

*Caulerpa taxifolia* [简体中文](#) [正體中文](#)

**System:** Marine

Kingdom	Phylum	Class	Order	Family
Plantae	Chlorophyta	Chlorophyceae	Caulerpales	Caulerpaceae

**Common name** Schlauchalge (German), lukay-lukay (English, Philippines), sea weed (English), killer alga (English), caulerpa (English)

**Synonym** *Fucus taxifolius* , Vahl, 1802

**Similar species** *Caulerpa mexicana*, *Caulerpa prolifera*, *Caulerpa racemosa*, *Caulerpa veravalensis*

**Summary** *Caulerpa taxifolia* is an invasive marine alga that is widely used as a decorative plant in aquaria. A cold-tolerant strain was inadvertently introduced into the Mediterranean Sea in wastewater from the Oceanographic Museum at Monaco, where it has now spread over more than 13,000 hectares of seabed. *Caulerpa taxifolia* forms dense monocultures that prevent the establishment of native seaweeds and excludes almost all marine life, affecting the livelihoods of local fishermen.



[view this species on IUCN Red List](#)

## Species Description

*Caulerpa taxifolia* is a light green macroalga with upright leaf-like fronds arising from creeping stolons. The fronds are flattened laterally and the small side branchlets are constricted at the base (where they attach to the midrib of each frond), are opposite in their attachment to the midrib (as opposed to alternating) and curve upwards and narrow towards the tip. The invasive aquarium clone is morphologically identical to native populations of the species. Frond diameter is 6-8mm and frond length is usually 3-15cm in the shallows, 40-60cm in deeper situations but can grow up to 2.8m in height (NIMPIS, 2002). *C. taxifolia* is distinguished from other Australian *Caulerpa* species by the branchlets that are constricted at the base (where they attach to the midrib of each frond) and they are opposite in their attachment to the midrib (as opposed to alternating). Also, the branchlets curve upwards and taper at the apex (NIMPIS, 2002).

## Notes

The cold-tolerant aquarium (Mediterranean) clone is the invasive strain of this species, and is therefore referred to as *Caulerpa taxifolia* in this profile. It was introduced to the Mediterranean in wastewater from the Oceanographic Museum at Monaco where it now covers over 13,000 hectares of seabed along 190km of coast. An invasive tropical strain has also been discovered near Sydney, Australia (Nova, 2003) and invasions were also detected in southern California (Williams & Grosholz, 2002). Genetic analysis has revealed that the *C. taxifolia* strains found in California are identical to those found in the Mediterranean and in many aquaria. They are also very similar to plants found in southern Australia, leading to the hypothesis that the invasive strain originated from Australia and was distributed via the aquarium trade to many parts of the world (Meinesz *et. al*, 2001b).

In the Mediterranean Sea, the molluscs *Oxynoe olivacea* and *Lobiger serradifalci* are found on *C. taxifolia* and feed on it. The grazing rate of these two ascoglossans is low and significantly effected by temperature. *Elysia subornata* is an opisthobranch that feeds only on species of *Caulerpa* and is a potential for biological control of *C. taxifolia* in the Mediterranean. During summer and autumn, the toxic substance produced by *C. taxifolia*, caulerpenyne, may be the reason there are few consumers (NIMPIS, 2002).

Research on the Mediterranean and tropical strains of *C. Taxifolia* revealed some major differences between them. The Mediterranean strain has larger fronds, lacks female gametes, can withstand lower temperatures, and has increased concentrations of defensive chemical metabolites (Raffaelli *et. Al*, 1997).

*C. Taxifolia* appears to have been distributed around the Mediterranean as fragments attached to ship anchors, as the locations of new outbreaks are predominantly associated with port and mooring facilities (Meinesz *et. Al*, 2001b).

Observation of native populations of *C. Taxifolia* growing at temperatures of 9 to 11°C in Moreton Bay, Australia, has raised doubts over whether the Mediterranean populations are of a genetically-modified, cold-adapted strain, as has been asserted by some authors (Phillips & Price, 2002).

