Agenda Item F.2
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April 2026

INTEGRATED WEST COAST PELAGICS SURVEY REVIEW

National Marine Fisheries Service (NMFS)
Southwest Fisheries Science Center (SWFSC)
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Methodology Review Panel Members:
André Punt (Chair), Scientific and Statistical Committee (SSC), University of Washington
John Budrick, Scientific and Statistical Committee (SSC), California Department of Fish and Wildlife
Michael Hinton, Scientific and Statistical Committee (SSC), IATTC, retired
Olav Rune Godø, Center for Independent Experts (CIE)
Larry Jacobson, Center for Independent Experts (CIE)

Pacific Fishery Management Council (Council) Representatives:
Lisa Hillier, Coastal Pelagic Species Management Team (CPSMT)
Mark Fina, Coastal Pelagic Species Advisory Subpanel (CPSAS)
Katrina Bernaus, Council Staff

Acoustic-Trawl Method Technical Team:
Annie Yau, SWFSC
Brad Erisman, SWFSC
Kelsey James, SWFSC
Alexander Jensen, SWFSC
Bryan Overcash, SWFSC
Josiah Renfree, SWFSC
Brittany Schwartzkopf, SWFSC
Kevin Stierhoff, SWFSC
Juan Zwolinski, University of CA, Santa Cruz and SWFSC

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80 **ACRONYMS AND ABBREVIATIONS**

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Acronym or Abbreviation	Meaning
ADCP	Acoustic doppler current profiler
ATM	Acoustic-trawl method
AWT	Aleutia wing trawl
CCE	California Current Ecosystem
CCAMLR	Comission for Conservation of Antarctic Marine Living Resources
CDFW	California Department of Fish and Wildlife
CIE	Center for Independent Experts
CPS	Coastal pelagic species
CPSAS	Coastal Pelagic Species Advisory Subpanel
CPSMT	Coastal Pelagic Species Management Team
DAS	Days at sea
DFO	Department of Fisheries and Oceans Canada
FL	Fork length
FM	Frequency modulated
F/V	Fishing vessel
IATTC	Inter-American Tropical Tuna Commission
ICES	International Council for Exploration of the Sea
IWCPS	Integrated West Coast Pelagics Survey
MFT	Multi-function trawl
NMFS	National Marine Fisheries Service
NMDS	Non-metric Multidimensional Scaling
NOAA	Natoinal Oceanic and Atmospheric Administration
NWFSC	Northwest Fisheries Science Center
OSU	Oregon State University
PFMC	Pacific Fishery Management Council
R/V	Research vessel
SL	Standard length
SSC	Scientific and Statistical Committee
SWFSC	Southwest Fisheries Science Center
TDR	Temperature-depth recorder
UW	University of Washington
WBAT	WideBand autonomous transceiver
WGIPS	Working Group on International Pelagic Surveys
WGACEGG	Working Group on Acoustic and Egg Surveys for Small Pelagic Fish

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OVERVIEW

The purpose of the meeting was to perform a methodology review related to the switch from a Nordic 264 bottom trawl to the new Multi-Function Trawl (MFT) net on the Integrated West Coast Pelagics Survey (IWCPS). The meeting was a routine part of procedure when substantive changes to surveys are implemented and there was no underlying biological emergency or issue to address.. Efforts were directed towards improving the survey but the main reasons for the methodology changes were programmatic (logistics, cost, etc.)

The IWCPS is based on the acoustic-trawl method (ATM), which is widely used around the world. The trawl is used to collect species- and size-composition data and acoustics are used to estimate total CPS abundance[1], The IWCPS was developed by the National Oceanic and Atmospheric Administration (NOAA)'s Southwest Fisheries Science Center (SWFSC) and its Northwest Fisheries Science Center (NWFSC) for surveying Pacific hake and coastal pelagic finfish species (CPS) off the west coast of the United States of America.

The meeting began with a welcome by Dr. Annie Yau, SWFSC. The Chair then noted that the aim of the review was to ensure data from the IWCPS survey data are sound and suitable for use in future CPS stock assessments. The Chair listed the major questions identified in the Terms of Reference: (1) Has the switch from a Nordic 264 to the new MFT net on the IWCPS resulted in important changes to the species- and length-selectivities? and (2) If so, have these changes resulted in important changes in the survey-derived data inputs for the stock assessment (biomass, age composition, weight-at-age)? The meeting also reviewed progress on the trawl-related research recommendations from the 2018 methodology review of the ATM survey (PFMC, 2018).

The meeting celebrated the life of Mike Okoniewski who made substantial and long-term contributions to the sustainable exploitation and understanding of West Coast CPS and had been a participant in several PFMC CPS assessment review meetings and methodology panels. Appendix 5 provides a summary of Mike's career and his contribution to West Coast Fisheries.

In the fall of 2020, the NOAA SWFSC and NWFSC were asked to integrate their two acoustic-trawl surveys: the SWFSC's CPS surveys (aka California Current Ecosystem or CCE Survey) and the NWFSC's Joint U.S.-Canada Integrated Ecosystem and Pacific Hake Survey. Both surveys collect data used to inform management of federally-managed fisheries and are conducted from south to north during the summer along the entire U.S. West Coast. The need to integrate the surveys was driven by upcoming changes in the availability of NOAA research vessels due to scheduled mid-life repairs. The new survey is called the Integrated West Coast Pelagics Survey and started in 2025.

The original NWFSC and SWFSC surveys each used their own vessel with around the clock operations. Integration required finding efficiencies to fit all of the same work into one day aboard one vessel. A primary difference between the two original surveys was in the trawl nets and operations.

[1] In this report the term "abundance" is generally synonymous with "biomass".

The SWFSC CPS survey used a Nordic 264 trawl net at night for CPS at the surface with acoustic sampling during the day. The NWFSC survey used an Aleutian Wing Trawl (AWT) during the day at depth for hake with acoustic sampling also during the day. NOAA collaborated with industry (fishers and net manufacturers) to design the MFT and associated net mensuration system that allows for fishing at any depth (for CPS or hake) based on changing the trawl door orientation and/or configuration of weights, flotation, and wire out. Real-time net performance monitoring is used to find operational and safety efficiencies. Thus, the new MFT makes it unnecessary to switch nets onboard during the survey. This is the primary operational difference between the IWCPS and previous CPS survey methods. The MFT has been used successfully in coastwide CPS surveys since 2024, with no other major changes to how recent SWFSC-only CPS surveys were conducted.

The summer 2025 survey was the first for CPS and hake. It spanned the west coast of the U.S., between the U.S./Mexico and U.S./Canada border. It progressed from south to north, between 3 June to 13 September. In the core region, the R/V *Shimada* accomplished 53 acoustic transects and 50 nighttime trawl clusters during 70 days at sea (DAS); in the nearshore region, F/Vs *Long Beach Carnage* and *Lisa Marie* accomplished 193 acoustic transects and 63 daytime purse seine samples in the nearshore region with 53 DAS. Biomass estimates were produced for seven populations or subpopulations of five coastal pelagic species.

This report is divided into seven subtopics related to the two major questions from previous research recommendations. It summarizes areas of disagreement, lists key unresolved problems, summarizes comments by the representatives of the Coastal Pelagic Species Advisory Subpanel (CPSAS) and Coastal Pelagic Species Management Team (CPSMT), and concludes with a list of new research recommendations. Appendix 2 lists the participants and their affiliations. Appendix 3 includes short biographies for the Panel. Appendix 4 is a list of the primary background documents that were provided to the Panel in advance of the meeting, via email and on a PAM site. These documents included past stock assessments for West Coast CPS, reports of biomass estimation for 2023 and 2024, and the report of the 2018 review of the ATM survey.

The MFT appears to be more efficient and have higher catch volumes for CPS. The magnitude of the potential increase in efficiency and catch has not been quantified. However, higher catches should increase sample size and the accuracy (but not comparability) of survey species- and length-composition data used in stock assessments and when computing biomass estimates. The MFT fishes deeper than the Nordic 264, potentially changing species- and length-composition data. Such changes have not been quantified but are likely to be modest, with limited effects on data and stock assessments for West Coast CPS.

The Panel recommends that work continue to quantify any changes in species- and length-composition data due to the change in survey net. NOAA should continue to and when needed cooperate with commercial fishing expertise to ensure best operation in the field (see Section 11 of this report).

This Panel endorses the continued use of the IWCPS to provide the survey-related inputs to the stock assessments for Pacific sardine, northern anchovy and Pacific mackerel. Indeed, there is little choice given lack of evidence to date for a change in selectivity and the difficulties and expense required to precisely measure any changes if they occurred (see below). In any case, the change from Nordic 264 to new MFT net in the IWCPS for CPS and hake is warranted because the new

net can be used for either CPS or hake without changing the net and rigging of the trawl. The resulting improvement in workflow is required in the IWCPS given limited resources.

The Panel recommends that the next benchmark assessments for the CPS should initially assume no change in survey trawl selectivity or acoustic catchability starting in 2024 because effects of changing the net on selectivity have not been identified and are therefore likely small. Sensitivity analyses can be used to evaluate potential changes in survey catches (e.g., by including a time block in survey selectivity and catchability starting in 2024). The assessment team can consider other sensitivity analyses or approaches as necessary. More certain information about possible effects and potential remedies should accumulate over time based on future surveys and field experiments. This could lead to changes to how survey selectivity and catchability are modelled, including treating the data before and after 2024 as separate survey time series.

The Panel commends the Technical Team for their thorough presentations, and willingness to respond to the Panel requests. As in previous reviews, the Panel wishes to emphasize that the Team had already identified most of the issues and were well prepared to discuss them.

The Chair thanked the SWFSC for hosting the meeting and the participants for the excellent and constructive atmosphere during the review, the results of which should help inform the Council and its advisory bodies to determine the best available science for the management of CPS.

1. RESULTS AND RECOMMENDATIONS FROM PAIRED TRAWLING TESTS IN OTHER SYSTEMS AND RESOURCE CONSIDERATIONS AS RATIONALE FOR SWITCHING FROM THE NORDIC 264 TO THE MFT WITHOUT PAIRED TRAWLING

Proponents' summary: Based on the collective knowledge and experience of fishery survey experts, reviews of best practices in the literature, and the logistical challenges associated with conducting enough catch comparisons (e.g., paired trawls) to detect meaningful differences, SWFSC scientists took the approach of generating data with the MFT by using it operationally during the survey to collect data for a comparison with the Nordic 264-collected data. These data could be compared to evaluate whether the change in the net type may have had meaningful, detectable effects on species- and length-selectivity and survey-derived inputs for CPS stock assessments. Based on the purpose and use of trawl data for CPS biomass estimates, the analyses presented to the meeting focused on understanding whether the MFT is sampling the same portion of the water column (vertical and horizontal spread), same overall community (species composition), and the same length distributions of the target species (length selectivity). Thus, the SWFSC implemented a plan to complete as many MFT hauls as possible and then compare the results with the extensive database on Nordic 264 hauls during previous surveys to evaluate whether the assumption that the net switch has maintained survey continuity is upheld or requires inter-survey calibrations.

1.1 Requests for the Team

Request 1.A: Elaborate on the scientific basis for the intercalibration between the MFT and the Nordic 264 trawls to help focus on future research tasks.
Rationale: The lack of temporal and spatial alignment is a significant shortcoming. Walker et al. (2017) emphasize the necessity of data alignment.

Response: The Team did not mean to imply that they followed the Walker et al. (2017) recommendations exactly and will check the language in the draft document for accuracy. The reference to this paper was an effort to summarize best practices. Also, see the response to Request 1.B.

Request 1.B: Identify research tasks (such as those recently carried out for hake) that could be used to estimate the length-specific efficiency of the MFT trawl as the basis for discussion under the future research item.

Rationale: Owing to the structural differences between trawl designs, it is anticipated that the MFT will exhibit enhanced efficiency in capturing both the largest and smallest fish. The reduction in escape probability for larger fish before entering the larger MFT contributes to increased capture rates of these sizes. In addition, the decreased escapement through the meshes at the front of the small-meshed liner in the MFT helps mitigate the "bucket effect", facilitating greater retention of smaller fish. These assertions are supported by results from tests conducted using the MFT on hake using external pocket nets and paired trawling.

Response: This response is a thought exercise and does not consider real resource or process limitations or impacts on survey operations.

- Paired-tow experiments are an obvious possibility but, based on the variability among years and trawls, it is likely that a very large number of paired trawls and possibly two vessels if net and door changes were required would be necessary to detect any potential differences, if such differences are larger than the natural variability in the environment.
- Forego one or more operational survey years or operational days at sea during a survey year (based on an adequate sample size TBD) and use these instead as research days. Use research days to invest in paired trawling (loosely defined as involving two vessels each hauling a different net, switching nets between tows on a single vessel, or using a single vessel with two net reels) to trawl the same area multiple times each night (maximum of three due to the duration of the nighttime period for surface trawling).
- Contract a second vessel and associated staff to use the Nordic 264 to follow the NOAA vessel that uses the MFT; switch nets on vessels and repeat.
- Individual nights of sampling on a single vessel could be partitioned into several trawl combinations. The simplest would be a single MFT and single Nordic 264. However, if two MFT hauls and one Nordic 264 haul were conducted each night, this would permit an evaluation of within-trawl variation as well as among-trawl variation (but again, sample size TBD).
- Conduct trawls in multiple regions along the coast (e.g., southern region dominated by anchovy; northern region dominated by jack mackerel) to account for spatial variation.
- Replicate the study over multiple years to consider, at least to some degree, annual variation.
- This design could also be carried out using external pocket nets by conducting paired trawls using the MFT (and Nordic 264) with and without external pocket nets. External pocket nets have been used to explore gear selectivity for the hake component of the IWCPS (Beyer et al., in review). It is, however, possible that adding external pocket nets could lead to changed net selectivity.
- Design details and Data Analysis - TBD once a literature review of best practices is completed (e.g., von Szalay and Brown 2001; de Robertis et al. 2017; Walker et al. 2017).

The Panel noted that the number of tows depends on the aim of the experimental work and will differ between quantitatively assessing changes in species- and length-selectivity and obtaining a broader understanding of the behavior of two nets. Experiments could be conducted stepwise based on the results of smaller-scale experiments. A complicating factor when comparing the previous net and new net is the difference in the trawl doors.

