

**FISH, FISHERIES  
&  
FOOD SECURITY**

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# OUTLINE

- Recent dietary recommendations for seafood
- How much fish production?
- Climate change and productivity
- Closing remarks

N.Y. Times 11-6-201

REGIMENS

## For Omega-3s, Fish May Do More Than Pills

4 5 6 7

Eating fish high in omega-3 fatty acids slightly reduces the risk for stroke, a large review of studies has found, but taking supplements of omega-3 fatty acids does not have the same effect.

Researchers writing in the online journal *BMJ* reviewed data from 38 studies that included almost 800,000 subjects and 34,817 cerebrovascular incidents. The studies varied in size and methodology; some were based on self-reporting of diets, some on blood tests, some on supplements. The researchers reviewed studies of healthy people and of those who had cerebrovascular disease.

The data showed that eating two to four servings of fish a week

reduced stroke risk by 6 percent compared with eating one serving or less, and having five servings a week reduced the risk by 12 percent. But the results of the randomized trials that had used omega-3 supplements showed no significant effect on risk.

"We think any beneficial effect of omega-3s is quite small," said the lead author, Rajiv Chowdhury, an epidemiologist at the University of Cambridge, "whereas fish comes with a package of many good nutrients and only small amounts of saturated fat."

What you do not eat when you eat fish may be just as important, Dr. Chowdhury said. "When you eat fish more frequently, you eat smaller amounts of potentially bad proteins like red meat."



# DIETARY RECOMMENDATION

Source	Recommended ounces/week			Species
	Adults	Children	Combined	
American Heart Association <a href="http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/Fish-101_UCM_305986_Artic">http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/Fish-101_UCM_305986_Artic</a>			7.0 or more	Preferably fatty
Association of Reproductive Health Professionals <a href="http://www.arhp.org/publications-and-resources/quick-reference-guide-for-clinicians/fish-and-health/translating">http://www.arhp.org/publications-and-resources/quick-reference-guide-for-clinicians/fish-and-health/translating</a>	6-12	6-12		
Harvard School of Public Health <a href="http://www.hsph.harvard.edu/nutritionsource/fish/">http://www.hsph.harvard.edu/nutritionsource/fish/</a>			3-6	Fatty fish
IOM Seafood Choices: Balancing Benefits and Risks <a href="http://www.nap.edu/catalog/11762.html">http://www.nap.edu/catalog/11762.html</a>	6-12	6		Avoid top predators

# DIETARY RECOMMENDATION

Two servings 3-6 ounces of fish a week; 0.375-0.75 lb a week

Order of magnitude calculation:

$0.375\text{-}0.75 \text{ lb/week} \times 52 \text{ weeks} = 19.5\text{-}39 \text{ lbs/person/yr}$

$3.15 \times 10^8 \text{ people} * 19.5\text{-}39 \text{ lb/person} = 6\text{-}12 \times 10^9 \text{ lbs}$

Following the recommendation gives a US consumption of 6-12 billion lbs of processed fish (fillets, etc.)

# DIETARY RECOMMENDATION

How many pounds does  $6-12 \times 10^9$  lbs of processed fish equal in fish in the round (whole, unprocessed)?

# DIETARY RECOMMENDATION

Eric,  
Seafood Manager at Whole Foods,  
gets a ratio of  
50% fillets from round weight  
(weight of whole, unprocessed fish).



# DIETARY RECOMMENDATION

Species	Yield	
	Skinless fillet	Edible flesh
Alaska Pollock	36	41
American plaice	34	49
Anchoveta	51	62
Atlantic cod	34	47
Atlantic herring	46	61
Mackerel	54	61
Redfishes	29	45
Salmon	50	62
Haddock	35	48
Pacific cod	30	41
Tilapias	37	37
Tuna	30	58

Average

39

51



# DIETARY RECOMMENDATION

How many pounds does 6-12 billion lbs of processed fish equal in fish in the round?

With a ratio of  $\frac{1}{2}$  of processed to unprocessed fish, this equates to 12-24 billion lbs of landed, whole fish

