# IMARES

## Marine Protected Areas on the High Seas

BO-10-003-009 Marine Biodiversity
KOL: Marine Biodiversity
IMARES Workshop Marine Protected Areas, IJmuiden, 20 January 2010

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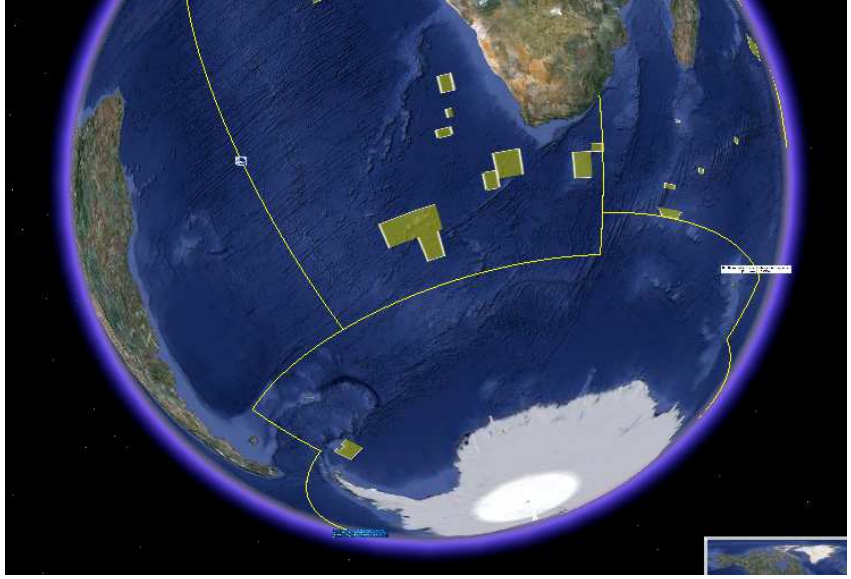
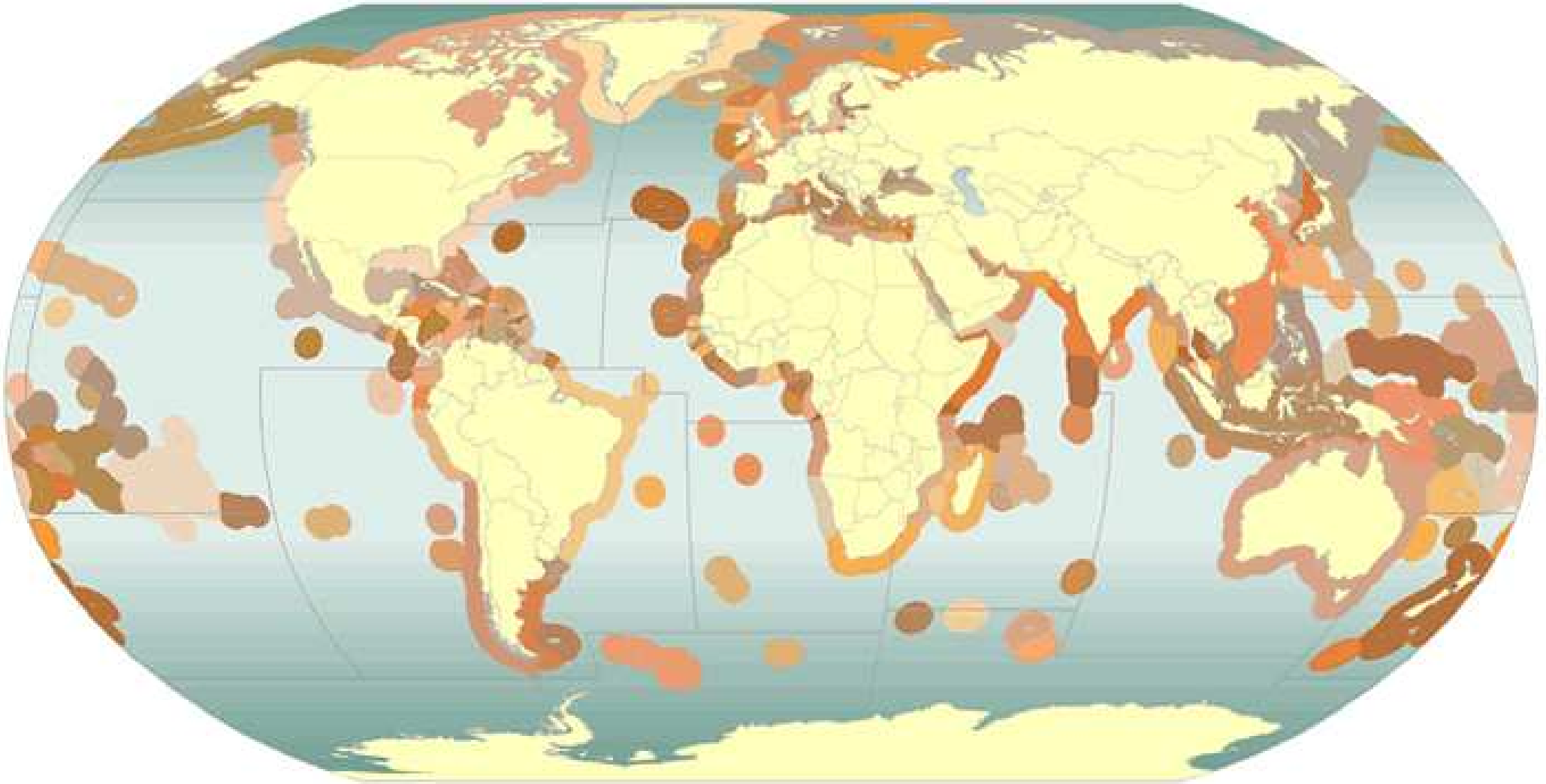


- 1. Introduction (High Seas, ecology, fisheries)
- 2. IMARES Project description
- 3. Demonstration of results

# High Seas (*mare liberum*): areas outside EEZ

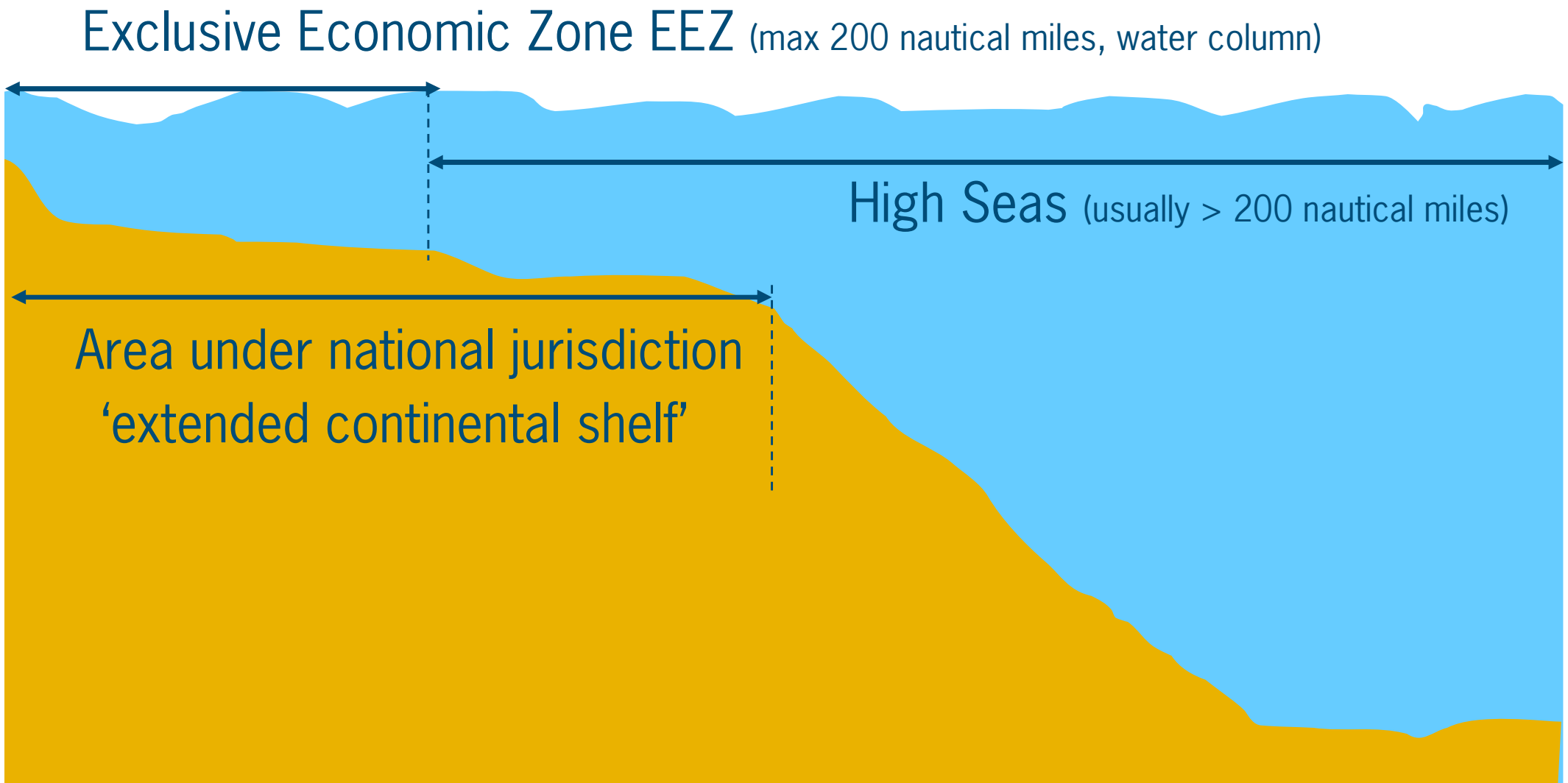


High Seas: 202 million km$^2$.

