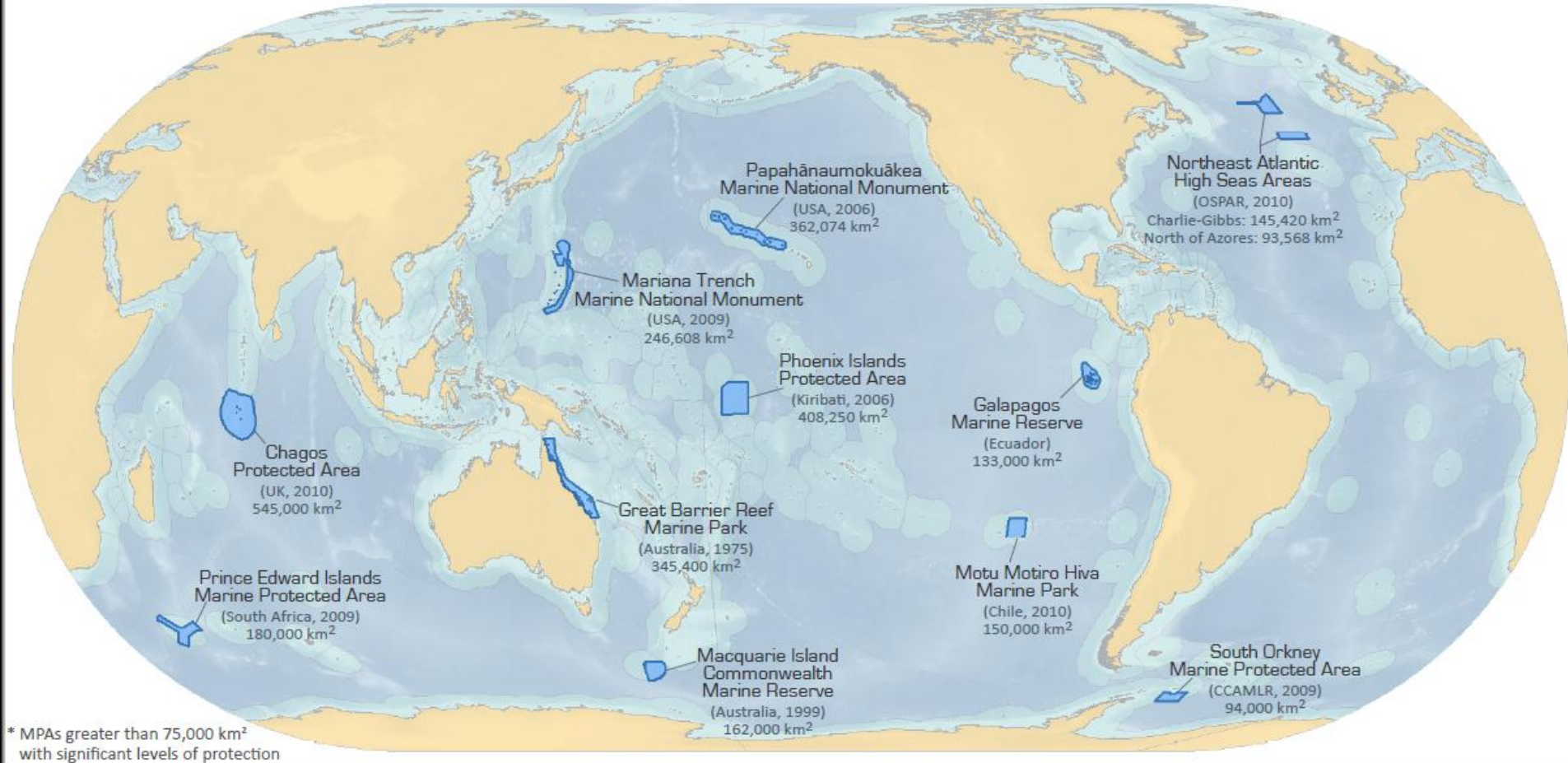


VERY LARGE MARINE PROTECTED AREAS*



MPAs

Are they an efficient use of conservation resources?

Defining a 'Marine Protected Area' (MPA)

Marine Protected Area (MPA) is a term used across the globe to describe: "any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment" (IUCN, 1988 / Kelleher and Kenchington, 1992: 24).



In the UK

MPAs are established primarily for the conservation of marine biodiversity and to protect species and habitats of international or national importance. The main types of MPA in the UK are Special Areas of Conservation and Marine Nature Reserves, which are protected by legal measures, and voluntary MPAs such as Voluntary Marine Conservation Areas and Voluntary Marine Nature Reserves.

International Requirements

“an ecologically coherent network of well-managed marine protected areas”

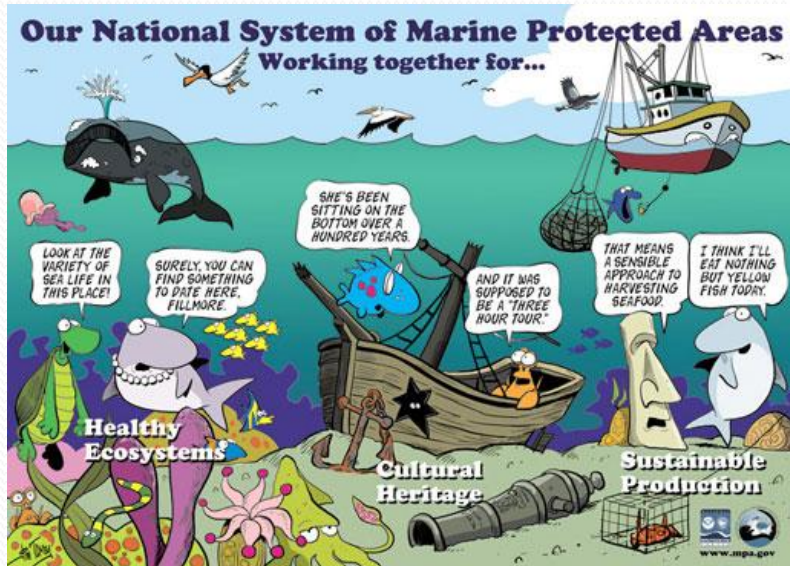
2010 under the Convention on the Protection of the Marine Environment of the North-East Atlantic (OSPAR)

Why?

- **Habitat protection**
- **Conserving cultural heritage**
- **Economics**
- **Biodiversity**
- **Enhancing fisheries**
- **Scientific study**

Turtle survives shark attack - Photo Alex Thornton

Conservation Strategy



- Under the EU Habitat & Birds Directive Special Area for Conservation (SAC) and Special Protected Areas (SPA) were designated
- Globally 1300 MPAs – 1% of marine areas and protected as c.f. 6% of terrestrial

• Expensive to police and interconnectedness of seas poses problems of management - pollution & overfishing can impact a reserve but cannot be easily attributed. Many stakeholders. List them, What are the implications of so many stakeholders?

