BaltCoast

Case Studies

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A Systems Approach Framework
for Coastal Research and Management
in the Baltic

BONUS

Case 1: A beach in the Curonian Lagoon

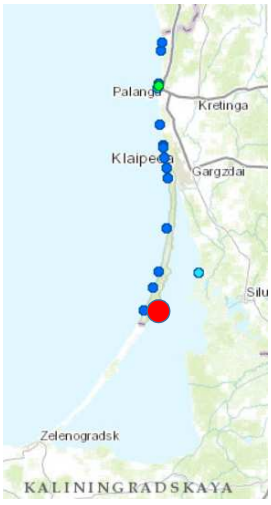
Current situation in Curonian lagoon

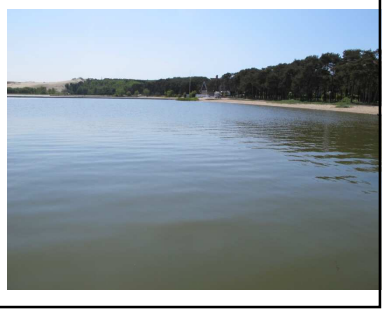
Beach in Kintai

In the past, especially in Baltic inner coastal waters, several beaches had to be closed because of insufficient bathing water quality. Today, increasing tourism causes a strong demand to reopen these beaches again and to establish additional beaches, especially in large lagoons, like the Curonian lagoon and on the Lithuanian coast.

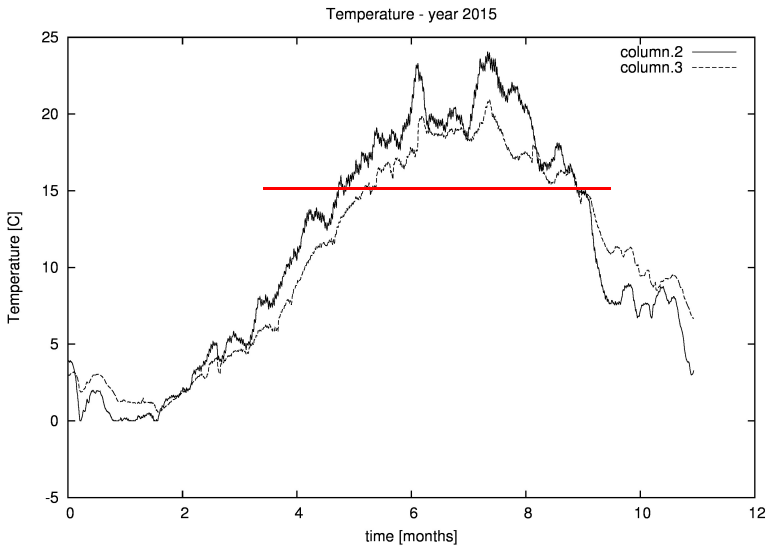
The proposed beach

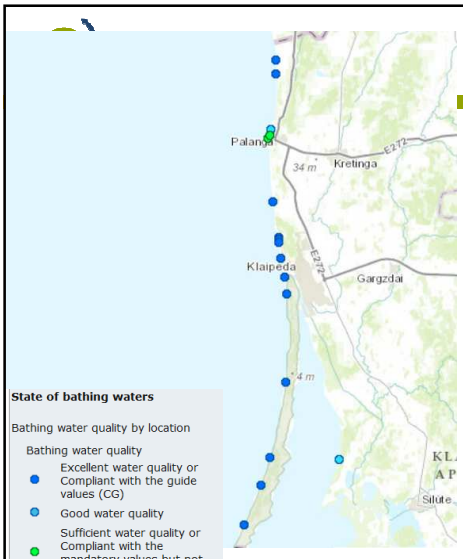
Neringa municipality wants to establish the beach on lagoon side





