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Marine Protected Areas: a long term investment in marine biodiversity conservation and sustainable exploitation of marine resources

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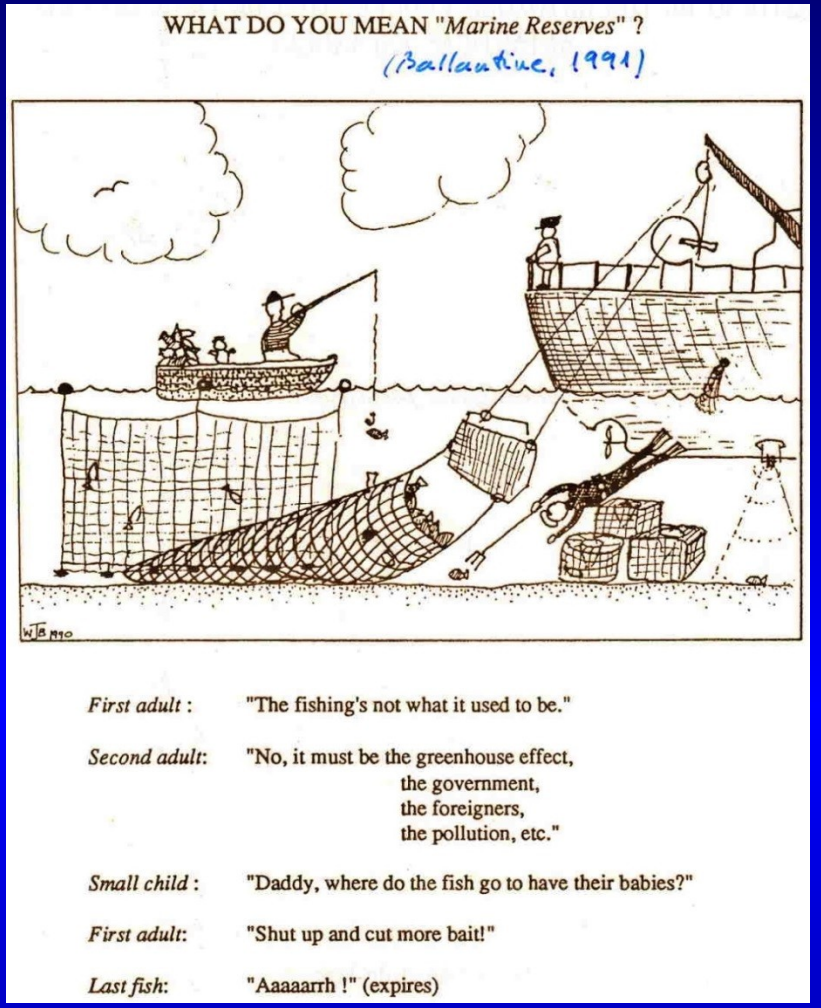
- MPAs necessity. Goods and services of tropical habitats
- Species or spaces?
- MPAs Design
- Zoning
- Management Plan

Why Marine Protected Areas?

- Coastal areas with scarce and very fragile habitats
- Very crowded and exploited (human impacts)
- Over-exploited
- Conflicts (urbanism vs. conservation, artisanal vs. trawling fishing, sportive vs. professional fishing… And…
- Urgent necessity to conserve our natural patrimony for our future generations

