

Declining Expectations – The Phenomenon of Shifting Baselines

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NCSR curriculum modules are designed as comprehensive instructions for students and supporting materials for faculty. The student instructions are designed to facilitate adaptation in a variety of settings. In addition to the instructional materials for students, the modules contain separate supporting information in the "Notes to Instructors" section, and when appropriate, *PowerPoint* slides. The modules also contain other sections which contain additional supporting information such as assessment strategies and suggested resources.

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NCSR Marine Fisheries Series

The marine fisheries issue is complex and represents an opportunity to approach the nature and management of a natural resource from several different perspectives in courses in natural resource or environmental science programs. Complete coverage of all fisheries-related topics is probably impractical for most courses unless the course is entirely devoted to fisheries. Instructors may select some topics for coverage and de-emphasize or ignore others. Thus, these curriculum materials are designed to meet a variety of instructional needs and strategies. The *NCSR Marine Fisheries Series* is comprised of the following:

1. *PowerPoint* Presentations

These presentations include *PowerPoint* slides, lecture outlines and detailed instructor notes on various marine fisheries topics.

- *Marine Fisheries Overview*
- *Marine Fisheries – Introduction and Status*
- *Marine Fisheries – Causes for Decline and Impacts*
- *Marine Fisheries – Management and Proposed Solutions*
- *Declining Expectations – The Phenomenon of Shifting Baselines*
- *The Role of Marine Reserves in Ecosystem-based Fishery Management*

2. *Decline of Atlantic Cod – A Case Study*

This module provides a comprehensive examination of the decline of the Atlantic cod. Instructional materials include student learning objectives, a *PowerPoint* presentation with instructor notes, student handouts, suggested resources and assessment. Brief descriptions of other fisheries for development as case studies are also provided.

3. *Comprehensive Resources for NCSR Marine Fisheries Series*

This module provides detailed summaries for six excellent videos that examine various aspects of the marine fisheries issue:

- *Empty Oceans, Empty Nets* (2002) – an overview of major marine fisheries issues (one-hour) – student handout provided
- *Farming the Seas* (2004) – an examination of issues associated with aquaculture (one-hour) – student handout provided
- *Deep Crisis* (2003) – an examination of current research on salmon and bluefin tuna using modern technology (one-hour)
- *Strange Days on Planet Earth – Episode 3- Predators*
- *Strange Days on Planet Earth – Episode 5 – Dangerous Catch*
- *Journey to Planet Earth – The State of the Planet's Oceans*

This module also provides a comprehensive glossary of terms commonly used in marine fisheries.

In addition, complete citations and brief summaries of web, print and video resources are provided that can be used to:

- Enhance existing lecture topics
- Develop lectures on new topics
- Develop geographically relevant case studies
- Update fishery statistics
- Select articles for student reading
- Access video and photos for presentation purposes

4. Activity-based Instructional Modules

- *Shrimp Farming –Environmental and Social Impacts* an evaluation of the environmental and social impacts of shrimp aquaculture (one hour)
- *Where Does Your Seafood Come From?* – students evaluate the sustainability of locally available seafood and the criteria that are used to make that determination (3-4 hours)

The manner in which instructors use the modules in this series will depend upon:

- The course in which the module will be used

The marine fisheries modules are most appropriate for inclusion in undergraduate courses such as *Environmental Science, Introduction to Natural Resources, Marine Biology, Introduction to Fisheries* and *Fisheries Management*. Parts of the modules may also have application in courses with a broader scope such as *General Ecology* and *General Biology*.

- The background of the students

The marine fisheries modules assume some understanding of basic ecology including populations, communities and ecosystem structure and function. The treatment of ecology in either a college-level or high school-level general biology course should be sufficient. Instructors may need to provide additional background to students who are not familiar with this material.

- The time that will be dedicated to the study of marine fisheries

There is sufficient information and resources in the marine fisheries modules to present anything from a single one-hour lecture to a major portion of a full academic term, lecture-only course. Instructors may select from the various components depending on course objectives and the amount of time allocated for marine fisheries topics.

Declining Expectations – The Phenomenon of Shifting Baselines

An Instructional Guide

This instructional guide is designed to provide instructors with lecture support on the concept of shifting baselines and its application to marine fisheries. Shifting baselines are defined and their contribution to fishery declines discussed. Various methods that are used to establish historical baselines are described and illustrated with case studies.

A general lecture outline and a more detailed *PowerPoint* presentation with instructor notes are provided. Print, video and web-based resources that cover the topic are summarized and cited. Instructors who wish to obtain greater detail on any of the topics discussed in this module are encouraged to seek out these additional resources or those cited in the *Comprehensive Resources for NCSR Marine Fisheries Series*.

Objectives

Upon successful completion of this module, students should be able to:

1. Define the concept of “shifting baselines”
2. Describe how shifting baselines have contributed to fishery declines
3. Describe the various methods that can be used to establish historical baselines
4. Evaluate the effect of the shifting baselines phenomenon for various fisheries
5. Describe how an understanding of historical baselines can be applied to the management of present day fisheries

General Lecture Outline

I. Introduction

- A. Definitions

- B. Examples

II. Methods for establishing historical baselines

- A. Written documents

- B. Photographs

- C. Biological deposits

- D. Interviews

III. Case studies

- A. Atlantic cod

- B. Sharks

- C. Pacific abalone

- D. California anchovy

- E. Gulf of California

IV. Applications to fisheries management

***PowerPoint* Presentation with Instructor Notes**

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Opinions expressed are those of the authors and
not necessarily those of the Foundation.



This presentation provides an examination of the phenomenon of shifting baselines and its application to fisheries management. Other marine fisheries topics such as status, causes for declines, the implications of fishery declines for marine ecosystems and fishery management practices are described in detail in other NCSR marine fisheries modules.

