

Introduction to Fisheries Management

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Session Outline

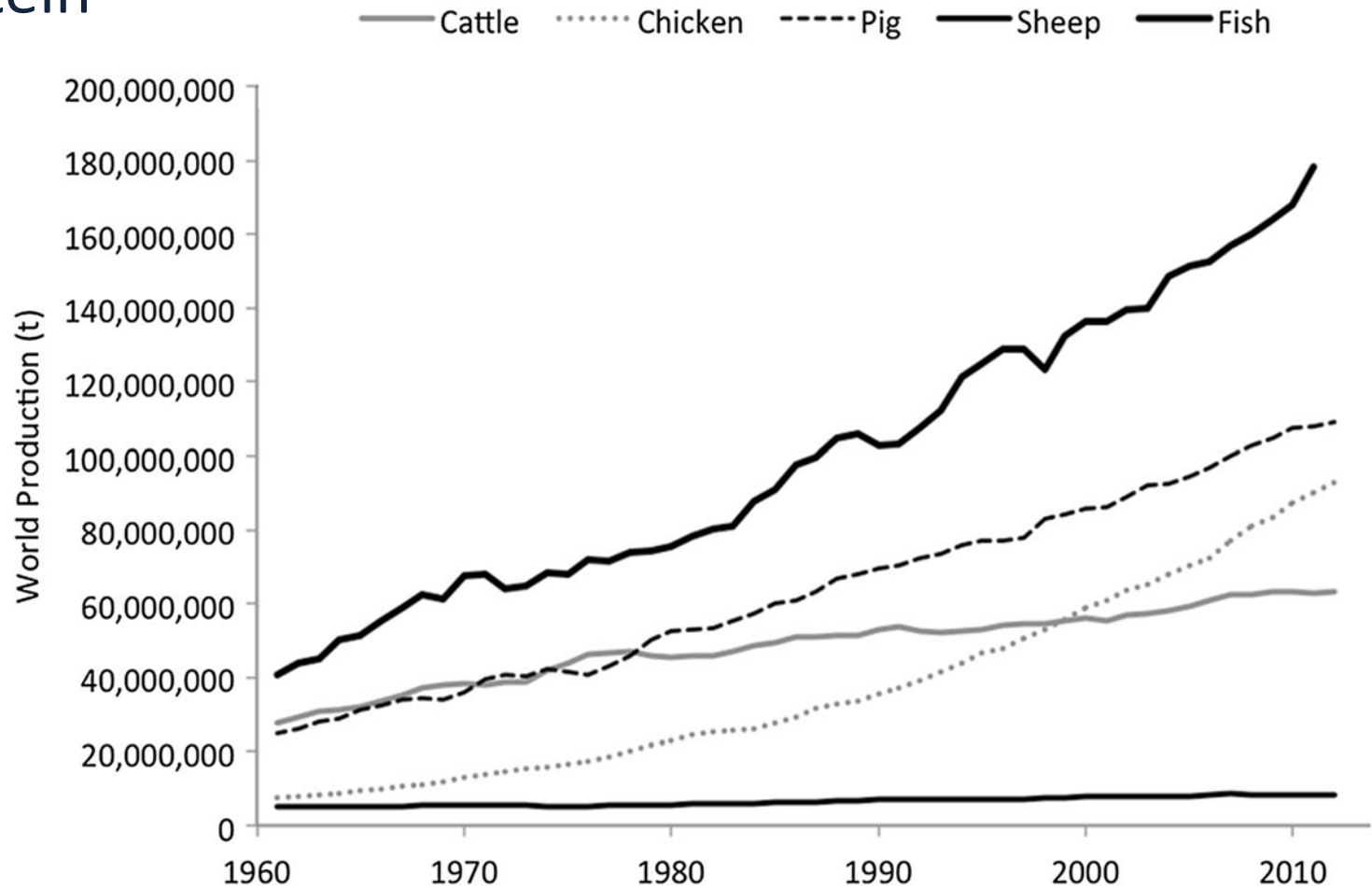
- State of the world's fish stocks
 - The importance of seafood
 - Global fishery trends
- Key challenges and conservation issues
 - Biological limits and overfishing
 - Bycatch and ecosystem effects

Ice-breaker

- Speak to those next to you, introduce your job or your recent projects.
- Collectively, write down four things you are hoping to learn about this week.

The importance of seafood

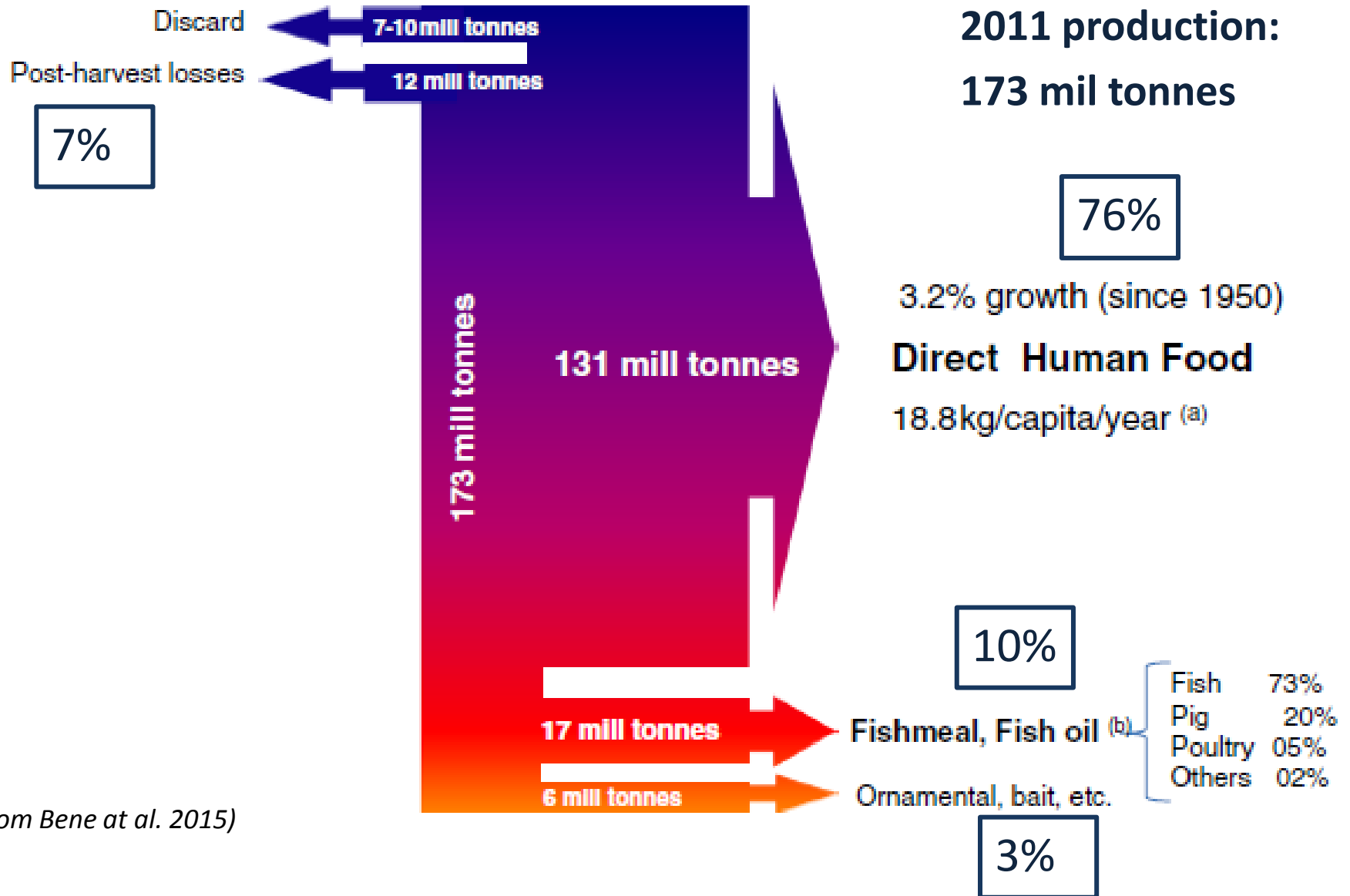
- 17% global animal protein consumption, 6.7% total protein



The importance of seafood

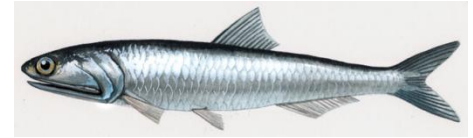
- 10% world's population rely on fishing industry as a livelihood
- Fastest growing food industry since 1950
 - Green revolution increased rice 3x
 - Blue revolution increased fish by 8x