# SOURCE OF HARVEST

## § Capture Fisheries

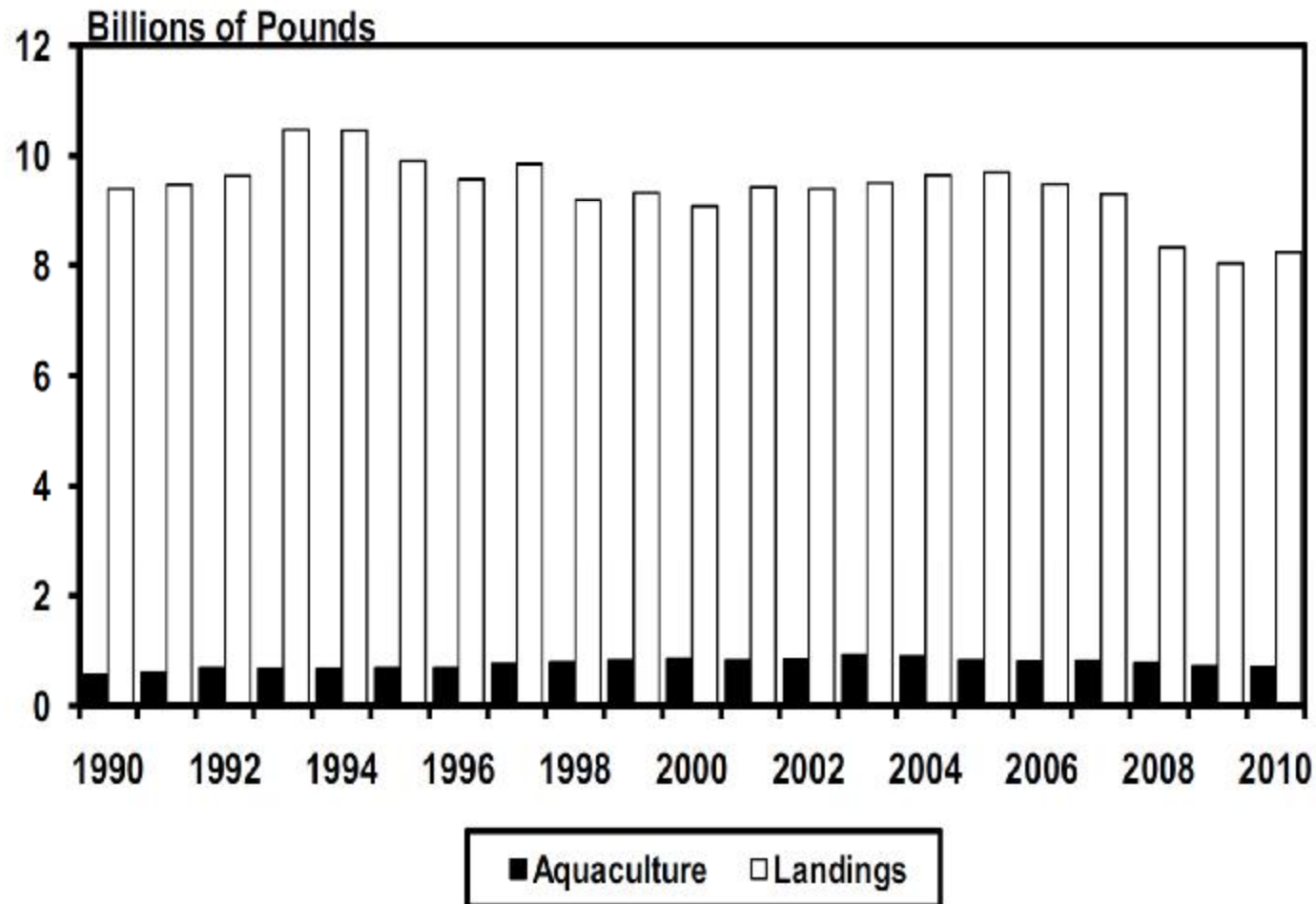
- Commercial
- Recreational

## § Aquaculture

# SOURCE OF HARVEST

Volume of Domestic Commercial Landings and Aquaculture Production

Note: The 2010 aquaculture production is estimated



# SOURCE OF HARVEST

<u>Rank</u>	<u>Species</u>	<u>Pounds (10<sup>3</sup>)</u>	<u>Overfished</u>	<u>Overfishing</u>
1	Pollock	2,826,692	No	No
2	Menhaden	1,875,035	No	Yes
3	Salmon	780,088	Varies	Varies
4	Flatfish	707,360	Varies	Varies
5	Cod	681,895	Varies	Varies
6	Hakes	521,246	No	No
7	Crabs	369,152	Varies	No
8	Squid	331,343	No	No
9	Schrimp	312,658	Varies	Varies
10	Herring	276,341	No	No

[http://www.fishwatch.gov/seafood\\_profiles/index.htm](http://www.fishwatch.gov/seafood_profiles/index.htm)

# DOMESTIC HARVEST SUMMARY

All U.S. Landings =  $9.9 * 10^9$  lbs (4.5 mmt)

Reduction Fishery =  $1.9 * 10^9$  lbs (3.6 mmt)

Edible fish and seafood landings =  $7.9 * 10^9$  lbs (3.6 mmt)

Recreational fisheries landings =  $2.01 * 10^8$  lbs

U.S. Aquaculture =  $1.2 * 10^9$  lbs

# DOMESTIC SUMMARY

## AVAILABLE:

Edible fish and seafood landings =  $7.9 \times 10^9$  lbs (3.6 mmt)

Recreational fisheries landings =  $2.01 \times 10^8$  lbs

U.S. Aquaculture =  $1.2 \times 10^9$  lbs

Total Edible =  $9.3 \times 10^9$  lbs (4.2 mmt)

