

# Mediterranean lagoon habitat within Hyères salt marshes (Provence, France): an Ecosystem-based approach for management

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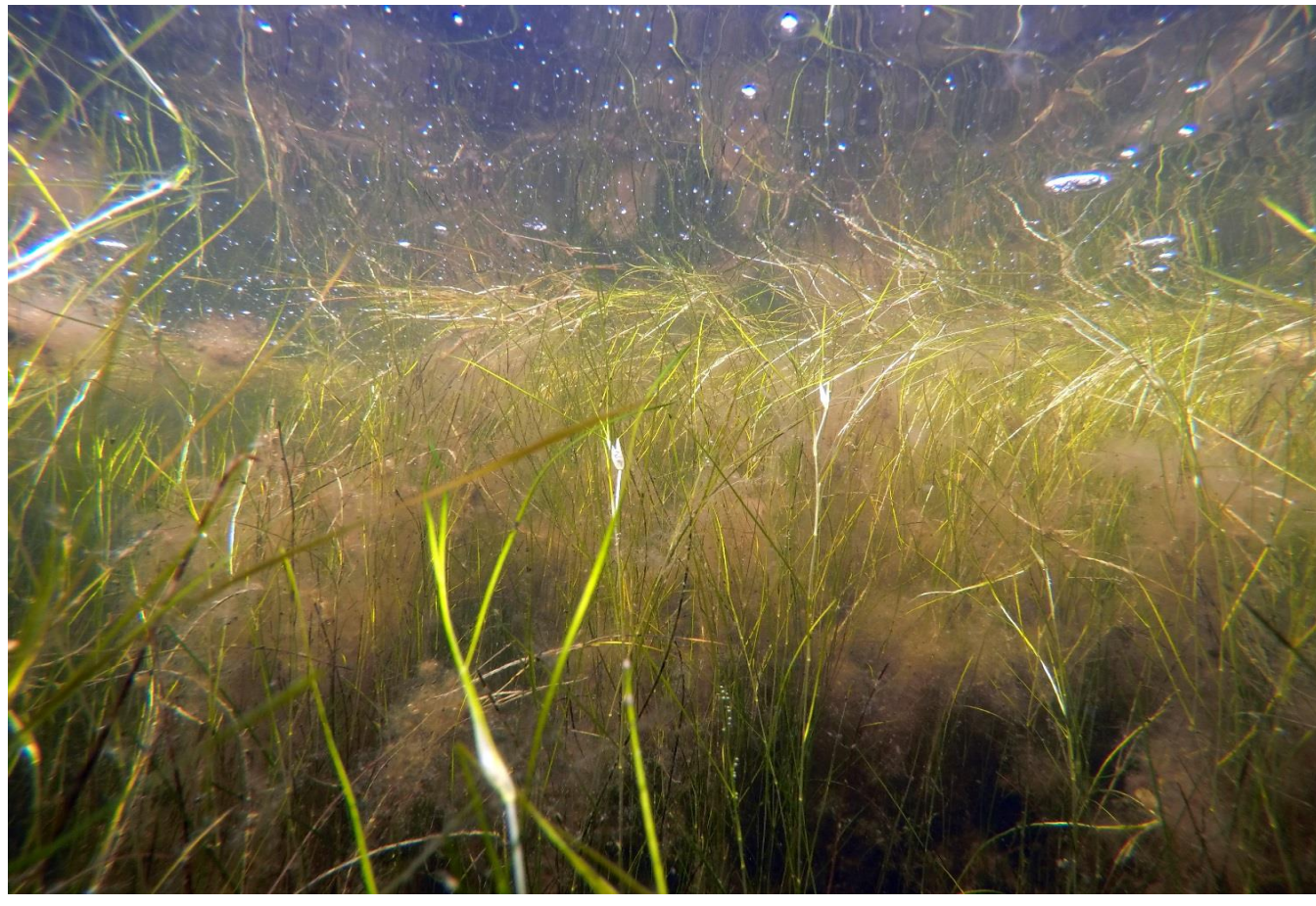