## Lifecycle Stages

Monoecious. In the Mediterranean reproduction is vegetative by fragmentation. In native populations, male and females gametes fuse forming a zygote which grows through two little known stages prior to becoming the adult (NIMPIS, 2002). Sexual reproduction has been observed in central Queensland. Gametes released in June - September in Adriatic Sea (NIMPIS, 2002).

## Uses

Widely used as a decorative plant in private and public saltwater aquaria (Meinesz *et. al*, 2001b).

## Habitat Description

Found on a wide variety of substrates from rock, sand and mud to seagrasses. It is usually found in depths of 3-35m, but has been recorded at depths down to 100m in the Mediterranean. The invasive aquarium strain is able to occupy up to 100% of the available substratum. Native populations in tropical waters are found on rocky reefs and seagrass meadows in sheltered or moderately wave-exposed areas in both polluted and pristine waters (NIMPIS, 2002).

The temperature range for the Mediterranean strain is 7°C - 32.5°C, while the maximum salinity is 38 ppt (NIMPIS, 2002).

## Reproduction

Native populations of *C. taxifolia* are known to reproduce sexually, however the aquarium strain is apparently an all-male clone (only producing male gametes). In the Mediterranean the aquarium strain spreads vegetatively by growth of the stolons or by regeneration from broken off fragments as small as 1 square centimetre in size (NIMPIS, 2002). The minimum reproductive temperature has been recorded as 25°C for all-male clones in the Adriatic Sea (NIMPIS, 2002).

## Nutrition

*Caulerpa taxifolia* gains nutrition through photosynthesis.

## General Impacts

The *Caulerpa taxifolia* aquarium strain in the Mediterranean Sea is extremely invasive and smothers other algal species, seagrasses and sessile invertebrate communities. It does this by either out-competing species for food and light or due to the toxic effects of its caulerpenyne compounds. Its large monospecific meadows have vastly reduced native species diversity and fish habitat (NIMPIS, 2002). Effects on humans are mostly related to the reduction of catches for commercial fishermen due to the elimination of fish habitat by *C. Taxifolia*, although the entangling of nets and boat propellers with this weed also affect efficiency (NIMPIS, 2002). Fish which are able to eat *C. Taxifolia*, such as the Mediterranean bream (*Sarpa salpa*), accumulate toxins in their flesh that make them unsuitable for human consumption (Meinesz & Hesse, 1991).

*C. Taxifolia* outcompetes the seagrasses *Posidonia oceanica* and *Cymodocea nodosa* in Mediterranean ecosystems (NIMPIS, 2002).

Economic impacts resulting from the cost of eradication included approx \$US6 million spent in Southern California up to 2004 (Anderson, 2004) and \$AUS6-8 million in South Australia.

## Management Info

**Preventative measures:** Nyberg and Wallentinus (2005) state that *Caulerpa taxifolia* is one of five top risk species in Europe. The authors study quantitatively ranked species traits which facilitate introduction and predominance using interval arithmetic to search for common patterns among 113 marine macroalgae introduced in Europe. From the abstract Nyberg and Wallentinus (2005) "Three main categories were used: dispersal, establishment and ecological impact. These were further subdivided into more specific categories, a total of 13. Introduced species were compared with the same number of native species randomised from the same families as the introduced. Invasive species (i.e. species having a negative ecological or economical impact) were also compared with non-invasive introductions, separately for the three algal groups. In many categories, as well as when adding all species, the introduced species ranked more hazardous than the native species and the invasive species ranked higher than the non-invasive ones. The ranking within the three main categories differed, reflecting different strategies between the species within the three algal groups. When all categories (excluding salinity and temperature) were summed, the top five risk species, all invasive, were, in descending order, *C. fragile* spp. *tomentosoides*, *Caulerpa taxifolia*, *Undaria pinnatifida*, *Asparagopsis armata* and *Grateloupia doryphora*, while *Sargassum muticum* ranked eight and *Caulerpa racemosa* ten. Fifteen of the twenty-six species listed as invasive were among the twenty highest ranked".

**Chemical:** Colonies of *C. taxifolia* that were discovered in Southern California were eradicated by covering and sealing them with PVC tarpaulins and injecting liquid chlorine underneath. Subsequent treatments at another location used solid chlorine formulations (Anderson & Keppner, 2001). Costs of the Southern Californian eradication were \$US2.33 million from 2000-01 for control and monitoring (Carlton, 2001), with an ongoing annual surveillance cost of \$US1.2 million until 2004 (Anderson, 2004).

