Ed Chesney- Associate Professor & Research Scientist

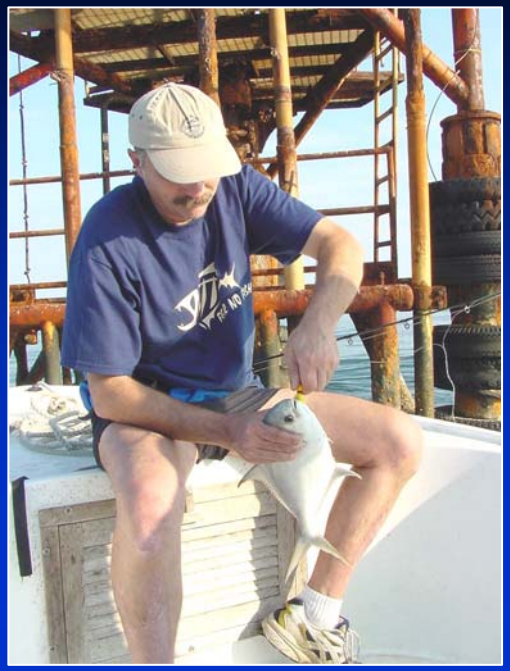
Louisiana Universities Marine Consortium (LUMCON)

Research Expertise-Oceanography, fisheries biology, fishery recruitment, early life history of fishes, fish culture, fish spawning, larval culture, larval feeding, aquaculture

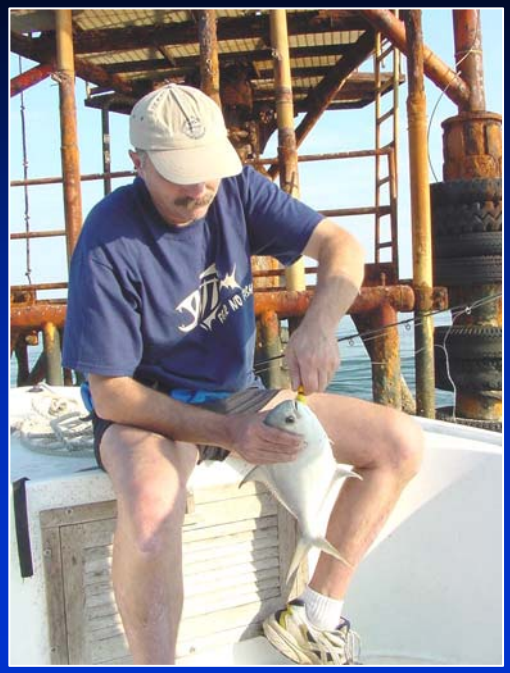
Catching and eating fish is a way of life in coastal Louisiana

Sportsman's Paradise

"I fish therefore I am"



Inshore-speckled Trout, red and black drum, flounder, sheepshead



Offshore greenwater-snappers, king and spanish mackerel, cobia, pompano and others

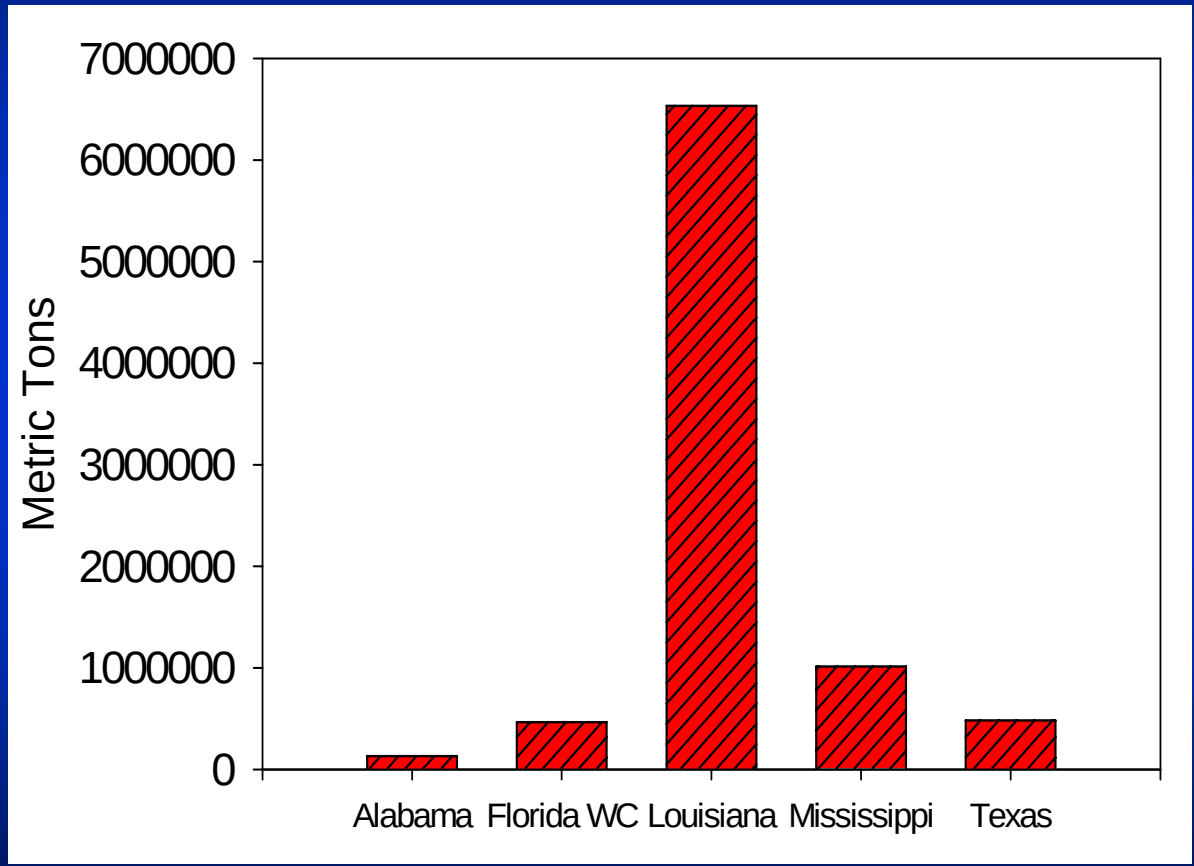
Bluewater- Tuna, Wahoo, Mahi mahi

Louisiana

- Second leading US fisheries landings (mostly saltwater) and second leading US aquaculture production (mostly freshwater)

GOM Total Fishery Landings by State 1994-2003

Louisiana typically yields >6 million mt of landings from the GOM during a decade



- Commercial Landings
  - Leader among lower 48 states accounting for ~80% of GOM landings

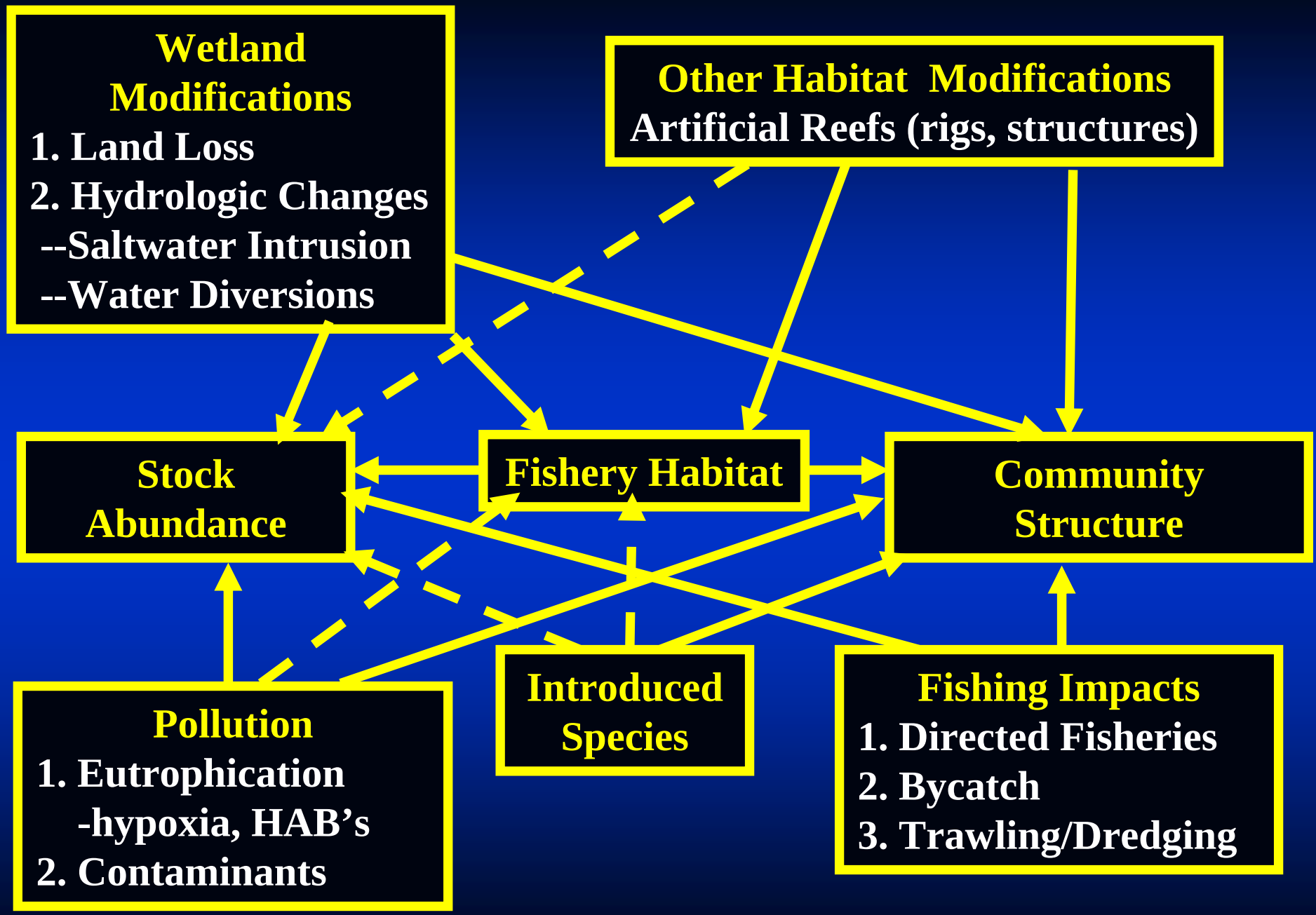
- Recreational Catches
  - Leader in per capita catch in US Atlantic & GOM

What generates this productivity?

Louisiana Coastal Zone

- One of the most valuable and productive coastal ecosystems in USA!

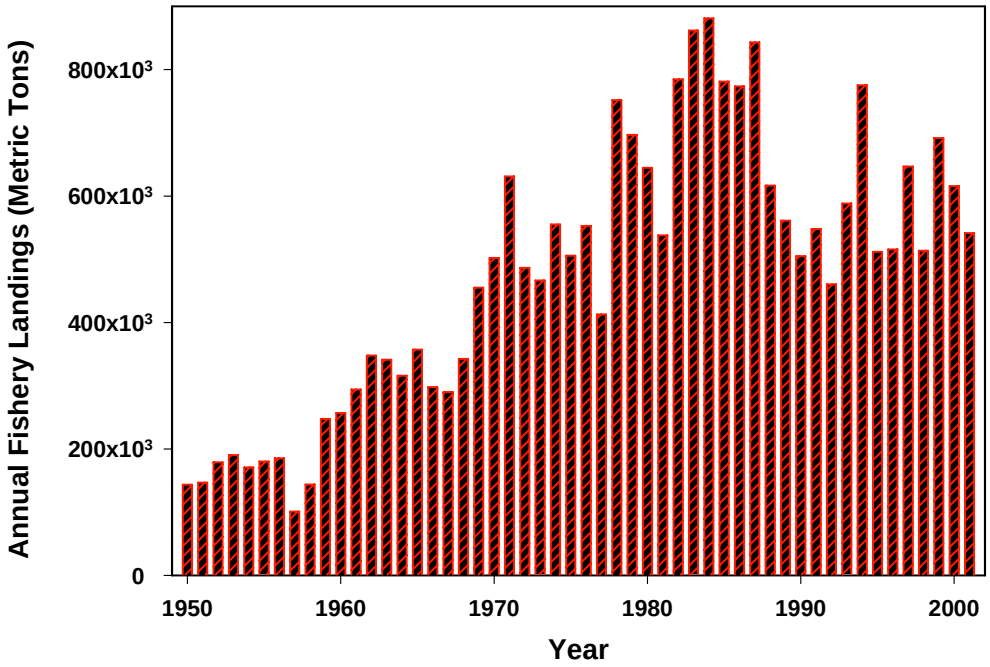
- Also one of the most heavily impacted systems


Wetland Modifications
1. Land Loss
2. Hydrologic Changes
--Saltwater Intrusion
--Water Diversions
Other Habitat Modifications
Artificial Reefs (rigs, structures)
Stock Abundance
Fishery Habitat
Community Structure
Pollution
1. Eutrophication
-hypoxia, HAB's
2. Contaminants
Introduced Species
Fishing Impacts
1. Directed Fisheries
2. Bycatch
3. Trawling/Dredging

The big three:

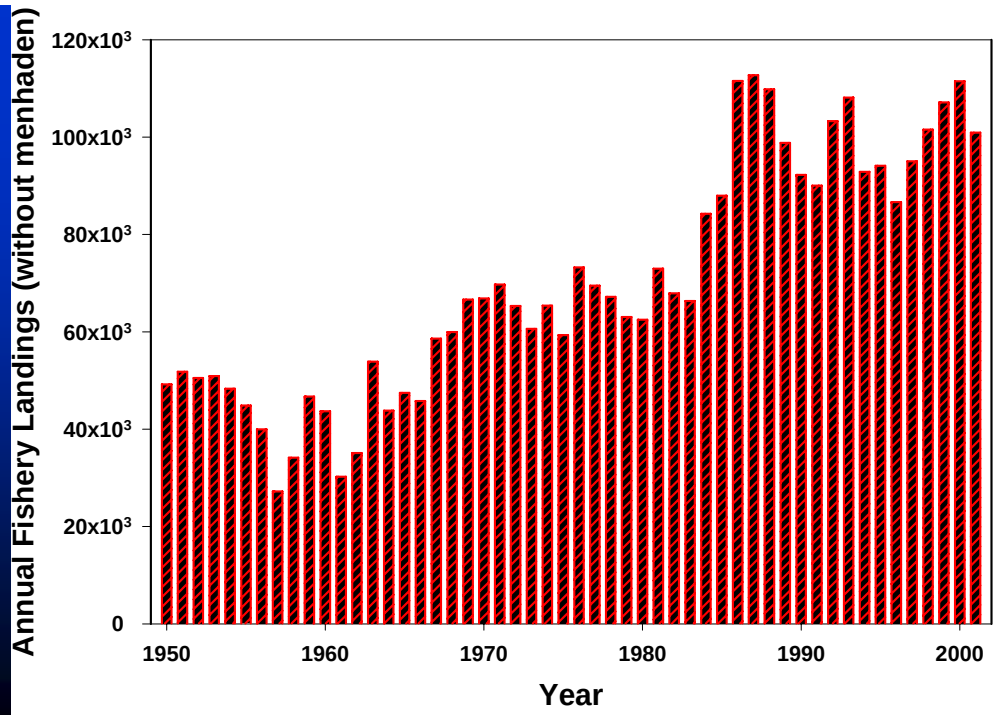
1. Fishing effects (i.e. bycatch and other)
2. Coastal change: habitat loss/change
3. Eutrophication and coastal hypoxia