Fig 1. *Ruppia spiralis* meadow of Hyeres salt marshes

## Abstract

Hyères salt marshes (Provence, France) are a Mediterranean lagoon deeply altered since antiquity; it is an example of socio-ecosystem characterized by industrial activities since 1848 for salt production and artisanal fishing (Pesquiers salt marsh). After the end of industrial exploitation in 1995, Hyères salt marshes became property of Coastal Society in 2001 and managed by Toulon Provence Méditerranée metropolitan area. Since then, access to the sites is restricted in order to preserve the historical heritage of the site and biodiversity of avifauna. This study is the first step of an ecosystem-based approach, *R. spiralis*, as primary producer, that belongs to one of the functional compartments of this ecosystem. Understanding the functioning of Hyères salt marshes lagoon ecosystem will improve its management in a concerted way according to the current priorities defined by the Marine Strategy Framework Directive.

## 1. Introduction

In Hyères salt marshes, the magnoliophyte *Ruppia spiralis* (Fig 1) plays an important functional role as essential habitat for juvenile fishes (Lenfant *et al.*, 2015). The hydraulic management plan, based on the ancient salt production network, does not favor the fish population. Juvenile fishes can settle in lagoons but their return to the sea is not assured, conducing to huge mortality at the end of summer and fall.

## 3. Results

Mapping of *R. spiralis* meadow:

- ✓ 50 ha on 550 ha on Pesquiers salt marsh (Fig 3a)
- ✓ 14 ha on 330 ha on Old salt marshes (Fig 3b)
- ✓ The distribution is heterogeneous on both sites

Biometric analysis of *R. spiralis* meadow:

- ✓ Dry biomass analyse: 66-558 gDW.m<sup>-2</sup>
- ✓ Flower density: 1434 ± 611 Fl.m<sup>-2</sup>
- ✓ Fruit density: 1520 ± 1096 Fr. m<sup>-2</sup>
- ✓ Comparable to well preserved Mediterranean lagoons (Table 1)

Table 1. Dry weight (gDW.m<sup>-2</sup>) of *Ruppia spiralis* in other Mediterranean lagoons

Lagoons	Biomass of <i>R. spiralis</i>	References
Camargue (France)	60-189	Verhoeven (1980)
Bahía del Fangar (Spain)	150-330	Calado et Duarte (2000)
Lake Ichkeul (Tunisia)	4-369	Casagrande and Boudouresque (2007); Shili (2008)
Smarlacca valley (Italy)	52-411	Azzoni <i>et al.</i> , (2001)
<b>Hyeres salt marshes (France, Provence)</b>	<b>66-558</b>	<b>Present work</b>
Tancada, Ebre delta (Spain)	61-656	Menéndez (2002)
Fra Ramon (Empordà, Spain)	95-802	Gesti <i>et al.</i> ,(2005)

## 2. Materials and methods

Hyeres salt marshes corresponds to Pesquiers salt marsh (550 ha) and Old salt marshes (330 ha) (Fig. 2).

Mapping of *R. spiralis* meadow: prospection on every pond was made and represented by six covering classes.

Biometric analysis of *R. spiralis* meadow was measured on Pesquiers salt marsh (n=12) and Old salt marshes (n=21).