## TOTAL RECOMMENDED CONSUMPTION:

$12\text{-}24 \times 10^9$  lbs of landed, whole fish (5.5-10.9 mmt)

# GLOBAL DIETARY RECOMMENDATION

Two servings 3-6 ounces of fish a week; 0.375-0.75 lb a week

Order of magnitude calculation:

$0.375\text{-}0.75 \text{ lb/week} \times 52 \text{ weeks} = 19.5\text{-}39 \text{ lbs/person/yr}$

$19.5\text{-}39 \text{ lbs/person/yr} = 8.9\text{-}17.7 \text{ kg/person/yr}$

$7 \times 10^9 \text{ people} * 9\text{-}18 \text{ kg/person/yr} = 63\text{-}126 \text{ x mmt/yr}$

Following the recommendation gives a World consumption of 63-126 mmt of processed fish (fillets, etc.)

# GLOBAL SUMMARY

## AVAILABLE:

Total Fish Landings= 148 mmt

Available fresh, frozen, cured = 127 mmt

## TOTAL RECOMMENDED CONSUMPTION:

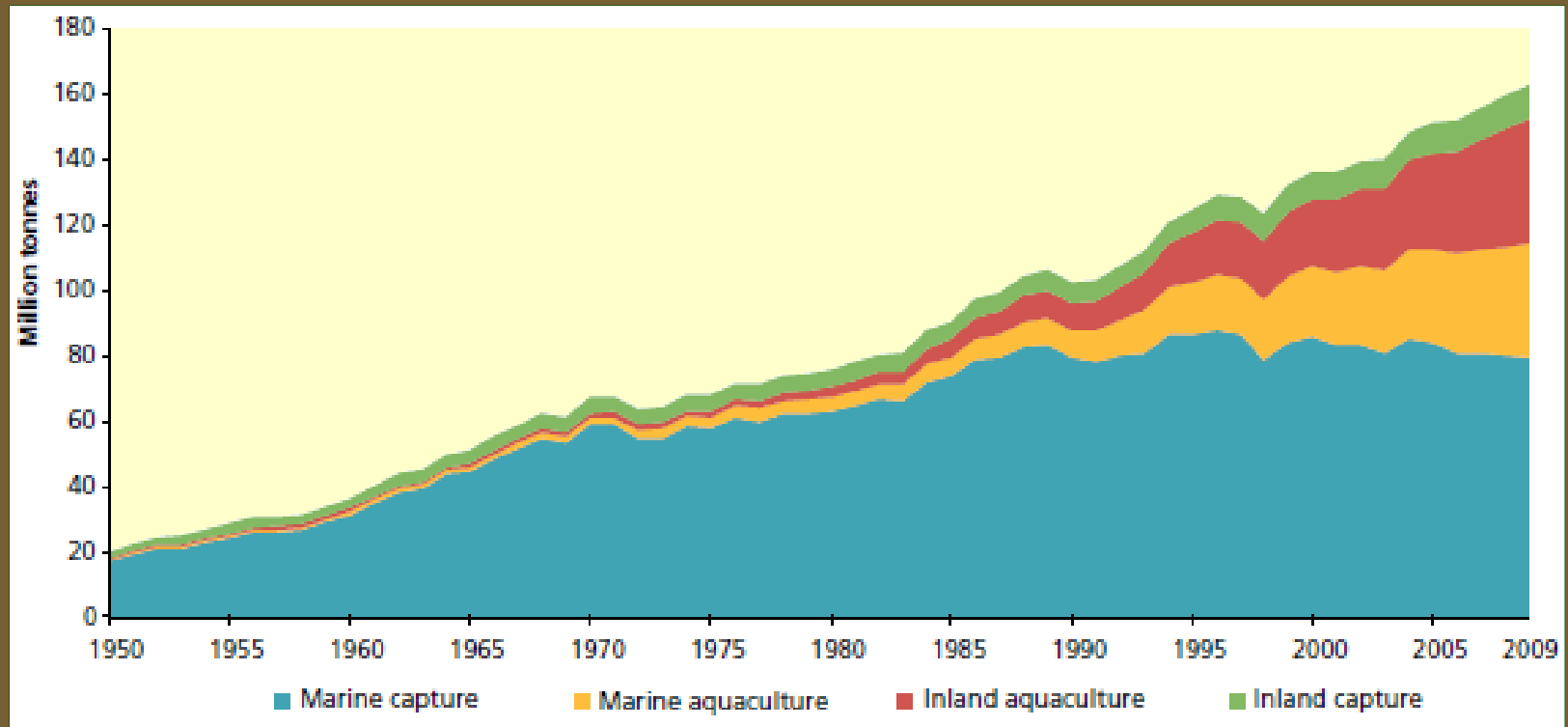
63-126 mmt of processed fish – fish fillets

126-252 mmt of landed, whole fish



# SOURCE OF HARVEST

## Worldwide Production



<http://www.thefishsite.com/articles/1361/global-overview-of-marine-fishery-resources>

