

Oceans and Fish

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Master Veg Program

(Many slides prepared by Charley Korn)



The Ocean is big....

- 70.78% of the Earth's surface
- Productivity – ocean vs. terrestrial environments



Productivity of Environments

in petagrams carbon per year

Ocean	48.5
Terrestrial	56.4
Tropical Rain Forest	17.8
Other Forests	9.1
Savannah	16.8
Perennial Grasslands	2.4
Shrubs with bare soil	1.0
Tundra	0.8
Desert	0.5
Cultivation	8.0

Source: World Atlas of Biodiversity: page 11, adapted from Field et al

Worldwide productivity



source: World Atlas of Biodiversity. B Groombridge & M.D. Jenkins. UNEP 2002

Biomass on land and sea

- Biomass (carbon) on land: 560×10^{15} grams
- Biomass (carbon) in the sea: $5-10 \times 10^{15}$ grams
- source: World Atlas of Biodiversity. B Groombridge & M.D. Jenkins. UNEP 2002

What threatens our oceans?

- Fishing
- Pollution
- Acidification
- Temperature (coral bleaching)
- Low oxygen
- Plastics?

Toxic garbage island?



Pictures from www.5gyres.org

More solid info from marinedebris.noaa.gov

Fish: Older than Dinosaurs

- ◎ Fish have been on the earth for more than 450 million years, long before dinosaurs.
- ◎ There are over 31,800 identified species of fish, and many more that have not yet been identified.
- ◎ There are more species of fish than all the species of amphibians, reptiles, birds and mammals combined.

Bluefin Tuna



- **Warm blooded – can swim up to 25 mph**
- **Can live to 30 years, grow to 12 feet long**
- **Can weigh 1,500 pounds**

Source: National Geographic April 2007

<http://ngm.nationalgeographic.com/2007/04/global-fisheries-crisis/montaigne-text>

U.S. Annual Per Capita Consumption (lbs.)

<i>Year</i>	Red Meat	Poultry	Fish & Shellfish
1910	96.0	11.8	11.2
1940	92.4	12.3	11.0
1970	131.9	33.8	11.8
2000	113.7	67.9	15.2
2006	109.1	75.1	16.5

USDA / Economic Research Service

What's the (Ocean) Catch?

- **95 million tons of Fish, Crustaceans, & Mollusks in 2004**
 - **China, Peru and the USA are the top producing countries.**

