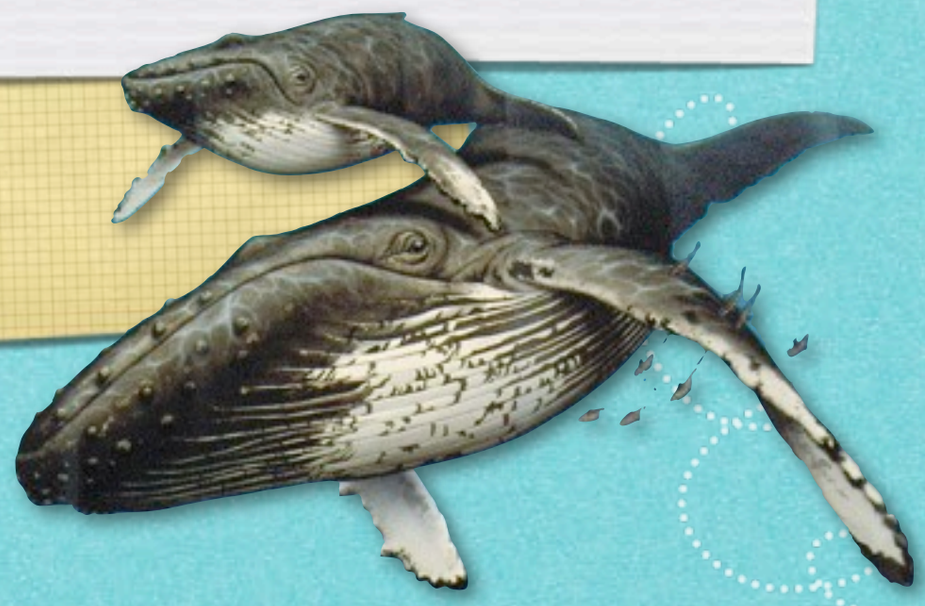
Biodiversity, whales and ocean health

What we do today, will determine the ocean our children inherit tomorrow

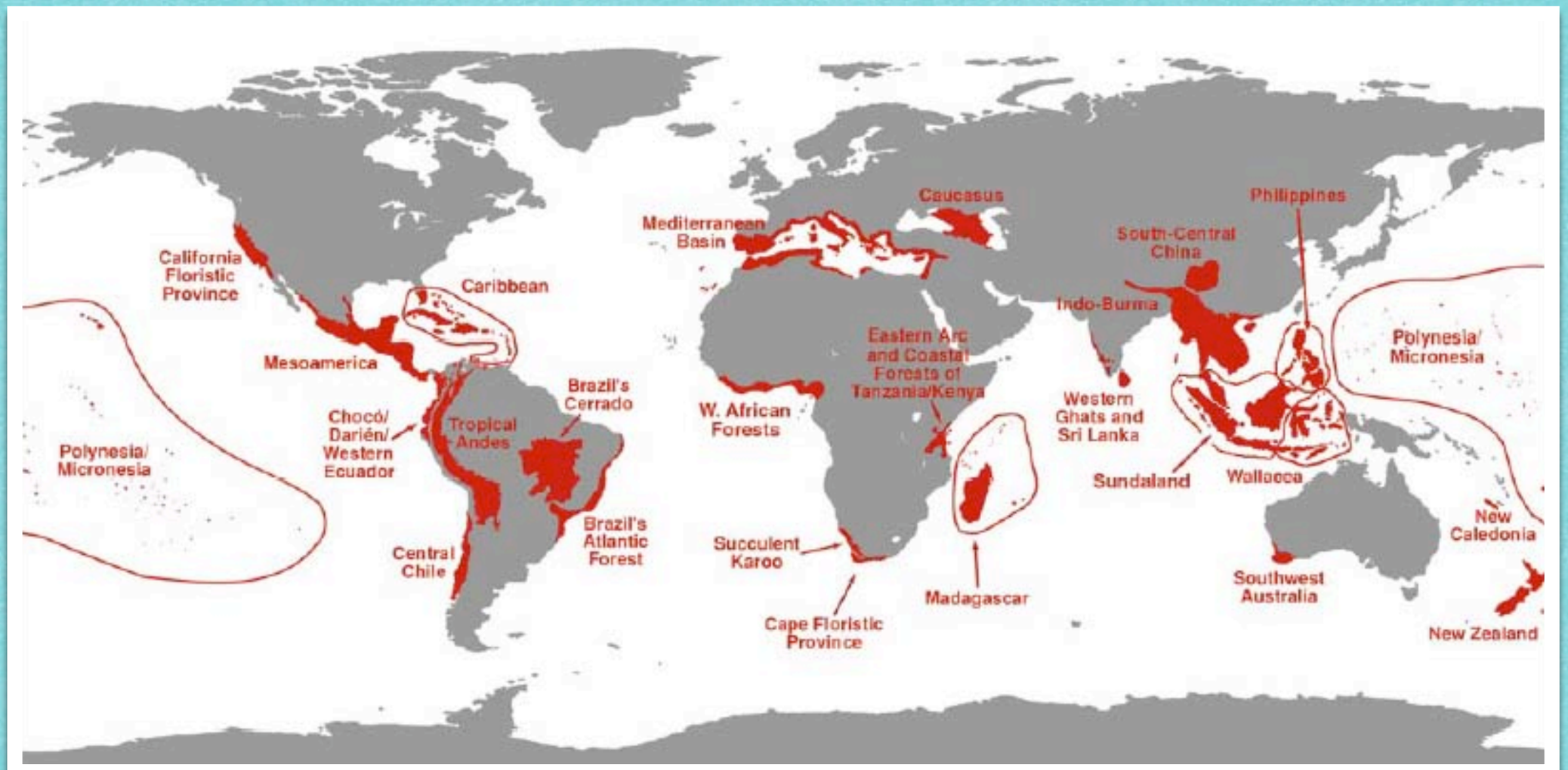
Lyne Morissette

UQAR SMER
Université du Québec à Rimouski
Institut des sciences de la mer de Rimouski



Biodiversity what's the problem?

- Humans are causing extinctions at an incredible speed:
  - 100 times faster than the predicted extinction rate without human activity;
  - Equals or overpass the great extinctions of the past;
- Why is biodiversity such an issue?
  - Loss of biodiversity = economic loss
  - Loss of ecosystem services that biodiversity provides
  - Loss of biodiversity make ecosystems more vulnerable