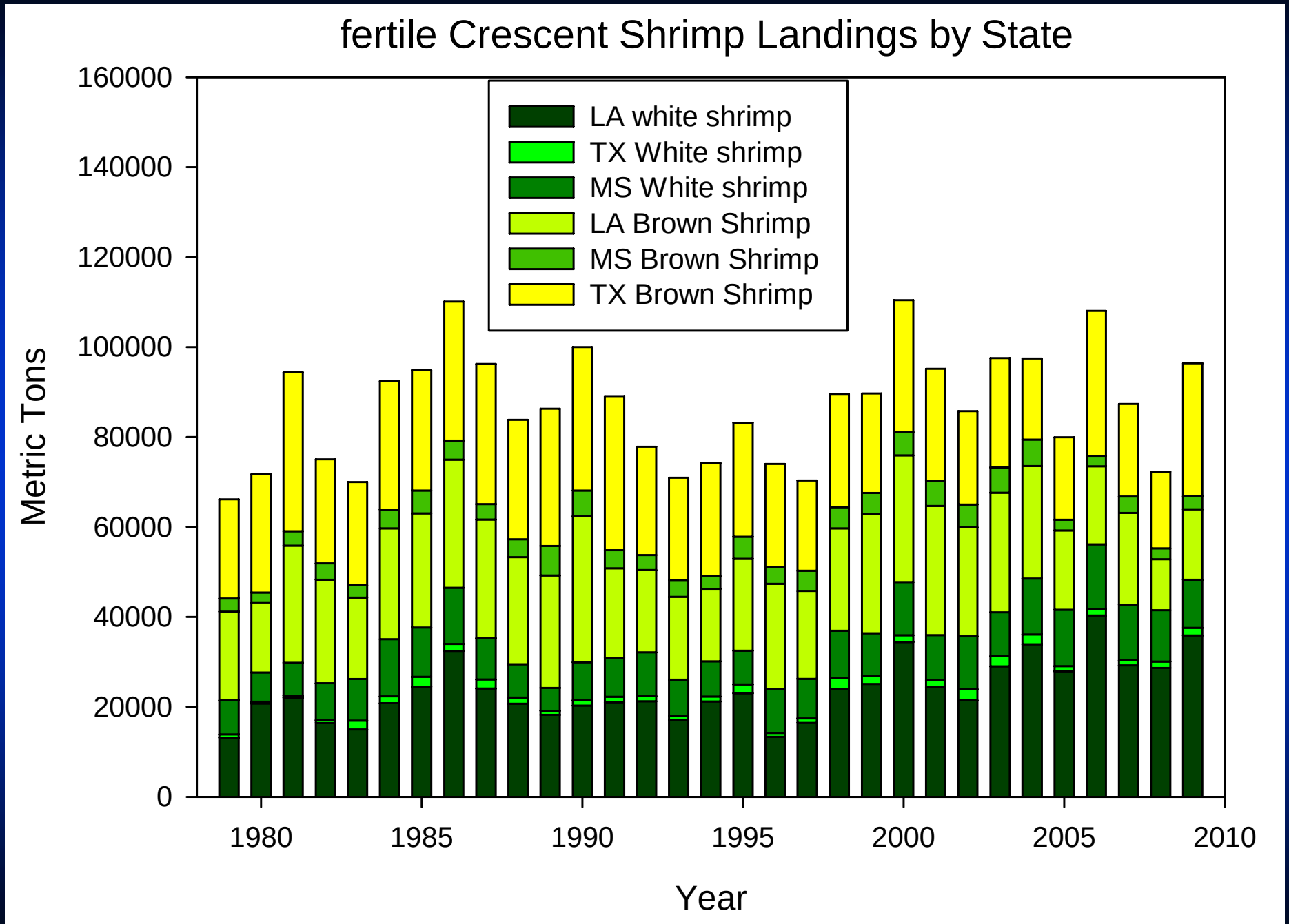
Are there any obvious trends in fishery production (yields) that reflect these environmental impacts?

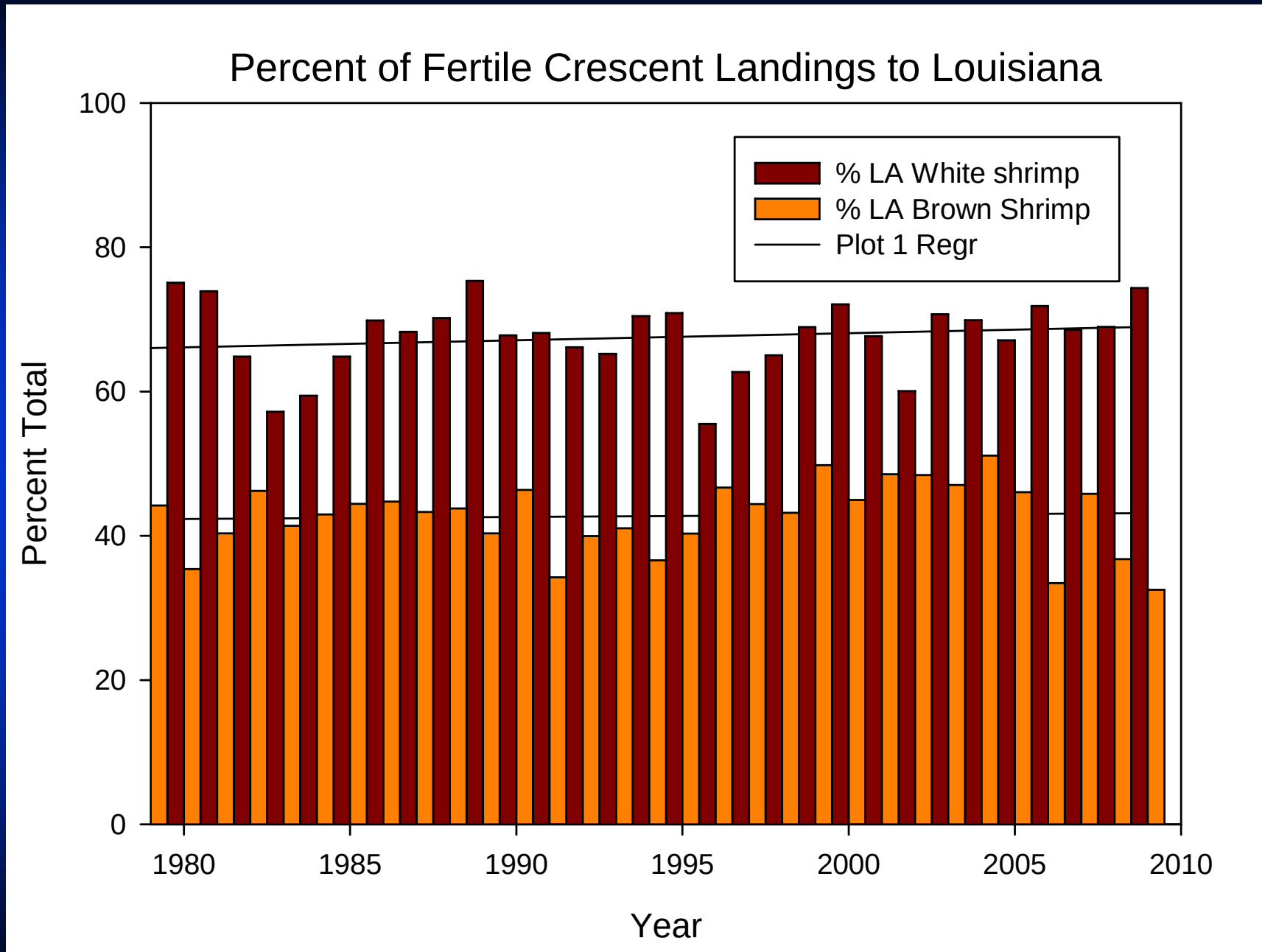


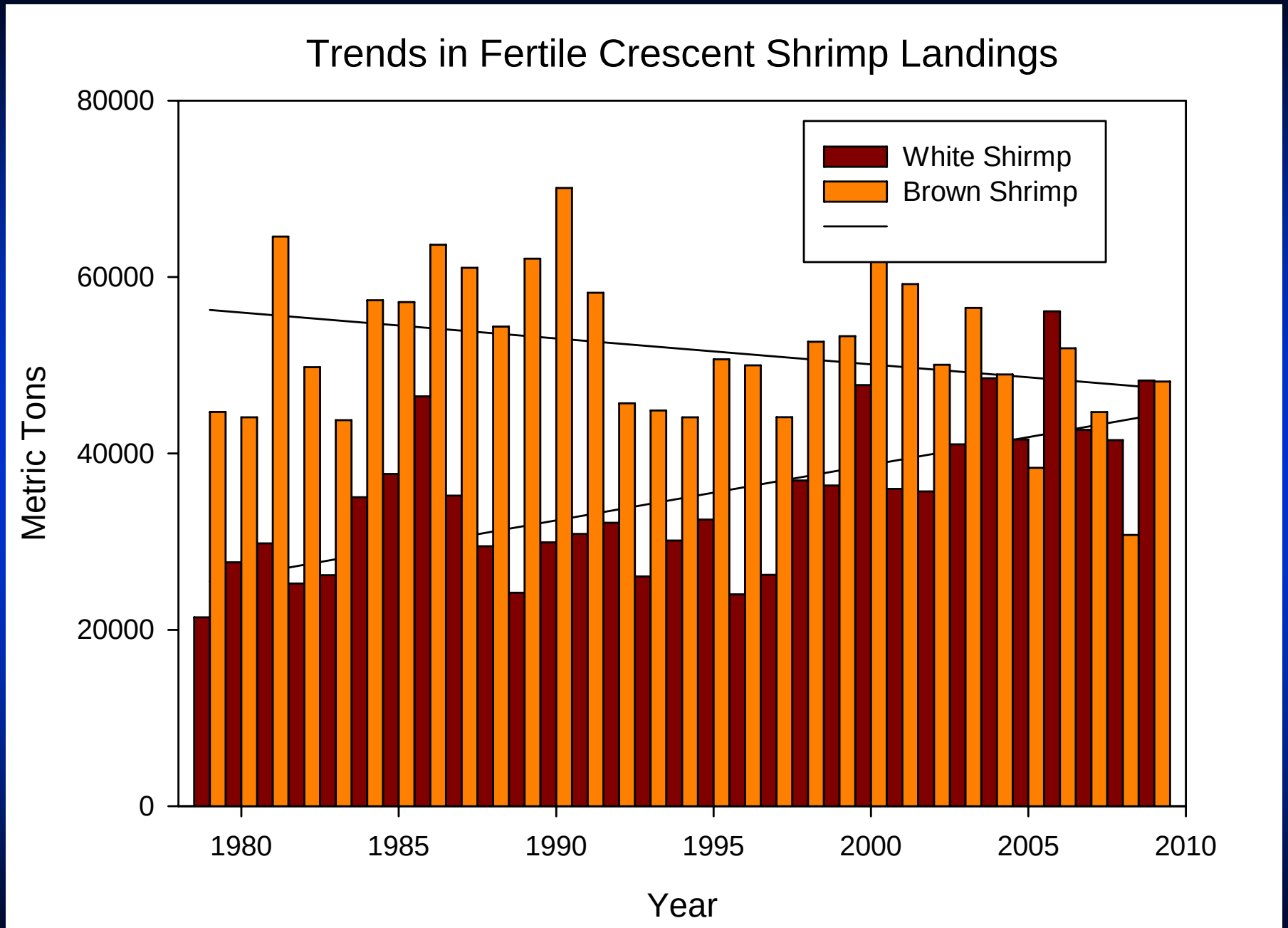
Affects on Fishery landings are not obvious!

