

Submission ID #: 70366

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Project Page Link: https://review.jove.com/files_upload.php?src=21461678

Title: Optical Trawl Surveys of Groundfish; A Video Trawl Survey of Western Gulf of Maine Atlantic Cod (*Gadus Morhua*)

Authors and Affiliations:

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Author Questionnaire

1. **Microscopy:** Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **No**
2. **Software:** Does the part of your protocol being filmed include step-by-step descriptions of software usage? **Yes**
3. **Filming location:** Will the filming need to take place in multiple locations? **Yes**
3 Miles
4. **Testimonials (optional):** Would you be open to filming two short testimonial statements **live during your JoVE shoot**? These will **not appear in your JoVE video** but may be used in JoVE's promotional materials. **No**

Current Protocol Length

Number of Steps: 11

Number of Shots: 28

Interviews

Videographer: Obtain headshots for all authors available at the filming location.

INTRODUCTION:

~~REQUIRED: Summarize your research focus and the main questions it aims to answer.~~

- 1.1. **Nicholas Calabrese**: This research provides a minimally invasive method for collecting trawl survey data to quantify abundance, distribution, and biomass.
 - 1.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

~~Describe the research contexts or systems in which this protocol can be applied.~~

- 1.2. **Kevin Stokesbury**: This system can be applied to any otter or midwater trawl net and adapted for science or increased fishing information.
 - 1.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

CONCLUSION:

~~What does this protocol allow researchers to study or measure?~~

- 1.3. **Kevin Stokesbury**: Researchers can estimate the abundance of species in trawl nets and assess diversity, increasing size selectivity for small fish and invertebrates.
 - 1.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

~~Describe the most important consideration or challenge when performing this protocol.~~

- 1.4. **Nicholas Calabrese**: Operating delicate optical equipment in harsh environments is challenging and requires some electrical repair skills and access to spare parts.
 - 1.4.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

~~How can future studies build on this work? Describe the questions or research directions that can be investigated next.~~

1.5. **Kevin Stokesbury**: Automating video analysis using AI and integrating stereoscopic measurements are the next steps in development.

1.5.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

Videographer: Obtain headshots for all authors available at the filming location.

Protocol

Videographer: Please always record an audio slate while filming each shot mentioned in the shotlist.

NOTE: Timestamps for SCREEN shots were added at the postshoot stage. Please contact post shoot integrator (Pallavi Sharma) for any discrepancies

2. Equipment Setup on the Vessel Deck

Demonstrators: Stephanie Merhoff and Helena Norton

- 2.1. To begin, arrange the survey net and pressure-sensitive winch on the vessel's deck [1]. Attach the survey trawl doors to the vessel's winch cables [2]. Then, secure the winch to the deck using a temporary weld [3].
 - 2.1.1. WIDE: Talent arranging the survey net and winch on the deck.
Videographer: Please obtain CU shot as well for this shot.
 - 2.1.2. Talent attaching the trawl doors to the winch cables.
 - 2.1.3. Talent welding the winch to the deck.
- 2.2. Next, wire the winch power cable into the vessel's breaker box to establish a stable electrical supply [1].
 - 2.2.1. Talent wiring the winch power cable into the vessel's breaker box.
- 2.3. Attach a cable block to a mount on the vessel's A-frame or similar support structure [1] and route the coaxial cable through the block toward the stern, positioning it adjacent to the net drum [2- TXT].
 - 2.3.1. Talent attaching a cable block to a mount on the vessel's A-frame.
 - 2.3.2. Talent routing the coaxial cable through the block towards the stern, positioning it adjacent to the net drum.
- 2.4. Attach the junction box to the rigid polyethylene cylinder [1]. Then, mount the cameras and lights onto the cylinder [2]. Connect the cameras and lights to the junction box using cables fitted with waterproof connectors [3].
 - 2.4.1. Talent attaching the junction box to the polyethylene cylinder.
 - 2.4.2. Talent mounting the cameras and lights onto the polyethylene cylinder.

- 2.4.3. Talent connecting the cameras and lights to the junction box using cables fitted with waterproof connectors.

