Planning for marine conservation: are we all at sea?

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Purpose of talk

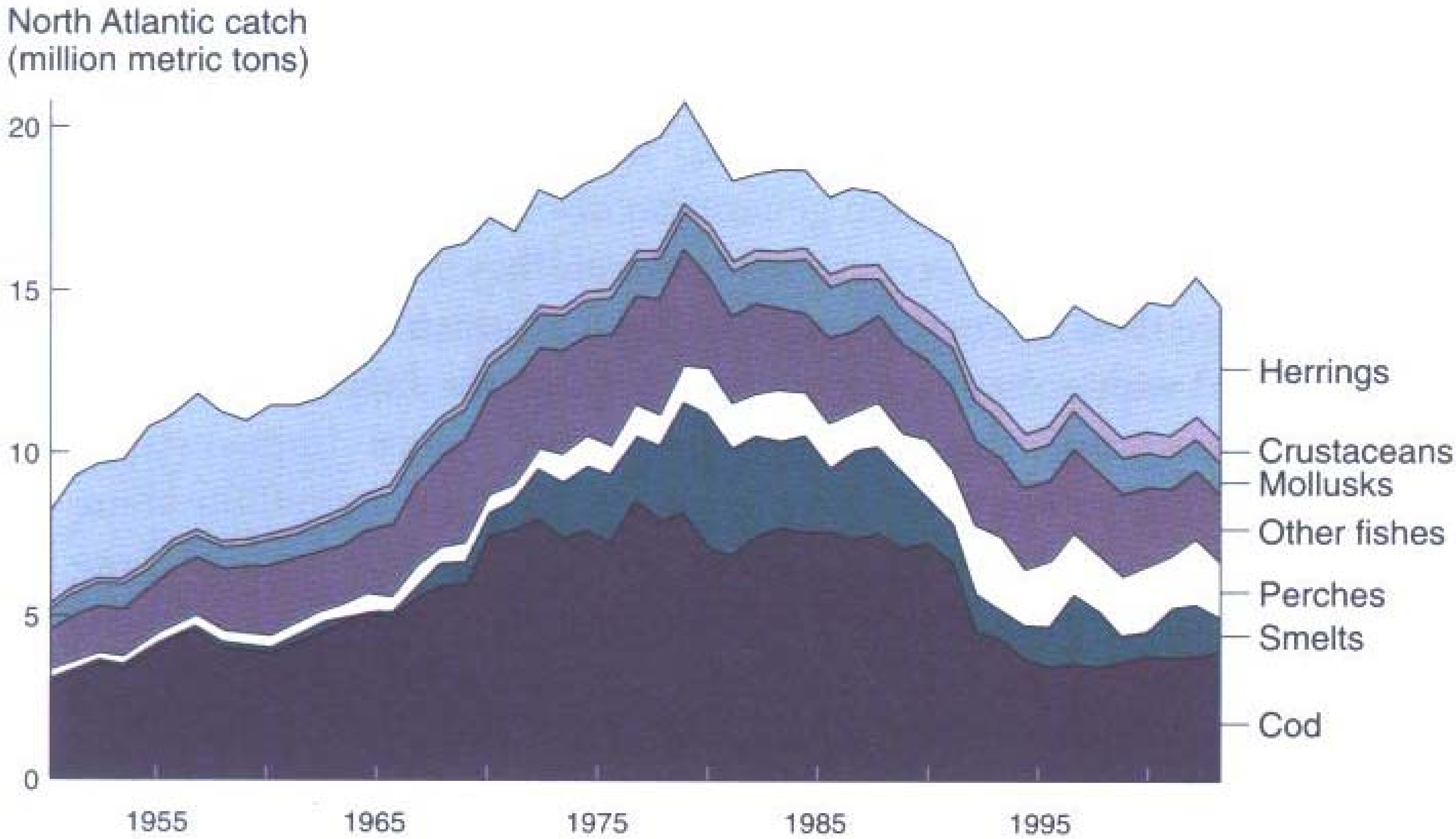
- To review the issues of planning for conservation in marine environments.

- To describe data and methodologies needed to aid planning

- To consider the role of economics in conservation planning

The problem

Catches in the North Atlantic 1950-1960



This is not a new type of problem.

What would happen on land?

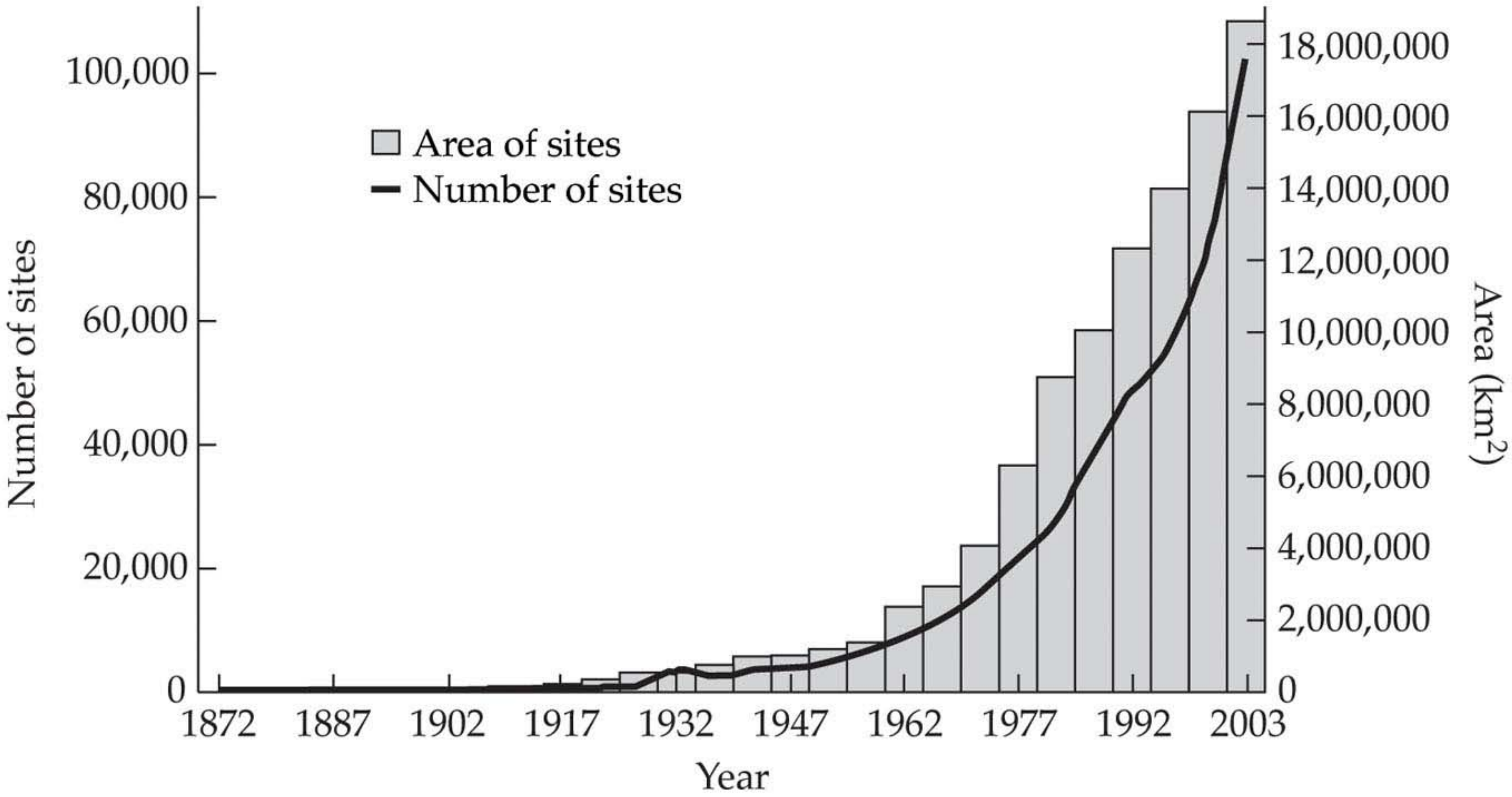
What would happen traditionally happen on land?

