Committee Staff Summary for November 6-7, 2024 MRC

4. Market Squid Fishery Management and Fishery Management Plan Review

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

Discuss Department report on Department Squid Fishery Advisory Committee (SFAC) review of California market squid fishery management and proposed recommendations, and develop potential committee recommendation.

Summary of Previous/Future Actions

• Commission adopted *Market Squid Fishery Management Plan* (FMP) and implementing regulations	August 2004
• Commission referred market squid fishery management review to its Marine Resources Committee (MRC)	April 2021
• Department presented proposed approach to squid fishery management review, including forming an SFAC	July 2021; MRC
• Department written update on squid management review planning	July 2022; MRC
• Department written updates on SFAC process	July and November 2023; MRC
• Received update and discussed SFAC meetings to date and next steps	March 19, 2024; MRC
• Received and discussed SFAC report and proposed recommendations	July 17-18, 2024; MRC
• **Today discuss Department's SFAC report and proposed recommendations, and potential MRC recommendation**	**November 7, 2024; MRC**

Background

The California market squid fishery is significant in California's fishery economy and has been undergoing a comprehensive review of management since 2021, the first of its kind since the Market Squid Fishery Management Plan (FMP) was adopted in 2004. A Department director's SFAC was established to assist in the management review process.

SFAC's deliberations across ten meetings culminated in a report, *Squid Fishery Advisory Committee Review of California Market Squid Fishery Management and Proposed Recommendations* (Exhibit 1). The report reviews SFAC discussions, options explored, and Department recommendations in six categories:

- Monitoring
- Fishing dynamics and empirical dynamic modeling (EDM)
- Fishing effort and temporal closures
- Small-scale fishery access
- Nets and squid spawning habitat
- Lighting and seabird habitat

At the July 2024 MRC meeting, the Department presented a summary of the report, including SFAC deliberations and emerging themes, options considered, and Department recommendations. The recommendations encompass: (1) potential FMP amendments and regulation changes; (2) non-regulatory outreach goals focused on advancing fishery "best practices" amongst the fleet; and (3) areas of continued research for potential future action related to small-scale opportunities, forecasting with EDM, and evaluating potential wildlife-fishery interactions with nocturnal seabirds. See Exhibit 2 for additional details concerning the SFAC process and July discussion.

Following discussion at the July 2024 meeting, MRC requested follow-up on several topics raised during public discussion: (1) the use of seal bombs (also known as marine mammal deterrent devices) in the market squid fishery; (2) lighting and seabird impacts, particularly for Scripp's murrelet at the northern Channel Islands; and (3) small-scale fishery access considerations.

Update

Today the Department will give a presentation to recap the SFAC process and resulting Department recommendations and highlight a proposed timeline for Commission FMP amendment and rulemaking processes (Exhibit 3). The Department will also address questions and discussion topics from the July 2024 MRC meeting as requested. The Department recognizes the continued interest in small-scale access to squid in port areas outside the traditional squid fishing grounds, and concerns from the seabird conservation community regarding potential interaction of lights from nighttime fishing with nocturnal sea birds, but continues to recommend non-regulatory approaches at this time to further explore the topics, which could lead to future management changes. Staff concurs.

The timeline proposed for the FMP amendment and rulemaking process is to receive the draft amended FMP and consider notice of proposed regulation changes in April 2025, hold a discussion in June 2025, and adopt the final amended FMP and regulations in August 2025.

Significant Public Comments

1. An environmental non-governmental organization submitted two reports analyzing the use of seal bombs in California's fisheries, specifically focusing on the market squid fishery, in response to MRC's inquiry in July 2024 (Exhibit 4).
2. An environmental non-governmental organization, which had an appointed conservation representative on the SFAC, expresses support to: (1) extend weekend closures to enhance precautionary management; (2) implement ribeline and rope purse line requirements to protect seabed habitat and squid egg beds; (3) adopt nighttime, area restrictions on squid fishing to aid the recovery of sensitive bird nesting sites; and (4) consider exploring small-scale fishery access (Exhibit 5).
3. Two seabird conservation groups urge MRC to support enacting closure of nighttime fishing and the use of artificial lights near Santa Barbara, Anacapa, and San Miguel islands to protect Scripps's murrelet, a threatened bird species. They state that artificial light used for squid fishing is a distinct threat to the nocturnal bird, which is listed as threatened under the California Endangered Species Act (exhibits 6 and 7).

Recommendation

Commission staff: (1) Advance the proposed FMP amendments and regulation changes as recommended by the Department, and schedule a three-meeting concurrent process to commence in April 2024; (2) support the Department's proposal to conduct outreach and continue research related to lighting best practices, forcasting with EDM, evaluating nocturnal seabird interactions with particular emphasis on Scripp's murrelet, and exploring small-scale access through experimental fishing permits, recognizing that future adaptive management may be warranted; and (3) track progress on the non-regulatory actions through updates at MRC meetings.

Department: (1) Advance for the Commission's consideration the proposed FMP amendments and regulation changes, as outlined in Exhibit 3, and schedule a three-meeting concurrent process to commence in April 2024; and (2) support continued non-regulatory actions, including outreach through a fishery "best practices" guide, continuing research on forecasting with EDM, evaluating potential wildlife interactions (primarily nocturnal seabirds) with squid fishery log data, and exploring small-scale fishing access through the Experimental Fishing Permit Program.

Exhibits

1. Department report, *Squid Fishery Advisory Committee Review of California Market Squid Fishery Management and Proposed Recommendations*, dated July 18, 2024
2. Staff summary from July 17-18, 2024 MRC meeting, Agenda Item 5 (*for background purposes only*)
3. Department presentation
4. Letter from Geoff Shester, California Campaign Director and Senior Scientist, Oceana, received October 23, 2024
5. Letter from Greg Helms, Manager, Fish Conservation Program, Ocean Conservancy, received October 24, 2024
6. Letter from Dennis Arguelles, Southern California Director, National Parks Conservation Association, received September 30, 2024
7. Letter from Lindsay Ardean, 2024 Vice-Chair for Conservation, Pacific Seabird Group, received September 30, 2024

Committee Direction/Recommendation

The Marine Resources Committee recommends that the Commission: (1) schedule for consideration proposed amendments to the Market Squid Fishery Management Plan and proposed regulation changes, as recommended by the Department, through a three-meeting concurrent process commencing in April 2024; and (2) support the Department's plans for outreach to provide a fishery "best practices" guide and for continued research on forecasting with empirical dynamic modeling, evaluating potential wildlife interactions with squid fishery log data, and exploring small-scale opportunities through the State's Experimental Fishing Permit Program.

Committee Staff Summary for July 17-18, 2024 MRC
For background purposes only

5. Market Squid Fishery Management and Fishery Management Plan (FMP) Review

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

Receive and discuss Department's Squid Fishery Advisory Committee (SFAC) and proposed recommendations.

