MANTIS: MARINE PROTECTED AREAS NETWORK TOWARDS SUSTAINABLE FISHERIES IN THE CENTRAL MEDITERRANEAN

Fiorentino F., Colloca F., Perez M., Prato G., Russo T., Sabatella R., Scarcella G., Solidoro C., Vrgoč N., Zerafa B.
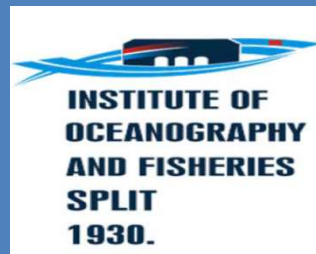
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The Mantis Partnership

MANTIS is a three year project funded by the DG MARE of the European Commission. The main objectives of the project are:

i) to review and integrate the knowledge of previous national and EU project on the space-time dynamics of fisheries resources and on Ecosystem Approach to Fishery Management (EAFM) in the Central Mediterranean and

ii) to investigate how a network of Marine Managed Areas (MMAs) can contribute to improve sustainable fisheries and to reach MSY target of CFP in the Central Mediterranean.

Two case studies and **Four target species** for each case study were considered:

- **The Strait of Sicily (*Parapenaeus longirostris, Merluccius merluccius, Mullus barbatus, Aristaeomorpha foliacea*)**