3. Wheelhouse Equipment Set-up for Video and Data Capture

- 3.1. First, secure the computer and monitors to a stable workstation in the wheelhouse [1]. Then, connect the GPS (G-P-S) devices to the computer to enable real-time spatial data acquisition [2]. Connect the net mensuration receiver to the computer [3] and connect cameras and lights to the power in the vessel's wheelhouse [4].
 - 3.1.1. WIDE: Talent securing the computer and monitors to a stable workstation in the wheelhouse.
 - 3.1.2. Talent connecting GPS devices to the computer ports.
 - 3.1.3. Talent connecting the net mensuration receiver to the computer.
 - 3.1.4. Talent connecting cameras and lights to power in the vessel's wheelhouse.
- 3.2. After verifying proper equipment function, launch the mapping software to display the vessel location [1]. Check if the time and date stamps are correctly displayed in the video recording software [2]. Enter the tow number to be overlayed on video [3]. Launch the net mensuration sensor software and begin recording the wingspread and doorspread data [4].
 - 3.2.1. SCREEN: 3_2_1.mp4: 00:06-00:08, 00:17-00:35
 - 3.2.2. SCREEN: 3_2_2.mp4: 00:01-00:08
 - 3.2.3. SCREEN: 3_2_3.mp4: 00:03-00:09
 - 3.2.4. SCREEN: 3_2_4.mp4: 00:02-00:05, 00:17-00:19, 00:58-01:26
- 3.3. Using the vessel's hydraulic winches, deploy the net and doors slowly [1] and start recording the video [2]. Turn on the lights after the cylinder enters the water [3].
 - 3.3.1. Talent setting the net and doors out using the vessel's hydraulic winches.
 - 3.3.2. SCREEN: 3_3_2.mp4: 00:02-00:08
 - 3.3.3. Talent turning on the lights after the cylinder enters the water.

4. Video and Data Acquisition for Each Tow and The Subsequent Review

- 4.1. Once the vessel's hydraulic winches are locked into position, proceed to record the location and speed data [1-TXT].
 - 4.1.1. SCREEN: 4_1_1.mp4: 00:06-end.
- 4.2. Stop recording location and speed data once the vessel's hydraulic winches are engaged for haul back, indicating the end of the tow [1]. Switch off the lights once the net and doors are hauled back and the lights reach the surface. Similarly, capture

video and data at all stations [2-TXT].

4.2.1. SCREEN: 4_2_1.mp4

4.2.2. SCREEN: 4_2_2.mp4

- 4.3. After completing the tow, secure the codend of the net using the codend clip [1]. Document the trawl catch aboard the vessel following standardized procedures [2].

4.3.1. Shot of crew attaching the codend clip.

4.3.2. TEXT ON A PLAIN BACKGROUND

- Empty the codend onto the vessel deck
- Sort the catch into baskets by species
- Measure, weigh, and sex a standardized subsample
- Record counts and weights for remaining catch

- 4.4. Offload all data from the wheelhouse computer to external hard drives [1]. Upload all videos to the annotation software [2]. Trained technicians shall review and annotate all target species and unidentified fish [3].

4.4.1. Shot of the external hard drives connected to the wheelhouse computer during data transfer. *Videographer: Please show the data transfer progressing on the computer screen as well.*

4.4.2. SCREEN: 4_4_2.mp4: 00:03-00:10, 00:19-00:21

4.4.3. SCREEN: 4_4_3.mp4: 00:03-00:15

Results

5. Results

- 5.1. During the 10 days of sampling, 47 usable survey tows were completed [1], including 4 closed codend [2] and 43 open codend tows during daylight hours [3].
 - 5.1.1. LAB MEDIA: Table 1 *Video editor: Emphasize the two columns Catch (Ind) and Catch (kg) and highlight all rows except those corresponding to 40 and 43.*
 - 5.1.2. LAB MEDIA: Figure 2 *Video editor: Emphasize the red dots.*
 - 5.1.3. LAB MEDIA: Figure 2 *Video editor: Emphasize the blue dots (mostly look like lines).*
- 5.2. The length-frequency distribution shows that Atlantic cod captured during the survey ranged from 41 to 81 centimeters [1].
 - 5.2.1. LAB MEDIA: Figure 3 *Video Editor: Please show the full graph and then emphasize the right end with length from 41 cm to 81 cm.*
- 5.3. The length-weight relationship demonstrates the expected increase in weight with fish length, confirming consistent biological measurements from the cod sampled during the survey [1].
 - 5.3.1. LAB MEDIA: Figure 4 *Video Editor: Please show the entire graph and highlight the equation given in the graph ($y = 1E-05x^{2.9778}$; $R^2 = 0.962$).*