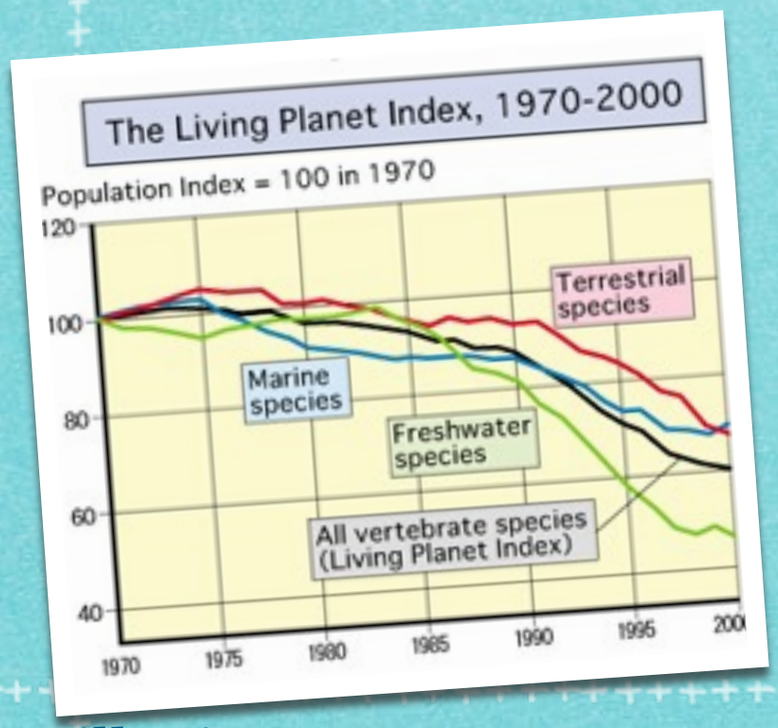


The Caribbean is one of the 25 biodiversity hotspots of the world

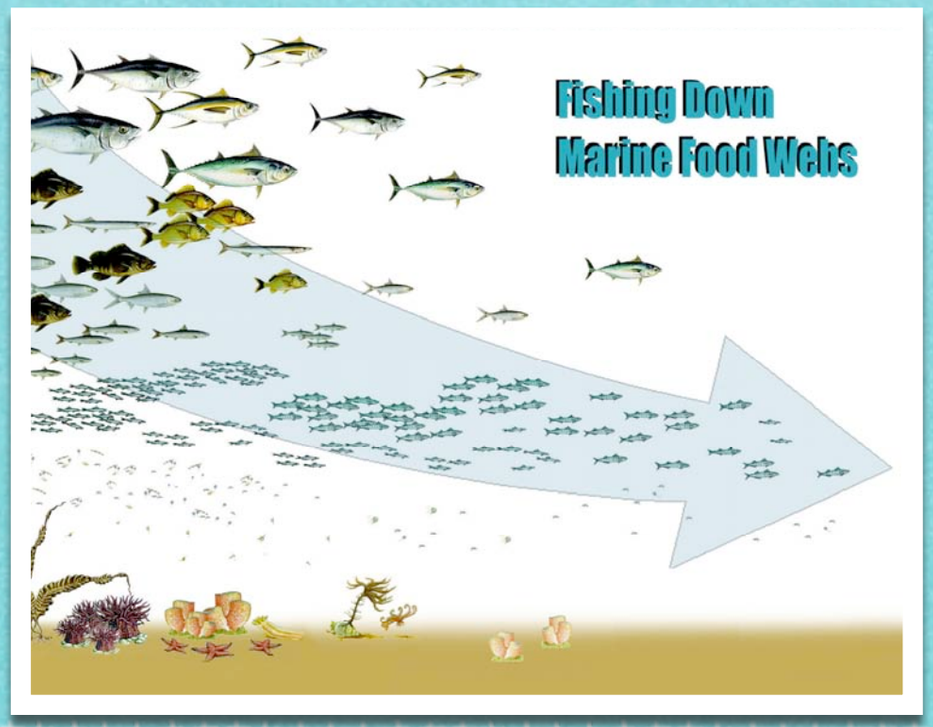
Myers *et al.* 2000; Nature

Loss of biodiversity is clear

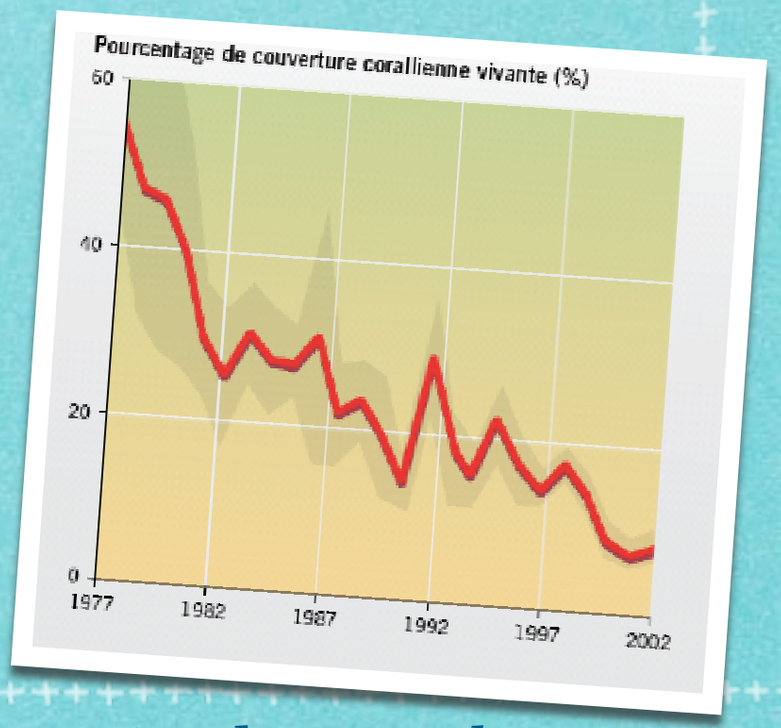
- Species are disappearing, especially in the ocean;
- In the Caribbean, the % of coral cover declined drastically



Millenium Ecosystem Assessment

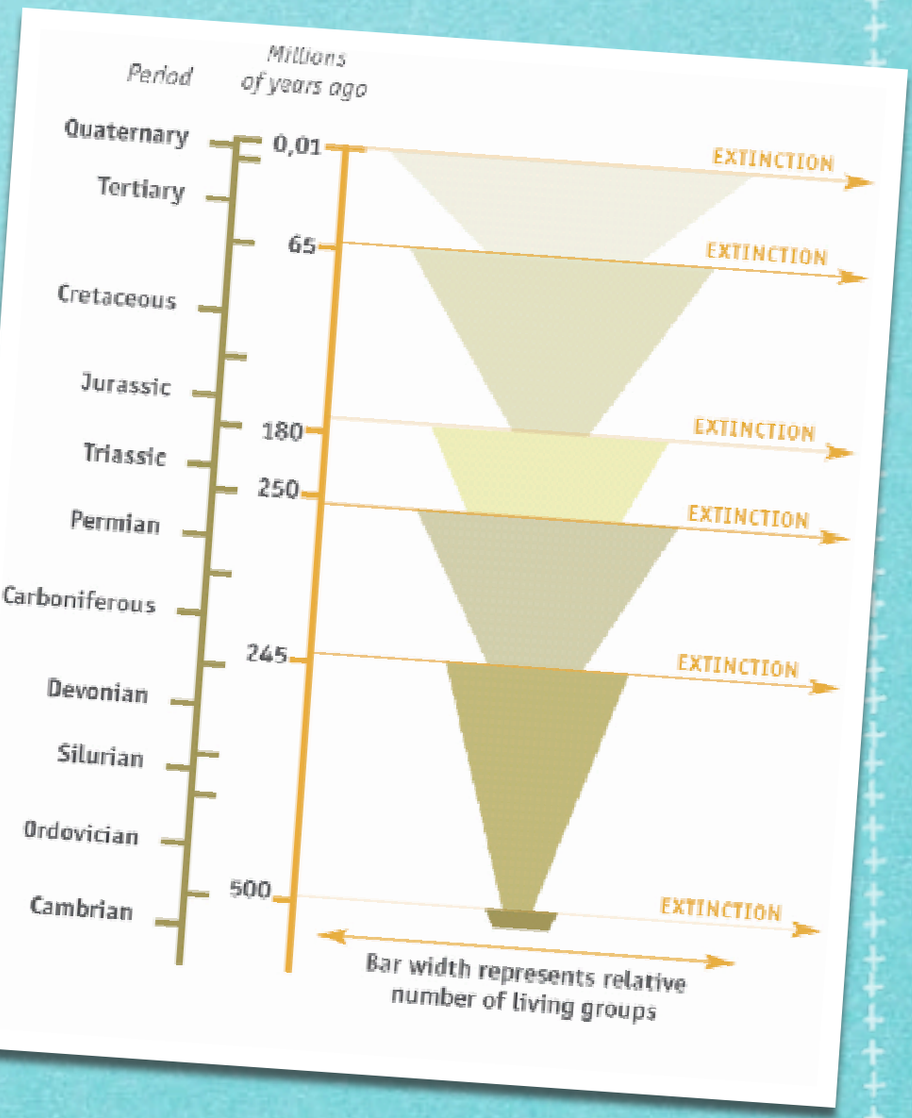


Pauly *et al.* 1998



Gardner *et al.* 2003

Are we creating the 6th extinction?