- **The North and Central Adriatic (*Solea solea, Merluccius merluccius, Mullus barbatus, Nephrops norvegicus*).**
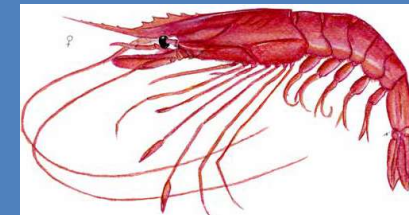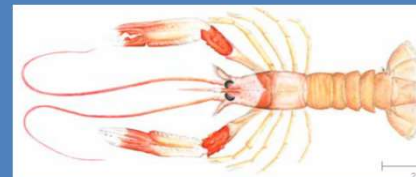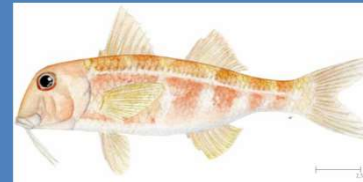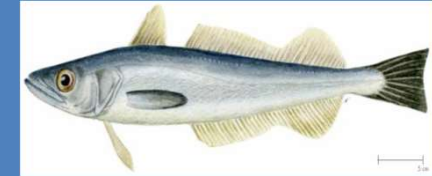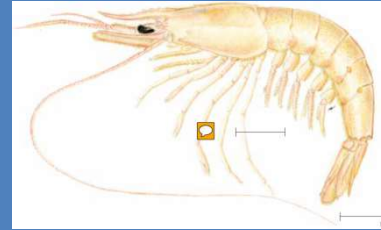
The MANTIS' activities are organized into 5 Work Packages (WP).
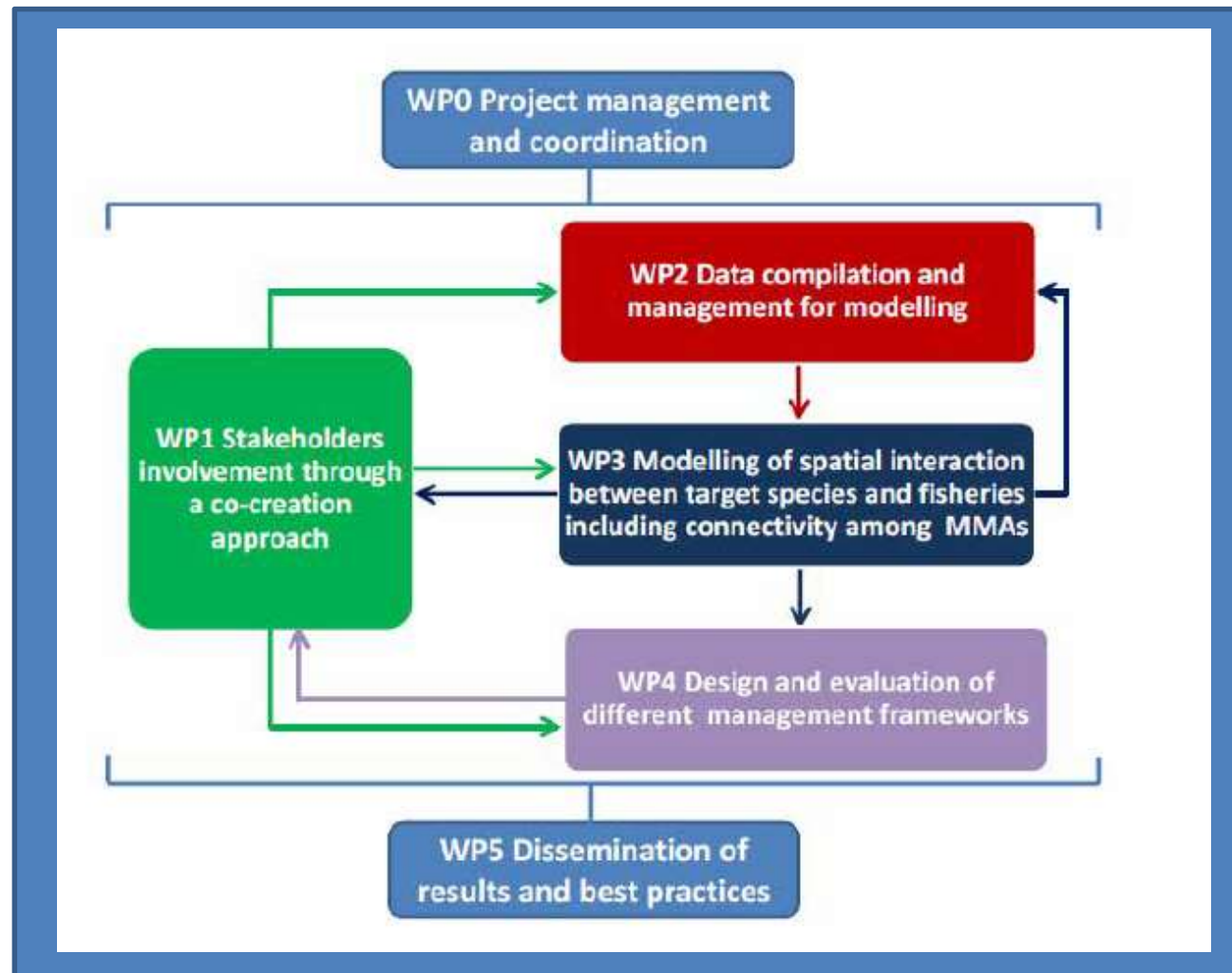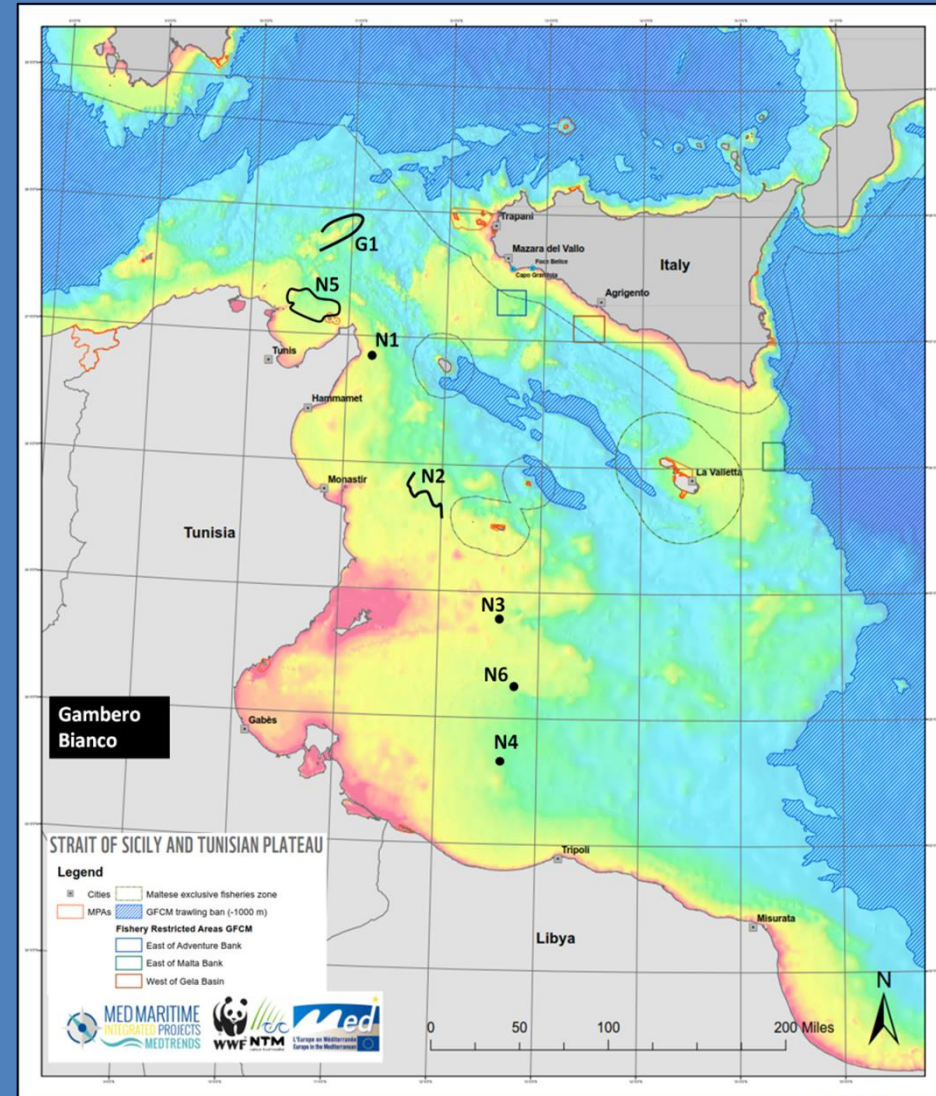
WP1 aims **to involve stakeholders in a participatory approach** to identify possible **technical/governance scenarios** for improving state of target stocks and fisheries in terms of MSY and EAFM objectives.

Partecipatory Mapping of EFHs in the Strait of Sicily

WP2 aims **to provide a database** including both all the relevant **georeferenced data** and information for modelling as well as outputs produced by MANTIS analyses.