Global fisheries production



Global fisheries production

- 23 species represent 40% of global catch
- Peruvian anchovy: 4-9 million tonnes /yr
 - Most ends up as fish meal and oil
- Western Pacific tuna fishery: 2.5 million tonnes /yr
 - Mainly skipjack, but also yellowfin, bigeye, albacore
- Alaskan Pollock fishery: 3 million tonnes /yr
 - McDonald's Fillet o' fish in US



Global fisheries production

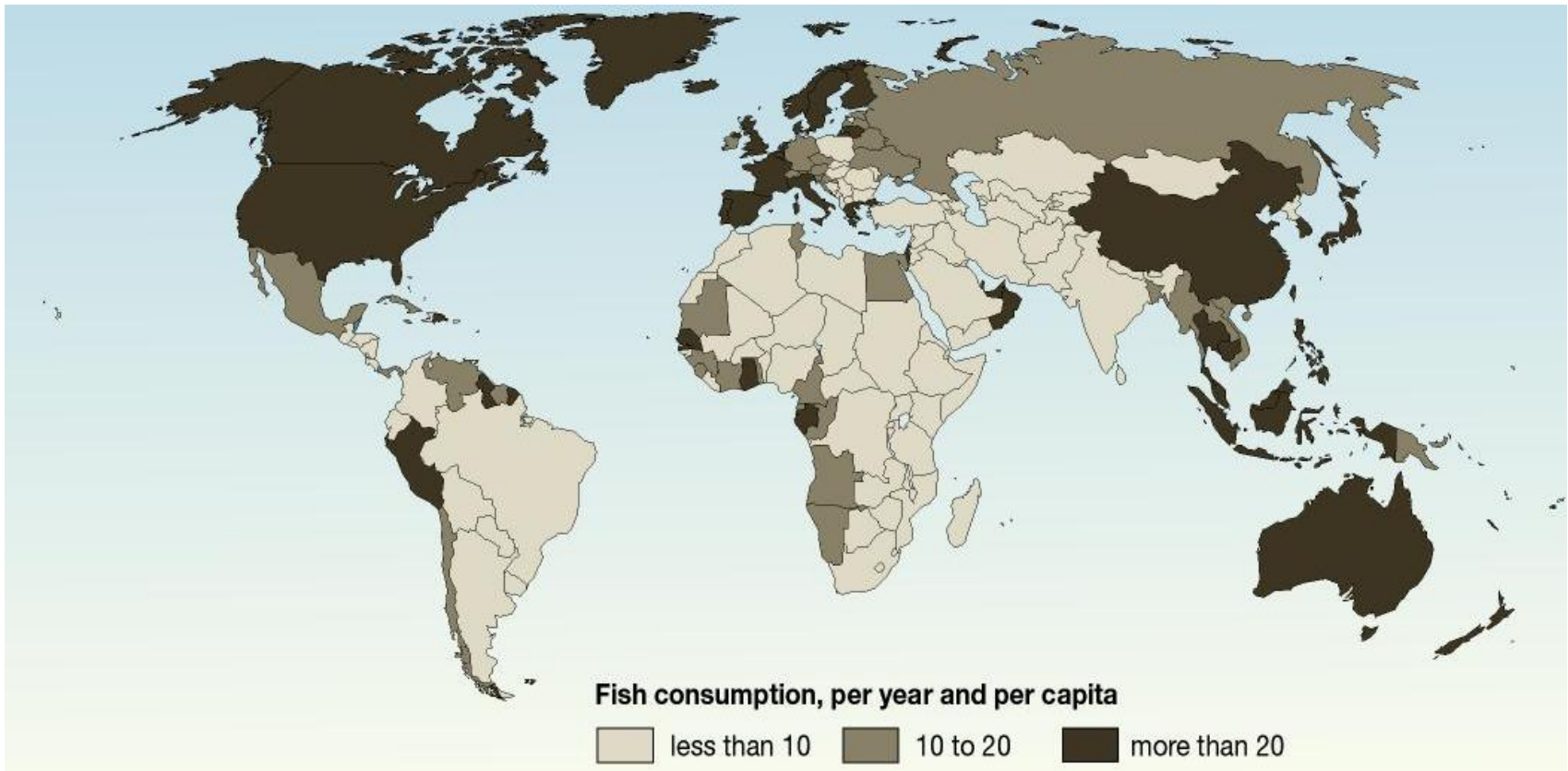
- Reported marine capture production

Country	Avg, 2003-2012	2014
China	12,759,922	14,811,390
Indonesia	4,745,727	6,016,525
United States of America	4,734,500	4,954,467
Russian Federation	3,376,162	4,000,702
Japan	4,146,622	3,630,364
Peru	7,063,261	3,548,689
India	3,085,311	3,418,821
Viet Nam	1,994,927	3,711,100
Myanmar	1,643,642	2,702,240
Norway	2,417,348	2,301,288

Global fisheries production

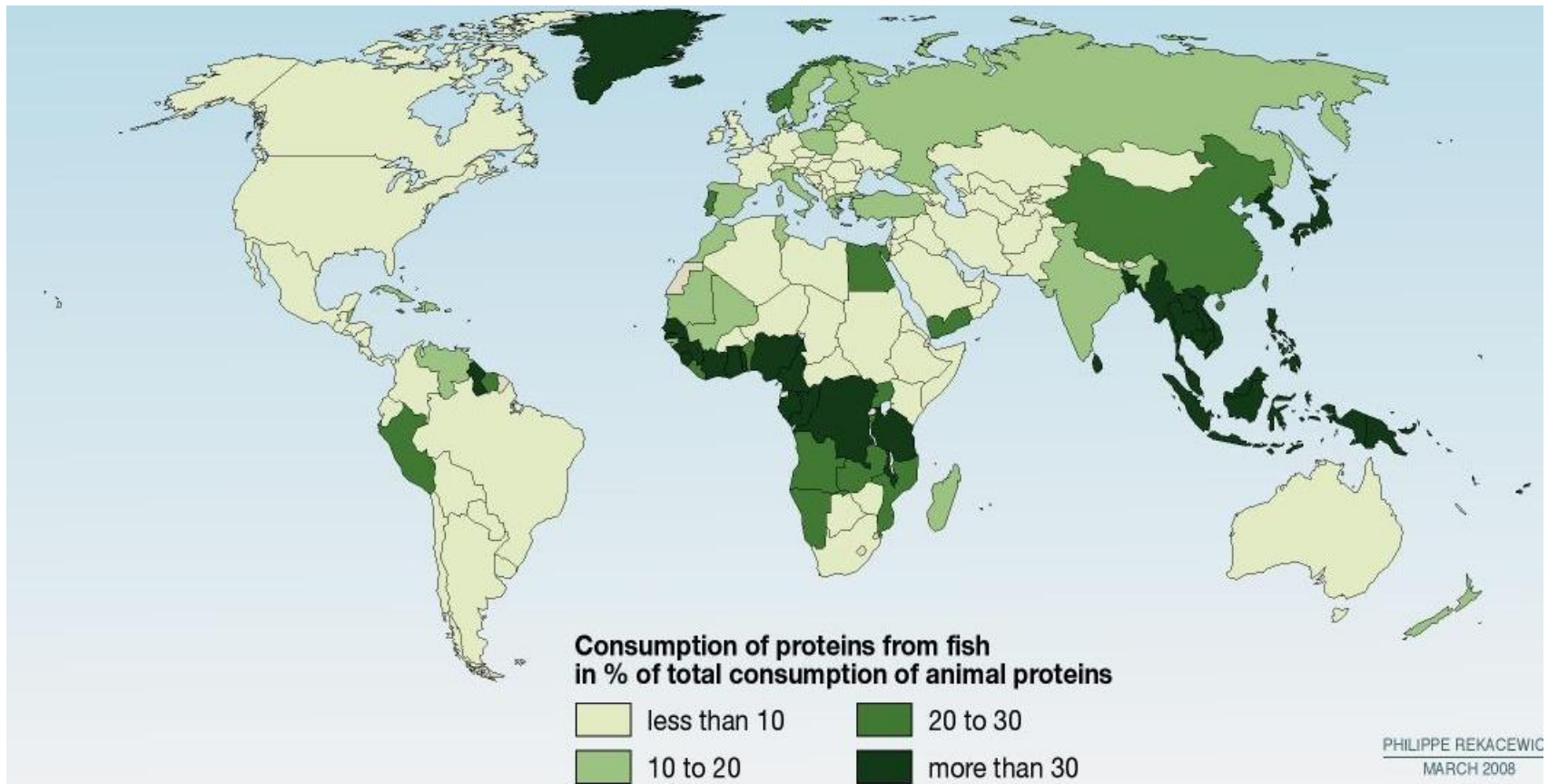
- Per capita consumption tripled in 60 years
 - 1950 – 6 kg pp/yr
 - 2014 – 20 kg pp/yr