World Ocean: 363 million km$^2$.

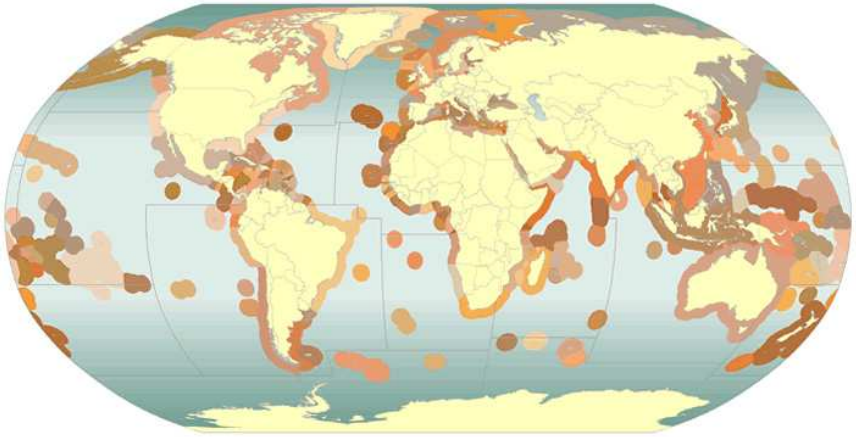
Cheung et al. (2005)

# High Seas and areas outside national jurisdiction



# EEZ and High Seas

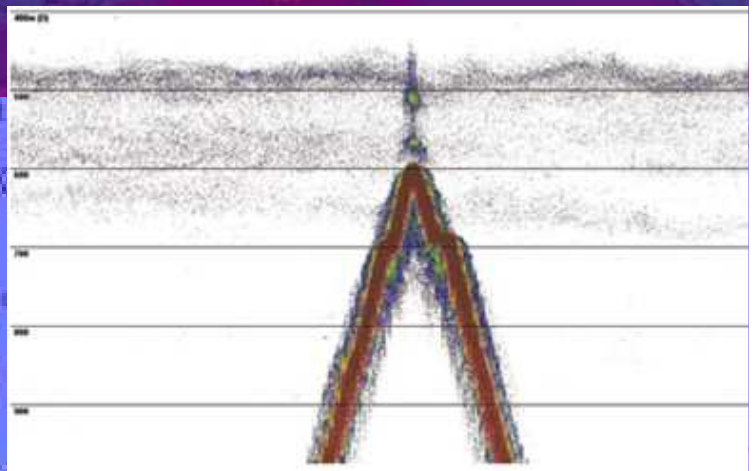
- Exclusive Economic Zone (per country)
  - 200 nm zone
  - Exploitation of natural resources (fish, oil, gaz, sand)
  - Building of structures
  - Scientific research
  - Marine Protected Areas
    - Natura 2000 (Europe)



- High Seas (> EEZ)
  - Nobody is owner
  - Fishery Management: RFMO
  - Oil: Seabed Authority
  - Marine protected Areas:
    - RFMOs
    - Seabed Authority
    - International Whaling Committee
    - International Maritime Organisation (IMO)
    - United Nations
  - Legal continental shelf

# Features of the high seas

- Seamounts
  - (>14000 big, -1000m. In total 100.000 small, only few hundred sampled)
- Knolls
- Ridges
- Continental shelf, slope



Fish schools on the top and the edges around Rusky knoll
Source: G. Patchell, Sealord Group

http://earthref.org/databases/SC/

# Seamounts

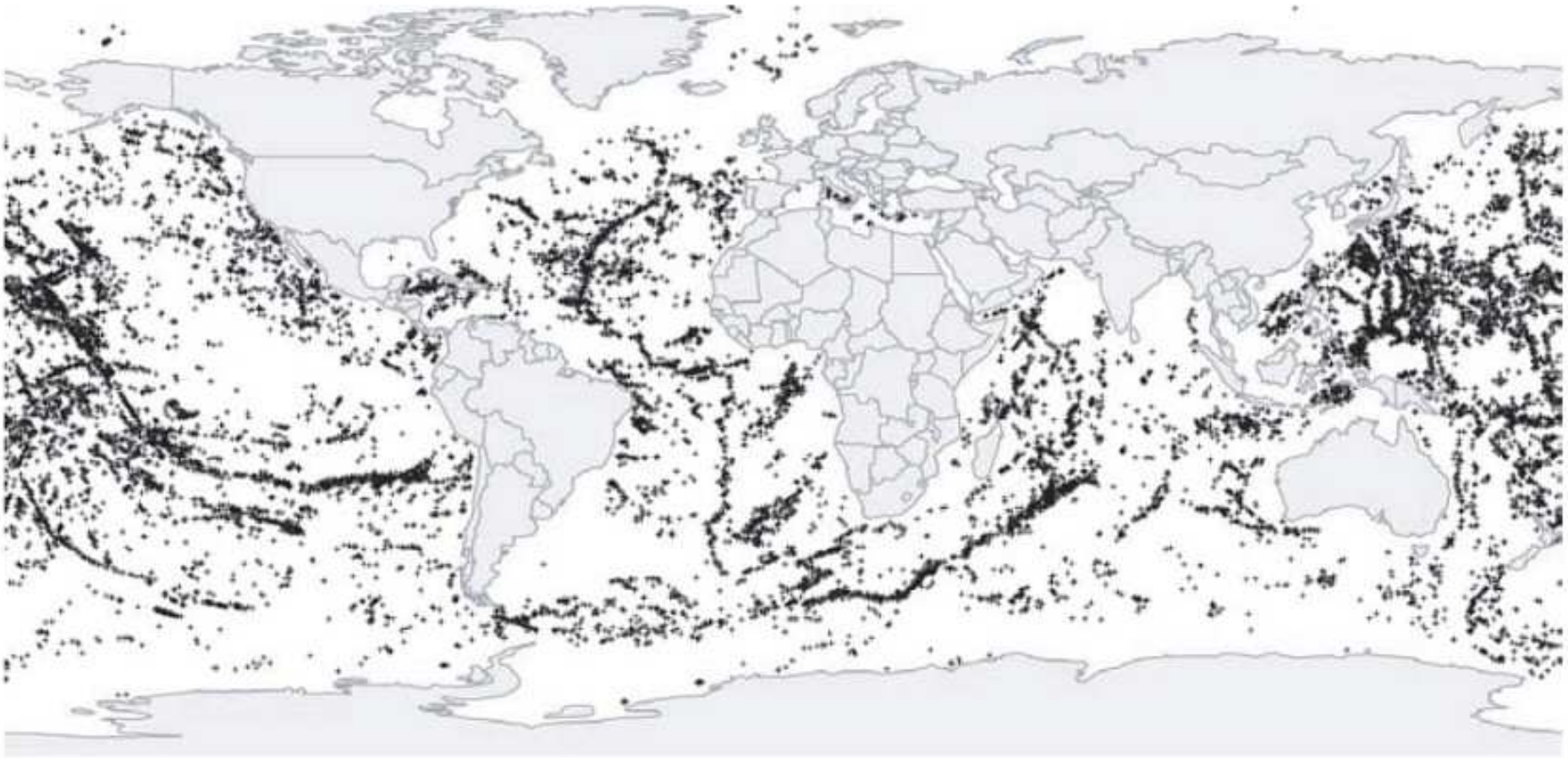
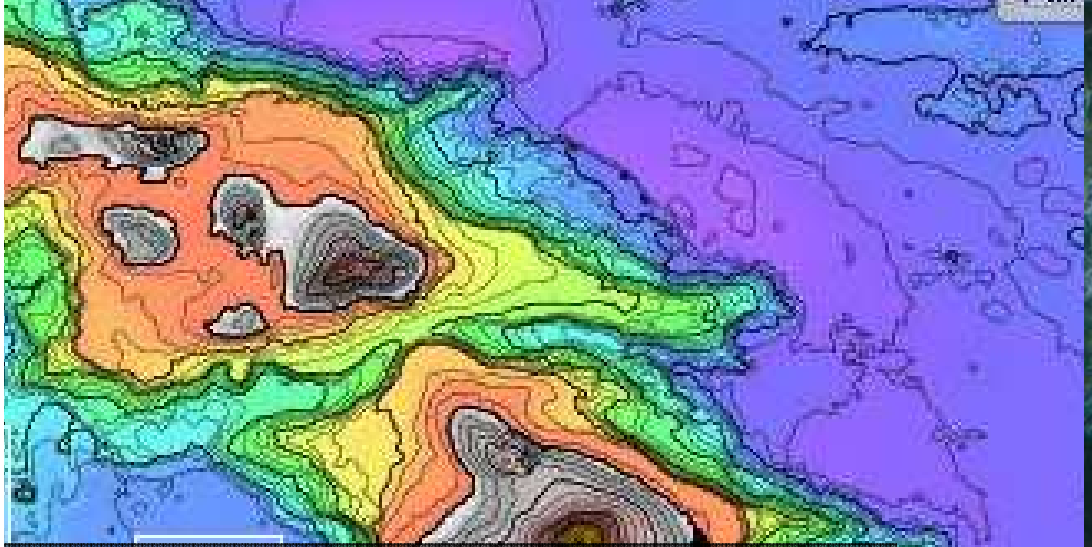