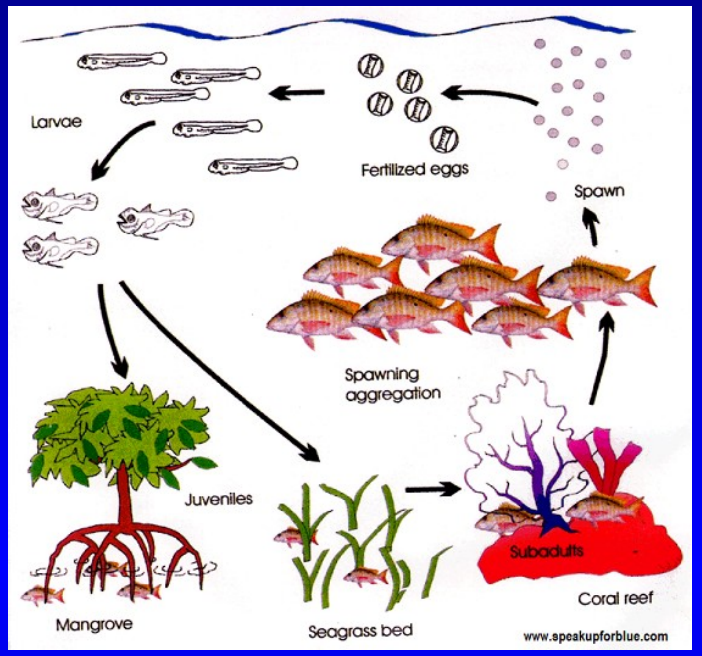


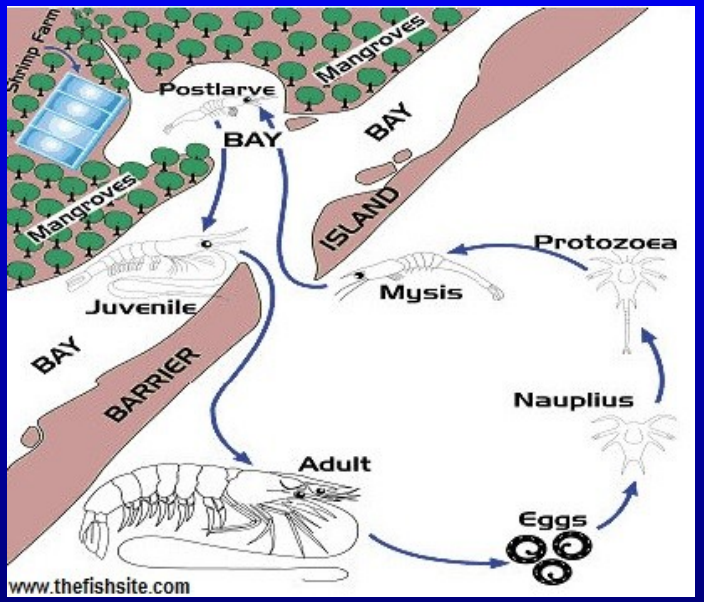
Important habitats in tropical areas

- Coral reefs
  - Less than 1% of the ocean surface, but…
  - The highest habitat in marine diversity (80,000 spp. => 30% of the oceans), at different levels (genetic, species, trofic guilds…)
- Seagrasses: marine plant meadows
- Mangroves: tropical inshore forests dominated by trees and shrubs that grow in salt water
  - The three habitats represents the nursery grounds to 40% of marine species

Goods and services

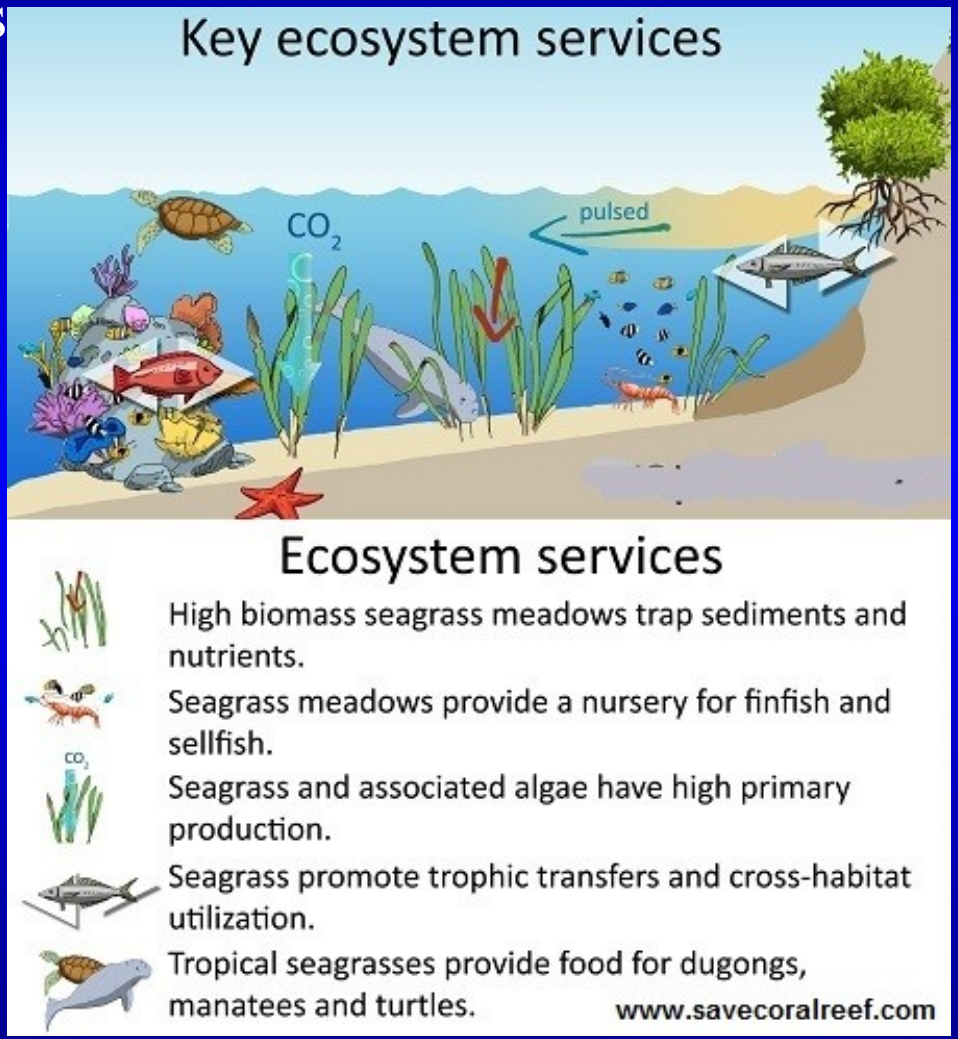
- Food and fishing: They sustain the fish and shelfish populations for 10^9 people.
- They are interconnected habitats for spawning and juveniles many commercially valuable species (fishes, crustaceans, molluscs…)
- The coral reefs, seagrasses and mangroves provides neraly 500,000,000,000 $/year to millions of people in economic goods and ecosystem services



