MINISTRY OF DEVELOPMENT – GENERAL SECRETARIAT FOR RESEARCH AND TECHNOLOGY

H.C.M.R.
HELLENIC CENTRE FOR MARINE RESEARCH

From the Habitat Directive to the Marine Strategy Framework Directive: The ecosystem based management in the Mediterranean

Natural science aspects

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FIRST TRAINING SCHOOL FOR THE PROMOTION AND APPLICATION OF EU MARINE ENVIRONMENTAL POLICY FRAMEWORKS IN NON-EU MEDITERRANEAN AND BLACK SEA COUNTRIES
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Eco-system: it sounds Greek to me!

- **Eco**

  from the Greek «*οίκος*» = house
- **system**

  from the Greek «*συν-ίσταμαι*» = consist

  «*ίσταμαι*» = stand «*συν*» = by, together

“The components of the house”

Our house: the Earth

How many ecosystems on Earth?

✓**The answer depends on how we look at the planet**

Management

From Wikipedia, the free encyclopedia

- **Management** is the act of getting people together to accomplish desired goals and objectives using available resources efficiently and effectively.

- Management comprises planning,organizing, staffing, leading or directing, and controlling an organization for the purpose of accomplishing a goal.

- Since organizations can be viewed as systems, management can also be defined as human action, including design, to facilitate the production of useful outcomes from a system.

Ecosystem management
= **“house keeping”** to maintain **useful outcomes**

Which outcomes?

- The capacity to provide “goods and services” for this and the next generations

  (= economic values)
- Aesthetic & cultural values
- Biodiversity (autonomous value)

The scientific background :

The Ecosystem Approach (EA)

The Ecosystem Approach concept goes back to the beginning of the 90’s or even earlier.

At those times it was mainly viewed as a novel tool for the scientific study – analysis of various ecosystems.

The Ecosystem Approach

The EA included a large number of theoretical issues and elements of modern biology, physics and chemistry such as:

- *Ecosystem theory,*
- *Theory of chaos,*
- *Non-linear systems theory, etc.*

Very quickly, though, ***management*** issues were also discussed and included in the EA

The Ecosystem Approach

Today the EA is considered mainly as a *management tool* more than anything else.

Based on a sound scientific knowledge of the ecosystem itself, the EA has incorporated and developed a large number of concepts regarding the management of human activities affecting the ecosystem.

The Ecosystem Approach in the EU environmental policy

- In this presentation, the evolution of the European Union (EU) Commission perception of **surface water protection** shall be given, as this has been recorded in relevant Directives which have been voted by the Council of Ministers of EU Member States during the last 30 years

Why an EU water quality policy?

- The **quality of surface waters** (both coastal and inland) directly affects human quality of life.
- Thus it is expected that a framework of legal provisions is created where the legal good under protection is the surface waters.

EEC is not an Environmental but an Economic Community

- The evolution of the legal framework reflects the demands of the European citizen for better quality of life, in a protected natural environment.
- But also reflects the fact that environmental coast has to be integrated in the final cost of a product.
- Otherwise the economic competition between Member States is unfair.

EEC Directives of the period 1970 – 1990

- The interest of the EEC Commission was originally focused on protecting freshwater by voting Directive 75/440/EEC, followed by Directive 76/160/EEC on the protection of bathing waters.
- Directives 78/659/EEC and 79/923/EEC on the protection of waters, destined for fish and mussel farming respectively, were soon also adopted.

Directives of the period 1970 – 1990.

- During the 80s, the EEC Commission expressed an interest for the protection of surface waters by passing Directives 84/360/EEC and 85/337/EEC relevant with Environmental Impact Assessment, as well as Directive 86/85/EEC on the protection from oil pollution.
- It is evident that by the end of the 80s the Commission had put great effort on safeguarding the quality of surface waters destined for particular uses.

The new trends

- A first change in the perspective of the European legislator may be recognised in Directive 91/676/EEC on the protection of waters against pollution caused by nitrates from agricultural sources, as well as in Directive 91/271/EEC concerning the **“sensitivity degree”** of waters (rivers, lakes and seas) receiving urban waste.
- These two Directives aimed at restricting phenomena of **eutrophication**, which at the end of the 80s culminated in severe ecological disaster to the water bodies in northern Europe.

The Habitats Directive 92/43/EEC

- Voted on 1992 the “Habitats” Directive aims the conservation of natural habitats and the creation of a network of sites under sustainable management, known as the NATURA 2000 network.
- HD represents an even bolder step towards the protection of biotopes by European Law and includes in its Annexes, among others, a list of sensitive hydrobiotopes and threatened aquatic species of the European flora and fauna.
- The HD suggests a rating system for the representativity of biotopes as well as of the conservation status.

From “water use” to “water quality”

- As can be seen from the above discussion, in the beginning of the 90s a change occurred: the Law seized aiming at the protection of *the use* of surface waters for the benefit of *the human – user* and turned to protecting the water environment itself.
- Unquestionably humans are directly benefited from the conservation of the natural environment, which is the ultimate purpose of these Directives

The concept of the ecological quality

- A truly revolutionary view came forth with a Proposal for a Directive of the EU Commission, which saw the light of publicity in the Official Journal of the EU on 8.7.94 (94/c222/06)
- In the Proposal, the term **“ecological quality”** of surface waters is defined for the first time as a value which is autonomous and independent of any use, economic exploitation and aesthetic approach.
- The concept of the ecological quality was integrated in the Water Framework Directive (**WFD**) voted on 2000.

The ecological quality concept in the Water Framework Directive

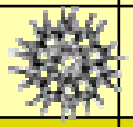
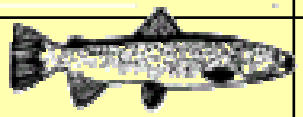
- The **ecological quality** is an overall expression of the structure and function of the biological communities
- Ecological status is determined by biological quality elements (BQE)
- Hydromorphological and physico-chemical quality elements are also taken into account
- A consistent classification of all European surface waters into status classes is necessary

WFD - the normative classification can be summarized as:

- **high** = no disturbance in the structure and function of the communities, or only minor deviations
- **good** = low levels of disturbance, but only slight deviations in the structure and function of the communities
- **moderate** = moderate deviations and significant effects
- **poor** = major biological alterations and substantial deviation
- **bad** = severe biological alterations and large deviation

Classification criteria for biological elements

generally: taxonomic composition and abundance

Biological Quality Elements	Rivers	Lakes	Transitional waters	Coastal waters
Phytoplancton 	x	x	x	x
Macroalgae and Angiosperms 			x	x
Macrophytes and phytobenthos 	x	x		
Benthic invertebrate fauna 	x	x	x	x
Fish fauna 	x	x	x	

Coastal water ecosystems

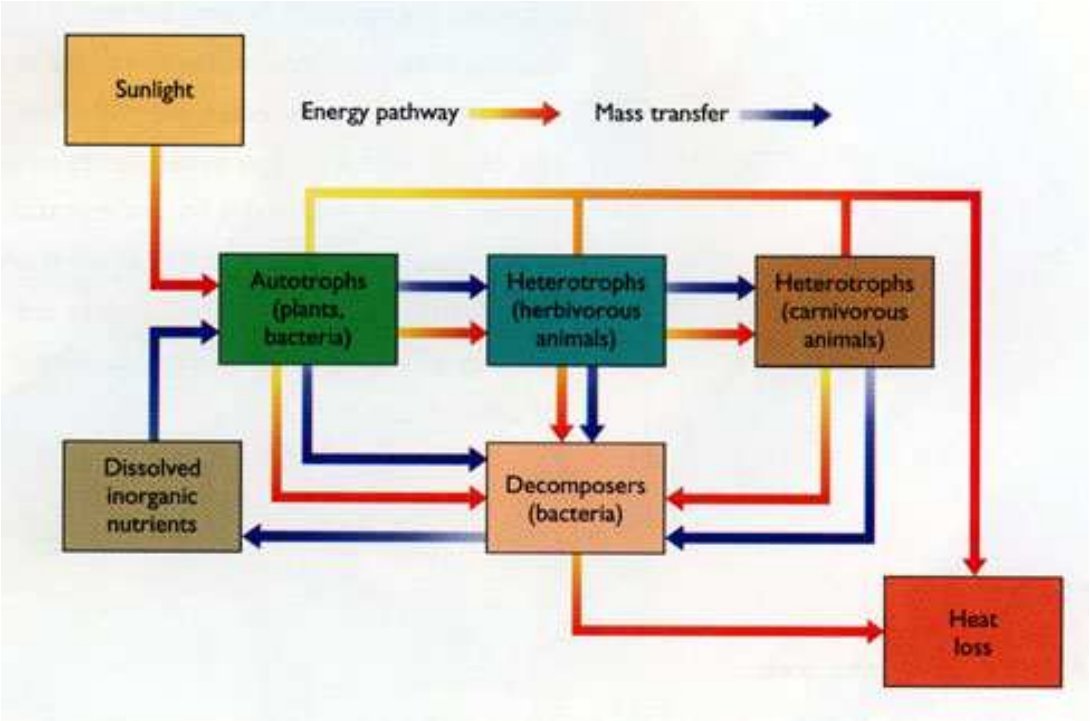
Transitional water ecosystems

Inland water ecosystems

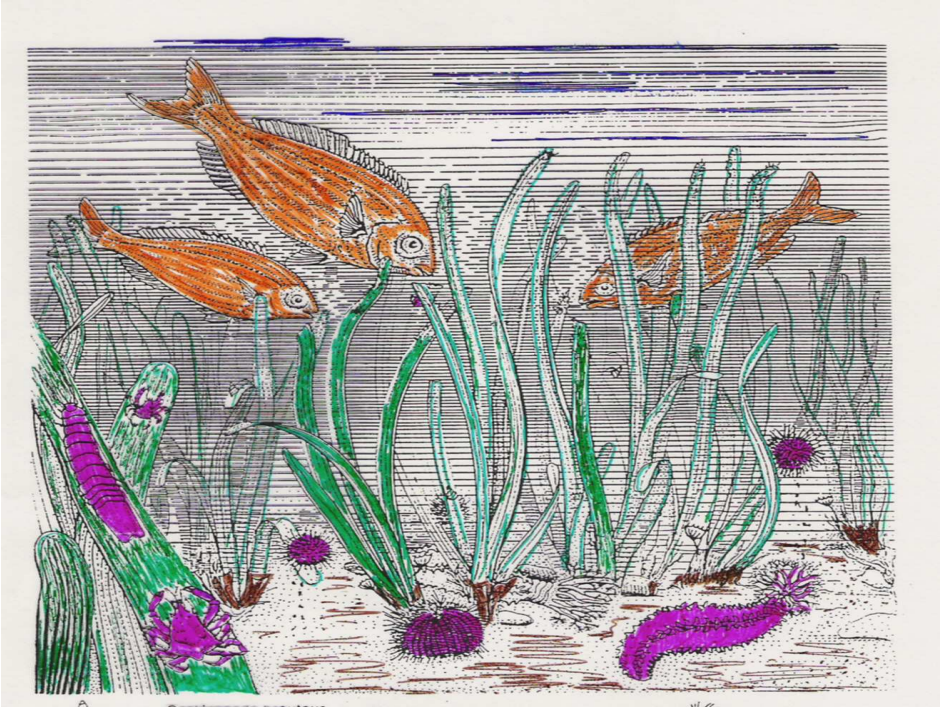
The boundaries are not always geographical

Two main factors to delimit an ecosystem:

- The flux of energy
- The flux of matter



A Mediterranean example:
The flux of energy, the flux of matter in a sea grass meadow



Ecosystem factors

- Abiotic factors

(temperature, salinity, light penetration, type of sediment)

+

- Biotic factors

(competition between species for space, food ect)

Benthic and Pelagic ecosystems

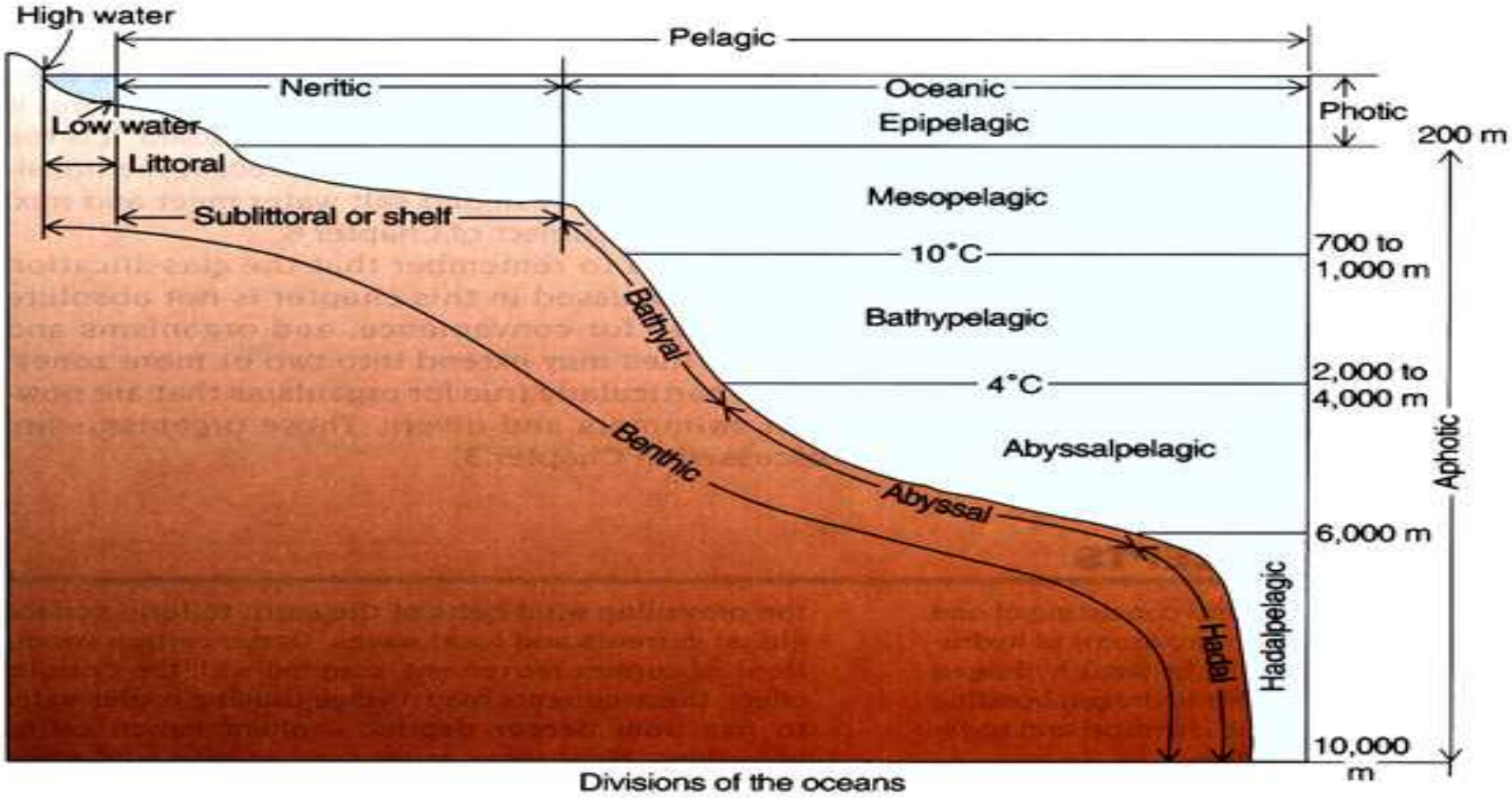
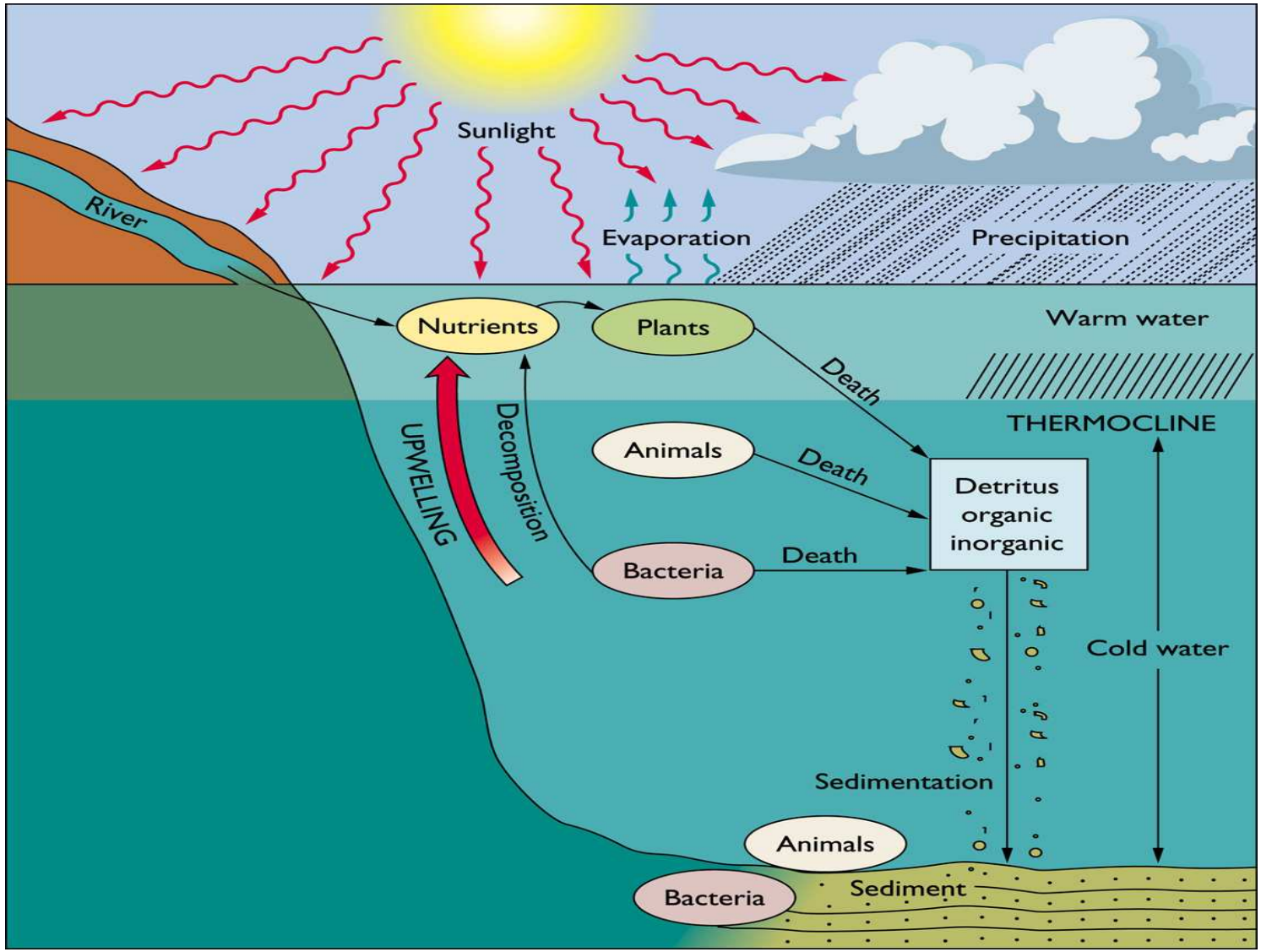
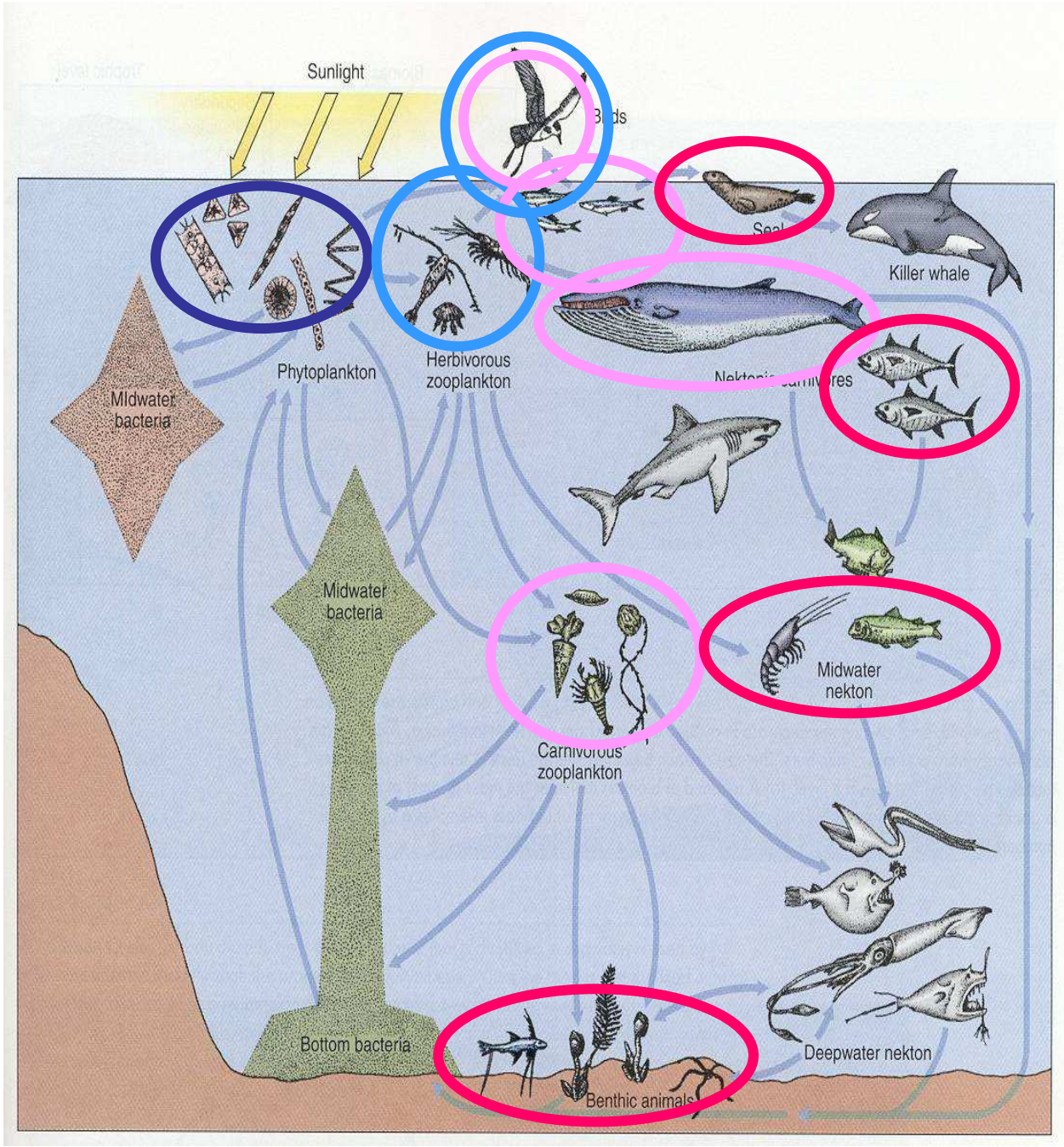
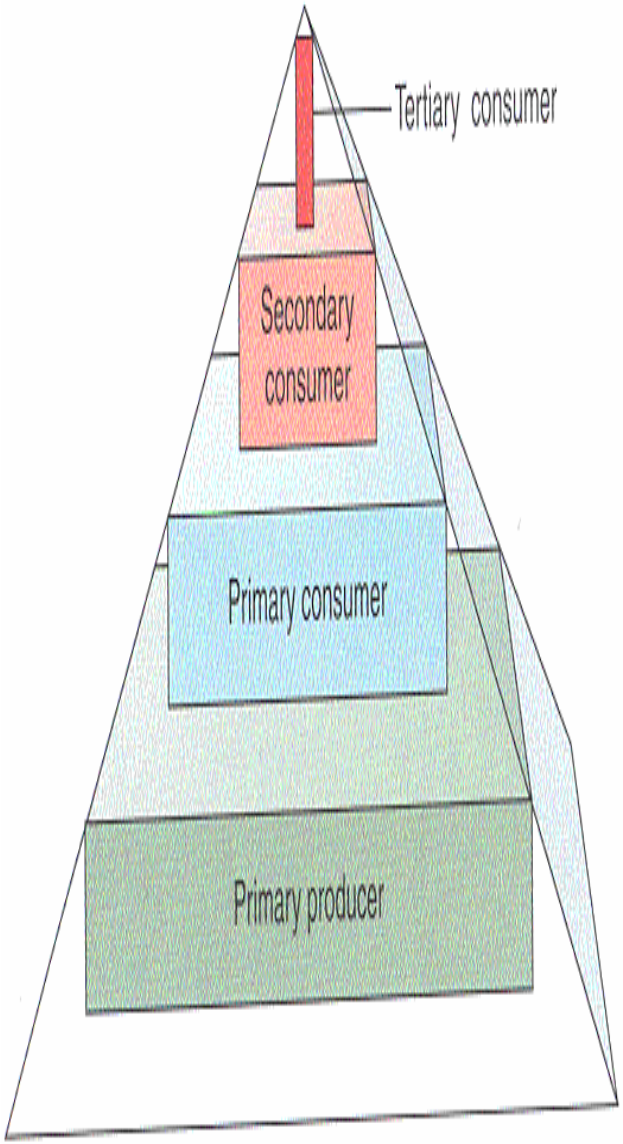


FIGURE 1.22 Divisions of the oceans (not to scale). (Modified from "The Treatise on Marine Ecology and Paleontology", J. Hedgpeth, *Ecology Memoir #67*. Copyright Geological Society of America.)