Summary of Previous/Future Actions

• Commission adopted *Market Squid Fishery Management Plan* (FMP) and implementing regulations	August 2004
• Commission referred market squid fishery management review to its Marine Resources Committee (MRC)	April 2021
• Department presented proposed approach to squid fishery management review, including forming a SFAC	July 2021; MRC
• Department written update on squid management review planning	July 2022; MRC
• Department written updates on SFAC process	July and November 2023; MRC
• Commission received update and discussed SFAC meetings to date and next steps	March 19, 2024; MRC
• **Today receive and discuss SFAC report and proposed recommendations**	**July 17-18, 2024; MRC**
• Discuss SFAC report and proposed recommendations, and potential MRC recommendation	November 7, 2024; MRC

Background

The market squid fishery is one of the largest commercial fisheries in California, in both landings volume and value. Managed under the Commission's authority since 2001, the fishery operates within the framework of the market squid FMP adopted by the Commission in 2004. The FMP defines harvest control rules, a restricted access program, environmental protections against seabird interactions, and fishery administration.

While regulations have been periodically adopted to adaptively manage various aspects of the fishery, 2021 marked the initiation of the first comprehensive review of market squid fishery management since the FMP's adoption. The Department-developed, multi-phase, management review, supported by the Commission, has been anchored in a SFAC. Established by the Department's director according to Section 53.02, the SFAC has played a crucial role in assisting with developing and reviewing fishery assessments, management options and proposals, and FMP amendments (see Exhibit 1 for background details on the SFAC).

Committee Staff Summary for July 17-18, 2024 MRC
For background purposes only

At the March 19, 2024 MRC meeting, the Department presented its overview of SFAC meetings to date and discussed next steps with the MRC. The Department relayed that, following the final SFAC meeting in May 2024, it would prepare a summary report and recommendations for adaptive management of the California market squid fishery.

Update

With the SFAC process complete, the Department prepared and has submitted a report, *Squid Fishery Advisory Committee Review of California Market Squid Fishery Management and Proposed Recommendations* (Exhibit 2), to MRC for discussion. The report reviews SFAC discussions over the course of 10 meetings, options explored, and Department recommendations developed through that process in six categories:

- *Monitoring*
- *Fishing dynamics and empirical dynamic modelling*
- *Fishing effort and temporal closures*
- *Nets and squid spawning habitat*
- *Lighting and seabird habitat*
- *Small-scale fishery access*

In addition to proposed FMP amendments and/or regulatory changes, the Department is continuing to explore small-scale opportunities outside of current major fishing areas through an experimental fishing permit (EFP) (e.g., development of local markets and low volume gear (hand jig and hand brail)). The Department is continuing research using empirical dynamic modelling and evaluating potential wildlife interactions with squid fishery log data.

For today's meeting, the Department will give a presentation recapping California market squid fishery dynamics and management, summarize SFAC deliberations and emerging themes, provide an overview of the options considered, and present Department-proposed recommendations (Exhibit 3). The recommendations encompass: (1) Potential FMP amendments and/or regulatory changes, (2) outreach goals focused on fishery "best practices," and (3) areas of continued research for potential future action.

The purpose of today's discussion is to review the process and outcomes detailed in the Department report and discuss Department-proposed recommendations. Today also represents an opportunity for MRC to ask questions or request further follow-up on any of the topics for review prior to the discussion and potential MRC recommendation scheduled for the November 2024 MRC meeting.

Significant Public Comments

Two fish processors from Noyo Harbor, Mendocino County, request that the Commission support developing a small-scale, open-access market squid fishery north of Point Arena to the California-Oregon border (outside current major fishing areas) to support local coastal fishing community access, recognizing geographic and weather constraints in the area. Specific requests include non-transferrable permits, maximum catch of five tons per day; and an annual

cap of 3,000 tons (exhibits 4 and 5).

Recommendation

Commission staff: Hear from SFAC members and stakeholders, clarify Department-proposed recommendations where needed, and identify any areas for further follow-up in advance of the final discussion scheduled for the November 2024 MRC meeting.

Department: See exhibits 2 and 3 for Department recommendations and rationale related to monitoring, fishing dynamics/fishing effort, fishery access, and gear and habitat. [RK1]

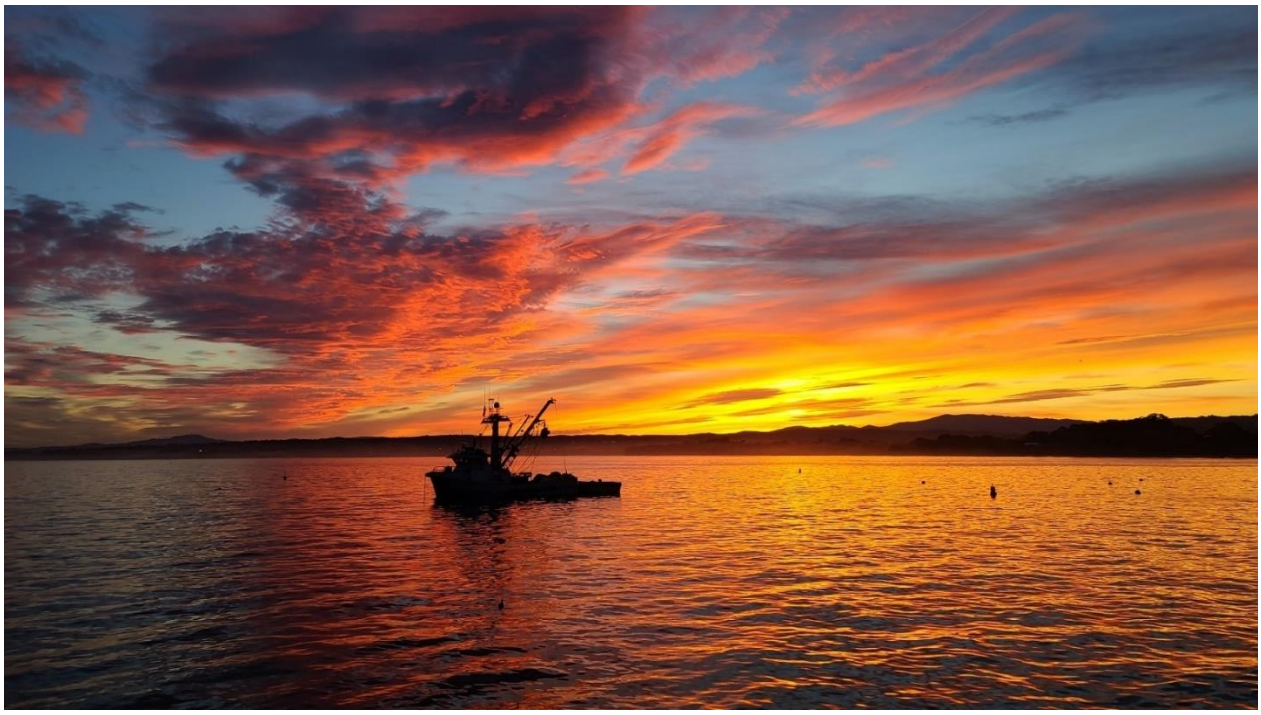
Exhibits

1. Staff summary from March 19, 2024 MRC meeting, Agenda Item 5 (*for background purposes only*)
2. Department report, *Squid Fishery Advisory Committee Review of California Market Squid Fishery Management and Proposed Recommendations*
3. Department presentation
4. Letter from Robert Juntz, Jr., Ocean Fresh LLC, received July 1, 2024
5. Letter from Scott Hockett, owner, Noyo Fish Company, received July 1, 2024