# EFFECT OF BETTER MANAGEMENT

Key indicators, annual data (unit)	Current	Rebuilt fisheries		
		Lower bound	Mean	Upper bound
Catch (t)	80.2	82.7	88.7	99.4
Catch value (US\$ billions)	87.7	92.6	100.5	116.3
Variable fishing cost (US\$ billions)	73.0	43.9	36.6	29.3
Normal profit (US\$ billions)	6.1	3.7	3.0	2.4
Wages (US\$ billions)	31.0	18.6	15.5	12.4
Subsidies (US\$ billions)	27.2	10.0	10.0	10.0
Rent net of subsidies* (US\$ billions)	- 12.5	39.0	54.0	77.0
Rent increase over current values (US\$ billions)	-	51.2	66.4	89.4
NPV of resource rent increases (US\$ billions)	-	665.2	972.0	1,428.1
Transition costs** (US\$ billions)	-	129.9	202.9	292.2
NPV net of transition costs (US\$ billions)	-	535.3	769.1	1,135.9

NPV: Net Present Value.

\*The (resource) rent is the return to 'owners' of fish stocks, which is the surplus from gross revenue after total cost of fishing is deducted and subsidies taken into account.

\*\*Transition costs include the costs to society of reducing current fishing effort to levels consistent with maximum sustainable yield and the payments governments may decide to employ to adjust capital and labour to uses outside the fisheries sector. Such payments may include vessel buyback programs and alternative employment training initiatives for fishers.

doi:10.1371/journal.pone.0040542.t001

Sumaila UR, Cheung W, Dyck A, Gueye K, et al. (2012) Benefits of Rebuilding Global Marine Fisheries Outweigh Costs. PLoS ONE 7(7): e40542.

doi:10.1371/journal.pone.0040542

<http://www.plosone.org/article/info:doi/10.1371/journal.pone.0040542>

# SOURCE OF HARVEST

## Increases in Aquaculture?



[ens-newswire.com](http://ens-newswire.com)

# Aquaculture to top 60% of fish production

29 Aug 2012

**Total global fish production, including both wild capture fish and aquaculture, reached an all-time high of 154 million tons in 2011, and aquaculture is set to top 60% of production by 2020.**

Research conducted by the Worldwatch Institute has found that wild capture was 90.4 million tons in 2011, up 2% from 2010. Aquaculture has been expanding steadily for the last 25 years and saw a rise of 6.2% in 2011.

Humans ate 130.8 million tons of fish in 2011, with the rest going to non-food uses such as fishmeal, fish oil, culture, bait, and pharmaceuticals. The human consumption figure has increased 14.4% over the last five years and consumption of farmed fish has risen tenfold since 1970, at an annual average of 6.6% per year.

The report says that "wild fish stocks are at a dangerously unsustainable level". As of 2009 (the most recent year with data), 57.4% of fisheries were estimated to be fully exploited and of the remaining fisheries in jeopardy, around 30% were deemed overexploited, while a little less than 13% were considered to be not fully exploited.

To maintain the current level of fish consumption in the world, the report says that aquaculture will need to provide an additional 23 million tons of farmed fish by 2020. To produce this additional amount, fish farming will also have to provide the necessary feed to grow the omnivorous and carnivorous fish that people want.

Continually increasing fish production, from both aquaculture and fisheries, raises many environmental concerns, says the report, and if aquaculture continues to grow without constraints, it could lead to degradation of land and marine habitats, chemical pollution from fertilizers and antibiotics, the negative impacts of invasive species, and a lessened fish resistance to disease due to close proximity and intensive farming practices.

