GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Gracilaria salicornia***

Gracilaria salicornia 简体中文 正體中文 **System:** Marine

Kingdom	Phylum	Class	Order	Family
Plantae	Rhodophycota	Rhodophyceae	Gigartinales	Gracilariaceae

Common name canot-canot (Arabic), red alga (English)

Synonym
Sphaerococcus salicornia , Agardh
Corallopsis salicornia , Greville
Corallopsis dichotoma , Ruprecht
Corallopsis cacalia , Agardh
Corallopsis salicornia , var. *minor* Sonder
Corallopsis opuntia , Agardh
Corallopsis concrescens , Reinbold
Gracilaria cacalia , Dawson

Similar species

Summary The introduction of alien algae in the marine environment is a potential threat to the health and stability of near-shore ecosystems. Gracilaria salicornia threatens coral reefs and native benthic communities in Hawaii and elsewhere. It may reduce marine species diversity and alter marine community structure.

view this species on IUCN Red List

Species Description
Gracilaria salicornia varies in colour from a bright yellow at the tips to orange, green or brown at the base. The thallus is cylindrical (0.5cm in diameter) and dichotomously branched with constrictions at the base of each dichotomy. In Hawai'i it generally grows in three-dimensional mats that are tightly adherent to hard substrata and can be up to 25-40cm in thickness; in calm environments it may grow in an upright and more openly branching form (Smith Pers. Comm. 2003).

Uses
Gracilaria salicornia is now commonly found in poke (a local raw fish salad) and is sold at a number of local markets around O'ahu, Hawaii.

Habitat Description
In the Tropics, alien marine plants pose threats to both coral-dominated habitats and sea grass beds (Smith Hunter and Smith 2002). Very limited research has been conducted on the ecology of *G. salicornia* in both its native and introduced ranges. However, evidence suggests that the unique mat-forming morphology of this species provides physiological adaptations allowing the species to tolerate a wide range of light environments (Beach *et al*. 1997, in Smith *et al*. 2004) while also monopolising nutrients that may be seeping from underlying sediments (Larned 1998, in Smith *et al*. 2004). Based on experiments investigating the potential use of temperature, salinity, and chemicals to kill *G. salicornia*, Smith *et al*. (2004) concluded that this species is remarkably resilient to environmental extremes. Only the highest seawater temperature (41°C) and salt saturated solutions (75% and 50%) caused mortality. This resilience allows *G. salicornia* to thrive in conditions ranging from freshwater to ambient seawater and across temperatures that fluctuate from cool freshwater runoff to warm hyposaline intertidal areas (Smith *et al*. 2004).

Reproduction
Reproduction is primarily through fragmentation and vegetative propagation (Smith Pers. Comm. 2003) followed by re-attachment to the substratum by the fragments/propagules.

General Impacts
In tropical regions, blooms of indigenous algae (such as *Gracilaria salicornia*) have often been tied to reductions in grazing intensity and increases in anthropogenically derived nutrient levels (Miller *et al*. 1999, McClanahan *et al*. 2001, McCook *et al*. 2001, Smith *et al*. 2001, Stimson *et al*. 2001, Thacker *et al*. 2001, in Smith Hunter and Smith 2002). *G. salicornia* is likely to damage native coral environments by over-growing native benthic organisms such as algae and marine invertebrates. Because of its large morphological stature and the dense mats it forms (5 to 10cm thick), *G. salicornia* can have large effects on benthic ecology by monopolising stratum (Smith *et al*. 2004)
In many cases, red alga becomes ecologically dominant and grows over coral reefs. For example, in areas of Hawaii such as Waikiki *G. salicornia* has become the single-most dominant benthic species in an area that before invasion was home to over 60 species of macroalgae (Doty 1969, in Smith *et al*. 2004. The long-term consequences of phase shifts from coral to algal dominance may include the loss of biodiversity, a decrease in the intrinsic value of the reef, changes in the community structure (eg: a reduction in the numbers of reef fish dependent upon corals for habitat and shelter), and erosion of the reef (Hughes 1994, in Smith Hunter and Smith 2002).

Management Info
Once introduced, *Gracilaria salicornia* has the ability to spread within a site laterally and become locally dominant but have limited long range dispersal (i.e. between sites or islands, and evaluated over ca. 20 years) (Smith Hunter and Smith 2002). This suggests that management primarily can be applied on a site by site basis and with less effort on controlling between site spread.
\r\nResults of herbivore preference tests, showed that several herbivorous fish species, including all of the species of acanthurids preferred (up to eight times more) native *G. coronopifolia* over alien *G. salicornia*. Although more work is needed to understand food preference of other grazers (such as sea urchins, crustaceans, mollusks, and turtles) these results suggest that enhancing fish stocks in invaded areas will not reduce alien algal populations (Smith *et al*. 2004).
Experiments designed to investigate the use of salinity, temperature and algicides to control algal growth found that *G. salicornia* is resilient to all treatments except the chemical option (Smith *et al*. 2004). Chemical treatments showed the highest degree of mortality overall, with only samples in the low algicide treatments surviving.
Manual removal of *G. salicornia* is currently the only feasible control strategy available. However, this technique is extremely time-consuming (6.9 hours per m^2 of substrate, significantly less for removing floating red algae unattached to substrate) and preliminary evidence suggests that *G. salicornia* will regrow rapidly. In addition, the removal activity itself generates fragments which are potential propagules and, therefore, care must be taken to avoid their dispersal. \r\n
A diverse and multidisciplinary approach is needed when addressing management issues about invasive species in the marine environment (Smith Hunter and Smith 2002). For example management plans need to take into account the presence of marine protected areas or fisheries management areas and cycles of nutrient fluxes.

Pathway
Gracilaria salicornia was introduced intentionally to two reefs on O'ahu, Hawai'i, in the 1970s for experimental aquaculture for the agar industry (Smith *et al*. 2004).A likely vector of transport of invasive marine algae is through ship fouling and/or ballast water. In Hawaii many alien algae were first collected in or around harbors and gradually dispersed to neighbouring areas (Smith Hunter and Smith 2002).

Principal source: Smith, J.E., C.L. Hunter, E.J. Conklin, R. Most, T. Sauvage, C. Squair, and C.M. Smith. 2004. Ecology of the invasive red alga *Gracilaria salicornia* (Rhodophyta) on Oahu, Hawaii. Pacific Science. 58 (2): 325-343
Smith, J.E., Hunter, C.L. and Smith, C.M. 2002. Distribution and Reproductive Characteristics of Non-indigenous and Invasive Marine Algae in the Hawaiian Islands, Pacific Science 56 (3): 299–315.

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ALIEN RANGE

[2] AUSTRALIA
[1] FIJI
[3] INDIA
[1] IRAN, ISLAMIC REPUBLIC OF
[1] KENYA
[1] MADAGASCAR
[1] MAURITIUS
[1] MOZAMBIQUE
[1] OMAN
[1] PHILIPPINES
[2] SEYCHELLES
[1] SOLOMON ISLANDS
[1] SRI LANKA
[1] TANZANIA, UNITED REPUBLIC OF
[6] UNITED STATES
[1] YEMEN
[1] CHINA
[1] GUAM
[1] INDONESIA
[1] JAPAN
[1] KUWAIT
[1] MALAYSIA
[1] MICRONESIA
[1] NORTHERN MARIANA ISLANDS
[1] PAKISTAN
[1] REUNION
[1] SINGAPORE
[1] SOUTH AFRICA
[1] TAIWAN
[1] THAILAND
[1] VIET NAM

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