Application of coarse sea salt at a concentration of ~50kg/m<sup>2</sup> has been used with moderate success in Australia, eradicating *C. taxifolia* from an area almost 5200 m<sup>2</sup> in one case, although in another case an area of 3000 m<sup>2</sup> showed a reduction in algal density but eradication was not achieved. The use of this method in the cooler months, when *C. taxifolia* naturally dies back, was recommended. Salting has so far only been successfully used on soft sediments in water <6m in depth (Glasby et. Al, 2004).

**Physical:** Simply covering *C. Taxifolia* colonies with black PVC plastic was found to be reasonably successful in Croatia. A total area of 512 m<sup>2</sup> was treated, with either no or sporadic regrowth occurring after treatment (McEnnulty et. Al, 2001).

Manual removal by scuba divers was successful in eradicating a small patch of *C. Taxifolia*, around 3.4 m<sup>2</sup>, in the French Mediterranean. The use of a suction pump to remove all fragments has also met with moderate success in other areas. Clearance rates for manual removal are from <1 m<sup>2</sup> to ~3 m<sup>2</sup> per diver per hour (McEnnulty et.al, 2001).

## Pathway

Cuttings can be distributed over long distances by boat anchors or fishing nets. Used as an ornamental species in home and public aquaria. *Caulerpa taxifolia* has established in a number of locations as the result of improperly disposed waste from aquaria. Cuttings can be distributed over long distances by boat anchors or fishing nets.

**Principal source:** [National Introduced Marine Pest Information System \(NIMPIS\). 2002. CSIRO, Australia.](#)

**Compiler:** Dra. M<sup>a</sup> Antonia Ribera, Laboratory of Botany, Faculty of Pharmacy, University of Barcelona, Spain & IUCN/SSC Invasive Species Specialist Group (ISSG)

**Review:** Dra. M<sup>a</sup> Antonia Ribera, Laboratory of Botany, Faculty of Pharmacy, University of Barcelona, Spain.

**Pubblication date:** 2006-04-18

## ALIEN RANGE

[6] AUSTRALIA

[1] FRANCE

[5] ITALY

[1] MONACO

[1] SPAIN

[4] UNITED STATES

[3] CROATIA

[1] GERMANY

[1] MEDITERRANEAN & BLACK SEA

[1] NEW ZEALAND

[1] TUNISIA

## BIBLIOGRAPHY

47 references found for *Caulerpa taxifolia*

### Managment information

[Anderson, L.W. 2003. California's Reaction to \*Caulerpa taxifolia\*: A model for invasive species rapid response actions. In Abstracts: Third International Conference on Marine Bioinvasions, March 16-19, 2003. Scripps Institution of Oceanography La Jolla, California](#)

**Summary:** Rapid response report for *Caulerpa taxifolia* in California.

Available from: [http://massbay.mit.edu/publications/marinebioinvasions/mbi3\\_abstract\\_book.pdf](http://massbay.mit.edu/publications/marinebioinvasions/mbi3_abstract_book.pdf) [Accessed 23 January 2009]

Anderson, L. W. J. 2004. Eradication of *Caulerpa taxifolia* in the US five years after discovery: are we there yet? In 13th International Conference on Aquatic Invasive Species, September 20-24, 2004, Ennis, County Clare, Ireland.

**Summary:** An abstract about the eradication of *C. taxifolia* in Southern California.

[Anderson, L. W. J., and Keppner, S. 2001. \*Caulerpa taxifolia\*: Marine algal invader provokes quick response in U.S. waters. \*ANS Digest\* 4\(2\): 13: 21-23.](#)

**Summary:** Information on the eradication of *C. Taxifolia* in California.

Available from: [http://www.anstaskforce.gov/ANS%20Digest%204\\_2.pdf](http://www.anstaskforce.gov/ANS%20Digest%204_2.pdf)

Boudouresque, C. F., Meinesz, A. and Gravez, V. 1994. First International Workshop on *Caulerpa taxifolia*, Nice, France, 17-18 janvier 1994. GIS Posidonie, Marseille, France. 392pp.