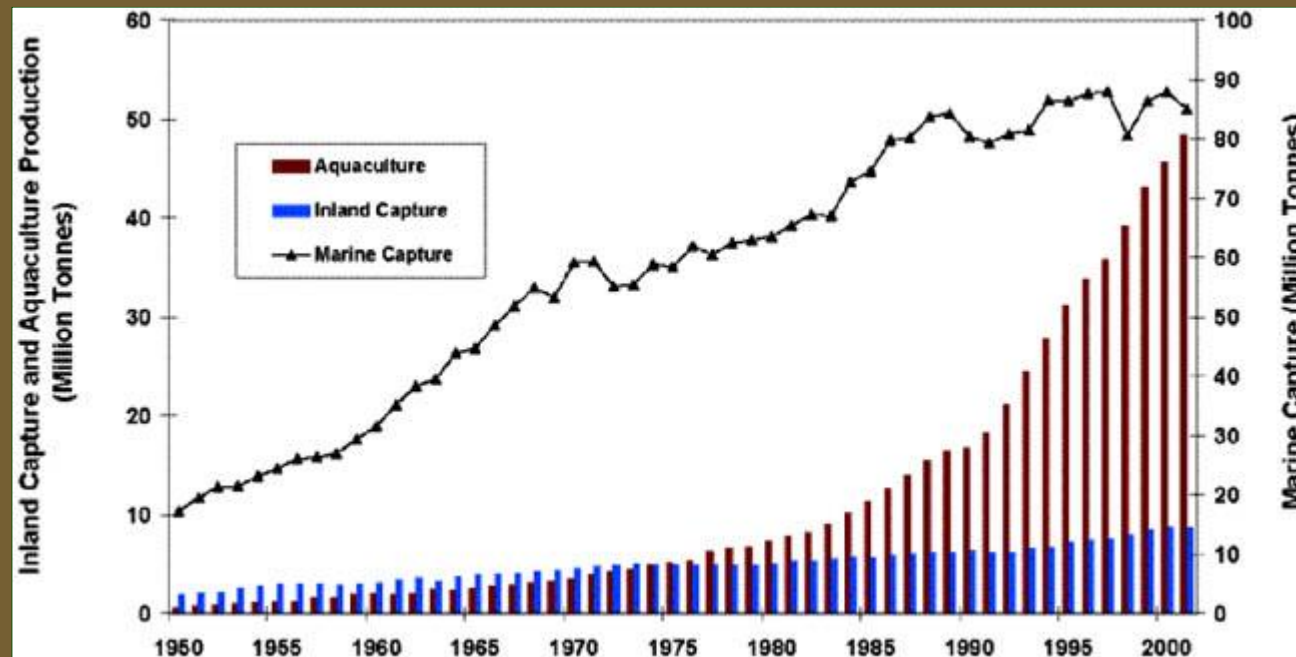
To prevent these problems the report's authors say that policymakers, fishers, and consumers need to find alternative sources for fish feed, combat illegal fishing, encourage more-sustainable practices in aquaculture, acknowledge the potential effects of climate change on the oceans, and think critically about what and how much fish to consume.



A report by the Worldwatch Institute says that aquaculture has been expanding steadily for the last 25 years and saw a rise of 6.2% in 2011.  
Credit: Marco Carè/Marine Photobank