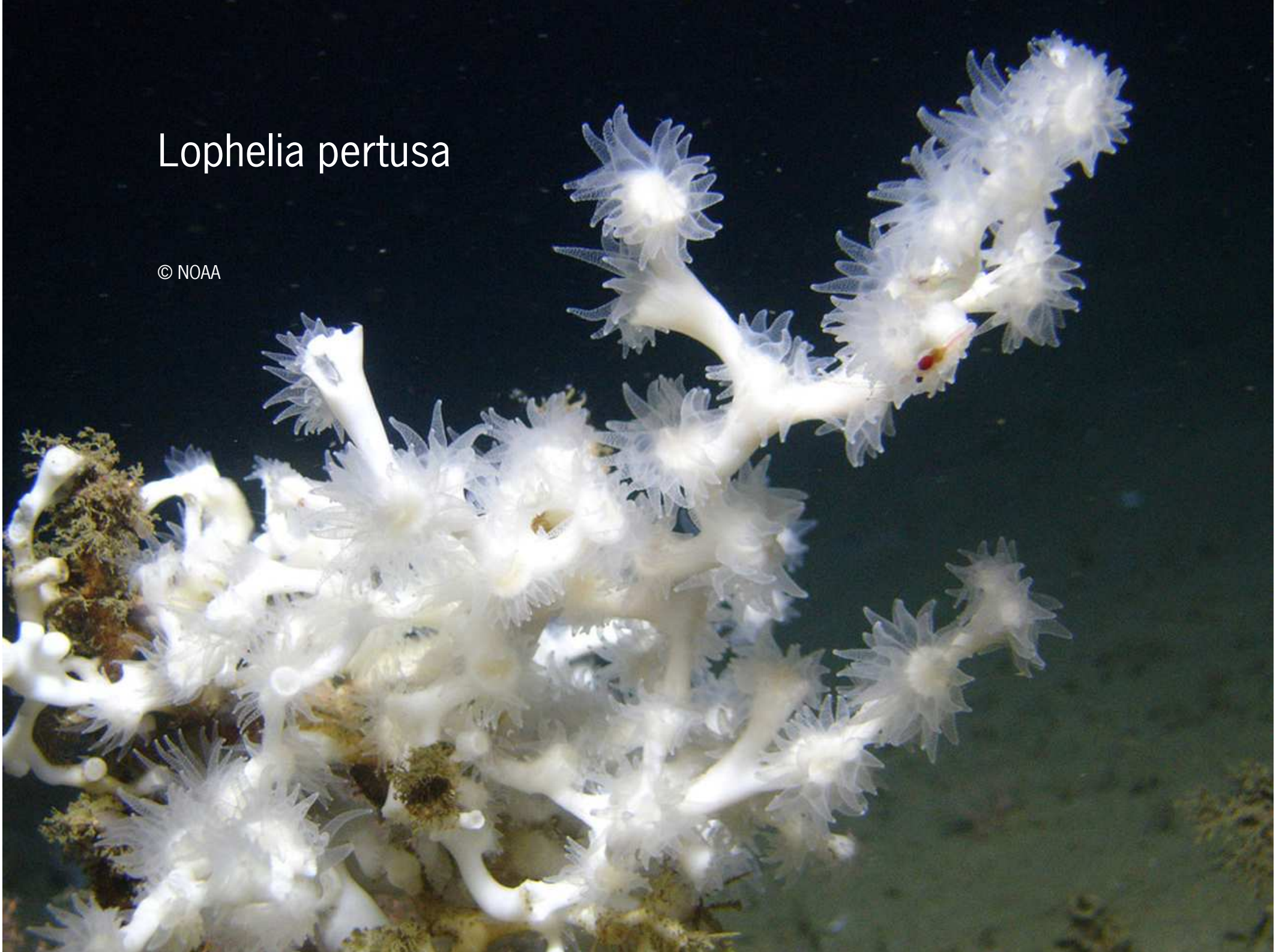
**FIGURE 2:** Distribution of large seamounts estimated by Kitchingman and Lai (2004). This map displays approximately 14,000, particularly well-defined (conical), seamounts. Including a wider range of seamount shapes and sizes could increase their number to 100,000.

Cheung et al. 2005





- Corals
- Sponges
- Chimneys
- Deep sea fish



Lophelia pertusa

# Records of corals

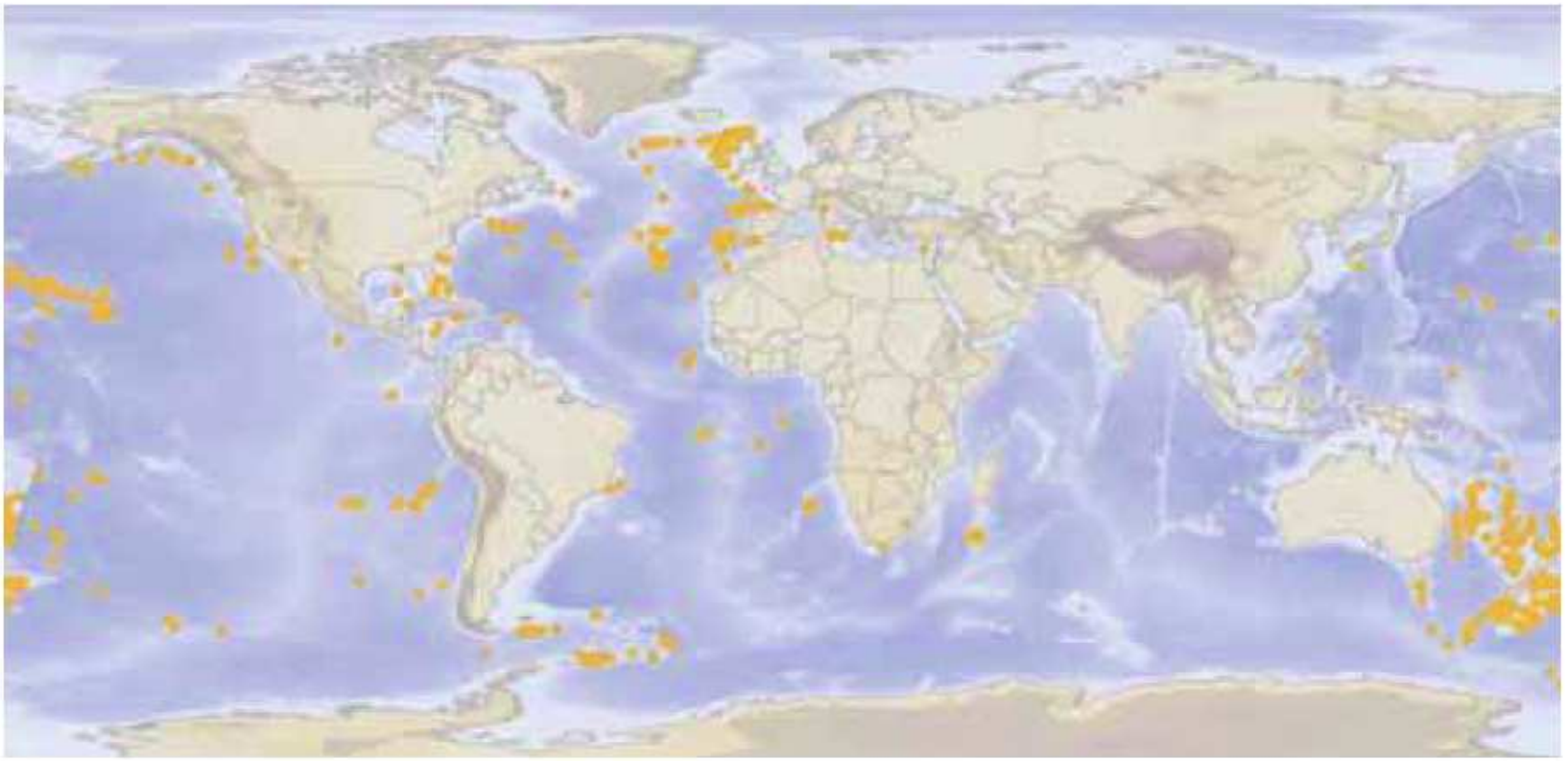
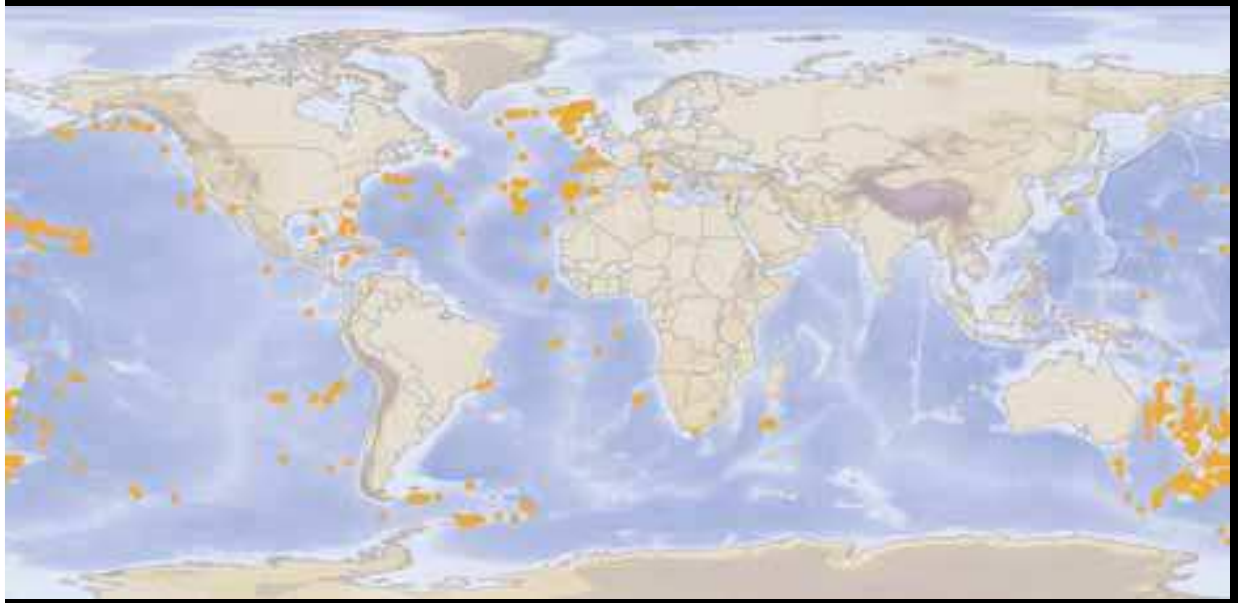