Shifting Baselines – An Introduction



Baiji - China's White River
Dolphin

Declared "extinct" 2006

Polar bear

Declared "threatened" 2007



© baiji.org foundation, Steven Leatherwood

First People

Despite the fact that people are probably among the most influential factors in shaping current environmental conditions, human nature is poorly equipped to deal with the gradual degradation of the environment. Environmental problems such as global climate change, the loss of biodiversity, the lack of freshwater availability and land use conversion from natural to human-dominated landscapes are among the most difficult environmental problems we have to contend with. Fisheries declines can be counted among these. These are problems that might best be described as chronic "drip by drip" environmental issues in contrast to more acute problems such as the release of millions of gallons of crude oil from an oil spill or the release of radiation from a nuclear power plant accident. Until recently, chronic, gradual environmental degradation received relatively little public recognition. Yet, in 2006, two of these problems saw the light of day – global climate change and extinction (as represented by the extinction of the Chinese river dolphin in the Yangtze River, China). For global climate change, Al Gore's "Inconvenient Truth" along with many mainstream media reports of ice shelf breakup, the loss of sea ice and starving polar bears probably helped to bring this issue to light.

Why do humans fail to recognize such insidious and perhaps irreversible problems for so long?

Shifting Baselines

"Fishing has a short memory. If you see twice as many fish as you've seen in the last 10 years, it's still twice as much of not very much."

Teri Frady - NMFS

Atlantic halibut
Provincetown,
Massachusetts
circa 1910



Post card from Census of Marine Life - History of Marine Animal Populations – Glenn Jones

The concept of "shifting baselines" was originally developed in 1995 by fisheries biologists, to explain the decline of commercial fish stocks. The concept is based on the contention that fishers, scientists and the general public are most familiar with those conditions that exist during their lifetime. Historical conditions that existed prior to this time frame are often not recognized. Those who are not aware of earlier stock levels accept recent levels as normal. Historical accounts of large fish and huge catches tend to be dismissed as unreliable anecdotes. As reference points of "how things used to be" are allowed to shift, we lose track of our standard and accept a more degraded state as being "normal" or "natural." As a result, we fail to recognize the extent and consequences of past environmental modifications by humans.

For instance, Atlantic swordfish used to grow to more than 1000 pounds, yet the average swordfish landed in 1995 weighed only 90 pounds, approximately 2 years short of reaching sufficient size for its first reproduction. Awareness of this difference has been shown to be related to the age of the fisherman, with younger fishermen generally unaware of (or un-accepting of) the existence of larger fish in the past.

The photo above is an Atlantic halibut (270 lb.) caught off Provincetown, MA circa 1910. Halibut have virtually disappeared from the North Atlantic due to overfishing. The few that are caught now are much smaller than the one seen on this post card.

Quote on slide is from Teri Frady (2002) Chief of Research Communications, National Marine Fisheries Service

Shifting Baselines - Definitions

“The tendency for people to define pristine nature as nature the way they first saw it, rather than the way it was in the beginning”.

Callum Roberts 2007
The Unnatural History of the Sea

“Inter-generational changes in perception of the state of the environment”

Sàenz-Arroyo, et al. 2005

Shifting baselines results in an incremental “lowering of standards” as each new human generation redefines what is considered “natural” or “normal” based on their own personal experiences. Each new generation lacks an understanding of how the environment “used to be.” This lower standard is now the new baseline for the next generation.

The shifting baselines phenomenon is “the tendency for people to define pristine nature as nature the way they first saw it, rather than the way it was in the beginning.” Roberts (2007) provides information from archival records that allow us to evaluate many fisheries (as well as sealing and whaling) from a longer perspective stretching back hundreds of years.

Quoted from:

Roberts, C. 2007. *The unnatural history of the sea*. Island Press, Washington, D.C. 435 pp.

“Shifting baselines are inter-generational changes in perception of the state of the environment. As one generation replaces another, people’s perceptions of what is natural, change even to the extent that they no longer believe historical anecdotes of past abundance or size of species.”

Quoted from:

Sàenz-Arroyo, A., et al. 2005

The Importance of Understanding the Past

“We have forgotten what we used to have. We had oceans full of heroic fish – literally sea monsters. People used to harpoon three meter-long swordfish in rowboats. Hemingway’s ‘Old Man and the Sea’ was for real.”



Winslow Homer's *Fog Warning* 1885

Jeremy Jackson
Scripps Institution of
Oceanography

Wikimedia Commons

Many fisheries biologists contend that the current composition and abundance of large marine organisms is but a shadow of what existed in the past. Myers and Worm (2003), for example, conducted a 10-year study and found that 90% of all large fish were gone – blue marlin, bluefin tuna, tropical groupers, Antarctic cod. These species are the “marine megafauna” and their loss is changing marine ecosystems globally. The average size of top predators is only 20-50% of what it used to be.

Jeremy Jackson, a marine biologist at Scripps Institute of Oceanography, sums up the current situation in the quote above.

Baselines are determined from historical and environmental archives

- Landing records
- Diaries and journals
- Logbooks
- Interviews
- Menus
- Photographs
- Shell middens
- Fish bones



Oyster shells – Hampton, Virginia
circa 1915

Post card from Census of Marine Life - History of Marine Animal Populations – Glenn Jones

Historical archives are (usually) written records of past abundance and diversity of marine animal populations. Landing records kept by canneries and other fish processing companies; diaries, journals and logbooks kept by fishermen; interviews—particularly with older fishermen; old photographs; and even, old menus from restaurants, can be used to directly or indirectly estimate historical abundance and diversity. Environmental archives include shell middens (piles of discarded shells) and excavations of fish bones in areas where fish were consumed or processed.

