

2020: ‘THE YEAR OF THE QUIET OCEAN’

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THE FIFTH SUSTAINABILITY SUMMIT

FOR SOUTH-EAST EUROPE AND THE MEDITERRANEAN

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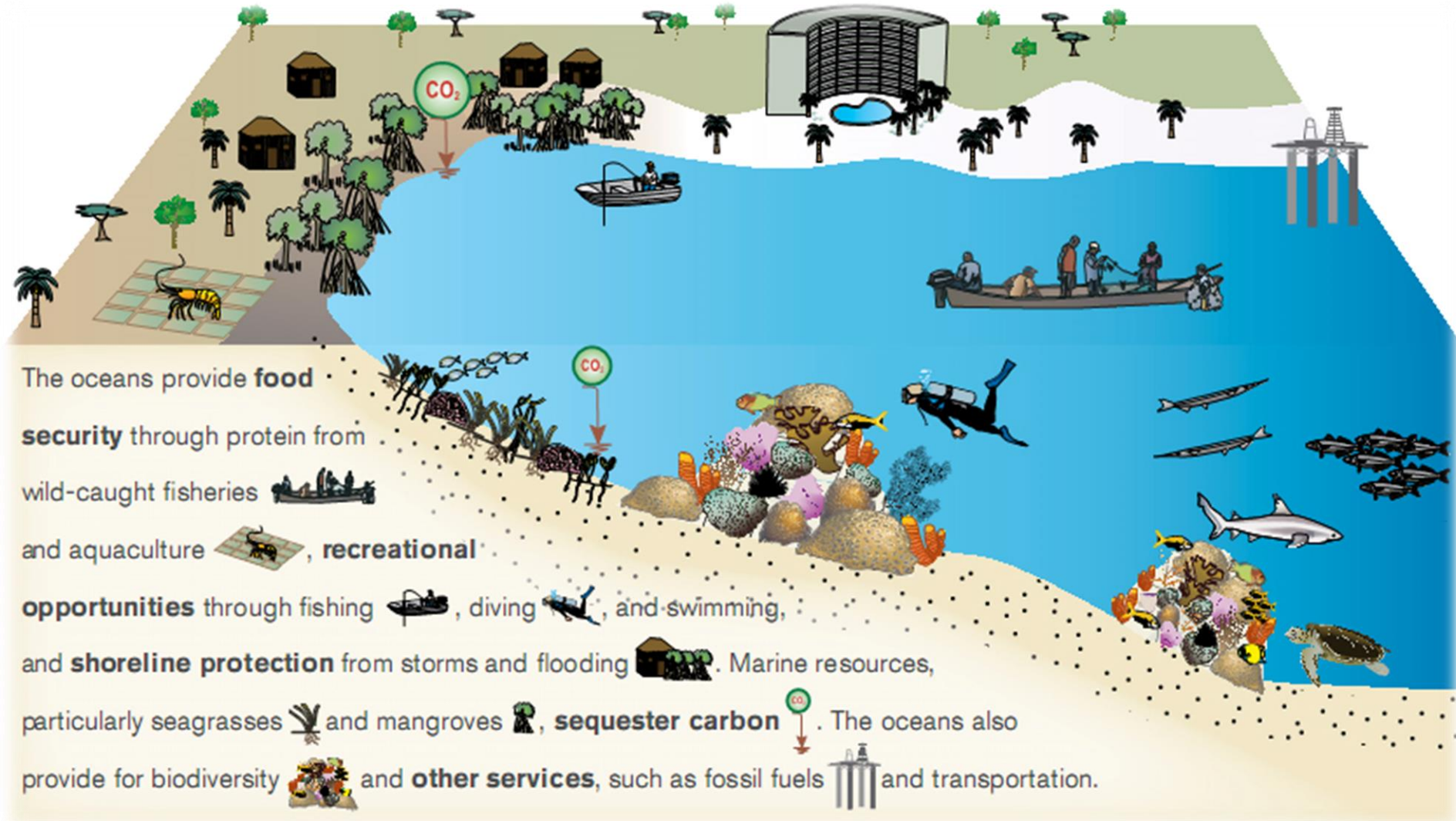


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2020: 'THE YEAR OF THE QUIET OCEAN'

❑ What is the impact of human noise to the oceans?

Global Marine Biodiversity

1970-2012:

- **49-74% of vertebrate population decline**
- Monitoring of 1234 vertebrate species and 5.829 populations.
- Vertebrates: Mammals, Birds, Fish, Amphibians, Reptiles.

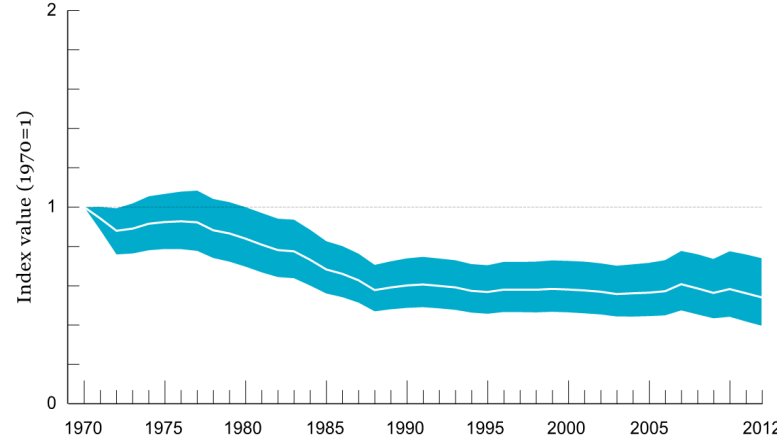


Figure 1: The global marine LPI shows a decline of 49 per cent between 1970 and 2012. This is based on trends in 5,829 populations of 1,234 species (WWF-ZSL, 2015).

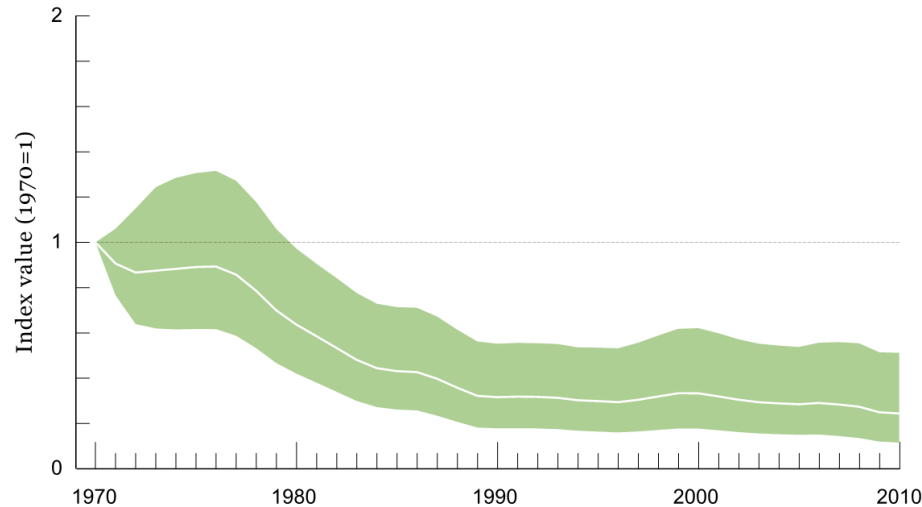
Key

- Marine Living Planet Index
- Confidence limits

State of the natural Marine Environment

Figure 3: The index for Scrombidae (tuna, mackerel, bonito) declined 74 per cent between 1970 and 2010 (WWF-ZSL, 2015).

- Key
- Scrombidae index
 - Confidence limits



The Marine Living Planet Index

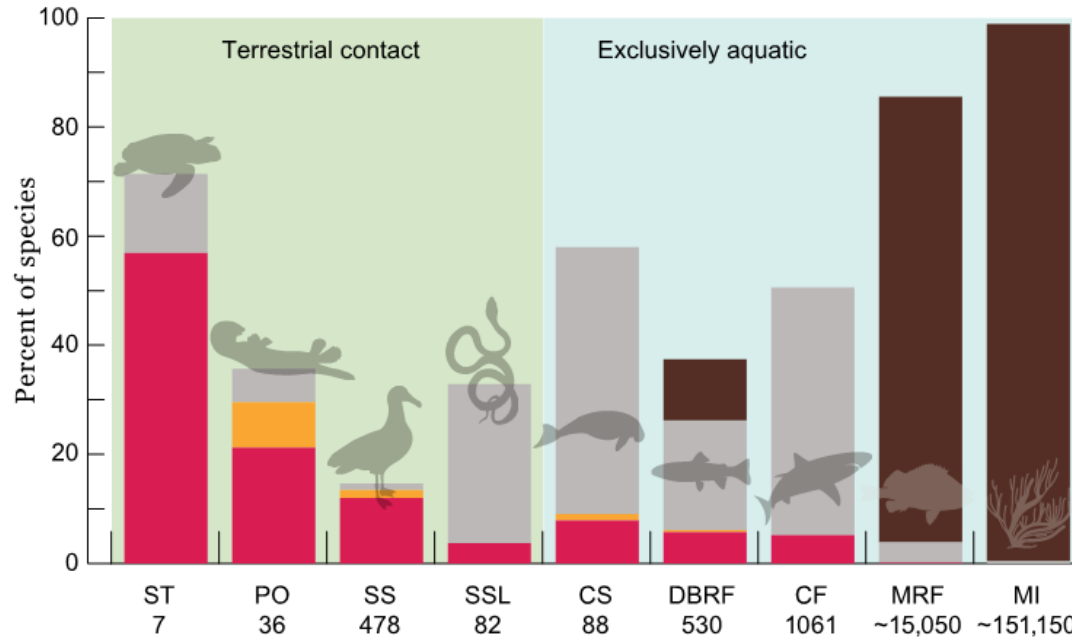


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State of the natural Marine Environment

Global Marine Biodiversity



Key

- Unreviewed
- Data deficient
- Extinct
- Endangered

Species groupings

- ST** Sea turtles
- PO** Pinnipeds and marine mustelids
- SS** Seabirds and shorebirds
- SSL** sea snakes and marine lizards
- CS** Cetaceans and sirenians
- DBRF** Diadromous/brackish ray-finned fishes
- CF** Cartilaginous fishes
- MRF** Exclusively marine ray-finned fishes
- MI** Marine invertebrates

Figure 4: Threatened marine species, as chronicled by the IUCN Red List.

Threat categories include “extinct” (orange), “endangered” (red; IUCN categories “critically endangered” + “endangered”), “data deficient” (light grey), and “unreviewed” (brown). Groups that contact land during some portion of their life history (green) are distinguished from species that do not (light blue). The total number of species estimated in each group is listed below the graph (McCauley et al., 2015).



