Ciona intestinalis **System:** Marine

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Ascidiacea	Enterogona	Cionidae

Common name cione (French), doorschijnende zakpijp (Dutch), gelbe seescheide (German), vase tunicate (English), sea vase (English), yellow sea squirt (English), ascidie jaune (French)

Synonym
Ascidia viridiscens , (Brugiere, 1792)
Ciona canina , (Mueller, 1776)
Ciona diaphanea , (Quoy & Gaimard, 1834)
Ciona ocellata , (Agassiz, 1850)
Ciona pulchella , (Alder, 1863)
Ciona robusta , (Hoshino & Tokioka, 1967)
Ciona sociabilis , (Gunnerus, 1765)
Ciona tenella , (Stimpson, 1852)
Phallusia intestinalis , (Linnaeus, 1767)
Tethyum sociabile , (Gunnerus, 1765)

Similar species

Summary
The sea vase, *Ciona intestinalis*, is a tunicate that has such widespread distribution that its natural range continues to be a source of constant debate. A major pest on shellfish aquaculture production, *C. intestinalis* is a highly competitive species. There is evidence of *C. intestinalis* displacing native species, reducing biodiversity, and altering community properties in some invaded habitats. Control of *C. intestinalis* is difficult due to its rapid recolonisation, difficulty of containment and proximity to valuable aquaculture production that limits the control options able to be used.

[view this species on IUCN Red List]

Species Description
Like all *Ciona* spp. *Ciona intestinalis* has a sessile adult stage which lives attached to submerged hard substrates (Holland, 2002). *C. intestinalis* usually adheres vertically to these substrates, with its siphons pointing downward (Marins *et al*, 2009). The body of *C. intestinalis* is cylindrical, reaching to 100 - 150 mm in length, with its two siphons at the anterior end (Marins *et al*, 2009). All *Ciona* spp. are encased in a soft leathery tunic, which in the case of *C. intestinalis*, it is thin, soft, gelatinous, translucent, and clear to greenish coloured, making the internal organs visible (McDonald, 2004; Jackson, 2008; in Marins *et al*, 2009).
The inhalant anterior opening into the gut is larger and terminal with eight lobes while the atrial siphon is smaller and shorter with six lobes (McDonald, 2004). Larvae are free swimming and tadpole-like in appearance, with a dorsal nerve cord, a rudimentary brain and a notochord (Holland, 2002). After dispersal, larvae attach to a surface with their head after which the tail is reabsorbed and metamorphosis into a sessile filter-feeding adult occurs (Holland, 2002).
Once settled, *C. intestinalis* provide a poor substrate for other settlers, producing strong anti-microbial compounds that may restrict epibiosis and therefore limit recruitment of other species (Finslay & Smith, 1995; in Blum *et al*, 2007). The maximum reported lifespan of individuals is 2 years, but a more typical lifespan is 1 year (Jackson, 2000; in Blum *et al*, 2007).

Notes
The origin of *Ciona intestinalis* populations in Canada is a source of debate. Locke (2009) describes populations in sourthern Nova Scotia as cryptogenic while populations in Atlantic Canadian waters are non-indigenous. In contrast, Therriault & Herborg (2008a) describe populations in Atlantic Canadian waters as cryptogenic and populations in Pacific Canadian waters as non-indigenous.

Lifecycle Stages
Larvae are free swimming and tadpole-like in appearance, with a dorsal nerve cord, a rudimentary brain and a notochord (Holland, 2002). After dispersal over a period of 1 - 5 days (Dybern, 1965; in Howes *et al*, 2007), larvae attach to a surface with their head after which the tail is reabsorbed and metamorphosis into a sessile filter-feeding adult occurs (Holland, 2002).

Uses
Species of sea squirt, including *Ciona* spp., were popular models for embryological research in the early part of the twentieth century. *Ciona* spp. were instrumental in the discovery of cytoplasmic determinants, and were one of the first animals to have a cell lineage mapped (Holland, 2002). More recently, numerous developmentally expressed genes have been cloned from *Ciona* spp., hundreds of gene expression patterns are published, and there are powerful methods for introducing gene constructs into *Ciona* spp. embryos using electroporation (Holland, 2002).

Habitat Description
Ciona intestinalis lives attached to submerged rocks or other hard surfaces, such as ropes, chains and boat hulls (Holland, 2002). *C. intestinalis* has a cosmopolitan distribution, tolerates organic pollution and a wide range of enviornmental conditions. It is abundant in ports and marinas all over the world (Meliane, 2003; in Marins *et al*, 2009; Therriault & Herborg, 2008a).

