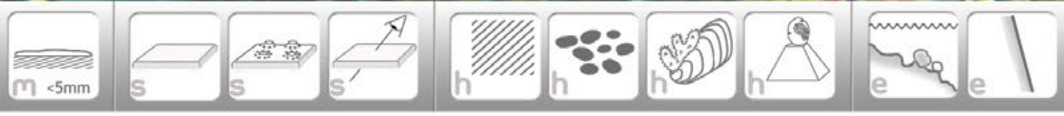
Brewin, B.I. (1946) Ascidians in the vicinity of the Portobello Marine Biological Station, Otago Harbour. *Transactions and Proceedings of the Royal Society of New Zealand* 76(2): 111-112.

Kott, P. (1985) The Australian Ascidiacea I. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23: 272-276.

Millar, R.H. (1982) The marine fauna of New Zealand: Ascidiacea. *New Zealand Oceanographic Memoir* 85: 62.

Botryllus schlosseri (Pallas, 1766)

Order Pleurogona Suborder Phlebobranchia Family Ascidiidae



External features

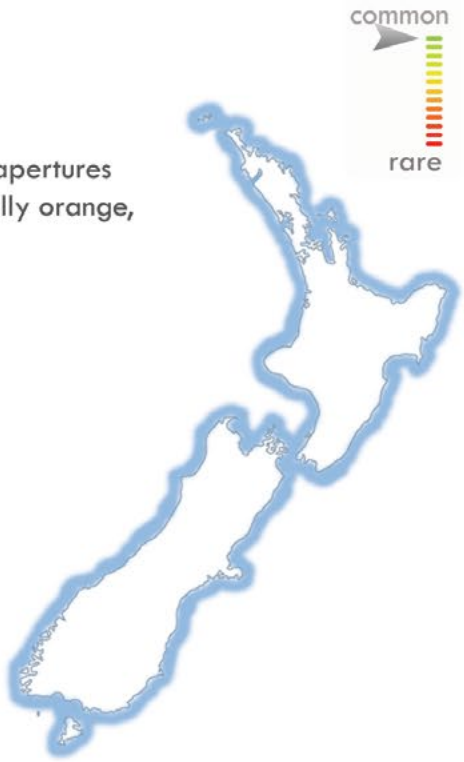
- Thin colonies, 3mm thick
- Circular zooid systems around common cloacal apertures
- Colonies can vary widely in colour, but are usually orange, green or purple

Habitat

- Very common in ports and harbours throughout New Zealand, encrusting wharf piles and undersides of mooring pontoons

Looks like

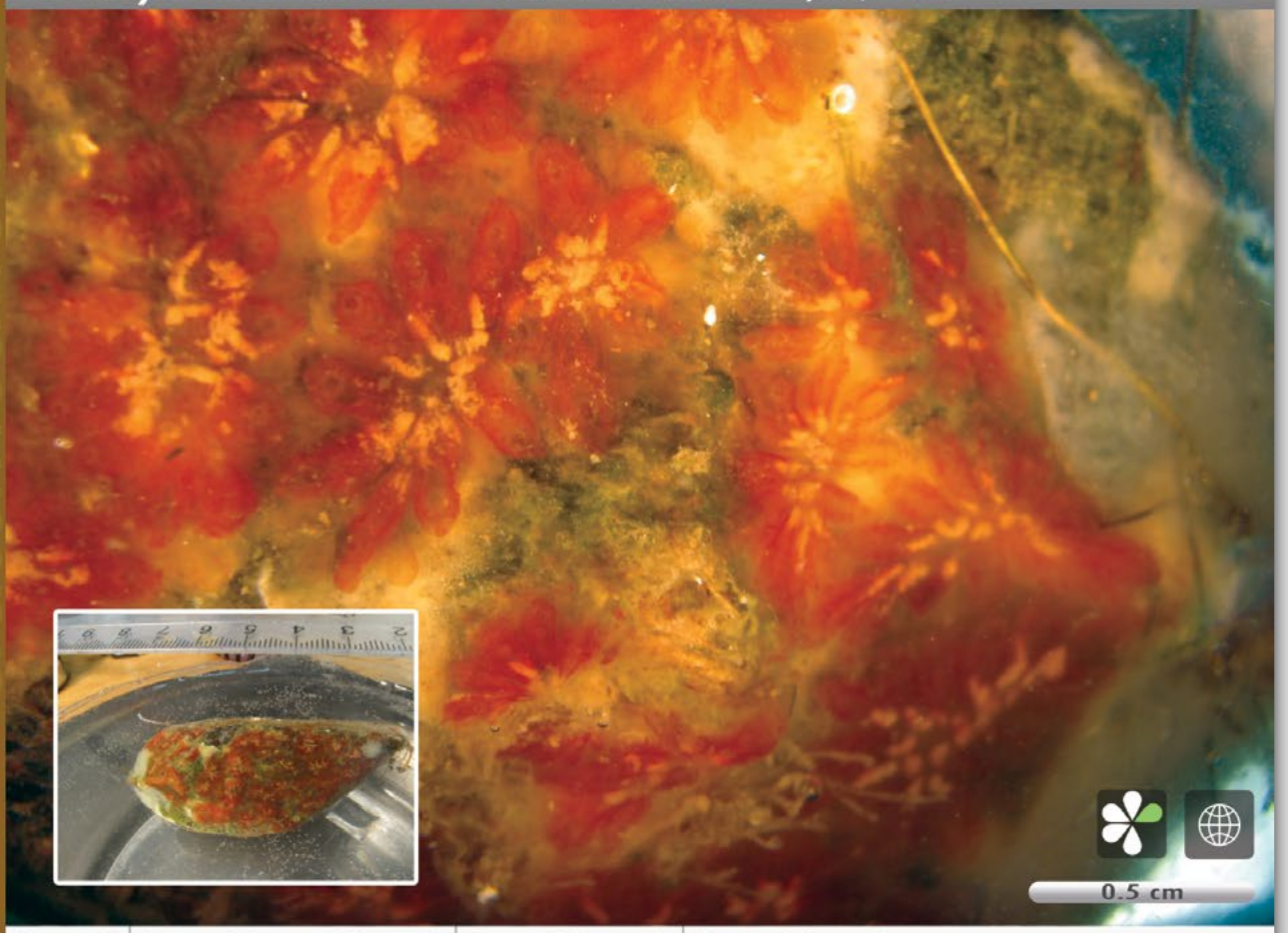
- *Botrylloides leachii* (see page 21)