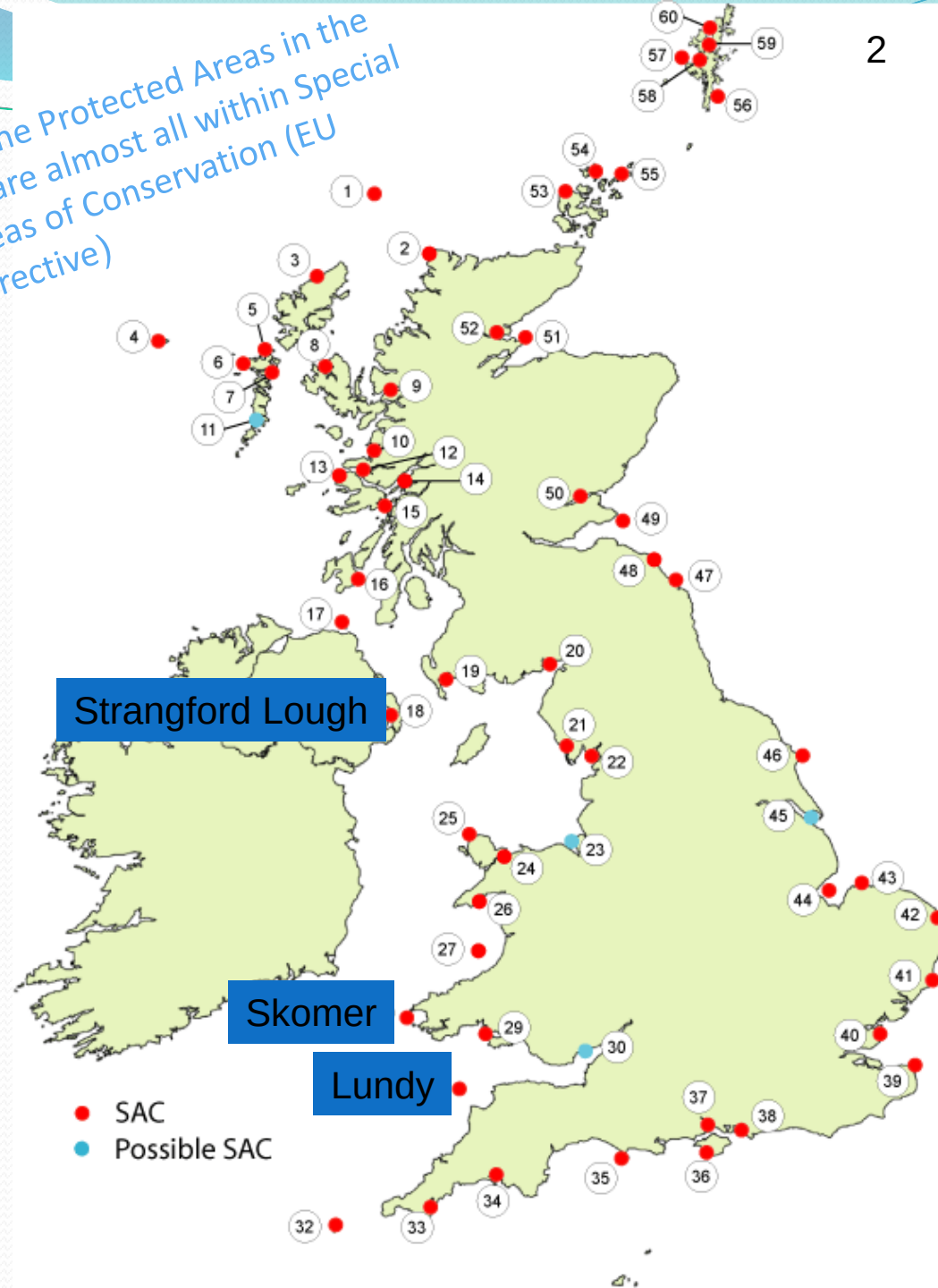
- Lundy designated a Marine Nature Reserve in 1986
- Management of Lundy by wardens, zoning (recreational zones, some no take zones, restricted diving zones, spearfishing restrictions etc) and byelaws

There three Marine Nature Reserves established under UK law.

Marine Protected Areas in the UK are almost all within Special Areas of Conservation (EU Directive)

A range of legislative measures are already in place to provide protection to important marine species and habitats. Currently have **207** marine protected areas in UK waters, which include:

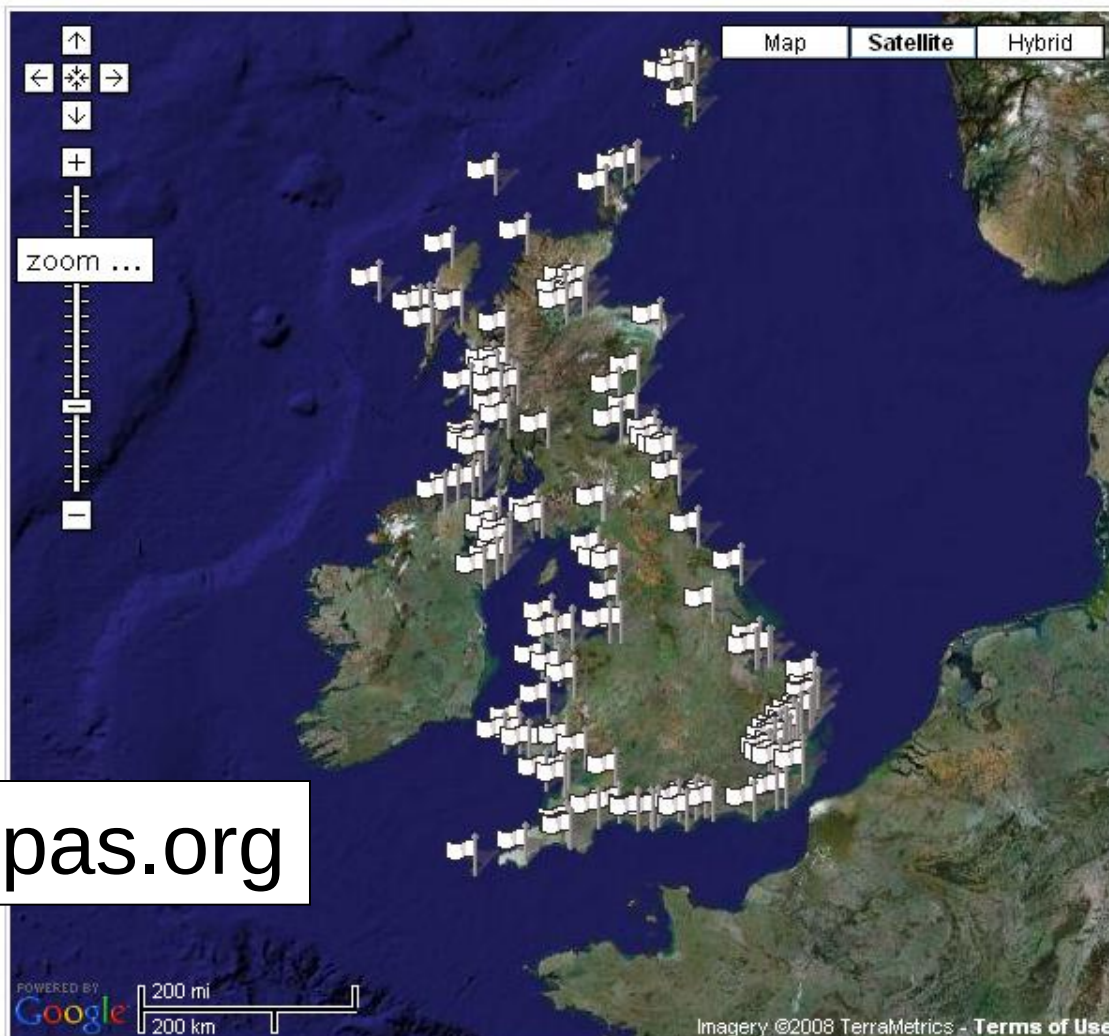
- 107 Special Protections Areas (SPAs) with marine habitats for birds,
- 94 Special Areas of Conservation (SACs) with marine habitats or species, (83 inshore, 9 offshore, 2 inshore and offshore). This includes 18 SACs currently in 'candidate' stage.
- 3 statutory Marine Nature Reserves (MNRs) : Lundy MNR, Skomer MNR and Strangford Lough MNR.
- 2 no take zones : Lamlash Bay on the east coast of Arran, and around Lundy in Devon.
- 1 Marine Conservation Zone (MCZ) around Lundy in Devon.
- In England there are also 28 SSSIs that are not part of SACs but have marine features




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The
information
resource for
Marine
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Areas
practitioners


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[Anglesey Coast -
Glannau Môn: Cors
heli](#)
[Ascrib, Isay and
Duvegan](#)
[Bae Cemlyn / Cemlyn
Bay](#)
[Bann Estuary](#)
[Belfast Lough](#)
[Benacre to Easton
Bavents](#)
[Benfleet and
Southend Marshes](#)

www.ukmpas.org

Why MPAs?

1. For the protection of the 'ecosystem goods and services' that biodiversity provides.
2. As a way of increasing fish stocks by providing refugia from where export of larvae and adults will occur.
3. For the conservation of biodiversity, including protection of rare, scarce and threatened species and habitats.
4. To maintain the value of diverse communities in providing resistance and resilience to change in marine communities.
5. For scientific study in areas that are as close as possible to natural (and therefore provide baseline).

