AUTHORS: M. RIUS & C. GRIFFITHS

SEA SQUIRTS

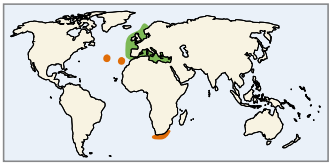
Ascidiacea

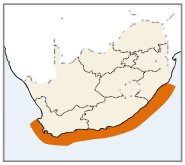
Despite their sedentary lifestyle and simple appearance, sea squirts (also termed ascidians or tunicates) are close relatives of vertebrates, as evidenced by the presence of a notochord during their tadpole-like larval stage. Adults are sessile and can be large and solitary or tiny and colonial. All draw water in through an incurrent siphon, filter it through a sieve-like branchial basket and then expel the filtered water through an excurrent siphon. Sea squirts are exclusively marine and can reach considerable abundance in low intertidal and sub-tidal habitats, forming large aggregations that structure benthic communities and filter large amounts of plankton and organic debris. When introduced away from their native range, normally via shipping, they can spread rapidly.

Light-bulb sea squirt

Clavelina lepadiformis

Group: Clavelinidae





Habitat: On man-made structures in harbours, particularly wharfs and ropes. **Identification and biology:** A strikingly beautiful and unmistakable colonial ascidian. Body elongated and enclosed in a completely transparent outer coating (test) with a bright white stripe up the side and around the siphons. Sieve-like pharynx clearly visible below siphons and bright orange visceral organs located in lower portion of test. Individuals typically 3 cm long and colonies about 5–10 cm in diameter. **Introduction and spread:** A recent introduction from the north-east Atlantic Ocean, first recorded in South Africa only in 2001, but already common in harbours and estuaries from Durban to Saldanha Bay. Not recorded on the open coast, but can be very abundant in sheltered harbours. **Impacts:** Since it does not appear to have invaded the open coast, unlikely to have significant impacts, although can be a significant fouling species in harbours. **Control:** No specific control methods known, but can be scraped from structures or killed by removing them from the water.

C. Griffiths

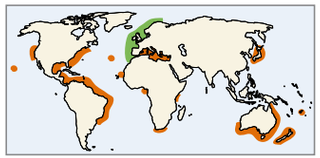
Key references: Monniot, C., Monniot, F., Griffiths, C.L. & Schleyer, M. 2001. South African ascidians. *Annals of the South African Museum*, 108:1-141.

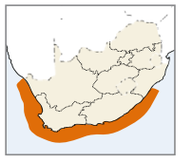
Turon, X., Tarjuelo, I., Duran, S. & Pascual, M. 2003. Characterising invasion processes with genetic data: an Atlantic clade of *Clavelina lepadiformis* (Ascidiacea) introduced into Mediterranean harbours. *Hydrobiologia*, 503:29-35.

Jelly crust tunicate

Diplosoma listerianum

Group: Didemnidae





Habitat: On rocky shores and artificial structures. **Identification and biology:** Forms thin, fragile, pale yellow to dark grey jelly-like sheets, within which pale, rounded and microscopic zooids are embedded. Breaks up easily and therefore often overlooked, or misidentified as a sponge. The zooids have independent incurrent siphons, through which water is sucked and filtered through the sieve-like pharynx. Filtered water discharged through larger, transparent and inconspicuous excurrent siphons dispersed over colony surface. Colonies grow over all types of substrata, and can reach diameters of 50 cm. **Introduction and spread:** Accidentally introduced from European waters prior to 1949, probably as a fouling organism. Now widespread in harbours and on sheltered shores from Alexander Bay to Durban. **Impacts:** Common and significant fouling species, especially of other ascidians. Impacts probably minimal because of fragile structure. **Control:** None known or proposed.

C. Griffiths

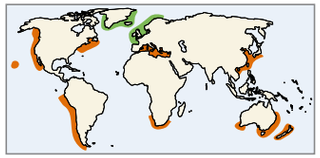
Key references: Millar, R.H. 1955. On a collection of ascidians from South Africa. *Proceedings of the Zoological Society of London*, 125:169-221.

Monniot, C., Monniot, F., Griffiths, C.L. & Schleyer, M. 2001. South African ascidians. *Annals of the South African Museum*, 108:1-141.

Vase tunicate

Ciona intestinalis

Group: Cionidae



Habitat: On floating pontoons, ship hulls, submerged ropes and wharfs, preferring shaded surfaces. **Identification and biology:** Tall, cylindrical, yellowish solitary ascidian with a soft, floppy, transparent test, revealing internal organs. Reaches 15 cm in length. Forms large aggregates on submerged structures. **Introduction and spread:** Accidentally introduced from the North Atlantic before 1955, now abundant in harbours and lagoons from Saldanha Bay to Durban. **Impacts:** Important pest, quickly coating marine structures. Dense growths smother and kill mussels on aquaculture facilities, especially on mussel ropes. **Control:** Mechanical removal tedious and needs frequent repetition; treating culture ropes with acetic acid, brine solution, hydrated lime and pressurised water effective; biological control using rock crabs feasible.