Examination of these historical records has suggested that massive declines in populations of marine mammals, turtles and large fish occurred along coastlines where people lived long before modern fishing records were kept (mostly post- WWII).

Archives of this nature are inherently mixed in quality and reliability, sometimes prone to exaggeration and even fantasy depending on the motivation and integrity of those who recorded them. Nevertheless, when taken in total, with so many accounts, recorded by so many people, in different geographic areas, it is unlikely that they paint an unrealistic picture of past diversity and abundance of fish populations.

PHOTO: A mountain of oyster shells from Hampton, VA circa 1915. Oyster harvests now are only about 4% of what they were in the early 1900s.

Atlantic cod fishery on the Scotian Shelf – Nova Scotia



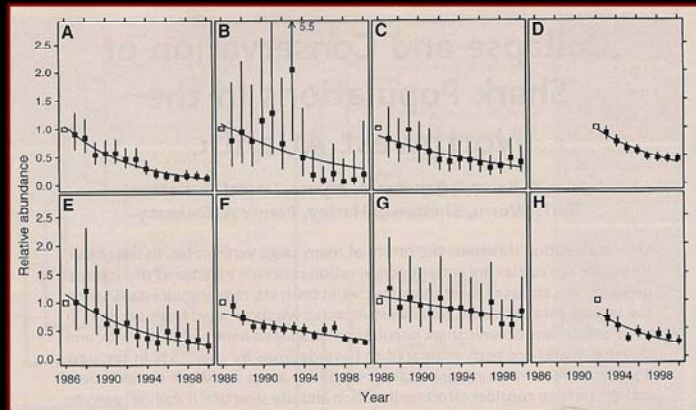
Fish biomass estimated from catch records of 236 schooners (1852-1859)

Biomass Estimates:
1852 – 1.26 million tons
2005 – 0.05 million tons

NOAA National Marine Fisheries Service

In the mid-1800s, the U.S. and Canadian fleet was made up of schooners like this one that fished the Grand Banks with handlines for cod and haddock. Researchers have reconstructed past population levels from detailed catch records from this schooner fleet (Rosenberg, et al., 2005 *Frontiers in Ecology and the Environment*). Scientists with the History of Marine Animal Populations (HMAP) program of the Census of Marine Life (www.coml.org) used historical and environmental archives (daily records of location and catch) to estimate the population size before and after human intervention. Historical reference points are required to determine how ecosystems are changed due to human involvement. Analyses like these impact the specific stock levels that are being chosen as criteria for considering a stock to be “rebuilt.” For example, fishing effort on the Scotian Shelf off Nova Scotia in the middle 1800s was determined by examining the records of 236 schooners based in Beverly, Massachusetts from 1852-1859. These reports suggest that by the late 1850s fishing patterns had changed after the handline fishery depleted cod stocks on the Scotian Shelf. Catch rates had declined by 50% between 1852 and 1859. This analysis has been used to estimate stock biomass of 1852 (1.26 million tons) and to compare to 2005 levels (less than 0.05 million tons). Today’s stock biomass on the Scotian Shelf is a tiny percentage of mid-1800s.

Shark abundance using fishing logbooks - Northwest Atlantic



From: Baum, et al. 2003 Science 299:389-392 reprinted with permission from AAAS

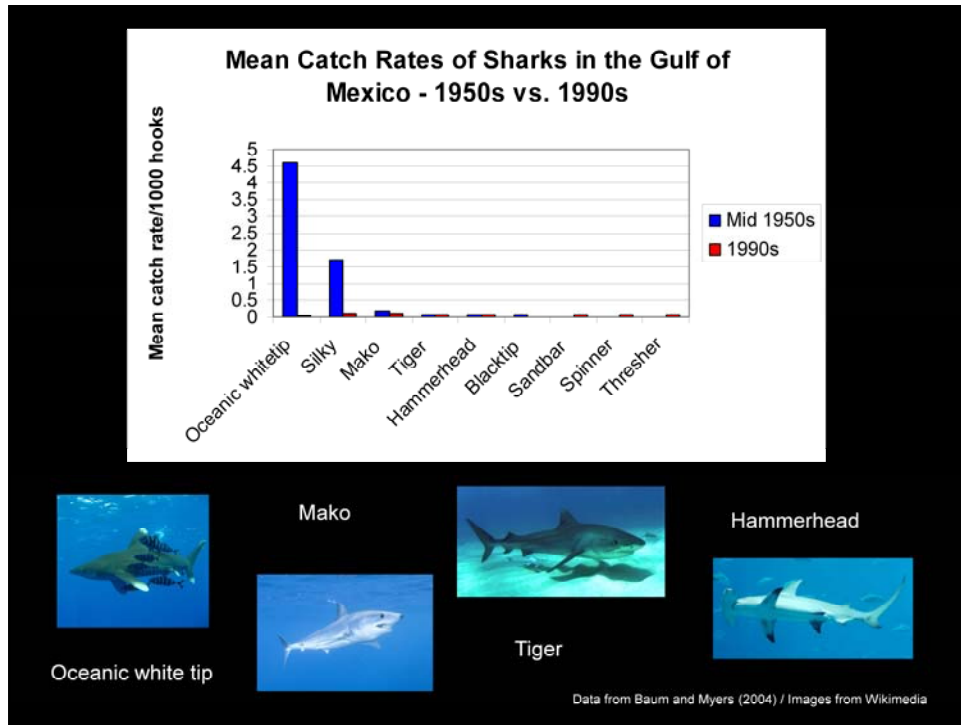
Baum, et al. 2003 used data collected from logbooks kept by fishermen in the U.S. longline fleet, which targets swordfish and tuna. Analysis of these data established estimates for population levels of sharks (which are frequently caught as bycatch) between 1986 and 2000 and confirmed that sharks are among those top predators that have experienced precipitous declines.