Habitat Management

- arresting and possibly reversing the global and local decline in fish populations and productivity by protecting critical breeding, nursery and feeding habits;
- raising the profile of an area for marine tourism and broadening local economic options;
- providing opportunities for education, training, heritage and culture;
- providing broad benefits as sites for reference in long-term research and nature-based tourism.

MPAs are needed to maintain the value of diverse communities in providing resistance and resilience to change.

The main threats are:

- **Physical disturbance and contaminants that reduce species diversity in communities.**
- **Introduction of non-native species that become dominant.**
- **Climate change impacts on dominant or key functional / structural species.**

Evidence in the scientific literature is weak, but see, for instance, Bevilacqua *et al.* 2006.

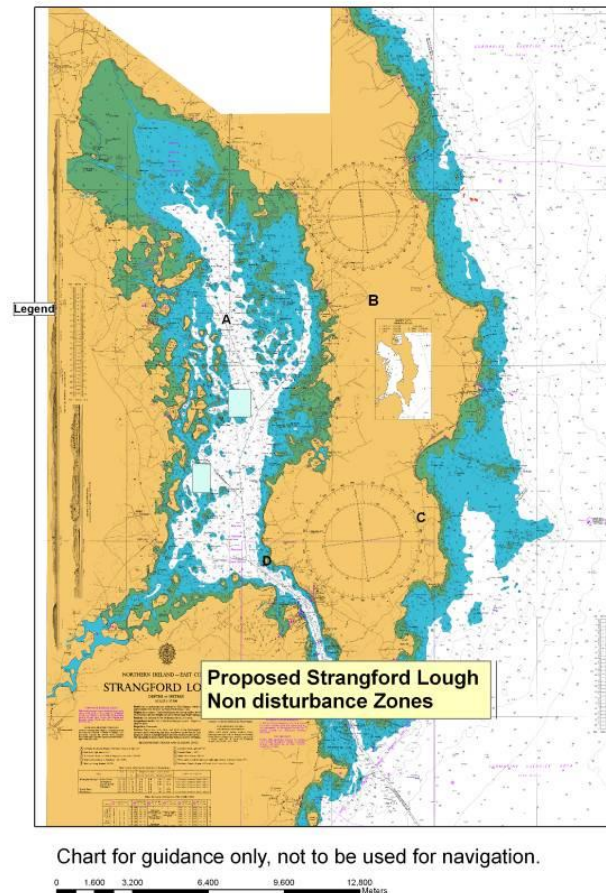
How are they chosen?

1. **Identifying bioregions** – patterns in biology, oceanography & physical coast/seabed characteristics
2. **Identifying candidate marine protected areas** – based initially on capacity to represent biodiversity
3. **Community Consultation** – environmental & socio-economic
4. **Zoning** – variable protection depending on resilience of that site



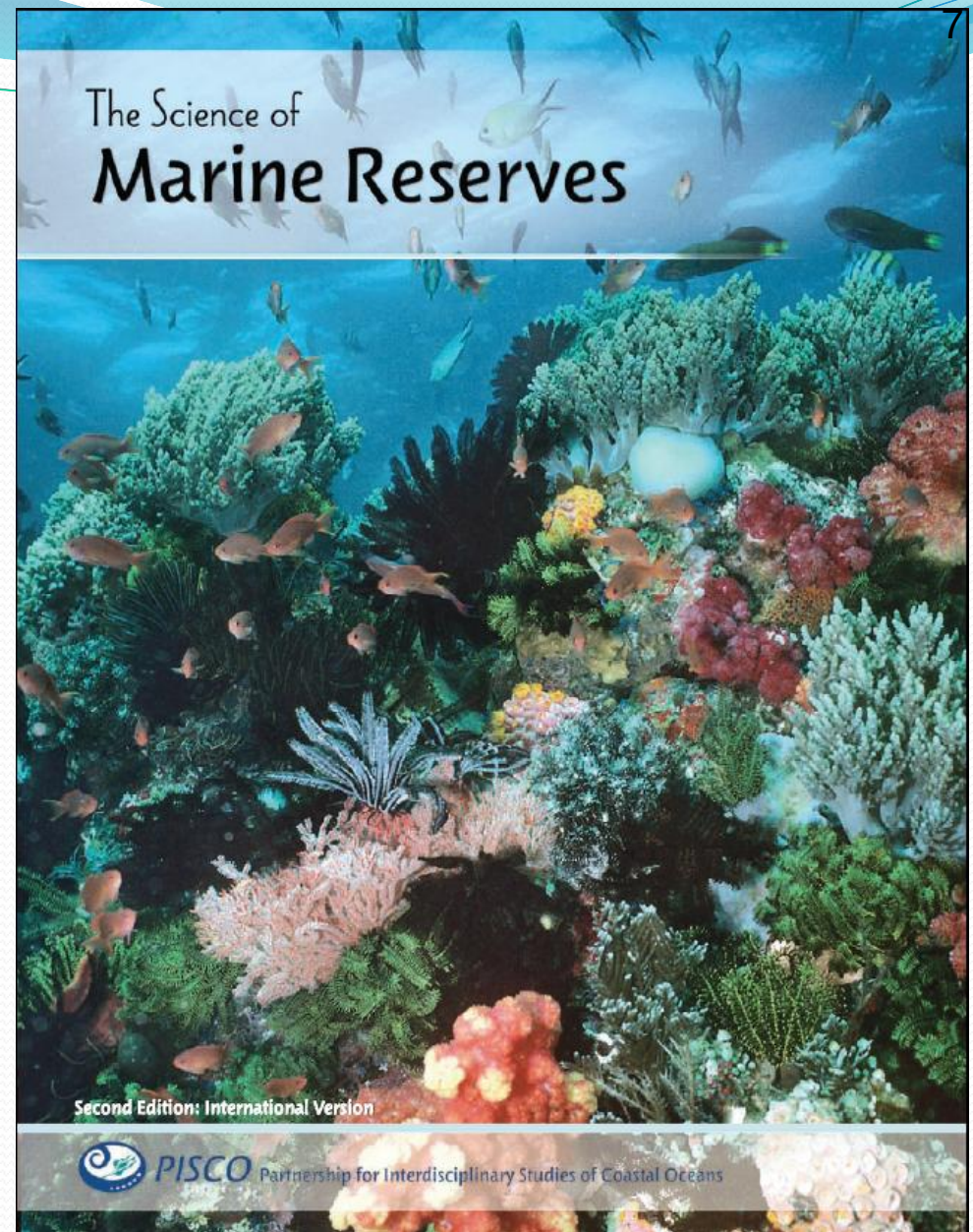
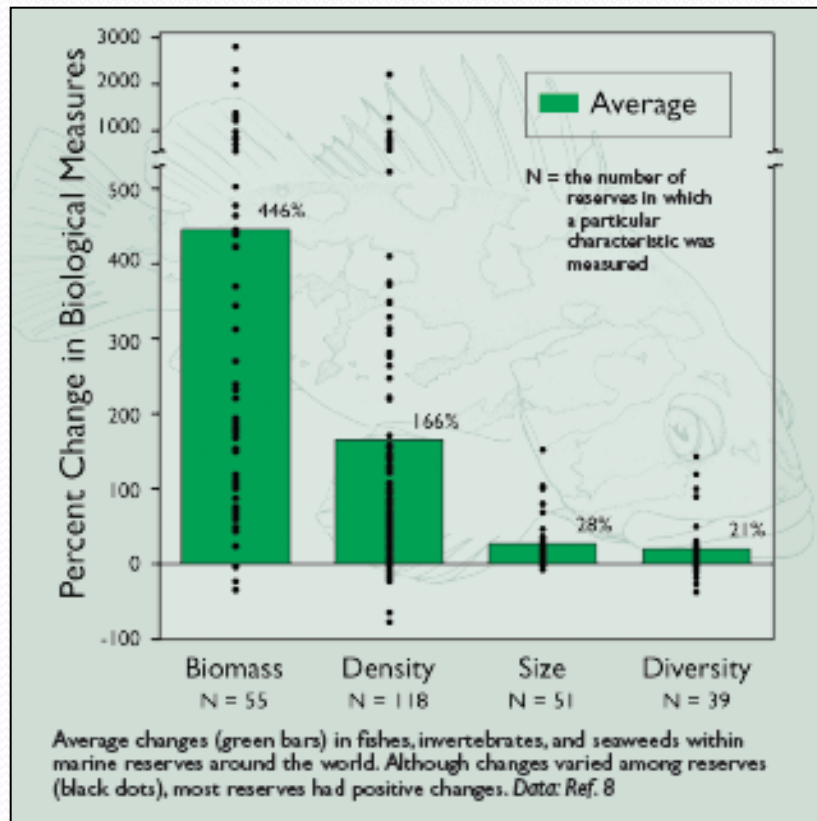
MPAs are needed to restore damaged ecosystems (where restoration is possible)

First, wreck your MPA – the case of Strangford Lough SAC mussel beds



Restoration zones (October 2007) – but will they work?