The reasons that the hake survey team used external pocket nets and paired towing to test net selectivity (Beyer et al., in review) as understood by CPS team is:

- It was important for the hake survey to invest in paired trawling, since they use trawls to validate individual schools that are acoustically identified as hake (e.g., hake vs. myctophid schools from acoustic backscatter); in addition, they are concerned with proportions of specific age classes within individual schools that are acoustically targeted (age 1s mixed with age 2+ adults).
- Other considerations regarding NWFSC Hake survey conducting paired tows included: (1) they had support from the Canadian Department of Fisheries and Oceans (DFO) via a second vessel from Canadian Coast Guard Vessel *Sir John Franklin* to conduct the trials; (2) the *Franklin* consists of a full crew compliant and biologists trained to perform this work; (3) prior to switching to the MFT, the NWFSC used an AWT with a 32 mm mesh liner in the codend and the DFO used an AWT with an 8 mm mesh codend liner. Therefore, there was a need to compare potential selectivity differences between the two AWTs with different mesh sizes (pre-existing); and (4) time to do the work during 2024, because it was a research year and not a survey year (the hake survey alternates between an operational year and a research year).

The Panel noted that useful information for hake was obtained with a small number of paired tows.

Request 1.C. Summarize any work conducted elsewhere in the world for CPS surveys on whether changes in the survey net have led to changes to selectivity.
Rationale: In the absence of paired tows for the CPS component of the IWCPS, the Panel was interested to know whether there was evidence that changing the trawl net in other ATM surveys has led to a change in species- or length-selectivity.
Response: The Team reviewed the procedures of ICES working groups on International Pelagic Surveys (WGIPS, ICES 2025) and on Acoustic and Egg Surveys for Small Pelagic Fish (WGACEGG, Doray et al. 2021). These groups coordinate multinational acoustic-trawl surveys to monitor transnational stocks of small pelagic species. No documentation was identified that specifically evaluates whether changes in the nets used for acoustic data classification influence length- or species-selectivity. Moreover, neither working group mandates the use of standardized pelagic midwater trawl nets for echo-classification. This appears to reflect the prevailing guidance that the selected midwater trawl need only be "deemed suitable to catch a qualitatively representative sample of the target school or layer" (ICES, 2025).

1.2 Discussion and Summary

It is important to consider the purpose of any paired trawling experiment given the nature of the ATM survey. Specifically, the data from trawling are not used to directly create the biomass indices but rather to attribute backscatter to species and to create length-compositions (and hence age-compositions and vectors of weight-at-age). This differs from trawl surveys where survey catch-per-unit effort data directly determine the biomass index. Differences in species- and length-

selectivity between nets will lead to differences in biomass indices because the trawl survey results are used to apportion backscatter among species. However, the distribution and abundance of CPS is such that many trawls will capture only a single species.

The Team found no discernible difference in selectivity between the two trawls that would impede the implementation of the survey in the future. The Panel had concerns regarding the analysis approach, particularly the use of data not aligned in time and space. However, it recognized that this approach offers an initial comparison of the two trawl types based on available data.

It was emphasized that the design of the new MFT represents a substantial improvement both operationally and in terms of potential selectivity. The mesh tapering towards the codend enhances filtering capacity, minimizing the loss of smaller fish at the liner. In addition, the larger opening is expected to increase the catchability of larger fish. Some Panel members questioned whether the increased trawl opening could alter the sampled depth range and thus impact the proportion of CPS collected. The Panel expressed surprise that such differences were not reflected in the data. The Team responded by noting that variation in sampling depth has not resulted in significant changes in species or size distribution based on a comparison of data from different locations and years.

The Panel emphasized that conducting comparative trawling or other efficiency studies is essential to fully comprehend the distinctions between the two types of trawls. Future research may incorporate external pocket nets (as referenced in the hake report), cameras, and alternative methods alongside paired trawling. A stepwise approach with an initially exploratory design aiming at identifying and understanding selectivity of the two trawls is suggested. Such alternative exploratory approaches require fewer resources than full scale paired trawling experiments and can be implemented during standard survey operations. The Panel suggests that this approach will help identify whether there is need for further research.

2. SPECIFICATIONS OF BOTH THE NORDIC 264 AND MFT NET SYSTEMS, INCLUDING DIMENSIONS OF NETS AND DOORS, MESH SIZES, AND MESH-SIZE TRANSITIONS

Proponents' summary: Compared to the Nordic 264, the MFT has a much larger mouth opening and overall mouth area, fishes deeper, and samples a greater proportion of the water column. Catches from the MFT are more consistent, with higher numbers of medium and large catches and fewer small catches than the Nordic 264 despite a shorter tow duration (30 vs 45 min). The mesh size of the codend is the same for both net types, but several design issues identified for the Nordic 264 in past reviews were considered and addressed during the design of the MFT, for example a more gradual taper in the net meshes to reduce the "bucket effect" that may result in escapement of fish from the net near the codend.

2.1 Requests for the Team

Request 2.A: Compare the consistency/variability in species- and length-composition among the tows in a small number (5) of clusters for the Nordic 264 and MFT nets to assess whether there is greater variability for the Nordic net. For two years of MFT sampling, take a random sample of ~5 clusters, plot Pacific mackerel, sardine, anchovy length compositions and species proportions for each trawl in the cluster. For comparison, select ~5 Nordic 264 clusters. Edit the graphs to make illustrations in figures easier to see. Indicate sample size.

Rationale: The comparison will help inform whether the MFT net provides more consistent results among tows within a cluster than the Nordic 264 net given the larger number of fish caught and less frequent water tows.
Response: The Team compared the consistency/variability in length-composition among hauls in two clusters for two years of the Nordic 264 and two years of the MFT for each species. The Team chose clusters that contained three hauls, but this was not possible for some species in some years in which case clusters with only two hauls were chosen. The Team also tried to have one cluster be from more southerly locations and one cluster from more northerly locations, when possible. Figure 1 shows the results for Pacific sardine. (All figures referenced herein are available in Appendix 1)

The results are inconclusive in terms of showing whether the MFT net leads to more consistent results among hauls within a cluster. In general, for all species, all hauls within a cluster have similar sized fish for both the Nordic 264 and MFT, although the total number of fish caught varied. It is important to recognize that trawl locations within a nighttime cluster are usually targeting different areas of backscatter and often spaced 10-nmi or more apart and not conducted as "replicate" tows, so variability within trawl clusters is not unexpected.

The Team also compared the variability in species composition among hauls in five clusters for two years of the Nordic 264 and two years of the MFT. They randomly selected clusters were all within 2°N of the mouth of the Columbia River (~46.25°N), where high variability in catch composition has been observed consistently. They prioritized clusters containing three hauls but had to include some with just two hauls due to realized trawling effort. They selected Nordic 264 survey years of 2019 and 2023 to prioritize recent years with sufficient sampling in that location to facilitate comparison. The selected clusters and corresponding inter-haul variability are shown in Figures 2 and 3.

Request 2.B: Plot measures of trawl geometry showing time sequences of skews for the MFT.
Rationale: Comparisons were made for other characteristics of the nets, and plotting these metrics will provide additional perspective on the performance of the MFT.
Response: The SWFSC routinely plots the depth data from the Time-Depth Recorders (TDRs) (purple and blue traces for the kite and footrope TDRs, respectively) and PX MultiSensors attached to the trawl doors (red and green traces for port and starboard doors, respectively, top panel) (Figure 4). The vertical opening (height) is computed from the difference in depth between the kite and footrope TDRs (middle panel). The door spread is measured by the PX MultiSensors system and plotted in the bottom panel. The speed (over ground) of the vessel is plotted in black in the top panel. The Team does not regularly have access to the skew data, nor speed through water, but the "auto trawl" system is routinely used when fishing to adjust the warps to avoid skewed geometries during the trawls. During a typical "good" haul, the kite is in the upper 5 m of the water column, the height is consistently ~20 m, and the door spread is ~60 m (Figure 4A). In contrast, "bad" hauls often have variable depths, narrow heights, and wide door spread (Figure 4B).

Trawl geometry data are also available using the position from the PX MultiSensors in the trawl doors and the PX Flow sensor, which is occasionally installed on the trawl kite. The geometry data provide distances from the flow sensor in the middle of the kite to each of the trawl doors, which provides a measure of the trawl skewness throughout the tow. The flow sensor has not been routinely used on the MFT trawls due to entanglement issues during deployment and retrieval. It

was used, however, during gear trials and early development, from which it can provide some sense of stability during those early tests (Figure 5).

Request 2.C. Provide the operations protocol for the trawl component of the survey.
Rationale: The Panel was not provided with such a protocol - documents like this are important to ensure consistency over time.
Response: The operations protocol from the trawl component of the 2025 IWCPS was provided to the Panel.

2.2 Discussion and Conclusions

The Panel appreciated the responses and suggested a new research recommendation related to the need for criteria to identify whether a trawl should be discarded when computing biomass and other survey outcomes.

3. PERFORMANCE OF THE NORDIC 264 AND MFT NETS DURING FISHING, INCLUDING SAMPLING DEPTH AND VERTICAL AND HORIZONTAL SPREAD OF THE NET MOUTH OPENING

Proponents' summary: To evaluate net performance, data from temperature-depth recorders (TDRs) were analyzed to compare sampling depths, net geometry, sampling volume, and data from trawl samples were analyzed to compare catch volume. The MFT sampled farther (~5 m) below the surface but also sampled a greater depth range than the Nordic 264. The MFT had a larger vertical opening and mouth area compared to the Nordic 264 due to its larger dimensions, which resulted in a greater volume sampled per trawl despite a reduction in the tow duration after switching to the MFT. The largest catch volume and median and average catch volumes of both the whole catch and CPS-only catch occurred using the MFT. The MFT had greater consistency in trawl performance, with higher proportions of medium and large catches and very few "water hauls" or small catches compared to the Nordic 264.

3.1 Requests for the Team

Request 3.A: Re-run the plot of mouth opening area removing values lower or greater than the 95% confidence interval to provide a clearer depiction of the variation over time.
Rationale: The current depiction with all trawls includes some very low and very high values that obscure the general trend over years.
Response: The number of hauls with an average net height (across the whole haul) lower than the 5% quantile or higher than the 95% quantile was low. Figure 6 plots the mouth opening of the Nordic 264 and MFT for six cruises when hauls with small and large net openings were excluded.

The Panel noted that Figure 6 confirms that the MFT with a larger net opening may reduce the effects of trawl avoidance.

Request 3.B: How could the suite of sophisticated acoustic technology be used to understand trawl efficiency (ME70, MS70, Trawl sonar, and WideBand Autonomous Transceiver (WBAT)).
Rationale: The efficiency of the trawl is impacted by pre-trawl fish behavior. The Team informed the Panel that sonar data had been collected but not fully analyzed. The results from this request could help clarify the way forward and research priorities.
Response: The team identified the following technologies and their potential use.

- EK80/Echosounders: Trawl catch can be normalized to nearby daytime CPS backscatter to determine whether there's a relationship between the sizes/compositions of catches with the acoustic data.
- MS70: The MS70 is a sideways looking multibeam sonar that provides a 3D grid of volumetric backscatter per individual ping. It is capable of insonifying the water column near the surface and thus could be used to measure the vertical distribution and density of CPS near the trawl.
- SX90: The SX90 is an omnidirectional sonar with multibeam swath capabilities. The sonar can be tilted at configurable angles to track fish schools at various depths. This can be used to assess vessel avoidance as well as characterize fish behavior near the trawl opening (although prop wash typically causes noise directly behind the vessel).
- ME70: Multibeam sonars insonify a swath of backscatter beneath the vessel, which can be used to examine vertical distributions, albeit primarily beneath the vessel. It may still be hampered for characterizing CPS near the sea surface available for trawling because of the depth of the transducer as well as a nearfield blind zone near the surface that is still unobserved.
- Trawl sonar (e.g., FS70): Trawl sonars are typically installed on the headrope of a trawl and are scanning sonars that provide a real-time cross-section of the net opening. This not only provides details on the shape of the net mouth but can also observe acoustic backscatter from organisms in relation to the net. The latter data can be used to determine if animals are entering or avoiding the net, and the former can provide an estimate of catch size based on the organism.
- TrawlEye: The Kongsberg PX TrawlEye is a miniature echosounder that can be positioned anywhere along the net and provides wireless real-time echosounder data to the ship. It can be used to observe organisms entering the net and potentially as a way to ascertain catch size. This sensor is primarily used to provide real-time trawl behavior and not for post-trawl analyses.
- The WBAT could be deployed with a transducer upward looking in an area with acoustic records of CPS to study vessel and trawl effects during sampling in its neighborhood.

The Panel noted that the SX90 could be used to assess movement of schools over time to assess if there is movement from the vessel.

Request 3.C: Compare nighttime catches with simultaneously recorded acoustic biomass.
Rationale: This comparison could help elucidate the absolute efficiency of the trawl. These data exist but have not been analyzed and might inform the discussion on sampling efficiency.
Response: During the 2024 CPS survey, the EK80s were set to record broadband FM data at nighttime (this is different from daytime when they record narrowband CW data). For every trawl from the 2024 survey, the concurrent nighttime FM data were processed to try and apply the same CPS filters for retaining only CPS backscatter.

The resulting CPS volume backscatter data were then integrated and summed and compared with the total trawl catch (Figure 7). There is essentially no relationship between backscatter and trawl catch rates.

Request 3.D: Explore the higher efficiency of the MFT for small fish of some species, including the uncertainty of these estimates. Focus on the small end of size composition (e.g., Figure E16 of Erisman et al., 2026).
Rationale: The potential "bucket effect" in the Nordic Trawl is probably removed by the MFT design. This is also supported based on the results from the experiments for hake. Changes in catchability of small fish may impact stock assessments, and this should be considered in assessment work.
Response: The Team focused on the left tail of the length density plots for each species to better explore the efficiency of the MFT for catching small-sized fish. They limited the x-axis for each species to align with the length groups identified in Figure E16. For sardine, smaller length ranges (< 150 mm SL) were collected using the MFT but in very low numbers when compared to the Nordic 264. This does not necessarily indicate the MFT is less efficient at catching smaller fish but may be a result of underlying community composition or timing of when the survey starts and the starting location.