Source: NMFS fishery statistics

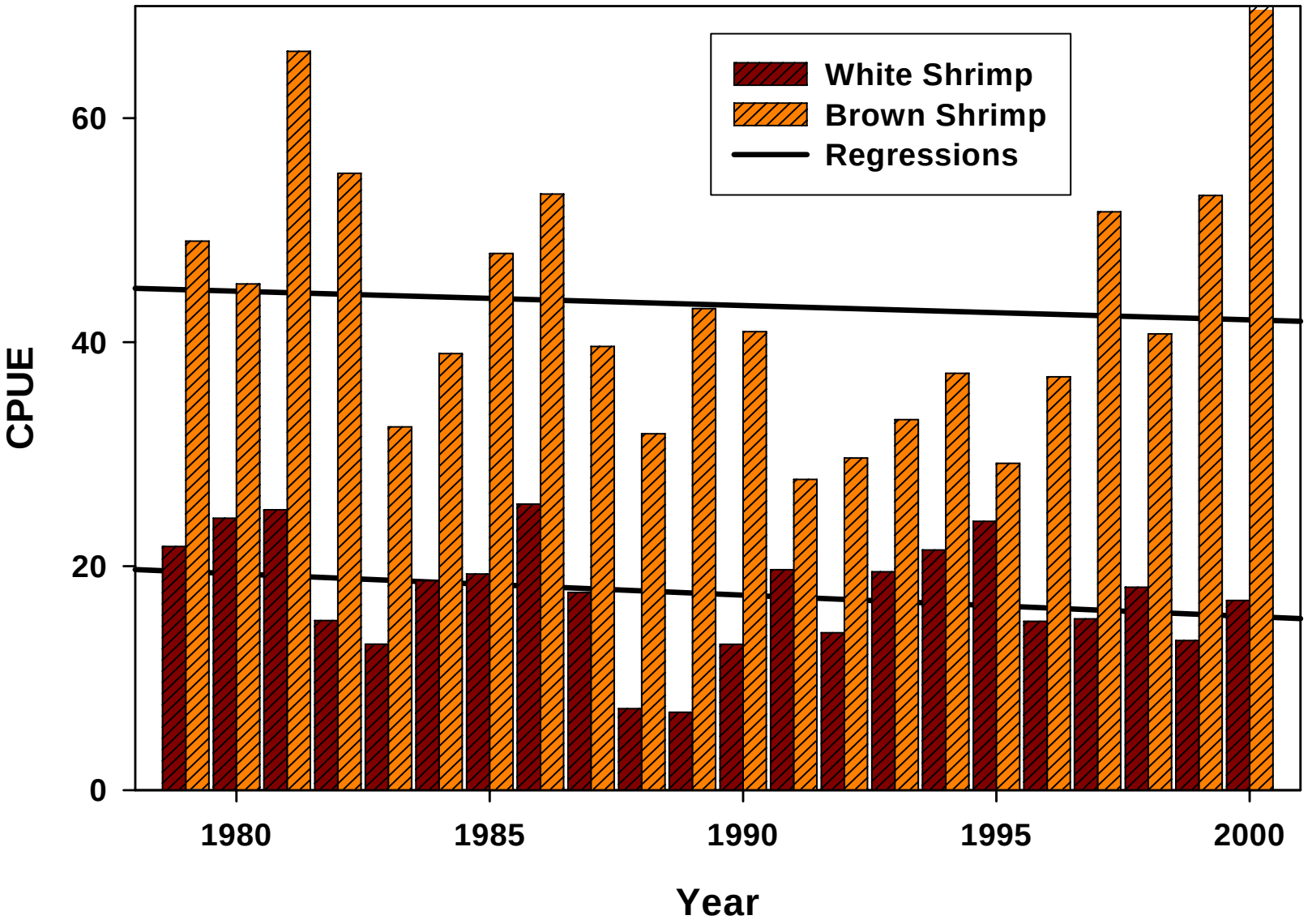


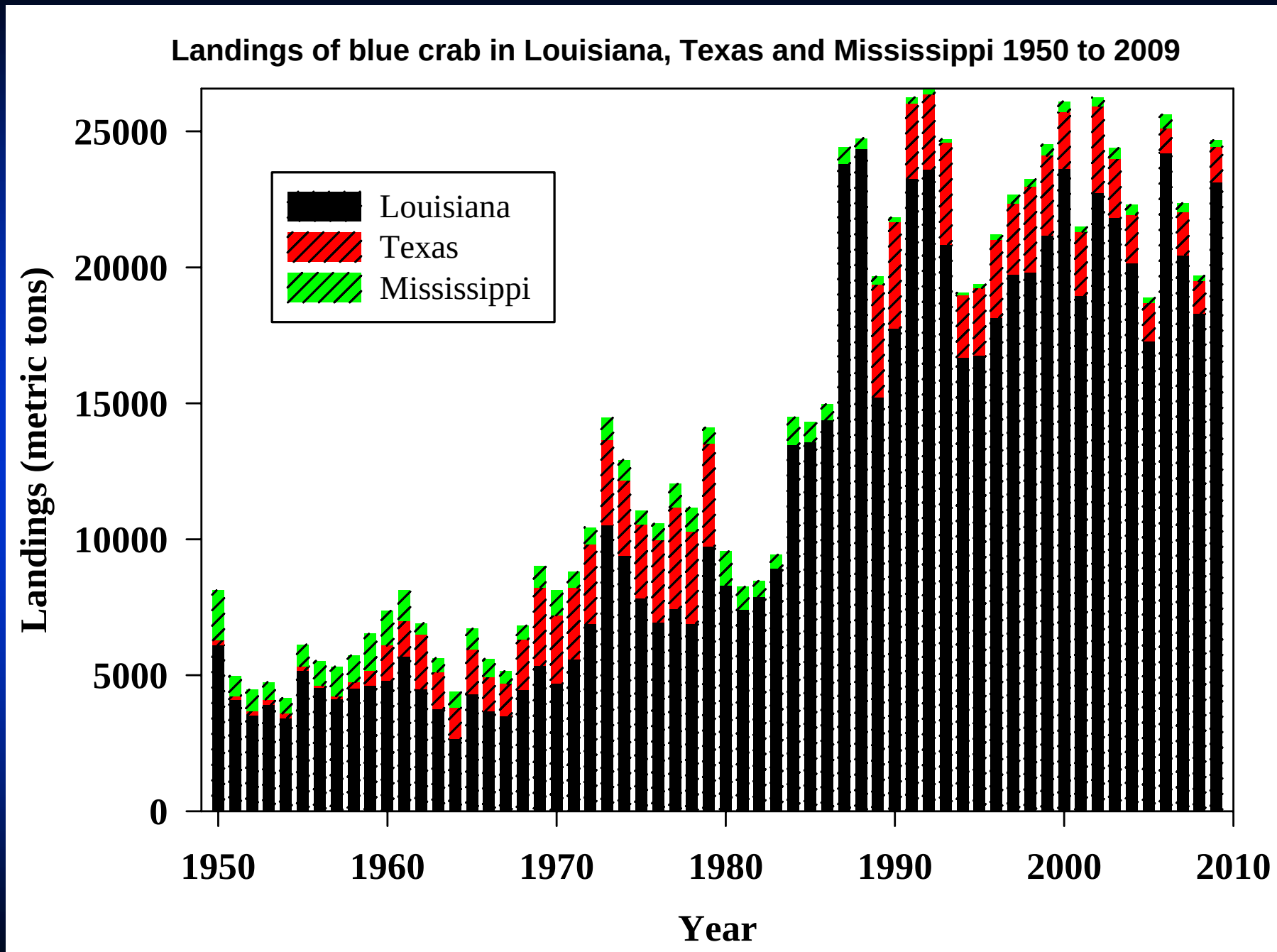

fertile Crescent Shrimp Landings by State
LA white shrimp
TX White shrimp
MS White shrimp
LA Brown Shrimp
MS Brown Shrimp
TX Brown Shrimp
Metric Tons
160000
140000
120000
100000
80000
60000
40000
20000
0
1980
1985
1990
1995
2000
2005
2010
Year

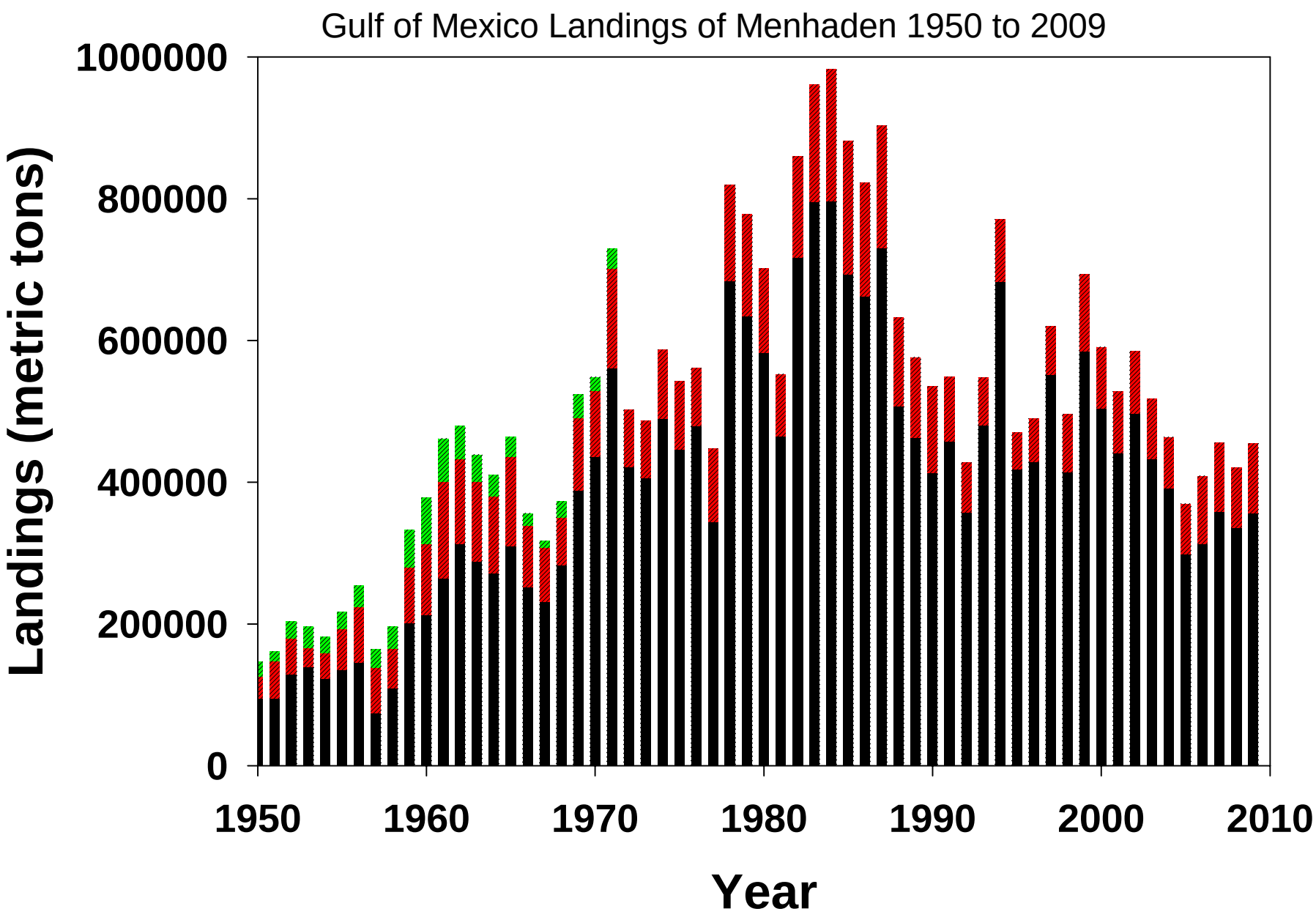

Percent of Fertile Crescent Landings to Louisiana
% LA White shrimp
% LA Brown Shrimp
Plot 1 Regr
Percent Total
100
80
60
40
20
0
1980
1985
1990
1995
2000
2005
2010
Year


Trends in Fertile Crescent Shrimp Landings
80000
60000
40000
20000
0
Metric Tons
White Shirmp
Brown Shrimp
1980
1985
1990
1995
2000
2005
2010
Year

Inshore fishery-independent Abundances

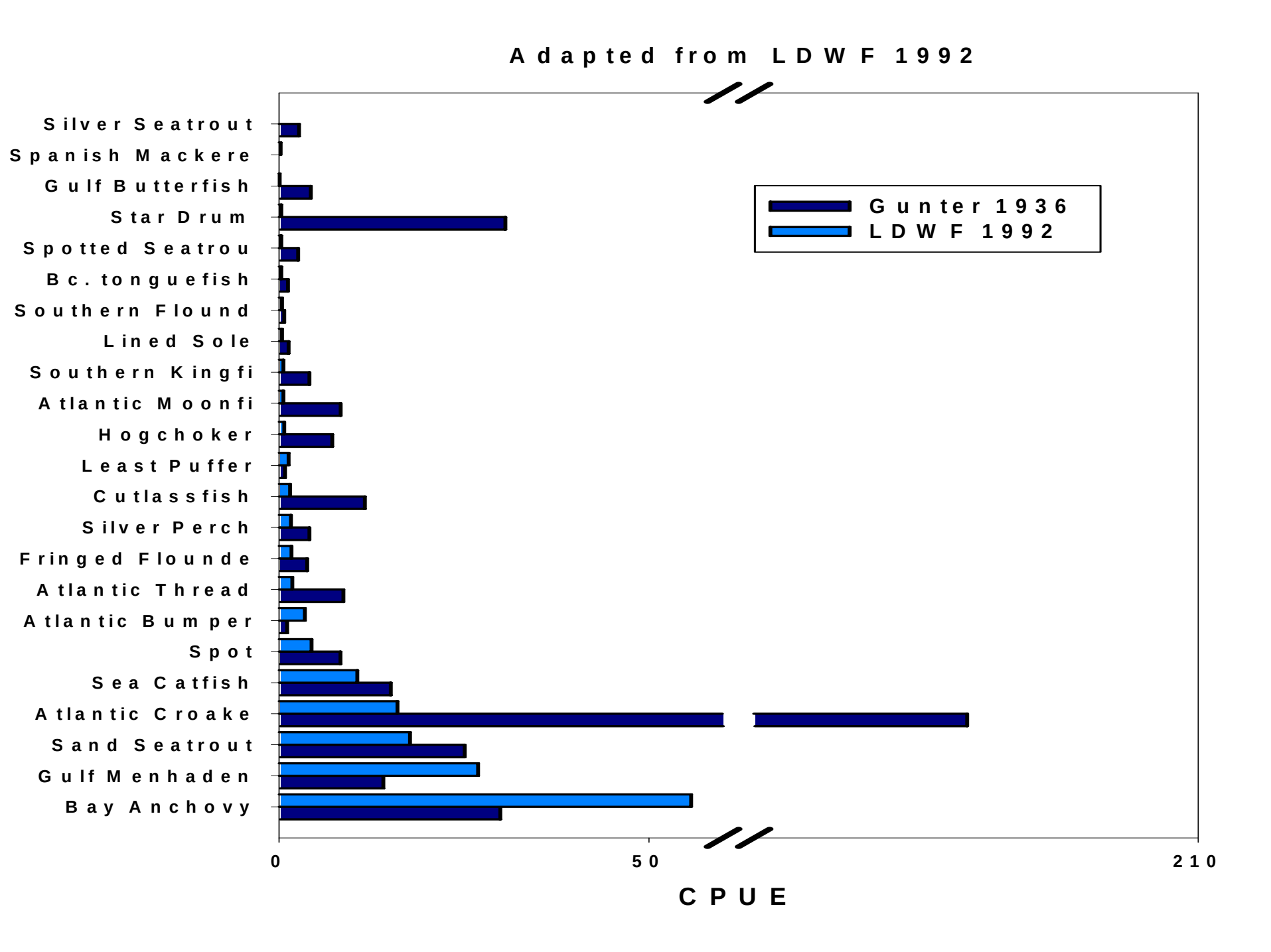



Landings of blue crab in Louisiana, Texas and Mississippi 1950 to 2009
Louisiana
Texas
Mississippi
Landings (metric tons)
0
5000
10000
15000
20000
25000
1950
1960
1970
1980
1990
2000
2010
Year


Gulf of Mexico Landings of Menhaden 1950 to 2009
Landings (metric tons)
1000000
800000
600000
400000
200000
0
1950
1960
1970
1980
1990
2000
2010
Year

No obvious signs of impacts to fishery yields!

What about community structure and fishery independent trends?


Adapted from LDWF 1992
Silver Seatrout
Spanish Mackere
Gulf Butterfish
Star Drum
Spotted Seatrou
Bc. tonguefish
Southern Flound
Lined Sole
Southern Kingfi
Atlantic Moonfi
Hogchoker
Least Puffer
Cutlassfish
Silver Perch
Fringed Flounde
Atlantic Thread
Atlantic Bumper
Spot
Sea Catfish
Atlantic Croake
Sand Seatrout
Gulf Menhaden
Bay Anchovy
Gunter 1936
LDWF 1992
0
50
210
CPUE

True or False

- Fishing is the principal cause of fish mortality in wild populations?

Answer:

- Predation is the number one cause of mortality of any organism living in the ocean. However fishing is an important source of mortality.

Chronic vs episodic events

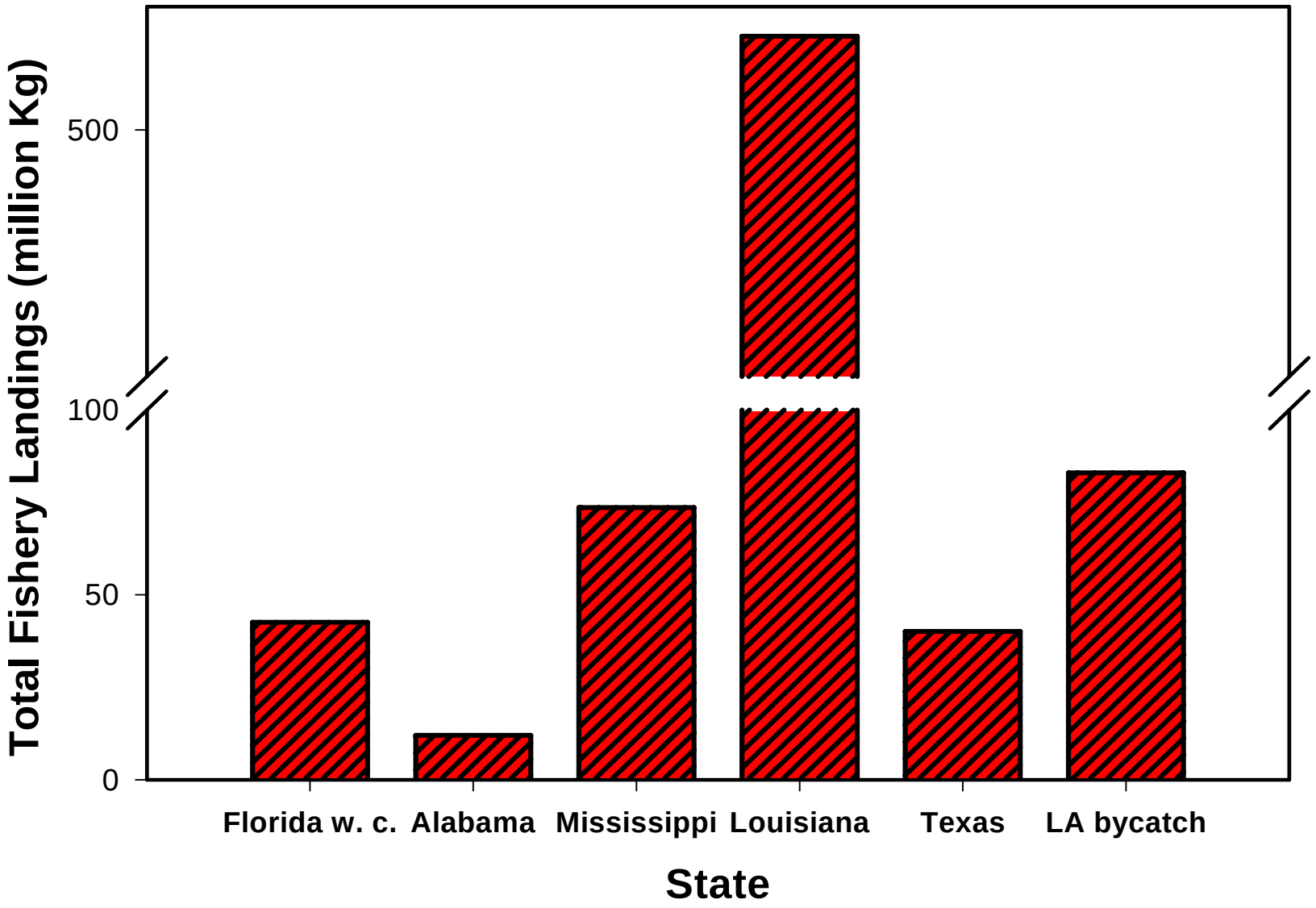
- Under most circumstances chronic mortality events are much more impactful to ecosystem function and integrity than episodic events.

