Trawl metadata: date, time, duration, number of fish in cage, manipulations from F/V Stormy Weather NEC-HH2006-1 in the Gulf of Maine, off New Hampshire coast from 2008-2008 (NEC_ProjDev project)

Website: https://www.bco-dmo.org/dataset/3461
Version: 20110405
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Project
» Northeast Consortium: Project Development (NEC_ProjDev)

Program
» NorthEast Consortium (NEC)

Contributors	Affiliation	Role
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Dataset Description

"Development of a Multi-Beam Sonar as a Fisheries Tool for Stock Assessment and Essential Fish Habitat Identification of Groundfish in the Western Gulf of Maine"

This data set:
Summary of acoustic data of encaged Atlantic cod collected by a dual 38 kHz/120kHz split-beam EK60 echosounder and 300 Hz EM3002 sonar during 19-29 June 2007.

Abstract
Stock assessments based on accurate abundance and distribution data are essential to developing effective management strategies for the Gulf of Maine stock of Atlantic cod, *Gadus morhua*. The purpose of this study was to prove the concept of using multi-beam sonar as a fisheries tool for studying the behavior and quantifying the abundance of groundfish. The focus of this research was was to develop multi-beam sonar (MBS) as a fisheries survey tool. MBS can complement traditional narrow-beam echosounder and trawl surveys because MBS has a large sampling volume, three-dimensional spatial description, and potentially fewer behavior-related sampling biases than traditional trawl surveys. Relationships between acoustic backscatter and fish biology need to be understood before reliable acoustic surveys using MBS can provide sciencebased information for stock assessments. A series of acoustic and optical measurements were made using 38- and 120-kHz EK60 split-beam echosounders and a 300 kHz EM3002 MBS. These were fixed to a surface platform over a 98 cubic meter submersible cage of 5-cm stretched mesh twine. After standard sphere calibration, the cage was stocked with 195 live Atlantic cod with a mean total length of 80.7 ± 0.8 cm (± standard error; range 51.5-105.0 cm) from nearby spawning grounds 10-15 km off the New Hampshire coast, USA. The sonars were synchronized to collect acoustic data on a captive population of mature cod of known size and number

under video surveillance by two underwater cameras. Cod were incrementally removed from the cage to provide a time-series of acoustic backscatter at four densities (n=195, 116, 66, and 23). Preliminary results demonstrate the feasibility of the EM3002 MBS to detect cod and show that quantification of the acoustic backscatter is possible.

See final report

Methods & Sampling

(from final report):

Experimental Cage
A cage (4 m wide x 5 m long x 4.9 m deep; approximately 100 m3) with 5-cm (2-inch) stretch nylon mesh, which has served as a harvest/transfer cage for the OOA project, was used for a series of acoustic measurement experiments (Figure 2). The cage consisted of a high-density polyethylene pipe of 10.2 to 25.4-cm (4 to 10-inch) diameter for the top frame, rail and flotation. A 0.9 m (3-foot) wide wood boardwalk surrounded the cage and supported multiple people and docking vessels. The net was covered with a top net and lowered by rope to any depth. The bottom of the net was weighted by a metal rectangular frame. The floating net cage was towed from Portsmouth harbor and moored offshore at the OOA site with four mooring lines.

Video Surveillance

Two LED underwater cameras were mounted through the mesh net of the cage to provide an upwardlooking and side-looking video record of the spatial distribution and behavior of the insonified fish during the experiments. Each camera recorded to a four-channel digital video recorder (IDView).

Acoustic Sampling
A 300-kHz EM3002 multi-beam sonar system (Kongsberg Maritime) and 38- and 120-kHz Simrad EK60 split-beam echosounders were used to collect acoustic backscatter of the fish in the cage. The EM3002 single head has 160 beams each with 1.5° circular beamwidth that can collectively cover a 130° sector. The circular beamwidth of the 38 kHz and 120 kHz transducers are 12° and 7°, respectively. The multiand split-beam transducers were mounted on a rigid pole with the EM3002 single head in the center and the 38 kHz and 120 kHz transducers mounted on either side. The transducers were center aligned according to outside physical dimensions. The transducer mount was lowered approximately 1-2 m from a bridge across the center of a fish cage (Figure 2 and 3). A profiling sound velocimeter (Odom Digibar-Pro) was used to periodically measure sound velocity profiles and upload the sound velocity profiles to the EM3002 software (Figure 4). The sound velocity probe was attached near the single EM3002 head to collect real-time sound velocity measurement at the same depth of the head for proper beam forming. Instruments transmitted data via cable to vessels tied up alongside the cage. The 10-m vessel R/V Cocheco, both operated by the Center of Coastal Ocean Mapping and Joint Hydrographic Center, provided ship support for sonar operations (Figure 5).