Over-fishing

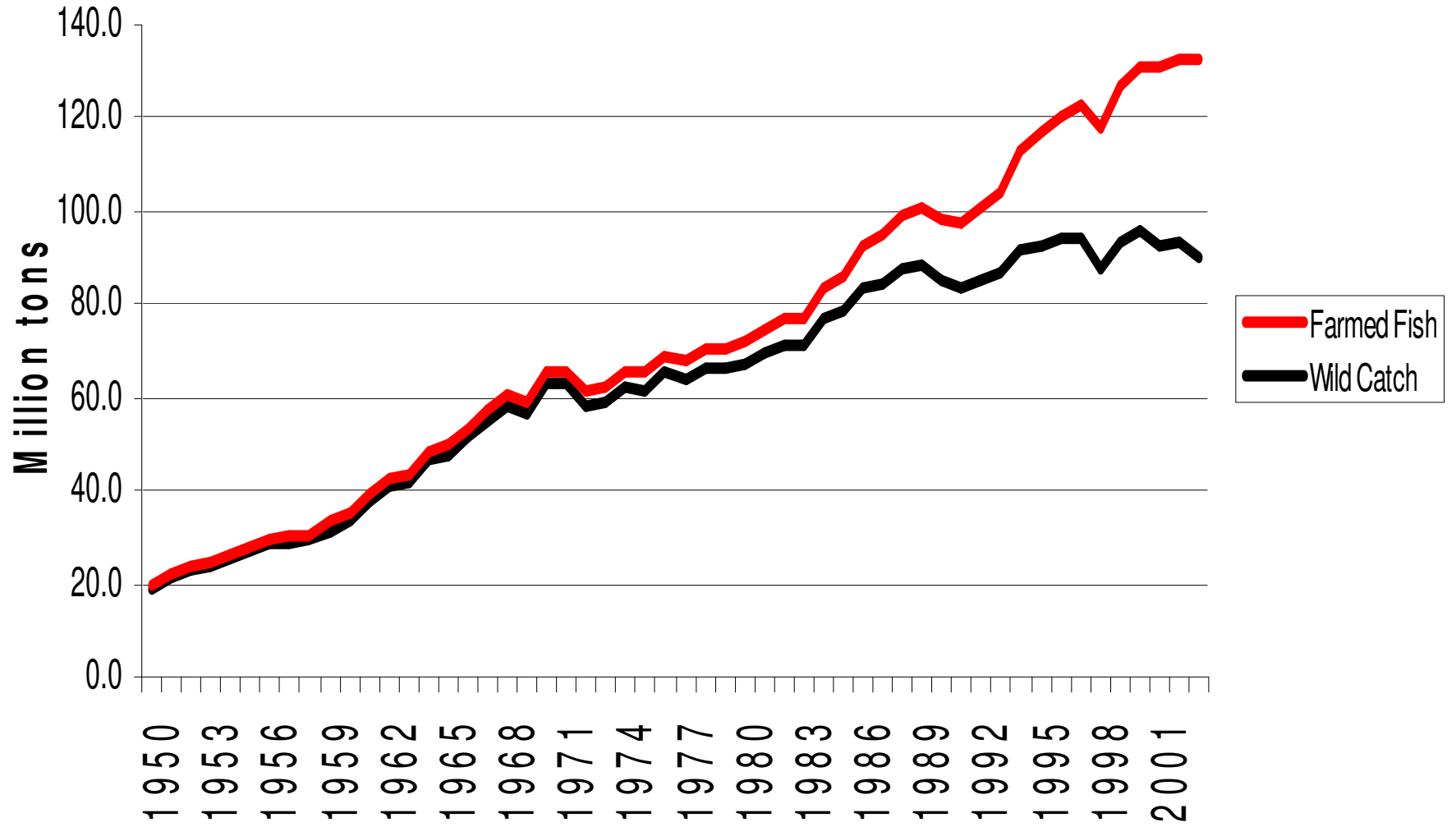
- **All of the world's fishing stocks will collapse before 2050 -- if over-fishing and other human impacts continue at their current pace.**
- **Already, nearly one-third of species that are fished, including bluefin tuna, Atlantic cod, Alaskan king crab, and Pacific salmon have collapsed, and the pace is accelerating.**

Over-fishing

- **It's possible that only 10% of all large fish (tuna, swordfish, marlin) and ground fish (cod, halibut, skate, and flounder) are left anywhere in the ocean (2003 study).**

Myers, R.A., & Worm B. (2003) Rapid worldwide depletion of predatory fish communities. *Nature* 423:280-283