# SOURCE OF HARVEST

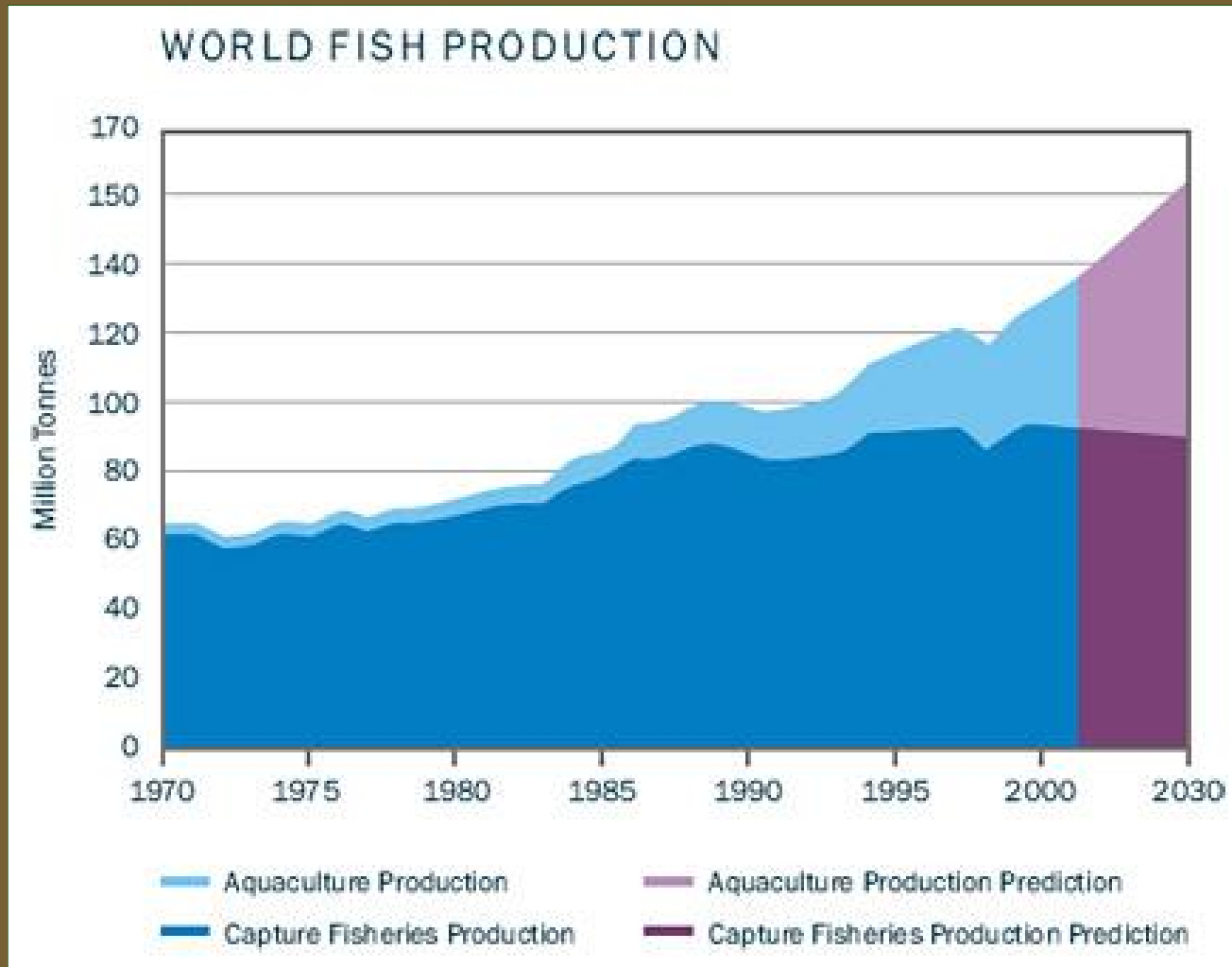
## Worldwide Production



<http://www.fao.org/docrep/006/J0703E/j0703e02.htm>

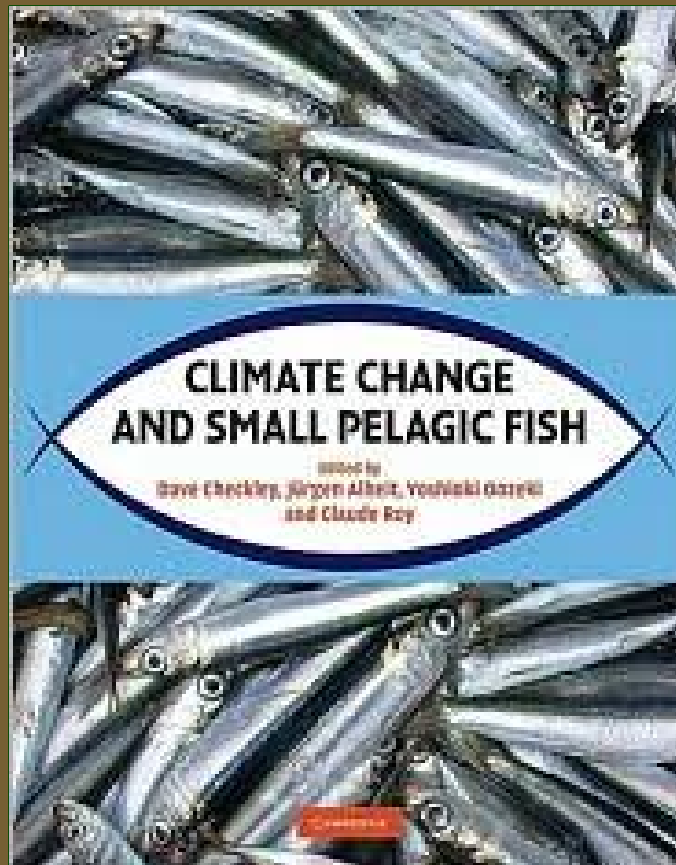
# SOURCE OF HARVEST

## Predicted Production



Source : Canadian Aquaculture Industrial Alliance

# CLIMATE CHANGE AND FISH PRODUCTION



# CLIMATE CHANGE AND FISH PRODUCTION

Fish to shrink by up to a quarter due to climate change, study reveals

Scientists predict 14-24% reduction in fish size by 2050 as ocean temperatures increase

