Responding to the challenges of sustainable development in the Mediterranean

Impact of pollution on marine Biodiversity

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There are few endemisms in the biodiversity in all marine ecosystems :
large diffusion of reproductive elements for most of the species (eggs, larvae,…)

1

Extincted species in the sea are exceptionnal

In the Sea, there are two kinds of major ecosystems :

Pelagic and Benthic

The biodiversity is much higher in the Benthic ecosystems because there is a high diversity of biotopes (habitats)

2

1- Benthic marine ecosystems are by far the richest in terms of biodiversity

“Marine biodiversity is higher in the benthic than in the pelagic system”

Joint group of Experts on the scientific aspects of marine environmental protection. GESAMP Reports, N℃6, 1997;

IMO/FAO/UNESCO – IOC/WHO/IAEA/UN/UNEP

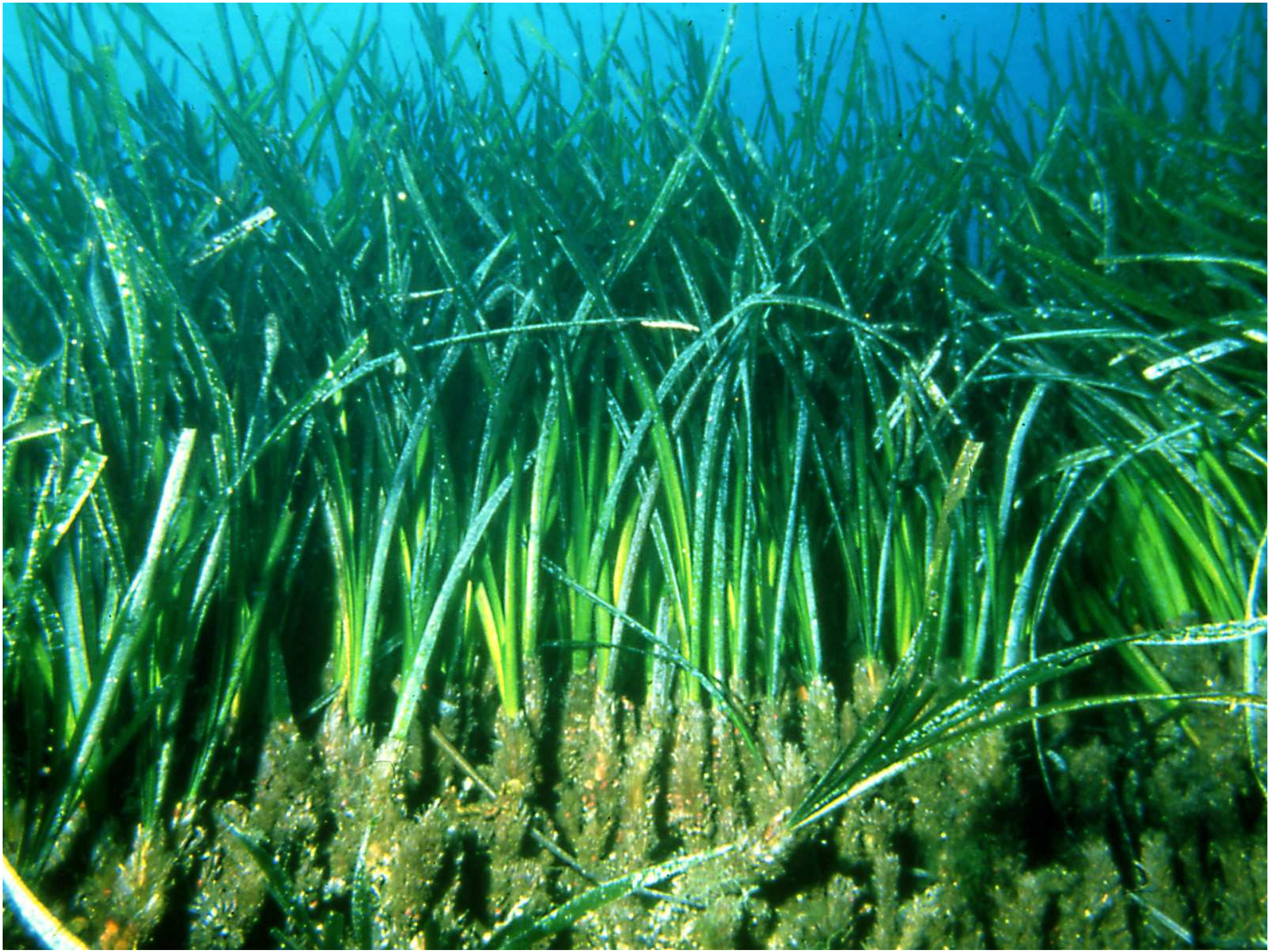
The biodiversity of the benthic littoral ecosystems is much more ritch than the deep benthic ecosystems for two reasons : light penetration and higher diversity of biotopes