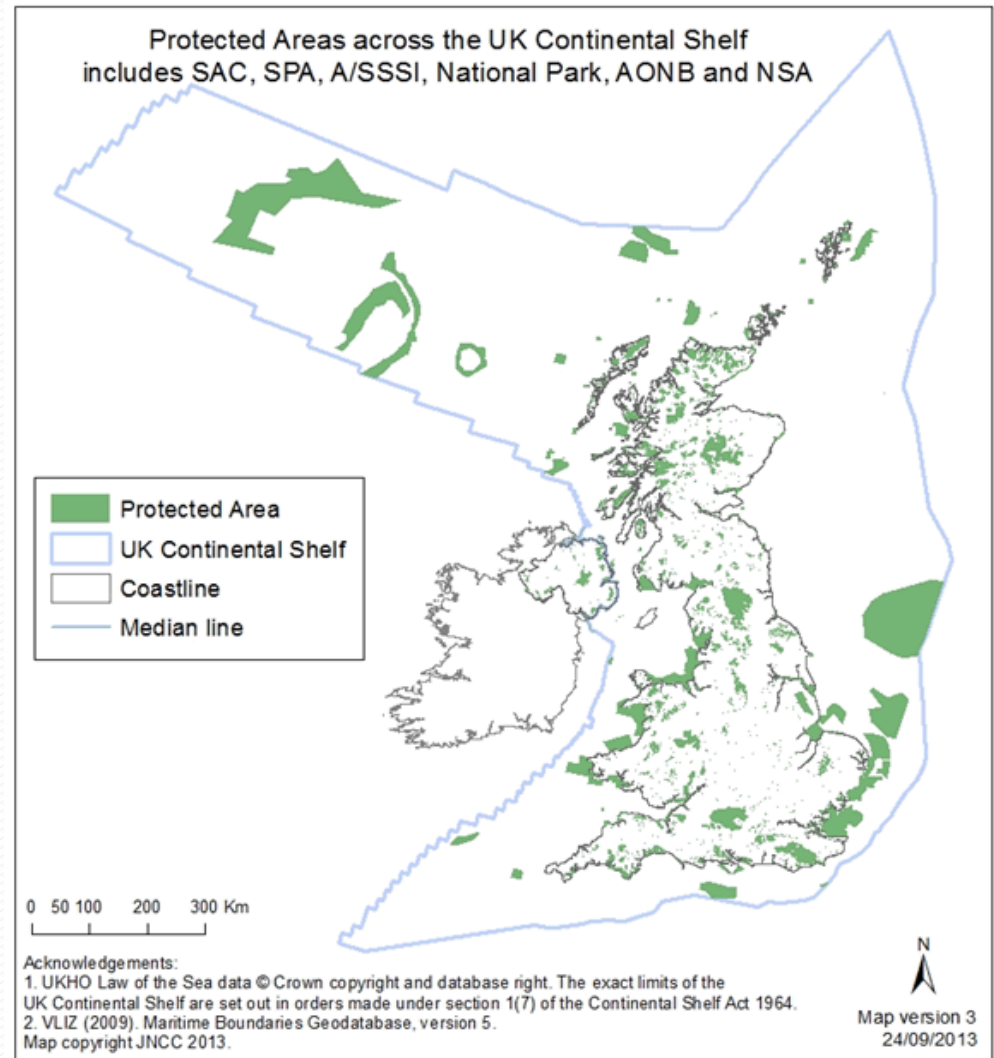
Some positive evidence of marine reserves:



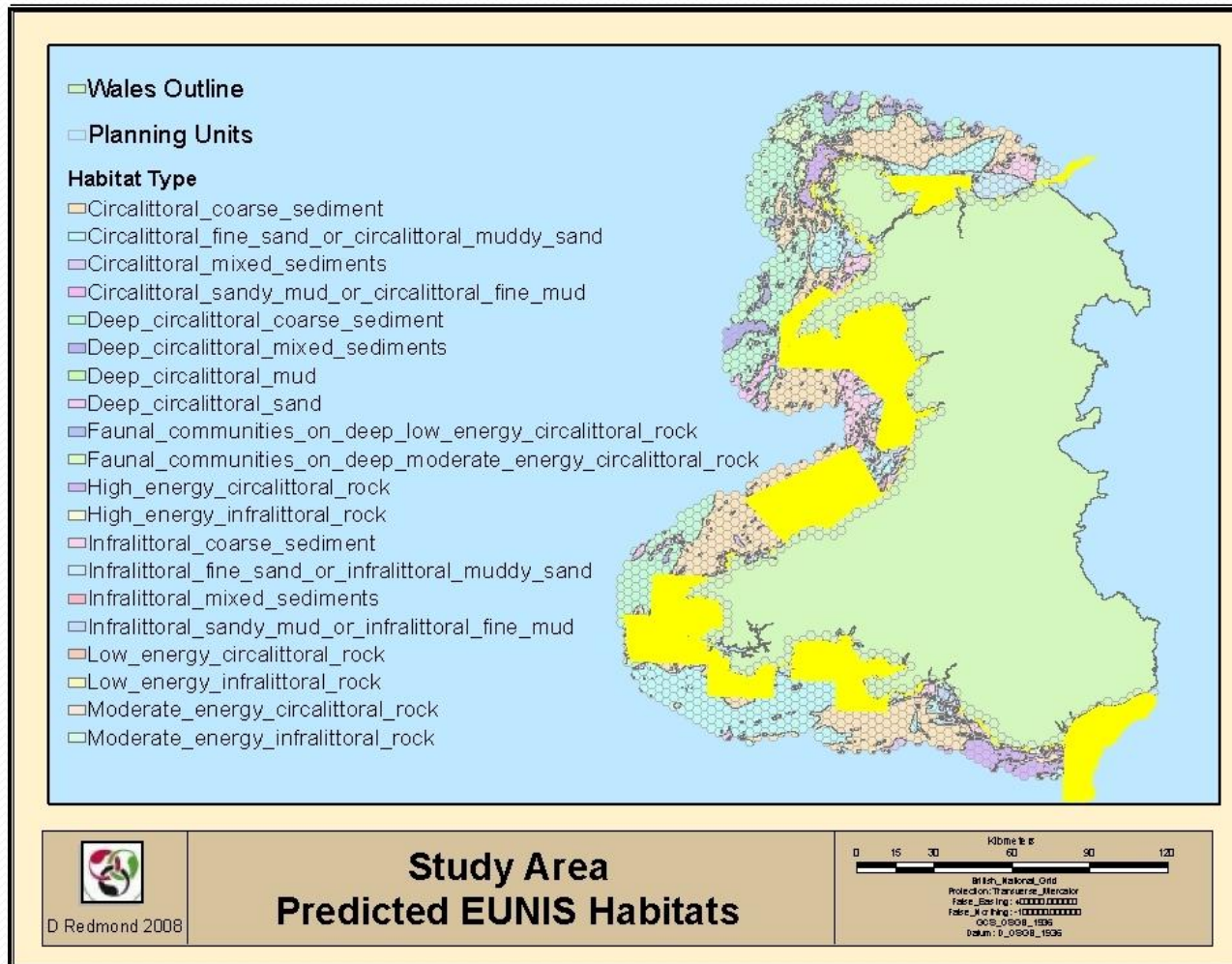
Partnership for Interdisciplinary Studies of Coastal Oceans. 2007. *The Science of Marine Reserves (2nd Edition, International Version)*. www.piscoweb.org/outreach/pubs/reserves

Research project The 'cost' of MPA

- Stewart, Noyce & Possingham's (2003) "Opportunity cost of ad hoc marine reserve design decisions"
- Wales has 30% of its territorial seas protected to some degree, but only 3 Km² strict no-take
- Policy relevance
- Lowering opportunity costs of past conservation decisions
- Is this an efficient use of achieving 'quantitative biodiversity conservation targets'?