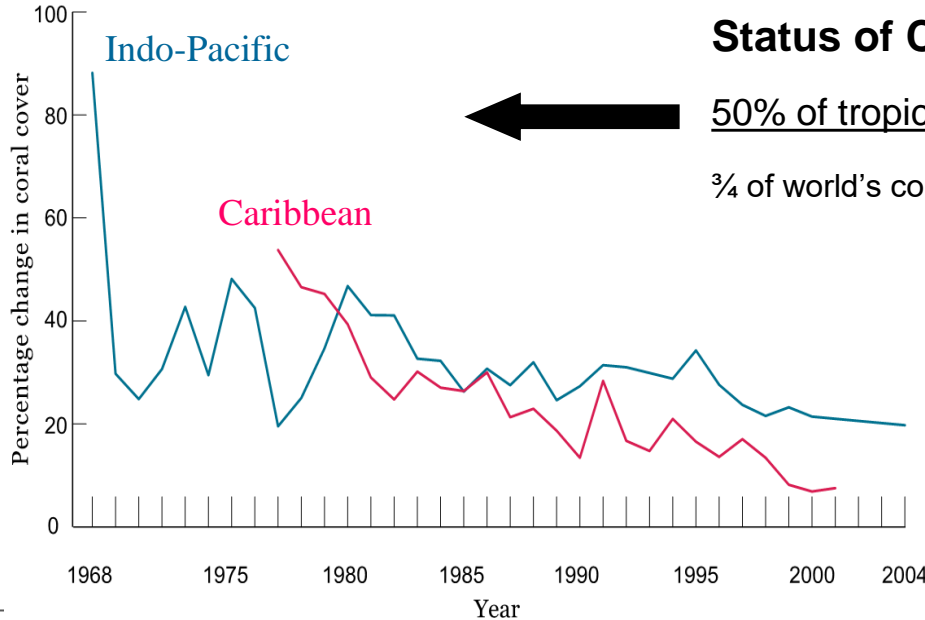
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Global Marine Biodiversity

Status of Coral Reefs



50% of tropical reefs is lost last 30 years (Hoegh-Guldberg et al., 2015)

3/4 of world's coral reefs are threatened (Burke et al., 2011)

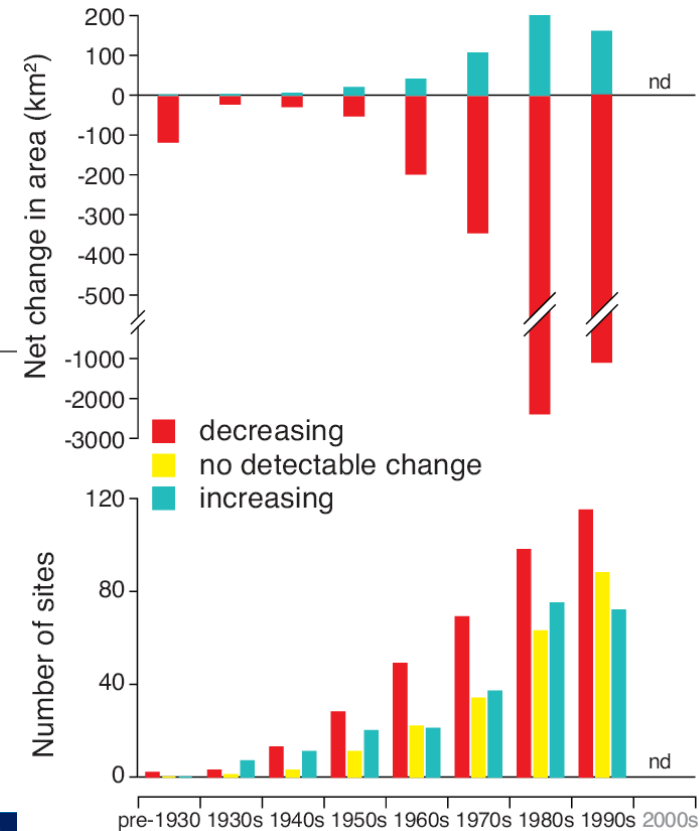
Status of Seagrasses

Global estimates: Decline 29%

Current cover 177000 km²

Lost 51.000 km²

(Waycott et al., 2009) 215 studies worldwide, 127 years





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Threats

1. Habitat loss and degradation

Habitat modification by either complete removal, fragmentation or reduction in quality of key habitat characteristics.

Factors:

Terrestrial: agriculture, logging, transport, mining, deforestation

Freshwater: fragmentation of rivers, alteration of freshwater flow

Coastal & marine:

- coastal development & infrastructure (cities, ports, marinas)

- Extraction of fossil fuels - (oil & gas)

- Light pollution (important for Marine Turtles)

- Noise pollution during seismic surveys (important for Marine Mammals)



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What is the impact of human noise to the oceans?

Threats

2. Overexploitation of fish stocks / over fishing – Direct

Unsustainable fishing or poaching

Fishing into greater depths

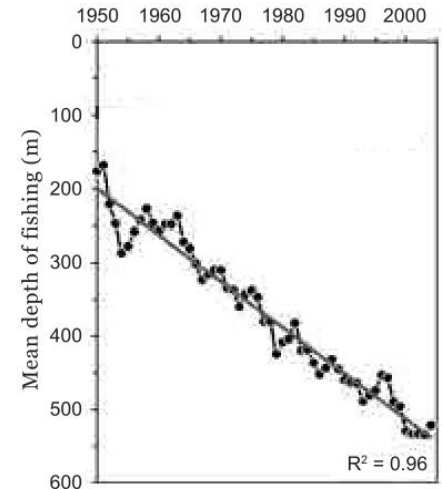
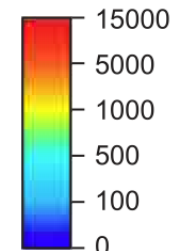
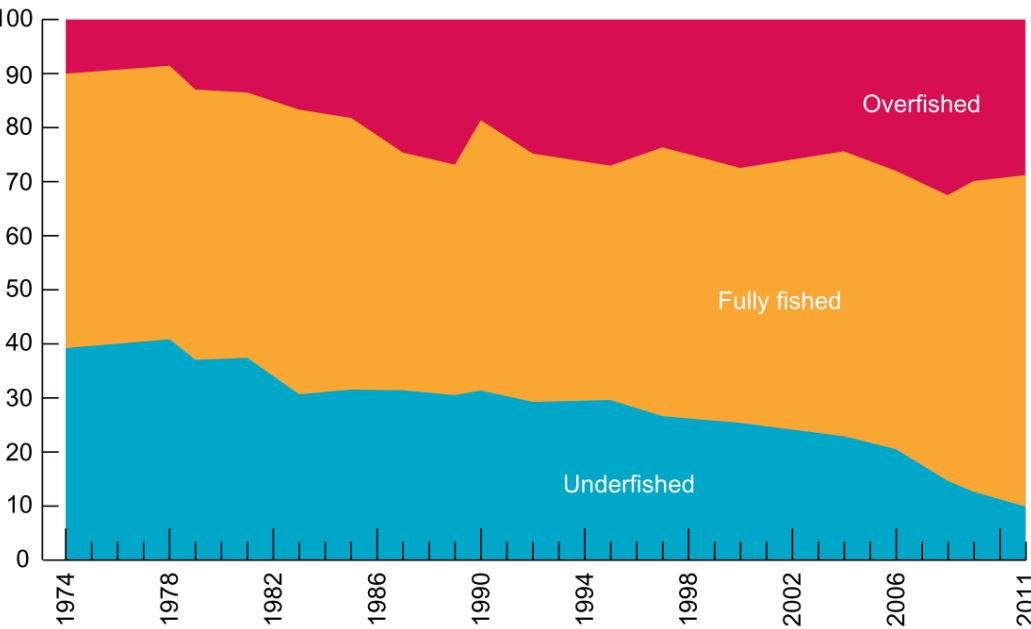
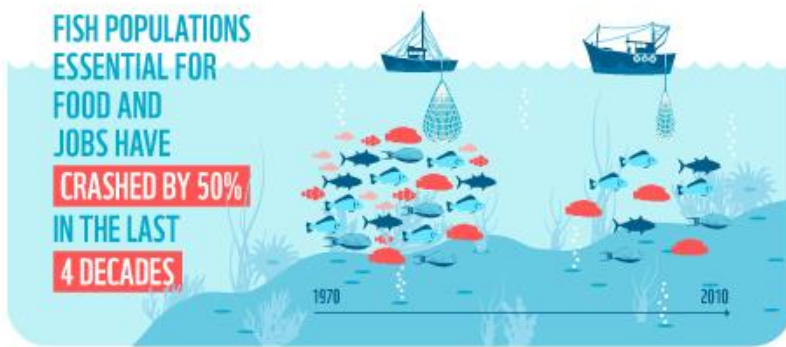
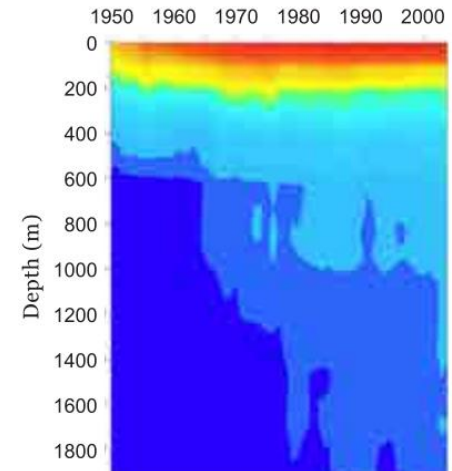


Figure 20: Global trends in the state of marine fish stocks, 1974-2011 (FAO, 2014b).

Key

- Overfished at biologically unsustainable levels
- Fully exploited fish stocks
- Not fully exploited stocks





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Threats

2. Overexploitation of fish stocks / over fishing – Indirect

When non-target species are killed unintentionally (e.g. Sharks, Marine Turtles, Dolphins, Seals, Birds)

- Fisheries bycatch

- Ghost fishing

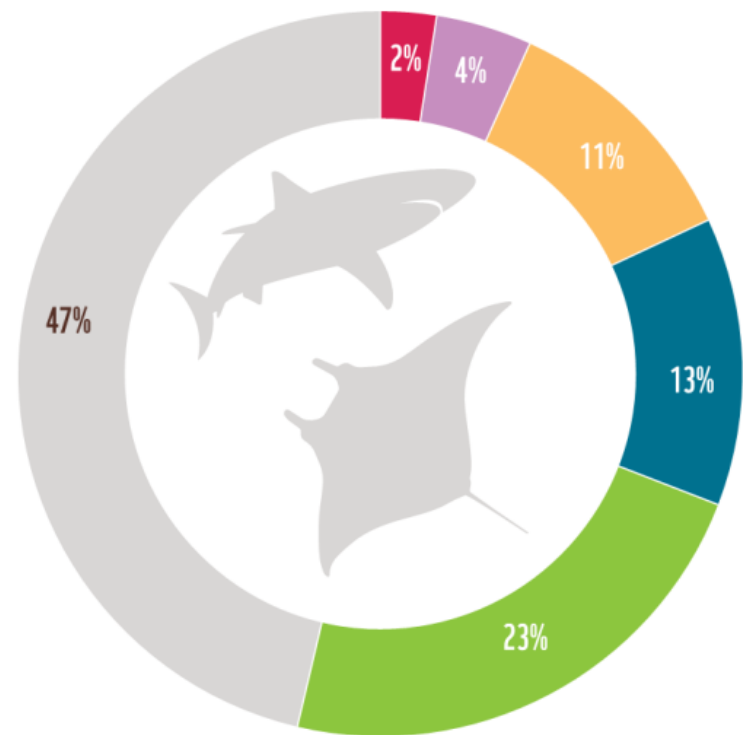


Figure 6: Shark and ray species at risk of extinction: an additional 7 per cent of the data deficient species are estimated to be threatened (Dulvy et al. 2014).