For northern anchovy the largest sample size of smaller individuals (< 100 mm SL) occurred during 2024 using the MFT. The very small anchovy measured during 2014 and 2015 could be a result of differing processing protocols. In general, larval fish are not measured. For northern anchovy, the larval transition sizes occur between 35-40 mm. It is possible that there was time and interest in 2014 and 2015 to measure these fish. Larval anchovies were collected using the MFT, but they were not measured so it is difficult to compare catches of fish < 40 mm.

For Pacific mackerel, smaller individuals (< 175 mm FL) were collected using the MFT, and the smallest observed individual was collected during 2024 using the MFT (47 mm).

If there were no small fish in the community to be collected at the time of trawling, neither net would catch them. However, at least for northern anchovy, the data may indicate that if small individuals are present during trawling, the MFT will be able to collect greater numbers. The Team observed this during 2024 where the MFT collected 3,306 northern anchovy < 100 mm SL, with the next largest sample size being 1,566 in 2019 using the Nordic 264. The timing and direction of the survey can also play into the uncertainties. If the survey goes from south to north, it will start in known spawning regions (e.g., southern California Bight) earlier during the year, closer to peak spring spawning season for some species, and consequently there could be a greater chance of very small fish being collected. These spawning grounds would be surveyed much later during the year when fish have had a chance to grow and are larger if the survey goes from north to south.

3.2 Discussion and Conclusions

There is variability between 2024 and 2025 in depth fished and the warp can change the performance of the net substantially. Data from a trawl sonar would be helpful to determine when there are issues with how the net is fishing.

There is strong evidence that the MFT is more "efficient" overall in the sense of higher catch rates (and fewer "water hauls"), resulting in larger samples to form the basis for species- and length-compositions. However, the lack of paired trawls makes it impossible to quantitatively evaluate the increase in efficiency. It is clear that the two nets are not sampling the same part of the water column, with the Nordic 264 fishing closer to the surface and the MFT deeper. The Team stated that if the head rope is right at the surface there is considerable noise and the wire-jacketed cable

can get caught up with the head rope meshes. The distribution of CPS at the surface is not well known, making it hard to judge the effect of fishing deeper with the MFT if there is any. The Nordic 264 may have been fishing above CPS schools so the MFT is thought to provide a more representative sample.

The change in the depth distribution of fishing has the potential to lead to changes in species- and length-selectivity given the differences in the diel behavior of each CPS by size. The work for hake led by Sabrina Beyer (NWFSC) shows that for hake the MFT retains fish better than the Aleutian Wing Trawl, but this result cannot be automatically generalized for CPS.

4. METHODS AND BIOMASS ESTIMATION FROM THE 2025 INTEGRATED SURVEY

Proponents' summary: The MFT has now been used successfully in coastwide CPS surveys since 2024, with no other major differences in methods during the IWCPS compared to SWFSC-only CPS surveys conducted in the CCE since 2015. Based on results of the 2025 survey, the CPS community in the CCE continues to be dominated by the central subpopulation of northern anchovy and jack mackerel. The point estimate for the ATM biomass of the northern subpopulation of Pacific sardine increased slightly from 2024.

5. SPECIES- AND LENGTH-SELECTIVITY COMPARISONS BETWEEN THE NORDIC 264 AND MFT NETS

Proponents' summary: The Team identified no meaningful differences in observed species composition between surveys conducted using the two net types. While data visualizations, descriptive statistics, and multivariate analyses of species catch and composition indicated a high degree of variability within and among survey years, there was no evidence for changes in species selectivity due to the change in net type. The Team observed differences in estimated average species richness and beta diversity between net types, but these differences may be attributed to underlying shifts in community composition over time.

Comparisons of length distributions by species and year revealed no meaningful differences in length selectivity for northern anchovy and sardine. However, the MFT captured the largest Pacific mackerel collected during the ATM survey, and greater proportions of both large Pacific mackerel and large jack mackerel. However, it is unclear if these observations could be attributed to net effects or underlying variability in the demographics of the CPS community.

5.1 Requests for the Team

Request 5.A: The Team should consider and be ready to discuss counterfactual analyses that might be used to determine how much potential changes in survey gear selectivity might affect assessment input data and assessment model results. Two potential general approaches were discussed:

- Modify the raw survey input data (fish in trawls) and use existing methods to calculate survey length- and species-compositions.
- Use simulated data in alternative assessment models to evaluate potential changes in estimated and projected stock size. For example, the number of large/old fish in composition data could be increased or decreased to mimic selectivity effects.

Rationale: The results from this analysis will help to assess the potential magnitude of the impact of the change in trawl net.
Response: Some ideas for approaching this are:

- *Survey:* It is possible to conduct a sensitivity analysis for the calculation of biomass indices and length-composition by modifying the raw trawl data that are analyzed to compute the inputs to the stock assessment. Given that age at length is highly variable, it is unlikely a change in length selectivity will yield an appreciable difference. A theoretical length selectivity could be applied to all Nordic trawl data and resulting biomass calculated, possibly a dome-shaped selectivity pattern to capture more of the larger and smaller animals. This application of length selectivity would also result in changes to species compositions. These analyses could be conducted for a single species at a time, and also for all species simultaneously. Trawl data from a Nordic 264 net could be applied to the acoustics of an MFT year. Such an analysis would have many different assumptions associated with it and is less realistic than the other presented options.
- *Assessment:* For a benchmark assessment, sensitivity analyses could be completed that change survey-derived input data and/or survey modelling assumptions and resulting impacts on assessment outputs could be calculated. The magnitude and direction of changes to survey-derived inputs and modeling could be informed by the prior section on survey ideas. A simulation study using a simplified model informed by a CPS benchmark assessment could be conducted that evaluates assessment performance under different conditions of net selectivity, recognized or unrecognized.

Request 5.B: Compute for each of the ATM/IWCPS surveys (Nordic 264 and MFT) the proportion of the total biomass (backscatter) that is assigned to single species versus mixed species trawl clusters.
Rationale: Figure E.3 of Erisman et al. (2026) shows that many trawl clusters are single species. Species selectivity will be most consequential for mixed species clusters.
Response: This is an informative calculation and will be attempted in the near future because it is too complicated to complete overnight.

5.2 Discussion and Conclusions

No definite conclusions about selectivity (species or length) could be drawn because all data from the two nets in comparisons were collected during different years. Thus, it was not possible to distinguish possible changes in selectivity from natural variability in length and age composition, growth, distribution and other biological characteristics (selectivity effects were confounded). This shortcoming was unavoidable as explained elsewhere.

The Panel agreed that the results for the two net types were useful and similar for the two nets in most cases. There are some differences, possibly due to the large number of comparisons, sampling error and natural variability. In particular, the minimum sizes of collected sardine, northern anchovy and jack mackerel were smaller in the MFT net while the maximum size for Pacific mackerel was larger. The MFT catch for large Pacific mackerel was particularly high. However, with the possible exception of Pacific mackerel, definite conclusions were precluded by sampling error, stock conditions and annual variability.

K-means cluster analysis and non-metric multidimensional scaling (NMDS) were used to group data into relatively homogenous statistical clusters for further analysis. Preliminary results for 1-6

or 1-10 clusters were used to decide that two clusters were appropriate for the data in both cases. There was no clear 'elbow' to indicate the best number of clusters. However, sharp elbows may not be typical in these types of analyses. Figures E6 and E9 of Erisman et al. (2026) indicate the benefit of additional groups decreases at about 4 in the k-means case and at about 3 in the NMDS case, suggesting that more than two groups would be appropriate. Two clusters are, however, a convenient choice because results for two dimensions can be plotted easily in one graph on one sheet of paper. Future work could check that results and conclusions would be the same using additional clusters.

6. STATISTICAL COMPARISONS OF LENGTH-SELECTIVITY BETWEEN THE NORDIC 264 AND MFT NETS FOR EFFECTS ON SURVEY-DERIVED AGE COMPOSITION AND WEIGHT-AT-AGE ESTIMATES

Proponents' summary: Comparisons of simplified survey-derived estimates of age composition and weight-at-age between nets for the three assessed CPS indicated varying effects of possible differences in length-selectivity. There were no consistent differences in estimated age composition and weight-at-age by net for Pacific sardine. Greater sampled lengths and ages for Pacific mackerel during MFT survey years translated into higher estimates of both weight-at-age and the proportional contribution of older ages (i.e., ages-4+). Estimated weight-at-age for older age classes of northern anchovy (i.e., ages-2+) were consistently highest during MFT survey years, and estimated age compositions for northern anchovy also exhibited the greatest variability during these years. While variability in survey-derived age composition and weight-at-age estimates for northern anchovy could be attributed to varying demographics, the shorter time series of available data, or net effects, the magnitude and consistency of differences between nets for Pacific mackerel provide stronger evidence for a possible difference in species-specific length-selectivity.

Request 6.A: Based on the available data and analytical approach, what level of difference in efficiency and selectivity would be large enough to have an appreciable difference on assessment outcomes?
Rationale: Results could be used to understand the urgency of additional experiments and research on MFT selectivity. This information will also inform power analyses for future work.
Response: There was insufficient time to complete this request. See the response to Request 5.A.

7. STATUS UPDATE ON TRAWL-RELATED RECOMMENDATIONS FROM THE 2018 ATM SURVEY REVIEW

7.1 Review of research conducted

7.1.1. Net mensuration (#4)

This work was conducted as recommended in the 2018 report. However, it is unexpected that the routines do not include standard use of trawl sonar. Starting problems are normal, but with well-defined procedures developed through experience this normally works well with other vessels/trawls. The Panel recommends that the SWFSC continue to collect these data and gain experience in the operation of trawl instrumentation, with the aim of developing this into an operational protocol that will ensure standardization of operation and quality control.

7.1.2. Trawl efficiency (#9)

This research aimed to test the efficiency (and suitability) of the existing trawl either by comparing acoustic density measures with swept volume densities of the trawl or comparing swept volume densities with similar measures from larger trawls and other gear types.

The Panel appreciates the effort to present an analysis using a limited amount of data to give a sense of this relationship. The resulting chart (Figure 7) displayed scattered points along both axes indicating that high densities of acoustically recorded fish did not lead to high catches, and high catches were seldom reflected in the acoustic record. It was noted that this demonstrates the potential impact of fish behavior, which is known to influence both the acoustic record and trawl catches of pelagic fish near the surface. It was agreed that this work should be continued. More data from different areas and over longer periods might lead to some clues on how to interpret this information.

7.1.3. Verify if acoustic CPS are the same as trawl CPS (#10)

This research aimed to develop methods to verify that daytime sound scatterers are the species and sizes caught in nighttime trawls; i.e. verify that efficient daytime sampling of the acoustic record gives similar results as present nighttime sampling strategy using approaches such as alternative daytime sampling strategies (e.g., curved trawling trajectories) and/or different trawls. The Panel thanked the proponents for the effort in following up this recommendation, including using different trawls, purse seines, and examining various trawl trajectories. The challenge of obtaining meaningful trawl catches during the day and that of operating the trawl through various depth trajectories were significant obstacles to fulfill the objectives of the recommendation. The Panel suggested that further collaboration with the industry using commercial trawl and purse seines could be helpful. It was suggested that a towed vehicle equipped with a stereo camera could potentially support online data with species and size composition as this validation is a crucial basis for the survey strategy.

7.1.4. Compare catches from different trawl depths (#1)

This research aimed to conduct night trawls at different depths in the same area, with the headrope at the surface, at 15 m, and at 30 m depth, for example to compare estimates of species and length composition. While no such depth dependent tows were conducted, the effects of unintentional variation in depth during MFT operations were studied but could not be used to resolve this issue due to operational difficulties in controlling depth of trawl. The Team reported that challenges with trawl operation at fixed depth complicates this idea. Efforts to improve the stability of the trawl during towing were discussed and factors such as different crews and limited training might be factors involved in this difficulty.

7.1.5 Compare cluster approach for low sample sizes (#3)

This research involved comparing the area (e.g.. over several transects) and the current cluster approach to convert backscatter data to biomass when sample sizes for a particular species are insufficient. The Team presented their analysis on this issue and noted that the introduction of the MFT has reduced the number of "waterhauls", which might lead to a better opportunity for similar analysis in the future when more cruises with the MFT net have been completed.

7.1.6 Assess behavior at the codend using ADCP (#1)

This research recommendation aimed to study fish behavior in front of the codend and trawl opening and measure flow inside/outside the trawl using a high frequency Acoustic Doppler

Current Profiler (ADCP). This would allow for an evaluation of the frequency with which fish escape. Such work is needed because the codend is relatively short with a small mesh liner and has probably insufficient filtering capacity at 4 knots. This might "block" the entrance of the codend and lead to an increased flow of water through the meshes in front of the codend where some fish would probably escape.

The Team presented some tests using Simrad PX Flow sensor (based on ADCP technology) mounted on the headline along with a camera mounted on the Marine Mammal Extruder Device during operation of the two trawls. Data from both the Nordic 264 and the MFT nets were collected. While the ADCP data have yet to be analyzed, information from the camera were used to adjust the MFT during the initial trials. The Team suggested that more measurements at different positions in the trawl could be helpful for studying the filtering capacity. The Panel supported this view. It was also suggested by the Panel that a combination with camera observations could be helpful. The Panel recommended that studies using ADCP and cameras be continued to ensure that the filtering capabilities of the MFT net do not represent a substantial selection factor. It would be advantageous to conduct such studies together with the use of external pocket nets.

8. AREAS OF DISAGREEMENT REGARDING PANEL RECOMMENDATIONS

There were no major disagreements among the Panel members and between the Panel and proponents although the proponents seemed to consider analytical results presented as strong evidence for similar selectivity in the two nets. The Panel agreed that results suggested similar selectivity but noted that comparisons were not rigorous because the two nets sampled in different years and locations. Both groups recognize that the new net will be used in future surveys. Both groups support continued research but neither group recommends large paired-tow or other field experiments at present.