In the figure above, each graph represents a different shark species:

- A – Hammerhead
- B – White
- C – Tiger
- D – Coastal and oceanic shark species combined
- E – Thresher
- F – Blue
- G – Mako
- H – Oceanic whitetip

Thus, fishing records such as logbooks can be used to estimate historic conditions. However, the shortcomings of archival records such as logbooks must be recognized. For example, considerable underreporting may occur (particularly if there is motivation on the part of fishermen to do so).

Fig. 2 from Baum, et al. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. Science 299:389-392 reprinted with permission from AAAS.



Baum and Myers (2004) also used logbooks to document past population levels of sharks in the Gulf of Mexico.

The solid bars on the graph illustrate the average catch rates per 1000 hooks in the 1950s compared to the 1990s for several species of sharks. So, for example, catch rates for oceanic whitetip sharks in the 1950s were approximately 4.5 sharks/1000 hooks compared to nearly zero in the 1990s. Comparisons between log book records and current catch statistics confirmed that the current population of oceanic whitetip sharks (*Carcharinus longimanus*) is less than 1% of what it was in the 1950s. Gulf of Mexico fishers and even scientists from the area show no understanding of the whitetip's former abundance in this ecosystem.

Baum, J. and R. Myers. 2004. Shifting baselines and the decline of pelagic sharks in the Gulf of Mexico. *Ecology Letters* 7(2):135-145.

Abalone in Santa Barbara, California



Santa Barbara,
California
circa 1920

Commercial
harvest of
abalone has
been banned
since 1997

Post card from Census of Marine Life - History of Marine Animal Populations – Glenn Jones

This is a post card from an abalone processing plant in Santa Barbara, California circa 1920. For a slow-growing mollusk like abalone, harvest at this level is essentially like mining. The price of abalone dramatically increased as supplies declined. Contrast this level of harvest with the depleted current population and the ban on commercial harvest which has been in place since 1997.

Even old seafood menus from restaurants can provide useful information. Examination of menus in California, for example, has allowed the tracking of availability and price of seafood back 150 years. This analysis revealed that a serving of abalone in a San Francisco restaurant, which today would cost between \$30 and \$40, cost only \$6-7 (in 2008 dollars) in the 1920s. The price differential reflects the scarcity of abalones after over-harvest, culminating in the 1997 ban on commercial harvesting.

Historical photographs



Key West, Florida
Recreational fishing
charter - 1957

Goliath grouper and
large unidentified sharks

Monroe County Library collection (Florida Keys)

Historical photographs can be used to establish baselines. This photo portrays the results of a Key West, Florida recreational fishing trip in 1957. Goliath grouper (now an endangered species) and large unidentified sharks are the primary catch.

Archived photos like this are used by Loren McClenachan of Scripps Institution of Oceanography to establish environmental baselines for the Census of Marine Life, a research program designed to better understand the biology of species found in the world's oceans.

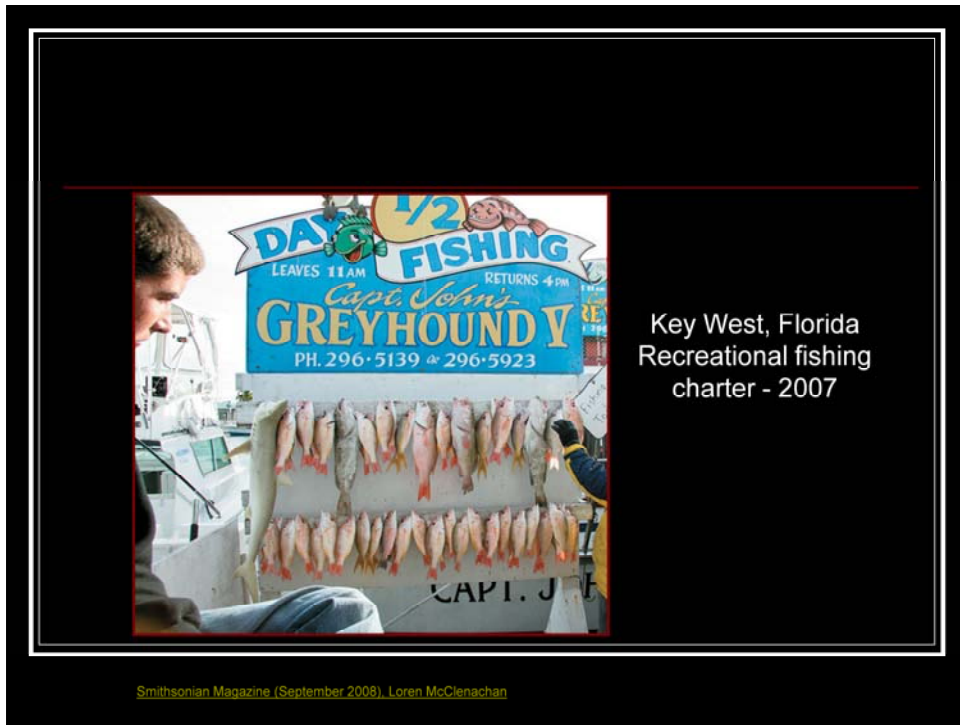


Key West, Florida
Recreational fishing
Charter – 1983

White margate

Monroe County Library collection (Florida Keys)