Key

■	Critically endangered 25 species
■	Endangered 43 species
■	Vulnerable 113 species
■	Near threatened 129 species
■	Least concern 229 species
■	Data deficient 465 species





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Threats

3. Pollution

Directly: affect a species by making the environment unsuitable for its survival (e.g. Oil spill)

Indirectly: affects food availability, physiological functions, reproductive performance, leading to a reduction in population numbers over time.

a) Pollution

Land based sources

80% of marine pollution including:

- Agricultural run-off (fertilizers)
- Urban waste (αστικά λύματα)
- Toxic waste from industries
- Seafood contamination

Sea based sources

- Aquaculture
- Fuel pollution
- Marine transport & oil-platform accidents





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Threats

3. Pollution

b) Marine debris

Macro-plastics (>2 cm)

~ 70% fishing gear

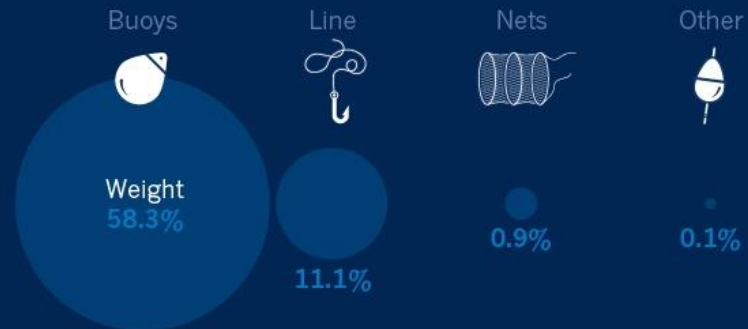
~ 30% other plastic

Eriksen et al 2014 – PLOS ONE

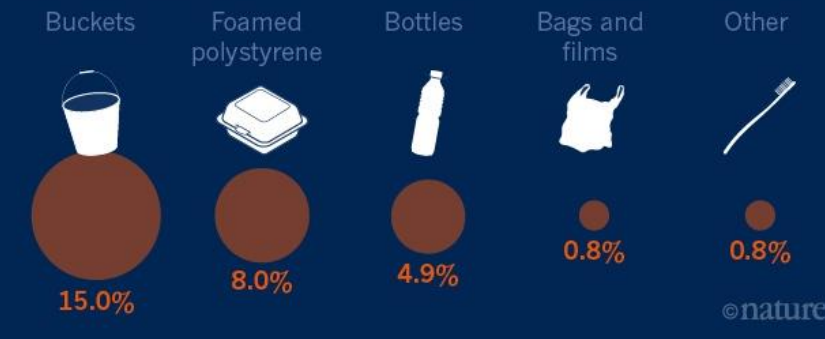
A PLASTIC CATCH

Combined data from visual surveys in the Pacific, South Atlantic, Indian Ocean and Mediterranean Sea suggest that fishing gear makes up the greatest share of macroplastics (>200 millimetres) in the oceans. Buoys alone account for more than 50% of such items by weight³.

FISHING GEAR



OTHER PLASTIC



©nature



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Threats

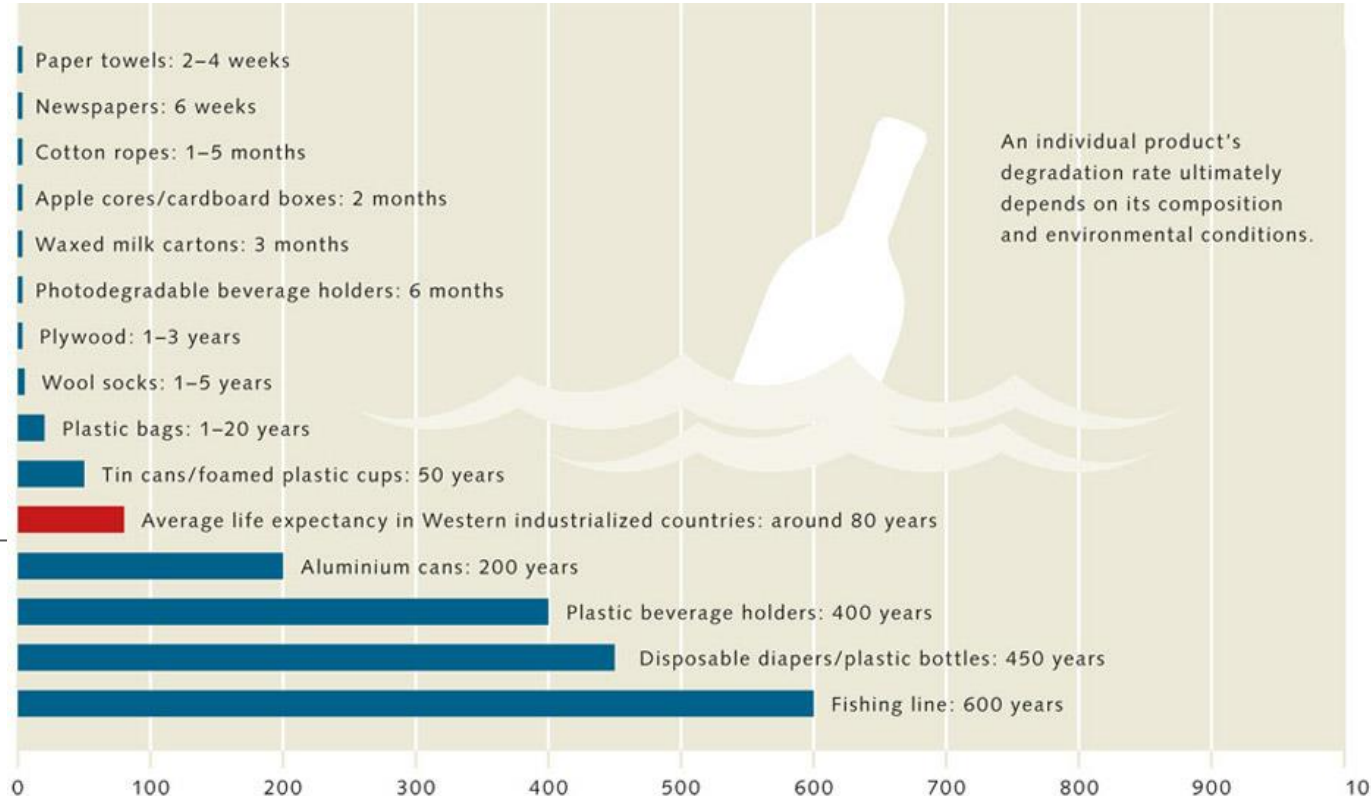
3. Pollution

b) Marine debris affects marine life

Directly: entanglement in fishing gear / ghost fishing.

Indirectly: swallowing of marine debris instead of food.

• 5 trillion plastic pieces (250.000 tones) and microplastic <2 cm (35.500 tones) afloat at sea (Eriksen et al., 2014).





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Threats

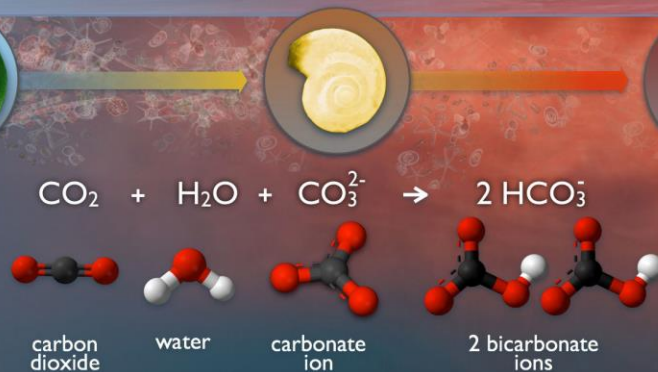
4 . Climate change

- Mean sea-level rise.
- Mean sea-temperature rise.
- Acidification
 - mean decrease of pH-level by 0.14 - 0.35 in the 21st century.
 - influences chemical composition of seawater (increase of carbonic acid (H₂CO₃))
 - decreases calcium carbonate saturation
 - subsequent effects to habitats and species, as well as to deep sea communities

OCEAN ACIDIFICATION

HOW WILL CHANGES IN OCEAN CHEMISTRY AFFECT MARINE LIFE?

CO₂ absorbed from the atmosphere



consumption of carbonate ions impedes calcification

• CO₂ is corrosive to the shells and skeletons of many marine organisms

Corals



Calcareous plankton





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4 . Climate change

- **UVB radiation** (increased mortality rates of algae, corals, crustaceans, fish larvae and other plankton – Llabrés et al. 2013)
- **Intensification of extreme events** (e.g. Storms).

Climate change effects

- Further habitat destruction
- Further reduction of biodiversity & fisheries production
- Shift in distribution patterns of species
- Changes in ocean currents circulation
- Increase of natural hazards





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5 . Invasive species

- May compete with native species for space, food and resources.
- May become predators of native species
- May spread diseases not previously present in an area.

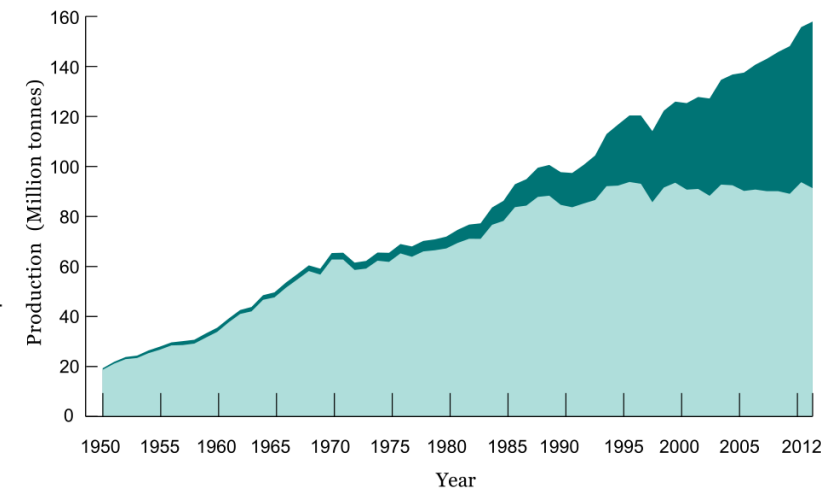
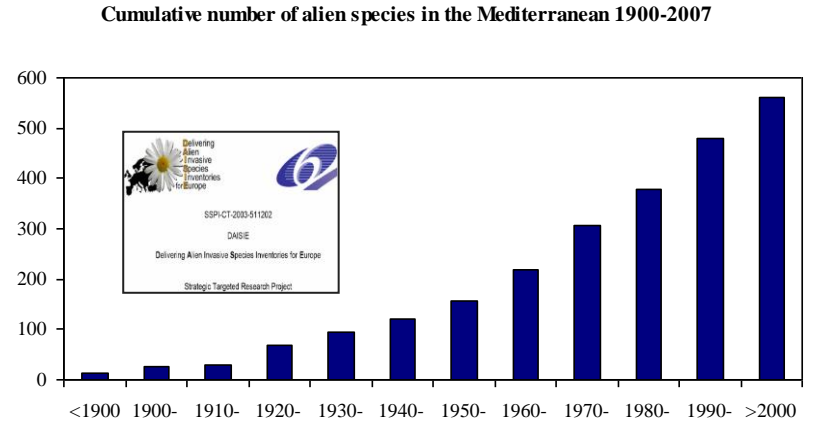
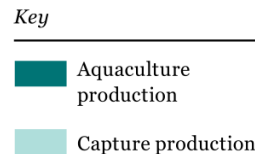
6. Aquaculture

- Increase of 8.6% per year over the last 30 years.
- Provides 58% of fish we eat.