**Summary:** This book includes a synthese of results of the CE- LIFE Program Spreading of the tropical seaweed *Caulerpa taxifolia* in the Mediterranean and the 46 lectures presented on the First International Workshop on *Caulerpa taxifolia*.

Boudouresque, C. F., Meinesz, A. and Gravez, V. 1998. Scientific papers and documents dealing with the alga *Caulerpa taxifolia* introduced to the Mediterranean, Ninth edition. GIS Posidonie publishers, Marseille, France: 1-60.

**Summary:** This publication contents the bibliographic references of 358 documents and scientific papers about *Caulerpa taxifolia* invasion in the Mediterranean Sea.

Carlton, J. T. 2001. Introduced species in U.S. coastal waters: environmental impacts and management priorities. Pew Oceans Commission, Arlington, Virginia.

**Summary:** An overview of many introduced marine species in the U.S.

Commonwealth of Australia. 2004. Environment, Communications, Information Technology and the Arts References Committee: report on the regulation, control and management of invasive species and the Environment Protection and Biodiversity Conservation Amendment (Invasive Species) Bill 2002.

**Summary:** A small amount of information on the cost of eradicating *C. taxifolia* from the West Lakes in Adelaide, South Australia.

Coquillard, P., Thibaut, T., Hill, D. R. C., Gueugnot, J., Mazel, C. and Coquillard, Y. 2000. Simulation of the mollusc *Ascoglossa Elysia subornata* population dynamics: application to the potential biocontrol of *Caulerpa taxifolia* growth in the Mediterranean Sea. *Ecological Modelling* 135: 1-16.

**Summary:** Growth, survival, reproduction.

[Cottalorda, J., Meinesz, A., Chiaverini, D. and Vaugelas, J. 2001. 1991/2001: 11 years of campaigns for public awareness of the \*Caulerpa taxifolia\* problem. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Using a public awareness campaign to help detect and halt the spread of *Caulerpa taxifolia* in Europe.

Available from: [http://massbay.mit.edu/publications/marinebioinvasions/mbi2\\_abstracts.pdf](http://massbay.mit.edu/publications/marinebioinvasions/mbi2_abstracts.pdf) [Accessed 23 January 2009]

[European and Mediterranean Plant Protection Organization \(EPPO\). 2006. Guidelines for the management of invasive alien plants or potentially invasive alien plants which are intended for import or have been intentionally imported. EPPO Bulletin 36 \(3\), 417-418.](#)

[Gacia, E., Rodríguez-Prieto, C., Delgado, O. and Ballesteros, E. 1996. Seasonal light and temperature responses of \*Caulerpa taxifolia\* from the northwestern Mediterranean. Aquatic Botany: 215-225.](#)

**Summary:** Seasonal light requirements and temperature tolerance of the Mediterranean *C. taxifolia* were examined by means of photosynthetic assays. These results indicate that this species is well adapted to light and temperature typical of the infralittoral and upper circalittoral zone in the Mediterranean. Its annual productivity pattern seems less affected by seasonal fluctuations than has been reported for endemic seaweeds; this response may explain its potentially high invasive capacity.

[Glasby, T., Creese, B., Gibson, P. 2004. The spread and attempted control of the invasive seaweed, \*Caulerpa taxifolia\*, in New South Wales, Australia. In 13th International Conference on Aquatic Invasive Species, September 20-24, 2004, Ennis, County Clare, Ireland.](#)

**Summary:** Information on the use of salting to control *C. taxifolia*.

[Glasby, T.M., Creese, R.G., and Gibson, P.T. Experimental use of salt to control the invasive marine alga \*Caulerpa taxifolia\* in New South Wales, Australia. Biological Conservation 122\(4\): 573-580, 2005.](#)

[McEnnulty, F.R., Jones, T.E. and Bax, N.J. \(2001\). The Web-Based Rapid Response Toolbox. Web publication: . Date of release: June 2001. Date of access: 19/10/2004](#)

**Summary:** Contains management information.

[Meinesz, A., Cottalorda, J.M., Chiaverini, D., Thibaut, T. and Vaugelas, J. 2001. Evaluating and disseminating information concerning the spread of \*Caulerpa taxifolia\* along the French Mediterranean coasts. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Methods in understanding the spread of *Caulerpa* along the French Mediterranean coast.