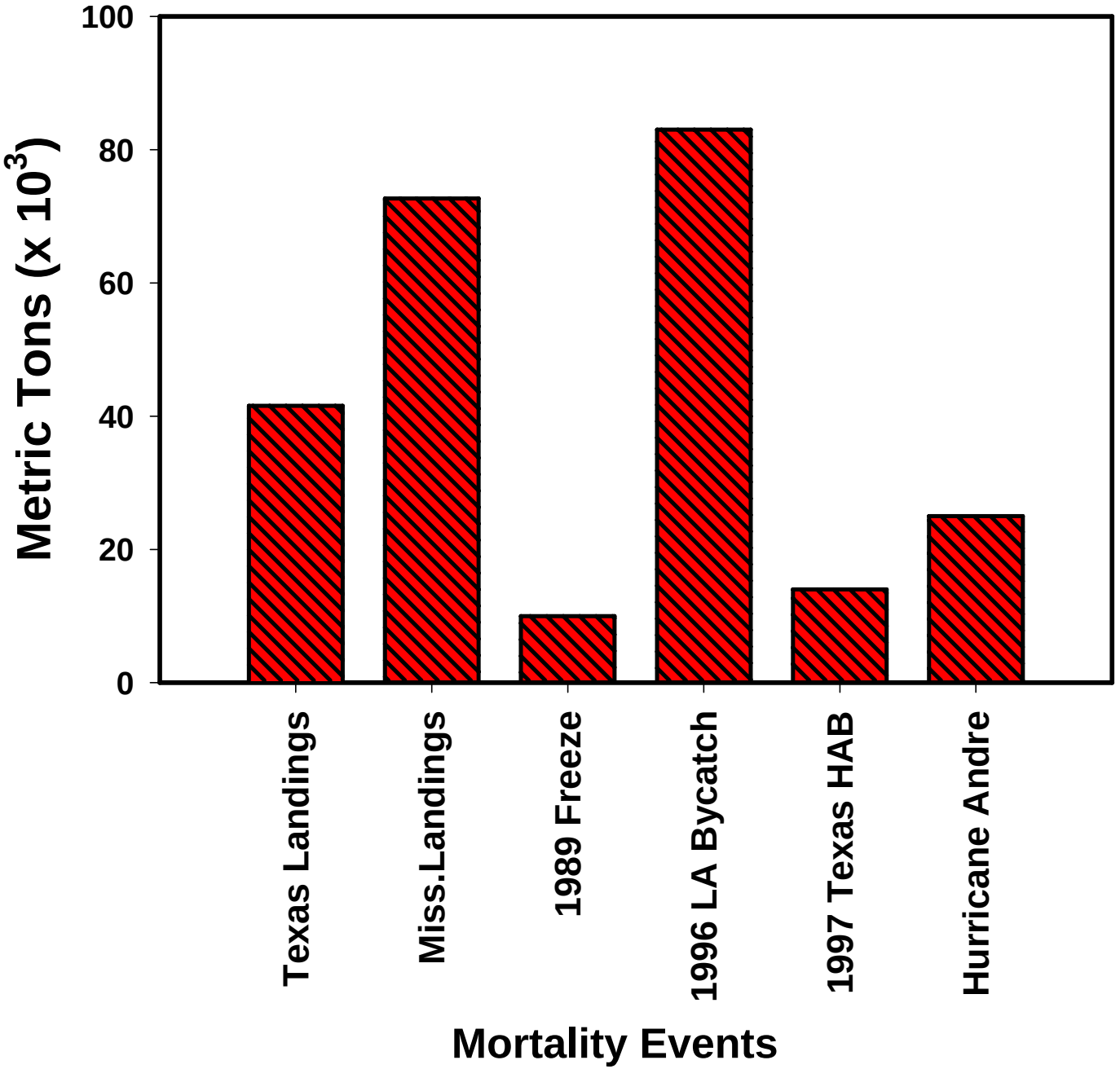
- Episodic events are often more visually stunning, hence attractive to the media.

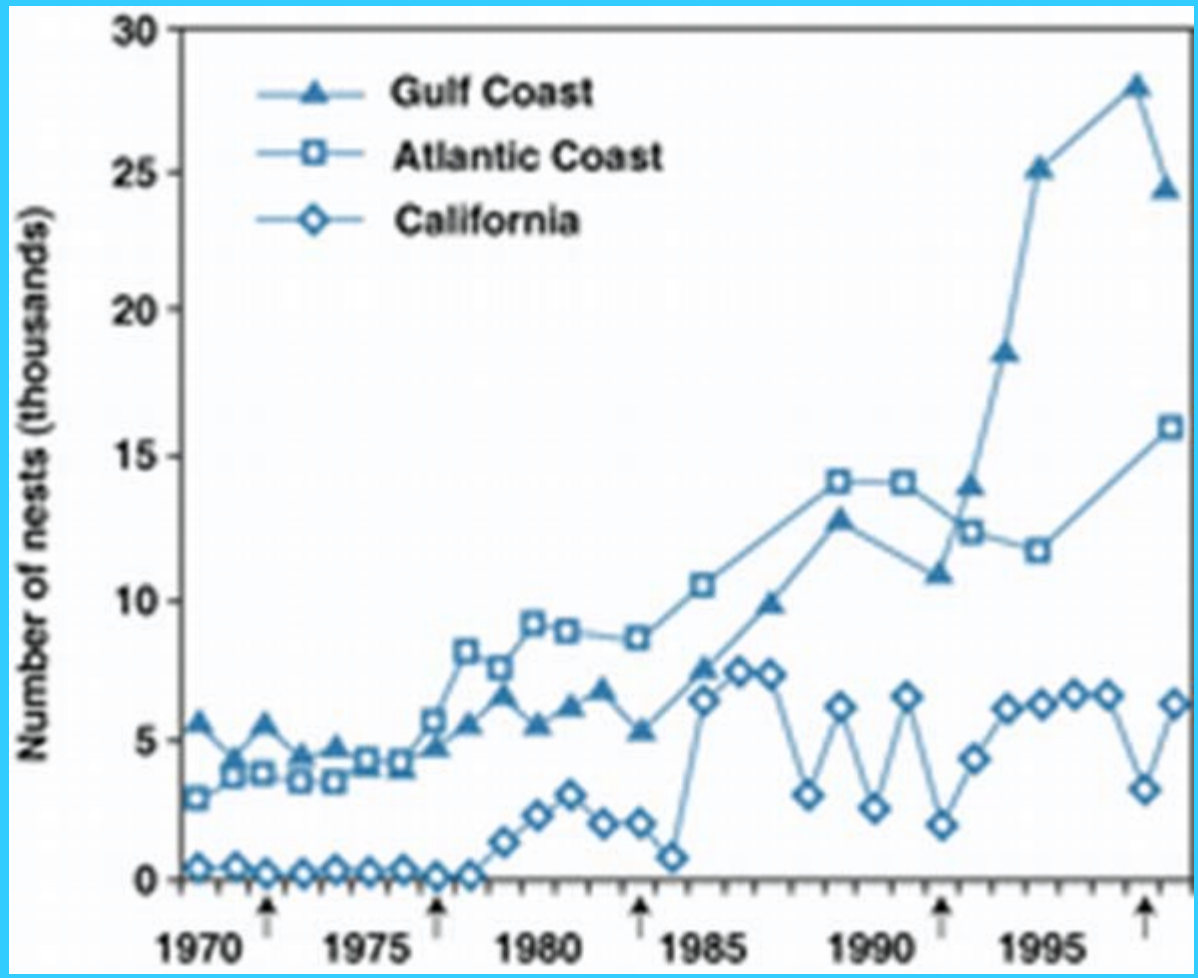
Fish Kill
1989 Freeze

Kills from toxic algae

Source: TPWD


Total Fishery Landings (million Kg)
500
100
50
0
Florida w. c.
Alabama
Mississippi
Louisiana
Texas
LA bycatch
State

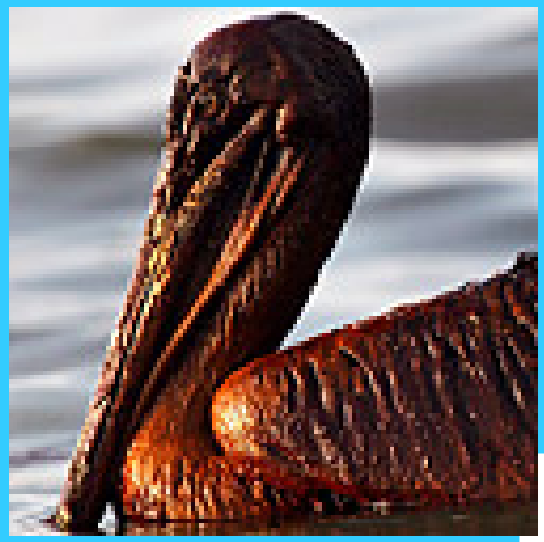

Metric Tons (x 10^3)
100
80
60
40
20
0
Texas Landings
Miss.Landings
1989 Freeze
1996 LA Bycatch
1997 Texas HAB
Hurricane Andre
Mortality Events



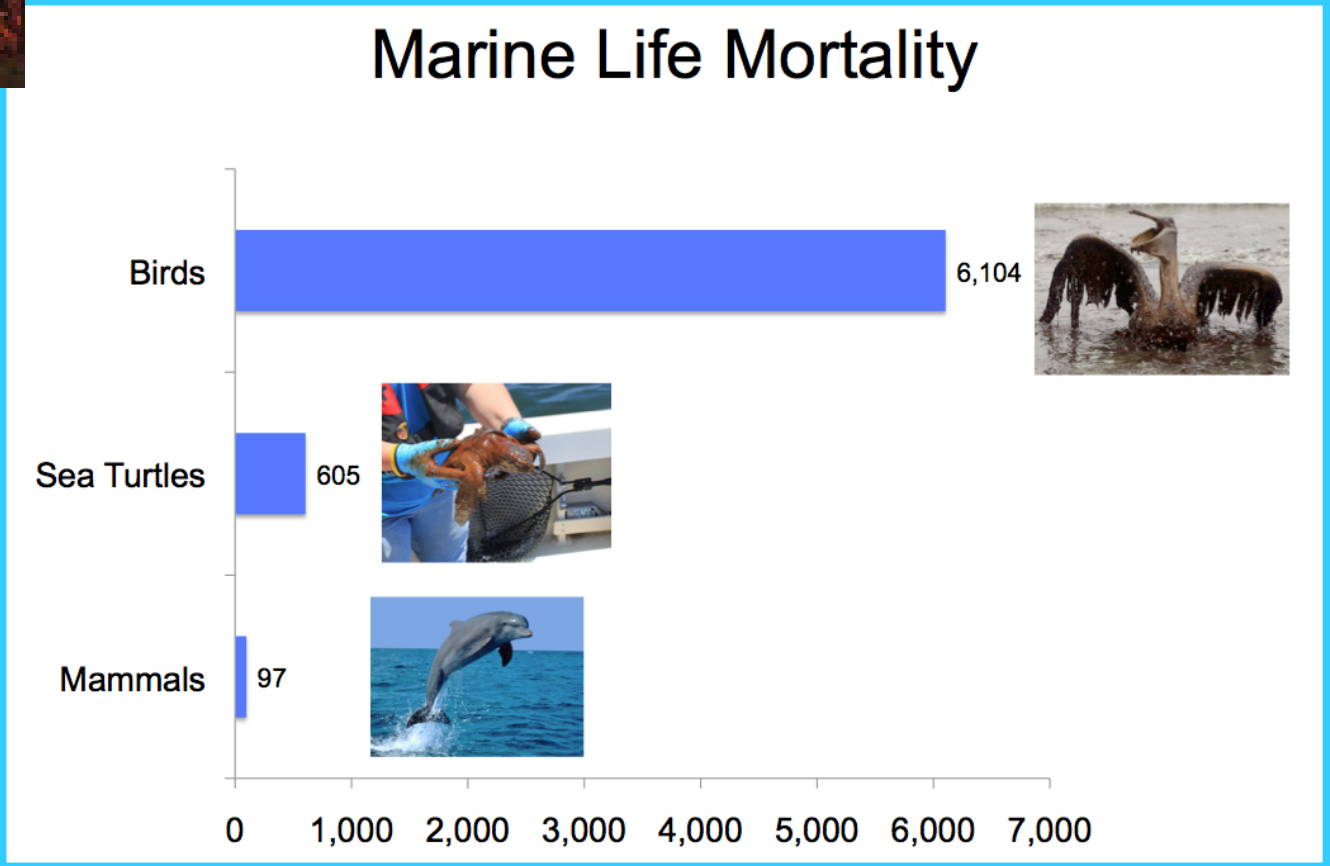
Gulf coast Brown pelican populations were among the healthiest before the spill

Perspectives on the Oil Spill

- Reduced prey availability during a severe ENSO events resulted in mass starvation of birds. During 1982–1983 ENSO, large numbers of dead and dying Brown Pelicans were observed in Galápagos Is. and Panama (Ainley et al. 1986); an estimated 70,000 adult and 210,000 nestling Peruvian Pelicans starved to death in Peru (Tovar et al. 1987).



