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NOAA FISHERIES PROTOCOLS FOR HYDRO-DYNAMIC DREDGE SURVEYS AND OCEAN QUAHOGS

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NOAA Fisheries Protocols

For Hydro-dynamic Dredge Surveys:

Surf Clams and Ocean Quahogs

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Table of Contents

Introduction

In response to the creation of the "NOAA Protocols for Groundfish Bottom Trawl Surveys of the Nation's Fishery Resources," the Assistant Administrator for NOAA Fisheries, Dr. William Hogarth, assigned the task of implementing national protocols for all surveys conducted by NOAA Fisheries which ultimately determines some type of population index or stock assessment analysis. Since the body of NOAA Fisheries work includes a multitude of surveys, the scope of the standardization was focused on those surveys which create guidelines that may impact the fishing public and industry in various ways. Whereas the original "National Trawl Survey Standardization Workshop" created only protocols for trawl surveys, specifically bottom trawls and mid-water trawls without the use of a rigid frame, the protocols outlined in this document will encompass sampling protocols employed by NOAA Fisheries researchers unique to hydro-dynamic dredge surveys for surf clams, *Spisula solidissima*, and ocean quahogs, *Arctica islandica*.

Since the principal products of dredge surveys are fishery-independent indices of stock abundance used in stock assessment models, the essential feature of maintaining "consistency from one survey to the next" is that survey catchability (i.e., the relationship between true population abundance and the survey index) must remain stationary and therefore lack any time trend. For surveys that geographically encompass the target stock, stationarity in survey catchability can often be achieved by ensuring constancy in the sampling efficiency of the dredge, which, in turn, can be achieved by ensuring consistency in the construction and repair of the dredge and the procedures used in its operation. The protocols proposed in this report are therefore focused on these issues.

Currently, the Northeast Fisheries Science Center (NEFSC) is the only Science Center conducting a triennial standard hydro-dynamic dredge survey for surf clams and ocean quahogs. It is NOAA Fisheries intent to maintain the over-arching theme throughout this document "to ensure that the methodology that is used currently is consistent over time". This document will provide the framework for national protocols if other Science Centers were to adopt a hydro-dynamic dredge survey for clams and quahogs. Interested parties should make a clear distinction between the label of a clam dredge and other dredge types. A hydro-dynamic clam dredge, specifically, is a towed cage assembly raised on runners with a submersible electric pump. The dredge is configured with a cutting blade and assembly set below the dredge to cut through the sediment. The hydro-dynamic pump is outfitted with an array of nozzles to excavate the sediment and clams forward of the cutting assembly. The dredge is set with a metal deployment warp (wire) and towed with a flexible polypropylene hauser (rope). A third electrical cable supplies 460 volts of power to the submersible pump. Commercial clammers use a surface supplied water delivery system rather than a submersible pump. The NEFSC adopted the submersible pump to control variations in pump output at depth.

NOAA Fisheries Hydro-dynamic Clam Dredge Survey Protocols

Length Measurement of Towing Hauser (flexible rope)

Problem Statement

The hydro-dynamic clam dredge survey uses a single cage style dredge rigged with a single deployment warp (i.e. metal wire). The dredge is deployed using a deck mounted winch and then towed using a flexible rope called a hauser mounted on a trawl winch. There are no trawl

doors or flexible panels. The clam dredge survey does not have the same issues as the trawl surveys. For trawl surveys having two warps, consistency in the measurements of warp length is important for maintaining consistency in trawl performance in two distinct ways. First, the length of the warp relative to the water depth (i.e. scope ratio) influences door spread and other aspects of trawl geometry. Second, the length of the warp on one side of the vessel relative to that on the other side influences the symmetry of the trawl and, depending on the degree of net skew, potentially influences trawl efficiency by affecting footrope contact with the bottom, head rope height, or fish herding. Dredge surveys have only the first issue to deal with in terms of effective bottom contact during the dredge haul. It is critical to have evenly spaced deployment markings (25 meters) on the flexible towing hauser so that the appropriate amount of scope is set at the dredge haul depth.

Currently during NOAA Fisheries clam dredge surveys, hauser length is determined statically by periodically measuring and marking the hauser at fixed increments (25 meters). Current methods of measurement have inherent problems that can lead to inaccurate measurement. For example, differential hauser length can result from inaccurate measurement and marking before a survey begins, from differential hauser stretch and contraction of marked sections during a survey. As a consequence, the proposed protocol uses a measuring system to detect differences in warp length beyond a tolerance level. Inspection of the towing hauser marks takes place on land and cannot be done at sea due to the lack of deck space during the survey. The NEFSC has adopted a 1% deviation tolerance between marks set in the towing hauser and a comparison wire with 25 meter markings. If a deviation is found then a re-marking will occur from that location forward to the

eye splice. The NEFSC will conduct hauser inspections at least once before, once between leg of the survey, and once afterward.

