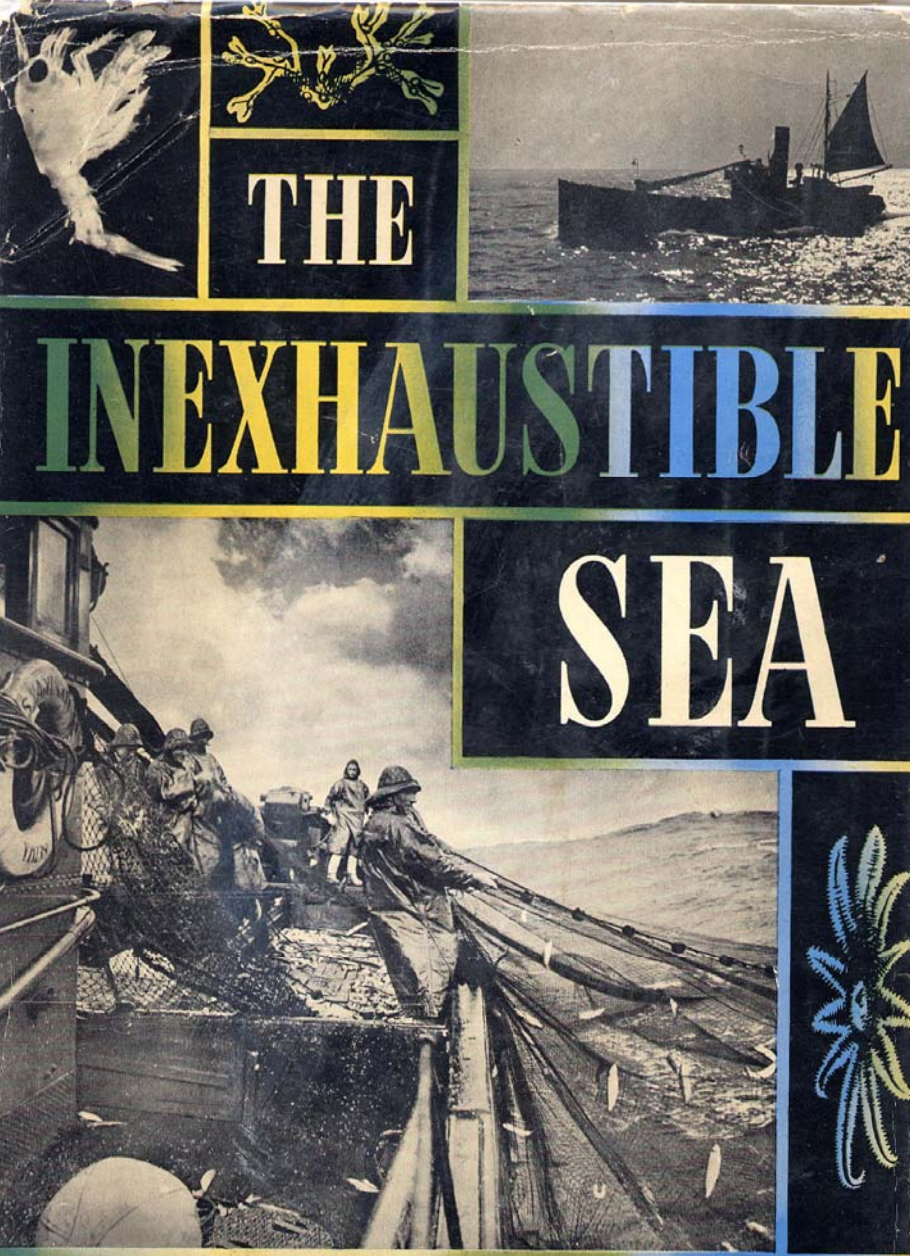


# The role of marine protected areas in sustaining fisheries

Callum Roberts

University of York, UK





THE

INEXHAUSTIBLE

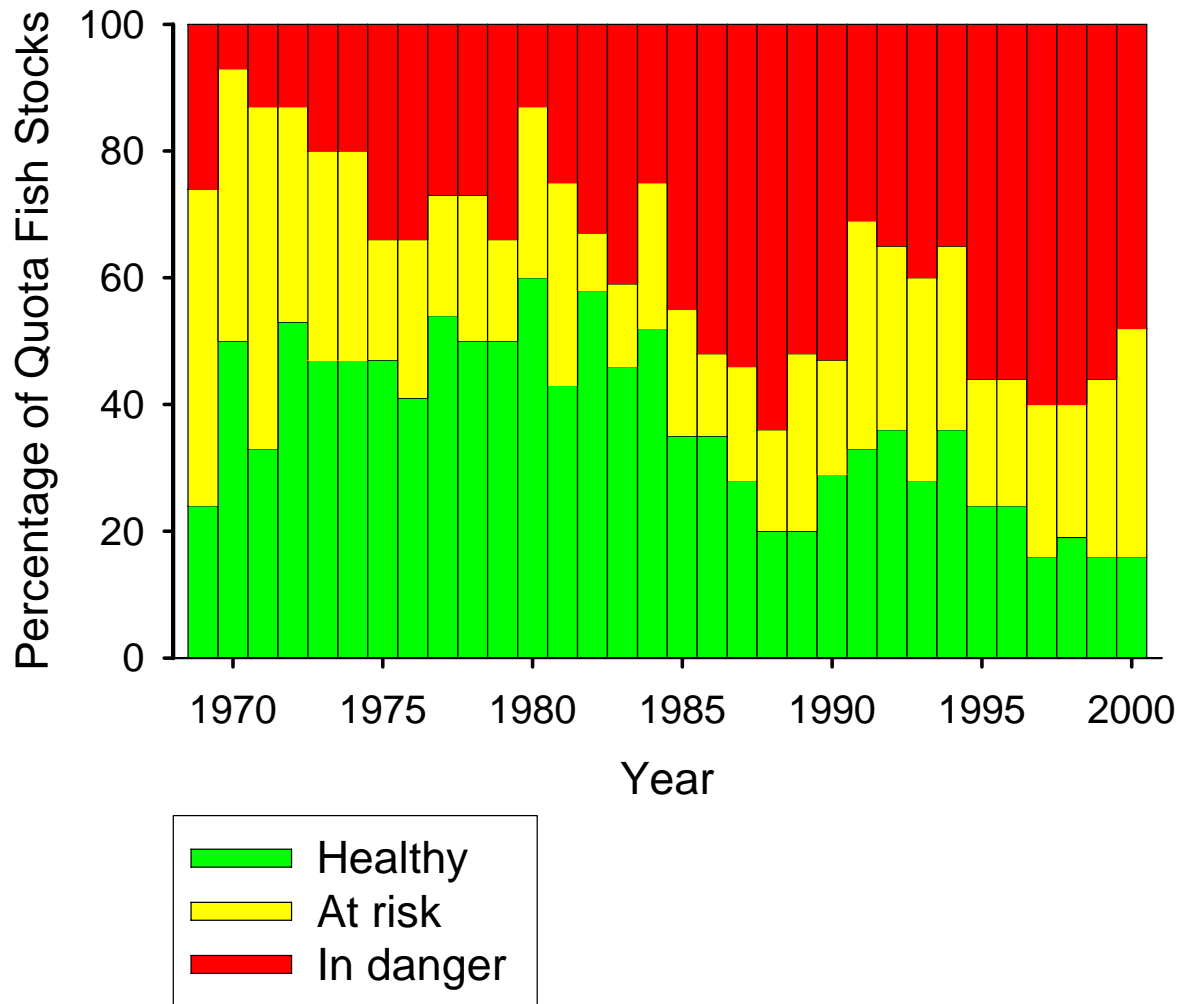
SEA

HAWTHORNE DANIEL  
and  
FRANCIS MINOT

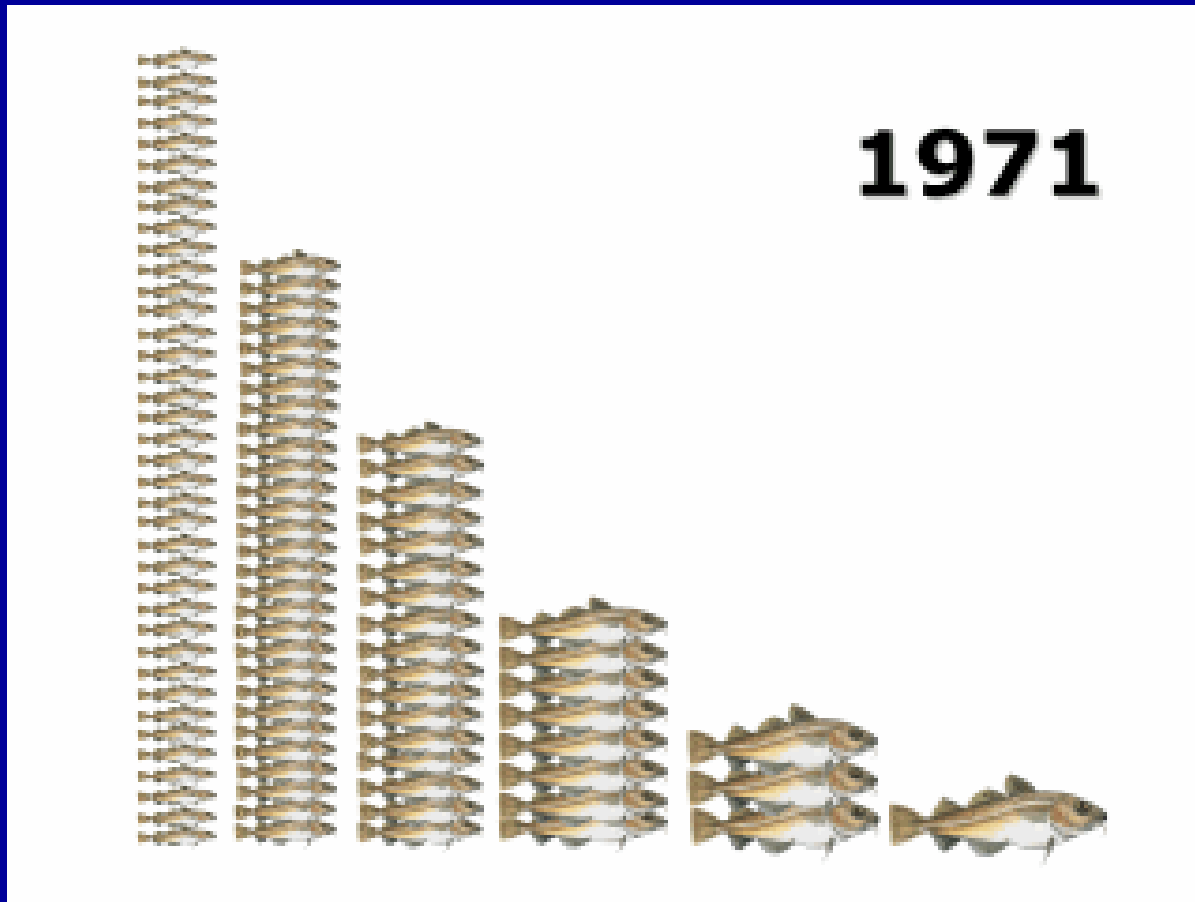
After World War II there was much optimism that fisheries could feed the World.

But at the beginning of the 21<sup>st</sup> century, we are not so sure.

# Quota management of fisheries in the European Union has failed to deliver sustainability



Data from ICES



Cod decline in the Kattegat,  
North Sea

Extinction is the ultimate  
in unsustainable fishing,  
whether or not the  
species of concern are  
targets of the fishery



# What is missing from fishery management?

- Real provision for habitat protection and recovery
- Precautionary targets
- Resolute enforcement

# Objectives of marine reserves



**Maintaining ecosystem processes and services**



**Sustaining fisheries**



**Conservation**



U.S. Fish & Wildlife Service

# Discover Nature's Best Hunting and Fishing:

*The National Wildlife Refuge System*

*The National Wildlife Refuge System is one of America's greatest conservation success stories. In its first*