Global Marine Capture



Enormity of the Methods

- It ain't a few kids with fishing poles



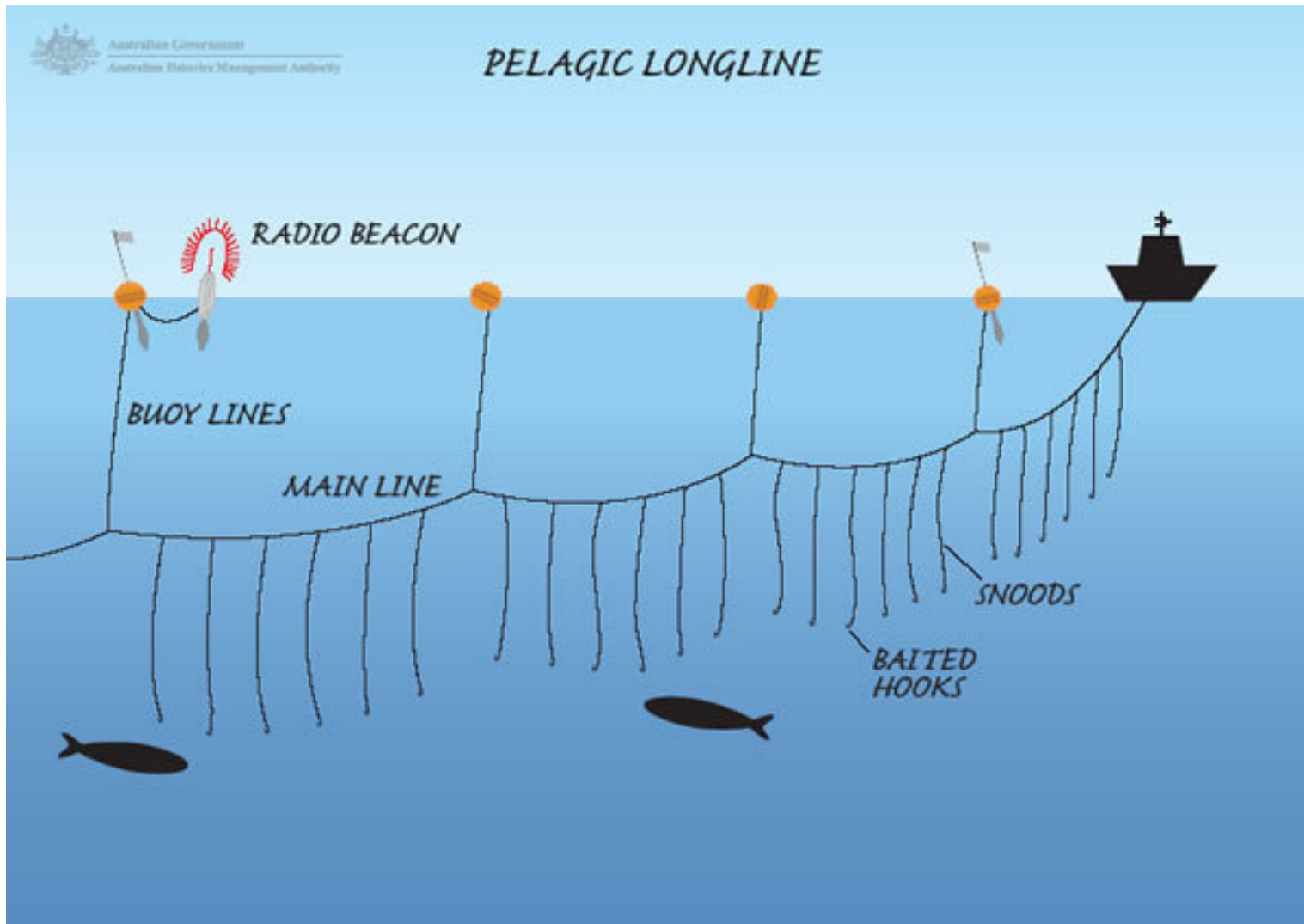
Longline Fishing

- **Most widely used fishing gear on earth; each year an estimated 2 billion longline hooks are set worldwide, mainly for tuna and swordfish**

Longline Fishing

- **Single boat sets monofilament line across 60 or more miles of ocean**
- **Each line bears vertical gangion lines that dangle, baited with up to 10,000 hooks**

