

# Spiny dogfish and rare earth metals from F/V Survivor NEC-ST2006-1 in the Gulf of Maine from 2007-2008 (NEC\_ProjDev project)

**Website:** <https://www.bco-dmo.org/dataset/3140>

**Version:** 23 June 2009

**Version Date:** 2009-06-23

## Project

» [Northeast Consortium: Project Development](#) (NEC\_ProjDev)

## Program

» [NorthEast Consortium](#) (NEC)

Contributors	Affiliation	Role
<a href="#">Tallack, Shelly</a>	Gulf of Maine Research Institute (GMRI)	Principal Investigator
<a href="#">Copley, Nancy</a>	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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## Dataset Description

### Do Rare Earth Metals Deter Spiny Dogfish? A Feasibility Study on the Use of Mischmetals to Reduce Dogfish Catches in Hook and Lobster Gear in the Gulf of Maine

Project Leader: Shelly Tallack, Gulf of Maine Research Institute

The purpose of this project was to test an array of fishing gear fitted with and without non-magnetic rare earth metal (lanthanide/cerium) to test the aversion by spiny dogfish to baited fishing gear as a means of reducing the catch of dogfish during time when dogfish abundance is problematic for fishermen. This study addresses the NEC research topics of: fishing gear selectivity and fish habitats and ecology. This study employed fishery-independent sampling techniques, and involved a team of approximately two fishermen and two scientists. Overall, there is little evidence to suggest that mischmetal has the potential to reduce the catch of dogfish in either commercial or recreational gear types in the Gulf of Maine.

## Methods & Sampling

In total, six dogfish research trips were undertaken, during August and September of 2007. The commercial lobster vessel, FV Survivor (13 m), was utilized as the research platform, which afforded extensive deck space and winch gear for efficient operation of the longline and jig gear.

To prepare for deployment on fishing gear, industry standard trapezoidal mischmetal ingots (HEFA Rare Earth Canada Ltd., Richmond, BC, Canada) measuring ~45 mm x ~45 mm x ~45 mm x ~130 mm were sliced into pieces measuring ~45 mm on each side, by ~5 mm thickness. For attachment to fishing gear, ~2 mm holes were drilled at ~5 mm up from the bottom edge and ~5 mm down from

the top corner of each mischmetal slice; the slices were then attached to jigging gear using 2 mm zip ties, and to the longline gear by threading the twine leaders through the drilled holes. On both jigging gear and longline gear, the mischmetal was secured ~10 cm up from the hook and bait.

A total of four (100 hook) longlines were built, each consisting of 50 control hooks (just hook and bait) and 50 treatment hooks (hook, bait and mischmetal). The hooks were arranged along the longline in alternating groups of 10 (i.e. 10 control, 10 treatment, etc.) as a means of efficiently verifying that equal numbers of treatment and control hooks were attached to each longline; this approach also enabled effective gear maintenance in the field where deck space is limited. Four longlines with 100 hooks were set on trips 1-3; at this time one longline was lost overboard. On trips 4-6, three longlines were set, two with 100 hooks each and one with 140 hooks. The additional hooks were added to make up for the lost longline, but mischmetal availability limited this increase to 40 hooks. In total, during six sampling days 21 longlines were set, totaling 2080 hooks (50% control and 50% treatment). All longlines were set at similar depths on each day (~60-100 m), in close proximity to one another to ensure similar fishing conditions between each set. Soak times ranged from 1-2 hours.

Jigging using rod and reel took place on each of the six vessel days, to test the effectiveness of mischmetal at deterring dogfish from recreational hook gear. Jigging was undertaken during the soak-time for each longline. Each rod and reel (n=3) was set up with two hooks (2-4 hooks is typical while fishing for groundfish), with one treatment and one control hook; 73 jig-lines were set, comprising a total of 146 baited hooks (50% control (C) and 50% treatment (T)).

All animals caught by both jig and longline gear were noted for: hook type (i.e. treatment or control), bait presence, species, size (total length, TL) and sex where possible. The catch was then released.

In addition, wire lobster gear was deployed on two days. Two strings were set for 24 hour soak times, each string comprising 16 traps in total. Control (n=8) and treatment (n=8) traps were alternated along each string. All traps were baited, and the treatment traps had three pieces of mischmetal attached around the trap entries. The total catch was counted and quantified by species; only fish species were measured, and where possible, such as in the case with elasmobranchs, sexed. *(from final report)*

In situ video footage was obtained through collaboration with the University of New Hampshire's Atlantic Marine Aquaculture Center (Durham, NH).

