



**Follow up of the spread of the green alga, *Caulerpa taxifolia*, in shallow water habitats of the French Riviera: preliminary analyses using airborne multi-spectral imagery and aerial photography**

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High resolution spectral images of shallow, marine habitats in the Bay of Menton, French Riviera, were obtained using a Compact Airborne Spectrographic Imager (CASI) mounted on a small helicopter. Images were collected in September-October, 1997, when perfect sky and sea conditions (no cloud, flat sea-surface, high water clarity) coincided with maximum seasonal development of *Caulerpa taxifolia*. Initial calibration demonstrated maximum information return when the instrument was set to record, principally, in the blue and blue-green regions of the electromagnetic spectrum (0.4 – 0.5  $\mu\text{m}$  wavelength). The images were corrected for radiometric distortion and aircraft roll and located in the horizontal plane to  $\pm 3$  m using differential GPS (UTM coordinates) and aerial photography (French National Geographic Institute, IGN). Superimposition of the geo-referenced images on bathymetric charts of the study area, prepared using sonar (1 m resolution), demonstrated that populations of *Caulerpa taxifolia* and the seagrass, *Posidonia oceanica*, could be differentiated and mapped to a depth of 15-20 m on the basis of their spectral signatures.

The data obtained by CASI contrast sharply with existing claims about both the cover of *C. taxifolia* in the Bay of Menton and the alga's capacity to invade beds of *P. oceanica*. The cover of *C. taxifolia* in the study area is considered to be higher than in most other parts of the French Riviera. CASI data indicate an average cover of only 2.5%. Dense populations of the alga are confined to 2 distinct localities. The first population exists in shallow-water along the more heavily developed eastern seaboard of Cap Martin; it extends from close to the shore to the upper limits of an ill-defined *P. oceanica* bed. While the two populations are mixed at their interface, none of the patches of *P. oceanica* that were recorded on photographs taken by the IGN in 1988 has been overgrown by *C. taxifolia*. The second population occupies an area 800 m long by 200 m wide in front of 2 storm-water drains that evacuate waste from the city of Menton and surrounding hills. Although, *P. oceanica* occurred here in the early part of this century it had disappeared before the emergence of *C. taxifolia*. In this locality, *C. taxifolia* shares the muddy-sand substratum with the phanerogam, *Cymodocea nodosa*.

The most interesting aspect of the data is that this mixed community of *C. taxifolia* and *C. nodosa* is now showing evidence of *de novo* colonisation by *P. Oceanica*. If this continues, it might be argued that *C. taxifolia* fulfils a similar early successional role to *Caulerpa prolifera* in the development of seagrass beds.