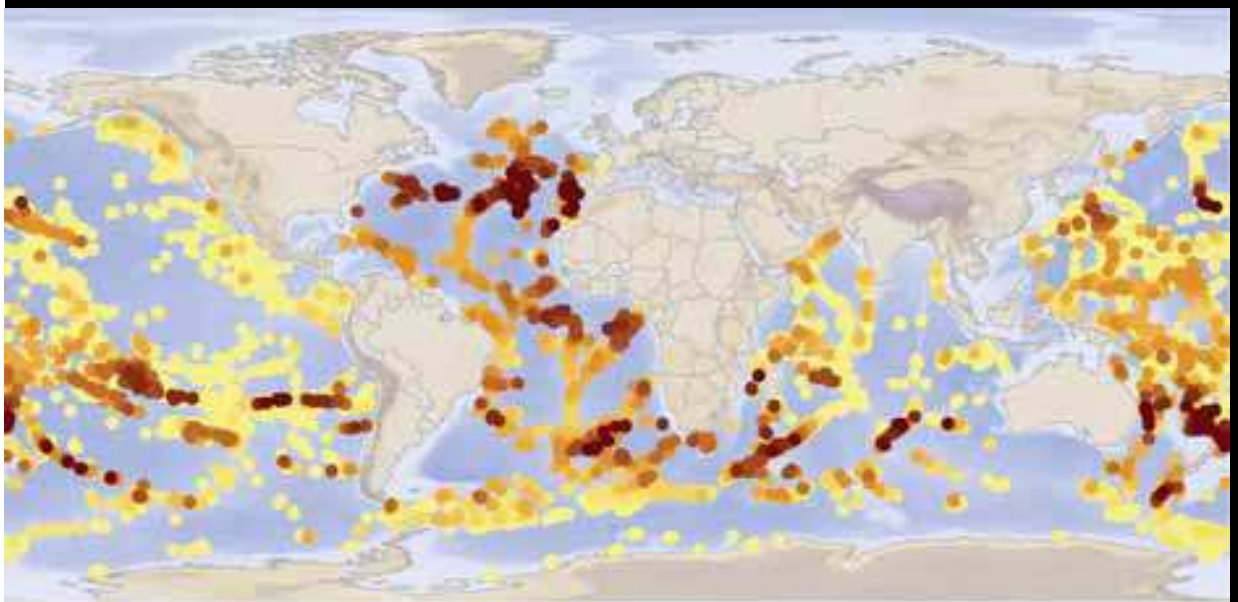
**Fig. 4.1 Global distribution of seamounts with records of corals (Scleractinia, Octocorallia, Antipatharia, Stylasterida and Zoanthidea).** *Source: Rogers et al. (in press)*

# Seamounts & corals



Rogers et al. 2007 / 6

Recorded findings of corals on seamounts



Predicted findings of corals on seamounts

# Cold water corals

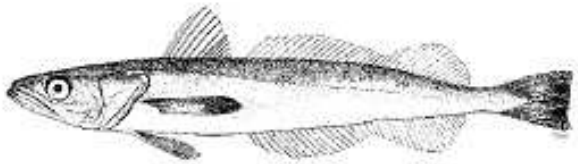
- More coral species than in shallow seas
- No symbiotic relationship with algae
- Down to -6000 m
- -1.1 °C
- 2 classes
  - Octocorals: soft corals + gorgonian sea fans
  - Hexacorals: hard coral reefs + tree/stick reefs


- Hexacoral
- 4-25 mm /y
- Thousands of years old
- Most found at 200-1000 m
- Some reefs up to 30m from seafloor
- One of largest: Norwegian (400m x 13 km)
- Habitat for sponges, anemones, fish, crusteceans etc

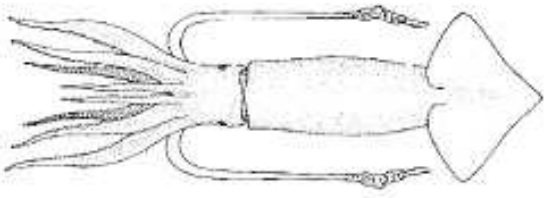
# Commercial species

FIGURE 1
Examples of species targeted by bottom fisheries in the high seas of the South West Atlantic

Argentine hake (*Merluccius hubbsi*)



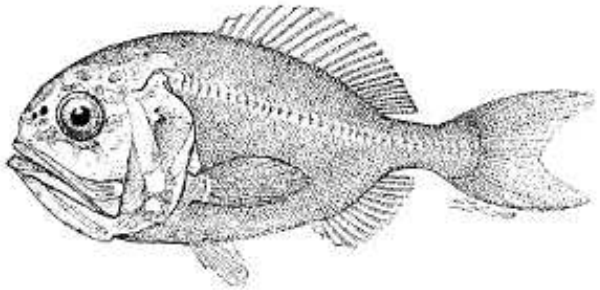
Argentine short-fin squid (*Illex argentinus*)



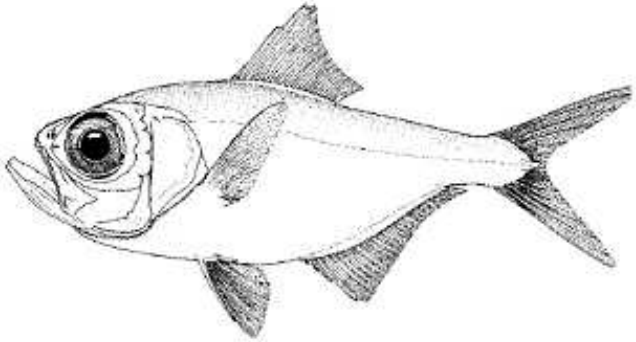
Source: FAO.

FIGURE 1
Examples of species targeted by bottom fisheries in the high seas of the Indian Ocean

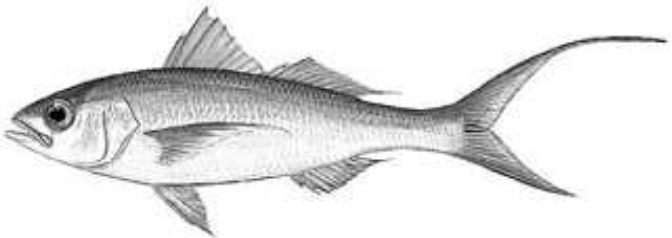
Orange roughy (*Hoplostethus atlanticus*)



Splendid alfonsino (*Beryx splendens*)



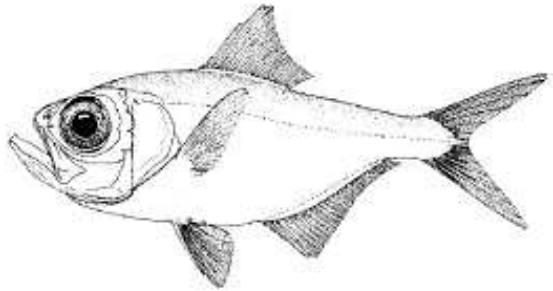
Deepwater longtail red snapper (ruby snapper) (*Etelis coruscans*)



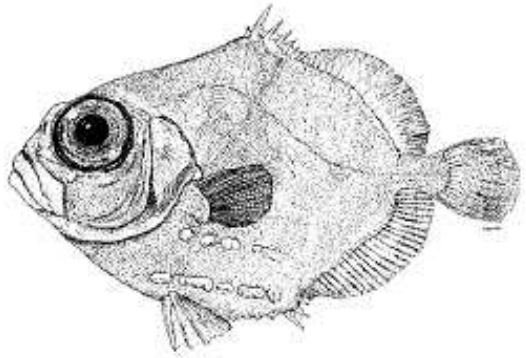
Source: FAO.

FIGURE 1
Examples of species targeted by bottom fisheries in the high seas of the North Pacific

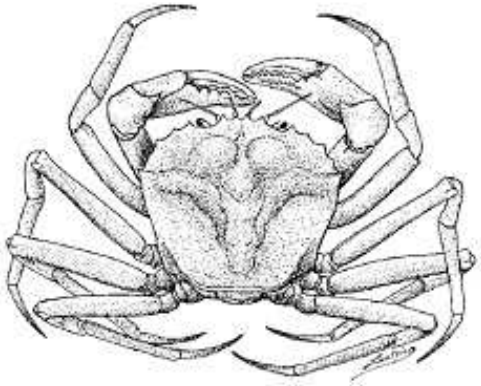
Alfonsino (*Beryx* spp.) (*Beryx splendens*)



Warty oreo (*Allocyttus verrucosus*)



Deep-sea (red) crab (*Geryon quinquedens*)



Source: FAO.