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**Damian Carrington**

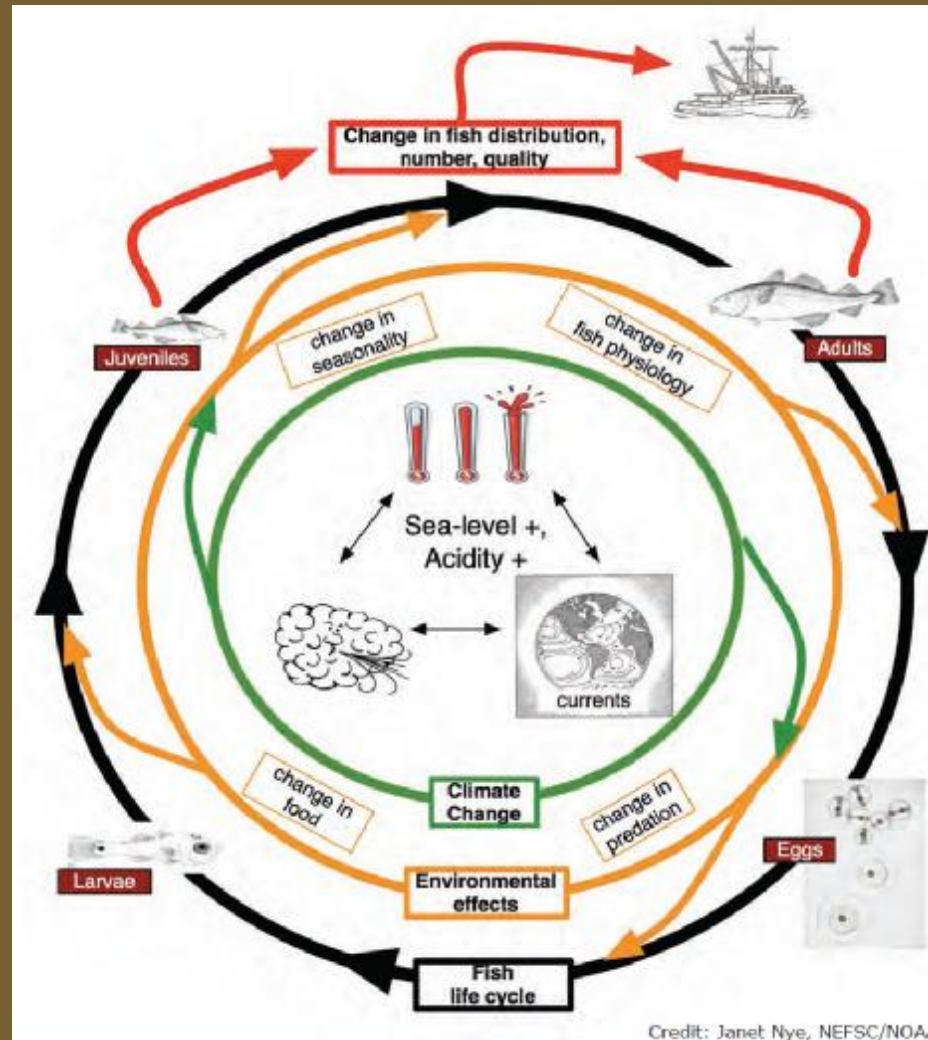
The Guardian, Sunday 30 September 2012 13.00 EDT



# CLIMATE CHANGE AND FISH PRODUCTION

The screenshot shows a web browser window displaying the Marine Stewardship Council (MSC) website. The browser's address bar shows the URL: [www.msc.org/healthy-oceans/the-oceans-today/climate-change](http://www.msc.org/healthy-oceans/the-oceans-today/climate-change). The website header includes the MSC logo and navigation links such as Home, About, Healthy oceans, Track a fishery, Get certified, MSC's impact, Where to buy, Check out more, Services, and Documents. The main content area is titled "Climate change and fish" and features a sub-header: "Our oceans and fish stocks may be under threat from changing water temperatures. Fisheries and communities around the world could be affected." Below this, the text explains that as climate changes, ocean temperatures rise, affecting fish stocks and species. It notes that many fisheries will be seriously affected, leading to more challenges. A section titled "How will climate change affect fish and fisheries?" lists several impacts: 40% of sea temperatures will change, fish stocks will change and fish will move to different areas, some species will go extinct in particular areas, predators and prey will move to different areas, changing food chains, wetlands and other low lying habitats where sea level rise will be caused by rising sea levels, water in rivers will get warmer, and sea weather may change, going to sea. The text also states that these changes may affect fisheries worldwide, but the impacts are likely to be particularly damaging for fisheries in developing countries. A section titled "Why is sustainable fishing important in a time of climate change?" lists two points: helping fishers adapt to climate change and manage fisheries, such as those in the MSC program, will be well positioned to cope with climate change, and feeding a hungry world healthily, sustainably and fairly, because fish stocks are becoming more important as agriculture suffers from drought and other impacts of climate change. A final section titled "What can you do to support sustainable fishing?" suggests buying sustainable fish and seafood, looking for the MSC ecolabel, and choosing shops with sustainable standards. At the bottom of the page, there are social media links for Facebook and Twitter, and a footer with links for Site map, Accessibility, Contact, Privacy policy, Terms and conditions, and About.

