COMMITTEE STAFF SUMMARY FOR NOVEMBER 16, 2023 MRC

2. EVALUATION OF BYCATCH IN THE CALIFORNIA HALIBUT SET GILLNET FISHERY IN SUPORT OF THE FISHERY MANAGEMENT REVIEW

Today's Item **Information ☐** **Action ☒**

Receive and discuss potential management measures proposed by the Department to address bycatch concerns and information gaps in the California halibut set gillnet fishery, provide direction on next steps, and potentially develop committee recommendation.

Summary of Previous/Future Actions

• Commission referred California halibut management review to MRC	August 19-20, 2020
• Commission referred bycatch evaluation for California halibut management review to MRC	December 15-16, 2021
• MRC received updates on bycatch evaluation	March 24 and July 14, 2022; MRC
• MRC received Department bycatch evaluation report; MRC recommendation to conduct bycatch acceptability evaluation for set gill nets (approved by Commission in December 2022)	November 17, 2022; MRC
• MRC received Department updates on bycatch evaluation for the California halibut gill net fishery	March 14 and 16, 2023; MRC
• MRC received and discussed Department evaluation of bycatch acceptability; MRC recommendation for potential management measures to reduce bycatch (approved by the Commission in August 2023)	July 20, 2023; MRC
• **Today receive and discuss management measures to address gillnet bycatch; potential MRC recommendation**	**November 16, 2023; MRC**

Background

Management review of the California halibut fishery commenced in late 2020, consistent with the requirements of the Marine Life Management Act (MLMA) and using the framework outlined in *2018 Master Plan for Fisheries, A Guide for Implementation of the Marine Life Management Act* (master plan) for meeting those requirements. A key requirement of the fishery management review is evaluating and addressing unacceptable bycatch in a way that limits bycatch to acceptable types and amounts.

The California halibut fishery management review has presented the first opportunity to use the four-step framework for evaluating bycatch laid out in Chapter 6 of the master plan, to: collect information on the type and amount of catch (Step 1); distinguish target, incidental, and bycatch species (Step 2); determine "acceptable" types and amounts of bycatch (Step 3); and address unacceptable bycatch (Step 4). See Exhibit 1 for background information about the development and completion of steps 1 and 2 for the California halibut set gill net and trawl fisheries.

For steps 3 and 4 of the bycatch evaluation framework, MRC recommended and the Commission supported separating set gill nets from trawl fisheries. The Commission is currently focused on completing steps 3 and 4 of the bycatch evaluation framework for set gill nets before transitioning to trawl fisheries.

In July 2023, the Department presented its California halibut set gill net bycatch evaluation report that included analysis of the master plan bycatch inquiries for twelve species, thereby fullfilling Step 3 of the bycatch evaluation framework. See Exhibit 2 for background information about the development and completion of Step 3.

Following in-depth dialogue among diverse partcipants and the Department, MRC recommended the bycatch evaluation framework proceed to Step 4, to develop potential management measures for reducing bycatch within the California halibut targeted fishery, noting the measures would also apply to other set gill net target fisheries. MRC recommended the Department focus on potential management measures in 11 categories: (1) soak time limits, (2) gear marking (to address potential for undocumented entanglements), (3) fisher-suggested bycatch reduction measures (e.g., reduced gill net height [mesh depth]), (4) gear loss reporting, (5) logbook improvements, (6) electronic monitoring technology, (7) observer coverage, (8) potential limits on permit transferability and/or retiring latent permits, (9) non-retention of giant sea bass and white sharks (may require legislative action), (10) temporal closures, and (11) other measures that may reduce bycatch and/or discard mortality of white sharks and tope sharks.

In August 2023, the Commission approved the MRC recommendation and requested that the Department develop the potential measures in consultation with fishery participants and stakeholders. In addition, the Commission requested the Department look into the potential ramifications of leglislative action to prohibit retention of white sharks, such as possible negative effects to white shark researchers who have historically utilized commercial set gill nets to assist with research initiatives.

Update

In response to the Commission's request, Department staff has had meetings with set gillnet fishermen and has met with representatives from environmental non-governmental organizations (ENGOs) to discuss potential management measures that would address bycatch concerns that are congruently feasible for the fleet. Department staff met with set gillnet fishermen in person the week prior to the November MRC meeting, to further discuss management options and Department recommendations. In addition, Commission and Department staff met with staff from the National Marine Fisheries Service to discuss and better understand entanglements of marine mammals within the set gillnet fishery, and met with academics regarding options to reduce byatch mortality of sensitive elasmobranch species (such as certain sharks).

Today's Meeting

The Department will present a summary of outreach efforts to engage the set gillnet fleet and interested stakeholders, present the findings and options for potential management measures, and highlight areas for potential MRC guidance (Exhibit 3). The Department identifies near-

term recommendations, including a proposal for regulation changes (referred to as “Phase 1”) consisting of soak time limits, increased gear markings, and mesh depth limits (management measures 1, 2 and 3), as well as developing a pilot project for electronic monitoring, electronic logbooks, and observer coverage (management measures 5, 6 and 7) intended to improve data collection. The proposed improvements could help fill data gaps and provide information needed to inform the development of other management measures (such as 10 and 11); as a result, the other measures may require more time to fully develop for a potential, subsequent rulemaking once data gaps are filled. The Department currently does not have recommendations for the remaining management measures (4, 8 and 9) but will discuss their exploration at today’s meeting.

Lastly, consistent with the Commission’s request, the Department will share data on commercial white shark landings and highlight that white sharks caught in set gill nets have not been utilized for research purposes since 2012.

Today’s discussion is intended to help shape a potential MRC recommendation.

Significant Public Comments

1. Four ENGOs (exhibits 4-7) and a joint letter signed by 27 ENGOs (Exhibit 8) support pursing management measures consistent with Commission direction, and offer recommendations for specific measures, including:
    - A 24-hour soak time limit (exhibits 6 – 8)
    - Temporal closures to protect tope (aka soupfin) sharks (exhibits 5 – 8)
    - Area closures for biodiversity hotspots, such as the Channel Islands (exhibits 6 – 8)
    - Robust gear markings (exhibits 4 and 6 – 8)
    - Gear loss reporting (exhibits 6 – 8)
    - Bycatch hard caps (exhibits 6 and, 7)
    - Prohibiting take of giant sea bass and white sharks (exhibits 4 and 7)
    - Phasing out permits (Exhibit 4)
    - Net height restrictions (exhibits 4, 7, and 8)
    - Logbook requirements (exhibits 7 and 8)
    - Observer programs (exhibits 6 – 8), for which one ENGO attached a observer program scoping report (Exhibit 7)
2. One of the ENGOs completed an analysis on the underreporting of marine mammal bycatch within California set gillnet fisheries, which it submitted by the October supplemental comments deadline and resubmitted for today’s discussion (Exhibit 9). The report compares self-reported logbook data to observer-based estimates of marine mammal take in the set gillnet fishery, concluding that only 6% of marine mammal interactions were reported by fishermen. Based on the analysis, the ENGO

advocates for resuming observer coverage, electronic monitoring, and increased logbook requirements within set gillnet fisheries to obtain accurate bycatch data.

Recommendation

Commission staff: Support the Department's near-term recommendations, and request the Department return to MRC in March 2024 with specific details for the proposed management measures and a timeline for initiating in 2024 the Department-recommended rulemaking. In addition, request that the Department continue to explore other long-term management options with fishery participants and stakeholders for a potential future rulemaking.

Department: Pursue near-term recommendations including a Phase 1 rulemaking (including soak time limits, increased gear marking, and mesh depth restrictions), and a pilot project developed to evaluate data improvements, including observer coverage and electronic logbooks and monitoring (Exhibit 3).

Exhibits

1. Staff summary from November 17, 2022 MRC meeting, Agenda Item 5 (for background purposes only)
2. Staff summary from July 20, 2023 MRC meeting, Agenda Item 3 (for background purposes only)
3. Department presentation
4. Letter from Todd Steiner, Executive Director, and Teri Shore, member of the board of directors, Turtle Island Restoration Network, received November 2, 2023
5. Letter from Ben Grundy, Associate Oceans Campaigner, Center for Biological Diversity, received November 3, 2023
6. Letter from Scott Webb, Director of Advocacy & Engagement, Resource Renewal Institute, received November 3, 2023
7. Letter from Dr. Geoff Shester, California Campaign Director & Senior Scientist, and Caitlynn Birch, Pacific Marine Scientist, Oceana, and attached observer scoping report, received November 3, 2023
8. Letter from Scott Webb, Director of Advocacy & Engagement, Resource Renewal Institute, transmitting a joint letter from 27 ENGOs, received November 3, 2023
9. Email from Caitlynn Birch, Pacific Marine Scientist, Oceana, re-submitting a letter and report that were provided to the Commission in October, related to underreporting of set gill net marine mammal bycatch, received November 3, 2023

Committee Direction/Recommendation

The Marine Resources Committee recommends that the Commission (1) support development of a rulemaking to include soak time limits, increased gear marking, and mesh depth restrictions in the set gillnet fishery, (2) add the rulemaking to the rulemaking timetable for 2024 with a specific timeline to be determined, and (3) request the Department return to the next Committee meeting with details for the proposed measures and potential timeline. In addition, support the Department pursuing a pilot project for data improvements, including observer coverage and electronic logbooks and monitoring.

COMMITTEE STAFF SUMMARY FOR NOVEMBER 17, 2022 MRC
For background purposes only

5. ASSESSING AND ADDRESSING BYCATCH IN CALIFORNIA FISHERIES

Today's Item **Information ☐** **Action ☒**

(A) ***Overview of process for evaluating and addressing fishery bycatch***
Review the four-step process for limiting bycatch to acceptable types and amounts as outlined in the 2018 Marine Life Management Act (MLMA) master plan for fisheries.

(B) ***Evaluating bycatch in the California halibut fishery***
Receive Department update on analysis of bycatch data for the California halibut fishery to support fishery management review.

(C) ***Determining acceptable bycatch types and amounts***
Discuss potential approaches to completing inquiries for determining what bycatch is "acceptable" within a specific fishery and develop potential committee recommendation.

Summary of Previous/Future Actions

• FGC referred California halibut management review to MRC	Aug 19-20, 2020; Webinar/Teleconference
• DFW update on California halibut stock assessment and management review	Mar 16, 2021; MRC, Webinar/Teleconference
• DFW update; MRC recommendation to schedule bycatch review discussion	Nov 9, 2021; MRC, Webinar/Teleconference
• FGC referred bycatch review to MRC	Dec 15-16, 2021; Webinar/Teleconference
• FGC received update on bycatch evaluation for California halibut management review	Mar 24, 2022; MRC, Webinar/Teleconference
• DFW written update on bycatch evaluation for California halibut	Jul 14, 2022; MRC, Santa Rosa
• **Today's update and discussion on bycatch evaluation for halibut; potential MRC recommendation**	**Nov 17, 2022; MRC, San Diego**

Background

The California halibut fishery is a multi-sector commercial and recreational fishery managed under FGC authority. In 2019, as part of the fisheries prioritization process required by the Marine Life Management Act (MLMA) and outlined in *2018 Master Plan for Fisheries, A Guide for Implementation of the Marine Life Management Act*, California halibut was prioritized for management review. In Aug 2020, DFW recommended that it initiate the management review process for California halibut; FGC concurred and referred the topic to MRC.

One key driver in halibut's high priority ranking included potential risks to bycatch species (including sub-legal-sized halibut) in commercial trawl and set gillnet fisheries. Bycatch, as defined by MLMA for state-managed fisheries, means "…*fish or other marine life that are taken in a fishery but are not the target of the fishery. Bycatch includes discards*" (California Fish and Game Code Section 90.5). MLMA requires that DFW manage every sport and commercial

marine fishery in a way that *limits bycatch to acceptable types and amounts* (Fish and Game Code Section 7056(d)), and specifies information, analysis, and management measures required to accomplish this for each fishery (Fish and Game Code Section 7058).

The master plan established a bycatch evaluation framework in Chapter 6 (“Ecosystem-based objectives") as guidance for achieving the requirements of Section 7058. The framework is detailed in a section titled “Limiting bycatch to acceptable types and amounts” (Exhibit 1). The section draws largely from the work of a group of diverse stakeholders, called the Bycatch Working Group, convened by FGC in 2015 to help inform review of bycatch management. The framework in the master plan is, in part, designed to help determine what constitutes “acceptable types and amounts” of bycatch for each fishery evaluated.

The California halibut fishery management review presents the first opportunity to utilize the master plan’s bycatch evaluation framework. In Dec 2021, FGC requested that MRC pursue the halibut bycatch evaluation as a separate work plan topic from the related fishery management review that the bycatch evaluation will inform, to ensure robust public engagement through this first evaluation process. In Mar 2022, DFW presented MRC with its approach to evaluating halibut fishery bycatch and, in Jul 2022, DFW provided a written update about its continued efforts and hurdles it is facing in analyzing halibut bycatch from the available data.

Today’s meeting is an opportunity to focus on the master plan guidance and discuss options for how to complete the steps in the process.

(A) ***Overview of process for evaluating and addressing fishery bycatch***

FGC staff will recap the four-step process laid out in the master plan framework to identify bycatch and consider its impacts (Exhibit 1):

Step 1 – Collect information on the amount and type of catch

Step 2 – Distinguish target, incidental, and bycatch species

Step 3 – Determine “acceptable” types and amounts of bycatch

Step 4 – Address unacceptable bycatch

Note that today’s meeting is focused on steps 1-3.

(B) ***Evaluating bycatch in the California halibut fishery (steps 1 and 2)***

Consistent with MRC discussion in Jul 2022, DFW has provided the recently-completed bycatch assessment report for the trawl and set gillnet California halibut fisheries that DFW developed in collaboration with an academic partner, which authored the final report (Exhibit 2). DFW believes that the report accomplishes the goals of steps 1 and 2 and is adequate to support the Step 3 analysis. DFW will present an overview of the complex assessment, methods and results—to help build a common understanding of the foundational data that can support the Step 3 evaluation of bycatch acceptability—and potential next steps for MRC consideration (Exhibit 3).

(C) ***Determining acceptable bycatch types and amounts (Step 3)***

The master plan specifies that DFW will determine if the amount and type of bycatch is unacceptable for a particular fishery using four criteria mandated in MLMA (Fish and Game Code Section 7058):

1. Legality of take of bycatch species
2. Degree of threat to the sustainability of the bycatch species
3. Impacts on fisheries that target the bycatch species
4. Ecosystem impacts

The master plan bycatch evaluation framework (Exhibit 1) lays out a detailed series of inquiries and recommended actions for each criterion under Step 3 that would be applied to each species of bycatch. The inquiries provide a structural basis for managers to consistently assess each criterion to determine what is "acceptable" bycatch in the fishery and to articulate the findings. However, given the number of bycatch species and the detailed inquiries that would need to be applied to each, it is necessary to prioritize which species to include in the Step 3 assessment. It is possible that selecting a handful of representative species for the assessment would be sufficient, as the benefit of proposed management actions will likely have benefits across multiple species.

Today's meeting provides an opportunity to explore how DFW might accomplish the bycatch inquiries for California halibut in a manner that is transparent, inclusive and timely. This discussion will inform MRC's direction or potential recommendation regarding an approach.

Significant Public Comments

A joint comment from two environmental non-governmental organizations emphasizes the importance of FGC's commitment to minimize fishery bycatch, with an initial focus on California halibut trawl and gill net gears, consistent with DFW's ecological risk assessment and prioritization. The organizations have conducted their own bycatch assessments of trawl and set gillnet gear in California using federal observer data and request a collaborative approach to implementing the bycatch inquiry. They also request that MRC provide direction on what additional analyses are needed and to outline the public process and timeline MRC will follow to make a recommendation to FGC (Exhibit 4).

Recommendation

FGC staff: (1) Recommend FGC support DFW moving forward with Step 3 of the bycatch evaluation to determine bycatch acceptability, using the bycatch analysis report DFW provided today (Exhibit 2) and a DFW-led workgroup of key communicators representing various interests to provide a forum for discussing responses to the Step 3 inquiries prior to bringing recommendations to MRC. (2) Recommend using MRC as a forum for broader discussion and, ultimately, MRC recommendation to FGC on DFW's findings. (3) Provide guidance on selection of bycatch species to begin Step 3.

DFW: Move forward with Step 3 of the framework in the master plan analysis based on the information contained in the steps 1 and 2 bycatch analysis report (Exhibit 2), and provide guidance on options for public engagement in determining bycatch acceptability.

Exhibits

1. Chapter 6 – "Ecosystem-based objectives: Limiting bycatch to acceptable types and amounts", extracted from *2018 Master Plan for Fisheries, A Guide to Implementation of the Marine Life Management Act*, dated June 2018
2. Report by Christopher M. Frees, DFW contractor: *Assessment of associated landed species and bycatch discards in the California halibut gill net and trawl fisheries*, received Nov 4, 2022
3. DFW presentation
4. Letter from Geoff Shester, Oceana, and Scott Webb, Turtle Island Restoration Network, received Nov 3, 2022

Committee Direction/Recommendation

The Marine Resources Committee recommends that the Commission (1) support the Department moving forward with evaluation of bycatch acceptability based on the analysis report submitted by the Department at the committee's November 2022 meeting; and (2) request that the Department pursue the following approach for completing the inquiries within the Step 3 evaluation framework and engaging stakeholders in the process: _____
_____.

COMMITTEE STAFF SUMMARY FOR JULY 20, 2023 MRC
For background purposes only

3. EVALUATION OF BYCATCH IN THE CALIFORNIA HALIBUT SET GILLNET FISHERY IN SUPPORT OF THE FISHERY MANAGEMENT REVIEW

Today's Item **Information ☐** **Action ☒**

Receive and discuss Department report summarizing its evaluation of fisheries bycatch and acceptability in the California halibut set gillnet fishery, provide committee direction on next steps, and potentially develop committee recommendation.

Summary of Previous/Future Actions

• Commission referred California halibut management review to MRC	Aug 19-20, 2020
• Commission referred bycatch evaluation for California halibut management review to MRC	Dec 15-16, 2021
• MRC received updates on bycatch evaluation for California halibut	Mar 24, 2022 and Jul 14, 2022
• MRC received bycatch evaluation report from Department; MRC recommendation for initial priorities in bycatch acceptability inquiry	Nov 17, 2022
• MRC received Department updates on bycatch inquiries for the California halibut gill net fishery	Mar 14 & 16, 2023
• **Today receive and discuss Department report on bycatch acceptability; potential MRC recommendation**	**Jul 20, 2023**

Background

Management review of the California halibut fishery commenced in late 2020, consistent with the requirements of the Marine Life Management Act (MLMA) and using the framework outlined in the *2018 Master Plan for Fisheries, A Guide for Implementation of the Marine Life Management Act* (master plan) for meeting those requirements. Steps taken by the Department have included pursuing stock assessments for the northern and southern stocks (2020-2021), exploring a scope and potential process for the multi-sector California halibut management review (2021), and, following Commission direction in December 2021, conducting an evaluation of bycatch in the California halibut fishery.

The California halibut fishery management review has presented the first opportunity to use the four-step framework for evaluating bycatch laid out in Chapter 6 of the master plan, to: collect information on the type and amount of catch (Step 1); distinguish target, incidental, and bycatch species (Step 2); determine "acceptable" types and amounts of bycatch (Step 3); and address unacceptable bycatch (Step 4).

At the November 2022 MRC meeting, the Department presented a report completed by a contracted academic scientist that evaluated and summarized catch and bycatch data compiled for the California halibut sectors with greatest bycatch concern: commercial trawl and

set gillnet halibut fisheries. Utilizing federal observer data provided by the National Marine Fisheries Service (NMFS), the Department and the contracted scientist used fishery expertise along with logbook and landings data to differentiate the subsets of observed sets targeting California halibut from other observed trawl and gillnet fishery sets. The report summarized target catch, top incidentally-caught species landed, top incidentally-caught species discarded, and discard mortality, fulfilling the information needs for steps 1 and 2 of the bycatch evaluation framework. See Exhibit 1 for additional background and context.

MRC supported relying on the Department-presented report as the foundation for completing Step 3 – evaluating acceptability of bycatch types and amounts. MRC discussed priorities for completing the detailed bycatch inquiries based on the new evaluation report, favoring an initial focus on top bycatch species from set gill nets targeting California halibut. In December 2022, the Commission approved an MRC recommendation to request the Department to (1) commence the step 3 evaluation of acceptability of bycatch in the *California halibut set gillnet fishery,* using the inquiries outlined in the master plan; (2) focus on completing bycatch inquiries for the *top ten species*; (3) engage stakeholders (halibut gillnet fishermen and stakeholder groups); and (4) bring results back to MRC in March 2023 for discussion and potential committee recommendation.

March MRC

In March 2023, the Department reported that it had completed Step 3 bycatch inquiries for 12 top bycatch species, as requested by the Commission, to help assess acceptability of bycatch types and amounts against the four criteria specified in the MLMA for determining acceptability: (1) legality of the take of bycatch species; (2) degree of threat to the sustainability of the bycatch species; (3) impacts on fisheries that target the bycatch species; and (4) ecosystem impacts (Fish and Game Code Section 7085(b)). The Department presented a summary of the inquiry results during the meeting, and committed to preparing a written report documenting its responses to inquiries and articulating its findings.

Discussion also centered around a separate evaluation conducted by two non-governmental organizations (NGOs), Oceana and Turtle Island Restoration Network (TIRN), in which they evaluated bycatch acceptability in set nets for all gillnet gear combined, in contrast to the subset of halibut sets analyzed by Department. The MRC co-chairs noticed discrepancies between the NGO and Department approaches, reporting and conclusions, and asked questions to help clarify differences in the differing analyses, and sources of divergent data and findings.

Following public discussion, MRC made four requests of the Department.

1. Look more closely at discrepancies between the NGO bycatch data and the Department data, including in relation to marine mammal and leatherback sea turtle entanglement.
2. Create a more comprehensive list of species that are retained and sold as incidental catch, including:
    (a) the percentage of fish that are caught and marketed, and
    (b) the percentage of species caught and discarded.

3. Clarify the bycatch percentage relative to pounds and number of individuals, to help reconcile the differences between the percentages reported by the NGOs and fishermen.
4. Provide a written report of the Department's evaluation of 12 top bycatch species that were summarized in the presentation, and return to today's MRC meeting with sufficient information to support a recommended determination regarding acceptability of bycatch types and amounts, to allow the process to advance to Step 4 (*addressing unacceptable bycatch types and amounts*) in the bycatch evaluation framework.

MRC also asked that Commission staff, the Department, and the two NGOs work together to reconcile differences in data and interpretations, where possible, to further advance discussions today.

Update

Since March, Commission and Department staff have strived to meet the MRC requests.

Commission, Department, and NGO Meetings

From April to July 2023, staff from the Commission, the Department, Oceana, and TIRN invested significant time through several meetings, covering multiple hours, to discuss and seek a shared understanding of bycatch within the California halibut set gillnet fishery and an analysis on the set gillnet fishery in general. Oceana and TIRN shared their raw data and methodology for several components of their report, including a description of how they extrapolated the combined California halibut and white seabass observer data to obtain fleetwide estimates. The Department summarized its raw observer data to share overall catch and bycatch rates of California halibut-only set gill nets. Each entity independently followed up with NMFS staff, researchers, and the literature to vet conclusions or interpretations or to clarify inconsistencies or uncertainty.

Commission staff completed an in-depth analysis of the NGO report (formally released in April), which included replicating analyses, evaluating assumptions, and reviewing key conclusions. Commission staff verbally shared with the NGOs where it disputed their conclusions due to inconsistencies with what the cited literature stated, flagged areas where there appeared to be erroneous information, and offered potential recommendations that would allow for a more conducive dialogue.