Available from: [http://massbay.mit.edu/publications/marinebioinvasions/mbi2\\_abstracts.pdf](http://massbay.mit.edu/publications/marinebioinvasions/mbi2_abstracts.pdf) [Accessed 23 January 2009]

[Meinesz A., Cottalorda J. M., Chiaverini D., Cassar N and De Vaugelas J. \(1998\) Suivi de l'invasion de l'algue tropicale de l'algue tropicale \*Caulerpa taxifolia\* en Méditerranée: situation au 31 décembre 1997. Lab. Environnement Marin Littoral, Université de Nice-Sophia Antipolis publications: 1-238.](#)

**Summary:** Report on the expansion of *Caulerpa taxifolia* in the Mediterranean coasts at end of 1997: 5 countries affected, 99 stations cited, 4630 ha concerned, 81 km of coast affected. The report included the cartography of the *C. taxifolia* populations in each station.

[Murphy, N.E. and Schaffelke, B. 2003. \*Caulerpa taxifolia\* in Australia: A growing problem. In Abstracts: Third International Conference on Marine Bioinvasions, March 16-19, 2003. Scripps Institution of Oceanography La Jolla, California](#)

**Summary:** Overview of identification techniques and a possible framework for the management of future incursions.

Available from: [http://massbay.mit.edu/publications/marinebioinvasions/mbi3\\_abstract\\_book.pdf](http://massbay.mit.edu/publications/marinebioinvasions/mbi3_abstract_book.pdf) [Accessed 23 January 2009]

[National Introduced Marine Pest Information System \(NIMPIS\) 2002. \*Caulerpa taxifolia\* species summary. National Introduced Marine Pest Information System \(Eds: Hewitt C.L., Martin R.B., Sliwa C., McEnnulty, F.R., Murphy, N.E., Jones T. & Cooper, S.\).](#)

**Summary:** Links are provided from the species summary page to more information on Common Names, Synonyms, Identification Notes, Similar Species, Morphology, Reproduction, Life Cycle, Habitat, Survival, Food, Competitors, Predators, Impact information, Vectors, Dispersal, Control options and additional information.

NIMPIS is available from: <http://www.marine.csiro.au/crimp/nimpis/>

This species summary is available from: <http://www.marine.csiro.au/crimp/nimpis/spsummary.asp?txa=9447> [Accessed 23 January 2009]

[National Pest Plant Accord, 2001. Biosecurity New Zealand.](#)

**Summary:** The National Pest Plant Accord is a cooperative agreement between regional councils and government departments with biosecurity responsibilities. Under the accord, regional councils will undertake surveillance to prevent the commercial sale and/or distribution of an agreed list of pest plants.

Available from: <http://www.biosecurity.govt.nz/pests-diseases/plants/accord.htm> [Accessed 11 August 2005]

[NIWA Science, National Centre for Aquatic Biodiversity & Biosecurity, 2002. Aquatic Biodiversity & Biosecurity Update Issue 1, Beware of the green invader](#)

**Summary:** Available from: <http://www.niwa.cri.nz/ncabb/abb/ma/pi/2002-01/green> [Accessed 23 January 2009]

[Ribera, M. A., Ballesteros, E., Boudouresque, C. F., Gómez, A. and Gravez, V. 1996. Second International Workshop on \*Caulerpa taxifolia\*. Barcelona, Spain, 15-17 December 1994. Publicacions Universitat de Barcelona: 1-457.](#)

**Summary:** This book includes a synthesis of results of the CE- LIFE Program Spreading of the tropical seaweed *Caulerpa taxifolia* in the Mediterranean and the 54 lectures presented on the Second International Workshop on *Caulerpa taxifolia*.

[Royal New Zealand Institute of Horticulture \(RNZIH\), 2005. \*Caulerpa taxifolia\*](#)

**Summary:** Available from: [http://www.rnzih.org.nz/pages/nppa\\_022.pdf](http://www.rnzih.org.nz/pages/nppa_022.pdf) [Accessed 1 October 2005]

[Thibaut, T. and Meinesz, A. 2001. Biological control of the invasive \*Caulerpa taxifolia\* in the Mediterranean Sea. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Possible biocontrol has been found for *Caulerpa*.