# Depth distribution of commercial fish species on seamounts

**Table 6.1: Depth distribution of commercial fish species on seamounts**

| Species (common name) | Code | Scientific name | Main depth range (m) * | Total depth range (m) * |
|---|---|---|---|---|
| Alfonsino | BYX | *Beryx splendens* | 300-600 | 25-1 300 |
| Cardinalfish | EPT | *Epigonus telescopus* | 500-800 | 75-1 200 |
| Rubyfish | RBY | *Plagiogenion rubiginosum* | 250-450 | 50-600 |
| Blue ling | LIN | *Molva dypterygia* | 250-500 | 150-1 000 |
| Black scabbardfish | SCB | *Aphanopus carbo* | 600-800 | 200-1 700 |
| Sablefish | SAB | *Anoplopoma fimbria* | 500-1 000 | 300-2 700 |
| Pink maomao | MAO | *Caprodon* spp. | 300-450 | To 500 |
| Southern boarfish | LBO | *Pseudopentaceros richardsoni* | 600-900 | To 1 000 |
| Pelagic armourhead | ARM | *Pseudopentaceros wheeleri* | 250-600 | To 800 |
| Orange roughy | ORH | *Hoplostethus atlanticus* | 600-1 200 | 180-1 800 |
| Oreos | OEO (BOE, SSO) | *Pseudocyttus maculatus, Allocyttus niger* | 600-1 200 | 400-1 500 |
| Bluenose | BNS | *Hyperoglyphe antarctica* | 300-700 | 40-1 500 |
| Redfish | RED | *Sebastes* spp. (*S. marinus, S. mentella, S. proriger*) | 400-800 | 100-1 000 |
| Roundnose grenadier | RNG | *Coryphaenoides rupestris* | 800-1 000 | 180-2 200 |
| Toothfish | PTO | *Dissostichus* spp. | 500-1 500 | 50-3 850 |
| Notothenid cods | NOT | *Notothenia* spp. | 200-600 | 100-900 |

** Main depth range refers to the commercial fishing depths; total depth range refers to the full known depth range of adult fish (from FishBase).*

UNEP report 2006:

Clark MR, Tittensor D, Rogers AD, Brewin P, Schlacher T, Rowden A, Stocks K, Consalvey M (2006). Seamounts, deep-sea corals and fisheries: vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction. UNEPWCMC, Cambridge, UK.

# Orange roughy

- Long lived species > 100 y
- Mature 23-40 y
- Low fecundity
- Size 20-60 cm, 3kg
- Around e.g. seamounts
- No recovery

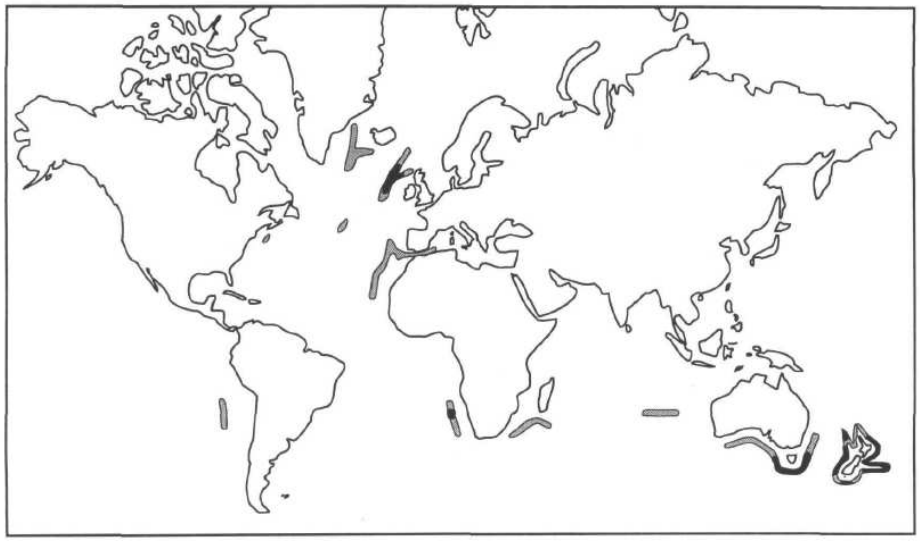
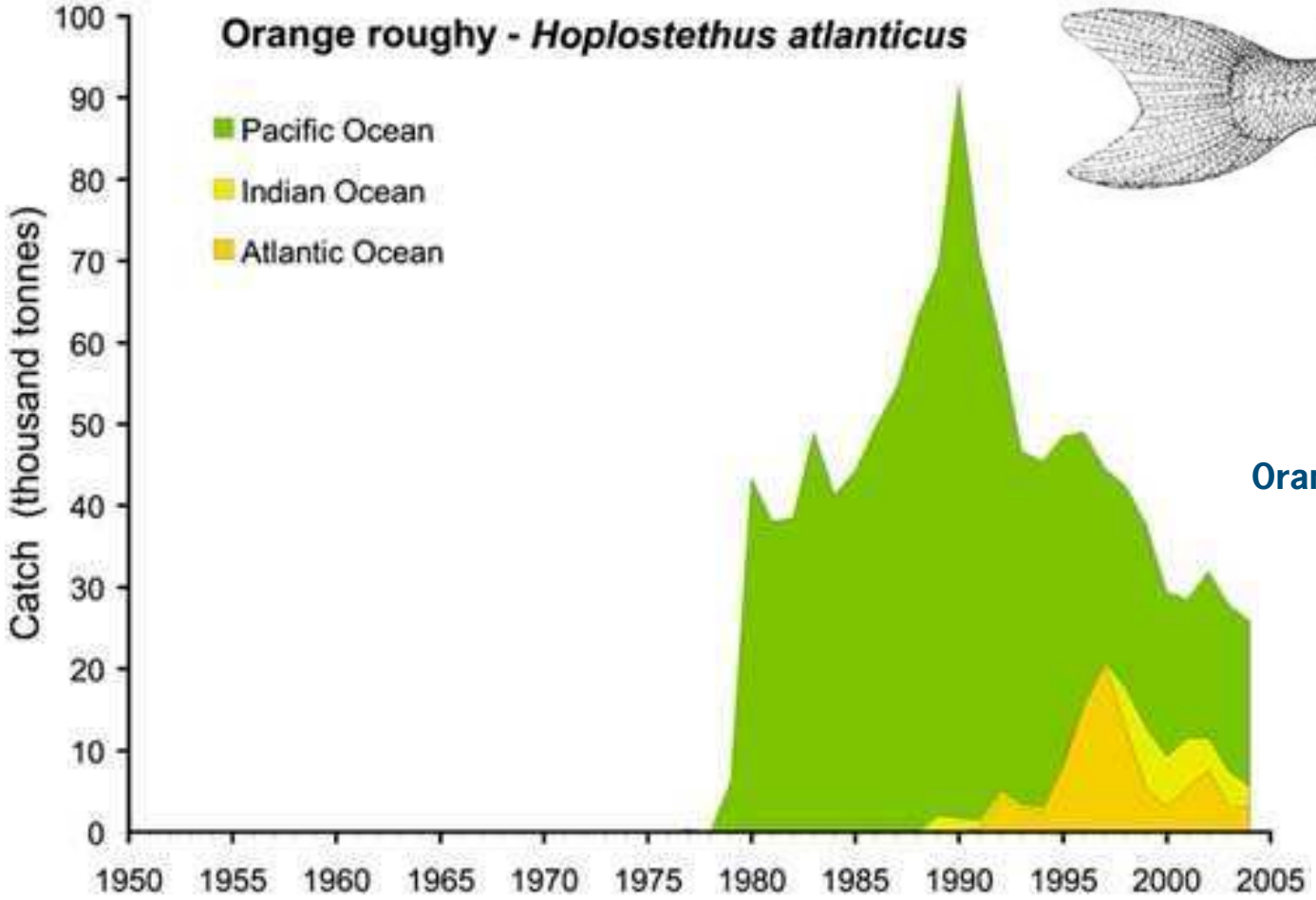
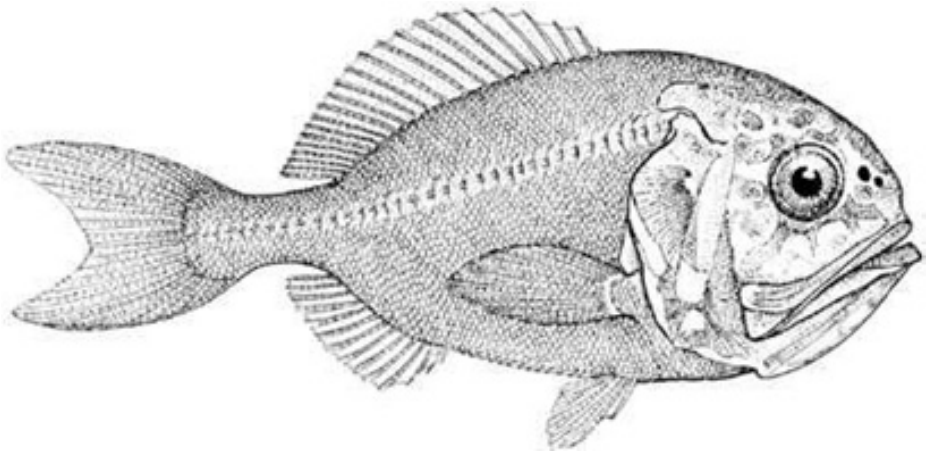


**Fig. 2** Known distribution of orange roughy (*Hoplostethus atlanticus*) around the world (stippled) and location of commercial fisheries (shaded).