9. UNRESOLVED PROBLEMS AND MAJOR UNCERTAINTIES

The main unresolved problem is that while the MFT fishes a somewhat different depth range to the Nordic 264 and it caught more large Pacific mackerel than the Nordic 264, the available data do not provide a basis to quantify the effects (if any) on the species- and length-selectivity of the trawl and hence the impact of the change in the net on the inputs to the stock assessment. The Panel identified several areas where additional research could be conducted that would reduce this uncertainty and the Panel conclusion provides advice on how this uncertainty should be treated in upcoming stock assessments.

The Panel focused on the trawl aspects of the IWCPS survey. Other aspects of the survey have changed, and the impact of these on the inputs to the stock assessment are unknown but are likely small.

10. MANAGEMENT, DATA OR FISHERY ISSUES RAISED BY THE CPSMT AND CPSAS REPRESENTATIVES

10.1 CPSMT Statement

On behalf of the CPSMT, the MT representative thanks the Integrated Survey Team and Review Panel for preparing and conducting this extensive review. We also thank the SWFSC for hosting

this review and appreciate the support of the Pacific Fishery Management Council. It is important to highlight that industry collaboration has been invaluable during the development, implementation, and review of the new MFT net technology and should continue to be supported.

The Panel's thoughtful discussions and conclusions reinforce the broader view that the most effective path forward is continued refinement of the new MFT survey system rather than attempting to fully resolve all differences between the Nordic 264 net and the MFT net under current resource limitations. Although paired trawl experiments or simulation studies could help identify and quantify net performance differences, long term value from improving MFT survey methodology and understanding of CPS behavior should be prioritized. As additional years of MFT data accumulate, discrepancies between nets will become clearer and can be addressed in future CPS stock assessments.

A forward-looking strategy emphasizes strengthening operational consistency, validating key assumptions, and expanding the temporal and spatial scope of information used to understand CPS stocks. High priority recommendations for future research needs and general considerations identified by the Review Panel center on building a more accurate, reliable, and adaptive acoustic–trawl survey program for CPS. Recommendations focus on improving how fish are detected, sampled, interpreted, and extrapolated across both surveyed and unsurveyed waters and should be prioritized as resources become available to help improve CPS assessments. Industry collaborations should be prioritized when initiating research recommendations whenever possible. The Integrated Survey Team's efforts to modernize the CPS survey to better support long-term management needs are to be commended.

10.2 CPSAS Statement

On behalf of the Coastal Pelagic Species Advisory Subpanel, the CPSAS representative noted that the agency has made great progress in integration of the CPS and hake surveys. The agency's ongoing cooperation with industry in developing and operating its trawl system should be continued as it appears to have improved both the efficacy of the survey and the confidence of industry in the survey.

The overall conclusions of the review panel seem sound and recognize that resource constraints prevent the agency from undertaking the research needed to understand differences between the performance of the new and old nets. As more data are collected over time, these differences may be better understood and perhaps less relevant. Panel recommendations on investigating these net differences via small-scale paired trawls or simulation studies may help clarify these effects; however, the greatest benefit may come from the agency devoting its efforts to continuous improvement of the new system and its understanding of CPS stocks. These efforts should include refining its use of the new system and survey methodology (e.g., considering the effects of using daytime trawls to collect catch composition data to apply to the previous night's acoustic data and further exploration of the effects of vessel avoidance, perhaps using side sonar and considering sonar depth) and include periodic progress reports that summarize findings (including findings responsive to requests from prior reviews). In addition, further exploration of alternative data sources (particularly data collected at times of the year other than during the short summer survey period) may return the greatest benefit for our understanding of CPS stocks in US waters.

The tribute to Mike Okoniewski at the start of the meeting was very much appreciated. He was a valuable member of the CPSAS team who is greatly missed.

11. RECOMMENDATIONS FOR FUTURE RESEARCH AND DATA COLLECTIONS

The research recommendations are provided, ranked by their likely impact on stock assessment results, but the Panel recognizes that the actual priorities will also be determined by the availability of resources as well as feasibility.

The following high priority research recommendations relate to the use of IWCPS data in current stock assessments

1. Further evaluate the likely magnitude of any changes based on expert opinion, qualitative analysis or relatively small field experiments.
2. Determine if changes are likely to be large enough to affect stock assessments or management using sensitivity analysis or other means. Are any current assessment problems actually due to the survey change in 2024?
3. Consider the urgency and temporal duration of possible problems in stock assessments due to the gear change. It should be relatively easy to treat ATM survey data for CPS as two surveys (one ending in 2023 and another starting in 2024) with different selectivity patterns after a few years as additional surveys are conducted.
4. Consider stock assessment modeling approaches for at least interim use that are robust to the survey gear change. For example, selectivity parameters after 2024 could be modeled with prior distributions for offsets that change appropriately as the model is fit during each new assessment. Many other approaches are possible (e.g., manage based on survey biomass estimates without modeling).

High priority

1. Conduct further studies on the capture efficiency and selectivity of the Nordic 264 trawl and the MFT including:
    a) Carry out paired trawling experiments. The aim should be to complete a limited study using 10-15 pairs that is considered sufficient for enhancing understanding of the selectivity properties of the two trawls. The experiments will be strengthened by including external pocket nets that quantify the number of escaping fish and cameras to observe fish behavior in the trawl, including escapement behavior close to the meshes.
    b) Continue processing and analyzing the nighttime echosounder data during trawling for comparison with the catch rates for the Nordic 264 trawl net and MFT, with the aim of establishing consistency in the relationship between these two measures of biomass.
    c) Use available acoustic equipment to enhance understanding of the impact of the vessel and the trawl on the acoustic backscatter and the catch. This could include use of the MS70 to map the vertical and horizontal distribution of the fish to the side of the vessel. The WBAT could be deployed in an area with fish during daytime cruising for recovery after nighttime trawling to study vertical distribution and the temporal change in biomass. Use the SX90 sonar to track individual schools when possible and feasible to assess whether CPS are avoiding the vessel and trawl.
    d) Continue measurements of water flow with the ADCP positioned at different parts of the trawl net with the aim of assessing the potential for escapement through the meshes.

The work should be coordinated with the other studies of trawl efficiency, e.g., using cameras and external pocket nets.

2. Continue to work on verifying whether acoustic CPS are the same as trawl CPS. This includes:
   a) Continued collaboration with the industry using commercial gears (commercial trawls and purse seine) as well using visual techniques such as a towed vehicle with stereo camera.
   b) Tracking of individual schools of CPS with, for example, the Simrad SX90 omnidirectional sonar to map their movement over time. The aim should be to support the assumption that fish remain in the same area over time, or alternatively there is systematic movement of the schools out of the area.
3. Compute for each of the ATM/IWCPS surveys (Nordic 264 and MFT) the proportion of the total biomass (backscatter) that is assigned to nearly a single species (85-95% single species) versus mixed species trawl clusters.
4. Develop criteria to identify whether a trawl should be discarded when computing biomass and other survey outcomes.
5. Representative inshore sampling procedures should be developed to reduce potential bias and increase accuracy of species and length composition data in the CPS survey. Daytime purse seine sets are used in shallow coastal waters instead of the trawling at night to collect species- and length-composition data. A nearest neighbor (purse seine set or trawl tow) is used instead of multiple tows in the same cluster to collect species and length data. Representative sampling in shallow coastal areas is difficult because species diversity is high and changes quickly with depth and because purse seines tend to sample a single species in one school during daytime (purse seines will operate at dusk during 2026 so that schools will disperse and sampling will improve to some extent). Escapement from purse seines is species-, abundance- and depth-dependent. Purse seines operate at depths shallower than the depth of the trawl net (about 27 m on the FV *Long Beach Carnage* and 40 m on the F/V *Lisa Marie* during 2025) so that grounds 1-4 nm from shore where the trawl cannot operate are under sampled. Species composition changes quickly with depth so that reduced sampling intensity at 1-4 nm distorts survey data. During 2025, some inshore backscatter was apportioned based on offshore trawl tows or relatively distant purse seine samples. Significant quantities of CPS are sometimes found in shallow coast water (e.g., sardines in 2025). These issues make representative sampling and collection of accurate biological data inshore difficult. Some unquantified bias that varies from year to year likely results.
6. Daytime trawling using the MFT net in the midwater trawl mode used for hake could be used to sample schools observed in the acoustics. The depth fished can be altered based on the depth of the school observed in the acoustic sonar. Conduct both daytime and nighttime trawling as the basis for validating that the fish surveyed acoustically during the day and using trawling at night have the same species and size composition.
7. Conduct a counterfactual analysis based on suggestion in Section 5.A to determine how much potential changes in survey gear selectivity might affect assessment input data and assessment model results. Two potential general approaches were discussed:
   a. Modify the raw survey input data (fish in trawls) and use existing methods to calculate survey length- and species-compositions.

b. Use simulated data in alternative assessment models to evaluate potential changes in estimated and projected stock size. For example, the number of large/old fish in composition data could be increased or decreased to mimic selectivity effects.
c. Determine if changes are likely to be large enough to affect stock assessments or management using sensitivity analysis or other means. Are any current assessment problems actually due to the survey change in 2024?
d. Consider the urgency and temporal duration of possible problems in stock assessments due to the gear change. It should be relatively easy to treat ATM survey data for CPS as two surveys (one ending in 2023 and another starting in 2024) with different selectivity patterns after a few years as additional surveys are conducted.
e. Consider stock assessment modeling approaches for at least interim use that are robust to the survey gear change. For example, selectivity parameters after 2024 could be modeled with prior distributions for offsets that change appropriately as the model is fit during each new assessment. Many other approaches are possible (e.g., manage based on survey biomass estimates without modeling)."

Medium priority

1. Expand the existing survey protocol for the CPS survey to include procedures and routines for collecting and processing trawl instrumentation information to obtain standard quantitative information (for example average values and associated variability measures) that can be used to evaluate the quality of each haul. It is recommended that survey protocols are routinely evaluated and updated according to experience and new information.
2. Attempt to validate species composition and length composition in the daytime based on deployment of stereo cameras mounted to a towed net sled or another appropriate platform. Use a real time depth sensor on the platform to adjust the depth of observation to match the observed school depth on the sonar during the acoustic operations. This will further address the need for validation as noted in section 7.1.3 of this report (request 10 from the 2018 ATM survey review). The sled could be attached to a single warp of the trawl net during daytime operations. Alternatively, a separate smaller hydraulic drum and pulley can be mounted and used for deployment if trials are successful. If a towed net sled is used as the platform for mounting the stereo cameras (Figure 8), an appropriate net could be used to capture fish, although the intention of the net would be more geared toward stabilization. Alternatively, mounting the stereo-cameras to an Autonomous Underwater Vehicle-like frame with a remotely operated alerion to quickly change depth of operation to intersect school at depths identified on the ship's sonar could be developed.

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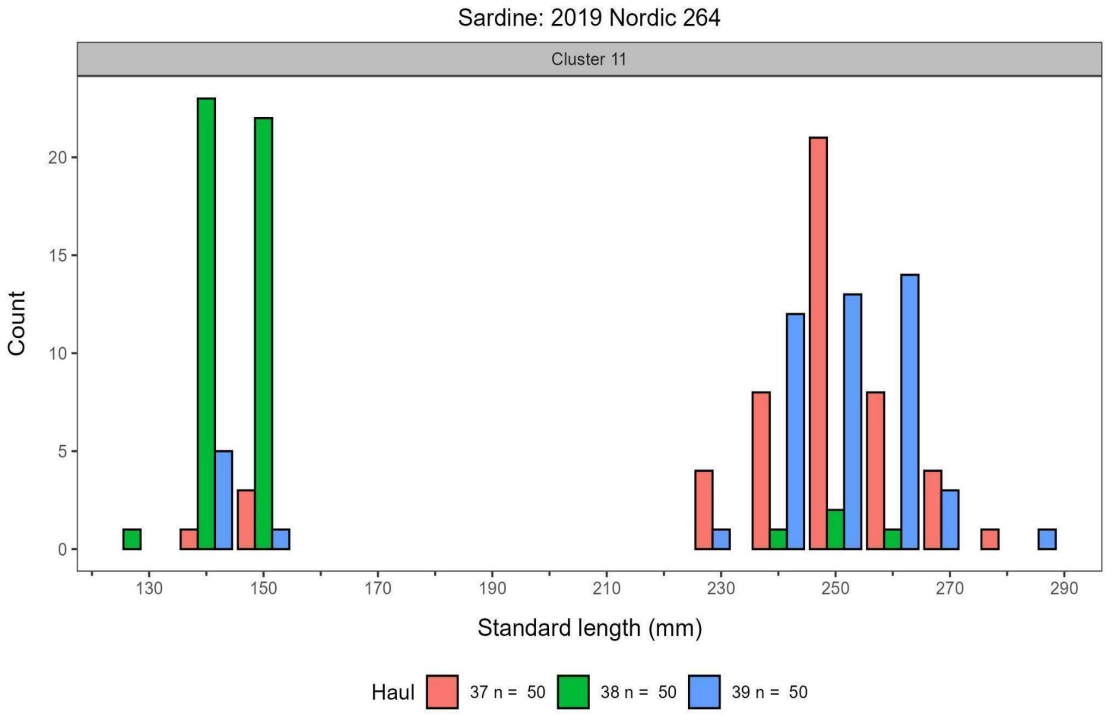
898 **Appendix 1: Figures**



