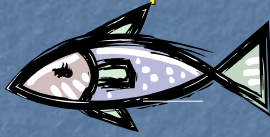
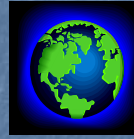


## Biotechnology and Seafood Part One: An Overview of the Status and Predictions for Seafood Consumption and Supply



Michael Morrissey, Director, Food Innovation Center  
and Rosalee Rasmussen, OSU Seafood Laboratory

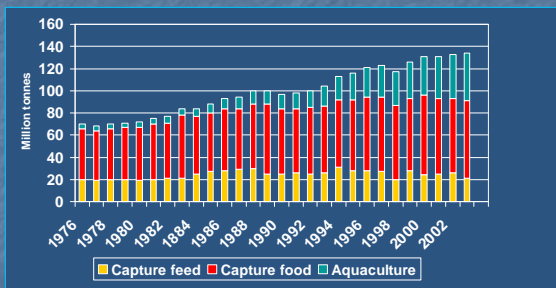
## World Seafood Supply ?



FAO, 2005

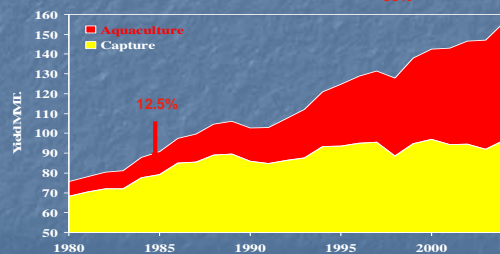
- Most world *known* fisheries are at capacity
- Current aquaculture represents > 35%
- Wild catch, 75% Edible + 25% Industrial
- Anticipate >10 million metric ton deficit by 2015
- Aquaculture production must double by 2050

## The global supply from the oceans



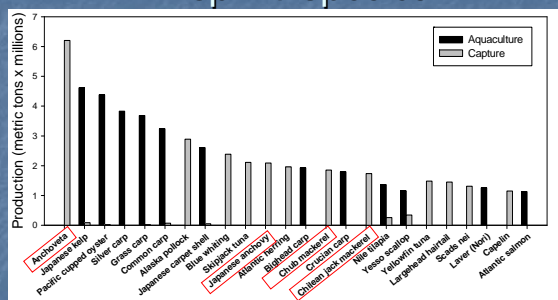
FAO 2005

## Recent Trends in Aquaculture and Fisheries



FAO 2005

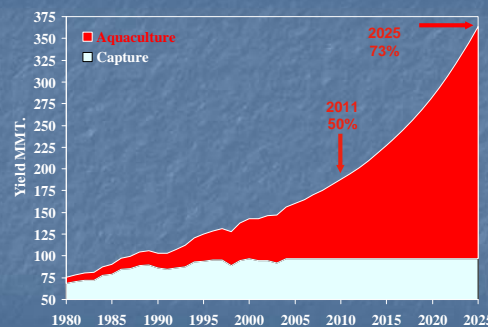
## Top 24 Species



Portion of wild fishery used for aquaculture feeds

From Aaron McNevin (WWF)