In particular:

- **MPAs** and any other areas in which relevant fishing activities are restricted,
- persistent **nursery and spawning grounds**,
- seasonal distribution of the **fleets and effort** derived also from VMS and AIS,
- **oceanographic models** depicting the circulation patterns for larval drifting,
- **other human activities** interacting with fisheries.

WP3 aims **to model the dynamics of target stocks** in terms of abundance and yield, including connectivity between spawning and nursery areas.

The two approaches applied are:

- **The SMART platform** (Russo et al., 2014), representing an innovative approach;
- **The ISIS- Fish platform** (Mahevas and Pelletier, 2004), an accredited model in this field.
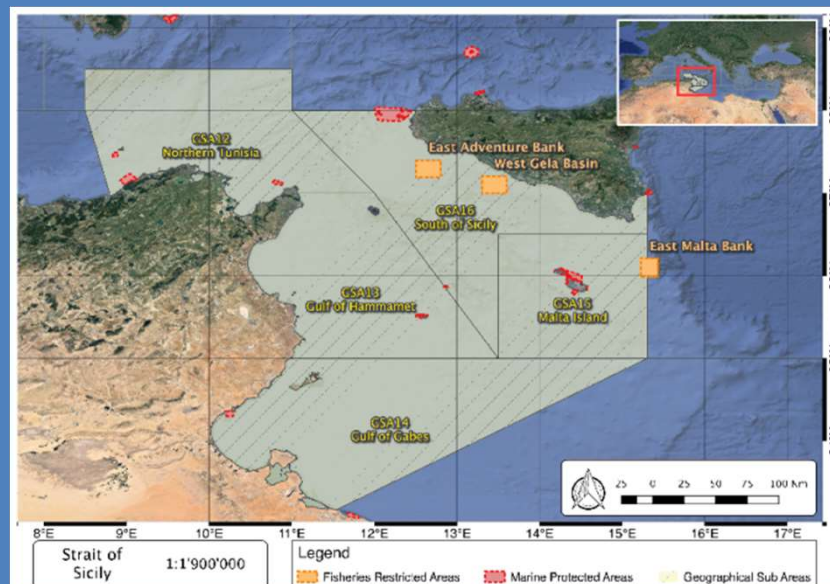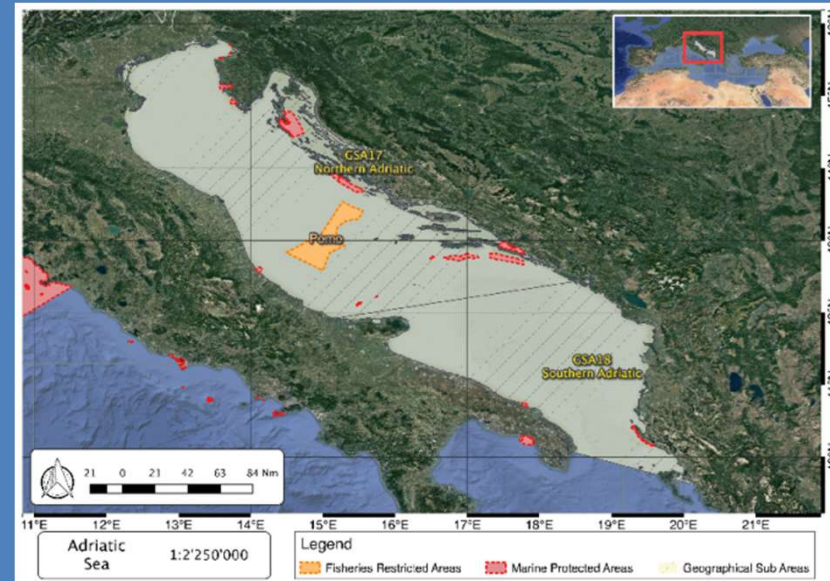
The general simulation approach of the MANTIS project

Set up of the simulation
Selection of areas for ban
Estimation of model parameters for each species, including spatial LPUE

Simulation (1st year)
Estimation of the optimized fishing effort pattern
Estimation of related cacthes and landings

Assessment
Modelling of effect at the scale of the whole population
Estimation of biomasses/cohort after 1 year of fishing ban

Spreading
Tuning of spatial LPUE accoring to the connectivy

Simulation (2nd year)

Assessment

A main aspect: the source-sink dynamics

- Adriatic-Ionian system

- Spatial resolution 1/64° (~1 nm)

- Simulation (2006-2012)

- Time step 200 s

- Forced by Operational **ALADIN** (ARSO - SLO, 4.4 km Alto Adriatico)