Protocol 1: Length Measurement of Towing Hauser

For the single warp dredging system, a single independently-calibrated measuring method, which will not be in real time, will be used to measure the hauser markings. Because only one towing hauser is deployed there is no concern of a percent difference between warp markings. The NEFSC does not regularly charter the survey on commercial vessels, but if the survey needs to be completed on a commercial vessel, the wire type and marking specifications shall be clearly stated to the contract vessel.

As stated above, the hauser will be inspected before, during, and after the survey. The NEFSC has adopted a 1% tolerance for deviations from the measurement wire. Specifications of the hauser measurement system used on the clam dredge survey will be included in an Operations Plan provided by the NEFSC to the officers and crew of the survey vessel.

Sub-protocols for Specific Hauser Measurement Technologies

Protocol 1a: Physical Hauser Markings

Physical marking of the hauser generally involves spooling it off the winch and onto a flat surface to measure the hauser 25 meter intervals relative to a standard measurement tool (metal wire of known length and marked). The NOAA Fisheries standard for such measurements, for

two warps, has been that both port and starboard warps will be measured and marked side-by-side to assure that the relative warp measurements between marks are exact. Even though clam dredging requires only one hauser, the spacing of marks on such a hauser, details of marking method (fiber marks interwoven in rope strands or painting of marks), and the degree of tension on the wire will be specified in the Regional Hydro-dynamic Clam Dredge Survey Protocols.

Protocol 1b: In-line wire meters

In-line wire counters are not used for the standard NEFSC clam survey to measure the metal deployment warp or the flexible towing hauser in real time.

Protocol 1c: Block wire counters

Block wire counters are not used for the standard NEFSC clam survey to measure the metal deployment warp or the flexible towing hauser in real time.

Protocol 1d: Geometric wire counters

Geometric wire counters are not used for the standard NEFSC clam survey to measure the metal deployment warp or the flexible towing hauser in real time.

Discussion

NEFSC Scallop protocols require that two independent warp measurements be reconciled when the differences in cumulative warp length varies from the metering system by +/- 5% at any scope value onboard and 1% tolerance on land. There are no electronic redundant metering systems aboard the Delaware II for checking hauser scope values. That is why it is important to have the towing hauser checked before, during, and after each triennial survey.

Use of Auto-trawl Systems

Protocol 2: Auto-trawl systems

The Delaware II, the research fisheries vessel that is used to conduct the NEFSC clam and quahog survey, is not outfitted with an auto-trawl system. This application is not critical for clam dredge operations.

Survey Operational Procedures

Problem Statement

Standardization of station selection, gear deployment, dredging operations, and retrieval procedures are critical for maintaining consistency in survey catchability over time. Factors that can affect gear performance and catchablility of marine organisms include selection of tow location; speed during setting, towing, and retrieval of gear; determination of scope ratio; estimation and standardization of tow distance; tow direction; and minimum towable sea state. Written unambiguous protocols specifying these and other issues may affect survey consistency and provide a mechanism for communication between scientific staff and the officers and crew of the research vessel which maintains continuity in procedures as personnel and vessels change overtime.

Protocol 3: Survey Operational Procedures

For the Groundfish Protocols, each Science Center was tasked with providing a written Operations Plan to their staff and the crew of the survey vessels that provides clear and

unambiguous definitions of all procedures required to properly conduct trawl sampling. This process will be followed for the clam dredge protocols, as well. The Operations Plan will be discussed by the Chief Scientist and the vessel crew at the start of each survey and again when crew changes occur. The Operations Plan may include, but is not limited to, the following issues:

a. Scope (2:1, hauser to water depth)
b. Speed of dredge haul (3.8 speed over ground)
c. Duration or distance of a dredge haul (5 minute dredge haul)
d. Direction of dredge haul (always toward the next station)
e. Location of sampling sites, and procedures to use if stations are suitable for towing
   -Predetermined stratified random sites, guidelines for when to haul or not
f. Criteria for determining the success of a dredge haul and procedures to use if a dredge haul was unsuccessful
g. Vessel and winch operation during dredge deployment and retrieval
h. Pump and power standardization and monitoring
i. Methodology for hauser measurement and verification
j. Dredge construction plans, at-sea repair instructions and repair verification check-list
k. Defining responsibility (i.e. survey scientists or vessel crew) for decisions regarding various aspects of the operations