Pelagic ecosystem: Biological production and biogeochemical cycles

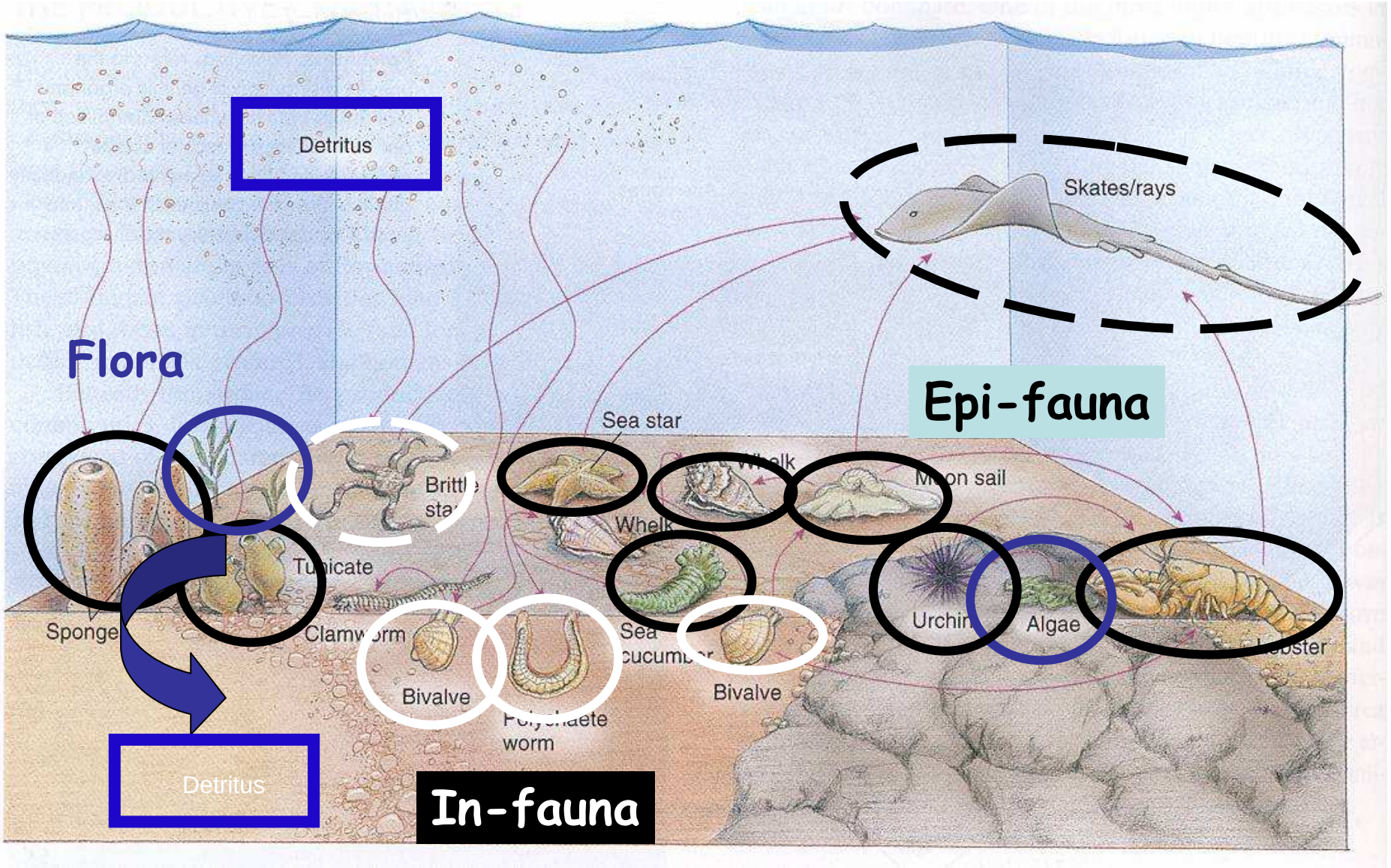




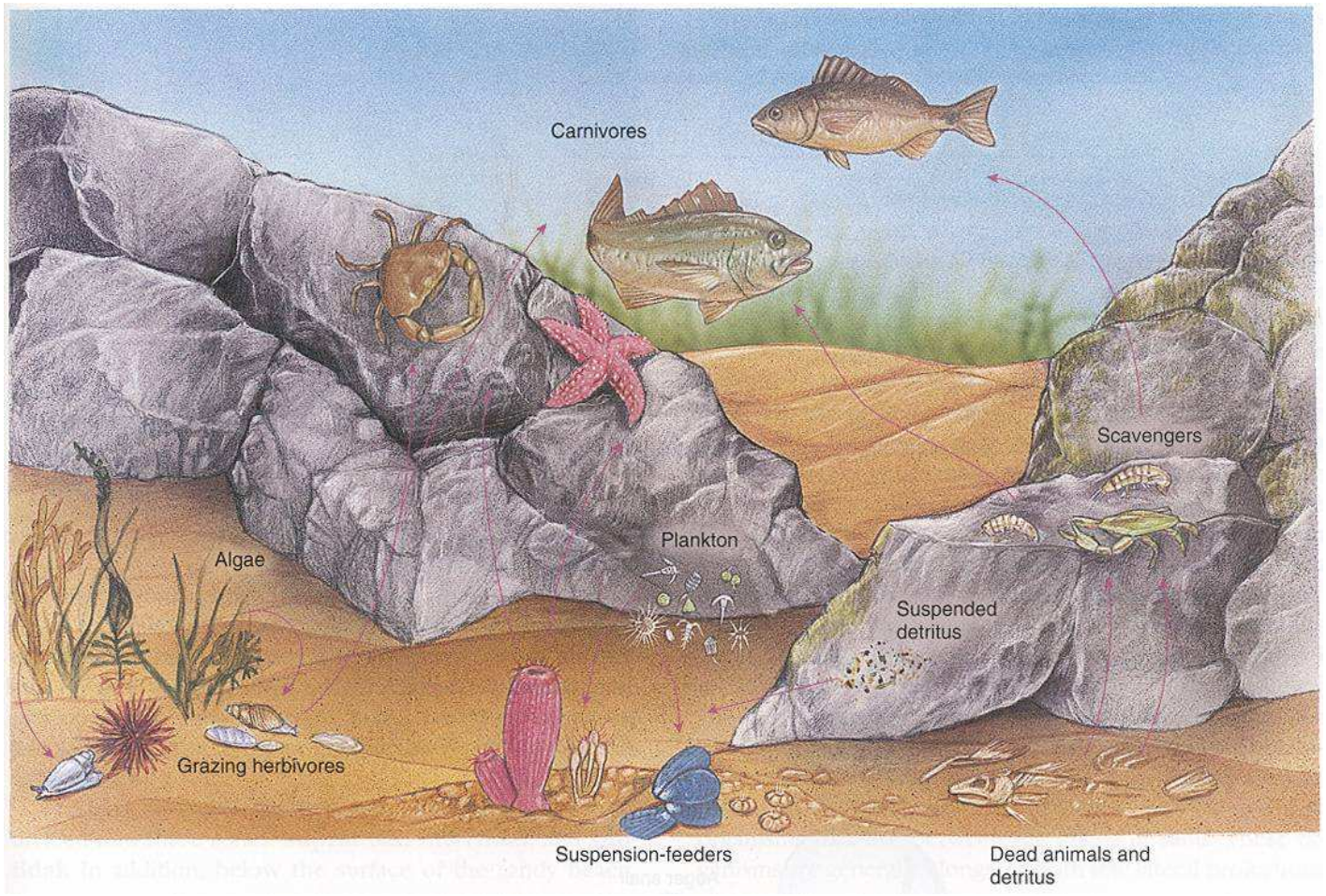


Pelagic ecosystem: Biological production and biogeochemical cycles

Shallow-water benthic ecosystem



How many habitats in the benthic ecosystem?

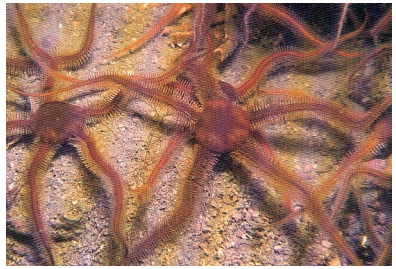


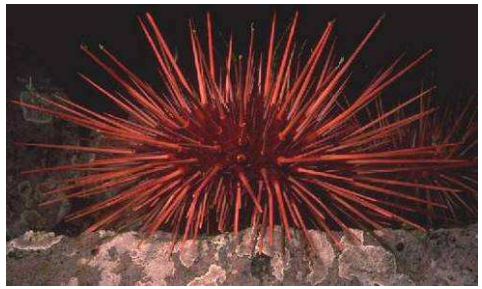
How many biological communities in the benthic habitat?

The concept of **biological community**

- As biological community we see an assemblage of animals and plants living together
- The species composition in a biological community depends on the biotic needs of every species (survival, nutrition, reproduction)
- Thus, the composition is not aleatory (hazardous) and reflects the local environmental conditions

Benthic life types: structural aspects of the biodiversity





Benthic vegetation

✓On sandy bottom

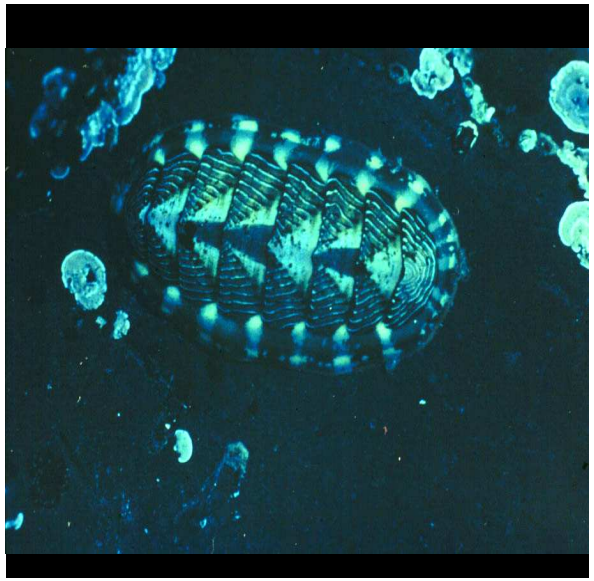
✓On rocky bottom

Unvegetated mud

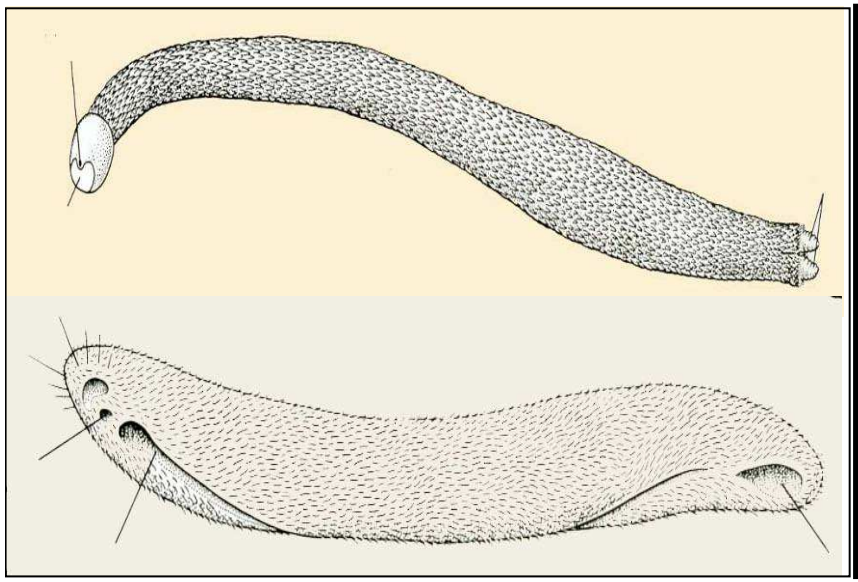
Polychaetes: The most dominant group of benthic organisms

Bivalves

Chitons



Caudofauveata

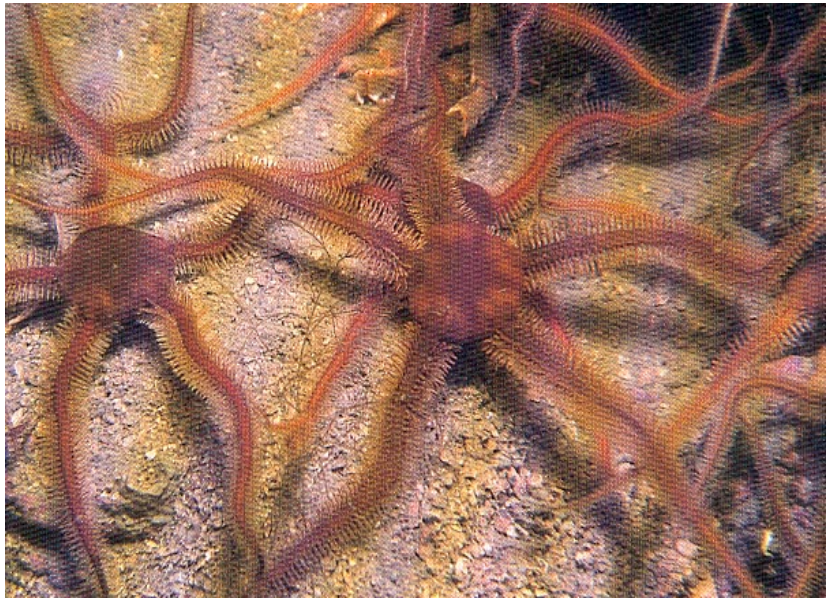


Gastropods

Mollusks

Crustaceans

Echinoderms

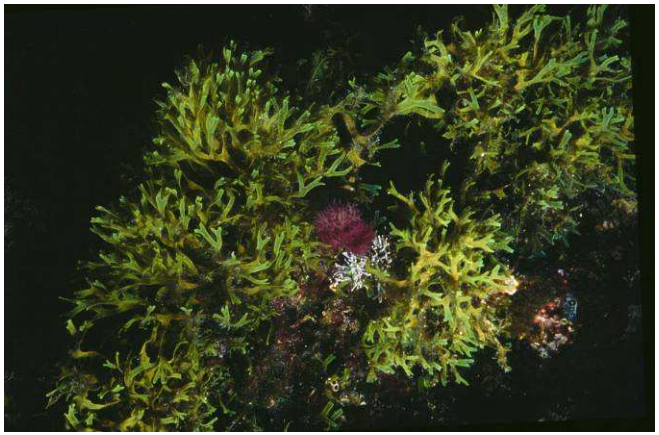


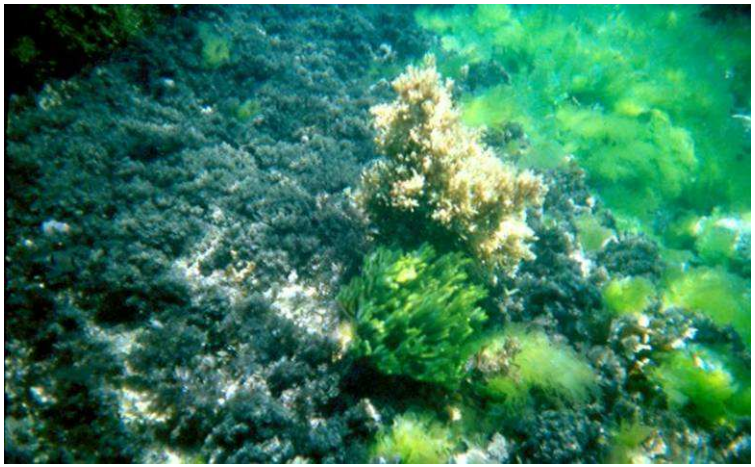
Fish

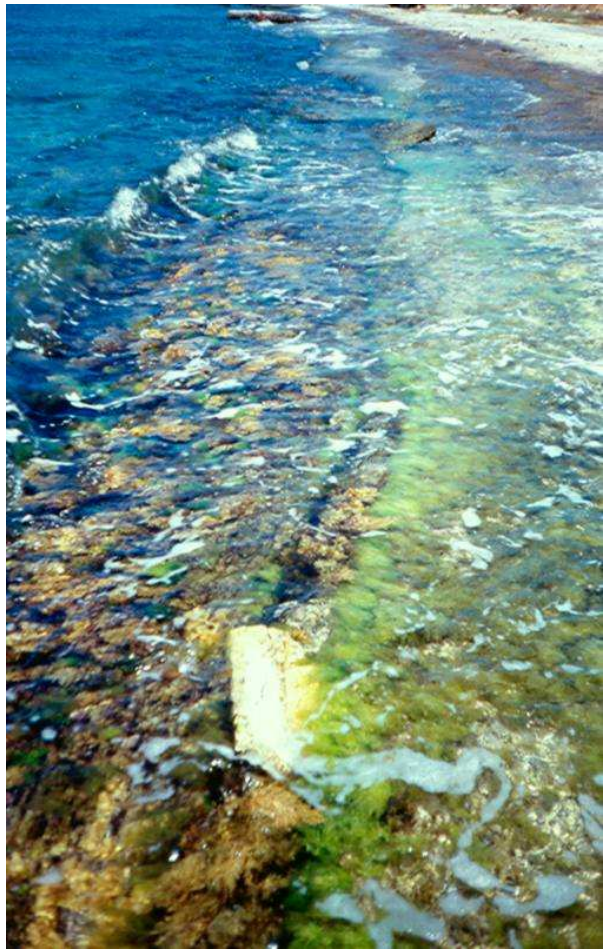
Food adaptations: functional aspects of the biodiversity

- Producers
- Grazers
- Suspension feeders
- Deposit feeders
- Predators
- Omnivores