Available from: [http://massbay.mit.edu/publications/marinebioinvasions/mbi2\\_abstracts.pdf](http://massbay.mit.edu/publications/marinebioinvasions/mbi2_abstracts.pdf) [Accessed 23 January 2009]

[Thresher, R. E., Kuris, A. M. 2004. Options for managing invasive marine species. \*Biological Invasions\* 6: 295-300.](#)

**Summary:** A review of management techniques used for invasive marine species.

[UNEP. 2004. \*Caulerpa taxifolia\*, a growing menace for the temperate marine environment. United Nations Environment Programme.](#)

**Summary:** A good general-information resource on *C. taxifolia*.

Available from: [http://www.grid.unep.ch/product/publication/download/ew\\_caulerpa.pdf](http://www.grid.unep.ch/product/publication/download/ew_caulerpa.pdf)



Williams, Erin & Edwin Grosholz (Eds) 2002. International *Caulerpa taxifolia* Conference Proceedings January 31 - February 1, 2002 San Diego, California, U.S.A. Hosted by the University of California Cooperative Extension With Support From: California Department of Fish & Game California Sea Grant College Program U.S. Fish & Wildlife Service, Aquatic Nuisance Species Task Force Proceedings Assistance Provided by: California Sea Grant College Program

**Summary:** The proceedings include summary papers containing both previously published and unpublished work on a wide range of issues concerning the invasion of *Caulerpa* and issues concerning similar invasive species and their habitats. The Editors have attempted to put together all the information presented in a way that accurately reflects how this information was presented at the conference. They hope that this information will help guide future eradication efforts in both the U.S. and elsewhere.

Williams, S. K., Grosholz, E. D. 2002. Preliminary reports from the *Caulerpa taxifolia* invasion in southern California. *Marine Ecology Progress Series* 233: 307-310.

**Summary:** Reports on *in situ* observations of a *C. taxifolia* invasion in Huntington Harbour, California.

Williams, S.L. 2003. Chlorine treatment of *Caulerpa taxifolia*. In Abstracts: Third International Conference on Marine Bioinvasions, March 16-19, 2003. Scripps Institution of Oceanography La Jolla, California

**Summary:** Experiment into the effectiveness of using chlorine as a way of controlling *Caulerpa taxifolia*.

Available from: [http://massbay.mit.edu/publications/marinebioinvasions/mbi3\\_abstract\\_book.pdf](http://massbay.mit.edu/publications/marinebioinvasions/mbi3_abstract_book.pdf) [Accessed 23 January 2009]

Woodfield, R.A. 2003. Status of the *Caulerpa taxifolia* eradication effort in Southern California. In Abstracts: Third International Conference on Marine Bioinvasions, March 16-19, 2003. Scripps Institution of Oceanography La Jolla, California

**Summary:** Report into the progress of eradication of *Caulerpa taxifolia* in Southern California.

Available from: [http://massbay.mit.edu/publications/marinebioinvasions/mbi3\\_abstract\\_book.pdf](http://massbay.mit.edu/publications/marinebioinvasions/mbi3_abstract_book.pdf) [Accessed 23 January 2009]

## General information

[Bienvenue sur le portail Caulerpas](#)

**Summary:** Up-to-date information on the distribution of *C. taxifolia* in the Mediterranean and worldwide. Contains a dynamic distribution map of the Mediterranean and is available in both French and English.

Available from: <http://www.caulerpa.org>

Boudouresque, C. F., Meinesz, A., Ribera, M. A. and Ballesteros, E. 1995. Spread of the green alga *Caulerpa taxifolia* (Caulerpales, Chlorophyta) in the Mediterranean: possible consequences of a major ecological event. *Scientia Marina* 59 (supl.1): 21-29.

**Summary:** This is a syntheses of the knowledge on the ecology, biology, toxicity, impacts and management of the Mediterranean populations of *Caulerpa taxifolia*. And it concludes that if *Caulerpa taxifolia* continues to spread at present rates we will witness a major ecological event, with a strong decrease of eco-diversity, in the Mediterranean coastal waters.