Nida beach and lagoon temperature





Aktualiu / **Lietuva**

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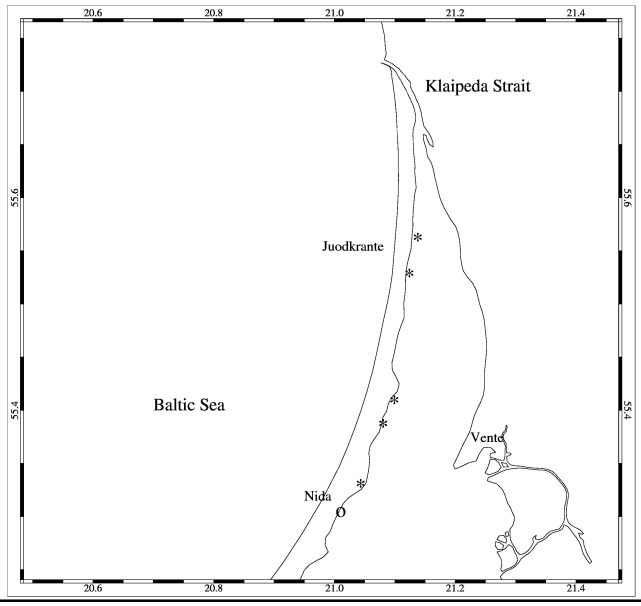
Kuršių marių ties Kintais maudyklos vanduo neatitiko higienos normų

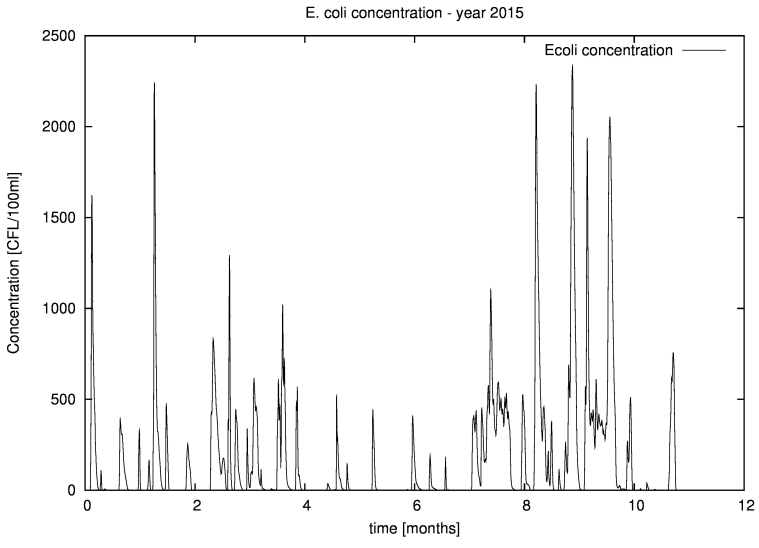
Sveikatos mokymo ir ligų prevencijos centras, įvertinęs gautus rugpjūčio mėnesio antros pusės maudyklų vandens kokybės tyrimų rezultatus, informuoja, kad Kuršių marių ties Kintais maudykloje vandens kokybė neatitiko Lietuvos higienos normos reikalavimų, todėl maudytis joje nėra saugu.

In august 2013 the amount of fecal coliform (*E. coli*) exceed 1.9 times the allowed threshold

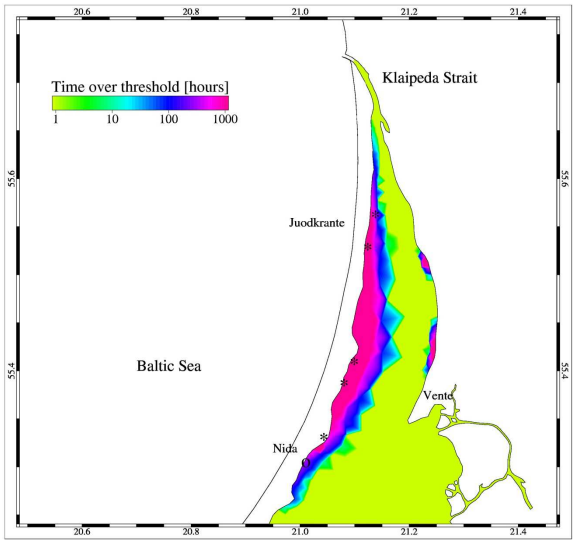
Modeling: sewage input



Scenario: concentration at Nida



Scenario: hours over threshold



Main points to consider

- What are the economic implications creating a beach inside the lagoon?
- Will this attract more people?
- Will sewage systems have to be upgraded?
- What will be the maintenance costs for the beach?