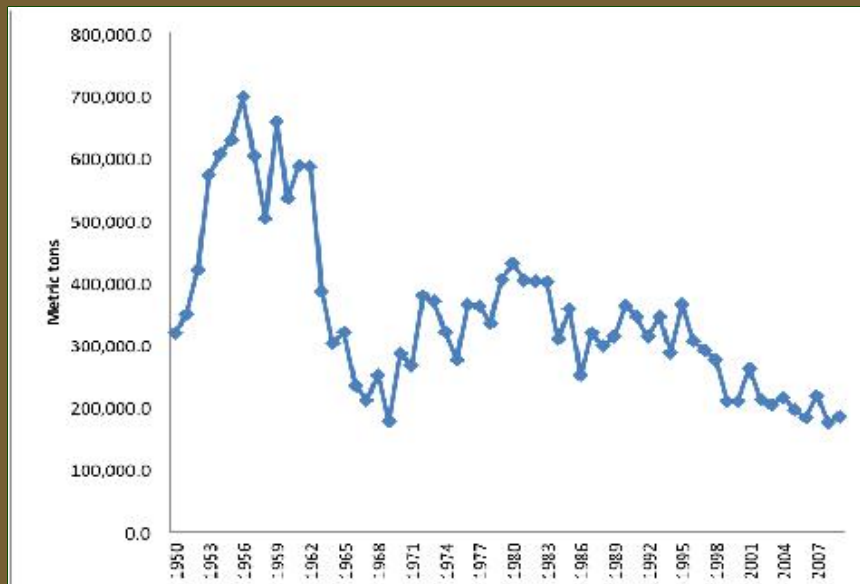
# CLIMATE CHANGE AND FISH PRODUCTION



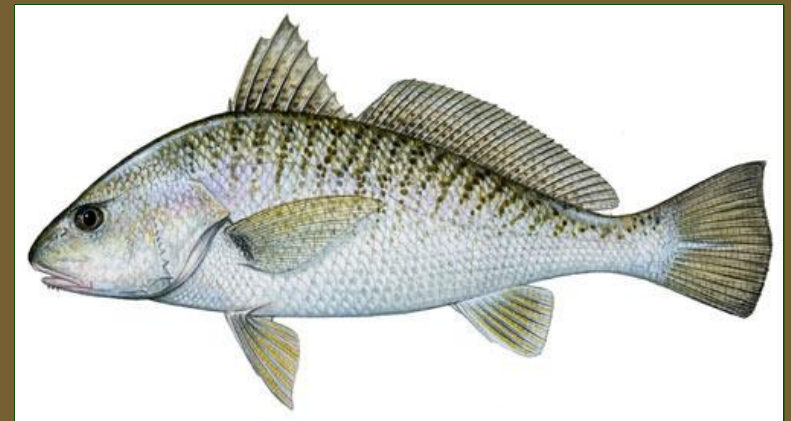
Credit: Janet Nye, NEFSC/NOAA

# CLIMATE CHANGE AND FISH PRODUCTION

Value of Atlantic menhaden  
Ecological services  
Commercial fishery



# CLIMATE AND FISH RANGE CHANGE

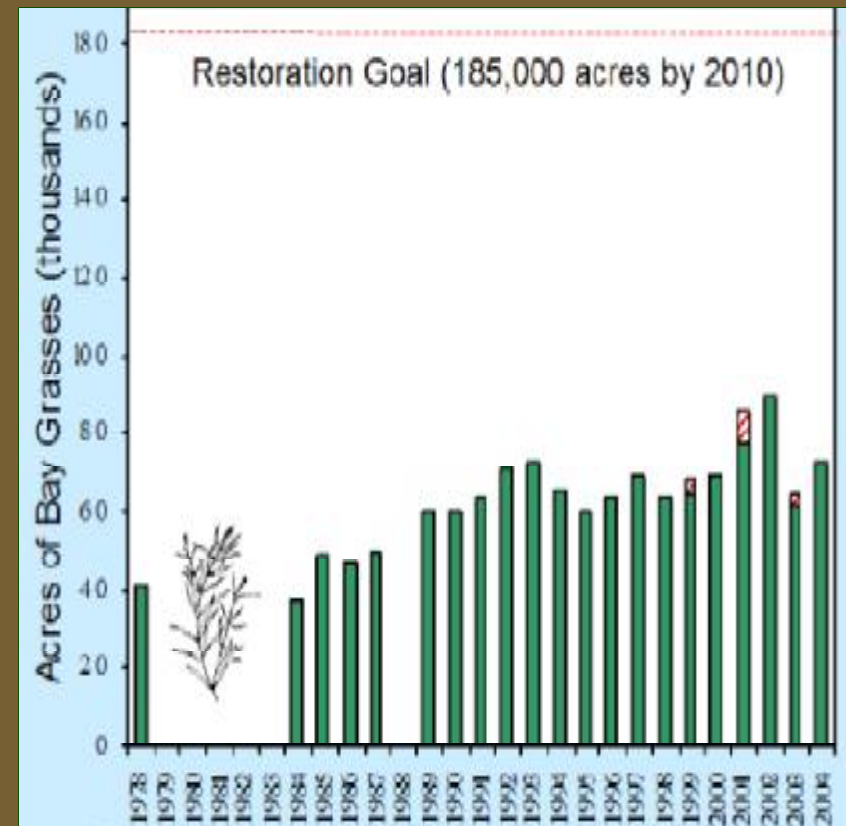


Atlantic croaker



# CLIMATE AND NURSERY HABITAT

- Seagrass habitat at historic lows
- No nursery habitat – No fish



Chesapeake Bay Foundation

# CONCLUSIONS

- U.S. Dietary Suggestions May Exceed Current US Domestic Fish Production
- Will Changes in Management and Aquaculture Bridge The Gap?
- Effects Of Climate Change On Fish Production Are Unknown

# NOT ENOUGH FISH IN THE SEA