Committee Direction/Recommendation (N/A)

Squid Fishery Advisory Committee Review of California Market Squid Fishery Management and Proposed Recommendations

California Department of Fish and Wildlife



Marine Resources Committee Meeting
of the California Fish and Game Commission.
July 18, 2024

EXECUTIVE SUMMARY

BACKGROUND

In 2023, the California Department of Fish and Wildlife (Department) convened a Squid Fishery Advisory Committee (SFAC) charged with reviewing and advising the Department on potential changes to California market squid (*Doryteuthis opalescens*) fishery management. This document reviews the final recommendations developed in that process, including the background, rationale, and other options considered. Recommendations are included in each of the following categories:

MONITORING

The recommendation is to develop an electronic logbook (e-log) for the California market squid commercial fishery. Paper logs are cumbersome and real-time data collection is essential to modernize long-term monitoring efforts and build fishery climate resilience.

EMPIRICAL DYNAMIC MODELING

The Department will continue to develop forecasts with Empirical Dynamic Modeling (EDM; 2024 onward). EDM shows promise in (1) informing the development of an e-log, (2) forecasting for industry and management planning in response to climate change, and (3) exploring potential future management options.

FISHING EFFORT AND TEMPORAL CLOSURES

The recommendation is to extend the existing weekend closure (noon Friday to noon Sunday) to start at 7am Friday Statewide. An additional extension to end Sunday at midnight in the Monterey Bay Area (to be defined) is also recommended. These changes provide added conservation in squid fishery management and a buffer for climate change at little expense or potentially improvement to fishery yields and performance. The extensions provide for additional uninterrupted spawning, which should benefit squid reproduction and spawning success.

SMALL-SCALE FISHERY ACCESS

The recommendation is that individuals interested in pursuing small-scale opportunities should utilize the newly established experimental fishery permit (EFP) program. The Department will work with potential EFP applicants to develop EFPs that would allow for limited small-scale fishery opportunities outside the primary commercial fishing areas and not to compete with the existing limited entry program. This allows for testing for the viability and enforceability of small-scale commercial fishing outside the restricted access program.

NETS AND SQUID SPAWNING HABITAT

The recommendation is to establish regulations that require the use of a ribline and rope purse line for all squid round haul fishing vessels. This change mitigates potential impacts to sandy bottom habitat and enhances sustainability by protecting squid egg beds and other benthic species.

LIGHTING AND SEABIRD HABITAT

The Department, with support from the SFAC, has developed a draft Fishery "Best Practices" document that will be distributed to all commercial squid fishery participants. The Department will continue to collaborate with researchers to evaluate potential wildlife interactions (primarily nocturnal seabirds at the Channel Islands National Park) using squid fishery log data. The Best Practices document includes precautionary conservation measures that squid fishing vessels should implement near shorelines and in sensitive bird nesting regions. Evaluations of interactions will use long-term monitoring to inform potential wildlife interactions.

INTRODUCTION

MARKET SQUID FISHERY MANAGEMENT PLAN

The Market Squid Fishery Management Plan (MSFMP) was drafted over the course of five years between 1998 and 2003, with input from two advisory groups - the original Squid Fishery Advisory Committee and a Squid Research Scientific Committee - appointed by the California Department of Fish and Wildlife (Department). The MSFMP was reviewed through an extensive California Fish and Game Commission (Commission) process and adopted in December 2004, with the final version officially published in March 2005 (CDFW, 2005). The MSFMP was developed under the provisions set forth by California's Marine Life Management Act (MLMA), which established state policies, goals, and objectives to govern the conservation, sustainable use, and restoration of California's living marine resources, including the market squid resource.

The MSFMP established a management program for California's market squid resource and procedures by which the State manages the market squid fishery. The goals of the MSFMP are to manage the market squid resource to ensure long term conservation and sustainability, reduce the potential for overfishing, and institute a framework for management that is responsive to environmental and socioeconomic changes. The tools implemented to accomplish the MSFMP goals were:

- Fishery control rules, including:
    - A seasonal catch limitation to prevent the fishery from over-expanding;
    - Weekend closures, which provide for periods of uninterrupted spawning;
    - Gear regulations regarding light shields and wattage used to attract squid and;
    - Monitoring programs designed to evaluate the impact of the fishery.
- A restricted access program, including provisions for initial entry into the fleet, types of permits, permit fees, and permit transferability that produced a moderately productive and specialized fleet.
- A seabird protection measure restricting the use of attracting lights for commercial purposes in any waters of the Greater Farallones National Marine Sanctuary.

ENHANCED STATUS REPORT

In 2020, the Department developed an Enhanced Status Report (ESR) for California's Market Squid Fishery in accordance with the MLMA's Master Plan. In general, ESRs systematically address objectives and requirements of the MLMA similar to but more succinctly than FMPs, and include topics such as landings,

fishing effort and location, and emerging needs. As an FMP was already in place for the Market Squid fishery, the ESR provided updated and more focused information pertaining to market squid life history information, the fishery, and management (CDFW, 2024). Additionally, the ESR included potential revisions to the FMP or management framework that have materialized since the 2005 implementation.

2023 MSFMP REVIEW – SQUID FISHERY ADVISORY COMMITTEE

Background

Between 2014 and 2017, fishing communities from northern California developed a petition that was submitted to the Commission for a community-based squid fishery with its own quota for the ports of Noyo, Eureka, and Crescent City. The inquiry for a community quota outside of the already established restricted access program led to consideration and discussion of potential squid fishery management changes. In August 2021, Monterey area fishermen submitted a petition seeking additional time restrictions for the fishery. In 2022, the State of Oregon also established commercial squid fishery management measures and regulations requiring the use of purse seine riblines, which provided additional basis for revisiting gear and potential habitat impacts in California. With increasing interest in evaluating existing management, new information identified in the ESR, and uncertainty involving climate change impacts on sustainable fisheries, the Department determined a need to revisit market squid regulations and initiated the process to form an advisory committee.