But:

- Common cause for:
 - habitat destruction
 - pollution & eutrophication (e.g. through fish-feed, fish excretas, fish, drugs, and debris)
 - spreading of disease & pathogens
 - spreading of invasive species

Figure 21: The continued increase in seafood production in the last 30 years is almost entirely due to aquaculture (FAO, 2014b).





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Threats

7 . Tourism

- Airport construction
- Coastal development
- Sewage disposal
- Cruise ships / motor boats / yachting (fuel, sewage and solid-waste disposal)
- Demand for seafood
- Demand for marine curiosities (usually rare, endangered or vulnerable species)



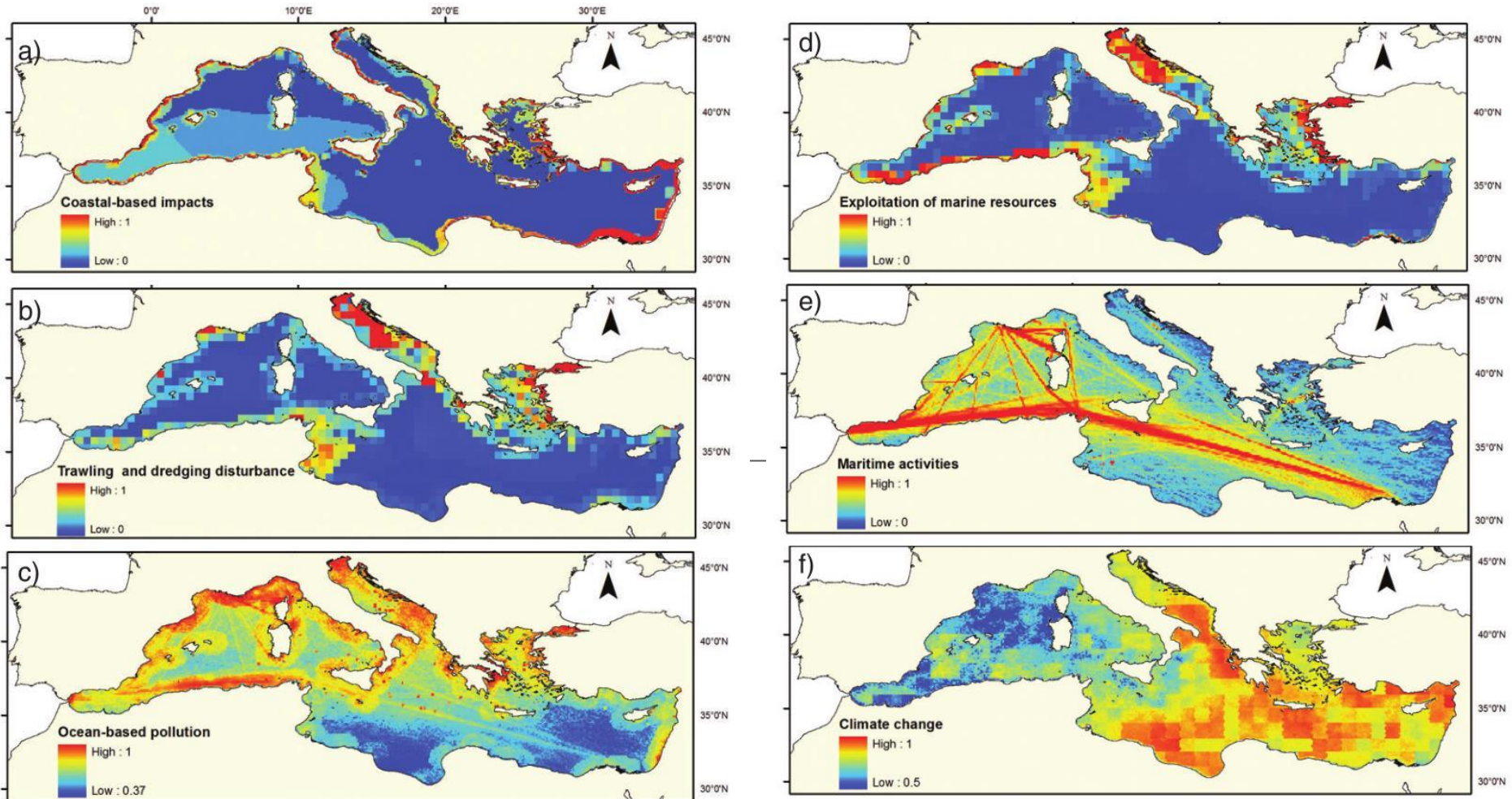


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Threats

8 . Effects of Cumulative Impacts



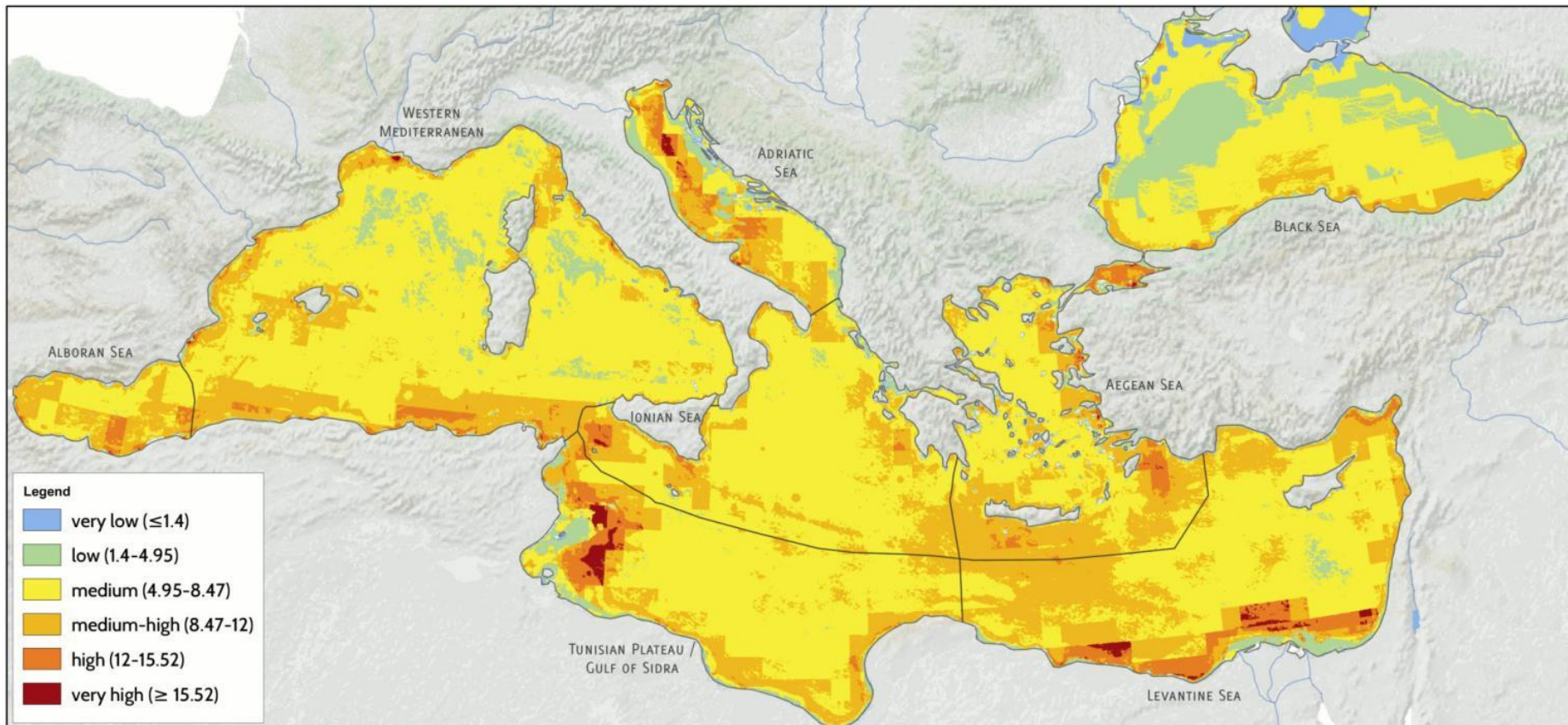
Coll et al. 2011. The Mediterranean Sea under siege: spatial overlap between marine biodiversity, cumulative threats

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8 . Effects of Cumulative Impacts



Micheli et al. 2013. Cumulative human Impacts on Mediterranean and Black Sea ecosystems.

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❑ What can we expect from now on as to the oceans' health?

Marine Protected Areas - MPAs

What is a MARINE PROTECTED AREA ?

A Marine Protected Area is an area of sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

– IUCN, the World Conservation Union

Seas and oceans the world over are at risk, and under severe threat from the actions of mankind. Marine Protected Areas are designated for the protection of the marine environment and the life that it supports, so as to ensure that future generations can enjoy the full benefits of the marine environment in all its glory.

Marine Protected Areas do not exclude access to humans – they encourage the sensible use of marine resources and ensure that the activities that take place are not harmful to the area.

MARINE PROTECTED AREA

... is an area of sea especially dedicated to the protection and maintenance of biological diversity, and natural and associated cultural resources through legal or other effective means (IUCN)...