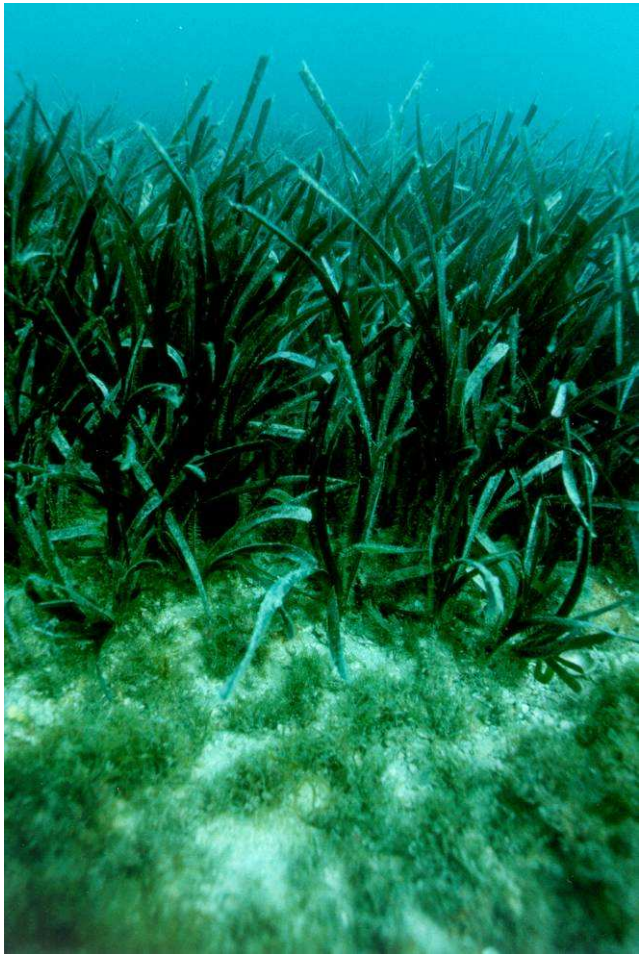
Producers: Macroalgae







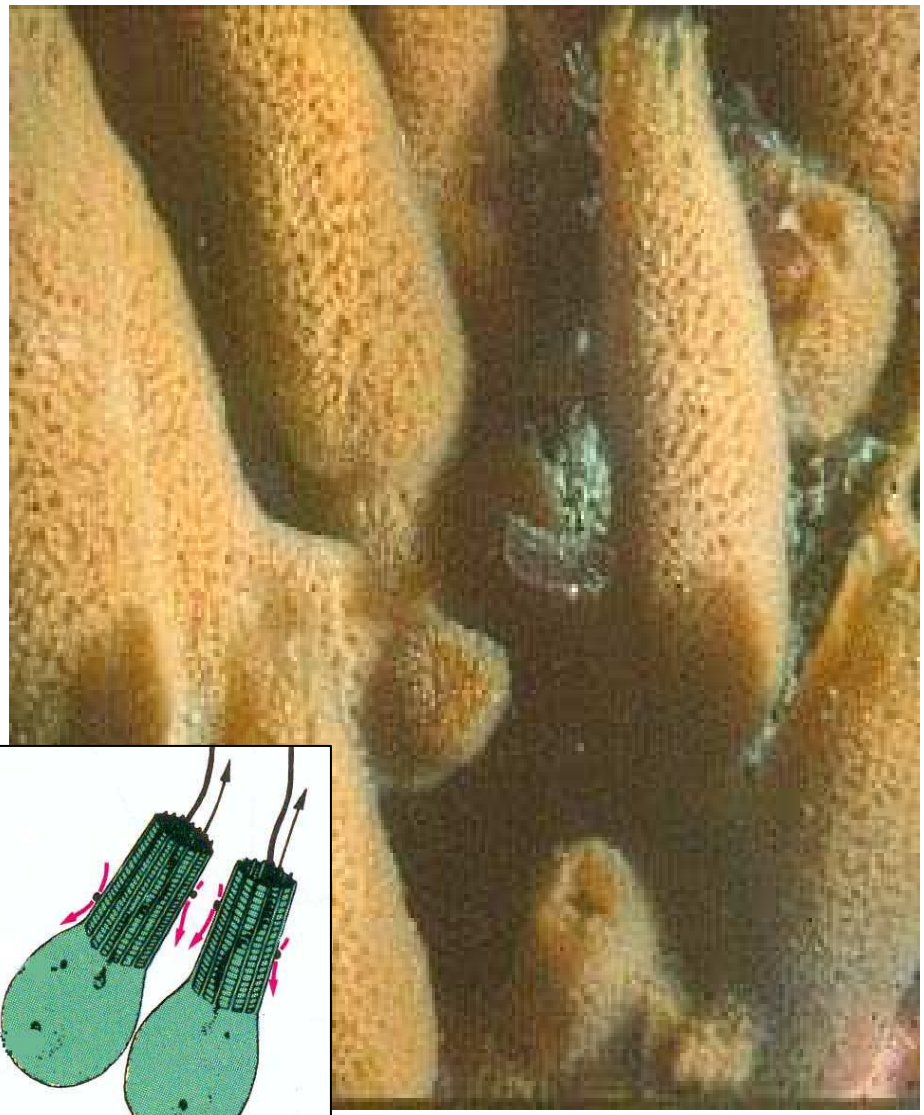
Producers: Marine Angiosperms

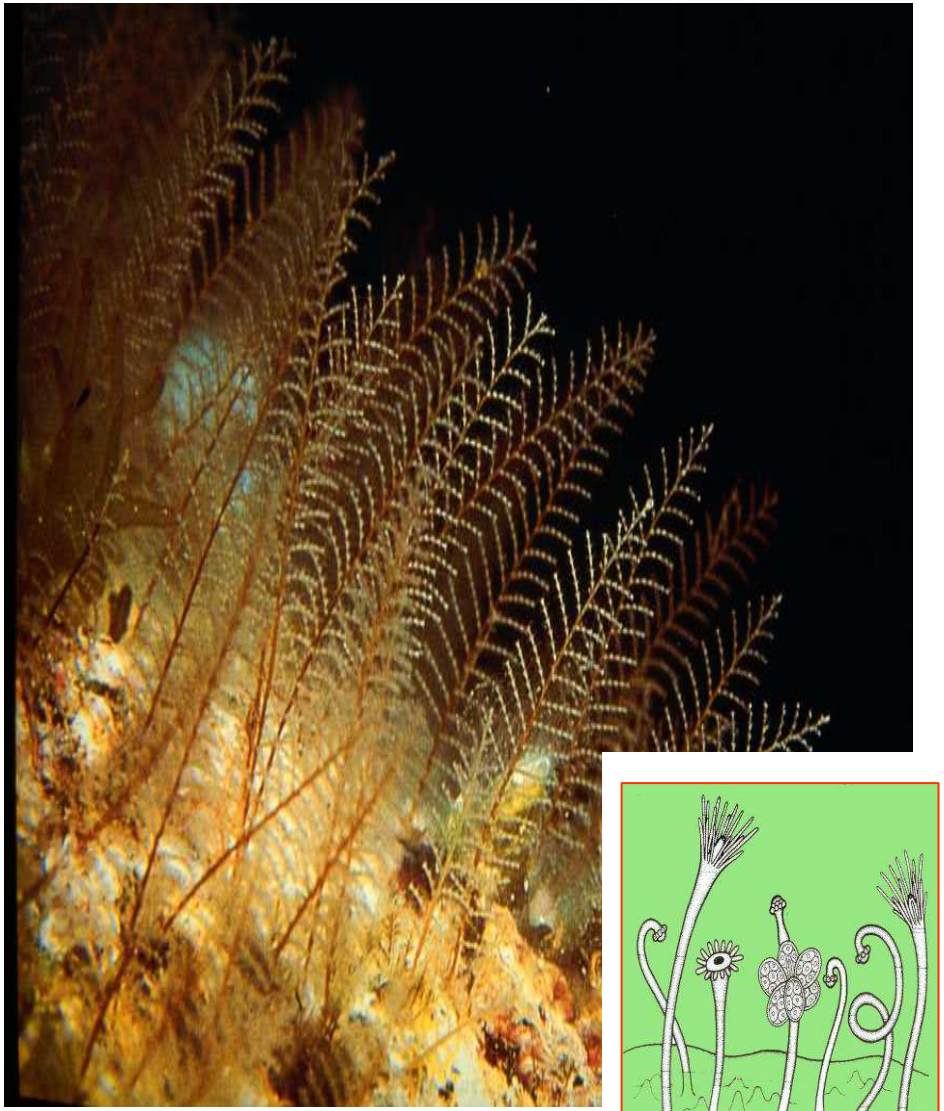


Grazers

Suspension feeders

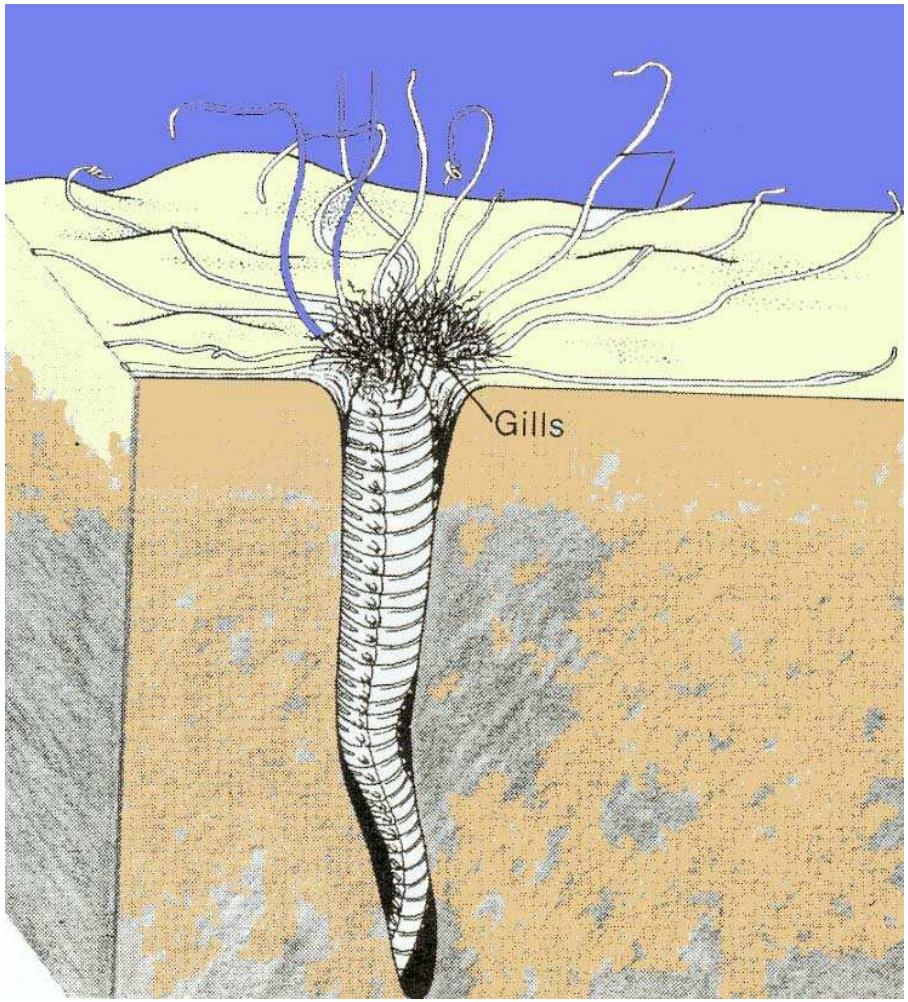
Suspension feeders



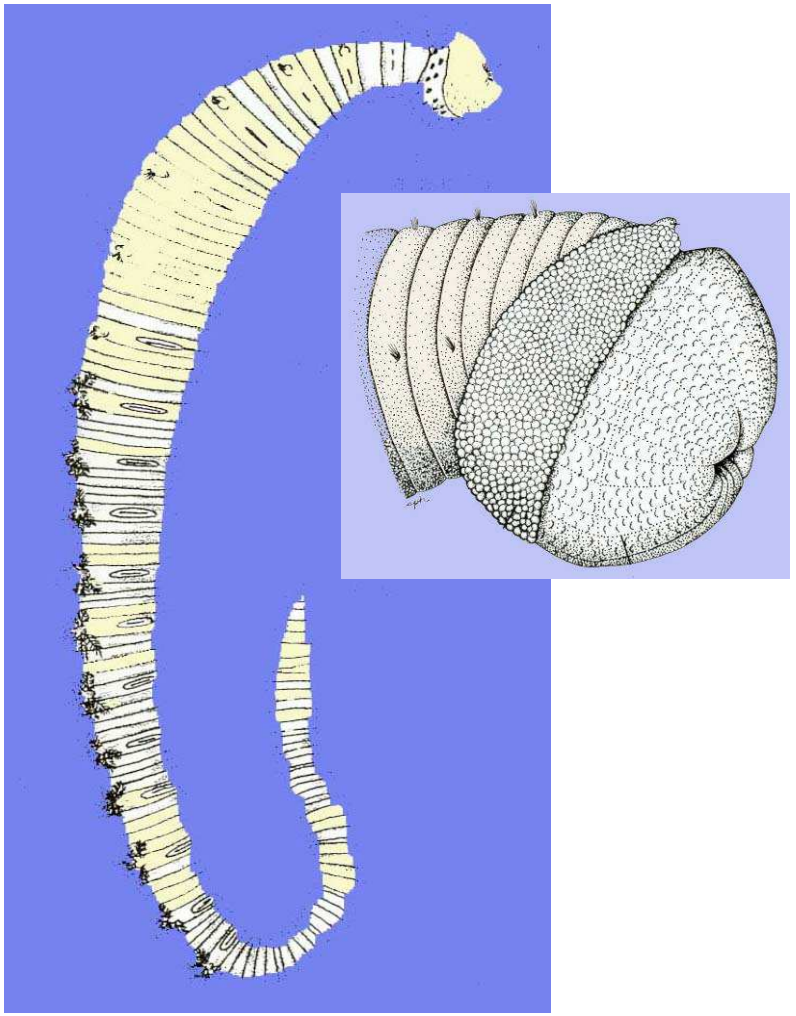


Deposit feeders

Tube – dwelling polychaetes



Burrowing polychaetes



Predators

The biological community is the base for all typologies

✓**On sandy substratum**

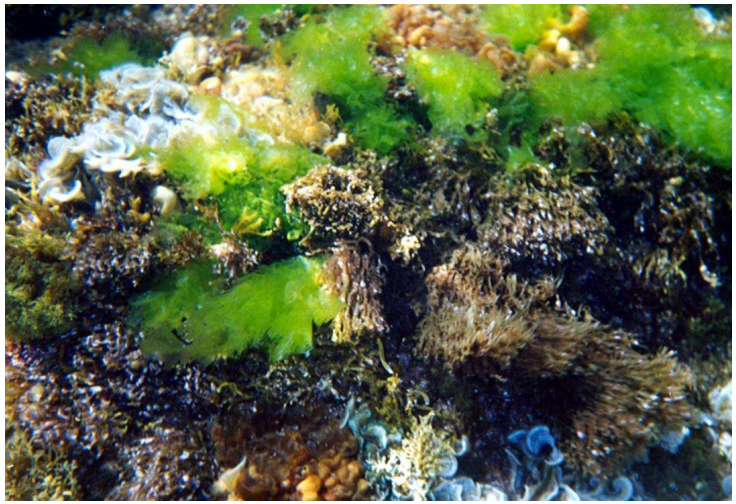
Posidonia oceanica **meadow**
=stable conditions

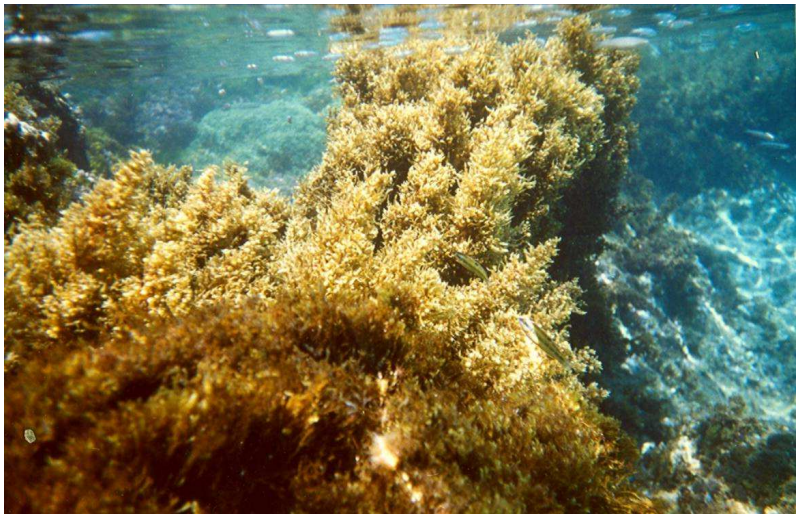
Cymodocea nodosa **meadow**
= instable conditions

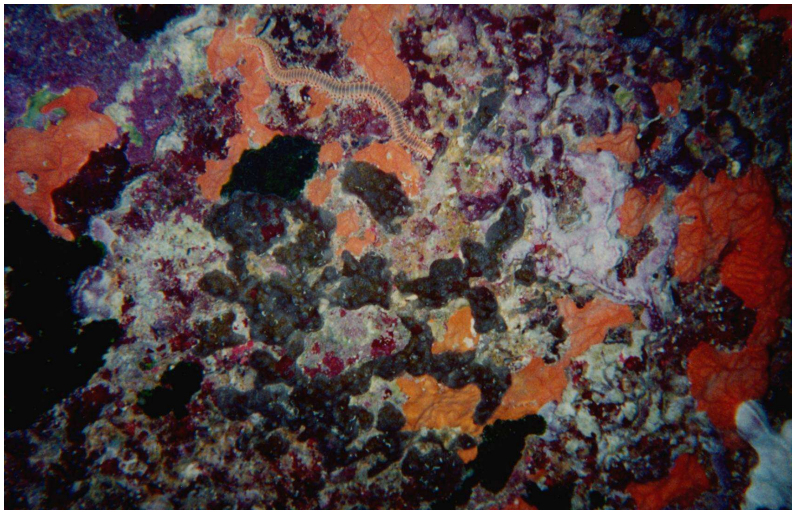
The biological community is the base for all typologies

On rocky substratum

Photophilic algae







Sciaphilic algae

The Mediterranean benthic bionomics: 60 years of history

- From the early 50's, a group of marine biologists working in the "*Station Marine d'Endoume*" (University of Marseille), guided by J.M. Pérès & J. Picard, began to develop new methods of research on the Mediterranean benthos and more particularly on its bionomy, because at that time the word ecology was still not in common use.
- The terms "bionomy" or *bionomics* are still in use

Some key papers on the Mediterranean benthic bionomics

- 1) Pérès J. M. & J. Picard, 1951. Nouvelle carte des fonds du Golfe de Marseille. *Vie et Milieu*, 7 p. avec carte.

  (2) Pérès J. M. & J. Picard, 1955. Biotopes et biocoenoses de la Méditerranée occidentale comparées à ceux de la manche et de l'Atlantique nord-oriental. *Arch. zool. Exp. géné*., 92 (1), 1-71.

  (3) Pérès J. M., 1961. Océanographie biologique et Biologie Marine. Vol. 1 « Vie benthique », *Presses universitaires de France*, *Paris*, 541 p.

  (4) Pérès J. M. & J. Picard, 1964. Nouveau manuel de Bionomie benthique de la Mer Méditerranée. *Recueil des Travaux de la Station Marine d'Endoume*, 47 (31), 3-137.

  (5) Pérès J. M, 1982. Ocean Management. *In* : Marine Ecology Ed. O. Kinne, *Wiley*, *London*, 5 (1), 642 p.

Bio-nomics

- **Bio** from the Greek *βίος* = life
- **nomi** from the Greek *νομή* = distribution

Ecole d'Endoume (1951-1982)

- For three decades a postgraduate education in France in marine biology and biological oceanography was created at the *Station Marine d'Endoume* (University of Aix-Marseille II, of which the Marine Station was a part).
- The *"Nouveau manuel de Bionomie benthique de la Mer Méditerranée"* is still available and is stil a basic book for any oceanographer and marine biologist working in the Mediterranean.
- It gave rise to the school of marine bionomics, internationally known as the *Ecole d'Endoume* which has influenced many oceanographic disciplines as well as the ***typology*** of the European marine ecosystem.

Why we need a typology?

Educational approach

The subdivision of the Earth ecosystem in habitat types (typology) facilitates their description and study

Management approach

All the EU or UN legal texts concerning the management of water systems refer to different types of waters proposing adequate management actions or measures

Example:

the EU Directive 91/271/EEC on waste water treatment proposing

- Primary treatment in oligotrophic waters
- Secondary treatment in mesootrophic waters
- Tertiary treatment in eutrophic waters

Typology and legal framework

Types of biological communities

The legal instrument for the protection of the Mediterranean Sea is the “Barcelona Convention” signed during the ’70 by all the Mediterranean States (+ the EEC) under the UN guidance. In the BARCOM annex a list of biological communities under protection status is given

Habitat types

The Habitat Directive 92/43/EEC describes 9 marine habitat types and clams the sustainable management of each type

Water body types

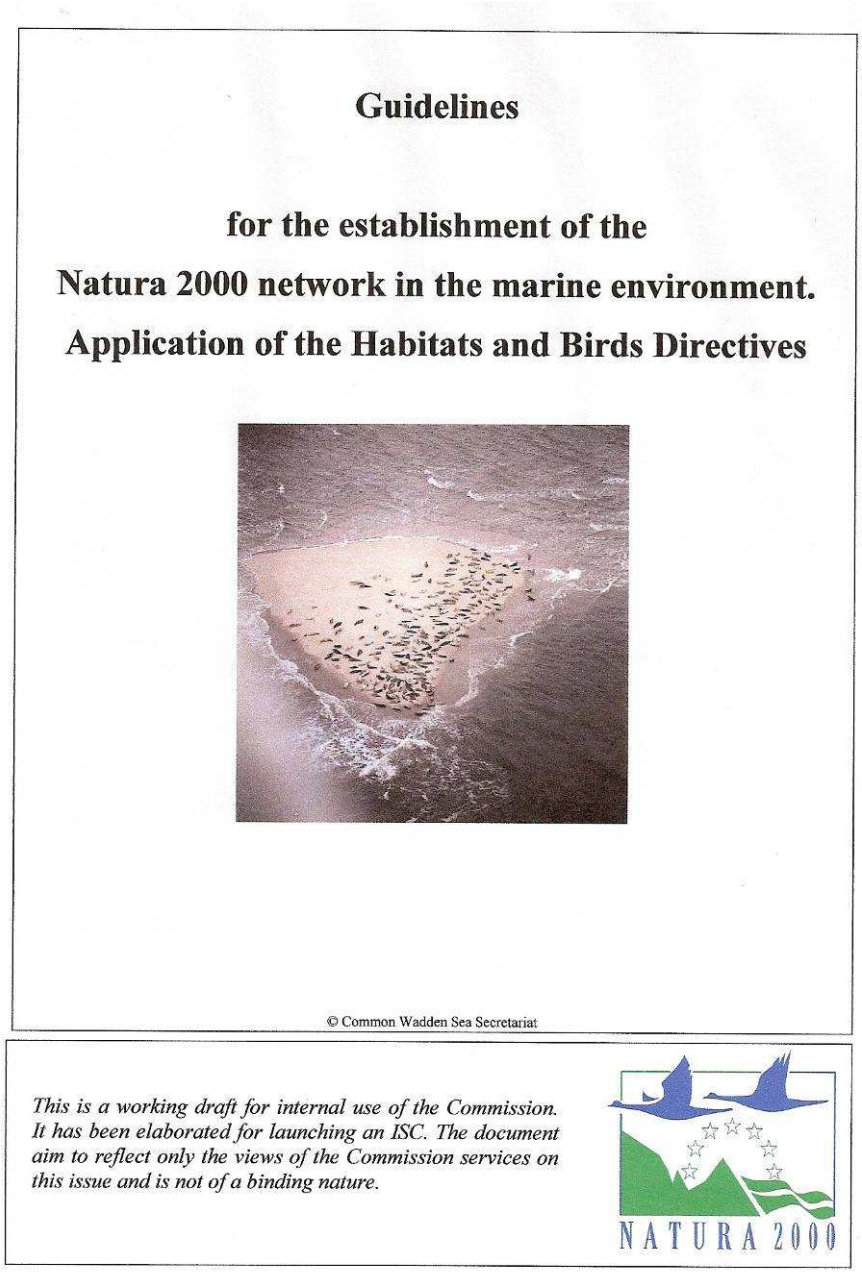
The Water Framework Directive 2000/60/EC refers to water body types and clams for a “*good ecological status*” of all European water bodies until 2015

Marine and coastal habitat types under the 92/43/EEC and Barcelona Convention

- Habitat type 1110 : sandbanks
- Habitat type 1120 (Posidonia meadows)
- Habitat type 1130 (estuaries)
- Habitat type 1140 (mudflats)
- Habitat type 1150 (coastal lagoons)
- Habitat type 1160 (large shallow inlets & bays)
- Habitat type 1170 (reefs)
- Habitat type 1180 (Submarine structures made by leaking gases)
- Habitat type 8330 (Marine caves submerged or semi-submerged)

Marine and coastal habitat types under the 92/43/EEC and Barcelona Convention

- Although these types are described under geo-morphological terms, there is a direct link between them and the biological communities included in the Barcelona Convention.
- On the Greek coasts occur some good examples of the habitat types described in the Annex I of the EU “Habitats” Directive (92/43/EEC).



Guidelines

for the establishment of the

Natura 2000 network in the marine environment.

Application of the Habitats and Birds Directives

This is a working draft for internal use of the Commission. It has been elaborated for launching an ISC. The document aim to reflect only the views of the Commission services on this issue and is not of a binding nature.

NATURA 2000

The 1110 habitat type: sandbanks

- Sandbanks are elevated, elongated, rounded or irregular topographic features, permanently submerged and predominantly surrounded by deeper water.
- They consist mainly of sandy sediments, but larger grain sizes, including boulders and cobbles, or smaller grain sizes including mud may also be present on a sandbank.

1110 under Barcelona Convention

- “Biocenosis of fine sands in very shallow waters (III. 2. 1.) facies with *Lentidium mediterraneum* (III. 2. 1. 1.)”,
- “Biocenosis of well sorted fine sands (III. 2. 2.) associations with *Cymodocea nodosa* (III. 2. 2. 1.) with *Halophila stipulacela* (III. 2. 2. 2), the latter considered determinant habitat”
- “Biocenosis of coarse sands and fine gravels mixed by the waves (III. 3. 1.) with association with rhodolithes (III. 3. 1. 1), considered determinant habitat
- “Biocenosis of coarse sands and fine gravels under the influence of bottom currents (also found in the Circalittoral) (III. 3. 2.)

1110 under Barcelona Convention

- It is possible to find a facies and an association which are determinant habitats: the maërl facies (= Association with *Lithothamnion corallioides* and *Phymatoliton calcareum*), also found as facies of the biocenosis of coastal detritic (III. 3. 2. 1), and the association with rhodolithes (III. 3. 2. 2.)”,
- “Biocenosis of infralittoral pebbles (III. 4. 1.) with facies with *Gouania wildenowi* (III. 4. 1. 1.), small teleostean which lives among pebbles.”