**H**unting and fishing are American traditions that date back long before the Revolutionary War. Today, hunting and fishing are enjoyed by millions of Americans who cherish this traditional connection with wildlife, as did their ancestors. In addition, hunting and fishing serve as an important wildlife management tool in many locations.

bowhunter arrowed a potential world-record whitetailed deer on this wildlife refuge.

*Kanuti National Wildlife Refuge* encompasses 1.4 million acres in north-central Alaska. Moose are the most popular quarry here, but hunters also come in search of black and brown bear, and caribou. Visitors braving the harsh winter are often





# The fishery effects of marine reserves and fishery closures



Fiona R. Gell and Callum M. Roberts

Trends Ecol. Evol. September 2003 Vol. 18 No. 9 pp. xxx-xxx ISSN 0169-5347

## TRENDS in Ecology & Evolution

### Fishery effects of marine reserves

- Measurably evolving populations
- Delimiting species
- Indirect effects of biological control agents
- Evolutionary demography of monocarpic perennials

**NEW!**

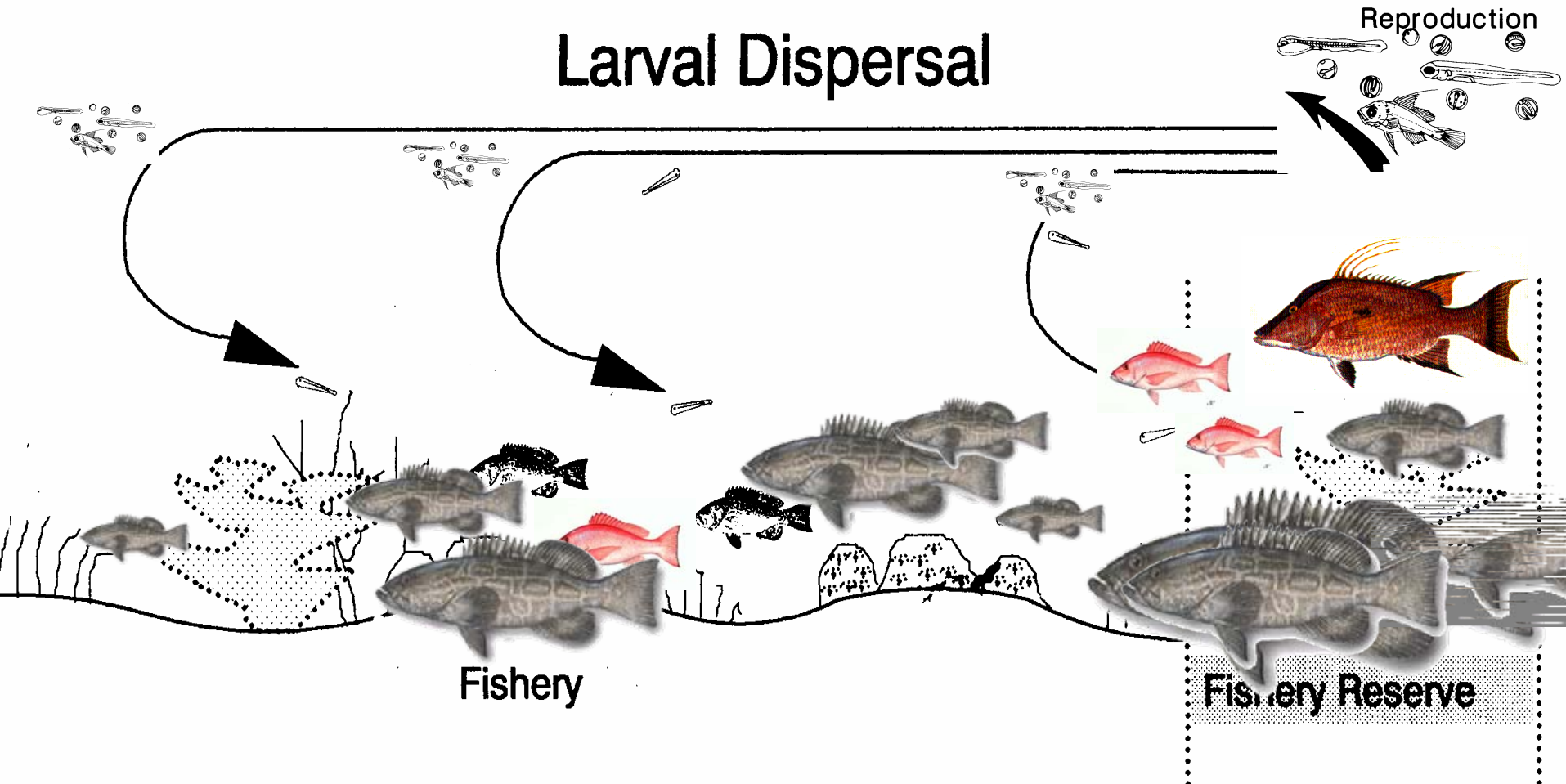
For unique research, comment and context in ecology, evolution, behaviour and systematics, insect science and aquatic science visit Elsevier's Ecology, Evolution and Environment Gateway at [www.ElsevierLifeSciences.com/Ecology-Evolution](http://www.ElsevierLifeSciences.com/Ecology-Evolution) hosted on BioMedNet