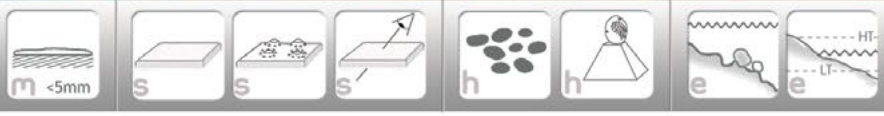


Kott, P. (1985) The Australian Ascidiacea. 1. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23: 267-269.

Botryllus tuberatus Ritter and Forsyth, 1917

Order Pleurogona Suborder Phlebobranchia Family Styelidae





External features

- Bright orange zooids are arranged in widely spaced circular systems, giving the colony a star-shaped appearance
- Colonies are small, delicate, very thin and transparent

Habitat

- Commonly encrusts other organisms such as mussels and oysters in intertidal and shallow subtidal environments

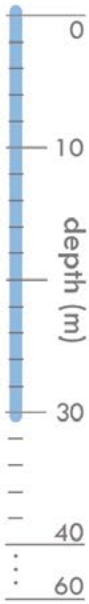
Looks like

- *Botryllus schlosseri* (see page 22)

Kott, P. (1985) The Australian Ascidiacea. 1. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23: 270-272.

Molgula manhattensis (De Kay, 1843)

Order Pleurogona Suborder Stolidobranchia Family Molgulidae



External features

- Body small and circular to oval
- At times occurring in large aggregates on the seafloor
- Inhalant and exhalant siphons are relatively long and close together on the upper surface
- White test, semi-translucent and relatively tough
- Sediment adheres to short hairs on the surface of the test, hairs are usually longer at the base, forming root-like processes

Internal features

- Gill slits spiral
- Gills folded
- Tentacles branched

Habitat

- Tolerant of high sediment and low salinity
- Has only been found in the Manukau harbour

Looks like

- *Molgula mortenseni* (see page 25)

Kott, P. (1985) The Australian Ascidiacea I. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23: 379-380.

Molgula mortenseni (Michaelsen, 1922)

Order Pleurogona Suborder Stolidobranchia Family Molgulidae

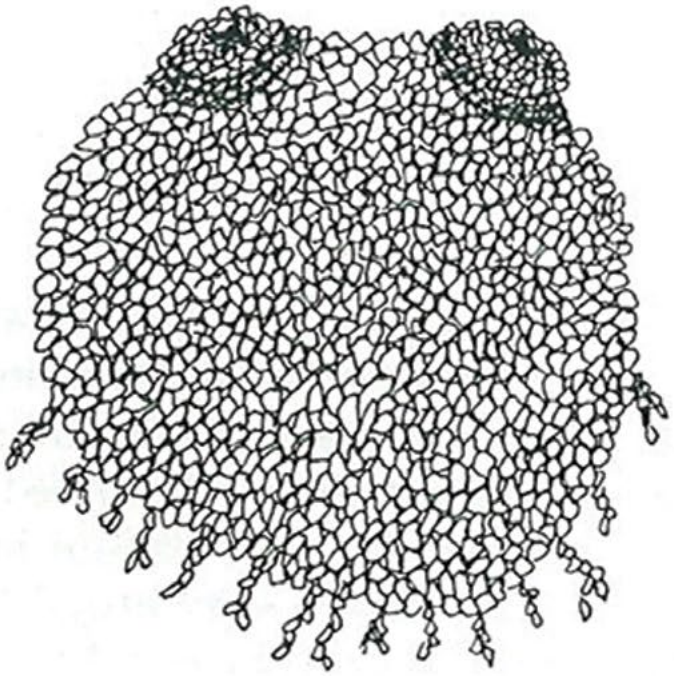
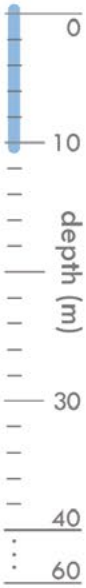


illustration sourced from Brewin (1951)

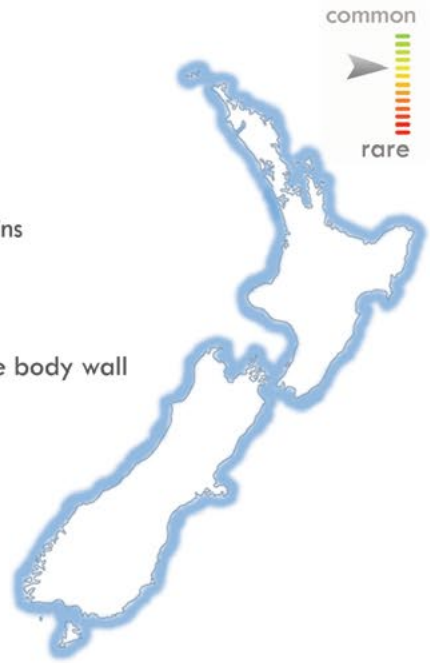
0.5 cm



External features
- 1-2 cm diameter
- Almost spherical
- Apertures close together on upper surface
- Test is thin, flexible, coated with fine sand grains

Internal features
- A kidney can often be seen clearly through the body wall
- Gill slit spiral
- Gills folded
- Tentacles branched

Habitat
- Can be found in aggregates of individuals in high sediment environments such as the harbour floor
- Often epizoic, living among shells and other large solitary ascidians



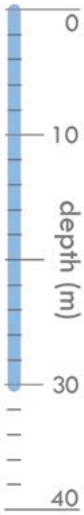
Looks like
- *Molgula manhattensis* (see page 24)

Brewin, B.I. (1951) Ascidians of New Zealand. Part VI. Ascidians of the Hauraki Gulf. Part II. *Transactions and Proceedings of the Royal Society of New Zealand* 79(1): 111.