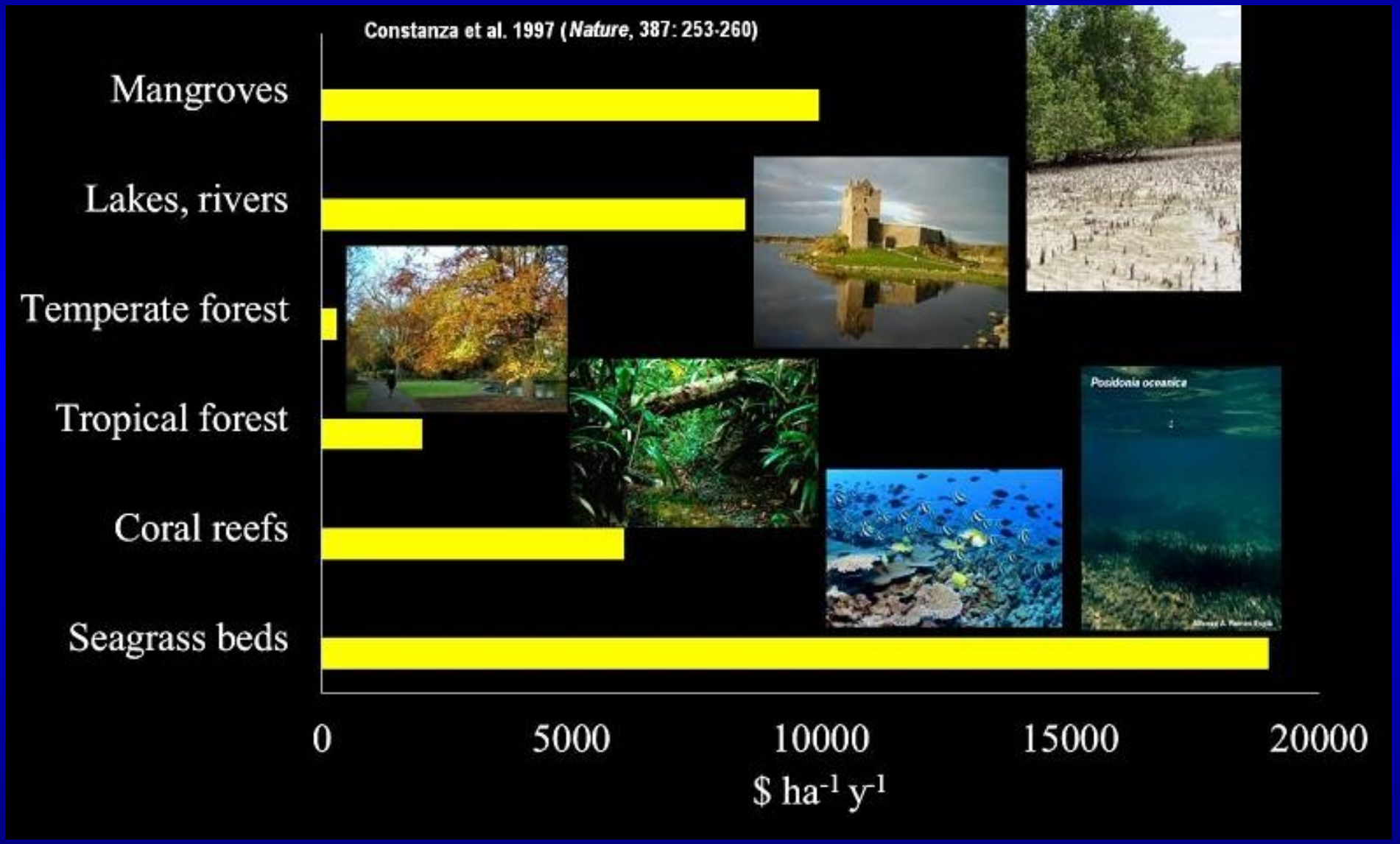


Ecosystem Services

- Coastal protection: They protected coastal communities ans beaches from storm and tsunamy damage, and sea level rise
- Mitigation of the greenhouse effect: sunking of CO_2 (corals, shells, leafs, stems, rhizomes…)
- Trap and breack down organic matter
- Facilitate sediment settlement
- Recycling nutrient and filter polluants



Infact, they represent the highest economical value of ecosystem services



But… they are in peril

- By sea and land-based activities
- Sea-based activities
  - Overfishing
  - Destructive fishing practices: blastfishing poisonous (cyanide), lost nets)
  - Dregging (hypersedimentation)
  - Collision and anchor damage
  - Coral mining
  - Coral collecting…
- It takes an estimated 100 years of recovery for a coral reef system to rebuild itself

