



Tuesday, March 1, 2005

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**Contacts: Terry Collins, +1-416-538-8712
Darlene Trew Crist, +1-401-295-1356, Sara Hickox, +1-401-874-6277**

First Ever Estimate of Cod Fishery in 1850s Reveals 96% Decline on Scotian Shelf

*16 pre-Civil War schooners could hold all adult cod left today;
New insight for officials setting ecosystem goals, rebuilding fishery remnant
Census Announces October Conference in Denmark: Oceans Before Fishing*

Once a dominant species, the volume of cod on the Scotian Shelf has plunged 96% since the 1850s, according to landmark research published today. In fact, just 16 small schooners of the pre-Civil War era could hold all adult cod currently estimated in the once-rich Scotian Shelf.

Writing in today's edition of *Frontiers in Ecology* (www.frontiersinecology.org), Census of Marine Life researchers¹ announced the first-ever estimate of cod levels in the 1850s, created using old schooner catch records and observations, coupled with modern modeling tools. And they say their findings have profound implications for contemporary policy makers trying to rebuild fishery "remnants" and restore the marine ecosystem.

"Managing the remnants of the ocean's resources is a critical issue worldwide, but evidence for what constitutes a healthy fish population remains controversial. As we attempt to rebuild these fisheries, our decisions should reflect real and realistic goals for management, not just recently observed catch levels."

¹ Andrew A. Rosenberg, W. Jeffrey Bolster, Karen E. Alexander, William B. Leavenworth, Andrew B. Cooper, and Matthew G. McKenzie

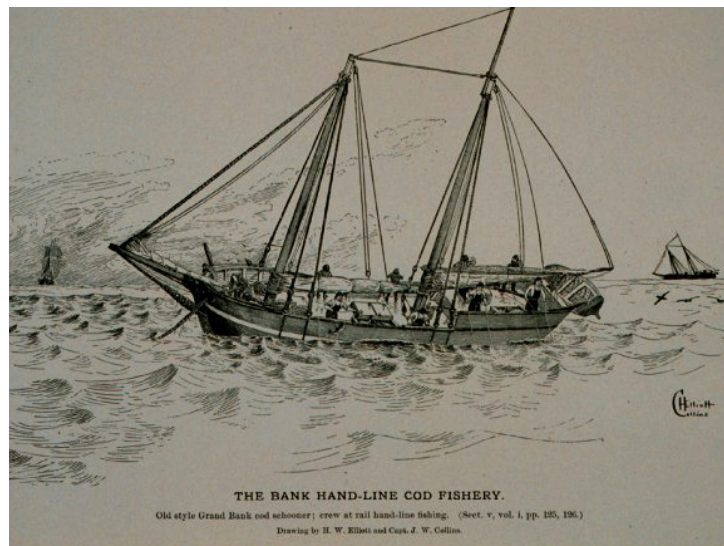
150-year perspective challenges ‘conventional wisdom’

The researchers say that a 150-year perspective challenges ‘conventional wisdom’ as to what constitutes a rebuilt cod stock in a productive marine environment.

In recent debates in New England over management of George’s Bank and Gulf of Maine cod stocks, for example, many argued that 1980s stock levels should be considered fully rebuilt. However, “this contradicted the evidence of basic cod biology, which suggested that cod stocks would only be rebuilt at higher levels.

“Our historical analyses indicate that recent levels of biomass and catch may grossly under-represent the productive potential of commercially important species.”

The researchers emphasize the importance of understanding ecosystem trends and determining baseline levels of marine species that existed prior to the industrialization of fishing. To date, declines have only been vaguely described for predatory fish species and complex coral reef systems around the world.



To estimate long ago fish levels, researchers used 1850s New England schooner records of daily catch locations and fleet activity on the fishing

grounds. Fishers then, using handlines, had “negligible incentive to falsify records” and, combined with ancillary documents, their logs “provide a solid, reliable basis for stock assessment.”

Illustration from 1880s shows fishermen lining the rails (left), each deploying two baited hooks (right) in essentially the same manner as European fishermen off Newfoundland in the 1500s. Although some Beverly captains employed dories for handling and a few experimented with tub trawls as catch declined, handlining from the vessel remained prevalent in this fishery until the early 1860s. Credit: NOAA National Marine Fisheries Service. High-res copy (7 MB): <http://www.coml.org/medres/medres5.htm>

Changing fishing patterns suggest handline fishery in sailing schooners depleted regional cod stocks. Between 1852 and 1857, Beverly vessels fished the Scotian Shelf close to 90% of the time, a figure that declined to 60% in 1859 as captains searched farther afield for more economically profitable concentrations of cod.