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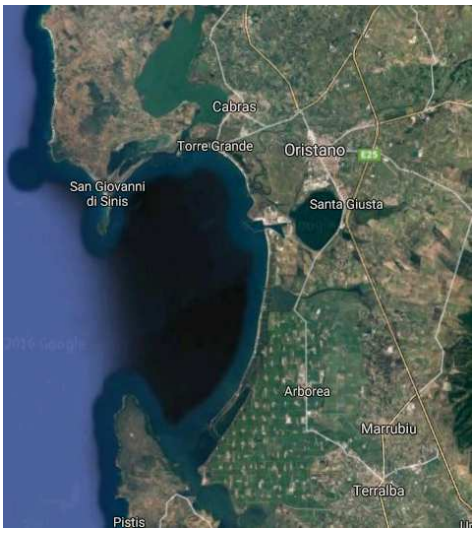
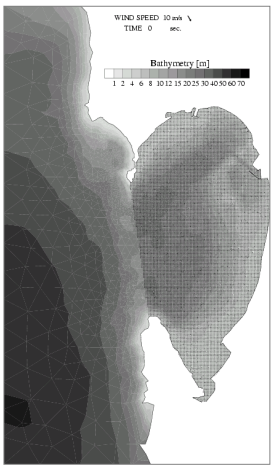
Case 2: A new sewage outlet

- The Gulf of Oristano is a small bay in the west of Sardinia
- The exchange with the ocean is mainly due to wind action, since there are very little tides
- Sewage outlets must be planned carefully because the exchange capabilities with the open sea are limited

The Gulf of Oristano





The Gulf of Oristano

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Sardinia has beautiful beaches

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The industrial port of Oristano

- A new sewage outfall is planned close to the industrial port.
- It is necessary to assess the impact of the sewage outfall on the surrounding areas.

The industrial port of Oristano

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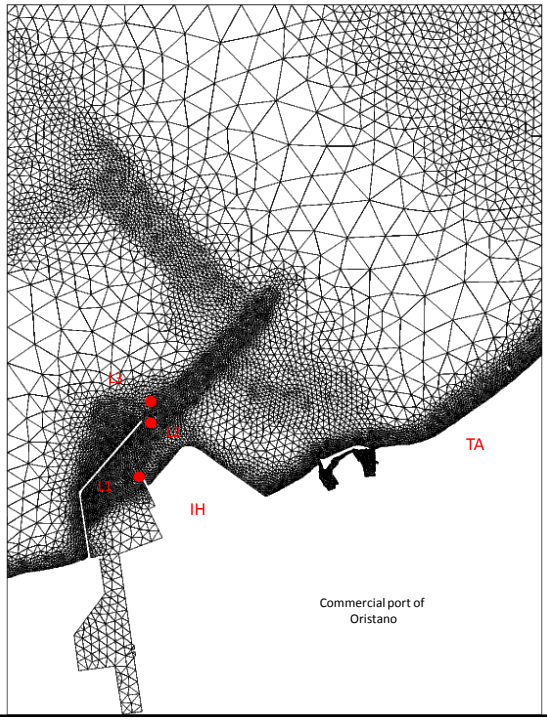
Impact of waste water discharge

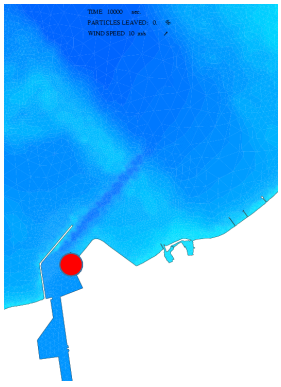
Test area:
- Industrial port [IH]
- Possible sewage outlet position [L1, L2, L3]
- Touristic area [TA]