Mediterranean “sandbanks”= sandy coasts under high wave action

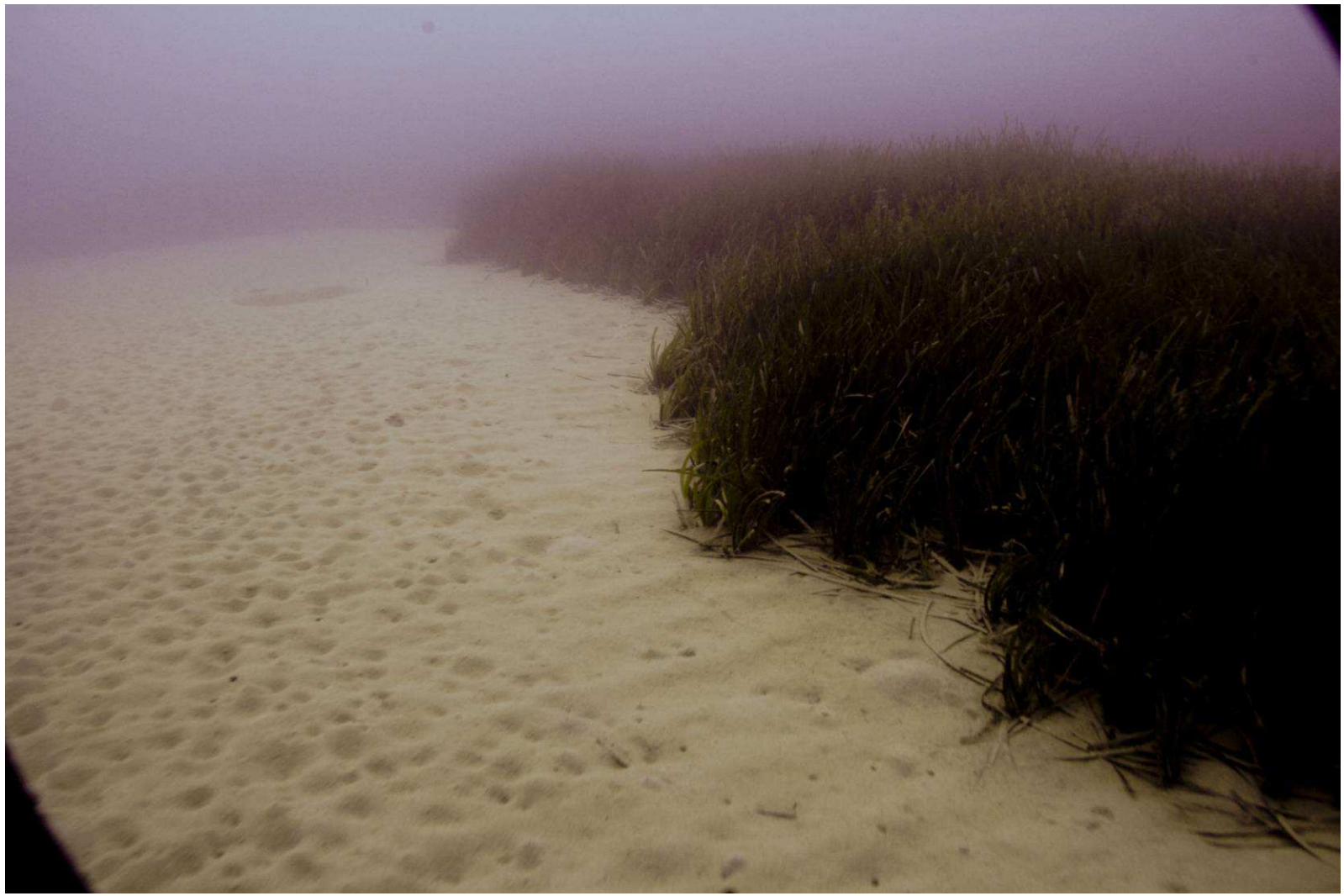
Depth: 0 m

Biocenosis of fine sands in very shallow waters

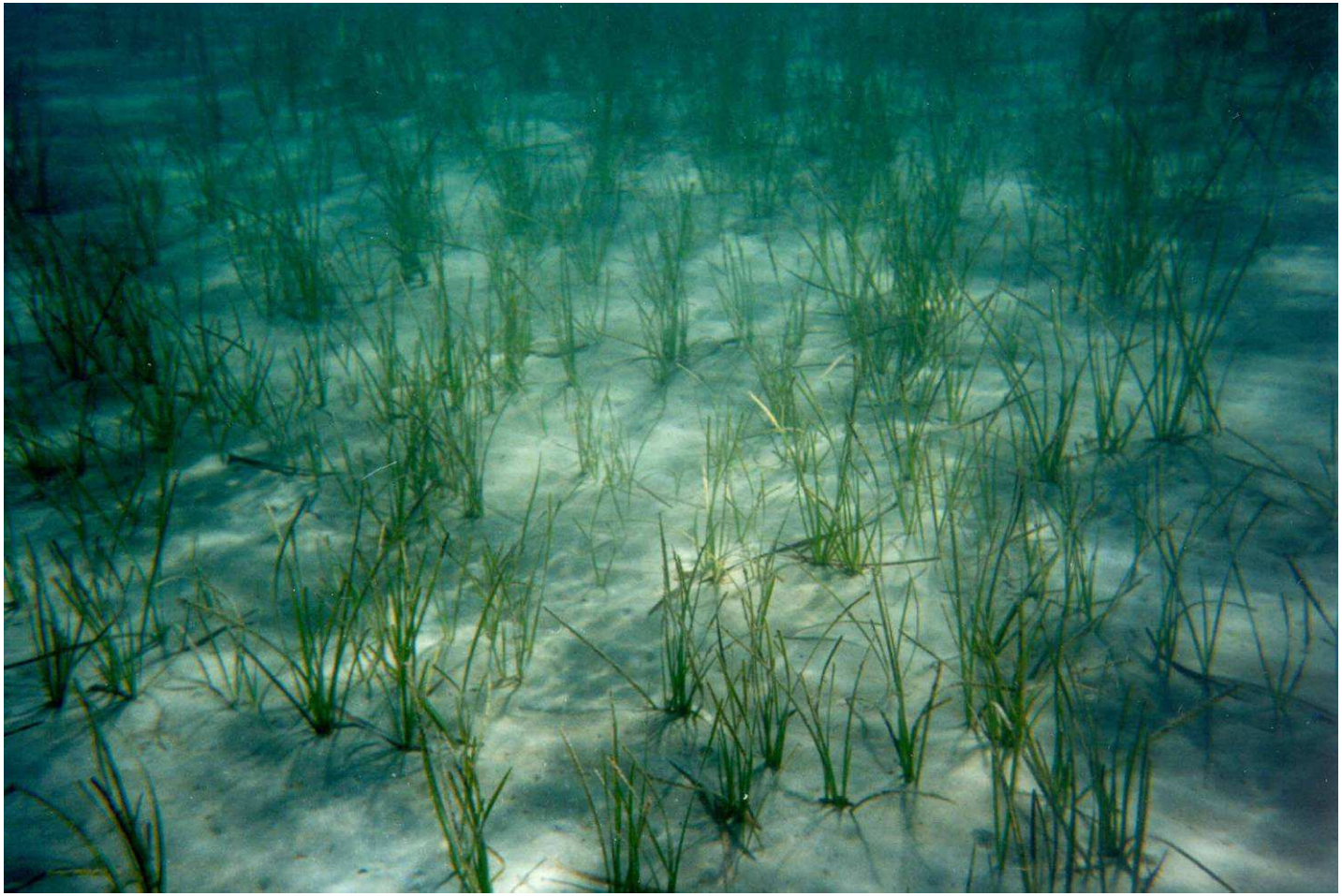
Depth: 12m

Biocenosis of well sorted fine sands

1110 without vegetation
Upper limit of *Posidonia oceanica* : 14,7m



1110 with *Cymodocea nodosa*

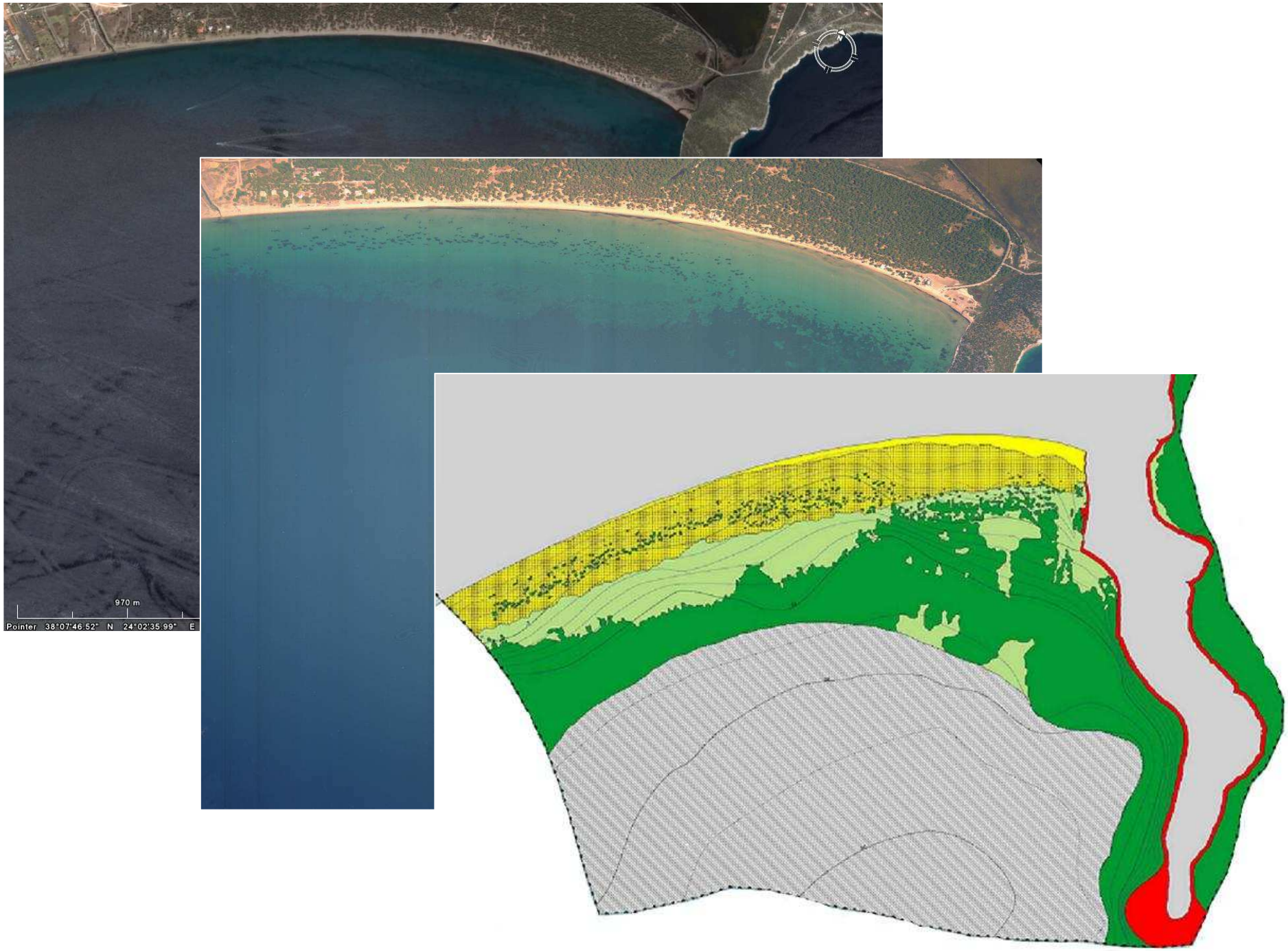


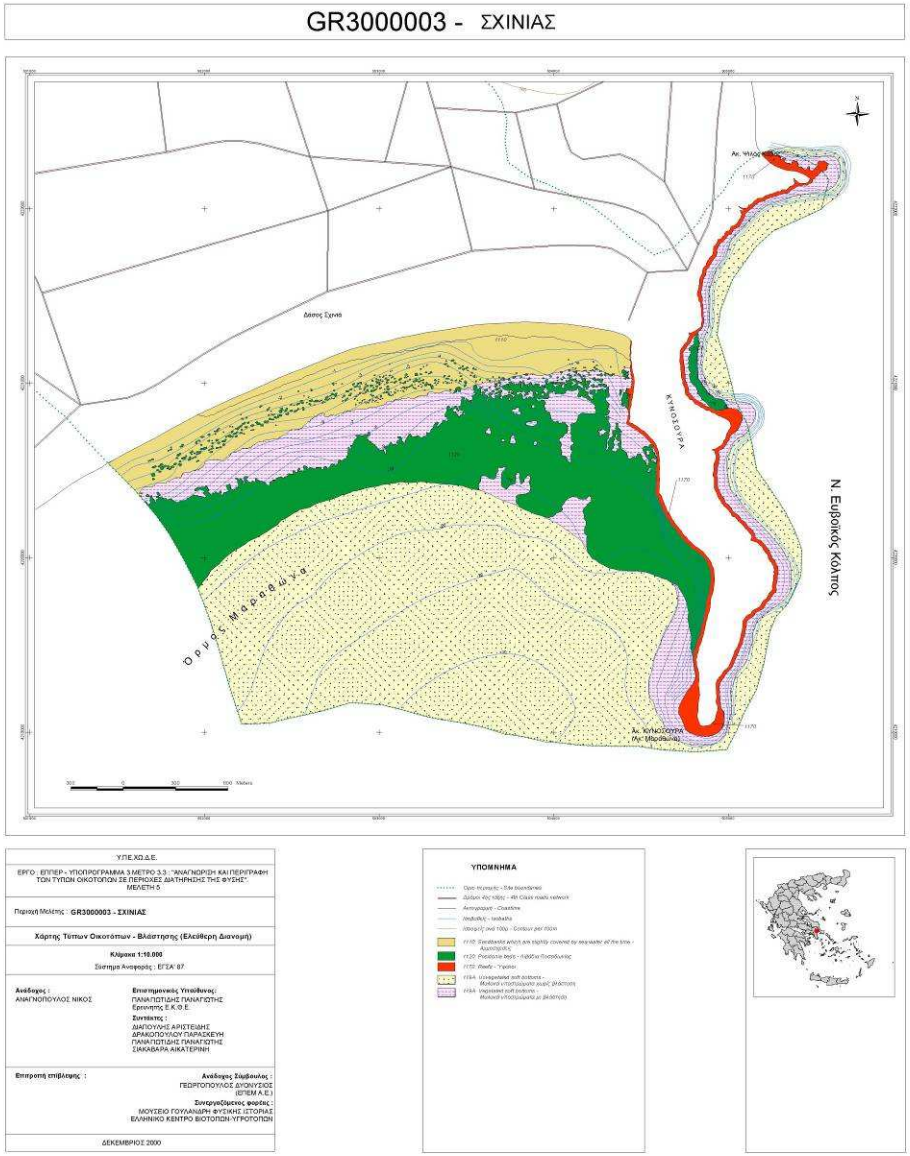
1110, associated terrestrial vegetation

1110, associated terrestrial vegetation

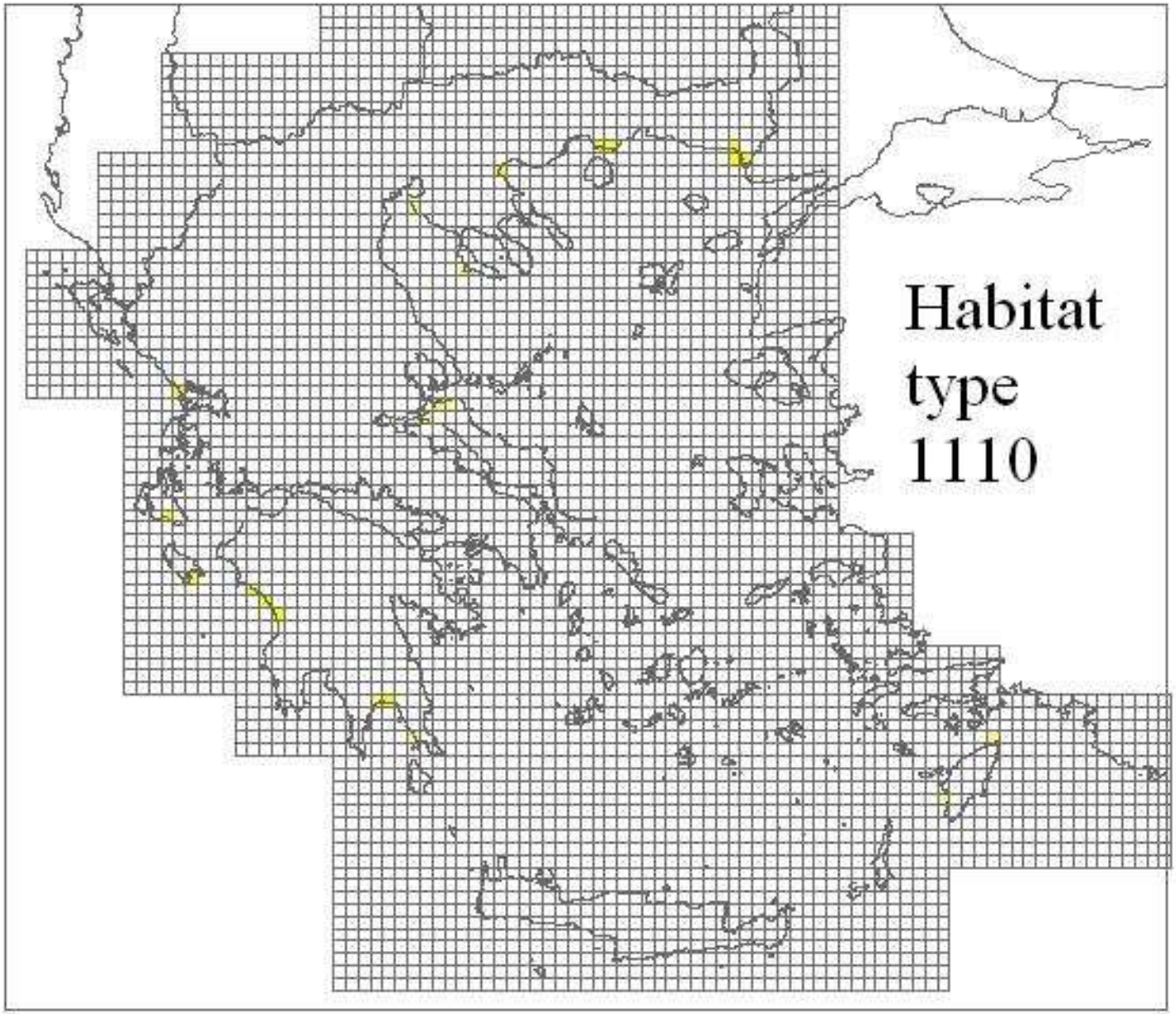
1110 associated with *Caretta caretta* nesting sites

1110 associated with *Caretta caretta* nesting sites


970 m
Pointer 38°07'46.52" N 24°02'35.99" E



Mapping 1110


Habitat
type
1110

1110

management problems

1110 management problems

Habitat type 1120 (Posidonia meadows)

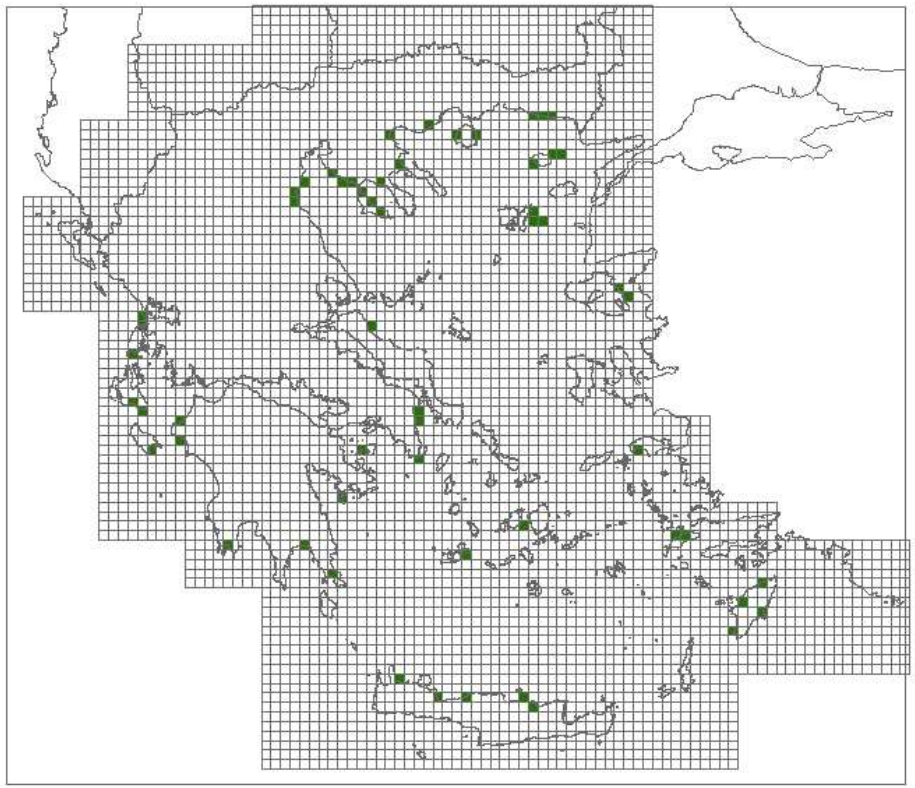
- Posidonia meadows are the most common biological feature on the Aegean as well as on the Ionian coasts
- They grow from the surface down to 15-20 m depth in the north part of Aegean and down to 25-30 in the southern part. In the Ionian sea the lower limit goes down to 35-40 m depth
- In the gulfs of the mainland the deeper limit is always less deep that in the islands

Habitat type 1120 (Posidonia meadows)

Habitat type 1120 (Posidonia meadows)

- According to the Barcelona Convention typology, in the habitat type "Posidonia meadows" (BC type III. 5. 1.) two ecomorphosis are described:

1. The ecomorphosis of striped meadows (III. 5. 1. 1.) and the ecompphosis of barrier-reef meadows (III. 5. 1. 2.)
2. A facies of dead “mattes” without much epiflora and an association with *Caulerpa prolifera* has also to be added.



Habitat type 1120
Disridution on the Greek coasts

Habitat type 1120 (Posidonia meadows)

1120 management problems

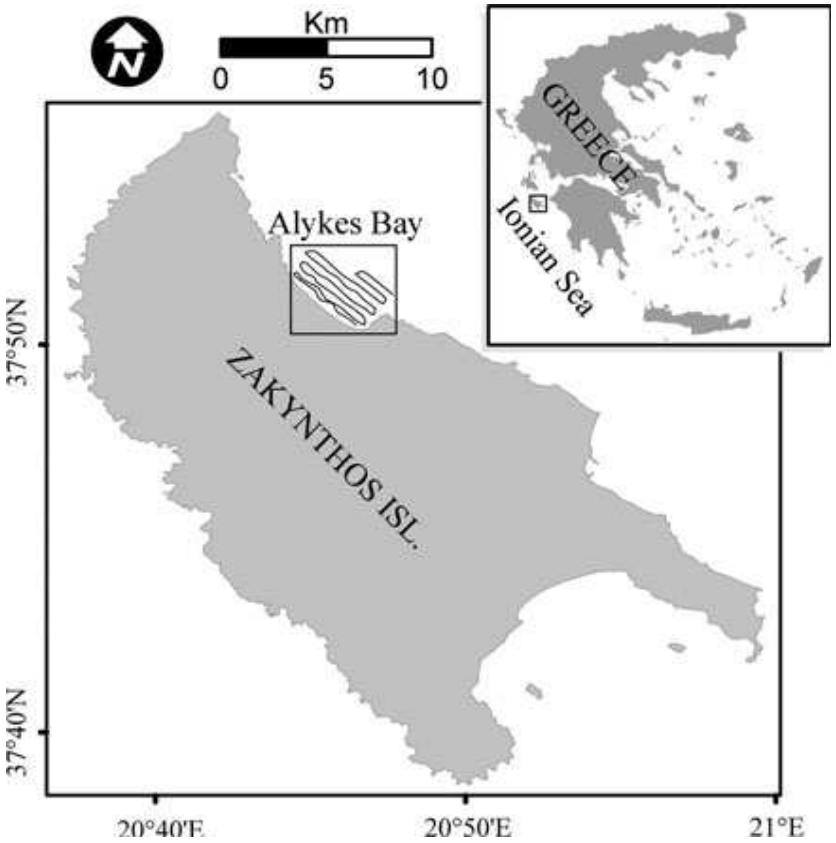
Inappropriate fishing activities

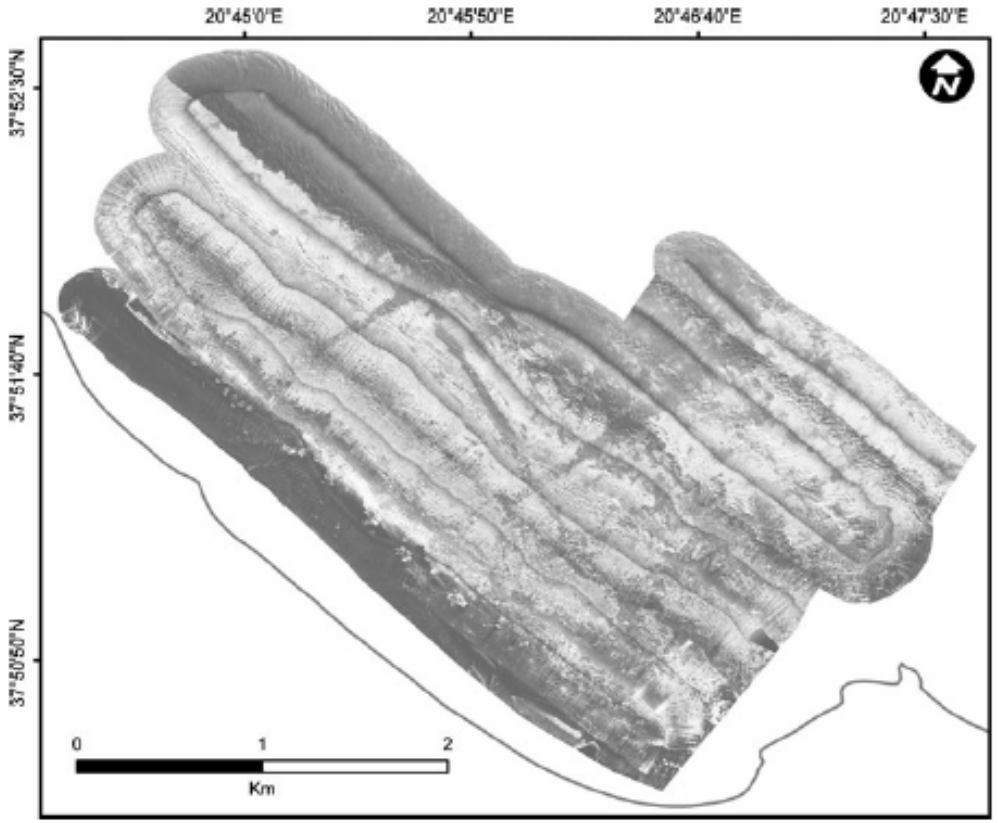
Need to balance between sustainable exploitation of resources and conservation

Identify those fishing activities that have a significant impact on the environment and that therefore must be banned.