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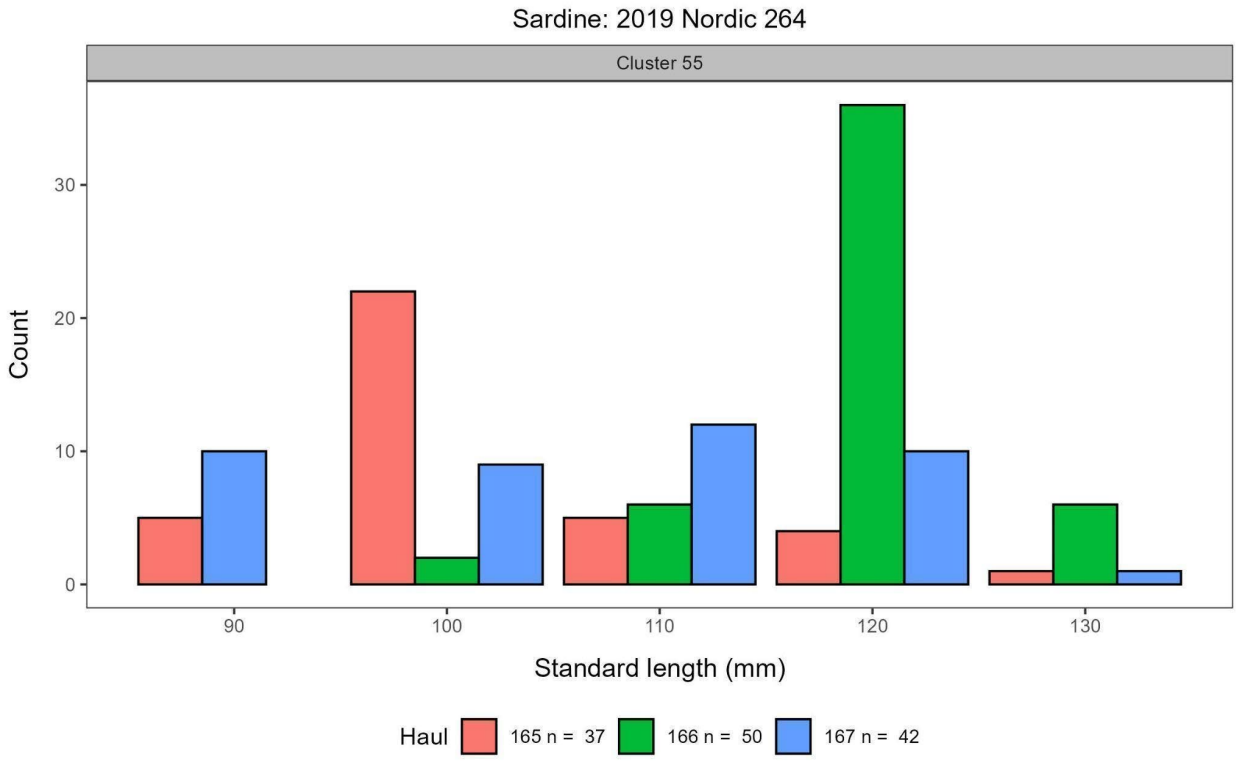

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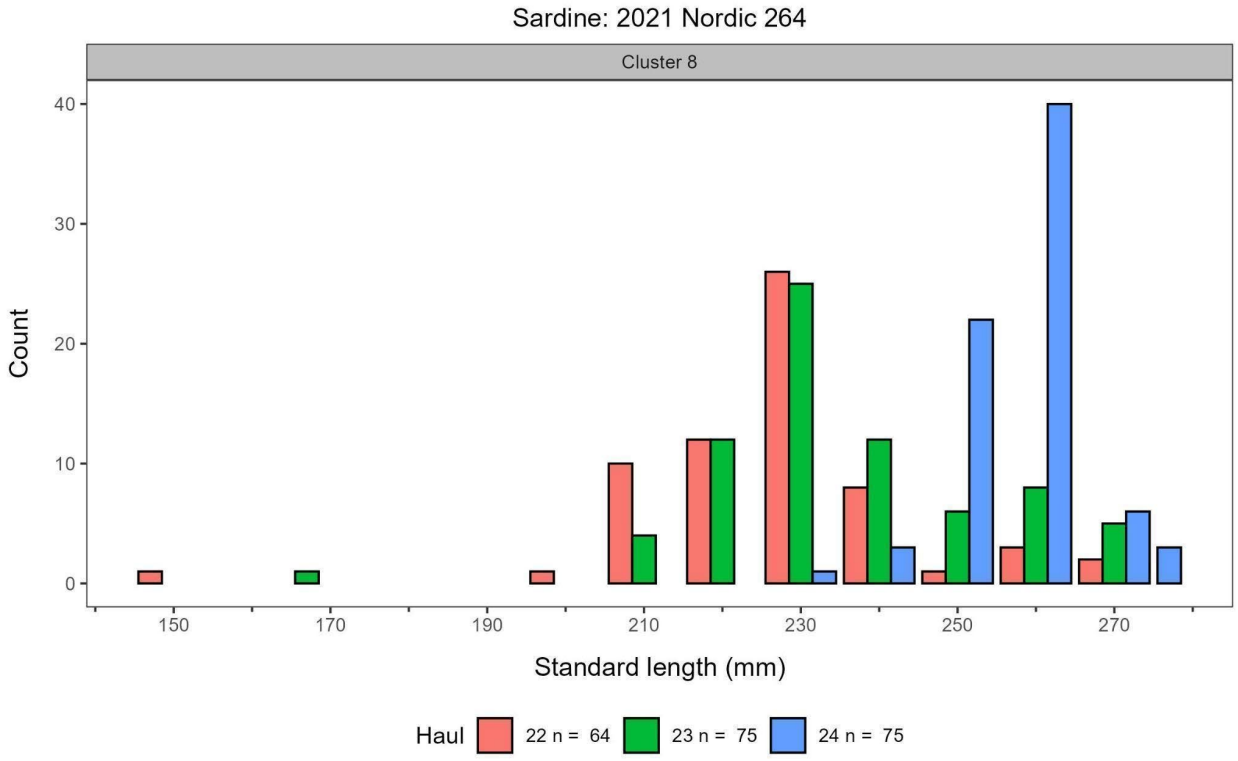

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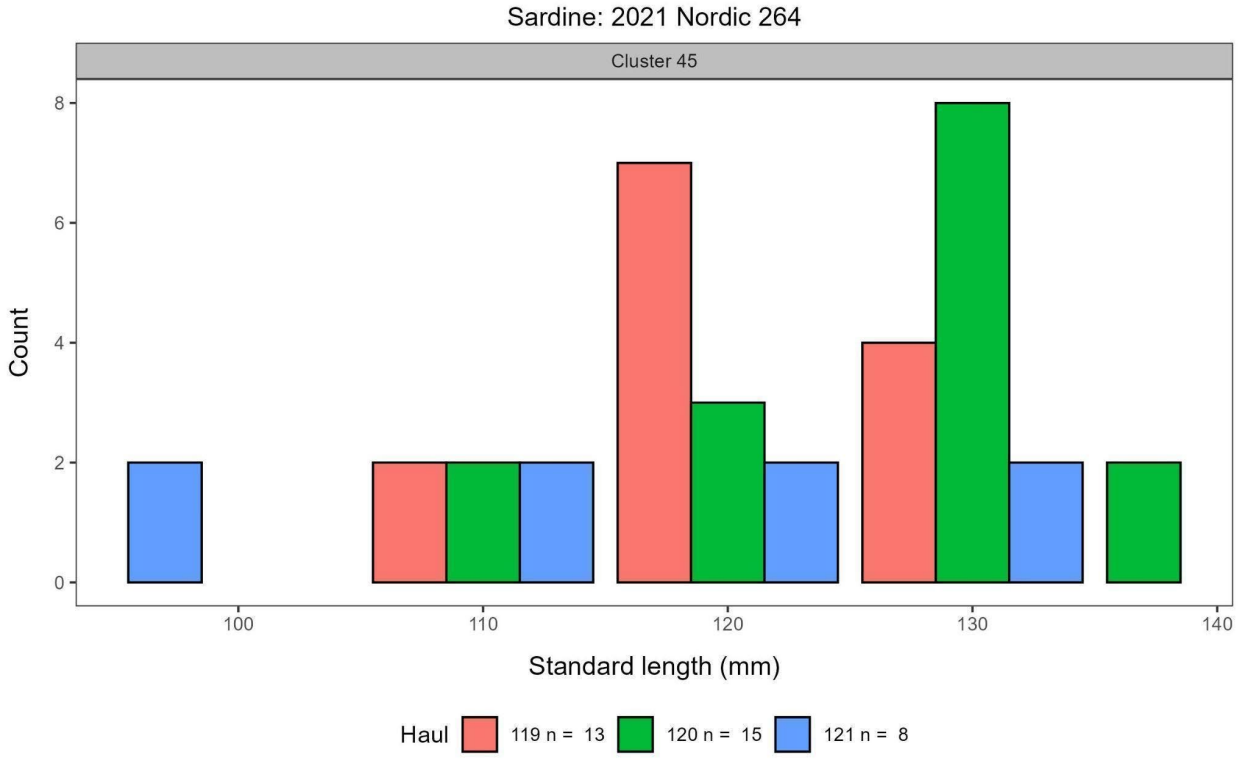

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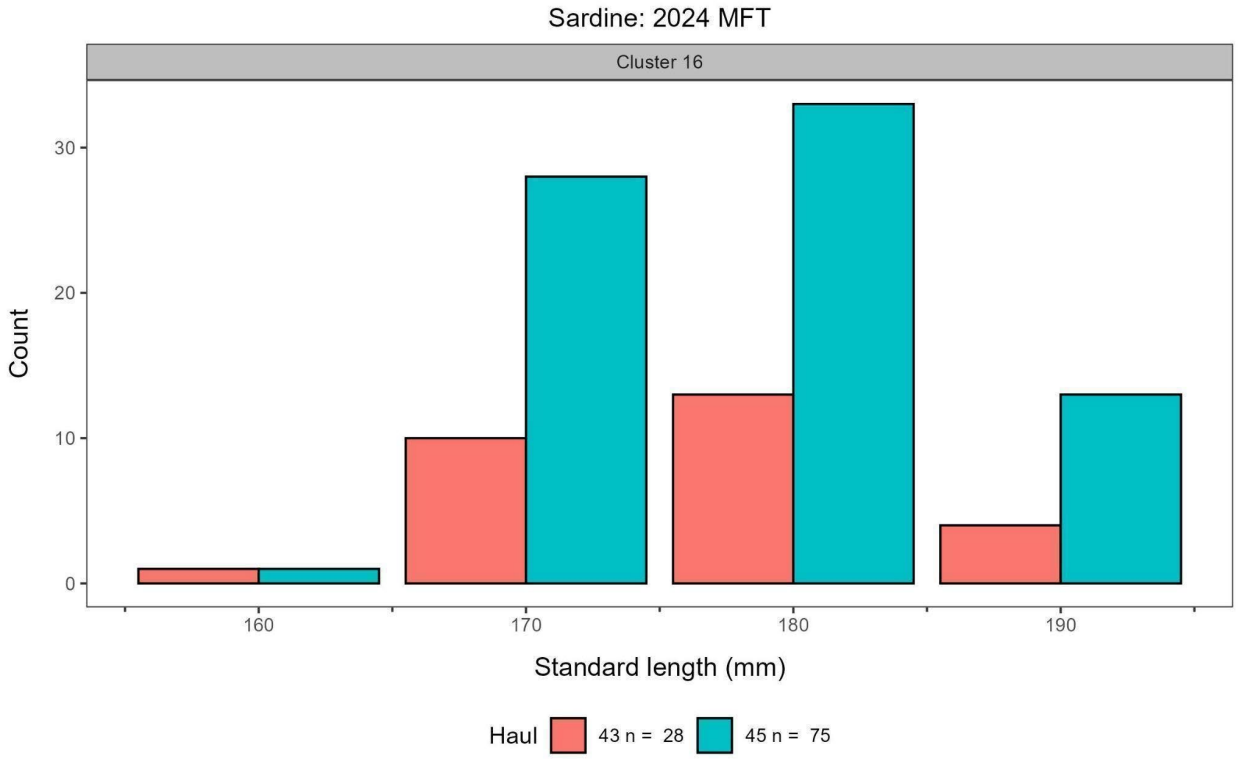

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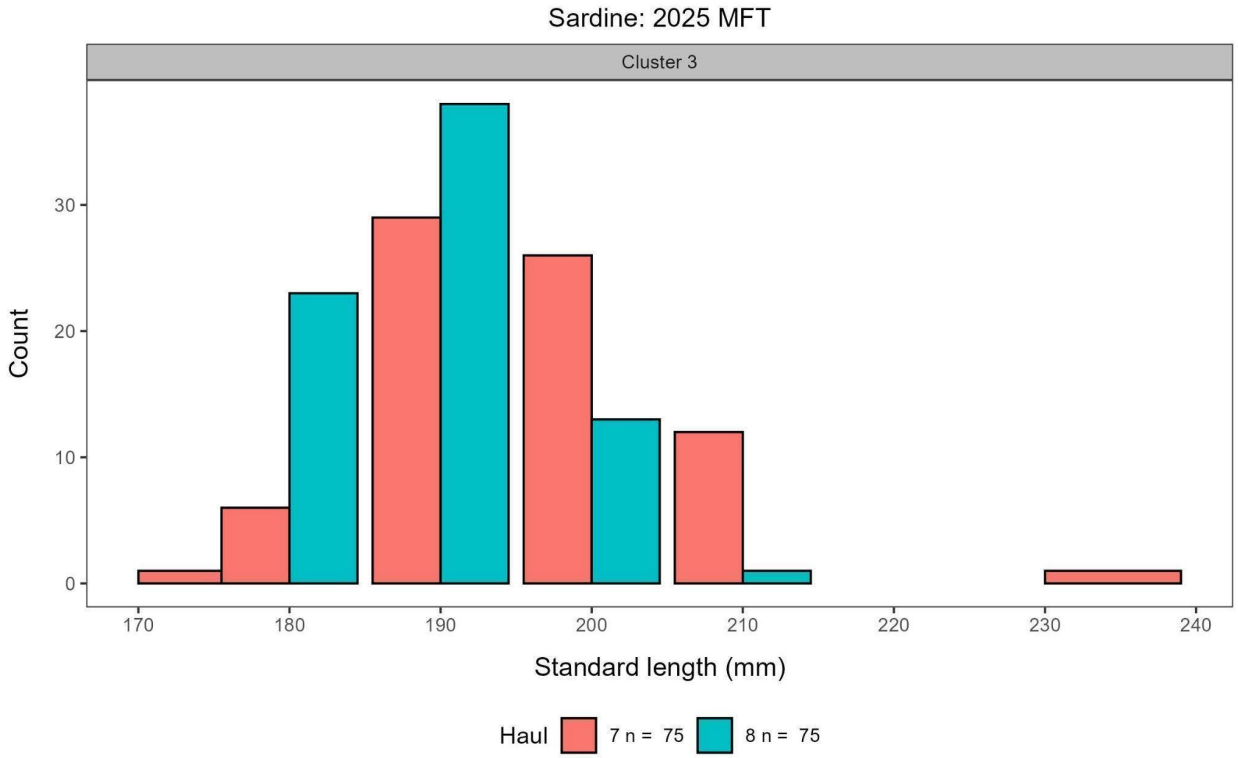