In 2023, the Department, with support from the California Ocean Protection Council and Resources Legacy Fund, initiated a review process for the market squid fishery and MSFMP. The Department convened a new Squid Fishery Advisory Committee (SFAC) charged with reviewing the fishery and advising the Department on potential changes to California market squid fishery management. The goals of the SFAC process were to:

- Review changes in fishery dynamics
- Respond to past stakeholder input and management change proposals
- Consider potential new management measures as guided by the MSFMP, Enhanced Status Report (ESR), and MLMA Master Plan
- Work with a postdoctoral scholar (post-doc) to forecast future landings and catch per unit effort (CPUE) and evaluate harvest control measures in the context of climate change using Empirical Dynamic Modelling (EDM)
- Explore opportunities for small-scale fisheries and the ability for coastal communities and local economies to adapt to climate change
- Modernize data collection and fishery monitoring efforts, including the use of electronic reporting

2022 SFAC Establishment

In spring of 2022, one-on-one interviews with interested stakeholders were conducted by the professional facilitation team, Concur Inc., to capture the broad range of perspectives on potential changes for squid fishery management and to test the willingness of interviewees to engage in an advisory deliberative process. In the fall of 2022, a call for nominations was released by the Department to squid fishery stakeholders and California Native American Tribes. SFAC members were selected in winter 2022 to participate as representatives for specific stakeholder groups, and an SFAC listserv was developed to keep the public and interested Tribes informed of the SFAC's progress. Concur assisted in developing a biography portfolio that included each of the SFAC members, meeting ground rules, and a committee charge to help the SFAC prepare for a series of meetings that would occur over the next 18 months. The SFAC consisted of a broad group of stakeholders, including representatives from the fishing industry, non-governmental organizations, government scientists, and the public.

Squid Fishery Advisory Committee Roster - 2023-2024

Name	**Affiliation**
Caitlin Allen Akselrud	Government Agency / Stock Assessment
Richie Ashley	Commercial/Recreational – Bait Fishery
Ryan Augello	Dealer/Processor
John Barry	Commercial Squid Fishing - Seine
Ken Bates*	Commercial Fishing – Small-Scale Access
Joe Cappuccio	Dealer/Processor
David Crabbe	Commercial Squid Fishing - Light/Brail
Mark Fina	Trade Association
Russel Galipeau	Non-Consumptive Users
Corbin Hanson	Commercial Squid Fishing - Seine
Greg Helms	Non-Governmental Organization
Porter McHenry	Commercial Squid Fishing - Seine
Tom Noto	Commercial Squid Fishing - Seine
Brian Susi-Blair	Commercial Squid Fishing - Light/Brail
Ken Towsley*	Dealer/Processor
Joe Villareal	Commercial Squid Fishing - Light/Brail
Anthony Vuoso	Dealer/Processor
Anna Weinstein*	Non-Governmental Organization
Dan Yoakum	Commercial Fishing - Access

* These members resigned from the SFAC prior to conclusion of the deliberative process and development of final recommendations

Meetings

The SFAC process included a series of in-person and remote meetings each discussing a specific set of topics for consideration. The meetings were designed to elicit detailed expressions of individual interests and commentary from members and directly respond to the SFAC goals. The SFAC process was supported by facilitation from Concur Inc. and subject matter experts with the Department, including insight from law enforcement. SFAC Members contributed a significant amount of their time to these meetings and their commitment to constructive engagement was invaluable. The meetings resulted in the set of recommendations found in this document. While not a consensus process, each recommendation had broad support from the majority of SFAC members. Summaries of each meeting's key outcomes are available on the Department's squid fishery management web page.

- Meeting 1 – February 2023, Virtual – Introductions
- Meeting 2 – April 2023, Santa Cruz – Effort and EDM
- Meeting 3 – May 2023, Virtual – Effort and EDM
- Meeting 4 – July 2023, Virtual – Monitoring
- Meeting 5 – August 2023, Seal Beach – Monitoring
- Meeting 6 – October 2023, Virtual – Gear/ Habitat
- Meeting 7 – November 2023, Virtual – Gear/ Habitat and Access
- Meeting 8 – January 2024, Oakland – Access
- Meeting 9 – March 2024, Santa Barbara – Initial Proposals
- Meeting 10 – May 2024, Long Beach – Finalize Department Recommendations

SFAC Outcomes and Department Recommendations

For each meeting, the Department provided a presentation to frame a specific topic, presented interim data and results, and asked the SFAC for feedback based on the information provided. Members were able to hear differing perspectives of observed phenomena from other members. The dialogue provided SFAC members with an understanding of the fishery from different standpoints and engaged the committee in problem solving.

Recommendations were developed for the following topics: monitoring; empirical dynamic modeling; fishing effort and temporal closures; small-scale fishery access; nets and squid spawning habitat; and lighting and seabird habitat. At the final SFAC meeting, the Department reflected on SFAC discussions using MLMA guidance and provided a list of "narrowed options" which were selected based on the following criteria: specificity and clarity of the proposal, feasibility and enforceability, and presence of some demonstrated level of support. Using the criteria listed above, the Department provided a preferred option and the SFAC provided input and refinement to

work toward a more complete recommendation with as broad support as possible among SFAC members.

The SFACs' review of market squid fishery management was guided by the MLMA goals described in and key to the development of the MSFMP:

1) Ensure long-term resource conservation and sustainability.
2) Employ science-based decision-making.
3) Increase constituent involvement in management.
4) Balance and enhance socioeconomic benefits.
5) Identify implementation costs and sources of funding.

The five goals were referenced at the onset of each major topic reviewed by the SFAC and used to help guide meeting objectives. Throughout the SFAC process, committee members were asked to provide input on the following:

- Level of support for existing market squid fishery management (i.e., status quo).
- Potential and/or preferable modifications, if any.
- Confidence with whether the squid fishery management framework will keep the fishery sustainable in the face of climate change.

MARKET SQUID FISHERY AND MANAGEMENT BACKGROUND

Market squid (*Doryteuthis opalescens*) are short-lived (6 to 10 months) and die after spawning (Butler et al., 2001). Once sexually mature, market squid invest all metabolic energy into reproducing and die naturally within a few days to weeks. Market squid aggregate to lay eggs in the nearshore sandy bottom, which can happen throughout the year (Cheng et al., 2020). While spawning aggregations are found and fished primarily off central and southern California, market squid are found from Baja to Southeastern Alaska (Jereb and Roper, 2010). The population, which functions as cohorts of aggregations, is responsive to oceanographic changes resulting in large fluctuations in abundance and regional distribution (Suca et al., 2022; Van Noord and Dorval, 2017; Zeidberg et al., 2006).