CONABIO. 2008. Sistema de información sobre especies invasoras en México. Especies invasoras - Algas. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Fecha de acceso.

**Summary:** English:

The species list sheet for the Mexican information system on invasive species currently provides information related to Scientific names, family, group and common names, as well as habitat, status of invasion in Mexico, pathways of introduction and links to other specialised websites. Some of the higher risk species already have a direct link to the alert page. It is important to notice that these lists are constantly being updated, please refer to the main page (<http://www.conabio.gob.mx/invasoras/index.php/Portada>), under the section Novedades for information on updates.

Invasive species - Algae is available from: [http://www.conabio.gob.mx/invasoras/index.php/Especies\\_invasoras\\_-\\_Algas](http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Algas) [Accessed 30 July 2008]

Spanish:

La lista de especies del Sistema de información sobre especies invasoras de México cuenta actualmente con información acerca de nombre científico, familia, grupo y nombre común, así como como hábitat, estado de la invasión en México, rutas de introducción y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la página de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualización, por favor consulte la portada (<http://www.conabio.gob.mx/invasoras/index.php/Portada>), en la sección novedades, para conocer los cambios.

Especies invasoras - Algas is available from: [http://www.conabio.gob.mx/invasoras/index.php/Especies\\_invasoras\\_-\\_Algas](http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Algas) [Accessed 30 July 2008]

Guerriero, A., Meinesz, A., d Ambrosio, M. and Pietra, F. 1992. Isolation of toxic and potentially toxic sesqui- and monoterpenes from the tropical green seaweed *Caulerpa taxifolia* which has invaded the region of Cap Martin and Monaco. *Helvetica Chimica Acta*.

**Summary:** The *Caulerpa taxifolia* of Cap Martin (France) contains the known sesquiterpenic toxins caulerpenyne and oxytoxin. Novel potentially toxic products isolated in small amounts from this seaweed include the sesquiterpenes taxifolial A, taxifolial B, 10,11 epoxycaul.

Guiry, M.D. & Nic Dhonncha, E., 2005. *Caulerpa taxifolia* AlgaeBase version 3.0. World-wide electronic publication, National University of Ireland, Galway.

**Summary:** AlgaeBase is a database of information on algae that includes terrestrial, marine and freshwater organisms.

AlgaeBase is available from: <http://www.algaebase.org>; *Caulerpa taxifolia* information is available from: [http://www.algaebase.org/SpeciesDetail.lasso?species\\_id=1413&-session=abv3:82D8C9F50cb2503A64PhW2DCE6D3](http://www.algaebase.org/SpeciesDetail.lasso?species_id=1413&-session=abv3:82D8C9F50cb2503A64PhW2DCE6D3) [Accessed 20 May 2005].

ITIS (Integrated Taxonomic Information System), 2004. Online Database *Caulerpa taxifolia*

**Summary:** An online database that provides taxonomic information, common names, synonyms and geographical jurisdiction of a species. In addition links are provided to retrieve biological records and collection information from the Global Biodiversity Information Facility (GBIF) Data Portal and bioscience articles from BioOne journals.

Available from: [http://www.itis.gov/servlet/SingleRpt/SingleRpt?search\\_topic=TSN&search\\_value=6974](http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=6974) [Accessed December 31 2004]

Jaubert, J.M., Minghelli, A., Chisholm, J.R., Marchioretti, M., Morrow, J. and Ripley, H. 2003. Cartography and risk assessment of the development of the alga *Caulerpa taxifolia* in the Northwest Mediterranean. In Abstracts: Third International Conference on Marine Bioinvasions, March 16-19, 2003. Scripps Institution of Oceanography La Jolla, California

**Summary:** Report into the latest effects of the *Caulerpa taxifolia* invasion in Southern France. Available from:

<http://massbay.mit.edu/resources/pdf/MarinePDF/2003/MBI2003abs7.pdf>

Jousson, O., Pawlowski, J., Zaninetti, L., Meinesz, A. and Boudouresque, C. F. 1998. Molecular evidence for the aquarium origin of the green alga *Caulerpa taxifolia* introduced to the Mediterranean Sea. *Marine Ecology Progress Series* 172: 275-280.