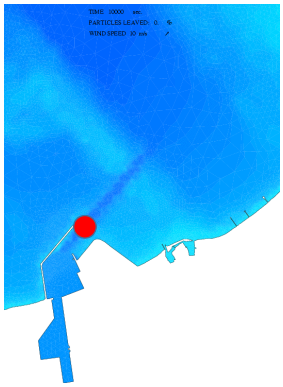
Evaluate impact of pollutants

- constant SW wind with speed of 8 m/s

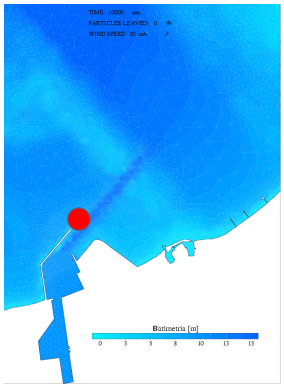
L1



L2



L3



Main points to consider

- Which solution out of the proposed ones is better and why?
- Are there other options to place the sewage outlet?
- What will be the costs for the pipeline?
- How will the touristic industry be impacted?
- What about the water quality in the harbour?

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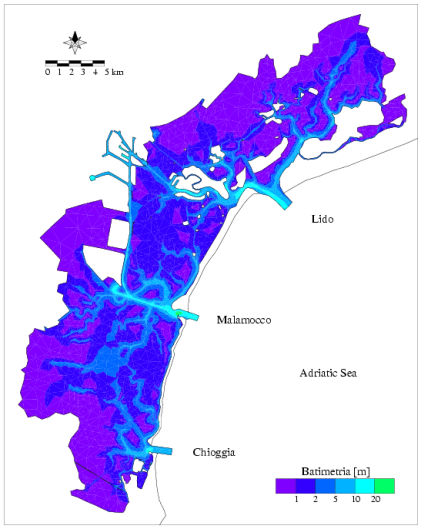
Case 3: The Venice lagoon mobile barriers (MOSE)

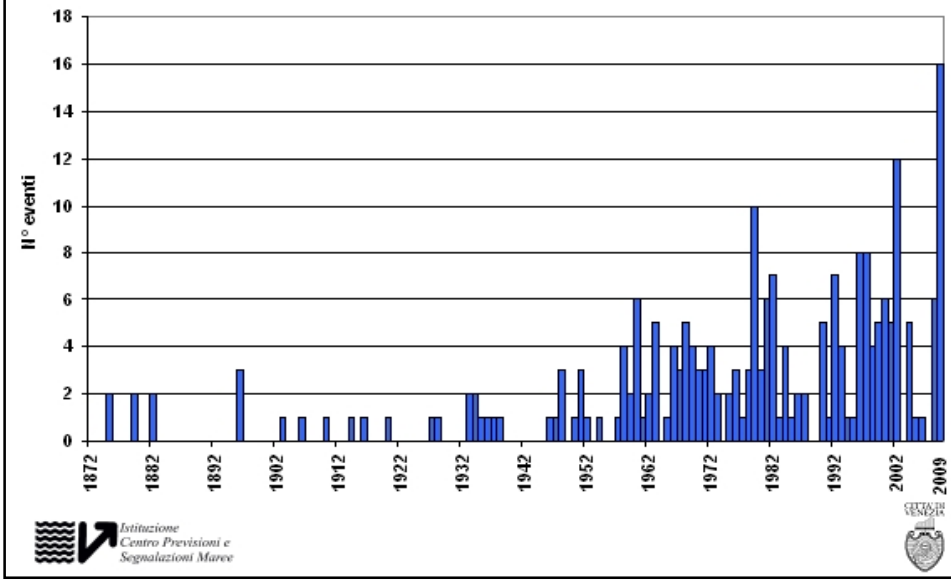
- 50 km long
- 10 km wide
- 300,000 inhabitants
- 30,000,000 tourists annually
- 1.5 m average depth
- tidal range 1.0 m
- 50 km^2 salt marshes