Model domain
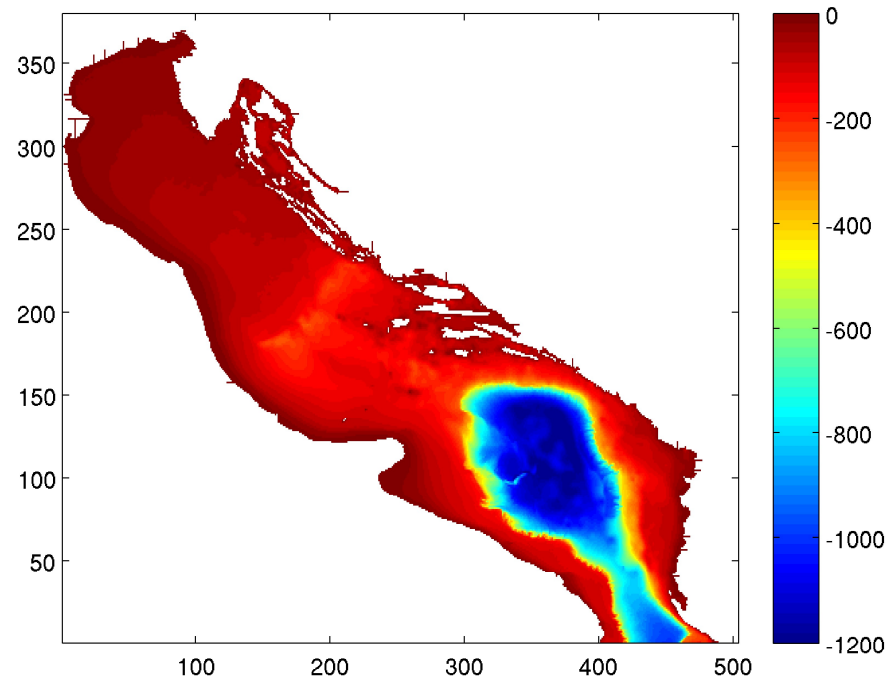
Modeling the dispersion of the Norway Lobster (*Nephrops norvegicus*) larvae in the Adriatic Sea

Célia **Laurent**, Donata **Melaku Canu**,
Elisabetta B. **Morello**, Stefano **Querin**,
Cosimo **Solidoro**.

Photography Credits: E.B. Morello

Nephrops norvegicus:
- An Important commercial resource
- Characterized by a particular life cycle :
  - Larvae are transported by currents for 1 to 3 weeks
  - Adults are sedentary
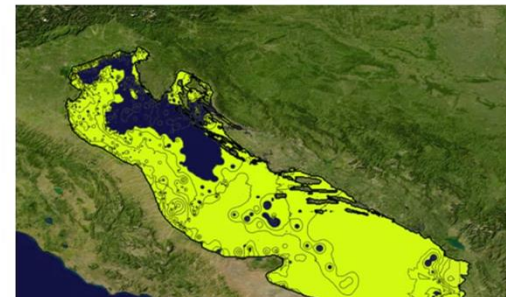 - Adults inhabit burrows in muddy sediments

The larval dispersal process is the base of some crucial factors for a sustainable fishing management of the Nephrops :

