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SIXTH EDITION

Invitation to Oceanography

Chapter 14

The Ocean's Resources

Policies on Marine Study

Several treaties regarding ownership and exploitation of marine resources have been ratified in the last fifty years.

- In 1954, President Truman extended U.S. control of the marine resources from the shoreline to a depth of 100 fathoms (183 m).
- The 1958 and 1960 Geneva Conventions on the Law of the Sea resulted in a treaty.
  - The country that owns the nearest land controls the:
    - sea bed
    - sea bed resources
    - water of the continental shelf

The 1982 United Nations' Draft Convention on the Law of the Sea

- It established territorial waters and an **Exclusive Economic Zone (EEZ)**
  - It extends for 200 nautical miles offshore **or**
  - to the edge of the continental shelf, if that is farther
- EEZs contain about 40% of the ocean
  - The high seas represent the remaining 60%.

Exclusive Economic Zones (EEZ)

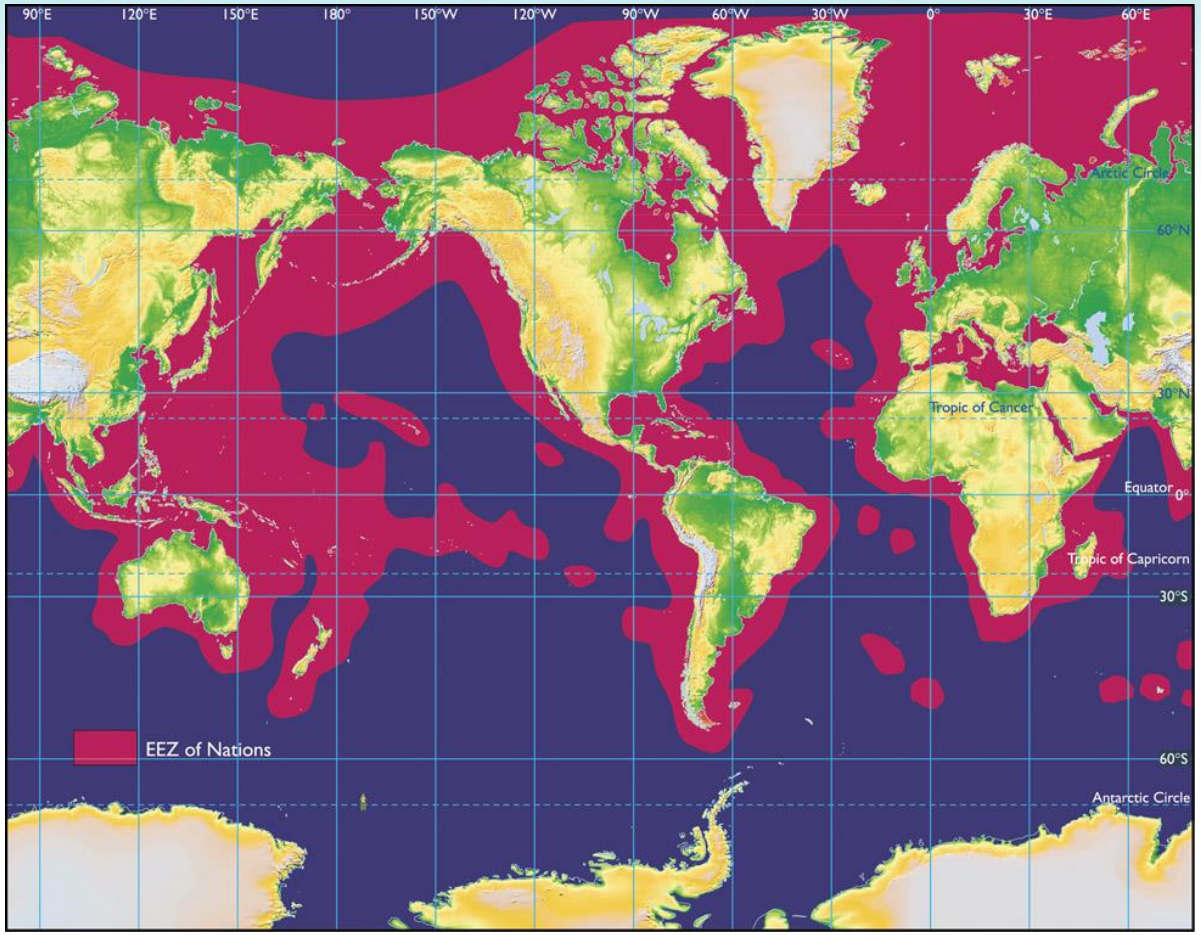

Figure 14.01: More than 40 percent of the world's ocean area is controlled by national governments.

