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BRIDGING SCIENCE AND INDUSTRY: NEXT-GENERATION MULTI-FUNCTION TRAWL SYSTEM FOR NOAA'S FISHERIES RESEARCH

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Southwest Fisheries Science Center

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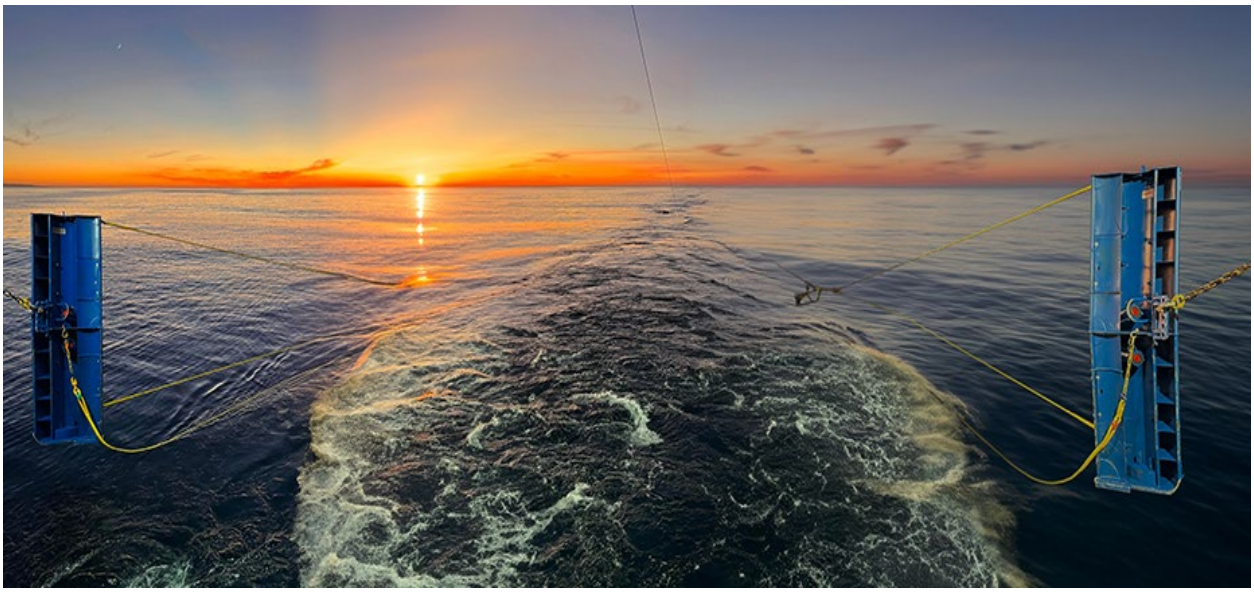
BRIDGING SCIENCE AND INDUSTRY: NEXT-GENERATION MULTI-FUNCTION TRAWL SYSTEM FOR NOAA'S FISHERIES RESEARCH



Greg Shaughnessy
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FOREWORD

The National Marine Fisheries Service (NMFS) combines information from echosounder data and trawl catches to assess stocks of Pacific hake (Pacific whiting) and multiple coastal pelagic fish species (CPS), such as Pacific sardine, northern anchovy, jack mackerel, Pacific mackerel and Pacific herring. The echosounder data are collected from ships along transects that are nominally perpendicular to the coastline, spanning the stock distributions. Throughout the survey area, multiple times each day, trawl nets are used to catch representative samples of fish observed in the echosounder data. The catch data enables conversion of the echosounder data to estimates of stock biomasses apportioned to lengths and ages.

The echosounder data includes information about both Pacific hake and CPS. However, the trawl sampling is different for pelagic and semi-pelagic species. Pacific hake are sampled in the midwater depths and near the seafloor during the daytime. CPS are sampled close to the sea-surface at night. These two approaches, midwater and surface sampling, require different trawl-system features and functions. For example, deeper trawling requires doors that pull the net down, and surface trawling requires headline floatation and doors that spread the net close to the surface.

In 2012, 2013, and 2015, NMFS combined the surveys of Pacific hake and CPS. In 2012, the echosounder and nighttime surface-trawl data were collected using one ship while the daytime midwater-trawl data were collected from another vessel. During the 2013 and 2015 surveys, both the midwater and surface-trawl data were collected, along with the echosounder data, from the same vessel. This approach reduced the survey cost, but it required time-consuming, potentially dangerous, daily transitions between two sets of trawl nets, bridles, and doors.

To improve the accuracy, efficiency, and safety of the integrated Pacific hake and CPS survey, NMFS envisioned a multi-function trawl system (MFT) to accomplish both midwater and surface trawling. The objectives of the new system were to incorporate a modern design with the latest materials and net mensuration technology to provide catches that accurately represent the fish stocks, and to make the ship and deck operations easier, safer, and more efficient. Notably, among many other requirements, the MFT should use a single set of doors for both midwater and surface trawling, alleviating the need to change bridles and doors at sea.

NMFS detailed its requirements for a novel MFT and solicited proposals for: 1) refining the MFT specifications, considering input from the fishing industry; 2) designing and supplying an MFT, incorporating the latest technology adopted by the commercial industry; 3) reporting the results of MFT testing; 4) refining the MFT based on testing results; and 5) training NOAA officers and crew to use, repair, and maintain the MFT.

Told from the perspective of the MFT designer and manufacturer, the following report details the chronological conception, design, construction, delivery, testing, and refinement of the MFT. The appendices include NMFS' request for industry information and involvement; the response from the author of this report; NMFS' procurement solicitation for an MFT; the MFT schematics and rigging plans; the MFT procedures for use aboard a NOAA ship; and the project instructions for the initial MFT testing cruise.

Remarkably, less than one year after delivery of the first MFT, it was used operationally. With this report as testament, NMFS gratefully acknowledges that the MFT invention, which serves to improve both government efficiency and science, was made possible by a strong government-industry partnership.

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Introduction

This report covers the industry-partner perspective of the development and preliminary testing of a multi-function research trawl-net system. This net system supports two of NOAA's mission critical acoustic-trawl fisheries surveys within the California Current Ecosystem (CCE). The design, construction, and component assembly resulted from contracts awarded by NOAA's Southwest and Northwest Fisheries Science Centers to the industry survey team led by myself, Greg Shaughnessy, Ocean Gold Seafoods, in collaboration with staff from both science centers.

Need and Concept

Historically, the Southwest Fisheries Science Center (SWFSC) and the Northwest Fisheries Science Center (NWFSC) conduct separate acoustic-trawl surveys in the CCE for Coastal Pelagic Species (CPS; e.g., Pacific sardine, northern anchovy, Pacific mackerel and jack mackerel) and Pacific whiting (Hake). For scientific and operational reasons, NOAA is integrating the two surveys into one. The combined survey leverages updated acoustic-trawl methods and the common geographic region to gain efficiency afforded by two surveys sharing one Fisheries Survey Vessel (FSV).

Formerly, each team used different trawl gears. A requirement for integration is one trawl system that is usable by both survey teams. The new net must maintain or improve the efficacy and selectivity of the historical nets. This is necessary to validate acoustic signatures and gather biological samples while preserving each survey's respective time-series. Operationally, the new design must be configurable to fish at the surface for CPS or midwater for Hake, and be equipped with industry-standard net-mensuration sensors. The latter is to allow the fishing master and scientists to monitor the effectiveness of the fishing effort in real time. The transition between fishing modes must be safe, quick, and easy for any deck crew to simplify deck operations and maximize fishing time.

Inputs and Design

My interest in NOAA's fishing operations for CPS began in 2016. Our industry was concerned that the near shore regions of the West Coast were under sampled because of constraints on the FSV. Through Pacific Fisheries Management Council (PFMC) contacts, we began working with Dr. David Demer, who was the Advanced Survey Technology Program lead at the SWFSC at the time. We partnered with Demer's team and provided the fishing vessel *Lisa Marie* to acoustically sample targets in the near shore. I volunteered aboard the FSV during a CPS survey as an Industry observer and advisor. My involvement with SWFSC's CPS survey provided insight into the type of trawl gear used and introduced me to the methods that comprise a fisheries-independent acoustic trawl survey. I also grew aware of SWFSC leadership's interest in integrating their epi-pelagic CPS survey with the NWFSC's midwater Hake survey.

My connections in the fishing industry run deep. I have been a participant in most fisheries on the US West Coast and Alaska with a major focus on trawling. The effort by the SWFSC and NWFSC to combine surveys required a single trawl setup that could perform both surface and midwater trawling. Midwater trawling matched my skillset. However, I only had limited knowledge of surface trawling. Researching a single net design, I reached out to friend and colleague, Seamus Melly of Swan Net USA, and to others within the commercial fishing industry. These discussions led to conversations with European fishermen, who trawl target species near the surface, which were backed by research and scientific literature. Armed with this new insight and flexibility, we set about designing a single net that can toggle between surface and midwater trawling using a single set of doors.

Request for Information (RFI)

In early 2023, NOAA's acquisition and grants office posted a Request for Information (RFI) for trawls, interested vessels, and design considerations for an integrated survey (**Appendix A**). We had done extensive design work on the creation of a completely modern trawl system. Through several revisions based on feedback from NOAA scientists, NMFS, and members of the commercial industry, our system design facilitates both midwater and surface trawling for bio-sampling onboard NOAA FSVs.

Response to RFI

As I was already preparing a comprehensive gear upgrade proposal for the SWFSC CPS survey, I saw NOAA's RFI as an opportunity to align my efforts with the agency's broader goal of integrating multiple survey methods into a single, modernized trawl system. My response to the RFI detailed the conceptual design, operational advantages, and potential improvements of a Multi-Function Trawl (MFT) system capable of both midwater and surface trawling.

In my submission (**Appendix B**), I emphasized the importance of developing a net system that would maintain the scientific integrity of both the CPS and Hake surveys while improving efficiency through a streamlined, adaptable design. Drawing on my experience in the commercial fishing industry and collaborations with net manufacturers, I proposed a system incorporating cutting-edge net design and materials, an optimized rigging configuration, an innovative door design, and a state-of-the-art net mensuration system for seamless transitions between surface and midwater trawling.

Integrated Survey Workshops

At a PFMC meeting in Vancouver, WA in June 2023, I gave a presentation on a pathway to modernize the fishing gear to streamline operations and maximize a single net and door combination that could perform both tasks. Throughout this process, SWFSC and NWFSC held meetings on a regular basis for all interested stakeholders to receive updates, and to give stakeholders opportunities to provide input on the integration of both surveys using one vessel.

Contract

In spring 2023, NOAA Fisheries solicited proposals for a multi-function trawl, testing and training (**Appendix C**). By summer 2023, my proposal (**Appendix B**) was selected. A budget was approved for purchasing the trawl system and training the ship's crew.

Manufacturing and Component Assembly

Swan Net USA, founded by fisherman Seamus Melly from Ireland in 1994, is the premier net manufacturer on the US West Coast and supplies most of the pelagic vessels fishing the Bering Sea, Gulf of Alaska, and West Coast fisheries from the California border to the North end of Vancouver Island. In addition, they provide trawl nets, doors and codends to the West Coast Pacific whiting (Hake) fleet.

Seamus Melly was instrumental to the design of the MFT and Swan Net USA was selected as the preferred provider of all components of the system (schematics in **Appendix D**). Manufacturing began in October 2023 and included:

- One set of trawl doors;
- One MFT net;
- One Marine Mammal Excluder Device (MMED) with SWFSC's grate;
- Two codends, one with a 32-mm mesh liner for midwater hake trawls and one with an 8-mm liner for surface CPS trawls; and
- All bridles, rigging, door legs, pennants and associated hardware.

Figure 1. *Seamus Melly, Swan Net USA, inspecting the MFT net construction. Image provided by Greg Shaughnessy.*

Net Mensuration and Door Sensors

Trawl sampling plays a crucial role in stock assessments and has been a fundamental tool for this purpose for many years. Accurate and defensible measurements of net performance are more important than ever before as trawl sampling comes under increased scrutiny from various stakeholders. Traditionally, logging sensors have been used to record net performance data for post-processing. However, these systems do not provide the real-time feedback of net parameters that is needed to obtain good catches. Real-time data also saves time at sea by reducing trawl deployments and time spent repairing the gear.

The net parameter data that is available to the researchers in real-time is extensive and growing. Horizontal distance between trawl doors (door spread), horizontal net opening (wing spread), headrope height and depth, vertical distance of the net opening, and bottom contact inform calculations of the sampled water volume, and help to ensure that the net fishes its intended target. Commercial industry is utilizing live feed cameras to view what is entering the codend.