[www.worldwildlife.org/oceans/pdfs/fishery\\_effects.pdf](http://www.worldwildlife.org/oceans/pdfs/fishery_effects.pdf)

Spillover

Reproduction & Dispersal

# Larval Dispersal



Fishery

Fishery Reserve

Colonization & Growth

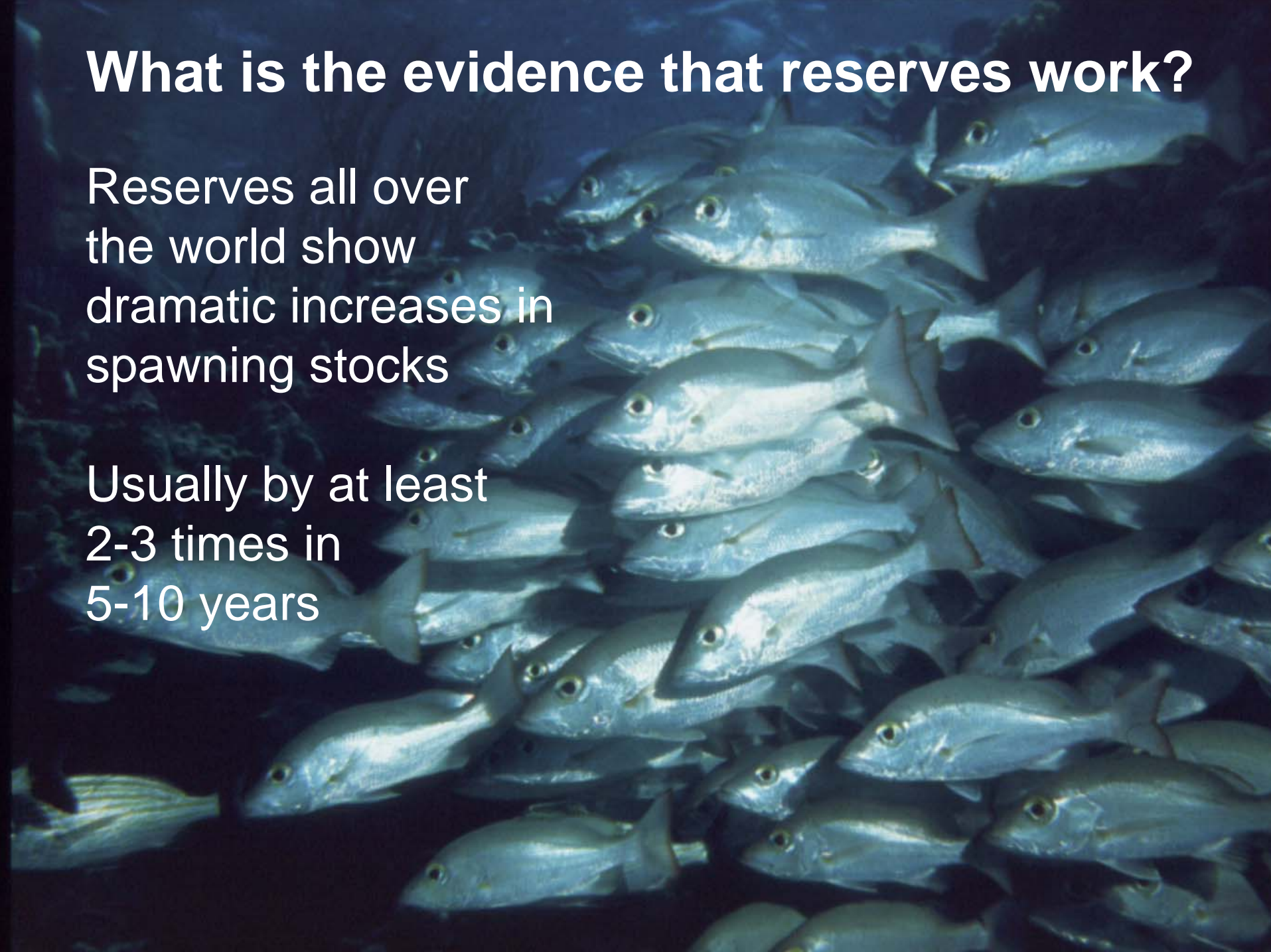
Abundance

Diversity

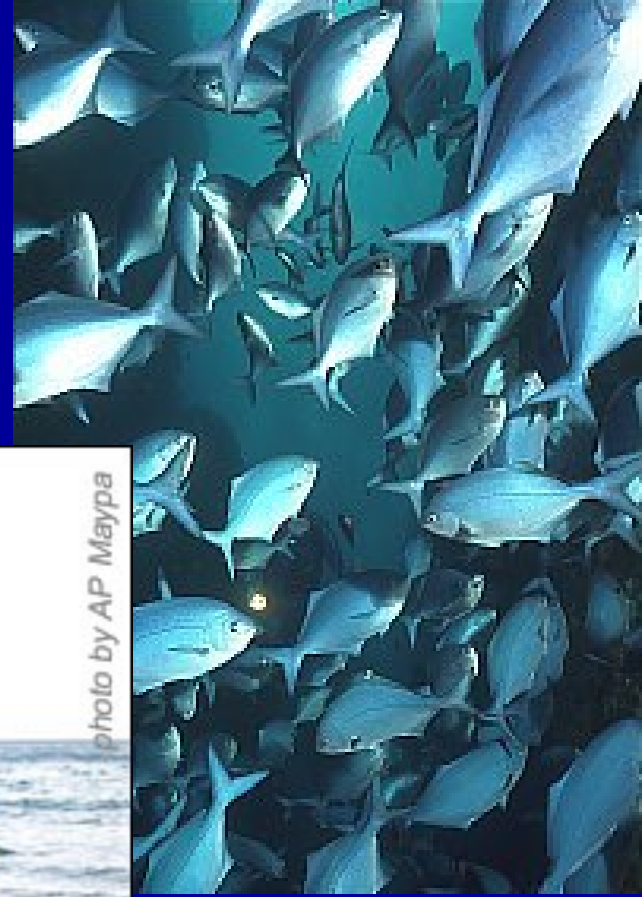
# What is the evidence that reserves work?