1. Identify the species / habitats of concern.
2. Establish reserves
3. Manage the reserves for the benefit of these species

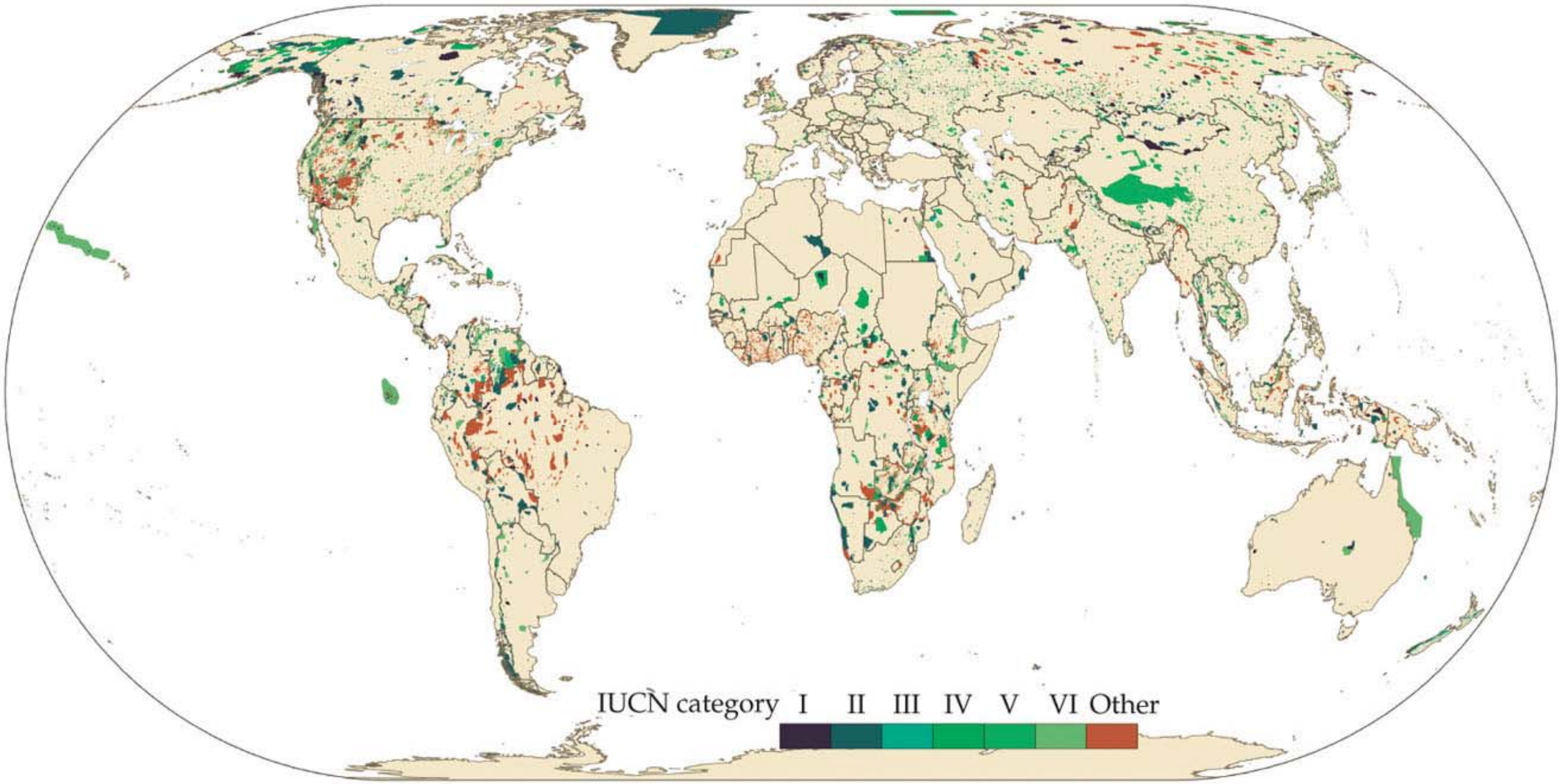
OR

Consider the landscape value and establish protected landscapes and/or amend planning rules.

Cumulative growth in protected areas from 1872–2003



Protected areas



Problems with this approach?

1. Reserves were actually established in areas which were ‘convenient’ and not in the best place for species.

2. Climate change

3. Limited / No use of economics in the decision-making

Costs/benefits of reserves

- Direct cost to individuals
- Direct benefit to individuals
- Indirect cost to individuals
- Indirect benefits to individuals

- Direct cost to regional economies
- Direct benefit to regional economies
- Indirect cost to regional economies
- Indirect benefit to regional economies

- Direct cost to society
- Direct benefit to society

Opportunity costs can be important in poor countries

Used:

NB conservation = NB direct use + NB indirect use + NB non-use - OC conservation

Results:

NB direct use = Nbtourism + NB forestry ($27+15m)

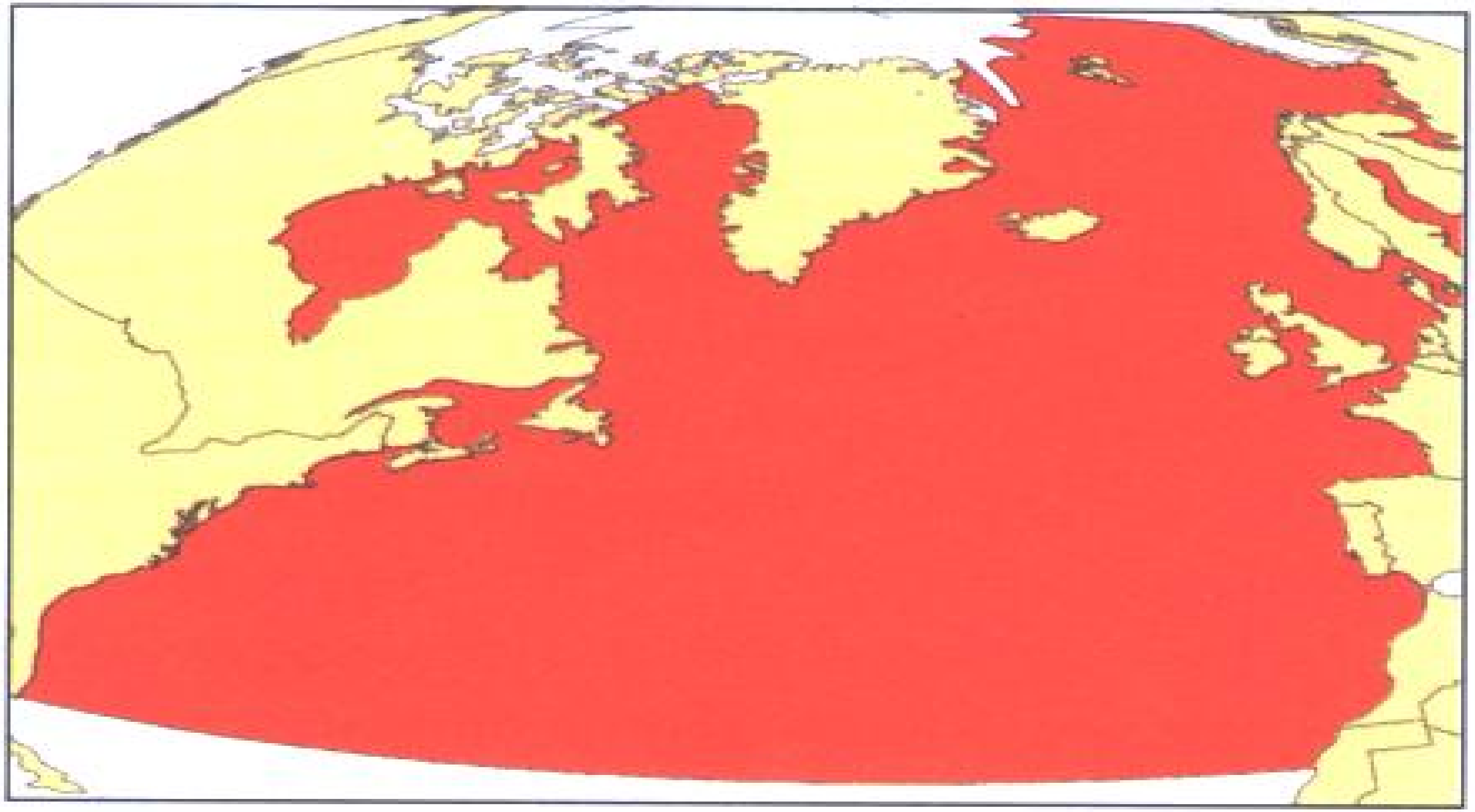
= $42m

Net opportunity cost = $203m.

Thus without considering any indirect or non-use values, the protected areas of Kenya are seen to have a net return to the country of -$161m. (Norton-Griffiths & Southey 1995)

Conservation in the marine environment

Protected areas in the North Atlantic are shown in white!! (Pauly & Maclean 2003)



Priorities in the marine environment

Most countries have signed an agreement to establish marine protected areas (MPAs).

It makes long term economic sense to protect the marine environment.

Need to learn from the mistakes of the terrestrial situation.

The rational approach?

1. Identify the species / habitats of concern.
2. Identify how to protect them
3. Be aware of the need for connectedness in the ecosystem
4. Estimate the full economic cost of the planned protection.
5. Develop reserve networks that are cost efficient (ie give desired protection at least cost).