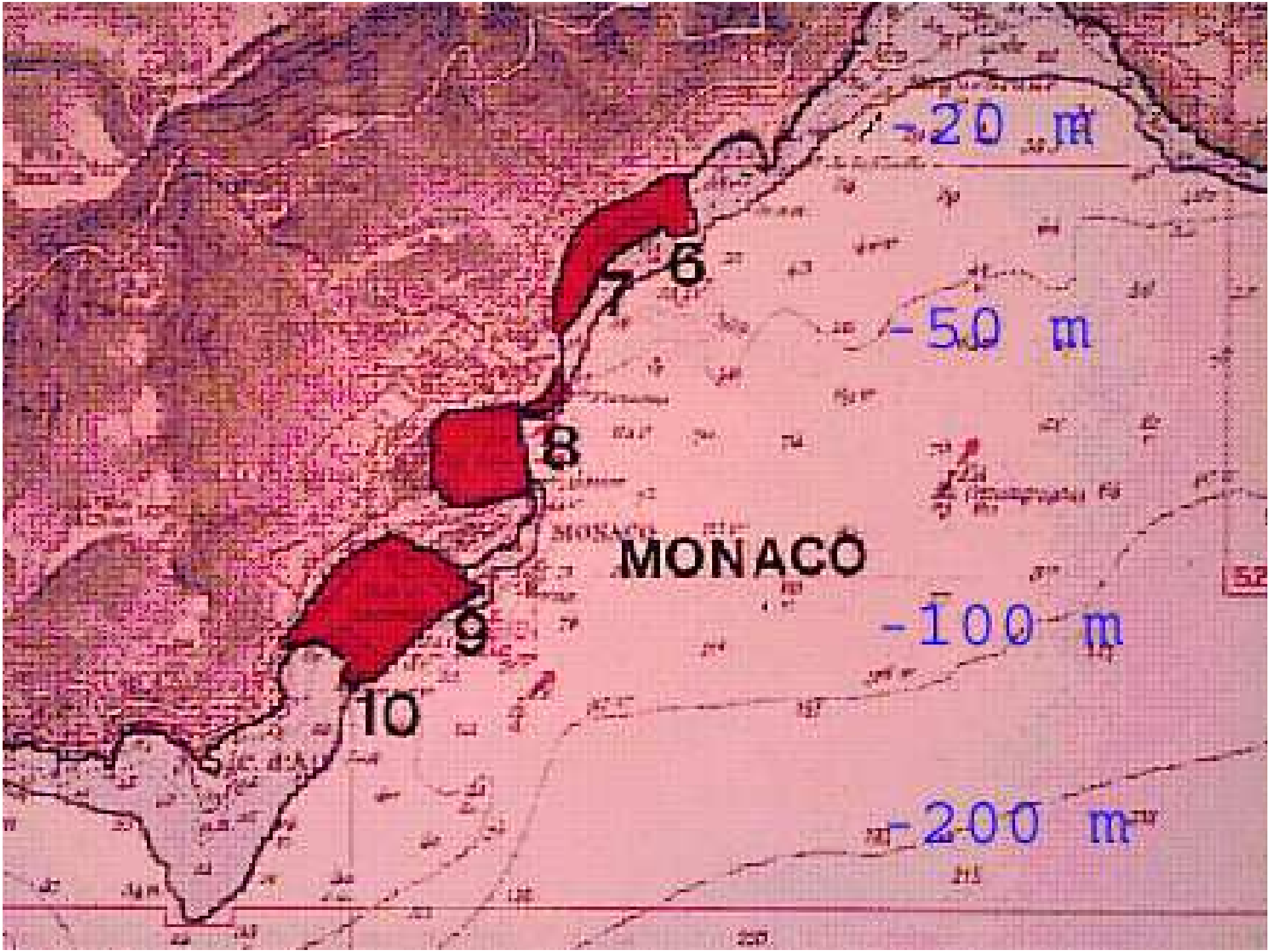
Coastal benthic ecosystems are highly diversified in their uppermost layer (between 0 and 20 m depth).