Reserves all over the world show dramatic increases in spawning stocks

Usually by at least 2-3 times in 5-10 years



Long-term studies in New Zealand, Philippines, Florida and many other countries show strong responses to reserve protection



Fish in reserves do live longer,  
grow larger and produce more  
eggs





**Egg production from protected fish stocks increases by much more than stock biomass**

**Catches do increase**



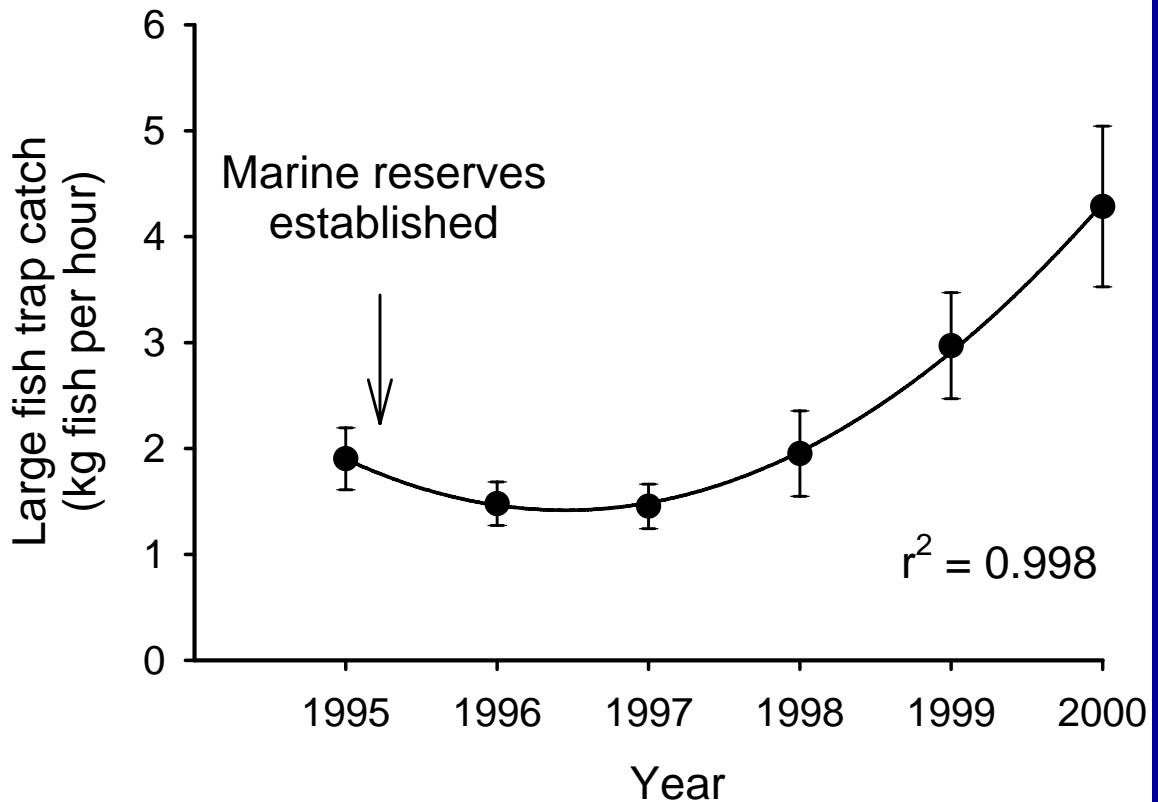
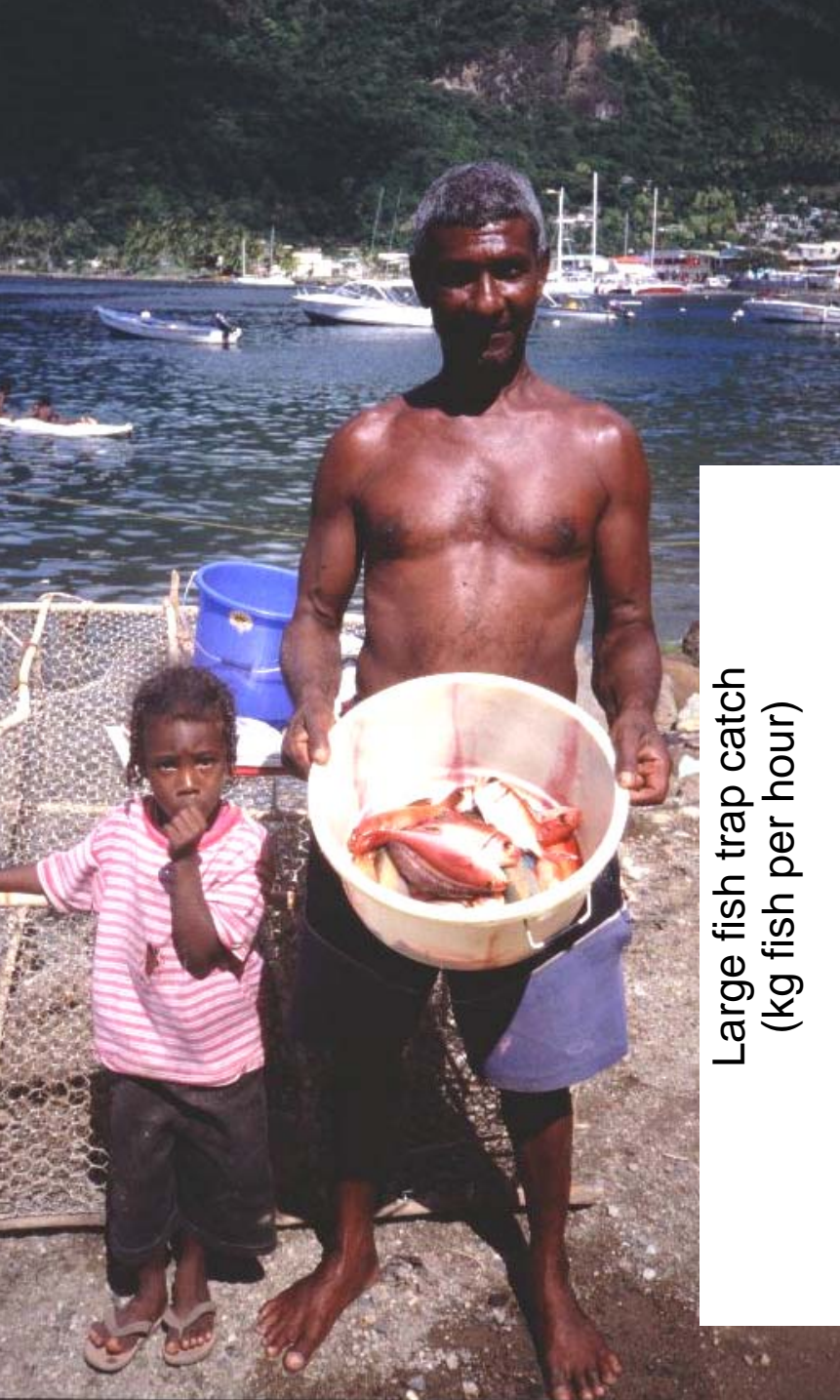
**Soufrière Marine Management Area,  
St. Lucia: Established 1995  
35% of reef area closed to fishing**



**SMMA Zoning Legend**

- Marine Reserve
- Fishing Priority Area
- Yachting Area
- Multipurpose Area
- Recreational Area