Some vessels left the Beverly fleet and may have left the cod fishery altogether, a familiar pattern in collapsing fisheries today. Catch per unit of fishing effort (CPUE in fish per day per ton of vessel) declined by over 50% between 1852 and 1859.

“In the logs themselves, effort was measured in a good day’s catch. On May 23, 1859, Gilbert Weston, captain of the *Dorado* on the Scotian Shelf’s Banquereau Bank, noted in his log that they ‘had 1000 hooks out (on trawls) and (caught) 130 (cod) fish.’ However, men who had fished in 1852 remembered good days when seven or eight handliners fishing two hooks apiece over the schooner’s rail could each bring in more than 100 fish. George Gould’s crew of eight on the *Betsy & Eliza* had four such good days in 1852, landing more than 1,000 cod on one long day in June.”

Estimated 1.26 metric tons of cod on Scotian Shelf in 1852

Using a mathematical formula, the researchers estimate cod biomass on the Scotian Shelf was 1.26 million metric tons in 1852, compared with less than 50,000 metric tons today, the adults within which represent 3,000 metric tons, or 6%.

The study notes the estimate of 1850 cod biomass is “quite conservative” as the old fishing logs only record adult cod. “Prevalent hook sizes in this deepwater fishery made landing smaller juvenile cod very unlikely.”

“Despite stringent regulations for the last 6–10 years and a slight rebuilding of fish stocks, the best estimate of adult cod biomass on the Scotian Shelf today comprises a mere 38% of the catch brought home by 43 Beverly schooners in 1855. In other words, 16 small schooners from this mid 19th century fleet could contain all of the adult cod on the Scotian Shelf today.”

The estimated abundance of cod in 1850 is consistent with earlier research led by fellow Census of Marine Life scientist Random Myers that estimated how much cod could be sustained in the North Atlantic ecosystem.

“Biomasses for many key marine species that are also valuable economic commodities probably follow the pattern we have estimated for this cod population.” the authors say. “That is, biomass of commercially important species today is only a small fraction of what existed before industrialized exploitation.”

Other researchers using entirely different types of data and methods recently showed similar levels of depletion for North Sea fish stocks.

Where has productivity gone?

“This has important implications for ecological models. Either cod comprised a much larger fraction of the total ecosystem biomass 150 years ago or the marine ecosystem was far more productive then.

“An important, and often overlooked, scientific question raised by our historical analyses is, where has all this productivity gone? One obvious possibility is that other species are now far more productive than they were 150 years ago, when biomass accumulated in stocks of cod and other demersals (fish found on or near the seafloor) that were previously dominant components of the ecosystem.

“Alternatively, the marine ecosystem may now be far less productive than in the past, because of a variety of natural and anthropogenic changes. Put directly, has exploitation and overexploitation fundamentally altered the structure of the ecosystem and have primary ecosystem goods and services been lost because of these changes? Thinking historically about the role of human activity in marine ecosystems opens up new data sources and promising avenues of inquiry that may begin to address fundamental ecological questions about the nature and magnitude of productivity.”

“Stock rebuilding programs should consider longer term, high biomass goals for full restoration.”

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Conference on the Oceans Before Fishing

The research will be a focus of discussion at a major conference 24-27 October in Kolding, Denmark. “**Oceans Past**, *Multidisciplinary Perspectives on the History of*

Marine Animal Populations,” is being Organized as part of the Census of Marine Life **History of Marine Animal Populations (HMAP)** project. An expected 150 researchers in natural sciences and humanities from around the world will discuss:

- how and why the diversity, distribution and abundance of marine life in the world's oceans changes over the long term; and
- the role humans have played in this dynamic process.

Details are online at <http://www.hmapcoml.org>

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Census of Marine Life ☒☒

Roughly 1,000 scientists from over 70 countries are involved in the \$1 billion Census of Marine Life, support for which comes from government agencies concerned with science, environment, and fisheries in a growing list of nations as well as from private foundations and companies. The Census is associated or affiliated with several intergovernmental international organizations including the Intergovernmental Oceanographic Commission of the UN, the Food and Agriculture Organization of the UN, the UN Environment Programme and its World Conservation Monitoring Centre, the Global Biodiversity Information Facility, the International Council for the Exploration of the Seas, and the North Pacific Marine Science Organization. It is also affiliated with international nongovernmental organizations including the Scientific Committee on Oceanic Research and the International Association of Biological Oceanography of the International Council for Science. The Census is led by an independently constituted international Scientific Steering Committee whose members serve in their individual capacities and a growing set of national and regional implementation committees. For more information: www.coml.org