Kott, P. (1985) The Australian Ascidiacea I. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23: 382-383.

Pyura pachydermatina (Herdman, 1881)

Order Pleurogona | Suborder Stolidobranchia | Family Pyuridae



External features

- The 'sea tulip' is easily distinguished by its long leathery stalk and bulbous body
- Stalks are generally smooth or horizontally wrinkled
- Large inhalant and exhalant siphons are obvious at the top of the body
- Surface of body smooth, colour in life creamy pink with purple along low longitudinal ridges
- Ridges more pronounced in smaller individuals

Internal features

- Gill slits elongate, folded
- Tentacles branched
- Gonads in paired blocks on each side of the body

Habitat

- 'Sea tulips' grow in high energy environments in southern New Zealand on the open coast, and harbours with high tidal flow
- Form dense forests on the sea floor from the intertidal down to 30 m

Looks like

- *Styela clava* (see page 33)

Brewin, B.I. (1946) Ascidians in the vicinity of the Portobello Marine Biological Station, Otago Harbour. *Transactions and Proceedings of the Royal Society of New Zealand* 76(2): 125-128.

Millar, R.H. (1982) The marine fauna of New Zealand: Ascidiacea. *New Zealand Oceanographic Memoir* 85: 82-23.

Microcosmus squamiger Michaelsen, 1927

Order Enterogona Suborder Stolidobranchia Family Pyuridae

External features
- Body elongate to oval
- Test leathery and tough, at times hard and occasionally brittle
- Apertures on short wart-like siphons

Internal features
- Gill slits simple
- Tentacles branched
- Left gonad crosses over the descending limb of the gut loop

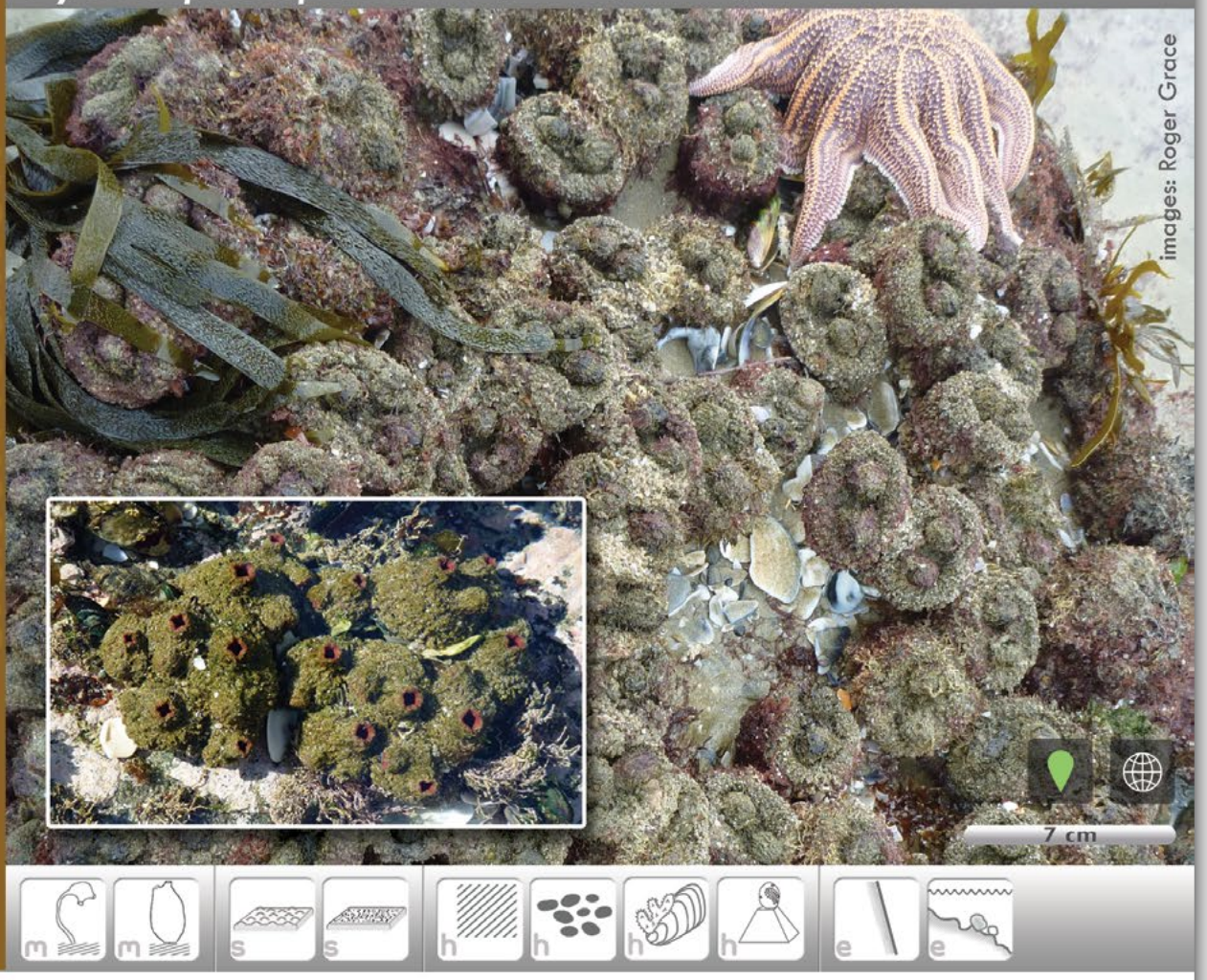
Habitat
- Usually occurs in large aggregates on rock, concrete and cave walls in sheltered and exposed locations