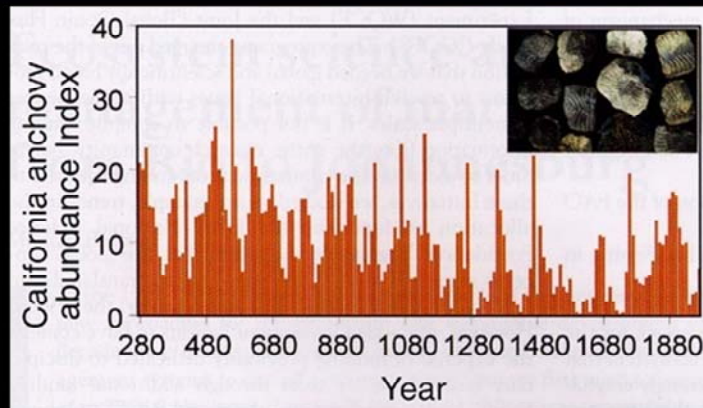
Key West fishing charter 1983. White margate (shown here) are now only rarely caught in waters off Key West.



Contrast the previous photographs to the catch from a 2007 Charter fishing trip out of Key West. Catches get smaller and fewer and some species disappear over time.

What are the consequences of the shifting baselines phenomenon to this fish stock as illustrated in this series of photos from Key West?

A 1600-year record of anchovy abundance from sediment cores



© Barange M. (2003) *Frontiers in Ecology and the Environment*

Fish scales (seen in inset) detected in sediment cores in the Santa Barbara Basin, California provide an estimate of California anchovy abundance over a 1600-year time frame. This is an example of another technique used to determine the baseline of historical marine ecosystem conditions.

Barange, M. 2003. Ecosystem science and the sustainable management of marine resources: from Rio to Johannesburg, *Frontiers in Ecology and the Environment* 4(1): 190-196.

http://tiee.ecoed.net/vol/v2/issues/frontier_sets/marine/abstract.html

Interviews with older fishers



Detailed information on spawning patterns, habitats and fishing effort in the Gulf of Maine has been obtained from “experienced” fishers

[Schooner Adventure](#)

“Experienced” fishers are a wealth of information concerning past fishery conditions, but their knowledge has rarely been tapped in any systematic manner. One exception is the work of Ted Ames of Stonington, Maine, a 2005 recipient of a MacArthur Foundation Fellowship. Ted is a commercial fisherman who has witnessed profound changes in the economic structure of fisheries based in the Gulf of Maine. He collected detailed information on spawning patterns, habitats and fishing effort in the Gulf of Maine using anecdotes from experienced fishermen as his main source of information. Using this information he was able to determine historical conditions of fish populations and to develop strategies for sustainable management of the fisheries in the future.

Shifting baselines in the Gulf of California

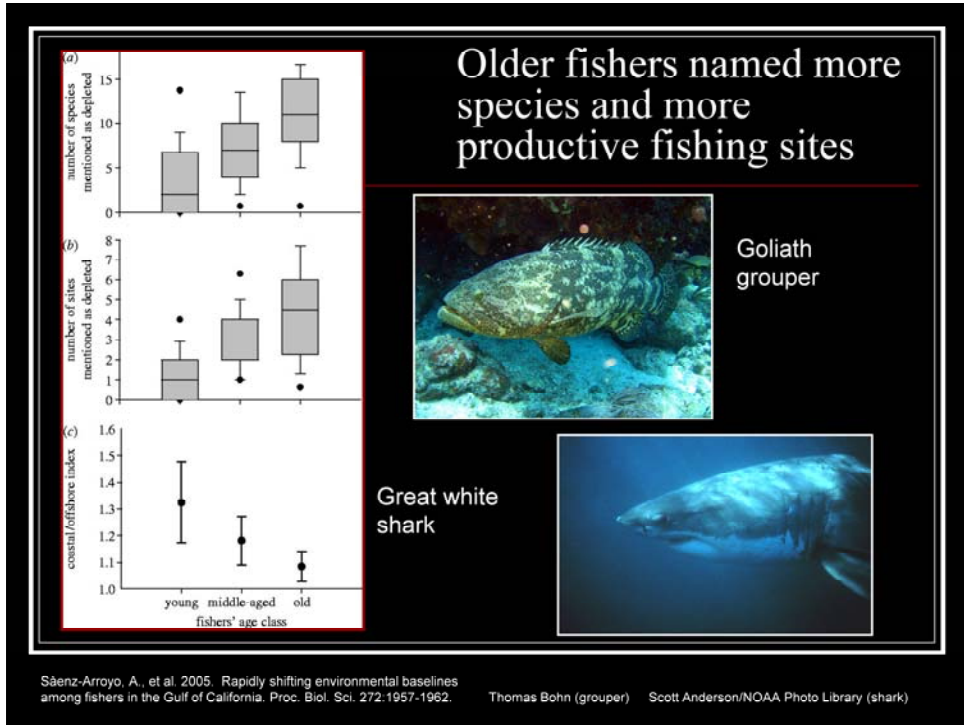
Interviews with three generations of fishers:

- Young (15-30 years)
- Mid-aged (31-54 years)
- Old (>55 years)



The Gulf of California is one of few remaining places in the world where large marine predators such as hammerhead sharks and marlin can still be found in large concentrations. Although impressive, the diversity here is probably a far cry from what existed in the not so distant past. While other ocean areas lost the majority of their large predators hundreds of years ago, the Gulf of California has only been subjected to intense fishing effort in the past 60 years. Since then, its rich biodiversity has been in steep decline. Anecdotal accounts of a rich marine fauna prompted a study of the perception of fishery declines by three generations of Mexican fishermen (“young” = 15-30 years old, “middle-aged” = 31-54 years and “old” = >55 years). Each fisher was interviewed about their fishing experience and their perception of how it had changed.