Who is threatened this time?

- "Ocean biodiversity shapes and enriches our way of life"
- Biodiversity provides great, vital services to human populations;
- Life will continue on earth, for species that can adapt;
- It is crucial that our activities are not the source of our own extinction.

Large mammals are indicators of a healthy ecosystem

- Whales are not only a charismatic species, but they are keepers of ecosystem structure as well as an important indicator of its productivity.



Threats to marine biodiversity

Whales: the ultimate threat to biodiversity?

- "Minke whales are the cause of declining fish stocks and the destruction of ecosystems; they are also a threat to the recovery of blue whales stocks"

Whales eat fish is that a myth?

- Several studies (often grey literature) suggest that "*whales are eating so much fish that there might not be enough fish left for humans*";

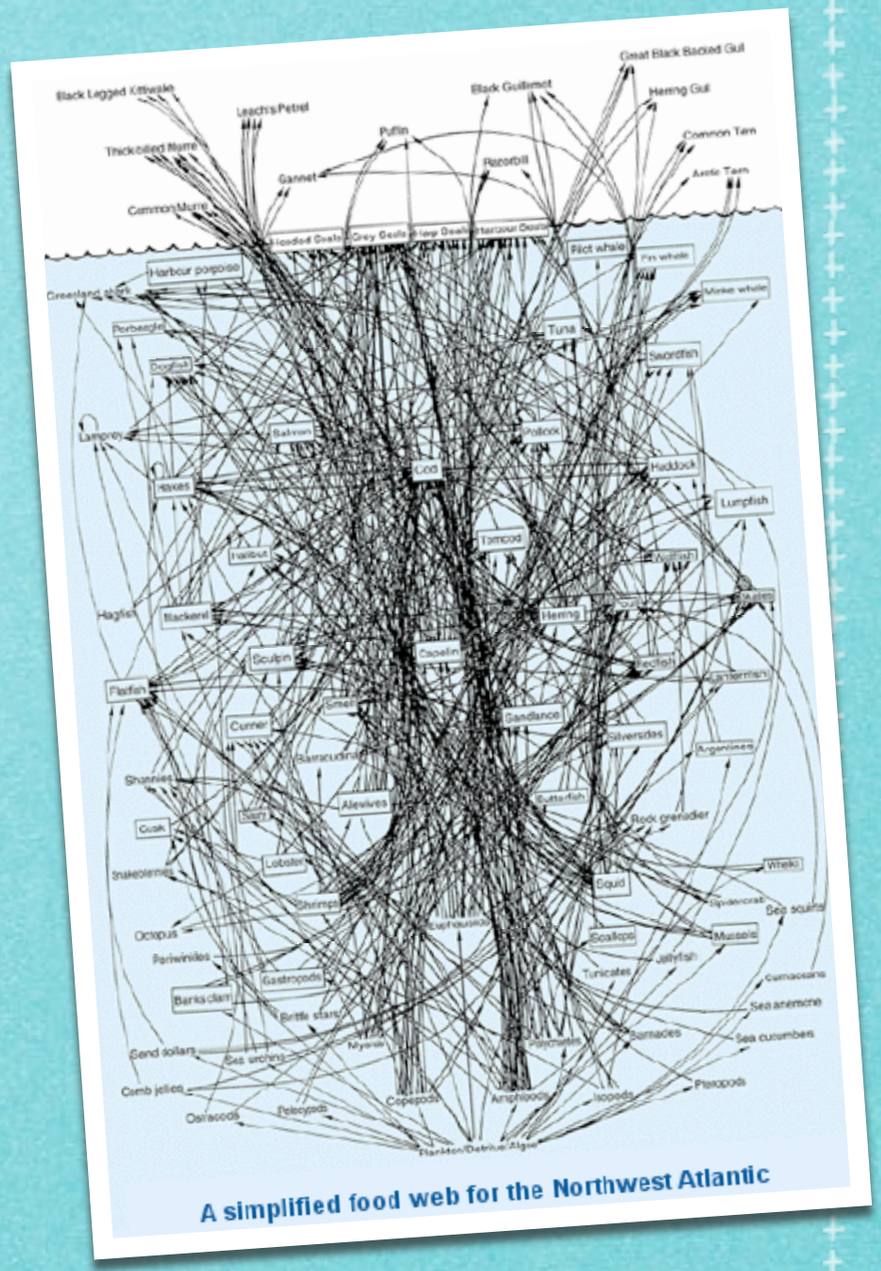
- There is a lack of scientific research on competition between marine mammals and fisheries in most areas of the world;

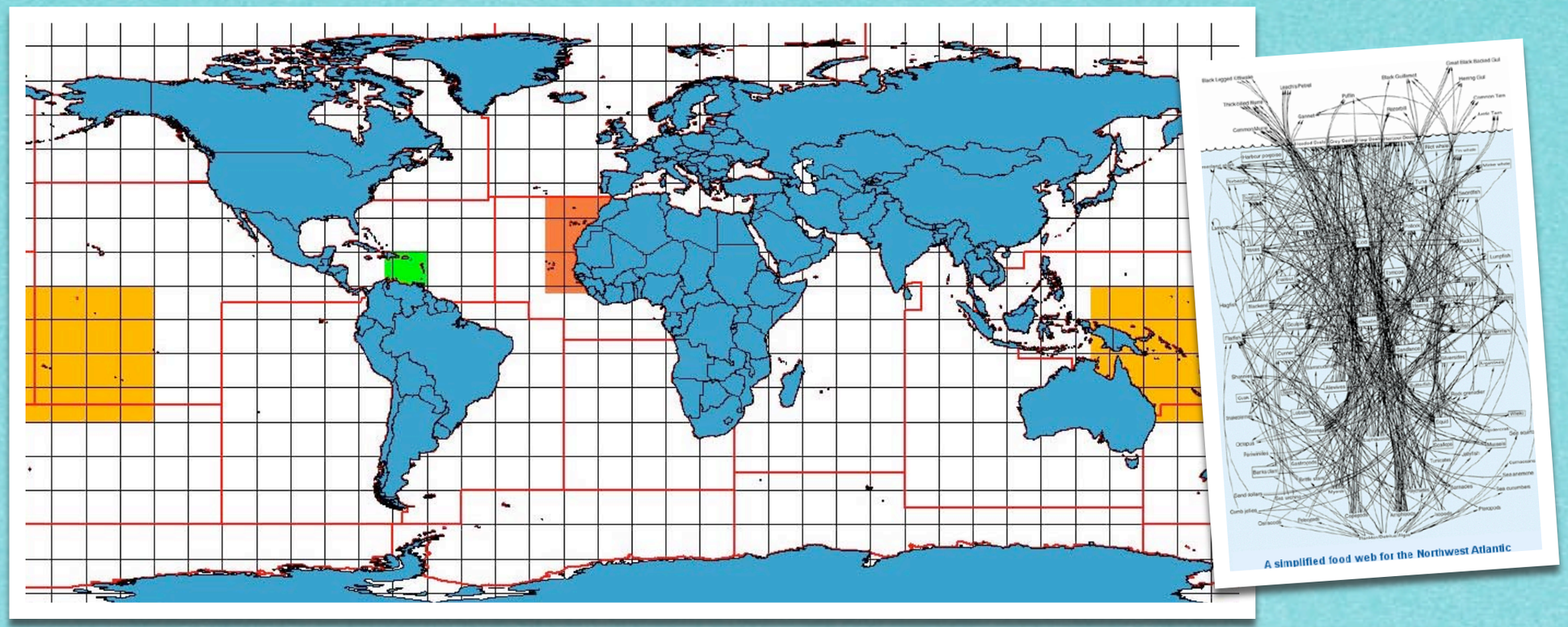
- Ecosystem models provide a useful technique for examining direct and indirect interactions between marine mammals and fisheries

