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On the occurrence of a population of *Cystoseira zosteroides* Turner and Cystoseira funkii Schiffner *ex* Gerloff et Nizamuddin (Cystoseiraceae, Fucophyceae) in Port-Cros National Park (Northwestern Mediterranean, France)

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Abstract : During a prospecting mission in Port-Cros National Park (France) in spring 2000, a deep water community dominated by *Cystoseira zosteroides* and *Cystoseira funkii* was found thriving over an isolated rocky formation, the "Rochers de la Passe de Bagaud". Not only is this finding the first citation of *Cystoseiretum zosteroidis* in the waters of Port-Cros, it is also the first record of *Cystoseira funkii* on the French continental coast.

Résumé : Au cours d'une mission de prospection dans les eaux du Parc National de Port-Cros (France) au printemps 2000 une communauté dominée par les espèces *Cystoseira zosteroides* et *Cystoseira funkii* a été trouvée dans les eaux profondes du site dit les Rochers de la Passe de Bagaud. Cette découverte répresente la première citation du *Cystoseiretum zosteroidis* dans les eaux de Port-Cros, et la première récolte de *Cystoseira funkii* sur les côtes continentales françaises.

Resum : Durant una campanya de prospecció al Parc National de Port-Cros (França) la primavera del 2000 es va trobar en una roca aïllada dels "Rochers de la passe de Bagaud", una comunitat algal dominada per les espècies *Cystoseira zosteroides* i *Cystoseira funkii*. Aquesta troballa representa la primera cita de l'associació *Cystoseiretum zosteroidis* a Port-Cros, i la primera cita de *Cystoseira funkii* a la costa continental francesa.

INTRODUCTION

Species of the genus *Cystoseira* are widespread in the Mediterranean Sea, which can be considered a focus of speciation for this genus (ROBERTS, 1978), with 29 recognised species on the check-list of Mediterranean seaweeds (RIBERA *et al.*, 1992). Identification at species level is usually difficult since most of the species have a highly variable, seasonal-dependent morphology, and a high degree of variability between populations (e.g. SAUVAGEAU, 1912; ERCEGOVIC, 1952; GÓMEZ *et al.*, 1982; MOTTA, 1989; SERIO,

1996a, 1996b; PIZZUTO, 1997a, 1997b; ALONGI *et al.*, 1998). Although most of the species of *Cystoseira* are highly photophylic and therefore inhabit shallow waters, some species also thrive only in relatively deep waters (GIACCONE & BRUNI, 1972). The geographic distribution of some of these deep-water species is relatively unknown because of difficulties in sampling and the restricted habitats they usually colonise.

Moreover, most of the species of the genus *Cystoseira* and the communities they constitute are highly threatened (BOUDOURESQUE *et al.*, 1990) and their abundance and distribution has been greatly reduced in the last fifty years because of pollution (HOFFMANN *et al.*, 1988; MUNDA, 1993; CORMACI & FURNARI, 1999), and cascading effects caused by overfishing (VERLAQUE, 1987; ARRIGHI, 1995). Therefore the discovery of a deep-water community dominated by two *Cystoseira* species within the Port-Cros National Park is noteworthy, and here we aim to make a preliminary description of these populations.

MATERIAL AND METHODS

During spring 2000, deep and isolated rocky bottoms were prospected in Port-Cros National Park by scuba diving. This study was within the framework a project TOTAL, which aimed to study and monitor gorgonian populations. One of the prospected rocky formations was the "Rochers de la Passe de Bagaud", situated between the islands of Port-Cros and Bagaud (Fig. 1). One of these formations occupies a surface of around 500 m² between 29 and 40 meters of depth. A platform of around 90 m² is covered by a population of seaweed of the genus *Cystoseira*, at depths ranging between 31 and 35.5 meters (Fig. 2).