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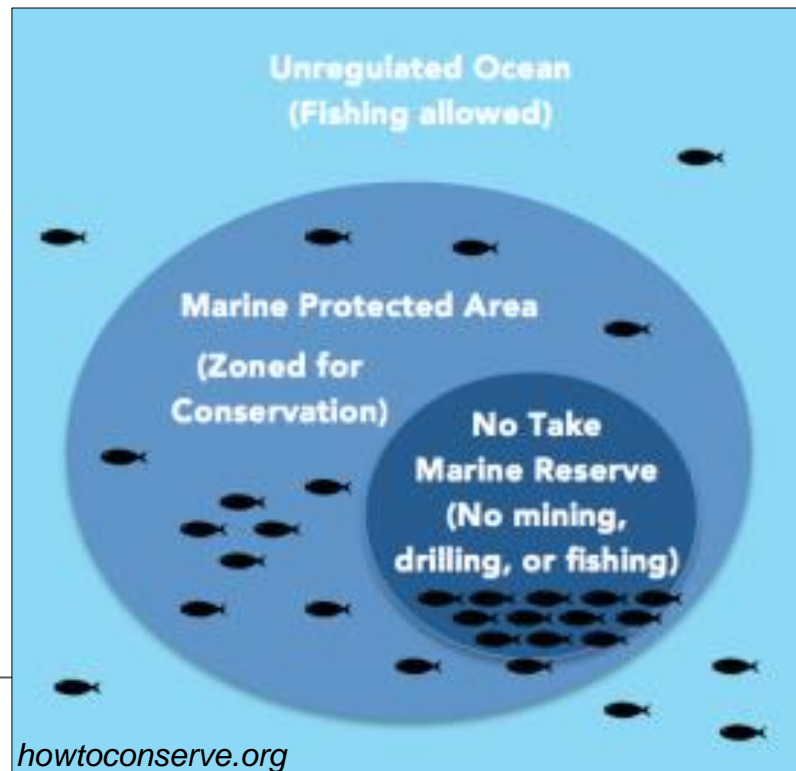
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Types of Marine Protected Areas (MPAs)

Marine Reserves – No-take Areas

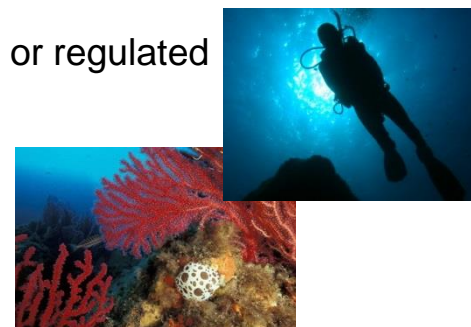
• A special type of Marine Protected Area fully protected from activities that remove animals and plants or alter habitats, except as needed for scientific monitoring”

- Fully Protected:
- all extractive and destructive activities are forbidden
- removal of plants or animals is forbidden
- only scientific monitoring allowed



- Prohibited activities include
- Fishing
- Aquaculture
- Dredging
- Mining

- Activities usually allowed or regulated
- Swimming
- Boating
- Scuba diving





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MARINE PROTECTED AREAS

SMART INVESTMENTS IN OCEAN HEALTH

MPAs ARE AN ESSENTIAL TOOL FOR THE RECOVERY AND PROTECTION OF OUR OCEAN AND THE VITAL SERVICES IT PROVIDES, BUT DO THEY MAKE ECONOMIC SENSE?



THE STUDY

A NEW STUDY EXPLORES THE BENEFITS OF MARINE PROTECTED AREA (MPA) EXPANSION BASED ON 6 EXPLORATORY SCENARIOS AND EXAMINES WHETHER AN ECONOMIC CASE CAN BE MADE GLOBALLY FOR EXPANSION OF MPAs.

6 EXPLORATORY SCENARIOS

EXPANDING MPAs TO COVER:

10% & 30%

INTO AREAS OF:

- LOW BIODIVERSITY & LOW HUMAN IMPACT
- HIGH BIODIVERSITY & LOW HUMAN IMPACT
- HIGH BIODIVERSITY & HIGH HUMAN IMPACT

HABITATS

THE HABITATS INCLUDED IN THIS STUDY ARE LIMITED TO:



BENEFITS

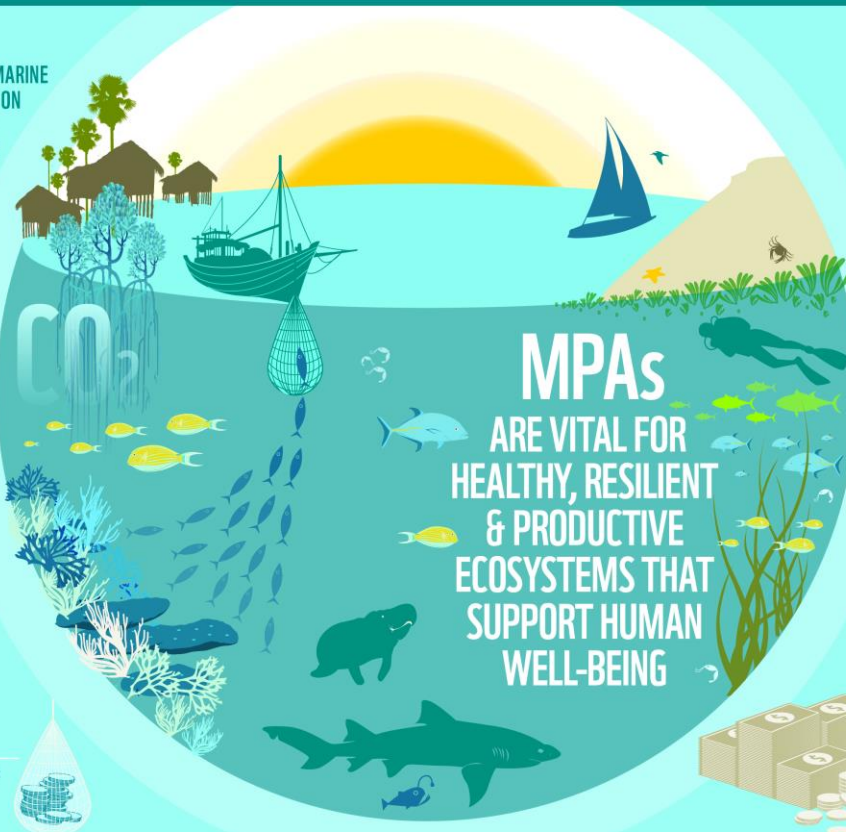
THE BENEFITS OF ECOSYSTEMS ARE LIMITED TO INCLUDE:



COSTS

THE COSTS OF EXPANDING MPAs THAT WERE INCLUDED IN THE STUDY ARE:

SET UP COSTS + OPERATING COSTS + OPPORTUNITY COSTS TO FISHERIES



THE RESULTS

THIS STUDY OF THE ECONOMIC IMPACT OF EXTENDING MPAs GLOBALLY SUGGESTS ECONOMIC BENEFITS OUTWEIGH THE COSTS

BENEFIT: COST RATIO

ACROSS ALL SIX SCENARIOS, BENEFITS OUTWEIGH THE COSTS RANGING BETWEEN

3:1 & 20:1

ECONOMIC BENEFITS

THE NET ECONOMIC BENEFIT OF EACH SCENARIO IS ESTIMATED TO BE IN THE RANGE OF USD 490-920 BILLION OVER THE PERIOD 2015-2050

THIS ADDS AN IMPORTANT REASON FOR GOVERNMENTS, BUSINESS, COMMUNITIES AND FINANCIAL INSTITUTIONS TO INCREASE INVESTMENT IN MPA IMPLEMENTATION

TOTAL NET BENEFITS

BENEFITS:

THE SCENARIO OF EXPANDING NO-TAKE MPAs BY

10%

US\$622-923 BILLION

THE SCENARIO OF EXPANDING NO-TAKE MPAs BY

30%

US\$791-1,145 BILLION

MINUS COSTS:

US\$45-47 BILLION

US\$223-228 BILLION

EQUALS TOTAL NET BENEFITS FROM 2015 TO 2050

US\$490-920 BILLION

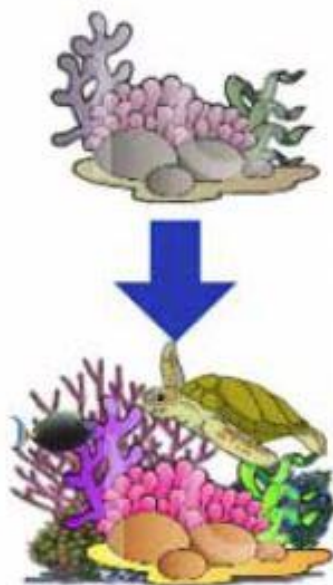
NET IMPROVEMENT ACROSS THE SCENARIOS AS MEASURED BY THE BENEFITS MINUS THE COSTS

This infographic is based on the study: Brander, L., Baulcomb, C., van der Lelij, J. A. C., Eppink, F., McVittie, A., Nijsten, L., van Beukering, P. 2015. The benefits to people of expanding Marine Protected Areas. VU University, Amsterdam, The Netherlands.

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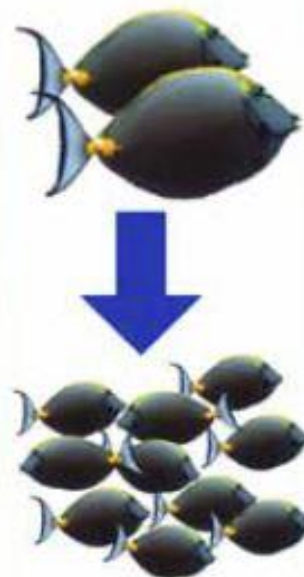
MPA Effects: How do they work?



MORE RESILIENT REEFS
MPAs Improve resilience of reefs, and allow damaged systems to recover.



LARGER FISH
In MPAs, Individual fish are able to grow larger in the absence of fishing pressure.



MORE OFFSPRING
Fish spawn in MPAs, producing many offspring. Larger female fish produce more eggs than small fish.



LARVAL SEEDING
Larvae produced in the MPA drift with the current outside of the MPA, where they settle and grow.

The establishment of year-round effectively enforced marine reserves (no-take areas) within Mediterranean MPAs has been generally linked to increases in fish biomass, density, species richness and size



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The purpose of Marine Protected Areas (MPAs)

MPA aims to several Ecological and Socio-economic goals including:

- ❑ **Conservation** of Marine Biodiversity
- ❑ **Protection of threatened**, rare or endangered species and populations
- ❑ **Protection of commercially** / economically important species
- ❑ **Preservation of habitats** that are critical for the survival and/or lifecycles of species, including
- ❑ **Fisheries management** (reduce fishing pressure, replenish fish-stocks, protect critical stages of species lifecycles, reduce by-catch, reduce competition among fishers)
- ❑ **Sustainable Economic development & Tourism**
- ❑ **Education & public awareness** (schools, universities, general public, stakeholders)
- ❑ **Research purposes** – provide natural laboratories and reference sites (e.g. transplantation of corals, effects of climate change)