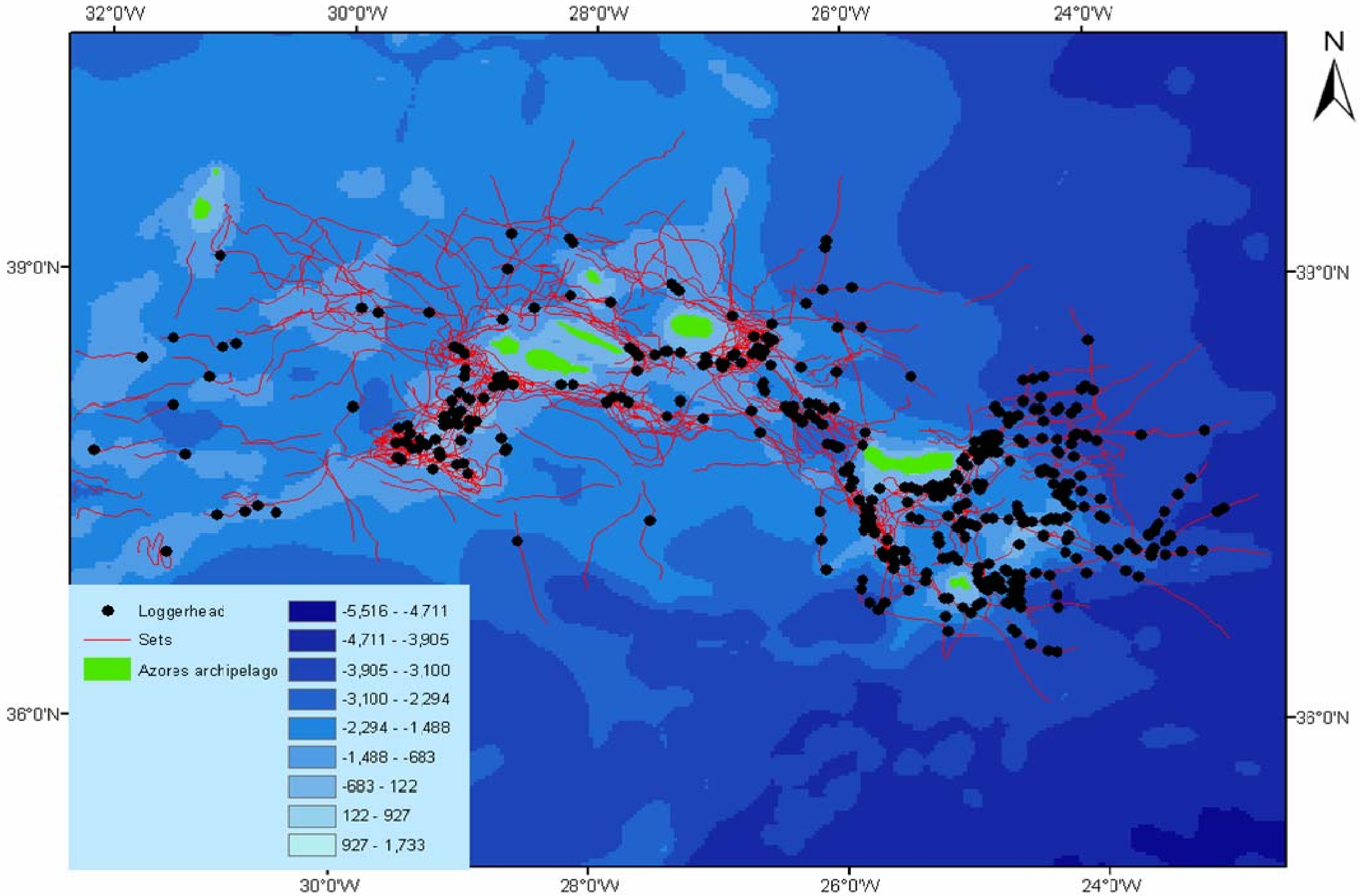
Theory is all good – but do we have the correct information?

What information do we need for planning marine reserves?

- Species distributions
- Habitat distributions
- Effectiveness of different conservation actions
- Economic value of different areas of sea
- Economic impact of conservation action
- Publics’ desire for conservation in the marine environment

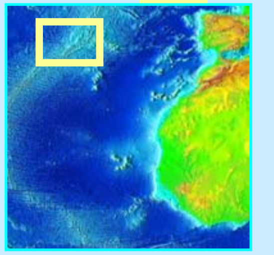
Distribution of loggerhead turtles in the Azores

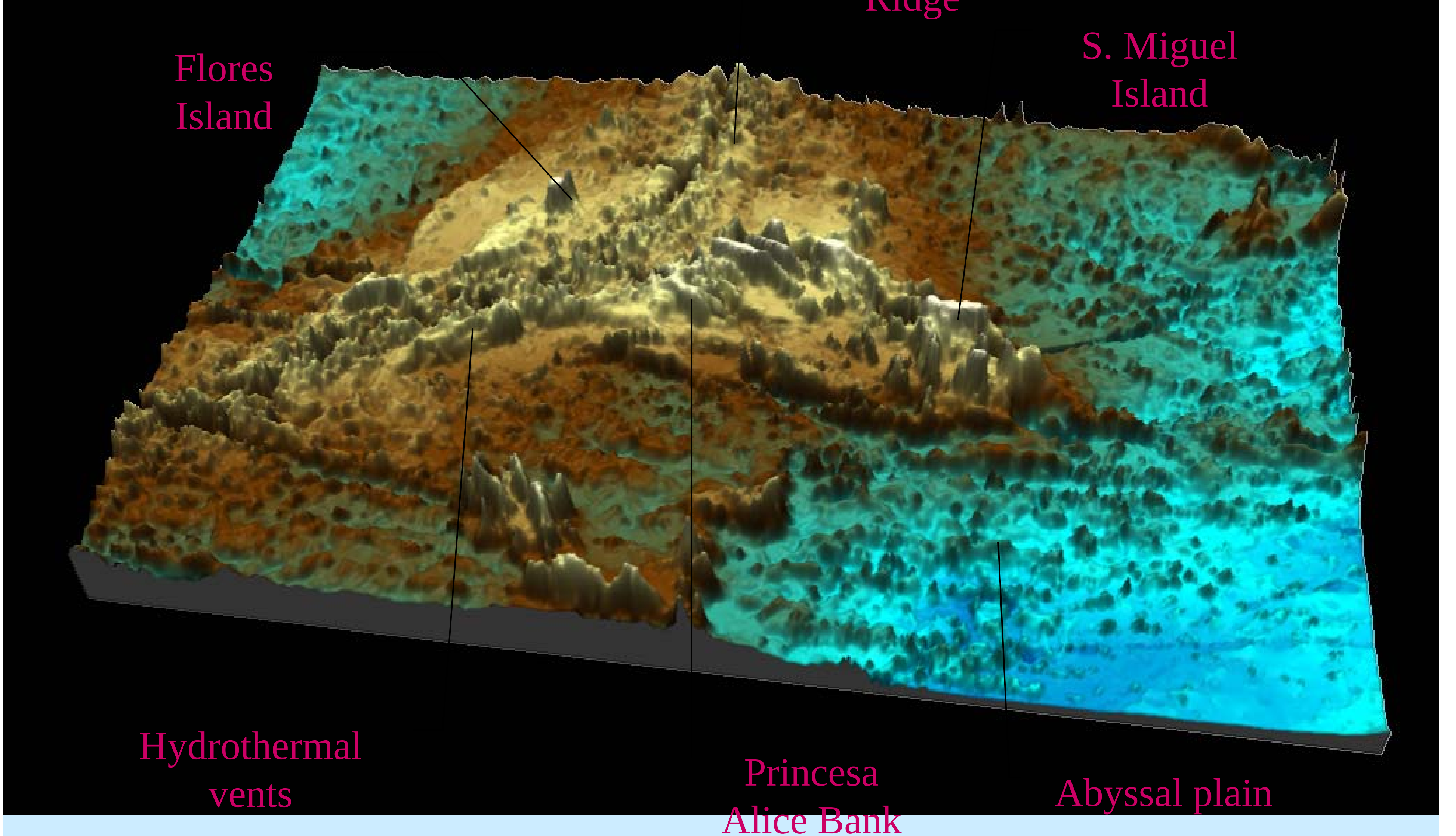
Santos et al (in press) – longline experiment 2000-2004