Pitch and roll of the doors, height of the doors off the sea bottom, net geometry (if the net is evenly towed), as well as water flow at the net opening are all necessary for confidence in the tuning and performance of the trawl operation.

Door roll is an essential performance parameter to see if the doors are flying correctly, as a quick adjustment can prevent gear damage and save hours lost to repairs and rework.

For directed trawls, geographic net position is necessary to show that the net is sampling the same water volume as that sampled by the vessel's acoustic systems. This is so that the fish caught in the net correspond to those observed by the onboard echosounders.

Both *FSV Reuben Lasker* and *FSV Bell M. Shimada* use a Simrad-Kongsberg FS70 headrope unit (net sonar) for live imaging.

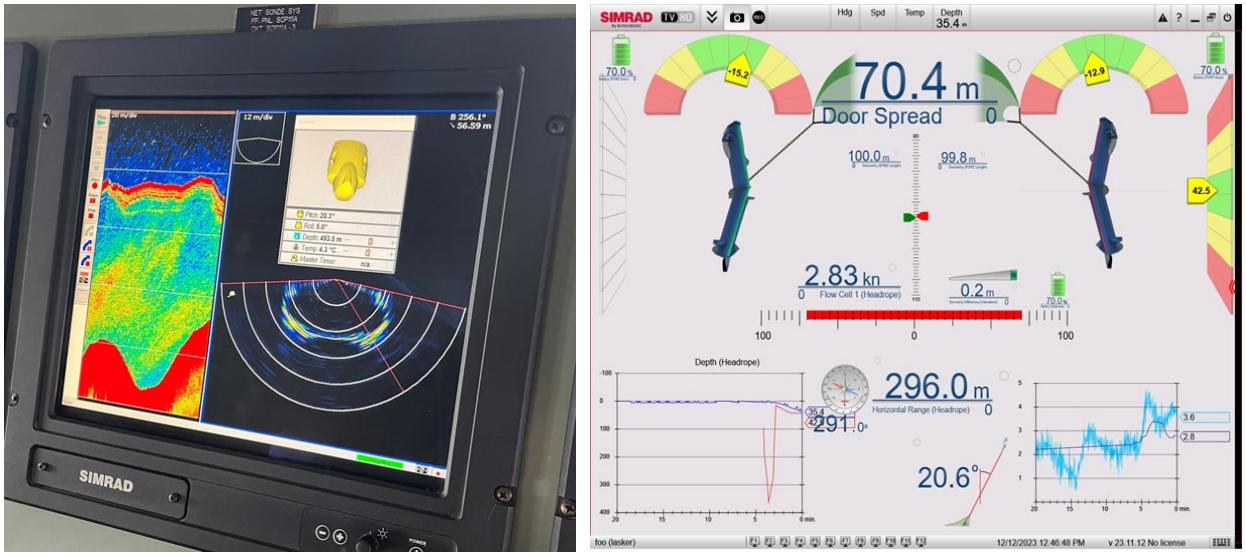

Figure 2. *FS70 display during an MFT deployment (Left). Display of Simrad-Kongsberg PX door sensors deployed on trawl doors (Right). Images provided by Greg Shaughnessy.*

Delivery Dates

The complete MFT system was delivered to the NOAA FSV *Reuben Lasker* in San Diego, California on December 9th, 2023.

Figure 3. *Delivery of the MFT to the FSV Reuben Lasker. Image provided by Greg Shaughnessy.*

Aerial Observations of the Net

During our testing phase, we utilized drone technology to capture high quality images and video of the net towing at the surface. NOAA's unique capabilities in this area were of great help to the net manufacturer and myself in identifying and evaluating what adjustments were needed to improve performance. This birds-eye perspective gave us a new way to view the net and door combination during the setting, fishing, and retrieval operations. The team used a number of tools and techniques to capture the desired imagery. Their primary tool was a DJI Mavic 3 Pro drone utilizing a 24 mm lens and a 20 MP camera. Flights maintained line-of-sight control and were limited to a maximum duration of 43 minutes.

Testing, Objectives and Refinements

The initial testing of the MFT system was conducted aboard *Reuben Lasker*, December 10 to 15, 2023, near San Diego, CA. The objectives were to: 1) test and refine the net configurations for both midwater and surface modes; 2) visually document the operation of the net with the combined use of images derived from modern net mensuration gear, an in-net camera system, and an aerial drone; and 3) develop protocols for survey operations (plan details in **Appendix E** and **Appendix F**).

We successfully used the MFT for both surface and midwater trawling. Based principally on the aerial video, we recommended the following refinements to the MFT for improved surface trawling performance: 1) increase floatation options; 2) add pockets in the headlines for removable floats, to stabilize the net; and 3) redesign the MMED grate and net section to improve water flow.

Figure 4. *Aerial drone image of the MFT being deployed from FSV Reuben Lasker. Aerial image provided by Trevor Joyce, SWFSC/MMTD, Aerial drone team.*

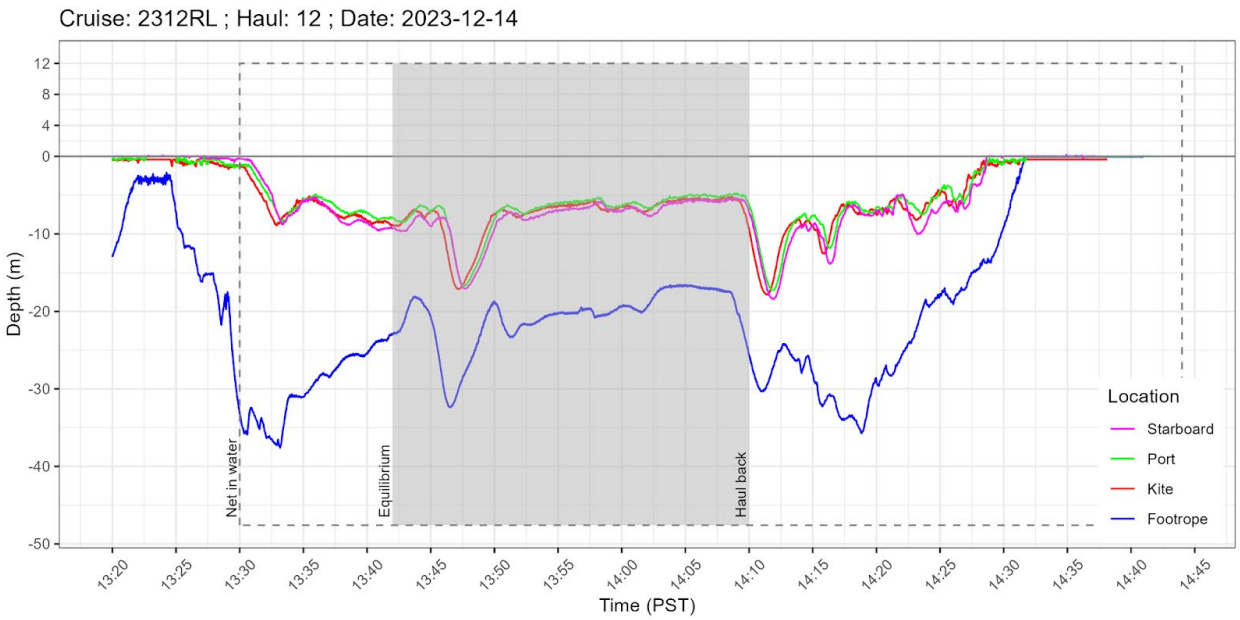

Figure 5. *Net data from the MFT in "surface mode" illustrating insufficiently stable, sub-surface trawling during the December 2023 gear trials conducted aboard FSV Reuben Lasker. The non-real-time data are from two temperature-depth recorders (TDRs) placed on the port and starboard wing tips (magenta and*

green lines), one on the kite (red line), and one on the footrope (blue line) to determine the fishing depths and vertical opening of the MFT net. Plot provided by Kevin Stierhoff, SWFSC.

During surface trawling, we observed slack webbing around the MMED that opened the meshes and allowed fish to escape. We determined that a modified grate would improve the shape of the net, allow the webbing to hang correctly, and improve water flow.

The suite of observations provided valuable insights into the MFT system's functionality, which enabled refinements to optimize efficiency and ensure reliable performance during surveys.

Figure 6. The original (right) and redesigned (left) MMED grates.

The refined MFT was tested June 26 to 28, 2024 aboard FSV *Reuben Lasker* off San Diego, CA. The objectives were to: 1) further test the MFT configured for surface trawling; 2) confirm if the headline floats stabilize the net on the surface; 3) confirm that refinements to the MMED section and grate improve water flow into the codend; and 4) evaluate the MFT catch performance with a closed codend.

Figure 7. *Aerial drone image of the MFT being deployed from FSV Reuben Lasker. Aerial image provided by Trevor Joyce, SWFSC/MMTD, Aerial drone team*.

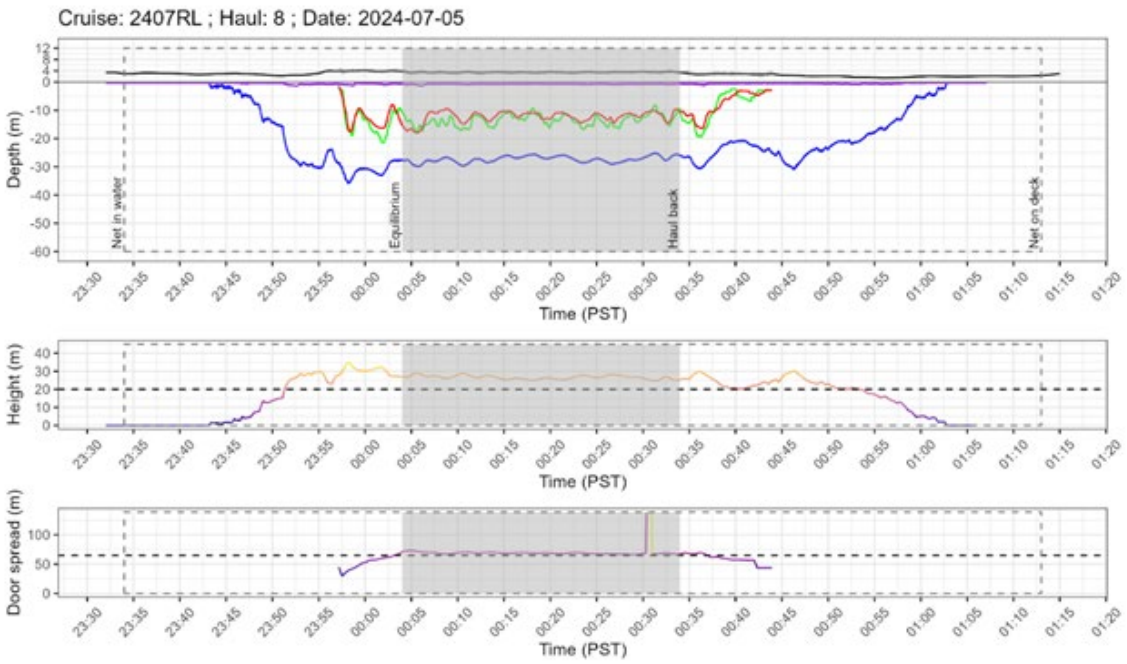

Figure 8. *Net data from the MFT in "surface mode" showing stable surface trawling during the 2024 Summer California Current Ecosystem Survey conducted aboard FSV Reuben Lasker. The non-real-time data are from two temperature-depth recorders (TDRs) placed on the kite (magenta line) and one on the footrope (blue line) to determine the fishing depths and vertical opening of the MFT net (top panel). The vertical opening (i.e., height) of the net was measured as the difference in depth between the kite and footrope TDRs (middle panel). Measurements of the port and starboard door depth (green and red lines, respectively; top panel) and door spread (bottom panel) were provided in real-time by the PxPos net mensuration system. The real-time information about net performance allowed adjustments by the Chief Bosun and vessel operator to optimize fishing. Plots provided by Josiah Renfree, SWFSC.*

Figure 9. Aerial drone image of the *MFT fully deployed at surface from FSV Reuben Lasker. Image provided by Trevor Joyce, SWFSC/MMTD, Aerial drone team.*

The June 2024 trials of the refined MFT included 11 tows and demonstrated that: 1) the addition of headline-float pockets stabilized the net during surface trawling; 2) modifications to the MMED grate and section increased water flow into the codend, improving the net efficiency; and 3) continuous training of the deck crew enhanced their proficiency in setting, hauling, and handling the MFT system, ensuring smoother operations.

The refined MFT was tested again, August 1 to 5, 2024, from NOAA FSV *Bell M. Shimada* near San Francisco, CA. The objectives of this cruise were to test the MFT in the midwater mode for catching hake and comingled species while making adjustment to achieve the specified net dimensions.