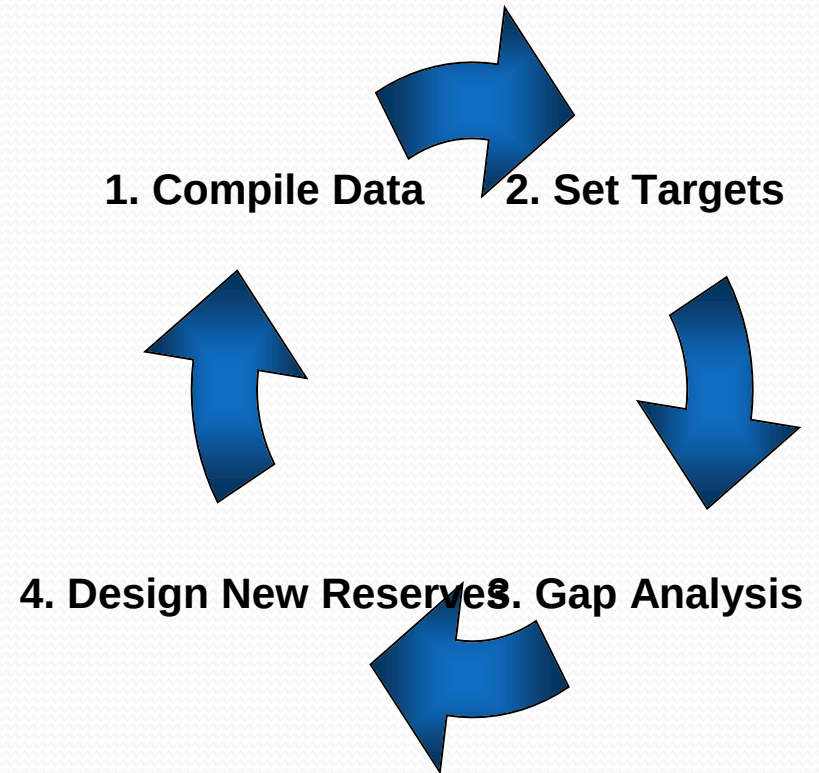


Study Area



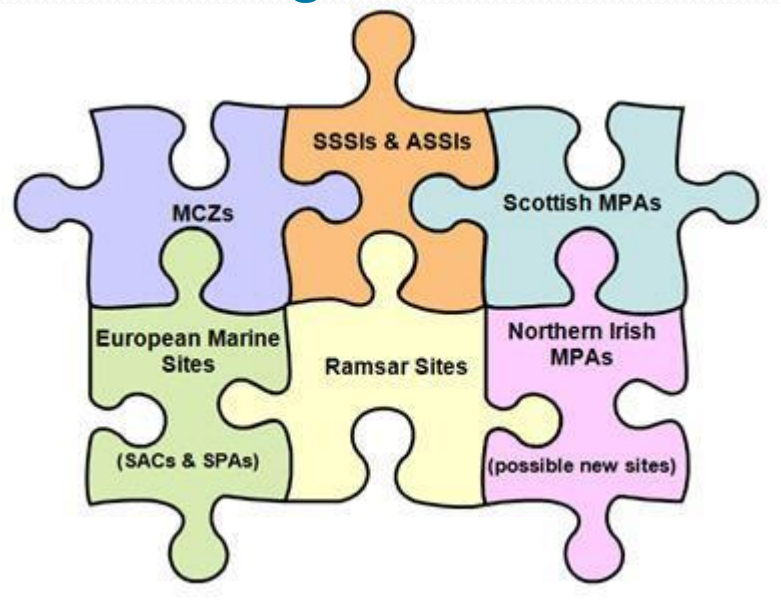
Principles & Methods

- Ecosystem-Based Management est.in the Marine and Coastal Access Act, 2009
- Systematic Conservation Planning (Margules & Pressey)
 - SCP facilitates a transparent, inclusive and defensible decision making process of reserve allocation



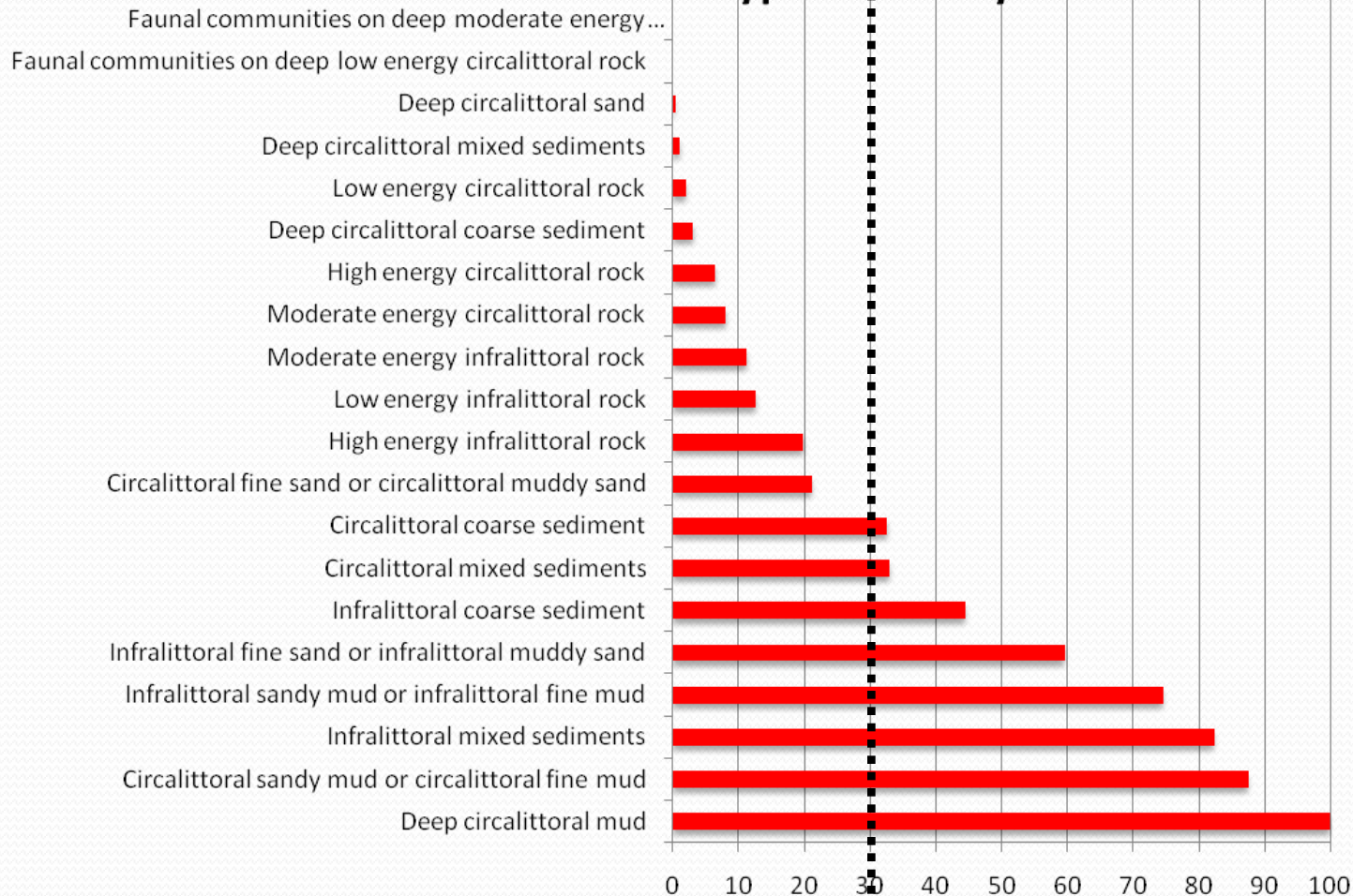
Overview of Results

1. Gap analysis revealed the inefficiency of the existing MPA network
2. New reserve scenarios demonstrated that inefficiencies could be minimised using a novel, two-step approach to reserve selection using Marxan