# Fishers now fish for less time and catch more than before reserves were set up



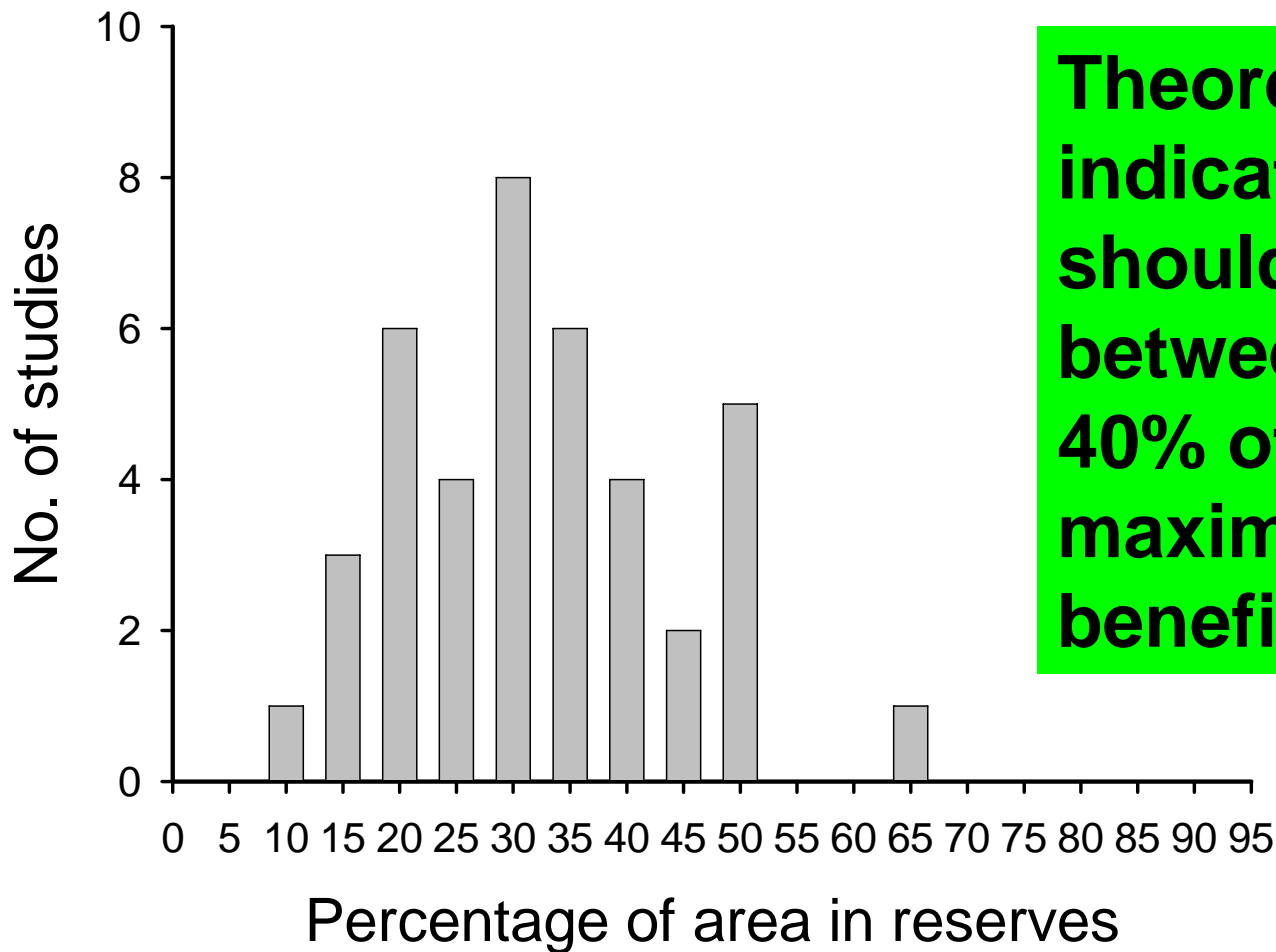


**Fishers begin to fish close to reserves indicating spillover is occurring**

Photo: Tim McClanahan, Mombasa Marine Reserve

# Conclusions of our study:

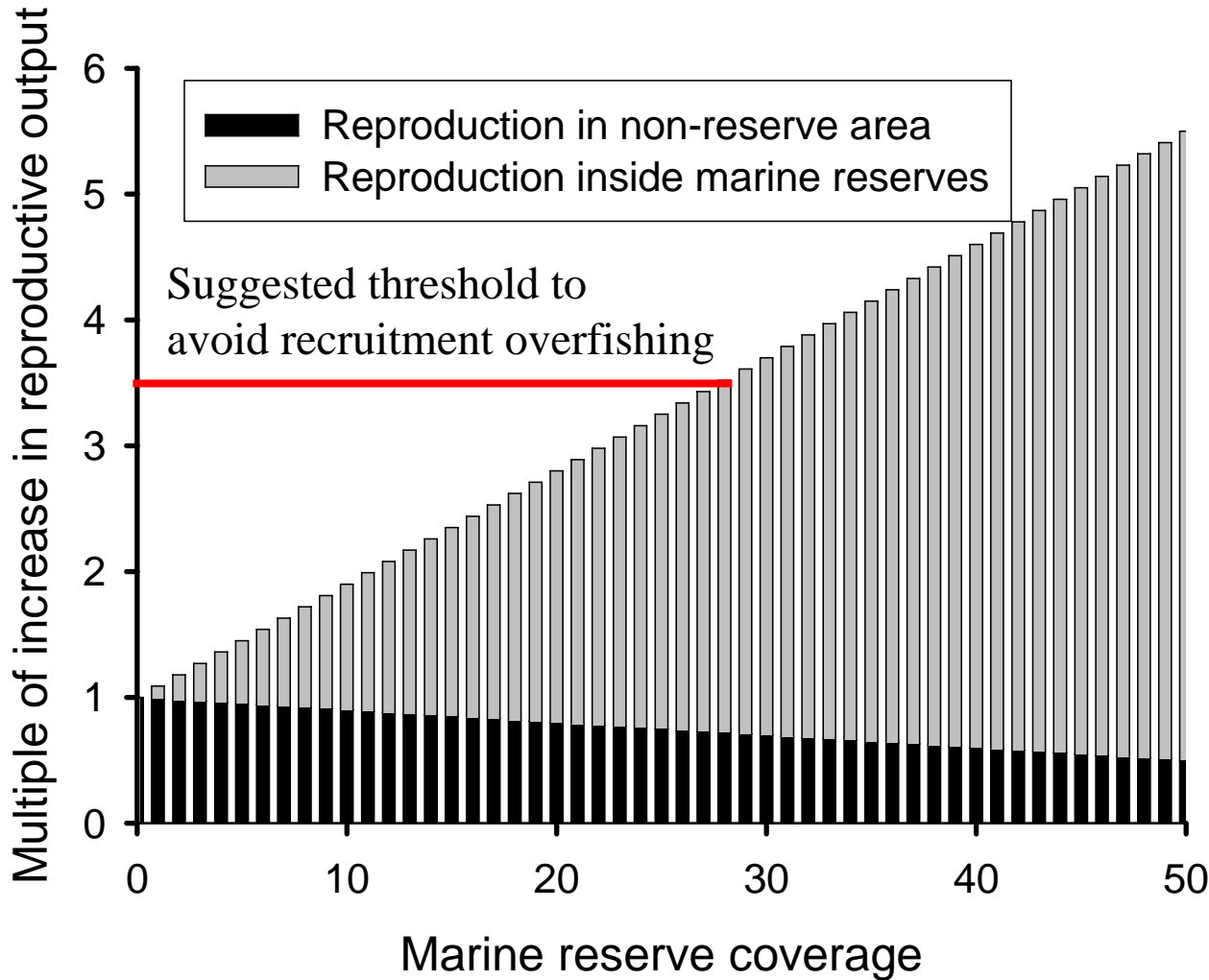
- **Marine reserves promote rapid and sustained recovery of exploited stocks**
- **They promote habitat recovery and increase biodiversity**
- **Effective marine reserves can be designed for any habitat that is exploited**
- **They work well across the spectrum from artisanal to industrial fisheries**
- **The key is to establish areas of the appropriate scale and enforce them well**



**Theoretical work indicates we should protect between 20 and 40% of the sea to maximise fishery benefits**

**The best demonstrations of fishery benefits to date have been from places where 10 to 40% of fishing grounds have been protected**

# Using marine reserves to rebuild sources of fish reproduction



Business as usual outside reserves;

Inside reserves, egg production increases ten-fold

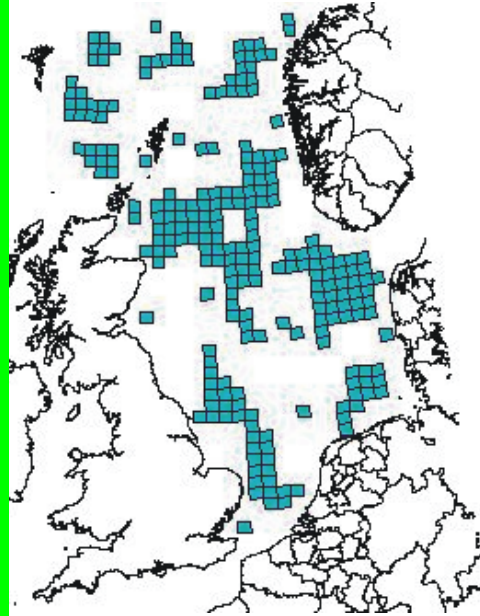
**To achieve the level of protection required we must fully integrate conservation and fisheries management**