A trawl cod-end full of Orange Roughy and oreo bycatch

# Deep sea fisheries

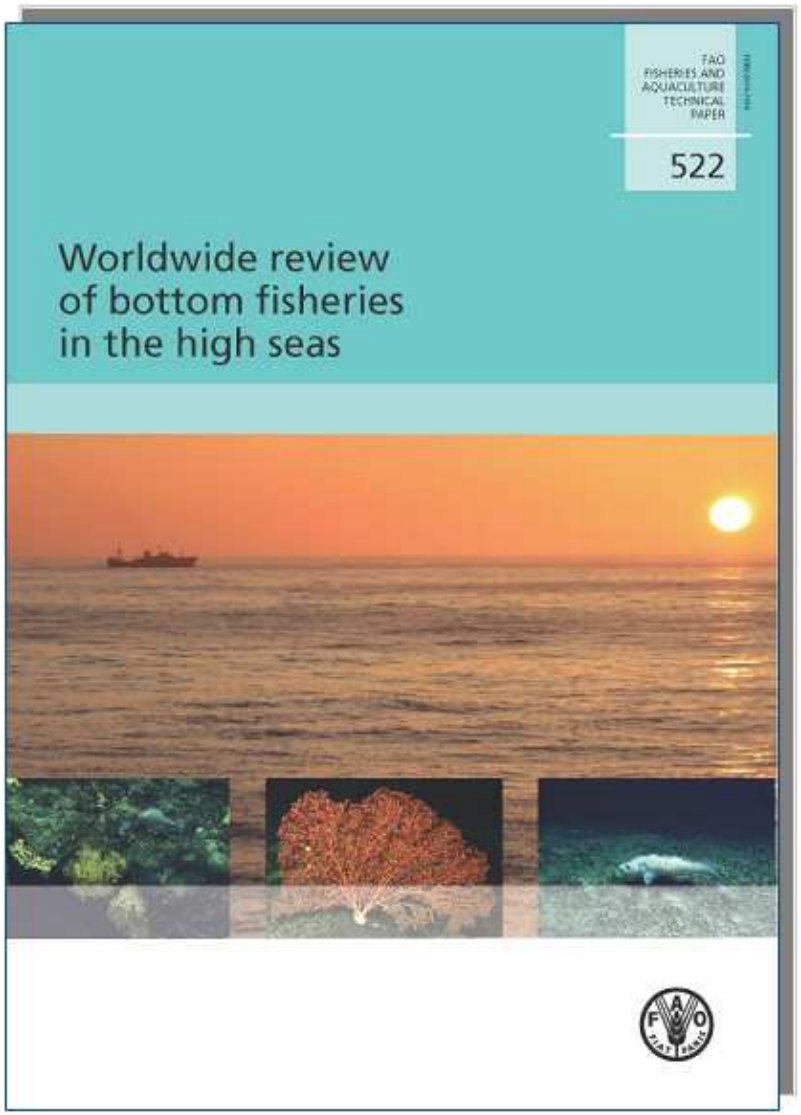


**Orange roughy** (*Hoplostethus atlanticus*) (FAO)

http://www.fao.org/docrep/009/a0653e/a0653e07.htm

# Review of Bottom fisheries in the high seas




Bensch et al. 2008

# Deep Sea Fisheries

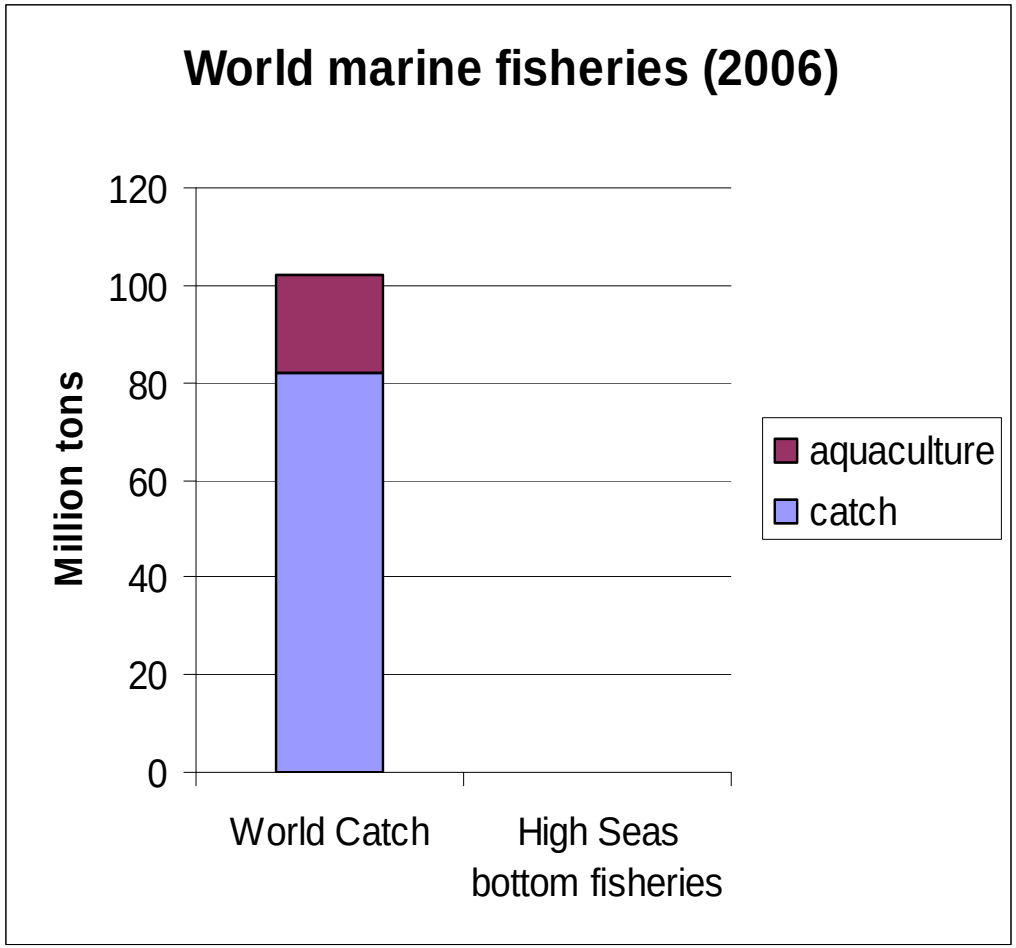
- Largely subsidized by governments
- 152 million $ / y = 25% of costs
- Profit < 10%
- Hence, fisheries not possible without subsidies

Sumaila et al. (2009)


*Work onboard a deepsea trawler in the Indian Ocean. Copyright: SIODFA.*

# Worldwide High Seas bottom fisheries (2006):

- High Seas
  - 285 vessels
  - 250.000 tonnes (0.3% of total world capture)
  - 450 million Euros
- World (total):
  - 81.9 million tonnes (+20.1 aquaculture)



# Legal Framework: treaty law

United Nations Convention on the Law of the Seas
(UNCLOS)
(1982)

## Fish stocks agreement (1995)(later):

Long term sustainability for migratory & straddling stocks

Precautionary approach

Impact assessments

Sustainability of other stocks in ecosystem

Minimize pollution/bycatch

Protect biodiversity

Prevent/eliminate overfishing

Complete data

Promote scientific research, management

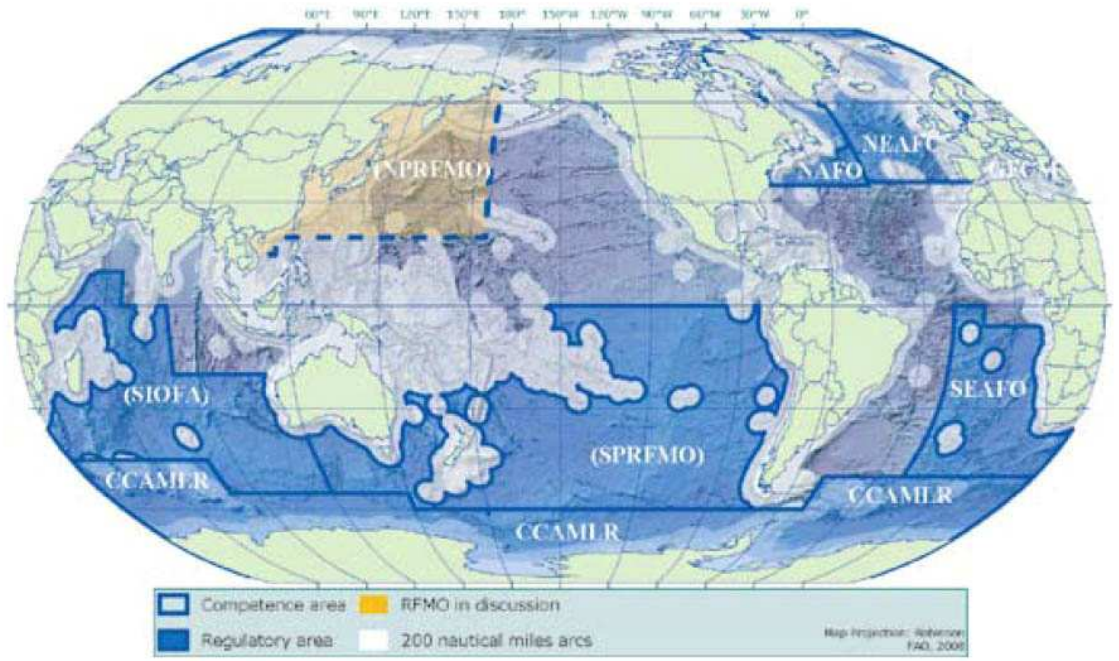
Implement conservation measures -> monitoring, control, surveillance

implementation

Regional Fisheries Management Organisations (RFMOs)

# RFMOs

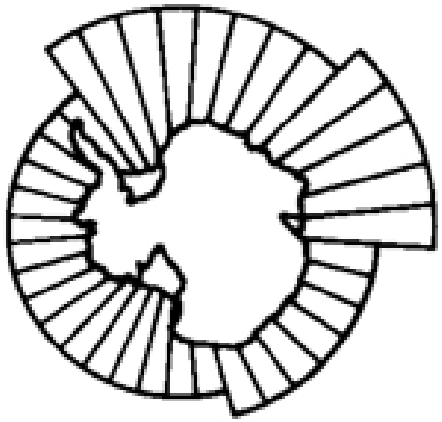
- Large part of the world are not covered by RFMOs
  - Northern Pacific
  - South West Atlantic




MAP 1
**Global high seas areas and coverage of relevant RFMOs**

# Regional Fisheries Management Organizations (RFMOs)





- 3 categories
  - 1. Established RFMO
  - 2. Under negotiation/agreement negotiated but not yet in force (S Pacific, N Pacific)
  - 3. No RFMO nor negotiations