Gap Analysis Results

Percent of Habitat Type Currently Protected



Design New Reserves

Input Parameters

Runs = 1,000

BLM = 200

Simulated Annealing
(normal iterative
improvement)

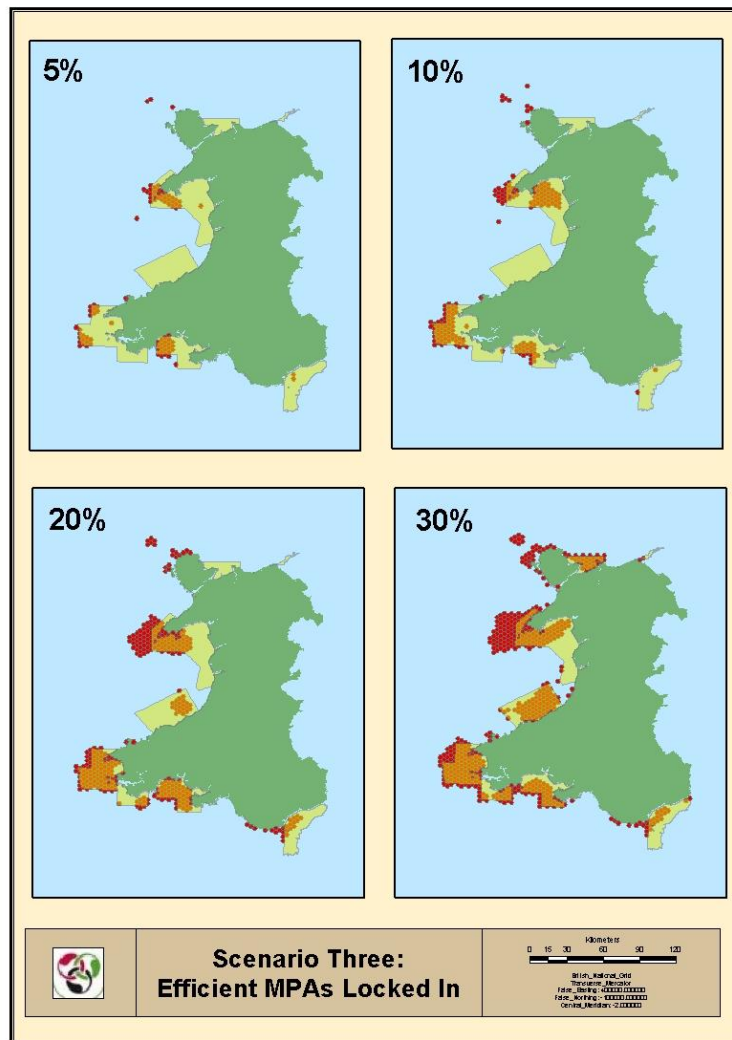
Iterations = 1,000,000

Temperature decreases =
10,000

Adaptive annealing

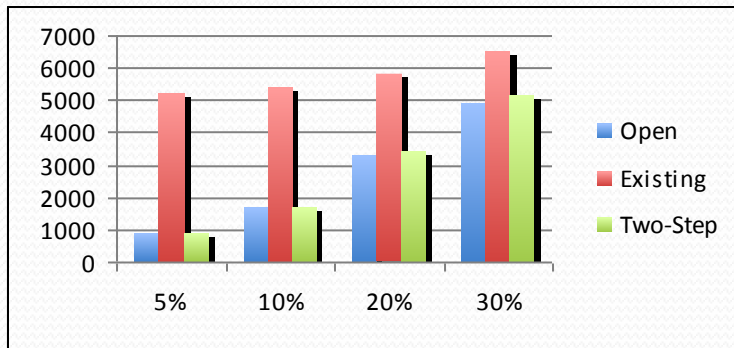
Cost = Area (Ha)

Penalty factor = 10,000

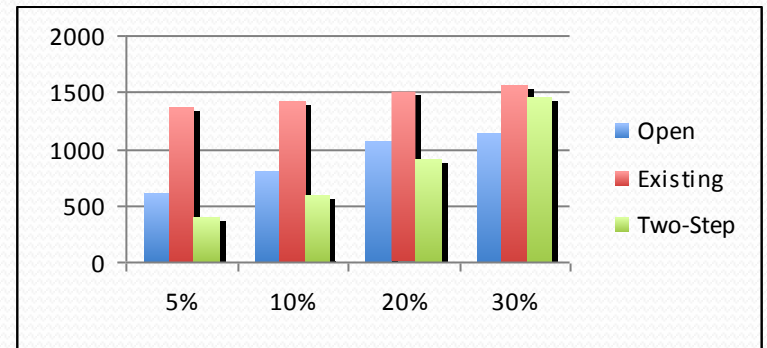


Comparison of Reserve Designs

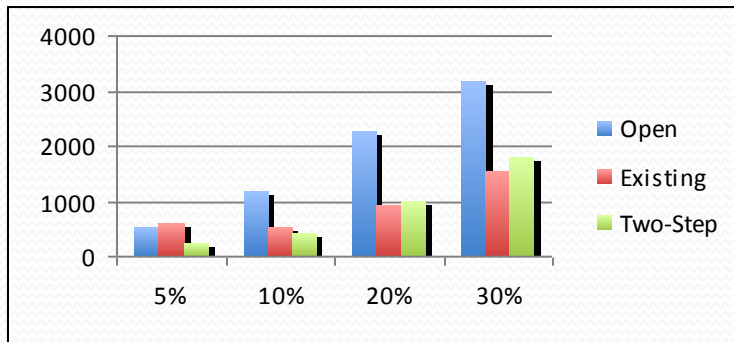
Total area required (Km²) for each scenario at four different conservation targets



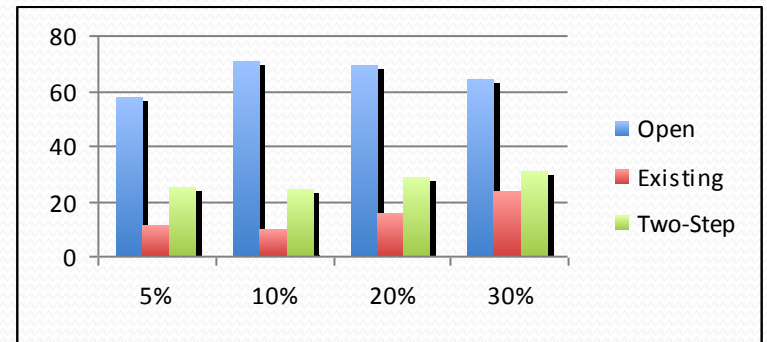
Total perimeter required (Km²) for each scenario at four different conservation targets



Area Outside Existing MPA network required (Km²) to meet the four different conservation targets



Percentage of area outside existing MPA network required to meet the four different conservation targets



Summary

- Current *ad hoc* MPA network is inefficient: 14 of 20 habitats not adequately represented
- Locking in existing reserves most costly solution: an extra 1,782 Km² at 30% target
- Difference in area between open (optimal) and 2-step is surprisingly small: less than 5% across range of targets



Implications & Limitations

- Method can be re-used on any scale
- Fuller et al's research in Nature Letters, July 2010
- Basic use of cost
- Garbage In – Garbage Out



Are Highly Protected Marine Nature Reserves (HPMNRs) are needed so that there are areas as close-as-possible-to-natural for scientific study?