## Data Processing Description

Data analysis:

Data analysis was undertaken by GMRI from October 2007 onwards. Analyses were performed using a combination of SPSS 15.0 software (SPSS, Inc, Chicago, IL), MATLAB (The MathWorks, Inc., Natick, MA) and Grapher 6 (Golden Software, Inc., Golden, CO). The categorical frequency data recorded for dogfish caught by control versus mischmetal hooks was analyzed using Chi-square analysis.

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## Data Files

File
<b>dogfish_alloys.csv</b> (Comma Separated Values (.csv), 351.57 KB) MD5:de28036bd9d2faf5fe4fd7405de4a582
Primary data file for dataset ID 3140

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## Parameters

Parameter	Description	Units																																	
stamina_haul_code	Stamina Index (1-4): 1. Alive, strong, much resistance to being handled 2. Alive, but moderate resistance to being handled 3. Alive, but weak, showing little resistance to being handled 4. Dead																																		
trip	sequential trip or cruise number																																		
date_local	local month, day and year																																		
sea_state	<p>the general condition of the sea:</p> <table border="1"> <thead> <tr> <th>WMO Sea State Code</th> <th>Significant Wave Height (meters)</th> <th>Characteristics</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Calm (glassy)</td> </tr> <tr> <td>1</td> <td>0 to 0.1</td> <td>Calm (rippled)</td> </tr> <tr> <td>2</td> <td>0.1 to 0.5</td> <td>Smooth (wavelets)</td> </tr> <tr> <td>3</td> <td>0.5 to 1.25</td> <td>Slight</td> </tr> <tr> <td>4</td> <td>1.25 to 2.5</td> <td>Moderate</td> </tr> <tr> <td>5</td> <td>2.5 to 4</td> <td>Rough</td> </tr> <tr> <td>6</td> <td>4 to 6</td> <td>Very rough</td> </tr> <tr> <td>7</td> <td>6 to 9</td> <td>High</td> </tr> <tr> <td>8</td> <td>9 to 14</td> <td>Very high</td> </tr> <tr> <td>9</td> <td>Over 14</td> <td>Phenomenal</td> </tr> </tbody> </table>	WMO Sea State Code	Significant Wave Height (meters)	Characteristics	0	0	Calm (glassy)	1	0 to 0.1	Calm (rippled)	2	0.1 to 0.5	Smooth (wavelets)	3	0.5 to 1.25	Slight	4	1.25 to 2.5	Moderate	5	2.5 to 4	Rough	6	4 to 6	Very rough	7	6 to 9	High	8	9 to 14	Very high	9	Over 14	Phenomenal	
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6	4 to 6	Very rough																																	
7	6 to 9	High																																	
8	9 to 14	Very high																																	
9	Over 14	Phenomenal																																	
wind_dir	wind direction reported as compass direction, using meteorologic convention of 'from' not 'to'																																		
wind_speed	wind speed	knots (nautical miles per hour)																																	
comments	comments pertaining to the cruise as opposed to the sampling.																																		
time_begin_set	time of beginning of the line setting process.																																		
depth_begin	depth at beginning of haul	meters																																	
lat_begin	latitude at start of measurement; negative denotes South	decimal degrees																																	
lon_begin	longitude at start of measurement; negative denotes West	decimal degrees																																	
time_end_set	time of completion of gear setting.																																		
time_begin_haul	time of start of hauling gear back to vessel																																		

depth_end	depth at end of haul	meters
lat_end	latitude at end time of measurement; in decimal degrees (negative denotes South)	decimal degrees
lon_end	longitude at end time of measurement; in decimal degrees (negative denotes West)	decimal degrees
time_end_haul	time of completion of hauling gear back to vessel.	
temp_ss	sea surface temperature at the haul start location	fahrenheit
gear	type of fishing gear used: longline, lobster traps, of jigging with fishing rods.	
line_num	sequential number of the longline lines, the jig set number or the trap number	
num_hooks_or_traps	number of hooks on a longline, of rods jigging, or traps deployed.	
traps_w_alloys	number of traps with alloy attached	
males_sampled	number of male spiny dogfish caught	
females_sampled	number of female spiny dogfish caught	
total_dogs	total number of spiny dogfish caught	
num_crab	number of crabs caught	
num_lobster	number of lobster caught	
num_sculpin	number of sculpin caught	
sample_num	hook, jig, or trap id number	
alloy_present_flag	Y=alloy was present on hook or trap; N=none present	
bait_present	for longline only, B=bait present on hook upon retrieval; NB=no bait on hook upon retrieval	