Market squid landings in California are highly variable in time and space with a large market demand, primarily from international markets. The market squid commercial fishing industry is routinely the largest in California in volume (amount of fish landed) and value (ex-vessel revenue). The fishery has averaged approximately 70 thousand tons landed each calendar year since the MSFMP was implemented. The fishery is valued at an average of $48 million in ex-vessel revenue each calendar year since 2005 (CDFW, 2024). In addition to commercial fishing, many recreational anglers use squid as dead or live bait to catch finfish species. (CDFW, 2023)

Implementation of the MSFMP followed an especially productive six-year period, followed by another productive period from 2010 to 2015 when the fishery approached or surpassed the 118,000-ton seasonal cap for five consecutive fishing seasons (Figure 1). The market squid fishing season runs from April 1 to March 31 of the following year. Since the implementation of the MSFMP, the Department observed the lowest statewide landings in 2019 at 13.6 thousand tons (Figure 1). Importantly, the relative value of market squid has increased substantially in recent decades. The ex-vessel value doubled from 2015 to 2023, increasing from an average of $0.30 per pound to $0.60 per pound (CDFW, 2023). In 2022, the value for time spent fishing market squid was noticeably larger than it was 10 years ago and is an important indicator for how fishery dynamics can change over time.

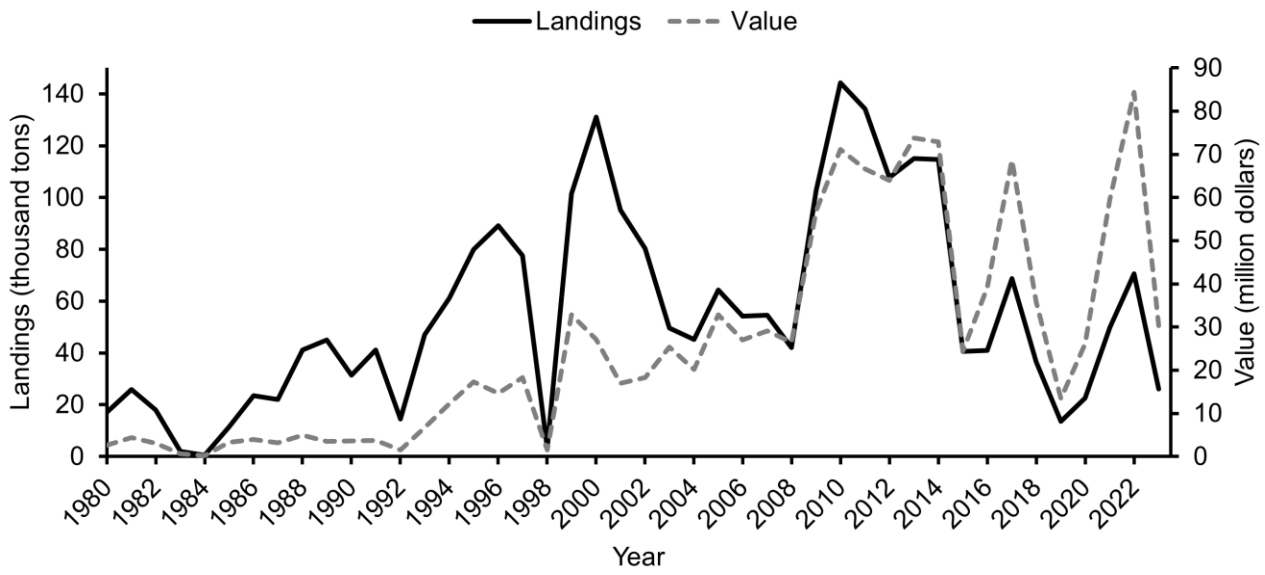


Figure 1. Market squid fishery landings (thousand tons) and value (million dollars) by calendar year from 1980 to 2022.

The major squid fishing areas are located on the central coast of California and the Southern California Bight with a hub of fish businesses in Monterey Bay, Ventura, and San Pedro. Notable fishing hotspots can be found off the Monterey Peninsula, the Northern Channel Islands, and Santa Catalina Island (Figure 2). Market squid spawning and fishing activity in California are typically considered asynchronous and seasonal, occurring between the area north of Point Conception ("northern region" or "north") and the area south of Point Conception ("southern region" or "south"). In fall and winter, fishing takes place almost exclusively in the southern region while the northern region typically makes up more of the landings during the spring and summer.

The commercial fishery was historically concentrated in the southern part of California. However, landings and the number of vessels fishing have increased around the Monterey Bay region since the 2014-2016 El Niño and correspond with changing fishery dynamics and oceanographic warming events in the California Current Ecosystem (CCE; Chasco et al., 2022). While a large body of scientific literature that explores squid dynamics and biology in response to abiotic influences (i.e., temperature, dissolved oxygen, and upwelling) exists, little is known regarding predictive fisheries models that explore long-term market squid fishery-dependent information in relation to climate drivers (Suca et al., 2022; Munch et al., 2018; Navarro et al., 2018; Ralston et al., 2018).