With HPMNRs, studies can be undertaken to:

- Separate changes that are occurring as a result of human activities (outside HPMNRs) from natural fluctuations (inside HPMNRs). I.e. using HPMNRs as reference locations.
- Investigate the consequences of removing exploitation on species interactions and community development / change / recovery.
- Compare recovery rates and resilience under close-as-possible-to-natural condition (inside HPMNRs) from perturbed situations (outside HPMNRs).



Case study (recovery following exploitation) from the UK's only No-Take Marine Reserve at Lundy



Lundy

Lundy

Why?

- Geology – seabed rocky
- Effective breakwater
- Filter feeding species – sponges, anemones, stony & soft corals
- Productive seas – tide-swept waters of Bristol Channel
- Sits between boundary of cold Boreal and warm temperate
- Sunfish and Basking sharks
- Breeding site for grey seals
- Seabirds – razorbills kittiwakes, Manx shearwaters and guillemots

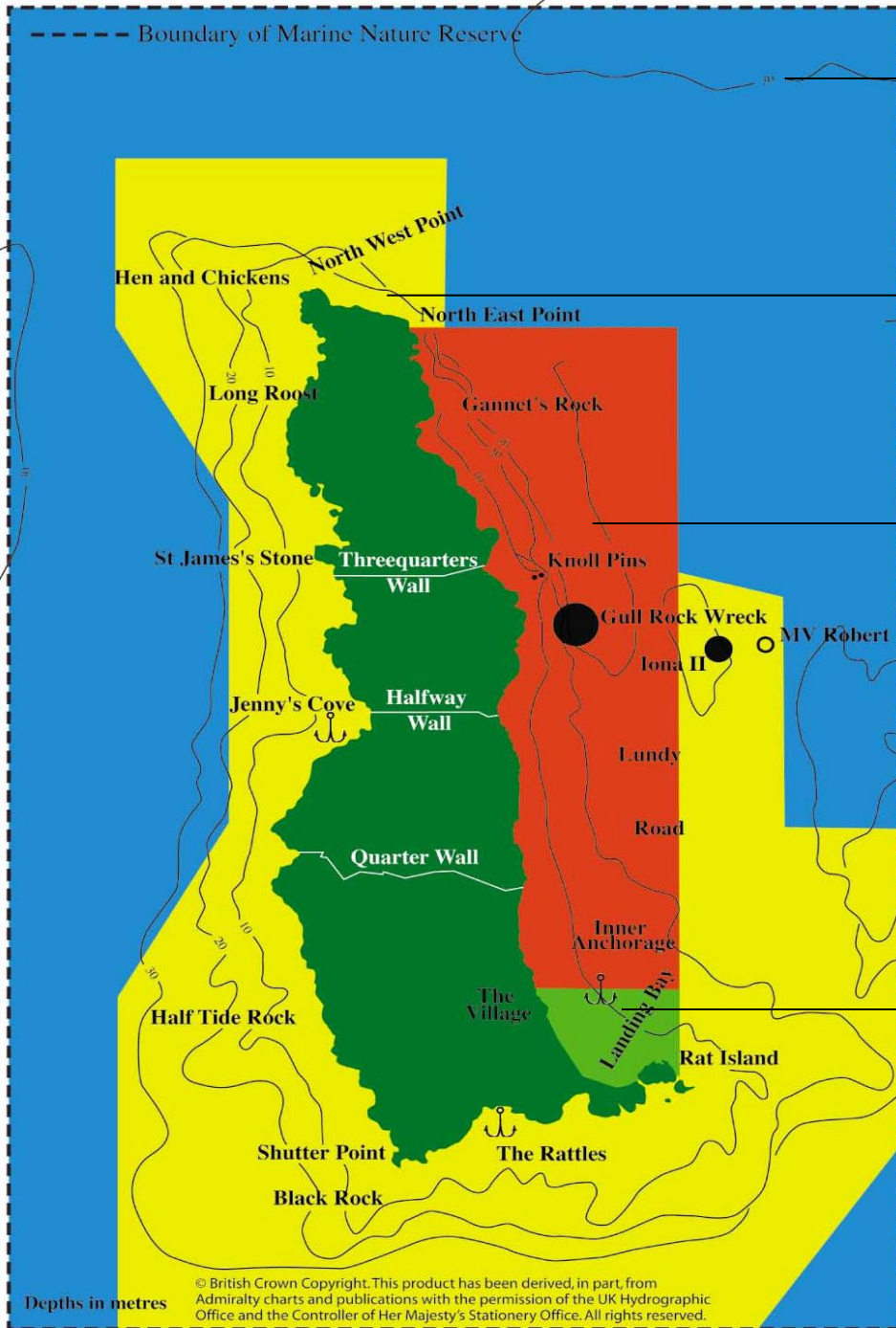
England's first marine conservation zone

- No Take Zone
- First legally enforced no fishing area Byelaw (2003)
- 4km² – variety of habitats and species

Also:

- SSSI, MNR, SAC
- NTZ is mandated by law and enforced by Fisheries Authorities.
- Some other NTZs exist in UK waters but are voluntary
- Rely on fishermen's honesty & understanding of biodiversity





General use zone – all activities allowed except spearfishing

'Refuge zone' (but fishing with static gear and angling permitted)

No-Take zone – no extraction but boating, access to the shore and recreational diving permitted

'Recreational Zone' (restrictions as for the Refuge Zone but used for moorings and anchoring)

The No-Take zone is 4.3 km²

Monitoring

- Lobster *Homarus gammarus*, brown crab *Cancer pagurus*, spider crab *Maja squinado*, velvet crab *Necora puber*
- Scallops *Pecten maximus*
- Rock epifauna – Sponges *Porifera spp.*, Corals & anemones *Cnidarians spp.*, sea squirts *Ascidians spp.*, starfish & sea urchins *echinoderms spp.*
- Dead man's fingers *Alcyonium digitatum* and trumpet anemone *Aiptasia mutabilis*
- Pink Sea Fan *Eunicella verrucosa*



No Take Zones (NTZ)

“An area of land and/or 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”

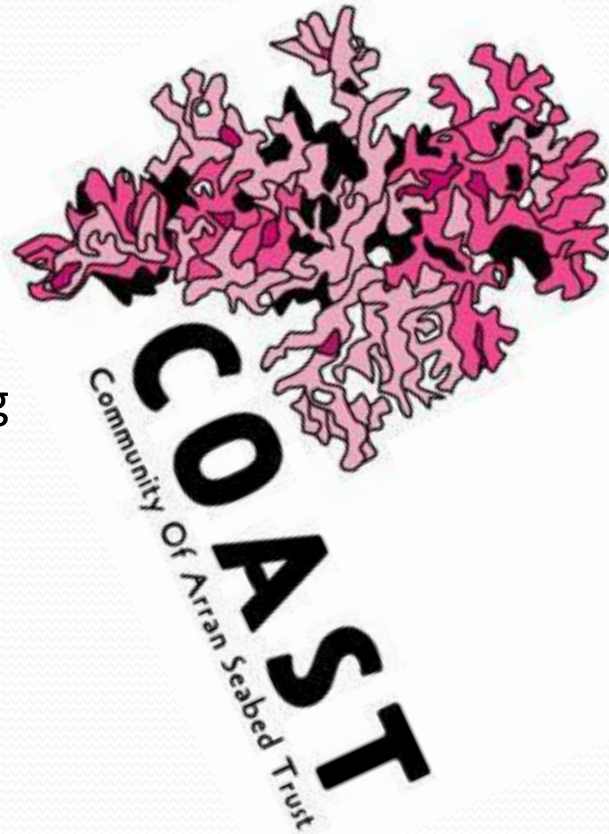
(IUCN, 1994:4)

- Closed to:
 - Extractive uses
 - Harmful anthropogenic activities
- Aims to protect biodiversity
- Achieve long-term sustainable fishing
- Well managed non-consumptive activities
- In isolation
- As part of a larger Marine Reserve