Hydrodynamic model: grid and bathymetry

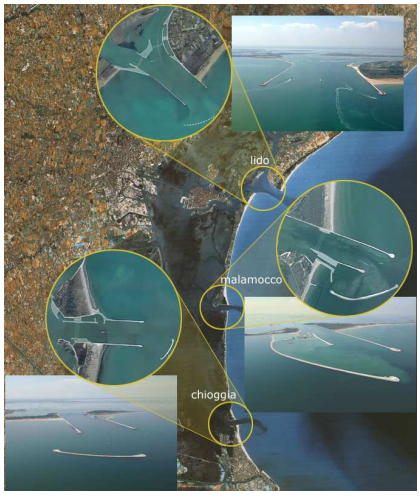


Venice is flooded 20 times a year

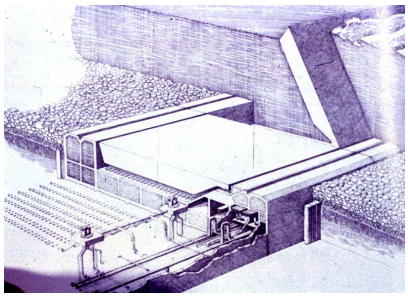
Annual frequency of flooding events (= tides >1.10 m above local datum) in Venice (from1872 to 2009)

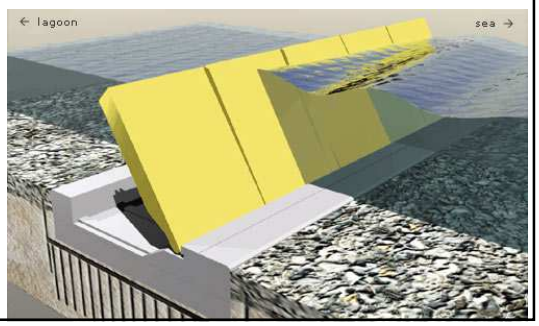


Interventions at the inlets: The Mose project



Mose: how it works





Pros & Cons

- Very efficient for protection
- Work only if needed
- Do not change the water budget of the lagoon
- Can be used to artificially enhance circulation in the lagoon
- Localized interventions

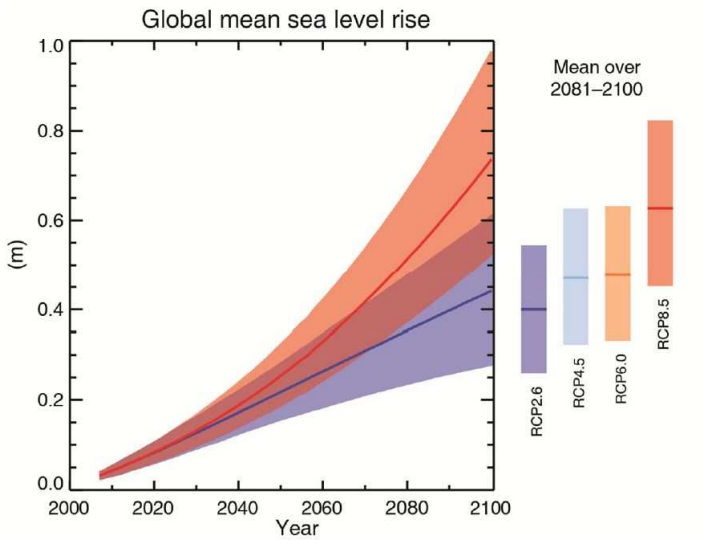
- Very expensive
- Maintenance and management will be difficult
- Sea level rise will question the utility of the barriers
- Strong intervention in the natural equilibrium of the lagoon