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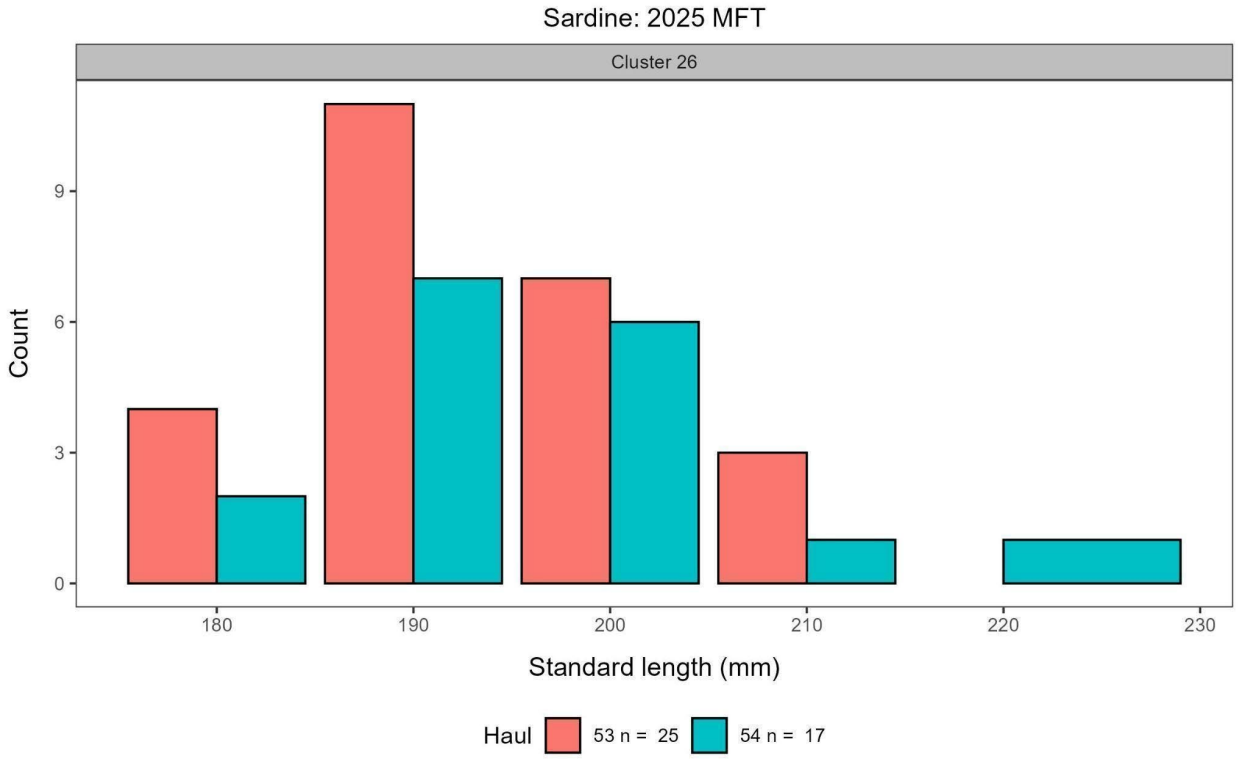

Figure 1. Length-composition among hauls in two clusters for two years of the Nordic and two years of the MFT for Sardine. Includes all panels above.

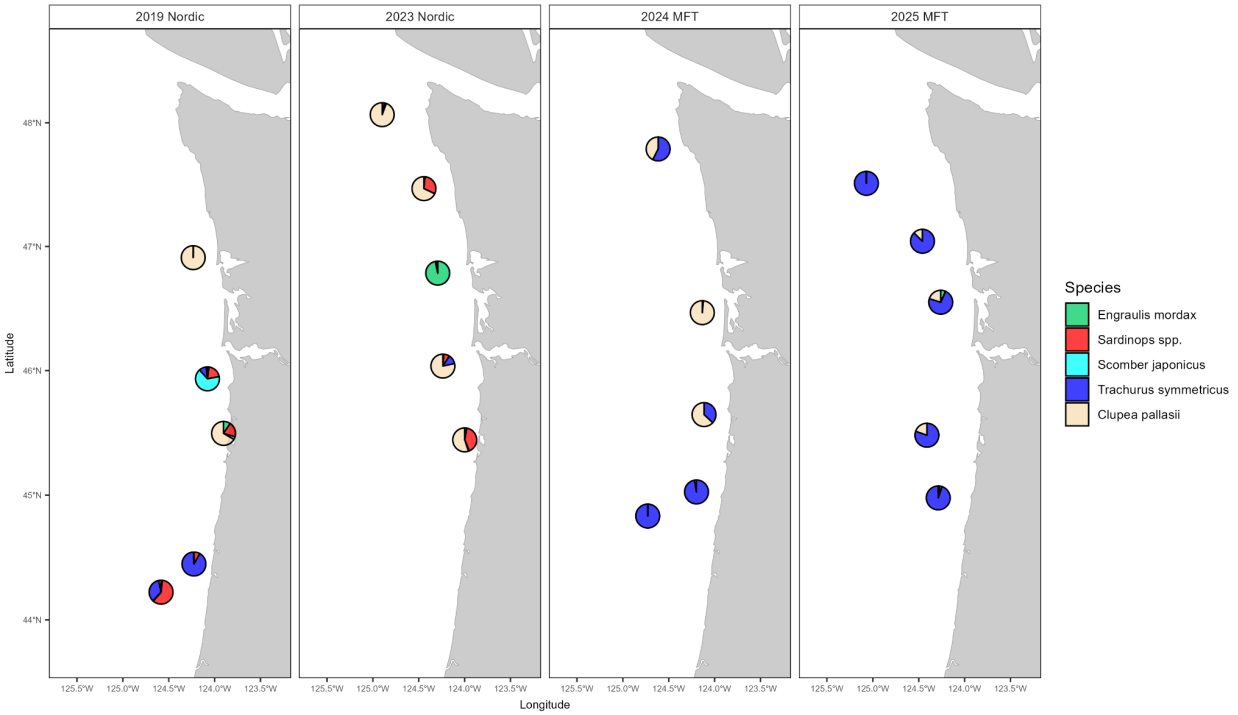

Figure 2. Species catch proportions within selected, spatially references trawl clusters for Nordic 264 (2019, 2023) and MFT (2024, 2025) survey years.

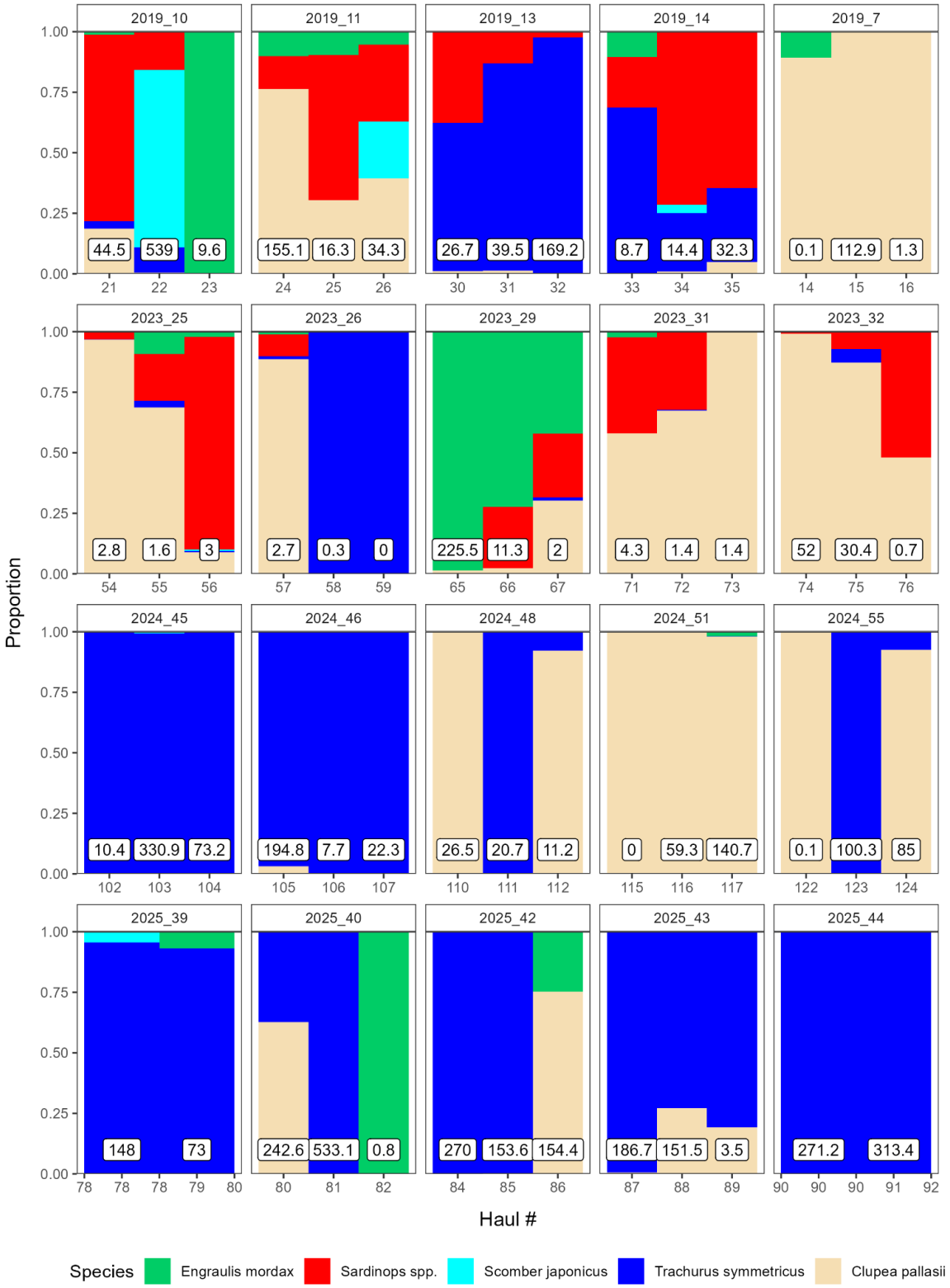

Figure 3. Within-cluster species composition variability for 2019, 2023, 2024, and 2025. Number labels indicate total haul catch weight (kg).

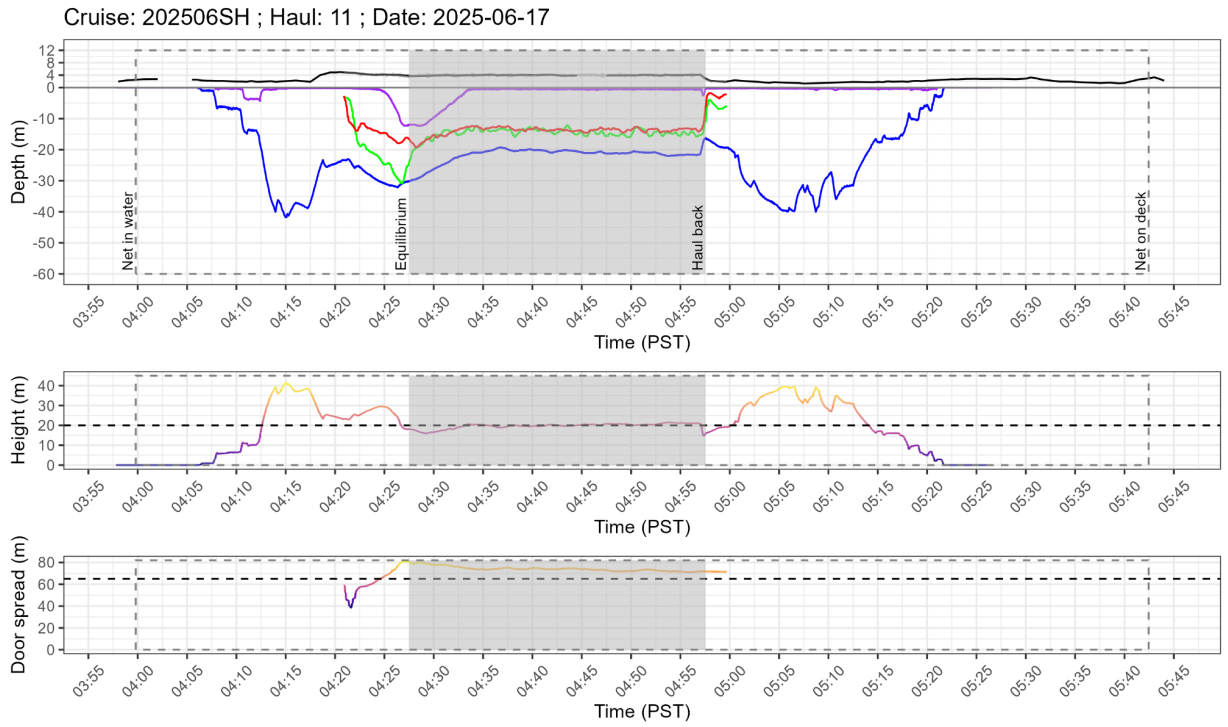

Figure 4A. Example plot of TDR and PX MultiSensor data from a typical "good" haul.