A case study on Zakynthos coasts

Source: Kyparissis *et al*., 2010





Georeferenced side scan sonar mosaic of the Alykes Bay seafloor: light tones represent areas of high seabed reflectivity while dark tones represent areas of low
seabed reflectivity

Source: Kyparissis *et al*., 2010

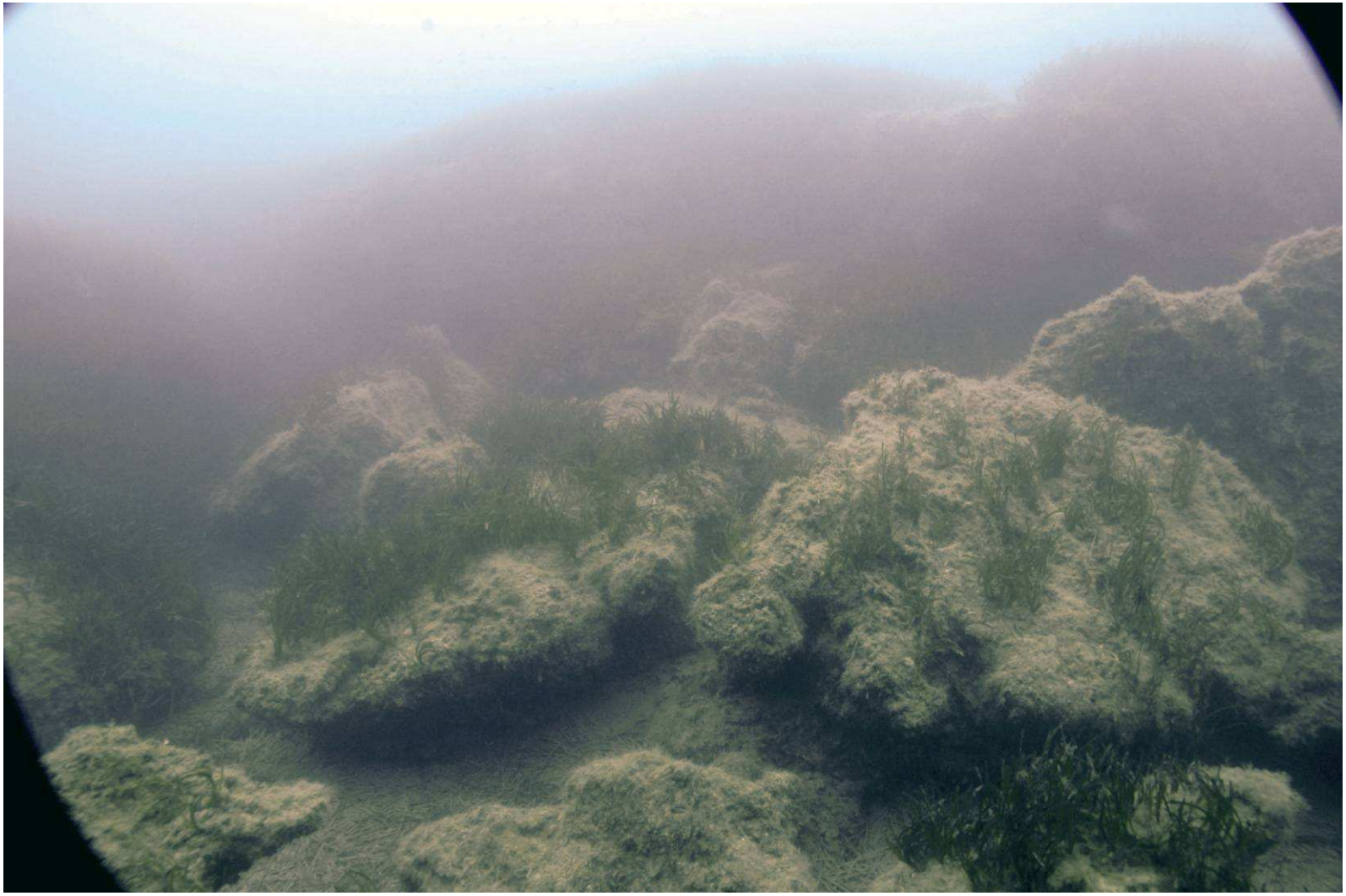
Posidonia oceanica meadow area affected by trawling, showing the distinct furrow created by an otter door. The furrow was about 2 m wide and the destroyed area was under extensive *Caulerpa racemosa* colonization.

Extensive spread of the polychaete *Sabella pavonina*, among *Caulerpa racemosa* fronds in the affected meadow areas.

Trawling impact on Posidonia meadows

Trawling impact on Posidonia meadows

Trawling impact on Posidonia meadows



Slow regeneration

Habitat type 1130 (estuaries)

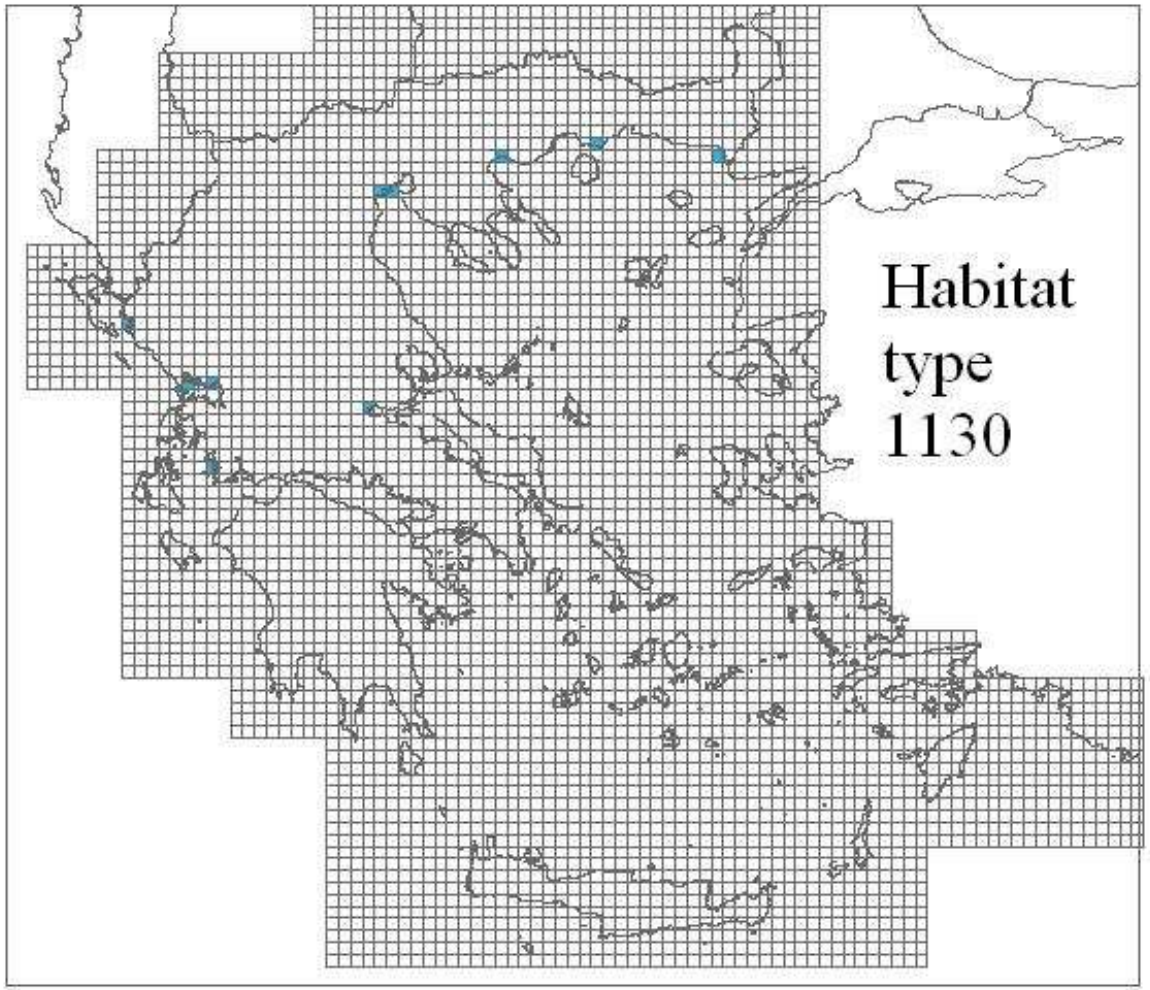
- On the Mediterranean coastline there are no estuaries comparable to the Atlantic ones due to the low tidal activity in the Mediterranean Sea. Nevertheless, on the Mediterranean coastline important salinity gradients are observed near the river mouths and the marine vegetation and animal life is adapted to this specific feature.
- Thus, the main ecological factor determining the presence of habitat type 1130 is fresh water coming to the sea surface from a river or stream during the wet period of the year (October to May) and marine water entering the deeper part of river mouth during the dry period of the year (June to September)

Habitat type 1130 (estuaries)

- On the Aegean coastline typical examples of 1130 occur near Evros, Nestos, Strymon and Axios rivers, where a clear gradient of salinity is observed in large marine areas.
- On the Ionian coastline there are some examples of the 1130 habitat type limited in the vicinity of Kalamas, Louros, Arachthos and Axeloos river.
- The gradient of salinity is reflected on a gradient of vegetation from *Ruppia maritima* and *Zostera noltii* seagrass meadows near the river mouth to *Cymodocea nodosa* and *Posidonia oceanica* towards the open sea.

Habitat type 1130 (estuaries)

Habitat type 1130 (estuaries)



Habitat type 1140 (mudflats)

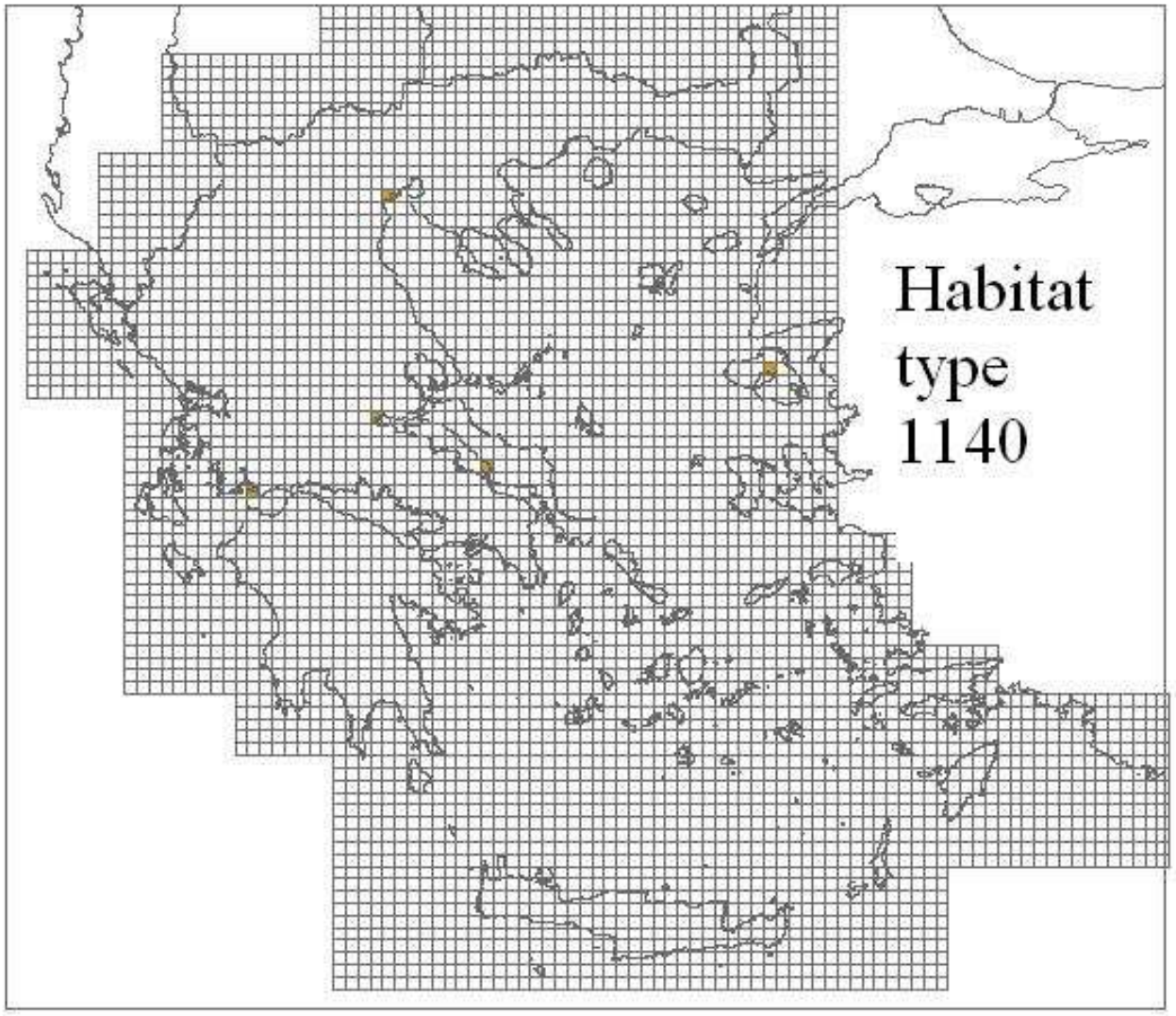
- The ecological characteristic determining the presence of habitat type 1140 is the presence of shallow and flat bottom covered with mud. Typical examples of habitat type 1140 occur in sites of the north Aegean coasts (Thessaloniki gulf, Porto Lagos) and north Evoikos coasts (Atalandi). In the Ionian coasts habitat type 1140 occur only in semi closed areas as Amvrakikos gulf or near river mouths (Kalamas).
- Vegetation in this habitat type is not permanent due to periodic exposure of the bottom to climate factors that prevail during the low tide. Nevertheless, there are species that can grow during certain periods of time on mudflats of the type 1140 like the sea grass *Zostera noltii* and *Cymodocea nodosa*.

Habitat type 1140 (mudflats)

Habitat type 1140 (mudflats)

- According to the Barcelona Convention typology, the habitat type 1140 can host the following biocenosis:
- Biocenosis of supralittoral sands (BC type I. 2. 1.), facies of phanerogam leaves which have been washed ashore.
- Biocenosis of slowly drying wracks (I. 3. 1.)
- Biocenosis of mediolittoral coarse detritic bottoms (II. 3. 1.), facies of banks of dead leaves of Posidonia oceanica and other phanerogams (II. 3. 1. 1.).

Habitat type 1140 (mudflats)

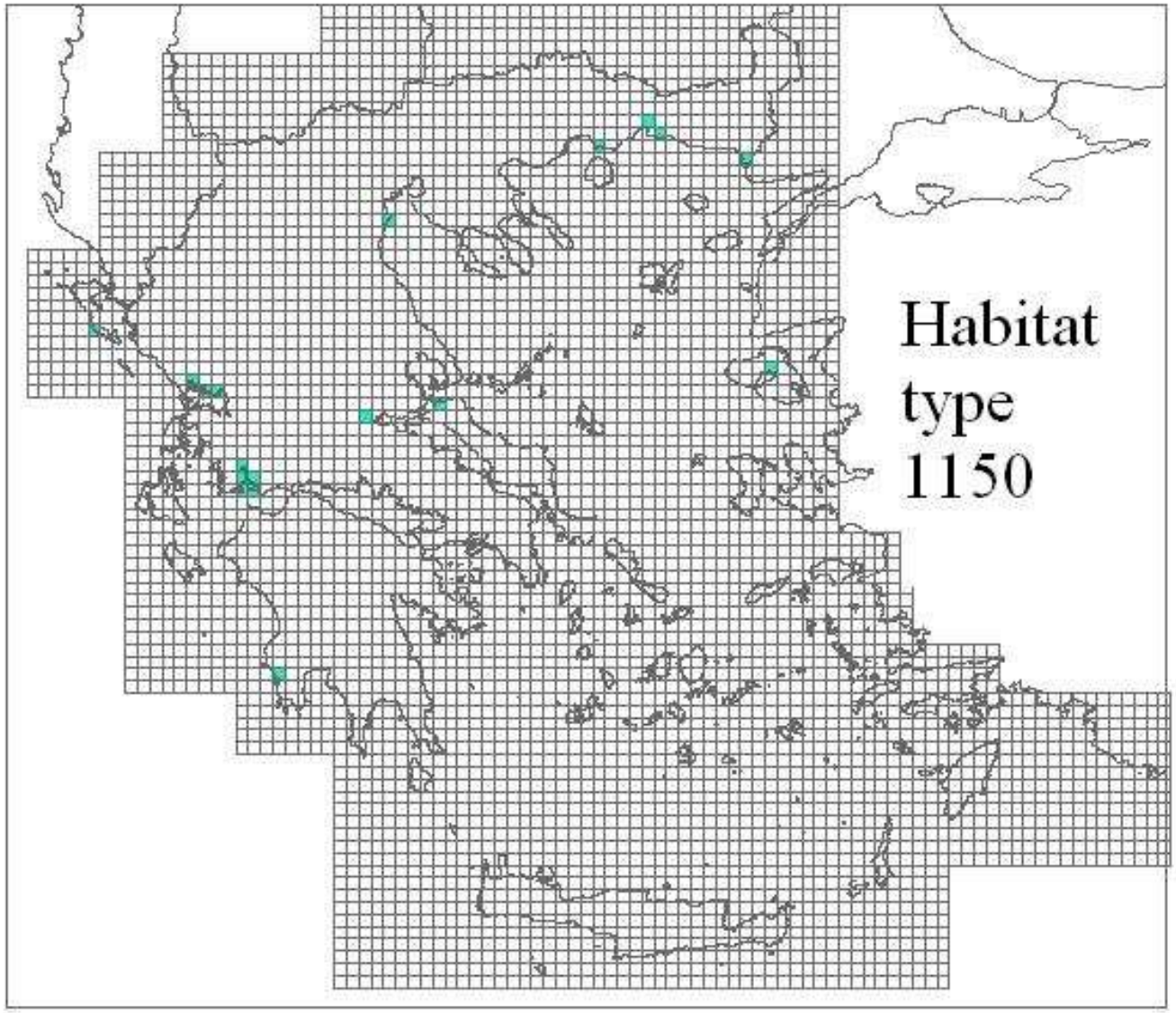


Habitat type 1150 (coastal lagoons)

- Typical examples of habitat type 1150 occur in North Aegean sites.
- The type of vegetation in this habitat type depends on salinity.
- In some sites there is vegetation similar to habitat type 1160 (shallow inlets), such as the populations of *Cystoseira barbata* and nitrophilus Chlorophytes.
- At other sites there is vegetation similar to habitat type 1130 (estuaries), such as the populations of *Ruppia maritima*, and *Zostera noltii*.

Habitat type 1150 (coastal lagoons)

Habitat type 1150 (coastal lagoons)



Habitat type 1160 (shallow inlets)

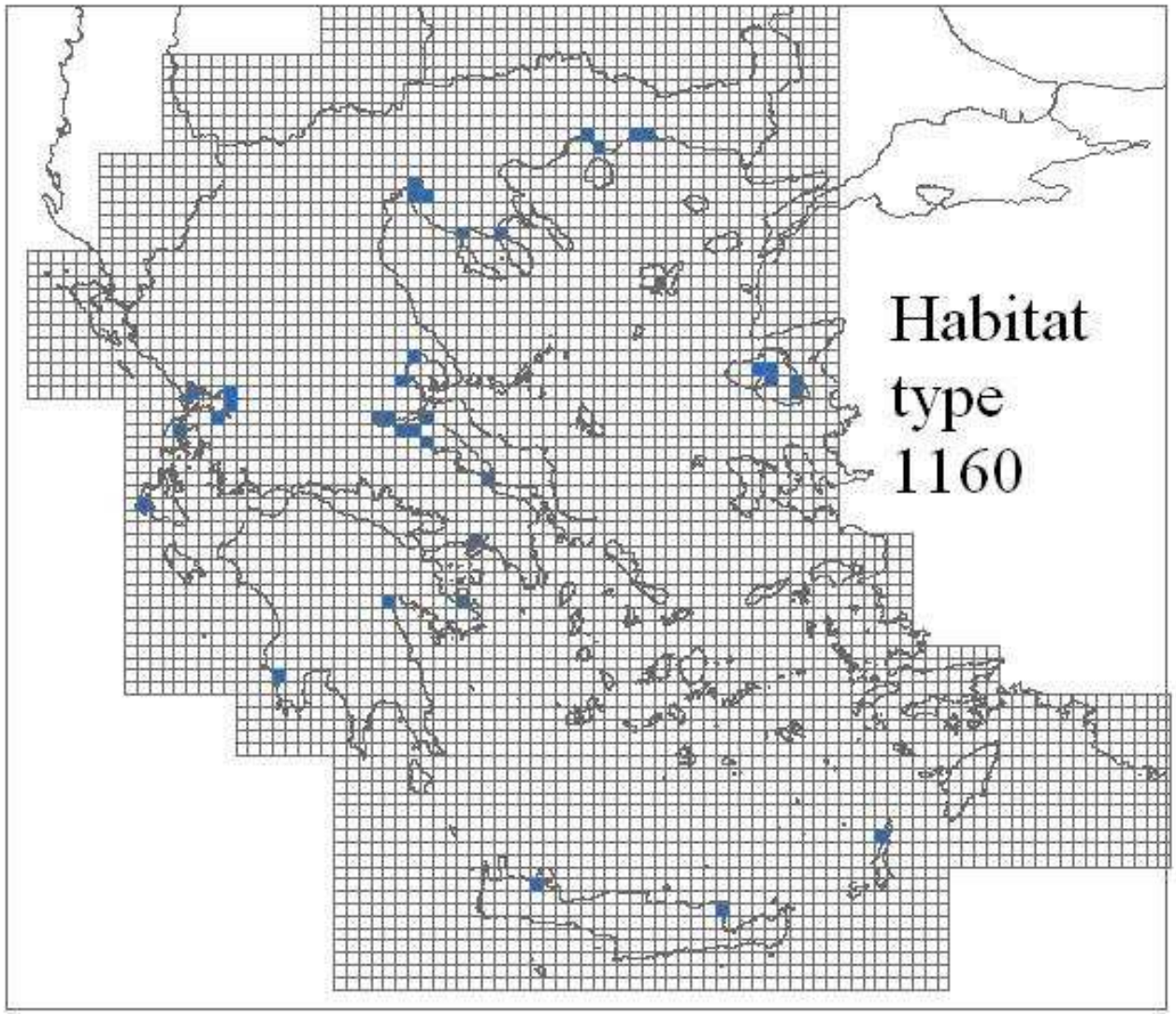
- The main ecological characteristic of the habitat type 1160 is the presence of semi closed bay where the depth does not exceed the 10-15 m. Good examples of the habitat type 1160 occur in many gulfs of the Aegean (Thessaloniki, Gera, Kalloni, Elefsis), as well as of the Ionian coasts (Amvrakikos, Pylos).
- Meadows of the Angiosperm *Cymodocea nodosa* are the dominant vegetation elements, as well as the populations of some *Cystoseira* species, such as *Cystoseira barbata* and *Cystoseira schiffneri*, growing on small stones and shells in low hydrodynamic conditions.
- During the last decade of the 20th century the invasive Lesepsian Chlorophyte *Caulerpa racemosa* is rapidly covering the muddy sands of habitat type 1160.

Habitat type 1160: shallow inlets &bays

Habitat type 1160 (shallow inlets)

- The habitat type 1160 corresponds to the Barcelona Convention “Biocenosis of superficial muddy sands in sheltered waters” (BC type III. 2. 3), also known as SVCM according Peres & Picard (1964). The following associations are included:
- Association with *Cymodocea nodosa* on superficial muddy sands in sheltered waters (BC type III. 2. 3.
- Association with *Zostera noltii* on superficial muddy sands in sheltered waters (BC type III. 2. 3. 5)
- Association with *Caulerpa prolifera* on superficial muddy sands in sheltered waters (BC type III. 2. 3. 6.)

Habitat type 1160 (shallow inlets)



1130, 1140, 1150, 1160 management problems

Inappropriate fishing & aquaculture activities

Port & industrial infrastructures

Need to balance between sustainable exploitation of resources and conservation

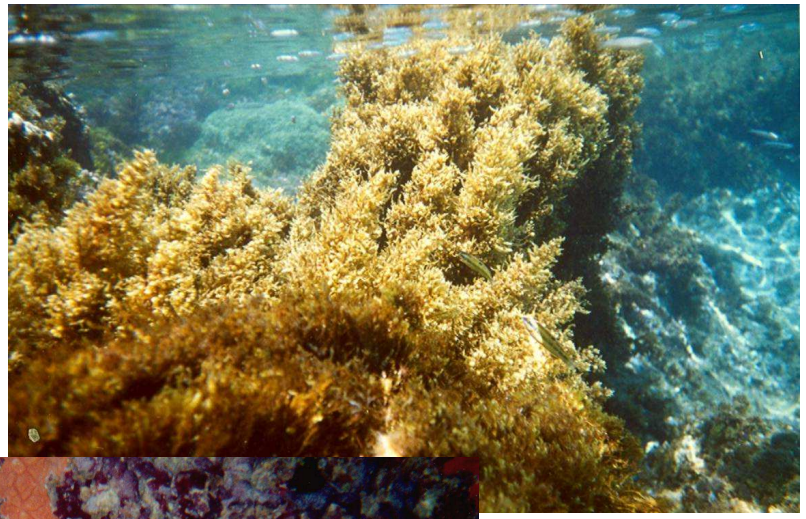
Identify those human activities that have a significant impact on the environment and that therefore must be banned.

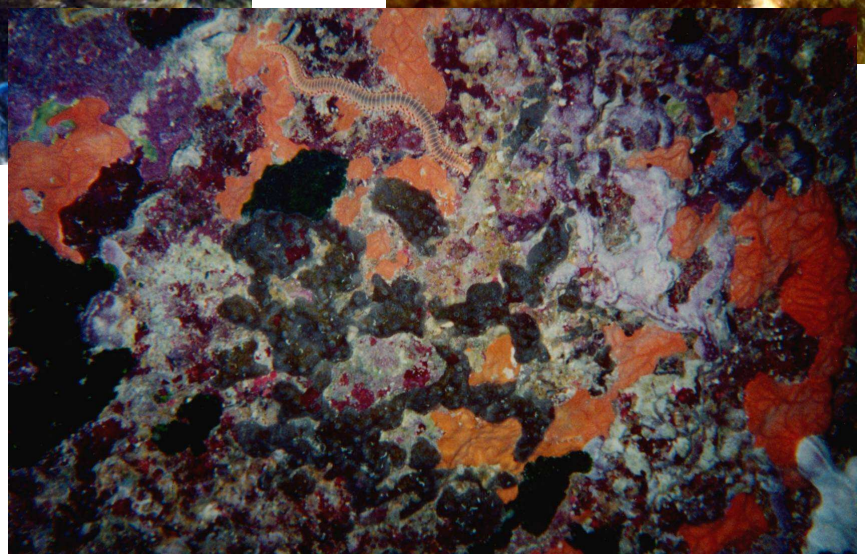

ISUZU

Habitat type 1170 (reefs)

- The geomorphological term “reefs” describes isolated rocky substarta surrounded by deeper waters, near the coast or offshore.
- At the upper part of these substrata the light conditions are favourable to the growth of photophilic algae, which can form a divers and well structured vegetation (canopy, bushy, grass & encrusting layers).
- At the deeper part sciaphilic algae are usually present.