**Summary:** The first molecular evidence that the tropical alga *C. taxifolia* escaped to the sea from a public or private aquarium is referred. These data show that this alga is genetically identical to the strain cultivated in western European aquaria since the early 1970 s.

Kaiser, J. 2000. California algae may be feared european species. *Science* 289: 222-223.

**Summary:** The first record of *C. taxifolia* in Californian coasts is reported.

Langar, H., Djellouli, A., Ben Mustapha, K. and El Abed, A. 2000. Première signalisation de *Caulerpa taxifolia* (Vahl) C. Agardh en Tunisie. *Bull. Inst. Sci. Tech. Mer* 27: 7-8.

**Summary:** The first record of *Caulerpa taxifolia* on the Tunisian coast is reported.

Lemée, R., Pesando, D., Issanchou, C. and Amade, P. 1997. Microalgae: a model to investigate the ecotoxicity of the green alga *Caulerpa taxifolia* from the Mediterranean Sea. *Marine Environmental Research* 44: 13-25.

**Summary:** The inhibition or delay of the proliferation of several phytoplanktonic strains by the action of organic extracts of *C. taxifolia* is reported. Seasonal variations of the toxicity were observed with a maximal effect in the summer.

Meinesz, A. and Hesse, B. 1991. Introduction et invasion de l'algue tropicale *Caulerpa taxifolia* en Méditerranée nord-occidentale. *Oceanologia Acta* 14(4): 415-426.

**Summary:** The first record of *Caulerpa taxifolia* in the Mediterranean coasts is reported and the authors point out that the development characteristics of this population are different from those in its native tropical areas.

Meinesz, A., Belsher, T., Thibaut, T., Antolic, B., Mustapha, K. B., Boudouresque, C-F., Chiaverini, D., Cinelli, F., Cottalorda, J-M., Djellouli, A., El Abed, A., Orestano, C., Grau, A. M., Ivesa, L., Jaklin, A., Langar, H., Massuti-Pascual, E., Peirano, A., Tunesi, L., de Vaugelas, J., Zavodnik, N., Zuljevic, A. 2001. The introduced green algae *Caulerpa taxifolia* continues to spread in the Mediterranean. *Biological Invasions* 3: 201-210.

**Summary:** A paper looking at the distribution and spread of *C. taxifolia* in the Mediterranean Sea.

Meinesz, A., Hesse, B. 1991. Introduction of the tropical alga *Caulerpa taxifolia* and its invasion of the northwestern Mediterranean. *Oceanologica Acta* 14(4): 415-426.

**Summary:** A review of the invasion of the Mediterranean by *C. taxifolia*.

[Nova. 2003. Deep Sea Invasion.](#)

**Summary:** Contains the chronology of the *C. taxifolia* invasion in the Mediterranean and around the world.

Available from: <http://www.pbs.org/wgbh/nova/algae/> [Accessed on 7 December, 2004].

Phillips, J. A., Price, I. R. 2002. How different is Mediterranean *Caulerpa taxifolia* (Caulerpales: Chlorophyta) to other populations of the species? *Marine Ecology Progress Series* 238: 61-71.

**Summary:** Information regarding the distribution of *C. taxifolia* within Australia.

Raffaelli, A., Pucci, S., Pietra, F. 1997. Ion spray tandem mass spectrometry for sensitive, rapid determination of minor toxic sesquiterpenoids in the presence of major analogues of the foreign green seaweed *Caulerpa taxifolia*, which is invading the Northwestern Mediterranean. *Analytical Communications* 34: 179-182.

**Summary:** A paper looking at differences between the chemical defences of the tropical and Mediterranean strains of *C. taxifolia*.

Schaffelke, B., Murphy, N., Uthicke, S. 2002. Using genetic techniques to investigate the sources of the invasive alga *Caulerpa taxifolia* in three new locations in Australia. *Marine Pollution Bulletin* 44: 204-210.

**Summary:** Has information on *C. taxifolia* distribution within Australia and the relationship between new occurrences and the invasive strain of this species.