Land-based activities

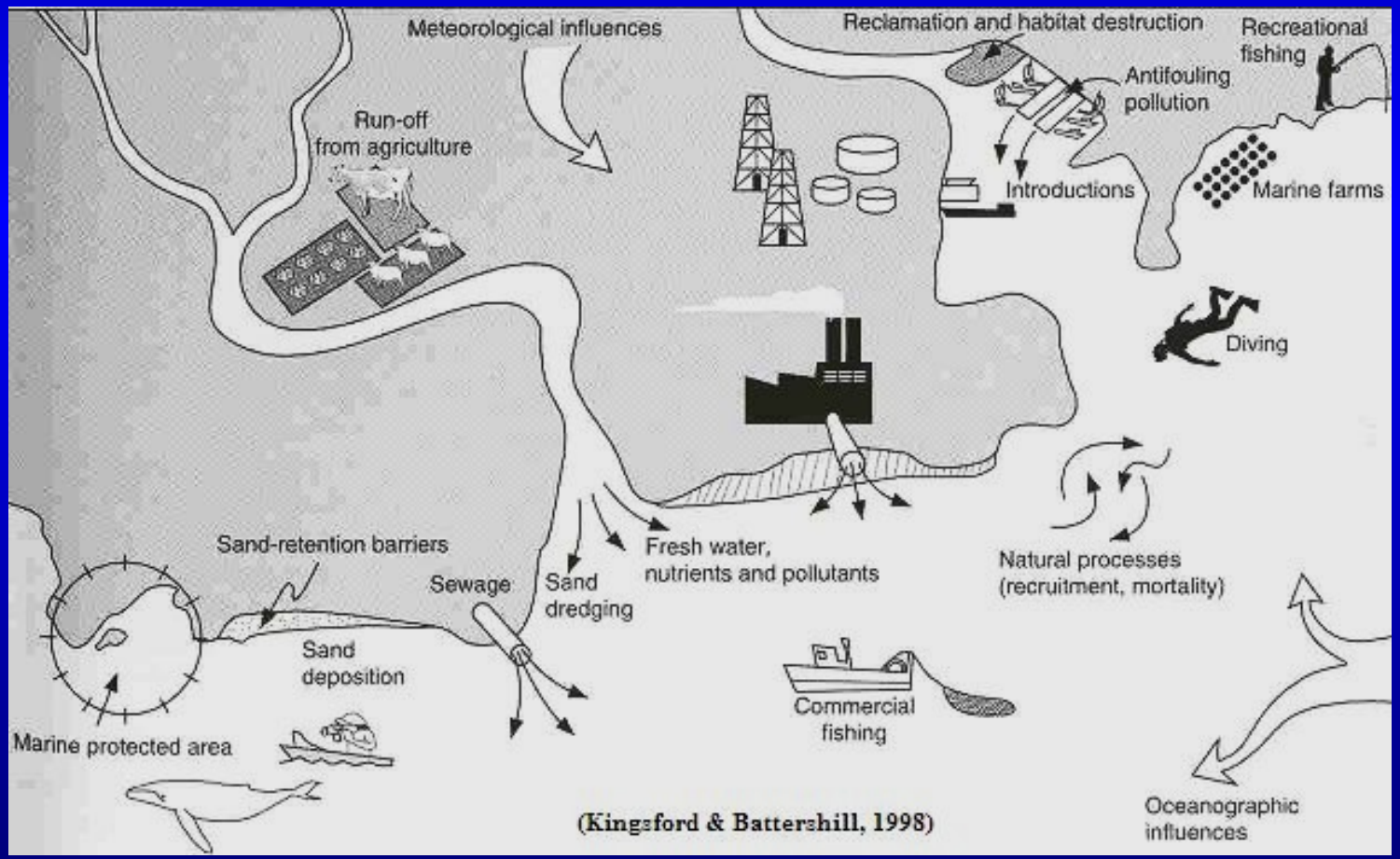
- Poor land use that cause erosion (hyper-sedimentation)
- Agriculture and sewage discharges that causes nutrient loading (eutrofication)
- Nonpoint source pollution carrying dissolved substances
- Coastal development and habitat destruction
- Overfrequentation that damage coastal habitats and dump wastes

And…

- Conflicts (professional-sportive fishermen, fishermen-divers, coastal development-ecologists…)

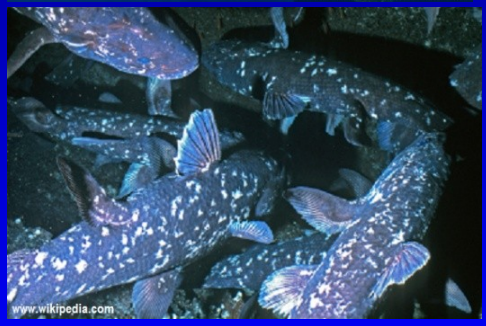
We need …

- Integrated Coastal Management (ICM)
- Fishery Management
- Protect marine biodiversity
- One of the more useful tool for these purposes => Establishment of Marine Protected Areas (MPA)



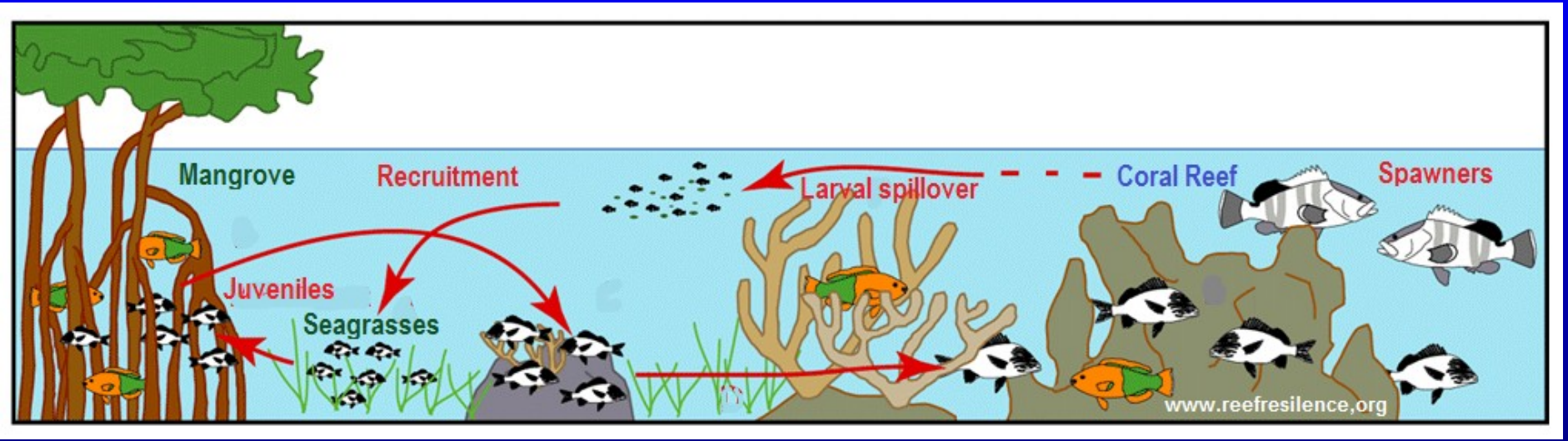
What to protect?...Species or Spaces?