Overall, there was a collective exploration of respective findings and conclusions and, although there remain disagreements in interpretations, the discussions helped to expose limitations with the various sources of data, highlighted areas of concern related to particular species, and facilitated a deeper understanding of the potential impacts of the fishery. In addition, the dialogue identified areas where it may be possible to move forward with potential management measures; although the potential measures have not yet been formally vetted with fishermen – a crucial step in the overall process – staff have discussed potential management measures that could improve understanding of the impacts of this fishery through increased data collection and monitoring, and options intended to reduce bycatch impacts.

Discussions and Opportunities with Fishermen

Several fishermen in the set gillnet fishery who attended the last two MRC meetings reached out to Commission and Department staff to share their knowledge and expertise of the fishery. They are interested in helping shape future management measures and are offering new ideas to explore. In addition, they invited the MRC co-chairs, and Commission and Department staff to join them on the water to observe fishery operations first-hand. To date, staff from the Department has joined one set gillnet fishing trip, while the MRC co-chairs and Commission staff are scheduling potential dates.

Today's Meeting

The Department prepared a bycatch evaluation report that summarizes the information presented in March (Exhibit 2). The report summarizes the methods and results of the California halibut bycatch evaluations in Step 1 (species type and amount of catch) and Step 2 (distinguish target, incidental and bycatch species), as well as the outcomes of completing Step 3 (determine acceptable types and amounts of bycatch) bycatch inquiries from the master plan for 12 species (spreadsheet copies in report appendix). The report offers movement toward considering management measures under Step 4, to help fill significant data gaps that limit information about the actual impacts of gill nets used in the California halibut fishery, and explores others to minimize bycatch types and amounts found to be unacceptable.

In addition, the Department has shared a table with six years of cumulative observed catch data from the NMFS California Set Gill Net Observer Program filtered for California halibut-targeted sets (447 sets of 1,258 observed sets) (Exhibit 3). The data are in the same format as the summary table of unfiltered set gill net observed catch, prepared by Oceana and shared with the Commission in June, derived from the publicly available observed catch data for all set gill net (1,258 sets) for the same years. Together, these tables assist in differentiating between observed catch data attributable to the California halibut set gillnet fishery specifically.

The Department report acknowledges that "…there are significant data limitations and knowledge gaps to determine amounts and types of bycatch and potential risks to sustainability, fisheries, and ecosystems. Lack of data to understand the total amount of bycatch in an individual fishery may potentially be considered 'unacceptable' under the MLMA and could lead to discussions with industry, stakeholders, and managers to address the insufficient and uncertain sources of data. Regardless of an acceptability determination, Department staff continue to move forward towards solutions and have identified potential management measures to address information gaps related to data limitations and interactions with some bycatch species in the set gill net fishery" (from Exhibit 2, page 23).

Staff believes that the Department's analyses of the top bycatch species types and amounts as requested by MRC support responding to provide a solid foundation for addressing bycatch in the California halibut fishery through potential management measures, as well as to set additional goals for enhanced understanding of sustainability in the fishery. MRC may wish to clarify what knowledge gaps remain, and identify areas of uncertainty to pursue (e.g., further partitioning incidental catch species to identify those to be managed by target species standards

and those to be managed under bycatch management standards, defining what constitutes bycatch "types" and "amounts" for purposes of bycatch acceptability evaluations, etc.).

The Department's presentation for today's meeting (Exhibit 4) will highlight species that are caught and landed in the fishery, species that are caught and discarded in the fishery, and potential management measures for MRC and the Commission to consider if they support advancing to Step 4 without additional analyses.

Significant Public Comments

The Commission received nine comment letters related to bycatch with California set gillnet fisheries. General themes of the comments are summarized below; see Exhibit 5 for all comment letters combined.

Comments about the Department's California Halibut Bycatch Report

1. Oceana and TIRN express appreciation for the amount of work Department and Commission staff and MRC have dedicated to addressing the concerns arising from California set gill nets, including understanding data complexities, listening to stakeholder concerns, and undertaking California's first bycatch acceptability determination. However, they critique several aspects of the Department's recent bycatch evaluation report for California halibut set gill net (in Exhibit 2), expressing concern that it deviates from the MLMA standards and falls short on appropriate and precautionary management actions to reduce unacceptable bycatch. They also recommend three alternatives for potential comprehensive management pathways, which include specific management actions such as full observer coverage, hard bycatch caps, reduced soak time, and temporary or long-term phase-out of permits (see comment letters 3 and 8 in Exhibit 5).

Comments Regarding Bycatch Concerns in Set Gillnet Fisheries (All Targets)

2. Oceana completed a white paper with analysis on bycatch within the set gill net fishery (all targets) using publicly available federal observer data. The report investigates soak time, catch composition, discard mortality, and post-release mortality, and suggests bycatch mitigation measures as options to reduce overall bycatch and discard mortality. In addition, for incidentally caught and retained species, it highlights those species most commonly retained as 'secondary targets' and evaluates which target species have or lack management measures to ensure sustainability. The analysis includes appendices of observer data and extrapolates total estimates of catch, discard, and discard mortality for all observed species across 15 years combined. See comment letter 3 in Exhibit 5.
3. An academic research scientist expresses concern over take with set gill net of two protected species: giant sea bass – a species he actively studies – and juvenile white sharks. He underscores the importance of having management plans and stock assessments that can inform catch limits and sustainable harvests (comment letter 1 in Exhibit 5). An individual also expressed concern over set gill net impacts on highly impaired giant sea bass in Santa Barbara, is concerned that recent observer coverage

has been minimal, and would like to see a transition away from this gear type (comment letter 2).

4. A joint letter from 5 California senators and 14 assembly members expresses concern about the types and rates of bycatch in California's set gillnet gear fishery, and urges the Commission and Department to follow the approach and criteria laid out in the MLMA regarding determining acceptable bycatch. They acknowledge the management measures taken thus far in the fishery but believe further management measures are needed to protect California's biodiversity (comment letter 6).
5. Four comments letters coalesce around similar key points, such as the historical and global threat of set gill nets to regional population levels; the effects of set gill nets on the health and biodiversity of southern California's unique ecosystem; the high discard rate and discard mortality recorded by federal observers; and a request to the Commission to formally determine that the types and amounts of bycatch in set gill nets are unacceptable. One commenter is specifically concerned about the threat to pinnipeds, cetaceans, and elasmobranchs (comment letter 5), while another expresses that ecosystem-based fisheries management should take a precautionary approach (comment letter 4). Two commenters contrast set gill net gear with the lower bycatch rate of California halibut caught with hook and line gear (comment letters 7 and 9).

Recommendation

Commission staff: Initiate discussions about potential management measures that may improve set gill net data collection and fill data gaps, and aid in reducing impacts of bycatch types and/or amounts that the Commission finds to be potentially unacceptable in the California halibut fishery. Request that the Department continue exploring possible management options with fishery participants and stakeholders, and provide an update for discussion at the November 2023 MRC meeting.

Department: Discuss potential improvements to data collection and fill information gaps, and support Department to continue stakeholder discussions and prioritize management actions.

Exhibits

1. Staff summary from November 17, 2022 MRC meeting, Agenda Item 5 (for background purposes only)
2. Department bycatch evaluation report, dated June 21, 2023
3. NMFS observed catch in the set gill net sets targeting California halibut, 2007-2017
4. Department presentation on its evaluation of bycatch in the California halibut set gill net fishery, received July 7, 2023
5. Compilation of comment letters received between June 20 and July 7, 2023

Committee Direction/Recommendation

The Marine Resources Committee recommends that the Commission support the Department exploring potential management measures with fishery participants and stakeholders to improve set gill net data collection, fill information gaps, and aid in reducing unacceptable bycatch

impacts in the California halibut set gillnet fishery; and schedule the topic for discussion at the November 2023 MRC meeting.

Agenda Item 2: Potential Management Measures for the California Gill Net Fishery

16 November 2023

Presented to:

Marine Resources Committee

Fish and Game Commission

Presented by:

Kirsten Ramey

Environmental Program Manager
Marine Region

Outline

- Background
- Potential Management Measures
- Stakeholder discussions
- Recommendations

Background

- Assessing and Addressing Bycatch per the Marine Life Management Act (Act)
  1. Collection of information on types and amounts of bycatch
  2. Distinguishing target, incidental, and bycatch species
  3. Determining “acceptable” types and amounts of bycatch
  4. Addressing unacceptable bycatch

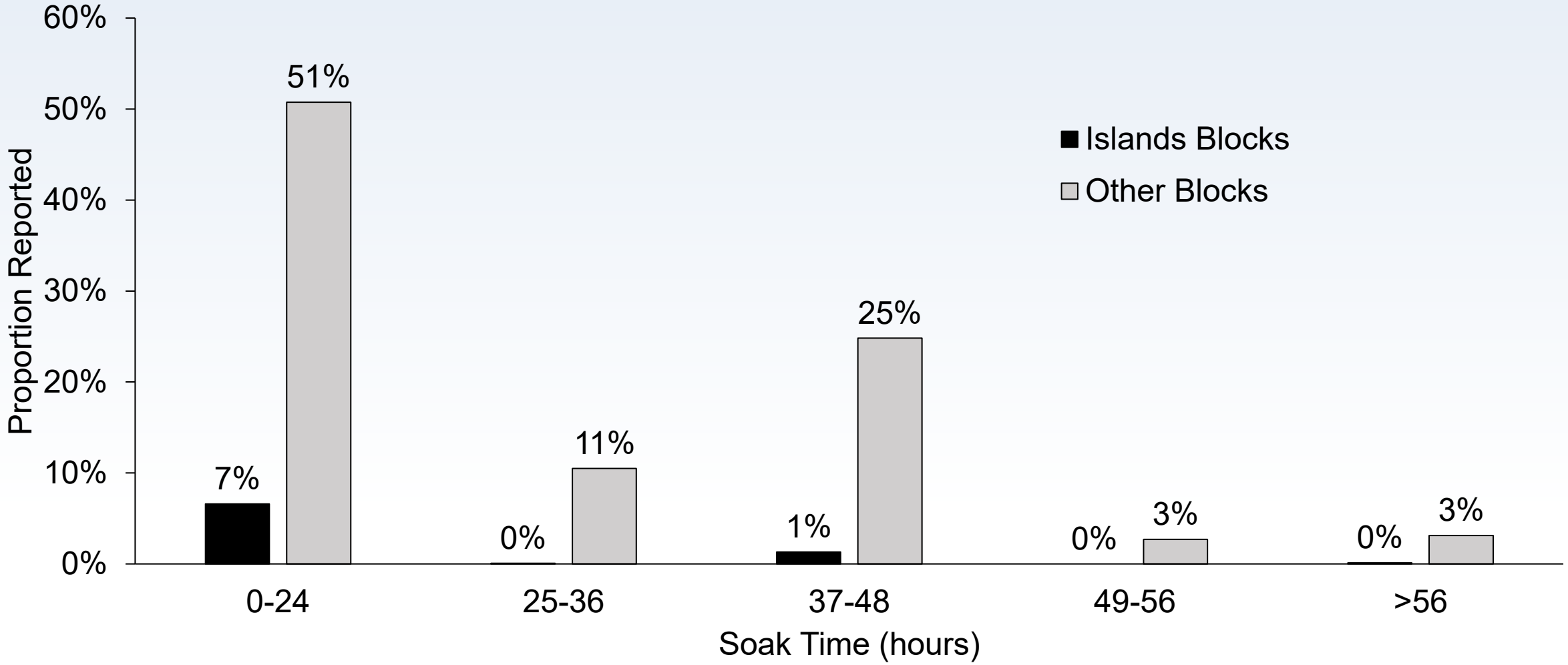
Potential Management Measures

1. Soak time
2. Gear marking
3. Mesh depth
4. Gear loss reporting
5. Logbook improvements
6. Electronic technology
7. Observer coverage
8. Non-transferable permits
9. Non-retention of great white sharks
10. Spatial/temporal closures

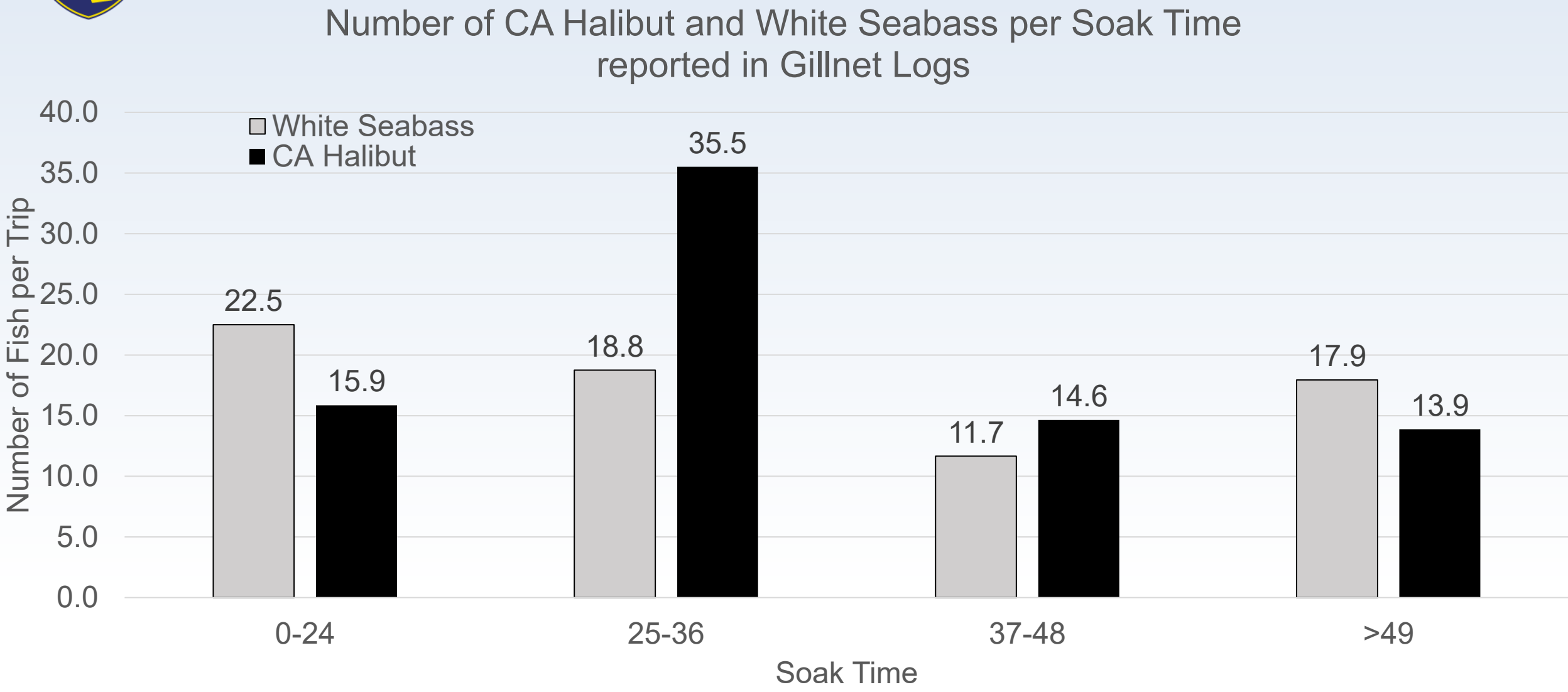

Photo Credit: CDFW

Soak Time

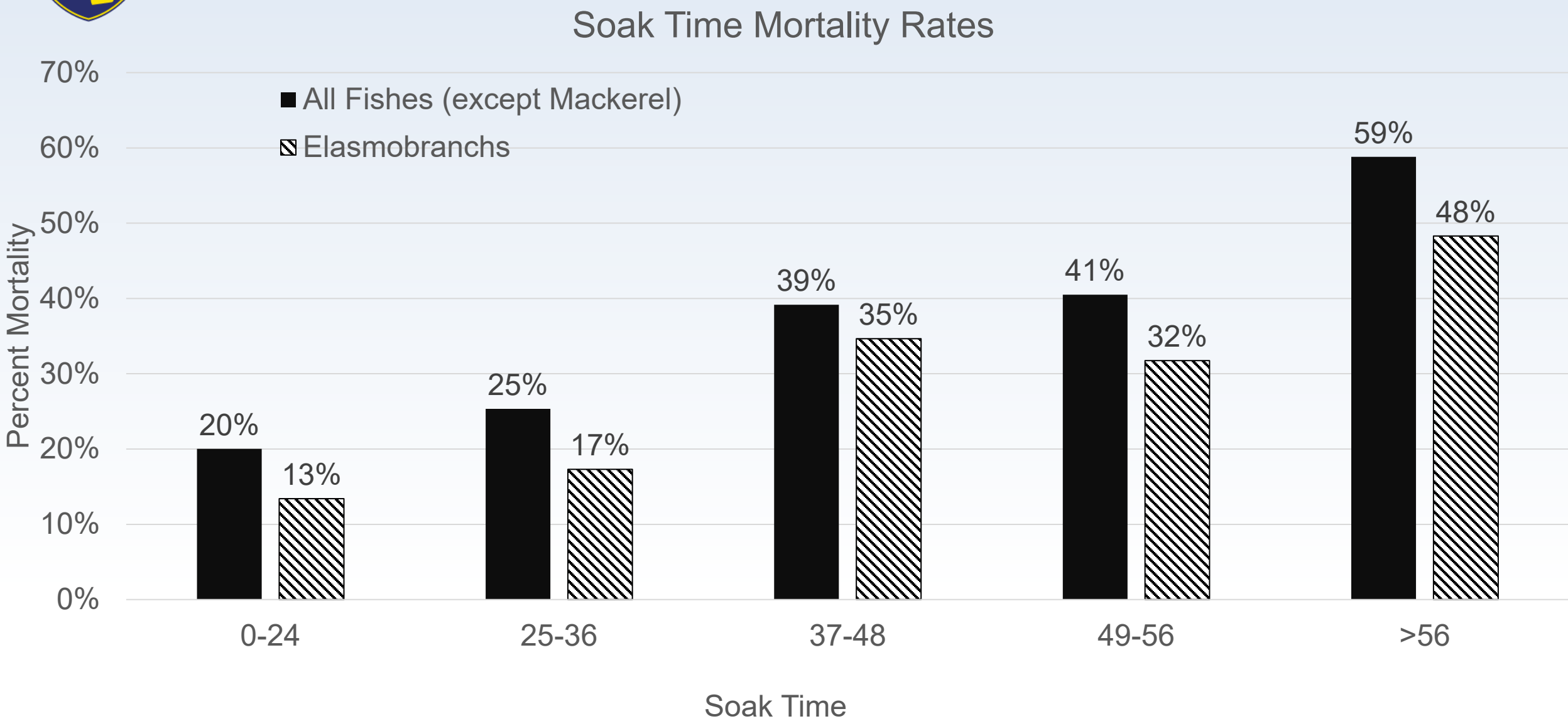
Range of Soak Times and Frequency Reported in the CA Set Gillnet Fishery by Block (2007-2022)



Catch Numbers per Soak Time



Soak Time Mortality



Soak Time Considerations

Considerations:

1. Majority of fleet report less than 24-hr soak
2. Catch numbers:
   a. White seabass catch is greatest 24 hours or less
   b. CA halibut catch is greatest between 25-36 hours
3. < 36-hour soak = lowest mortality rates
4. Costs associated with more frequent gear tending
5. Weather and safety provision
6. Enforcement

Gear Marking Ideas


Photo Credit: Gill net permittee


Photo Credit: Gill net permittee


Photo Credit: Gill net permittee


Photo Credit: Gill net permittee

Gear Marking Considerations

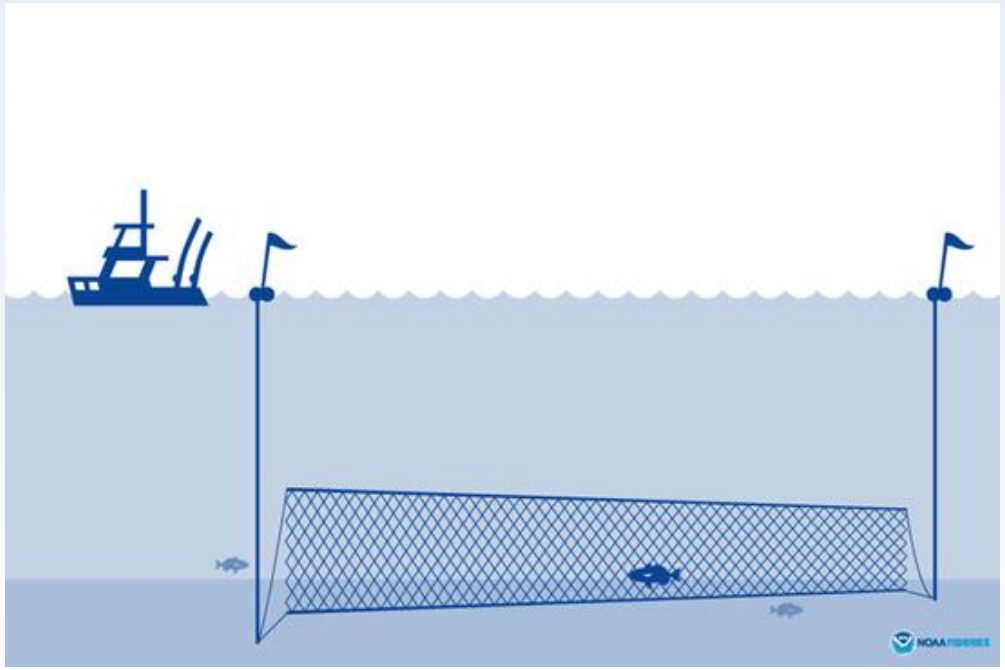
Photo Credit: Amazon.com

Considerations:

1. Functionality of gear
2. Availability of materials
3. Additional costs
4. Color visibility and contrast
5. Uniqueness

Mesh Depth

1. Mesh size:
   a. CA halibut >8.5 inches
   b. White seabass >6 inches
2. Net length for CA halibut:
   a. No more than 9,000 feet in combination
   b. No more than 6,000 feet in specific area in SB County
3. Recommend mesh depth (net height)
   a. No greater than:
      a. 25 meshes for CA halibut
      b. 50 meshes for white seabass



Gear Loss Reporting

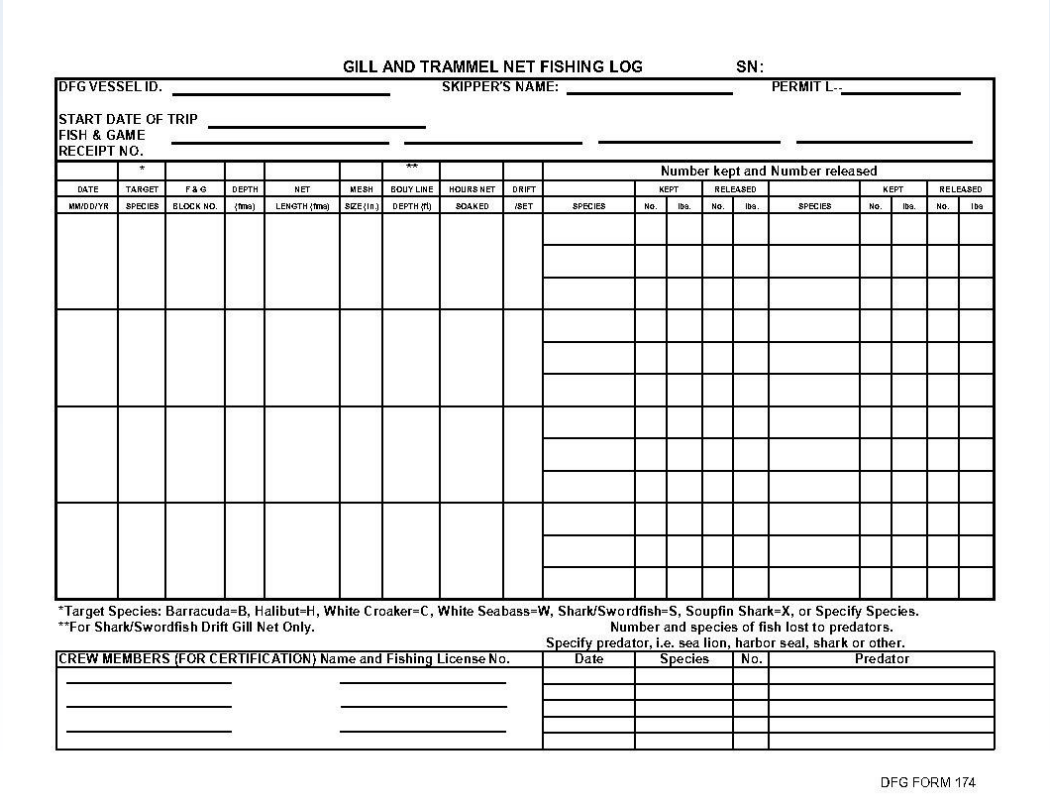
Fish and Game Code 8601.5: mandates notification no later than 72 hours after returning to port following the loss of a set net, including:

- Date and time lost
- Location, including depth
- Description, including mesh size, length, height, target species, and whether anchors are attached
- Name and fisherman's ID number of owner and/or of person fishing the net
- Name and ID number of the vessel

Logbook Improvements and Electronic Technology

Data Objectives:

1. Fishing location and depth
2. Target species
3. Effort: (e.g. fishing duration, gear soak time)
   a. Number of fishing trips and sets
   b. Kept catch per individuals and weight
4. Net type and specifications
5. Bycatch, including discards
6. Protected species interactions



GILL AND TRAMMEL NET FISHING LOG SN:

DFG VESSEL ID. _____ SKIPPER'S NAME: _____ PERMIT L-: _____

START DATE OF TRIP _____

FISH & GAME _____ _____ _____ _____

RECEIPT NO.