The lagoon with tidal marshes

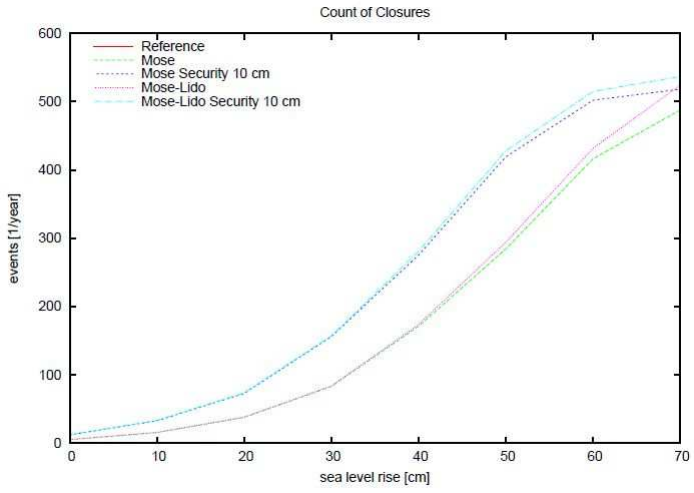
Ship traffic and the MOSE

- The planned mobile barriers will not only change the water exchange with the open sea but they will also interfere with the ship traffic

IPCC report 2013 (AR5)



Closures of Mose (projection)



approx. 1 closure per day for 50 cm SLR

If or when?

- The question will not be **if** it happens but **when** it happens
- In this case the only possibility will be to cut off the lagoon from the Adriatic Sea, transforming it into a fresh water lake
- In order to close the lagoon some conditions must be fulfilled:
  - no pollution
  - a sewage system for the city of Venice
  - the industrial and touristic port should be transferred out of the lagoon
- The Danube Delta or the Baltic lagoons show us nice examples of fresh water lagoons

Main points to consider

- Can we estimate the benefits of limiting the water level to 110 cm?
- What is the implication to ship traffic?
- How many closures a year are affordable for the ship traffic and the water exchange?
- How will tourism be impacted by the MOSE?
- How can we deal with a regime shift in the ecological system? Do we maybe need an ecological model to deal with this?

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Case 4: Connectivity in the Mar Menor

- The Mar Menor is a lagoon on the Mediterranean coast of Spain
- Touristic industry is very important
- The exchange with the Mediterranean is extremely limited

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The Mar Menor is heavily populated

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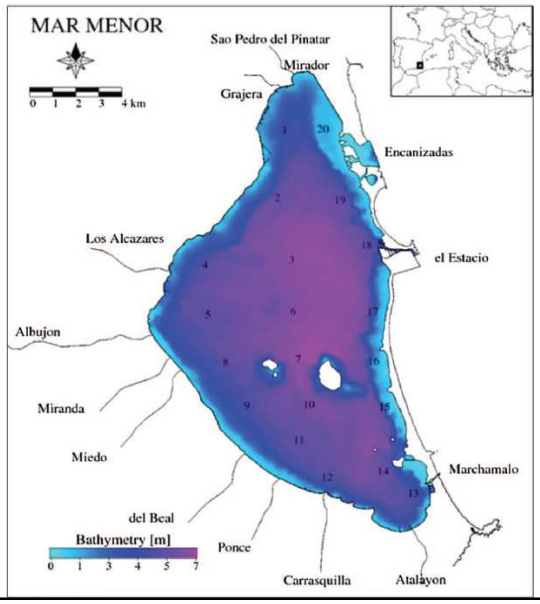
Modeling connectivity in the Mar Menor