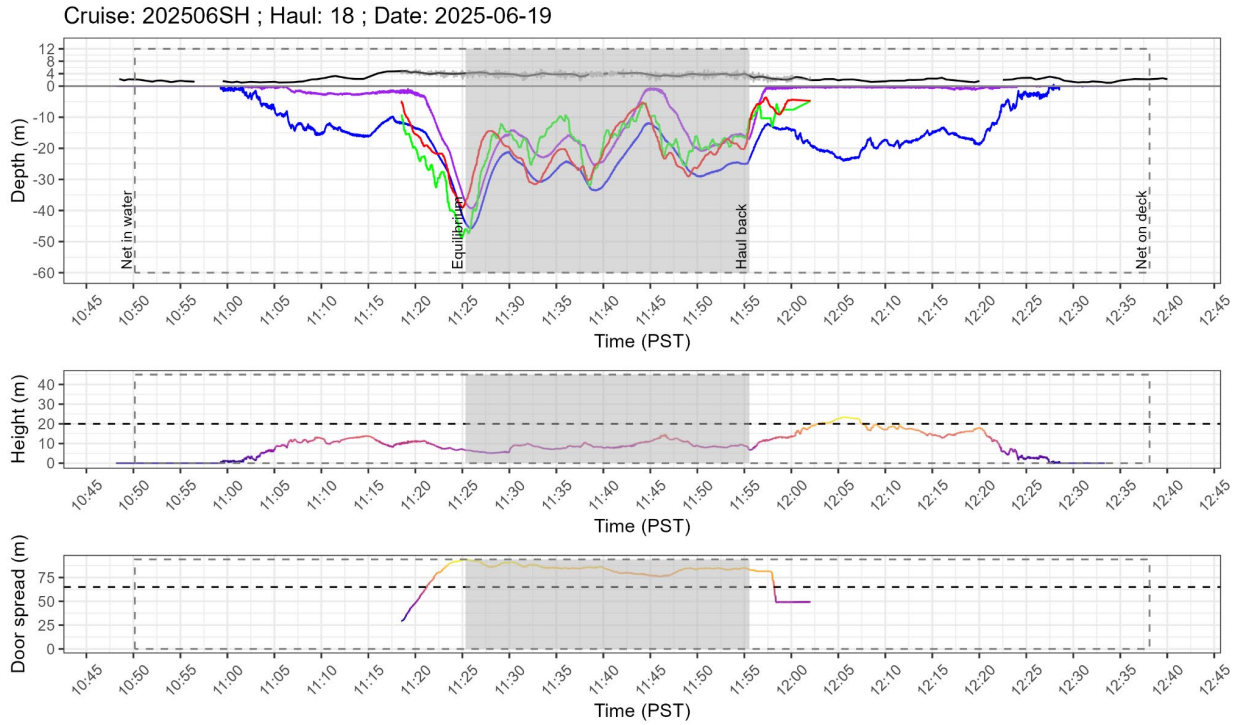

Figure 4B. Example plot of TDR and PX MultiSensor data from a "bad" haul.

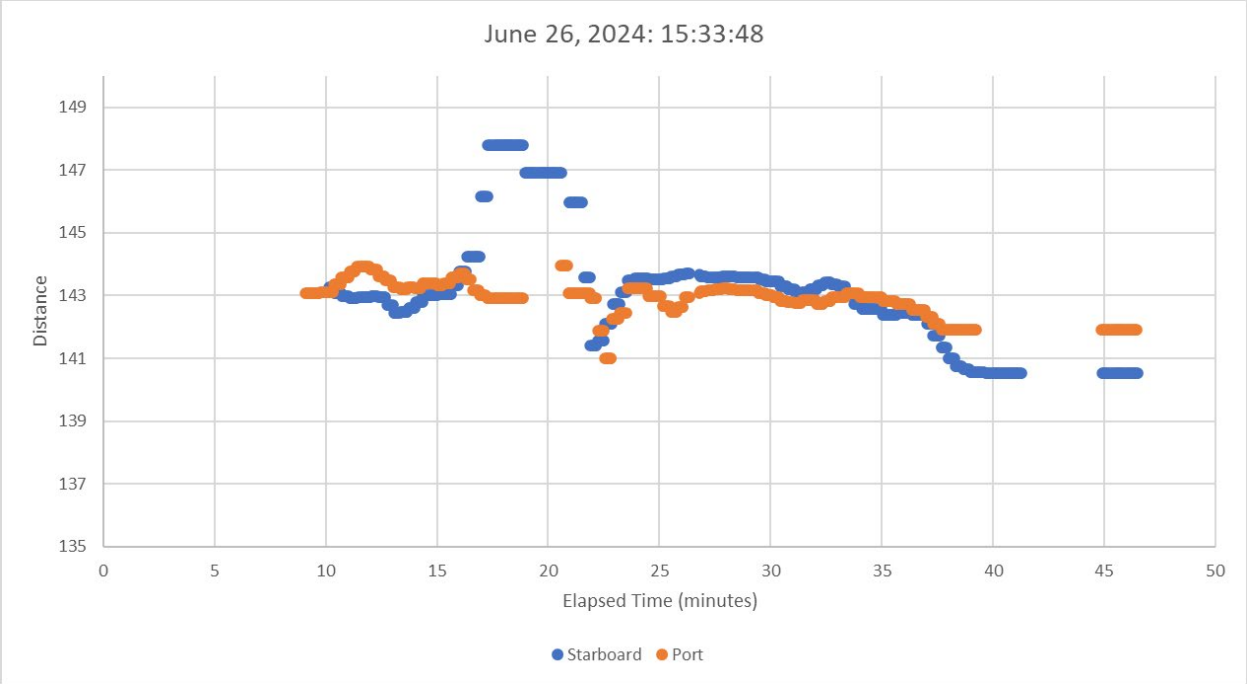

Figure 5. Example of geometry data available via the PX MultiSensors and PX Flow sensor.

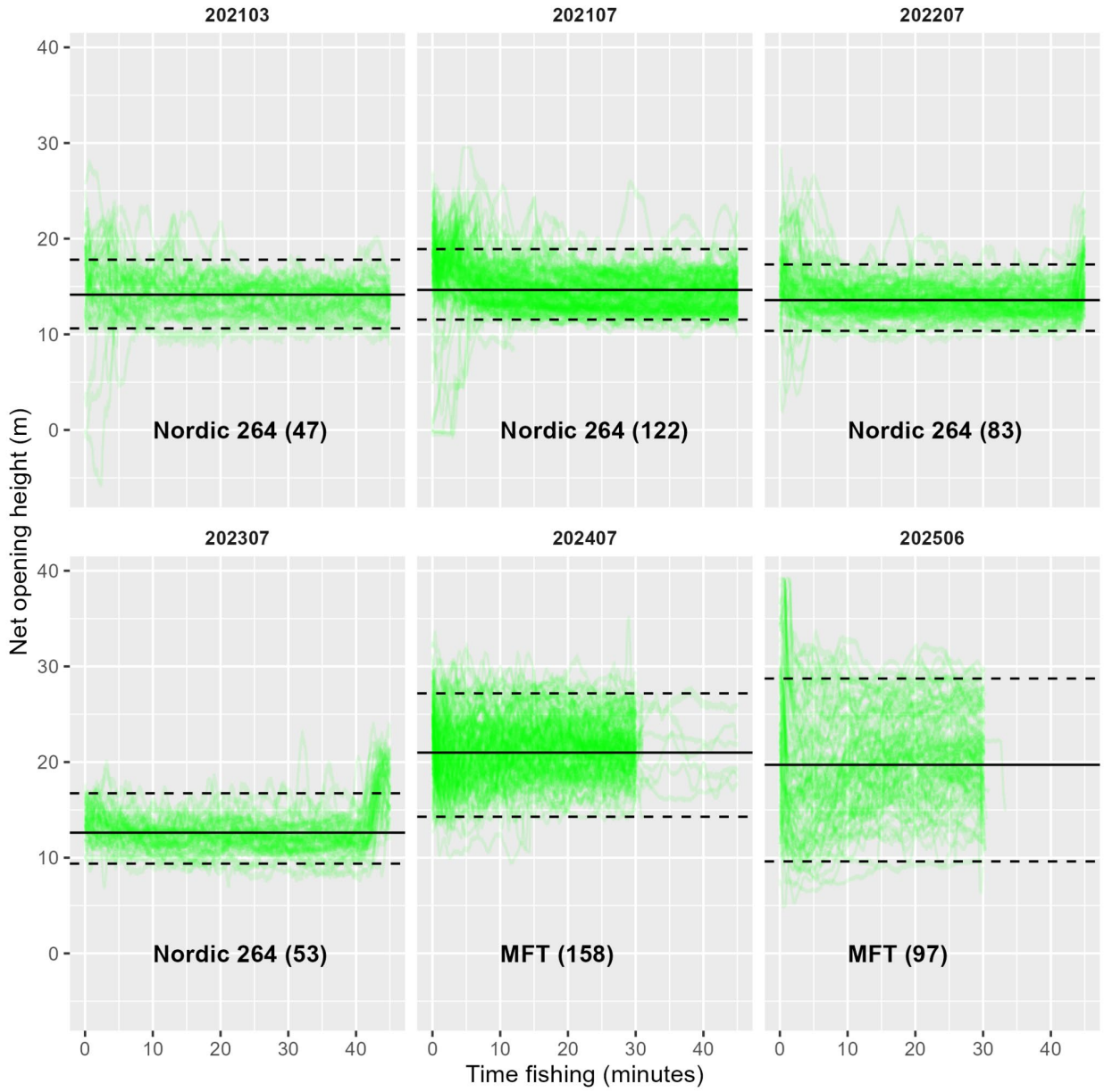

Figure 6. Net opening height for each haul within the 5% and 95% quantiles over the duration of active fishing for each cruise. The solid line is the mean net opening height. The dashed lines are the 5% and 95% quantiles. Gear type and number of hauls plotted is noted for each cruise.

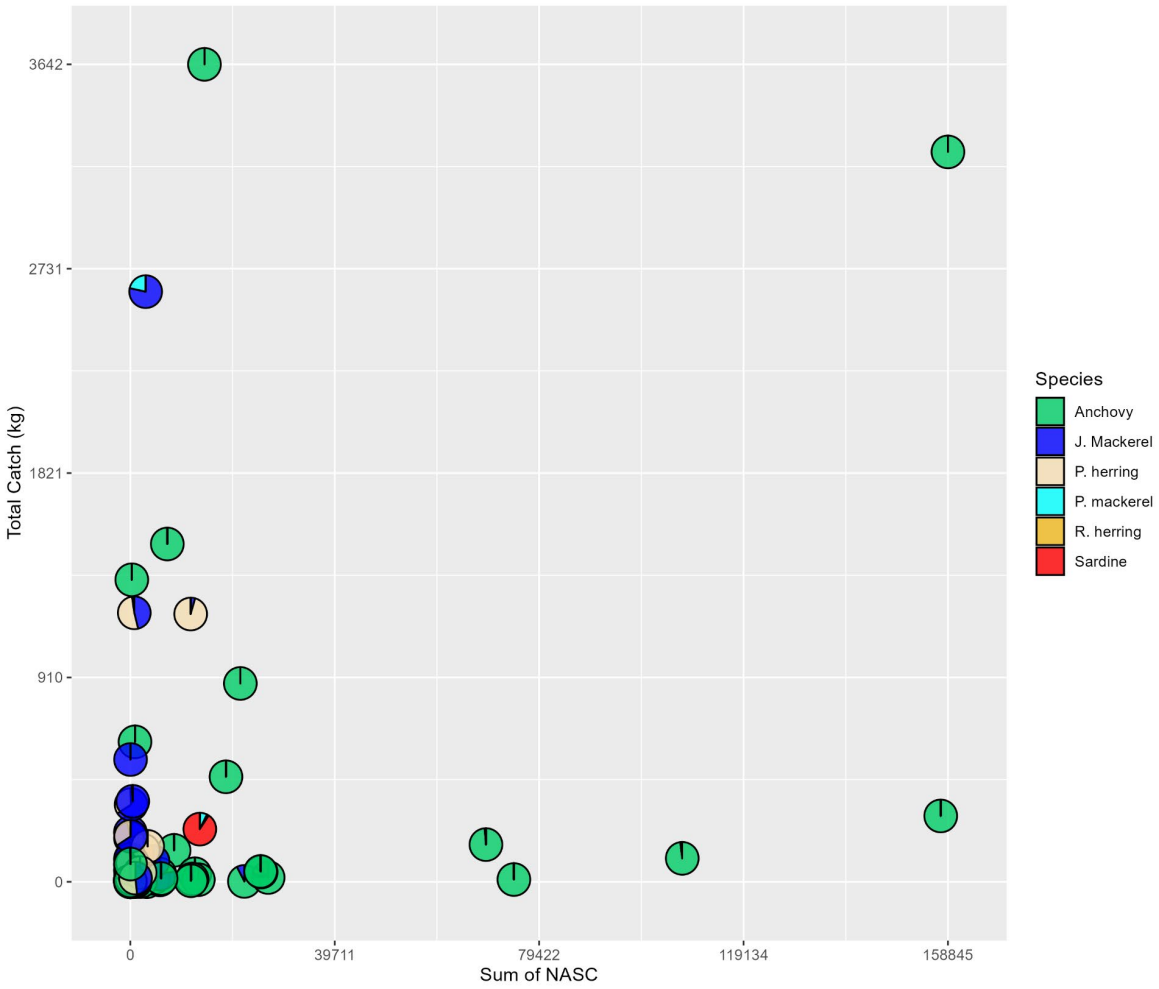

Figure 7. Total CPS catch vs integrated CPS backscatter based on acoustics and trawling at night.

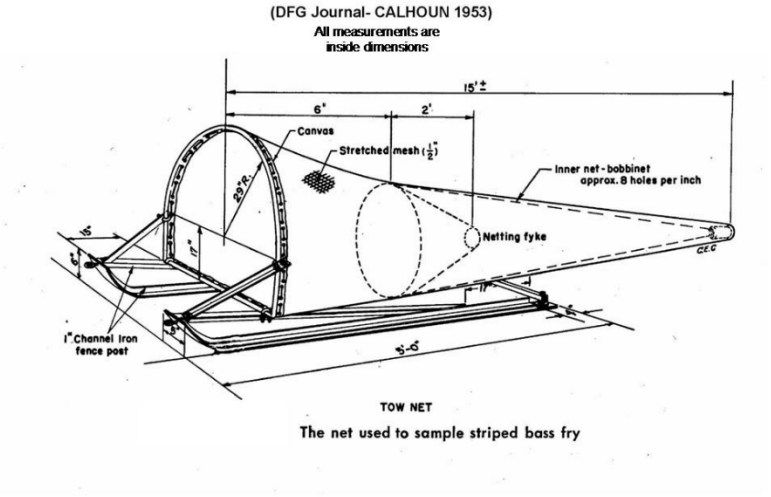

Figure 8. Townet option for a platform to mount stereo cameras on front bracing to observe length and species composition of schools detected in acoustic survey during daytime operations.