- Of course, we must to protect emblematic spp. that merit especial protection, as
  - Fishes (whale shark, coelacanth)
  - Sea turtles (green, hawksbill, loggerhead, leatherback)
  - Mammals (dugong, humpback whale, dolfins)
- And … other fishes and invertebrates (CITES)
  - Sea-horses (*Hippocampus* spp.)
  - Corals (blue, cawliflower, cactus, organ-pipe, brown-stem, mushroon)
  - Molluscs (giant clam, triton conch)



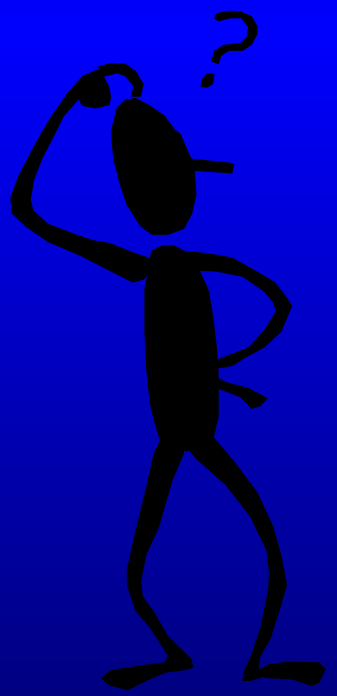
But… it is necessary to protect the habitats

- The species live and reproduce in the habitats
- If you protect some areas of coral reefs, mangroves and seagrasses => you protect
- Marine biodiversity and …
- Spawning and nursery (juvenile) concentration areas of commercial spp. (groupers, seabreams, lobsters…)



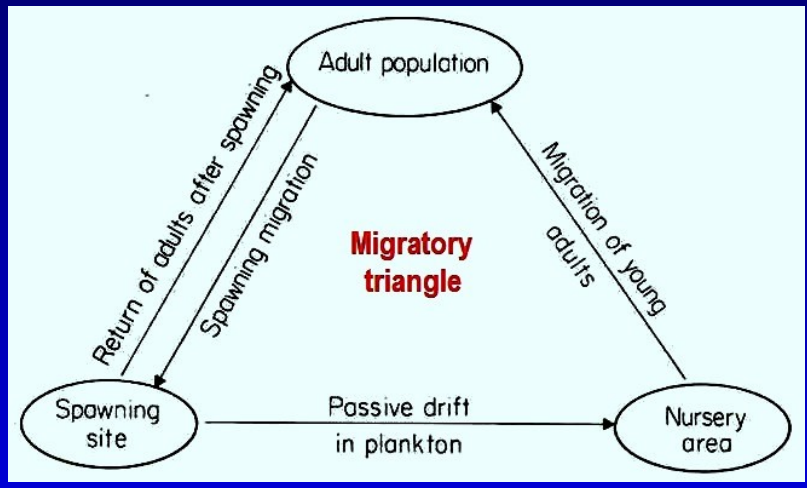
MPA Plannig

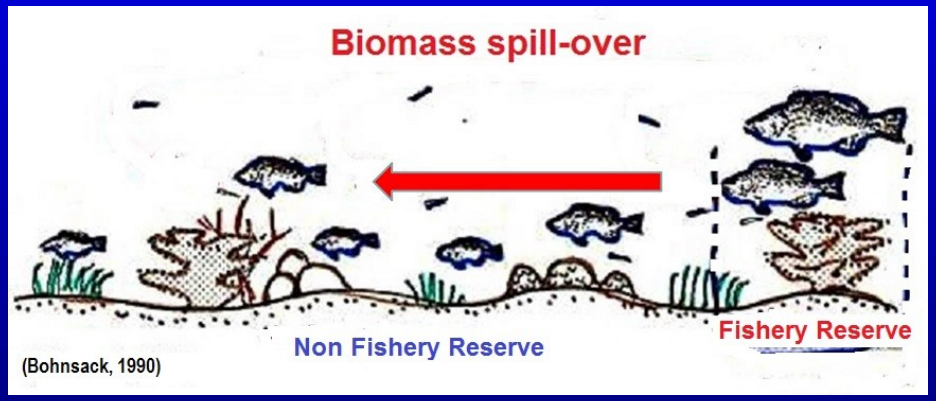
- It is necessary an adequate desing, zoning and management plan
- Design: the 4 ‘S’: Site, Size, Shape and Sloss
  - Site (location) => habitats and species to protect
  - Size => function of habitats (bionomical mapping) and biology of the target species
  - Shape => more spillover and easy to delimitate
  - SLOSS debate: Single Large or Several Small
- Zoning: core, buffer and multi-use zones
- Management Plan: participation of administrations, scientists and communities (fishermen and local people’s responsibles)



Location (Coastal MPAs)

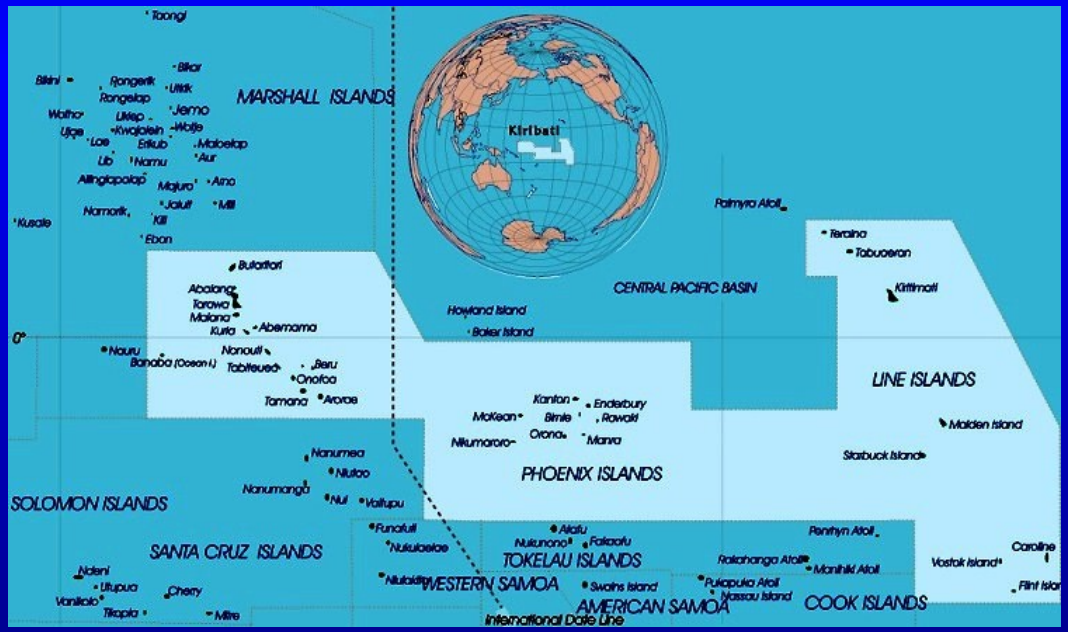
- Inshore: depth ≥ 50m
- Habitat mapping => main habitats: coral reefs, seagrasses, mangroves
- Spawning and/or nursery areas of the target spp. (migratory triangle)
- Existence of corridors (hard bottoms, seagrasses)=> exportation of biomass (fishing outside of MPA)