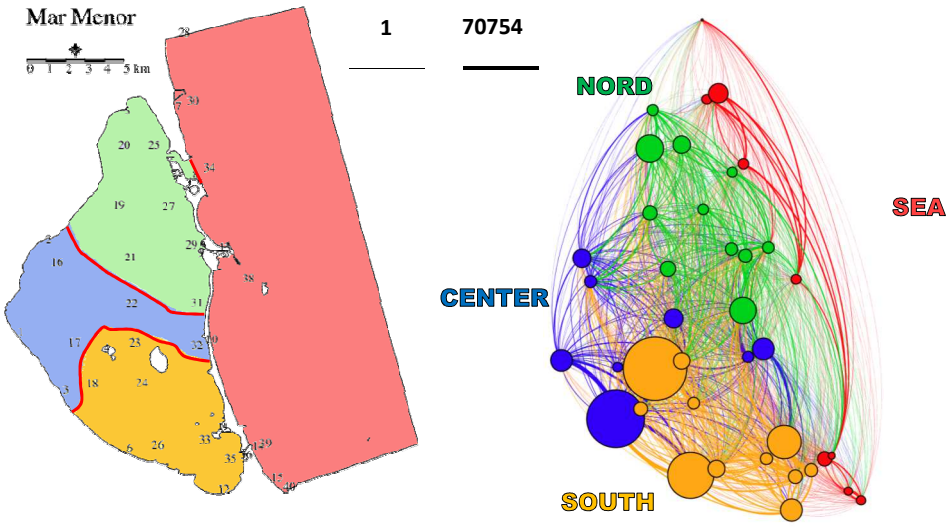


Connectivity results

PARTICLES EXCHANGED

Range thickness

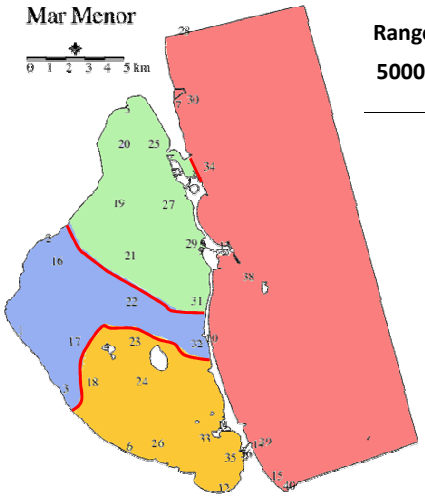
1 **70754**



Connectivity results

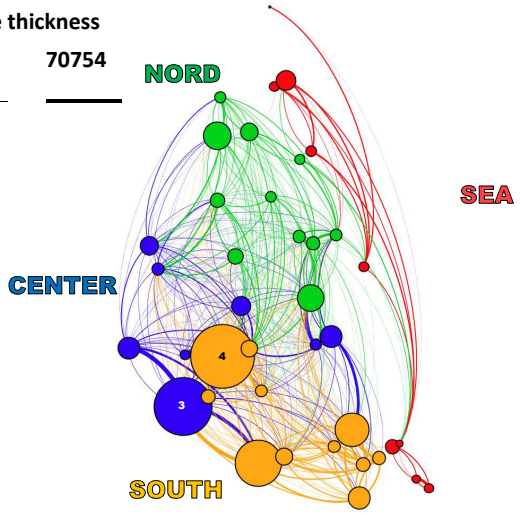
PARTICLES EXCHANGED

Edges filtered



Range thickness

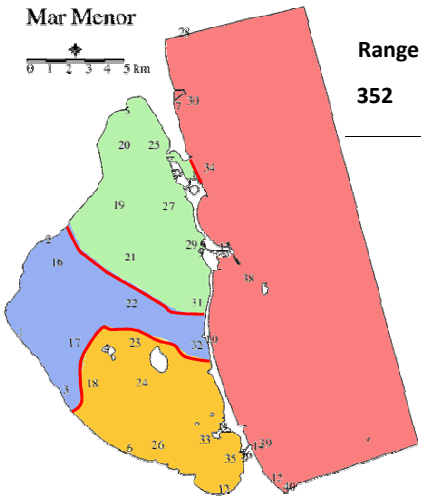
5000 **70754**



Connectivity results

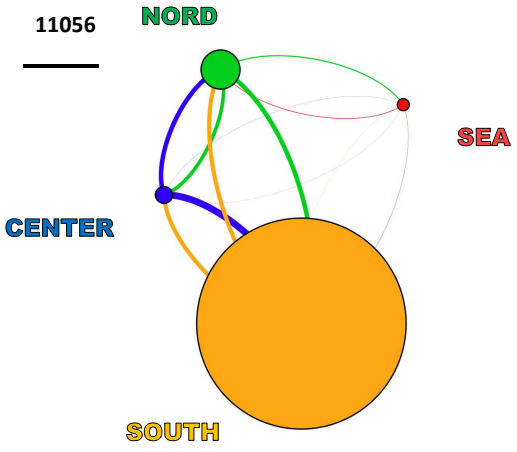
PARTICLES EXCHANGED

Range of particles exchanged averaged on groups edges

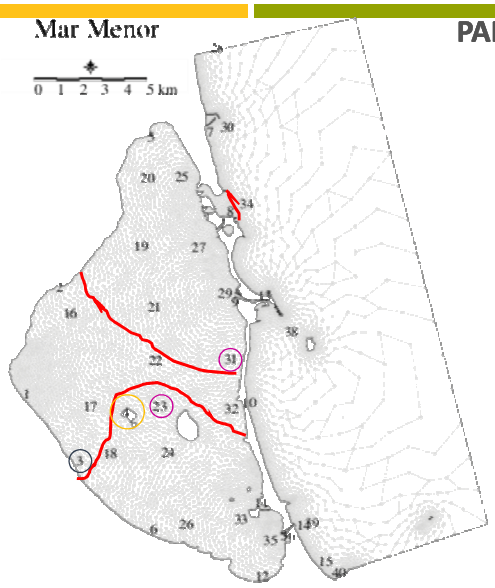


Range thickness

352 **11056**



Connectivity results: conclusions



PARTIAL CONCLUSIONS:

Particles generated in the northern sub-basin are the most scattered in the lagoon; particles generated in the southern sub-basin are more confined.
The central stations 31 and 23 act as transit areas.

These patterns are consistent with the circulation of the main current at the Estacio inlet, which crosses the basin transversally.

Enlarging the main entrance