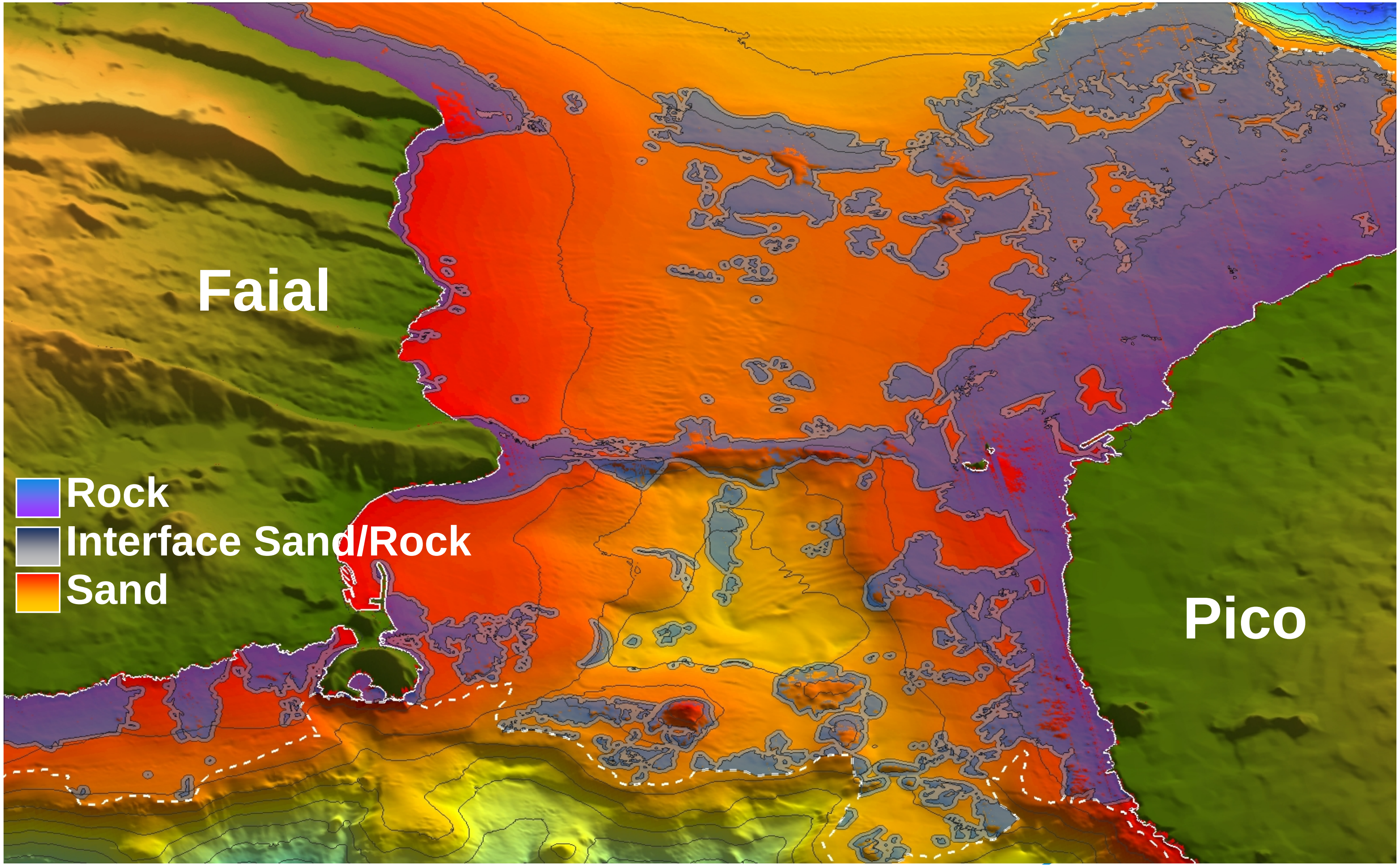
Topographical map of the seabed around the Azores

Adapted from Menezes (2007)





Map of substrate types in Pico-Faial channel

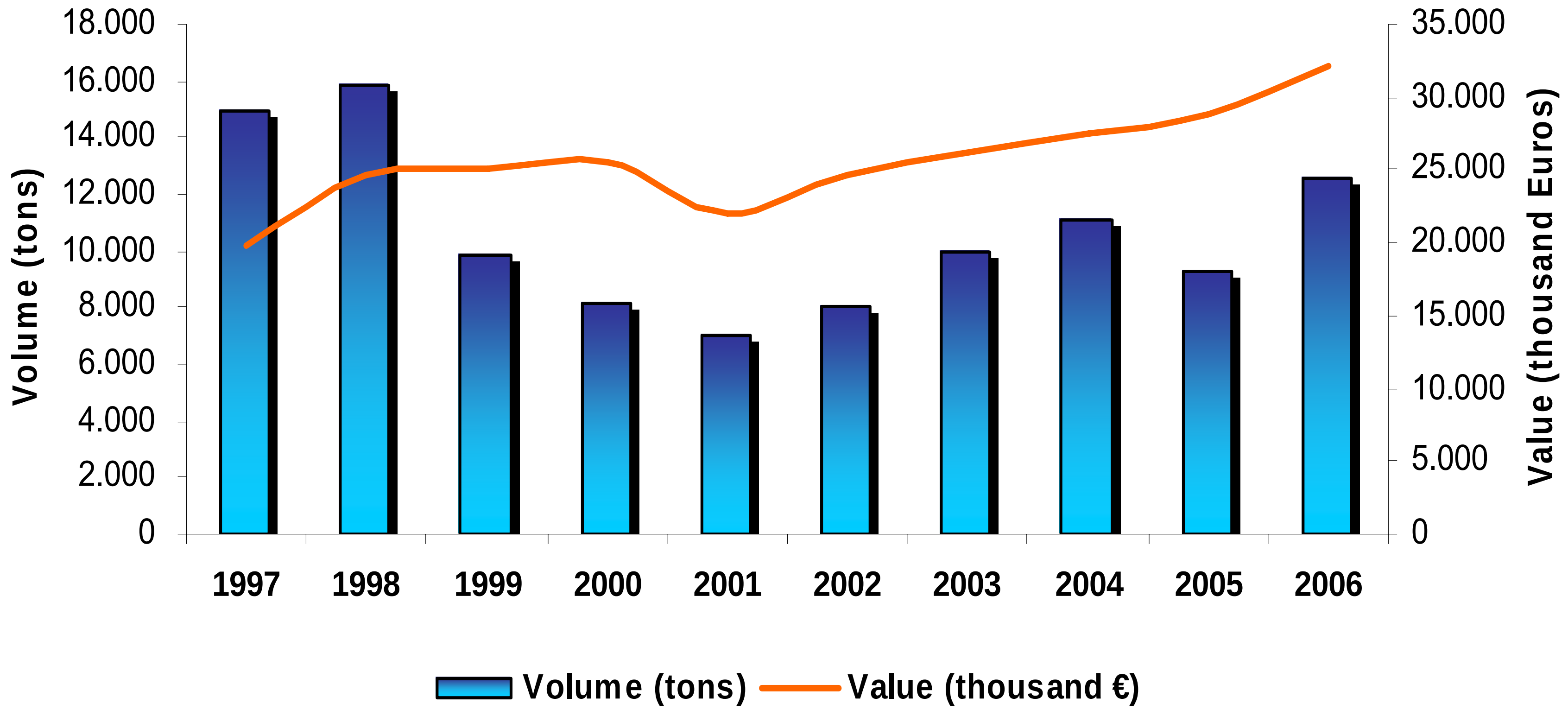


What sort of economic values does the sea have?

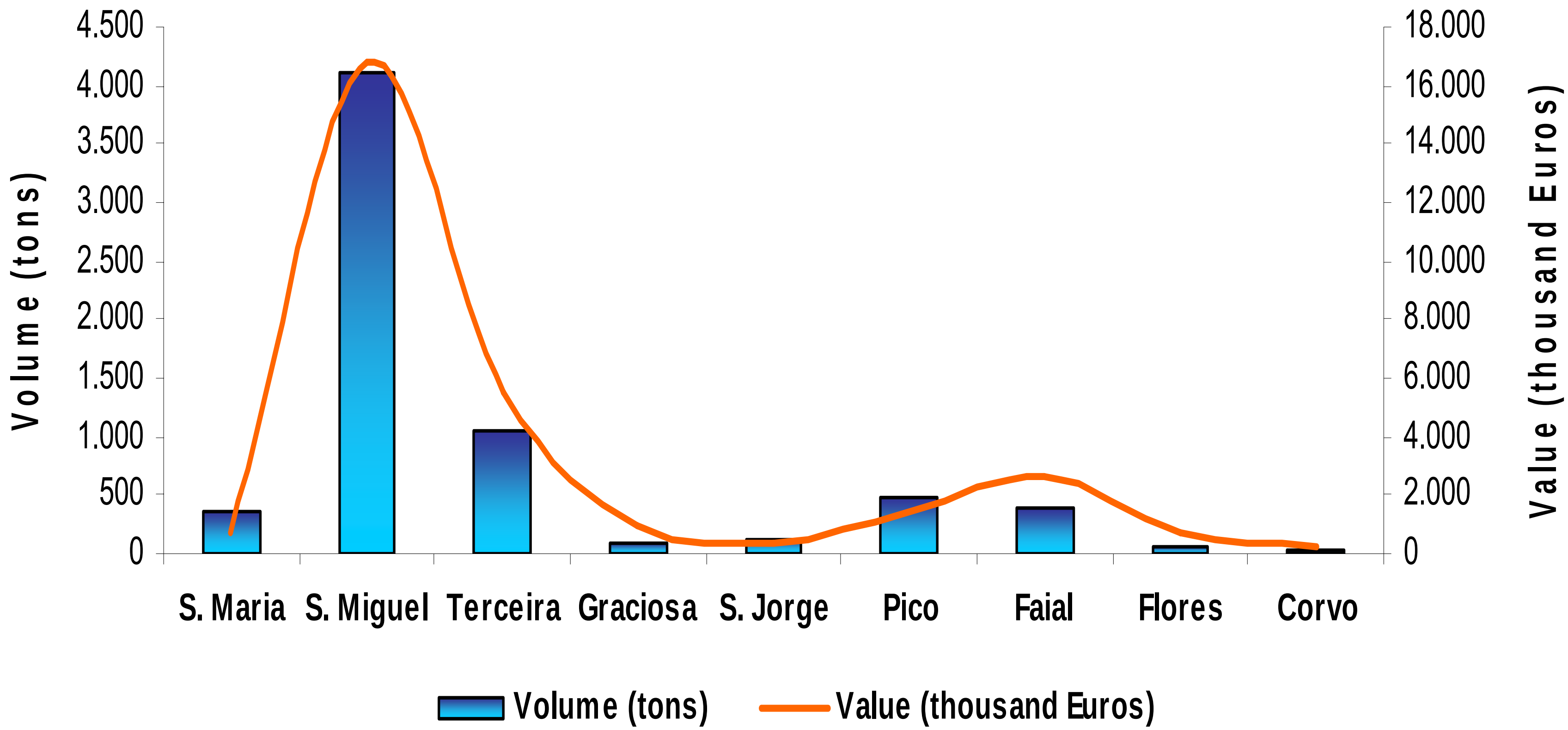
- Commercial Fisheries
- Recreational fisheries
- Recreational diving
- Whale watching
- Nautical sports/Sailing
- Tourism/general recreation
- Transport and Shipping
- Wind farms, ocean wave energy
- Science and Research