	*					**			Number kept and Number released							
DATE	TARGET	F & G	DEPTH	NET	MESH	BOUY LINE	HOURS NET	DRIFT		KEPT		RELEASED			KEPT		RELEASED	
MM/DD/YR	SPECIES	BLOCK NO.	(fms)	LENGTH (fms)	SIZE (in.)	DEPTH (ft)	SOAKED	/SET	SPECIES	No.	lbs.	No.	lbs.	SPECIES	No.	lbs.	No.	lbs.

*Target Species: Barracuda=B, Halibut=H, White Croaker=C, White Seabass=W, Shark/Swordfish=S, Soupfin Shark=X, or Specify Species.

**For Shark/Swordfish Drift Gill Net Only. Number and species of fish lost to predators. Specify predator, i.e. sea lion, harbor seal, shark or other.

CREW MEMBERS (FOR CERTIFICATION) Name and Fishing License No.		Date	Species	No.	Predator
_____	_____				
_____	_____				
_____	_____				

DFG FORM 174

Electronic Technology Considerations

Considerations and challenges for EM:

1. Regulatory mandate and phase-in period
2. Costs: initial set-up and on-going
3. Equipment functionality (e.g. battery life, limitations)
4. Data collection, flow, confidentiality, timing, and processing
5. Integration with e-logbook

Electronic Technology Options

Pursue a pilot study to test e-logbook, electronic monitoring (EM) and observer coverage

1. EM vendors
    a. Fishery profile
2. Funding opportunities
    a. Bycatch Reduction Engineering Program, Fisheries Innovation Fund or Fisheries Information System Program

Observer Coverage

- NOAA's West Coast Regional Observer Program (WCROP)
  - Mandated by MMPA, ESA and MSFCA
  - Covers CA large mesh drift gillnet, deep-set pelagic longline, shallow-set pelagic longline, deep set buoy gear, and CA set gill net
  - CA set gill net was last observed in 2017
  - Potential re-instatement in 2025
- Pilot project

Non-Transferable Permit

Fish and Game Code:

1. 8681: *shall not be used except under a revocable, nontransferable permit issued by the Department.*
2. 8681.5(b): *any person who has an existing, valid permit may transfer that permit to any person otherwise qualified*

Title 14, CCR:

1. Section 174: Permits to use gill nets or trammel nets for commercial purposes

Commercial White Shark Landings

Year	Drift Gill Net (Large Mesh)	Drift Gill Net (Small Mesh)	Set Gillnet	Portion Used for Research
2000	0	0	4	0
2001	0	0	3	0
2002	0	0	< 3	< 3
2003	0	0	< 3	< 3
2004	0	0	< 3	< 3
2005	0	0	3	< 3
2006	0	0	8	8
2007	0	0	5	4
2008	0	< 3	7	6
2009	0	0	16	11
2010	0	0	13	11
2011	0	0	< 3	< 3
2012	0	0	6	5
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	0	0
2016	0	0	0	0
2017	0	0	< 3	0
2018	0	0	< 3	0
2019	0	0	4	0
2020	0	0	< 3	0
2021	0	0	5	0
2022	0	0	4	0
Total	**0**	**< 3**	**89**	**53**

Spatial/Temporal Closure Considerations

1. Goal: limit interactions between target and bycatch species
    a. Spatial and temporal distribution of target and non-target species
    b. Compliance monitoring and enforcement
    c. Can potentially relocate bycatch impacts
    d. Lead to socio-economic impacts

Stakeholder Discussions

- Key industry representatives
- NOAA Fisheries staff
- Commission staff
- Non-government organizations

Near-Term Recommendations

- Phase I Regulatory Package:
  - Soak time
  - Gear marking
  - Mesh depth
- Pilot Project for data improvements:
  - Fleet profile for e-logbooks and electronic monitoring
  - Observer coverage

Thank You

mlmafisheriesmgmt@wildlife.ca.gov

MLMA Master Plan - Bycatch Criteria

CA Marine Species Portal - California Halibut

November 2, 2023

California Fish and Game Commission
Marine Resources Committee
California Natural Resources Building
715 P Street, 16th Floor
Sacramento, California 95814

Re: Item 2 - Evaluation of bycatch in the California halibut set gill net fishery in support of the fishery management review -- November 16, 2023, Marine Resources Committee

– Support and Expedite New Management Measures

Via Email and Hard Copy

Dear Commissioner Sklar and Commissioner Murray,

Turtle Island Restoration Network (TIRN) supports the 11 new management measures proposed by the Marine Resources Committee (MRC) for the California halibut set gill net fishery to reduce the high levels of bycatch that result in the discard and death of dozens of non-target fish and marine species. We urge you to immediately expedite the implementation of all 11 measures described at the August 2023 meeting and provide specific timelines and mechanisms needed to do so.

First and foremost, urgent consideration and action must be given to MRC's suggested Measure (8) potential limits on permit transferability and/or retiring latent permits. To that TIRN would add a sunset date for all permits. If legislation is required, we urge you to support it.

TIRN recognizes and appreciates the extensive work done to date by the California Fish and Game Commission and the California Department of Fish and Wildlife (CDFW) toward developing a suite of management measures to reduce bycatch and bycatch mortality associated with set gillnet fishing. Addressing the unintended catch and discarding of dead or injured marine life including giant sea bass, white sharks, whales, highly endangered leatherback sea turtles and sea lions is a top priority for California.

We understand that the MRC may be forwarding fewer than the full slate of 11 measures described at the August 2023 MRC meeting for review at the Nov. 16 meeting. That is disappointing given the urgency to improve the sustainability of our fisheries and protect vulnerable marine biodiversity. We see fishing practices, climate change and other factors causing tremendous harm along the California coast and beyond. Now is the time to take bold action to begin to restore our oceans and reverse decades of harm.

If a phasing of the 11 measures is required, please provide a specific timeline for each measure and begin implementation no later than the end of 2024. In addition to reforming in-the-water fishing gear and practices such as soak time, gear marking and net height, it is essential to move quickly forward on observer coverage, E-logbooks, electronic monitoring, seasonal/time-area closures, gear loss reporting.

Finally, and most importantly, to ensure the long-term sustainability of our fishery and marine resources as required by state and federal law, the following must happen asap:

1. Prohibiting the take of giant sea bass and shark and other protected marine species in the set gillnet fishery and;
2. Phasing out permits in the fishery by preventing transfer of permits, retiring latent permits and setting a sunset date for all permits.

Thank you for your time and consideration.

Sincerely,

Todd Steiner, Executive Director

Teri Shore, TIRN Board of Directors

Cc: Susan Ashcraft, Commission Marine Advisor, Chuck Bonham, Executive Director, Kirsten Ramey, Department staff

November 3, 2023

Marine Resources Committee
California Fish and Game Commission
California Natural Resources Building
715 P Street, 16th Floor, Sacramento, California 95814

Re: Agenda Item 2: Evaluation of bycatch in the California halibut set gillnet fishery in support of the fishery management review

Dear President Sklar and Commissioner Murray,

The Center for Biological Diversity supports the full suite of management measures that the Commission asked the Department to review and wishes to see them moved forward in a timely manner to reduce bycatch in the California halibut set gillnet fishery.

Implementing temporal closures, soak time limits, and other key bycatch mitigation regulations will minimize the incidental catch of species of concern including the tope shark.

Background on the Set Gillnet Fishery and Depletion of Tope Shark

Previous state regulations on gillnet usage in coastal waters have proven to be effective in reducing harm to non-target species. In 1994, California banned gill nets in some state waters - within 3 nautical miles of the mainland and within 1 mile of the Channel Islands - in response to a collapse in white seabass stock.[1] Quickly following the implementation of the ban, the numbers of tope sharks increased significantly.[2] In contrast, the number of tope sharks did not increase from 1950-94. This suggests the increase in tope abundance was caused by the gillnet closure. Researchers saw an increase from 0 topes caught per test station to 0.48 individuals caught per test station.[3] This increase was also seen for giant sea bass and leopard sharks.[4]

In 2020 the IUCN listed tope sharks as critically endangered. Scientists found an 88% decline in global populations of topes over the last three generations (79 years).[5] The authors of the IUCN report found that there is no reliable estimate of the tope numbers for the northeastern Pacific population (Baja to British Columbia).[6] This species is an ecologically important predator that

[1] Cal. Fish & G. Code §§ 8610.2, 8610.3
[2] Pondella, D.J. and Allen, L.G. (2008) The Decline and Recovery of Four Predatory Fishes from the Southern California Bight. Marine Biology, 154, at 307.
[3] *Id.* at 310.
[4] *Id.* at 307-313.
[5] Walker, T.I. et al., *Galeorhinus galeus*, The IUCN Red List of Threatened Species 1, 4 (Feb. 14, 2020).
[6] IUCN classified the *Galeorhinus galeus* as "Critically Endangered," or "facing an extremely high risk of extinction in the wild," on Feb. 14, 2020 (IUCN Red List Categories and Criteria Version 3.1)

has not recovered from historic depletion several decades ago when it was targeted by the Vitamin A fishery.[7]

Last year, NMFS found that listing may be warranted for the tope shark under the ESA.[8] The listing factor that weighed most heavily for listing the tope shark was its exploitation for commercial purposes. This 90-day finding was in response to a petition filed by the Center in 2022.[9]

Conclusion

The Center for Biological Diversity supports the full suite of management measures and thanks the Committee for its work to protect marine life by reducing bycatch in California fisheries.

Sincerely,

Ben Grundy
Center for Biological Diversity

[7] Muñoz, Sebastián Ignacio Hernández, Population genetics of the school shark (*Galeorhinus galeus*) in New Zealand, Australian and Chilean Waters, Ph.D Thesis, Victoria Univ. Wellington 11 (2013); Walker et al. 2020, at 8, 9; Nosal et al. 2021, at 1579.

[8] *Endangered and Threatened Wildlife; 90-Day Finding on a Petition To List the Tope Shark as Threatened or Endangered Under the Endangered Species Act*, 87 Fed. Reg. 25,209 (Apr. 28, 2022).

[9] Center for Biological Diversity & Defend Them All Foundation, Petition to List the Tope Shark (*Galeorhinus galeus*) As Endangered or Threatened Under the Endangered Species Act (February 15, 2022), available at https://s3-us-west-2.amazonaws.com/s3-wagtail.biolgicaldiversity.org/documents/Tope_Shark_ESA_Listing_15_February_2022_FINAL.pdf.

From: Scott Webb <swebb@rri.org>
Sent: Friday, November 3, 2023 5:00 PM
To: Ashcraft, Susan@FGC
Cc: Matthews, Kinsey-Contractor@fgc Ramey, Kirsten@Wildlife Chance Cutrano FGC <FGC@fgc.ca.gov>
Subject: Public Comment for MRC Agenda Item 2: RRI Public Comment

Hi Susan,

I also want to submit the attached Public Comment on behalf of the Resource Renewal Institute under MRC Agenda Item 2: "Evaluation of bycatch in the California halibut set gill net fishery in support of the fishery management review," to be available for the briefing booklet.

All the best,

Scott
--
Scott Webb (he/him)
Director of Advocacy & Engagement
Resource Renewal Institute

Resource Renewal Institute
40 Years. Innovation for a Sustainable Future.

November 3, 2023,

President Eric Sklar, Commissioner Murray
California Fish and Game Commission
P.O. Box, 944209
Sacramento, CA 94244-2090

RE: Marine Resource Committee Agenda Item 2: Evaluation of bycatch in the California halibut set gill net fishery in support of the fishery management review

Dear President Skalr and Commissioner Murray,

The Resource Renewal Institute (RRI) would like to extend our appreciation to the Marine Resource Committee (MRC) and the Department of Fish & Wildlife (CDFW) for the time and resources spent analyzing the bycatch associated with California set gillnets. After an extensive, multi-year review of the data associated with this fishery, stakeholders are ready for action.

RRI urges the MRC to recommend a robust management package comprised of the management measures and data collection improvements the Commission directed CDFW to bring forward to the MRC at the August 2023 Fish and Game Commission meeting.[1] This package should meaningfully reduce bycatch and establish data collection methods that do not rely on commercial gillnet-reported data. While we do wish to express our gratitude to the Department for presenting short-term management measures, there exists an opportunity to enhance the proposed package through strengthening the recommendations and formulating clear timelines for the implementation of management measures not included in the short-term package. Achieving this would represent a promising first step, positioning the Commission on a trajectory toward the reduction of bycatch to acceptable types and amounts in this fishery.

<u>Management and Workload Recommendations</u>

In addition to ensuring management measures apply to all gillnet permits, making improvements to self-reported logbooks, and implementing the Gillnet fleet suggested net height restrictions, RRI would like to see the following regulations and workload planning be recommended for adoption by the whole Fish & Game Commission during the November MRC meeting:

1. *A Maximum 24-Hour Soak Time*

[1] Ashcraft, Susan; Mathews, Kinsey. "Staff Report for August 22-23, 2023 Item 23 A Marine Resource Committee." California Fish and Game Commission, https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=214928&inline

RRI believes having nets in the water for less time is the most pragmatic measure to reduce bycatch mortality. Not only will it minimize overall bycatch mortality and limit interactions with vulnerable and nontarget species, but it will also result in fresher seafood. According to the CDFW presentation prepared for Agenda Item 2 at the November MRC, close to 60% of trips, when distributed by fishing block, are already under 24 hours.[2] Set gillnet fishery logbook data from 2007 to 2022 show that approximately 72% of sets' soak times are already less than 24 hours.[3] The best available science indicates that a 24-hour soak time is an effective way of reducing bycatch mortality for elasmobranchs in the Southern California Gillnet fishery,[4] and the CDFW presentation indicates that trips with 0-24 soak time have the lowest bycatch mortality rate in trips targeting White Seabass and California Halibut. With the exception of weather-related events, we firmly believe that 24 hours should be the absolute maximum soak time allowed for set gillnets trips.

2. *Robust Gear Marking and Lost Gear Reporting*

While we applaud the Department for beginning to test gear marking for gillnets, we request that the markings not only be distinguishable but durable and have similar standards as other California fisheries that use unique gear markings. Line markings must go beyond attaching nylon rope to current gillnets and should consist of a standardized mesh net color to identify a California from a Mexico gillnet easily.

RRI also believes that Fish and Game Code 8601.5 alone is not enough to efficiently report lost gillnets. Lost gear can result in unreported bycatch of vulnerable species as well as another source of pollution in the ocean. RRI is in favor of CDFW moving to a more proactive approach of monitoring lost gear that does not rely exclusively on commercial gillnet self-reporting.

3. *Establish a Timeline for Closure of Biodiversity Hotspots and Nursery Grounds of Vulnerable Species*

In 2022, the United Nations Biodiversity Conference (COP 15) provided California with a significant international platform to demonstrate its steadfast commitment to biodiversity conservation leadership.[5] However, other nations have taken more proactive measures to safeguard their areas of marine biological importance from indiscriminate fishing gear. This past summer, the Australian government took a commendable step by banning gillnet fishing in the Great Barrier Reef, a UNESCO World Heritage

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[2] Ramey, Kirsten. *Presenation for Agenda Item 2: Potential Management Measures for the California Gill Net Fishery*. California Department of Fish & Wildlife.

[3] Birch, Caitlynn, and Geoff Shester. Marine Resources Committee Agenda Item 3: Set Gillnet Bycatch Evaluation. Oceana, 7 July 2023, https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=214928&inline

[4] Lyons, K., et al., The degree and result of gillnet fishery interactions with juvenile white sharks in southern California assessed by fishery-independent and -dependent methods. Fish. Res. (2013) http://dx.doi.org/10.1016/j.fishres.2013.07.009

[5] California Natural Resources Agency. “Press Release: California Action Protect Biodiversity UN.” 19 December 2022, https://resources.ca.gov/Newsroom/Page-Content/News-List/California-Action-Protect-Biodiversity-UN.

site, due to the substantial bycatch of vulnerable species.[6] The parallels between the Great Barrier Reef and our own Channel Islands, some of the most productive and diverse marine ecosystems globally, cannot be ignored.

The Santa Barbara Channel, which encompasses the Channel Islands, is a refuge for one-third of the world's cetacean species, emphasizing the international significance of these waters. Additionally, the Channel Islands are the sole UNESCO Biological Reserve on the California coast and serve as important pupping and nursery grounds for numerous vulnerable species, including the Tope Shark, an Endangered Species Act (ESA) candidate species.[7] The IUCN categorizes the tope shark as Critically Endangered, estimating a decline of 88% of the global population, with one of the leading causes attributed to bycatch.[8,9] There has not been a formal stock assessment for tope sharks in the last 70 years,[9] but recent scientific studies indicate there is cause for concern for tope shark stock on the West Coast.[10] Federal observer data from 2007 -2021 indicate Tope sharks have been discarded in relatively high numbers and have a 64% mortality rate when caught.[11] In light of these concerning trends, it is imperative that the California Fish and Game Commission adopt a precautionary approach in line with the Marine Life Management Act (MLMA). What's more, the Commission must establish a timeline for implementing strategic area closures around regions of biological significance, such as the Channel Islands.

4. *Establish a Timeline for the Pilot Observer Program, Independent Data Collection Methods, and Enforcement Mechanisms.*

There currently are no independent enforcement mechanisms to monitor the discard of species in the set gillnet fishery. The lack of independent data has hindered consensus between concerned stakeholders, regulatory agencies, and the commercial gillnet fleet. Relying exclusively on gillnet self-reported data leaves room for bias and will continue to prove insufficient when monitoring the scale of the bycatch, as well as measuring the efficacy of any adopted regulations. The state must mandate independent data collection, including a pilot state-run observer program and consistent electronic

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[6] Jaynes, Cristen Hemingway. "'Globally Significant Moment for Ocean Conservation': Australia to Phase Out Gill Net Fishing in Great Barrier Reef." *EcoWatch*, 5 June 2023, https://www.ecowatch.com/gill-net-fishing-great-barrier-reef.html

[7] Nosal, Andrew P. et al., Triennial Migration and Philopatry in the Critically Endangered Soupfin Shark Galeorhinus Galeus, 58 J. APPLIED ECOLOGY 1570 (2021), available at https://besjournals.onlinelibrary.wiley.com/doi/pdf/10.1111/1365-2664.13848

[8] IUCN classified the Galeorhinus galeus as "Critically Endangered," or "facing an extremely high risk of extinction in the wild," on Feb. 14, 2020 (IUCN Red List Categories and Criteria Version 3.1)

[9] CDFW. 2001. California's Living Marine Resources: A Status Report. Chapter 6. Soupfin Shark. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=34352

[10] Walker, T. I. et al., Galeorhinus galeus, THE IUCN RED LIST OF THREATENED SPECIES (Feb. 14, 2020), https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T39352A2907336.en

[11] National Marine Fisheries Service. Accessed 2022. California Set Gillnet Observer Program, Observed Catch 2007-01-01 to 2017-12-31. Available: https://media.fisheries.noaa.gov/2022-01/setnet-catch-summaries-2007-2010-2013-2017.pdf

monitoring. This observer program should also measure the soak time of each set length of each set, how many set net panels are cast, the mesh size for each set, and where the effort is located. This information will provide the Department and stakeholders with adequate data to understand the total effort and accurately estimate total catch and discards as was required in Step 2 of the bycatch inquiry.

Considering the magnitude of species caught, the minimal monitoring over the last 15 years, and the innate sustainability concerns with set gillnets, 100% observer coverage must be required. Fisheries with similar bycatch concerns, such as the West Coast groundfish trawl fishery and the Hawaii shallow-set pelagic longline fishery, both require 100% observer coverage to track interactions with vulnerable species [12,13]. In conjunction with 100% observer coverage, the Department should adopt hardcaps to enforce individual quotas upon catching a vulnerable or endangered species. These hard caps should apply to species currently and historically at risk of entanglements from gillnets, such as marine mammals, seabirds, sea turtles, giant seabass, white sharks, and the aforementioned tope shark. Hardcaps coupled with 100% observer coverage.

We applaud CDFW for engaging with the National Marine Fishery Service West Coast Gillnet Observer Program to reinitiate the federal observer coverage. We request that a timeline for implementing a state-run pilot observer program be established to ensure the state has independent data collection sources that do not depend on NMFS funding and can become an asset to other data-deprived state-managed fisheries.

Statutory Changes and Funding

As mentioned in the ENGO sign-on letter to the Commission, we understand there are management measures that we support that may require statuary change and may be outside the Commission's authority, including the sale of protected species, time, and/or area closures, or changes to gillnet permits. RRI does not intend for new programs associated with management from set gillnets to divert resources from the Department and strongly supports additional funding necessary for the Department to effectively manage this fishery.

We again extend our appreciation to both the MRC and CDFW for their dedication to developing this regulatory management package. While the proposed measures hold promise, there is an opportunity to enhance the short-term management package and establish a clear pathway with an associated timeline for the full management suite for this gear type. We look forward to a constructive dialogue at the upcoming MRC and to showcasing California's leadership in biodiversity protection under the MLMA.

[12] "Overview of Observed West Coast Fishery Sectors." NOAA Fisheries, 25 January 2023, https://www.fisheries.noaa.gov/west-coast/fisheries-observers/overview-observed-west-coast-fishery-sectors.

[13] Van Niekerk, Jody. "West Coast Region Observer Program | NOAA Fisheries." NOAA Fisheries, 17 April 2023, https://www.fisheries.noaa.gov/west-coast/fisheries-observers/west-coast-region-observer-program.