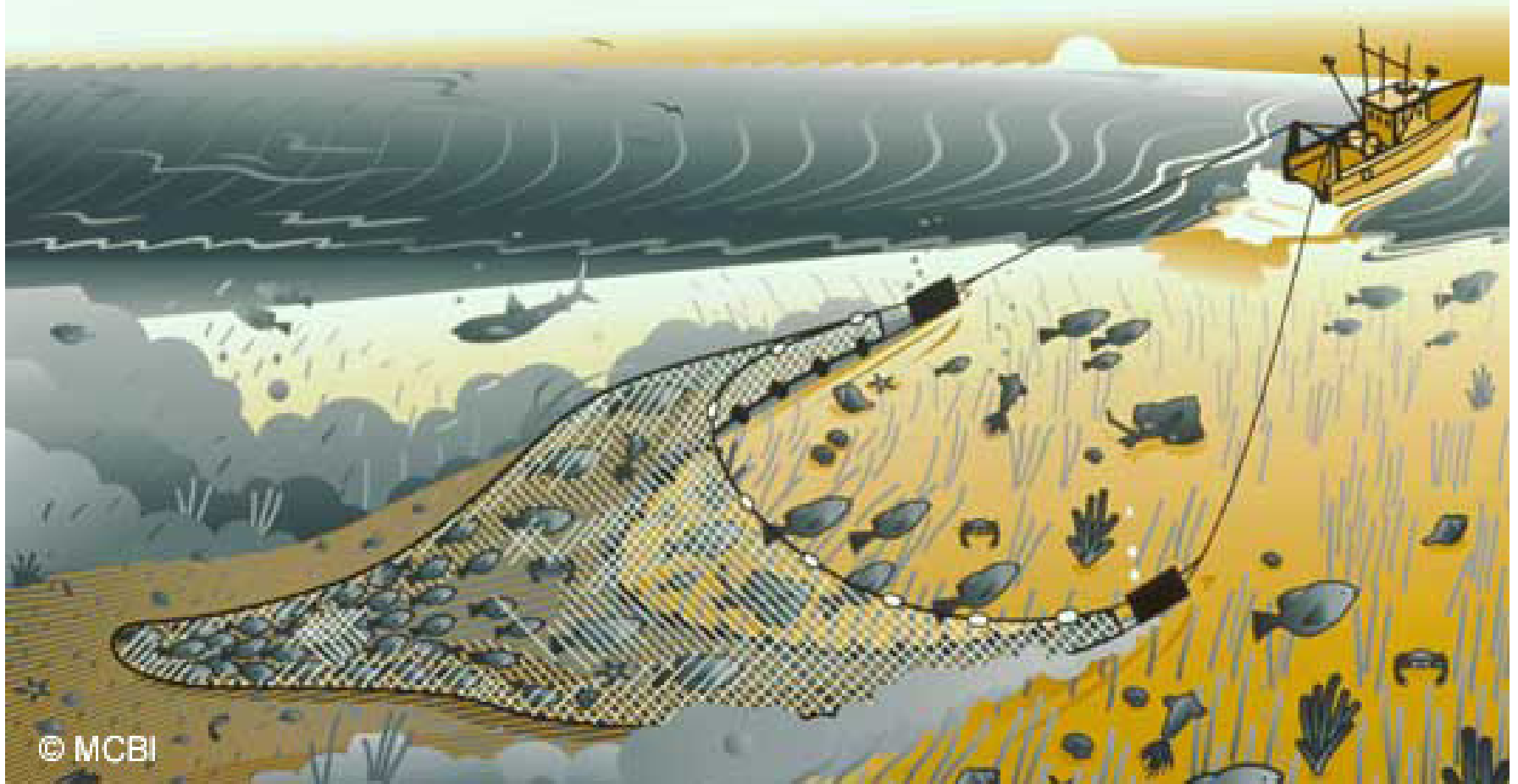
Longline Fishing



Bottom Trawling

- **Bottom trawling involves dragging huge, heavy nets along the sea floor. Large metal plates and rubber wheels attached to these nets move along the bottom and crush nearly everything in their path.**