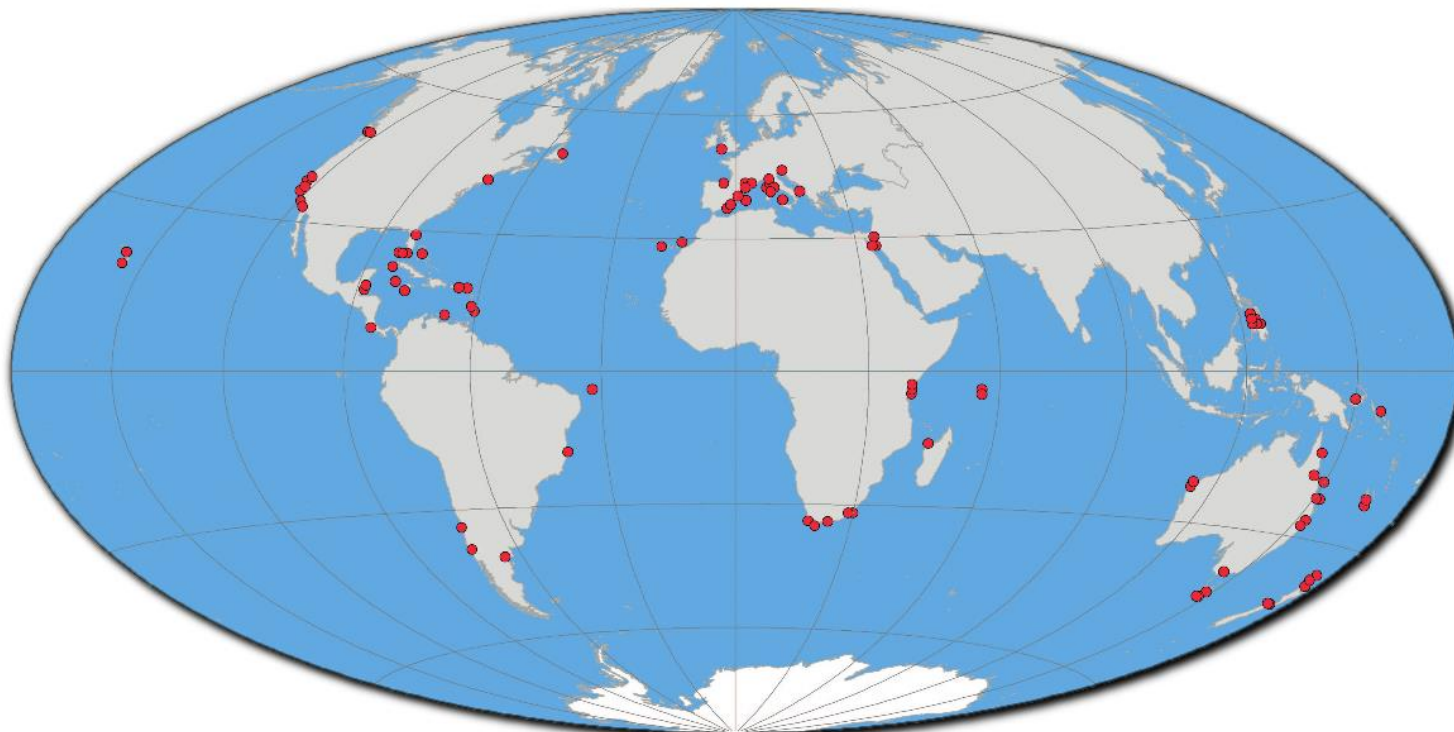


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• In **2015** at least 11.300 MPAs existed worldwide, covering **3.7% of the ocean**, in **2021 7.7%** of the ocean (But only a small number of them were Marine Reserves = only 1.4% of the global seas receive complete and permanent)

Goal = protect at least 10% of the oceans and seas through the establishment of MPAs by 2020! (*Convention on Biological Diversity - IUCN*) **not achieved**



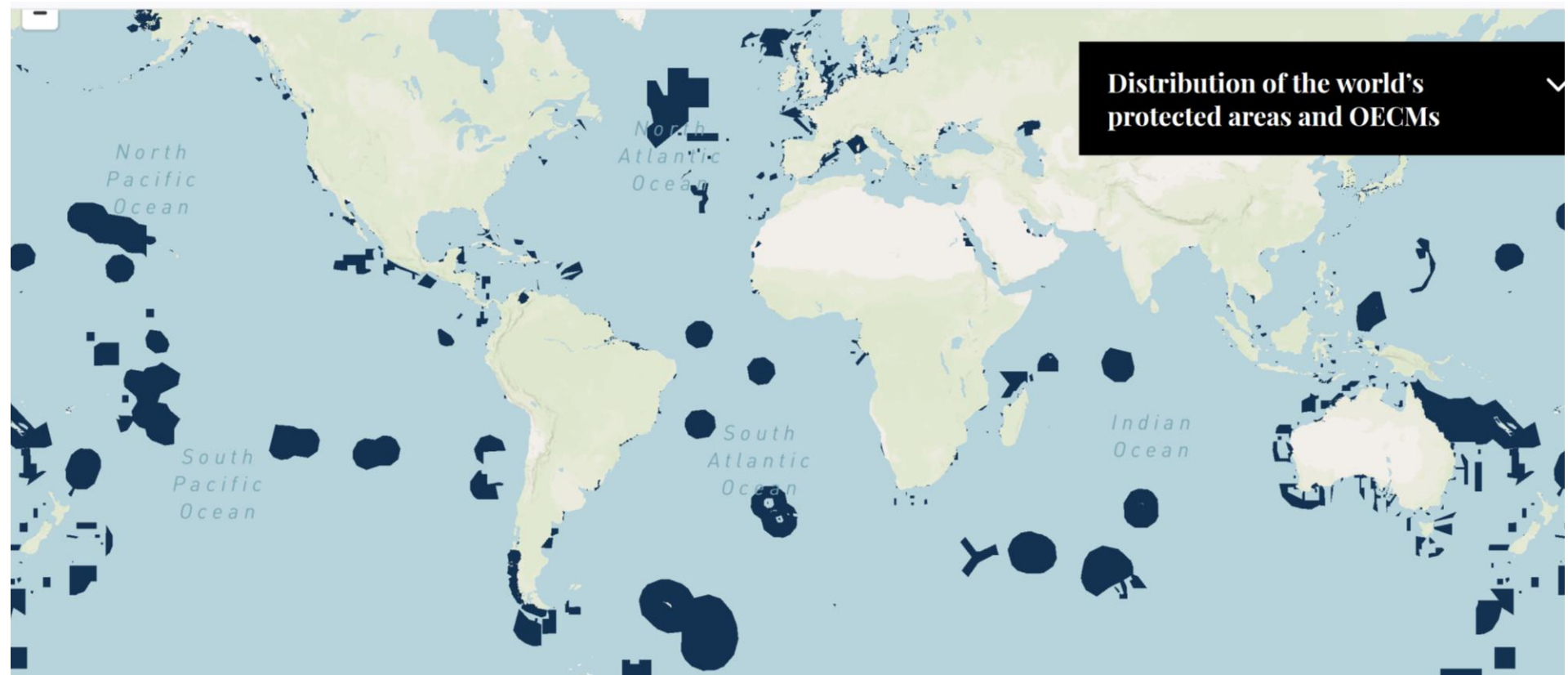
(PISCO) 2011. The Science of Marine Reserves (2nd Edition, Europe). 22 pages.



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- **Next Goal** = From 7.7% now-days to **30%** in **2030** (**The Ocean Dimension of the 2030 Agenda: Conservation and Sustainable Use of the Ocean, Seas, and Marine Resources for Sustainable Development**)

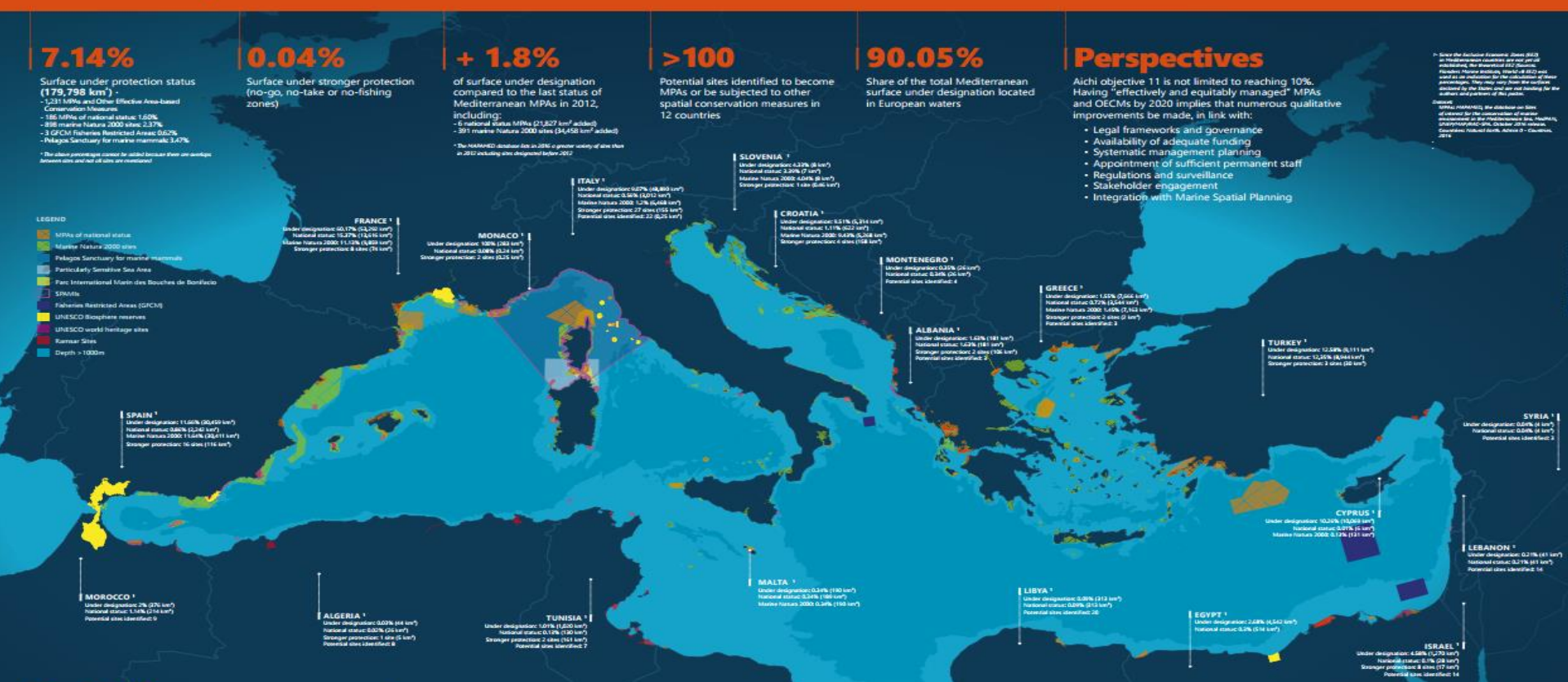




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The system of Mediterranean Marine Protected Areas in 2016