1. Pressure-sensitive
Pronunciation link: <https://www.merriam-webster.com/dictionary/pressure-sensitive>
IPA: /'preʃər 'sensətɪv/
Phonetic Spelling: presh·ur sen·suh·tiv
2. Winch
Pronunciation link: <https://www.merriam-webster.com/dictionary/winch>
IPA: /'wɪntʃ/
Phonetic Spelling: winch
3. Trawl
Pronunciation link: <https://www.merriam-webster.com/dictionary/rawl>
IPA: /'trɔ:l/
Phonetic Spelling: trawl
4. Coaxial
Pronunciation link: <https://www.merriam-webster.com/dictionary/coaxial>
IPA: /koʊ'æksiəl/
Phonetic Spelling: koh·ak·see·uhl
5. Polyethylene
Pronunciation link: <https://www.merriam-webster.com/dictionary/polyethylene>
IPA: /,pɑ:li'eθə,li:n/
Phonetic Spelling: pol·ee·eth·uh·leen
6. Waterproof
Pronunciation link: <https://www.merriam-webster.com/dictionary/waterproof>
IPA: /'wɔ:tər,pru:f/
Phonetic Spelling: waw·tur·proof
7. Junction
Pronunciation link: <https://www.merriam-webster.com/dictionary/junction>
IPA: /'dʒʌŋ(k)ʃən/
Phonetic Spelling: jungk·shuhn
8. Mensuration
Pronunciation link: <https://www.merriam-webster.com/dictionary/mensuration>
IPA: /,menʃə'reɪʃən/
Phonetic Spelling: men·shuh·ray·shuhn
9. Hydraulic
Pronunciation link: <https://www.merriam-webster.com/dictionary/hydraulic>
IPA: /haɪ'drɔ:lik/
Phonetic Spelling: hy·draw·lik
10. Spatial
Pronunciation link: <https://www.merriam-webster.com/dictionary/spatial>
IPA: /'speɪʃəl/
Phonetic Spelling: spay·shuhl
11. Acquisition
Pronunciation link: <https://www.merriam-webster.com/dictionary/acquisition>
IPA: /,ækwə'zɪʃən/
Phonetic Spelling: ak·wuh·zi·shuhn

12. Overlaid
Pronunciation link: <https://www.howtopronounce.com/overlaid>
IPA: /,oʊvərˈleɪd/
Phonetic Spelling: oh·vur·layd
13. Wingspread
Pronunciation link: <https://www.merriam-webster.com/dictionary/wingspread>
IPA: /ˈwɪŋˌspred/
Phonetic Spelling: wing·spred
14. Doorspread
Pronunciation link: No confirmed link found
IPA: /ˈdɔːrˌspred/
Phonetic Spelling: door·spred
15. Annotation
Pronunciation link: <https://www.merriam-webster.com/dictionary/annotation>
IPA: /ˌænəˈteɪʃən/
Phonetic Spelling: an·uh·tay·shuhn
16. Codend
Pronunciation link: <https://www.howtopronounce.com/codend>
IPA: /ˈkɑːdˌend/
Phonetic Spelling: kod·end
17. Subsample
Pronunciation link: <https://www.merriam-webster.com/dictionary/subsample>
IPA: /ˈsʌbˌsæmpəl/
Phonetic Spelling: sub·sam·puhl
18. Technicians
Pronunciation link: <https://www.merriam-webster.com/dictionary/technician>
IPA: /tekˈnɪʃən/
Phonetic Spelling: tek·nish·uhn
19. Atlantic
Pronunciation link: <https://www.merriam-webster.com/dictionary/Atlantic>
IPA: /ətˈlæntɪk/
Phonetic Spelling: ut·lan·tik
20. Centimeters
Pronunciation link: <https://www.merriam-webster.com/dictionary/centimeter>
IPA: /ˈsentəˌmiːtər/
Phonetic Spelling: sen·tuh·mee·tur
21. Biological
Pronunciation link: <https://www.merriam-webster.com/dictionary/biological>
IPA: /ˌbaɪəˈlɑːdʒɪkəl/
Phonetic Spelling: by·uh·loj·ih·kuhl
22. Standardized
Pronunciation link: <https://www.merriam-webster.com/dictionary/standardize>
IPA: /ˈstændərˌdaɪz/
Phonetic Spelling: stan·derd·dyz

23. Vessel

Pronunciation link: <https://www.merriam-webster.com/dictionary/vessel>

IPA: /'vesəl/

Phonetic Spelling: ves·uhl

24. Tension

Pronunciation link: <https://www.merriam-webster.com/dictionary/tension>

IPA: /'tɛnʃən/

Phonetic Spelling: ten·shuhn

25. Frequency

Pronunciation link: <https://www.merriam-webster.com/dictionary/frequency>

IPA: /'fri:kwənsi/

Phonetic Spelling: free·kwuhn·see