EEZ of the United States

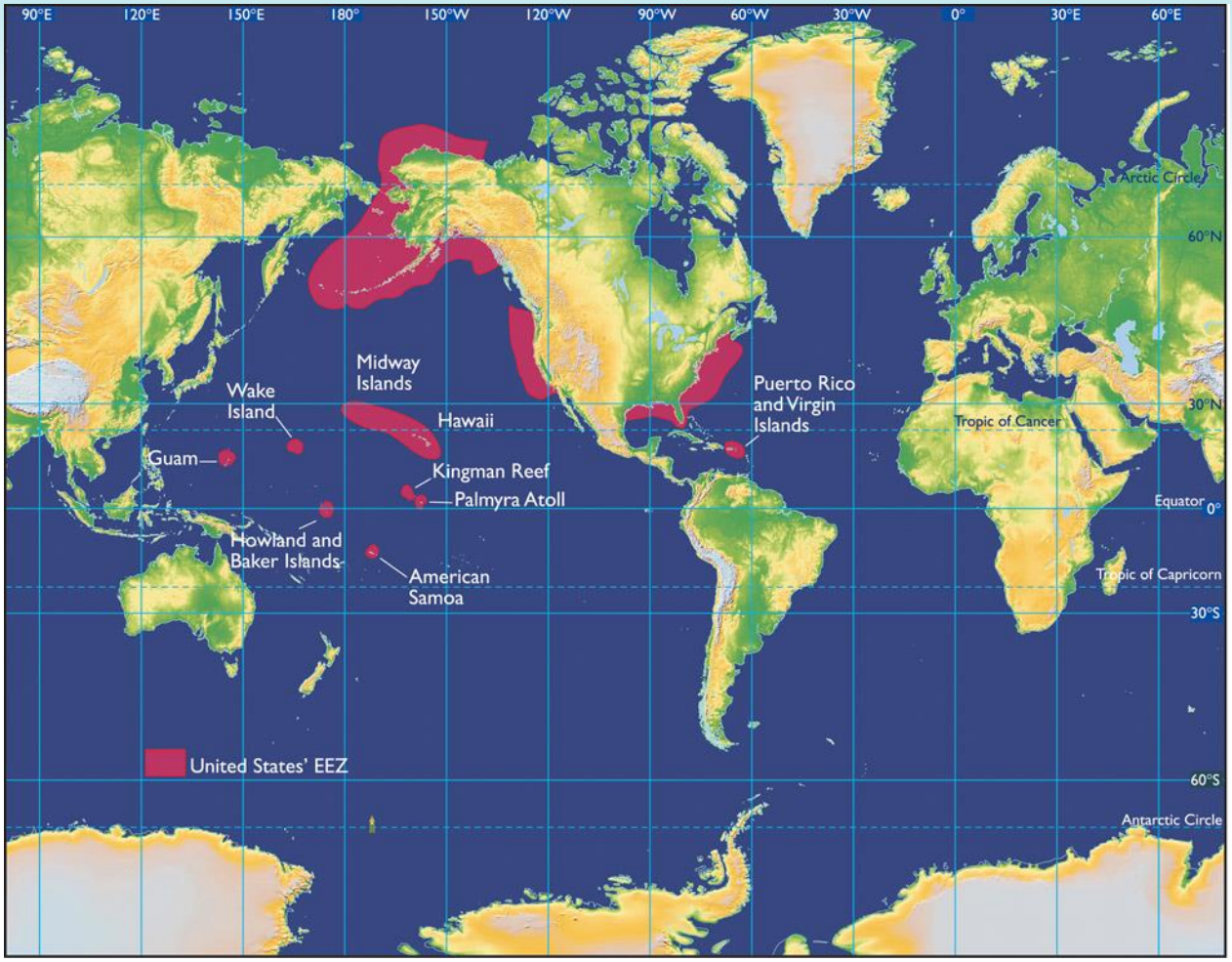

Figure 14.02: Exclusive Economic Zones of the United States.