The Mediterranean : a sea under pressure

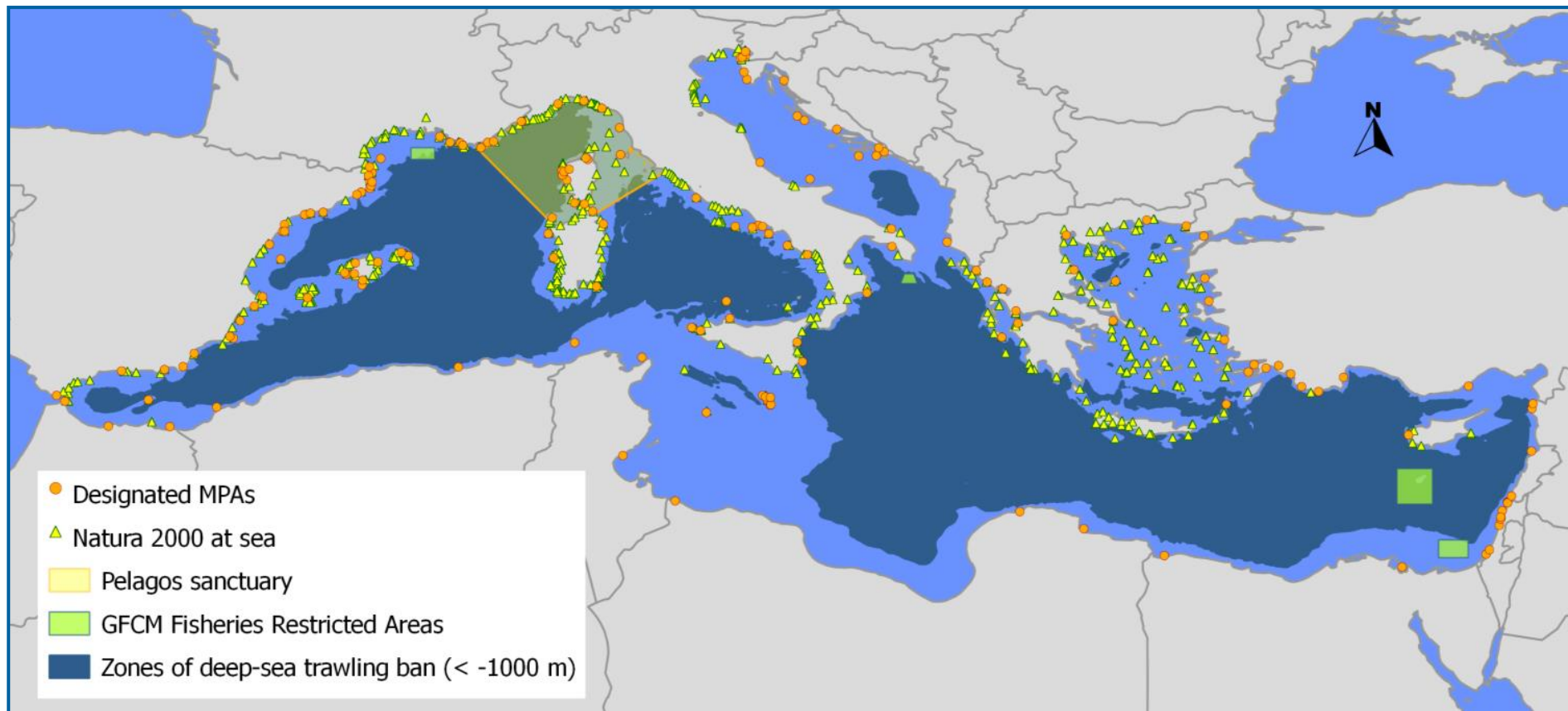
- 1/3 of the global maritime traffic
- 1st world tourist destination
- Booming exploitation of hydrocarbons at sea
- Overexploited resources
- Land-based pollutions
- Drastic impacts linked to climate change
- Over 900 non-native marine species including at least 40 invasives

Source: Pinger, MacIsaac, 2017; WWF, 2016; Piner, 2016

¹FAO, 2016. The state of Mediterranean and Black Sea Fisheries. General Fisheries Commission for the Mediterranean, Rome, Italy.

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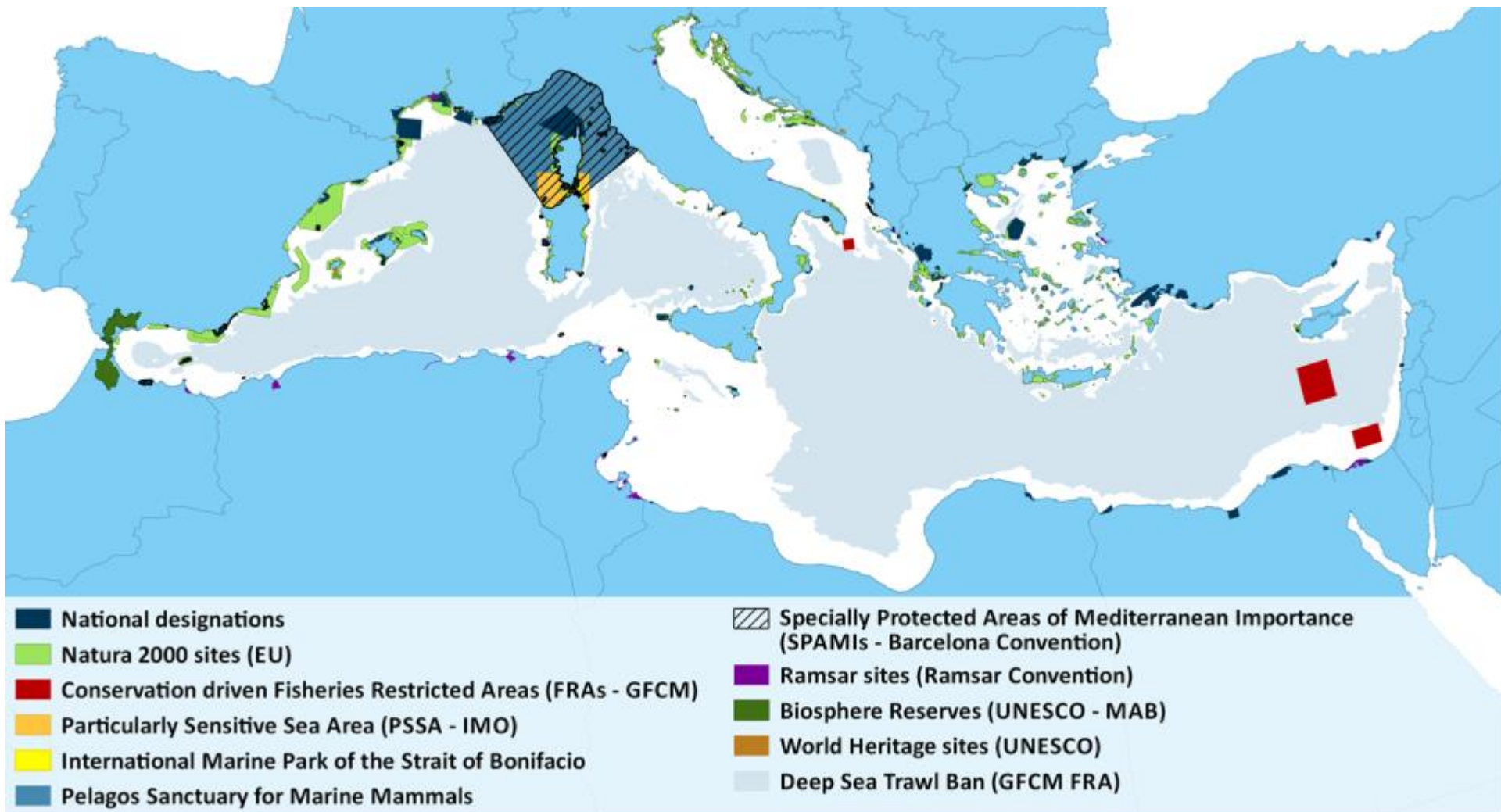


MEDITERRANEAN SEA – Protected Areas



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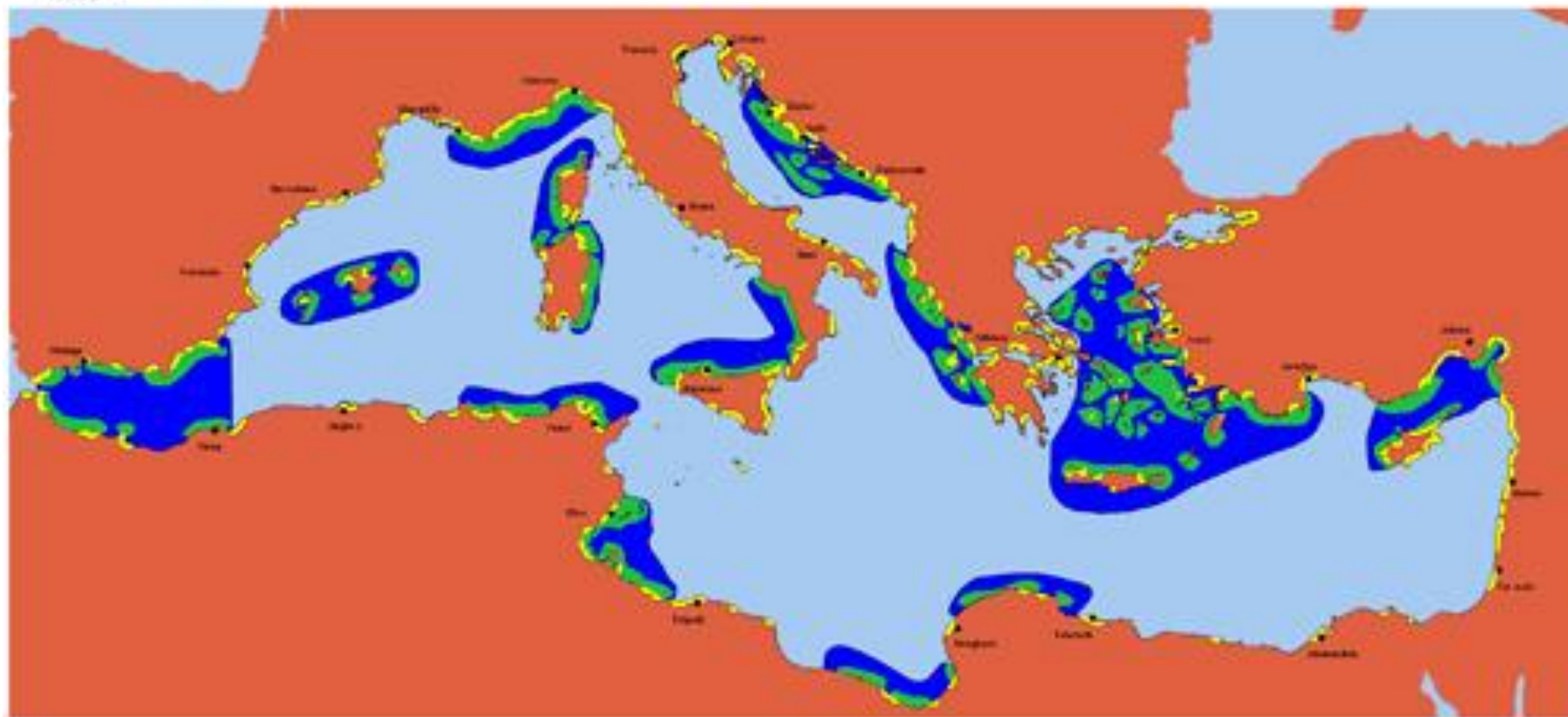
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MEDITERRANEAN SEA – Protected Areas



The Mediterranean: 13 Key Areas to Protect



Green Presence of high sea bottom biodiversity and/or important species/habitats

Yellow Major threats as pollution hot spots, main harbours and coastal big cities

Blue Areas of general interest which host the main biological richness and are the most threatened





MedPAN – Network of Marine Protected Areas in the Mediterranean Sea (www.medpan.org)

Members





**ΔΙΚΤΥΟ ΠΡΟΣΤΑΤΕΥΟΜΕΝΩΝ ΠΕΡΙΟΧΩΝ
NATURA 2000 ΣΤΗΝ ΕΛΛΑΔΑ - 1996**

**NATURA 2000 Network of
Protected Areas in Greece - 1996**



Πίνακας. Κατανομή των περιοχών του Δικτύου NATURA 2000 στην Ελλάδα

Περιφέρειες	Αριθμός περιοχών NATURA
Μακεδονίας – Θράκης	78
Ηπείρου - Δυτικής Μακεδονίας	40
Θεσσαλίας - Στερεάς Ελλάδας	53
Πελοποννήσου, Δυτικής Ελλάδας & Ιονίου	65
Αττικής	10
Αιγαίου	73
Κρήτης	52
ΣΥΝΟΛΟ	371

Η έκταση των περιοχών του δικτύου NATURA 2000 στην Ελλάδα ανέρχεται σε 4.294.205 ha και καλύπτει το 27,3% της χέρσου και το 16,1% του παράκτιου και θαλάσσιου χώρου και το 5,5% των χωρικών υδάτων).