Testing included eleven trawls with differing door configurations and net dimensions. We trained the deck crew on the proper MFT procedures. The crew appreciated the trawl's ease of use, function, and streamlined operations. The addition of pocket nets for evaluating the net's selectivity added approximately 25 minutes to each trawl deployment.

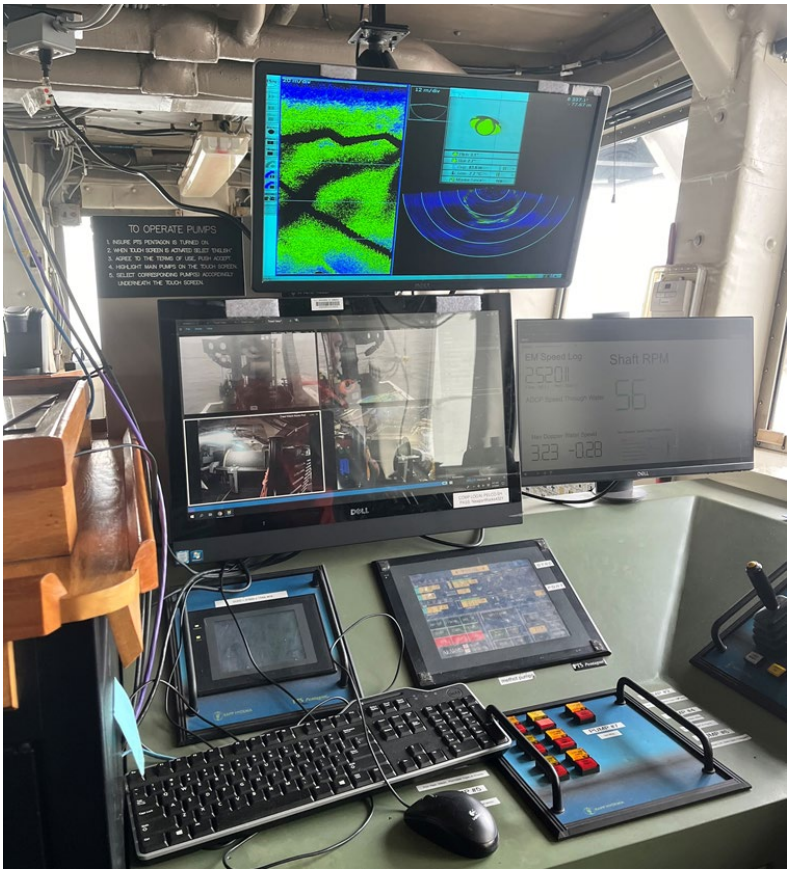

Figure 10. *Trawl station onboard FSV Bell M. Shimada. Image provided by Greg Shaughnessy.*

February 2025, industry survey team traveled to Victoria B.C. to load a complete MFT system on loan from the NWFSC onboard the *CCGS Sir John Franklin* and trained Canadian Fisheries researchers on operational procedures.

March 2025, industry survey team onboard the *FSV Bell M. Shimada* for further training and refinement in preparation of this summer's inaugural integrated survey using the MFT system.

Figure 11. *(Left) Shaughnessy and Melly training onboard FSV Reuben Lasker 2023. Image provided by CDR Claire Surrey-Marsden. (Right) Shaughnessy and Melly arriving at CCGS Sir John Franklin for training 2025. Image provided by Greg Shaughnessy.*

Annual Maintenance and Repair

Annual maintenance of the MFT system is crucial to ensure its long-term performance, reliability, and safety in support of NOAA's fisheries surveys. Regular inspections and upkeep of key components, including trawl doors, netting materials, bridles, and mensuration sensors help prevent wear and tear that may compromise the system's effectiveness or lead to costly repairs. Maintenance routines also provide an opportunity to recalibrate sensors, test modifications, and to incorporate feedback from previous survey operations ensuring that the system remains aligned with evolving scientific and operational needs. By prioritizing annual maintenance, the MFT can continue to deliver accurate, high-quality data for stock assessments, optimize vessel operations, and enhance the safety and efficiency of the deck crew, ultimately contributing to the sustainability and success of fisheries management efforts.

Key Points

- **Integration of Surveys:**
  - This project aims to support the integration of two key NOAA surveys—Coastal Pelagic Species (CPS) and Pacific Hake—using a single trawl system to improve efficiency and maintain the scientific integrity of both methodologies.
- **Design and Features of the Multi-Function Trawl System:**
  - The MFT system is capable of surface and midwater trawling with quick transitions, supporting real-time data collection via advanced net mensuration sensors. The system includes innovative designs for net geometry, doors, and other trawl components.
- **Collaborative Development:**
  - The project brought together fishermen, net designers, and NOAA scientists, emphasizing collaboration between scientific and commercial sectors. This approach fostered innovation and ensured the trawl met operational and scientific requirements.
- **Testing and Refinements:**
  - The MFT system underwent multiple testing phases aboard NOAA vessels, including adjustments for improved stability, performance in both surface and midwater modes, and refinements to components such as floats and MMEDs. Testing is ongoing and as new data is collected, the MFT system, processes, and training will be further refined.
- **Operational and Environmental Goals:**
  - By leveraging modern materials and designs, the MFT system reduces fuel consumption, enhances operational safety, and improves the efficiency and accuracy of biological sampling, supporting sustainable fisheries management in the California Current Large Marine Ecosystem.

Conclusion

The MFT system represents a significant advancement in fisheries survey method, addressing NOAA's need for an integrated solution to optimize resources, enhance data collection, and support sustainable fisheries management. By combining the expertise of commercial fishing industry leaders, innovative net design engineers, and NOAA scientists, the project successfully developed a versatile trawl system capable of meeting the dual demands of surface and midwater sampling.

Through iterative testing and refinements, the MFT system has proven its ability to perform reliably under varying conditions, maintaining the scientific rigor required for accurate stock assessments, while improving operational efficiency and safety. Key enhancements, such as real-time net mensuration feedback and adaptable net configurations, have demonstrated their value in refining survey protocols and expanding ecosystem resolution capabilities.

The success of this project underscores the importance of collaboration and innovation in addressing the challenges of modern fisheries research. The MFT system will play a vital role in NOAA's efforts to integrate surveys, improve ecosystem understanding, and foster sustainable resource management. Building on this foundation, future endeavors can continue to bridge gaps between scientific research and industry practices, ensuring robust, data-driven decision-making for the marine environment.

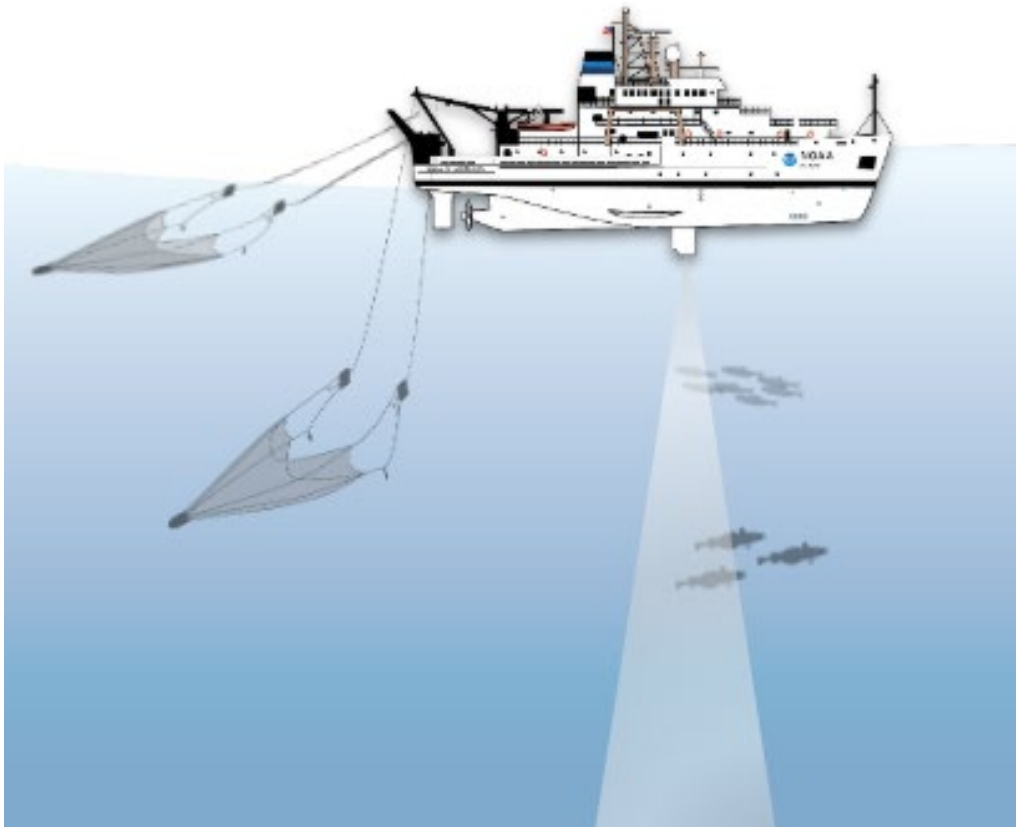

Figure 12. MFT concept drawing. Graphic provided by Su Kim, NWFSC/NOAA Fisheries.

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I would like to thank all of the talented and dedicated people involved in this project - the command, deck, engineering, steward, electronic and survey departments on the NOAA Fisheries vessels, the research teams at NOAA Fisheries, and our fishing industry colleagues. The efforts of the following individuals, and many others, made this accomplishment possible.

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NMFS Office of Science and Technology

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- John Crofts, Deputy Director
- Sarah Mesnick, Ph.D., Science Liaison

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- Josiah Renfree, Research Ocean Acoustic Engineer, Acting Lead
- Steve Sessions, Equipment Specialist
- Kevin Stierhoff, Ph.D., Research Fisheries Biologist
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- Rebecca Thomas, Ph.D., Research Fish Biologist
- Amanda Vitale, Fish Biologist, Contractor with AIS in support of NWFSC FRAM

NOAA Office of Marine and Aircraft Operations (OMAO)

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- CDR Charles Wisotzkey, Executive Officer *FSV Reuben Lasker* R228
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- Matt McFarland, Chief Boatswain, *FSV Bell M. Shimada* R227
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Commercial Fishing Industry

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- David Barbee - Simrad Product Advisor and Field Service Engineer, Simrad
- Mike Okoniewski, Fisheries Consultant
- Kyle Lambert, Ocean Gold Seafoods
- Gordon Shaughnessy, Editor

Figure 13. *Successful MFT operations depend on the scientists, industry experts, and the ship's command and crew make the MFT net operations at sea and in the laboratory. Images provided by Greg Shaughnessy and NOAA Fisheries/SWFSC.*

Appendix A - RFI

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
ACQUISITION AND GRANTS OFFICE
REQUEST FOR INFORMATION
TRAWLS, INTERESTED VESSELS, AND DESIGN CONSIDERATIONS FOR INTEGRATED SURVEY

This is a Request for Information (RFI), for market research purposes, in accordance with Federal Acquisition Regulations (FAR) Part 10 Procedures. This is not a solicitation, nor does it guarantee a solicitation will be issued. Requests for a solicitation will not receive a response. This is not a request for proposals and it does not obligate the government in any manner.

Background

The NWFSC's Fisheries Engineering and Acoustic Technologies (FEAT) team and the SWFSC's Advanced Survey Technologies (AST) Program are working to integrate two California Current Ecosystem (CCE) stock assessment surveys: *The Joint U.S.-Canada Integrated Ecosystem & Pacific Hake Acoustic Trawl Survey* and the *Coastal Pelagic Fish Species (CPS)/California Current Ecosystem (CCE) Survey*, with a goal of implementing the first integrated survey by the Summer of 2025. The joint NWFSC and DFO survey produces a biomass estimate and age composition data for Pacific hake and the SWFSC's survey produces estimates of the biomasses, distributions and demographics for seven stocks of five CPS (i.e., Pacific sardine, Northern anchovy, Pacific mackerel, Jack mackerel and Pacific herring) providing the only fishery independent inputs to stock assessments for effective management of these commercially valuable species.

The following reports detail the data collections and analyses of the two surveys:

https://repository.library.noaa.gov/view/noaa/43727
https://repository.library.noaa.gov/view/noaa/46625
https://repository.library.noaa.gov/view/noaa/48667

The new integrated survey will maximize use of valuable ship time, integrate knowledge, skills, methods and other resources across Centers and, with international partners, provide a more holistic understanding of the CCE. Flexibility has been a key element in the success and resiliency of these individual surveys, for example, by ensuring sampling systems (e.g., multi-frequency echosounders) are available on multiple platforms. The integrated survey must maintain flexibility in the new survey design and implementation.