species	common name of captured animal	
sex	sex of captured spiny dogfish: M=male, F=female	
length_cm	length of dogfish	centimeters
stamina_haul_code	<p>stamina code of dogfish after hauling in.</p> <ol style="list-style-type: none"> <li>1. Alive, strong, much resistance to being handled</li> <li>2. Alive, but moderate resistance to being handled</li> <li>3. Alive, but weak, showing little resistance to being handled</li> <li>4. Dead</li> </ol>	
num_alloys_present	For traps only. Each trap entry was rigged with 3 pieces of mischmetal, and there were two entries per trap, so 3-3 means 3 alloys remained on each entry, 3-1 means 3 were on one entry and only one remained on the other, etc.	

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## Instruments

<b>Dataset-specific Instrument Name</b>	Fishing Rod
<b>Generic Instrument Name</b>	Fishing Rod
<b>Generic Instrument Description</b>	Used to catch fish.

<b>Dataset-specific Instrument Name</b>	Lobster Trap
<b>Generic Instrument Name</b>	Lobster Trap
<b>Generic Instrument Description</b>	A lobster trap (often called a lobster pot) is a baited trap which traps lobsters or crayfish and is used in lobster fishing. A lobster trap can catch multiple lobsters at once and can be a various sizes. An opening permits the lobster to enter a tunnel of netting and proceed into a "chamber" or "kitchen", where there is bait, and then into the "parlor" from which it cannot escape.

<b>Dataset-specific Instrument Name</b>	Long Line Fishing Gear
<b>Generic Instrument Name</b>	Longline Fishing Gear
<b>Generic Instrument Description</b>	Longlining employs a central fishing line that can range from one to 50 miles long; this line is strung with smaller lines of baited hooks, dangling at evenly spaced intervals. Longlines can be set near the surface to catch pelagic fish like tuna and swordfish, or laid on the sea floor to catch deepdwelling fish like cod and halibut. ( <a href="http://www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_gear.aspx">www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_gear.aspx</a> )

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## Deployments

### NEC-ST2006-1

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/57988">https://www.bco-dmo.org/deployment/57988</a>
<b>Platform</b>	F/V Survivor
<b>Report</b>	<a href="http://northeastconsortium.org/ProjectFileDownload.pm?report_id=954&amp;table=project_report">http://northeastconsortium.org/ProjectFileDownload.pm?report_id=954&amp;table=project_report</a>
<b>Start Date</b>	2007-03-30
<b>End Date</b>	2008-12-30
<b>Description</b>	<p>Catches of spiny dogfish, <i>Squalus acanthias</i>, are considered to be unacceptably high by many inshore fishermen (commercial and recreational) during the summer and fall months in the Gulf of Maine. However, biologically, these species are considered vulnerable to overexploitation. Despite the range of views and opinions about dogfish, there is a strong common interest for finding a practical and economic dogfish deterrent for application in various fishing gears. Through an industry-science collaboration, a total of six research trips were executed during August and September 2007. Triangular slices of the rare-earth metal cerium/lanthanide alloy (or 'mischmetal') were incorporated into three commercial gear types (longlines, rod and reel gear and lobster gear) to assess the material's effectiveness at reducing dogfish catches. For each gear type, catches with mischmetal (treatment) were compared with a 'control' (i.e. no mischmetal present). In situ underwater video footage was captured to aid the interpretation of data. Field observations were inconclusive for the lobster gear since the traps caught no dogfish, regardless of treatment. For both hook gears, a slight reduction in dogfish catch was recorded (~6% for rod and reel, and ~5-10% for longline), but these results were not statistically significant. One complicating factor for the study was the high rate of mischmetal dissolution, which led to the rapid disintegration of the mischmetal slices in all gears. In situ video footage verified persistent dogfish feeding behavior on bait regardless of mischmetal presence and when one dogfish pursued the bait, the scene would generally escalate to frenzied feeding by multiple dogfish. Overall, there is little evidence to suggest that mischmetal has the potential to reduce the catch of dogfish in either commercial or recreational gear types in the Gulf of Maine. Contract # PZ07087; Contracted Gulf of Maine Research Institute</p>

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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 Fishermen'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

<b>Funding Source</b>	<b>Award</b>
National Oceanic and Atmospheric Administration (NOAA)	<a href="#">PZ07087</a>

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