Bottom Trawling



© MCBI

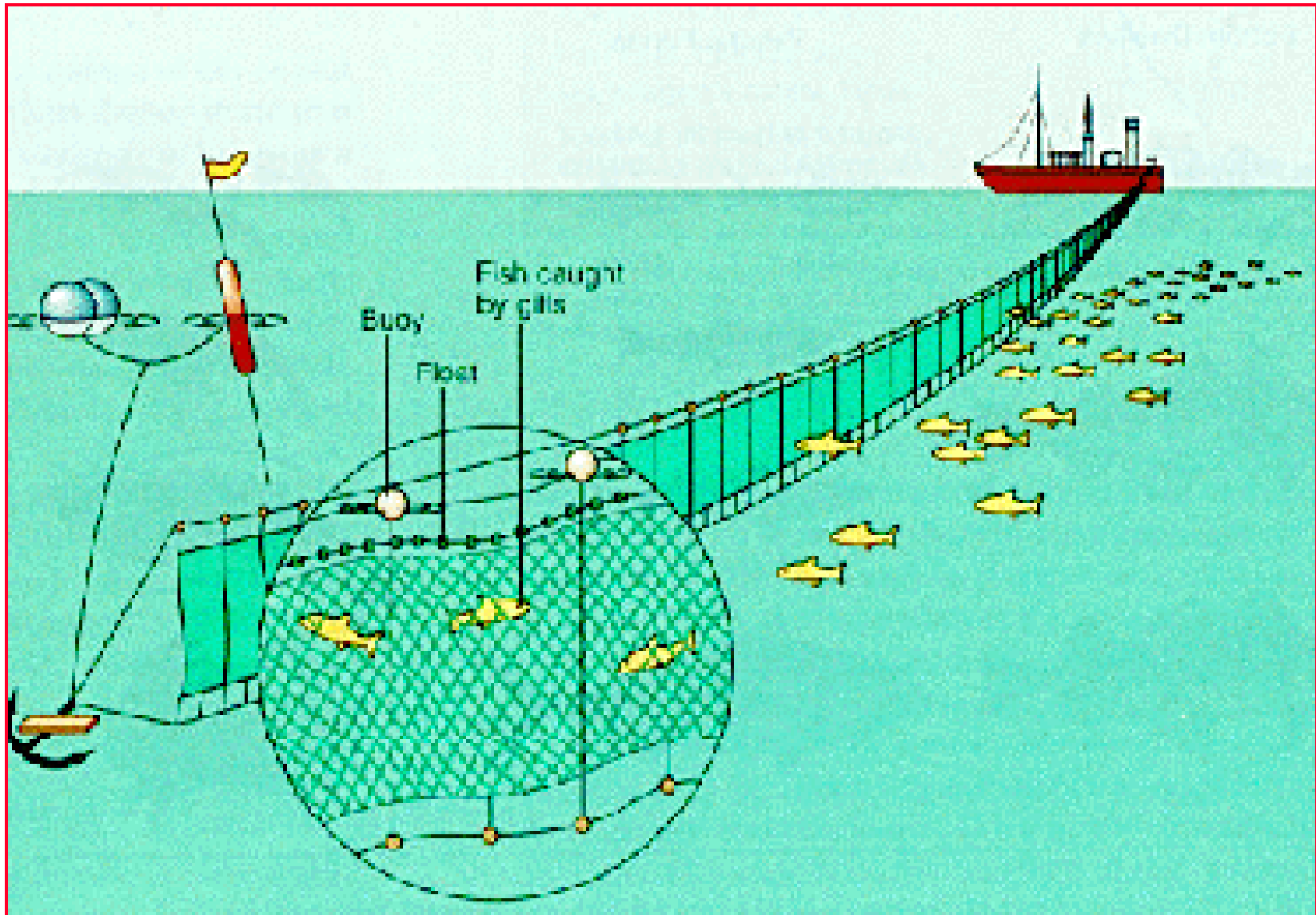
Before and After Bottom Trawling



Drift Nets

- **In the North Atlantic, shark and monkfish nets are set 1,600 feet below the surface, then left untended to sail and randomly ensnare life.**
- **In stormy seas, they may be lost or abandoned, yet they continue to fill with prey**

Drift Nets



Bycatch Victims

- One in four animals caught in fishing gear dies as bycatch.



Monterey Bay Aquarium, World Wildlife Fund

Bycatch Victims

- **Different types of fishing practices result in different animal/species being killed as bycatch:**
 - **nets kill dolphins, porpoises and whales**
 - **longline fishing kills birds**
 - **bottom trawling devastates marine ecosystems.**