Big three sustained relatively low immediate mortality given the size and extent of the spill



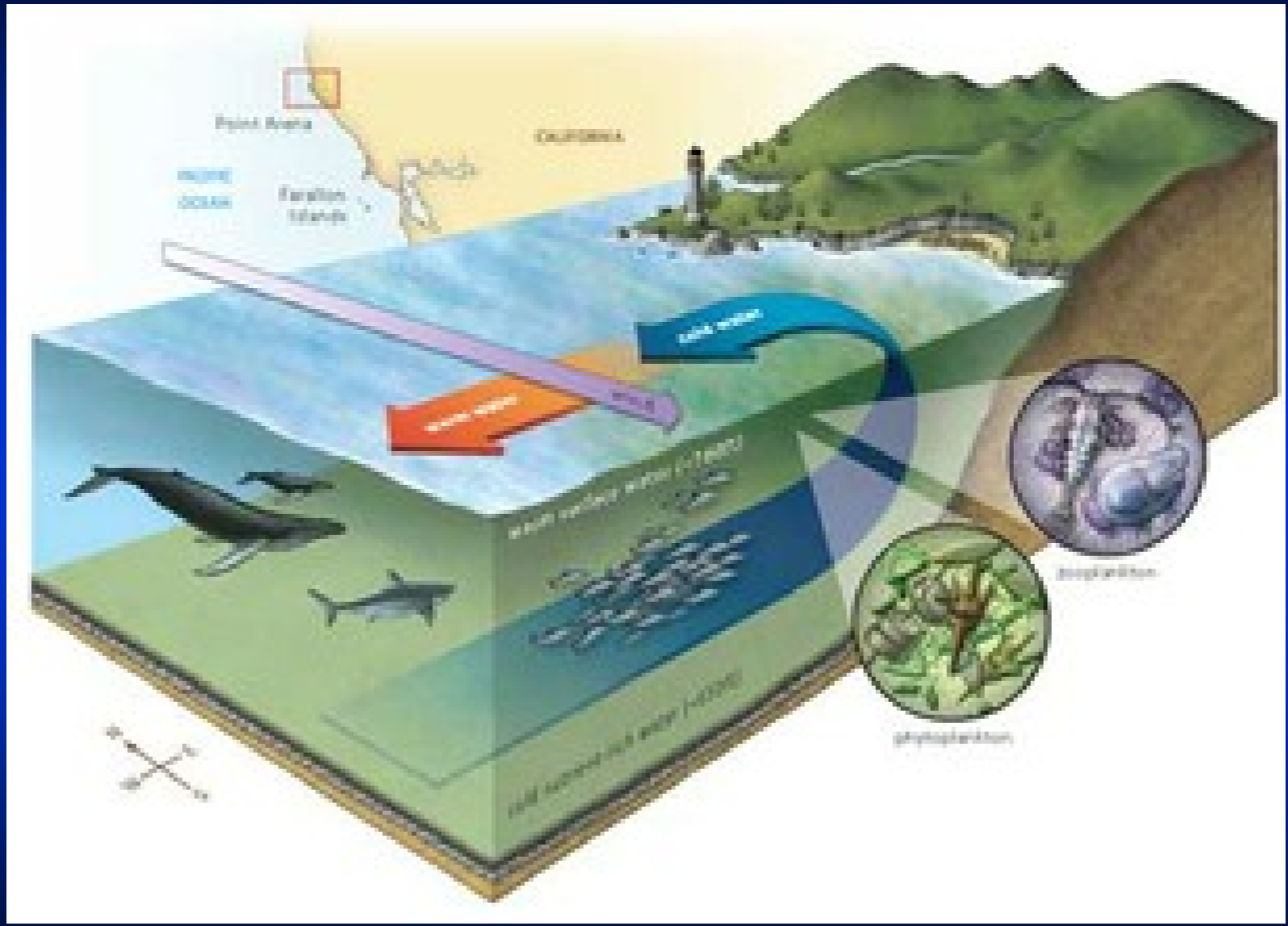
What areas of ocean are most productive?

- Coastal zone adjacent to rivers
- upwelling zones

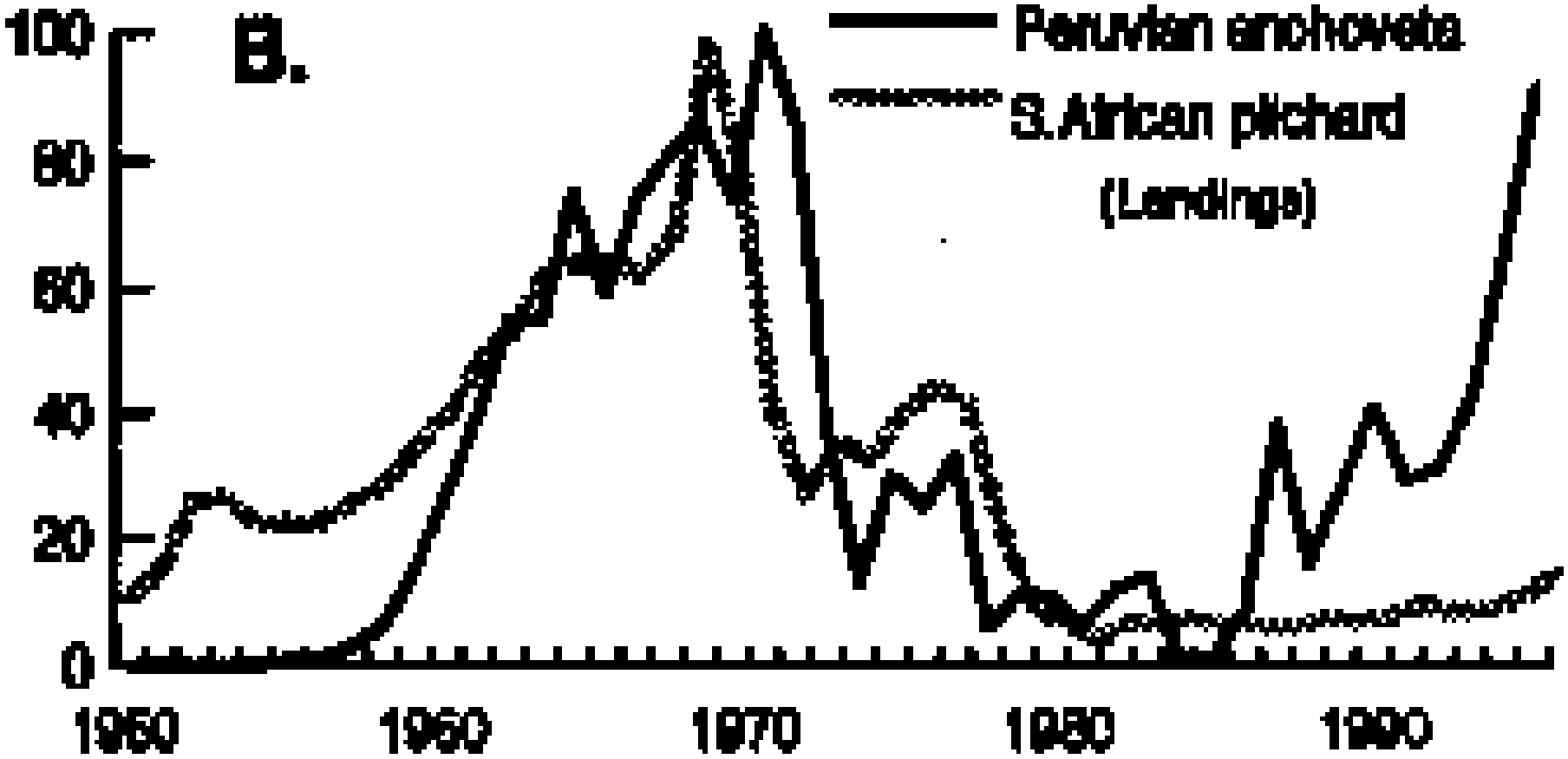
Region	Percent Area Of Ocean	Percent Primary Production	Percent Global Fish Production	Percent Potential Global Fish Production
Estuaries	0.5	2.6	5.2	5.9
Shelves	6.4	15.3	26.2	22.3
Upwelling	1.4	4.6	8.5	8.1
Oceanic	91.7	77.5	60.1	63.7

From Houde and Rutherford 1993.

What is an upwelling?



Source: http://baynature.org/articles/



http://www.fao.org/WAICENT/FAOINFO/FISHERY/publ/circular

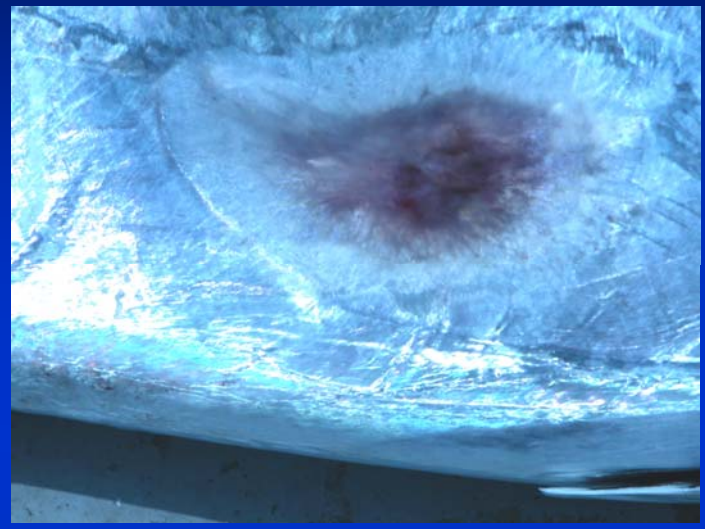
- Horrible ecological event but from an ecosystem integrity standpoint not a total disaster.

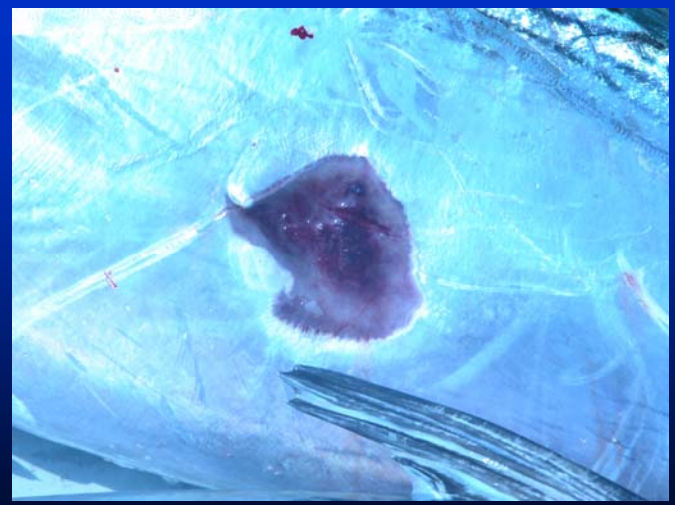
Perspectives on the Oil Spill

- **Secondary (sub-lethal) effects may be more important!**
  - **Large numbers of survivors probably ate oil exposed prey**
    - **Increased cancer rate or reduced reproductive success**
    - **Difficult to establish cause and effect**

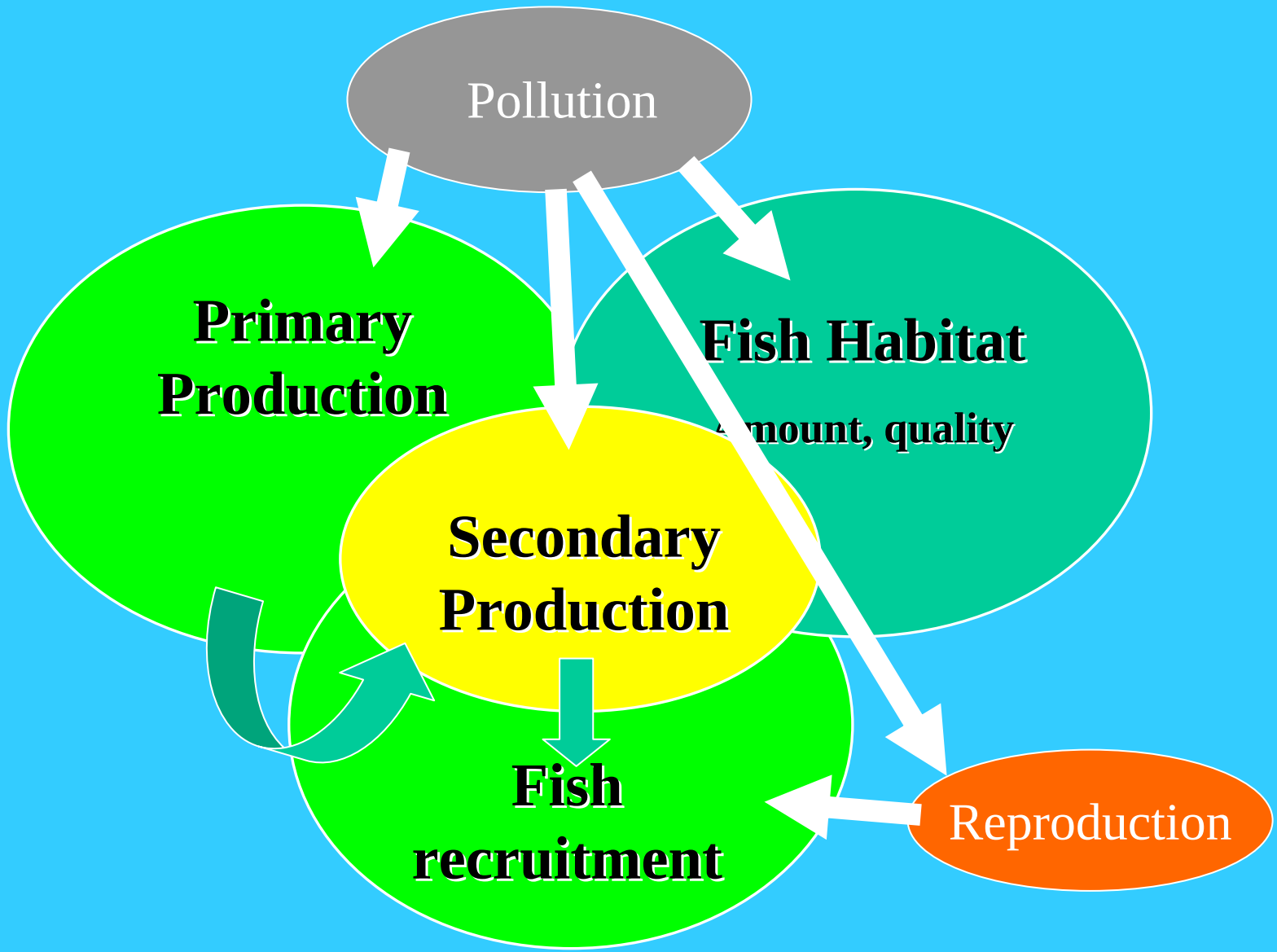
Vermillion snapper-

Little Tunny- *Euthynnus alleteratus*





Potential Bottlenecks for Fish Production



Nature's Lottery for fish-Recruitment in the Ocean

- What is recruitment?
- What factors dictate recruitment success?

Recruitment of fishes

- In a fisheries sense, recruitment is defined as the number of fish which grow into the catchable size range in a unit of time (usually a year).
- In an early life history sense recruitment is considered those young fish that have reached a stage of development and size where they have a high probability of continued survival.