This RFI seeks input on: (1) the design of a single trawl net capable of fishing both in the midwater (e.g., for hake) and at the surface (e.g., for CPS), either as a modification of an existing design (e.g., Aleutian Wing Trawl or AWT) or an entirely new design including the net, rigging, and doors; (2) potential charter vessels to support sampling efforts in the integrated survey, in coordination with a NOAA Fisheries Survey Vessel (FSV); and (3) integrated survey design considerations and sampling protocols.

Trawl Net Design

Existing trawling methods: Both surveys use trawling to collect biological samples of target species to validate acoustic data, but the surveys use different nets and deploy them in different depths, and at different times of the day. The NWFSC uses a midwater trawl (AWT) during the day to trawl on Pacific hake aggregations detected acoustically at depths from 100 to 500+ meters; the SWFSC uses a Nordic 264 trawl at night to sample CPS dispersed and feeding at the surface in areas where they were detected acoustically, schooling at depth, during the daytime. The AWT is equipped with Fishbuster doors, durable

spectra rigging, a large kite supporting a Simrad FS70 net-sounder on the vessel's 3rd wire, and a video or stereo camera in the intermediate ahead of the codend.

Single net design: To develop more flexibilities and efficiencies for the integrated survey, the NWFSC and SWFSC survey teams seek ideas and input to either modify an existing net design or develop a new net capable of fishing both during the day in the midwater and at night at the surface, with minimal transition effort by a vessel's deck crew, from a NOAA FSV or from a charter fishing vessel. The design is to include rigging, doors, mensuration instruments, and other hardware to support this dual fishing capability and vessel flexibility.

Interest in charter vessel participation in the integrated surveys

If you are an owner or captain of a charter vessel and are interested in participating in the integrated surveys, beginning in 2025, please let us know. We will assemble a list of interested parties and corresponding vessel specifications, such as: existing and potential echosounder and sonar systems, trawling and catch processing capabilities, internet access and communications equipment; and bunks, laboratory, side-station deployment systems for other survey instrumentation, and deck workspaces for scientists.

Survey design considerations and sampling protocols

Finally, this RFI seeks your input on the overall integrated survey design and sampling protocols. Such information could include, but is not limited to, the survey area, i.e., southern, northern, nearshore and offshore extents, time of year, maximum sampling depth, and acoustic transect spacing and orientation relative to the coast.

The NAICS code for any **net design or manufacture** is anticipated to be 314994, Rope, Cordage, Twine, Tire Cord, and Tire Fabric Mills with a size standard of **1,000 employees**.

The NAICS code for any **support charter vessels** is anticipated to be 541370 Surveying and Mapping (except Geophysical) Surveys with a size standard of **$15M per year** or Research and Development in the Physical, Engineering, andLife Sciences (except Biotechnology) with size standard of **1,000 employees**.

NOAA/NMFS requests input from industry and interest from net designers, manufacturers, and/or charter vessels. Please indicate your status in your responses.

Requested Information:

Responses to this notice shall be limited to five pages or submitted through Google Forms

1. Entity information and preferred contact information.
2. Stakeholder status (e.g., Potential Vendor, Fishing Industry Participant, Scientist, etc).
3. If you are a Fishing Industry Participant, please share your target fishery (if multiple, list all fisheries) and any other relevant information (e.g., type of nets).
4. Feedback on the potential for a modified or new trawl net design.
5. Feedback about potential use of charter vessels in an integrated survey.
6. Input on the overall integrated survey design and sampling protocols.
7. Are you a potential vendor for net/design manufacture? If so, please provide:
    a. The organization's UEI number, CAGE code, and organization/company structure (corporation, LLC, partnership, joint venture, etc.).
    b. Written confirmation of the organization's registration in SAM (www.sam.gov). Offerors should be registered to be considered as a source.

c. The size classification of the organization under the appropriate NAICS code, and if the organization is classified as a small business, HUBZone small business, Service-Disabled Veteran Owned small business, Woman-owned small business and/or 8(a) certified small business.
d. General statement providing the organization's relevant experience and/or capability to provide the described design/manufacturing.
e. Any additional information you would need to consider this opportunity.

8. Are you interested in participating as a charter vessel? If so, please provide:
    a. The organization's UEI number, CAGE code, and organization/company structure (corporation, LLC, partnership, joint venture, etc.).
    b. Written confirmation of the organization's registration in SAM (www.sam.gov). Offerors should be registered to be considered as a source.
    c. The size classification of the organization under the appropriate NAICS code, and if the organization is classified as a small business, HUBZone small business, Service-Disabled Veteran Owned small business, Woman-owned small business and/or 8(a) certified small business.
    d. General statement providing the organization's relevant experience and/or capability to participate.
    e. Any additional information you would need to consider this opportunity.
9. Please add any comments, concerns, or feedback not reflected in previous questions. Capability statements and other responses shall be submitted to Sarah Waugh at sarah.waugh@noaa.gov or through the **linked Google Response form** no later than **5:00 PM Pacific Time on Tuesday, February 28, 2023**. Please do not call regarding this notice. Any questions regarding this notice must be submitted in writing via e-mail to the above e-mail address no later than **5:00 PM Pacific Time on Monday, February 20, 2023**. An amendment may be posted if necessary, so firms are encouraged to "follow" this announcement for future actions.

This request is not to be construed as a commitment on the part of the Government to award a contract, nor does the Government intend to pay for any information submitted as a result of this request. No entitlement to payment of direct or indirect costs or charges by the Government will arise as a result of the submission of contractor's information. The Government shall not be liable for or suffer any consequential damages for proprietary information not properly identified. Proprietary information will be safeguarded in accordance with the applicable Government regulations.

Appendix B - RFI Response

Section 1 – Entity Information

Preferred Contact:
Greg Shaughnessy
Ocean Gold Seafoods, Inc. – COO
West Coast Pelagic Conservation Group – VP
Commercial Fisherman
Email: gshaughnessy@oceancos.com
Phone: 360-310-0662

Section 2 – Stakeholder Status

Fishing industry participant

Section 3 – Target Fisheries

- Pacific Whiting
- Rockfish
- Other Groundfish
- Dungeness Crab
- Pink Shrimp
- Mackerel
- Sardines

Section 4- Feedback on Trawl Design

I have been involved with the Southwest Fisheries Science Center (SWFSC) since 2016 as an industry partner, as they conduct their annual Acoustic Trawl Method (ATM) survey of Coastal Pelagic Species (CPS) populations in the California Current Ecosystem. Our group, West Coast Pelagic Conservation Group (WCP), has provided a fishing vessel to augment the ATM survey in observing and recording CPS populations acoustically in the nearshore, and then validating observed aggregations with sample collections using purse seine gear. The F/V *Lisa Marie* augments NOAA's ATM survey to observe and record CPS populations in the near-shore waters with multifrequency echo sounders and validates the CPS composition from live samples caught by purse seining.

To date I have participated in multiple trips (5-6 days each) with the NOAA FSV *Reuben Lasker* as they surveyed off the Washington coast. I have logged 22 sets and haul backs of survey surface trawl gear. As an experienced trawlerman, my role was to observe and advise the SWFSC ATM survey team on gear deployment.

During my time onboard, I learned extensive information on the current trawl system. This includes door design, net type, bridle lengths, setback distance, floatation approach, mensuration sensors used, and what portion of the upper water column they intend to sweep. The following equipment list details what is currently in use:

- Doors: NET Systems, foam filled
- Trawl: NET Systems, Nordic 264 (N264) rope trawl
- Bridle length: 73 m (240 ft)
- Setback distance: 1.5 m (5 ft)
- Floatation: Polyform A-5, on top wingtips

- TDRs: RBR Duet, X3
- Headrope depth: 0 to 10 m below the sea surface
- Towing speed: 3.5 kt
- Opening: 15 m x 20 m (300 m^2)

For the last several years, I have discussed with the SWFSC ATM Survey Team how their trawl equipment and techniques might be improved by using new door and net designs adopted by the commercial industry. Since the advent of the NET Systems gear, modern trawl doors have been improved for greater flexibility and other efficiencies. Trawl nets, bridles, and main warps now incorporate new materials that wear well, weigh less, promote self-spreading, improve water flow, and results in less fuel consumption. Also, the *Lasker* net-sensor suite should be upgraded to provide real time recorded information on door spread, vertical and horizontal net opening, net geometry, and position.

These surveys provide critical data on stock abundance. Modernizing the fishing gear as outlined will improve sample collections and make ship and deck operations safer and more crew friendly.

In December 2022, I was informed that the SW and NW Fisheries Science Centers were planning to integrate the annual CPS and biennial whiting surveys onto one vessel, while maintaining the integrity of the survey information. Presently, CPS are sampled with a surface-trawl at night and whiting with a midwater trawl during the day.

I researched trawl system designs to discern if there was a single net and door combination that could handle both surface trawl and midwater trawl without sacrificing the efficacy of either. After discovering several potential designs, I consulted with a premier net manufacturer, Seamus Melly (Swan Nets; Seattle, WA). He and I began by summarizing the midwater trawl system used by the NWFSC to sample whiting:

- Doors: NET Systems, Super V Fishbuster
- Trawl net: NET Systems, Aleutian Wing Trawl (AWT)
- Bridle length: 82.3 m (270 ft)
- Setback distance: 3 m (10 ft)
- Cluster weights: 2-340 kg (2-750 lb)
- Mensuration sonar: Simrad FS70, Kongsberg
- Headrope depth: 92-183 m (50-100 fm)
- Towing speed: 3.5 kt
- Opening: 20 m x 40 m (800 m^2)

Guided by these two net dimensions, we began developing an experimental trawl-system design with the goal to maintain the N264 and AWT swept area net profile while enhancing performance. The new design would use contemporary door technology capable of surface or midwater trawling. It would incorporate ease of use mechanisms to maximize execution. This would include adjustments for bridle length, cluster weights, or floatation and setback distances. I continue to evaluate vendor options for mensuration sensors that provide real-time data when fishing both midwater and surface trawls.

The NOAA Fisheries RFI stated their interest to procure a single net system to support their concept for an integrated CPS-whiting survey. I advanced the aforementioned experimental trawl-system design review through consultations with fellow fishermen, scientists, and trawl gear manufacturing experts and then completed the trawl-system design detail. This allowed me to provide an informed response to any future competitive procurement solicitation. I proposed that NOAA Fisheries conduct sea-trials for testing, refinement, and evaluation, and for training ship's crew on the use of a *Multi-Function Trawl* system. A comprehensive report on the results of these tests should be provided for peer review and to CPS-whiting industry reps and management bodies. This will allow survey improvements and decisions to be data driven and guided by expertise.

Section 5 – Feedback on Potential Vessels

I believe that collaborative partnerships between the science community and commercial industry are foundational for a more accurate and comprehensive database. Fostering positive working relationships between the two parties is one of my goals. Currently, F/V *Lisa Marie* complements the SWFSC ATM CPS surveys. This has produced high quality data for both NOAA Fisheries and our industry. I highlight the benefits of these partnerships in 2022 when the *Lasker* had crewing issues. WCP and the *Lisa Marie* adapted to pick up the *Lasker's* workload and completed the Northern survey, the acoustic work and species composition sampling, onshore and offshore, from the Canadian border to Bodega Bay, CA. Had WCP and the *Lisa Marie* not been trusted members of the SWFSC ATM CPS survey team, there would have been a substantial gap in the acquisition of this valuable data.

Section 6 – Input on Overall Integrated Design

CPS surveys are conducted annually while the whiting surveys are conducted biennially. Annual surveys are required for CPS due to the relatively short lifespans of small pelagic fishes and the large geographic range they cover. However, as learned in 2011 and 2012, an annual survey of whiting also has advantages for tracking cohorts, particularly during periods of lower stock abundance.

Section 7 – Potential Vendor Info

UEI: SW7AJGU47YN8
Cage Code: 85AY8
Ocean Gold Seafoods Inc.
Registered in SAM
NAICS Code: 424460 (Small Business)

Greg Shaughnessy has had 40+ years of experience with procurement of innovative trawl equipment.

Section 9 – Charter Vessel Participation

Currently only *Lisa Marie* is participating in the CPS ATM survey.