3

Coastal benthic ecosystems between 0 and -20 m depth extend over limited areas only

It is on this narrow 'oasis' of marine life that most the pollutions are concentrated and were the seafront constructions (reclamations) are built.




-20 m
6
-50 m
8
MONACO
9
-100 m
10
-200 m

4

Impact of human activities are concentrated on the shores : on the richests ecosystems of the sea

Damages to the marine biodiversity :

- best known, documented, published, are the damages having an impact on health or on the economy (fisheries ...).

(transparency, chemical oxygen demand, total phosphorus and nitrogen, pollutants load, red tides, bacterial or hydrocarbures pollutions)

- **Global cumulative impacts of habitat destruction in the marine coastal ecosystems by constructions reclaimed from the sea are underestimated.**

The assessment of the negative impact of reclamations is often seen as hostile to development. For this reason, few studies have deal with this conflicting and politically sensitive subject, and there has been little financial or personal investment in this field.

But ...Habitats destruction is at the top of the pyramid of biodiversity loss on the planet, even ahead of invasions by allogenous species, chemical or bacteriological pollutions or overexploitation of natural living resources.

In marine environment, each construction reclaimed from the sea destroys an underwater habitat by covering it or by confining the water inside breakwaters. A high density of constructions built on narrow shallow bottoms represents a major damage to the subsea environment.

Destructions of marine habitats are cumulative.

Destruction by reclaimed lands are irreversible.

// **Chemical or bacteriological pollutions or overexploitation of natural living resources are mostly localized and With reversible damages on the marine life.**

Actual situation In the front of French Mediterranean coasts

On the basis of an exhaustive inventory of the constructions reclaimed from the sea

and of surface area and linear measurements,

the rates of destruction of shallow coastal bottoms and of the occupation of the seafront by man-made structures have been calculated .

Data are online :

http://www.medam.org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Impact on the landscape

This form of impact is assessed by comparison of:

- the length of built-over seafront

-with the length of the seafront prior to any construction

(initial length of the natural coast).

This assessment provides a basis for proposing rates of artificial landscape by man-made constructions

Ecological impact

The ecological impact is assessed on the basis of comparison of

-the cumulative surface area of constructions reclaimed from the sea

- with the surface area of the littoral shallow bottoms (0-10m, 10m-20 m) which are the richest in the marine environment.

This assessment provides a basis for proposing rates of destruction for all the littoral ecosystems.

Coast line before any construction on the sea

- **The overall length of the French Mediterranean coastline measures 2 056 km, excluding the shoreline of the Etang de Berre (100 km) and of Monaco (5 km) ;**
- **977 km for Corsica**
- **853 km for Provence – Alpes – Côte d'Azur**
- **226 km for Languedoc - Roussillon.**

Initial coast line

**The initial coastline,
(that is as it was before
any construction)
has been digitalised
on the basis of old maps.**

Initial shallow seafront area

We have delimited and digitalised the initial coastline and the marine contour lines (isobaths) of the shallow bottoms (from 0 to 10 m and 10 to 20 m depth).