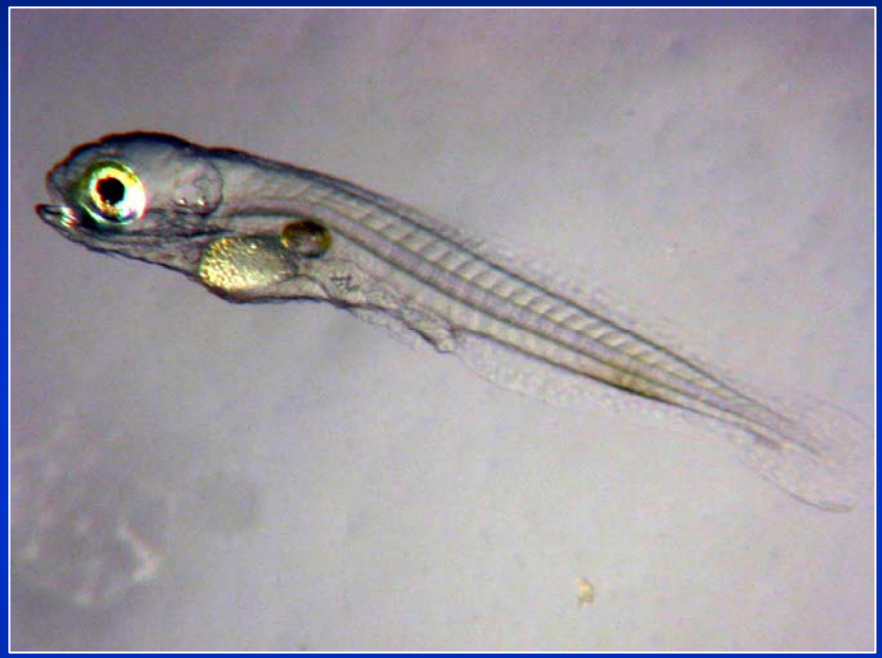
Population Dynamics and Reproduction in Fishes

- Many fishes and other aquatic organisms are highly fecund.
- In nature the larvae of these organisms die at a high rate due to natural causes (predation, starvation, advection from nusery areas).
- Species low on the food chain are typically more fecund and tend to be more abundant and are able to sustain higher exploitation rates.

Examples of Natural Fecundity

- In fish fecundity increases with weight.
- A 22 in. female red snapper is capable of spawning every 4 days from late May through September and can produce up to 255,000 eggs in a single spawn or batch.
- Annual fecundity could be ten times that and Snapper can live to 50 year old so lifetime fecundity is higher.
- (Q) How many offspring must survive for population stability?

Red Drum Larva ~4 days old and 4 mm TL



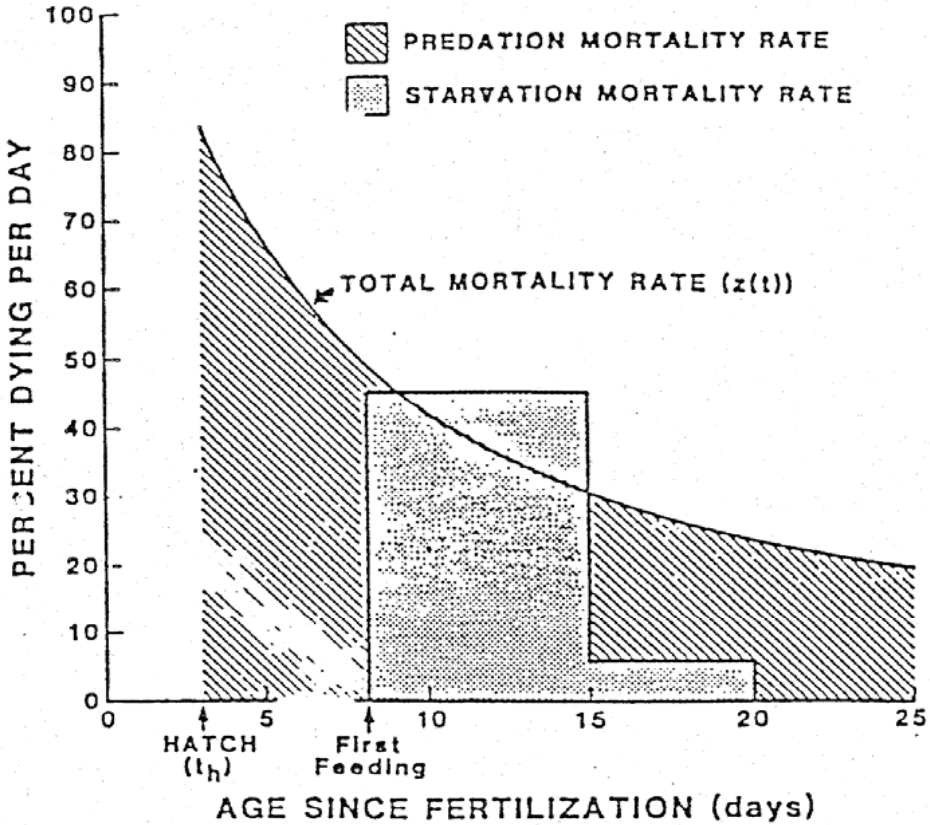


Figure 4. Total mortality rate of larval jack mackerel Trachurus symmetricus as a function of age since fertilization. Mortality due to predation + mortality due to starvation = total mortality (from Hewitt et al., 1985).

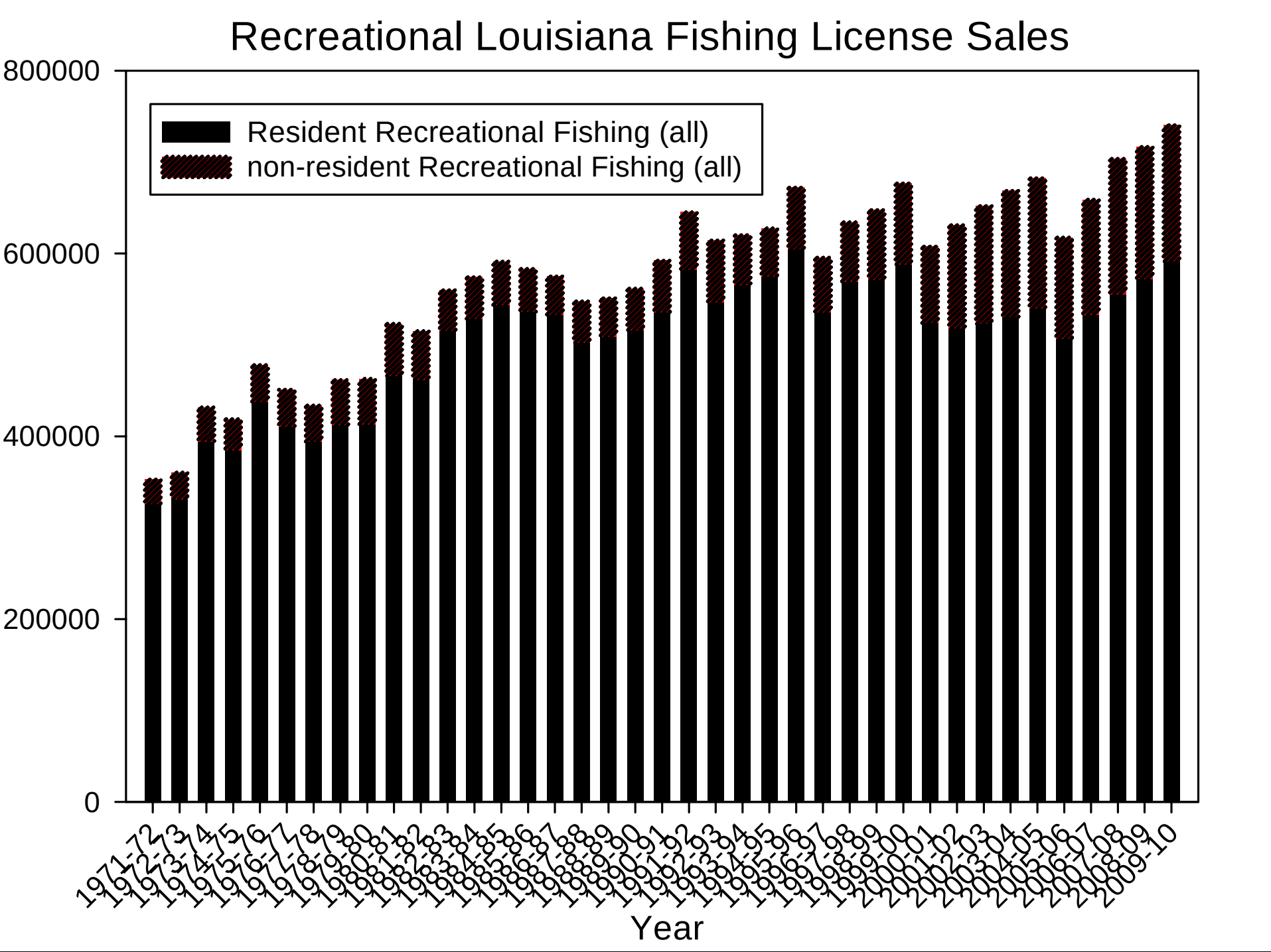
Table 1.1 Comparison of traits of freshwater and marine teleost fish eggs and larvae.

Early life-history trait	Freshwater	Marine
Egg diameter (median, mm)	1.70[a]	1.02[a]
Egg buoyancy	Mostly negative[a]	Mostly positive[a]
Incubation period (days)	10.9 ± 0.27[a]	7.0 ± 0.33[a]
Hatching length (median, mm)	5.40[a]	2.87[a]
Hatching dry weight (μg)	359.7 ± 72.8	37.6 ± 6.4
Metamorphic dry weight (mg)	9.3 ± 1.6	10.8 ± 0.95
Larval duration (days)	20.7 ± 1.1	36.1 ± 1.1
Metabolic rate ($\mu l\, O_2\, mg^{-1} h^{-1}$)	2.8 ± 0.4	5.9 ± 0.4
Ingestion rate ($\mu g\, \mu g^{-1} day^{-1}$)	0.46 ± 0.09	0.57 ± 0.07
Growth rate ($\mu g\, \mu g^{-1}\, day^{-1}$)	0.18 ± 0.02	0.20 ± 0.01
Growth efficiency	0.32 ± 0.03	0.29 ± 0.3
Instantaneous mortality (day^{-1})	0.16 ± 0.04	0.24 ± 0.02
Expected larval mortality (%)	94.7	99.9
Starvation risk	Lower	Higher
Larval mortality	Density-independent	Density-dependent
Stage for recruitment regulation	Juvenile period	Larval period
Recruitment variability	Lower	Higher

Values (means ± 1 SE, unless stated otherwise) are adjusted for differences in temperature, where appropriate. Data are from Houde (1994), except where indicated by superscript "a". Houde omitted salmonids, sturgeons, and ictalurid catfishes from calculations for freshwater fishes because of their unusually large, demersal eggs. Other calculations (with superscript "a") are based on data for 42 freshwater species from 21 families and 42 marine species from 34 families, derived from various published sources.

True or False

- Recreational fishing has relatively little impact on fish populations compared to commercial fishing?

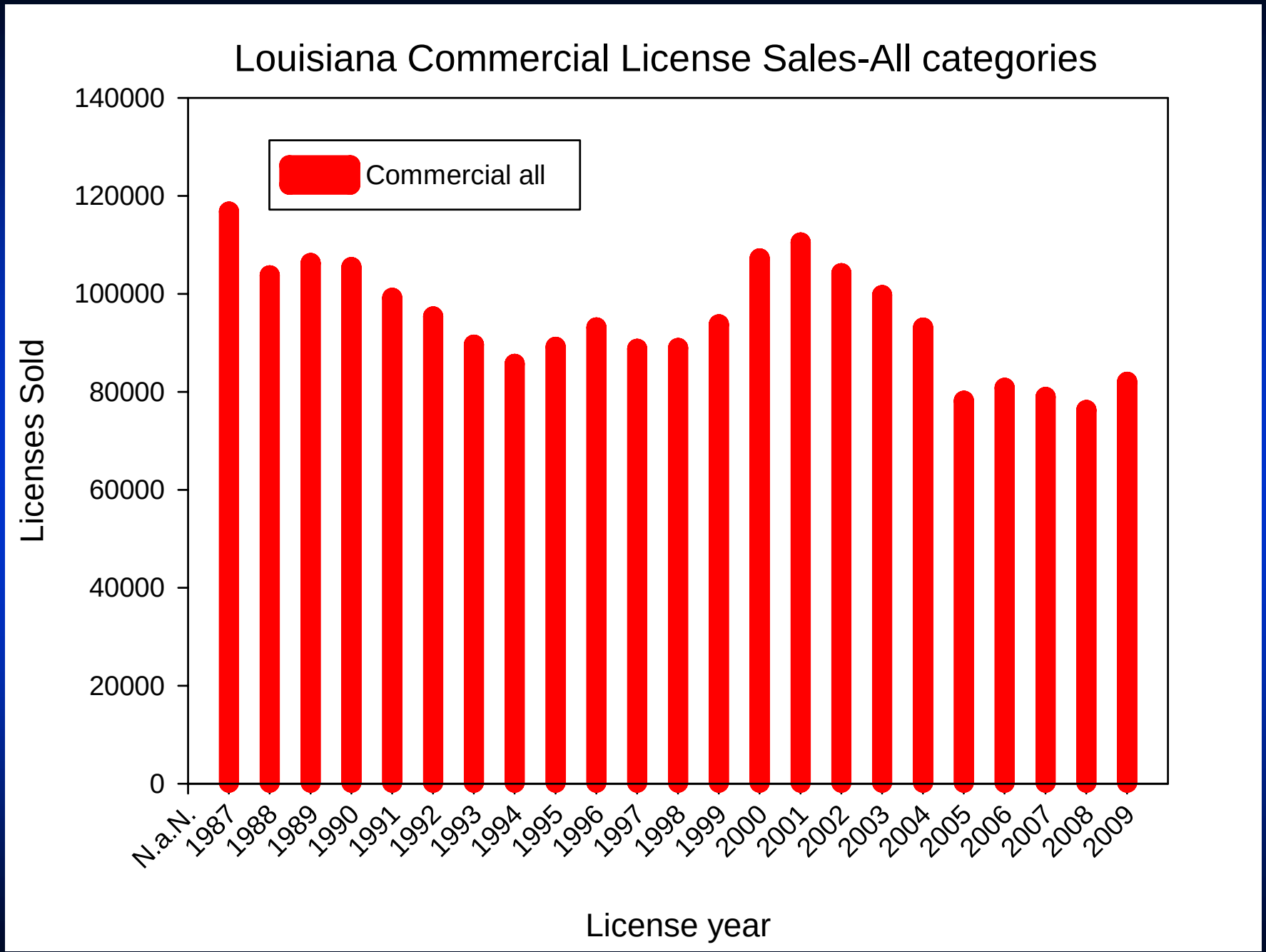

Recreational Louisiana Fishing License Sales
800000
600000
400000
200000
0
Resident Recreational Fishing (all)
non-resident Recreational Fishing (all)
1971-72
1972-73
1973-74
1974-75
1975-76
1976-77
1977-78
1978-79
1979-80
1980-81
1981-82
1982-83
1983-84
1984-85
1985-86
1986-87
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
Year

Catch and Release Facts

- In 2006 Florida had the most saltwater recreational fishermen in the United States : 3.7 million anglers plus another 2.9 million saltwater anglers from other states reported saltwater fishing trips to Florida in that year. Those recreational fishermen (6.6M total) released just over 44% of their catch in 2006.

True or False

- Recreational fishing has a much more important economic impact on our community than commercial fishing so we should allocate all those fish resources to that sector.