## Future Trends in Aquaculture and Fisheries



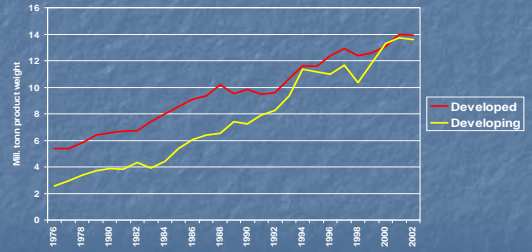
FAO data and Diana projection

## Growth in Aquaculture will take place in Developing Countries

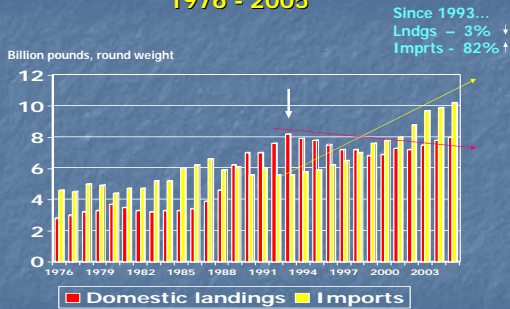


1. Income through exports
2. Needed protein for domestic consumption

## Global exports of seafood products from developed and developing countries

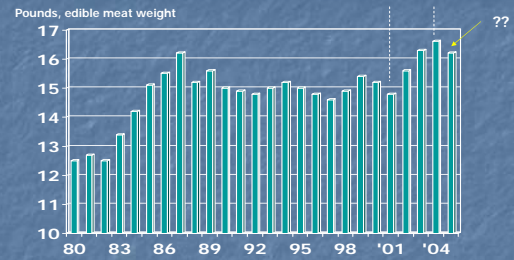


## Sources of Edible US Seafood Supply 1976 - 2005



Source: "Fisheries of the United States", various years. NOAA / NMFS.

## Per Capita Consumption of Edible Seafood in US



Source: "Fisheries of the United States", various years. NOAA / NMFS.

## Seafood Preferences in USA

Rank	1990		2000		2005	
1	Tuna	3.7	Tuna	3.5	Shrimp	4.1
2	Shrimp	2.2	Shrimp	3.2	Tuna	3.1
3	Cod	1.4	Pollock	1.6	Salmon	2.4
4	Pollock	1.3	Salmon	1.6	Pollock	1.5
5	Salmon	0.7	Catfish	1.1	Catfish	1.0
6	Catfish	0.7	Cod	0.8	Tilapia	0.9
7	Clams	0.6	Clams	0.5	Crab	0.6
8	Flatfish	0.6	Crabs	0.4	Cod	0.6
9	Crabs	0.3	Flatfish	0.4	Clams	0.4
10	Scallops	0.3	Scallops	0.3	Flatfish	0.3

(per capita; NMFS 2006)

## Traditional Preferences

Rank	1990		2000		2005	
1	Tuna	3.7	Tuna	3.5	Shrimp	4.1
2	Shrimp	2.2	Shrimp	3.2	Tuna	3.1
3	Cod	1.4	Pollock	1.6	Salmon	2.4
4	Pollock	1.3	Salmon	1.6	Pollock	1.5
5	Salmon	0.7	Catfish	1.1	Catfish	1.0
6	Catfish	0.7	Cod	0.8	Tilapia	0.9
7	Clams	0.6	Clams	0.5	Crab	0.6
8	Flatfish	0.6	Crabs	0.4	Cod	0.6
9	Crabs	0.3	Flatfish	0.4	Clams	0.4
10	Scallops	0.3	Scallops	0.3	Flatfish	0.3

(per capita; NMFS 2006)

## New Choices in USA

Rank	1990	2000	2005
1	Tuna 3.7	Tuna 3.5	Shrimp 4.1
2	Shrimp 2.2	Shrimp 3.2	Tuna 3.1
3	Cod 1.4	Pollock 1.6	Salmon 2.4
4	Pollock 1.3	Salmon 1.6	Pollock 1.5
5	Salmon 0.7	Catfish 1.1	Catfish 1.0
6	Catfish 0.7	Cod 0.8	Tilapia 0.9
7	Clams 0.6	Clams 0.5	Crab 0.6
8	Flatfish 0.6	Crabs 0.4	Cod 0.6
9	Crabs 0.3	Flatfish 0.4	Clams 0.4
10	Scallops 0.3	Scallops 0.3	Flatfish 0.3

(per capita; NMFS 2006)

## Other Seafood Consumption Notes ...

Seafood purchases by consumers was \$65.2 Billion in 2005, up by 5% from 2004

77% eat seafood at least once a month

Of those, 51% eat more than 5 years ago

58% consumers eat more seafood than 2 years ago ... reason: Health (64%) Taste (60%) Variety (52%)

Source: H.M. Johnson & Associates

## Omega-3 Fatty Acids

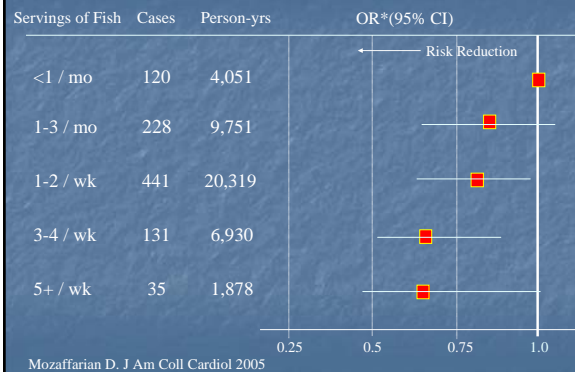
eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)

