

# **Sustainable Seas - Marine Fisheries Fisheries and Fishing**

## **Maximum Sustainable Yield and Fishery Management**

### **Mariculture**

#### **Reading:**

**Ch 9: 9.12**

**Ch 14: 14.7-14.9**

**Ch 17: 17.1, 17.17-17.21,17.25**

Graphic: Chub mackerel catch, Peru, T.Dioses, photographer, courtesy of National Marine Fisheries Service, NOAA.

### **Fishing Facts**

**36 million people worldwide earned their living by fishing in 1998**

**16 percent of animal protein consumed by people worldwide comes from fish**

**75% the world fish catch is used for human consumption**

Data source: Food and Agriculture Organization of the United Nations.

Graphic: Fishing in the Eastern Atlantic. J.Prado, photographer, courtesy of NOAA.

### **How Many Fish are in the Sea? What Determines Support for the Food Web? The Cod Wars (Late 1950's to mid 1970's)**

**Cod was so important to Iceland and Britain that they almost went to war over fishing rights three times in the 20<sup>th</sup> century**

**These conflicts led to the development of Exclusive Economic Zones (EEZs)**

Graphic: Garrison, Fig. 17.33.

## Where are the Fish?

**>75% of the world's fish is caught in estuaries, nearshore regions and on the continental shelves**

Data source: National Academy of Sciences

Graphic: (top) Ocean color, an estimate of the distribution of marine plants, image by the SeaWiFS project, NASA/Goddard Space Flight Center and Orbimage. See Garrison Fig. 13.6, (bottom) UN Food and Agriculture Organization.

## Some Commercially Important Fish

**National Academy of Sciences: 10 major species represent 35% of world fish catch**

Graphic: See Garrison, Table 17.1.

## Current Issues in the Marine Fishing Industry

### Viability of the Industry

- return on investment
- safety
- access to stocks

### Resource Management

- sustainable yields
- bycatch
- impacts on habitat and ecology

Graphic: High-tech equipment is used to locate schools of tuna. A. Urcelayeta, photographer. Courtesy of United Nations Food and Agriculture Organization and NOAA.

## What Does it Take to Sustain a Commercial Fishery?

**The needs of the fish must be met during each stage of their life...**

**Habitat - some fish need nearshore habitat as juveniles and offshore habitat as adults - others live only near specific ocean features (e.g., undersea mountains, "seamounts")**

## Gear Selectivity

### Trawls

- bycatch

- disturbance of bottom ecosystems

### Purse seines

- can catch mammals, juvenile fish

### Longlines and gillnets

- can catch seabirds
- abandoned equipment continues "fishing"

Graphics: (top) separating shrimp from bycatch, National Marine Fisheries Collection, courtesy of NOAA, (bottom) "ghost" pot off Kodiak Island, Alaska, courtesy of National Marine Fisheries Service, NOAA.

## **Maximum Sustainable Yield (MSY)**

**MSY: The maximum amount that can be caught without impairing future stocks**

**Managing at MSY must consider:**

- need for breeding stock
- availability of food for animals higher in the food web

Graphic: Catch from a purse seine, National Marine Fisheries Collection, courtesy of NOAA.

## **Possible Consequences of Exceeding MSY**

- 1. More effort required to catch a smaller amount of fish**
- 2. Degradation of marine environment due to more invasive fishing techniques**
- 3. Short-term collapse of the commercial fishery**
- 4. Disruption of ecosystem if the fished species is replaced with other species**
- 5. Long-term collapse of the commercial fishery**

## **World Fish Catch (1950's-2000's)**

### **World Fisheries By the Numbers**

**World marine fish catch from wild sources is currently flat or declining**

**About 70% of world fisheries are now fully or over fished**

Source: (top) World fish catch 1950-2000, (bottom) Development of world fisheries, 1951-2005, both courtesy of UN Food and Agriculture Organization.

## **Peruvian Anchovies: "Short-Term" Collapse of**

### **a Commercial Fishery**

**Rapid development of the fishery was followed by a collapse in the fish's population and slow recovery of the commercial fishery**

Graphic top: Northern anchovies, cousin of the Peruvian anchovy. Courtesy of NOAA/NURP.

## **Management Strategies Used in Peru The North Atlantic Cod Fishery (Georges Bank) Ecosystem Reorganization: Lessons Learned from Georges Bank**

**After collapse of the Georges Bank (NW Atlantic) cod, haddock and flounder fishery the fishery never recovered**

**Before stocks could rebuild, the ecological niche of these valuable commercial species was filled by "trash" fish - skates and dogfish**

## **Managing for Future Sustainability? Orange Roughy (aka Slimehead)**

**Clever marketing and good eating created a strong demand in the 1980's**

**1998 exports from New Zealand = \$80 million**

**Management challenges:**

- slow-growing, long-lived**
- 20-30 years from birth to breeding age**
- small size (30-40cm)**
- unknown juvenile ecology**

Graphics: courtesy of New Zealand Ministry of Fisheries.

## **Today's Orange Roughy Fishery**

### **Mariculture – The Next Wave in the Marine Fishing Industry**

**Mariculture = Farming of marine organisms (in estuaries, bays, nearshore environments or specially designed structures)**

**Aquaculture = Farming of aquatic organisms (freshwater or marine)**

**By 2030 aquaculture will dominate fish supplies, less than half of consumption will be from "captured" fish<sup>1</sup>**

<sup>1</sup> United Nations Food and Agriculture Organization, 2000 Report

Graphic: Courtesy of U.N. Food and Agriculture Organization.

## **Mariculture and the Future – Coming Soon to a Grocery Near You**

**Species that can be maricultured...**

- desirable as food and easy to market**

- **uncomplicated life cycles**
- **disease resistant**
- **high growth rate in small spaces**
- **easy and cheap to feed**
- **simple habitat**

Graphic: Floating fish cage, J.P.McVey, photographer, courtesy of NOAA.

## **Mariculture in the U.S. Today**

### **Challenges:**

- **high permit and investment costs**
- **conflicts over land use and ecological impacts**

### **Some successfully marketed species:**

- **oysters, clams, mussels, salmon, shrimp**

Graphics: (top) Plastic tanks used for aquaculture, Florida. E.McVey, photographer, (bottom) First harvest of cultured cobia at the Florida research laboratory. J.Alarcon/D.Benetti, photographer. Both courtesy of NOAA

## **Preview of Next Lecture**

### **Marine Pollution**

### **Reading: 18.2-18.9**

Graphic: Marine sediments being analyzed for oil contamination following a January 1996 spill of 828,000 gallons of home heating oil into coastal waters of Rhode Island. Photo courtesy of NOAA Damage Assessment and Restoration Program.