Louisiana Commercial License Sales-All categories
Commercial all
Licenses Sold
140000
120000
100000
80000
60000
40000
20000
0
N.a.N.
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
License year

Economic impact of saltwater fishing for Gulf States 2006

	Retail Sales	Total Multiplier Effect (Economic Output)	Salaries, Wages and Business Owner's Income	Jobs	Federal Tax Revenues	State and Local Tax Revenues
Alabama	$226,709,771	$378,557,412	$106,466,400	3,762	$23,965,155	$20,436,730
Florida	**$2,997,500,518**	**$5,123,992,575**	**$1,568,389,759**	**51,588**	**$378,902,841**	**$311,265,319**
Louisiana	**$472,092,061**	**$757,091,876**	**$210,847,634**	**7,733**	**$45,605,182**	**$49,976,489**
Mississippi	$63,268,219	$102,347,443	$27,848,813	1,116	$5,831,236	$6,061,288
Texas	$981,292,755	$1,793,001,667	$553,339,043	18,542	$118,914,671	$101,907,407
United States *	$11,051,345,543	$30,327,313,593	$9,407,680,614	263,898	$2,211,291,290	$1,805,857,463

Ex-vessel Value of LA Commercial Landings

Year	Metric Tons	Pounds	$
2006	416,708.20	918,674,923	$278,291,550
2007	453,166.90	999,051,803	$289,230,436
2008	416,756.80	918,781,969	$275,203,898
2009	455,930.60	1,005,144,684	$284,425,434
GRAND TOTALS:	1,742,562.50	3,841,653,379	$1,127,151,318

Doesn’t include equipment, boats, fishing gear, fuel sales, license revenues, tax dollars or other economic multipliers.

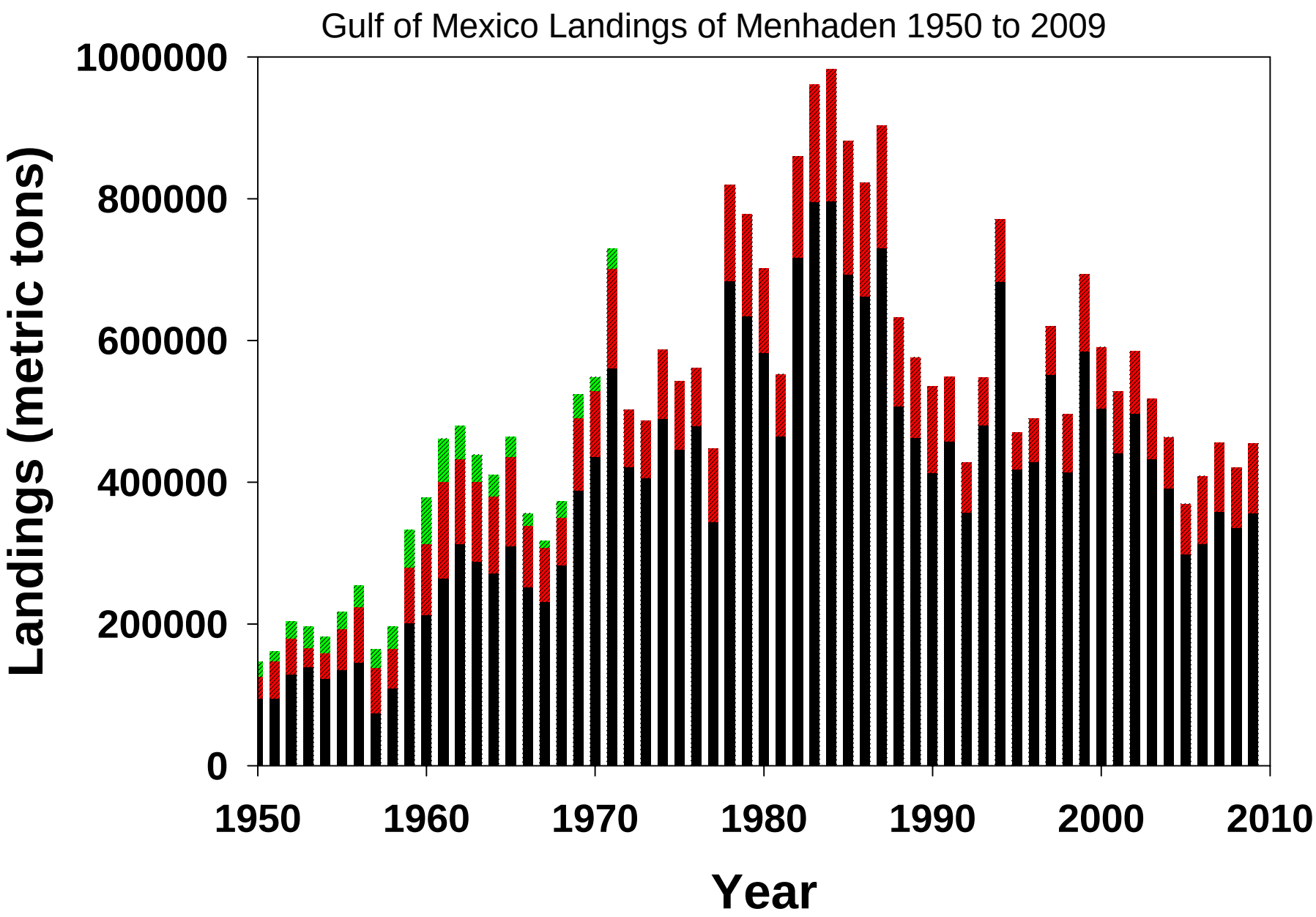
True or False

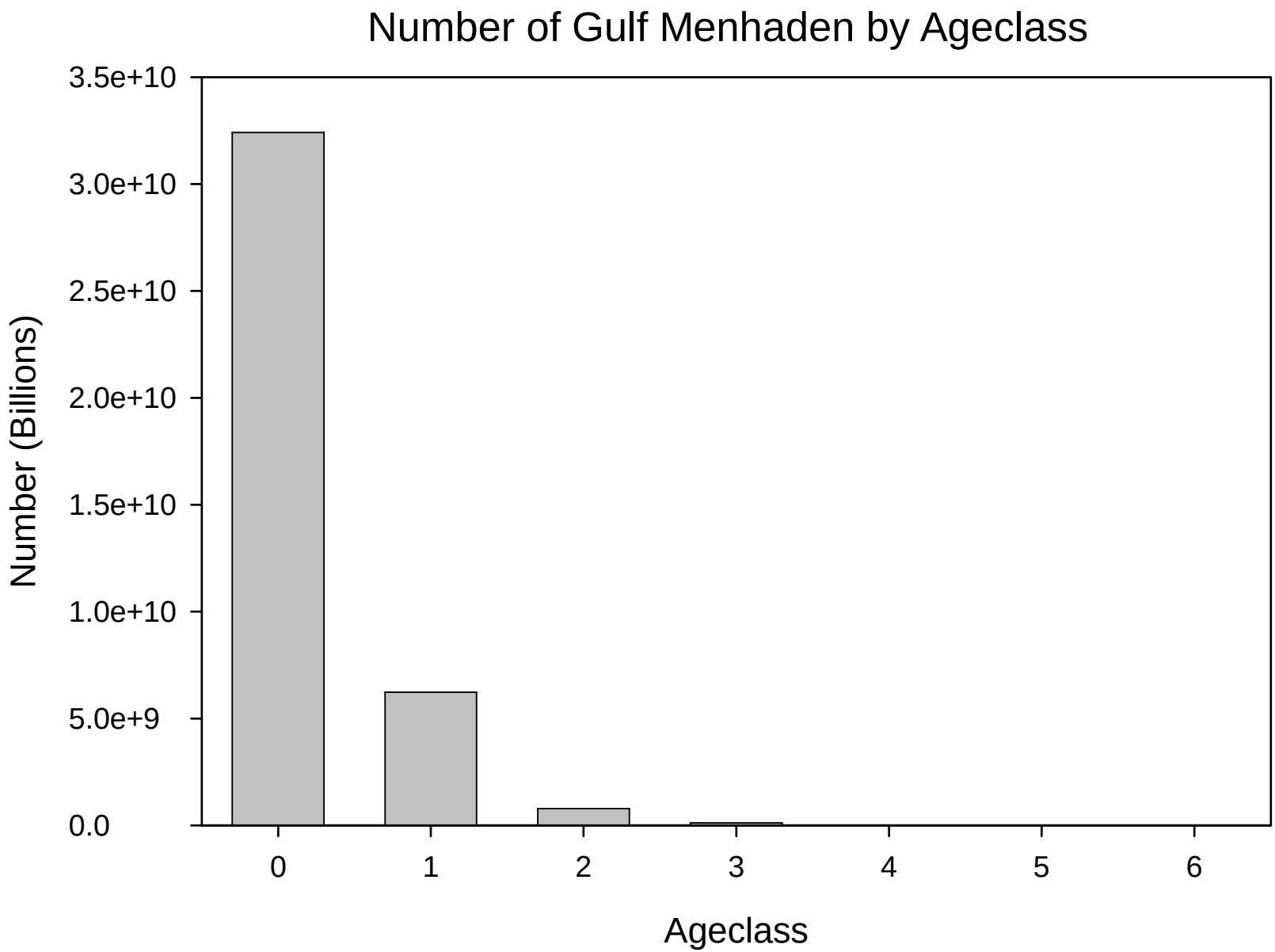
- Undersized speckled trout die if they are release so why don’t we remove the size limit and keep undersized fish?

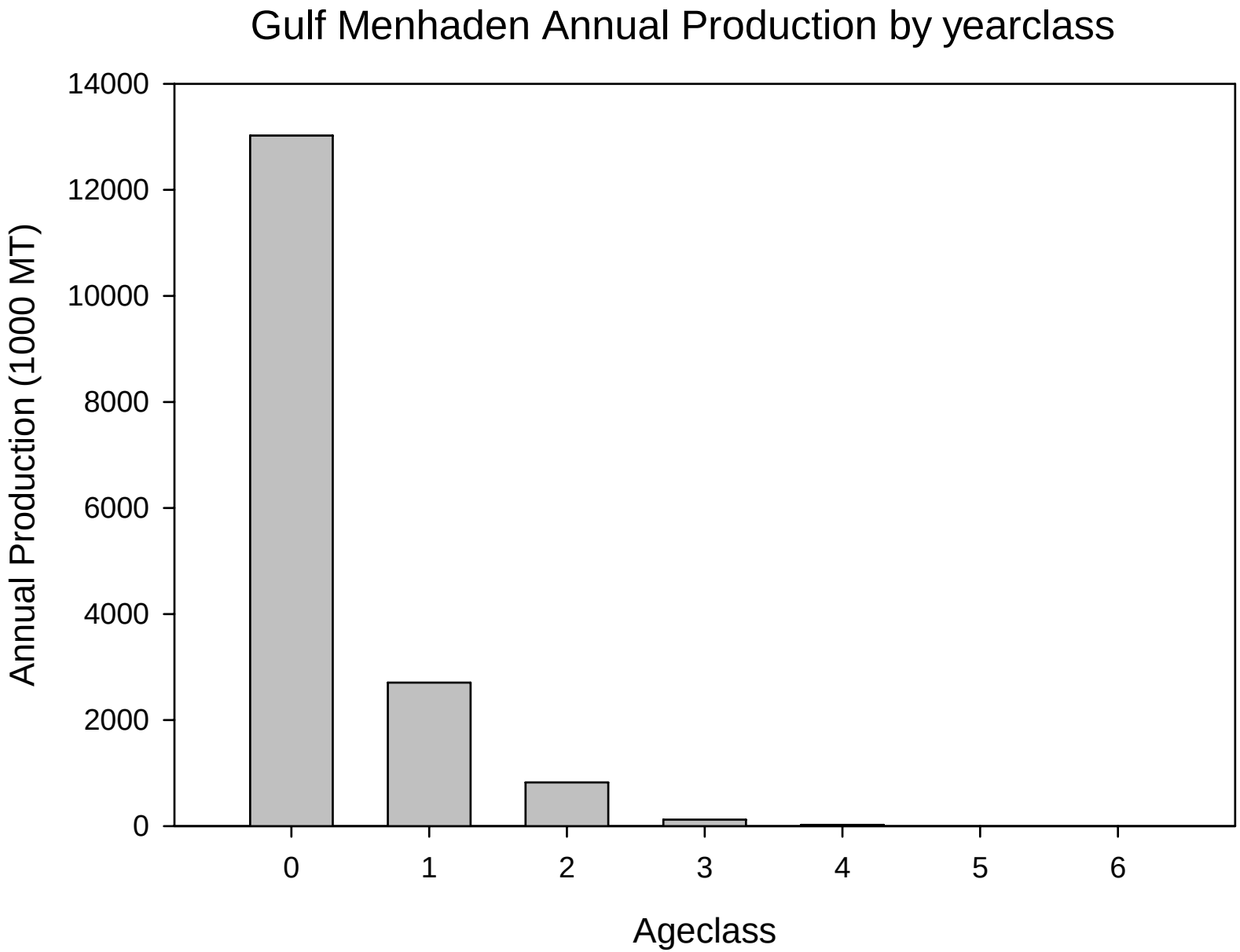
True or False

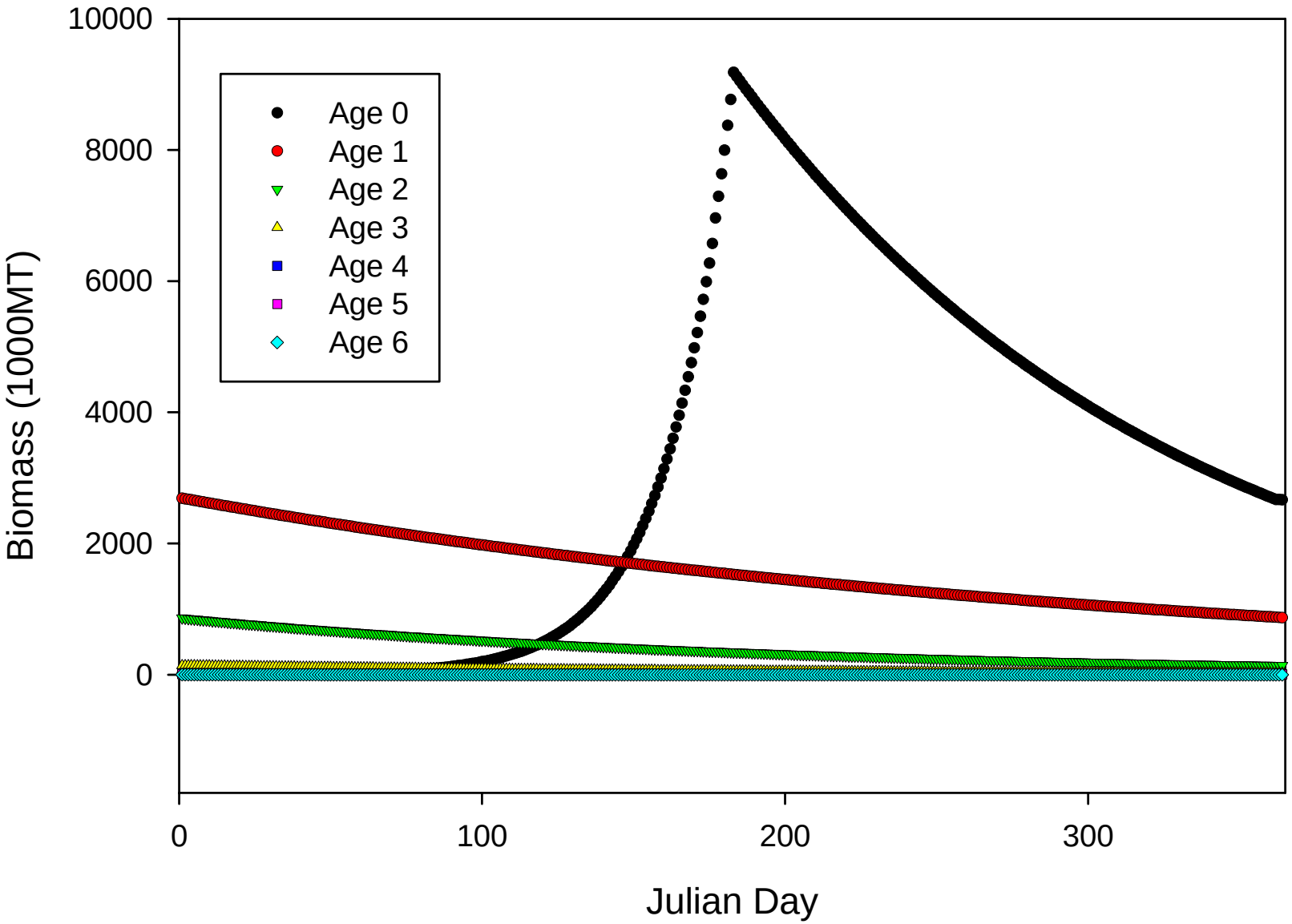
- The Gulf menhaden fishery is by far the largest (by weight) in the Gulf of Mexico (454,761mt in 2009).