Section 10 – Comments

NOAA FSV configuration options to consider;

- FSV *Reuben Lasker* = single net reel
- FSV *Bell M Shimada* = dual net reels

Trawl Doors and Net Options

- 2 sets doors, 2 nets
- 1 set doors, 2 nets
- 2 sets doors, 1 net
- 1 set doors, 1 net

If it was my job to collect representative samples of fish observed with echo-sounders, presently done with daytime midwater trawls for whiting and nighttime surface trawls for CPS, I would target improvement of the sampling efficiency and effectiveness. This goal would lead me to research innovative designs and experiment with a single set of doors and single net to determine if it can accomplish both tasks without compromising the quality of the species composition data.

Appendix C - Solicitation

This is an excerpt of the Statement of Work section from the Combined Synopsis/Solicitation document.

(VI) STATEMENT OF WORK

Background

The National Marine Fisheries Service (NMFS) presently conducts two acoustic-trawl surveys in the California Current Ecosystem, one biennially for assessing Pacific hake (Pacific whiting) and another annually for assessing multiple coastal pelagic fish species (CPS), such as Pacific sardine, northern anchovy, jack mackerel, Pacific mackerel and Pacific herring. These surveys, which provide critical data on stock abundances and distributions, will be combined in 2025 and beyond. Although the integration of these surveys requires more efficient data collections, it also provides opportunities to improve the quality and quantity of assessment information. For example, modernizing the trawl gear could ease ship and deck operations, make them safer, and provide catches that better represent the target fish populations.

Presently, Pacific hake are sampled in the midwater during the daytime using an Aleutian Wing Trawl 24/20 (AWT) and CPS are sampled at the sea-surface at night using a Nordic 264 rope trawl (N264). Specifications for the two nets are summarized below:

Midwater trawl used to sample Pacific hake:
Net: NET Systems, Aleutian Wing Trawl 24/20 (AWT)
Doors: NET Systems, Super V Fishbuster
Bridles: length: 82.3 m (270 ft); setback: 3 m (10 ft); cluster weights: 2-340 kg (2-750 lb)
Opening: 20 m x 40 m (800 m2)
Headrope depth: 92-183 m (50-100 fm)
Cod end mesh: 32 mm
Towing speed: 3.5 kt
Mensuration: Simrad FS70, Kongsberg

Surface trawl used to sample CPS:
Trawl: NET Systems, Nordic 264 rope trawl (N264)
Doors: NET Systems, foam filled
Bridles: length: 73 m (240 ft); setback: 1.5 m (5 ft); wingtip floatation: Polyform A-5
Opening: 15 m x 20 m (300 m2)
Headrope depth: 0 to 10 m
Cod end mesh: 8 mm (includes marine mammal excluder device, MMED)
Towing speed: 3.5 kt
Mensuration: RBRduet3 temperature depth logger (2 ea)

In 2013 and 2015, NMFS deployed both nets from a single NOAA Fisheries Survey Vessel (FSV), *Bell M. Shimada*, using a split-net reel and two sets of doors, to trawl both midwater and at the surface. For future integrated surveys, beginning in summer 2025, NMFS anticipates a need to trawl from one NOAA FSV, perhaps *Reuben Lasker*, which has a single net reel and multiple, evolving, net mensuration systems (see section **7**). Additionally, NMFS aims to improve trawl performance using a modern design and the latest materials, and have the option to do trawl sampling from chartered fishing vessels. This is a firm fixed price contract to design, deliver, and test a multi-function trawl system (MFT), including refinement and training.

Scope of Work

For use in an annual, integrated survey for Pacific hake and CPS, beginning in summer 2025, NMFS is procuring an MFT, with a single set of doors, for both midwater and surface trawling, that is safer than changing doors and nets at sea, and more efficient at catching representative samples of the target species. *Importantly, the acoustic-trawl surveys require only representative samples of the target species lengths and ages, and not commercial sized catches.* During the performance period, the vendor shall: consult NMFS survey and assessment scientists, CPS and whiting industry representatives, and fisheries management entities on the MFT design; design, fabricate and deliver the MFT; perform testing and evaluation of the MFT; report on the MFT testing and evaluation results, incorporate stakeholder feedback in refinements to the MFT, and train officers and crew aboard a NOAA Fisheries Survey Vessel (FSV) to routinely deploy the refined MFT, reconfiguring it daily for both midwater trawling and surface trawling.

Tasks

Task 1
Consider input, provided by NMFS, from hake and CPS fishermen, and NMFS scientists on the MFT design, procedures for performance testing and evaluation, refinement, training, and maintenance. NMFS will decide on the final MFT specifications.

Task 2
Design and supply one (1 ea) MFT system that incorporates the latest gear technology adopted by the commercial industry, considering the Task 1 consultations, and conforming to the description and specifications below. The MFT shall include all net system components, sans net mensuration, e.g., main warps, doors, bridles, weights and floats, net, and two (2 ea) swappable cod ends (specifications below). The main warps, doors, bridles, weights and floats shall be compatible with the AWT and the N264.
The MFT net shall include swappable cod ends, one with 8 mm mesh and a Marine Mammal Excluder Device (MMED) for surface trawling, and another with 32 mm mesh and no MMED for midwater trawling. The cod ends should be easily and quickly swappable, e.g., using quick links and a zipper stitch. Relative to the AWT and N264, the MFT trawl doors shall provide flexibility for both midwater and surface trawling; and the materials used for the net, bridles, and main warps shall promote self-spreading and water flow. The doors, bridles, setback, weights and floatation shall be constructed from modern materials and be quickly and safely configurable for efficient, daily-sequential midwater and surface trawling, using either of the two cod ends. The MFT doors and net shall accommodate Government furnished Simrad PX multi-sensors and position sensors to provide real-time recorded information on door spread, vertical and horizontal net opening, net geometry, and position when fishing midwater or at the surface. The MFT shall conform to the following specifications:
Target species: All sizes of Pacific hake and CPS
Target depths: surface to 600 m depth (rated to 1000 m)
Towing speed: 3.5-4.5 kts
Swept area: 300-800 m2
Doors: Readily convertible for midwater or surface with PX sensor cans
Bridles: Adjustable lengths, setback, weights and floatation for midwater or surface headrope depths
Cod end: configurable for both 8 mm mesh liner with MMED, and 32 mm mesh liner without MMED.
The MFT shall be deployable from a NOAA FSV, a class C FSV, or a charter fishing vessel with as little as 600 horsepower.

Task 3
Report to NMFS on the results of testing and evaluation of the MFT performance for midwater and surface trawling, conducted aboard a NOAA FSV.

Task 4
Refine the MFT, conforming to the results of the testing and evaluation report and feedback received from NMFS.

Task 5
Train officers and crew aboard a NOAA FSV on the daily reconfiguration and use of the MFT for midwater and surface trawling, and MFT repair and maintenance.

Period of Performance

The period is from the award date through September 30, 2024.

Place of Performance

The contract will be performed at the contractor's facility and aboard a NOAA FSV.

Deliverable Schedule

NMFS shall supply the vendor with a written summary of consultations with hake and CPS fishermen, and NMFS scientists, regarding the MFT, within 5 business days of the contract award date.

Task 1
Report in writing to NMFS on the vendor's analysis of and response to the aforementioned summary, within 2 weeks of the contract award date.

Task 2
Deliver the MFT system to a NOAA FSV at NOAA MOC-P, Newport, OR, or to SWFSC, 8901 La Jolla Shores Drive, La Jolla, CA 92037, at NMFS' discretion, within 14 weeks of the contract award date.

Task 3
Report in writing to NMFS on the MFT performance for midwater and surface trawling, no later than 4 weeks following testing and evaluation aboard a NOAA FSV, during a period of up to 4 days at sea (2 people), departing and returning from ports ranging from Seattle, WA to San Diego, CA, with dates and locations determined by NMFS.

Task 4
Refine the MFT, aboard a NOAA FSV, at SWFSC, or at another location chosen and facilitated by the contractor, conforming to the results of the testing and evaluation report and feedback received from NMFS scientists, CPS and hake industry representatives, and fisheries management entities, no later than 12 weeks following the testing and evaluation.

Task 5
Prepare a training manual and use it to train officers and crew aboard a NOAA FSV on the daily reconfiguration and use of the MFT for midwater and surface trawling, and MFT field repair and maintenance, during a period of up to 10 days at sea (1 person), departing and returning from ports ranging from Seattle, WA to San Diego, CA, with dates and locations determined by NMFS.

Appendix D - Swan Net Schematics and Rigging Plans

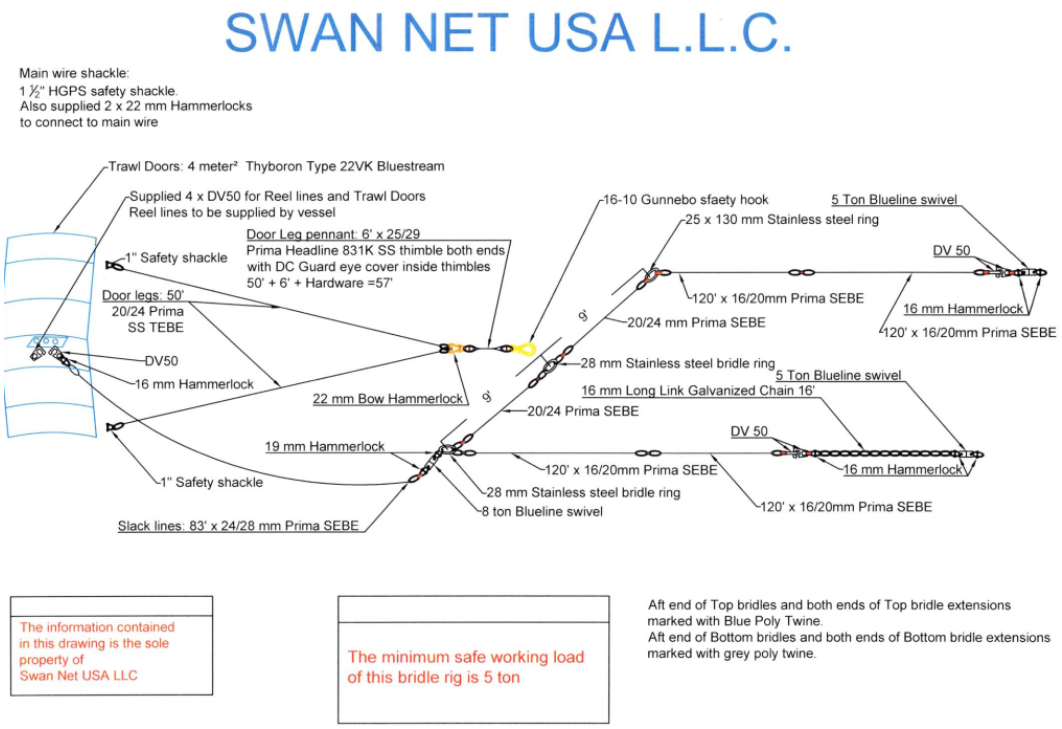


Image D - 1: *Door legs, pennants, bridles, and attachment points.*

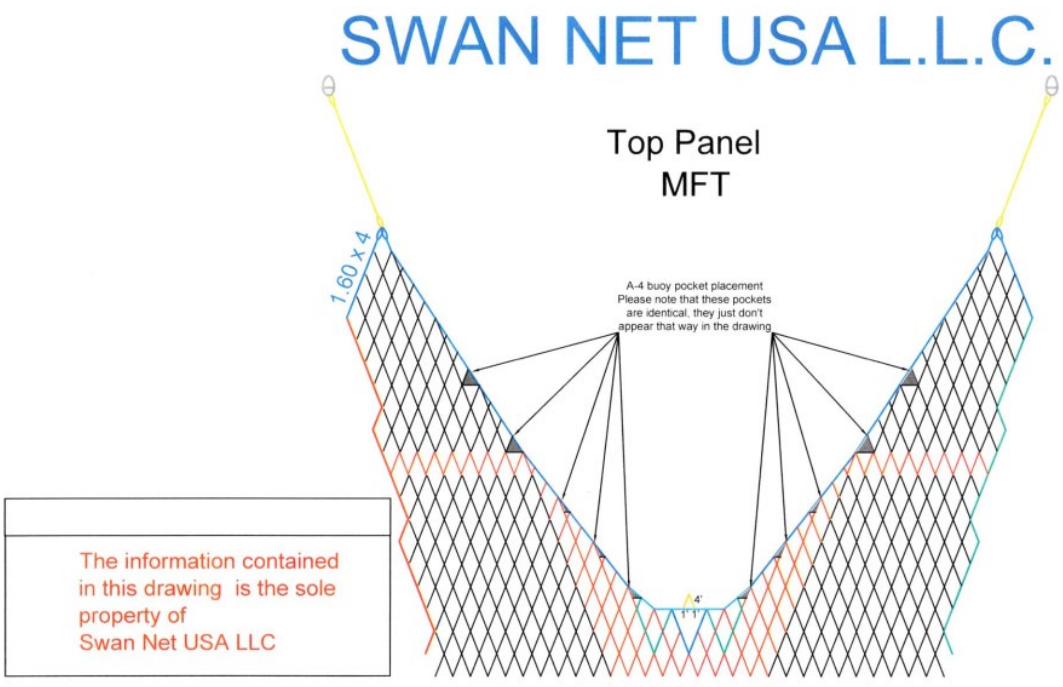


Image D - 2: *Placement points for added floatation on the top panel of the net.*