From a Japanese book for kids

Ecosystem modelling

- Allows the investigation of complex interactions
  - Explaining the decline of Steller sea lions in Alaska (Guénette et al. 2006);
    - Compare ecosystems on a common modelling basis (Morissette et al. in review);
- Provides an overview of interactions between species in ecosystem
- Can supplement existing single-species approaches
- Is considered to be the only reliable method to address the issue of competition between





Study areas

Caribbean, Northwest Africa & South Pacific

31 trophic groups, including fish, plankton, and 10 groups of marine mammals

ALBERT-LUDWIGS-UNIVERSITÄT FREIBURG

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ASU ARIZONA STATE UNIVERSITY

LENFEST OCEAN PROGRAM

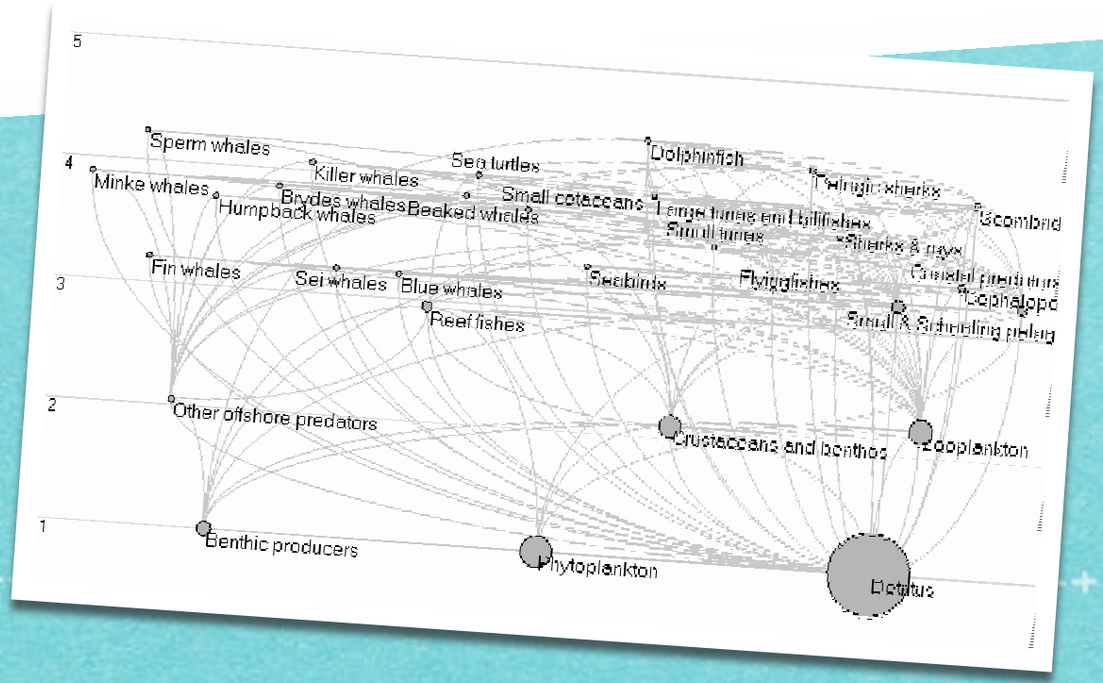
The Caribbean story

FISH and FISHERIES

FISH and FISHERIES, 2010,

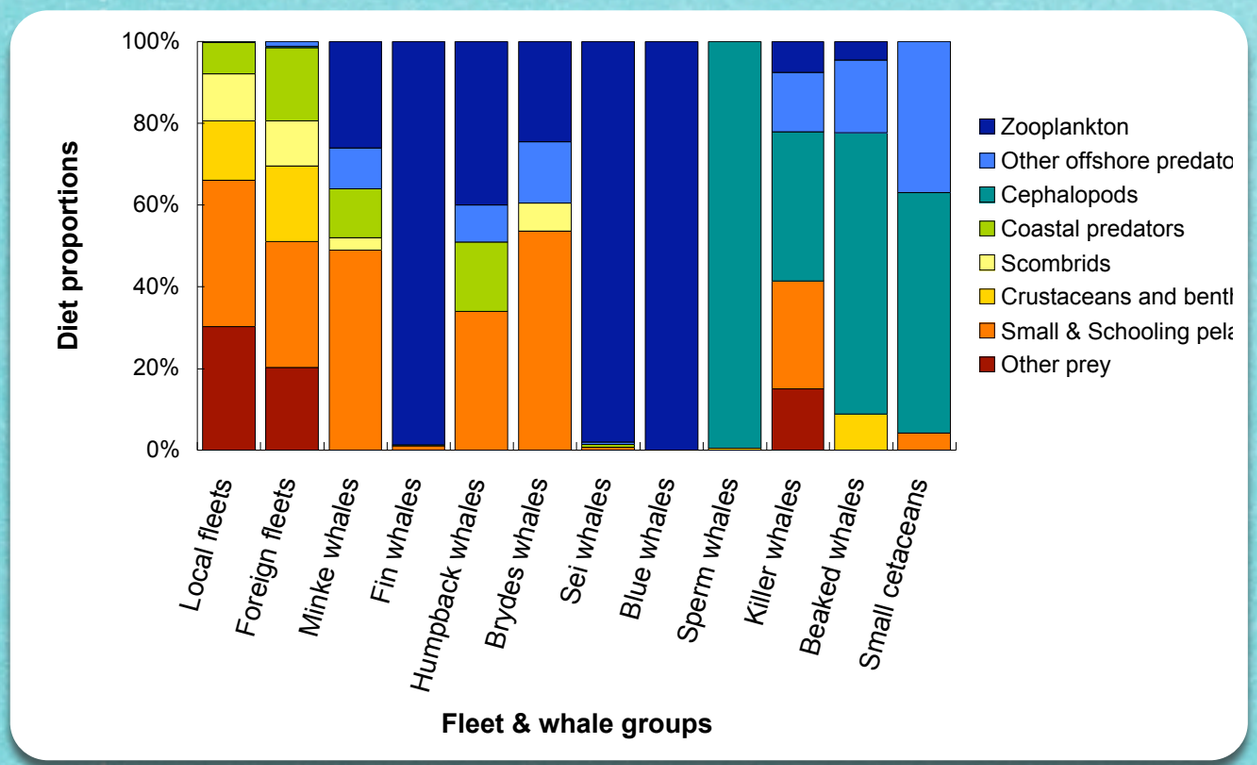
"Whales eat fish"? demystifying the myth in the Caribbean marine ecosystem