Hydrocarbons

- **Hydrocarbons** are compounds that contain mostly hydrogen and carbon.
  - Common hydrocarbons include petroleum, oil and natural gas (methane, CH_4).

- Hydrocarbons are derived from marine sedimentary rocks that contain large amounts of organic matter, mostly the remains of dead plankton that did not oxidize or fully decay.

- In the geologic past, mud and remains of plankton accumulated on the sea bottom and were preserved by anoxic water.

- These deposits were buried and resulting high temperatures transformed the organic material into hydrocarbons.

Sand and Gravel on the US continental shelves

Figure 14.05: Sand and gravel deposits of the United States continental shelf.

Manganese Nodules

- are composed of about:
  - 20-30% manganese
  - 10-20% iron oxide
  - 1.5% nickel
  - less than 1%
    - cobalt
    - copper
    - zinc
    - lead

- Locally, the nodules can be very abundant, as on the subtropical sea floor of the Pacific Ocean, where billions of kilograms occur.
- Currently, there are legal, economic, and environmental problems associated with mining nodules from the deep sea.
- There are also technological challenges and extreme costs associated with large scale exploitation plans.

Manganese Nodules on the sea floor

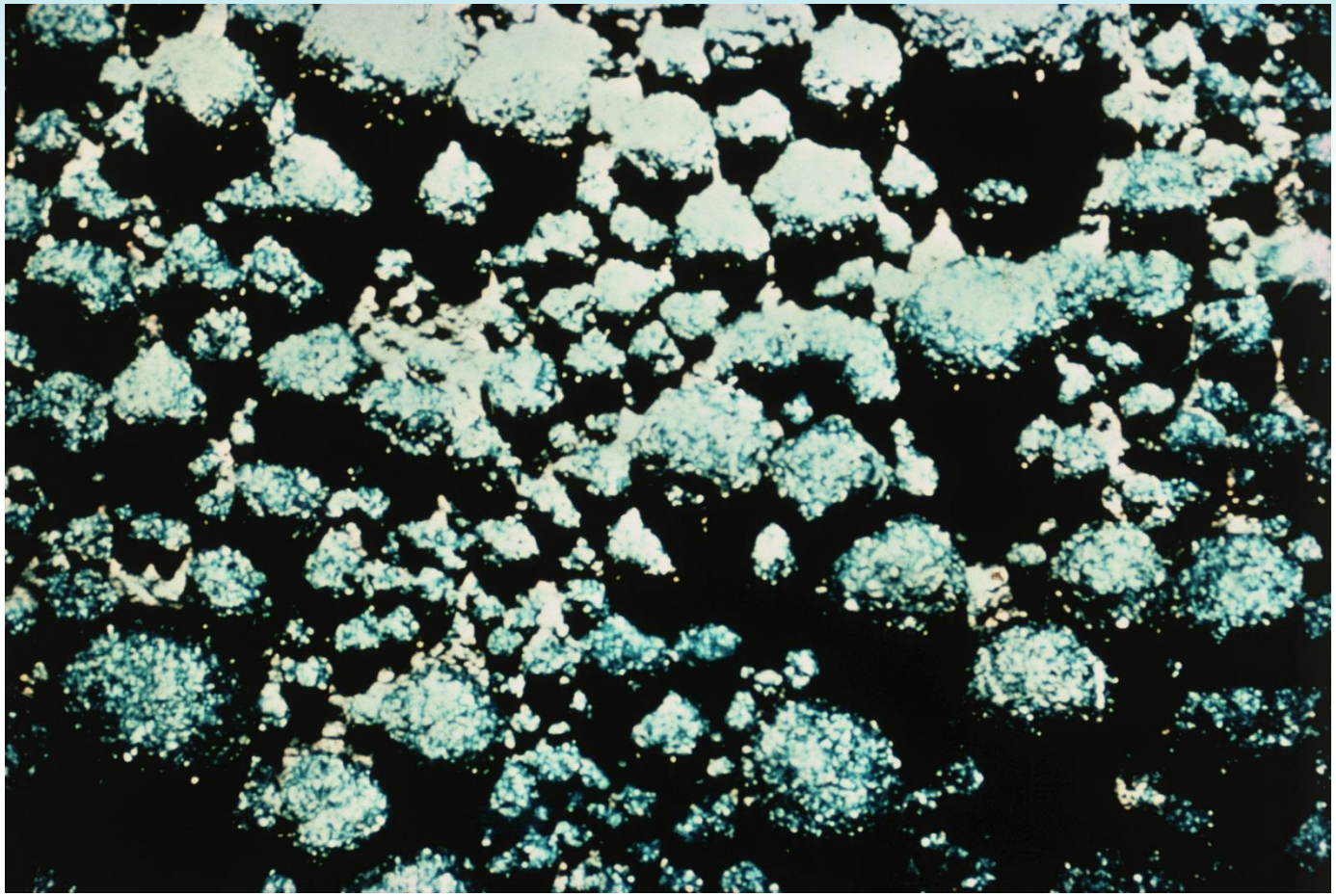

Figure 14.06: Photograph of a dense concentration of nodules blanketing the sea bottom of the South Pacific Ocean.

Cobalt

- The sides of many seamounts and islands are enriched in cobalt between the depths of 1 and 2.5 km.
  - The element forms a crust due to chemical reactions between rocks and seawater.

- Cobalt is a strategic metal used in making jet engines.
  - The U.S. can not produce sufficient cobalt to meet its needs.

Phosphorus

- Phosphorus is required for growth by all organisms.
- Deposits generally form on submarine terraces where coastal upwelling generates high productivity.
- Organic wastes and remains accumulate in the sediment.
- As they decay, they release phosphorus compounds, which precipitate as phosphate nodules.

Phosphorus

- Nodules grow at the rate of about 1 - 10mm/1000 years.
- World consumption of phosphate by chemical and agricultural companies is about 150 million tons per year.
- Known supplies should last until 2050.

Fish

- Marine finfish are divided into:
  - pelagic fish
    - live in the water column
  - groundfish
    - live near or on the sea floor

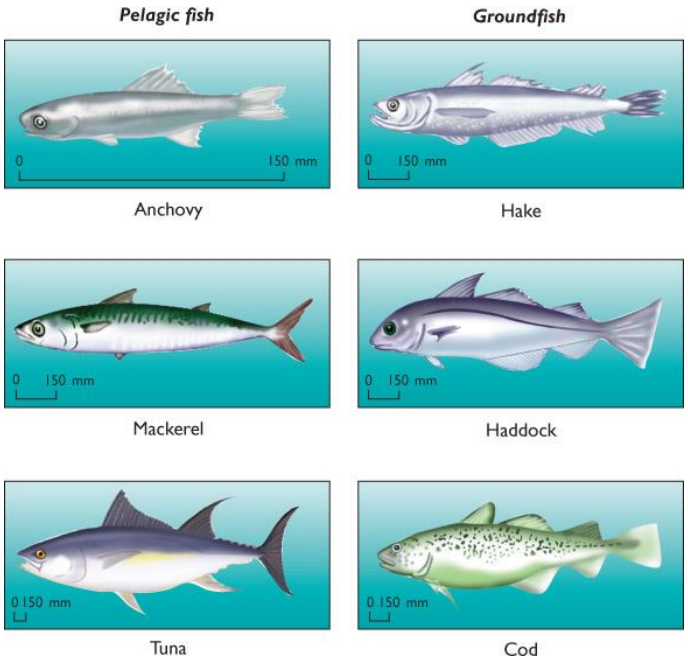

Figure 14.07: Various commercially important fishes.