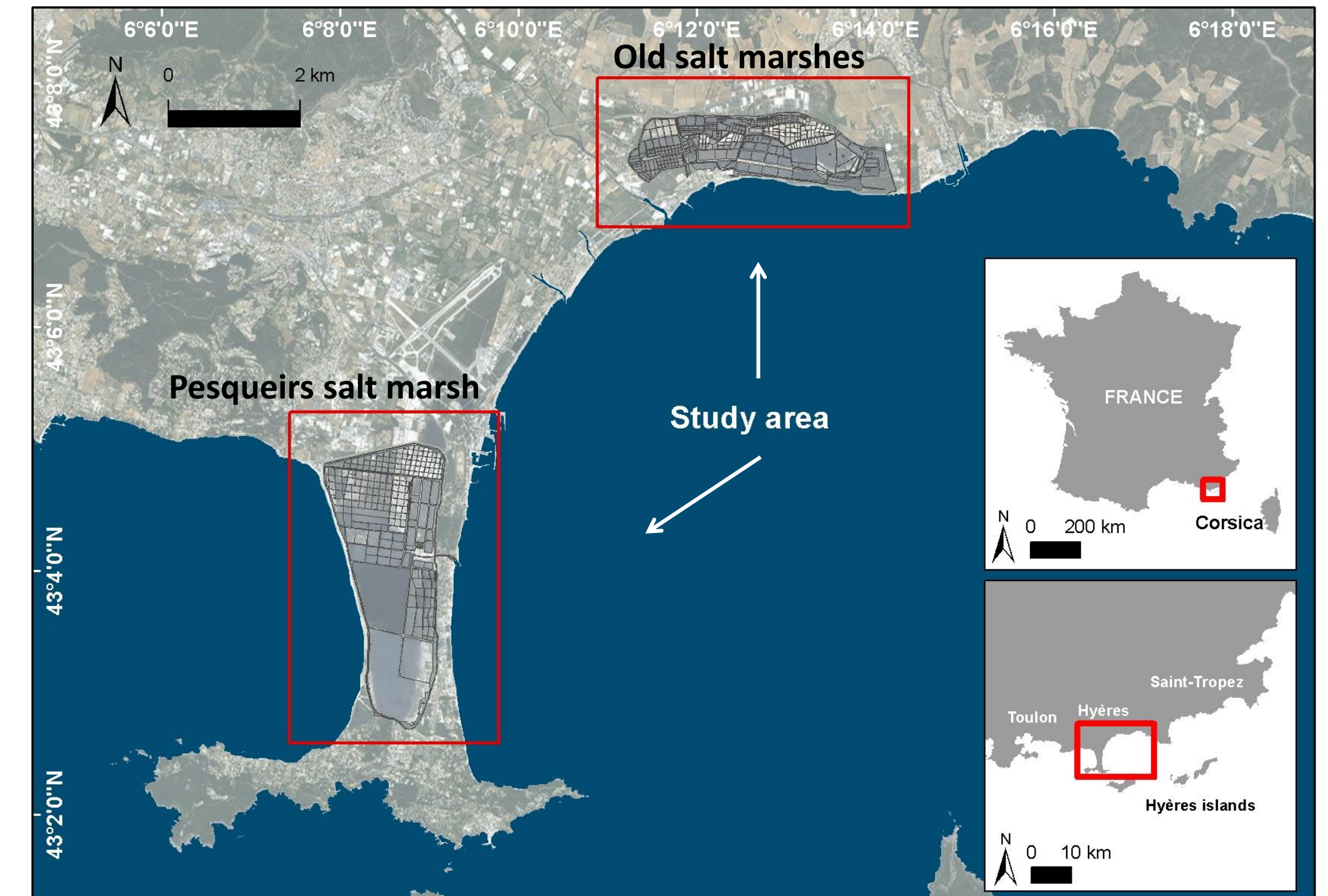


Fig 2. Hyères salt marshes study area

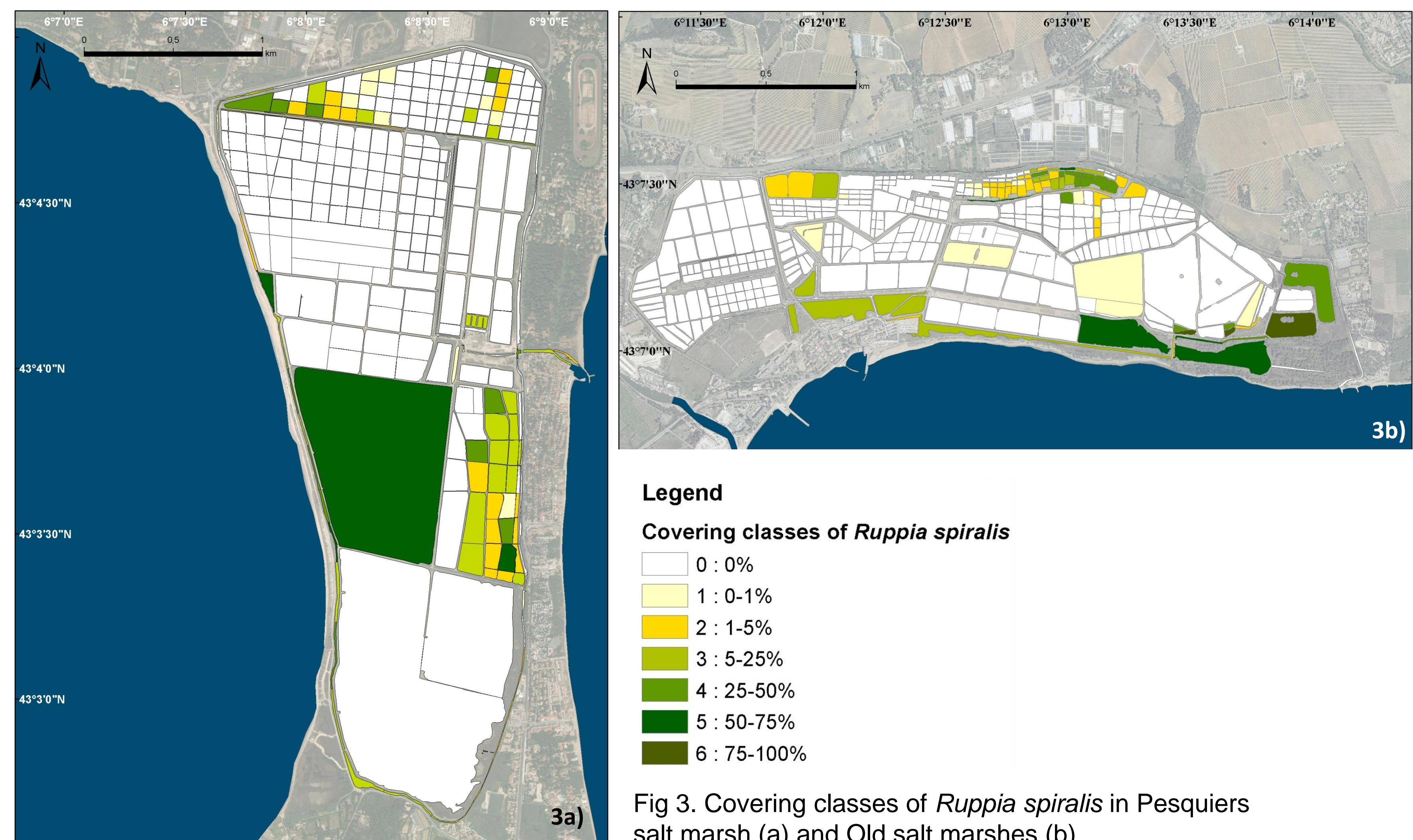


Fig 3. Covering classes of *Ruppia spiralis* in Pesquiers salt marsh (a) and Old salt marshes (b)

## 4. Conclusion

These first data on plant compartment (stem, foliar and root systems) are the first step to develop an Ecosystem-Based Approach for Hyères salt marshes (Fig. 4). This approach will allow the improvement of the management of the sites considering the entire ecosystem.