Commercial fisheries

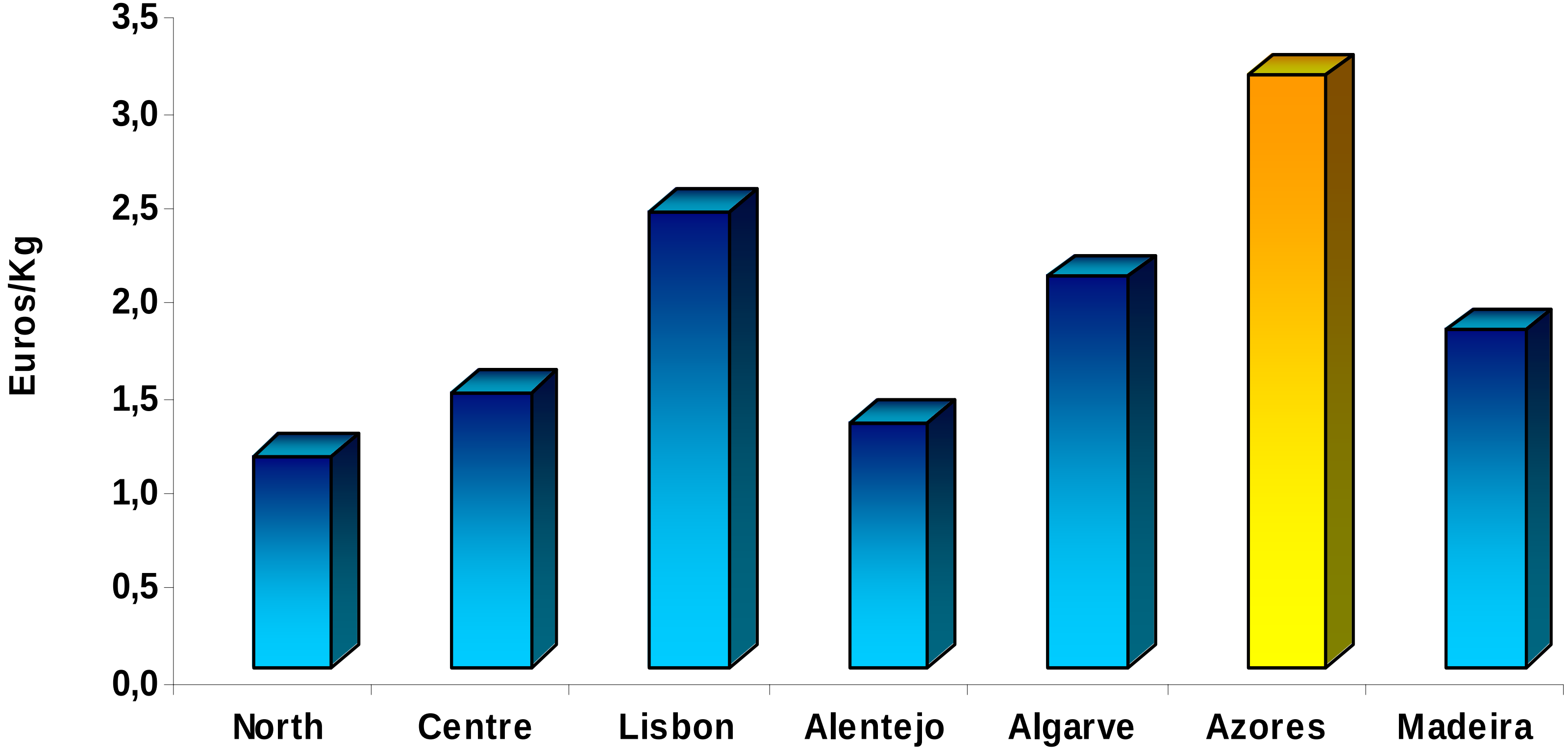
Volume and value of total landings of fish in the Azores 1997-2006



Fish landings by island 2005



Average ex-vessel prices by region 2005



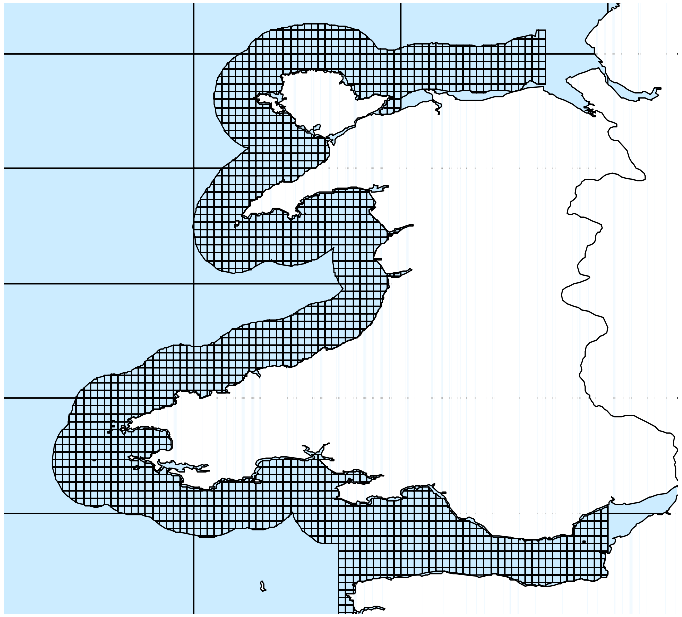
How do we include these data in conservation planning?

An example from Wales

(Richardson et al 2006).

- Planning unit cost =

  lost revenue to fishers



Coarse resolution data

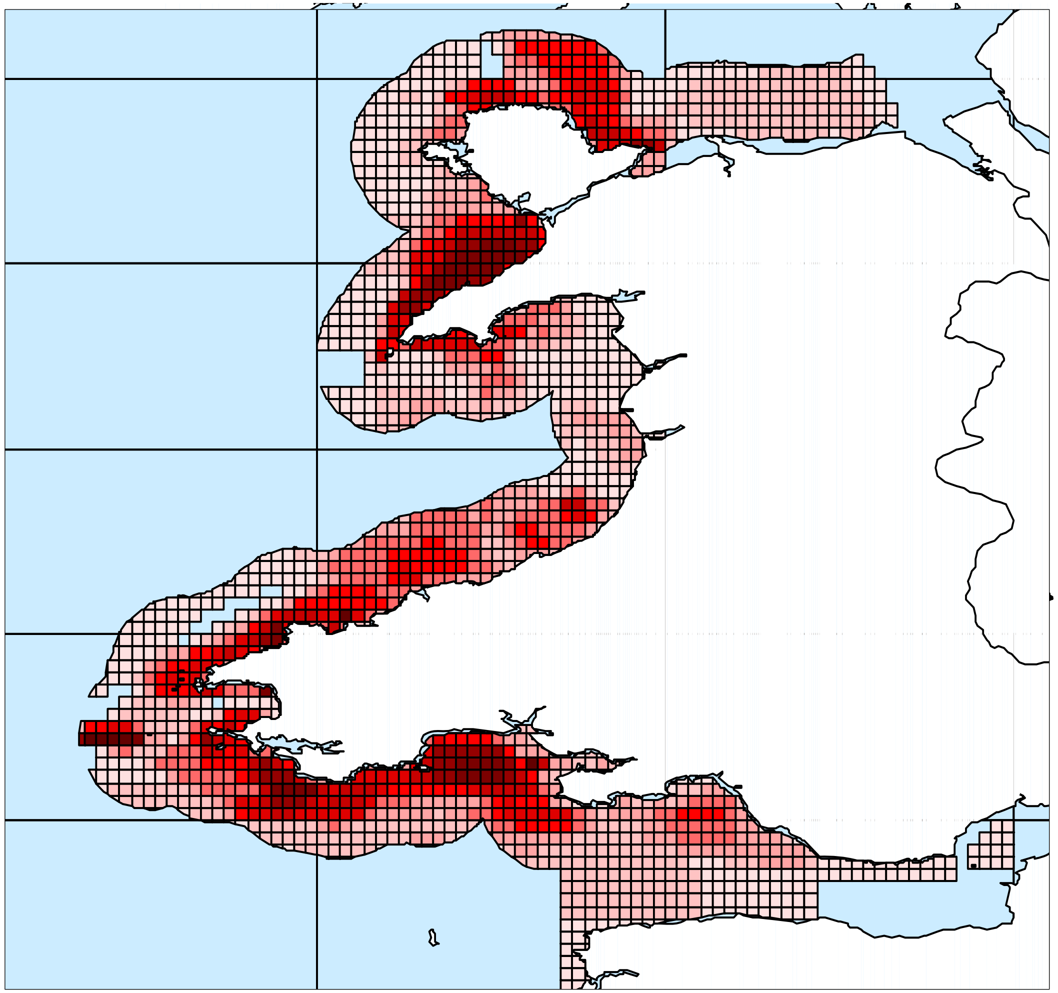
- Official fishery statistics (DEFRA FSU) Resolution = ICES subrectangle (~10,000km^2)