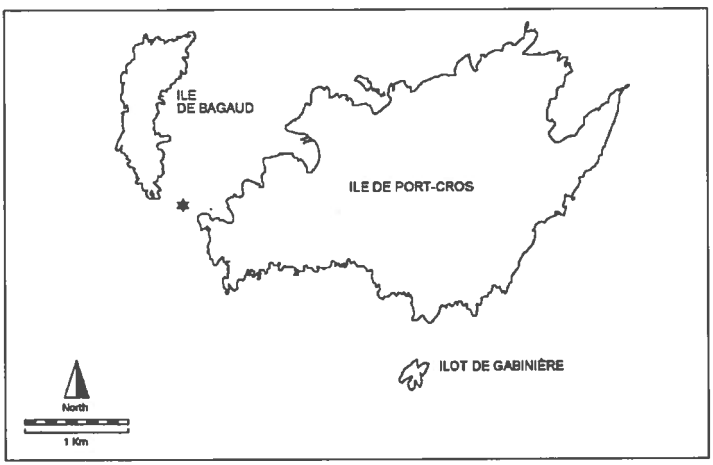

Fig. 1 - Location of the study site.

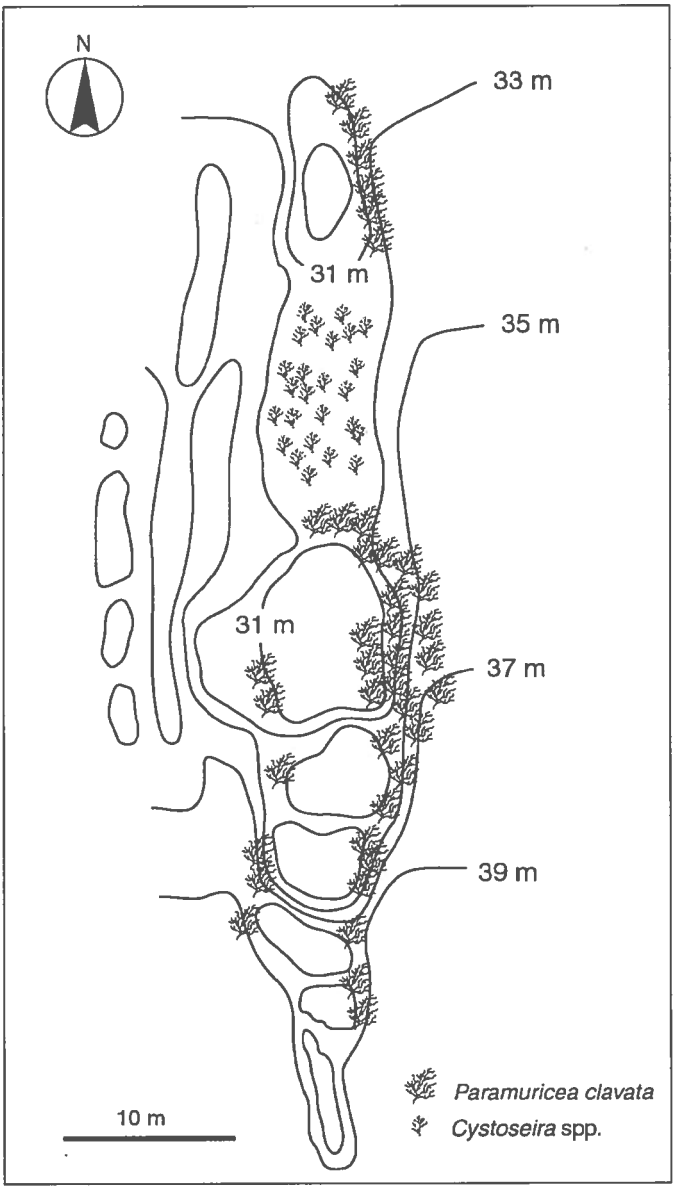

Fig. 2 - Schematic representation of Cystoseira's rock and location of the populations of *Cystoseira zosteroides* and *Cystoseira funkii*.

