Styela clava **System:** Marine

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Ascidiacea	Pleurogona	Styelidae

Common name Asian tunicate (English), rough sea squirt (English), club tunicate (English), leathery sea squirt (English)

Synonym *Styela mammiculata* , Carlisle 1954
Bostryorchis clava , Redikorzev, 1916
Styela barnharti , Ritter and Forsyth, 1917
Styela clava , Herdman, 1881
Styela clava clava , Nishikawa, 1991

Similar species *Styela plicata*

Summary Styela clava is a fouling organism native to the Pacific Coast of Asia. Because of its hardy nature and ability to withstand salinity and temperature fluctuations, Styela clava easily establishes wherever it is introduced. It can reach extreme densities and out-compete native organisms for food in the water column. Styela clava also predate on the larvae of native species causing population declines. It is a nuisance to mussel and oyster farmers.

view this species on IUCN Red List

Species Description
Styela clava is a large, club-shaped solitary ascidian with a tough leathery body wall with conspicuous bumps, growing up to 160mm long. It consists of an elongated, cylindrical body on top of a stalk of variable length. It can be brownish-white, yellowish-brown, reddish-brown, or yellowish-grey. There are two short siphons toward the top of the organism pointing upward, each with a 4-lobed opening. The body has conspicuous tubercles and rounded swellings on the upper portion and rounded longitudinal ridges on the lower half. The stalk surface is creased. Internally, the gut is a simple U-shaped loop (Fuller, 2005; and NIMPIS, 2002).

Uses
Styela clava is eaten as seafood in Korea (Fuller, 2005).

Habitat Description
Styela clava is present on coasts in low wave energy environments and sheltered embayments in the upper sublittoral zone to at least 25m depth. As a fouling species, it is common on rocks and pylons and can reach densities of 500-1500 individuals per square metre. It is a hardy species, capable of withstanding salinity changes and temperature fluctuations. It can attach itself to concrete and cement, wood, vessel hulls and reefs. *S. clava* has also frequently been found on permanently submerged floating surfaces, such as buoys and pontoons. It has also been documented attaching itself to other organisms (*Crassostrea gigas*, *Mytilus edulis*, and *Sargassum muticum*) (Davis and Davis, 2005; and NIMPIS, 2002).

Reproduction
Styela clava is hermaphroditic but male and female gonads mature at different times, hence they are not self-fertile. The gonads are closely applied to the visceral surface of the body wall. It reproduces sexually, is oviparous and larval development is usually of one day duration. Spawning in *S. clava* is temperature dependant and it is believed to only be able to spawn in waters above 15°C. Fertilisation is external and eggs and larvae planktonic for between one to three days, after which they settle and metamorphose into the sessile adult. Reproduction occurs throughout all but the coldest periods. *S. clava* can live 2-3 years and reach maturity around 10 months (JNCC, 1997; NIMPIS, 2002; and Parker *et al.* 1999).

Nutrition
Styela clava is a suspension feeder that consumes matter such as phytoplankton, zooplankton, oyster larvae and other suspended organic materials (NIMPIS, 2002).

General Impacts
When *Styela clava* populations explode they often out-compete many native species for food. *S. clava* can reach densities of 500-1500 individuals per square metre. These extreme densities can have negative impacts on native and aquaculture species through competition for space and food, as well as predation of larvae from the water column. *S. clava* invasiveness is enhanced through its hardy nature; capable of withstanding salinity changes and temperature fluctuations (JNCC, 1997; NIMPIS, 2002).
It can also occur as fouling on vessels, aquaculture and fishing equipment and other artificial structures. Dense fouling on fishing equipment, moorings, ropes, etc. can be time consuming to remove and can result in tangling of fishing gear. Hull fouling increases drag on vessels, requires an increase in the frequency of hull cleaning, and increases fuel costs. In Japan it has been known to impact human health causing an asthmatic condition in oyster shuckers when hammering open *Styela* fouled oysters in poorly ventilated areas (NIMPIS, 2002).