- Derived £ value of each PU to the fishery:
  - landings' value per hectare
  - → assigned value to each PU

Fishers’ data

Fine resolution data

- Interview survey:
  - 161 commercial fishers
  - Considered representative
- Relevant data:
  - Fishing patches (5 km^2 +)
  - Fishing revenue
- Calculated each PU’s £ value to the fishery



The reserve design task

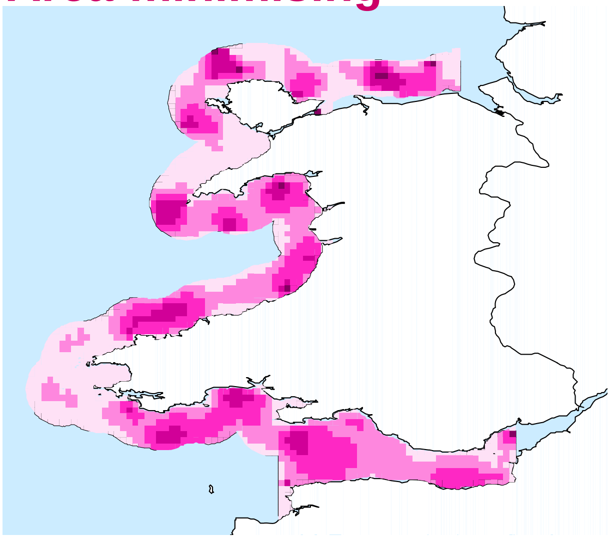
- Select set of planning units that:
  - Protects ≥ 30% of each biodiversity feature (arbitrary):
    - Seabed sediment
    - Spawning areas
    - Nursery areas

    and
  - Minimises initial lost revenue to the fishery

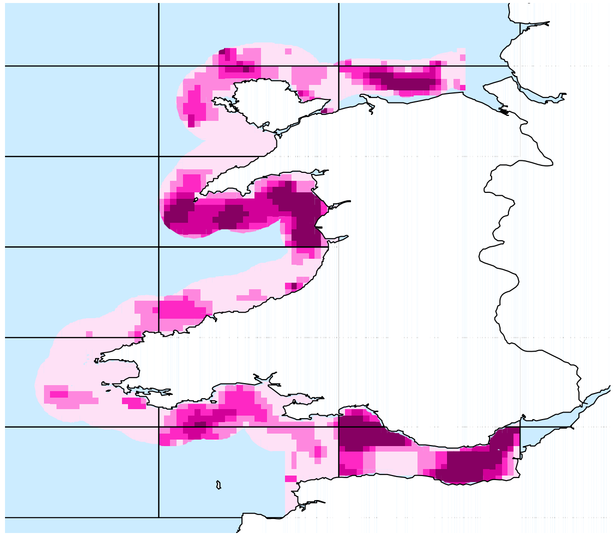
- Resulting reserve networks:
  - Compared with those designed without economic data
  - Predicted fishery losses

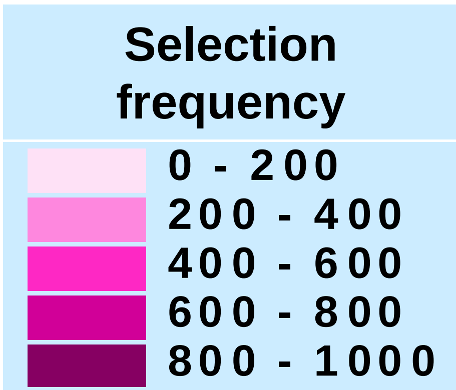
Priority setting outputs

Area-minimising

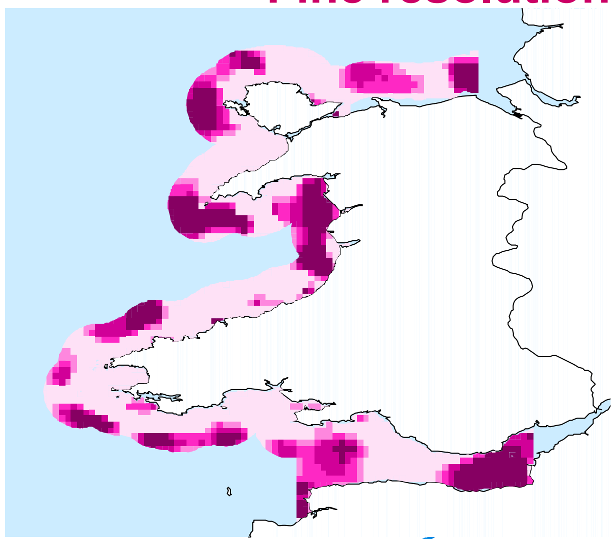


Coarse resolution





Fine resolution



Recreational fishing

In the EU, and estimated 25 million recreational fishers spend an estimated 25 billion Euros annually on their sport (Dillon 2004).

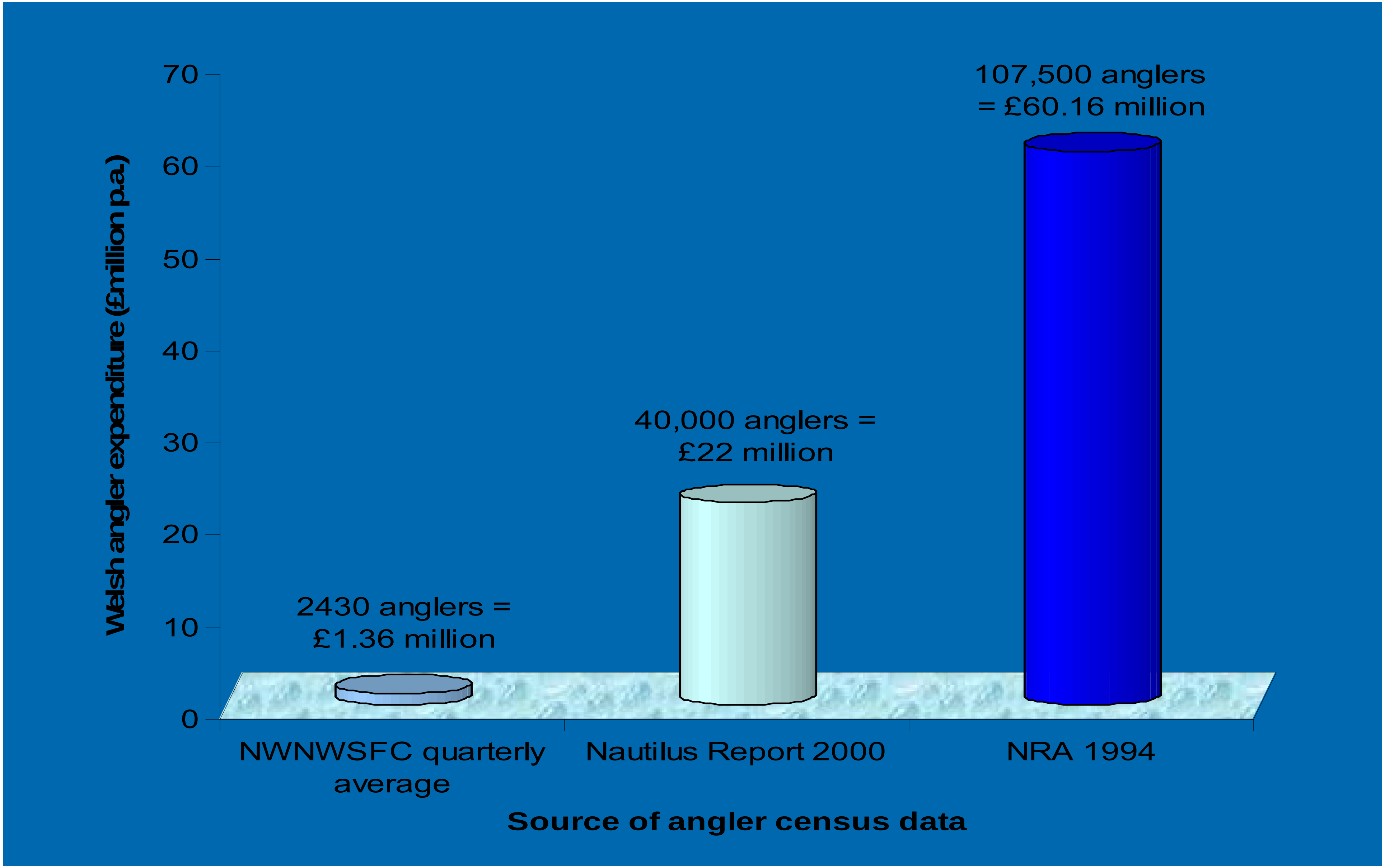
Recreational fisheries in the Azores

(Diogo in prep)