Fish follow the money



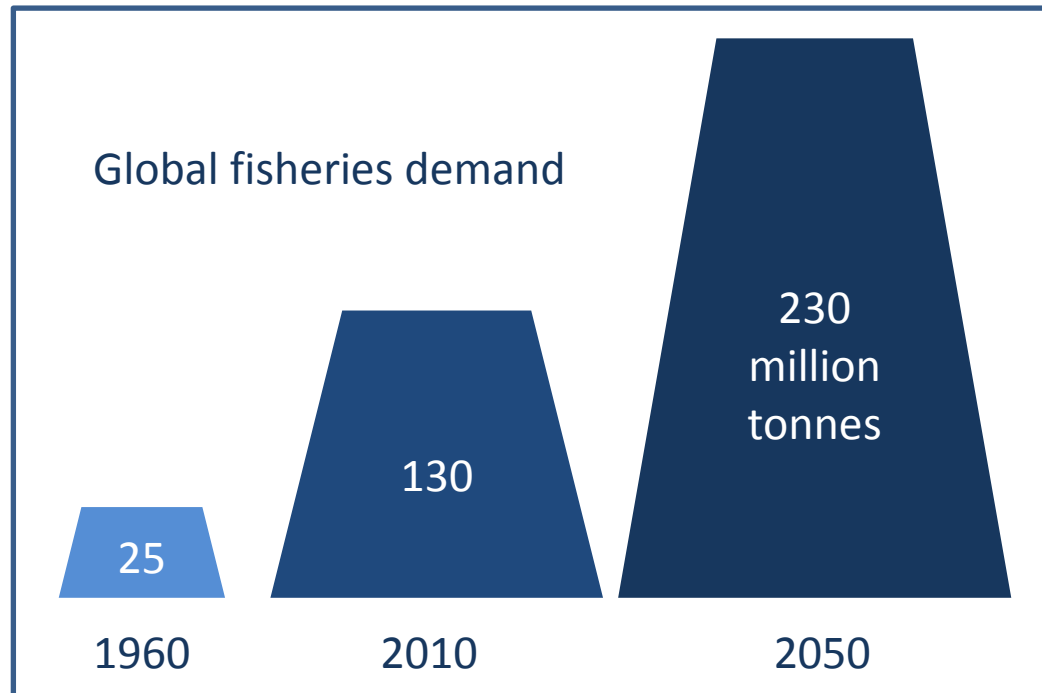
Global fisheries production

- Highly important in coastal developing countries
 - > 60% daily protein in Ghana, Cambodia, Bangladesh, Indonesia
 - Three quarters of countries where fish is the main protein source are considered poor or food deficient



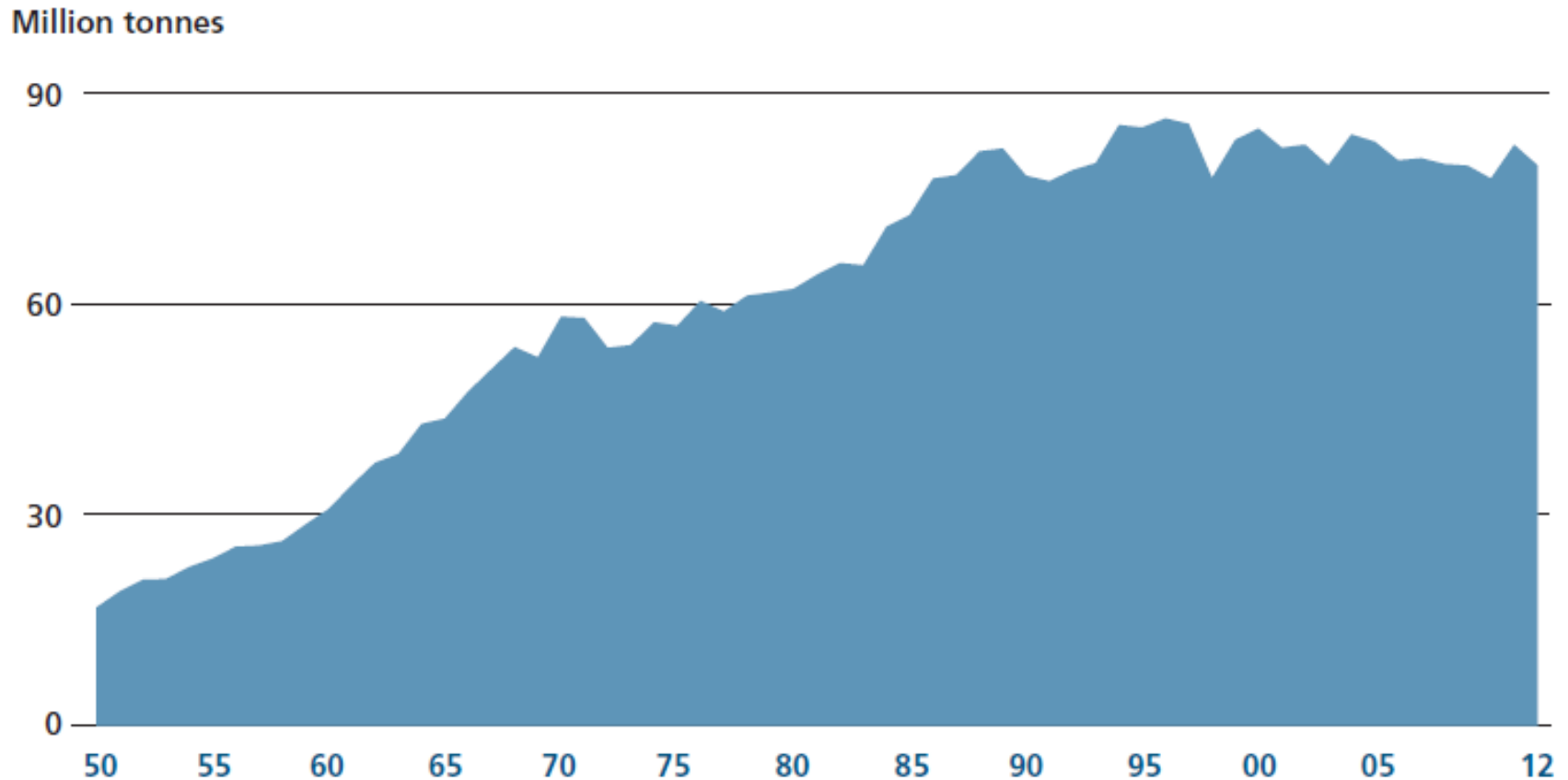
Future fisheries demand

- Per capita consumption is set to rise
 - e.g. China's per capita demand predicted to double to 41kg by 2030
- Population predicted to hit 9 billion by 2050
- Need 60% more animal protein by 2030



Future fisheries production?