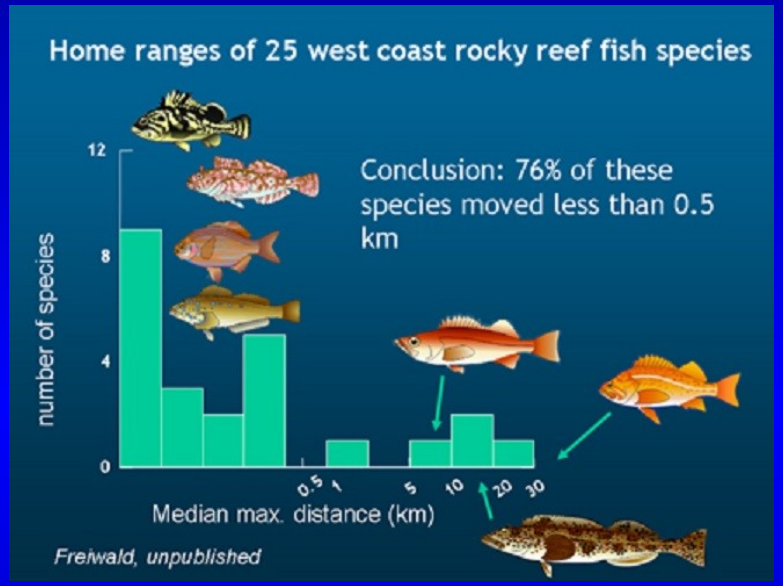
Sizes

- Very variable:
- Biggest: 41.10^6 ha (Phoenix Islands MPA, Pacific)
- Smallest: 1 ha (Monaco Marine Reserve, Mediterranean Sea)
- Medium size: 1600 ha



Experience informs:

- The size depends on habitats (coral reefs, seagrasses, mangroves) and biology of species to protect
- Also, it depends on location, human pressure, control and enforcement capabilities
- Very small MPA (< 100ha) are not operative
- Bigger than 10000ha present problems to control



Type	Adult phase	Embrion. devel.	Examples	MPA size (ha)
A	fixed or territorial	direct	Sygnathidae	< 1000
B	fixed or site dependent	planktonic larvae	Serranidae, Sparidae, lobsters	1000-10000
C	± limited adult territory	planktonic larvae	Merluccidae, Mullidae	10^4-10^5
D	large adult range	nursery area	Thunnidae, squids	10^5 -10^6
E	free swimming	Planktonic larvae/direct	Xiphiidae, cetaceans, pelagic sharks	> 10^6

MPA size for some species

- 100-1000 ha: nesting areas (turtles, birds), spp. development direct (eg. Seahorses)
- 1000-10000 ha: coral reefs, mangroves, seagrasses (groupers, seabreams, lobsters, dugong)
- 10000-100000 ha: demersal spp. on soft bottoms (red-mullet, flat fishes…)
- > 100000 ha: big pelagic spp.

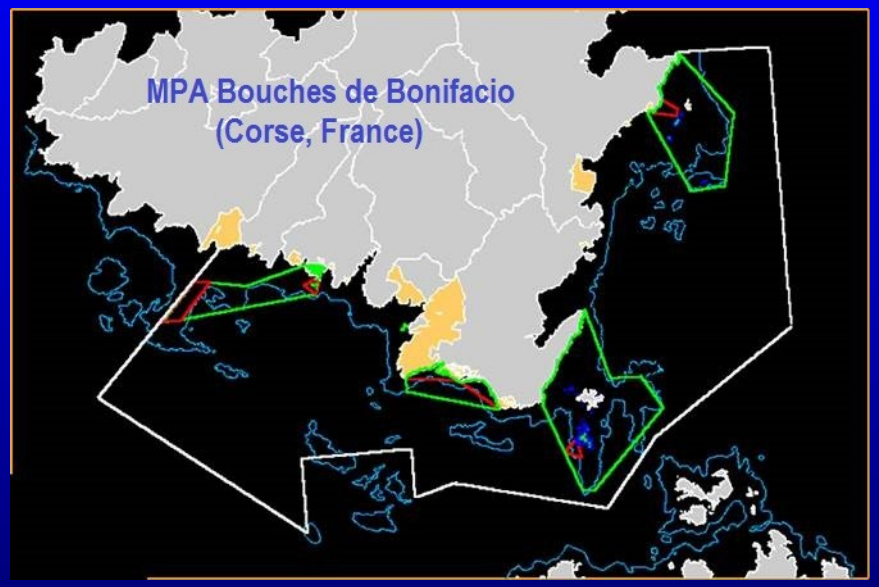
Shape

- Enlarged perimeter (biomass and larvae spillover)