Sàenz-Arroyo, A., et al. 2005 Rapidly shifting environmental baselines among fishers in the Gulf of California. *Proc. Biol. Sci.* 272:1957-1962.



See notes slide 17

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While most previous accounts of shifting baselines had been anecdotal in nature, this represents the first time that a quantitative measure was attempted. Researchers found that although most fishers believed that fishing had led to the loss of some species and fishing sites, there was a rapid intergenerational shift in their perception of what past conditions were like. Old fishermen named five times as many species that had been depleted (Fig. A) and four times as many fishing sites as once being abundant and productive (Fig. B) when compared to younger fishers. Old fishers recalled times when large marine predators like bull sharks, hammerhead sharks, large groupers, large snappers and Pacific green turtles were abundant and widespread. Middle-aged fishers were less aware of past abundance and diversity and only a few young fishers were aware that these species had ever been abundant.

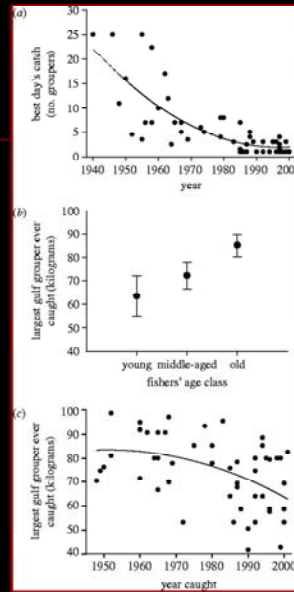
Interestingly, even old fishers did not recall what was apparently an even richer fauna that included pearl oysters, great white sharks and goliath groupers. The presence/abundance of these species is well-documented in the reports of early Europeans visiting the area in the 17th and 18th centuries.

There was a time when large fish could be caught in large numbers close to shore. As nearshore fishing sites became depleted, fishers moved further offshore. Few younger fishers realized that inshore sites had once been productive (Fig. C).

A rapid shift in perception of what is natural explains in part why society is so accepting of the overall loss of biodiversity.

Sàenz-Arroyo, A., et al. 2005. Rapidly shifting environmental baselines among fishers in the Gulf of California. *Proc. Biol. Sci.* 272:1957-1962.

Number and size of Gulf groupers declined with time



Monroe County Library Collection, Edwin O. Swift Jr.

Sáenz-Arroyo, A. et al. 2005. Rapidly shifting environmental baselines among fishers in the Gulf of California. *Proc. Biol. Sci.* 272:1957-1962.

See notes slide 18

Notes slide 18

Fishers were also asked about their experience fishing for one of the largest and most abundant of the Gulf of Mexico species – the Gulf grouper. Specifically, they were asked what had been their most productive day fishing for this species and when that day had occurred. “Best day catches” declined precipitously from the 1940s and 1950s through the 1990s (Fig. A). As an illustration of shifting baselines, only 10% of young fishers considered the species depleted, 56% of middle-aged fishers and 85% of old fishers.

Fishers were also asked how big the largest grouper they had caught had been and when that capture took place. Again, there are significant differences among the three ages of fishers (Fig. B). (Mean weight +/- 95% confidence interval).

Fig. C is a regression of the year in which fishers recalled landing their largest fish vs. the size of the fish. This suggests that the largest fish really are in decline.

One of the most concerning aspects of this study is how quickly baselines shifted among Gulf of California fishers. A major shift in the perception of the resource occurred in as little as 60 years. Even though many of the younger fishers had come from fishing families, apparently historical conditions had not been passed on or at least they had not been assimilated by young fishers. This rapid shift occurred in a cultural environment that was rural, had daily contact with the natural world and had fishing as part of its heritage. As societies become more urban and have less contact with the natural world, one would expect even more rapid shifts in perception.

Shifting Baselines and Fisheries Management



Goliath grouper – Key West, Florida - 1958

Fisheries managers use historical baselines to establish management goals

Historical accounts could be used to establish location and distribution of marine reserves

Monroe County Library collection (Florida Keys)

Documentation of and public awareness of historical conditions is an essential element of sustainable fisheries management. Without an understanding of past conditions, present day citizens (or scientists, or government agencies, or politicians, for that matter), are unlikely to show much enthusiasm for conserving a resource about which they have no familiarity. The relatively new field of historical ecology attempts to discover this information using some of the techniques described in this presentation. Sharing this information and passing it on from one generation to the next becomes essential in an effort to slow the process of shifting baselines.

As marine reserves become another tool used in fisheries management, historical baselines will be useful to determine past areas of high diversity and abundance. These areas may be good candidates for reserve locations.

Photo shows several Goliath grouper (now endangered) from a recreational fishing trip in Key West 1958. It is shown here as an illustration of the application of historical ecology. This and other historical photos were used to establish historical baselines in Florida. The study is part of the Census of Marine Life – a worldwide effort to use past ocean conditions to compare to current conditions.

Helmuth, L. 2008. Our imperiled oceans: Seeing is believing. *Smithsonian Mag.* (September 2008)

Shifting Baselines and Fisheries Management



"Modern oceans have been so vastly altered by overexploitation of fishes as to be barely recognizable semblances of their pre-exploitation states."

Callum Roberts 2007
*The Unnatural
History of the Sea*

Sockeye salmon in a salmon cannery in Bellingham, Washington (circa 1917)

Howard E. Buswell Photograph # 494, Center for Pacific Northwest Studies,
Western Washington University, Bellingham WA 98225-9123.

See notes slide 20

Notes slide 20

“Modern oceans have been so vastly altered by overexploitation of fishes as to be barely recognizable semblances of their pre-exploitation states.”

Roberts, C. 2007. *The unnatural history of the sea*. Island Press, Washington, D.C. 435 pp.