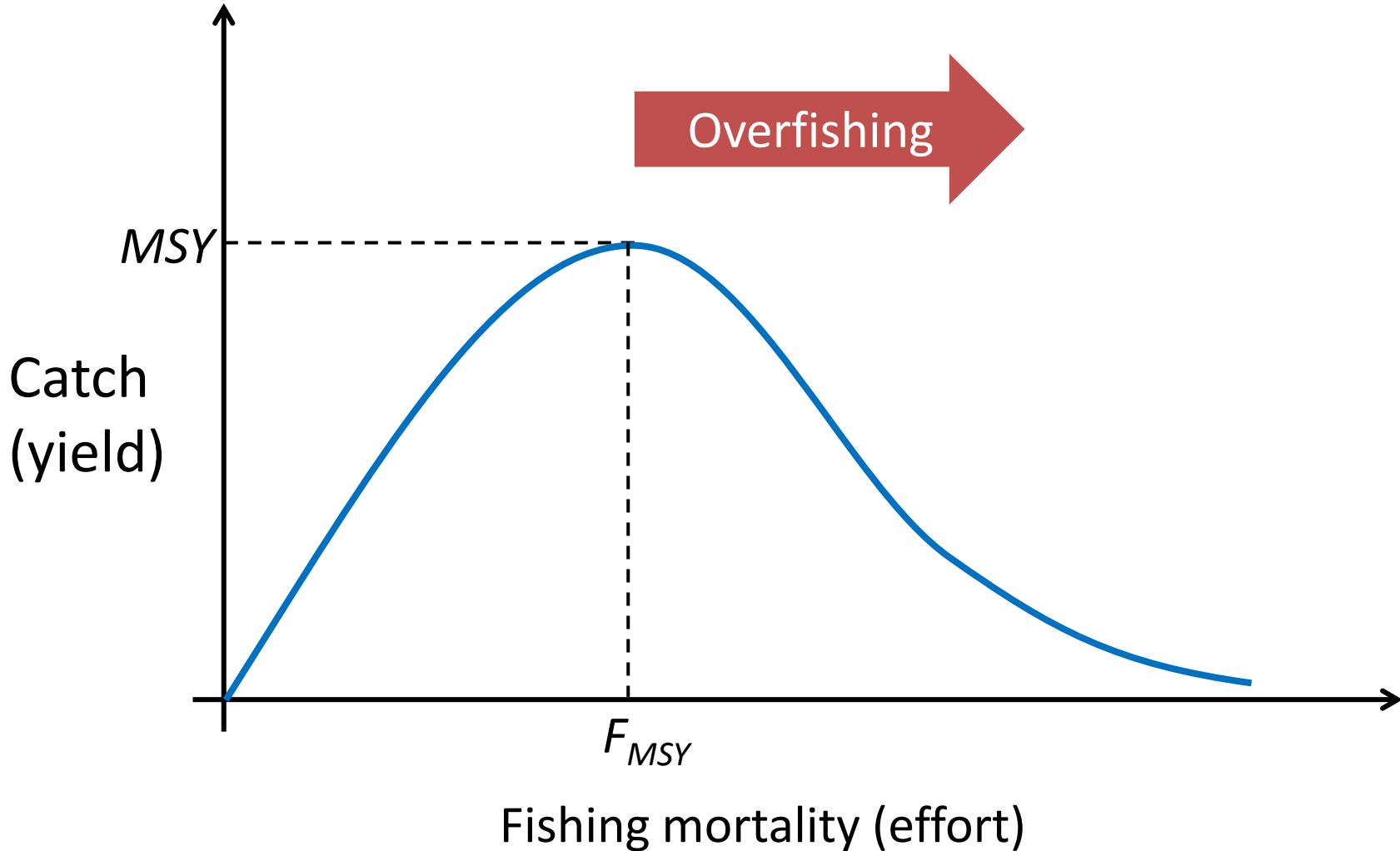
- Marine wild fisheries production has levelled off
 - Most stocks now exploited, declines in coastal productivity
 - We can only take what nature can provide



Why can't we just fish more?

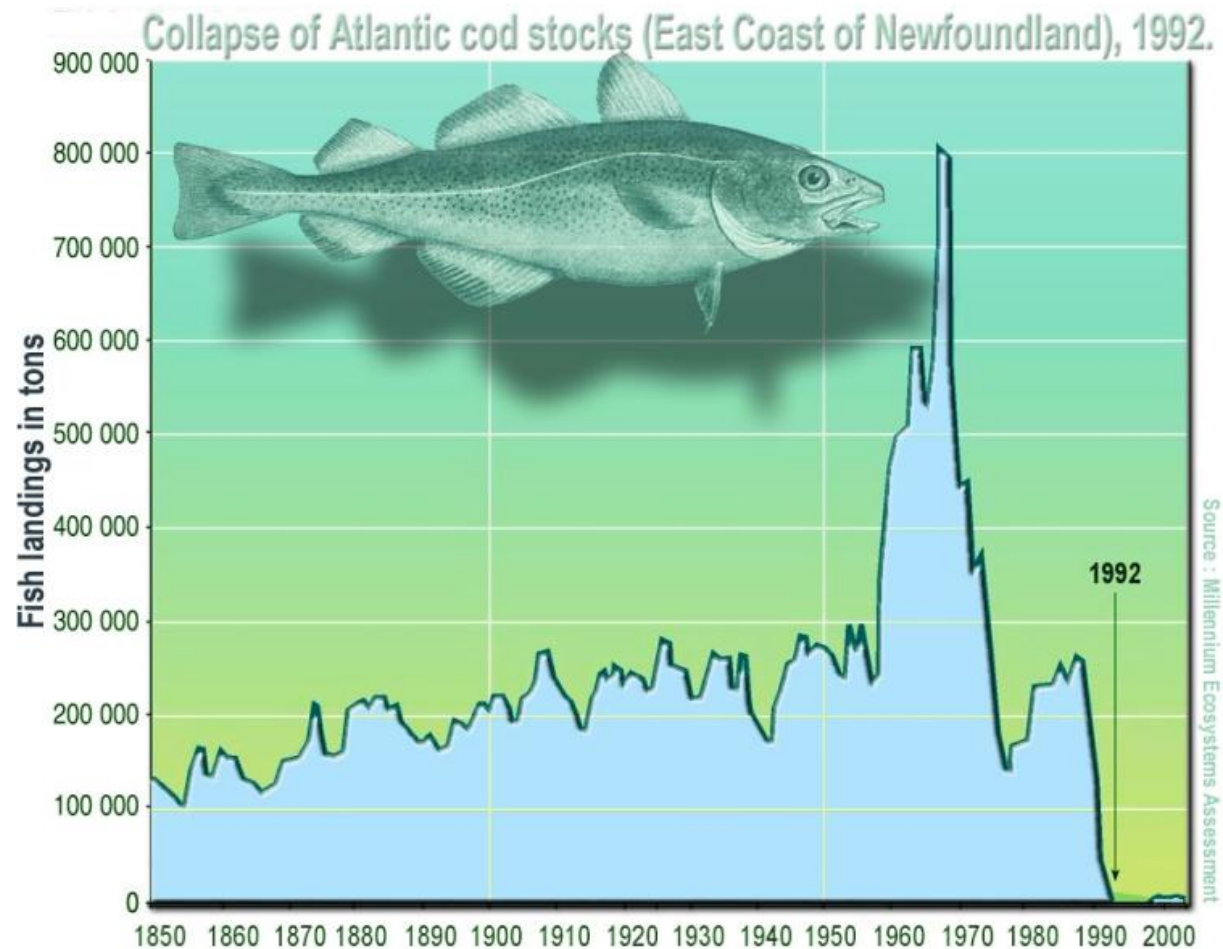
- Biological and environmental limits to global productivity
- Overfishing has reduced stocks below optimal productivity
- Biomass is lower than optimal egg production to replenish stock
- Target biomass is generally between 30-60% of the maximum stock size (due to density-dependence)

What is overfishing?



Overfishing: Atlantic cod

- 500 year old fishery – boats travelled from Europe for centuries
- Stock fell to 1% in 1992 and fishery closed
- 40,000 people out of work