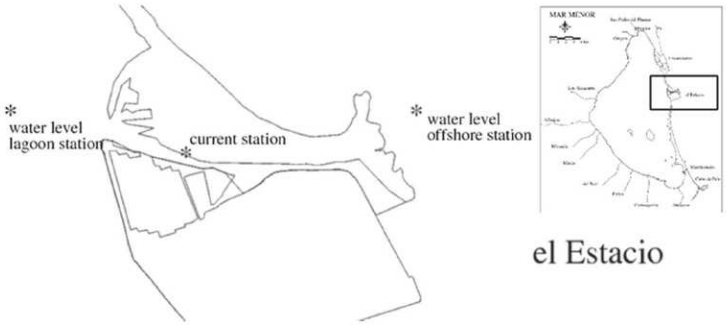


Fig. 2. Location of stations for water level and current measurements for the period 25/12/85–25/04/86.

- There is intention to enlarge the main entrance to the Mar Menor

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The main entrance to the lagoon

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The Mar Menor during Climate Change

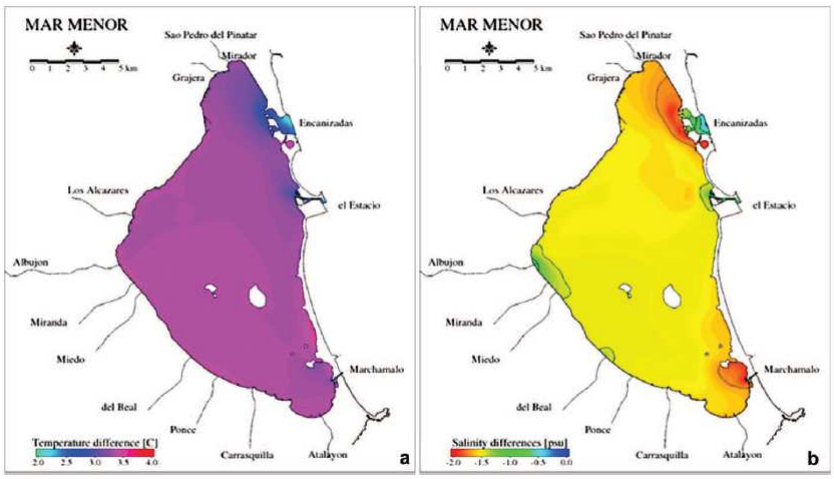

Fig. 7. Spatial differences between 2100 and 1997 values of the annual average for temperature (a) and salinity (b).

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Main points to consider

- What are the economic implications enlarging the inlet?
- How does the circulation change?
- Is it always beneficial having more exchange with the sea?
- What happens to salinity in the Mar Menor?
- Will the fish population change in the lagoon?
- How might tourism be affected by the opening?

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