Sincerely,

Scott Webb
Director of Advocacy
Resource Renewal Institue

Chance Cutrano
Director of Programs
Resource Renewal Institute

OCEANA Protecting the World's Oceans
99 Pacific Street, Suite 155C
Monterey, CA 93940 USA

+1.907.586.4050
OCEANA.ORG

November 3, 2023

Mr. Eric Sklar, President
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

RE: MRC Agenda Item 2: Evaluation of Bycatch in the California Halibut Set Gillnet Fishery in Support of the Fishery Management Review

Dear President Sklar and members of the Commission:

Oceana appreciates the investments made by the Marine Resource Committee (MRC), California Fish and Game Commission (Commission), and California Department of Fish and Wildlife (Department) to improve California state fisheries under the Marine Life Management Act Master Plan for Fisheries. We support the suite of management measures for the set gillnet fishery that the Commission tasked the Department with scoping last August.

We are encouraged that the near-term regulatory package is ready for MRC approval at this meeting and thank the Department and members of the fleet who have helped develop options to improve data and reduce bycatch. While this agenda item is focused on the California halibut set gillnet fishery, we support the Department's recommendation that new regulations to reduce bycatch and improve data collection should apply to all set gillnets, including those targeting white seabass. This is consistent with our previous requests, the National Marine Fisheries Service List of Fisheries, and the Commission's discussion of the need to address bycatch during the most recent White Seabass Fishery Management Plan annual review. We support updating the management of the set gillnet fishery through three mechanisms:

1) Near-term regulations that include measures to substantially reduce bycatch and bycatch mortality, and improve data collection;
2) Regulations that focus on long-term data streams including observer coverage and electronic monitoring, along with bycatch reduction measures based upon that data; and
3) Legislation that addresses issues outside of the Commission's authority.

Detailed below are Oceana's recommendations for robust and reasonable measures that reduce bycatch, bycatch mortality, and improve data collection.

1. Phase 1 Regulatory Package (Implementation Goal 2024)

The suite of proposed management measures for Phase 1 provides a step toward the needed improvements of the set gillnet fishery. However, to directly and meaningfully reduce bycatch and bycatch mortality and address identified data needs, we recommend additional alternatives be included along with the Department's recommendations.

A. Maximum Soak Time

Limiting soak times for set gillnets is the only measure in the Phase 1 package that will reduce bycatch mortality. Numerous data sources demonstrate that any duration longer than 24 hours does not meaningfully reduce bycatch mortality. This means a maximum soak time of no greater than 24 hours, and soak times of 8 and 12 hours should be considered in the regulatory package in addition to the 36-hour soak time proposed by the Department. Maximum soak times are standard in many other commercial gillnet fisheries, generally ranging from 6-24 hours in regions with high shark and sensitive species bycatch.[1,2,3,4] Because gillnets are non-selective gear, soak time limits are one of the only measures that can be implemented to reduce ecosystem impacts and bycatch mortality. It is an essential management tool; and we strongly support implementation of a robust soak time limit in the set gillnet fishery.

Extensive research in gillnet fisheries concludes soak time has significant impact on bycatch mortality, and across the board most species benefit from decreased soak durations,[1,4,5] particularly sharks and rays,[6,7] which experience high rates of discard in the set gillnet fishery. Reducing soak time will likely have varying degrees of benefits depending on the physiology of each species, however those that do not experience near 100% initial mortality upon capture will benefit from increased survivorship by limiting soak times. Across various studies, shorter soak times result in higher survivorship, with soak times of 6 to 12 hours having highest survivorship, and little to no benefit for soak times greater than 24 hours. Many of the sharks and rays recorded as bycatch in the NMFS observer data (for white seabass and halibut sets) are vulnerable,[8,9] and the Department's bycatch evaluation states: "the majority of the elasmobranchs evaluated are considered to have moderate or unknown risks of threats to sustainability, fisheries, and ecosystems." [10] The discard mortality rates of nearly all shark species indicate they would benefit from limiting soak times to less than 24 hours. Some example species include the tope (soupfin) shark, pacific angel shark, brown smoothhound shark, bat ray, California skate, spiny dogfish, and white shark, amongst others.

A 48-hour or 36-hour maximum soak time will not significantly reduce mortality of bycatch of key sensitive species. Aggregating mortality rates across species groups (e.g., all elasmobranchs) may

[1] Bell JD, Lyle JM. Post-Capture Survival and Implications for By-Catch in a Multi-Species Coastal Gillnet Fishery. PLoS One. 2016 Nov 18;11(11):e0166632. doi: 10.1371/journal.pone.0166632. PMID: 27861602; PMCID: PMC5115765.

[2] BUCKEL, J.A., HINES, R.J. And MCARTHUR, T.C., JR (2006), Incidental catch and discard of red drum, Sciaenops ocellatus, in a large mesh Paralichthyidae gillnet fishery: experimental evaluation of a fisher's experience at limiting bycatch. Fisheries Management and Ecology, 13: 113-119. https://doi.org/10.1111/j.1365-2400.2006.00485.x

[3] Buchanan, Seana & Farrell, Anthony & Fraser, Jake & Gallaugher, Patricia & Joy, Ruth & Routledge, Rick. (2002). Reducing GillNet Mortality of Incidentally Caught Coho Salmon. North American Journal of Fisheries Management - NORTH AM J FISH MANAGE. 22. 1270-1275. 10.1577/1548-8675(2002)022<1270:RGNMOI>2.0.CO;2.

[4] Lyle, J.M., Bell, J.D., Chuwen, B.M, Barrett, N., Tracey, S.R., and Buxton, C.D., Institute for Marine and Antarctic Studies, University of Tasmania, 2014, Assessing the impacts of gillnetting in Tasmania: implications for by-catch and biodiversity, Hobart, August, CC BY 3.0

[5] Murray KT. 2009. Characteristics and magnitude of sea turtle bycatch in US mid-Atlantic gillnet gear. Endangered Species Research 8: 211–224.

[6] Braccini M, Van Rijn J, Frick L (2012) High Post-Capture Survival for Sharks, Rays and Chimaeras Discarded in the Main Shark Fishery of Australia? PLoS ONE 7(2): e32547. https://doi.org/10.1371/journal.pone.0032547

[7] Lyons, K., et al., The degree and result of gillnet fishery interactions with juvenile white sharks in southern California assessed by fishery-independent and dependent methods. Fish. Res. (2013), http://dx.doi.org/10.1016/j.fishres.2013.07.009

[8] NMFS. 2022. California Set Gillnet Observer Program Observed Catch Summary, January 1, 2007, through December 31, 2017. Available: https://media.fisheries.noaa.gov/2022-01/setnet-catch-summaries-2007-2010-2013-2017.pdf

[9] Pacoureau N, et al. 2021. Half a century of global decline in oceanic sharks and rays. Nature. 2021 Jan;589(7843):567-571. doi: 10.1038/s41586-020-03173-9. Epub 2021 Jan 27. PMID: 33505035.

[10] CDFW. 2023. Evaluating Bycatch in the California Halibut Set Gill Net Fishery. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=213567&inline

obscure the fact that particular species, such as white sharks and tope sharks, are unlikely to benefit from soak times greater than 24 hours. For example, a study investigating white shark mortality in California set gillnets, Lyons et al. 2013, illustrates the difference between a 24-hour soak time (probability of mortality ~ 0.5) and a 48-hour soak time (probability of mortality ~ 0.9) to be the difference between releasing the shark alive and dead.[11] As illustrated in the Lyons study, the survivorship benefits occur mainly prior to 24 hours and drop off steeply past that point. In addition, bycatch mortality of tope sharks is relatively high (64%) based on observer data. So, in evaluating bycatch mortality, the Commission should ensure that its soak time would benefit key species of concern.

Although an 8-to-12-hour soak time would be ideal for minimizing bycatch mortality for key sensitive species, we could support a 24-hour soak time because it is largely consistent with the current patterns of fishing in the set gillnet fleet. According to CDFW logbooks, ~72% of self-reported sets are under 24 hours.[12] This would improve upon the "best practices" already occurring within the fleet and reduce the number of sets that have greater physiological impacts and entanglement risks. Regarding enforcement of a 24-hour soak time, we support an explicit exception be made for weather, illness, or injury, consistent with gear tending requirements for other gear-types. We support the Commission requiring electronic net sensors to better enforce a 24-hour soak time.

If the Commission recommends a maximum soak time greater than 24 hours, we recommend new time and/or area closures be implemented in the near-term package to reduce bycatch and bycatch mortality (discussed below).

B. Time and Area Closures

We request the Commission implement time and area closures to reduce bycatch and bycatch mortality, address specific bycatch concerns, and increase protection of important areas of biodiversity in the Southern California Bight. Specific species of concern that would benefit from time/area closures include:

- *Tope (soupfin) sharks:* We support strong measures to protect the critically endangered tope shark from set gillnet bycatch. We understand the Department is analyzing potential options to protect tope sharks. For example, a seasonal closure to California halibut set gillnets to protect tope sharks during their spring spawning period, which aligns with the existing March 15-June 15 closure to white seabass set gillnets. This would protect tope sharks during their sensitive spawning period and would also reduce overall set gillnet fishing effort, reducing mortality on the Southern California halibut stock and directly reducing bycatch. Recent tagging work by Nosal et al. 2021[13] also identified gestation and nursery grounds for female sharks, which could inform area closures.
- *Great white sharks*: The Lyons et al. 2013 study identified areas of high white shark captures and found white sharks were captured in greater numbers in blocks where target species (CA Halibut and white seabass) CPUE was low.
- *Giant seabass*: these iconic fish often aggregate in specific known areas. We recommend the

[11] Lyons, et al. 2013, "Average net soak times for live and dead sharks were also significantly different 29.5 ± 22.6 and 40.7 ± 11.3 h; W = 961, p<0.001)."

[12] CDFW, pers. comms. 2023. Self-reported Soak Times in the California Set Gillnet Fishery.

[13] Nosal, AP, Cartamil, DP, Ammann, AJ, et al. Triennial migration and philopatry in the critically endangered soupfin shark Galeorhinus galeus. J Appl Ecol. 2021; 58: 1570–1582. https://doi.org/10.1111/1365-2664.13848

Department consult with giant seabass researchers to identify and consider time/area closures in such areas.

We support the Commission prohibiting set gillnet fishing within all waters of the Channel Islands National Marine Sanctuary and around Cortes and Tanner Banks. The Channel Islands National Marine Sanctuary is a special area renowned for its biodiversity that contains critical grounds for sensitive species of concern, such as tope sharks.

Cortes and Tanner Banks are incredible offshore banks boasting some of the best and most iconic important sportfishing opportunities on the US West Coast, sensitive seafloor habitats, and highly migratory species. Due to their ecological and recreational importance, the Commission should prohibit gillnets in these areas.

C. Gear-marking

All elements of the set gillnet gear should be frequently and uniquely marked in a way that will allow future entanglements to be negatively or positively attributed to the California set gillnet fishery. Based on records of large whales and pinnipeds entangled in unidentified gillnets off the West Coast, the lack of unique gear marking has prevented a definitive positive or negative fishery attribution. In many cases, only a small section of net, buoys, or line may be visible.[14,15,16] We would like to acknowledge and thank members of the fleet for their engagement with the Department in testing proposed gear-marking options. We understand the Department is currently considering adding a piece of unique line every several fathoms on the headrope containing fishermen's L-numbers. However, based on our discussions with NMFS and our experience with evaluating entanglements in the Dungeness crab fishery, these improvements do not go far enough to accomplish the goal of enabling positive or negative attribution of gillnet entanglements. Thus, these new markings are unlikely to solve the problem of "unidentified gillnet fishery" entanglements.

At a minimum, we recommend the Department mandate the use of a standardized mesh color across the California set gillnet fleet, a unique color combination for the headrope (corkline) and footrope, and a unique color, stripe, or pattern on the standard black corkline floats. CDFW is currently working on a unique bicolor pattern for its Dungeness crab fishery in combination with other states (see examples below). We recommend the Department implement this same approach of requiring a unique 2-color combination throughout the entire line (using different colors) for California set gillnets. We note that fishermen ideally should weigh in on the exact colors, and these must be different from other colors and patterns being developed for gear marking currently underway in trap fisheries. All improvements should be standardized across the fleet and include input from the NMFS entanglement response team.

[14] Pacific Marine Mammal Center, Orange County, pers comm. 2022.

[15] Stock Assessment Report: Long-beaked Common Dolphin, California Stock. 2008. Table 1. "Undetermined Strandings". Available: https://media.fisheries.noaa.gov/dam-migration/po2008docl-ca-508.pdf

[16] NMFS. 2023. West Coast Whale Entanglement Summary, 2022. Available : https://media.fisheries.noaa.gov/2023-04/2022-whale-entanglements-report.pdf

Unique line markings as currently proposed for each West Coast state's Dungeness crab fishery. The black line indicates it is a Dungeness crab fishery, and each of the three colors identifies the gear to a state. California's Dungeness crab fishery color combination is shown in purple and black.

D. Gear-loss Tracking

We recommend the Commission establish a gear tag monitoring program that would require gear tags distributed by the Department to be present on each gillnet buoy during fishing and returned to CDFW at the end of each year. Any tags issued but not returned would indicate gear lost or abandoned gear and should result in a fee or penalty. This is a reasonable and effective interim solution in the near term, while the Department considers new technologies such as electronic net sensors that could provide more definitive tracking of gear location and gear loss.

With no incentive or accountability measures to accurately report lost gear, we do not support self-reported tracking of set gillnet loss as the primary means for quantifying and tracking gear loss. Set gillnets are among the most common fishing gears collected by the California Lost Gear Recovery Project.[17] The Commission recommended the Department explore ways to improve gear loss reporting. Permittees are already required to self-report lost gear under California Fish and Game Code Section 8601, which also authorizes the Commission to require the owner of lost or abandoned gear to pay for all recovery costs. However, we understand from the Department that this self-reporting is not happening, and the provisions are not being enforced.

E. Maximum Mesh Depth (Net Height)

We support the fishermen's recommendation to enshrine current mesh depths as maximum net heights for nets targeting white seabass and nets targeting halibut as a new regulatory requirement. We note enshrining current fishing practices in regulation is not a bycatch reduction measure, but is good practice, and we appreciate fishermen proposing measures to improve upon management of their fishery.

F. Reinstating Federal Observer Coverage

We are encouraged that the Department is engaging with the federal NMFS West Coast Region Observer Program to explore opportunities to resume federal observer coverage of the California set gillnet fishery. Federal observer coverage is allocated based on funding available and priorities across fisheries. We urge the Commission to work with and support the Department's efforts to push NMFS for resumed set gillnet observer coverage as a high near-term priority. This does not require changes to California regulations but can be considered a key element of the Commission's near-term efforts to improve bycatch data.

[17] Bond, Amy. 2022. Lost Fishing Gear Recovered off Southern California Coast. UC Davis. Available: https://www.ucdavis.edu/climate/news/tons-lost-fishing-gear-recovered-southern-california-coast

2. Phase 2 Regulatory Package (Implementation Goal 2025)

Efforts to develop a Phase 2 regulatory package should continue concurrently with the Phase 1 process with the management and monitoring measures described below slated for a 2025 implementation.

A. State Pilot Observer Program

Based on the needs of the set gillnet fishery and the potential to improve data collection in other state fisheries, we recommend the Department develop a state observer program starting with a 3-year pilot program. The pilot program should involve electronic monitoring and human observers, and ideally identify areas of data and technology needs, and logistical and regulatory authority issues to inform a longer-term state observer program. Contracting with NMFS's current observer contractor, Frank Orth & Associates, may be an easier lift logistically to get state observers on boats. At the conclusion of the 3-year pilot, the Department could transition to a long-term permanent observer program based on the results and lessons learned from the pilot. This approach could be adapted to other fisheries in the future. For more information, please see our attachment to this letter: *Scoping a California State Fishery Bycatch Monitoring Program.* We note that new statutory and regulatory authority may be needed to implement an effective state program and are ready to assist the Department to ensure adequate authority exists to carry out the needed management activities.

B. Electronic Monitoring and Logbooks

We support the Department developing a regulatory package requiring electronic logbooks and electronic monitoring of the set gillnet fishery as part of a broader effort to modernize California fisheries data collection. We recommend consideration of the following components: cameras and sensors, vessel tracking (including Automatic Identifications Systems [AIS]), remote monitoring centers, electronic reporting, remote sensors, integrated data platforms, and compliance monitoring. As noted in our attached report, electronic monitoring should be tested in concert with human observers to evaluate its accuracy and determine ways that electronic monitoring can best complement human observers.

C. Bycatch Caps

Setting hard caps on bycatch for protected and vulnerable species is essential to ensuring bycatch stays within sustainable limits. The regulatory package should include bycatch caps based on observer data species of concern such as tope shark, giant seabass, white sharks, and all marine mammals, and sea turtles. Consistent with bycatch hard caps in other fisheries, reaching or exceeding the cap should automatically result in fishery closures for a pre-determined duration (e.g., one year or one season). This should include hard caps for gray whales and humpback whale entanglements in gillnets that are or may be California set gillnets using a precautionary approach as is done under the Dungeness crab fishery RAMP regulations.

3. Legislative Action in 2024

For proposed statutory changes outside of the scope of the Commission's authority, we look forward to engaging further with the Department and the Commission as the legislature addresses exemptions that currently allow the sale of protected species, makes changes to gillnet permits, and finds creative solutions to reduce bycatch.

We appreciate the productive dialogue with the Department and Commission, and the proactive work by the Department to put together a thoughtful suite of management and data improvement measures. We look forward to continued discussions with the Commission, Department and other interested and affected parties at the November 2023 Marine Resources Committee.

Sincerely,

Geoffrey Shester, Ph.D.
California Campaign Director & Senior Scientist

Caitlynn Birch
Pacific Marine Scientist

Attachment: "Scoping a California State Fishery Bycatch Monitoring Program"

OCEANA Protecting the World's Oceans

Scoping a California State Fishery Bycatch Monitoring Program

November 2023

Emerson Damiano
Oceana, Pacific Research Intern
University of Southern California

Caitlynn Birch
Oceana, Pacific Marine Scientist

Geoff Shester, Ph.D.
Oceana, California Campaign Director & Senior Scientist

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Executive Summary

Monitoring and accurately quantifying fishery bycatch are essential components of modern fishery management, especially for fisheries with unselective gear types and/or high ecological risk. This initial scoping document explores the potential development of a state-managed California fishery bycatch monitoring program using a combination of human observers and electronic monitoring (EM). The immediate purpose of this document is to provide a resource to the California Department of Fish and Wildlife (CDFW) and California Fish and Game Commission (Commission) outlining key background information required to build a successful observer program for the California set gillnet fishery as an initial pilot program that could then be expanded to other state fisheries as needed. This report does not detail the internal staffing and infrastructure costs of building a new program within CDFW – as these costs are highly variable – and acknowledges a critical aspect of implementing such a program is dedicated, long-term funding.

Section I summarizes the elements of an observer program, including an overview of existing federal observer programs. These elements include qualifications for observers, observer contracts, the funding and costs of existing observer programs, methods to ensure random sampling of fishing trips under partial observer coverage, and safety and data collection protocols.

Sections II and III summarize federal Alaska observer programs, the West Coast Groundfish Observer Program, and the West Coast Region Observer Program and how they are structured and funded.

Section IV explores case studies of state-developed observer programs, including the California state set gillnet observer program of the 1980s, the Massachusetts state sampling program, and the North Carolina state observer program.

Section V discusses EM and examines the extent to which EM can complement or substitute human observers. This section of the report provides information on 1) how EM works, 2) leading EM systems, 3) current EM usage nationally, 4) the advantages and disadvantages of EM, 5) electronic logbooks in fisheries, and 6) a discussion of costs of systems, installation, video review, and program management. This section also discusses how EM could be implemented in California fisheries in combination with human observers.

Section VI presents recommendations for reinstating federal observer coverage in the immediate term and developing a new state-managed observer program through a pilot project for the California set gillnet fishery. It also provides specific recommendations for improving observer data collection protocols for set gillnets.

Introduction – The Need for a California State Fishery Observer Program

The Need for Data on Fisheries Bycatch in California

Under California law, "Bycatch" means fish or other marine life that are caught in a fishery, that are either not the target of the fishery or not retained. "Bycatch" includes discards of target species as well as retained non-target species.[1] Primary conservation concerns with bycatch include discarded animals that do not survive and retained catch of species not managed in Fishery Management Plans (FMPs) or without current stock assessments. These types of bycatch present significant risks to sustainable fisheries because they can contribute to overfishing and population declines.[2] California's marine ecosystems are a center for biodiversity and many marine species are regularly targeted in fishing.

A key data gap in many state-managed fisheries, including those in California, is the species composition and quantity of the catch, including retained and discarded species. California fishery managers are currently reviewing bycatch in California halibut gillnet and bottom trawl fisheries. Some observer data is available for the California set gillnet fishery (Table 1); however, data gaps remain – specifically, limited sporadic coverage and a lack of comparable total effort data. A key management need is to improve bycatch estimates through regular, standardized collection of data on catch and discards, and fishing effort.

Year	Annual Percent Observer Coverage
2007	17%
2008	0%
2009	0%
2010	12.5%
2011	8%
2012	Unknown
2013	Unknown
2014	0%
2015	0%
2016	0%
2017	Unknown
2018	0%
2019	0%
2020	0%
2021	0%
2022	0%

Table 1. NMFS California set gillnet observer coverage levels from 2007 to 2022.[3] The observer program ceased observing the fishery in 2017. In years 2012, 2013, and 2017, percent coverage is unknown because the total number of fishing sets during those years is unknown.

[1] California Fish and Game Code Section 90.5. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=178840
[2] NMFS. 2011. U.S. National Bycatch Report (W. A. Karp, L. L. Desfosse, S. G. Brooke, Editors). U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-117E, 508 p. https://spo.nmfs.noaa.gov/sites/default/files/tm117E.pdf
[3] NMFS. 2022. California Set Gillnet Observer Program Observed Catch Summary, January 1, 2007, through December 31, 2017. Available: https://media.fisheries.noaa.gov/2022-01/setnet-catch-summaries-2007-2010-2013-2017.pdf

Under the California Marine Life Management Act (MLMA), state FMPs must include information on amount and type of bycatch, analysis of bycatch and its legality, and the effect of the bycatch on other fisheries and the ecosystem. If the California Fish and Game Commission deems bycatch unacceptable under the MLMA standards, they must seek solutions to minimize the bycatch. This process is guided by a bycatch inquiry detailed in the MLMA Master Plan for Fisheries.[4]

Currently, there is no state program to collect bycatch information for state fisheries, and the state must rely upon landings data, logbooks, and federal observer data to assess bycatch impacts. Landings data provides information on the species that are retained, but does not provide information on catch that is discarded at sea. The state also relies upon logbook reporting requirements and resulting data, which requires fishermen to log all fishing activity under a given permit. All fisheries, state and federally managed, are required to report protected species interactions to the National Marine Fisheries Service (NMFS), which provides some information on protected species bycatch. However, such self-reporting may not be accurate especially if there are incentives to misreport or underreport. An Oceana analysis of self-reporting data obtained via the Freedom of Information Act found that approximately 94% of marine mammal interactions in the California set gillnet fishery are not self-reported, despite this reporting being required by law.[5]

Fishery Observers and Electronic Video Monitoring

Observers, or trained biological technicians that work aboard fishing vessels to quantify total catch, estimate bycatch, and monitor fishery interactions with marine mammals and other protected species, are currently the best method for tracking bycatch.[6,7,8] NMFS deploys observers on fishing fleets to monitor federally managed species under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Marine Mammal Protection Act (MMPA), and/or the Endangered Species Act (ESA).