Benefits of NTZ

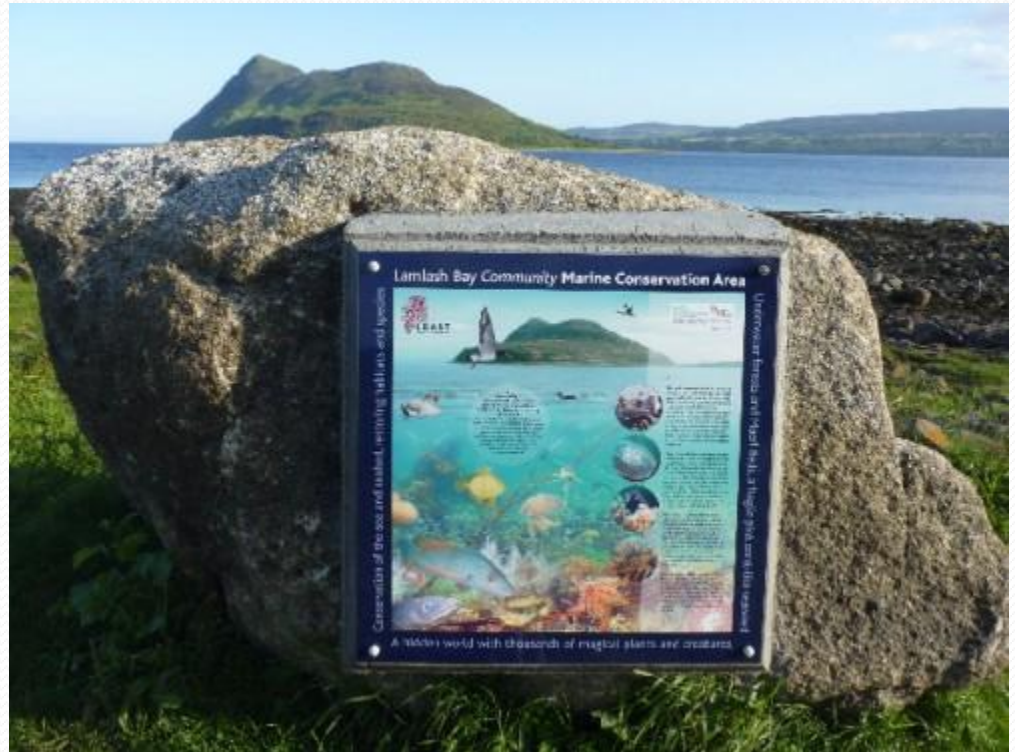
1. Ecosystem resilience
2. Species Diversity
3. Abundance
4. Nursery ground
5. Body size
6. Larger fish & invertebrates = more young
7. Conservation of habitats
8. Prevention of over-fishing
9. Protection of many other species
10. Larval dispersal and spill-over
11. Supplementary migration
12. Insurance against uncertainty
13. Tourism!
14. Education
15. Science



Issues to consider

What is important?

- Size of NTZs is important
- Networks
- Located in productive areas
- Temporary or permanent?
- Are/should they be complied to?
- Enforcement
- Some are Community Protected Areas e.g. Lamlash Bay Is. Aaron



What are they for? Biodiversity conservation/fisheries management or both?

New Zealand – purely biodiversity conservation BUT Fisheries benefit – an added value

Considerations

Most fisheries are against NTZ

Other options

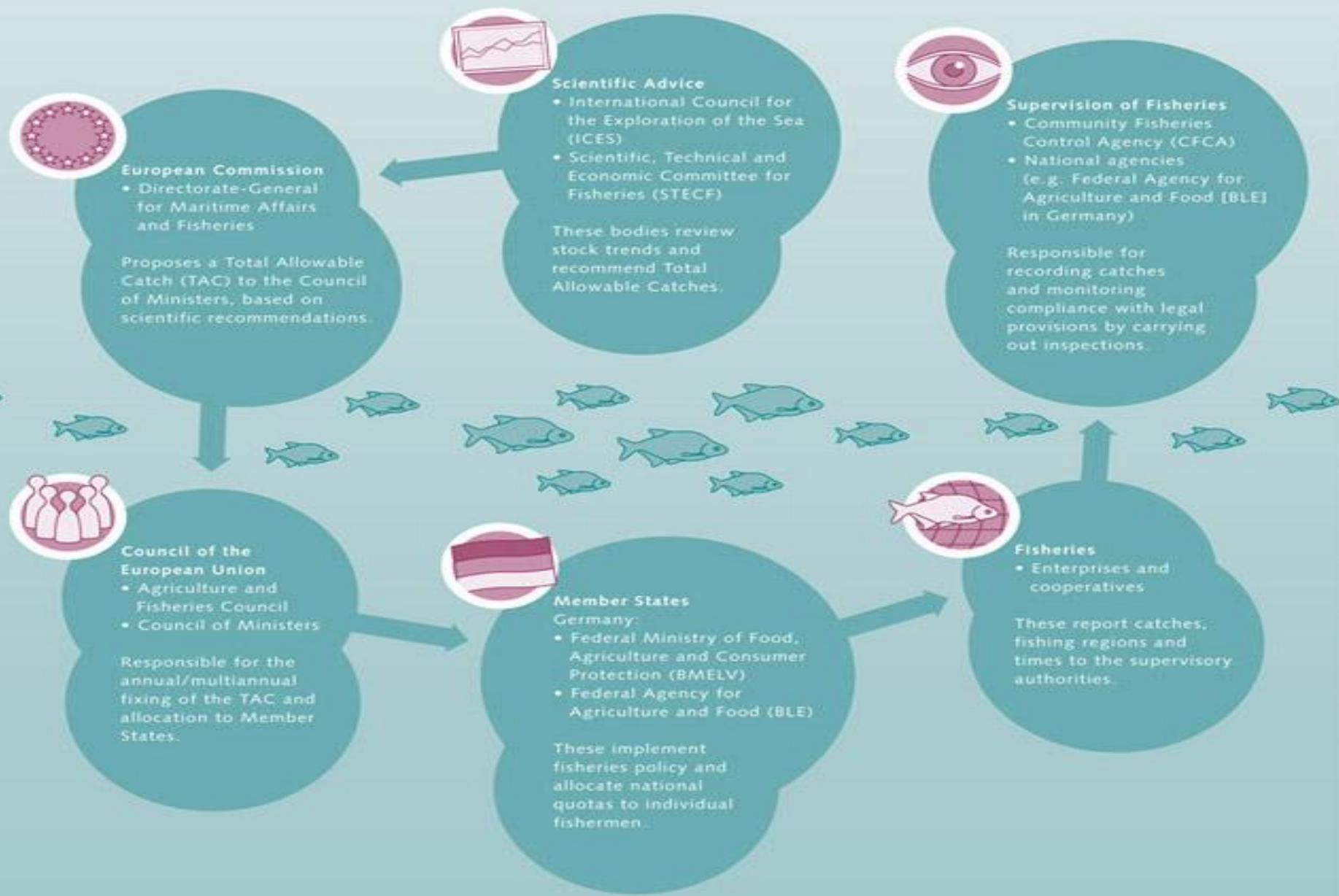
- Less pressure on resources and fewer competing countries
- Total Allowable Catch (TACs)
- Marine zoning and catch controls preferred
- Compensation
- Voluntary Time closures (e.g. Parts of Scotland)
- Common fisheries Policy: Days at sea, quotas (Wise, 2013)

Some measured commercial benefits

- Densities of snapper 15% higher in NTZs
- 4 times more spiny lobster (Tonga Island Reserve)
- Rock lobster increasing in size and number by 7% per year (DoC, 2005)



Fixing Total Allowable Catches (TACs) within the framework of the EU's Common Fisheries Policy



Conclusion

- Quality vs. quantity of protected areas
- Bigger Bang for Conservation Buck
- Return on Investment – Conservation value for future generations
- Competition with other resource users
- Poor past planning decisions can be overcome
- Don't get lost in models



Connectivity Conservation

Coastal Management of Coral Reefs

TED Ed should take 1 hour to complete.

Watch, think, then 'dig deeper': [coral video and exercise](#)

Adapted from: Discovering the Deep: Conserving our spectacular, vulnerable coral reefs - Joshua Drew

Seminar?

1. What is the role of MPAs in Habitat Management?
2. Review closed area management