**Fisheries are a conservation problem, and conservation is a necessity for sustainable fisheries**

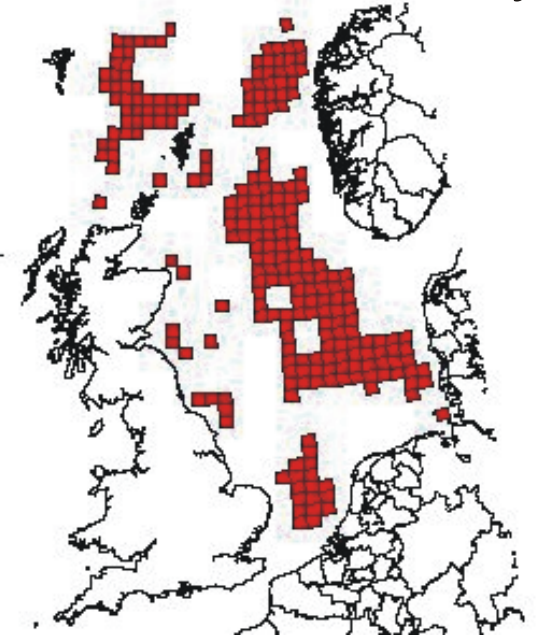
## Biodiversity Only

## Fisheries + Biodiversity

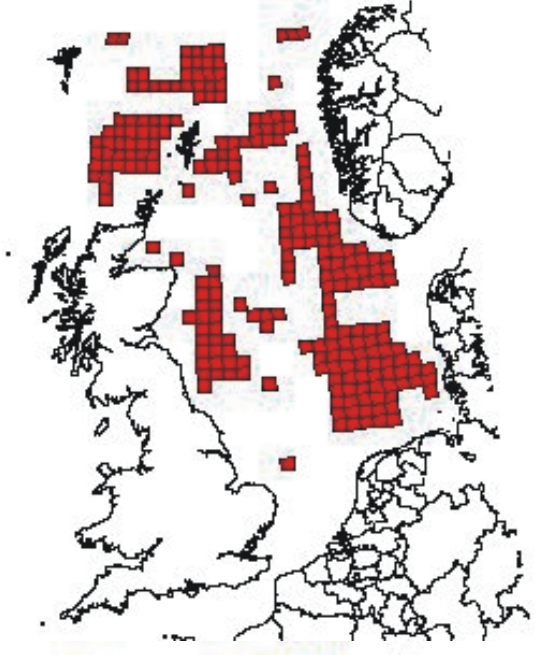
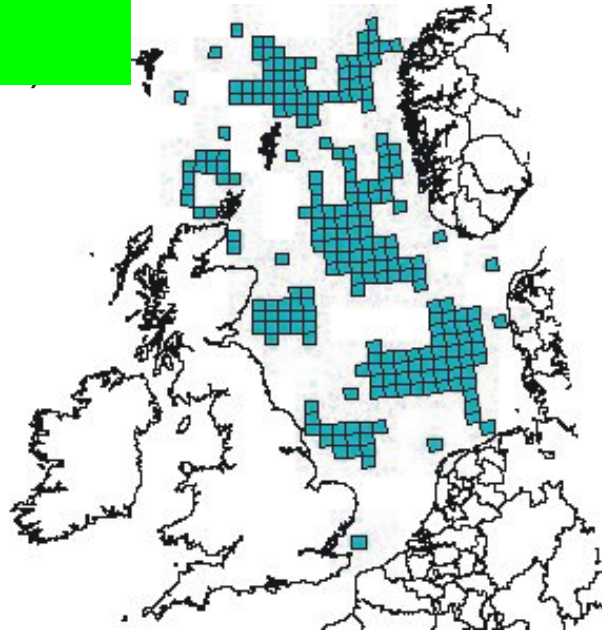
This is what a marine reserve network covering 30% of the North Sea might look like



(D)



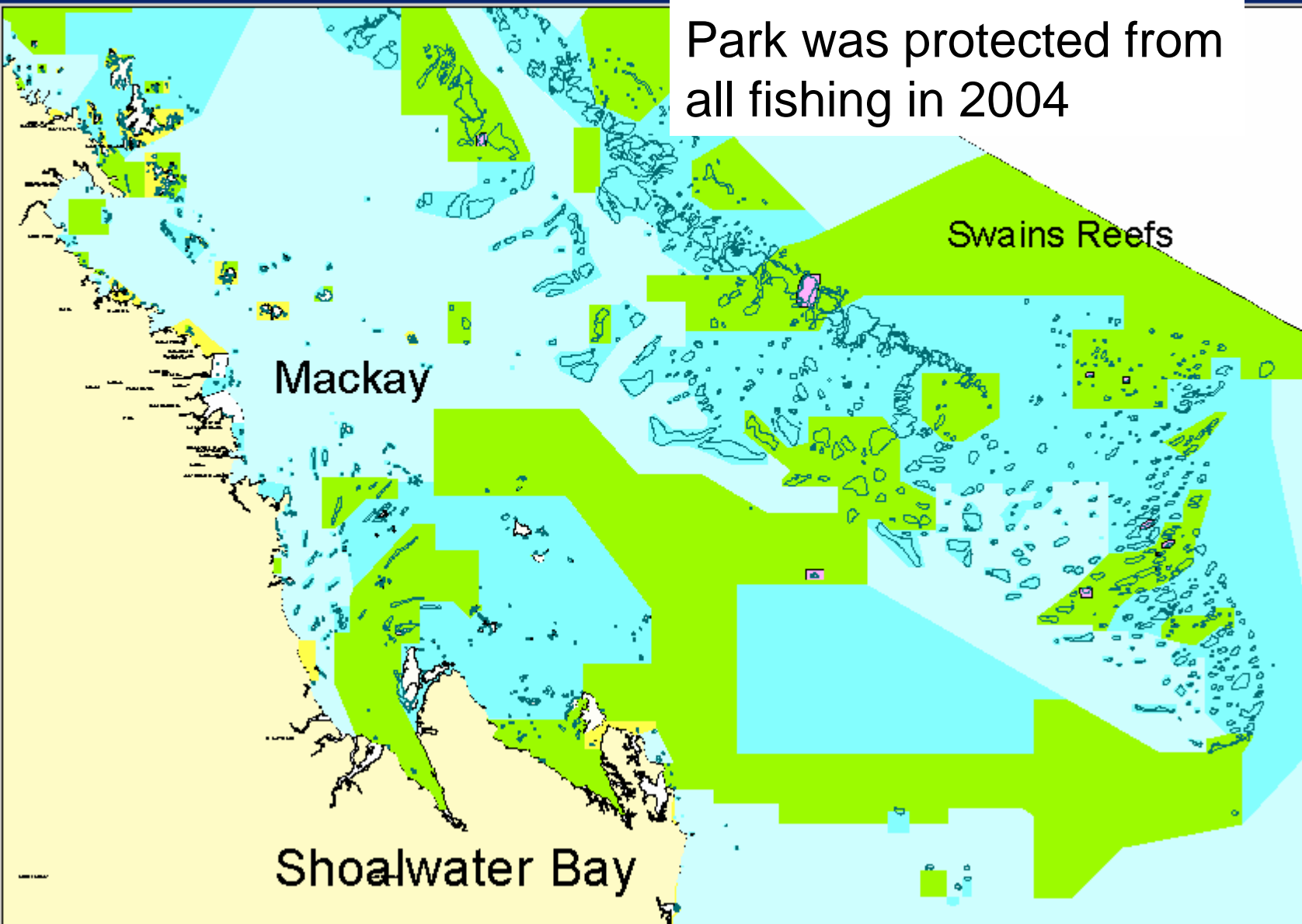
(E)