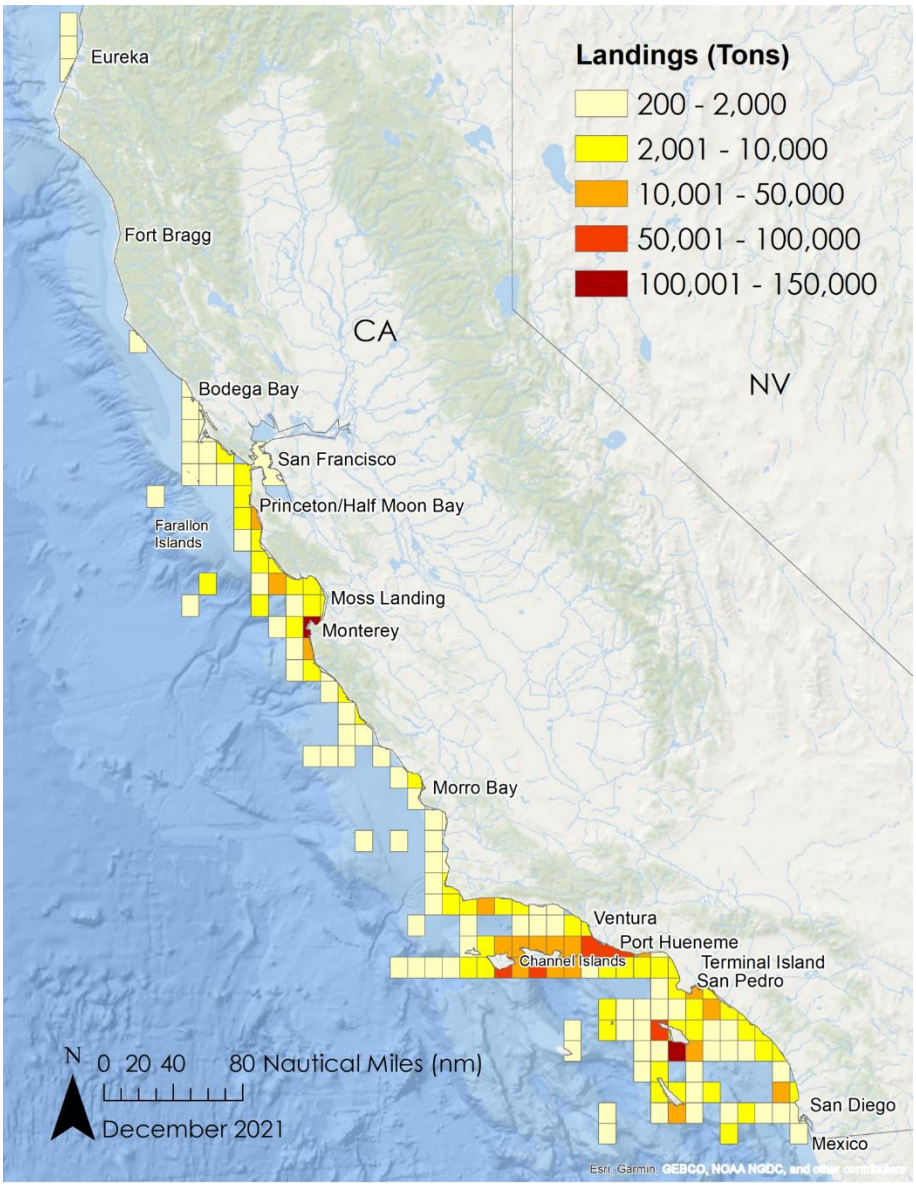


Figure 2. Market squid fishery landings (tons) summarized as a heat map by CDFW fishing block from 2005 to 2021.

Although market squid are included in the federal Coastal Pelagic Species (CPS) Fishery Management Plan (FMP), the California fishery is primarily managed at the State-level through the MSFMP. In addition to the MSFMP fishery control measures (see Fishery Management Plan), the CPS FMP and Magnuson-Stevens Act required that Maximum Sustainable Yield (MSY) be determined for all species in the federal plan. Without an accurate biomass estimate, determining MSY for market squid was problematic, hence the Pacific Fishery Management Council (PFMC) approved the use of egg escapement as a proxy for MSY for the market squid fishery. The estimates of egg escapement are evaluated in the context of a threshold (proxy set at 30%) that allows for

sustainable reproduction year after year (PFMC, 2024). With support from the National Oceanic and Atmospheric Administration (NOAA), the Department evaluates the 30% target escapement statewide by fishing season (CDFW, 2024). Additional conservation is provided by California's Marine Protected Area (MPA) network, which was designed with consideration for market squid spawning grounds and provides for additional escapement.

SFAC DISCUSSIONS AND DEPARTMENT RECOMMENDATIONS

MONITORING

Fishery monitoring efforts, from data collection to fisheries modelling, were a fundamental component during SFAC meetings and the market squid fishery management review. Long-term monitoring and time series data supported science-based discussions during the management review process. Three core market squid fishery monitoring tools and fishery dependent datasets managed by the Department were discussed:

- Landings – Marine Landings Data System
- Logbook – Marine Logs System
- Biological – Market squid fishery dockside sampling

Marine landings data, collected since 1969, are now submitted by fish dealers and businesses through electronic fish tickets (E-tix). The logbook program includes on-the-water effort and location information submitted on paper logs by vessel operators. The dockside sampling time series began in 1998. Department staff monitor offloads at the docks and subsample squid for processing in a laboratory. Importantly, the dockside sampling program supports bycatch monitoring and provides inputs for the egg escapement modelling as a measure of relative spawning potential over time.

The market squid fishery logbook program began in 1999 shortly after the Legislature passed Senate Bill (SB) 364 (Sher), deeming it necessary to adopt and implement squid fishery management measures. The logbooks (Appendix I) are a requirement under Fish and Game Code (FGC) §8026, and California Code of Regulations (CCR) Title 14 §149. The logbook program enables the Department to monitor daily fishing activity, fishing trends, and provide more precise location and catch data than the landings dataset. Logbook data are useful in marine spatial planning, particularly during discussions of MPA locations and scoping for offshore wind and marine aquaculture (Morris Jr. et al., 2021). The logs were designed to learn about fishery and resource dynamics, and was originally intended to aid in the development of population models (CDFW, 2005).

While the Department's collection of marine landings data transitioned from paper receipts to electronic fish tickets in 2019, the market squid fishery logbook data are still collected through paper logbooks, post mail, and manual entry by Department staff (Appendix I). The objectives in working with the SFAC to review the market squid fishery logbook program were to:

- Better understand the current use of logbooks,

- Qualify and quantify the validity and accuracy of the information provided on paper logs,
- Evaluate the relative importance/usefulness of existing logbook data fields,
- Gauge interest in electronic logs, and
- Discuss areas for data collection improvement and/or techniques to collect data electronically.

The market squid fishery logbook data are currently used:

- To observe fishery dynamics over a finer spatial and temporal resolution,
- To explore novel population modelling techniques with EDM,
- In marine spatial planning such as fishery impact analyses during offshore wind and aquaculture scoping,
- For fishery business operations and record keeping, and
- For enforcement.

After reviewing current and potential future uses for market squid logbook data, the SFAC confirmed broad-based support to move away from paper logbooks and transition towards electronic data collection. Multiple vessel operators volunteered to participate in a pilot program, if available, to help the transition. Additional interest in logbook data improvements included capturing information about lightboats through E-tix. Currently, the only documentation lightboat operators have of their lighting activity is through paper logs, which can be cumbersome for operators, permit holders, and the Department to source as proof of fishing activity.

As part of SFAC meeting 4, Kate Wing, a contractor with the Department, shared a mock-up of a potential electronic log (e-log). The mock-up entailed an account set up form, a function to record the start and end of trips, buttons with GPS locations for different types of fishing events such as lighting, and other important details (Figure 3). In the effort of modernizing and advancing the market squid logbook, the Department, EDM team, and SFAC described and discussed specific examples of modifications to data fields and the information collected. Though not a comprehensive list, below are some examples and suggested modifications:

- Add fields for seine vessels to report time spent searching and lighting – Time spent searching and lighting should be reported by all vessels, not just lightboats, and are important metrics for calculating fishery CPUE.
- Add more detailed information about market orders and economic influences on effort or catch.

- Add more detailed monitoring of marine mammal interactions during fishing activity.
- Monitor the use of marine mammal deterrents.
- Improve reporting on vessel and net specifications.
- Make it easy for the permit holder and vessel operator (if different) to access vessel or trip reporting.
- Minimize the amount of time that operators need to interact with reporting forms while actively fishing (i.e., consider Bluetooth sensors on hydraulics).