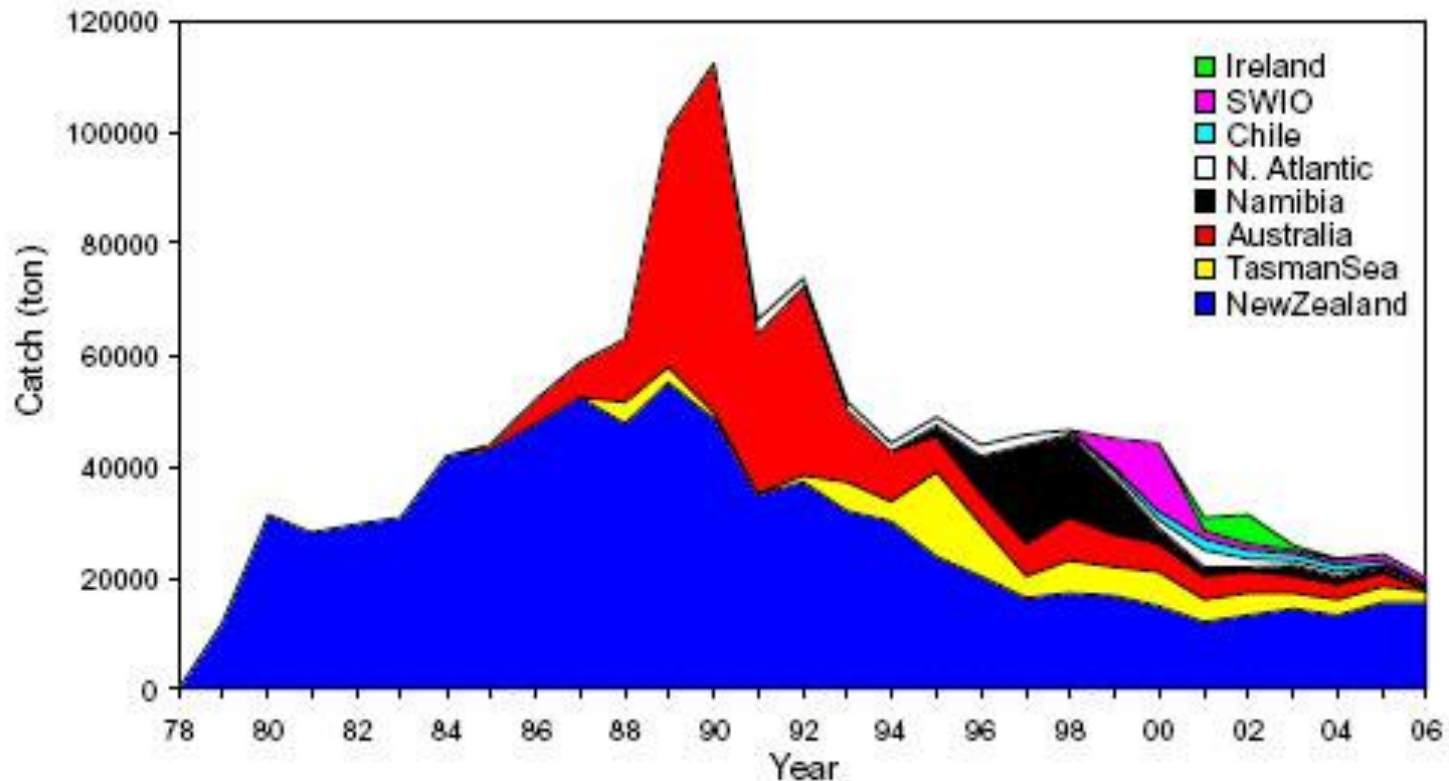
Going bigger and deeper

- Capacity to overfish is increasing with larger boats
- Targeting species we know little about
- Consolidation of fishing capacity in large companies



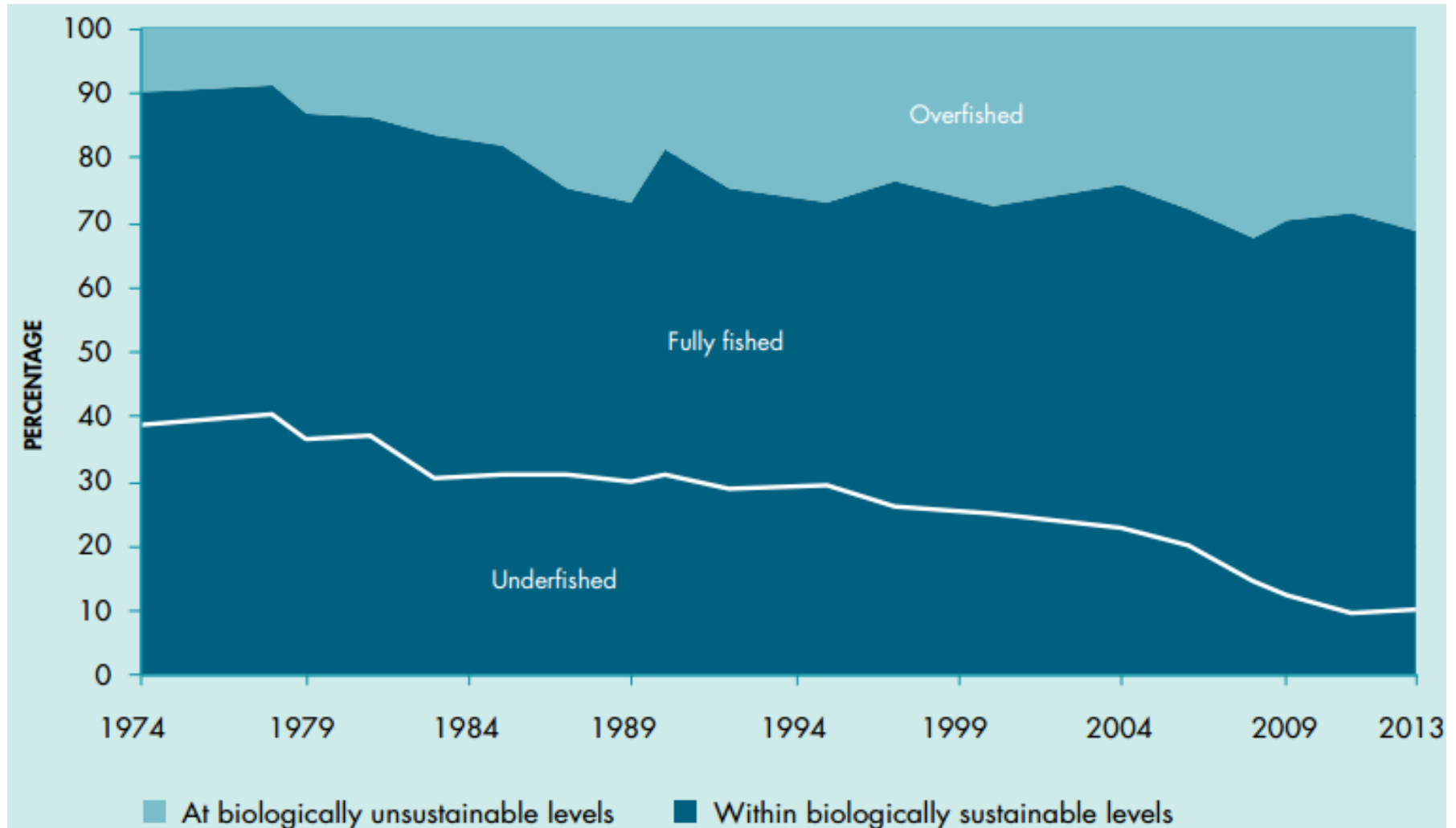
Overfishing: Orange Roughy

- Deep sea 600-1200m, easily harvested (aggregates on seamounts)
- Slow growing, matures at 30, can live to 150
- The science wasn't done until too late