- Eventual connectivity among the various spawning areas?
- Existence of sub-populations?
- Existence of other potential
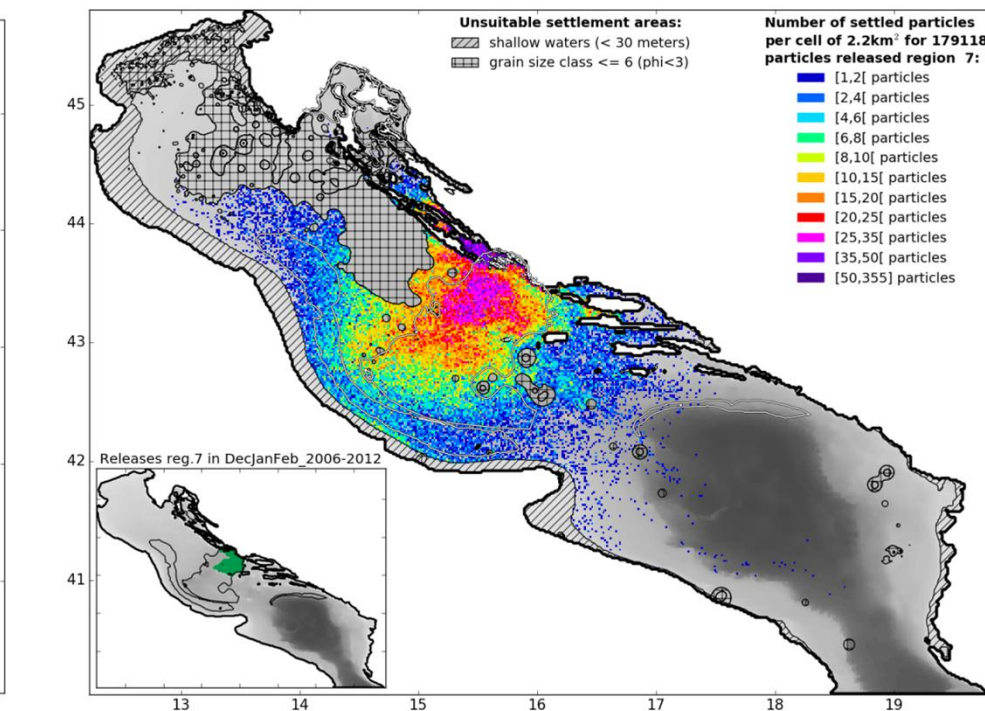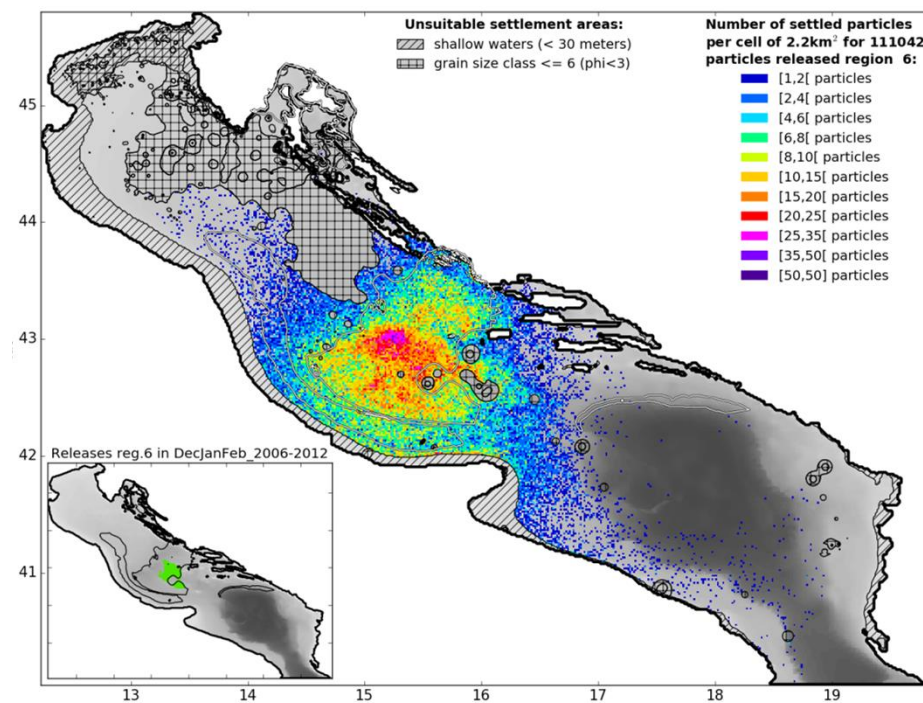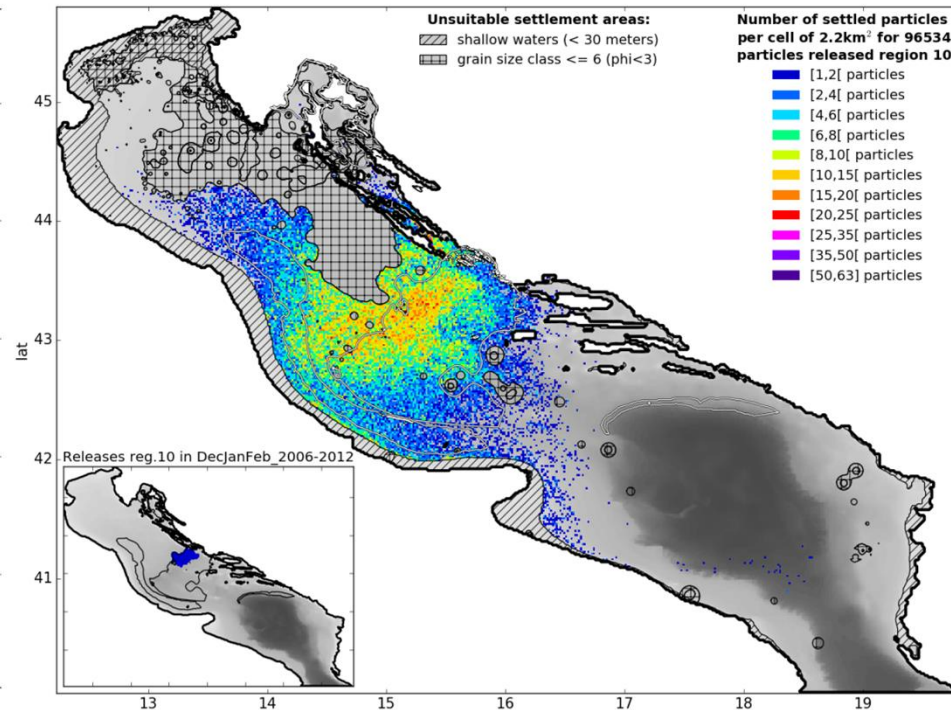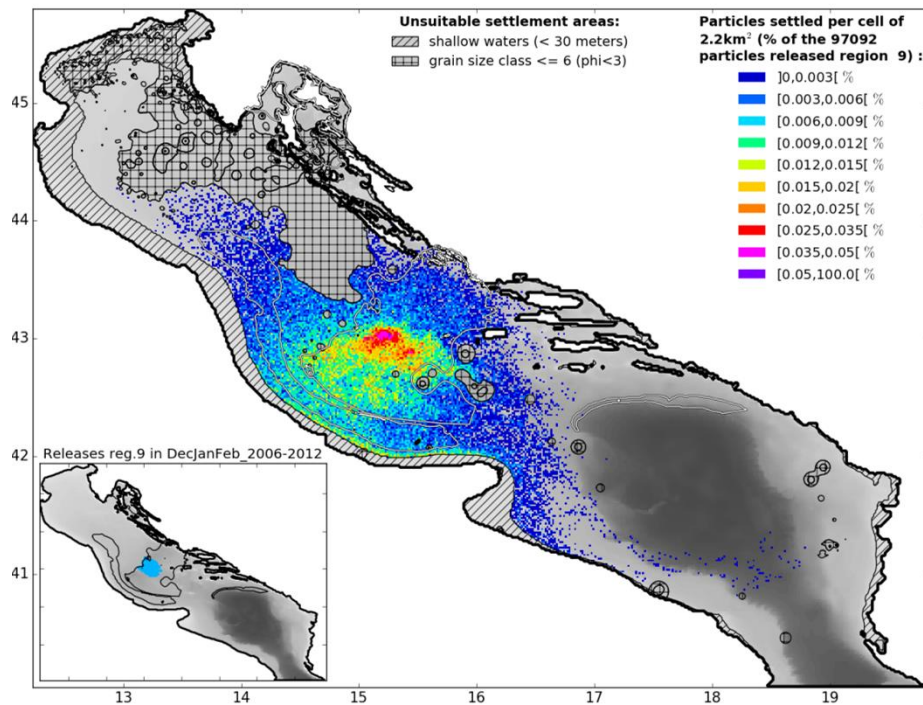
Nephrops spawning areas in the Adriatic
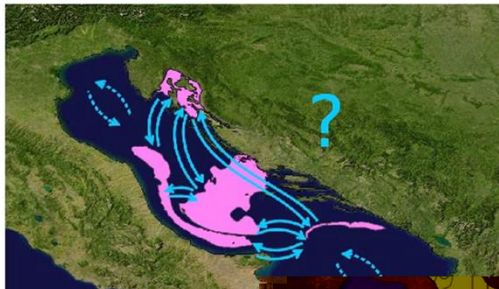
Optimal grain size