- The Gulf of Mexico menhaden purse seine fishery captures fishes that red drum and other game fish eat so we should close down that fishery before it collapses from overfishing like the Atlantic menhaden fishery?


Gulf of Mexico Landings of Menhaden 1950 to 2009
Landings (metric tons)
1000000
800000
600000
400000
200000
0
1950
1960
1970
1980
1990
2000
2010
Year


Number of Gulf Menhaden by Ageclass
3.5e+10
3.0e+10
2.5e+10
2.0e+10
1.5e+10
1.0e+10
5.0e+9
0.0
Number (Billions)
0
1
2
3
4
5
6
Ageclass


Gulf Menhaden Annual Production by yearclass
Annual Production (1000 MT)
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
Ageclass


Biomass by Ageclass and julian Day
Biomass (1000MT)
10000
8000
6000
4000
2000
0
Age 0
Age 1
Age 2
Age 3
Age 4
Age 5
Age 6
0
100
200
300
Julian Day

True or False

- Oil and gas structure increase the production of fish in the sea?





ANCHOR
ICE & FUEL






MISS LUCY




Perspectives

- How do fishermen view coastal structures or specifically oil rigs in GOM?
- What happens to fish and other secondary production when structures are placed in the coastal zone?
- What synergies might new structures placed in the coastal zone offer fishermen and other stakeholders?
- Can new structures be designed to “improve” habitat suitability for key species?

Fish aggregate around these structures, especially highly desirable reef associated fishes such as groupers and snapper

MMS Offshore GOM Facts

These statistics reflect data through 10-26-2009 09:24:19 AM (CST)
and will be updated weekly.

Water Depth in Meters	Active Leases	Approved Applications to Drill	Active Platforms
0 to 200	2,462	33,459	3,591
201 to 400	160	1,095	21
401 to 800	337	829	9
801 to 1000	420	493	7
>1000	3,416	1,557	24

Alan Walker-

Towers of Life

“Build it and they will come”

Alan Walker-

Towers of Life

Any object in the coastal act as a FAD and sometimes interacts with biota in unpredictable ways

Saltwater Recreational Survey Structure

Voluntary survey-located on web at rodnreel.com

Asked a series of 28 question related to:

- demographics (gender, age, residency)
- frequency of saltwater fishing
- fishing habits (mode, type of fishing methods, gear)
- general fishing location in coastal Louisiana (depth, blocks, distance from shore, use of offshore structures)
- Series of question related to their understanding of environmental issues (i.e. contribution of the Mississippi river make to fishery production, hypoxia, value of structures as artificial reefs).

Demographics

Gender:

- ⇒ Male 98% (978); Female 2% (25)

Age:

- ⇒ No. of responses: 997 (97%)
- ⇒ Mean 40.8, Max 82, Min 14

Louisiana Residence:

- ⇒ Resident 92% (914)
- ⇒ Non-Resident 8% (81)

Do you fish the offshore waters (> 3 miles) of Louisiana?

64% (647) Yes

36% (362) No

Do you generally fish around offshore oil and gas structures?

77% (706) Yes

23% (210) No

If yes, please estimate the percentage of time spent fishing at structures:

15% (115) 25% or less

27% (205) about 50%

54% (412) >90%

4% (28) none

Do you think offshore structures improve the quality of your offshore fishing in Louisiana?

99% (882) Yes

1% (11) No

Please assign a percentage of effort devoted to your predominant mode of offshore fishing.

Category	25% or less	about 50%	>90%	None
Bottom Fishing	20% (176)	34% (296)	34% (289)	3% (28)
Trolling	31% (268)	19% (167)	8% (68)	10% (84)
Drift line	27% (230)	14% (122)	5% (42)	12% (106)
other	12% (104)	7% (58)	7% (59)	13% (115)

Characteristics	Fish Cage	Shellfish Raft or longline	Energy Structure
Alters Energy Flow	Yes	Yes	Yes
Energy Flow Dynamics	Energy input from outside; shunts local PP to filter feeders	Shunts Local PP to Mussels and Benthos	Shunts Local PP to Filter-F colonizers
Alters Food Web	In some cases	Yes	Yes
Increase Hard Substrate	Yes	Yes	Yes
Acts as a FAD	Yes	Yes	Yes
Changes Community Structure	Yes	Yes	Yes
Amount of bio-fouling	Age dependent	Age dependent	Age dependent
Increased Sec. Production	Possible localized effect from feed energy	Possible localized trophic level effect	unlikely-but location specific

True or False

- The fish I buy and eat from the store comes mostly from wild fisheries?

SOFIA 2008?

The State of World Fisheries and Aquaculture (SOFIA)

>Fifty percent of the world's fishery production is now from aquaculture

True or False

- Cultured fish are less efficient to produce and should be avoided because it requires the harvest of wild fish as fish meal to feed captive cultured fish?

What about the use of wild fish as broodstock and as a protein source in Aquaculture feeds?

- Anti-aquaculture interests contend that :
- the use of wild fishes is simply taking two pounds of wild fish to make one pound of domesticated fish and so there is no net gain in fish production from aquaculture, only the reduction of wild forage fish to support wild fisheries.

What about the use of wild fish as a protein source in Aquaculture feeds?

- This assertion is **not correct**.
- The impact of using wild fish to grow fish in captivity depends on the type of fish you use and how you use them in aquaculture.
- *No matter how you calculate it, aquaculture combined with wild fisheries harvests can produce much more fish than wild fishery harvests alone.*

What about the use of wild fish as a protein source in Aquaculture feeds?

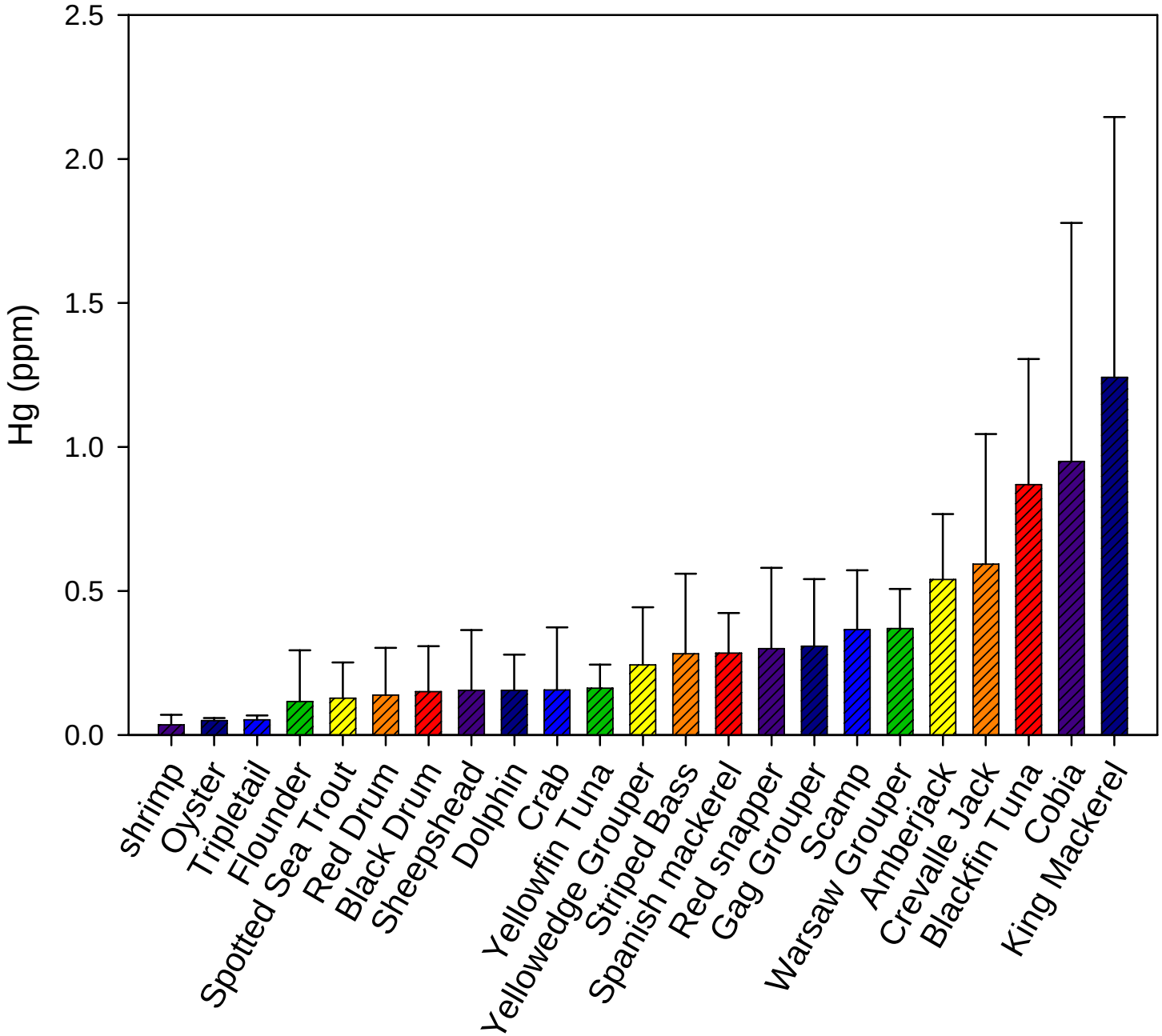
- Some fish are more efficient at using plant proteins and so the use of fish proteins can be reduced in feeds relative to what it takes to grow a fish in the ocean. By growing these species in captivity finfish global production can be enhanced.
- Nutritionists are also developing ways to incorporate more plant proteins into feeds for fish that require high protein content feeds. Many marine species can utilize levels of up to 40% plant proteins in their diet without compromising growth.

What about the use of wild fish as broodstock and as a protein source in Aquaculture feeds?

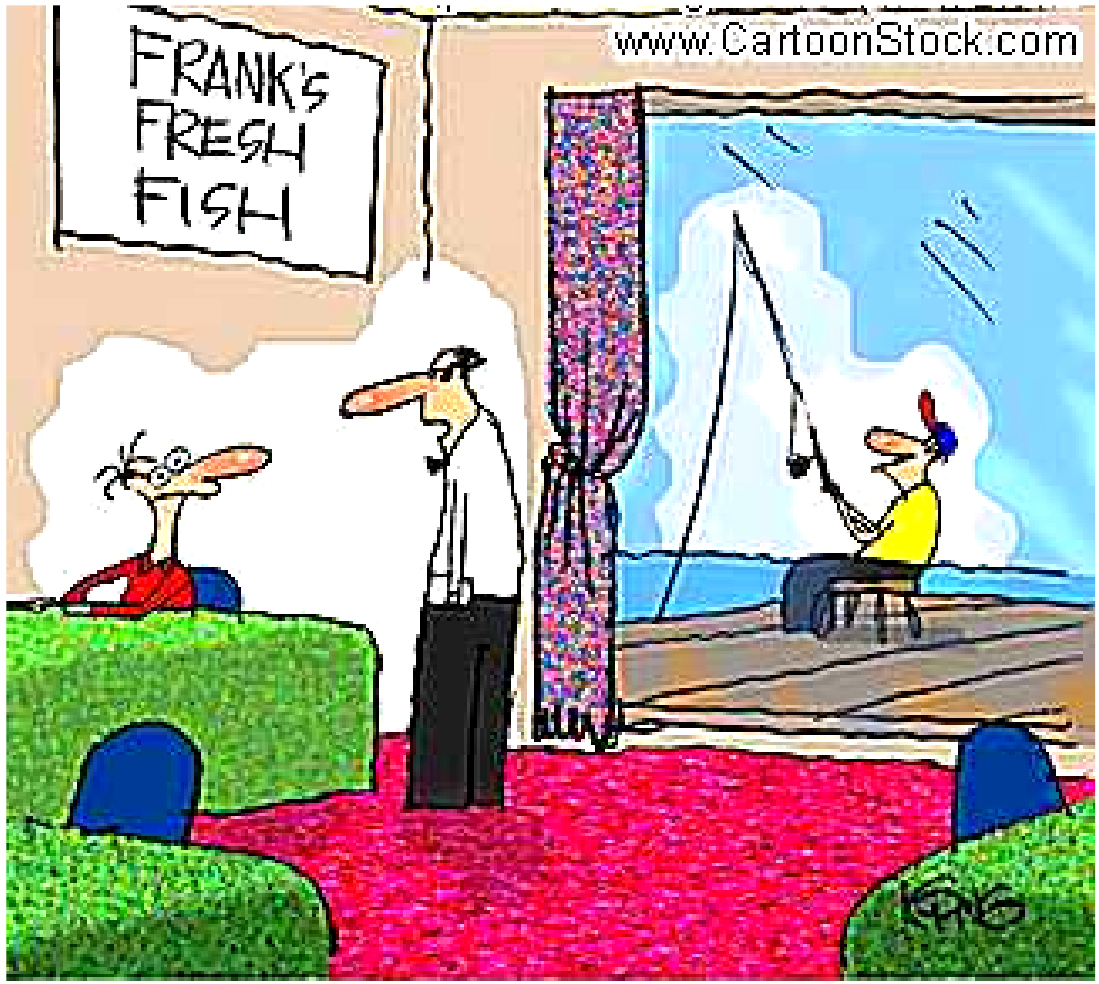
- Cultured fish are harvested at at relatively small size and age so the biomass used to grow them goes into production (growth) rather than supporting biomass (at a much higher rate than in wild fisheries).
- Forage fish that feed low on the foodchain can actually enhance overall fish production when used as fish feed because of their ability for compensatory recruitment and growth.

True or False

- From a health perspective, cultured fish are not as good for you as wild caught fish because of water quality and fish nutrition issues?


LDEQ-All Species
Hg (ppm)
2.5
2.0
1.5
1.0
0.5
0.0
shrimp
Oyster
Tripletail
Flounder
Spotted Sea Trout
Red Drum
Black Drum
Sheepshead
Dolphin
Crab
Yellowfin Tuna
Yellowedge Grouper
Striped Bass
Spanish mackerel
Red snapper
Gag Grouper
Scamp
Warsaw Grouper
Amberjack
Crevalle Jack
Blackfin Tuna
Cobia
King Mackerel

Thank you for listening!



"Your fish dinner should be along shortly.
Frank just had a nibble."