Looks like
- *Pyura* species complex (see page 29)
- juvenile *Cnemidocarpa nisiotus* (see page 31)

Kott, P. (1985) The Australian Ascidiacea I. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23: 356-358.

Pyura praeputialis (Heller, 1878)

Order Pleurogona Suborder Stolidobranchia Family Pyuridae



External features

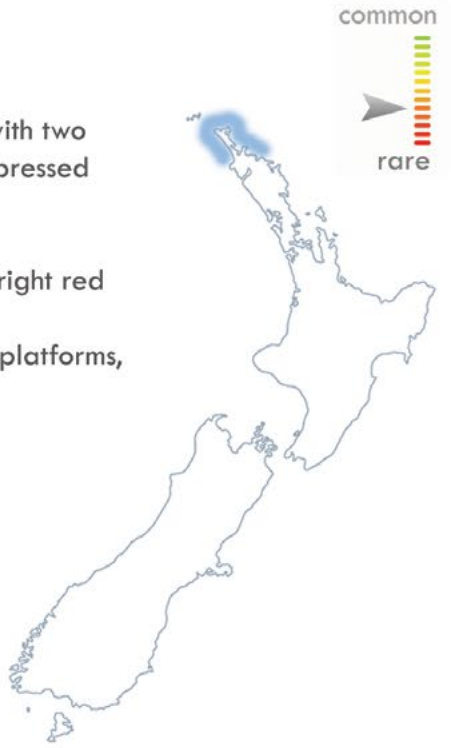
- Body stumpy, chalice-shaped when contracted, with two large mounds representing siphons, set in the depressed upper surface of the body
- Test tough, thick, cartilaginous, coated with sand
- When uncontracted, cross-shaped siphons with bright red orange body wall visible
- Individuals form dense aggregates on intertidal platforms, sometimes occupying 100% cover

Internal features

- Gill slits elongate, folded
- Tentacles branched

Habitat

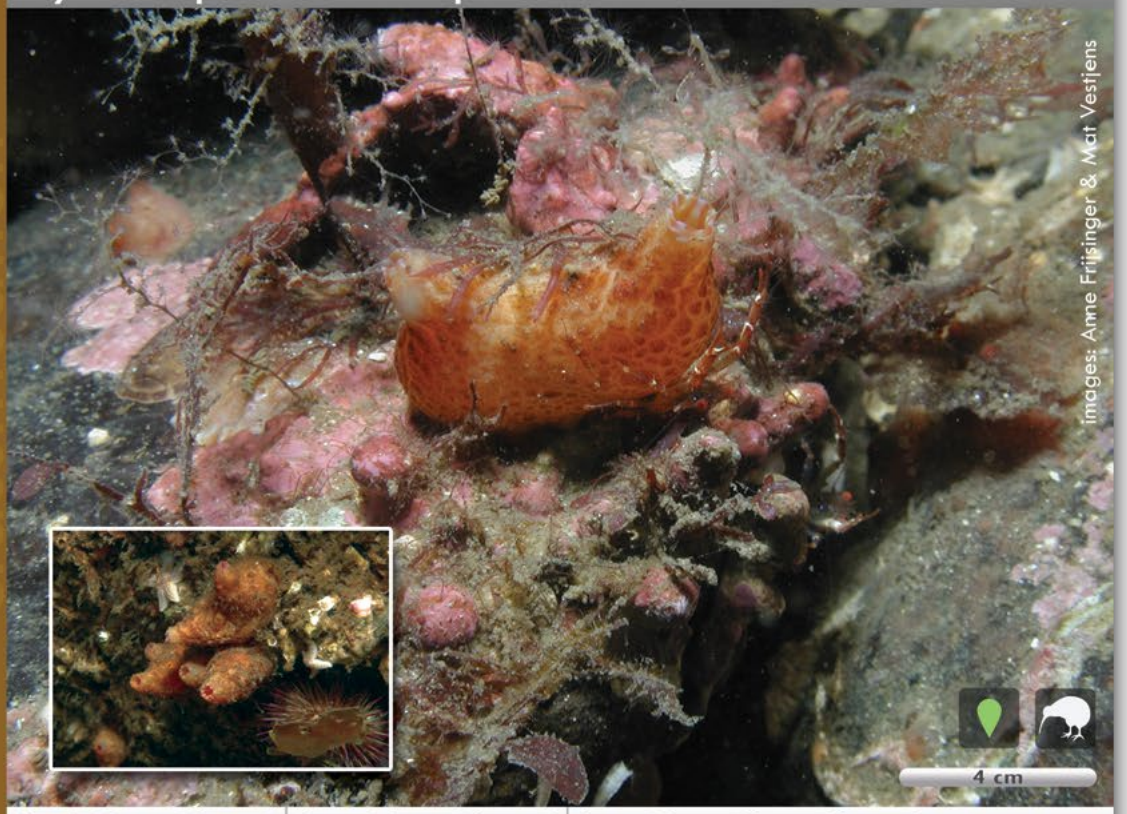
- Intertidal platforms, can be found subtidally down to 12 m



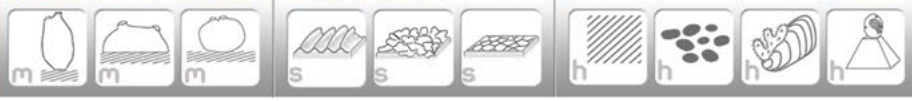
Kott, P. (1985) The Australian Ascidiacea I. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23: 328-331.