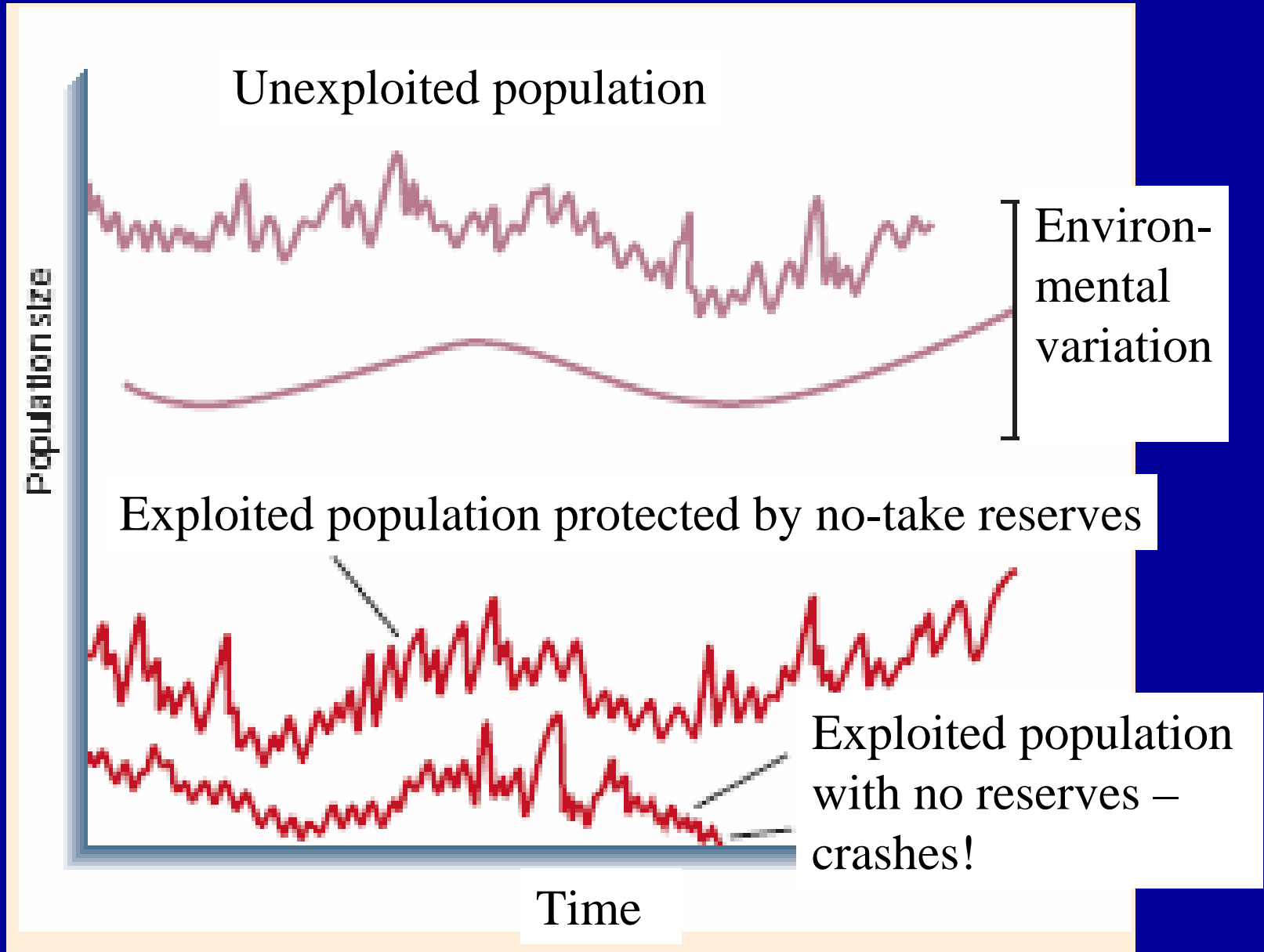
Post CP2 - workshopping

- Reefs\_p.sh
  - bioregions -
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  - Rzp\_03111:
    - Gene
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33.4% of the Great Barrier Reef Marine Park was protected from all fishing in 2004

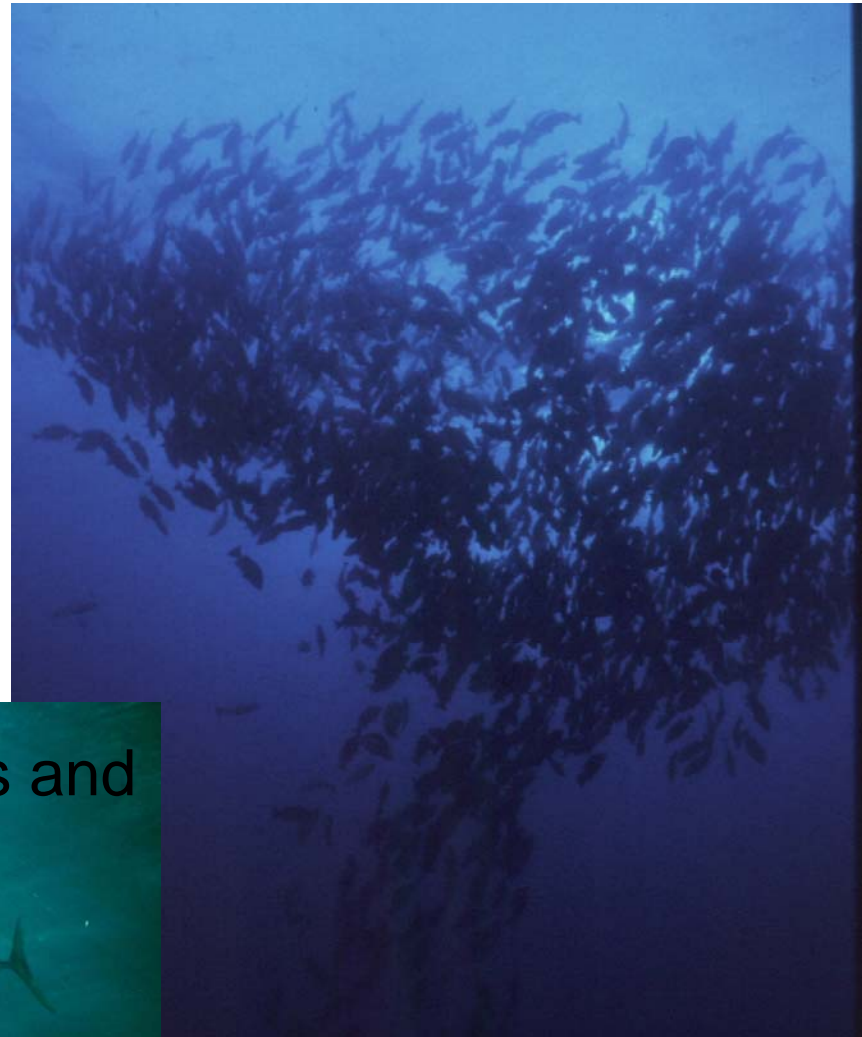
# Marine reserves rebuild resilience in marine ecosystems