Global marine stock status

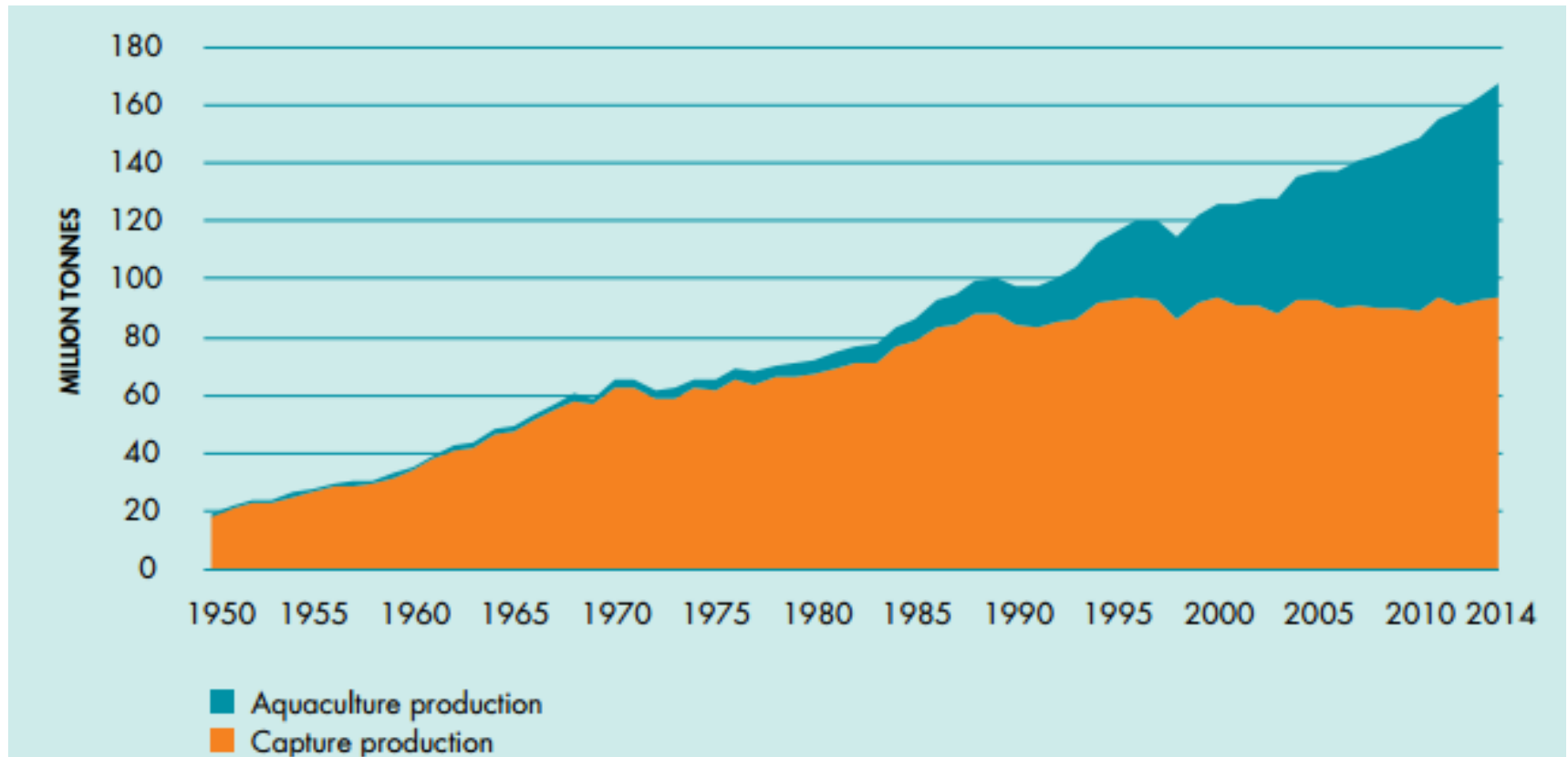
- The ocean is almost fully exploited



What about aquaculture?

- Already provides 45% of seafood production
- Significant capacity exists for expansion

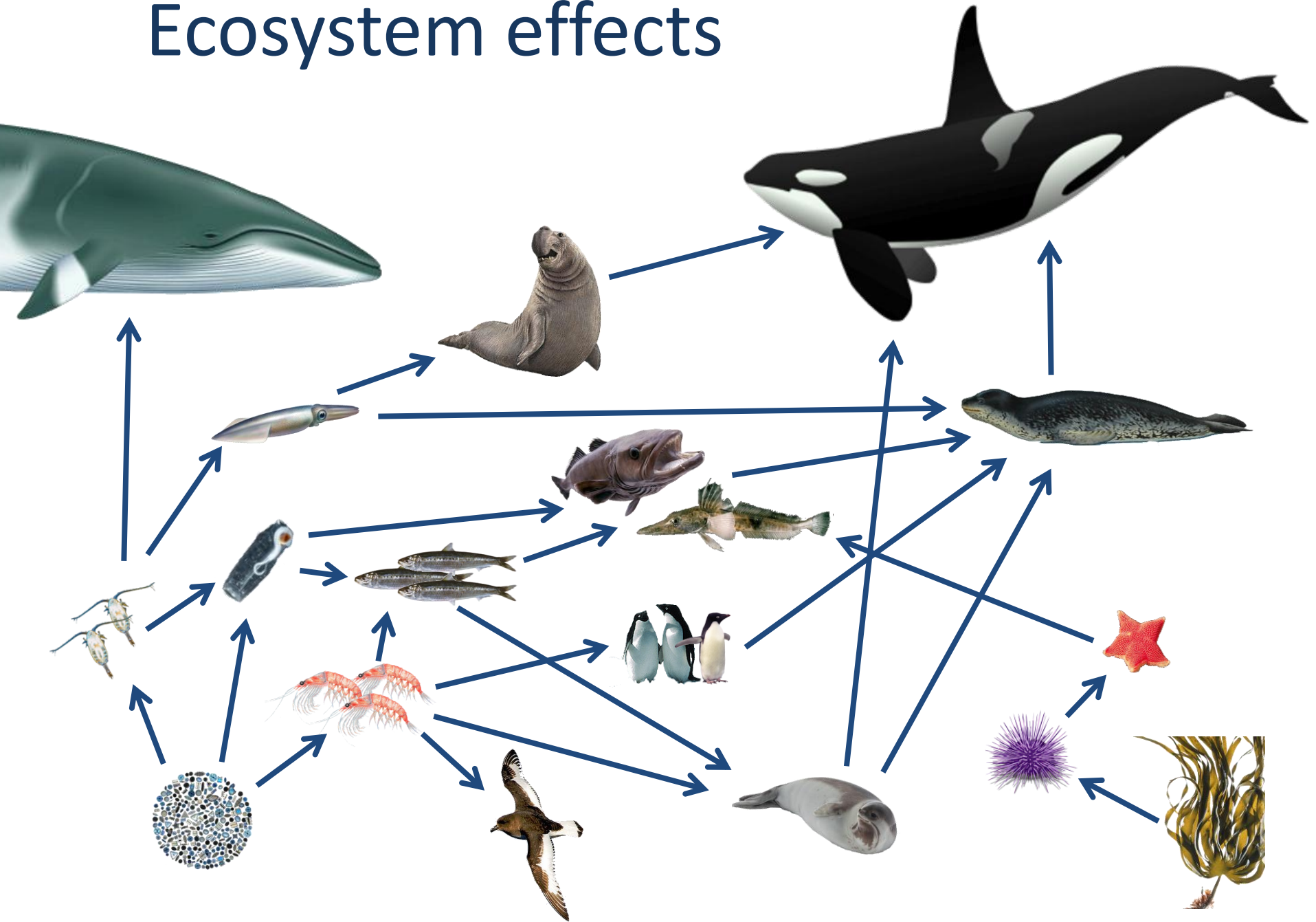
Global capture fisheries and aquaculture production



Ecosystem effects



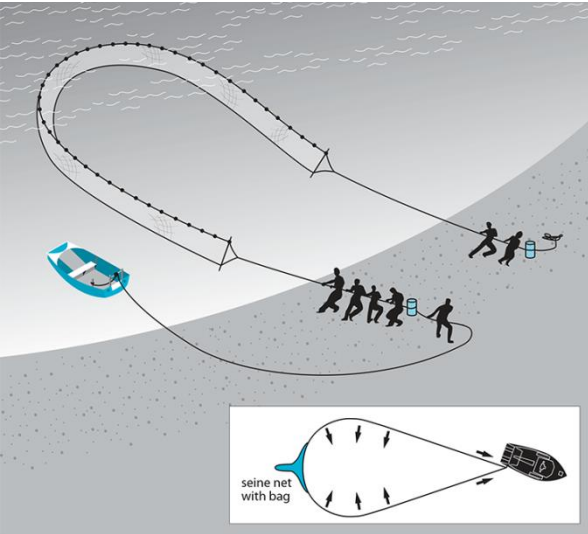
Ecosystem effects



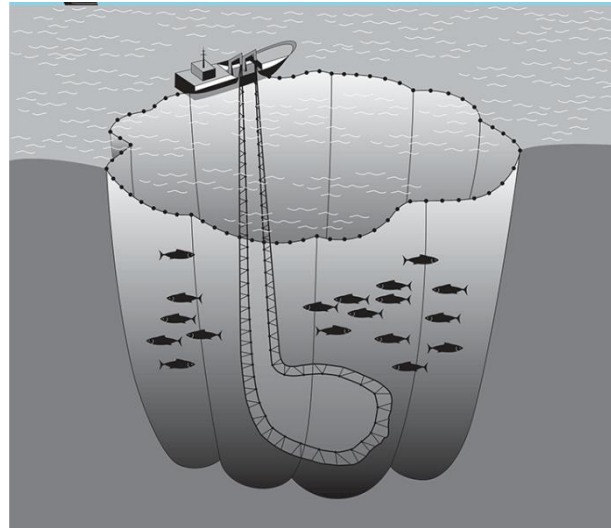
Ecosystem effects

- Bycatch
 - “Incidental catch of non-target species”
- Interactions with threatened, endangered, and protected species
 - “Interactions” often means “deaths”
- Habitats and ecosystems
- Managing for sustainability

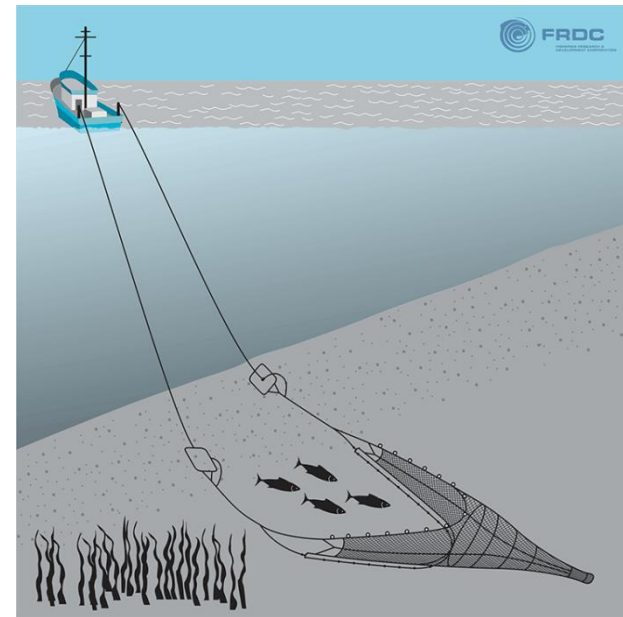
Types of fishing: nets



Haul seine
(whiting, mullet)