At its discretion, the federal government may deploy observers for state-managed fisheries that interact with federally managed fish or protected species. However, outside of these critical species, federal observer programs do not have authority over many state fisheries, and observing a specific state fishery may not be a federal priority. From 2007-2022, NMFS observed 6 years of fishing in the California set gillnet fishery, with a coverage level less than

[4] See CDFW. Master Plan for Fisheries. Chapter 6. Available at: https://wildlife.ca.gov/Conservation/Marine/MLMA/Master-Plan/Ecosystem-based-Objectives
[5] Oceana. 2023. Underreporting of Marine Mammal Bycatch in the California Set Gillnet Fishery. Available: https://usa.oceana.org/wp-content/uploads/sites/4/2023/10/Oceana_CA-set-gillnet-self-reporting-analysis.pdf
[6] Karp, W.A., McElderry, H. and Nolan, C.P., 1999. Catch monitoring by fisheries observers in the United States and Canada. https://www.fao.org/3/x3900e/x3900e13.htm
[7] Davies, S.L., Reynolds, J.E. (eds.), 2002. Guidelines for developing an at-sea fishery observer programme. FAO Fisheries Technical Paper, No. 414. FAO, Rome 116p. https://www.fao.org/3/y4390e/y4390e.pdf
[8] Perez Roda, M.A., Gilman, E., Huntington, T., Kennelly, S.J., Suuronen, P., Chaloupka, M., Medley, P., 2019. A Third Assessment of Global Marine Fisheries Discards. FAO Fisheries and Aquaculture Technical Paper. No. 633. FAO, Rome 79 pp.
https://www.researchgate.net/publication/330400691_A_third_assessment_of_global_marine_fisheries_discards

20% in those years (Table 1). This means 10 of those years were left unobserved, despite the NMFS 2011 National Bycatch Report recommendation for this fishery "…to increase observer coverage to at least 20% to better document bycatch of key species with low abundance."[9] An increase in coverage would require a substantial increase in program funding to implement. NMFS has not observed the fishery since 2017 and California has no control over the level of federal observer coverage in this fishery.

Curtis and Carretta (2020) found that high levels of observer coverage (as high as 100%) are needed to detect bycatch of rare or infrequently caught species,[10] so observer programs should consider what the appropriate coverage is needed based on management needs. Quantifying total amounts of bycatch with precision requires both observer data and total fishing effort. A key data gap in the California set gillnet fishery is the inability to estimate total bycatch, as the federal observer program measures fishing effort differently than the state of California. The state has been tracking the number of times a permitted vessel lands fish, also called the number of trips. The observer program has recorded catch data per "set", or every time a net is deployed and retrieved. Incomparable units of fishing effort between the observer program and total fleetwide effort prevent fishery managers from quantifying the scope of bycatch and total catch, making it difficult to assess potential impacts to fish stocks and bycatch species.

To address these issues, an effective solution would be to set up a California state-run fishery observer program. Rather than relying on the federal government to provide observers, California would create a program that ensures an effective amount of observer coverage and data collection that meets the management needs. Implementing a state-run observer program is a complex and costly undertaking and requires coordinated effort among federal and state fishery managers. The California halibut set gillnet fishery has been prioritized as the first state fishery to be run through the updated management process outlined in the MLMA Master Plan for state fisheries.[11] Considering the bycatch monitoring needs of the California set gillnet fishery and the moderate fleet size, this fishery is ideal for a pilot state-run observer program.

This report discusses several existing federal observer programs, as well as case studies on state-run observer programs and examines the potential of EM in fisheries management.

[9] NMFS. 2011. U.S. National Bycatch Report [W. A. Karp, L. L. Desfosse, S. G. Brooke, Editors]. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-117E, 508 p. https://repository.library.noaa.gov/view/noaa/31335
[10] Curtis, K Alexandra, and James Carretta. 2020. Assessing Observer Coverage Needed to Document and Estimate Rare Event Bycatch. Fisheries Research (May 1, 2020): 105493. https://doi.org/10.1016/j.fishres.2020.105493
[11] "Prioritizing Management Efforts: Chapter 2 of the Marine Life Management Act." MLMA Master Plan. Available: https://mlmamasterplan.com/2-prioritizing-management-efforts/. Accessed 23 June 2023.

Section I. Elements and Considerations for Observer Programs

There are many different observer programs that can be implemented for fishery observation; the type of program is dependent on which questions the observer program is trying to answer. When setting up a fishery-specific observer program it is important to consider how human observation can provide the data needed to ensure bycatch is tracked and accounted for as much as possible. This section explores critical aspects of existing federal observer programs to inform a potential state-run pilot observer program.

Images courtesy of NOAA Fisheries. Fishery observers on vessels recording fish length.

Observer Qualifications

Any observer program must develop qualification requirements and training for its observers. Across federal observer programs, there are generally two levels of observers. The first level of observers are at-sea monitors, who require less training and no Bachelor of Science. These observers generally record their observations of total observed catch counts on the vessel. The second level of observers are biological technicians who collect samples and measurements of species along with additional data. These fishery observers are required to have a Bachelor of Science, specialized training, and knowledge of species identification. Biological technician observers tend to cost more, as they require higher education and extensive training; and because they collect more data.

Contracting Observers

Federal observer programs contract observers through third-party organizations. NMFS uses many different third-party contractors to provide observers throughout the United States. In the Atlantic, the Gulf of Mexico, the Caribbean, and the Southeast United States, NMFS uses A.I.S., Inc. to provide observers. In the Northeast, NMFS utilizes A.I.S., Inc., East West Technical Services LLC, and Fathom Resources LLC to provide observers to eight different fisheries. In the Pacific Islands, NMFS uses FLOAT partners to provide observers to the fisheries, and in the North Pacific, NMFS utilizes A.I.S., Inc., Alaskan Observers, Inc., Saltwater, Inc., and TechSea International, Inc. to provide observers to the region. On the West Coast, NMFS uses Alaskan Observers, Inc., Frank Orth & Associates, Saltwater, Inc., and TechSea International, Inc. to

provide observers.[12] The NMFS West Coast Regional Observer Program, which has observed the California set gillnet fishery in the past, contracts observers through Frank Orth & Associates.

Assigning Observers to Ensure Random Coverage

Unless 100% of fishing effort is observed, random sampling of effort in a fishery is critical to obtain accurate representative estimations of total bycatch. Under this randomized sampling system, fishermen must be prepared for an observer to be on their vessel during any given fishing trip. If observers are a part of a direct contract, congressionally mandated system, fishermen are required to give 48-hour notice of their fishing trips. All reported fishing trips are then placed in a pool and are randomly selected for observer coverage. This ensures the most fair and equal randomized selection system. However, if an observer program is not a regulatory requirement, fisherman approval is needed before putting observers on a vessel, which may affect the randomness of the observer sample.

Some vessels may be deemed unobservable due to the size of the vessel, weather conditions, or the safety of the observer. To ensure random, unbiased, sampling in this situation, there either needs to be an elimination of the unobservable exemption (i.e., prohibit fishing without an observer) or require equivalent data collection through EM on vessels that cannot host an observer.

Data Collection Protocols

A key element of managing an observer program is training observers to use consistent data collection protocols. Data collection by observers depends both on the management needs of the fishery as well as the fishing technique. There are different methods for observing and counting bycatch for different gear types, such as trawl fisheries or gillnet fisheries. Some observer programs count bycatch and catch via the weight of the catch, rather than individual species. For example, the observed catch and bycatch in the West Coast Groundfish trawl fishery is recorded by weight to enable management of weight-based individual fishing quotas by species. Conversely, the California set gillnet fishery is observed based on counts of individuals because the primary purpose is to estimate how many individual marine mammals are taken.

Counting catch via different units creates challenges in comparing across fisheries or making extrapolations if fish are counted in different units than are recorded during landing. For the California set gillnet fishery, where landed catch is reported via weight, recording observed catch and bycatch in a method that is easily transcribed to weight would allow for comparison and extrapolation based on total landing weight. One way to accomplish this is to record the length of each individual fish, or a subsample of each species, which can be converted to estimated weight using known length-weight ratios. Standardizing bycatch reporting enables comparison across fisheries and improved accuracy of total bycatch estimates.

[12] NMFS. 2021. Observer Providers. Available: www.fisheries.noaa.gov/national/fisheries-observers/observer-providers. Accessed June, 2023.

Observer Coverage

One hundred percent observer coverage requires an observer on every single fishing trip. This method removes the operational complexities of ensuring random sampling and eliminates uncertainties in estimating total bycatch from partial sampling, but it is more expensive. The closer to 100% observer coverage of the fleet the higher the chance rare event or infrequently caught species are detected.[13] This method is also employed to enforce strict limits on protected species interactions such as sea turtle interactions in the Hawaii shallow-set longline fishery, or individual vessel quotas on fish species such as the West Coast trawl fishery.

Partial observer coverage (i.e., less than 100%) is less expensive than full coverage but increases uncertainty in total bycatch estimates, and requires additional methods to ensure representative sampling. Higher coverage rates offer more accurate depictions of bycatch in the region by increasing awareness of rare species catch, providing better knowledge of total catch, and allowing more opportunity for biological sampling.[13]

The Funding and Costs of a Human Observer Program

Current federal observer programs are either funded by congressionally mandated funds via direct contract with the observers, or by the industry, when an industry pays for observer coverage of a certain number of trips. Most observer programs fall under the direct contract category, with the exception of several industry-funded programs in Alaska. Congressional funds also pay for all observer training. The cost of maintaining observer programs changes depending on the size of the fleet that needs monitoring, the distance of the fishery from the coast, the percentage of the fleet covered by observers, and the time observers need to be on the vessel.

Observation costs can be dependent on fishing vessel and gear type as well, which impacts cost estimates. Estimating costs is challenging, as there are fixed costs upon initially establishing the program, and variable costs depending on the level of observer coverage. Fixed costs include the training of observers, management of the program and its data, regulatory costs, insurance for observer maritime safety, and payment of the observer contractor. Variable costs depend on the number of observers, the number of observed trips, observer transportation, housing, and wages.

In direct contract programs, the programs ask for a certain number of sea days covered. The hiring company of third-party observers determines how many observers to hire to ensure there is enough availability. In a year where the California set gillnet fishery was observed in the West Coast Region Observer program, fiscal year 2013, the WCROP received the majority of its observer program funds ($899,357) through the National Observer Program (NOP) budget line.[14] These funds cover all annual costs of running the program. The program observed a total of 391 sea days in 2013 using 5 observers for the California large-mesh drift gillnet, the California set gillnet, and the California deep-set pelagic longline fisheries. In 2013 the program observed 169

[13] Curtis, K Alexandra, and James Carretta. 2020. Assessing Observer Coverage Needed to Document and Estimate Rare Event Bycatch. Fisheries Research (May 1, 2020): 105493. https://doi.org/10.1016/j.fishres.2020.105493
[14] NMFS. 2017. National Observer Program FY 2013 Annual Report. NOAA Tech. Memo. NMFS F/SPO-178, 34 p. https://media.fisheries.noaa.gov/dam-migration/fy2013_nop_annual_report.pdf

sets in the California set gillnet fishery, however it is unknown what annual percent coverage this provided (Table 1). For context, NMFS estimates fleetwide effort in the California set gillnet fishery has ranged from 1,387 to 2,123 sets from 2007 – 2011.[15]

Lack of direct data on past program costs specifically for the California gillnet fleet make estimating observer costs difficult. Comparing potentially similar programs may provide a general estimate of annual program costs. For example, an annual estimate of at-sea monitoring for a single gillnet vessel in the New England Groundfish fishery is ~ $28,500 per year.[16] This estimate comes from a projected costs estimates report for the Groundfish fishery, and is based on an example gillnet vessel of 40ft, that fished 50 days/trips (3 sets/trip), assuming each trip was18-24 hours. The estimate includes all program management, data processing, overhead and observer costs accrued annually for an established 100% coverage program. Annual costs of an observer program are based on a number of assumptions that may not necessarily reflect the fishing and observer needs of the California gillnet fleet, but do provide an idea of what a 100% coverage observer program may cost annually.

Challenges

There are challenges to consider in designing and managing an observer program. Observers require additional space on a vessel that may not be available on certain vessels. Additionally, harassment on fishing vessels in the form of physical, emotional, and sexual abuse has occurred. Fishermen may feel threatened having an observer document their catch. Therefore, NMFS has ensured specific training for observers to mitigate harassment and put a protocol in place to report incidents. In addition to training, NMFS provides a debriefing session and in-season advising for observers placed on fishing vessels. Observers are encouraged to report inappropriate behavior and are provided training to identify inappropriate behavior.[17]

In partially observed fisheries, the "observer effect" is a well-documented phenomenon, where fishermen behave and fish differently with observers onboard.[18] This effect can impact the

[15] NMFS. California Set Gillnet Observer Program Observed Catch Summary, January 1, 2007, through December 31, 2017. https://media.fisheries.noaa.gov/2022-01/setnet-catch-summaries-2007-2010-2013-2017.pdf
[16] CapLog Group LLC. 2019. Projected Cost of Providing Electronic Monitoring to 100 Vessels in New England's Groundfish Fishery. Commissioned by the Nature Conservancy. Available: https://em4.fish/wp-content/uploads/2019/04/TNC-EM-Cost-Assessment-Report-Submission-to-NEFMC-4_10_19.clean_.pdf
[17] NMFS. "Keeping Fishery Observers Safe from Harassment." *NOAA*, 11 Dec. 2019, www.fisheries.noaa.gov/feature-story/keeping-fishery-observers-safe-harassment.
[18] Faunce, C. and Barbeaux, S. "Deployment and Observer Effects as Evidenced from Alaskan Groundfish Landing Reports." [Poster] Seattle, WA. (2008). Available at: https://access.afsc.noaa.gov/pubs/posters/pdfs/pFaunce02_deployment-observer.pdf

precision and accuracy of fishery-level inferences drawn from observer data, though this is rarely addressed when extrapolating up to total catch and discard estimates.[19,20,21]

Another challenge that must be considered when creating a partial coverage observer program is the difficulty of setting up a program for random sampling. Random sampling is difficult to achieve on both operational and conceptual levels because observer data must be random on multiple levels. For example, there must be a random sample of the vessels, a random sample of the fishing effort (in number of trips or number of sets), as well as a random sample of the catch and bycatch being recorded.[22] One issue for random sampling design is that some vessels may be deemed unobservable due to the size of the vessel, weather conditions, or safety of the observer.

Partial coverage observer programs rely upon fishermen to notify the observer program in advance when they are going fishing. Unless there is careful monitoring of fishing activities and accountability for failing to provide notification, fishermen may be able to avoid being observed. Even if fishermen do call to give notice of their upcoming fishing trip, there are questions of whether an observer is available, if there is enough funding for the ideal number of at-sea days covered, and the complexities of getting observers to a certain location.

Section II. Overview of US and Alaska Federal Observer Programs

There are many observer programs already in place all over the country, most managed by NMFS under the authority of the MSA or the MMPA.[23] Table 2 provides an overview of existing federal observer programs in Alaska and West Coast, the number of observers, and the percent coverage for a given fleet.

[19] Benoît, Hugues & Allard, Jacques. (2009). Can the data from at-sea observer surveys be used to make general inferences about catch composition and discards? Canadian Journal of Fisheries and Aquatic Sciences. 66. 2025-2039. 10.1139/F09-116. https://cdnsciencepub.com/doi/10.1139/F09-116

[20] Mucientes, Gonzalo, Marisa Vedor, David W. Sims, and Nuno Queiroz. (2022) "Unreported Discards of Internationally Protected Pelagic Sharks in a Global Fishing Hotspot Are Potentially Large." Biological Conservation 269: 109534. https://doi.org/10.1016/j.biocon.2022.109534

[21] Walsh, W. A., Kleiber, P., and McCracken, M. (2002). Comparison of logbook reports of incidental blue shark catch rates by Hawaii-based longline vessels to fishery observer data by application of a generalized additive model. Fish. Res. 58, 79 –94. doi: 10.1016/S0165-7836(01)00361-7. http://www.soest.hawaii.edu/pfrp/reprints/walsh_logbook_blue_shark.pdf

[22] Cahalan, Jennifer & Faunce, Craig. 2020. Development and implementation of a fully randomized sampling design for a fishery monitoring program. Fishery Bulletin. NOAA. 118. 87-99. 10.7755/FB.118.1.8. https://spo.nmfs.noaa.gov/sites/default/files/pdf-content/fish-bull/cahalan_0.pdf

[23] Benaka, L. (editor). 2023. National Observer Program FY 2021 Annual Report. NOAA Tech. Memo. NMFS-F/SPO-241, 32 p. https://spo.nmfs.noaa.gov/tm.htm.

Location	Authority to Place Observers	Fisheries Observed	Number of Vessels	Funding Sources	Target Coverage	Actual Coverage	Number of Observers
Alaska	MSA	Bering Sea & Aleutian Islands (BSAI) Groundfish Trawl BSAI and Gulf of Alaska Catcher Processors Longline Pacific Cod GOA Groundfish Program and Catcher Processors	1,418	North Pacific Marine Resource Observers National Observer Program Reducing Bycatch Congressional Funding Industry Funding	100%	100%	378
Alaska	MSA	BSAI and GOA Groundfish, Trawl, Longline, and Pot Fisheries US Pacific Halibut Fishery	1,418	North Pacific Marine Resource Observers National Observer Program Reducing Bycatch Congressional and Industry Funding	Pot: 15 - 18% Hook/ Line: 15-18% Trawl: 16 - 21%	Pot: 16.5 – 20.5% Hook/Line: 12.4 – 17.4% Trawl: 19.9 – 28.2%	378
TOTAL ALASKA REGION OBSERVER PROGRAM FUNDING (CONGRESSIONAL): $8,951,381 TOTAL ALASKA REGION INDUSTRY EXPENDITURES: $16,029,415 TOTAL ALASKA REGION OBSERVER PROGRAM FUNDING (ALL SOURCES): $ 24,980,796							
West Coast	MSA MMPA	California Large Mesh Drift Gillnet Fishery	7	National Observer Program	20%	22.8%	9
West Coast	MSA MMPA	Deep Set Buoy Gear Exempted Fishing Permit (EFP)	30	National Observer Program	10 – 30%	24.7%	9
West Coast	MMPA	California Deep-Set Pelagic Longline	3	National Observer Program Industry Funded	20%	26.7%	9
West Coast	MSA	**West Coast Trawl Catch Share** **Catch Share Using Electronic Monitoring**	140	National Catch Share Program West Coast Observers Industry Funding National Observer Program Cost Recovery National Catch Share Program	100%	100%	95 47
West Coast	MSA	**West Coast Groundfish Non-Catch Share Fisheries**	LE Long-line 190; trap 33 OA Permits: ~1,000	National Observer Program West Coast Observers Reducing Bycatch	10%	LE: 34% OA: 2-18%	56
TOTAL WEST COAST REGION OBSERVER PROGRAM FUNDING (CONGRESSIONAL): $8,931,781 ($1,219,173 of which funds the West Coast Region Observer Program – DGN, DSBG, Pelagic Longline) TOTAL WEST COAST REGION INDUSTRY EXPENDITURES: $2,918,664 TOTAL WEST COAST REGION OBSERVER PROGRAM FUNDING (ALL SOURCES): $11,850,445							

Table 2: NOAA federal observer programs in Alaska and West Coast, according to the NMFS National Observer Program Annual Report 2021. Table provides location in the United States, the authority through which the observers are placed on vessels, fisheries observed, the number of vessels in the fishing fleet, the source of funding, target coverage, actual coverage, number of observers in the program, and observer program funding. Bolded programs are described in Federal Case Studies.[24]

[24] Benaka, L. (editor). 2023. National Observer Program FY 2021 Annual Report. NOAA Tech. Memo. NMFS-F/SPO-241, 32 p. https://spo.nmfs.noaa.gov/tm.htm

Section III. Federal West Coast Observer Programs

There are two main federal observer programs on the U.S. West Coast: The West Coast Groundfish Observer Program and The West Coast Region Observer Program.

West Coast Groundfish Observer Program

The West Coast Groundfish Observer Program is overseen by NMFS' Northwest Fisheries Science Center, and places observers on both Catch Share Groundfish fisheries and Non-Catch Share Groundfish fisheries. [25] The goal of this program is the collection of coast-wide, year-round catch and discard amounts by species for groundfish fisheries along the West Coast to manage individual quotas for federally managed trawl groundfish fisheries. The program also tracks and estimates protected species bycatch, including threatened and endangered fish, seabirds and marine mammals. NMFS works with third-party private companies to train and provide at-sea observers to quantify the discard rate and ensure it does not result in excessive overfishing of groundfish species. The program measures catch via weight. This program currently observes a number of West Coast fishing sectors, including the West Coast Groundfish Trawl Catch Share, the Limited Entry Bottom Trawl, the West Coast Fixed Gear, the West Coast Pink Shrimp Trawl, the California Halibut Trawl, and the West Coast Nearshore Groundfish fisheries.[26] Occasionally, the West Coast Groundfish Observer Program observes state-managed fisheries and fisheries operating under an exempted fishing permit.

Observers in this program work on vessels fishing with a variety of gear types, including longline, pot, and shrimp trawls. During their time at sea, which can last up to three weeks, observers gather fishing effort and location information, sample species composition, and collect biological data from both target and non-target species. This program is all-encompassing: it trains observers, devises sampling plans, manages observer resources, notifies vessels when they are required to have observers onboard, outfits observers with safety and sampling gear, stores and manages collected data, and debriefs observers. This program is essentially divided into two components: catch share and non-catch share.

The Catch Share Program requires 100% observer coverage while the vessel is active in the catch share fishery. Full coverage is needed to enforce individual vessel catch limits. The Non-Catch Share Groundfish Observer Program uses partial observer coverage, and NMFS has developed a vessel selection process to ensure random sampling coverage. The Non-Catch Share Program is paid for via federal funds, whereas the Catch Share Program is paid in part by industry in addition to congressional funds.

[25] NMFS. 2023. West Coast Groundfish Observer Program. https://www.fisheries.noaa.gov/west-coast/fisheries-observers/west-coast-groundfish-trawl-catch-share-observer-program
[26] Benaka, L. (editor). 2023. National Observer Program FY 2021 Annual Report. NOAA Tech. Memo. NMFS-F/SPO-241, 32 p. https://spo.nmfs.noaa.gov/tm.htm

West Coast Region Observer Program

The West Coast Region Observer Program (WCROP) is managed by NMFS, and places trained fishery observers aboard fishing vessels primarily to monitor the incidental catch of marine mammals, sea turtles, and seabirds.[27] In addition to protected species, observers also collect data on target and non-target fish species and selected biological specimens. The program is run by NMFS West Coast Regional Office in Long Beach, California, and monitors California fisheries, including the California large-mesh drift gillnet fishery, California deep-set buoy gear, and the California deep-set pelagic long-line fishery. In 2021, the WCROP received $1,219,173 in funding to monitor these 3 fisheries, which covered all annual costs of running the program.[26] This funding employed 9 WCROP observers, which covered a total of 456 at-sea days (approximately 25% of fishing effort) observing the 3 California fisheries in 2021 (Table 2). The program once also monitored the California set gillnet fishery and began placing observers on vessels in the 1990's but ceased in 2017.

When in place, the goal of the California set gillnet observer program was to monitor and estimate marine mammal take by the number of individual animals under the MMPA. Because the California set gillnet fishery is managed by the state, NMFS authority to observe the fishery is based on the take of federally protected marine mammals under the MMPA. While observers were on vessels, they collected data on all species in addition to protected species. This fishery is a limited entry fishery primarily conducted in federal waters (3 to 200 nautical miles from shore) in southern California that targets a multi-species assemblage including California halibut, white seabass, California barracuda, and yellowtail. Between 2007 and 2017, 6 years were observed.[28] The observer program is not currently active in the California set gillnet fishery. There are currently 35 active set gillnet vessels from Santa Barbara to San Diego, and 90 existing permits. Observers of the California set gillnet fishery were contracted exclusively through Frank Orth & Associates.[29] The observer program requests a certain number of at-sea days annually for all its observer fisheries, and Frank Orth hires the appropriate number of observers. On average, the company hires 7 to 10 observers in a season.