ΔΙΚΤΥΟ ΠΡΟΣΤΑΤΕΥΟΜΕΝΩΝ ΠΕΡΙΟΧΩΝ NATURA 2000 ΣΤΗΝ ΕΛΛΑΔΑ ΝΕΕΣ ΠΕΡΙΟΧΕΣ Δεκ. 2017

- 100 νέες περιοχές
- Μεγάλο Ποσοστό Θαλάσσιων Περιοχών (από 6% σε > 20%)

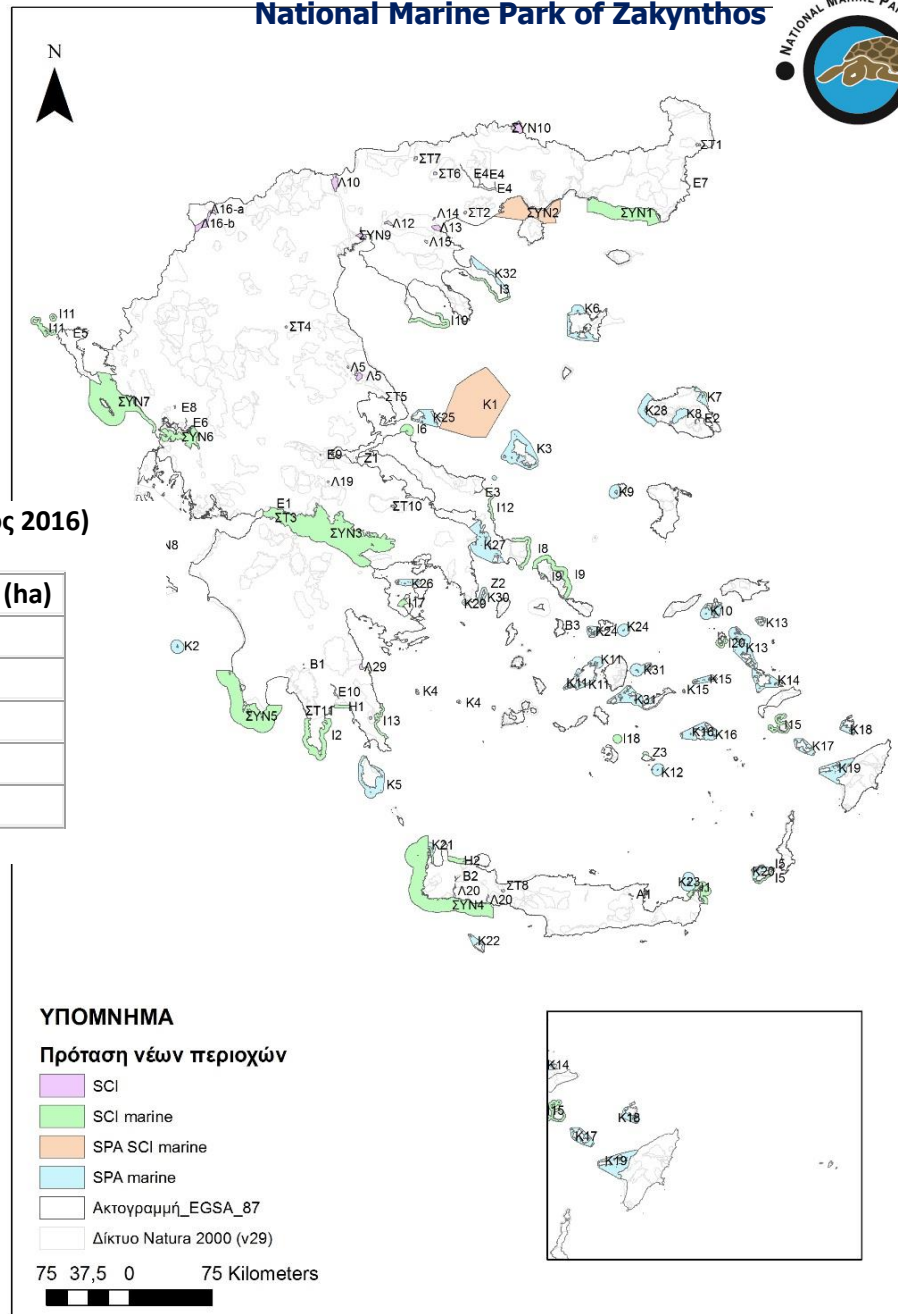
Συγκεντρωτικός Πίνακας επέκτασης εκτάσεων Δικτύου NATURA 2000 (Ιούνιος 2016)

ΤΥΠΟΣ	Αριθμός	Έκταση χέρσου (ha)	Έκταση θάλασσας (ha)
TKS χερσαίοι	39	47.433	
TKS θαλάσσιοι	28		1.011.293
ΖΕΠ θαλάσσιοι	32		844.343
TKS – ΖΕΠ θαλάσσιοι	1		75.686
ΣΥΝΟΛΟ	100	47.433	1.931.322

NATURA 2000 Network of Protected Areas NEW ADDITIONS Dec.. 2017

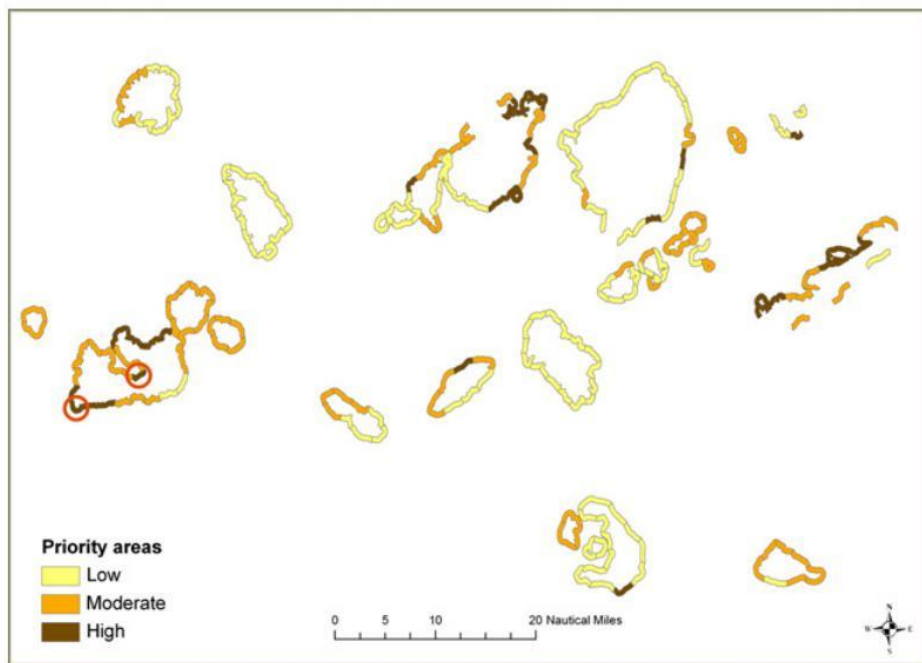
- 100 New areas
- Increased % of Marine Protected Areas (from 6% to > 20%)

National Marine Park of Zakynthos





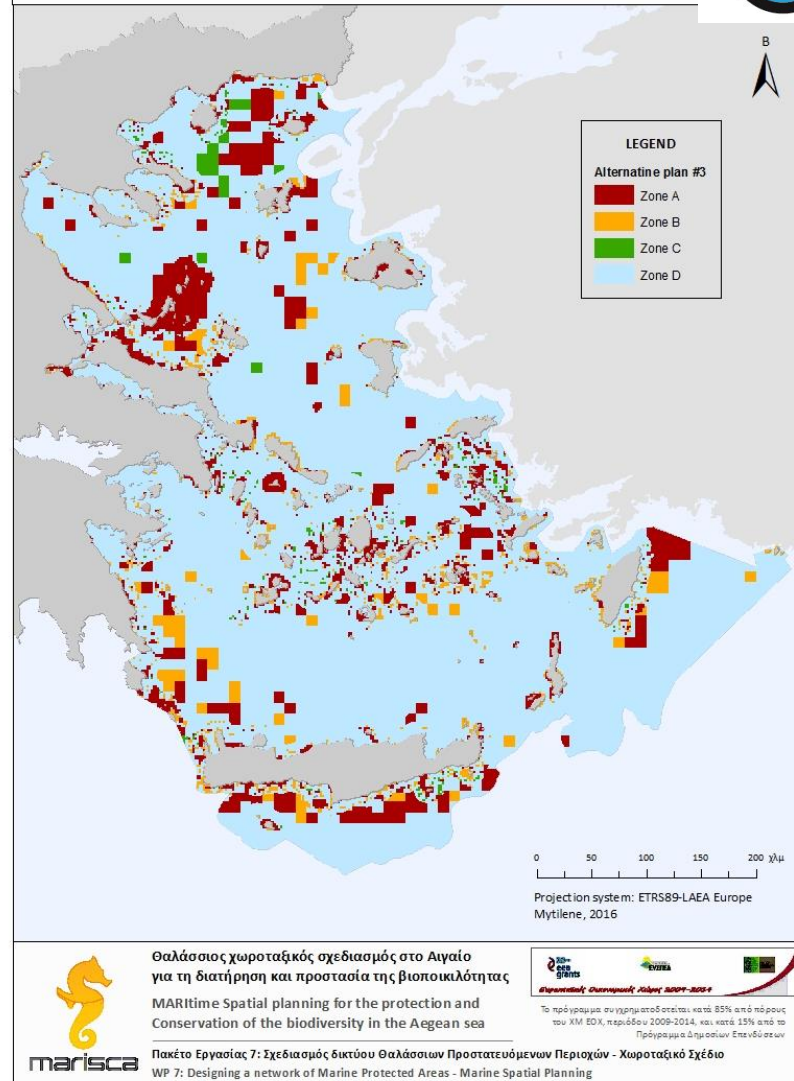
MARINE SPATIAL PLANNING in the Greek Seas (S. Aegean/Cyclades Islands) and AEGEAN Sea)



Giakoumi et al. 2010 – Designing an **MPA network** in the Cylades archipelago



Alternative management plan



Markantonatou et al. 2017 - Designing an **MPA network** in the Aegean Sea based within the framework of **Marine Spatial Planning**



The network of Marine Protected Areas in the Mediterranean



Since the end of 2016, 163 new MPAs have been designated in the Mediterranean and contribute to a 2 points overall net gain in the percentage of surface under designation. A total of **23 nationally designated MPAs** have been declared in **9 Mediterranean countries** covering **48,764 km²**, or **1.9 % of the Mediterranean** and a total of 140 new Marine Natura 2000 sites have been created in **3 Mediterranean countries**, covering about **17,782 km²**, or 0.7 % of the Mediterranean.