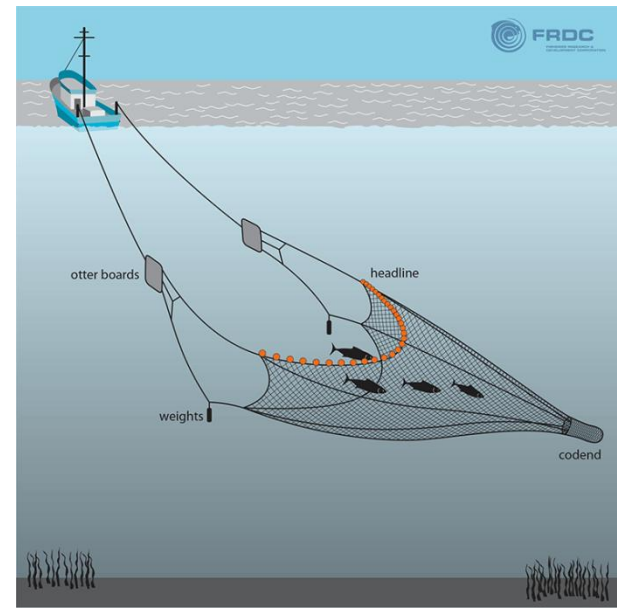


Purse seine
(sardines, tuna)

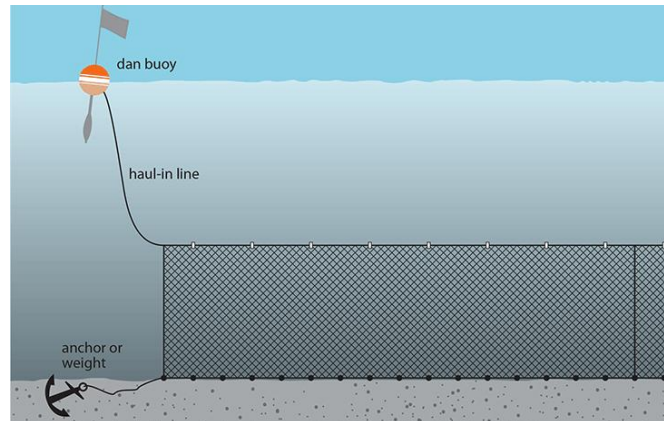


Bottom trawl (prawns, flathead)

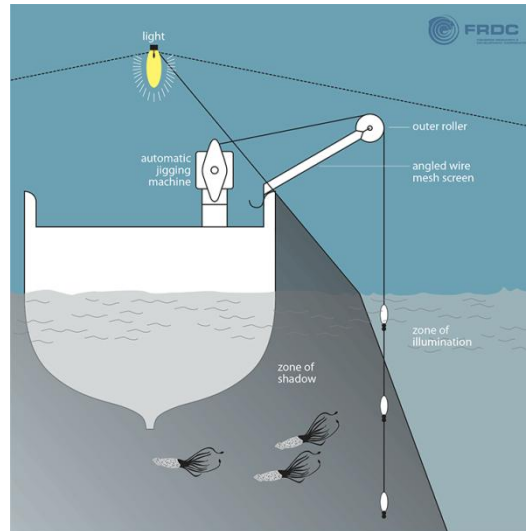
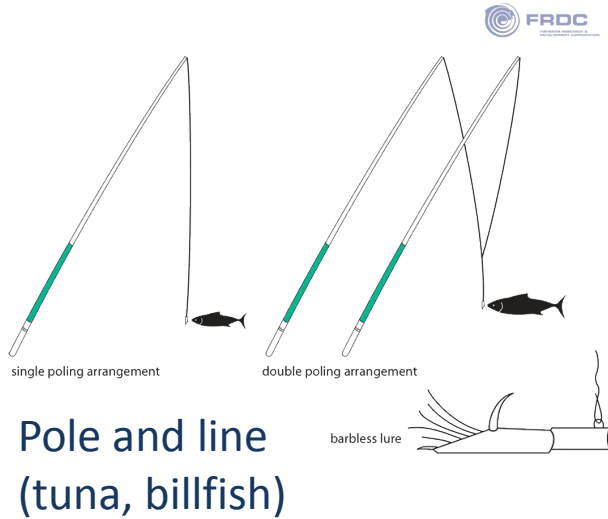
Mid-water trawl (mackerel)



Gill net
(bream,
flathead,
sharks)

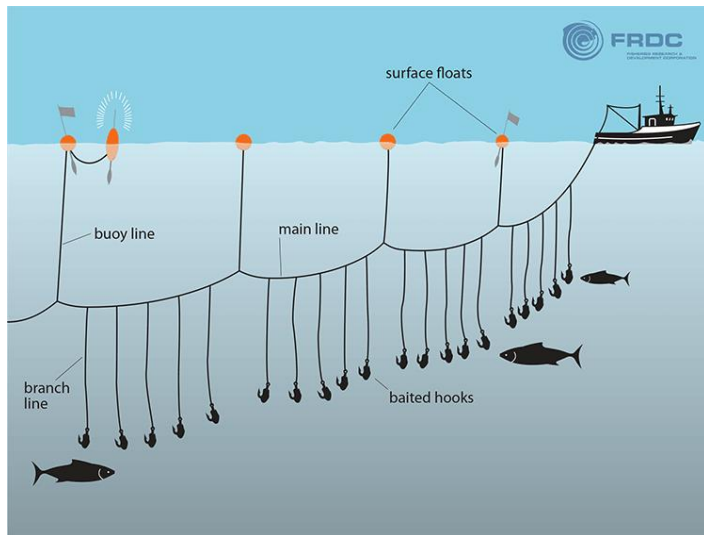


Types of fishing: hook and line

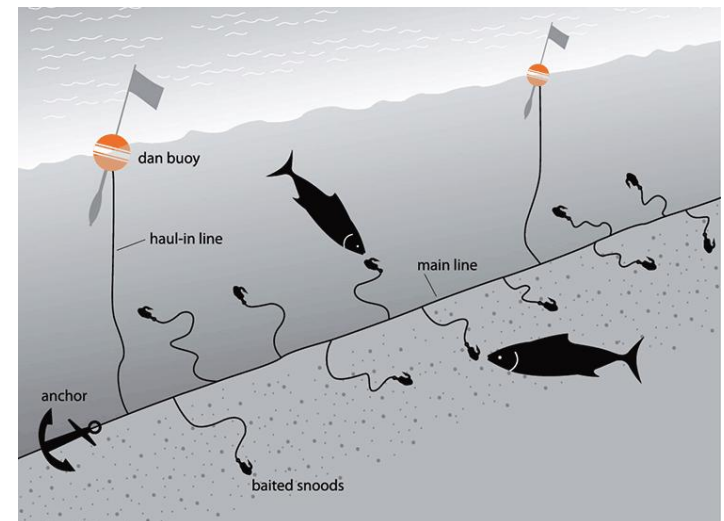


Jigging
(squid)

Also:
Traps and pots
(crabs, lobsters)
Dredges (scallop)



Drifting
longline
(tuna,
billfish)



Bottom longlines
(blue-eye, ling)

Bycatch

- Most fishing techniques are not species-specific
- Bycatch may be unmarketable species, juveniles, or target fish discarded because quotas reached
- Bycatch can account for the majority of the landed catch (e.g. Prawn/shrimp fishing has 80-90% bycatch)



Bycatch

- Survival of bycatch is highly variable:
 - 0% (e.g. deep-water bottom trawl fishery)
 - 100% (large rays in a shallow seine fishery)
- Bycatch mortality of juveniles reduces population growth (e.g. bigeye tuna)
- Depletion of bycatch species can cause ecosystem shifts, reducing productivity of target species because of reduced food supply

Interactions with TEP species

- Many larger marine species, especially mammals, have been depleted through hunting (e.g. whales, seals, turtles)
- Can be caught in nets and drowned, or entangled in ropes or lobster pots
- Seabirds depleted from longline fishing and trawling
- Sharks are especially vulnerable because of slow growth and reproductive rates