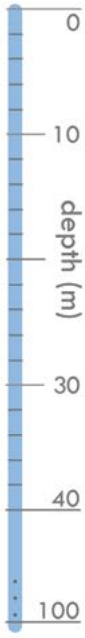
Pyura species complex

Order Enterogona Suborder Stolidobranchia Family Pyuridae



images: Anne Frijsinger & Mat Vestjens





A 'species complex' is a group of closely related species that cannot be easily distinguished in the field due to their physical similarity. They often appear to vary only by the smallest details.

External features

- Tough leathery test either deeply furrowed, warty, finely wrinkled, or in several layers

Internal features

- The siphons are long, muscular and often pigmented with deep purple
- Gill slits elongate
- Tentacles branched
- A long gonad on each side of the body wall may be arranged in paired blocks

Habitat

- Found growing on the seabed attached to shell debris and fouling wharf piles

Looks like

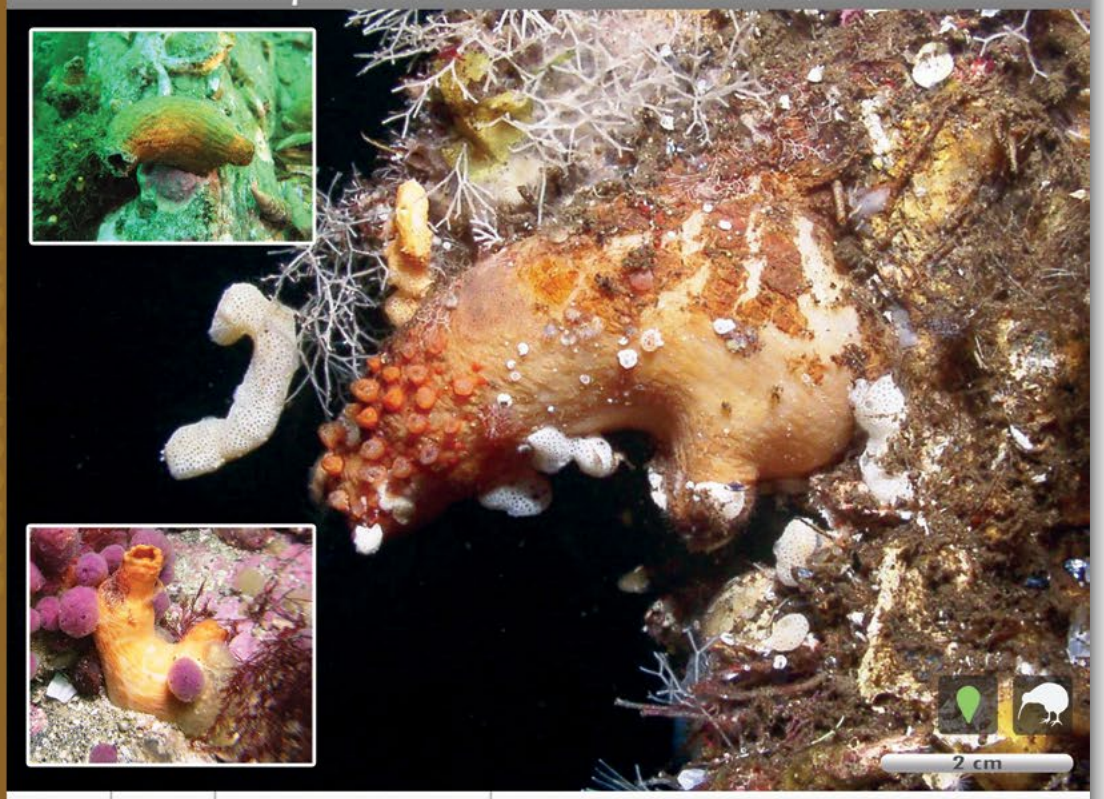
- *Cnemidocarpa nisiotus* (see page 31)
- *Microcosmus squamiger* (see page 27)

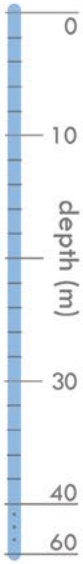
Brewin, B.I. (1946) Ascidians in the vicinity of the Portobello Marine Biological Station, Otago Harbour. *Transactions and Proceedings of the Royal Society of New Zealand* 76(2): 87-131.

Millar, R.H. (1982) The marine fauna of New Zealand: Ascidiacea. *New Zealand Oceanographic Memoir* 85: 114 pp.

Cnemidocarpa bicornuta (Sluiter, 1900)

Order Pleurogona Suborder Stolidobranchia Family Styelidae





87

External features

- Four bands of magenta pigment on the orange siphonal lining
- Warty processes around the siphons
- Inhalant siphon usually at the top of the seasquirt, with a distinctive 'saddle' between the widely spaced siphons
- Light orange to cream test, leathery and longitudinally wrinkled
- Often fouled with hydrozoans, bryozoans and filamentous algae

Internal features

- Gill slits elongate, folded
- Tentacles smooth
- Gonads attached to the body wall under the gill sac are long and tubular, sometimes bent backwards at their terminal end

Habitat

- Very common in ports, harbours and coastal environments.
- May be locally abundant on shallow reefs and wharf piles.
- Generally co-occurs with *Cnemidocarpa nisiotus* in trawl catches.