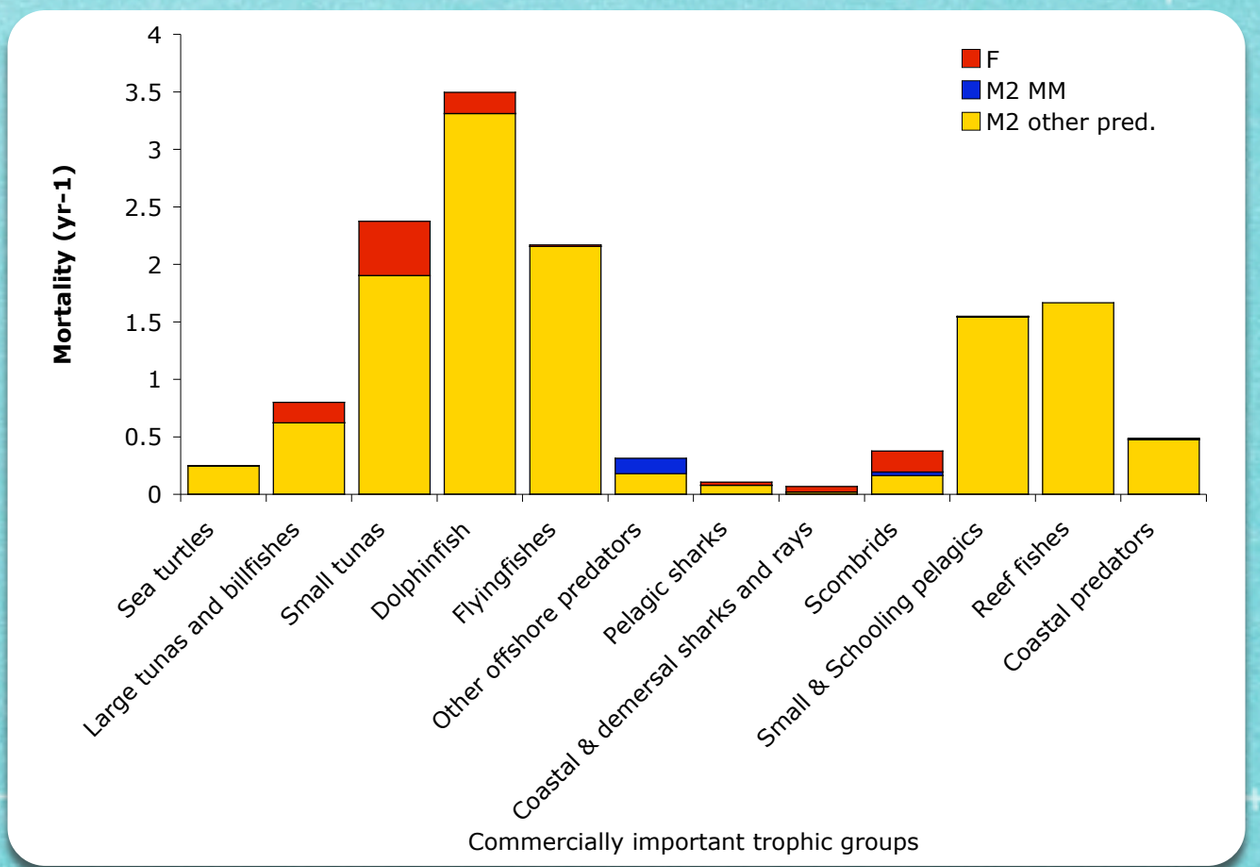
Lyne Morissette, Kristin Kaschner, & Leah Gerber



Who are the predators in the Caribbean ecosystem?

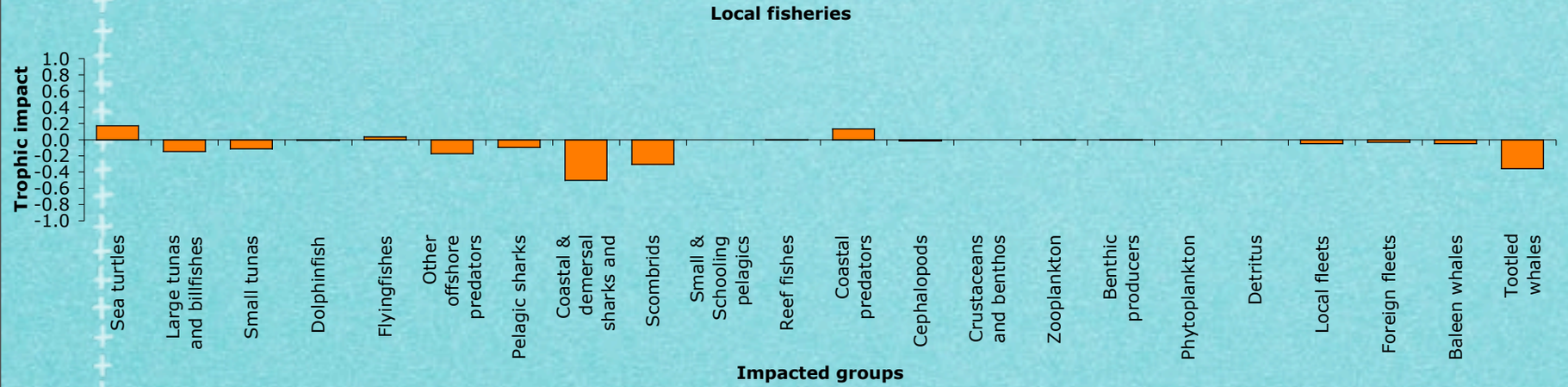
- Whales eat different prey than that targeted by fisheries;
- The main predators in the Caribbean ecosystem are not marine mammals, but large predatory fish.