In most cases, fisheries management efforts are implemented only after exploitation has peaked and significant declines have occurred. Roberts uses historical accounts by early explorers to establish a baseline for population levels of marine animals in the historic past. Fisheries have now penetrated the deepest and most remote parts of the ocean where our ability to manage stocks on a sustainable basis appears questionable. Therefore, a fundamental shift is needed in the approach to fisheries management and ocean conservation. Roberts' proposed solution is to manage fisheries in a global network of marine reserves and protected areas. This is a radical departure from traditional fisheries management.

For more information on shifting baselines, see Chapter 18, in Roberts, C. 2007. *The unnatural history of the sea*. Island Press, Washington, D.C. 435 pp.

The image above (circa 1917) illustrates historic sockeye salmon harvest in the Pacific Northwest. The caption reads “50,000 salmon in the cannery of the Carlisle Packaging Company,” a salmon cannery in Bellingham, Washington. Fish traps set by companies like this one between 1890 and the 1930s caught huge numbers of salmon supporting the Puget Sound commercial salmon fishery. Several salmon stocks are now extinct and others have declined to the point that they require protection under the Endangered Species Act.

Photo Credits

- [baiji.org foundation](#) , Steven Leatherwood
- Baum, J. and R. Myers (2004)
- [First People](#)
- Howard E. Buswell, Western Washington University
- Monroe County Library collection (Florida Keys), Edwin O. Swift Jr.
- NOAA National Marine Fisheries Service
- NOAA Photo Library, Scott Anderson
- Post card from Census of Marine Life - History of Marine Animal Populations, Glenn Jones
- Sáenz-Arroyo, A., et al. (2005)
- [Schooner Adventure](#)
- Science AAAS – multiple images reprinted with permission from AAAS
- [Smithsonian Magazine \(September 2008\), Loren McClenachan](#)
- © [Barange M. \(2003\) *Frontiers in Ecology and the Environment*](#)
- Thomas Bohn
- Wikimedia Commons

Resources

The literature on marine fisheries declines is voluminous and scattered. I have tried to organize resources such that they will serve a variety of instructor needs. There has been a concerted effort to emphasize those print and web resources that provide the most recent and easily accessible information. Selections from journal articles are primarily from readily available journals (e.g., *Science*, *Nature*) and from the “secondary literature” (e.g., *Scientific American*, *BioScience*) rather than the less accessible and more detailed “primary literature” found in fisheries journals.

I. Shifting Baselines Resources

These print and web resources provide some discussion of the shifting baselines phenomenon and its relationship to fishery declines.

Baum, J.K. and R.A. Myers. 2004. Shifting baselines and the decline of pelagic sharks in the Gulf of Mexico. *Ecology Letters* 7(2): 135-145.

Several recent studies, including this one and Myers and Worm, 2003 (cited below), have provided us with the “missing baselines” by which we can compare current population levels and thus get a more realistic picture of population trends.

Bunce, M., et al. 2007. Shifting baselines in fishers’ perceptions of island reef fishery degradation. *Ocean and Coastal Management* 51: 285-302.

This comprehensive study of an island coral reef fishery presents evidence of shifting baselines. Older fishers recalled a greater former abundance of fish and reported more fish species as depleted when compared to young fishers.

Christensen, V., et al. 2003. Hundred-year decline of North atlantic predatory fishes. *Fish and Fisheries* 4: 1-24.

Clover, C. 2006. *The end of the line – How overfishing is changing the world and what we eat.* Univ. of California Press, Berkeley, CA. 386 pp.

Ellis, R. 2004. *The empty ocean.* Shearwater Books. Washington, D.C. 384 pp.

In addition to a general description of fishery declines, case study accounts for several species are provided, including menhaden, tuna, swordfish, cod, Patagonian toothfish and Atlantic salmon.

Helfman, G.S. 2007. *Fish conservation: A guide to understanding and restoring global aquatic biodiversity and fishery resources.* Washington D.C. Island Press.

Helmuth, L. 2008. Our imperiled oceans: Seeing is believing. *Smithsonian Magazine* 39.6: 56-59.

www.smithsonianmag.com/science-nature/seeing-is-believing.html

This brief article written for general audiences describes some of the “shifting baselines” work being done by the History of Marine Animal Population (HMAP) project (cited below). Several historical photographs of fish caught on charter boats based in Key West, Florida are shown to illustrate.

History of Marine Animal Population (HMAP)

Census of Marine Life

www.hmapcoml.org

This program attempts to document historical population levels of marine organisms for comparison with current levels. Several photographs are available that can be used to illustrate “baseline levels” for marine fish.

Iudicello, S., M. Weber and R. Wieland. 1999. *Fish, markets and fishermen: The economics of overfishing.* Island Press, Washington, D.C. 192 pp.

Jackson, J.B.C. 2001. Historical overfishing and the recent collapse of coastal ecosystems. *Science* 293: 629-638.

McClenachan, L. 2009. Documenting loss of large trophy fish from the Florida Keys with historical photographs. *Conservation Biology* 23: 636-643.

Myers, R.A. and B. Worm. 2003. Rapid worldwide depletion of predatory fish communities. *Nature* 423: 280-283.

Pauly, D. 1995. Anecdotes and the shifting baseline syndrome of fisheries. *Trends in Ecology and Evolution* 10: 430.

This brief article by Daniel Pauly is the first description of shifting baselines syndrome as it applies to fisheries.

Pauly, D. and R. Watson. 2003. Counting the last fish. *Scientific American* (July 2003): 43-47.

Pauly, D. and J. Maclean. 2003. *In a perfect ocean.* Island Press, Washington, D.C. 175 pp.

This book from the Sea Around Us Project provides a comprehensive examination of the status and history of the fisheries of the North Atlantic Ocean.