Looks like

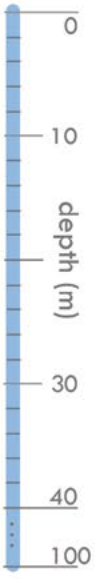
- *Cnemidocarpa nisiotus* (see page 31)

Brewin, B.I. (1946) Ascidians in the vicinity of the Portobello Marine Biological Station, Otago Harbour. *Transactions and Proceedings of the Royal Society of New Zealand* 76(2): 117-119.

Millar, R.H. (1982) The marine fauna of New Zealand: Ascidiacea. *New Zealand Oceanographic Memoir* 85: 69.

Cnemidocarpa nisiotus (Sluiter, 1900)

Order Pleurogona | Suborder Stolidobranchia | Family Styelidae



External features

- Oval shaped body with two siphons approximately half a body length apart
- In the water this species is easily recognized by maroon siphonal linings and four pale yellow to white longitudinal bands
- Body wrinkled, dark brown
- Warty processes occur around the siphons
- Test leathery, usually fouled with hydroids, bryozoans and algae

Internal features

- Gill slits elongate
- Tentacles smooth
- Gonads flask-shaped, attached to the body wall underneath the gill sac

Habitat

- Very common in ports, harbours and coastal environments
- Can be locally abundant on shallow reefs and wharf piles
- Generally co-occurs with *Cnemidocarpa bicornuta* in trawl catches

Looks like

- *Cnemidocarpa bicornuta* (see page 30)

Brewin, B.I. (1950) Ascidians of New Zealand. Part IV. Ascidians in the vicinity of Christchurch. *Transactions and Proceedings of the Royal Society of New Zealand* 78(2-3): 349-350.

Millar, R.H. (1982) The marine fauna of New Zealand: Ascidiacea. *New Zealand Oceanographic Memoir* 85: 69.

Styela canopus Savigny, 1816

Order Pleurogona Suborder Stolidobranchia Family Styelidae

External features

- Body small, upright and oblong shaped with no stalk and two short closely spaced siphons on the top
- Test tough with warty tubercles occurring around the siphons and longitudinal transverse wrinkles, becoming less distinct on the posterior surface
- A variable number of fine stripes run down the external surface of the lobes, these can often be obscured by wrinkles in the tough leathery test

Internal features

- Gill slits elongate
- Tentacles smooth
- Testis follicles outside ovary

Habitat

- Occurs subtidally on wharf piles in low abundance
- Present distribution, Nelson Harbour

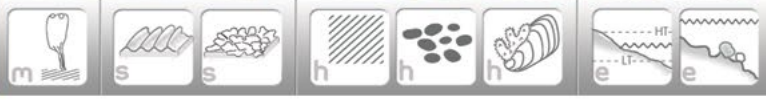
Looks like

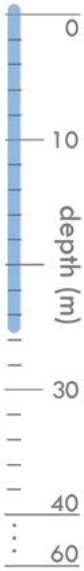
- *Pyura* species complex (see page 29)

Kott, P. (1985) The Australian Ascidiacea I. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23:112-115.

Styela clava (Herdman, 1881)

Order Pleurogona Suborder Stolidobranchia Family Styelidae





External features
- Individuals usually have a short stalk, generally no longer than the cylindrical body
- Short siphons close together at the top of the body
- Leathery test and conical, warty swellings at the top around the siphons
- Posterior half of test creased longitudinally and down the stalk
- Anchored to substratum by root-like processes

Internal features
- Gills folded
- Gill slits elongate
- Tentacles smooth
- Testis follicles outside ovary

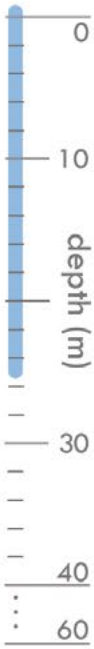
Habitat
- Settles on artificial structures such as marina pontoons and marine farms, and the seabed
- Can be locally abundant

Looks like
- *Pyura pachydermatina* (see page 26)

Kott, P. (1985) The Australian Ascidiacea I. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23:115-116.

Styela plicata (Lesueur, 1823)

Order Pleurogona Suborder Stolidobranchia Family Styelidae



External features

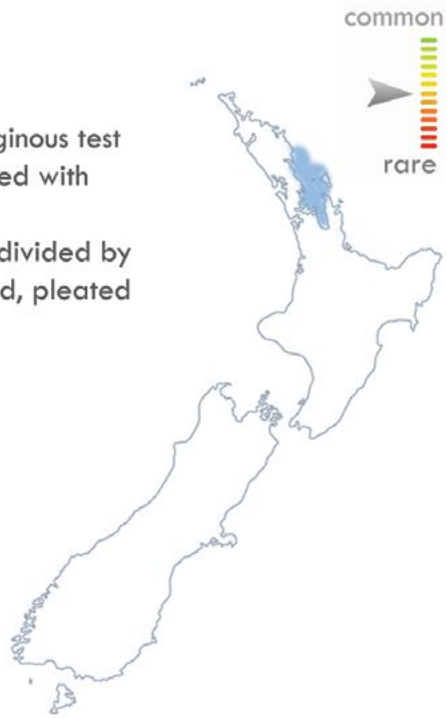
- Body ovoid with smooth, dull white, firm cartilaginous test
- Often occurs in dense clusters and is rarely fouled with other organisms
- Test divided into longitudinal ridges further subdivided by horizontal creases, giving it a distinctly knobbled, pleated appearance

Internal features

- Gill slits elongate
- Tentacles smooth
- Testis follicles outside ovary

Habitat

- Confined to harbours and coastlines of the Hauraki Gulf

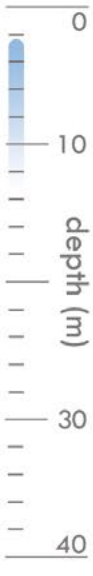


Kott, P. (1985) The Australian Ascidiacea I. Phlebobranchia and Stolidobranchia. *Memoirs of the Queensland Museum*. 23:116-118.