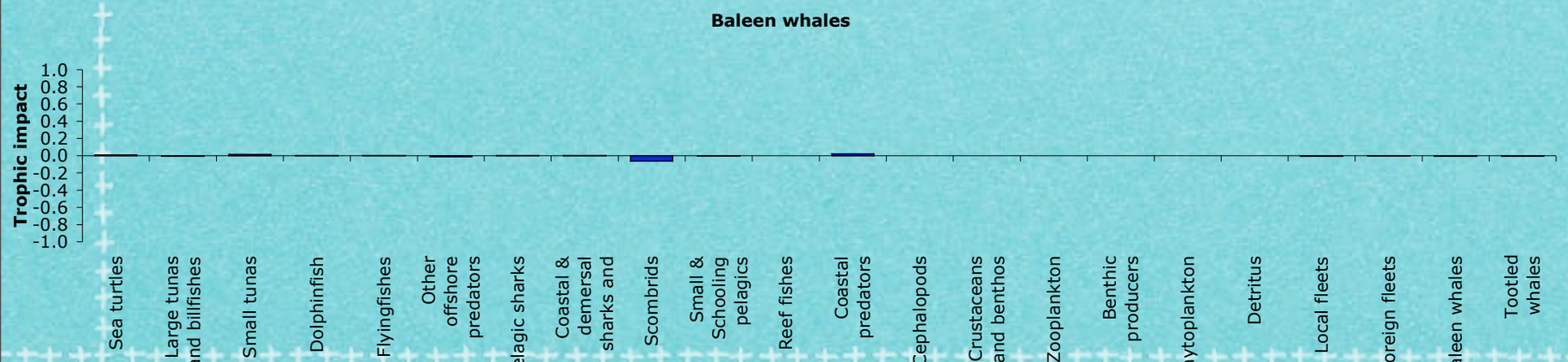




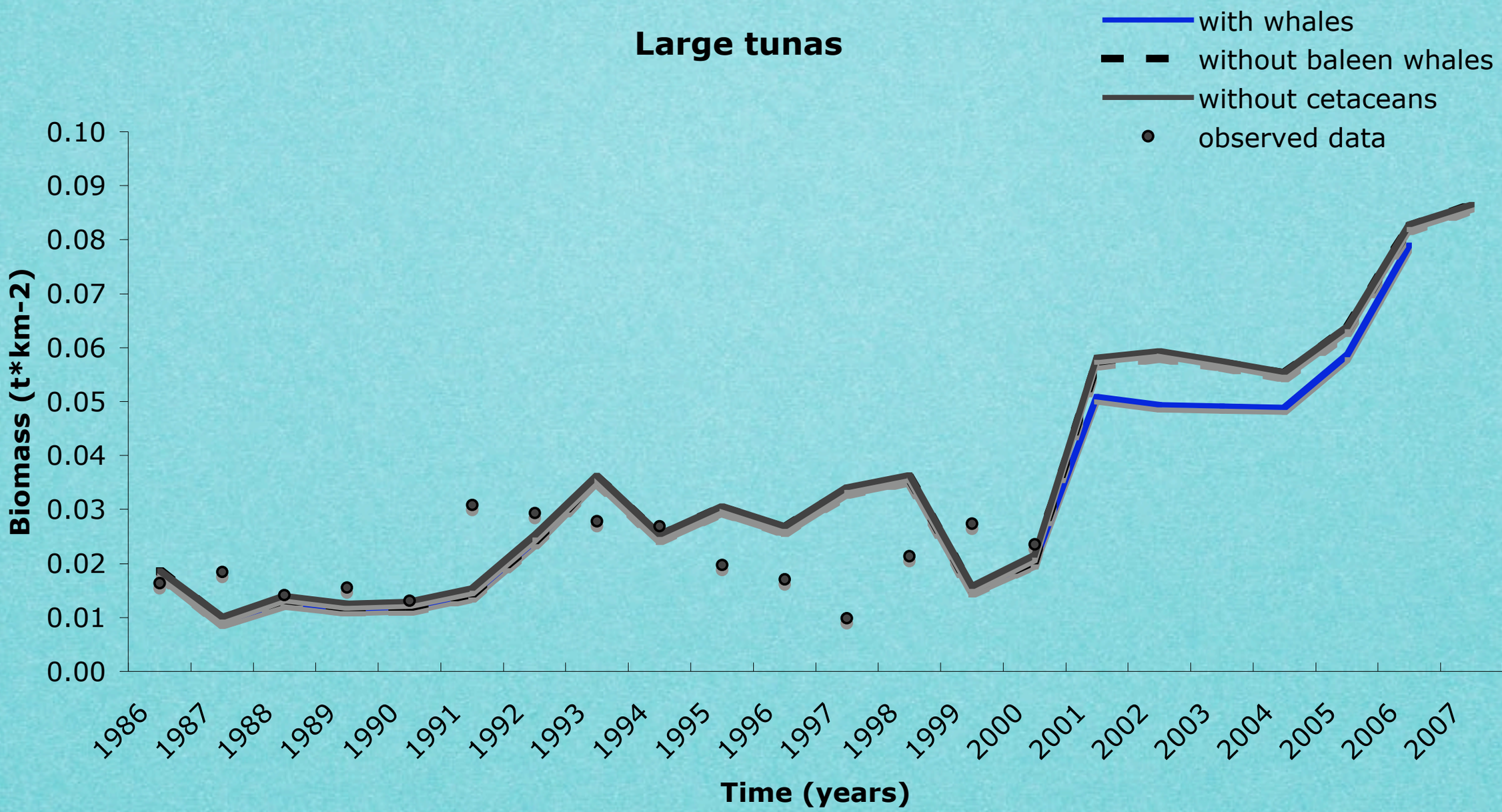
Mixed trophic impacts

- Used to evaluate important trophic interactions between groups;
- show impacts of marine mammals or fisheries on other groups of the foodweb, due to direct AND indirect interactions





What if we kill the whales?



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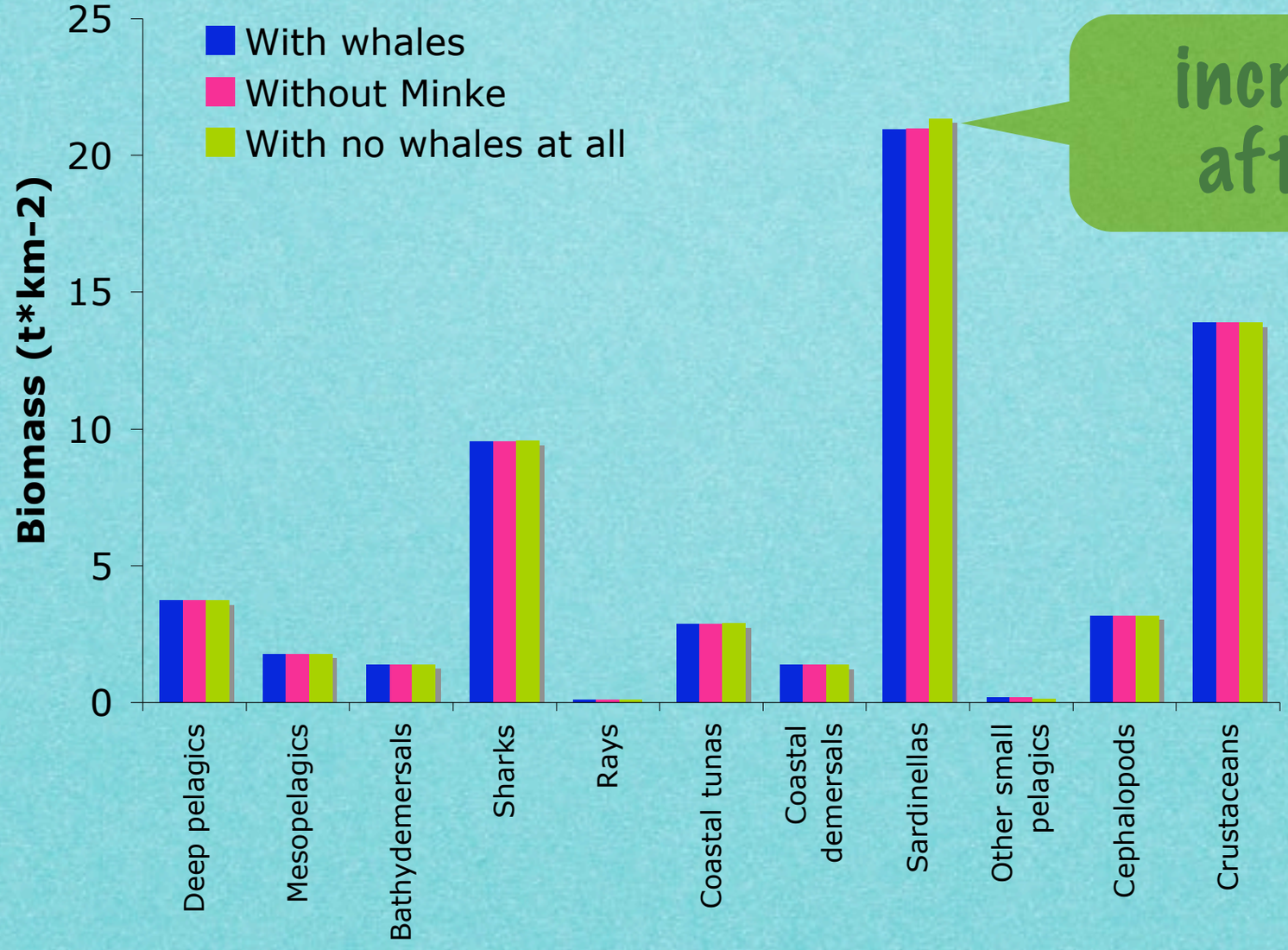

increase of 1.9% after 20 years

Similar conclusions all over the world

- Baleen whales feed on krill and small fish, not the ones targeted by fisheries;
- They are not known to feed in tropical breeding areas;
- Even assuming they would feed, their impact on the ecosystem is still minimal;
- Overexploitation of marine resources is the real problem; blaming whales is just detracting the attention from it.

POLICYFORUM

ECOLOGY

Should Whales Be Culled to Increase Fishery Yield?

We examine the scientific evidence for the assertion that commercial fisheries are negatively impacted by whales in tropical breeding areas.

Leah R. Gerber,[1]* Lyne Morissette,[1,2] Kristin Kaschner,[3,1] Daniel Pauly[4]

Science and international politics play complicated roles in the global arena of whale conservation and the management of the resources of the world's oceans. The International Whaling Commission (IWC), charged with the global conservation of whales and the management of whaling, introduced a moratorium on commercial whaling in 1986 because of the widespread depletion of whale species and stocks. Despite a lack of scientific data to indicate that many whale stocks have recovered, every year a heated debate takes place at the IWC meeting about the future of commercial whaling. Recently, whaling countries have introduced a new argument for resuming whaling by blaming whale populations for the decline in commercial fish stocks.