Habitat type 1170 (reefs)





Habitat type 1170 (reefs)

- In the habitat type 1170 could be included the following algal associations which are described under the term “Biocenosis of infralittoral algae” in the Barcelona Convention (BC types III.6.1),
- III. 6. 1. Biocenosis of infralittoral algae
- III. 6. 1. 2. Association with *Cystoseira amentacea (* var. *amentacea*,
- var. *stricta*, var. *spicata)*
- III. 6. 1. 5. Association with *Corallina elongata* and *Herposiphonia secunda*
- III. 6. 1. 6. Association with *Corallina officinalis*
- III. 6. 1. 7. Association with *Codium vermilara* and *Rhodymenia ardissonei*
- III. 6. 1. 8. Association with *Dasycladus vermicularis*
- III. 6. 1. 9. Association with *Alsidium helminthochorton*

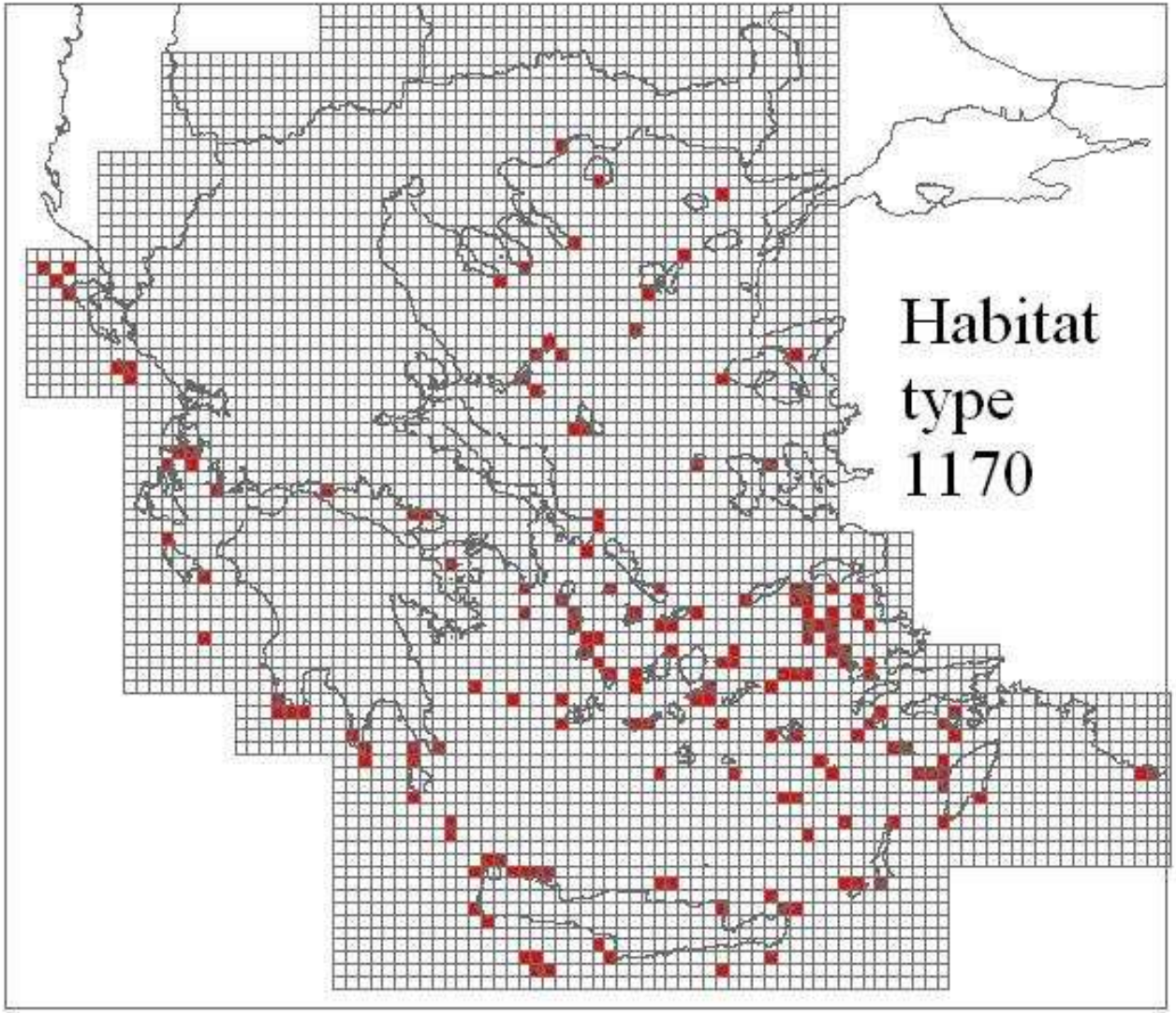
Habitat type 1170 (reefs)

- III. 6. 1. 10. Association with *Cystoseira tamariscifolia* and S*accorhiza polyschides*
- III. 6. 1. 11. Association with *Gelidium spinosum v. hystrix*
- III. 6. 1. 12. Association with *Lobophora variegata*
- III. 6. 1. 13. Association with *Ceramium rubrum*
- III. 6. 1. 15. Association with *Cystoseira brachycarpa*
- III. 6. 1. 16. Association with *Cystoseira crinita*
- III. 6. 1. 17. Association with *Cystoseira crinitophylla*
- III. 6. 1. 18. Association with *Cystoseira sauvageauana*
- III. 6. 1. 19. Association with *Cystoseira spinosa*
- III. 6. 1. 20. Association with *Sargassum vulgare*

Habitat type 1170 (reefs)

- III. 6. 1. 21. Association with *Dictyopteris polypodioides*
- III. 6. 1. 22. Association with *Calpomenia sinuosa*
- III. 6. 1. 23. Association with *Stypocaulon scoparium* (*=Halopteris scoparia)*
- III. 6. 1. 24. Association with *Trichosolen myura* and *Liagora farinosa*
- III. 6. 1. 25. Association with *Cystoseira compressa*
- III. 6. 1. 26. Association with *Pterocladiella capillacea* and *Ulva*
- *laetevirens*
- III. 6. 1. 28. Association with *Pterothamnion crispum* and *Compsothamnion thuyoides*
- III. 6. 1. 29. Association with *Schottera nicaeensis*
- III. 6. 1. 30. Association with *Rhodymenia ardissonei* and *Rhodophyllis divaricata*
- III. 6. 1. 32. Association with *Flabellia petiolata* and *Peyssonnelia squamaria*
- III. 6. 1. 33.Association with *Halymenia floresia* and *Halarachnionligulatum*
- III. 6. 1. 34. Association with *Peyssonnelia rubra* and *Peyssonnelia* spp.
- To these associations two specific formations have to be added:
- III. 6. 1. 1. Overgrazed facies with encrusting algae and sea urchins
- III. 6. 1. 35. Facies and Associations of Coralligenous biocenosis (in enclave)

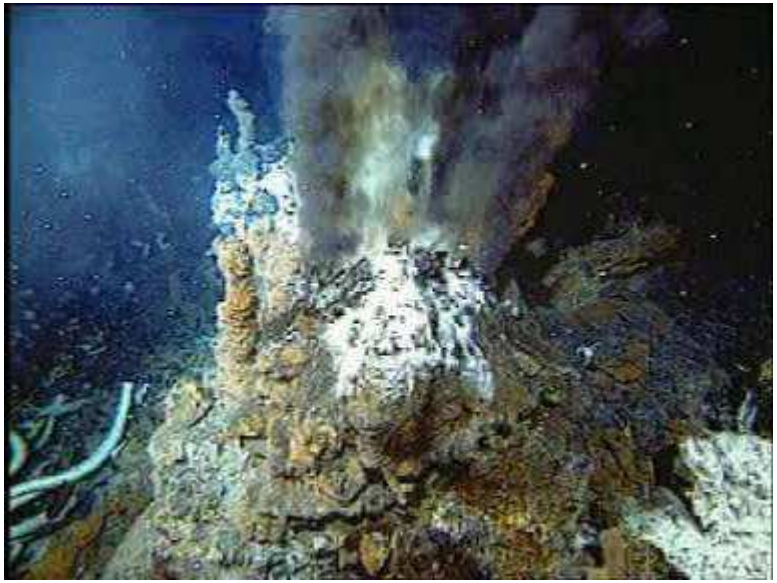
Habitat type 1170 (reefs)

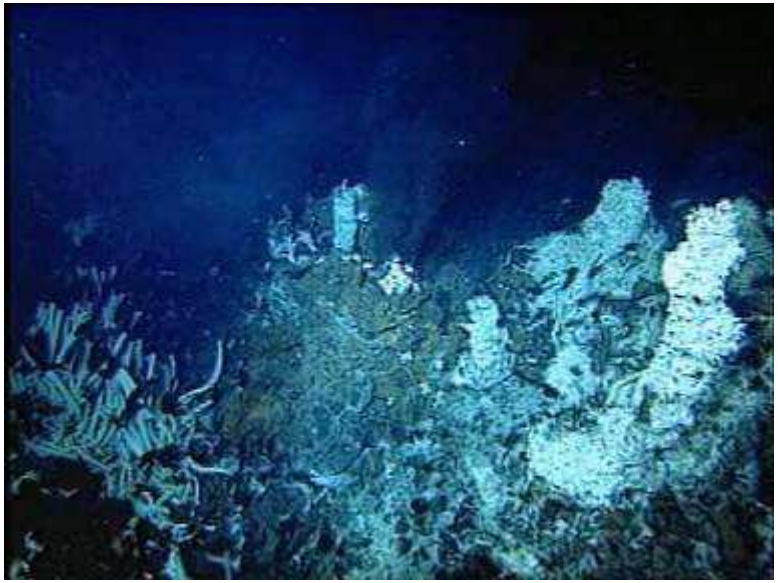


Habitat type 1180 (Submarine structures made by leaking gases)

- Habitat present ?
- Methane seeps & carbonate crusts reported, often associated with mud volcanoes,
- see eg Olu-le Roy et al 2OO4;
- Foucher, 2009;
- Pape *et al*, 2010 Probable pockmarks reported by Hasiotis et al (2002)

Habitat type 1180 (Submarine structures made by leaking gases)



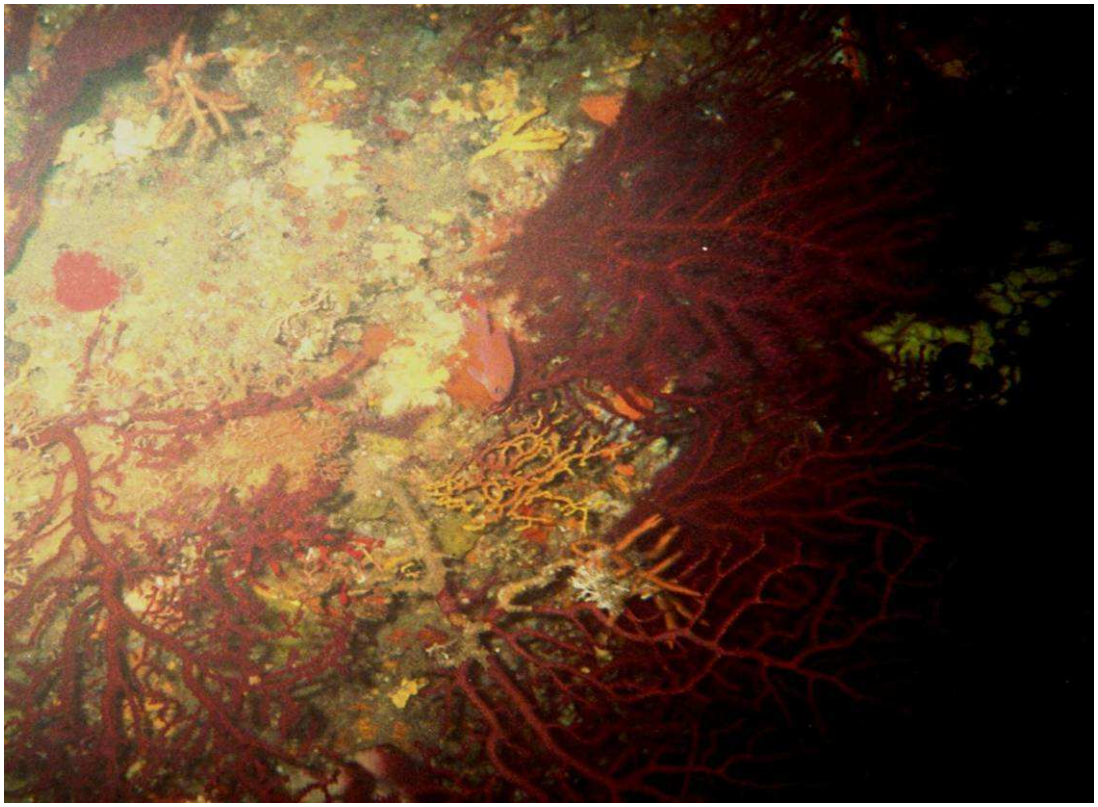


Habitat type “Marine caves submerged or semi-submerged” (code 8330)

- Marine caves were observed along many rocky calcareous coasts. The dominant vegetation was the sciaphilic association *Udoteo-Aglaothamnietum tripinatum*.
- The most common species were *Flabella petiolata*, *Peyssonnelia squamaria* and *Peyssonnelia rubra*. Good examples of the habitat type 8330 in the Aegean occur in the marine park of Sporades archipelago and the Cyclades archipelago.
- In the Ionian coasts good examples of the habitat type 8330 occur in the Echinades archipelago, as well as in Zakynthos, Kefalonia and Corfu islands.

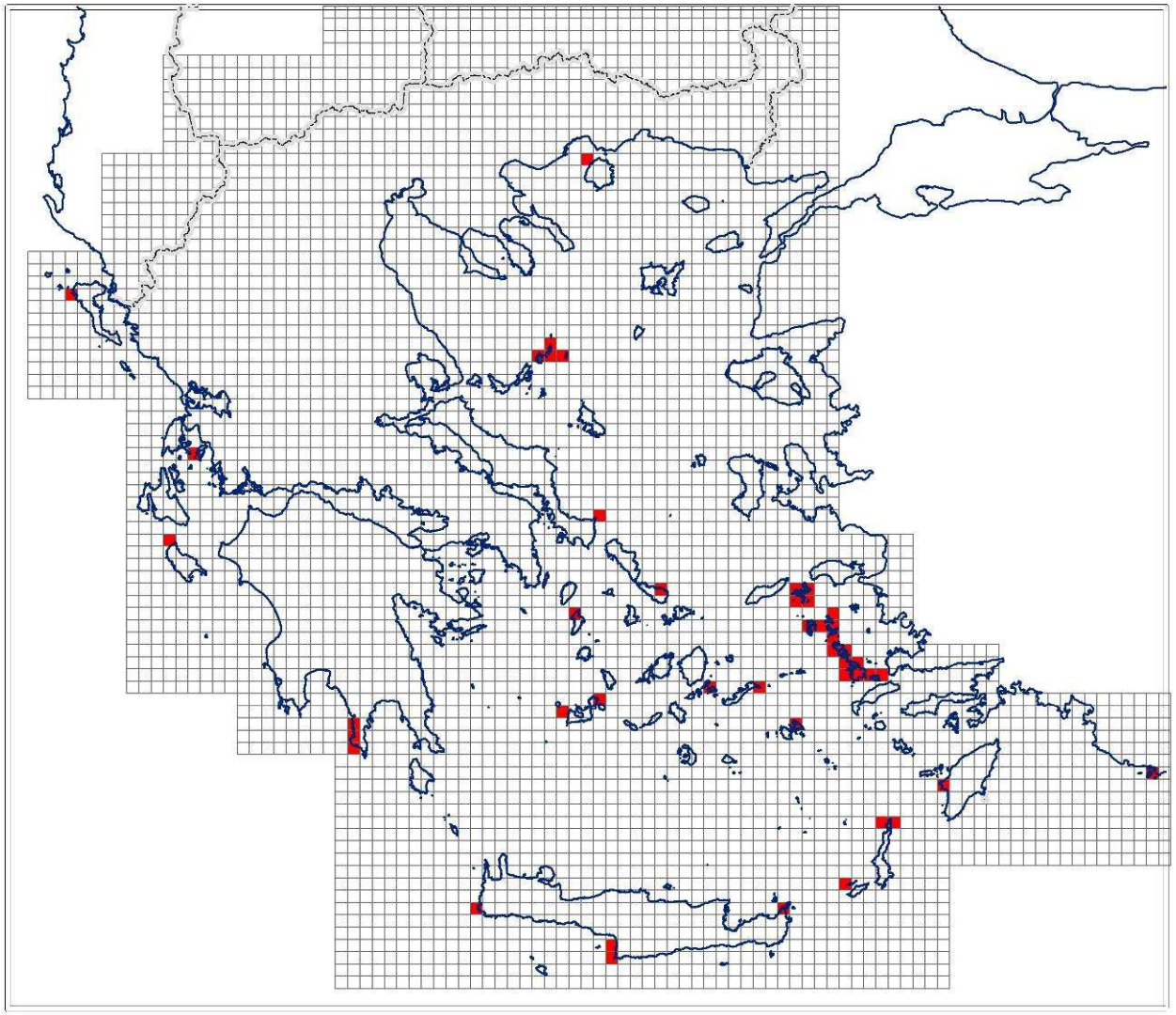
Habitat type “Marine caves submerged or semi-submerged” (code 8330)

Habitat type “Marine caves submerged or semi-submerged” (code 8330)



Habitat type “Marine caves submerged or semi-submerged” (code 8330)

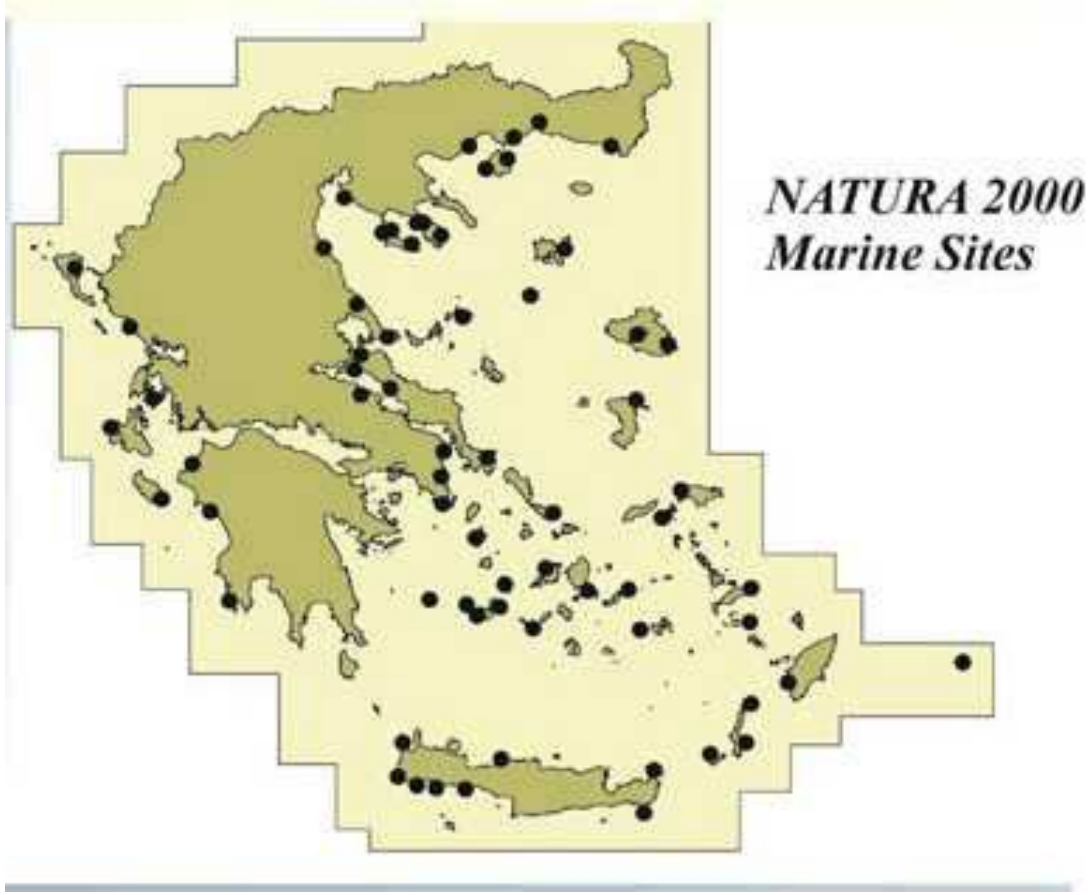
HABIATAT TYPE 8330



Implementation of the Habitat Directive in Greece

The institute of Oceanography coordinate the habitat mapping in 67 Natura sites

(1999-2001)



The concept of Marine water body types under the WFD 2000/60/EC

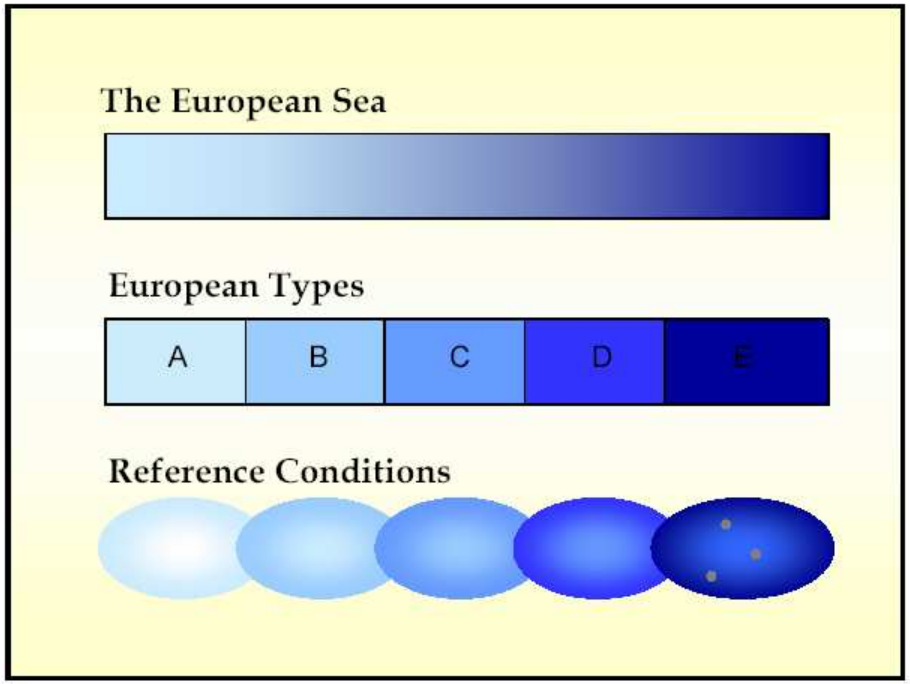
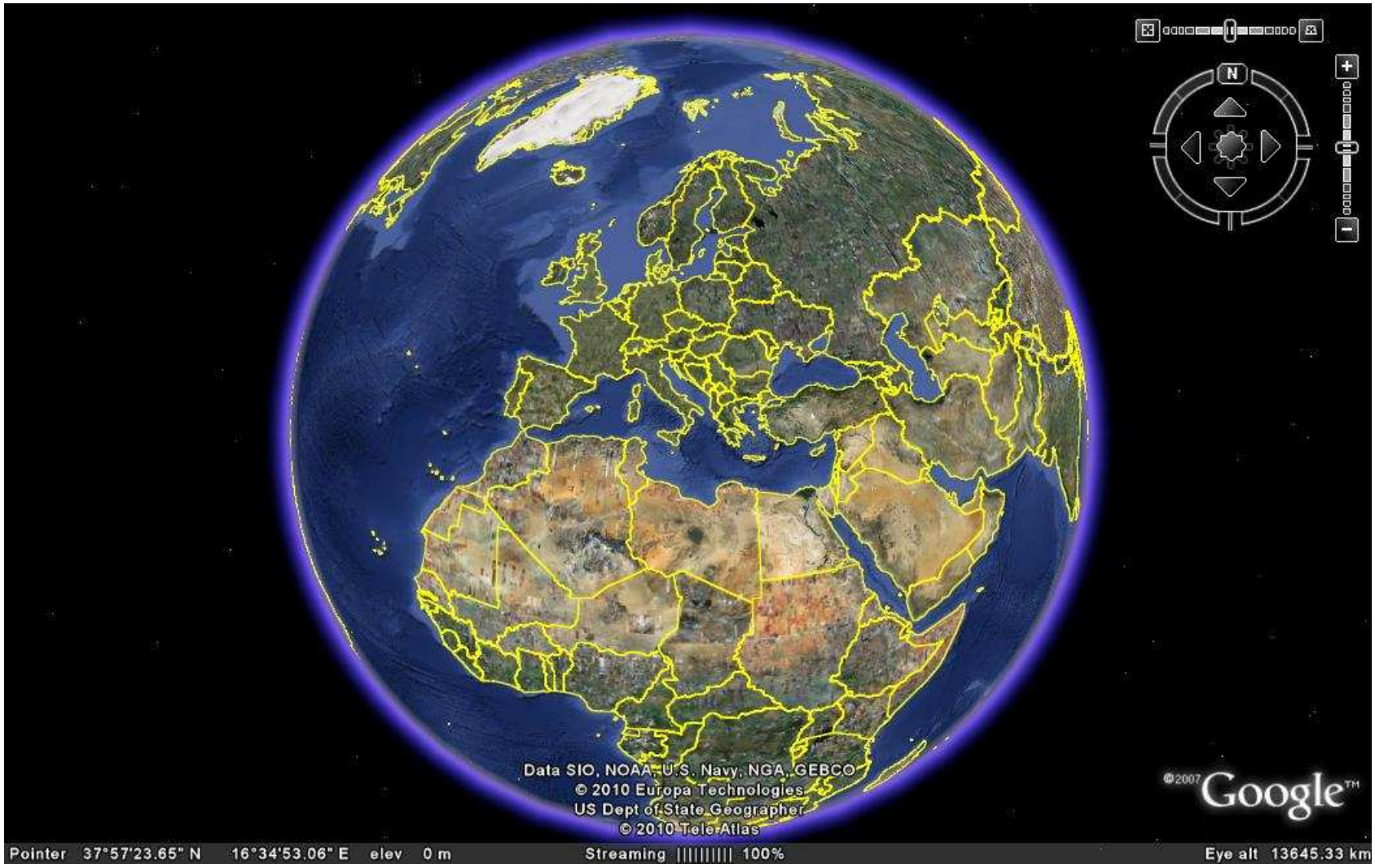


Figure 4.1. The relationship between all the seas in Europe (the European Sea), typology and type-specific reference conditions. The European sea is a continuum. Typology falsely compartmentalises this continuum into a number of physical types. The reference conditions for a specific water body type must then describe all possible natural variation within that type. In type E, sites are shown. This shows how sites within a type may be used to establish the natural variability within the type.