Ocean Fisheries

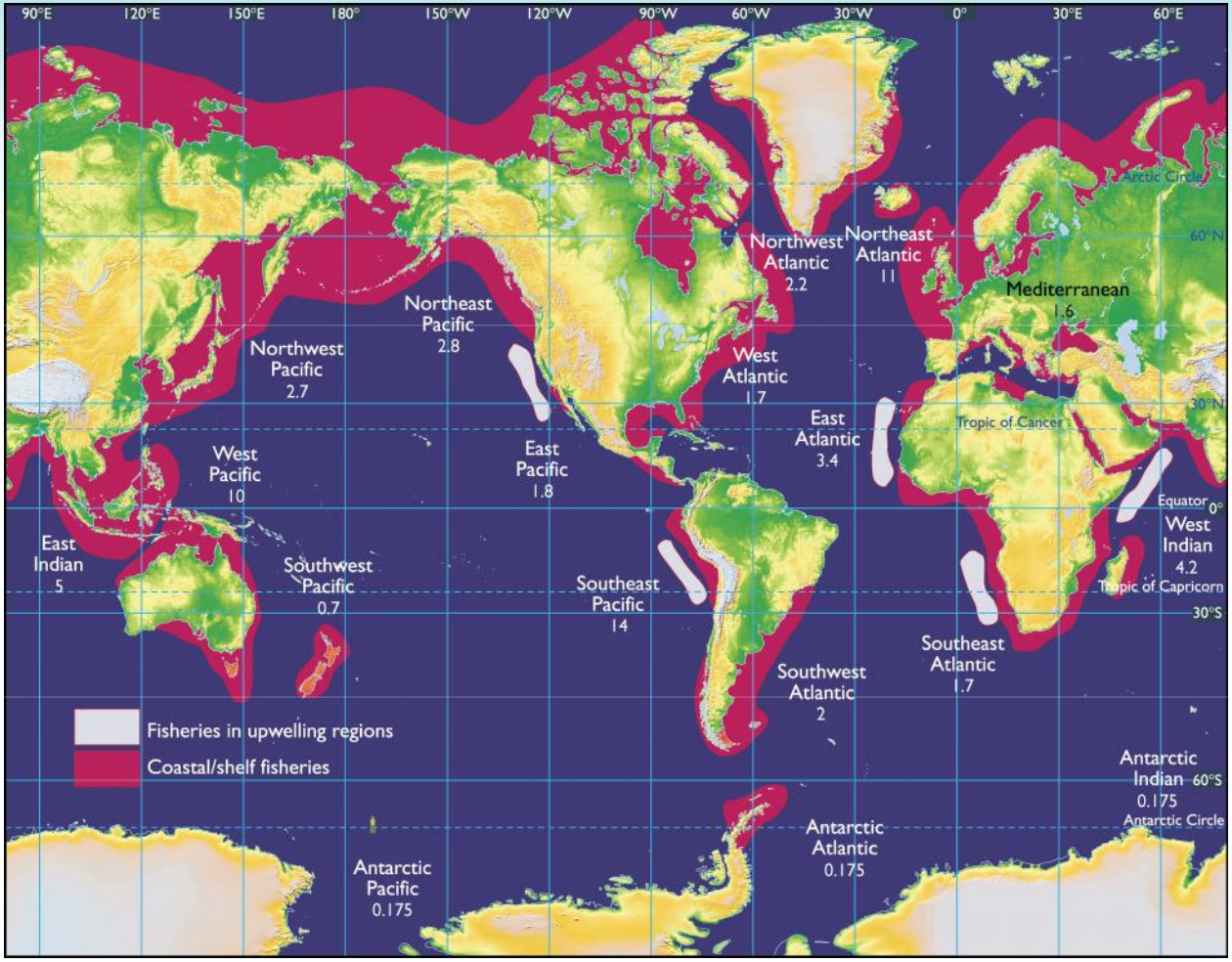

Figure 14.08: Location of world's major commercial fisheries and the tonnage (in millions) of the total fish catch for 2002.

Drift Nets

- are controversial.

- They capture everything too large to pass through the mesh of the net, needlessly killing many organisms.
  - The 1989 United Nations' Convention for the Prohibition of Long Drift Nets prohibited drift nets longer than 2.5 km.
    - Compliance is largely voluntary and impossible to enforce on the open sea.

Fishing

- World ocean fish production appears to have leveled at between 80 and 90 million tons annually.

- Currently, the expense incurred in fishing exceeds the profit from the sale of the fish.

- Fishing industries only survive through government subsidy.

Mariculture is marine agriculture or fish farming of finfish, shellfish, and algae

- Mariculture requires raising the organisms under favorable conditions until they are large enough to be harvested for food.
- Currently, about one out of every four fish consumed was raised in mariculture production.
- For some organisms the percentage supplied by mariculture is even larger.
  - Salmon
  - Oysters
  - Mussels

FIGURE 14-8

The practice of mariculture. Oysters being grown in coastal waters.