North Pacific Fisheries Management Organisation

International Consultations on the Establishment of the
South Pacific Regional Fisheries Management Organisation

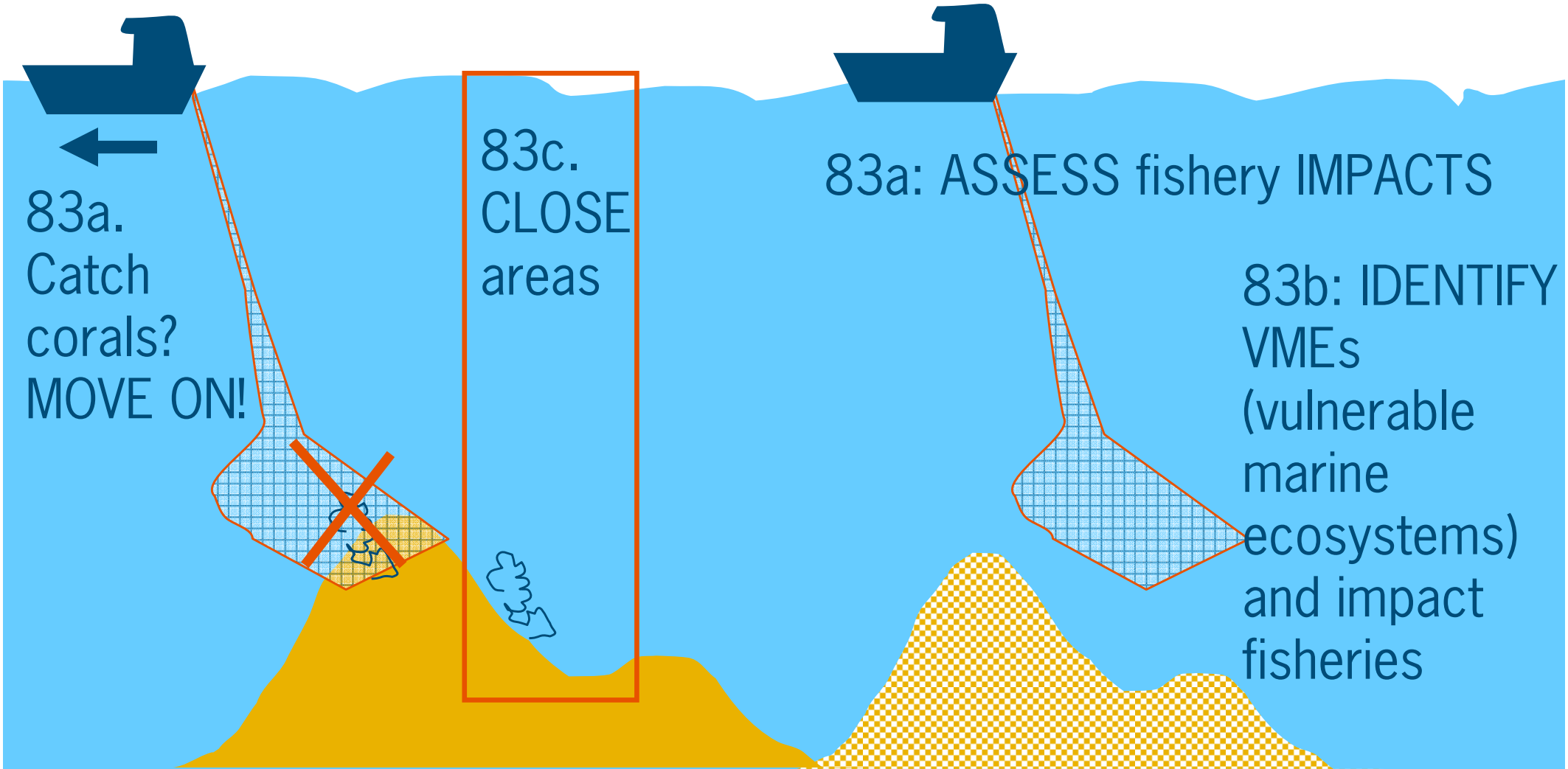
Southern Indian Ocean Fisheries Arrangement
(SIOFA)

# What do they do? (RFMO, RFMA)

- Countries that fish in an area (e.g. NW Atlantic) should be member of the RFMO (legal requirement)
- RFMO has set of rules
- Vessels should comply to the rules
- Yearly meetings
  - Yearly recommendations (yearly allowed catch, etc.)
  - Not in all cases: Scientific Committee for advice

# Legal Framework: Soft law:
# UN GA resolution 61/105

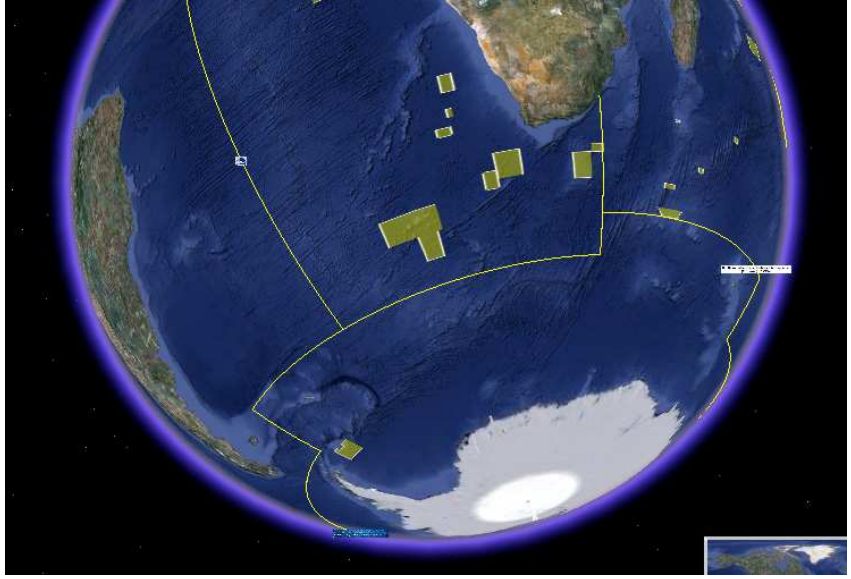
UN calls upon Regional Fisheries Management Organizations (RFMOs)
to adopt and implement measures no later than 31 Dec 2008



# Identification of VMEs (vulnerable marine ecoystems)

- How to determine VMEs? -> FAO criteria
  - Uniqueness or rarity
  - Functional significance of the habitat
  - Fragility
  - Life-history traits of component species that make recovery difficult
  - Structural complexity

- Problems
  - Are all bycatches reported?
  - Who determines VMEs? Observers?

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# IMARES project

BO-10-003-009 Marine Biodiversity

- Part 1.
  - Areas closed to bottom fisheries
    - VMEs (Vulnerable Marine Ecosystems).
    - VME indicator species: sponges, corals, etc.
  - Evaluation UN resolution 61/105 (Gianni)

- Part 2.
  - CBD criteria (EBSAs)
    - CBD: Convention on Biological Diversity
    - By 2012 a network of marine MPAs should be established
    - EBSAs: Ecologicially and Biologically Significant Areas
    - VME=EBSA?

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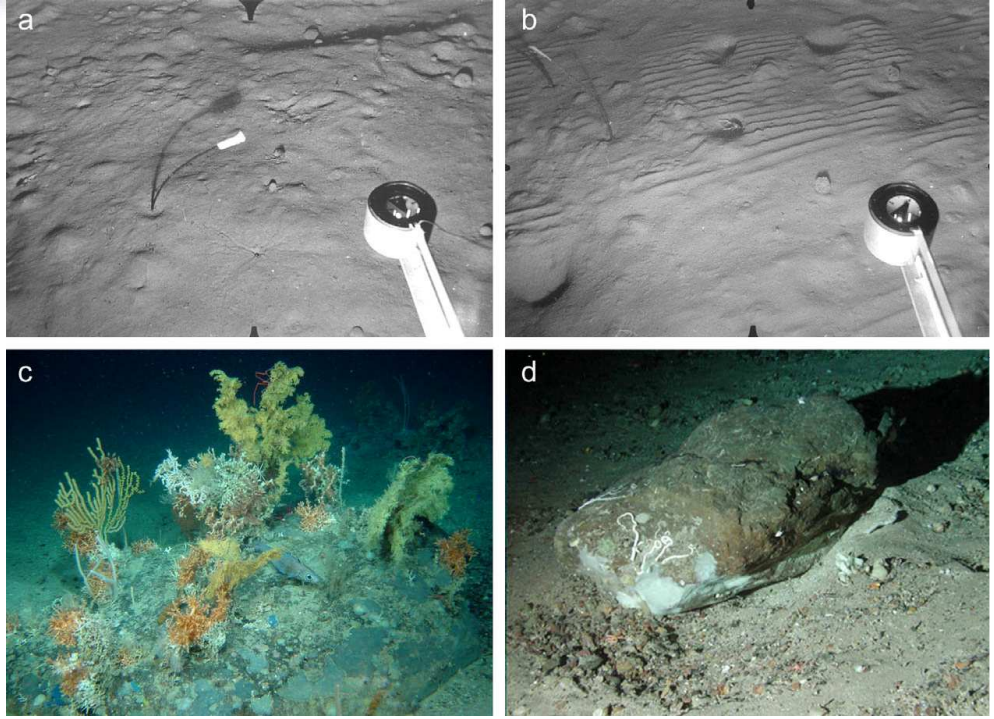
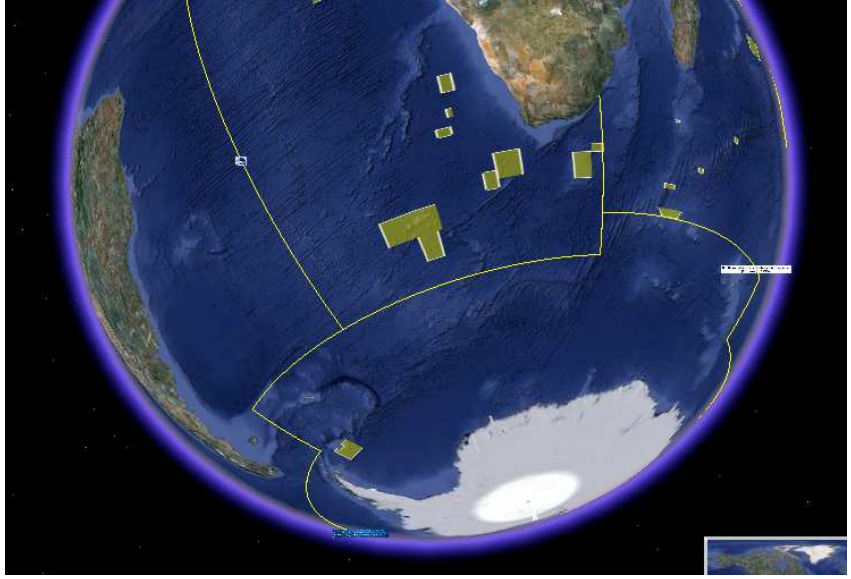
high seas areas closed to bottom fisheries