Type	Average expenditure/ person/yr	Est. no. fishers	Est. total expenditure/yr
Coastal rod fishing	389	1606 *	624 734
Boat fishing	1138	n.a.	
Spearfishing	263	1142 (licences 2001)	299 775

*Faial-Pico, 2004-2005

Economic value of recreational angling in Wales



Other recreational activities

Whale watching in Azores (Oliveira 2005)

1993 – 2 companies, 2 vessels, 492 clients

2004 – 15 companies, 35 vessels, 30,000 clients

(estimated total capacity - 253 102 clients)

Revenue (ticket sales) – 1 381 882 €

Willingness to pay for whale watching in the Azores
(Oliveira 2005)

- **Travel-Cost Method (estimated values for 2004)**

Total Consumer Surplus = 1 522 960€

(n=8820)




Commercial activity

Transport of people by ship

	Embarked		Disembarked	
	2005	**2006**	**2005**	**2006**
S. Miguel	19 160	11 017	19 044	9 834
Terceira	20 975	15 237	21 291	15 646
Faial	182 249	181 504	182 998	181 991
Total Azores	**460 932**	**435 525**	**460 932**	**435 525**

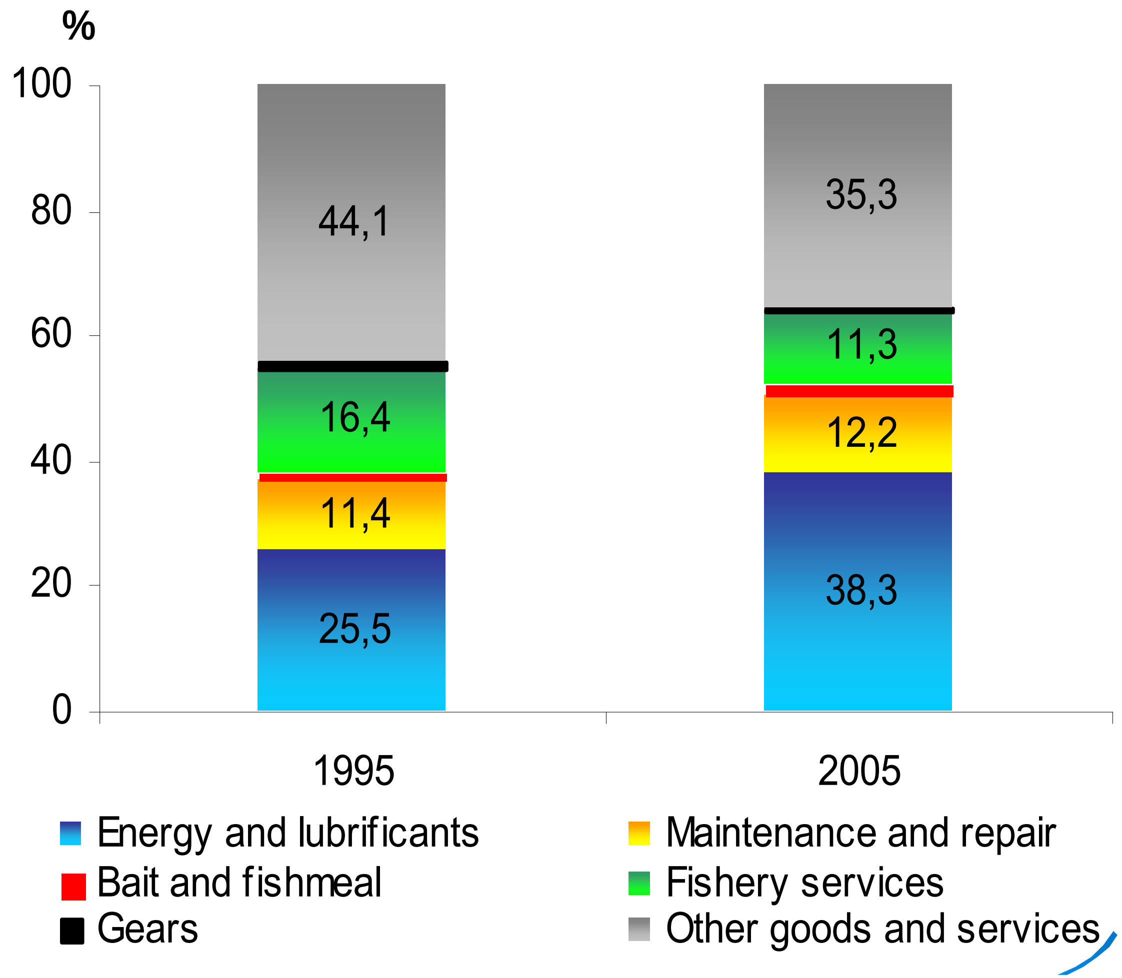
Population of Azores in 2005= 242,241

Goods transported by ship to / from the Azores (tonnes)

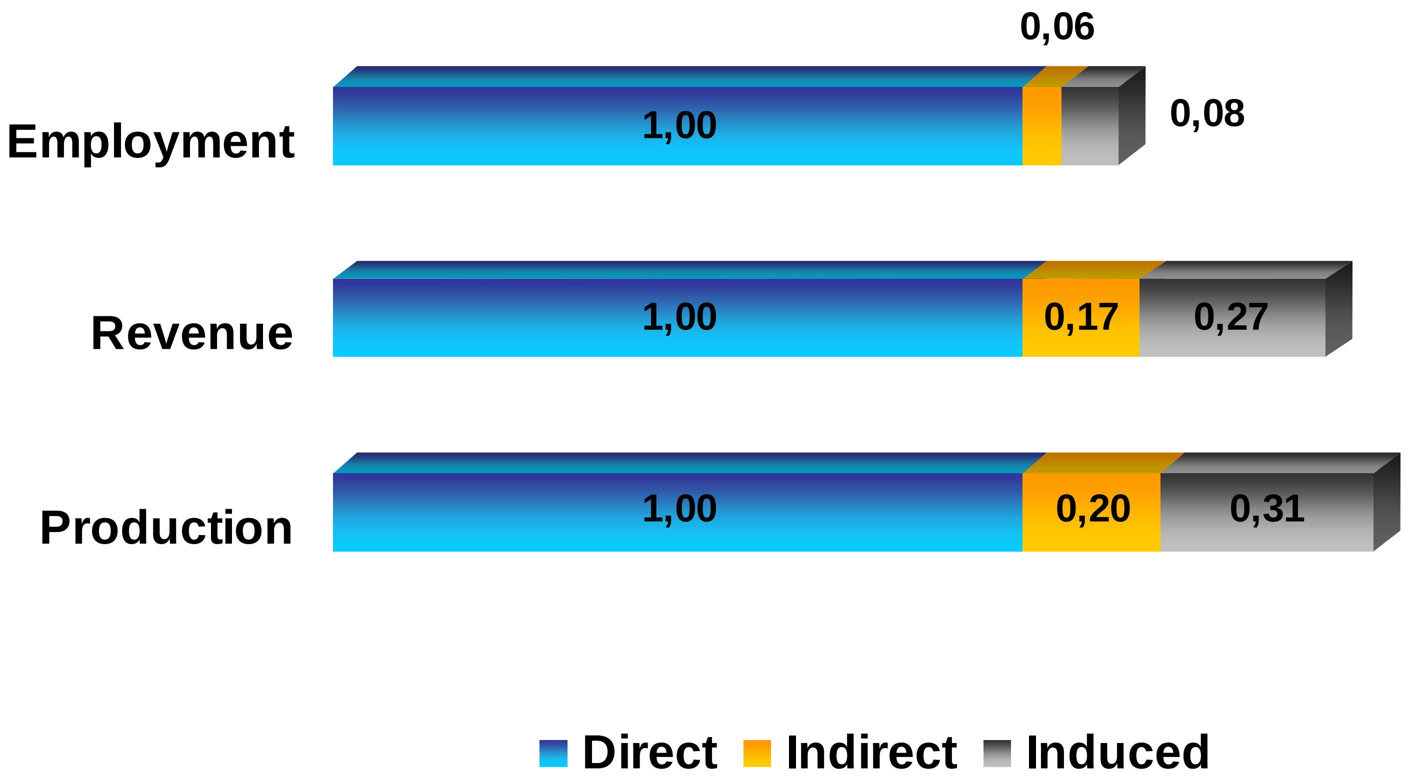
	Loaded		Unloaded	
	2005	**2006**	**2005**	**2006**
S. Miguel	517 818	511 309	1 203 221	1 236 500
Terceira	182 123	172 605	519 392	546 195
Faial	7 789	9 986	105 657	106 625
Total Azores	**737 610**	**723 803**	**2 087 949**	**2 133 742**