The surface areas between these bathymetric layers is measured.

From 0 to -20 m depth) = 168 769 ha (1 688 km²), including

- 500 km² for Corsica,

-668 km² for PACA,

- 520 km² for Languedoc-Rousillon

Inventory of seafront developments

The complete inventory of all 947 seafront developments on the French Mediterranean coast includes all constructions with a surface area of more than 100 m² directly occupying The marine environment.

Seven types of seafront development have been defined

Harbours: 149

Surface area of generally more than 1 ha.

2/7 Little harbours: 109

Harbour without a harbour master, with a surface area of generally less than 0.5 ha. :

3/7

Land fills : **137**

Area of land
reclaimed from the sea for
the construction of parking lots,
gardens, buildings, shopping centres,
Industry, airport, roads, etc.

4/7

Breakwater protected beaches: 62

Breakwater protected beach : development consisting of two rocks dump breakwaters, curving inwards towards each other at the seaward end and delimiting an area reclaimed land and a sheltered stretch of water for bathing

5/7 Groins: 397

Structured pile of rocks designed to protect the shore against erosion (axis generally perpendicular to the coast).

6/7 Landing pier (jetties): 58

Solid structure with vertical sides (in contrast to rock dump groins) for boats to draw alongside.

7/7 River mouth breakwater: 35

Construction of two breakwaters situated on either side of the mouth of a river flowing into the sea.

Two types of surface area have been taken into account:

1- Built-over surface

Built-over surfaces are the emerged parts of constructions reclaimed from the sea bottom.

The subsea habitats built over are irreversibly destroyed.

We have not taken into account the immersed parts of constructions or jetties built on piles.

2 - Water body

This means a stretch of water enclosed by a structure (harbour, man-made beach).

The enclosure of this water body irreversibly upsets the enclosed ecosystems. The water, in particular in harbours, is exposed to various forms of pollution such as heavy metals (from antifouling paints), oils, waste and various organic substances (from sewage from inhabited boats).

Linear measurement

- ***Length of man-made coastline***
= artificial coastline

This is the length of the original seafront on which constructions have been built.

Actual impacts on landscapes

226 km (of the 2056 km) seafront is now artificial.

So 11 % of the seafront has the appearance from seawards of piles of rocks, blocks or concrete tetra pods.

This impact is very uneven:

40.6 % of the seafront is man-made in the Gard, 27.4 % in the Alpes-Maritimes, 89 % for the coast of Monaco and only 2.1% for the coast of Corse du Sud.