Appendix 2: List of Participants

Methodology Review Panel Members:

André Punt (Chair), Scientific and Statistical Committee (SSC), University of Washington
John Budrick, Scientific and Statistical Committee (SSC), California Department of Fish and Wildlife
Olav Rune Godø, Center for Independent Experts (CIE)
Michael Hinton, Scientific and Statistical Committee (SSC), IATTC, retired.
Larry Jacobson, Center for Independent Experts (CIE)

Pacific Fishery Management Council (Council) Representatives:

Lisa Hillier, Coastal Pelagic Species Management Team (CPSMT)
Mark Fina, Coastal Pelagic Species Advisory Subpanel (CPSAS)
Katrina Bernaus, Council Staff

Acoustic-Trawl Method Technical Team*:*

Annie Yau, SWFSC
Brad Erisman, SWFSC
Kelsey James, SWFSC
Alexander Jensen, SWFSC
Bryan Overcash, SWFSC
Josiah Renfree, SWFSC
Brittany Schwartzkopf, SWFSC
Kevin Stierhoff, SWFSC
Juan Zwolinski, University of CA, Santa Cruz and SWFSC

Other:

Owen Hamel, SSC, NWFSC
Francisco Werner, SSC
Steve Crooke, CPSAS
Matt Everingham, CPSAS
Brian Hoover, CPSAS
Trung Nguyen, CPSMT, CDFW
Kirk Lynn, CPSMT, CDFW
Nick Wegner, CPSMT, SWFSC
Caitlin Allen Akselrud, SWFSC
Matthew Craig, SWFSC
Emmanis Dorval, SWFSC
John Hyde, SWFSC
Peter Kuriyama, SWFSC
Melissa Liotta, SWFSC
Freddie Logan, SWFSC
Will Satterthwaite, SWFSC
Steve Teo, SWFSC
Zachary Skelton, SWFSC

William Watson, SWFSC
Sabrina Beyer, NWFSC
Julia Clemons, NWFSC
Elizabeth Phillips, NWFSC
John Pohl, NWFSC
Rebecca Thomas, NWFSC
Katie Davis NMFS, WCR
Laura Gray, NMFS WCR
Joshua Lindsay, NMFS WCR
Chelsea Protasio, CDFW
Greg Shaughnessy, Ocean Gold Seafoods
Diane Pleschner-Steele, California Wetfish Processors Association

Appendix 3: Panel Biographical Summaries

André E. Punt is a Professor of Aquatic and Fishery Sciences at the University of Washington, Seattle. He received his B.Sc, M.Sc and Ph.D. degrees in Applied Mathematics at the University of Cape Town, South Africa. Before joining the University of Washington, André was a Principal Research Scientist with the CSIRO Division of Marine and Atmospheric Research. His research interests include the development and application of fisheries stock assessment techniques, bioeconomic modelling, and the evaluation of the performance of stock assessment methods and harvest control rules using the Management Strategy Evaluation approach. He has published over 450 papers in the peer-reviewed literature, along with over 400 technical reports. André is currently a member of the Scientific and Statistical Committee (SSC) of the Pacific Fishery Management Council and chair of its Coastal Pelagic Species subcommittee, the Crab PLAN Team of the North Pacific Fishery Management Council, and the Scientific Committee of the International Whaling Commission.

John Budrick is a Senior Environmental Scientist with the California Department of Fish and Wildlife. He received his B.Sc and Ph.D from University of California at Berkeley in Environmental Science, Policy and Management, focusing on use population genetics to inform spatial structure of assessments and management. Early in his career, he worked with the Pacific Herring survey in San Francisco Bay using midwater and acoustic methods. In addition, he was the lead biologist for the Pelagic Organism Decline project with the Department using midwater and tow net surveys to sample the endangered Delta smelt and threatened longfin smelt. Thereafter, he was the California representative to the Groundfish Management Team of the Pacific Fishery Management Council for eight years. In his twenty years with the Department, the last ten have been as a member of the Scientific and Statistical Committee contributing to stock assessments, methodology reviews, stock assessment reviews and other science informing management in the Pacific Fishery Management Council.

Michael G. Hinton (Senior Scientist Emeritus, Inter-American Tropical Tuna Commission) was a member of the scientific staff of the IATTC from 1986-2016. He was responsible for research and assessments of billfish resources in the eastern Pacific Ocean. His research interests focused on investigation of integrated biological- and ocean-system models using real-time satellite-based ocean data. Michael supervised the IATTC Tuna/Billfish statistics and data systems and the operations of IATTC field stations in Central and South America (1986-2011). He has served on a number of international and national committees, among them are the Steering Committee for the Fishery Resource Monitoring System (FIRMS: firms.fao.org/firms), the United States Argo Science and Implementation Panel, and the Billfish Working group of the International Scientific Committee for Tunas and Tuna-like Species in the North Pacific. Dr. Hinton served (2000-2020) as a member of the adjunct/affiliated faculty of the Environmental and Ocean Sciences program, University of San Diego. He is a Fellow of the American Institute of Fisheries Research Biologists. Prior to coming to the IATTC in 1986, he was with the Tulalip Tribes of Washington, where he was responsible for stock assessment and management of salmon resources. He is a member of the Scientific and Statistical Committee (SSC) of the Pacific Fishery Management Council. Dr. Hinton holds a B.S. (*cum laude*) and M.S. from the University of Washington, Seattle, and a Ph.D. from Scripps Institute of Oceanography, University of California, San Diego.

Larry Jacobson has a PhD in Fisheries Science from the University of Minnesota and has been a practicing fisheries scientist and stock assessment specialist since 1986. He has worked on invertebrate and finfish fisheries in the Southern Ocean, Eastern and Western Pacific, and Atlantic oceans as well as the Great Lakes of North America. He has led or served on teams for 93 stock assessments (including those for Pacific sardine, northern anchovy and Pacific mackerel) and published 42 peer-reviewed papers in scientific journals. He has been a member of multiple US and international scientific review committees, including as a CIE reviewer and the committee chair. He was a member of the Pacific Fishery Management Council's Scientific and Statistical Committee (1995-1998), including as chair of its Groundfish Subcommittee (1996-1999). He was a member of Northern Anchovy Fishery Management Plan Development Team (1989-1991), co-chair of the Coastal Pelagic Fisheries Management Plan Development Team (1991-1998), and Chair of the Invertebrate Subcommittee, Northeast Stock Assessment Workshop (SAW) (1999-2019). Much of his work after 1989 involved survey and commercial gear catchability/selectivity studies in the field and laboratory, including survey design, planning for sampling at sea, statistical model development, modeling and review of procedures and results. He led a cooperative experiment to measure sea scallop shell height measurement errors in visual and dredge surveys and then accounted for the errors in the stock assessment, reinterpreted deep sea red crab data from a visual transect survey and led teams that designed and conducted depletion experiments at sea for Atlantic surfclam and ocean quahog to estimate commercial and survey gear efficiency. He has interpreted ichthyoplankton survey data for Pacific sardine and northern anchovy as well as acoustic data for Atlantic herring. Larry retired in 2018 and is now a fisheries consultant.

Olav Rune Godø retired from his senior scientist position at Institute of Marine Research and is now senior advisor at Christian Michelsen Research. He received his Cand. real. in fisheries biology and his Ph.D. in marine survey methodologies, both at the University of Bergen. He has worked in the demersal fish department, served as section head in the pelagic fish department before building a new group in survey methodology, all duties at the Institute of Marine Research. In recent years his focus has been development of marine ecosystem acoustics. His research interests include trawl-acoustic survey methodology, fish behavior, biophysical interaction and fisheries-induced evolutionary changes. During the last 5 years of his career at Institute of Marine Research he was Norwegian representative to CCAMLR (Commission for Conservation of Antarctic Marine Living Resources). He has published about 100 publications in peer-reviewed journals and in addition to several book chapters and a number of technical papers and reports. Dr. Godø has served on the board of four research programs of the Research Council of Norway, has been a member of the scientific steering committee of Census of Marine Life and a member of a SCORE WG on observation methods. He also has been a member of several ICES working groups.

Appendix 4: Documents provided to the Panel before the meeting

Document prepared for the meeting

Erisman, B., James, K., Jensen, A., Overcash, B., Renfree, J., Schwartzkopf, B., Kevin Stierhoff, K. and Zwolinski, J. Assessment of the Multi-Function Trawl Net system for Acoustic-Trawl Surveys of Coastal Pelagic Species in the California Current Ecosystem for the Integrated West Coast Pelagics Survey.

Stierhoff, K.L, Renfree, J.S. and Zwolinski, J.P. Distribution, biomass, and demographics of coastal pelagic fishes in the California Current Ecosystem during summer 2025 based on acoustic-trawl sampling.

Other documents provided to the Panel

Allen Akselrud, C., Jensen, A.J., Kuriyama, P.T., Hill, K.T. and Zwolinski, J.P. 2025. Update assessment of the Pacific sardine resource in 2025 for U.S. management in 2025-2026. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-719. https://doi.org/10.25923/z1xh-b932.

Jensen, A.J., Allen Akselrud, C., Zwolinski, J.P., Kuriyama, P.T. and Kevin T. Hill. 2025. Catch-only stock assessment of Pacific mackerel (*Scomber japonicus*) for U.S. management in the 2025-26 and 2026-27 fishing years. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-718. https://doi.org/10.25923/t6rp-yj85.

Kuriyama, P.T., Allen Akselrud, C., Zwolinski, J.P. and Hill, K.T. 2024. Assessment of the Pacific sardine resource (*Sardinops sagax*) in 2024 for U.S. management in 2024-2025. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-698. https://doi.org/10.25923/jyw3-ys65.

Kuriyama, P.T., Zwolinski, J.P., Teo, S.L.H. and Hill, K.T. 2022. Assessment of the Northern anchovy (*Engraulis mordax*) central subpopulation in 2021 for U.S. management. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-665. https://doi.org/10.25923/jv24-1539.

Pacific Fishery Management Council. 2018. Methodology review panel report: Acoustic trawl methodology review for use in coastal pelagic species stock assessments. https://www.pcouncil.org/documents/2018/04/agenda-item-c-3-attachment-2.pdf.

Shaughnessy, G. 2025. Bridging Science and Industry: Next-Generation Multi-Function Trawl System for NOAA's Fisheries Research. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-722. https://doi.org/10.25923/zawd-1675.

Stierhoff, K.L., Renfree, J.S., and Zwolinski, J.P.. 2025. Distribution, Biomass, and Demographics of Coastal Pelagic Fishes in the California Current Ecosystem During Summer 2024 Based on Acoustic-Trawl Sampling. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-721. https://doi.org/10.25923/v99f-me72.

Stierhoff, K.L., Zwolinski, J.P. Renfree, J.S. and Demer, D.A. 2024. Distribution, biomass, and demographics of coastal pelagic fishes in the California Current Ecosystem during summer 2023 based on acoustic-trawl sampling. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-703. https://doi.org/10.25923/1vgs-sf98.

Appendix 4: In memoriam: Mike Okoniewski (Greg Shaughnessy)



Mike was a champion for fisheries, deeply committed to science-based data collection, thoughtful review, and informed recommendations to the Pacific Fishery Management Council. He possessed a remarkable understanding of the process and shared that knowledge generously. Mike had a gift for explaining complex fisheries issues with calm clarity and steady conviction. His voice carried weight not because it was loud, but because it was informed, principled, and sincere.

Michael Mathew Okoniewski passed away on January 9, 2026, with Nancy, his devoted wife of 30 years, by his side, after a determined five-year struggle with heart disease. He was 78 years old. He is survived by his son, Jordan, and daughter-in-law, Shelby, both committed educators who carry forward his dedication to service and learning. Mike deeply loved his family and held close the many meaningful connections he built throughout our industry. To him, those relationships were rooted in loyalty, shared values, mutual respect and trust.

Mike's fishing circle was made up of many within the science and Council community. The same people who worked alongside him in research and policy were often beside him on the water, reflecting the deep bonds he built both professionally and personally.

Mike was fond of telling everyone about his brother Steve and his accomplishments in the NFL. He would want me to tell you about Steve being the 45th pick in the 1972 NFL draft. He played for the Buffalo Bills, Green Bay Packers, and the St. Louis Cardinals as a defensive tackle.

Mike joined Pacific Seafood in 1994 as a warehouse manager and quickly moved up the ranks. Mike was part of a core team that built, expanded, and modernized Pacific Seafood into the industry leader it is today. Mike took an early interest in the development of the reemerging sardine fishery in the Pacific Northwest. He wanted to assure access for the fishers, processors, and

markets. During this time, Mike built lasting friendships with the good folks at the SWFSC, UW, and OSU.

Mike was one of the most passionate fishery advocates on the West Coast. Throughout his career, he earned the respect of colleagues not only as a skilled professional, but as a generous mentor, sharing his knowledge and hard-earned wisdom with patience and care. Over the years, Mike dedicated himself to countless advisory and leadership roles within the fisheries community. He served on the Groundfish and Coastal Pelagic Advisory Subpanels and the Marine Planning Committee for the Pacific Fishery Management Council. He contributed to the Marine Resource Education Program, advised Positively Groundfish, participated in the Columbia Basin Task Force, the annual Sardine Tri-national, and was a founding member of the West Coast Pelagic Conservation Group. Each role reflected his deep commitment to stewardship and sound, science-based policy.

Mike was deeply committed to ensuring access to healthy fisheries and strongly supported meaningful investment in science and research. He understood that responsible stewardship required sound data and long-term thinking and believed that providing healthy protein began with healthy fish stocks, sustainably managed for the enduring benefit of our fishermen, our communities, and our nation. For Mike, sustainability was not optional — it was essential.

Thanks for this opportunity to remember our good friend Mike O.