Management Info
A two year study was undertaken for the Department of Environment and Heritage (Australia) by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) to identify and rank introduced marine species found within Australian waters and those not found within Australian waters.
All of the non-native potential target species identified in this report are ranked as high, medium and low priority, based on their invasion potential and impact potential. A hazard ranking of potential domestic target species based on invasion potential from infected to uninfected bioregions identifies *Styela clava* as a 'medium priority species' - these species have a reasonably high impact/or invasion potential.
For more details, please see Hayes *et al.* 2005.
The rankings determined in Hayes *et al.* 2005 will be used by the National Introduced Marine Pest Coordinating Group in Australia to assist in the development of national control plans which could include options for control, eradication and/or long term management.
NIMPIS (2002) states that, \"In some power plants, raw water systems, reservoirs, locked marinas and impoundments, water levels can be lowered (drawn-down) to expose fouling infestations to the air. Subsequent freezing or desiccation due to ambient temperatures may kill a large proportion of the exposed population.\"
The authors go on to state that this method has been successful in controlling *S. clava*. Various combinations of salinity, temperature and exposure to air have proved successful in killing *S. clava* fouled on oysters without harming the oysters (NIMPIS, 2002).
The dipping of dredged oysters, and associated species, in saturated or strong salt solutions is extremely effective in killing ascidians without harming the oysters. Brine dipping of oysters fouled with *Sargassum muticum*, *Codium fragile* ssp. *tomentosoides* and *S. clava* was found to be an effective control. Brine dipping infested oysters is considered the cheapest, safest and most effective method of control of fouling species, however, this requires collection of all the fouled oysters to place them in a bath as it is not possible to implement in the open environment (NIMPIS, 2002).

Pathway
Possible methods of *Styela clava* dispersal include being transferred on oysters (JNCC, 1997).*Styela clava* was possibly transported on the hulls of warships following the end of the Korean War in 1951 (JNCC, 1997).

Principal source: NIMPIS, 2002 *Leathery sea squirt : Styela clava*
JNCC, 1997 *Styela clava*

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

Review: Expert review underway: \ Andrew N. Cohen\ San Francisco Estuary Institute Oakland California USA

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ALIEN RANGE

[2] ATLANTIC - NORTHEAST
[9] CANADA
[3] FRANCE
[2] IRELAND
[1] NETHERLANDS
[4] PORTUGAL
[5] UNITED KINGDOM
[4] AUSTRALIA
[1] DENMARK
[1] GUERNSEY
[1] JERSEY
[6] NEW ZEALAND
[3] SPAIN
[24] UNITED STATES

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Managment information
Centre for Environment, Fisheries & Aquaculture Science (CEFAS)., 2008. Decision support tools-Identifying potentially invasive non-native marine and freshwater species: fish, invertebrates, amphibians.
Summary: The electronic tool kits made available on the Cefas page for free download are Crown Copyright (2007-2008). As such, these are freeware and may be freely distributed provided this notice is retained. No warranty, expressed or implied, is made and users should satisfy themselves as to the applicability of the results in any given circumstance. Toolkits available include 1) FISK- Freshwater Fish Invasiveness Scoring Kit (English and Spanish language version); 2) MFISK- Marine Fish Invasiveness Scoring Kit; 3) MI-ISK- Marine invertebrate Invasiveness Scoring Kit; 4) FI-ISK- Freshwater Invertebrate Invasiveness Scoring Kit and AmphISK- Amphibian Invasiveness Scoring Kit. These tool kits were developed by Cefas, with new VisualBasic and computational programming by Lorenzo Vilizzi, David Cooper, Andy South and Gordon H. Copp, based on VisualBasic code in the original Weed Risk Assessment (WRA) tool kit of P.C. Pheloung, P.A. Williams & S.R. Halloy (1999).
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The Ocean Biogeographic Information System (OBIS) Dataset Extent Map, Distribution of *Styela clava*
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