# MPAs for mobile species and on the high seas

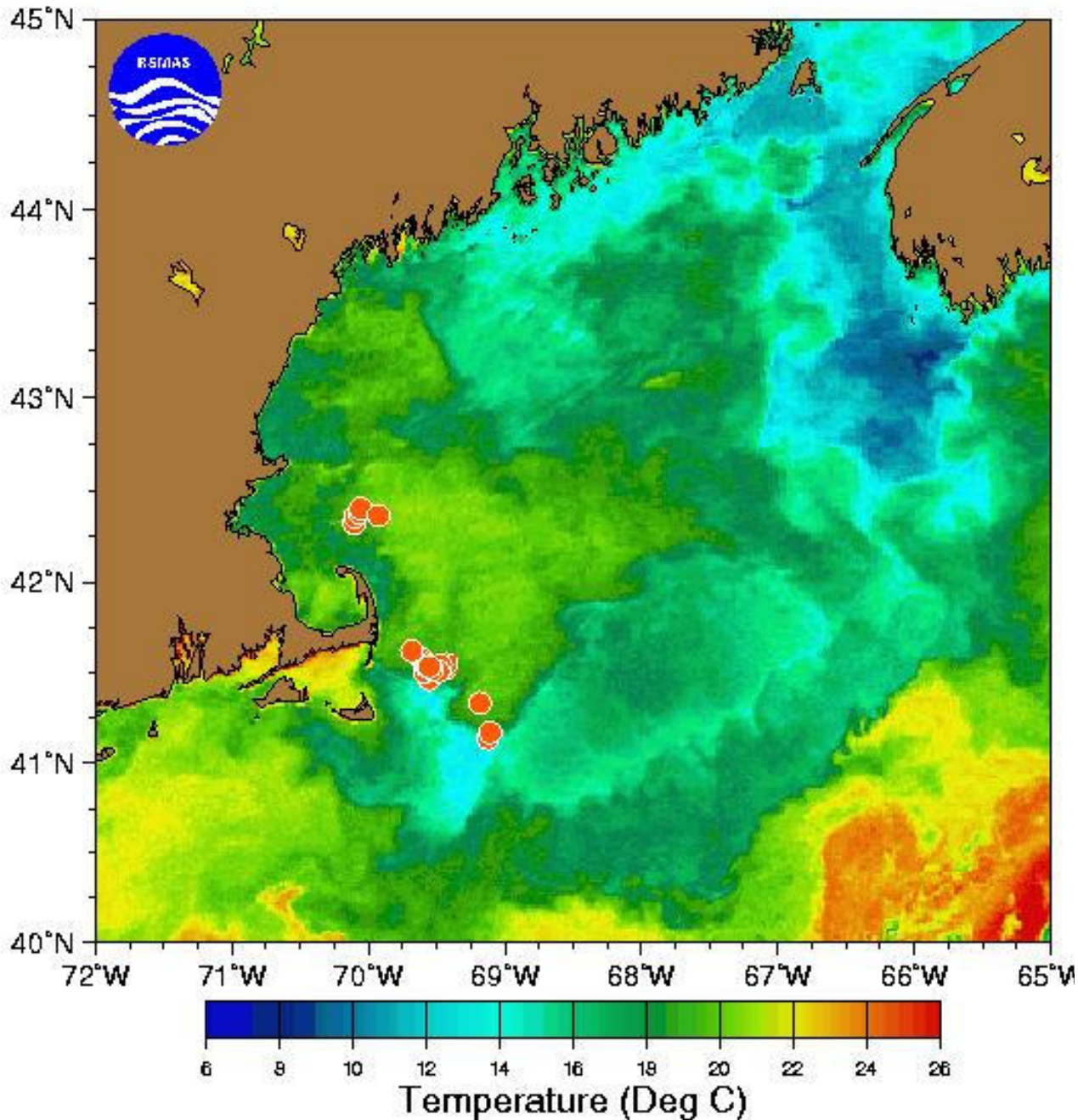
Protect nursery areas with high juvenile by-catch



Protect migration routes and bottlenecks



Protect spawning aggregation sites

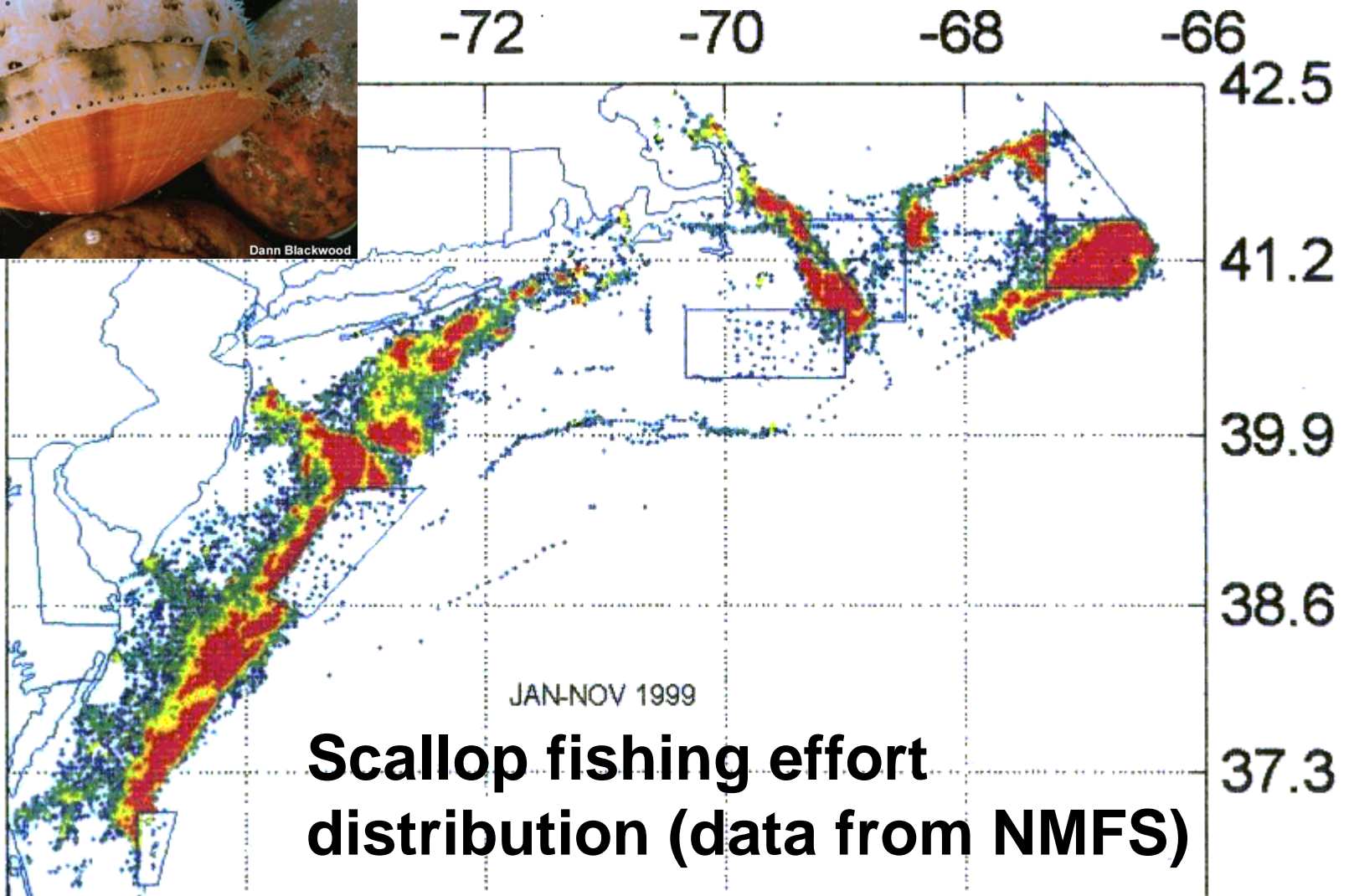


Circles show location of bluefin tuna schools in August 1996

Mobile reserves (time-area closures) are possible



Dann Blackwood



## Scallop fishing effort distribution (data from NMFS)

**Satellite technology permits enforcement of offshore reserves – real time vessel monitoring**

The deep sea cannot feed humanity if we mismanage shallow seas

Deep sea habitats are fragile.....and easily destroyed by fishing

Deep sea fish have low production...and quickly disappear



# There is a strong international mandate for marine protected areas

- World Summit on Sustainable Development: Nations agreed to establish national networks of marine protected areas by 2012
- World Parks Congress, 2003: Recommended at least 20-30% of the sea should be protected from all fishing
- Running cost of this network estimated as \$12-14 billion per year; less than the \$15-\$30 billion spent on subsidies that support excess fishing

Balmford, Gravestock et al. (2004) PNAS 101: 9694-97

# A few comparisons:



**\$14 billion**



**\$15 billion**



**\$31 billion (USA and Europe)**



**\$18 billion**

[www.gedweb.com](http://www.gedweb.com)

<http://claudia79.tripod.com>

# Marine reserves supply key missing ingredients for fishery management

- They protect habitats and facilitate recovery
- They can prevent extinctions
- They promote resilience
- They add precaution
- But they also need resolute enforcement

World Summit: Nations also committed to rebuilding fish stocks to maximum sustainable yield levels by 2015

In my view, we cannot achieve this without a large-scale, international network of marine protected areas, including the high seas





**Now is a time of great opportunity:**

**We have a strong mandate to create MPA networks**

**We have good science to inform protected area selection**

**We have a near empty canvas on which to implement real and lasting protection**

**There has never been a more timely moment to act!**