Couched in terms of "ecosystem management," whaling countries, including Japan, advocate the culling of whales as a solution to recover overexploited fish stocks and to increase fishery yield (*1*, *2*). Some developing countries, which may benefit economically and politically by supporting pro-whaling nations at IWC (*3*–*7*), have also supported the "whales-eat-fish" assertion. The Caribbean-driven St. Kitts Declaration at the 58th Annual Meeting of the IWC stated: "scientific research has shown that whales consume huge quantities of fish making the issue a matter of food security for coastal nations" (*6*). This issue was also claimed to be one of global concern at a 2008 symposium of IWC members in the Northwest Africa region (*8*).

When scientific information about the role of whales in marine ecosystems and for the economies of developing nations are considered, it becomes clear that delegates from developing countries who support the pro-whaling nations at the IWC may in fact be acting against the best interest of their countries. Whaling does not provide direct benefit to the fisheries that these countries closely depend on (*9*), but rather leads to the loss of species that are important for the structural integrity of their ecosystem (*10*–*12*). Living whales, on the other hand, may actually represent an alternative source of income through whale watching (*13*, *14*).

The rationale for whaling as the solution to depleted fisheries has been questioned by many in the scientific community in light of documented overfishing in oceans globally (*15*), a lack of spatially explicit overlap of resource exploitation between fisheries and whales (*2*), and the unpredictable consequences of culling (*16*, *17*). Based on stomach content analyses of whales caught during the Japanese scientific whaling program and available data on whale abundance, Japanese scientists estimate that whales consume several times as much food as the combined global fisheries catch in recent years (*18*). However, the methodology used by Japanese researchers to support their claim that whales' consumption of fish is an important component of fish declines has been repeatedly criticized (*19*–*22*). Although these discussions have been insightful, they have not stimulated movement within the IWC to break the current deadlock.

One of the obstacles in scientific studies of whales is that there are few data and models available to inform policy discussions. This is particularly true in the tropical waters bordering many of the developing countries that support the resumption of commercial

[1]Ecology, Evolution, and Environmental Science, School of Life Sciences, Arizona State University, Tempe, AZ 85287–4501, USA. [2]Institut des Sciences de la Mer de Rimouski, 310 Allée des Ursulines, Rimouski, QC, G5L 3A1, Canada. [3]Institute of Biology I (Zoology), Evolutionary Biology and Ecology Laboratory, Albert-Ludwigs-University, Freiburg, Germany. [4]Sea Around Us Project, Fisheries Centre, University of British Columbia, Vancouver, BC, V6T 1Z4, Canada.

*Author for correspondence. E-mail: leah.gerber@asu.edu

Negligible effects of removing whales on commercial fish biomass relative to the effect of a fishing moratorium. Estimated increases in fish biomass for best estimates of whale feeding and fishing rates, 5- and 10-fold underestimates of whale feeding, and 1.5 and 2-fold underestimates of fishing. For details, see (*9*).

PHOTO CREDITS (LEFT TO RIGHT): ERIKA ANTONANZAS/ALAMY; LEAH GERBER; JUPITER IMAGES

peer scientists and editors didn't believe that "whales eat fish"...

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*Author for correspondence. E-mail: ly

80

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Ecosystem models clarify the trophic role of whales off Northwest Africa

Lyne Morissette[1,2,*], Kristin Kaschner[3], Leah R. Gerber[2]

[1]Institut des sciences de la mer de Rimouski, 310, Allée des Ursulines, C.P. 3300, Rimouski, Quebec G5L 2Y9, Canada
[2]School of Life Sciences, Arizona State University, Box 874501 Tempe, Arizona 85287-4501, USA
[3]Evolutionary Biology & Ecology Lab, Institute of Biology I (Zoology), Albert-Ludwigs-University Freiburg, Germany

ABSTRACT: There is global concern about the interaction between whales and fisheries, and in some countries, great whales are viewed as a threat to fisheries by potentially eating fish species that could be exploited for human consumption. We developed an ecosystem model to explore the trophic interactions between cetaceans and fisheries off Northwest Africa and to examine the potential impact of a reduction in the abundance of baleen whales on fishery yields. This allowed us to characterize the structure and function of the ecosystem in terms of biomass, mortalities, consumption rates, food habits, and fisheries. Faced with sparse data for our study area, we explicitly accounted for uncertainty in ecosystem structure, model accuracy, and input data and conducted an extensive sensitivity analysis. We tested model performance with time series of biomass and catches for important species of the system. Our results indicate that the overlap between prey species consumed by cetaceans and species targeted in fisheries is low. Furthermore, for a wide range of assumptions about whale abundances, diet composition, and food consumption in breeding areas, we found that whale consumption is several orders of magnitude lower than total fishery catches and 2 orders of magnitude lower than the amounts taken by other trophic groups. Finally, simulations of substantial reductions of whale populations did not influence the biomass of commercially important fish, nor any other species of the foodweb. These results suggest that fisheries yields would not benefit from the removal of whales in this area.

KEY WORDS: Competition · *Ecopath with Ecosim* · Cetaceans · Predation · Trophic impacts · Marine mammal-fisheries interactions · Ecosystem modeling

INTRODUCTION

In recent years, there has been much debate about the potential impacts of large whales on marine ecosystems (Clapham et al. 2007, Corkeron 2009, Gerber et al. 2009), and it has been proposed that whales play an important role in the worldwide decline of fisheries resources (e.g. Komatsu & Misaki 2003). It has been implied that the amounts of fish eaten by whales represent a surplus resource that would be directly available for human consumption if cetacean numbers were to be reduced. However, the validity of such arguments is questionable in light of documented overfishing occurring on a global scale (Pauly et al. 2002, Myers & Worm 2003), the lack of scientific evidence for existing large-scale competition between marine mammals and fisheries (Kaschner 2004, Morissette 2007), and the unpredictable consequences of culling (Paine et al. 1998, Scheffer et al. 2001). Nonetheless, the 'whales eat fish' issue has become a significant point of contention at recent International Whaling Commission (IWC) meetings.

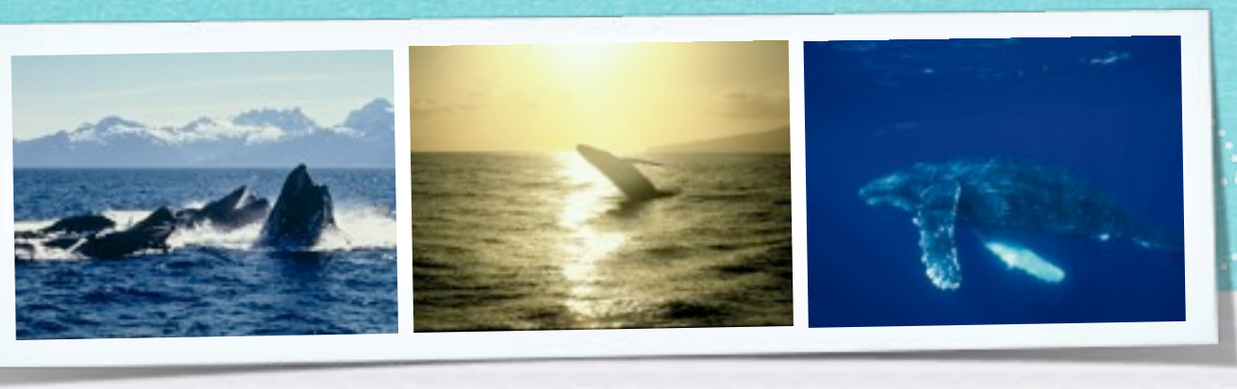
Little is known about the ecological consequences of the removal of whales in terms of their past roles as consumers in food chains and as prey and carrion (Katona & Whitehead 1988, Weslawski et al. 2000, Springer et al. 2003). Evidence suggests that ocean ecosystems have experienced a dramatic shift in structure as a result of the removal of large whales as well as extensive fishing activities (Pauly et al. 2002),

*Email: lyne.morissette@globetrotter.net

Where to go from there?