Clam Dredge Construction and Repair

Problem Statement

Standardization of clam dredge construction and repair is unquestionably the most critical element for survey standardization because, on NOAA Fisheries clam surveys, standard clam dredges are not simply devices to capture surf clams and ocean quahogs but are scientific instruments used to sample clam and quahog populations and, as such, must conform to higher levels of tolerance in their construction and repair than commercial clam gear. The difference in the objectives of commercial fishing and scientific sampling, and its concomitant effects on clam dredge design and repair, are rarely appreciated and often have contributed to misunderstanding between NOAA Fisheries and the commercial clam industry. This misunderstanding can directly impact clam dredge survey standardization in two distinct ways. First, the NEFSC lacks the ability to completely build their own survey clam dredges and must partially rely on commercial dredge manufacturers to supply commercially standard materials that are then assembled by NEFSC staff. Second, some members of the crew of NOAA Fisheries research vessels that make at-sea repairs to survey clam dredge have gained their expertise from their past experience as commercial dredge fishers or trained on the clam research vessel. The repair techniques used by commercial fishers, however, are typically those needed to return the gear to service as soon as possible rather than those needed to return it to service in the same condition as before damage. Because NOAA Fisheries clam survey dredges are true scientific sampling instruments, the protocols considered in this section are designed so that clam dredges are constructed and repaired with a level of detail needed to ensure, within specified tolerances, that the identical clam dredge is used at every sampling site on every cruise.

Protocol 4: Clam Dredge Construction and Repair

Construction plans for each clam dredge design will be maintained be each Science Center (NEFSC is the only Center, at this time, that conducts a standard clam dredge survey) and included in the Operations Plan. The plans must include engineering drawings of the clam dredge and supporting materials. In addition, each plan must contain a description of all materials used, and the quantities of these materials considered important for proper clam dredge function. The clam dredge survey is further complicated by the additional mounting equipment (clam ramp) and hydraulic and electrical components. Each component will have plans and mounting specifications relative to the clam operation.

A checklist will be developed for each clam dredge design (presently one design) specifying the dimensions, and their tolerances, or other design features considered important for proper clam dredge function. The checklist will be used to verify that each newly constructed or repaired clam dredge is within operational tolerances before use.

Verification that a clam dredge is within operational tolerances will be conducted by members of the scientific staff of each Science Center (NEFSC) who are trained in clam dredge construction and repair verification.

Methodology for at-sea trawl repairs will be specified in an Operations Plan and communicated by the Chief Scientist to the crew of the vessel at the start of each cruise. A clam dredge repair checklist will be included in the Operations Plan and used by a member of the scientific staff to verify that the repaired clam dredges are within operational tolerances.

At this point there is no need for a national training course in clam dredge construction and repair, because there is only one Center conducting clam dredge surveys. A regional training course will be developed in the future for the NEFSC.

Discussion

The intent of the National Protocols is to ensure that, through more exacting specification and verification, the clam dredge used in a survey will perform identically regardless of the circumstances under which the clam dredge was constructed and repaired.

Changes to Regional Clam Dredge Protocols

Protocol 5: Approval of Regional Dredge Protocols

Changes to Clam Dredge Survey Regional Operational protocols will be at the discretion of the appropriate Science Director who may approve of such changes directly or specify a peer review process to further evaluate the justification and impacts of the proposed changes.

Recommendations for Additional Work to Implement Protocols

Clam Dredge Standardization Working Group (CDSWG)

Recommend the creation of a Clam Dredge Standardization Working Group that will coordinate the development of national and regional standards and protocols, and share information to

improve the precision and accuracy of such surveys. Information and technology would be exchanged among Science Centers facilitated by a National Marine Surveys Workshop, similar to those conducted periodically for stock assessments.

Regional Protocols

At present, there is only one triennial standardized clam survey conducted by the Northeast Fisheries Science Center in Woods Hole, Massachusetts. The items contained are described in general terms for National Clam Protocols to allow other Centers to adopt the approach developed by the NEFSC. In the Regional Clam Protocols, the specific methodology used by the NEFSC is described in detail or referenced to the Field Operations Plan for clam dredging.

Appendix 1: Northeast Fisheries Science Center

Regional Standard Operating Protocols for Standard Surf Clam and Ocean Quahog Dredge Survey