Plants of the genus *Cystoseira* were identified at species level and their density estimated *in situ* by means of 20 randomly located 50 cm x 50 cm quadrats, covering a total of 5 m^2. Some specimens were collected to confirm the identifications *in situ* and were preserved in formaline: seawater as vouchers (E. Ballesteros Herbarium).

RESULTS AND DISCUSSION

All the *Cystoseira* specimens identified belonged to the species *Cystoseira zosteroides* (Turner) C. Agardh (Fig. 3) and *Cystoseira funkii* Schiffner *ex* Gerloff et Nizamuddin (Fig. 4). The former is well known, and is widely distributed along the Eastern and Western Mediterranean (e.g. RIBERA *et al.*, 1992) and has previously been reported in the region of Port-Cros by GAUTIER & PICARD (1957), PÉRÈS & PICARD (1963) and COPPEJANS (1977). In contrast, *C. funkii* is a commonly misidentified species whose taxonomic position has recently been validated by VERLAQUE *et al.* (1999), who also report its distinctive features. Although some *C. funkii* specimens may have already been collected (and misidentified) from the French Mediterranean areas, except Corsica, and may be deposited in some herbaria, our specimens from Port-Cros are the first properly identified records of this species from the continental Mediterranean coasts of France, Port-Cros marking the northern-most point of distribution for this species (see distribution map in VERLAQUE *et al.*, 1999).

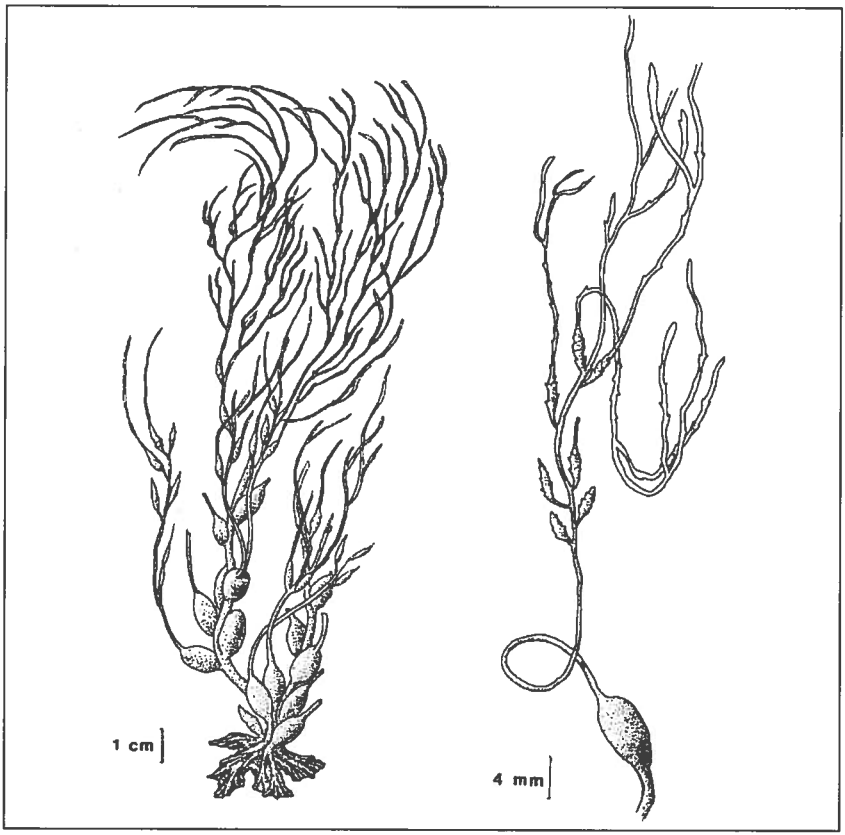

Fig. 3 - Habit and detail of branches bearing receptacles in a specimen of *Cystoseira zosteroides* from Cystoseira's rock (Herbarium E. Ballesteros).