- Heart disease
  - Reduces incidence of CHD
- Type II diabetes
  - Lower incidence
- Cancer
  - inhibits cancer and tumor growth
- Immune Response
  - improved resistance to disease
- Nervous System
  - neurodevelopment in infants
- Lessens depression, bipolar disorder



Japanese infant formula with DHA

## Tuna/Other Fish and Congestive Heart Failure



## Recommended Guidelines

- Current American diets are 5oz/person/wk
- American Heart association recommends two 6 oz. Servings per week
- Need to increase supply in the U.S. from 4.5 billion lbs to 10 billions lbs.
- Where will the fish come from?

## Seafood Sources for USA

Choices	Supply Trend	Domestic Supply		Imported	
		Harvest	Farmed	Harvest	Farmed
Shrimp	↑ Incr.	Limited	↑ Pend.	↑ Incr.	↑ Incr.
Salmon	↑ Incr.	Limited	Limited	↑ Incr.	↑ Incr.
Tilapia	↑ Incr.	Limited	↑ Pend.	Limited	↑ Incr.
Catfish	↑ Incr.	Limited	↑ Pend.	↑ Incr.	↑ Incr.
Cod	Limited	Limited	N.A.	Limited	↑ Pend.
Flatfish	Limited	Limited	N.A.	Limited	↑ Pend.
Tuna	Limited	Limited	N.A.	Limited	N.A.
Haddock	Limited	Limited	N.A.	N.A.	N.A.
O.Perch	Limited	Limited	N.A.	N.A.	N.A.
Pollock	Limited	Limited	N.A.	N.A.	N.A.

**Bottom Line ...**

**Demand will continue to *exceed* Supply**

***No News Flash!!!***

But how will continued pressure on wild stocks and the aquaculture industry worldwide ...

*... and the Supply issues that may arise ...*

*influence future quality, safety, and supply consistency ... and thus consumer confidence ... for seafood products in the US??*



**Traditional Sources?**


- Fisheries Management for wild captures has reached or exceeded maximum sustainable yields for most traditional and popular selections

**Is Cultured Product the Seafood Messiah?**

- World aquaculture since 1970's increased about 1% in volume per year vs. population increases >3% per year ..... until most recently increases in aquaculture involved products not commonly selected in the USA

Growing dependence on **aquaculture** will pose new consumer-related challenges...

New choices offer more selections, but the introduction can be confused with traditional product values



Tilapia      Basa      Barramundi

Growing dependence on **aquaculture** will pose new trade-related challenges...

Product identity and traceability can be questioned

**Species Identity**




**Traceability**



\*FDA currently inspects only 1% of food imports" ... seafoodnews.com (3/19/07)

Growing dependence on **aquaculture** will pose new environmental and political challenges...

Increasing production promises more supply, but expansion can impact environments and socio-economic situations..... This is not so different from other agriculture situations, forestry and other resource uses.



**"Sustainability"** permeates US / World fisheries management efforts ...

1996 Sustainable Fisheries Act → NMFS, Office of Sustainable Fisheries

... and **"Sustainability"** is influencing domestic and international seafood marketing

Marine Stewardship Council (MSC) → Walmart

Earth Easy → Sustainable Seafood Brands (Vital Choice Seafoods, Ecofish, Wild Catch, etc)

Monterey Bay Aquarium (Seafood Watch guide cards)

Other environmental groups joining in on the Sustainable Harvest / Culture concern ...

World Wildlife Fund  
 Environmental Defense Fund  
 Sustainable Fisheries Foundation

Audubon Society  
 Food and Water Watch  
 National Environmental Trust

Seafood Choice Alliance  
 Fish for the Future Foundation  
 Project Aware  
 Sustainable Fisheries Initiative (New England Aquarium)

Additional emerging theme.....Natural Seafood



All Natural Salmon by 2009

Natural seafood is the best

Natural Seafood for pets



... potential confusion !

### Negative Impacts – GMOs

- Factors limiting escapee impacts
  - Most fish have been little domesticated; that is, they are essentially wild fish



### What about Developing Countries?

- Improved fish growth rates
- Improved feed conversion
- Increased net profits
- Increase marine protein supply



### Home grown & Hand Harvested