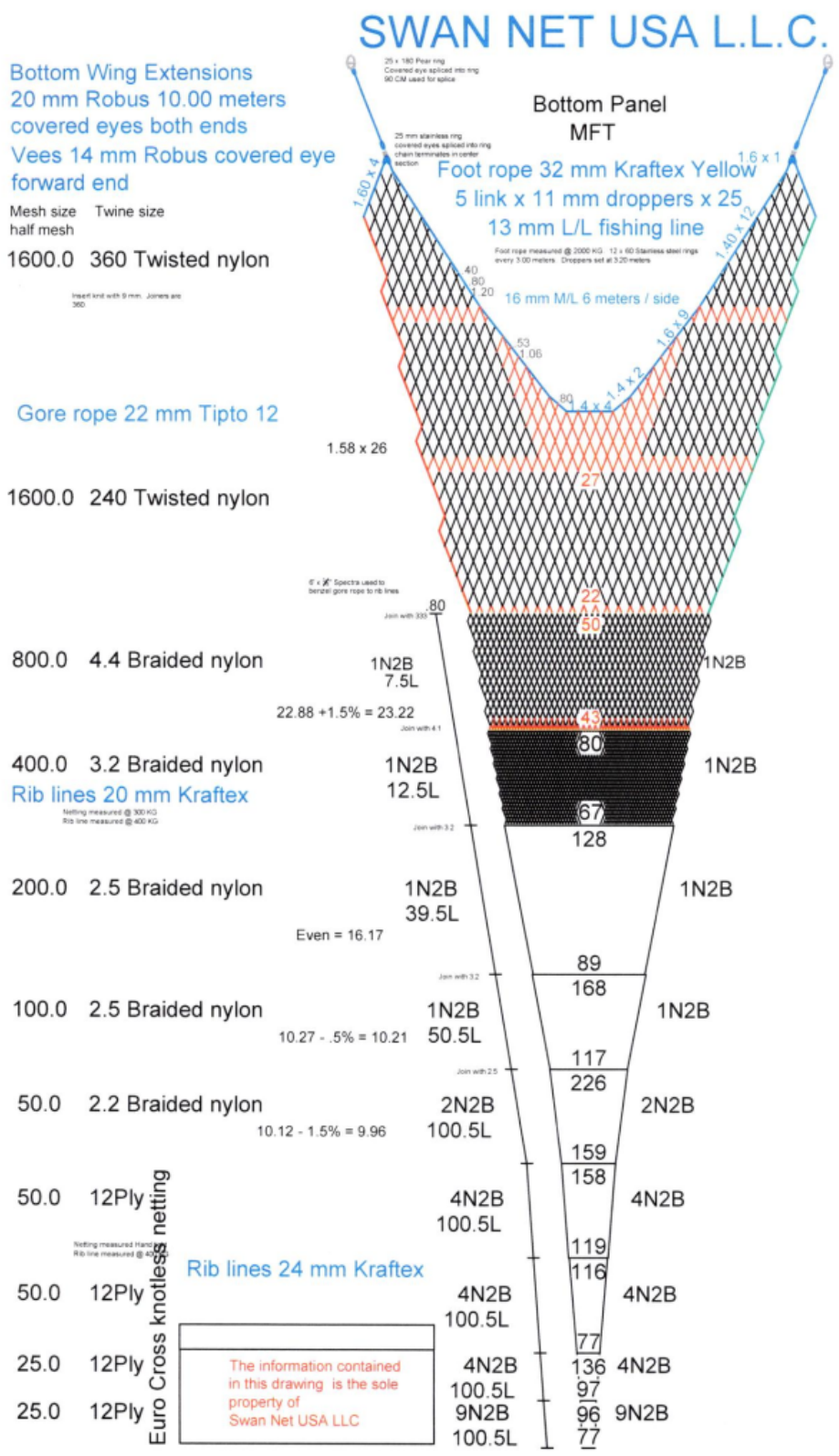


Image D - 3: *Details of the bottom panel of the net.*

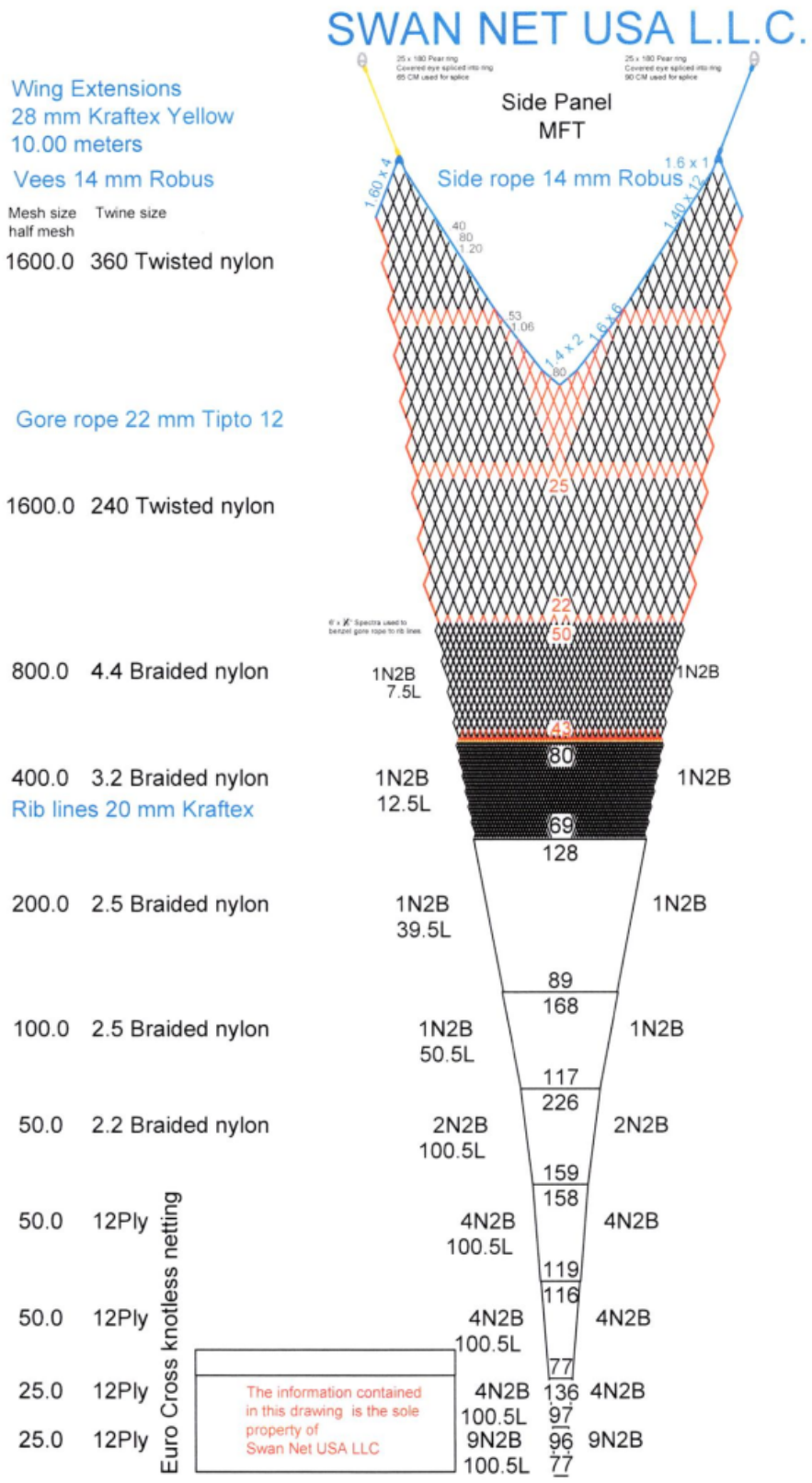


Image D - 4: *Details of the side panels of the net.*

SWAN NET USA L.L.C.