- IWC might not be the best forum to discuss science and real ecological issues;
- Conservation of marine resources is a urgent matter to address, and should not be driven by political disputes;
- Education of the future generations might be the way to go...

Agadir, Morocco
June 2010



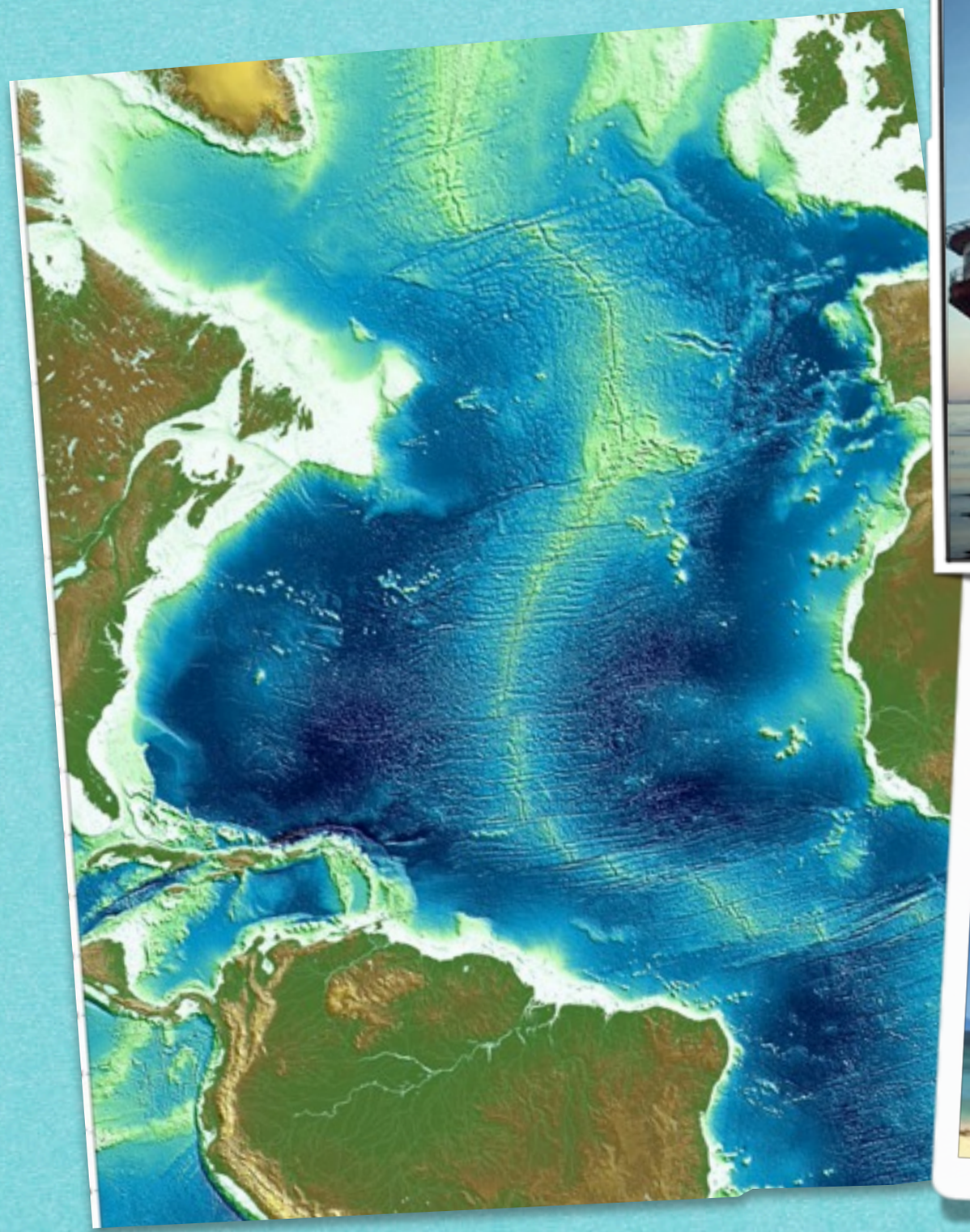
A whale's journey

Conservation without borders

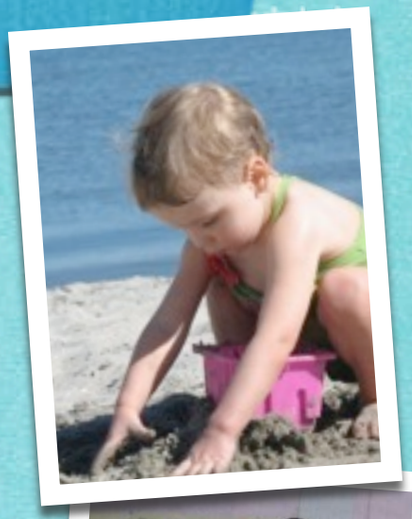
"What we do today, will determine the ocean our children inherit tomorrow"

- The project aims to figure out how conservation measures in breeding grounds (Caribbean) can affect the rest of the life cycle of humpback whales when they are up north to feed (Canada), and *vice-versa*.
- The "*Quest for Quill*"
  - Guadeloupe: once a major breeding site (but no longer)
  - Canada: whales are colonizing new areas (why?)
- Pairing two sanctuaries for the conservation of whales

"Quill"



Education: the key to change the world?



- *"The whales you protect here are the same that we protect there"*
- Conception of educational materials;
  - "Quest for Quill" book in 3 languages (French, English & Créole)
  - in-class presentations
- In-school education projects;
- Class pairing
  - "our schools, our whales"
- Global North-South education program

Conservation of marine biodiversity

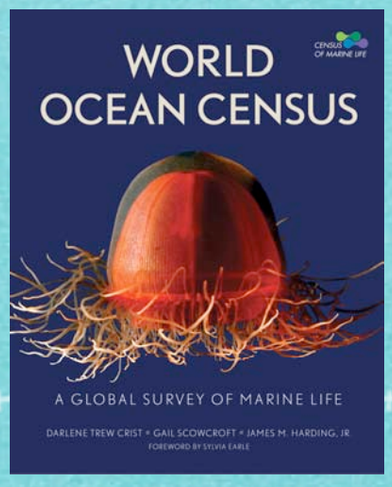
- We know more about the surface of the moon than the bottom of our oceans;
  - USA: 2.1 billion $ per year since 2001 for space station;
  - ... while only a few millions are spent for the conservation of ecosystems
- What we need is a major research program, the scale of the spatial program, to study biodiversity its conservation, and the consequences of its loss

A ray of hope at the global scale

- The Census of Marine Life aims to assess and explain the past, present and future diversity, distribution and abundance of life in the oceans
  - 2000 scientist
  - 82 countries
  - $750 million over 10 years
  - more than 200,000 species described thus far
  - great success in raising public awareness

CENSUS OF MARINE LIFE

Encyclopedia of Life



In conclusion

- Whales are keepers of ecosystem structure as well as an important indicator of its productivity;
- Whales ARE NOT A THREAT to marine resources in the Caribbean!
- It is crucial that our activities are not the source of our own extinction;
- Scientific research, conservation measures, but also education of the younger generations, the leaders of tomorrow, need to joint their efforts to fight to protect life in the ocean.