Millar, R.H. (1982). The marine fauna of New Zealand: Ascidiacea. *New Zealand Oceanographic Memoir* 85: 80.

Asterocarpa humilis (Heller, 1878)

Order Enterogona Suborder Stolidobranchia Family Styelidae



External features

- Body globular, maroon siphons with eight white internal longitudinal bands
- Grey to buff-coloured translucent flexible test
- Test smooth and flexible, at times encrusted with sponges, hydroids and algae

Internal features:

- Gill slits elongate
- Tentacles smooth
- Gonads in star-shaped clusters on either side of the body wall

Habitat

- Occurs subtidally under boulders, on wharf piles and fouling bivalves

Brewin, B.I. (1946) Ascidians in the vicinity of the Portobello Marine Biological Station, Otago Harbour. *Transactions and Proceedings of the Royal Society of New Zealand* 76(2): 114 -116.

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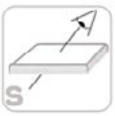
icons morphology

	ball	spherical, globular
	loaf	rounded elongate, hemispherical
	amorphous	without definable shape, often with lobed surface, potato or tuber-shaped, massive
	thick encrusting	spreading over substratum, more than about 20 mm thick
	thin encrusting	spreading over substratum, less than about 5 mm thick
	fingers	finger-like, often arising from an encrusting or restricted base, digitate
	meandering	wandering along and above substratum attached at intervals, repent
	stalked grouped	stalked with club-shaped bodies attached to a common basal mat
	stalked simple	single stalked bodies
	grapes	bunched vase-shaped individuals joined basally

	brain	hemispherical with brain-like corrugations
	sausage	long tubular sausage-shaped colonies
	lobed cluster	closely packed flat topped lobes joined by basal mat
	medusa	many single bodies on long stalks arising from a narrow basal mat
	solitary saddle	widely-spaced siphons with low saddle in between
	solitary stalked vase	elongated body with a short narrow stem, siphons closely spaced at anterior end
	solitary stalked	oval bulbous body with 2 siphons on a long narrow stem
	solitary mound	low, laterally elongate, oval shaped, with 2 siphons, separated by about ½ a body length
	solitary rounded	rounded body, siphons often close together at the anterior end
	solitary oblong	vertically elongated body with 2 siphons at the anterior end

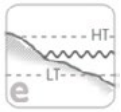
icons surface

	smooth	even, hairless, silky, can be slightly undulating		warty	bearing small flattened bumps or tubercles, verrucose
	radial systems	zooid apertures line subdermal canals radiating and branching away from common cloacal apertures		hairy	hairs projecting from the body of solitary ascidians, often holding sand grains, hirsute
	circular systems	zooid apertures form rings around common cloacal apertures		raised lobes	common cloacal apertures raised at the terminal end of lobes
	spiny	prickly bundles of very long spicules projecting from the test of solitary ascidians		transparent	gelatinous and see-through, translucent
	rough	irregularly pitted and ridged surface, often tough, rugose		wrinkled siphons	siphons raised above the body wall, wrinkled and often warty
	sand in test	sandy sediment incorporated into test of colonial ascidians, feels granular		spicules	star-shaped carbonate granules visible in and on the test
	deeply wrinkled	bearing irregularly parallel ribs and grooves along the body wall		parallel systems	zooid oral apertures in parallel lines along subdermal canals
	honeycomb	test surface with ridges in a honeycomb pattern		no systems	zooids open separately forming paired openings on low humps in the test

icons habitat

	rock	hard substrate such as mudstone, sandstone, basalt, compressed carbonates		mud	very fine muddy and silty sediments derived from terrigenous rocks, soils and clays
	rubble	shell, stone, and pebble rubble		epizoic	living or growing on the external surface of an animal
	sand	small coarse grains of worn silica, rock, and shell		artificial substratum	anything man-made such as mooring blocks, mussel lines, wharf piles

icons environment

	intertidal	exposed shoreline zone between high and low tides, including rock flats, pools, overhangs, crevices, organisms exposed to wave action, temperature extremes, full illumination, and desiccation
	subtidal	zone below the low tide, including rock flats, slopes, walls, crevices, overhangs, boulder fields, organisms exposed to wave surge and currents, and subdued illumination
	wall	underwater cliffs and slopes, organisms exposed to wave surge and currents, and subdued illumination
	indents	underwater caves, shelves and overhangs, organisms may experience wave surge, subdued illumination, or near darkness

	covered rock	sand and rubble spread over underlying hard substrate, organisms attached to basement rock susceptible to inundation and scouring from wave surge and currents, and subdued illumination
	seabed	composed of a variety of sedimentary substrates including coarse gravels, shell hash and sands to finer sand, mud, and silts, organisms susceptible to inundation and scouring from wave surge and currents, and subdued illumination
	bank	seabed raised into a bank of compacted rubbles and other carbonate materials including shell, kina and sealace hash, organisms exposed to wave surge and currents, and subdued illumination

icons life history

	solitary	one animal bound by a single test
	colonial	multiple animals bound by a single test

	native	species first described from and only found New Zealand waters, endemic
	introduced	species first described from outside of New Zealand waters and is found in New Zealand and other locations, invasive