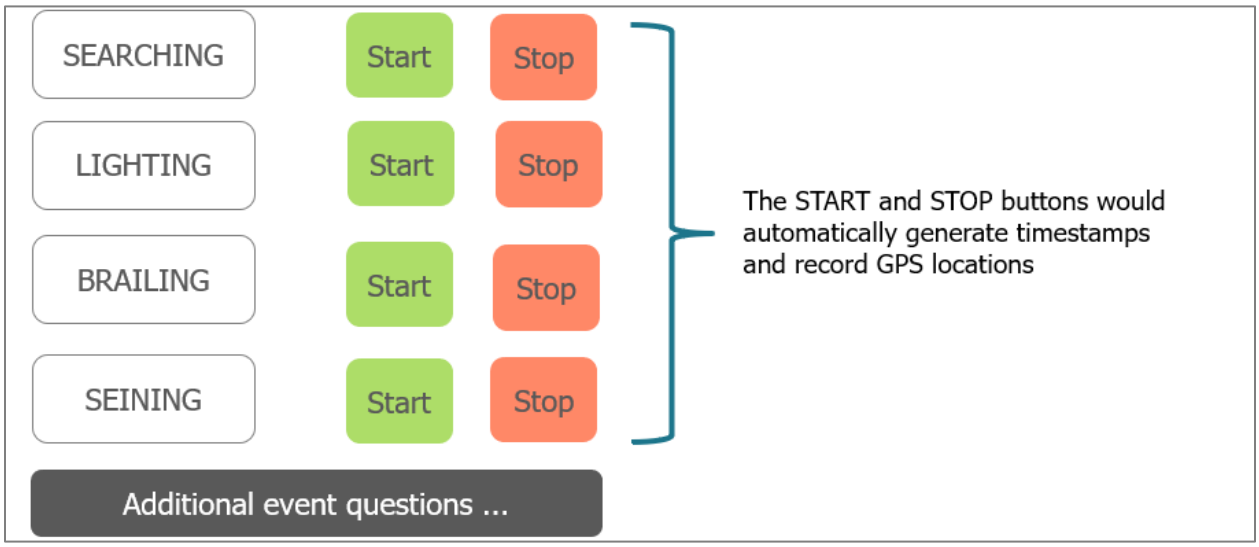


Figure 3. Example of a potential electronic log form with start and stop buttons for various fishing events. Mock-up designed by Kate Wing.

Electronic data collection in the form of an e-log could generate more timely and reliable information as well as reduce time and effort for vessel operators and Department staff. By minimizing manual entry and written records of detailed information such as GPS coordinates, the validity and accuracy of data collected can improve. An e-log also enables more real-time monitoring, better quality assurance and quality control, and improved compliance.

Additional topics discussed that were deemed outside the scope of the Department's active monitoring programs included interest in utilizing observers on vessels, primarily to document wildlife interactions and bycatch during fishing and lighting. Vessel operators and crew explained that seining operations are not conducive to and can be unsafe for on-board observers. Due to the existing investment in dockside observations of bycatch and the logistical constraints of getting observers on vessels, equivalent observations could be made from a nearby Department vessel. Continued outreach with the fleet and upfront

investment in well-planned monitoring tools could provide more detailed documentation of fishery interactions with other wildlife.

Narrowed Options:

- Develop an e-log for the California market squid commercial fishery

Department Recommendation:

- Develop an e-log for the California market squid commercial fishery

EMPIRICAL DYNAMIC MODELLING

While market squid is currently considered a sustainable fishery, a need exists to modernize management and planning in the context of climate change. In the primary fishing grounds, located in the southern region of California, market squid landings, larval abundance, and size at maturity declined during major El Niño events. As noted above, cumulative landings have increased in central and northern California since the 2014-2016 El Niño. Climate drivers can alter the seasonal and spatial cycles in spawning activity, which in turn can impact fishing behavior, fleet dynamics, and socioeconomics of fishing communities (CDFW, 2024; Chasco et al., 2022). Given that El Niño Southern Oscillation (ENSO) variability is likely to increase in the future, a better understanding of how market squid respond to environmental forces is needed as conditions shift (Ohman et al., 2020). Sea surface temperature (SST) is one of the primary sources of information on ENSO patterns.

Empirical dynamic models (EDMs) capture nonlinear dynamics and system drivers that haven't been measured by including lags (i.e. previous measurements of the same data stream at different time steps). EDMs can be used to make predictions based on patterns in long-term data such as environmental drivers and are unbiased by predetermined model equations. EDMs can work particularly well for short-lived species (Giron Nava et al., 2017; Munch et al., 2018). California market squid fishery data and data sets include landings and logbook data on vessel-specific effort and dockside sampling, larval abundance surveys conducted by both California Cooperative Oceanic Fisheries Investigations and industry researchers with the California Wetfish Producers Association (CWPA), and juvenile abundance information resulting from NOAA surveys of juvenile rockfish. Preliminary work conducted by Dr. Stephan Munch and Bethany Johnson using EDM indicated excellent capability to forecast market squid landings, tease out complex spatial and temporal dynamics, and highlight survey information of greatest value.

2022-2024 EDM Post-Doc Objectives:

- Forecast future squid landings and CPUE (i.e., proxy for market squid abundance) over relevant temporal and regional geographic scales.
- Incorporate environmental drivers (i.e., SST) into EDM.
- Seek stakeholder input on calculating CPUE, management options, and desired fishery performance metrics.
- Set up a harvest control analysis to evaluate CPUE under different fishing effort and climate scenarios (See Fishing Effort and Temporal Closures).

The EDM post-doc investigator, Dr. Lucas Medeiros, was onboarded in July 2022 to tackle the objectives listed above. Initial SFAC meetings focused on introducing EDM and the various sources of time series data from 2000 to 2023. Early data exploration at quarterly resolution indicated apparent differences between SST and fishery dynamics in the regions of California north and south of Point Conception. Given the differences, the modelling team constructed separate models of the northern and southern regions of the fishery, delineated at Point Conception, with quarterly forecasts.

Both quarterly time series exhibited seasonality in SST with more variability in SST in the South than in the North. Landings and logbook catch were highly correlated, and initial comparisons of catch and effort were tightly coupled and not independent (i.e., landings/catch scaled with time spent fishing). Once the modelling team incorporated search time into the effort metric, landings became more decoupled from effort, which is necessary to effectively use CPUE as a proxy for abundance. Hindcasts were performed to predict CPUE as an estimate of squid abundance based on lags in CPUE, effort (i.e., hours fishing and searching), and SST. The northern model more accurately predicted past CPUE than the southern model, while both were far more accurate in their predictions than an average seasonal trend. Additionally, positive correlations were found between estimates of fishery CPUE and paralarval CPUE informed by CWPA surveys, particularly at biologically relevant lags. Positive correlations at biologically relevant lags help to validate the use of CPUE as an abundance indicator and provides support for the continued monitoring of paralarvae.