Coastal water body types
in the Mediterranean eco-region

1. *Rocky shallow (C1)*
2. *Rocky deep (C2)*
3. *Sedimentary shallow (C3)*
4. *Sedimentary deep (C4)*
5. *Very sheltered bays (C5)*

Water body types in the Mediterranean

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© 2005 National Geographic Society
Image © 2005 EarthSat
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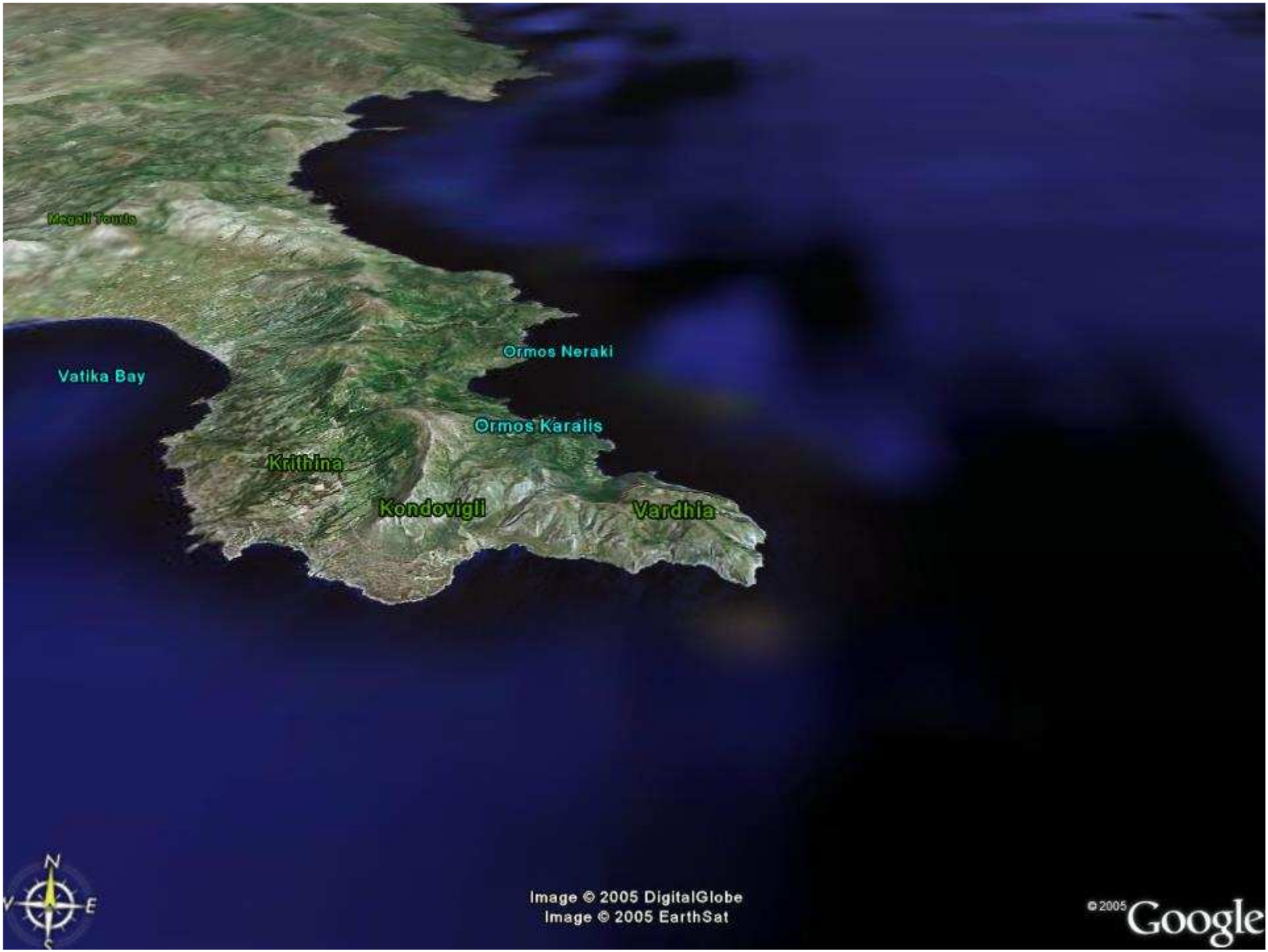
Megali Toumba
Vatika Bay
Ormos Neraki
Ormos Karalis
Krithina
Kondovigli
Vardhia
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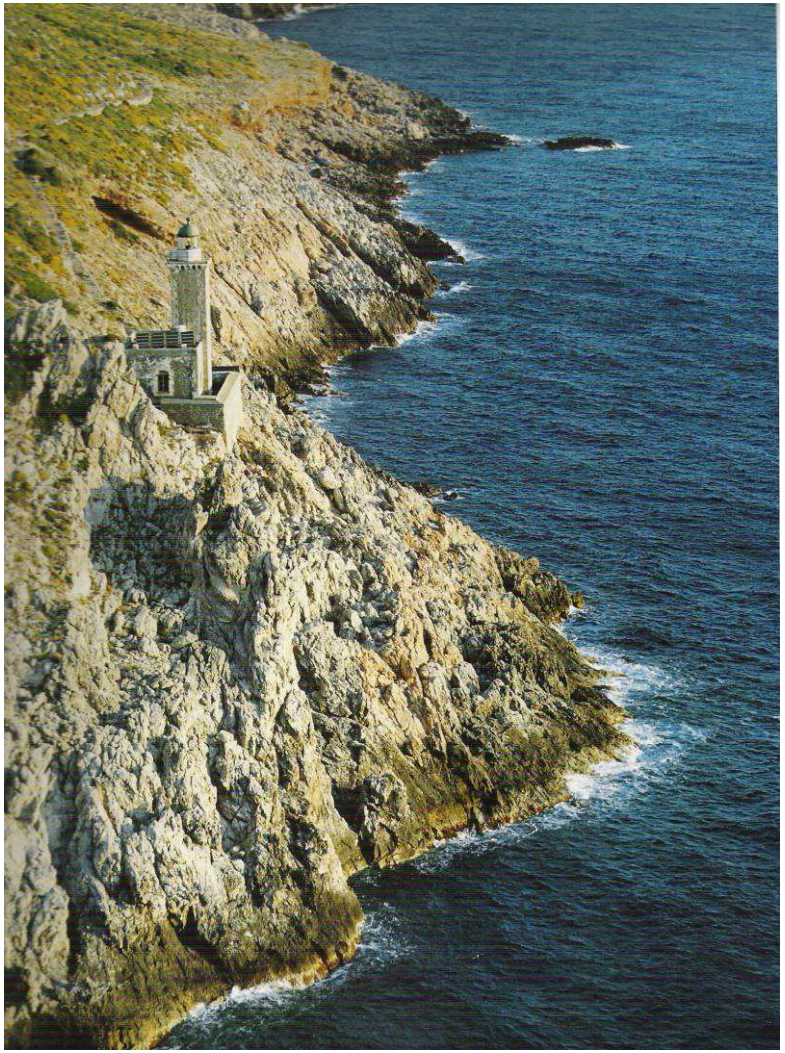
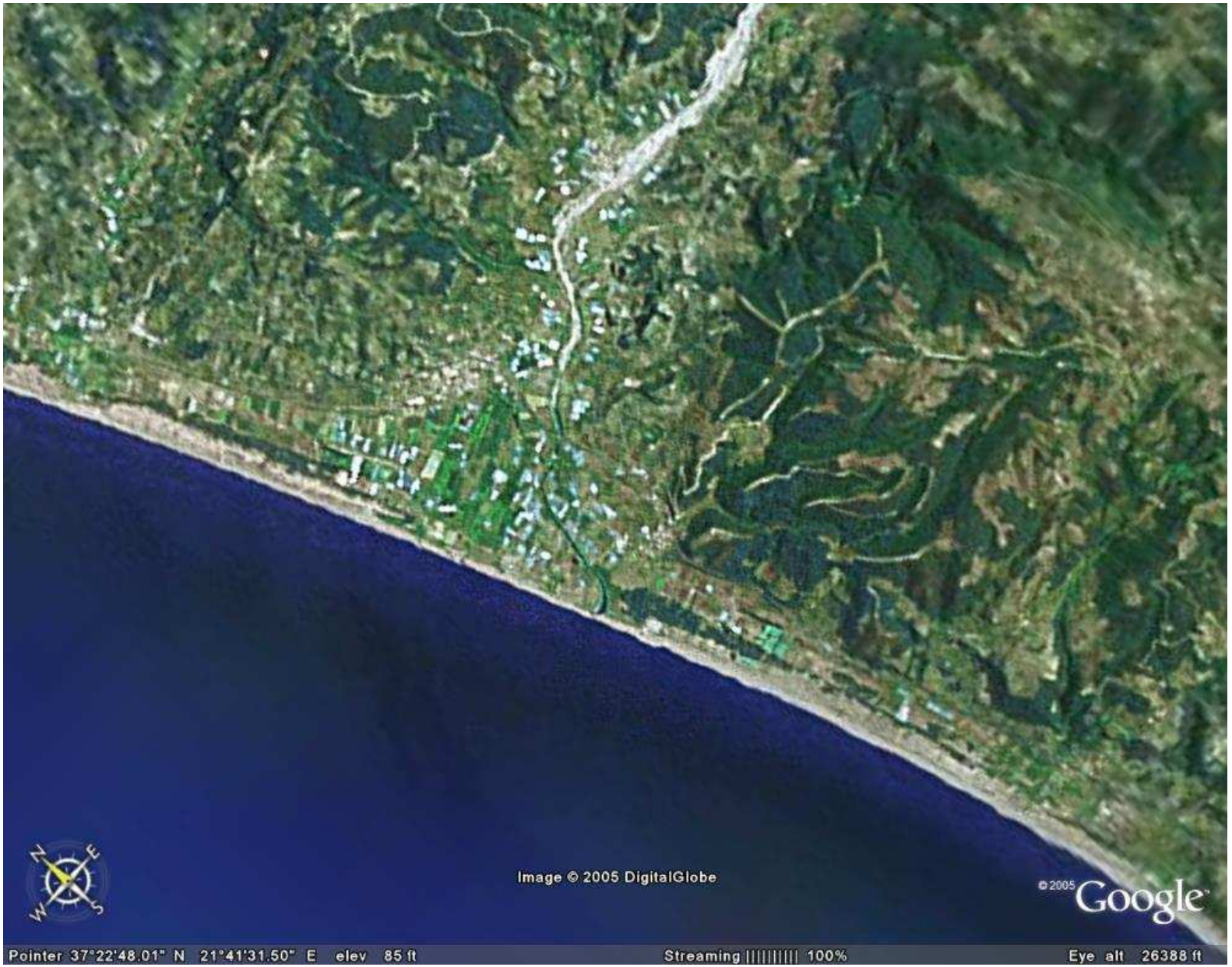
Image © 2005 DigitalGlobe
Image © 2005 EarthSat
© 2005 Google

Rocky deep (C2)

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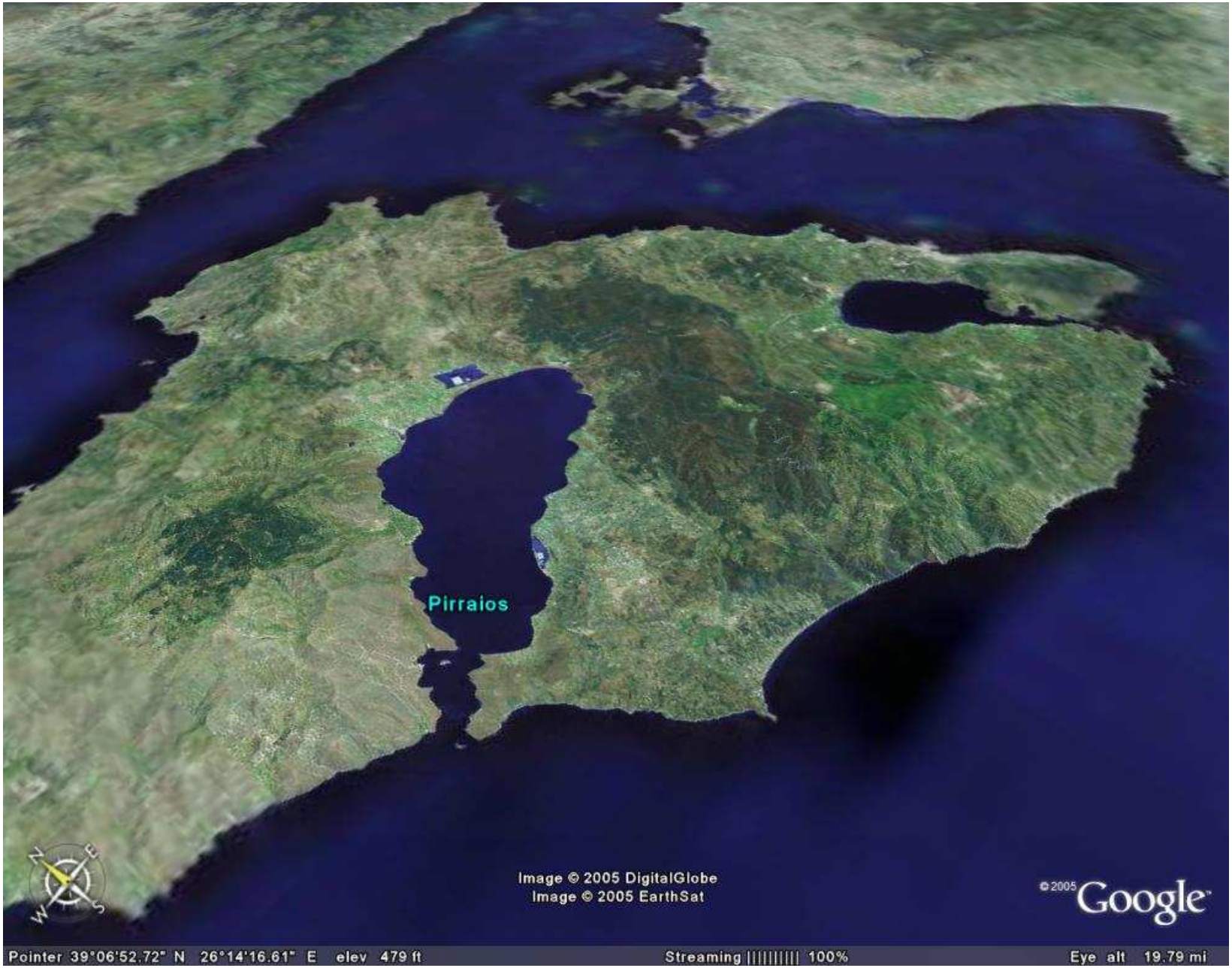
© 2005 Google
Pointer 37°22'48.01" N 21°41'31.50" E elev 85 ft
Streaming 100%
Eye alt 26388 ft

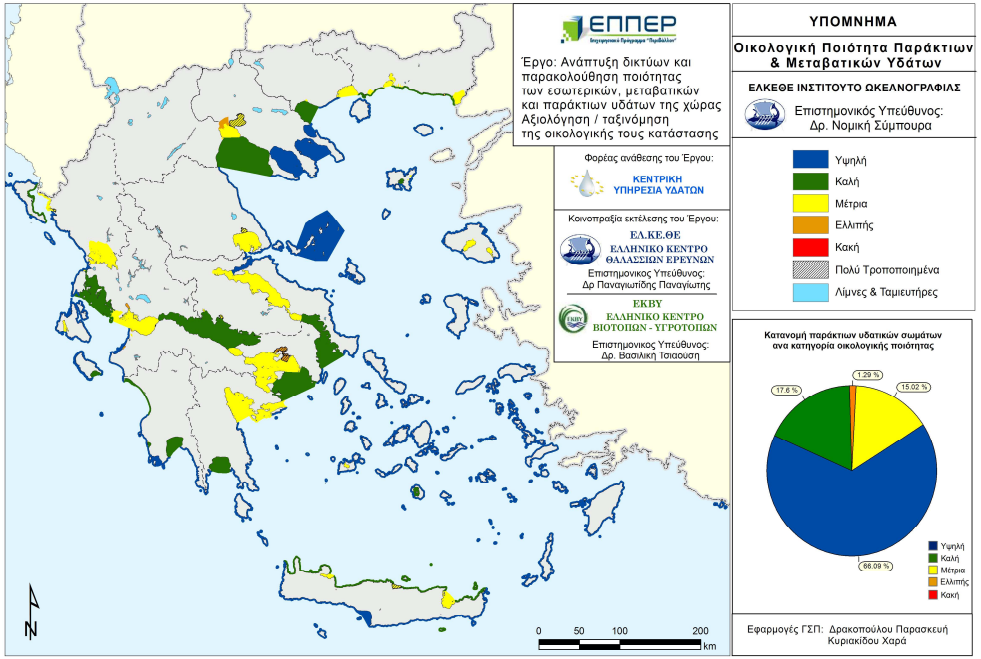
Sedimentary deep (C4)


Pirraios
Image © 2005 DigitalGlobe
Image © 2005 EarthSat
©2005 Google
Pointer 39°06'52.72" N 26°14'16.61" E elev 479 ft
Streaming 100%
Eye alt 19.79 mi

Implementation of the WFD in Greece

The institute of Oceanography coordinate the design of the national network for the WFD implementation

and gave the first estimation of Ecological Quality (2008 - 2009)

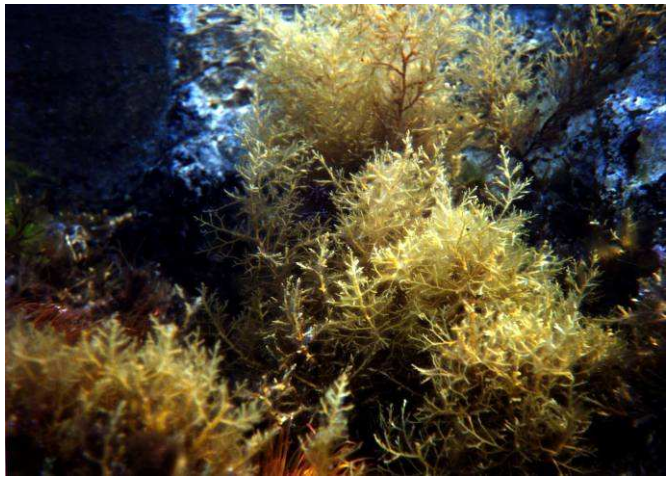


Implementation of the WFD in Greece

- Overview of traditional indices-are they sufficient?
- Need for new metrics for coastal ecosystems

e.g. assessment of phytobenthos
as a quality element

BQE phytobenthos in the Mediterranean



Biotic indexes

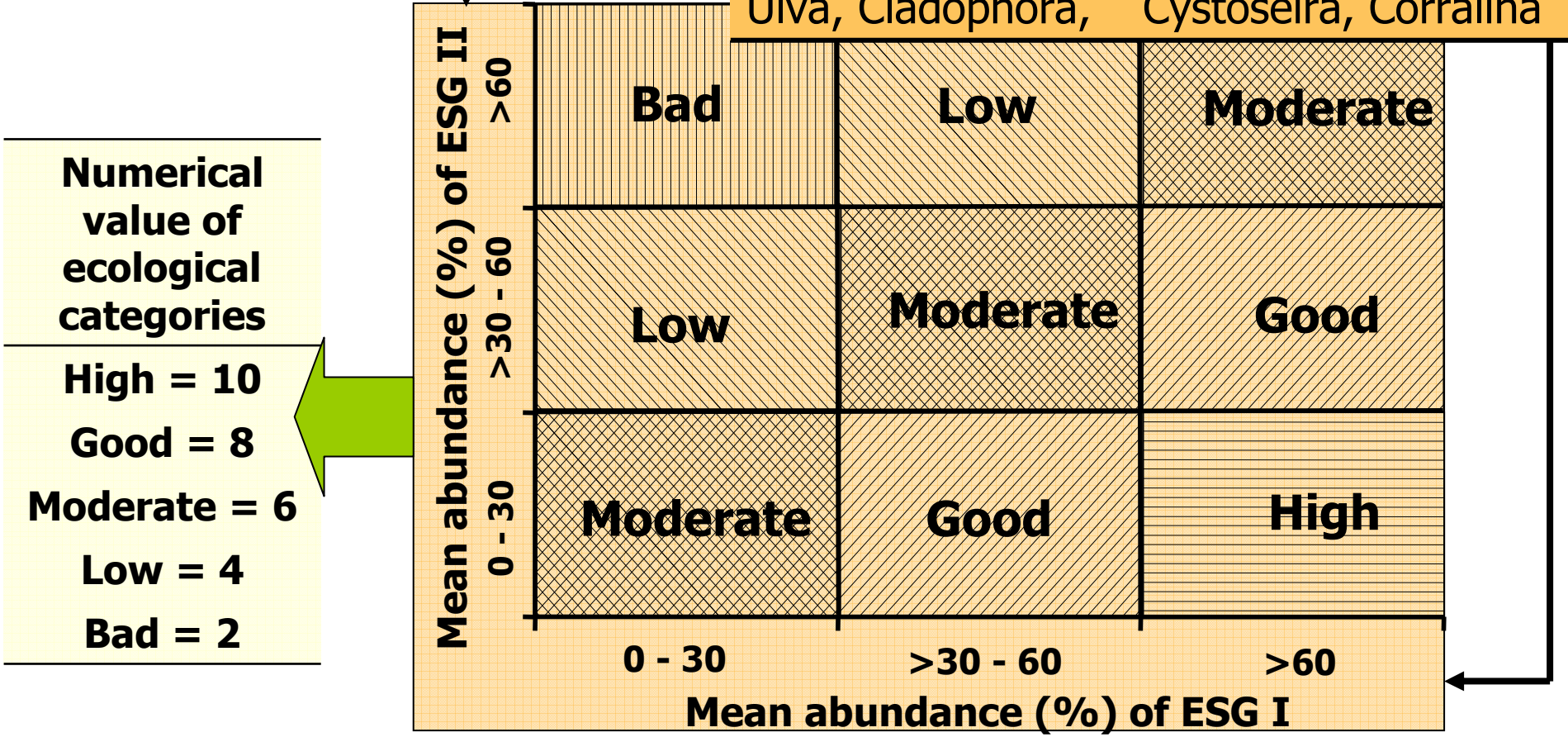
- Presence/absence of indicator species (but in which condition?)
- Shannon, Pielou (sample size dependence, non monotonic reaction to organic pollution)
- Bray-Curtis Similarity index (differenciation but cause?)