# Part 1. Overview of areas closed to bottom fisheries




Davies et al. 2007

- Factsheets, maps
  - When, where, how
  - Which RFMO
- Identification of world wide trends in measures
  - Are other protective measures needed?
- Workshops
- Review implementation 61/105 (update 2010)

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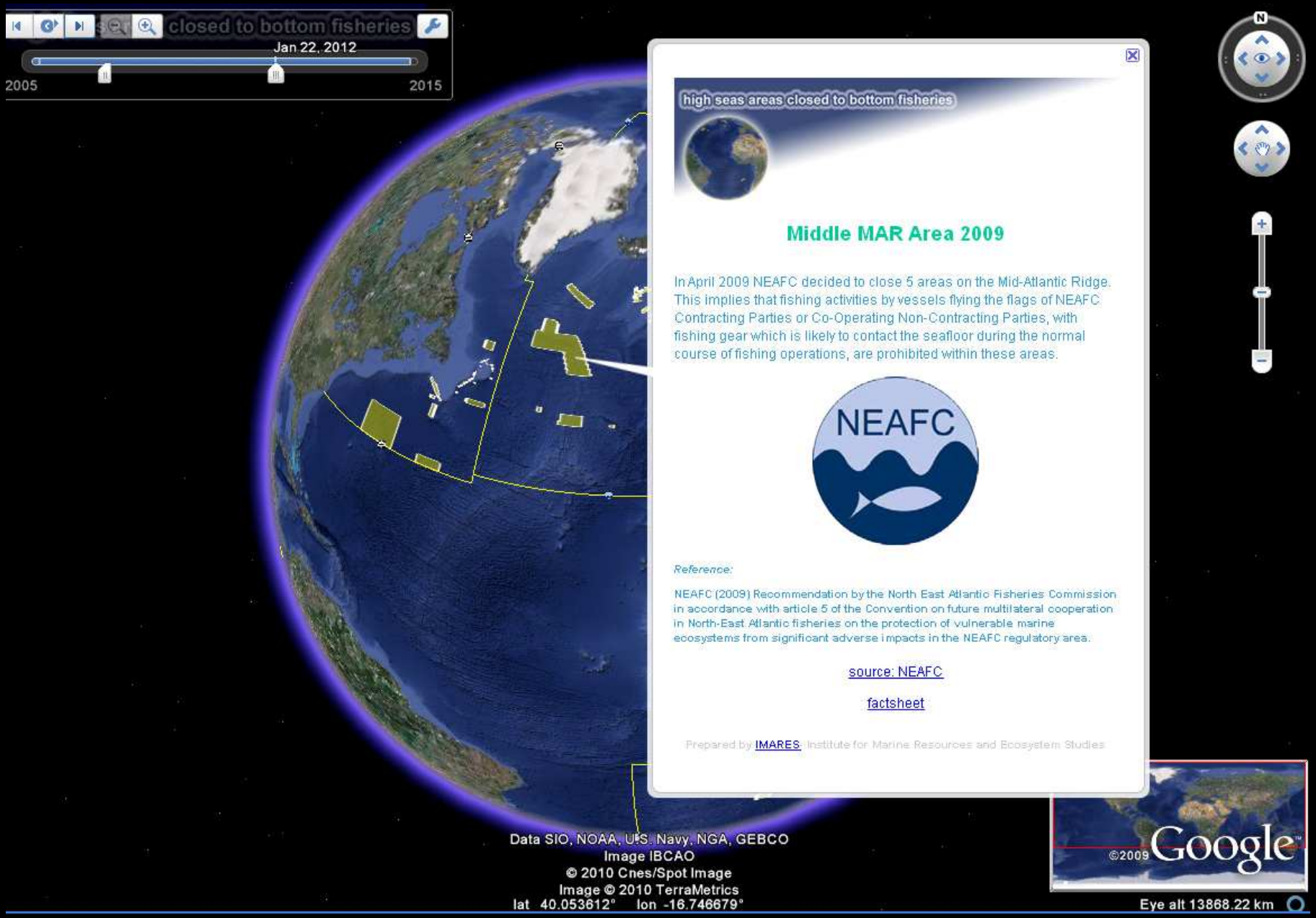
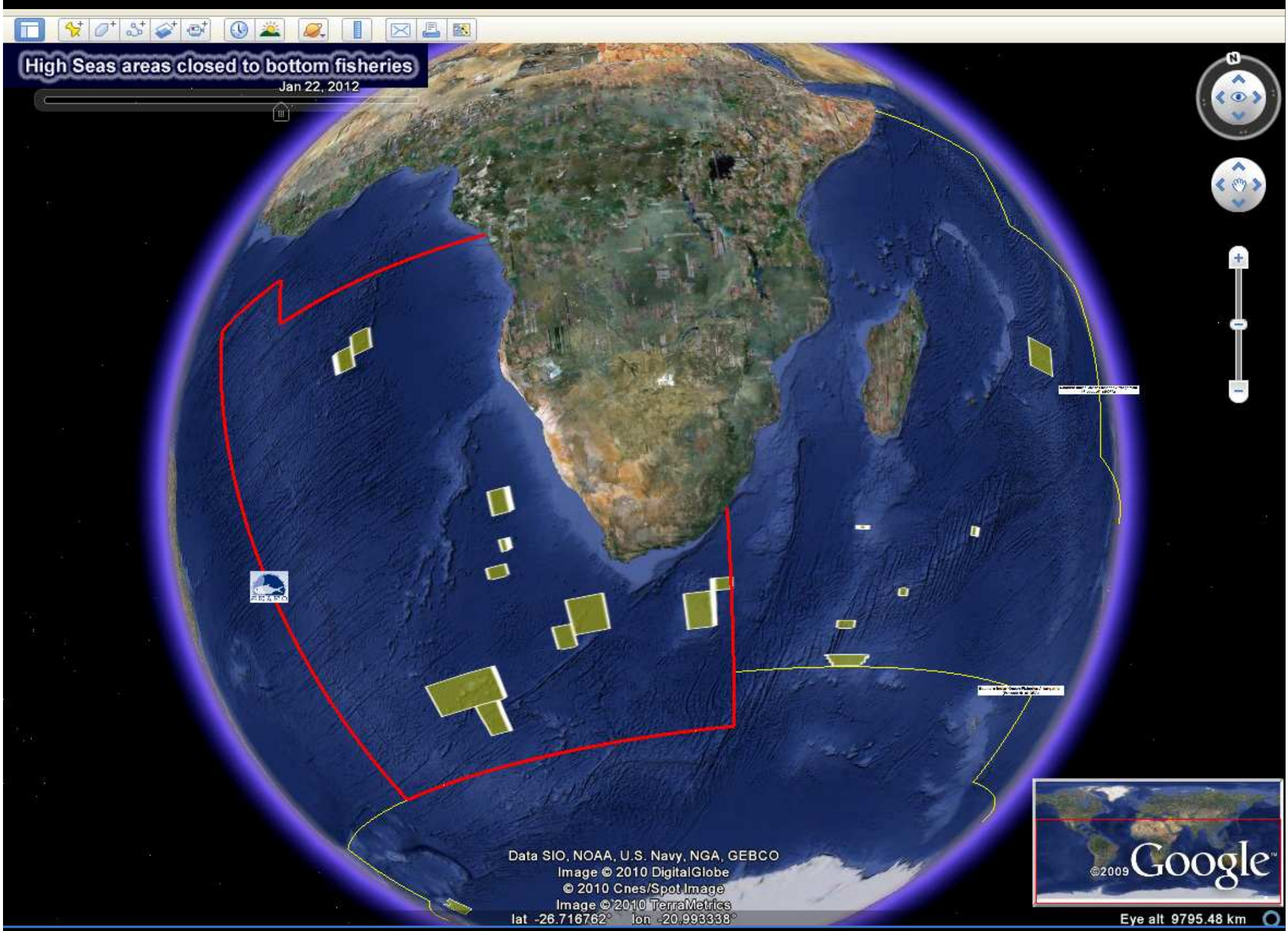
# Google Earth application showing High Seas areas closed to bottom fisheries




High Seas areas closed to bottom fisheries
Jan 22, 2012
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2010 DigitalGlobe
© 2010 Cnes/Spot Image
Image © 2010 TerraMetrics
lat -26.716762° lon -20.993338°
©2009 Google
Eye alt 9795.48 km

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