Calibration
Sonar systems were calibrated by standard sphere calibration as described by Foote et al. (1987, 2005). A 38-mm tungsten carbide sphere, 23-mm copper sphere, and 60-mm sphere were used to collect single TS for calibration of the 300 kHz EM3002 sonar, 38 kHz E60 and 120 kHz EK60 echosounder, respectively. For each transducer, a sphere attached to monofilament line was lowered by a fishing rod from the sonar mount platform to a depth of 8-10 m and above the lowered cage. For the EM3002, the sphere was also lowered in other beams. The difference between the mean TS and the known TS for the sphere was adjusted by setting a gain offset.

Experiments
Before stocking the cage with live fish, acoustic measurements were obtained on the empty cage to determine whether there was acoustic transparency of the net or whether the cage would be well-defined to permit experiments to be conducted with the cage submerged or at the surface with the net cover open. After determining that the net formed discrete top and bottom echoes in the split-beam echosounders' echograms and all four sides were distinct in the water column image in the EM3002 (Figure 5), all experiments were performed at depth with the cage completely sealed. Live adult cod (n=195) were stocked in the empty experimental cage at the surface at four stocking densities (approximately 0.25, 1, and 2 fish per m3) starting with the highest density. Fish were insonified in the cage from the surface by the three synchronized echosounders at 1 ping per second. Acoustic measurements on the largest cage population continued on the first day through 2 hours past sunset to provide a preliminary assessment of diel effects on the acoustic

estimates of density. Depth of the bottom of the cage was also manipulated between depths of 6 and 17 m.

Data Processing Description

Data Analysis
Acoustic data from the EM3002 and EK60 sonars were acquired using Seafloor Information System (SIS) Version 3.4.1 software and Simrad ER60 scientific echo sounder application, respectively. The latest version of SIS includes additional features for water column data collection and operational parameterization features more relevant for fisheries applications. Post-processing of datagrams and echograms were done mainly using Matlab (Math Works) and Echoview (Sonardata). Additional statistical analyses were performed using SAS software.

Only preliminary analysis has been completed, but abundance and biomass will be estimated from acoustic backscatter by several methods using target strength and backscatter amplitude. Echo counting and echo integration methods are commonly used and were previously described for Atlantic cod using split-beam data by Rose (2003) and McQuinn et al. (2005). For multi-beam sonar, echo strength will need to be compensated for beam pattern which has been studied for Atlantic herring by Melvin et al. (2003). Density and biomass will be estimated by several methods such as echo counting, echo integration (Simmonds & MacLennan 2005) and other statistical techniques such as scatter statistics (Denbigh et al. 1991), assuming relative abundance is proportional to echo intensity.

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Data Files

File
caged_cod_meta.csv (Comma Separated Values (.csv), 2.11 KB) MD5:ef417ee465b79602a7373e16c17b0de7 Primary data file for dataset ID 3461

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Parameters

Parameter	Description	Units
date_local	date in local time	mm/dd/yyyy
inst	type of echosounder used	text
time_local	start and end time of insonification	HH:MM:SS
duration_minutes	duration of insonification of cages	minutes
pings	number of pings during insonification of cages	integer
number	number of fish is cage	integer
comments	comments pertaining to experiment	text

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Instruments

Dataset-specific Instrument Name	Multibeam Echosounder
Generic Instrument Name	Multibeam Echosounder
Dataset-specific Description	300-kHz EM3002 multi-beam sonar system (Kongsberg Maritime) - used to collect acoustic backscatter of the fish in the cage. The EM3002 single head has 160 beams each with 1.5° circular beamwidth that can collectively cover a 130° sector.
Generic Instrument Description	A Multibeam Echosounder system is used to measure bathymetry (depth of the ocean). The resultant data can be used to map large areas of the seafloor.