Section IV. State-Managed Observer Programs

While there are many federal observer programs run by NMFS, there are very few state-managed observer programs. The most comprehensive and long-lasting state program is in North Carolina. Massachusetts also has a small-scale sampling program. Rather than relying on observers provided by NMFS, states provide and contract the observers; however, in some state programs funding is partially provided by the federal government.

Historic State Observer Program in the California Set Gillnet Fishery

[27] NMFS. 2023. West Coast Region Observer Program. Available : https://www.fisheries.noaa.gov/west-coast/fisheries-observers/west-coast-region-observer-program. Accessed June 2023.
[28] NMFS. California Set Gillnet Observer Program Observed Catch Summary, January 1, 2007, through December 31, 2017. Available: https://media.fisheries.noaa.gov/2022-01/setnet-catch-summaries-2007-2010-2013-2017.pdf
[29] NMFS. 2023. West Coast Region Observer Program. Available : https://www.fisheries.noaa.gov/west-coast/fisheries-observers/west-coast-region-observer-program. Accessed June 2023.

The historic state observer program for the California set gillnet fishery ran from 1987 to 1990 before NMFS began monitoring the fishery from 1990 onward. It was created by the California Department of Fish and Wildlife (CDFW), then called the California Department of Fish and Game, and was a voluntary program. The program's goal was to assess retained and discarded catch, as well as data on discarded bird and marine mammal species such as the common murre, harbor porpoise, and southern sea otter.[30] The funding for this program came from CDFW and private sources.

Observers were not always placed on the same vessel as the fishermen; instead, they often followed and counted catch aboard a separate vessel. This program had approximately 5% coverage during the 3 years of operation.[30]

North Carolina State Observer Program

The North Carolina State Observer Program first began in 2009 when NMFS informed North Carolina that its estuarine gillnet fisheries would be subject to federal closures under the ESA unless the state found a solution to address unauthorized takes and discards of endangered sea turtles. [31] The request from NMFS expanded to Atlantic sturgeon in January 2012.

In response to these requests, the North Carolina Division of Marine Fisheries (DMF) applied for and obtained two Incidental Take Permits for sea turtles and Atlantic sturgeon in its fisheries using anchored gillnets in estuarine waters. The reason the state applied for these permits was to ensure they could continue to allow fishing in these estuarine gillnet fisheries while minimizing bycatch of sea turtles and sturgeon. The Incidental Take Permits require these fisheries to have observers from the DMF. The minimum amount of observer coverage under this permit is 7% of large mesh fishery and 1% of small mesh fishery, and observers must collect data from every moment they are onboard to stay in compliance with the federal Incidental Take Permit that the state requested from the federal government.[32]

The DMF works with an observer contractor that provides observers for the North Carolina State Observer Program. All observers are trained in protected species interactions, fishing effort, gear characteristics, and fish populations. Because observers cannot be on all fishing trips, the DMF uses a federally approved statistical system to observe a portion of trips and provide an extrapolated estimate on takes. Observers are therefore put on trips with fishermen randomly selected from the permit pool.

[30] CDFG. 1986. Progress Report: California Gill and Trammel Net Investigations (Northern Area). Prepared by P.W. Wild. (pers. comms. Burr Heneman)
[31] North Carolina Division of Marine Fisheries. 2023. North Carolina Observer Program. Available: https://www.deq.nc.gov/about/divisions/marine-fisheries/science-and-statistics/observer-program#ProgramDetails-4364
[32] Register, Rhett. 2015. The Power of Observation. North Carolina Sea Grant, Coastwatch. Available: https://ncseagrant.ncsu.edu/coastwatch/previous-issues/2015-2/autumn-2015/the-power-of-observation/

The North Carolina State Observer Program was appropriated $1.1 million in 2013 for the fiscal year of 2013-14 to maintain the observer program.[32] In addition, the DMF approved a 25% increase in commercial fishing license fees starting in the fiscal year of 2014 to 2015 to fund the program in the future. After seeking further public input for additional funding for the program, the North Carolina Fisheries Association suggested that the North Carolina Marine Fisheries Commission establish a Commercial Fishing Resource Fund, which receives revenues from a 100% increase in fees for six of the different commercial fishing licenses. This fishery has over 2,600 participants, so such an approach may not work for smaller fisheries like California set gillnet fishery with fewer than 40 active participants. The fee money contributed to the fund to pay for observer coverage to fulfill the state's Incidental Take Permit. The North Carolina Incidental Take Permit program is scheduled for renewal in late 2023.

In addition to the observer program, self-reporting by fishermen is required. Fishermen have guidelines to follow for each protected species caught. For example, regulations are in place for both sea turtle bycatch prevention and protocol for commercial or recreational fishermen when a sea turtle is caught. Recreational and commercial fishermen are required to self-report unobserved interactions with sea turtles and Atlantic sturgeon to the DMF. While this data is likely incomplete, it helps the DMF biologists improve their understanding of impacts to protected species so they can work with fishermen to avoid hotspot areas. However, self-reporting is widely understood to be biased and vastly under-represents bycatch. Self-reports should therefore not be used in management or for estimating bycatch.

Massachusetts State Sampling Program

The smaller scale Massachusetts State Observer Program also has a program entitled Fisheries Dependent Investigations (FDI), which works with fishermen to collect data to inform stock assessments and fishery policy to avoid excess bycatch in the fishery.[33] The agency also completes sampling requests submitted by biologists and collaborators and conducts long-term monitoring research projects. Yearly funding is provided by the National Fish and Wildlife Foundation and the Nature Conservancy.

FDI conducts fisheries sampling on docks and commercial vessels. The agency employs a sampling methodology consistent with the NMFS Northeast Fisheries Observer Program. FDI priorities include sampling for the agency's Lobster Investigations Project and experimental fisheries. These data support commercial trawl, gillnet, longline, and dredge fisheries management.

In addition to sampling on the water, the FDI samples fish markets to inform stock assessments. Observers sample commercial catches that include species such as striped bass, dogfish, squid, black sea bass, menhaden, and tautog. One of their largest portside sampling programs is the Atlantic herring portside sampling and bycatch avoidance program, which was started in 2008 by the Massachusetts Department of Marine Fisheries (DMF). The goal of the program is to reduce

[33] Massachusetts Division of Marine Fisheries. Fisheries Dependent Investigations. Available: www.mass.gov/service-details/fisheries-dependent-investigations. Accessed June 2023.

river herring and American shad bycatch by 50%. Rather than placing biologists on the vessels as observers, the program has biologists sample landings when vessels offload their catch. The DMF samples an average of 133 trips and 17,000 metric tons of landings each year.[34] Coverage rates for Atlantic herring typically exceed 75%. Observers also record fish length and collect biological samples portside. If bycatch is found in a landing, they report the fishing location as a hotspot and encourage fishermen to avoid fishing those areas.

Although the Massachusetts sampling program is state-run, they coordinate their protocols and sampling priorities with NMFS Northeast Fisheries Observer Program.

Section V. Electronic Monitoring of Bycatch

Electronic Monitoring Background

Electronic monitoring, or EM, is a broad category of systems used to monitor fisheries. There are different EM systems, such as video monitoring, logbooks, count catch data, vessel monitoring systems to track vessel locations, electronic logbooks allowing fishermen to digitally enter data, and electronic fish tickets to replace paper tickets when fish are sold. The choice of systems depends on the management needs. Important factors to determine which EM system to use include the location of the fishing trip, gear-type, the duration of the fishing trip, and the amount of bycatch.

Video EM is a tool used to collect fishing data including the number of fish that are caught, fishing effort, and bycatch. Cameras are generally placed on vessels pointed at the deck and can watch fishing activity up to 24-hours a day. Some systems may monitor fishing 24-hours a day but are only triggered to record when gear-hauling hydraulics activate. This saves space on EM-related hard drives. EM companies work with the fishing vessels to place cameras to ensure the fishermen are comfortable with the camera angle, the necessary data that are collected, and blind spots are being prevented as much as possible. These systems may one day have the potential of replacing or complementing a human observer, however, a human is still required to review the footage as artificial intelligence recognition technologies are not fully developed.[35]

[34] Massachusetts Division of Marine Fisheries. Herring Portside Sampling and Bycatch Avoidance. Available: www.mass.gov/service-details/herring-portside-sampling-and-bycatch-avoidance. Accessed June 2023.
[35] D.C. Bartholomew et al. 2018. Remote Electronic Monitoring as a Potential Alternative to On-Board Observers in Small-Scale Fisheries. Biological Conservation 219 (2018): 43 p. http://www.sciencedirect.com/science/article/pii/S0006320717307899.

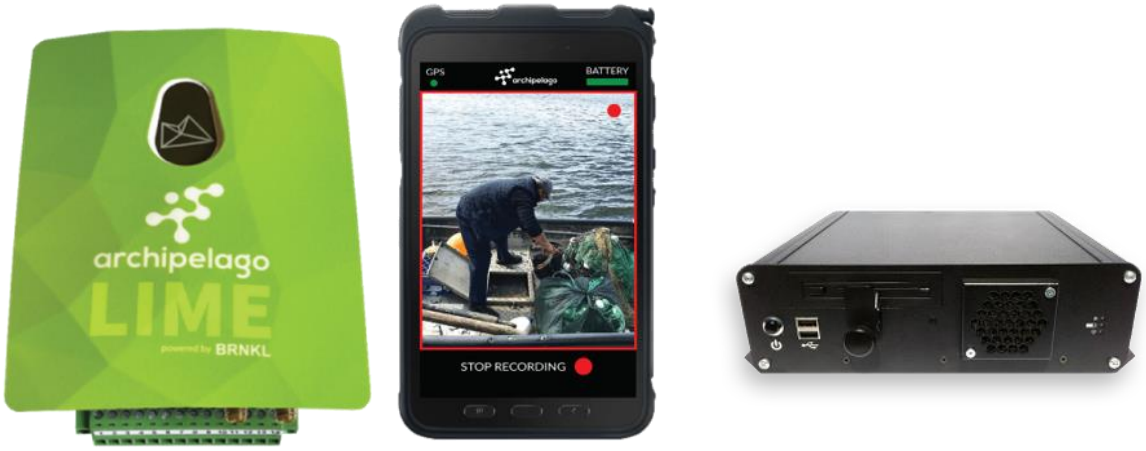
Images courtesy of NOAA Fisheries. Electronic monitoring systems installed on fishing vessels.

Leading Electronic Monitoring Systems

EM is an expensive technology for what is currently a small collection of clients. The technology is competitive because there is no standardized method for EM, and EM companies compete for a small number of fishermen or observer programs to choose their systems over another system.

Existing EM providers include Archipelago Marine Research Ltd., Saltwater, Inc., TeamFish, Transparensea, New England Marine Monitoring, and Integrated Monitoring. The programs tend to remain within their region of origin, and all have different business models.

Some of the service providers offer hardware and software but not video review, while some offer all three. Archipelago Marine Research Ltd. is one of the leading systems in EM in California. They provide comprehensive data collection platforms, high-quality video cameras and gear sensors, full design and management of EM systems, log systems, comprehensive training, and EM options for small inshore fishing to large pelagic vessels.



Images courtesy of Archipelago Marine Research Ltd. Different EM observation systems including (from left to right) a vessel tracking system, a system using video to track discarded vs. retained catch, and a system that records data from cameras for commercial fishing vessels.

Federal Encouragement for Electronic Monitoring Utilization

NMFS and the National Fish and Wildlife Foundation (NFWF) have programs in development to help encourage fishermen to participate in EM programs. NMFS's program, the Fisheries Information System Program, is a state-regional-federal partnership that offers an annual, competitive funding proposal process that helps improve EM monitoring.[36] Additionally, the NFWF has a fund entitled the Fisheries Innovation Fund, which offers financial incentive for fishermen to put EM systems onto their vessels.[37] One potential project could be to install EM video systems and observers at the same time then investigate the efficacy of these video systems for set gillnets.

Current Electronic Monitoring Usage

In the United States there are several EM programs that have been fully implemented, including the Alaska small-boat fixed gear program, the Atlantic pelagic longline fishery, and the Northeast groundfish fishery.[38] Each EM program is designed to meet the different management needs of the fisheries. The Alaska EM program is used to monitor and collect data on all catch, while the Atlantic longline fishery EM program monitors incidental catch of bluefin tuna.[39] The Northeast groundfish fishery employs two EM programs – a logbook audit model on smaller vessels and on larger vessels a system that monitors compliance with maximized retention.[40]

There are also many EM projects and programs in development in the United States.[39] On the West Coast, EM in the groundfish fishery is anticipated to be fully implemented in 2025. In Alaska, full implementation of EM in the midwater trawl pollock fishery is scheduled for 2024. EM projects are also underway in the Pacific Islands pelagic longline fishery, in addition to several pilot EM projects in Alaska and the Gulf of Mexico. EM for bycatch monitoring has not yet been explored for California set gillnets.

Advantages and Disadvantages

One major disadvantage with EM systems is that so far there has been no coordinated effort to standardize the hardware and software of EM technology. Even if the technology can be standardized and artificial intelligence incorporated, it will likely augment rather than replace human observers. While EM has proven to be an effective tool to meet fisheries monitoring

[36] NMFS. 2023. Fisheries Information System Program. Available: www.fisheries.noaa.gov/national/commercial-fishing/fisheries-information-system-program. Accessed June 2023.
[37] National Fish and Wildlife Foundation. 2023. Fisheries Innovation Fund. Available: www.nfwf.org/programs/fisheries-innovation-fund?activeTab=tab-3. Accessed June 2023.
[38] NMFS. 2020. National Electronic Monitoring Workshop Report 2019/2021. https://s3.amazonaws.com/media.fisheries.noaa.gov/2020-09/2020-EM-National-Workshop-Report-FINAL-4-webready.pdf?ci7Mq1XPdpkHw2yzVtxGTtWXXObKWlPr
[39] NMFS. 2020. National Electronic Monitoring Workshop Report 2019/2021. 46 p. https://s3.amazonaws.com/media.fisheries.noaa.gov/2020-09/2020-EM-National-Workshop-Report-FINAL-4-webready.pdf?ci7Mq1XPdpkHw2yzVtxGTtWXXObKWlPr
[40] NMFS. 2022. Electronic Monitoring for Sectors [Fact Sheet]. Greater Atlantic Regional Office, 2 p. https://media.fisheries.noaa.gov/2022-05/EM-spring2022-508nefsc.pdf

objectives, data collected require manual review and analysis to extract meaningful catch accounting information. This can be an expensive and time-consuming effort. Developing an accurate machine learning or algorithm-based model for marine species recognition requires a large and diverse dataset of labeled and verified images. Collecting such data can be challenging, especially for rare or lesser-known species. However, efforts are underway to advance these systems and develop durable models. The EM Innovation (EMI) project is one that aims to address these issues by researching and piloting cost-effective and durable machine learning and computer vision (CV) advancements for EM camera system deployments, with the goal of providing near real time, automated, catch accounting and reporting. [41]

Another complexity with video EM is confidentiality. Fishermen have raised concerns with cameras running 24 hours a day on their vessels and have expressed concern about how the footage will be used or shared. To address this concern, NMFS has created a confidentiality policy entitled Policy on Electronic Technologies and Fishery-Dependent Data Collection that details how they apply information law to the data they are collecting. [42]

Another challenge posed by EM is blind spots and system maintenance. There are certain fishery operations that are more prone to data gaps or data tampering, and all captains and crews with EM systems must maintain these systems, including cleaning the camera lens so that clear images can be captured. In most cases, a trial is needed to figure out where cameras should be placed to evaluate the appropriate operations of the vessel, and every EM program to date in the U.S. has completed trials to work out the best placement for cameras on a vessel. Even with the presence of cameras, it is important to review the video footage to understand vessel crew behavior and catch handing operations, such as recognizing if a bycatch event occurred outside the view of the cameras (e.g., in the water next to the vessel). A longline fishery operating at night may be difficult to monitor solely through a camera lens, even with floodlights, so human observation may be necessary in these situations. Since EM for set gillnets has not yet been explored on the West Coast, systems will require testing to determine how to make EM viable for this gear type.

Despite these disadvantages, in the long-term, EM has potential to be more efficient than humans on certain tasks, such as counting catch. Therefore, any new efforts to use EM to quantify bycatch should use both human observers and EM video on the same trip, so that the data collected by each method can be compared.

[41] Lee Son, G. S. et al. 2023. Development of electronic monitoring (EM) computer vision systems and machine learning algorithms for automated catch accounting in Alaska Fisheries. AFSC Processed Rep. 2023-01, 113 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115. https://repository.library.noaa.gov/view/noaa/49143

[42] Alger, Brett. 2019. Policy on Electronic Technologies and Fishery-Dependent Data Collection. Office of Science and Technology, 5 p. https://media.fisheries.noaa.gov/dam-migration/04-115.pdf

Electronic Logbooks

Logbooks rely on fishermen self-reporting catch and other information about their fishing trips. Historically, fishermen filled out paper logbooks and submitted them to fishery managers. Electronic logbooks offer the potential for submitting this information digitally through a tablet with internet connection or cellular service. However, in the context of bycatch data collection, the use of electronic logbooks may mimic existing under-reporting and biased data problems with self-reporting, especially if there is an incentive not to report bycatch. For fisheries with high rates of bycatch, electronic logbooks may not be practical for obtaining catch and bycatch composition. That said, they may be useful for collecting other data from fishermen, such as the type of nets used, the start and end points of fishing activities, and bycatch hotspots. Electronic logbooks could also be a means to report data collected by oceanographic and environmental sensors on fishing vessels or gear.

How Electronic Monitoring Could Be Implemented

If EM was to be implemented as part of a California State Observer Program, it should initially be considered as a complement to human observers, rather than a replacement. Once EM has been demonstrated to have comparable accuracy to human observers, a data optimization system could inform a percentage of observation covered entirely by humans and portion covered entirely by EM. However, it is imperative that observer programs treat human observers and EM systems as two completely different observation methods. Humans can collect data in a detailed and accurate manner, whereas a camera can offer efficient data collection without the same accuracy. There are costs and benefits to each method; therefore, observers and cameras cannot be expected to collect the same data. Comparing data collected by observers and EM on the same fishing trips would be informative in future applications of EM.

Other types of EM than video monitoring could be used to complement observers. EM systems with vessel tracking and net sensors can track when and where nets are in the water, while human observers could collect fine scale data such as species identification, catch composition, and biological samples. In this example, EM and human observers complement one another.

EM is still in its early stages, and fully developing the technology to meet the needs of the fishery managers may take longer than originally anticipated. Communication with the industry and programs already using EM is invaluable to ensure EM continues to develop optimally and previous mistakes are not repeated.

The Costs of Electronic Monitoring

EM has the potential to collect certain data efficiently and reduce costs. A 2018 study conducted in Peru estimated that an EM system would cost half of the cost of human observers.[43] Additionally, for cod vessels in Alaska, EM costs were estimated at 27 to 41% less than the costs of observers.[44]

However, in many fisheries EM costs remain high and the technology has not yet reached the point of replacing human observers. Existing EM companies compete for a tiny marketplace with a small number of customers; therefore, the companies are not making a lot of money to further develop their hardware and software. Even though it may be relatively inexpensive to build a simple program that counts catch in a gillnet, it may not be feasible to expect automatic species identification, so it will likely be necessary to include human review of the video footage.

Cost estimations for EM are complex due to the variability of situations and the many different types of EM. EM costs are dependent on the number of vessels participating in the EM program, the number of systems that need to be purchased and/or replaced on an annual or recurrent basis, deployment rates, field support services, video review, and other factors. Vessel length can be used as a general proxy for the cost of purchasing and installing EM. A 2017 report projecting cost estimates for EM in the New England Groundfish Fishery concluded: 1) the video monitoring systems cost approximately $8,000 to purchase and install per vessel; 2) the average costs (based on the gear type) for 100% video review ranged from $270 to $335 per day; and 3) the average annual cost per vessel for equipment, purchase, installation, program management, and review of 100% of video collected was estimated at $15,000.[45] Once established, the highest annual cost is accrued from EM submission, review and reporting. For gillnet vessels in this fishery, 100% EM video review is estimated to cost $284 per fishing day (4 sets/day, at $71/set). In this projected EM costs report, a cost breakdown is presented of a sample gillnet vessel based on the scenario of 100% EM coverage and 50% video review (Figure 1).

[43] D.C. Bartholomew et al. 2018. Remote Electronic Monitoring as a Potential Alternative to On-Board Observers in Small-Scale Fisheries, Biological Conservation 219: 43 p., http://www.sciencedirect.com/science/article/pii/S0006320717307899.
[44] S. Buckelew et al. 2015. Electronic Video Monitoring for Small Vessels in the Pacific Cod Fishery, Gulf of Alaska. North Pacific Fisheries Association and Saltwater Inc., 2015, 19 p. https://www.npfmc.org/wp-content/PDFdocuments/conservation_issues/Observer/EM/Pcod%20Tech%20report_FINAL.pdf
[45] CapLog Group LLC. 2019. Projected Cost of Providing Electronic Monitoring to 100 Vessels in New England's Groundfish Fishery. Commissioned by the Nature Conservancy. Available: https://em4.fish/wp-content/uploads/2019/04/TNC-EM-Cost-Assessment-Report-Submission-to-NEFMC-4_10_19.clean_.pdf

Sample Vessel Two:
Gear: Gillnet
Length: 40 feet
Trips per Year: 50 trips
Trip Length: 18-24 hours
Sets per Trip: 3 sets per trip
EM Catch Handling Efficiency: Average
Vessel EM Service Requirements: Average

Estimated Annual (Year 3) Cost for User-Specified Vessel	
Policy, Regulatory and Program Dev Costs	**$ -**
Program Planning and Development	$ -
On-Vessel Costs	**$ 1,620**
EM Equipment and Software	$ -
Repair and Support of EM Systems	$ 1,620
Program Admin and Operations Costs	**$ 9,527**
Program Management	$ 2,520
Management Software and Systems	$ 300
EM Submission, Review and Reporting	$ 6,000
EM Video / Data Storage	$ 707
Total for EM Program	**$ 11,147**

100% ASM Coverage v 100% EM Coverage	
# of Fishing Days	50 days
Sample FY2018 ASM Rate for full day (18-24 hr)	$ 570
Vessel Cost for 100% ASM Coverage	**$ 28,500**
Vessel Cost for 100% EM Coverage	**$ 11,147**

Figure 1. Example estimation of annual EM cost of a gillnet vessel in the New England Groundfish fishery, based upon 100% EM coverage and 50% video review. EM estimates are compared to at-sea monitoring (ASM) estimates for the same vessel.[45]

The costs presented in the 2017 report represent those of an experimental program that tested new processes and technologies. As any EM program evolves from experimental to an established stage, it is reasonable to expect cost per vessel to decrease.

Section VI. Recommendations for a California Observer and Bycatch Monitoring Program

Objectives for the State Observer Program

Within the California set gillnet fishery, the main needs of an observer program are to collect accurate catch and bycatch compositions both by weight and number of individuals, of species such as fishes, invertebrates, marine mammals, sea turtles and seabirds, and other rare species. If coverage is less than 100%, accurate and consistent information on fishing effort is essential to ensure that expanded estimates of total catch and bycatch are achievable. Bycatch data collected by the observer program would be most useful when collected in the same unit as landed catch data, which is currently recorded by weight. Total effort of the fleet can be tracked in several ways, however, and the observer program should track number of sets, sets per trip, the length of the net panels, and soak duration to quantify accurate total effort of the fleet.