Roberts, C. 2003. Our shifting perspectives on the oceans. *Oryx* 37: 166-177.

Roberts, C. 2007. *The unnatural history of the sea*. Island Press, Washington, D.C. 435 pp.

This text evaluates many fisheries (as well as sealing and whaling) from a perspective that stretches back hundreds of years. Roberts claims that, "Modern oceans have been so vastly altered by overexploitation of fishes as to be barely recognizable semblances of their pre-exploitation states." Historical accounts by early explorers are used to establish a baseline for population levels in the historic past. Fisheries have now penetrated the deepest and most remote parts of the ocean thus driving stocks below any level of sustainability. The author claims that a fundamental shift is needed in the approach to fisheries management and ocean conservation. His proposed solution is to manage fisheries in a global network of marine reserves and protected areas, a radical departure from traditional fisheries management.

Sàenz-Arroyo, A., et al. 2005. Rapidly shifting environmental baselines among fishers in the Gulf of California. *Proc. Biol. Sci.* 272: 1957-1962.

www.pubcentral.nih.gov/articlerender.fcgi?artid=1559885

This is an easily readable article describing some recent research that quantifies the shifting baselines phenomenon among fishers in the Gulf of Mexico. It would be a good selection to assign for student reading.

Safina, C. 1998. *Song for the blue ocean: Encounters along the world's coast and beneath the seas*. Henry Holt and Co., NY. 445 pp.

This resource examines fisheries resources in the Northeast, Pacific Northwest and the western Pacific Ocean.

Safina, C. 1995. The world's imperiled fish. *Scientific American* Nov. 1995: 46-53.

Although now a bit outdated, this brief article provides an excellent summary of the status of marine fisheries and the primary causes for decline.

Shifting Baselines

www.shiftingbaselines.org

The web site provides a description of the "shifting baselines" phenomenon and also includes an amusing video ("Fish Story") that students may enjoy.

Sumaila, U.R., et al. 2008. Fuel price increase, subsidies, overcapacity, and resource sustainability. *ICES Journal of Marine Science* 65: 832-840.

II. Resources For Digital Images

There are a number of web-based sources for fisheries-related digital photos that instructors can use to augment NCSR fisheries modules. Most of those listed below allow educational use of their images without seeking copyright permission as long as proper acknowledgement is presented along with the photo. However, instructors should check the documentation on each web site and follow the required procedure for use.

ARKive – Images of Life on Earth

www.arkive.org

This web site provides useful biological and conservation information (description, status, range, habitat, threats and conservation) on a wide variety of species as well as images and short video clips.

FishBase – A Global Information System on Fishes

www.fishbase.org

FishBase is a huge relational database that emphasizes the biological characteristics of nearly all fish known to science. Photos and other media are available for download.

MarineBio

www.marinebio.org

A comprehensive conservation-based site that includes links to multimedia (video and images) for a number of commercially important fish species.

Marine Photobank

www.marinephotobank.org

This SeaWeb-sponsored web site provides access to a great deal of fisheries-related information that is useful to instructors including publications, links to other sites and a “marine photo bank.” The images in the photo bank are free for non-commercial use and would be useful to develop in-class presentations. All aspects of fisheries are portrayed in these images including fishing methods, aquaculture, marine species of concern, bycatch and marine protected areas.

Northeast Fisheries Science Center

www.nefsc.noaa.gov

This regional center of the National Marine Fisheries Service provides all of the original line drawings from the “Bible of New England Fisheries,” Fishes of the Gulf of Maine.

NOAA Ocean Explorer

<http://oceanexplorer.noaa.gov/gallery/gallery.html>

This site includes visual and audio material from NOAA Ocean Explorer expeditions. There are videos, podcasts, slideshows and audio files available. Files are organized into several categories including: maps, living ocean, sound in the sea, cultural heritage, history, technology, explorers and a YouTube video playlist.

NOAA Photo Library

www.photolib.noaa.gov/collections.html

This site, maintained by the National Oceanic and Atmospheric Administration, is a government site with several image collections relevant to fisheries. Instructors will find the following collections particularly useful:

The National Undersea Research Program

National Marine Sanctuaries

Fisheries

National Marine Fisheries Historical Image Collection

III. Video Resources:

Empty Oceans, Empty Nets. 2002. Habitat Media. VHS/DVD 57 min.
734 A Street
San Rafael, CA 94901
415-458-1696
www.habitatmedia.org

This one-hour video explores most aspects of commercial fisheries from several perspectives including commercial fishers, fishery scientists and concerned citizens. It is probably the most comprehensive, high quality video production on this topic. Case studies of the Atlantic cod, salmon, bluefin tuna and swordfish are provided. The ecological impact of commercial fishing is emphasized but there is also good coverage of proposed solutions and success stories. Current efforts to restore fisheries, protect essential fish habitat and implement market-based solutions are included. The concept of shifting baselines is clearly illustrated with interviews of swordfishermen of different ages.

DETAILED NOTES ON THIS VIDEO ARE AVAILABLE IN THE *COMPREHENSIVE RESOURCES FOR NCSR MARINE FISHERIES SERIES*.

Oceans and Marine Life – Marine Video and Animation
National Environmental Trust
www.net.org/marine/video.vtml

This environmental organization posts on-line video clips (or links to clips on other sites) concerning fisheries issues. Short (2-3 minute) videos include:

- *“Take a Pass on Chilean Sea Bass” – a humorous depiction of seafood choices made by consumers in a restaurant*
- *“Overfishing Animation” – an illustration of the global decline of large, predatory fish over the past 50 years (based on data from Myers and Worm, 2003)*
- *“Small Fish, Big Problem” – a humorous depiction of shifting baselines*