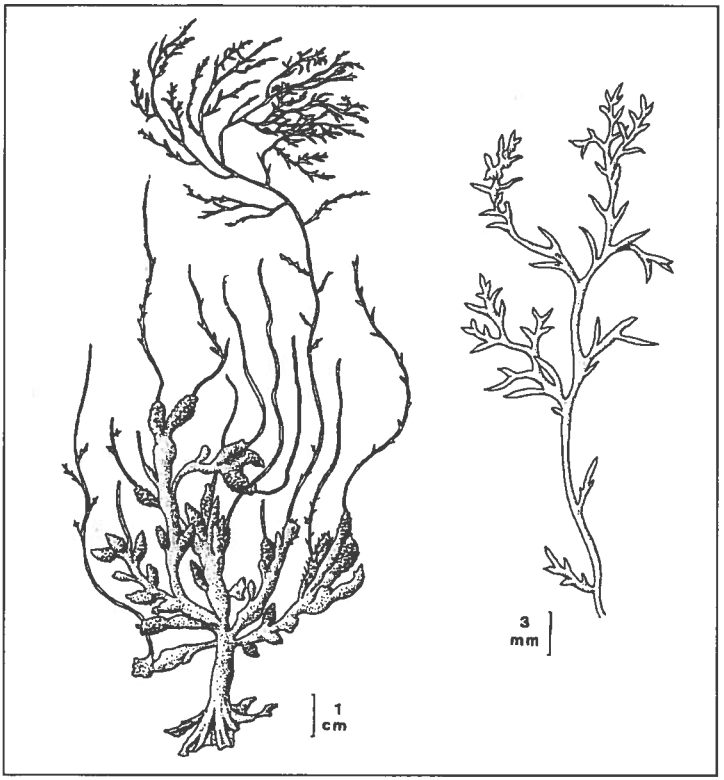

Fig. 4 - Habit and detail of branches bearing receptacles in a specimen of *Cystoseira funkii* from the Cystoseira's rock (Herbarium E. Ballesteros).

The total density of *Cystoseira* plants was 20.4 individuals/m², *C. zosteroides* being the most abundant with an average density of 11.8 plants/m² and *C. funkii* accounting for 8.6 plants/m². These densities are much higher than those recorded in Scandola (Corsica, France, 40 to 45 meters depth), where densities of *Cystoseira* plants in the *Cystoseiretum zosteroidis* range from 6.4 to 9.9 plants/m², with densities of 4.7 to 6.2 plants/m² for *C. zosteroides*, 1.5 to 3.2 for *C. spinosa*, and 0.2 to 0.4 plants/m² for *C. funkii* (BALLESTEROS *et al.*, 1999).

Although no complete inventories of seaweeds or sessile fauna have been made, the community of *C. zosteroides* and *C. funkii* in Port-Cros corresponds to the *Cystoseiretum zosteroidis* association described by GIACCONE (1973) and more thoroughly studied by BALLESTEROS (1990) and BALLESTEROS *et al.* (1999). The habitat of the community in Port-Cros also corresponds to the habitat described for *Cystoseiretum zosteroidis* which characteristically develops in deep waters, with low irradiances, and high unidirectional hydrodynamism (GIACCONE, 1973; BALLESTEROS, 1990).

Deep water *Cystoseira* communities, such as those found in Port-Cros, are included in the "Livre rouge des végetaux, peuplements et paysages marins ménacés de Méditerranée" because they are threatened by anthropogenic activities (BOUDOURESQUE *et al.*, 1990). The presence of at least one well established population of *C. zosteroides* and *C. funkii* in deep waters in Port-Cros highlights the need to perform a more exhaustive study on this type of community in Port-Cros and in surrounding areas. Its naturalistic interest and conservation implications requires a major research effort, particularly in the Port-Cros National Park, a marine reserve created for the study and conservation of the marine environment.

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