Larvae mortality rate for every spawning area?

Where are the potential settlement area?

Top-left panel legends:

Unsuitable settlement areas:
- shallow waters (< 30 meters)
- grain size class <= 6 (phi<3)

Particles settled per cell of 2.2km² (% of the 97092 particles released region 9):
-]0,0.003[%
- [0.003,0.006[%
- [0.006,0.009[%
- [0.009,0.012[%
- [0.012,0.015[%
- [0.015,0.02[%
- [0.02,0.025[%
- [0.025,0.035[%
- [0.035,0.05[%
- [0.05,100.0[%

Releases reg.9 in DecJanFeb_2006-2012

Top-right panel legends:

Unsuitable settlement areas:
- shallow waters (< 30 meters)
- grain size class <= 6 (phi<3)

Number of settled particles per cell of 2.2km² for 96534 particles released region 10:
- [1,2[particles
- [2,4[particles
- [4,6[particles
- [6,8[particles
- [8,10[particles
- [10,15[particles
- [15,20[particles
- [20,25[particles
- [25,35[particles
- [35,50[particles
- [50,63] particles

Releases reg.10 in DecJanFeb_2006-2012

Bottom-left panel legends:

Unsuitable settlement areas:
- shallow waters (< 30 meters)
- grain size class <= 6 (phi<3)

Number of settled particles per cell of 2.2km² for 111042 particles released region 6:
- [1,2[particles
- [2,4[particles
- [4,6[particles
- [6,8[particles
- [8,10[particles
- [10,15[particles
- [15,20[particles
- [20,25[particles
- [25,35[particles
- [35,50[particles
- [50,50] particles

Releases reg.6 in DecJanFeb_2006-2012

Bottom-right panel legends:

Unsuitable settlement areas:
- shallow waters (< 30 meters)
- grain size class <= 6 (phi<3)

Number of settled particles per cell of 2.2km² for 179118 particles released region 7:
- [1,2[particles
- [2,4[particles
- [4,6[particles
- [6,8[particles
- [8,10[particles
- [10,15[particles
- [15,20[particles
- [20,25[particles
- [25,35[particles
- [35,50[particles
- [50,355] particles