Regional economic impacts

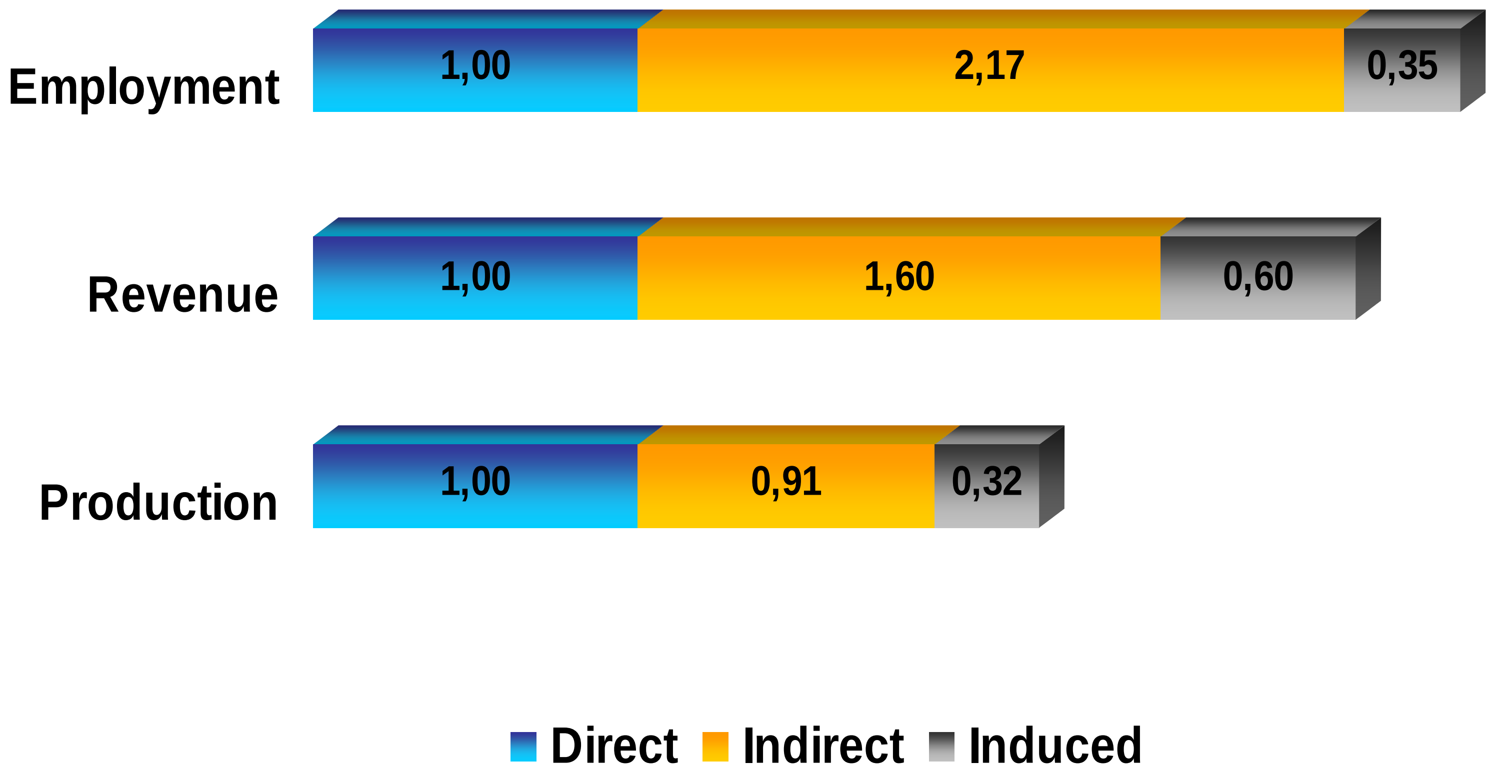
Expenditure (not including labour) by fishers in Portugal 1995 & 2005



Economic multipliers for Fishery, Aquaculture Products and related services in the Azores 2001 (Ferreira 2006)



Economic multipliers for Fish Processing Industry in the Azores 2001 (Ferreira 2006)



Economic impact in Wales (Richardson 2006)

- Commercial fishing is a relatively small industry in Wales, its regional socioeconomic importance, to coastal communities, has been under-estimated.

- Complete removal of the catching sector in Wales would result in economy-wide losses of:

  - £101 million in output (gross revenue, 2003 £),
  - £21 million in household income
  - 1200 full-time equivalent (FTE) jobs

Recreational fishing in Wales

- The removal of sea angling opportunities from Wales could result in losses of
  - £118 million in output,
  - £28 million in household income
  - 2100 FTE jobs.

- Visiting anglers (ie non residents) provide
  - £15 million in output,
  - £3 million in income
  - 268 FTE jobs

Ecosystem services

Ecosystem services

- Costanza *et al.* (1997) identified 17 classes of ecosystem service ranging from climate regulation to recreation.

- They estimated that the total value of ecosystem services to humankind lies between US$ 16-54trillion per year, with an average of $US33 trillion per year.

- The most valuable services provided by ecosystems are gas regulation and nutrient recycling.

- The ecosystems which provide the greatest value per ha are estuaries, wetlands and swamps / floodplains.

- The value of these ecosystems is largely related to their role in nutrient recycling and waste treatment.

Ecosystem Goods & services

Gas and Climate Regulation

The maintenance of the chemical composition of the atmosphere by marine living organisms

Bioremediation of Waste

Removal of pollutants through storage, dilution, burial and recycling.

Nutrient cycling

The storage, cycling and maintenance of nutrients by living marine organisms

Ecosystem Goods & services

Resilience and Resistance (Life Support or glue value)

The life support value which arises from the interrelationships of ecosystem functions

Disturbance prevention (Flood and storm protection)

The dampening of environmental disturbances by living marine organisms. cf wetlands, salt marshes and corals

Raw materials, including ornamental resources

The extraction of marine organisms for all purposes, except human consumption.

Ecosystem Goods & services

Cultural Heritage and identity

There is value associated with the marine environment e.g. for religion, folk lore, painting, cultural and spiritual traditions associated with fishing communities.

Cognitive Values

Cognitive development, including education and research, resulting from marine organisms

Feel good or warm glow

Value which we derive from marine organisms without using them.

Examples of willingness to pay (WTP) bids for threatened and endangered species (all figures in 1993 US$).

(source Loomis and White 1996).

Species	Low value	High value	Mean
Grizzly bear			46
Northern Spotted owl	44	95	70
Whooping crane			35
Red cockaded woodpecker	10	15	13
Bald eagle	15	33	24
Bighorn sheep	12	30	21

Existence values of marine species

Common name	Reference	Annual WTP for change in species population ($US)
Gray and blue whale	Hageman (1985)	23,95
Gray whale	Loomis and Larson (1994)	18,14
Bottlenose dolphin	Hageman (1985)	17,73
California sea otter	Hageman (1985)	20,75
Northern elephant seal	Hageman (1985)	18,29
Monk seal	Samples and Hollyer (1989)	9,57
Humpback whale	Samples and Hollyer (1989)	13,83

Source: Adapted from Eagle and Betters (1998)

About 11 economic valuation studies published of marine species since 1985-2003

Summary: data and methodology

- Much data on fisheries catches – but not spatial
- Good data on other commercial activities – but economics are not readily available.
- Poor biological data – esp. spatially
- Growing economic data on recreation
- Almost no ecosystem goods and services data – and not spatial
- Poor dataset on public desire to conserve marine species

Methodologies

Planning methodologies derived for terrestrial systems are easily applicable to marine systems – so no major problem here.

Options for marine conservation

But the data are only part of the issue – what about the effectiveness of the mechanisms:

- Marine Protected Areas (and networks)
- Assignation of property rights
- Zonal gear restriction
- Activity Zonation

Conservation is too important to be left solely to the biologists

Our research agenda

- Natacha is concerned with economic impacts of fishing in the Azores, including the spatial allocation of catch value and economic multiplier.
- Adriana is trying to value the ecosystem goods and services around two islands and allocate them spatially.
- MARBEF is trying to identify ecosystem goods and services in different locations around EU
- Gareth is concerned with valuing goods & services in Wales, in understanding impacts of EU policy on marine conservation and in the economic and environmental impacts of assigning property rights to fishers

Conclusion

The problem

- Fisheries are collapsing
- Marine ecosystems are being damaged
- Politicians need to do something
- But we don't have good data to enable rational planning
- We can get the data together to enable planning but we need to do some basic research.
- A need for multidisciplinary approaches

Is there political and social will to conserve marine systems?

- People don't love fish (unless they are cooked)
- People can't see the seabed – so any damage is hidden
- The sea seems vast – so why worry?
- The key to bringing about marine conservation is to get political will.
- But if there are no votes in it then this is a tough job.
- So we can predict that marine conservation will struggle until there is widespread public buy-in or a major disaster – by which time it will be too late.

So if you are interested - get engaged

Thank you

Obrigado

Diolch