Habitats and ecosystems

- Some techniques such as bottom trawling and dynamite fishing are inherently destructive to the ocean floor ecosystem
- Habitats such as deep reef, corals and seagrass are most at risk
- These habitats often underpin the productivity of fish stocks
- The act of removing so many fish from the ecosystem can cause regime shifts in the balance of species

Managing for sustainability

- Overall management performance in each EEZ

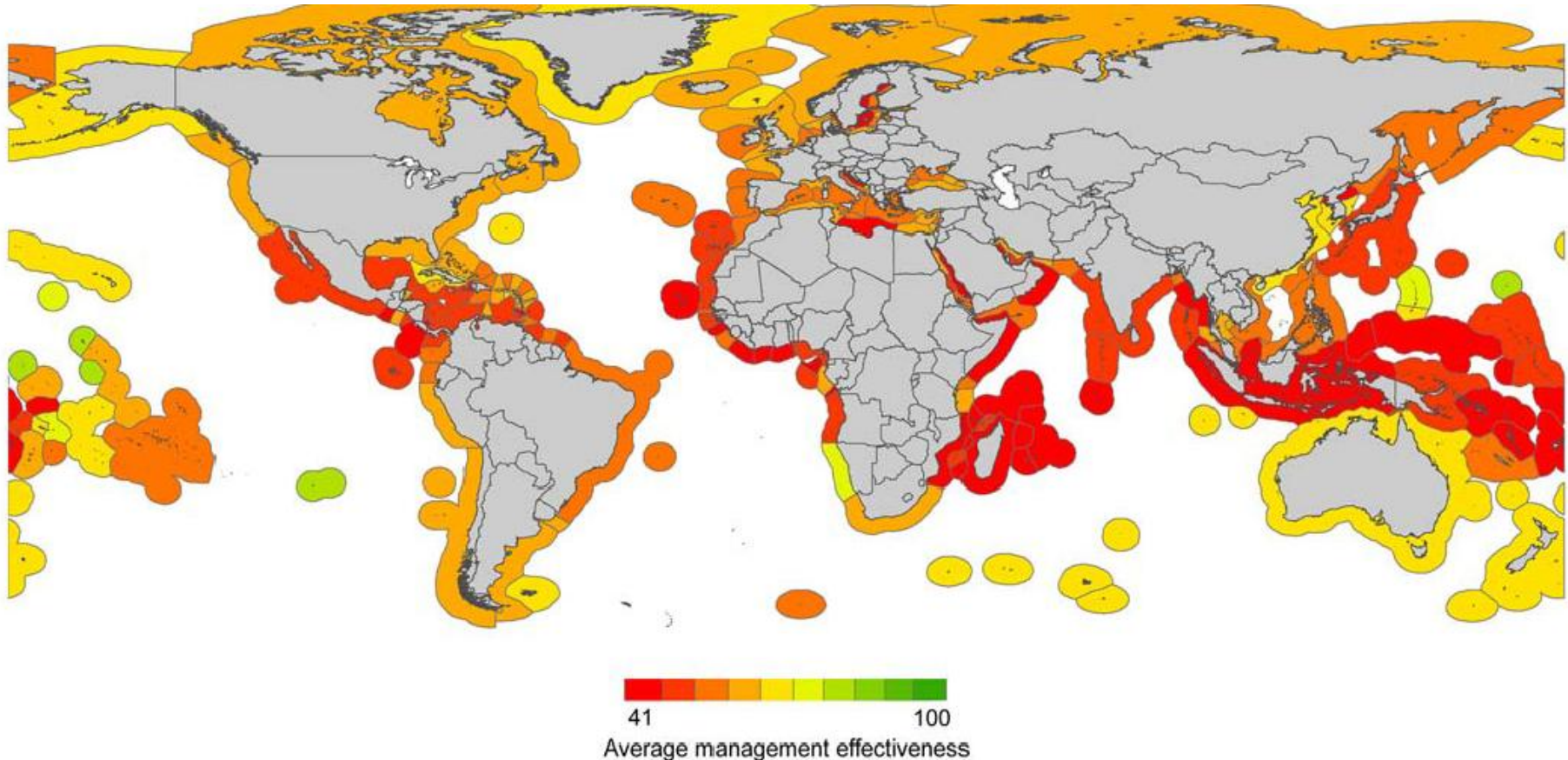
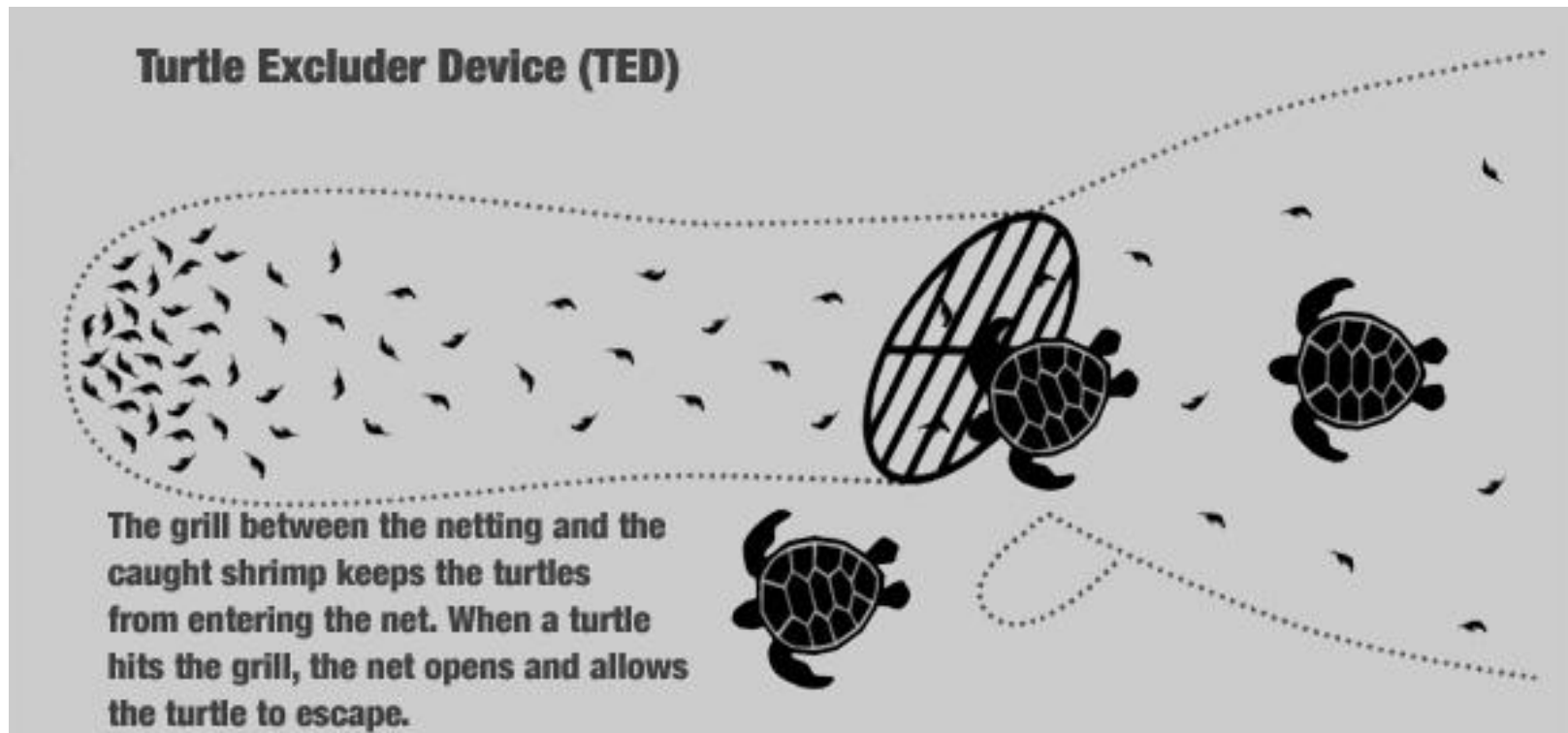


Figure 4. Overall management effectiveness of the world's exclusive economic zones. This map shows the average, for each surveyed area, of their scores on the scales of scientific robustness, policymaking transparency, implementation capability, fishing capacity, subsidies, and access to foreign fishing.

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Managing for sustainability

- All these sustainability challenges can be addressed.
 - There is such a thing as sustainable fishing!
- Requires **management** and **enforcement**



Group activity

- Consider a fishery that you are familiar with. What are the major ecosystem impacts of that fishery?
- Thinking about what you've learned, what could be done to reduce these impacts?
- Can you think of any other major management challenges for this fishery?



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