Releases reg.7 in DecJanFeb_2006-2012

Network analysis graphs to show the source-sink dynamics

Dots (nodes) represent each sinking area (1-10), and its relative dimension represents the percentage of sinking particles in each area, relative to the total sank.
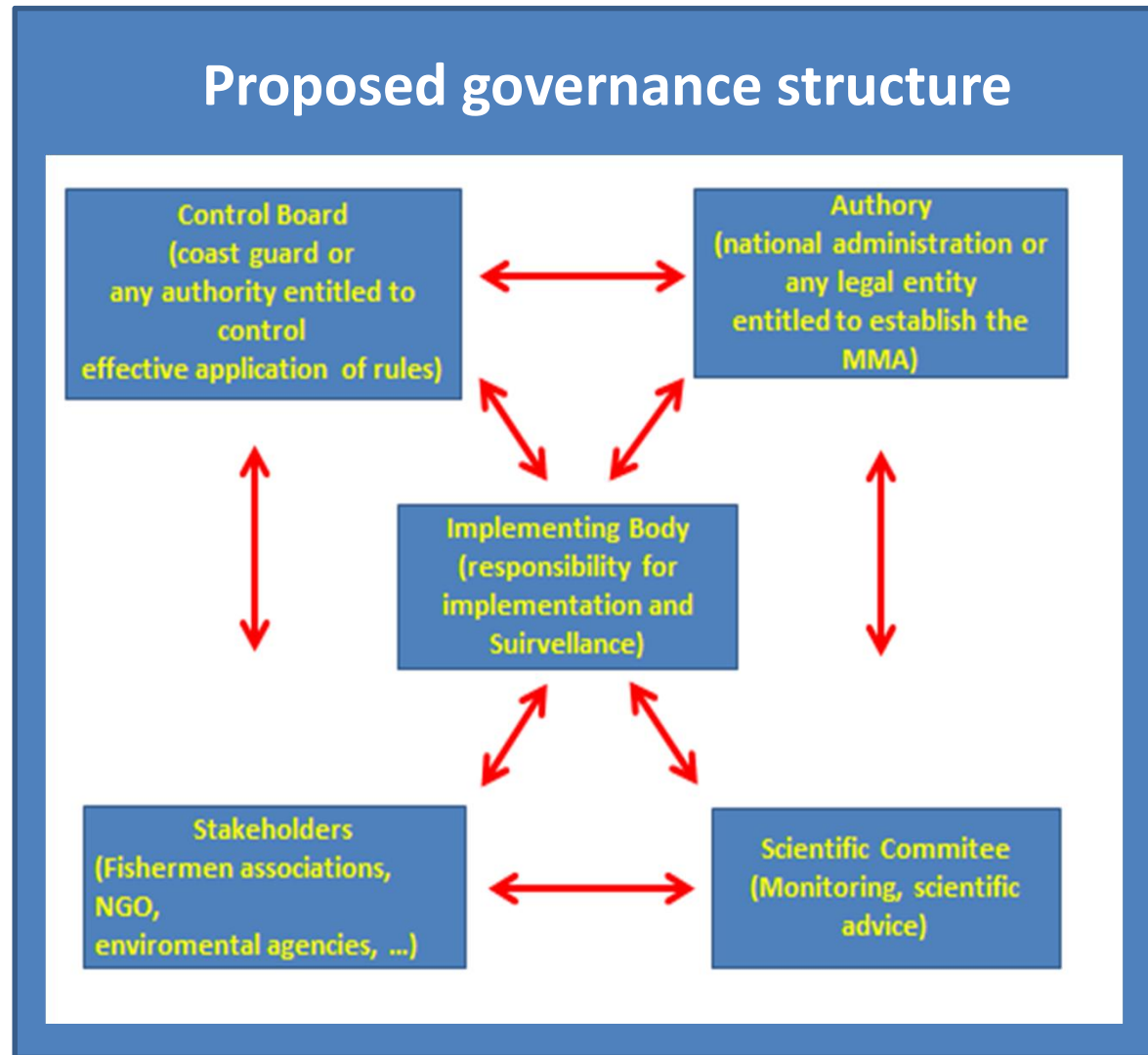
Lines represent the fluxes of particles between two nodes, and the line colour refers to the colour of the donor node, the thickness is related to the magnitude of the flux.
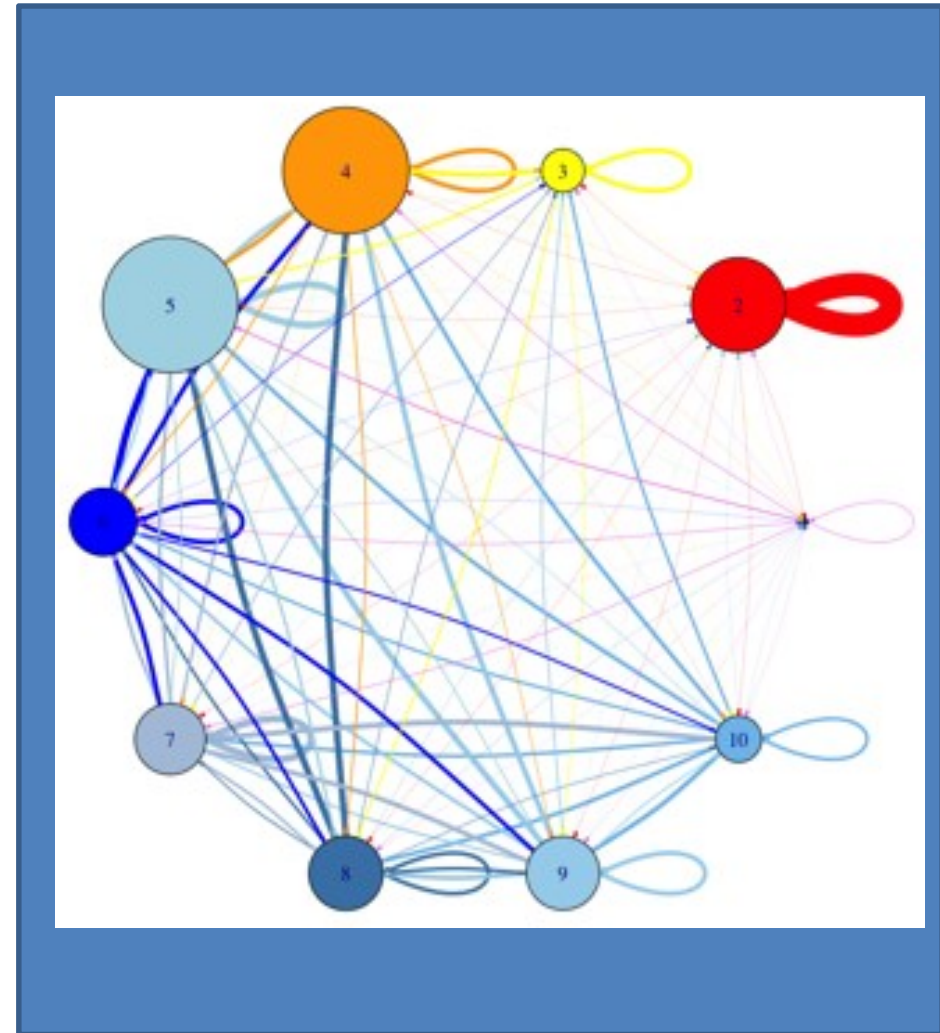
The migration pattern of the adult component of the stock is derived by the variation of the spatial distribution of age classes obtained by SMART analyses on FD and FI sources of data.
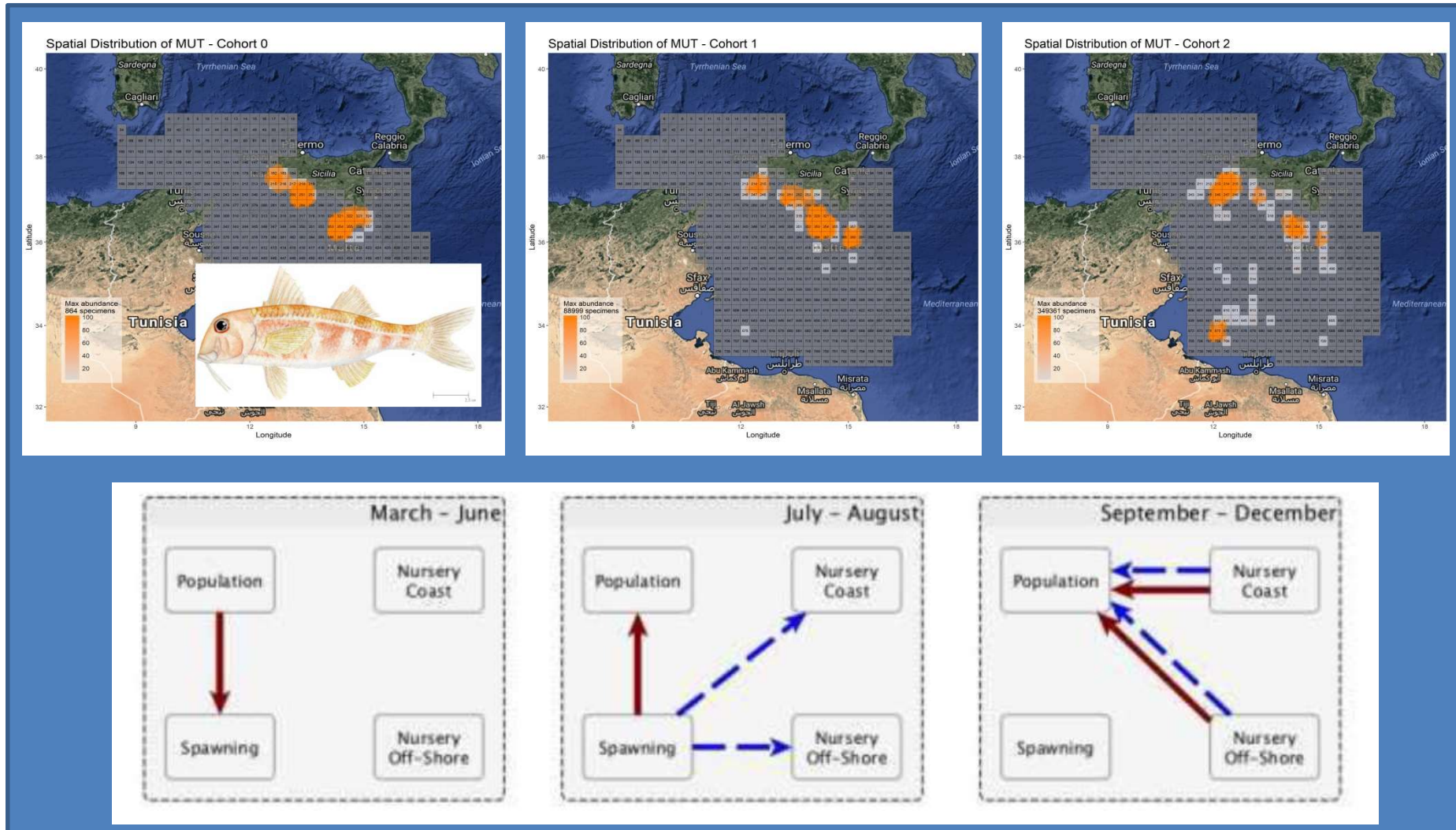
WP4 aims **to design and assess a management framework** including the establishment, maintenance, monitoring and governance **of the MMA network**, also considering the involvement of the stakeholders (Fishers, NGOs, Public Administrations).

Proposed governance structure

Control Board
(coast guard or
any authority entitled to
control
effective application of rules)

Authory
(national administration or
any legal entity
entitled to establish the
MMA)

Implementing Body
(responsibility for
implementation and
Suirvellance)

Stakeholders
(Fishermen associations,
NGO,
enviromental agencies, ...)

Scientific Commitee
(Monitoring, scientific
advice)

Finally **WP5** aims **to disseminate results** obtained and **best practices** experienced during the MANTIS activities **through a web site, meetings and dissemination materials.**

Many thanks for the attention

You can find more information on
http://jadran.izor.hr/mantis/