Dataset-specific Instrument Name	Split-Beam Echosounder
Generic Instrument Name	Split-Beam Echosounder
Dataset-specific Description	Simrad EK60 with 38- and 120-kHz split-beam echosounders - used to collect acoustic backscatter of the fish in the cage. The circular beamwidth of the 38 kHz and 120 kHz transducers are 12° and 7°, respectively.
Generic Instrument Description	"The split-beam echosounder has a transducer which is divided into four quadrants.The target direction is determined by comparing the signals received by each quadrant... The transmission pulse is applied to the whole transducer but the signals received by each quadrant are processed separately...The target strength is estimated from the transducer sensitivity in the relevant direction, namely the beam pattern and the on-axis sensitivity." From "Fisheries Acoustics: Theory and Practice" by E. John Simmonds, D. N. MacLennan, Wiley-Blackwell; 2 edition.

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Deployments

NEC-HH2006-1

Website	https://www.bco-dmo.org/deployment/58660
Platform	F/V Stormy Weather
Report	http://northeastconsortium.org/ProjectFileDownload.pm?report_id=865&table=project_report
Start Date	2008-06-21
End Date	2008-06-25
Description	The purpose of this project was to examine the feasibility of multi-beam sonar as a fisheries acoustic survey method for stock assessments, EFH identification, and evaluation of time/area closures for Atlantic cod. The proposed research included installing, calibrating, and testing multi- and split-beam sonar configurations in experimental cages for detection of cod. Once experimental methodologies were proven, relations between acoustic measurements and fish biology were examined through experimental manipulation of wild fish caught by fishing industry participants. Results from the proposed research would naturally lead to further experimentation and cooperative research using a multi-disciplinary approach of acoustic and trawl sampling to describe spatial distribution and relative abundance of spawning cod aggregations within EFH such as the rolling area closure 133 in the Western Gulf of Maine.

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Project Information

Northeast Consortium: Project Development (NEC_ProjDev)

Website: http://northeastconsortium.org/

Coverage: Georges Bank, Gulf of Maine

The Northeast Consortium encourages and funds **cooperative research** and monitoring projects in the Gulf of Maine and Georges Bank that have effective, **equal partnerships** among fishermen, scientists, educators, and marine resource managers.

Priority areas for Northeast Consortium funding include selective fishing-gear research and development. The development of selective fishing gears that enhance gear selectivity, target healthy stocks, reduce bycatch and discard, reduce or eliminate technical barriers to trade, minimize harvest losses, and improve fishing practices. Studies of new and developing fishing gears and technologies aimed at reducing environmental impact is funded under Project Development.

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Program Information

NorthEast Consortium (NEC)

Website: http://northeastconsortium.org/

Coverage: Georges Bank, Gulf of Maine

The Northeast Consortium encourages and funds
cooperative research and monitoring projects in the Gulf of Maine and Georges Bank that have effective, **equal partnerships** among fishermen, scientists, educators, and marine resource managers.

At the 2008 Maine Fisheremen's Forum, the Northeast Consortium organized a session on data collection and availability. Participants included several key organizations in the Gulf of Maine area, sharing what data are out there and how you can find them.

The Northeast Consortium has joined the Gulf of Maine Ocean Data Partnership. The purpose of the GoMODP is to promote and coordinate the sharing, linking, electronic dissemination, and use of data on the Gulf of Maine region.

The Northeast Consortium was created in 1999 to encourage and fund effective, equal partnerships among commercial fishermen, scientists, and other stakeholders to engage in cooperative research and monitoring projects in the Gulf of Maine and Georges Bank. The Northeast Consortium consists of four research institutions (University of New Hampshire, University of Maine, Massachusetts Institute of Technology, and Woods Hole Oceanographic Institution), which are working together to foster this initiative.

The Northeast Consortium administers nearly $5M annually from the National Oceanic and Atmospheric Administration for cooperative research on a broad range of topics including gear selectivity, fish habitat, stock assessments, and socioeconomics. The funding is appropriated to the National Marine Fisheries Service and administered by the University of New Hampshire on behalf of the Northeast Consortium. Funds are distributed through an annual open competition, which is announced via a Request for Proposals (RFP). All projects must involve partnership between commercial fishermen and scientists.

The Northeast Consortium seeks to fund projects that will be conducted in a responsible manner. Cooperative research projects should be designed to minimize any negative impacts to ecosystems or marine organisms, and be consistent with accepted ethical research practices, including the use of animals and human subjects in research, scrutiny of research protocols by an institutional board of review, etc.

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Funding

Funding Source	Award
NorthEast Consortium (NEC)	unknown NEC_ProjDev NEC

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