Impact on the coastal ecosystems

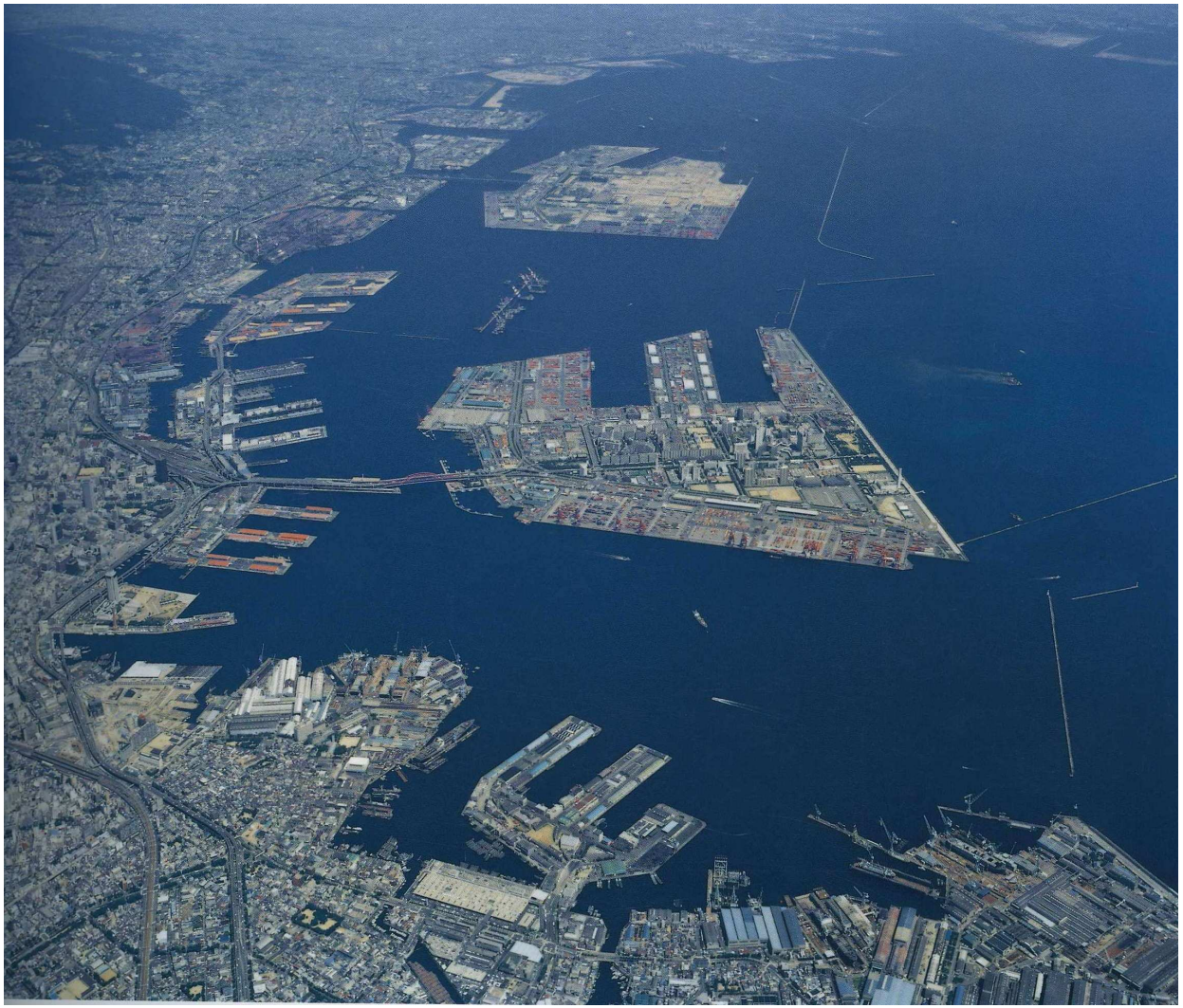
5 282 ha have been built on the coastal benthic ecosystems and are thus permanently (definitively) damaged or destroyed.

Between Menton and Martigues (Alpes-Maritimes, Monaco, Var and east of the Bouches-du-Rhône), 500 constructions have been built occupying 17.8 % between 0 and -10 m depth and 11 % between 0 and -20 m.

Conclusion about the actual situation:

Habitat destruction in the marine coastal ecosystems by constructions reclaimed from the sea (physical pollution) is by far the major cause of alteration of marine biodiversity on the French Mediterranean coasts

Coastal restructurations = irreversible physical pollution is not sustanaible !



Global change : expected response

Strong enhances of habitat destruction in the marine coastal ecosystems and of the coastal landscapes by new constructions reclaimed from the sea

to protect the shore line : Groins, dikes, with more and more vertical rocky shores

Consequences

Homogenisation of the shore line substrates at the sea level
+ much more artificial concrete, blocs, rocks at the sea level)
+ less shallow water sandy or muddy substrates (tidal flats).

-> Hy level modification of the global biodiversity of the intertidal ecosystems

For a sustainable development in the respect of the marine biodiversity Protect for ever the natural coastal landscape (France)

National Trust (GB) or *Conservatoire du littoral*

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