Kappaphycus spp. **System:** Marine

Kingdom	Phylum	Class	Order	Family
Plantae	Rhodophyta	Florideophiceae	Gigartinales	Solieriaceae

Common name guso (English), agar agar seru laut (English), red alga (English), eucheuman (English), cottonii (English), chilin-t' sai (English), eucheuma (English), kirinsai (English), agar agar pulau (English), agar agar besar (English), algae (English), algues rouges (French), agar-agar (English), agal agal besar (English), brown licorice (English), agal agal (English)

Synonym

Similar species *Kappaphycus alvarezii, Kappaphycus cottonii, Kappaphycus inermis, Kappaphycus interme, Kappaphycus procrusteanum, Kappaphycus striatum*

Summary Kappaphycus spp. are red algae species that have been introduced in various parts of the world for the purpose of harvesting the gelling agent kappa carrageenan, which is used in industrial gums and as a smoothening agent used in ice cream, toothpaste, jellies, medicines and paint. This species can regrow from fragments as small as 0.5cm making it an extremely difficult species to control.

view this species on IUCN Red List

Species Description
Kappaphycus spp. is a tough, fleshy, firm; algae that can grow up to 2m tall. The thalli are coarse, with axes and branches 1-2cm in diameter and heavy major axes that are relatively straight, but lacking secondary branches near the apices. These algae frequently and irregularly branch with most branches both primary and secondary branches intercalated between primary branches. The algae is shiny green to yellow orange (University of Hawai‘i, UNDATED).

Notes
Woo *et al.* (1999) state that, \"Results from various studies so far suggest that a combination of several characteristics of the algae allow for its success as an invader: phenotypic plasticity that allows for persistence in high and low wave energy environments, asexual reproduction through fragmentation which may increase dispersal capabilities, physiological adaptations which permit coalescence and attachment to substrate, and possible chemical and morphological characteristics which lead to low grazer preference.\" \"Once established in an area, *Kappaphycus* spp. alga may be able to spread laterally but, does not appear to be able to spread long distances or between islands\" (Smith *et al.* 2002).

Lifecycle Stages
The life cycle of *Kappaphycus* spp. are triphasic consisting of three independent life stagesthe carposporophyte (2N), tetrasporophyte (2N) and gametophyte (N) phases (Aska and Azanzab, 2002).

Uses
Granbom *et al.* (2004) states that, \"The marine red alga *Kappaphycus alvarezii* is economically important due to the production of the gelling agent kappa carrageenan, which is used in industrial gums and other products.\" Tighe (1998) state that, \"carrageen is a smoothening agent used in ice cream, toothpaste, jellies, medicines and paint.\"

Habitat Description
Kappaphycus spp. can be found on reef flats and reef edges anywhere from 1 to 17m deep. It is often loosely attached to broken coral. Unattached fragments can be found floating in shallow and deep waters. This species can form large, moving mats of unattached fragments (University of Hawai'i, UNDATED).

Reproduction
The University of Hawai'i (UNDATED) states that, \"At the tip of each branch is a cluster of apical cells potentially high in regenerative capabilities that are able to regenerate a new thallus after breaking off. A broken tip can grow into full-sized thalli in a short period of time.\" Smith *et al.* (2002) report the results of their study that showed that \"*Kappaphycus* spp. regrew in the field from fragments as small as 0.5cm. This method of reproduction is most likely the primary mode of propagation for *Kappaphycus* spp.\" They further observe that *Kappaphycus* spp. in Hawai'i have only recently been observed to reproduce sexually.

General Impacts
Kappaphycus spp. high growth rate, plastic morphology, and extremely successful vegetative regeneration makes them potentially destructive invasive species not just in Hawai'i but around the globe (University of Hawai'i, UNDATED). Conklin *et al.* (UNDATED) reports that *Kappaphycus* spp. is a serious danger to the coral reefs. Research has shown that *Kappaphycus* spp. have the ability to overgrow and kill coral. Woo *et al.* (1999) states that, \"Observations have shown that the alga is able to coalesce into the tissue of the coral, providing a strong means for attachment, and thus allowing the alga to persist in high wave energy environments. The novel substrate and structure the algae provides may permit settlement of epiphytes previously absent, as well as shelter and protection for mesograzers.\" Woo (2001) documented fragments of *Kappaphycus* spp. weighing 0.05 g that were capable of net growth in the field, suggesting that fragments created by physical disturbance can be carried by waves and currents to new locations where they can possibly establish.

Management Info
There are few studies in relation to the management and control of *Kappaphycus* spp. Most of the documented effort ongoing are into the study of the basic biology of the species. Some authors have begun researching possible biological control agents of this species, but there is very little information regarding control of this species.
In a study conducted by Conklin *et al.* (UNDATED), the authors demonstrated that, \"1) *Kappaphycus* spp. will regrow in plots after mechanical harvest unless further action is taken, 2) increases in nutrient availability lead to increased rates of regrowth, and 3) the enhancement of herbivore densities dramatically decreased the rate at which regrowth occurrs. The results obtained with the urchins in the above experiment led to the addition of urchins to plots where *K. alvarezii* cover was approximately 60%. These plots showed that urchins in high densities could reduce invasive algal cover by almost 100% in 2-3 months.\"

Principal source: *Kappaphycus alvarezii* (The University of Hawai'i, UNDATED)

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

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Pubblication date: 2005-05-16

ALIEN RANGE

[1] AMERICAN SAMOA
[1] FIJI
[1] INDONESIA
[5] KIRIBATI
[1] MALAYSIA
[1] SOUTH AFRICA
[4] VENEZUELA
[2] CHINA
[3] INDIA
[2] JAPAN
[1] MADAGASCAR
[3] MEXICO
[6] UNITED STATES
[1] VIET NAM

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