Currently, NMFS combines data from all California set gillnets as a single fishery. However, there are two distinct mesh sizes (6.5 inches and 8.5 inches) which are intended to target different species assemblages. We recommend future observer coverage clearly identify the mesh

size used in each set to enable analysis of the bycatch and catch data by mesh size in addition to in aggregate.

Specific to the California set gillnet fishery, NMFS has previously recommended a minimum of 20% observer coverage year-round.[46] Higher coverage levels up to 100% may be necessary to detect rare species interactions and/or enforce potential hard caps on bycatch.

Authority and Funding

When setting up a state-run observer program, the state must establish regulations to require vessels to carry observers upon request, along with notification requirements. NMFS currently requires the California set gillnet fishery to carry observers upon request under the authority of the MMPA.

Since California does not currently have a state-run observer program, new funding will be needed. One option would be to establish a new budget allocation to CDFW to establish and run an observer program. Another option would be to seek funding from the California Ocean Protection Council to develop a pilot observer program. There may be federal funding opportunities through the NMFS Bycatch Reduction and Engineering Program, and Saltonstall-Kennedy grant programs. Additionally, non-state funding from non-governmental or philanthropic organizations (such as the National Fish and Wildlife Fund) could be used to fund the program through a public-private partnership.

The fishing industry could be required to pay at least partially for the costs of observers either directly or through increased landings fees, like the funding model described above in the North Carolina State Observer Program. As another example, the North Pacific Groundfish and Halibut Fishery Observer Program is funded based on the amount of target organisms landed by vessels in the partial coverage category. The vessels are given a 1.65% fee multiplied by the price of landed catch weight.[47] This fee percentage is set in regulation and reviewed periodically by the North Pacific Fishery Management Council. Additionally, this fee is split between the buyer of the fish and the vessel owner or operator. This program also started funding certain EM fleets in 2019. However, it is important to note that the California set gillnet fleet is significantly smaller with a fraction of the participants compared to the fleets in the examples above.

Recommendations for Observing the California Set Gillnet Fishery

We recommend a 3-phase approach where initially the state would work with NMFS to reinstate the federal observer coverage while the state concurrently develops its own pilot state observer program that would inform a long-term program and expand to other state managed fisheries. The benefit of this approach is that observer coverage of the gillnet fleet could resume near-term.

[46] NMFS. 2011. U.S. National Bycatch Report [W. A. Karp, L. L. Desfosse, S. G. Brooke, Editors]. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-117E, 508 p. https://spo.nmfs.noaa.gov/sites/default/files/tm117E.pdf
[47] NMFS. 2022. Observer Fee Collection and Payment - North Pacific Groundfish and Halibut Fisheries Observer Program. Available : www.fisheries.noaa.gov/alaska/commercial-fishing/observer-fee-collection-and-payment-north-pacific-groundfish-and-halibut. Accessed June 2023.

However, the eventual implementation of a state-run program would be a long-term solution for state fishery monitoring and management needs. For any of these potential observer programs, data collected at sea must be consistent and comparable with landings and total effort data.

i. Reinstating Observer Coverage by the National Marine Fisheries Service

In the immediate term, reinstating the currently dormant federal observer coverage could ensure timely data for the California set gillnet fishery. The state of California would need to work with NMFS to allocate funds for additional, regular observer coverage, and possibly an increase in the number of observers, under the existing West Coast Region Observer Program.

Under this approach, it is important to consider whether NMFS can amend its current data collection protocols to meet the state's management needs, such as adding new requirements for observers to take length or weight measurements of observed marine species. Additionally, it is important to ensure there are enough observers in the region to provide coverage to an additional fishery. In its review of available bycatch data in the set gillnet fishery, CDFW raised concerns that "the Federal Observer Program only documented a sub-sample of the fleet, and observation assignments were not randomly sampled across the various fishing ports or active permittees".[48] To address this issue and to ensure that observer data are accurate and usable in the future, additional funds may be needed to hire the appropriate number of observers and ensure random assignment.

To avoid past data discrepancies between the observer program and the state's records, the state would need to refine logbook reporting requirements to align its estimates of total fishing effort with the way NMFS tracks effort. If the NMFS observer program continues to record catch per set, the state should consider also tracking total effort by number of sets, to allow for accurate extrapolation of the observer data.

ii. A Pilot California State-Managed Observer Program

We recommend the best long-term approach for California to obtain accurate bycatch data for its data-limited fisheries is to implement a California state-run observer program. This state-managed observer program could begin as a three-year pilot program for the California set gillnet fishery, for which a discrete funding package would fund with the goal of informing long-term costs. This could be considered a one-time funding allocation over a limited duration, which would likely be a higher initial cost as the program is being developed.

Under this approach, the state would have the ability to determine observer coverage needs, the selection process for vessels, and what data the observers are collecting. The state would also need to develop its own training protocols and requirements to ensure all observers are properly trained, as well as provide the necessary equipment. Previous state observer programs have largely used existing federal training and data collection methods to ensure data is comparable

[48] CDFW. 2023. Evaluating Bycatch in the California Halibut Set Gill Net Fishery. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=213567&inline.

and the agencies remain collaborative. One suggestion would be for the state to partner with public state universities to train observers.

Notably, the state would not be starting from scratch. The state could draw upon the training and data collection protocols from existing federal programs and could consider contracting observers from the same observer providers that already have experience observing the California set gillnet fishery and other fisheries, which in this case is the contractor Frank Orth and Associates.

The challenges with creating a state program are first and foremost the costs. Building a new program will require time, training, negotiation, funding, and the creation of new roles in CDFW. These roles would include contract management with the observer provider, training manager and overseer, debriefing observers, communication with the captain of the vessels, data management and data queries, and coordination with other programs around the country.
As discussed above, we recommend including an EM program alongside the development of a human observer program to better evaluate and develop EM as an efficient long-term solution. In addition to catch accounting, vessel tracking and net sensors would enable fishery managers to validate soak times, net length, and fishing locations. The next step would be to create trials for video cameras while observers are also on vessels to compare data and assess the accuracy and limitations of EM. California can look to other fisheries using more advanced EM systems, such as Alaska, to evaluate those tools and compare the costs of observers to the installation of EM systems and the of hiring technicians to review video footage.

iii. Long-term Permanent California Fisheries Observer Program

Under this approach, funding for the initial development of the pilot project to get the program up and running would then be followed by ongoing funding to continue the program into the long term. Upon completion of the pilot state observer program, funding, infrastructure, workload, staff capacity, equipment and technology needs could be assessed to inform long-term budget and funding pathways for regular observer coverage. This program, once established, could be expanded to other state-managed fisheries.

VII. Conclusion

Accurate and consistent catch and bycatch data are critical to sustainably manage the target species and ensure the overall health of the ocean ecosystem. This report compiles several examples of federal observer programs across the country, and it must be noted that all NMFS observer programs receive millions of dollars in appropriations. This highlights the need for dedicated, long-term funding, which is the greatest barrier to implementing and continuing an observer program for state-managed species. While there are many factors to consider in addition to funding, California can draw on experience from the federal government, other states, and its own historic program to develop a fishery observer program for state-managed fisheries such as the California set gillnet fishery. In this report, we have outlined a potential pathway for the state to implement more regular and extensive monitoring of its fisheries, utilizing human observers

and new EM technologies. Ultimately, an investment in increased observer coverage will benefit fishing communities, sustainable fisheries populations, and marine ecosystems.

Acknowledgments

We would like to express our sincere gratitude to the experts who generously provided valuable information and advice during the preparation of this report. Their expertise and insights significantly enriched our understanding of the subject matter.

The information and recommendations presented in this report are solely at the discretion of the authors, and it does not necessarily reflect the viewpoints or endorsement of the experts who offered their guidance or peer review. Moreover, the experts are not officially affiliated with this report.

These individuals include:

- Lee Benaka: NOAA Bycatch Lead, lee.benaka@noaa.gov
- Kenneth Keene: NOAA National Observer Program Coordinator, kenneth.keene@noaa.gov
- Brett Alger: NOAA Electronic Technologies Coordinator, brett.alger@noaa.gov
- Charles Villafana: NOAA Fish Biologist, charles.villafana@noaa.gov
- Scott Casey: Frank Orth & Associates, seagoat98@hotmail.com

We additionally wish to thank CDFW staff and one anonymous reviewer for their peer review of earlier drafts of this report.

From: Scott Webb <swebb@rri.org>
Sent: Friday, November 3, 2023 4:36 PM
To: Ashcraft, Susan@FGC [redacted] FGC <FGC@fgc.ca.gov>
Cc: Ramey, Kirsten@Wildlife [redacted] Matthews, Kinsey-Contractor@fgc [redacted] Shester, Geoff <GShester@oceana.org>; Cbirch <cbirch@oceana.org>
Subject: Public Comment for MRC Agenda Item 2: NGO Sign-On Letter

Hi Susan,

Happy Friday! I want to submit the attached NGO Sign-on letter under MRC Agenda Item 2: "Evaluation of bycatch in the California halibut set gill net fishery in support of the fishery management review," to be available for the briefing booklet.

I will also submit individual comments for the Resource Renewal Institute before the 5 p.m. deadline.

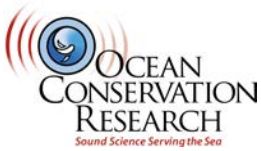
Thank you so much!

All the best,

Scott

--
Scott Webb (he/him)
Director of Advocacy & Engagement
Resource Renewal Institute

OCEANDEFENDERS.ORG



November 3, 2023

Mr Eric Sklar, President
California Fish and Game Commission
P.O. Box 944209,
Sacramento, CA 94244-2090

Dr. Charles Bonham, Director
California Department of Fish & Wildlife
P.O. Box 944209,
Sacramento, CA 94244-2090

MRC Agenda Item 2: Evaluation of bycatch in the California halibut set gill net fishery in support of the fishery management review

Dear Director Bonham, President Sklar, and Members of the Commission,

We, the undersigned organizations, commend the California Fish and Game Commission and the California Department of Fish and Wildlife (CDFW) for developing a suite of management measures to reduce bycatch and bycatch mortality associated with set gillnet fishing. Addressing the unintended catch and discarding of dead or injured marine life is a top priority for California, and we applaud the extensive work the Commission and CDFW put into fulfilling the state's commitment to protecting marine biodiversity from this threat.

We support the suite of management changes and data collection improvements the Commission directed CDFW to bring forward. Of those, we believe the following list of measures can be readily adopted and help reduce the bycatch in this fishery to acceptable levels. They should be applied to all set gillnets, not just those targeting California halibut. We ask the Commission to initiate a regulatory package at the December 2023 meeting to adopt the following measures.

1. A maximum soak time of no greater than 24 hours for all set gillnets to significantly reduce bycatch mortality of sharks, rays, and other vulnerable species due to substantial evidence that demonstrates soak times longer than 24 hours drastically decrease the survivorship of all species, decrease the quality of the target catch, and increase entanglement and depredation impacts;
2. Temporal closures to protect vulnerable species like tope (soupfin) sharks during their spawning season, as well as new area closures to set gillnets to protect areas of high biodiversity;
3. Limitations on the maximum net height for trips targeting halibut as suggested by the gillnet fleet;
4. A system to track set gillnet gear loss that does not depend on self-reporting;
5. Unique gear-marking that allows set gillnets to be identified throughout all elements of the gear. Unique gear-marking would increase the likelihood that gear involved in wildlife entanglements can be positively or negatively attributed to the fishery and minimize the potential for unattributed entanglements;
6. New logbook requirements to precisely quantify set gillnet fishing effort.

These policies will only be rendered effective if the state adopts independent methods of collecting bycatch data and enforcing regulations. We strongly support implementing a CDFW-led pilot observer program utilizing human observers and simultaneously testing electronic monitoring. This will be an asset to the Commission and CDFW by providing unbiased data for stakeholders to measure the success of the proposed regulations and could serve as a model for obtaining catch and bycatch data in other Commission-managed fisheries. The National Marine Fisheries Service (NMFS) has an existing observer program for the set gillnet fishery, yet they have not observed the fishery since 2017. In the interim, we ask the Commission to request that NMFS immediately resume observer coverage of set gillnets in 2024. We also support a move toward electronic logbooks and electronic vessel monitoring to verify fishing locations to increase the accuracy of data on catch and bycatch in the set gillnet fishery.

CDFW has confirmed that certain measures discussed by the Commission require statutory change. For proposed statutory changes outside of the scope of the Commission's authority, we look forward to engaging further with CDFW and the Commission as the legislature addresses exemptions that currently allow the sale of protected species, makes changes to gillnet permits, and finds creative solutions to reduce bycatch.

We are grateful to the Commission and CDFW for developing a suite of regulatory measures to reduce bycatch and improve data collection for set gillnets off the California coast. The successful adoption of these measures will meaningfully reduce bycatch in set gillnets, benefiting a wide suite of vulnerable fish, sharks, rays, and marine mammals. This comprehensive package will ensure effective implementation of the MLMA's requirements to ensure bycatch is limited to acceptable types and amounts.

Sincerely,

Scott Webb
Director of Advocacy
Resource Renewal Institute

Geoff Shester
California Campaign Director
Oceana

Caitlynn Birch
Pacific Marine Scientist
Oceana

Jason Schratwieser
President
International Game Fish Association

Francine Kershaw
Senior Scientist
Natural Resources Defense Council

Dan Silver
Executive Director
Endangered Habitats League

Kurt Lieber
President
Ocean Defenders Alliance

Michael Bear
Community Science Director
Shark Stewards

Joy Primrose
ACS Oregon Chapter President
American Cetacean Society

Mark J Palmer
Associate Director
International Marine Mammal Project of Earth Island Institute

Emily Parker
Coastal and Marine Scientist
Heal the Bay

Ashley Eagle-Gibbs
Interim Executive Director
Environmental Action Committee of West Marin

Tomas Valadez
Senior Conservation Manager
Azul

Ben Grundy
Oceans Campaigner
Center for Biological Diversity

Rachel Bustamante
Interim Ocean Program Director
Earth Law Center

Stefanie Brendl
Executive Director
Shark Allies

Todd Steiner & Teri Shore
Executive Director & Board Member
Turtle Island Restoration Network

Andrew Johnson
California Representative
Defenders of Wildlife

Lesley Handa
Lead Ornithologist
San Diego Audubon Society

Natalie Para
Campaign Director
Ocean Preservation Society

Lincoln O'Barry
Campaigns Coordinator
Dolphin Project

William Rossiter
Vice President
NY4WHALES

Erica Donnelly-Greenan
Executive Director
Save Our Shores

Andy Rogan
Science Manager
Ocean Alliance

Erin Politz
Vice President
The SeaChange Agency

Georgia Hancock
Director and Senior Attorney, Marine Life Program
Animal Welfare Institute

Michael Quill
Marine Programs Director
Los Angeles Waterkeeper

Michael Stocker
Director
Ocean Conservation Research

From: Birch, Caitlynn <cbirch@oceana.org>
Sent: Friday, November 3, 2023 3:34 PM
To: FGC <FGC@fgc.ca.gov>
Cc: Ashcraft, Susan@FGC < Ramey, Kirsten@Wildlife <[redacted] Shuman, Craig@Wildlife <[redacted]>; Matthews, Kinsey-Contractor@fgc <[redacted] Shester, Geoff <GShester@oceana.org>
Subject: Oceana Comment Letter for Nov MRC, Agenda Item 2

Good Afternoon,

Please include the attached comment letter and attachment in the binder materials for the November MRC under Agenda Item 2. We'd also like to resubmit for inclusion in the binder (also under Agenda Item 2) our last comment letter and attachment previously submitted to the October FGC meeting.

Thank you Kirsten and Craig for the ongoing discussions over the past months and for the advanced copy of the Department's presentation.

Susan and Kinsey – we look forward to touching base on Monday :)

Looking forward to seeing you all in San Diego at the MRC.

Have a great weekend,

Caitlynn

Caitlynn Birch | Pacific Marine Scientist
OCEANA Protecting the World's Oceans
99 Pacific Street, Suite 155C
Monterey, CA 93940
D 831.332.1757 | **O** 907.586.4050
cbirch@oceana.org | www.oceana.org

OCEANA Protecting the World's Oceans

99 Pacific Street, Suite 155C
Monterey, CA 93940 USA

+1.907.586.4050
OCEANA.ORG

September 29, 2023

Mr. Eric Sklar, President
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090
Agenda Item 18: General Public Comment: Marine Mammal Bycatch Underreporting in the Set Gillnet Fishery

Dear President Sklar and Members of the Commission:

We are writing to express our strong support for the Commission's efforts to increase observer coverage in the set gillnet fishery targeting California halibut and white seabass. The availability of accurate data on marine mammal interactions and protected species is vital for informed decision-making and responsible fisheries management.

The analysis provided in our attachment compares self-reported data to observer-based estimates of marine mammal take in the set gillnet fishery, finding that only 6% of marine mammal interactions were reported. The substantial gaps in bycatch self-reporting underscore the critical importance of reliable data in evaluating the impacts on populations and ensuring compliance with state and federal wildlife protection laws. The wide disparities between self-reported and estimated marine mammal takes in the fishery highlight a pressing issue of underreporting, which can have significant consequences for both marine life conservation and sustainable management practices if relied upon without independent observer data.

In light of these findings, we commend the Commission for its proactive steps towards improving data on bycatch and the work the California Department of Fish and Wildlife continues to do to explore options for increased observer coverage, electronic monitoring, and logbook requirements in the set gillnet fishery. Increasing observer coverage is a pivotal move towards transparency and accuracy in data collection. We urge the California Fish and Game Commission to continue its efforts to expand observer coverage in the California set gillnet fishery to ensure that decision-makers have access to credible, objective, and verifiable information. By doing so, the Commission will not only enhance its ability to safeguard marine life but also promote responsible and sustainable fishing practices that are crucial for the long-term health of our ocean ecosystems. We look forward to the Commission's Marine Resource Committee meeting in November where the Committee will be considering recommendations for management and monitoring improvements in the fishery.

Thank you for your dedication to preserving California's marine resources, and we look forward to our continued work with you on these critical initiatives.

Sincerely,

Geoffrey Shester, Ph.D.
California Campaign Director & Senior Scientist

Caitlynn Birch
Marine Scientist

Attachment: Underreporting of Marine Mammal Takes in the California Set Gillnet Fishery Underscores Need for Observers

OCEANA Protecting the World's Oceans

Underreporting of Marine Mammal Takes in the California Set Gillnet Fishery Underscores the Need for Observers

September 2023

C. Birch, Pacific Marine Scientist
G. Shester, Ph.D., Senior Scientist

Collecting accurate data on the catch of sensitive or protected species is critical for fishery managers to evaluate impacts to populations and ensure fisheries comply with state and federal wildlife protection laws. Fishery managers are often limited by available data such as landings data that does not include discards; and must rely upon observer data and self-reported data from fishermen to quantify impacts and adjust management accordingly. Independent and accurate fisheries observer data is considered the gold standard for quantifying catch, bycatch, and protected species interactions because it comes from objective sources that are trained to document and identify species. However, limited resources often limit or preclude desired levels of observer coverage. In the California set gillnet fishery targeting white seabass and California halibut, fishery observers have been present on a small portion of total fishing effort in 6 of the last 15 years, and observed zero fishing trips in 8 of those years, with no observer coverage since 2017.

In the absence of independent observer data, managers rely upon logbook and self- reporting data to fill key information gaps. Federal regulations under the Marine Mammal Protection Act (MMPA) require each commercial permittee to report all marine mammal interactions to the National Marine Fisheries Service (NMFS) within a 48-hour period, and fishermen must maintain an accurate and complete record of catch in logbooks. However, the value of this information is reliant on accurate reporting. In this analysis we find a significant difference between the number of self-reported and estimated marine mammal takes based on observer data in the California set gillnet fishery, suggesting underreporting of marine mammals is taking place in the fishery. A lack of verifiable independent observer data poses a major challenge to the conservation and management of this fishery and the wildlife it catches.

After conducting a bycatch inquiry under the California Marine Life Management Act in 2023 for the California halibut set gillnet fishery, the California Fish and Game Commission recommended improving data on bycatch and tasked the California Department of Fish and Wildlife with scoping potential options for increased observer coverage, electronic monitoring, and logbook requirements to fill information gaps.

To quantify self-reported marine mammal interactions and total estimated marine mammal take in the fishery, Oceana compared self-reported marine mammal takes in the California set gillnet fishery obtained through a Freedom of Information Act (FOIA) request to federal estimates of marine mammal take based on observer data. Each self-report includes the species, date, and location.

Species	Number Self-Reported
Sea lion	161
Harbor seal	27
Pacific white-sided dolphin	3
Common dolphin	2
Harbor porpoise	1
Northern elephant seal	1
Gray whale	1
Total	**196**

Table 1. Total self-reported marine mammal interactions by the set gillnet fleet 2002 – 2022. Source: NMFS FOIA Response 2023.

From NMFS-released FOIA records, self-reports in the California set gillnet fishery from 2002 – 2022 accounted for a total of 196 protected species interactions comprising 7 different marine mammal species. Eighty-two percent of self-reports involve the California sea lion, followed by the harbor seal at 14 percent. Rarer event species represent 4 percent of total reported interactions, and involve the common dolphin, the Pacific white sided dolphin, harbor porpoise, northern elephant seal, and gray whale (Table 1). Annual self-reports from 2002 to 2022 for the fishery average 8 marine mammal interactions per year. The full dataset, with species, date, and number of animals involved in each interaction is shown in Table 4.

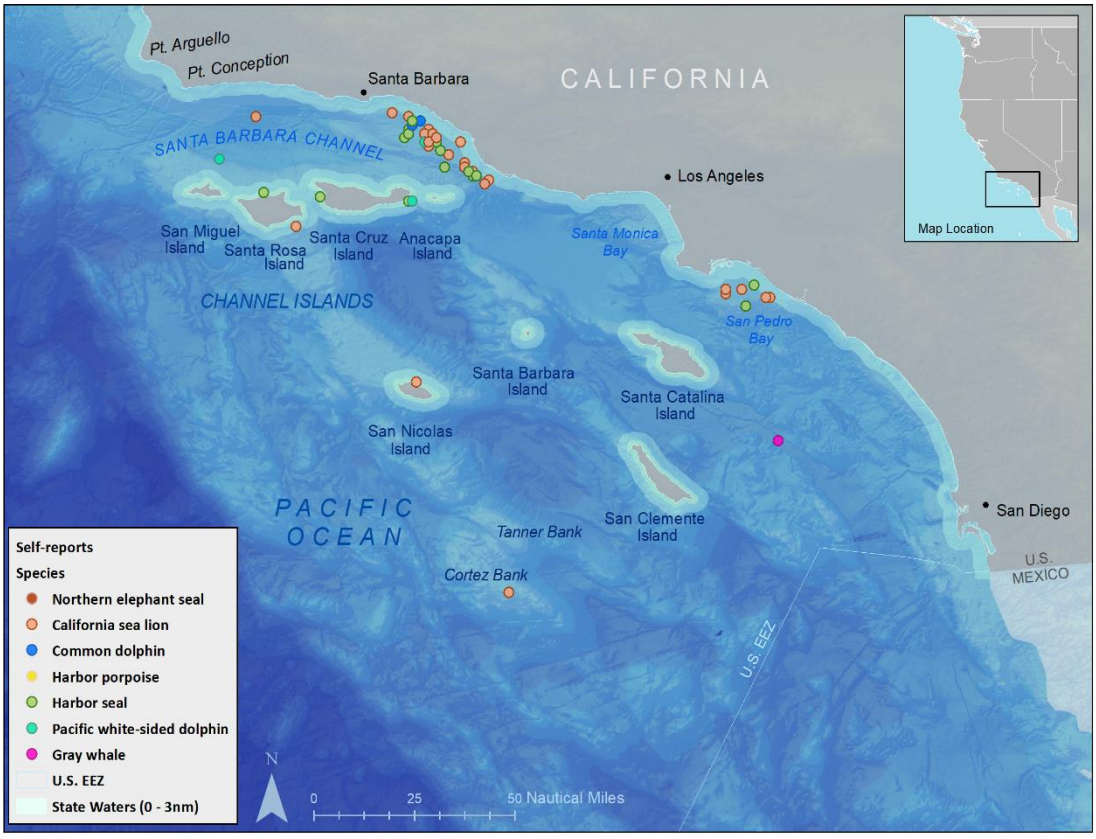


Figure 1. Locations of all (n = 170) non-erroneous marine mammal interactions self-reported to NMFS in the set gillnet fishery from 2002 – 2022. Twenty-six reports contained erroneous coordinates not within the fishing area that were removed. Each data point may represent more than 1 interaction.