glossary

amorphous	without definable shape, often with lobed surface, potato or tuber-shaped, massive
ampullae	blind terminal expansion of the epidermal vessels, often flask-shaped in the Botryllidae
anterior	front
apertures	openings of the body to the exterior for exchange of water, inhalant 'mouth' (branchial) aperture, exhalent (atrial) aperture
artificial substratum	anything man-made such as mooring blocks, mussel lines, wharf piles
ball	spherical, globular
bank	seabed raised into a bank of compacted rubbles and other carbonate materials including shell, kina and sealace hash, organisms exposed to wave surge and currents, and subdued illumination
brain	hemispherical with brain-like corrugations
cartilaginous	having the texture of cartilage, firm and tough yet flexible
circular systems	zooid apertures form rings around common cloacal apertures
covered rock	sand and rubble spread over underlying hard substrate, organisms attached to basement rock susceptible to inundation and scouring from wave surge and currents, and subdued illumination
deeply wrinkled	bearing irregularly parallel ribs and grooves along the body wall
environment	physical, chemical, ecological, behavioural, and other conditions experienced by an organism
epizoic	living or growing on the external surface of an animal
fingers	finger-like, often arising from an encrusting or restricted base, digitate
firm	requires some pressure to compress, firm
fleshy	feels like skin or edam cheese, dense, slightly stretchy, cellular material more abundant than fibrous material
gelatinous	jelly-like, slippery
gill sac	organ used for both the exchange of gasses (breathing) and collection of food
gonad	reproductive structure
granular	sand papery texture due to presence of calcareous spicules in the test
grapes	bunched vase-shaped individuals joined basally
habitat	environment and local situation an organism lives in
hairy	hairs projecting from the body of solitary ascidians, often holding sand grains, hirsute
honeycomb	test surface with ridges in a honeycomb pattern
indents	indentations in the substrate such as underwater caves, shelves and overhangs, organisms may experience wave surge, subdued illumination, or near darkness
intertidal	exposed shoreline zone between high and low tides, including rock flats, pools, overhangs, crevices, organisms exposed to wave action, temperature extremes, full illumination, and desiccation
loaf	rounded elongate, hemispherical
lobed cluster	closely packed flat-topped lobes joined by basal mat
meandering	wandering along and above substratum attached at intervals, repent
medusa	many single bodies on long stalks arising from a narrow basal mat
morphology	shape
mud	very fine muddy and silty sediments derived from terrigenous rocks, soils and clays
no systems	zooids open separately forming paired openings on low humps in the test
opaque	impenetrable by light
parallel systems	zooid oral apertures in parallel lines along subdermal canals
posterior	back
radial systems	zooid apertures line subdermal canals radiating and branching away from common cloacal apertures
raised lobes	common cloacal apertures raised at the terminal end of lobes
rock	hard substrate such as mudstone, sandstone, basalt, compressed carbonates
rough	irregularly pitted and ridged surface, often tough, rugose
rubble	shell, stone, and pebble rubble
sand in test	sandy sediment incorporated into test of colonial ascidians, feels granular
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seabed	composed of a variety of sedimentary substrates including coarse gravels, shell hash and sands to finer sand, mud, and silts, organisms susceptible to inundation and scouring from wave surge and currents, and subdued illumination
smooth	even, hairless, silky, can be slightly undulating
solitary mound	low, laterally elongate, oval shaped, with 2 siphons, separated by about ½ a body length
solitary oblong	vertically elongated body with 2 siphons at the anterior end
solitary rounded	rounded body, siphons often close together at the anterior end
solitary saddle	widely-spaced siphons with low saddle in between
solitary stalked vase	elongated body with a short narrow stem, siphons closely spaced at anterior end
solitary stalked	oval bulbous body with 2 siphons on a long narrow stem
spicules	star-shaped carbonate granules visible in and on the test

spiny	prickly bundles of very long spicules projecting from the test of solitary ascidians
stalked grouped	stalked with club-shaped heads attached to a common basal mat
stalked simple	single stalked bodies
subdermal canal	a canal that connects zooids together around a common cloacal aperture (exhalent)
subtidal	zone below the low tide, including rock flats, slopes, walls, crevices, overhangs, boulder fields, organisms exposed to wave surge and currents, and subdued illumination
surface	patterning or ornamentation on the surface of the body of an animal
tentacle	tentacles surround the inhalant (branchial) aperture; they can be simple or branched and are important characters at the genus level
test	a protein coating surrounding the body, it can be tough and leathery in some solitary species, or a gelatinous matrix surrounding zooids in colonial species
testis follicle	sacs that contain sperm; these are usually cream-coloured and the ovary is orange, containing eggs
thick encrusting	spreading over substratum, more than about 20 mm thick
thin encrusting	spreading over substratum, less than about 5 mm thick
translucent	lets light through the test, but not enough to perceive distinct details through it.
transparent	test of both colonial and solitary ascidians can be gelatinous, apearing see-through, translucent
wall	underwater cliffs and slopes, organisms exposed to wave surge and currents, and subdued illumination
warty	bearing small flattened bumps or tubercles, verrucose
wrinkled siphons	siphons raised above the body wall, wrinkled and often warty
zooids	small individual seasquirts of the same species living communally in a common test, often forming systems to pump water, or opening individually to the exterior

acknowledgements

This guide is dedicated to the late Patricia Mather (nee Kott) in acknowledgement of her lifetime contribution to the taxonomy of Southern Hemisphere ascidians. Our knowledge of the New Zealand ascidian fauna is richer for the early works of Sluiter, Michaelsen and more recently, those of Brewin and Millar. Many of the images presented here were taken during NIWA's Marine Biotechnology Programme collection voyages; many thanks to Vicky Webb for having the foresight to support our research in this area. This work was funded by the New Zealand Foundation of Reaserch and Technology Contract CO1X0219 (Biodiversity and Biosecurity) to NIWA.

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further reading

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