C. Griffiths

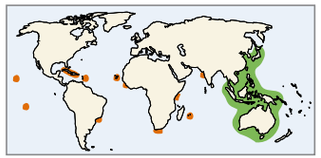
Key references: Carver, C.E., Chisholm, A. & Mallet, A.L. 2003. Strategies to mitigate the impact of *Ciona 516 intestinalis* (L.) biofouling on shellfish production. *Journal of Shellfish Research*, 22:621-631.

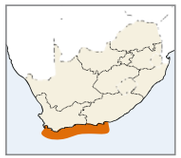
Robinson, T.B., Griffiths, C.L., McQuaid, C.D. & Rius, M. 2005. Marine alien species of South Africa – status and impacts. *African Journal of Marine Science*, 27:297-306.

Crevice ascidian

Ascidia sydneiensis

Group: Ascidiidae





Habitat: Harbours and marinas, rocky shores, usually in crevices or under rocks. **Identification and biology:** Large (up to 15 cm in length), solitary, sometimes semi-transparent but mostly covered by other fouling species. Lies on its side among other ascidian species forming large clumps, or in narrow cracks and crevices, often covered in gravel and pieces of shell. Siphons elongated and ridged, with lobed openings. Tunic breaks easily when collected. **Introduction and spread:** Probably introduced as a fouling organism from the north-eastern Pacific on ships and first recorded from False Bay in 1932. Now common in harbours and under boulders on rocky shores from False Bay to Bushman's River. **Impacts:** Common and significant fouling species in harbours. **Control:** None attempted and would be difficult, given the cryptic habitat.

C. Griffiths

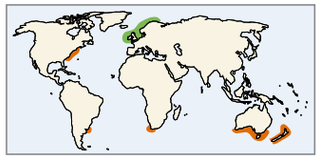
Key references: Millar, R.H. 1955. On a collection of ascidians from South Africa. *Proceedings of the Zoological Society of London*, 125:169-221.

Monniot, C., Monniot, F., Griffiths, C.L. & Schleyer, M. 2001. South African ascidians. *Annals of the South African Museum*, 108:1-141.

Dirty sea squirt

Ascidiella aspersa

Group: Ascidiidae



Habitat: Attached to harbour ropes and floating pontoons. **Identification and biology:** Up to 10 cm long, solitary, rounded and elongated. Incurrent siphon located at the top of the body, excurrent siphon about one-third down the side of the body. Tunic grey and semi-transparent, sometimes papulate and pale red around the siphons, usually covered with other sessile life forms (epibionts) that grow on it and/or detritus. Tunic stronger than Crevice ascidian (above) but still fragile. Individuals can form aggregates with others of the same species or other fouling species. **Introduction and spread:** A European species occurring from Saldanha Bay to Table Bay. **Impacts:** Not known, but together with Vase tunicate (p. 72) and Leathery sea squirt (p. 74) form important clumps of fouling in Table Bay harbour. **Control:** Likely the same methods suggested for Vase tunicate.

C. Griffiths

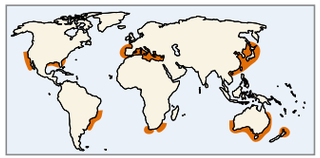
Key references: Locke, A. 2009. A screening procedure for potential tunicate invaders of Atlantic Canada. *Aquatic Invasions*, 4:71-79.

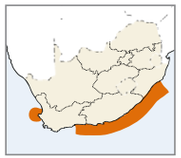
Monniot, C., Monniot, F., Griffiths, C.L. & Schleyer, M. 2001. South African ascidians. *Annals of the South African Museum*, 108:1-141.

Pleated sea squirt

Styela plicata

Group: Stylelidae





Habitat: Harbours and marinas. **Identification and biology:** Squat, off-white, solitary ascidian, with four pairs of brown stripes on each siphon. Often covered by fouling species such as algae and other ascidians. Body height 5–10 cm, occasionally reaching 15 cm. **Introduction and spread:** Introduced through shipping supposedly from Asia and now common in harbours from Richard's Bay to Mossel Bay. In 2010 a single specimen was spotted in Saldanha Bay. **Impacts:** Can out-compete other native ascidians by affecting some of their early life-history stages. Found on mussel ropes in South Africa in low abundances and forms large aggregations in harbours where it can be an important fouling organism. **Control:** No known method.

M. Rius

Key references: Barros, R.C., Rocha, R.M. & Pie, M.R. 2009. Human-mediated global dispersion of *Styela plicata* (Tunicata, Ascidiacea). *Aquatic Invasions*, 4:45-57.

Rius, M., Turon, X. & Marshall, D.J. 2009. Non-lethal effects of an invasive species in the marine environment – the importance of early life-history stages. *Oecologia*, 159:873-882.

