

## *Ulva californica* Wille

### Relevant synonyms

*Ulva angusta* Setchell & N.L.Gardner

*Ulva scagelii* Chihara

- a. Ribbon-like specimens. b. Surface view.  
c. Transverse section.  
Bars: a = 5 cm; b-c = 20  $\mu$ m.

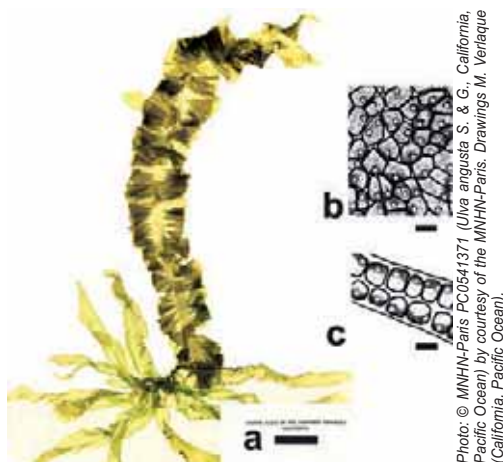


Photo: © MNHN-Paris FC0641371 (*Ulva angusta* S. & G., California, Pacific Ocean) by courtesy of the MNHN-Paris. Drawings M. Verlaque (California, Pacific Ocean).

### Short description

Small to large (1.5 cm to 1 m high); very variable in shape: cuneate, ovate-reniform to linear often twisted spirally; blades, to 7 cm wide and tapering gradually near the base, with margins undulated to crisply ruffled; thallus membranous and translucent, grass-green, distromatic throughout (usually not tubular); thickness: 35-55  $\mu$ m in central portion and 20-25  $\mu$ m near margin; cells in surface view arranged in irregular longitudinal and transverse arrangements, irregularly polygonal in shape with rounded corners, 3-14 x 5-33  $\mu$ m; chloroplasts with 1-2 pyrenoids covering the entire outer wall; cells mostly subquadrate in cross-section.

### Distinguishing characteristics

Small individuals are indistinguishable from native species without molecular studies. When large, the ribbon-like blades, distromatic in all its parts are distinctive; confusion possible with:

- *U. australis* Areschoug: basal portion of plants concentrically wrinkled and very thick (450-500  $\mu$ m), holes frequent;
- *U. lactuca* Linnaeus: digitate blades;
- the tubular *Ulva* spp. (formerly named *Enteromorpha* spp.) with complanate ribbon-like thallus, like *U. intestinalis* Linnaeus and *U. linza* Linnaeus: thallus hollow, at least near the base and margins (but tubular *U. californica* were reported from Ireland; Brodie *et al.*, 2007);
- *Umbraulva dangeardii* M.J.Wynne & G.Furnari and other blade-like species of *Ulva*: other combinations of characters.

## Biology / Ecology / Habitat

Shallow subtidal communities; annual (winter).

## Distribution

**Worldwide:** described from California (Wille, 1899); Pacific Ocean, widely distributed: north Pacific: Japan, Korea, Taiwan, North America (from Alaska to México); south Pacific: Argentina, New Zealand, Antarctica and sub-Antarctic Islands; north-eastern Atlantic (introduced): first observations in Scotland (Tan *et al.*, 1999, as *Ulva* sp.) and Ireland (Brodie *et al.*, 2007); records from Iran and Senegal require confirmation. **Mediterranean:** recorded first in 2011 from Italy, Venice (Wolf *et al.*, 2012). The identity and the Pacific origin of Mediterranean populations have been confirmed by morphological and molecular genetic studies (Wolf *et al.*, 2012).

## Mode of introduction

Accidental, probably transferred with shellfish imported for farming from the north Pacific.

## Establishment

Well established in the Venice Lagoon.

## Importance to humans

Potentially invasive; risk of green tides.



**1st Mediterranean record**  
Venice Lagoon, 2012  
[2011].

## Key references

- Brodie J., Maggs C.A. and John D.M., 2007. *Green seaweeds of Britain and Ireland*. pp. [i-v], vi-xii, 1-242, 101 figs. London: British Phycological Society.
- Tan I.H., Blomster J., Hansen G., Leskinen E., Maggs C.A., Mann A., Sluiman H.J. and Stanhope M.J., 1999. Molecular phylogenetic evidence for a reversible morphogenetic switch controlling the gross morphology of two common genera of green seaweeds, *Ulva* and *Enteromorpha*. *Molecular Biology and Evolution*, 16: 1011-1018.
- Wille, N., 1899. In: Collins F.S., Holden I. and Setchell W.A., 1899. *Phycotheca boreali-americana. A collection of dried specimens of the algae of North America*. Vol. Fasc. XII-XIII, Nos. 551-650. Malden, Massachusetts.
- Wolf M.A., Sciuto K., Andreoli C. and Moro I., 2012. *Ulva* (Chlorophyta, Ulvales) biodiversity in the North Adriatic Sea (Mediterranean, Italy): cryptic species and new introductions. *Journal of Phycology*, 48: 1510-1521.