Bycatch Victims

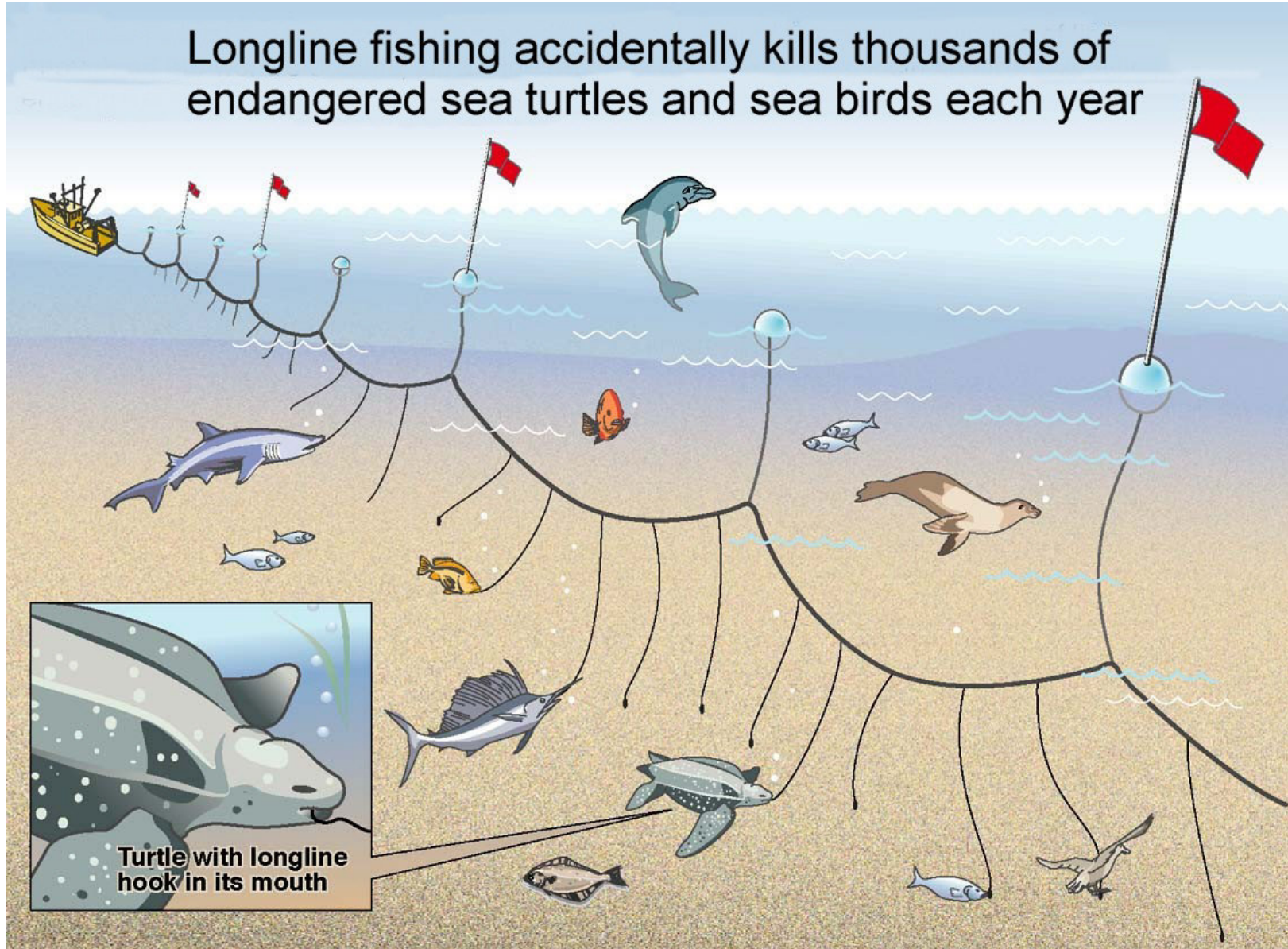
- **It has been estimated that 100 million sharks and rays are caught and discarded each year.**
- **An estimated 300,000 whales, dolphins and porpoises also die as bycatch each year, because they are unable to escape when caught in nets.**

Longline Bycatch Victims

- **Each year, longlines kill thousands of unintended species that take the bait, including approximately:**
 - **40,000 sea turtles**
 - **100,000 albatrosses and 200,000 other seabirds**
 - **millions of sharks**

Longline Bycatch Victims

Longline fishing accidentally kills thousands of endangered sea turtles and sea birds each year



Bottom Trawling Bycatch



ngm.nationalgeographic.com/2007/04/global-fisheries-crisis/olson-skerry-photography photograph by Brian Skerry

- Only the shrimp in this Mexican fisherman's hands will be sold
- Everything else in the picture will go to waste.

Fishing Units of Production

- "Optimal" level of fishing?
- This way of thinking ignores the individual

Worldwide: Animals Killed for Food 2008

(Millions)

Chickens	52,887	Peruvian anchovy	300,000-870,000
Ducks	2,556	Atlantic herring	3,600-22,000
Turkeys	669	Bombay duck	2,600-38,000
Total birds	56,769	European pilchard	8,300-15,000
Pigs	1,313	Atlantic mackerel	1,400-1,700
Sheep	527	Total wild fish	970,000-2,700,000
Goats	398		(77,388,322 tonnes)
Cattle	298		
Total mammals	2,572		
Farmed fish (Est)	6,400- 110,000		

There is no humane slaughter for fish



- <http://www.guardian.co.uk/commentisfree/cif-green/2010/sep/14/fish-forgotten-victims>

Omega 3

- **Fish are not the sole source of Omega 3 fatty acids. Other options include:**
 - ✓ **Flax oil and seeds**
 - ✓ **Hemp oil and seeds**
 - ✓ **Walnuts**
 - ✓ **Oil from single-cell algae**
 - ✓ **Supplements (look for non-gelatin capsules)**

Marine Reserves

- A subset of “Marine Protected Areas”
- Ocean areas where there is no removal of animals and plants, and no altering of the habitat

Effects of Marine Reserves

- Biomass increase by 446%
- Density of plants and animals increased 166%
- Body size of animals increased 28%
- Species density increased 21%
- Source: <http://www.piscoweb.org/outreach/pubs/reserves>
- Ultimate source: http://www.piscoweb.org/files/file/science_of_marine_reserves/Lester_etal_2009_MEPS.pdf

Effects of Marine Reserves