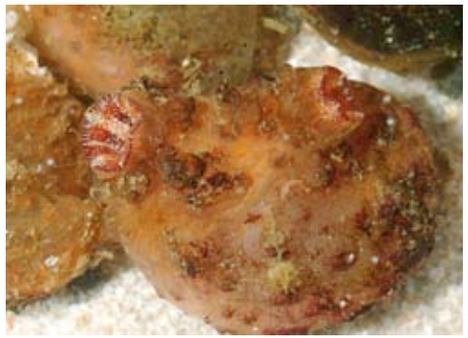
Leathery sea squirt

Cnemidocarpa humilis

Group: Stylelidae

NB: WORLD MARINE BASE

Habitat: On wharfs, harbour ropes, etc. in harbours. **Identification and biology:** A solitary species with leathery tunic normally covered by epibionts. The tunic is extremely tough, especially when stressed. The siphons are fairly prominent and elongated with wide openings. Typically reaches a maximum length of about 5 cm. **Introduction and spread:** Accidentally introduced via shipping and now common in harbours and marinas in various parts of the world. It is a common species in New Zealand, Australia and the southern part of South America. Recorded from outside harbours, including those close to Simon's Town. **Impacts:** Can be an important fouling species on marine structures, especially on floating pontoons and harbour ropes. **Control:** Unknown.



C. Griffiths

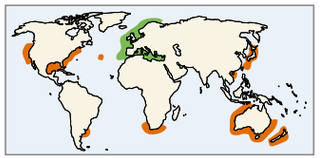
Key references: Monniot, C., Monniot, F., Griffiths, C.L. & Schleyer, M. 2001. South African ascidians. *Annals of the South African Museum*, 108:1-141.

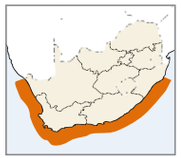
Primo, C. & Vázquez, E. 2008. Zoogeography of the southern New Zealand, Tasmanian and southern African ascidian fauna. *New Zealand Journal of Marine and Freshwater Research*, 42:233-256.

Star sea squirt

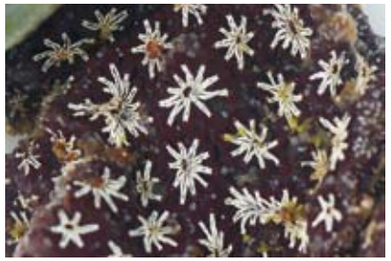
Botryllus schlosseri

Group: Stylelidae





Habitat: On rocky shores, artificial structures and seaweeds. **Identification and biology:** Colonial, forming firm, gelatinous sheets on rocks, seaweeds and other hard structures. Colony diameter typically 5–10 cm; individual zooids do not exceed 2–3 mm in diameter. Background colour usually chocolate, zooids white and arranged in distinct star-shaped groups of 8–12 individuals. However, this species presents several colour morphs, so the most distinctive characteristic is the shape of the zooids. Each zooid has an independent incurrent siphon; filtered water is ejected through a common exhalant opening in the centre of each circular group. **Introduction and spread:** Considered a European species, it was first recorded in South Africa in 1946, now occurring in harbours and sheltered lagoons from Alexander Bay to Durban. **Impacts:** An encrusting filter-feeder that can coat man-made structures creating a nuisance, but unlikely to have significant impacts. **Control:** No control methods known.



C. Griffiths

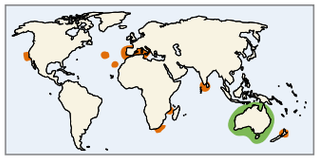
Key references: López-Legentil, S., Turon, X. & Planes, S. 2006. Genetic structure of the star sea squirt, *Botryllus schlosseri*, introduced in southern European harbours. *Molecular Ecology*, 15:3957-3967.

Monniot, C., Monniot, F., Griffiths, C.L. & Schleyer, M. 2001. South African ascidians. *Annals of the South African Museum*, 108:1-141.

Blunt-spined microcosmus

Microcosmus squamiger

Group: Pyuridae



Habitat: Aggregates on wharfs, ropes, etc. in harbours. **Identification and biology:** Solitary, with irregularly oval, red-brown tunic typically covered with other fouling organisms, making it hard to spot. Attaches to substratum by its bottom and side, the closely spaced short siphons ending in striped red-and-orange bands. It usually forms large aggregates, mostly with other individuals of the same species, but also with other species of ascidians and mussels. Body usually no longer than 5 cm. **Introduction and spread:** Accidentally introduced from Australia via shipping, now common in harbours and marinas from Richard's Bay to Mossel Bay. **Impacts:** Can be an important fouling species on marine structures. On the west coast of North America found fouling oyster farms, and in the Mediterranean found outside harbours, covering rocky reefs and excluding native species. **Control:** Unknown.

C. Griffiths

Key references: Rius, M., Pascual, M. & Turon, X. 2008. Phylogeography of the widespread marine invader *Microcosmus squamiger* (Ascidiacea) reveals high genetic diversity of introduced populations and non-independent colonizations. *Diversity and Distributions*, 14:818-828.

Rius, M., Pineda, M.C. & Turon, X. 2009. Population dynamics and life cycle of the introduced ascidian *Microcosmus squamiger* in the Mediterranean Sea. *Biological Invasions*, 11:2181-2194.