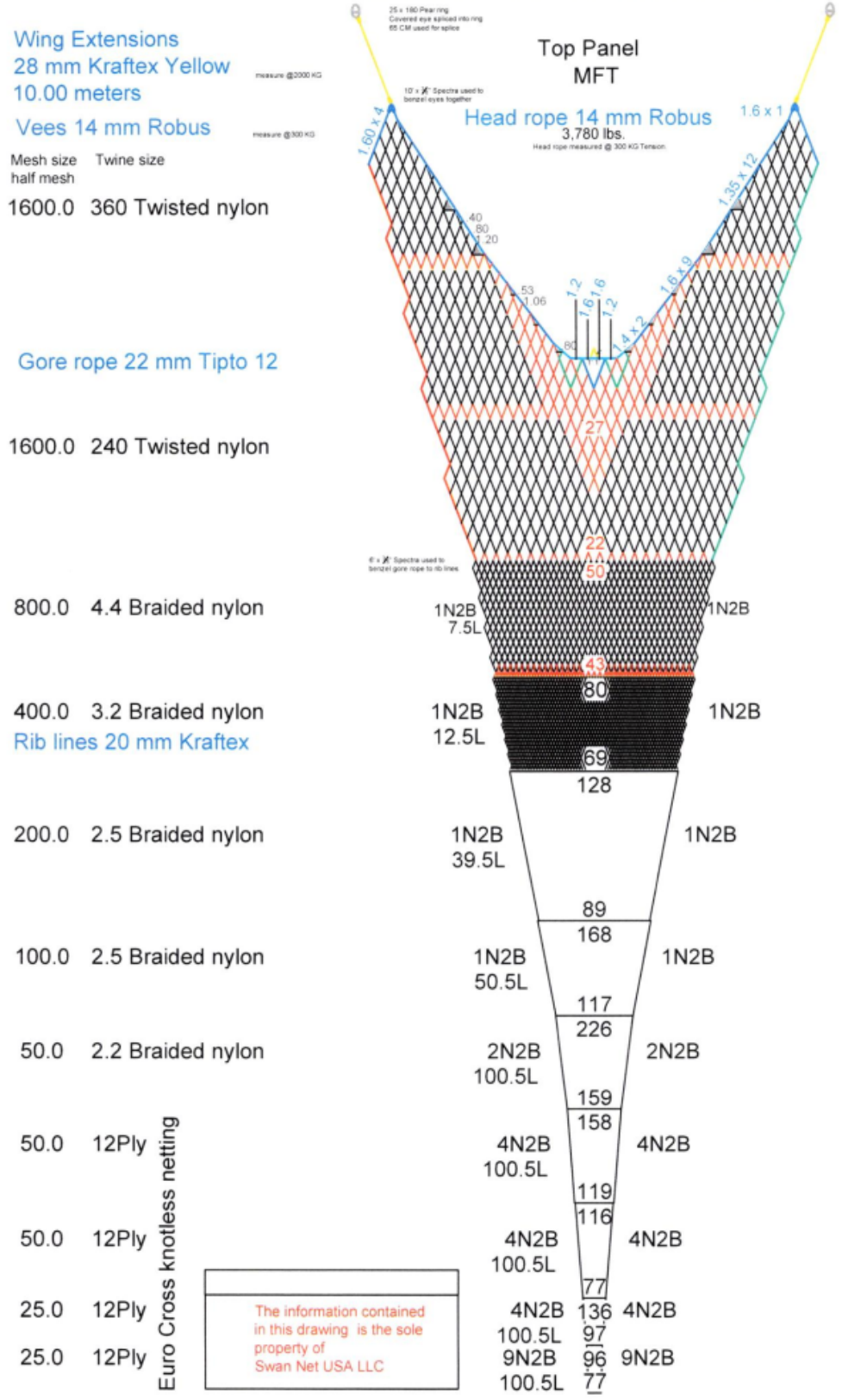


Image D - 5: *Details of the top panel of the net.*

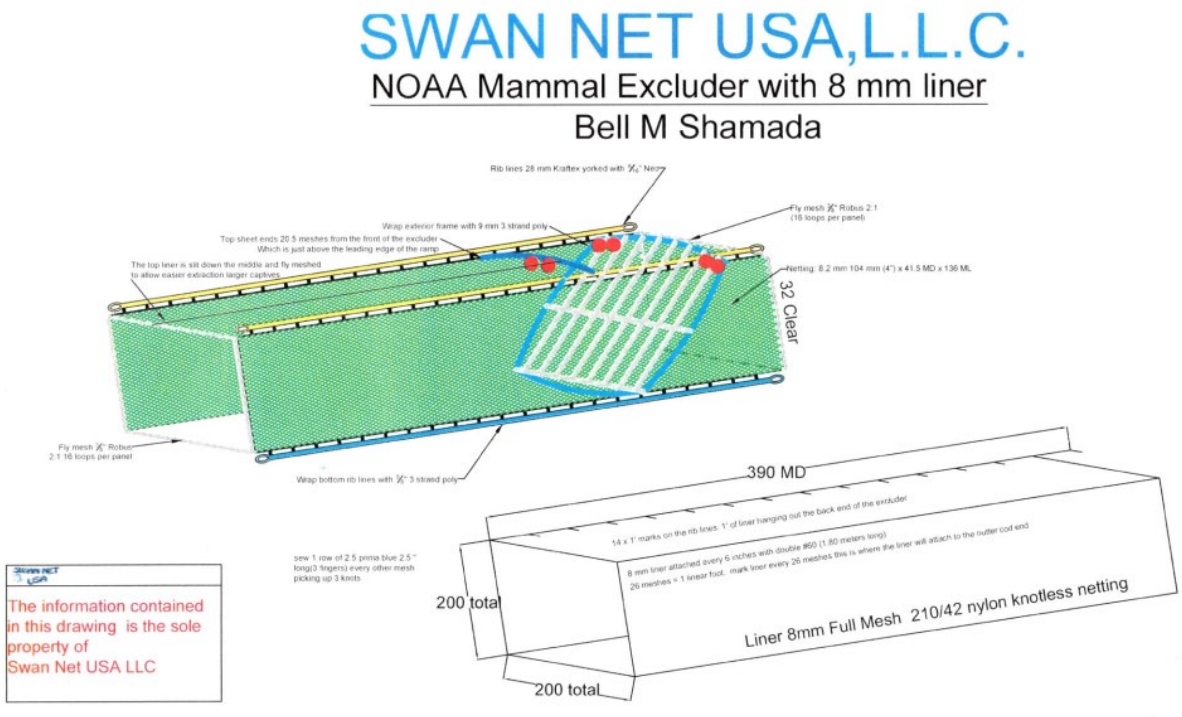


Image D - 6: *Detail of the marine mammal extruder device (MMED) with an 8mm lining.*

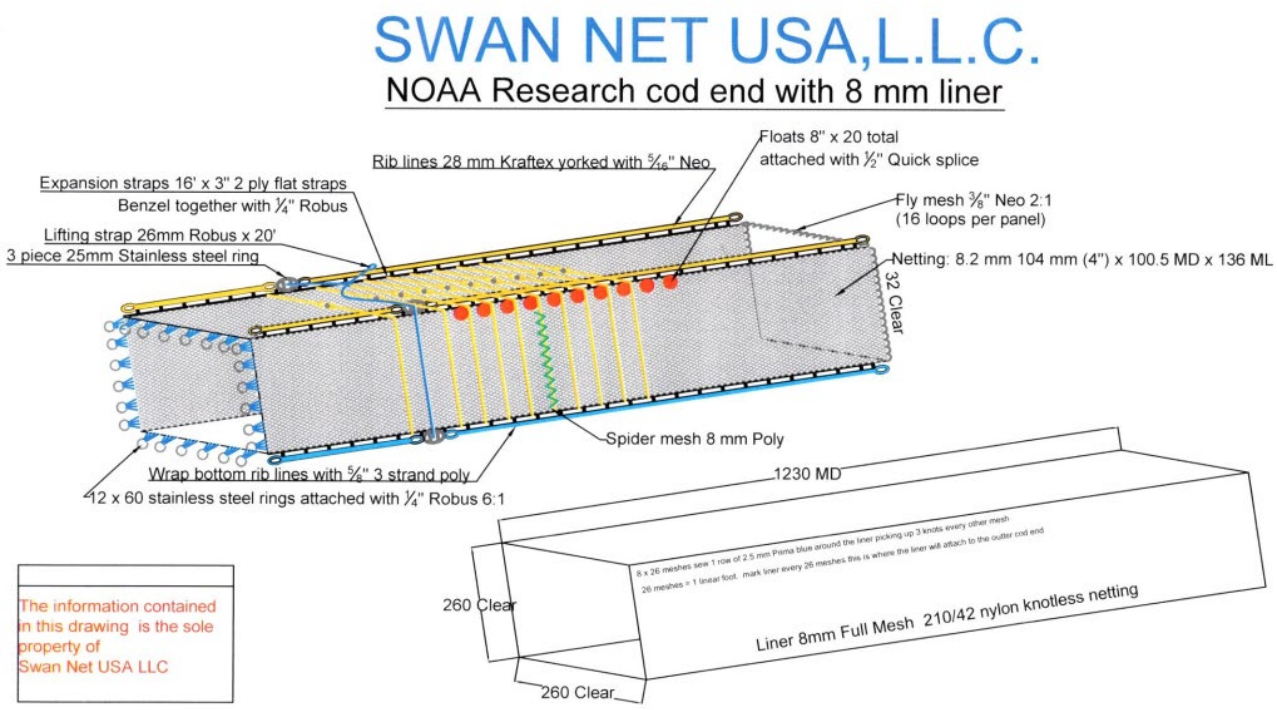


Image D - 7: *Detail of the research cod end with an 8mm liner.*

Trawl Doors

The Type 22 BLUESTREAM VF/VK FLIPPER pelagic trawldoor: High efficient trawl door. Thyborøn, Denmark: Thyborøn Trawldoor [accessed 2025 April 18]. https://thyboron-trawldoor.dk/products/type-22-bluestream-vf-vk-flipper/

The BLUESTREAM technology is the key feature on TYPE 22 trawl doors. By developing a more fluent and efficient waterflow we have succeeded in bringing this revolutionare invention to the world's fishermen. More spread for less resistance, simply as said.

This means fisherman can downsize to the smaller sized BLUESTREAM Type 22 doors and increase their trawling efficiency. The smaller sized, more efficient door increases the spreading force and decreases the resistance by more than 50% which translate into significant fuel savings. The impressive fuel savings and performance of the BLUESTREAM Technology has already been proven on several fishing vessels all over the world.

The BLUESTREAM trawl doors are a totally versatile high aspect trawl door. These doors can be used for all kinds of fishing set-ups including bottom fishing, semi-pelagic fishing "flying doors off the bottom" and direct pelagic fishing after species as mackerel, herring, blue whiting, or sprats. The design of the TYPE 22 VF can be customized and a keel with wear shoes can be added to suit and last longer for bottom trawling.

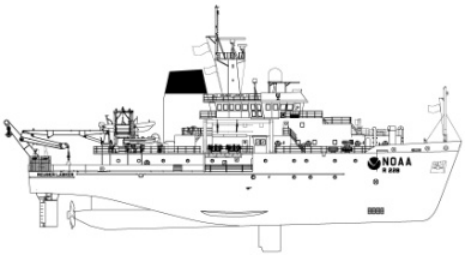
The TYPE 22 has already proven itself by its eye-catching performance on several state-of-the-art fishing vessels. Both inside and outside of European waters.

As one of our patented features, the TYPE 22 also comes as a FLIPPER model. With the flipper function it is possible to reduce the surface area of the trawl door by opening 1, 2, 3, or 4 flaps in the door. This offers a lot of adjustment possibilities for many different fishing setups and provides extremely high stability when fishing deep or fishing very close to the surface with a lot of turns. Furthermore, this feature can increase the efficiency of the trawl doors even more than with only the BLUESTREAM technology implemented. . Furthermore, the pitch and roll of the trawldoor can be controlled, when reducing the size of the trawl doors, either in the top or the bottom. This feature will make it easier working the doors in deeper or shallow water or in strong tide.

Image D - 8: *Detail of the Thyboron Type 22 VF trawl doors.*

Appendix E - MFT Procedures

OFFICE OF MARINE AND AVIATION OPERATIONS
NOAA SHIP *Reuben Lasker*
DECK OPERATIONS



AUTHORIZED BY:
CDR Claire Surrey-Marsden, NOAA
Commanding Officer, NOAA Ship Reuben Lasker

PROCEDURE	1102-17.1 RL
VERSION	3.0
EFFECTIVE DATE	9/26/2022
REVIEW DATE	9/26/2025
ISM CODE REFERENCE	Section 7
RESPONSIBLE POSITION	CO, *Reuben Lasker*

MULTI-FUNCTION TRAWL (MFT) PROCEDURES

1. PURPOSE

1.1. To provide minimum requirements for conducting Multi-Functional Trawl Procedures aboard NOAA Ship *Reuben Lasker*.

2. **SCOPE**

2.1. This procedure applies to NOAA Ship *Reuben Lasker*.

3. **RESPONSIBLE POSITIONS**

3.1. The following positions or groups have action item responsibilities within this procedure:

- Ship Commanding Officer
- Officer of the Deck
- Deck Boss
- Two on-deck ABs
- Chief Sci / Sci
- Survey Tech

4. **RESPONSIBILITIES AND PROCEDURES**

4.1. The Commanding Officer (CO) ensures trawling operations are conducted per this procedure.

4.2. For those ships conducting trawling operations, the CO must develop Ship's Specific Instructions (SSIs) for this procedure

4.3. Develop SSIs for each type of trawl operation conducted. These instructions should at a minimum include the following:

- Personnel requirements: Training, Personal Protective Equipment (PPE), number of personnel, and location
- Deck configuration
- Ship Specific Equipment Checks: (i.e., Net sensor calibrations, trawl warp measurements, wire counters calibrated etc.)
- Coordination between the deck, bridge, and scientists
- Effective communications between the bridge, deck, and scientists using either radio or agreed upon hand signals or a combination of both
- Operational Risk Management (ORM)
- Procedures for hangs and crossed doors

4.4. Training and Qualification

4.4.1. Prior to conducting trawling operations onboard *Reuben Lasker*, all bridge officers, survey and deck

crew must receive training and familiarization with the equipment, including:

4.4.1.1. Familiarization with the net, its use, and trawl terminology (head rope, foot rope, kite, shooting the doors, streaming the net, etc.)

4.4.1.2. Trawl system, gantry, outhaul winch, trawl gate, and the supporting equipment

4.4.1.3. Familiarization with PPE and safety equipment

4.4.1.4. Understanding of general safety concerns

4.4.1.5. Knowledge of standard hand signals and radio communications

4.4.1.6. Demonstration of setting and hauling the nets

4.4.1.7. Supervised hands on training

Only properly qualified crew who have been checked out by the Commanding Officer and the Chief Boatswain (CB) or Lead Fisherman (LF) will be approved to operate the winches.

4.5. Environmental Parameters

4.5.1. Trawling will be conducted at the discretion of the Commanding Officer if environmental parameters are outside of the following:

- Wind greater than 30 knots
- Waves greater than 10 ft
- Depth shallower than 50 m

4.6. Communications

4.6.1. All comms are conducted via VHF radio (F1), or another agreed upon channel

4.7. Roles and Responsibilities

Officer of the Deck (OOD):

Positioned on the bridge and is responsible for controlling and navigating the ship during the operation. The OOD shall reference this procedure to ensure the operation is conducted safely and in accordance with the established procedure. The OOD is in charge overall but shall also recognize the experience, expertise, knowledge, and skills of the other team members when evaluating their input. Controls the ship's Speed through Water (STW) and heading to safely fish the net while meeting the requirements of the mission. Presses appropriate SCS buttons when necessary and logs fishing events in the Deck Log.

Deck Boss:

The Deck Boss (DB) is responsible for operating the net reels and directs the personnel on the deck. The person is stationed at the net reel controls on the 01 deck (the "barbeque") when the doors are out of the water, and is usually stationed at the aft control console on the bridge while the doors are in the water. This role is often filled by a member of the deck department who has been checked out by the CB or LF. Deck boss controls the warp payout to safely fish the net while meeting the requirements of the mission.

On Deck Personnel:

Deck personnel who, under the guidance and supervision of the deck boss, conduct the on deck operations including: preparing the net prior to trawling, guiding the gear, and attaching and detaching equipment as required (e.g., Simrad ITI transducer, TDRs, and dolphin dissuasive device pingers).

Chief Scientist (CS):

Provide the ST with a list of equipment that needs to be attached to the net and locations of attachment. Provide the OOD the intended station, intended depth for the head rope, speed (STW or SOG). Work with the OOD to guide the net to where they need it and acquire the measurements required from the net mensuration display on the bridge. In charge of assigning scientists to conduct the various protected species watches.