Reproduction
As with all Ascidians, *Ciona intestinalis* is hermaphroditic and potentially capable of self-fertilisation (Silva & Smith, 2008). It is also a solitary (opposed to colonial) Ascidian which undergoes broadcast spawning (Silva & Smith, 2008). Each mature individual can potentially spawn once per day over the spawning period, releasing appproximately 500 eggs per day (Carver *et al*, 2003). Eggs are negatively buoyant and released in mucus strings that tangle and attach to nearby adults, contributing to the dense aggregations of adults (MarLIN, 2004; in McDonald, 2004).

Nutrition
Ciona intestinalis is a filter feeding organism, feeding on particles in the water column (Daigle & Herbinger, 2009). Clearance rates increase in an approximately linear relationship with increasing temperature with rates ranging from 4.6 ml per min per individual at 4 °C to about 29 ml per min per individual at 19 °C (Daigle & Herbinger, 2009).

General Impacts
The most severe impacts of *Ciona intestinalis* worldwide have been on aquaculture production, causing substantial economic losses to the shellfish industry in particular (Robinson *et al*, 2005). Higher *C. intestinalis* densities are generally linked to lower mussel size and condition, with heavy fouling resulting in up to 50 % mussel mortality (Daigle & Herbinger, 2009). This is due mainly to inhibited growth and yield through food and space competition (Daigle & Herbinger, 2009; Rocha *et al* 2009) as well as increasing weight of gear, leading to difficulties in handling and processing (Locke *et al*., 2009b).
Additionally, as a highly competitive species within subtidal, epibenthic communities, *C. intestinalis* has also displaced native species, lowered biodiversity, and altered community properties in some invaded habitats (Blum *et al* 2007; Therriault & Herborg, 2008b).

Management Info
Please follow this link for detailed information on the management of *Ciona intestinalis*. A brief summary can by found below.
Preventative measures: A risk assessment carried out by Hayes *et al* (2005) in Australia determined that *C. intestinalis* was one of top ten species in both its likelihood to be spread to uninfected bioregions by shipping and its damage potential. Preventative requirements on Prince Edward Island, Canada failed to stop the spread of *C. intestinalis* (Locke *et al*., 2009b). The only regulated vector in Canada is ballast water coming in from commercial shipping (Locke *et al*., 2009a)
Monitoring: Tunicate collectors were created and used to detect the presence and distribution of exotic tunicate species in the Bay of Fundy, including *Ciona intestinalis* (LeGresley *et al*, 2008).
Physical control: Aquaculture farmers surveyed by Clancey & Hinton (2003) revealed that physical removal methods such as hand scrubbing, scraping or high pressure spraying were the most common treatments used to remove tunicates that had become established on gear, however *C. intestinalis* quickly re-established populations within short periods.
Chemical control: A number of chemical treatments to control *C. intestinalis* have been trialed (Carver *et al*, 2003). While some like acetic acid and calcium hydroxide have shown promising results, chemicals have the potential to alter estuarine pH are and have been shown to be biocidal to a variety of non-target organisms such as species of bacteria, shrimp and fish (Locke *et al*, (2009b).
Biological control: Potential biological control agents include the rock crab, *Cancer irroratus* and green crab, *Carcinus maenas*. The use of crab predators for the control of *C. intestinalis* in aquaculture is limited for a number of reasons (Carver *et al*, 2003). Grazing species such as *Littorina littorea* and the shrimp *Rhynchocinetes typus* have also been trialled, with the shrimp in particular showing promising results (Dumont *et al*., 2009).
Cultural control: These refer to aquaculture management practices and generally include avoiding times of high *C. intestinalis* recruitment, changing or rotating the gear used or air drying depending on the species being farmed and the gear being used. More information on *C. intestinalis* recruitment patterns and population development is necessary to develop more effective management procedures (Ramsay, *et al*, 2009).

Principal source:

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ALIEN RANGE

[1] ATLANTIC - NORTHWEST
[1] AUSTRALIA
[4] BRAZIL
[6] CANADA
[1] CHILE
[1] HONG KONG
[1] KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF
[4] NEW ZEALAND
[1] SOUTH AFRICA
[3] UNITED STATES

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Summary: This compilation of information sources can be sorted on keywords for example: Baits & Lures, Non Target Species, Eradication, Monitoring, Risk Assessment, Weeds, Herbicides etc. This compilation is at present in Excel format, this will be web-enabled as a searchable database shortly. This version of the database has been developed by the IUCN SSC ISSG as part of an Overseas Territories Environmental Programme funded project XOT603 in partnership with the Cayman Islands Government - Department of Environment. The compilation is a work under progress, the ISSG will manage, maintain and enhance the database with current and newly published information, reports, journal articles etc.
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