The majority (45%) of reported marine mammal interactions occurred in the Santa Barbara Channel (Figure 1). This is an area of high relative fishing effort,[1] with a shallow shelf feature allowing for set net fishing just outside the state waters 3 nautical mile (nm) boundary, and close to Santa Barbara and Ventura ports. Nine percent of reported interactions occurred in San Pedro Bay, another shallow shelf area close to shore and coastal ports. Reported interactions around the main Channel Islands represented 10% of total reports, while 23% occurred around Cortez Bank, San Nicolas Island and East of San Clemente Island. While protected species takes at Cortez Bank occurred at a singular location, there were two reported interactions that involved 24 and 18 California sea lions at this location. The single self-reported gray whale interaction occurred East of San Clemente Island offshore from Huntington Beach. Thirteen percent of location coordinates associated with reports were erroneous [e.g., on land or outside the area where set gillnets are authorized] and are not displayed on the map in Figure 1. All reports and locations were self-reported by set gillnet fishermen.

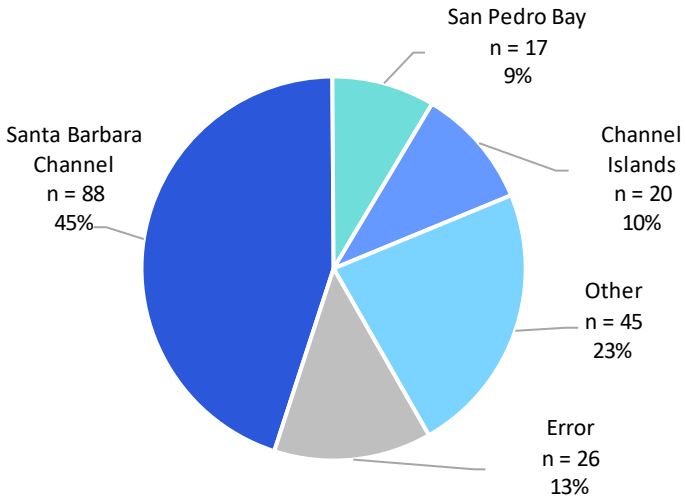


Figure 2. Proportion of self-reported marine mammal interactions by location in the Southern California Bight, 2002 – 2022. Source: NMFS FOIA Response 2023.

NMFS estimates annual marine mammal takes in Marine Mammal Stock Assessment Reports (SARs) by extrapolating the number of marine mammal interactions observed during the proportion of fishing effort observed to the total annual fleetwide fishing effort. These total estimates are based upon unbiased subsamples of fishing data collected by trained observers and do not typically include self-reported data. These estimates are intended to be the best estimate of total marine mammal take, although they are likely underestimates and do not include extrapolated estimates of post-release or entanglement mortality associated with fishing gear. The Pacific Marine Mammal Center and other marine mammal rescue centers frequently rescue and euthanize mammals entangled in fishing gear, many of which are caused by monofilament netting consistent with set gillnets. These mortalities represent additional mortalities not included in the NMFS estimates based purely on observer data. However, if fishermen are self-reporting all interactions with protected species as required by federal law, the self-reports should be consistent in number to the total estimated number of marine mammal takes based on federal observer data.

California set gillnets are fished in Southern California federal waters (3 – 200 nm) with exceptions (1-3 nm in state waters around the Channel Islands). Two gillnet mesh sizes are used including 6.5-inch mesh intended to target white seabass and 8.5-inch mesh to target California halibut. Many other species are retained and landed, and there are high relative rates of discards including bycatch of protected species. The NMFS observer program summary data combines both mesh sizes and presents the data as a single California set gillnet fishery targeting California halibut and white seabass.

Oceana compared self-reported annual marine mammal takes obtained through our FOIA request to total NMFS estimated annual marine mammal takes for the set gillnet fishery from 2005 to 2022 as published in the

[1] California Department of Fish and Wildlife, pers. comms. (2022). Fishing effort by California halibut landed (mt) for the California halibut set gillnet fishery.

federal Marine Mammal SARs.[2,3,4,5,6] The NMFS estimates based on observer data and specific to the set gillnet fishery are only available for California sea lion and harbor seal stocks beginning in 2005, and not for the other marine mammal species reported in the self-reports. SARs estimated take in the fishery are unavailable for the harbor seal stock past 2012, limiting the data available for comparison to 2005 – 2012. Estimates for the California sea lion are available from 2005 – 2016 (Table 2).

From 2005 – 2012, looking at only California sea lion and harbor seal reports for which we have comparable take estimates from the stock assessment reports, a total of 100 sea lion and seal takes were self-reported by fishery participants, averaging 12 mammals per year. Over this same period (2005 – 2012), NMFS estimates total marine mammal serious injury/mortality for California sea lions and harbor seals in the fishery to be 1,698, with an average of 212 marine mammal takes per year. This indicates that 6% of the estimated annual marine mammal interactions were self-reported by fishery participants during this period (Figure 3 & 4).

While the NMFS estimates for annual California sea lion and harbor seal take are not available in more recent years due in part to the absence of observer data, the number of self-reports per year remain extremely low, and indicate underreporting is likely still occurring. From 2002 to 2012 the number of self-reports averaged 13.6, whereas for years 2013 to 2022, an average of 4.6 mammals were reported each year. Underreporting of bycatch and protected species takes is a global issue occurring in many fisheries despite regulations requiring fishermen to report all marine mammal interactions.[7,8] For instance, Oceana conducted a similar analysis with comparable results in the California swordfish drift gillnet fishery.[9] In theory, bycatch reporting in mandatory fishing logbooks could be a cost-effective, scientifically valuable way to monitor protected species bycatch. However, results from this analysis and others show significant under-reporting and use of such data typically results in negatively biased estimates of bycatch rates, supporting that logbooks in their current form are not reliable for use in management.[10,11,12] This chronic underreporting of protected species underscores the importance of independent federal or state fisheries observers and electronic monitoring to ensure unbiased data is available for fishery managers, and that human impacts on marine mammals and other species are accurately quantified.

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[2] NMFS. California Sea Lion (U.S stock) Stock Assessment Report 2018. Table 1, pg. 3. https://media.fisheries.noaa.gov/dam-migration/po2014slca_508.pdf

[3] NMFS. California Sea Lion (U.S stock) Stock Assessment Report 2014. Table 1, pg. 3. https://media.fisheries.noaa.gov/dam-migration/po2014slca_508.pdf

[4] NMFS. California Sea Lion (U.S stock) Stock Assessment Report 2008. Table 1, pg. 4. https://media.fisheries.noaa.gov/dam-migration/po2011slca_508.pdf

[5] NMFS. Harbor Seal (California stock) Stock Assessment Report 2014. Table 1, pg. 10. https://media.fisheries.noaa.gov/dam-migration/po2014sehr-ca_508.pdf

[6] NMFS. Harbor Seal (California stock) Stock Assessment Report 2011. Table 1, pg. 12 . https://media.fisheries.noaa.gov/dam-migration/po2011sehr-ca_508.pdf

[7] Basran, Charla Jean, and Guðjón Már Sigurðsson. (2021) "Using Case Studies to Investigate Cetacean Bycatch/Interaction Under-Reporting in Countries With Reporting Legislation." *Frontiers in Marine Science* 8.. https://doi.org/10.3389/fmars.2021.779066.

[8] Mucientes, Gonzalo, Marisa Vedor, David W. Sims, and Nuno Queiroz. (2022) "Unreported Discards of Internationally Protected Pelagic Sharks in a Global Fishing Hotspot Are Potentially Large." *Biological Conservation* 269: 109534. https://doi.org/10.1016/j.biocon.2022.109534.

[9] Oceana,(2021). Underreporting of Marine Mammal and Sea Turtle Bycatch in the California Swordfish Drift Gillnet Fishery. https://usa.oceana.org/wp-content/uploads/sites/4/593/marine_mammal_bycatch_is_grossly_underreported.pdf

[10] Wade, Paul R., Kristy J. Long, Tessa B. Francis, André E. Punt, Philip S. Hammond, Dennis Heinemann, Jeffrey E. Moore, et al. (2021) "Best Practices for Assessing and Managing Bycatch of Marine Mammals." *Frontiers in Marine Science* 8.. https://www.frontiersin.org/articles/10.3389/fmars.2021.757330.

[11] Walsh, W. A., Kleiber, P., and McCracken, M. (2002). Comparison of logbook reports of incidental blue shark catch rates by Hawaii-based longline vessels to fishery observer data by application of a generalized additive model. Fish. Res. 58, 79–94. doi: 10.1016/S0165-7836(01)00361-7

[12] Emery, T. J., Noriega, R., Williams, A. J., and Larcombe, J. (2019). Changes in logbook reporting by commercial fishers following the implementation of electronic monitoring in Australian Commonwealth fisheries. Mar. Policy 104, 135–145. doi: 10.1016/j.marpol.2019.01.018

California fishery managers recently recommended increased observer coverage for the set gillnet fishery, given the fishery has not been observed since 2017. The California Department of Fish and Wildlife is currently in the process of scoping observer coverage, electronic monitoring, and new logbook requirements to fill such data gaps. For accurate estimates of species commonly taken in set nets, like California sea lions, 20 to 30% observer coverage may be adequate provided this coverage occurs every year and is free of sampling bias.[13] However, detecting and accurately estimating bycatch of rare interactions (such as sea turtles) likely requires nearly 100% observer coverage.[14] Accuracy of electronic monitoring technologies to correctly estimate bycatch has not been examined for California set gillnets, and this should be an area of future inquiry to determine its potential. In summary, this analysis suggests that self-reporting of protected species interactions and other bycatch species greatly underestimates actual bycatch, is not reliable, and highlights the need for increased observer coverage.

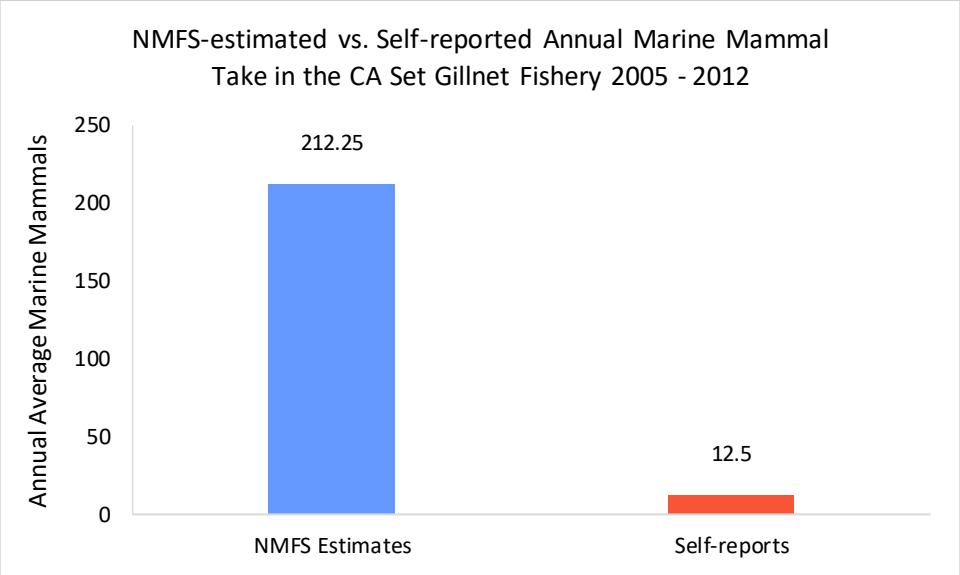

Figure 3. California set gillnet marine mammal take, 2005-2012, comparing the average annual self-reported bycatch to NMFS's estimated average annual take of California sea lions and harbor seals. NMFS estimates an average of 212 animals per year experience serious injury/mortality in this fishery. Over this same period, self-reported interactions averaged 12.5 per year. Source: Marine Mammal Stock Assessment Reports, (SARs) California Sea Lion and Harbor Seal Stock; NMFS FOIA Response 2023.

[13] National Marine Fisheries Service,(2011). U.S. National Bycatch Report [W. A. Karp, L. L. Desfosse, S. G. Brooke, Editors]. U.S. Dep. Commer., NOAA Tech. Memo. pg. 359. Available: https://repository.library.noaa.gov/view/noaa/31335

[14] Curtis, K. & Carretta, James. (2020). ObsCovgTools: Assessing observer coverage needed to document and estimate rare event bycatch. Fisheries Research. 225. 105493. 10.1016/j.fishres.2020.105493.

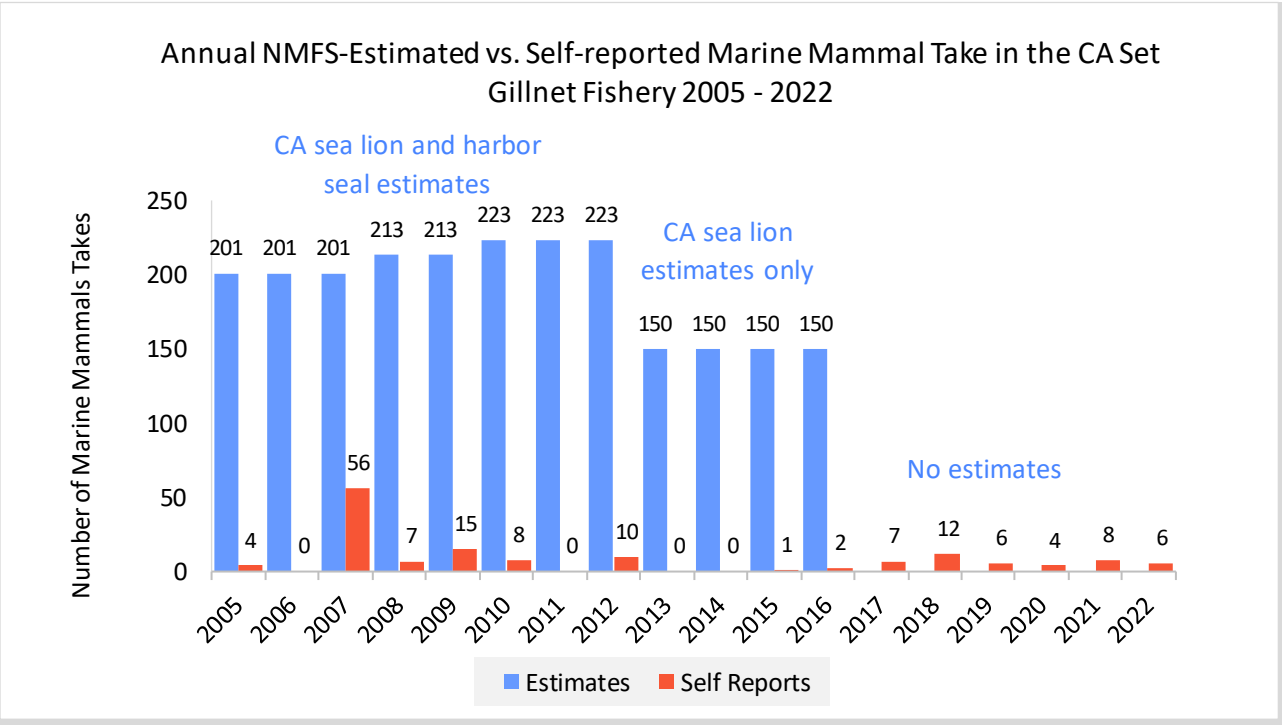

Figure 4. California set gillnet annual marine mammal take, 2005 – 2022, comparing self-reported annual marine mammal take to NMFS's annual estimated take for the California sea lion and harbor seal in the fishery. NMFS-estimated take for the harbor seal stock is available 2004 – 2012 for the set gillnet fishery. NMFS's California sea lion estimated take is available 2005 to 2016. From years 2017 to 2022 there are no NMFS' estimates of marine mammal take based on observer data. While recent NMFS estimates of marine mammal take in the fishery are unavailable, the trends in self-reported marine mammal interactions have remained low. Notably, 2007 is the first year of operation for the current observer program in the fishery (with the exception of 12 sets observed in 2006), and is the year that had the highest observer coverage (17.5%) during which a clear increase in self-reports is evident. Source: Marine Mammal Stock Assessment Reports, (SARs) California Sea Lion and Harbor Seal Stock; NMFS FOIA Response 2023.

	California sea lion		Harbor seal		Other Mammals
Year	SARs Estimates	Self-Reports	SARs Estimates	Self-Reports	Self- Reports
2005	190	3	11	1	
2006	190		11		
2007	190	52	11	4	
2008	190	6	23		1
2009	190	15	23		
2010	200	7	23	1	
2011	200		23		
2012	200	10	23		
2013	150		NA		
2014	150		NA		
2015	150		NA		1
2016	150	2	NA		
2017	NA	3	NA	3	1
2018	NA	6	NA	4	2
2019	NA	5	NA		1
2020	NA	3	NA		1
2021	NA	7	NA		1
2022	NA	6	NA		

Table 2. California set gillnet annual marine mammal take, 2005 – 2022, comparing self-reported annual marine mammal take to annual estimated take for the California sea lion and harbor seal. Estimated take for the harbor seal stock is available 2004 – 2012 for the set gillnet fishery. California sea lion estimated take is available 2005 to 2016. From 2017 to 2022 there are no estimates of marine mammal take based on observer data. Source: Marine Mammal Stock Assessment Reports, (SARs) California Sea Lion and Harbor Seal Stock; NMFS FOIA Response 2023.

Year	California sea lion	Harbor seal	Common dolphin	Pacific white-sided dolphin	Harbor porpoise	Northern Elephant seal	Gray whale	Total Annual Self-Reports
2002	9	5						14
2003	5							5
2004	22	9						31
2005	3	1						4
2006								0
2007	52	4						56
2008	6				1			7
2009	15							15
2010	7	1						8
2011								0
2012	10							10
2013								0
2014								0
2015							1	1
2016	2							2
2017	3	3	1					7
2018	6	4	1			1		12
2019	5			1				6
2020	3			1				4
2021	7			1				8
2022	6							6
Total	**161**	**27**	**2**	**3**	**1**	**1**	**1**	**196**

Table 3. Self-reported annual marine mammal take in the California set gillnet fishery by species, 2002- 2022. Source: NMFS FOIA Response 2023.

Year	Date	Species	Number of Interactions
2002	4/4/2002	California sea lion	1
2002	4/4/2002	Harbor seal	1
2002	4/29/2002	California sea lion	2
2002	4/29/2002	Harbor seal	1
2002	8/22/2002	California sea lion	1
2002	8/22/2002	Harbor seal	1
2002	8/23/2002	California sea lion	3
2002	8/23/2002	Harbor seal	2
2002	12/19/2002	California sea lion	2
2003	2/13/2003	California sea lion	3
2003	5/29/2003	California sea lion	2
2004	4/26/2004	California sea lion	2
2004	5/7/2004	Harbor seal	1
2004	5/7/2004	California sea lion	1
2004	5/8/2004	California sea lion	1
2004	5/8/2004	Harbor seal	1
2004	5/12/2004	Harbor seal	1
2004	5/12/2004	California sea lion	3
2004	5/13/2004	California sea lion	1
2004	5/13/2004	Harbor seal	1
2004	5/20/2004	California sea lion	3
2004	5/20/2004	Harbor seal	1
2004	5/22/2004	California sea lion	3
2004	5/22/2004	Harbor seal	1
2004	5/27/2004	Harbor seal	2
2004	5/27/2004	California sea lion	3
2004	6/22/2004	California sea lion	3
2004	6/22/2004	Harbor seal	1
2004	6/27/2004	California sea lion	1
2004	6/27/2004	California sea lion	1
2005	9/27/2005	California sea lion	2
2005	9/30/2005	California sea lion	1
2005	9/30/2005	Harbor seal	1
2007	1/24/2007	California sea lion	3
2007	1/24/2007	Harbor seal	1
2007	2/25/2007	California sea lion	3
2007	3/10/2007	California sea lion	24
2007	3/10/2007	California sea lion	18
2007	3/10/2007	California sea lion	1
2007	3/12/2007	California sea lion	1
2007	3/14/2007	Harbor seal	1
2007	3/16/2007	California sea lion	1
2007	4/11/2007	Harbor seal	1

2007	5/16/2007	California sea lion	1
2007	8/8/2007	Harbor seal	1
2008	3/30/2008	Harbor porpoise	1
2008	3/30/2008	California sea lion	1
2008	1/7/2008	California sea lion	5
2009	5/15/2009	California sea lion	1
2009	6/2/2009	California sea lion	2
2009	6/2/2009	California sea lion	1
2009	6/3/2009	California sea lion	2
2009	6/10/2009	California sea lion	1
2009	6/13/2009	California sea lion	3
2009	6/13/2009	California sea lion	1
2009	6/15/2009	California sea lion	1
2009	8/18/2009	California sea lion	3
2010	3/26/2010	California sea lion	1
2010	3/30/2010	California sea lion	2
2010	3/30/2010	Harbor seal	1
2010	4/7/2010	California sea lion	1
2010	4/8/2010	California sea lion	3
2012	2/2/2012	California sea lion	7
2012	2/10/2012	California sea lion	2
2012	10/4/2012	California sea lion	1
2015	7/30/2015	Gray whale	1
2016	4/27/2016	California sea lion	2
2017	4/21/2017	California sea lion	1
2017	4/21/2017	Harbor seal	1
2017	4/22/2017	Harbor seal	1
2017	5/4/2017	California sea lion	1
2017	5/4/2017	Common dolphin	1
2017	6/7/2017	California sea lion	1
2017	6/7/2017	Harbor seal	1
2018	3/8/2018	Common dolphin	1
2018	3/20/2018	Harbor seal	1
2018	4/8/2018	California sea lion	1
2018	5/1/2018	California sea lion	2
2018	5/1/2018	Harbor seal	1
2018	5/2/2018	California sea lion	1
2018	5/2/2018	Northern elephant seal	1
2018	5/2/2018	Harbor seal	1
2018	5/3/2018	Harbor seal	1
2018	5/3/2018	California sea lion	1
2018	12/8/2018	California sea lion	1
2019	5/23/2019	California sea lion	5
2019	6/16/2019	Pacific white-sided dolphin	1
2020	4/14/2020	California sea lion	2

2020	4/14/2020	Pacific white-sided dolphin	1
2020	5/21/2020	California sea lion	1
2021	2/19/2021	California sea lion	2
2021	6/1/2021	California sea lion	2
2021	6/1/2021	Pacific white-sided dolphin	1
2021	6/30/2021	California sea lion	3
2022	5/24/2022	California sea lion	6
Total	**2002 – 2022**	**7 species**	**196**

Table 4. Self-reported marine mammal take in the California set gillnet fishery by date, species, and number of animals involved in each interaction. Source: NMFS FOIA Response 2023.