- EEI – biotic index (quantitative, functional diversity)

The EEI index

Orfanidis, Panayotidis & Stamatis (2001)

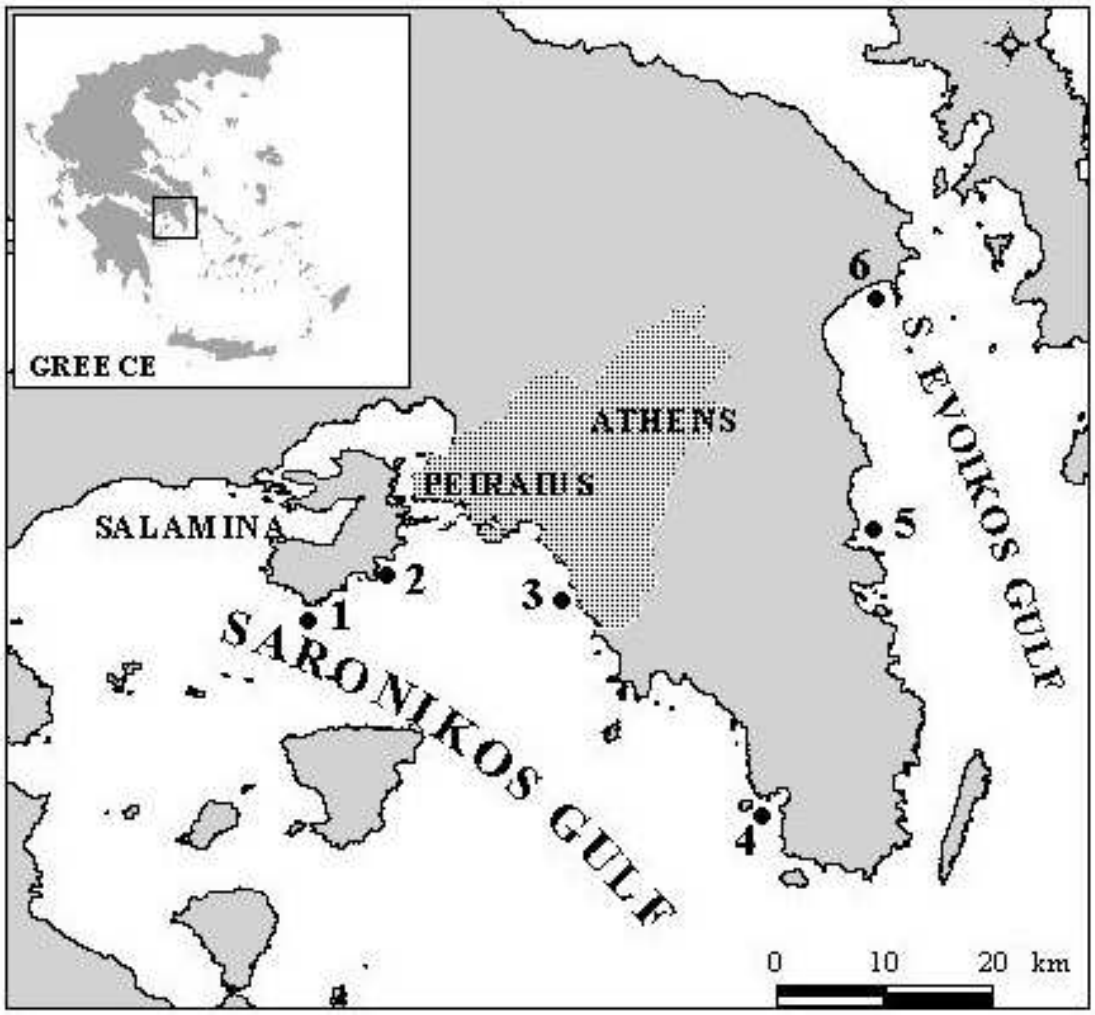
ESG II	ESG I
Sheet filamentous coarsely branched groups	Thick leathery, jointed calcareous, crustose group
High productivity	Low productivity
Annuals	Perennials
Ruderals	Competitors
Ulva, Cladophora,	Cystoseira, Corralina

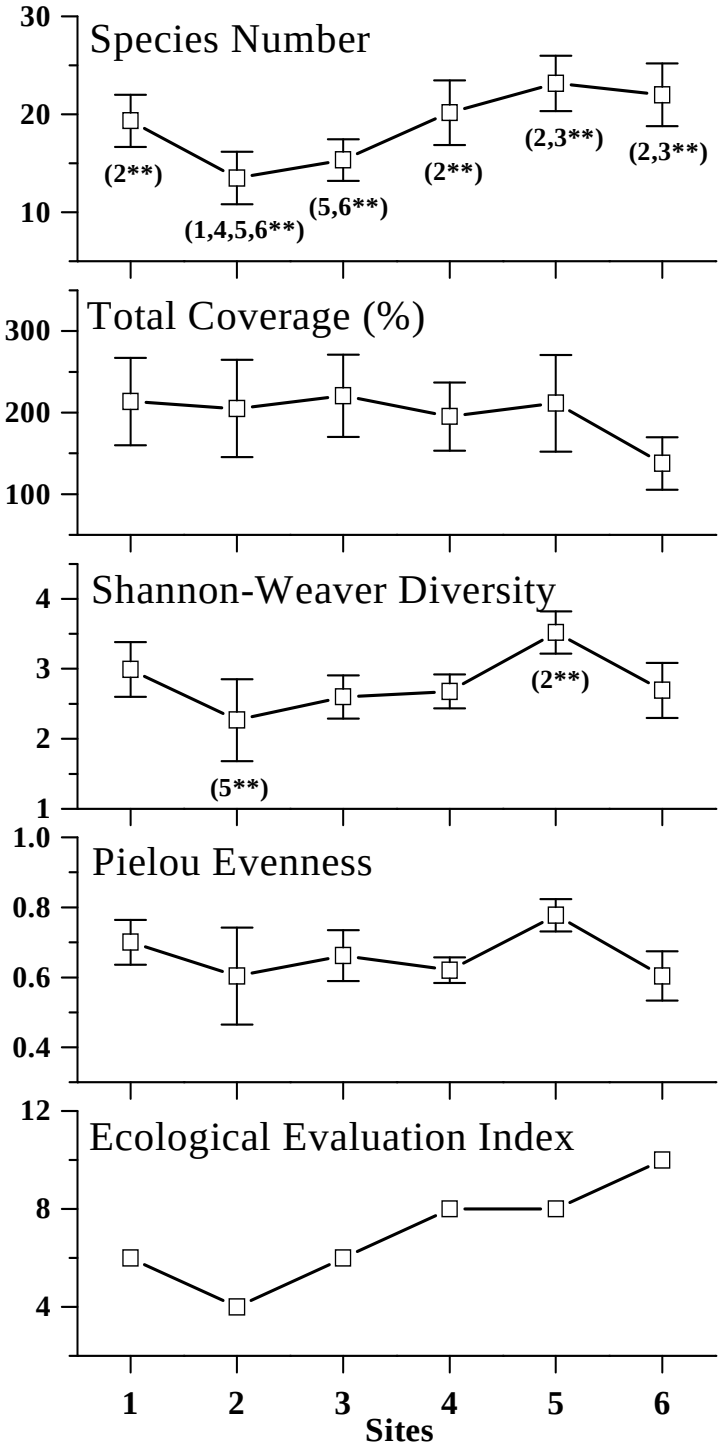


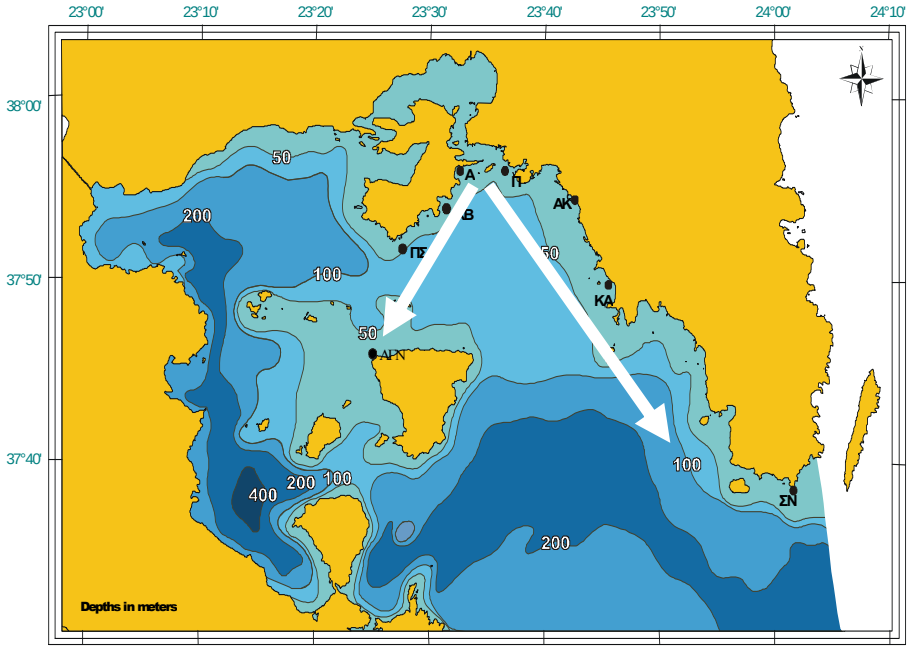
Numerical value of ecological categories
High = 10
Good = 8
Moderate = 6
Low = 4
Bad = 2

A case study:

Panayotidis et al., 2004



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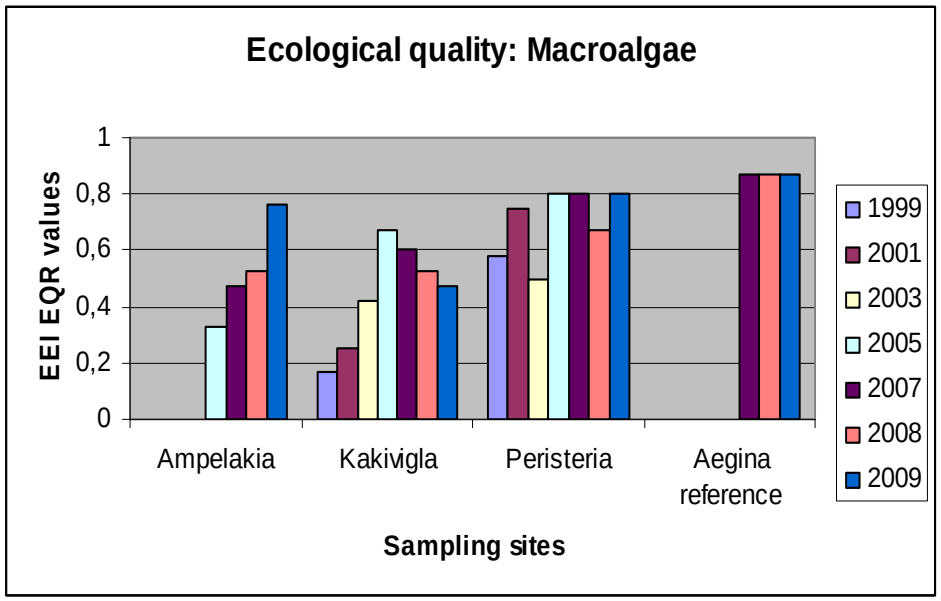
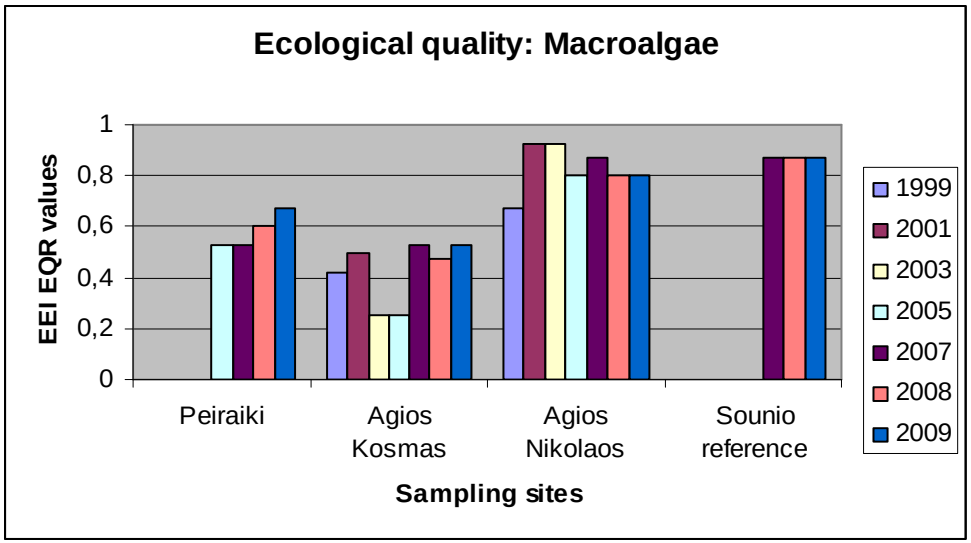
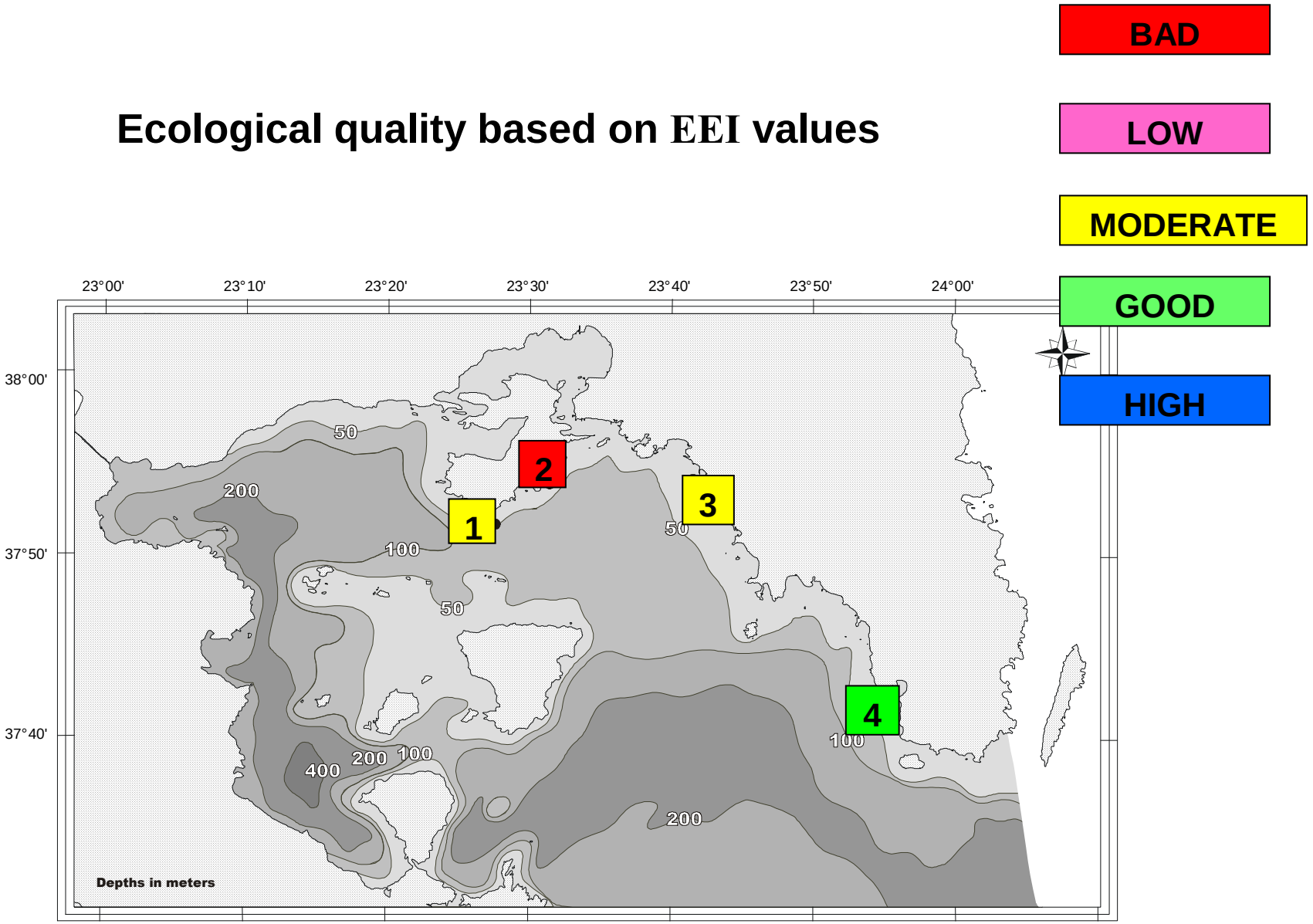
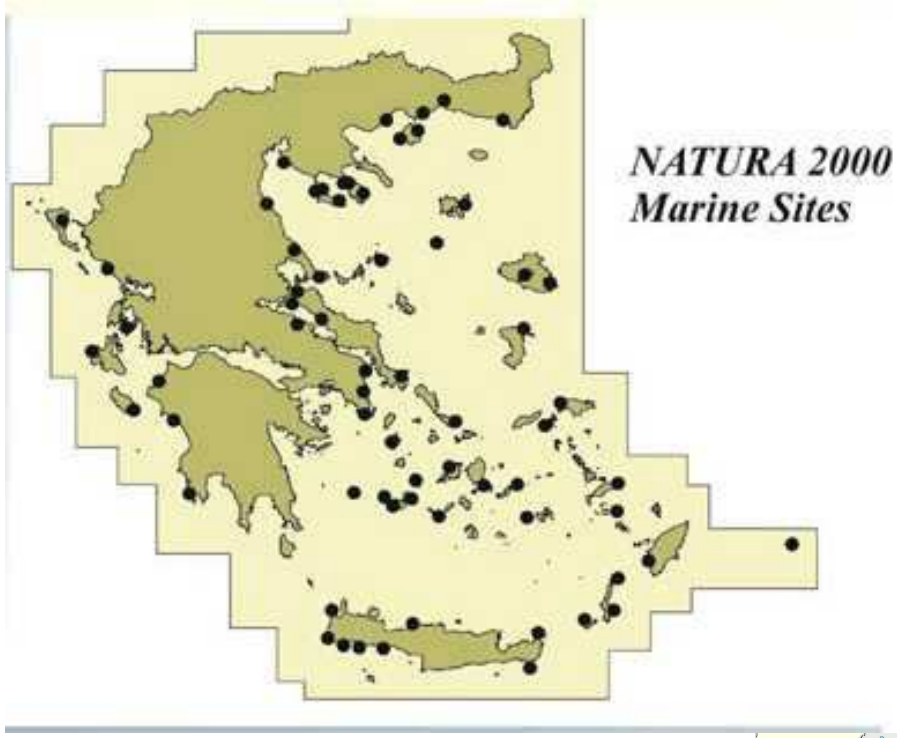
ΓΣ
ΑΚ
ΚΑ
ΑΓΝ
ΣΝ
Depths in meters


Ecological quality: Macroalgae
EEI EQR values
1
0,8
0,6
0,4
0,2
0
Ampelakia
Kakivigla
Peristeria
Aegina reference
Sampling sites
1999
2001
2003
2005
2007
2008
2009


Ecological quality: Macroalgae
EEI EQR values
1
0,8
0,6
0,4
0,2
0
Peiraiki
Agios Kosmas
Agios Nikolaos
Sounio reference
Sampling sites
1999
2001
2003
2005
2007
2008
2009

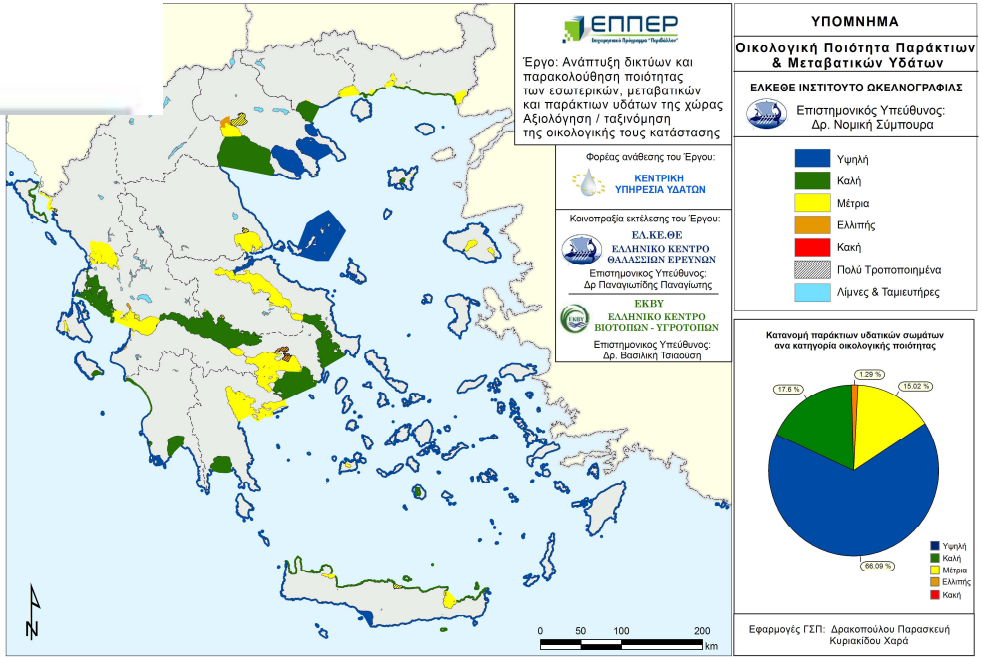
Ecological quality based on EEI values





From the HD to the WFD

However, this is not enough



Why a EU Maritime Policy?

Europe's oceans are facing a number of threats:

- loss or degradation of biodiversity
- loss of habitats
- nutrient input - eutrophication
- contamination by dangerous substances
- impacts of climate changes

Why a new Framework Directive?

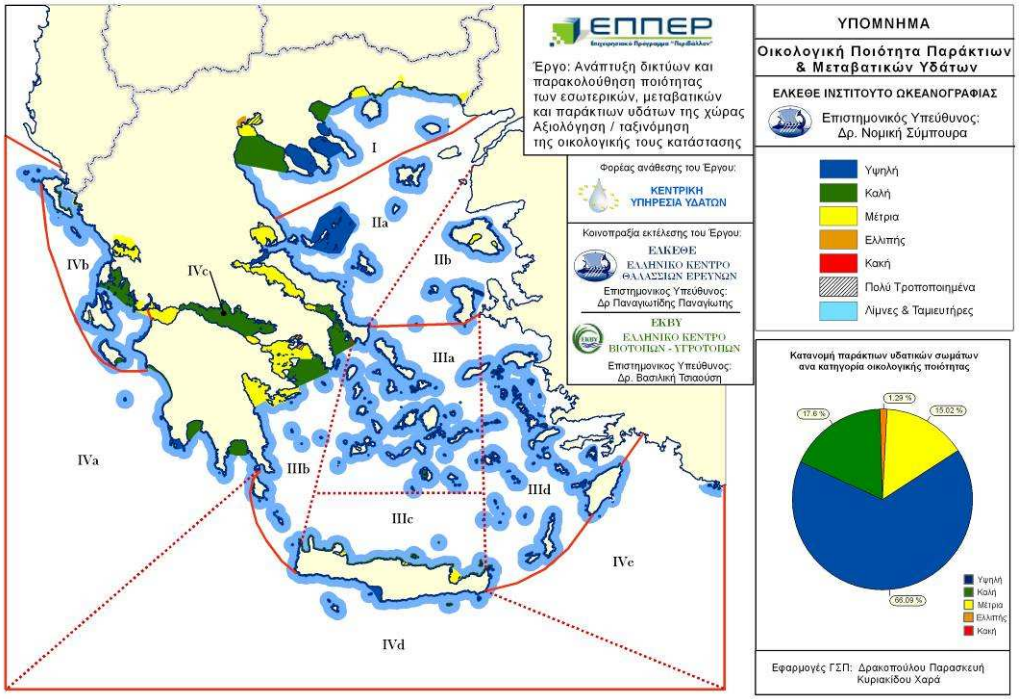
- If we see the EU policy as a step foreword from the Member States policy and
- we agree that the sustainable management of the sea is something more than the coastal management we need more:
- The ***"Marine Strategy"*** Framework Directive voted on 2008.

Towards the Marine Strategy Framework Directive Implementation

The Institute of Oceanography participated at the integration of the Directive at the national legal system

(2010)

The monitoring is foreseen for 2014



Thank you for your attention