### References

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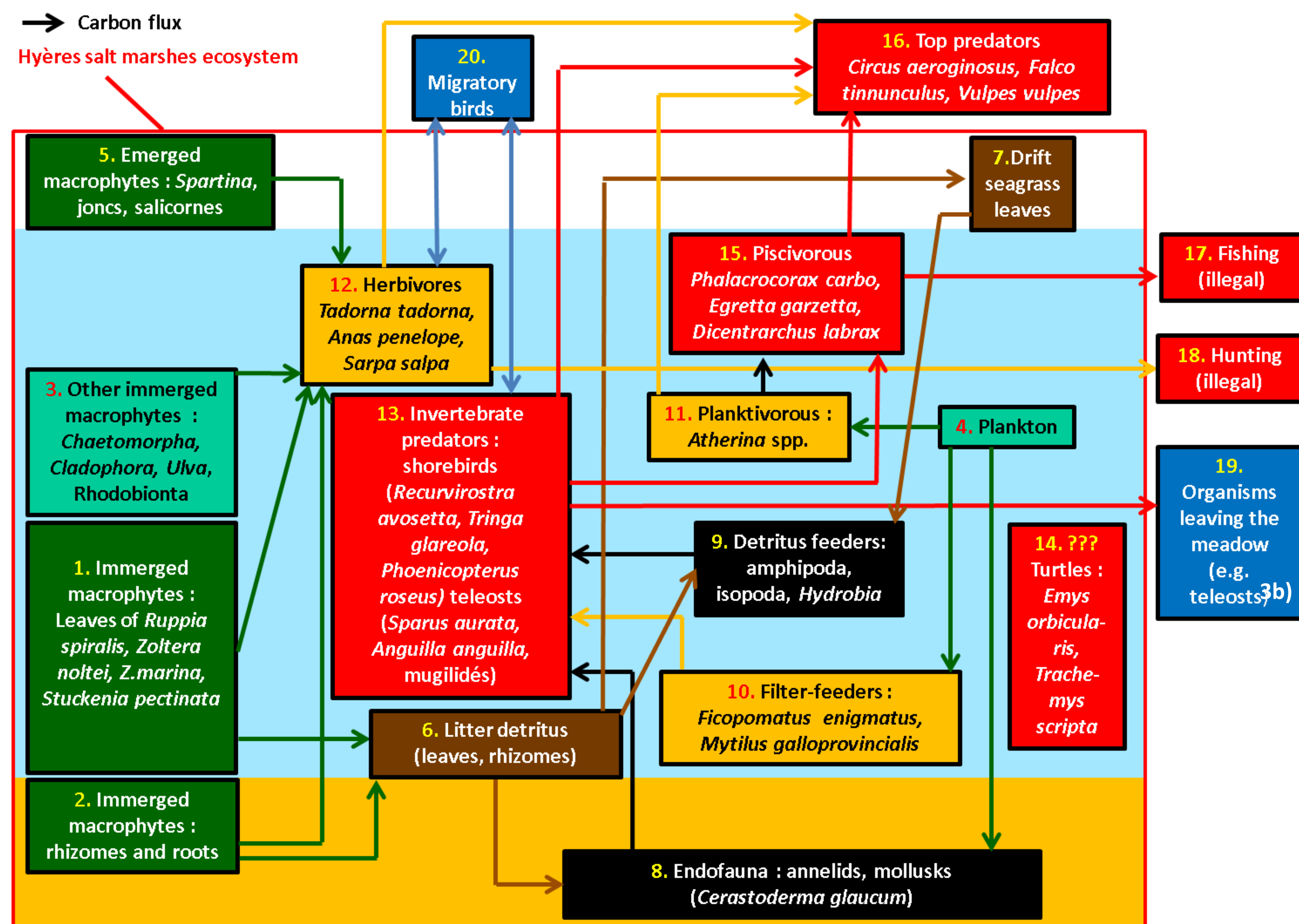


Fig 4. A preliminary Ecosystem-based approach of Hyères salt marshes inspired by *Posidonia oceanica* seagrass meadow ecosystem-based approach (Personnic *et al.*, 2014)



Financial support