Supervise scientists processing of the catch.

Survey Tech (ST):

The Survey tech is responsible for attaching/removing scientific equipment from the net (e.g., Simrad ITI transducer, TDRs, and dolphin dissuasive device pingers) and ensuring proper operation of the Simrad ITI system. The ST also assists with SCS button pushing, time keeping and helps to transfer the trawl catch from the back deck to the wet lab.

4.8. Procedures before Deployment

The Bridge determines if conditions are safe for deployment taking into consideration vessel traffic, weather, sea state, and crew experience.

- Conduct ORM as required
- Power up equipment in sufficient time to be ready for use
- Inform deck, survey, and scientists of arrival time to station
- Check trawl location for traffic, fishing gear, and other relevant conditions
- For bottom trawls, check bottom for obstructions, wrecks, pipe lines, cables, and abrupt topography changes
- Establish communications between the deck, bridge, and scientists
- Set lights/day shapes/fog signals as required by International Regulations for Preventing Collisions at Sea 1972 (COLREGS)
- Set up trawl direction and speed based on scientific requirements, wind, swell, and bottom slope
- Determine amount of wire out based on scientific requirements and desired trawl depth
- Log as required

NOTE: No net may be deployed/recovered without authorization from the Officer of the Deck.

30 minutes prior to deployment:

1. Conduct GAR with CB, CS, and survey to determine if conditions are safe for deployment taking into consideration vessel traffic, weather, sea state, and crew experience. If conditions are marginal, turn the ship into seas to conduct weather discussion. (OOD/Deck/CS)
2. Inform CS 20 min prior to arrival on station (OOD)
3. Scientist reports to the bridge, enters appropriate data into SCS with the help of the OOD, clicks “Begin Mammal Watch” and begins to look out for mammals as per the PI. (CS)
4. Ensure an appropriate number of (depending on the environmental elements and net requirements) generators are on line. (OOD)
5. Review trawl station area for traffic, fishing gear and other possible hazards. (OOD)
6. Conduct a security call if conditions warrant. (OOD)
7. Calculate set up distance based upon wire out as dictated in the PI. (OOD)
8. Ensure all personnel engaged in fishing operations have appropriate PPE (hardhats, thermal protection, PFD, gloves). (OOD/DB)

4.9. Procedures for Net Deployment

- Maneuver ship as appropriate for safe deployment of the trawling gear
- Set day shapes, trawling lights, and fog signals as necessary
- Use SSI for deployment details

Procedures for net deployment:

1. Set up the ship into swell/wind, unless conditions dictate otherwise, making about 2.0-2.5 kts (weather dependent) through water. (OOD)
    - For complete listing of operational speeds please reference the Operational Speeds "Cheat Sheet" located in the fishing binder on the bridge
2. OOD confirms marine Mammal Watch complete (15 minutes) (OOD)
3. Set lights/day shapes/fog signals as required by COLREGS. (OOD)
4. Update AIS status to "Engaged in Fishing". (OOD)
5. Inform DB "ready to stream Net". (OOD)
6. DB begins streaming the net. (DB)
7. Click the "Net in water" button on SCS and log "net in the water" in the deck log. (OOD)
8. Deck personnel and Survey Tech attach gear to the net while it is being streamed. (Deck/ST)
9. Increase speed to 3.0 – 3.5 STW when Tom weights are attached to continue streaming. (OOD)
10. Deck transfers net from net reel to the doors and DB informs OOD when transfer is complete (Deck,DB)
11. Bring speed up to 4.0 – 4.2 kts STW to shoot doors. (OOD)
12. DB shoots the doors when the ship reaches shooting speed and announces "Shooting Doors''. This is logged in the deck log a "shoot doors" button is pressed in SCS (OOD)
13. DB shoots doors to initial wire out length (185m unless instructed otherwise). Inform OOD when 50 and 10 meters to go and when brakes are engaged. (DB)
14. Push the "Begin Fishing (EQ)" button on SCS and start the timer. Announce "fishing" over the VHF F1 and log 'fishing' in the deck log (OOD)
15. While fishing the OOD maintains 3.5 to 4.0 STW (aim for 3.8kts) (OOD)

4.10. Procedures for Haul Back

- Maneuver ship as appropriate to enable safe recovery of the trawling gear
- Secure day shapes, trawling lights, and fog signals as necessary
- Use SSI for haul back details

Procedures for haul back:

1. OOD monitors elapsed time, gives warning at 15, 5 and 2 minute to go, and gives notification that it's time to "haul back" net. (Haul back will also commence if tension reaches 6 tons regardless of time left) (OOD/DB)
2. Push the "Haul Back" button on SCS and log in the deck log. (OOD)
3. DB begins hauling the net in, OOD gradually begins to reduce speed not to drop below 2.5 STW (DB, OOD)
4. DB brings the trawl doors up to the stern and seats the doors. (DB)
5. Adjust speed as necessary (condition dependent) to reduce strain on gear and maintain steerage for retrieval. (OOD)
6. Deck department transfers the net from the doors to the net reel. (Deck)
7. Ropes and net are spooled onto the net reel and attached gear is removed. (Deck/ST)
8. OOD assists Deck in spooling the net by maneuvering the ship when directed by the DB. In general aim to have the net centered on the net reel (OOD)
9. When the cod end comes aboard, log "Net on Deck" and Push the "Net on deck" button in SCS. (OOD)
10. Secure day shapes, trawling lights and fog signals as necessary. (OOD)
11. Update AIS status to "Underway using engines". (OOD)
12. Deck personnel raise the gate, secure the crane, reel, and all stern equipment. (Deck)

13. OOD waits for communication from DB that gear and personnel are secure and ready to proceed to the next station. (OOD, DB)

4.11. Procedures for Hangs and Crossed Doors

- Keep unnecessary people off the back deck
- Ensure communications between the bridge, winch operator, and back deck
- Use SSI for details on responding to hangs and crossed

Procedures for crossed doors:

1. DB informs OOD that doors are observed/suspected to be crossed. (DB)
2. Stop haul back (DB), maintain course and minimum 1 knot ahead (OOD).
3. Call EOS/EOOD and energize the bow thruster. (OOD)

a. Secure main propulsion if fouling of the propeller is imminent.

4. OOD calls CO and makes appropriate entries in the deck log (OOD)
5. OOD reduces speed to bare steerage ahead (1 knot) and anticipates utilizing the bow thruster. (OOD)
6. Every 30 seconds Deck provides trawl wire angle bearings (e.g. tending aft or other direction) relative to the stern.
7. Deck personnel keep unnecessary personnel off the trawl deck. (Deck)
8. OOD adjusts speed or course adjustments as necessary to facilitate recovery of gear. (OOD)
9. DB informs Bridge when doors are uncrossed. (DB)

Procedures for broken leg/torn net:

1) DB informs OOD that the net is damaged. (DB)
2) Stop haul back. (OOD, DB)
3) Call EOS/EOOD and energize the bow thruster and secures main propulsion if necessary to avoid fouling the screw. (OOD)
4) OOD calls CO and makes appropriate entries in the deck log (OOD)
5) OOD reduces speed to bare steerage ahead (1 knot). (OOD)
6) Deck personnel keep unnecessary personnel off the trawl deck. (Deck)
7) OOD assists Deck as the situation dictates with speed or course adjustments (OOD)
8) DB informs Bridge when the net is on deck. (DB)

Appendix F - Project Instructions

Project Instructions

Date Submitted	October 25, 2023
Platform	NOAA Ship *Reuben Lasker*
Project Number	RL-24-02
Project Title	Multi-function Trawl Testing
Project Dates	December 11, 2023 to December 15, 2023

Prepared by _____ Dated December 8, 2023
Dr. David Demer, Chief Scientist
Fisheries Resources Division, SWFSC

Approved by _____ Dated _____
Dr. Annie Yau, Director
Fisheries Resources Division, SWFSC

Approved by _____ Dated _____
Kristen Koch, Science and Research Director
Southwest Fisheries Science Center

Approved by _____ Dated _____
Captain Keith Golden, NOAA
Commanding Officer
Marine Operations Center – Pacific

1. Overview

1.1. Project Purpose

The National Marine Fisheries Service (NMFS) presently conducts two acoustic-trawl surveys in the California Current Ecosystem, one biennially for assessing Pacific hake (Pacific whiting) and another annually for assessing multiple coastal pelagic fish species (CPS), such as Pacific sardine, northern anchovy, jack mackerel, Pacific mackerel and Pacific herring. Pacific hake are sampled in the midwater during the daytime using an Aleutian Wing Trawl 24/20 (AWT) and CPS are sampled at the sea-surface at night using a Nordic 264 rope trawl (N264). These surveys, which provide critical data on stock abundances and distributions, will be integrated in 2025 and beyond. To integrate the sampling, NMFS expects to trawl from one NOAA FSV, perhaps *Reuben Lasker*, which has a single net reel and an evolving net mensuration system.

The principal aim of this project is to test a new multi-function trawl system (MFT); characterize its midwater and surface-trawling performance using: the net mensuration system, and video from in-net cameras and an aerial drone; and develop protocols for survey operations. Initially, testing will be done in daylight for both modes. Refinements will require iterations to tune the configurations and to learn how to correctly and quickly switch from one mode to the other. This is a new, unique trawl, and the vendors will be refining the configurations and developing operational protocols. Scientists will be observing, learning, processing catches, and helping to document test results and protocols. A secondary objective is to conduct some cursory tests on the net's catch performance. This should also guide further tuning of the net in each configuration.

This project will start and end at Tenth Avenue Pier, San Diego, CA. After departing San Diego Bay, *Lasker* will conduct midwater and surface-trawl testing and refinement operations nearby, 11 am to 11 pm. The surface-trawl performance will be observed during daytime using an aerial drone. Critically, the trawl performance in both modes will be evaluated using the ship’s net mensuration system. From 11 pm to 11 am, the ship will transit to the next trawling location and conduct reconnaissance transects to locate hake and CPS using the EK80 echosounder. Then, the trawl with refined configurations will be used to sample hake and CPS. Midway through the cruise, the ship’s small boat will be used to exchange personnel.

Project Impact

The MFT testing is needed to prepare for the integrated hake and CPS surveys in summer 2025 and beyond. The MFT will be tested and refined using the available net mensuration equipment, and the officers, crew, and scientific personnel will be trained on the setup, operational use, maintenance and storage of the MFT and net mensuration system. A Kongsberg representative will be aboard to guide the use of the present net mensuration equipment and to consult on improvements to the system. Without this project and associated data collections, the agency’s preparations for an integrated hake and CPS survey will be limited. This will delay or otherwise hinder progress towards a more efficient and effective ecosystem survey, which is needed for the assessment and management of multiple valuable stocks.

Project Performance Metrics

(A) Surface trawl sets: approximately twelve (12). Midwater trawl sets: approximately twelve (12). However, the principal objective is to test and refine the trawl, not to complete a certain number of sets, nor to sample a certain number of fish.
(D) Total project performance metrics required to achieve Project Purpose:

(1) Acoustic/Echo Sampling: EK80 echosounder and ADCP data will be recorded continuously throughout the survey, and hake and CPS backscatter will be monitored using Echoview LiveView software..

(2) Video/Optical Sampling: Video data will be collected inside the net during all tows, and from an aerial drone during all daytime surface trawls when the pilots are aboard, weather permitting.

(3) Visual Observation Sampling: Visual observations will be conducted prior to each set as part of the Marine Mammal Protocols (see Section 2.3).

(4) Tactile/Tangible Sampling: Approximately six (6) net tows will be conducted daily, some with and others without the codend closed.

(5) Chemical/Oceanographic Sampling: Sea-surface temperature, salinity, and fluorescence will be sampled continuously using the ship's thermosalinograph and flow-through fluorometer.

(6) Other Mission Sampling: N/A

1.2. Days at Sea (DAS)

Five (5) DAS.

1.3. Participating Institutions

NOAA/NMFS/Southwest Fisheries Science Center, 8901 La Jolla Shores Drive, San Diego, CA, 920137

NOAA/NMFS/Northwest Fisheries Science Center, 2725 Montlake Boulevard E, Seattle, WA 98112

Ocean Gold Seafoods, Inc, 1804 North Nyhus Street No. 1104, Westport, Washington 98595-0001 (Greg Shaughnessy, 360-619-2019 or 360-310-0662 or 360 249-1221, gshaughnessy@oceancos.com)

Swan Net USA, LLC, 8300 Military Rd. South, 100, Seattle, WA 98108 (Seamus Melly, 206-763-6139, seamusm@swannetusa.com).