Perimeter = 19 km

Perimeter = 22km

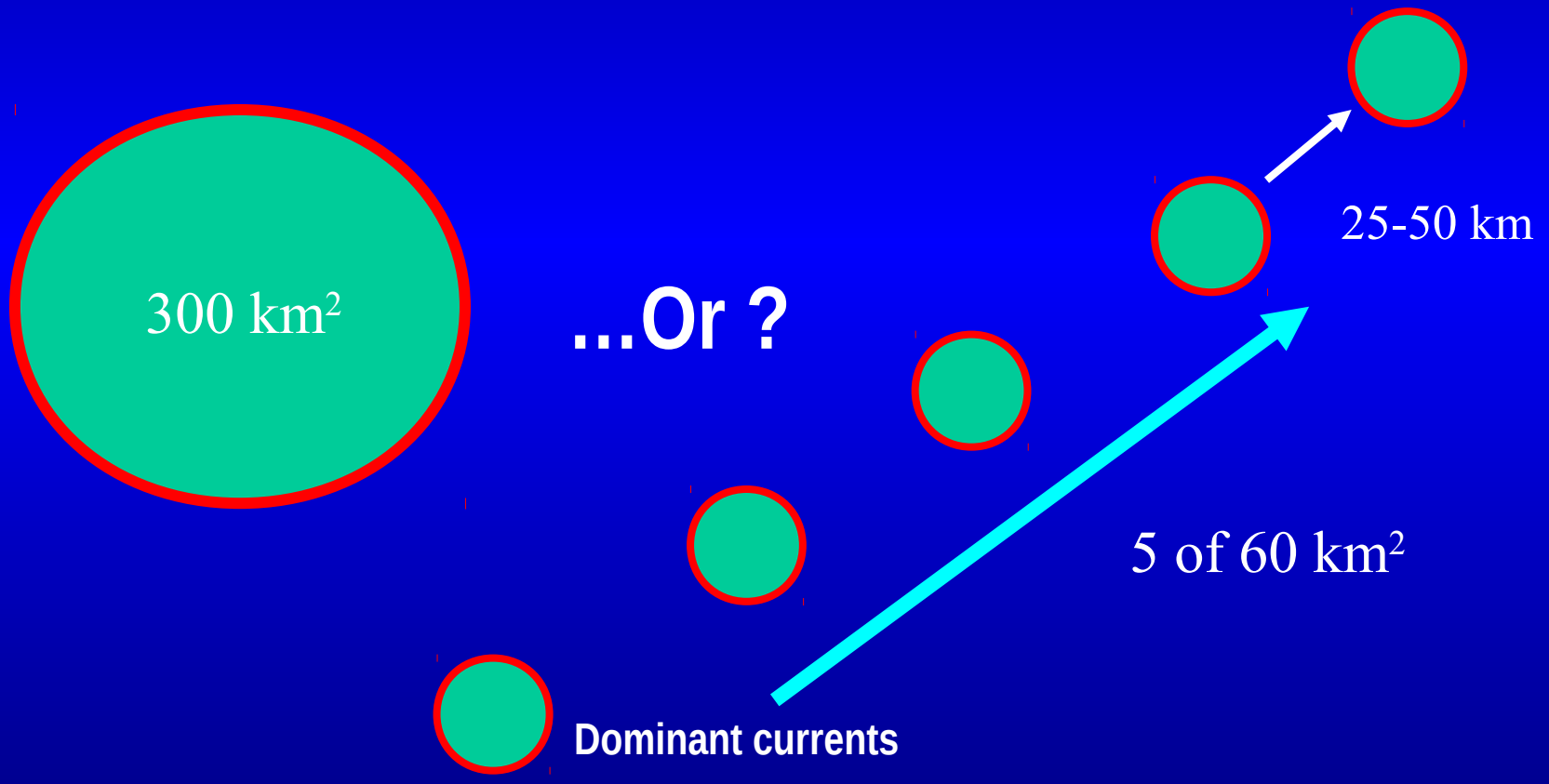
- Easy to delimitate (buoys, coastal marks) and understand



SLOSS Debate

Fisheries Interest (larvae and biomass spillover)

- "Single Large or Several Small"



Zoning: Biosphere Reserves Philosophy (UNESCO)

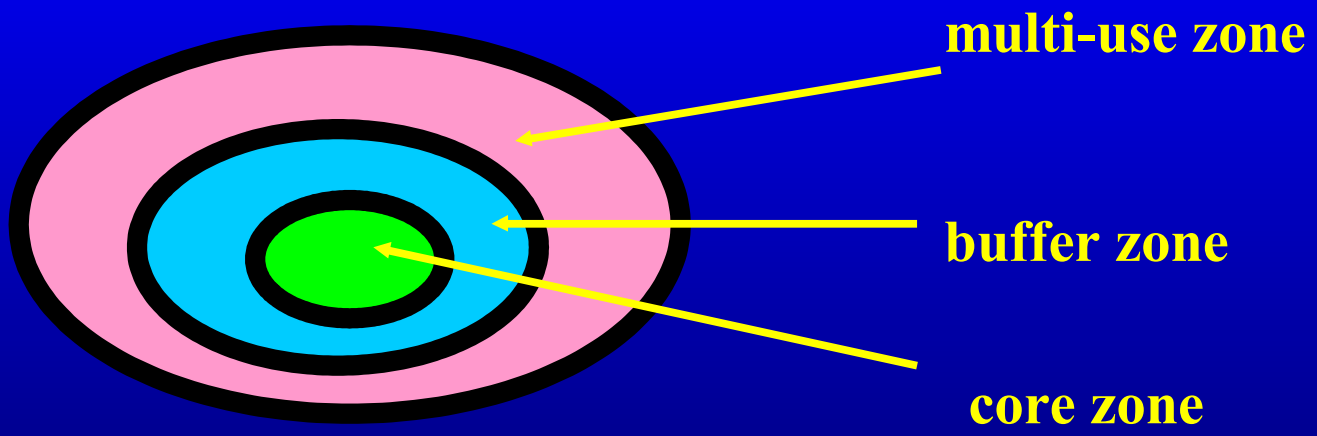
- ***Conservation function*** : preservation of the different levels of biological biodiversity (genetic, taxonomic, habitats, ecosystems).

- ***Logistic function*** : research from inside and outside the MPA, as well as supplying services for education/formation, information and enforcement/surveillance.

- ***Development function***: to allow traditional uses (artisanal fishing) and low impacts activities ('eco-tourism'), which sustain the local populations with a rational exploitation of natural resources.

Zoning: Managed zones (Biosphere Reserves)

- Core zone (10-20%): strictly protected area (only scientific monitoring)
- Buffer zone (30-40%): protection of the core zone (very selective fishing: long-line, trawl-line, hand-line; controlled diving activities)
- Multi-use or peripheral zone (50%): free area access (bathing, sunning, snorkelling, scuba...); small-scale fishing (nets, hooks, traps).



MPAs not only for habitats and species …

- They also provides economic, recreational and educational opportunities for local communities and vistors
- Traditional fishing techniques
  - Not agressive and very selective methods (hooks)
  - Safety, quite near to the base-port
  - Long-term activity based on auto-renovable resources
- New jobs and activities
  - Sea trips, fishing-tourism
  - Diving support
  - Small restaurants (traditional seafood)
  - Educational activities, interpretation center
  - Rangers…

Management Plan

PLANNING

SCIENTIFIC SUPPORT
habitats
species
mapping

SOCIO-ECONOMIC SUPPORT
profesional/sportive fisheries
leisure/tourism activities
local communities, ONGs

LEGAL SUPPORT
sea & coastal administrations
other related administrations
legislation

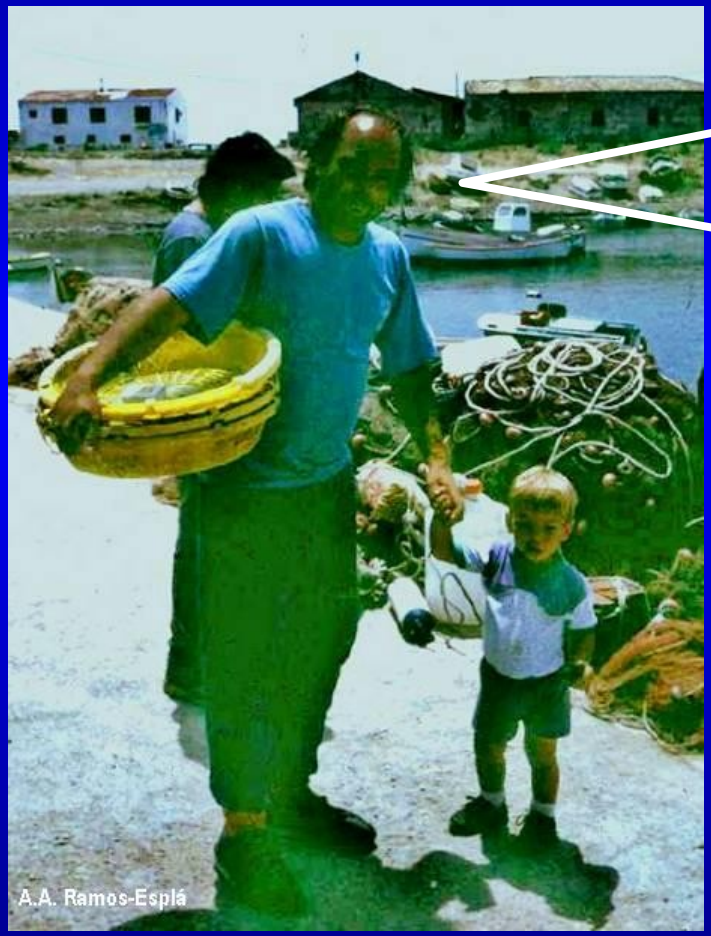
Key principles for MPAs to work

- Well designed (site, size, shape, corridors)
- Enforcement and compliance
- Flexible Management Plan (experience feed-back)
- Sustainably financed (eco-taxes)
- Local community engagement
- Staff capacity and long-term working
- If not => paper MPAs (about 25% world MPAs).
- In this case, it is better not establish the MPA (to avoid over-frequentation)

MPAs around the world

- High success => about 5000 MPAs (2014)
- Constant increase (medium ≈ 4.6%/year)
- Urgent necessity in the Southwest Indian Ocean Ecoregion
- 15 MPAs (2013) to cover 1000 km² (< 0.5% of coastal areas)

Marine Protected Areas => to protect vulnerable habitats/species, but also …



Thanks for your attention, and thinking for our future

The artisanal fishermen and their childrens

Permitted/not permitted uses

- Core zone: only scientific monitoring
- Buffer zone:
  - Traditional selective fishing practices (hooks)
  - Diving (permits, number control)
- Multi-use zone (control of visitors)
  - Traditional fishing (nets, tramps, shellfish collection for food)
  - Anchoring (located places)
  - Bathing
  - Sunning
  - Snorkelling
- Not permit uses (e.g.)
  - Spearfishing
  - Aquaculture
  - Coral collection
  - 'Feeding'