The SFAC was well-positioned to build on collaborative data gathering and accountability. Modelling efforts were informed by commercial squid vessel operator experience and knowledge, particularly when attempting to accurately calculate effort. Importantly, EDM work helped to prioritize the types and frequency of data collected in a transition to electronic, real-time monitoring.

The harvest control analysis was constructed by imposing varying degrees of fishing effort and forecasting landings and CPUE under three different SST scenarios. While SST states had only modest impacts on forecasts, larger impacts were observed when changes in fishing effort were imposed in the northern and southern regions. The results supported discussions about fishing pressure and time spent fishing (see Fishing Effort and Temporal Closures). EDM struggled to capture extreme highs and lows of landings and SST in either region. EDM is an area for further exploration given that expansions, shifts, or dramatic changes in

market squid landings or proxies for abundance at various life stages are most likely to occur under environmental extremes.

Narrowed Options:

- Continue forecasts with EDM (2024 onward)

Department Recommendation:

- Continue forecasts with EDM (2024 onward)
    - Test forecasting for industry and management planning.
    - After testing period and the development of real-time monitoring for fishing effort (e-log), explore the potential use of EDM to help inform harvest control rules as management procedures.

FISHING EFFORT AND TEMPORAL CLOSURES

At the onset of the SFAC meetings, stakeholders were interested in pursuing additional temporal and spatial closures in the Monterey Bay Area, as well as exploring lighting dynamics (See Lighting and Seabirds, below). Data summaries were initially reviewed to aid discussions about fishery dynamics and potential changes since the development of the MSFMP.

An iterative approach was used between the modelling team and the SFAC to quantify fishing effort in EDM, resulting in significant discussion about some of the drivers that impact fishing effort. Economic and market factors discussed include trade wars, processing capacity, freight costs, availability of cold storage, and market demand. Overall reliance on squid fishing has increased with fishery closures such as Pacific sardine (*Sardinops sagax*), incidental catch restraints, or limited markets in other fisheries such as northern anchovy (*Engraulis mordax*). Fishing also becomes more competitive, particularly when concentrated in easily accessible fishing locations such as Monterey Bay.

SFAC members confirmed that in their experience, effort and dynamics are distinct between the north and south regions, and the regions should be discussed and modeled separately. While the Department manages the fishery statewide by fishing season (April 1 to March 31), the SFAC determined a need to consider the biogeographic and fishery differences between the two regions. The southern region made up the bulk of the landings historically, but in 2014 the northern region exceeded the south for the first time since the MSFMP (Figure 4). In 2020, the Department documented more squid seiners offloading in the Monterey port area than any season prior.

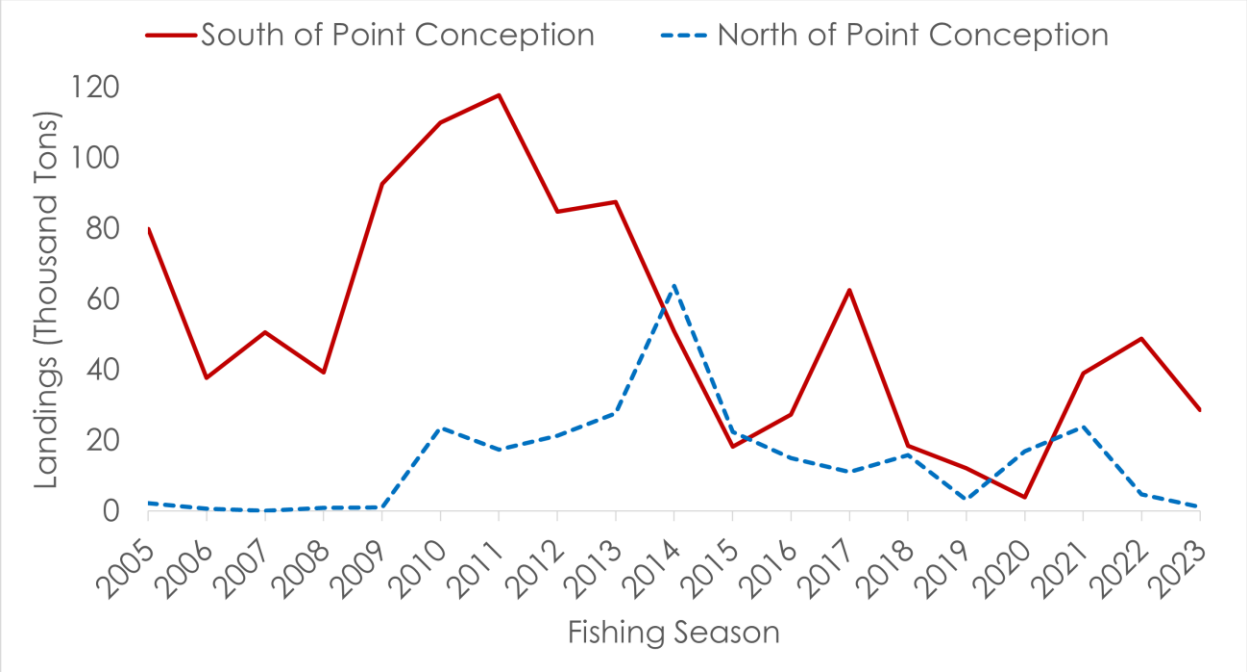


Figure 4. Market squid fishery landings (thousand tons) by regions south and north of Point Conception and fishing season (April 1 to March 31 of the following year).

In 2021, a petition was submitted to the Commission requesting a weekend closure extension and incorporation of half-day closures on weekdays in the Monterey Bay Area. The original request was to extend the weekend closure by 12 hours from noon Friday to midnight on Sunday, and to close commercial market squid fishing from noon to midnight Monday through Thursday. The rationale for the proposed change was the concern that increased fishing pressure in the Monterey Bay Area was not allowing enough time for squid to spawn. The petition was not considered at the Commission and was referred to the SFAC process.

While the weekend closure was the primary topic discussed under fishing effort, additional feedback included interest in re-visiting the seasonal catch limit of 118,000 tons, exploring a daily catch limit on the number of sets or trips to slow down the rate of fishing, and a seasonal closure that varies by region to allow squid "scouts" more time to build spawning aggregations. The underlying goals behind these interests were to boost localized spawning potential, provide for long-term sustainability and added conservation, and improve fishery yields.

SFAC members voiced strong support to keep a seasonal catch limit (SCL) in place, particularly to provide market stability. The SCL was historically only utilized during prolific periods of squid abundance (i.e., 2010 to 2014). Some

SFAC members were interested in exploring alternative, forecast-driven, or in-season ways to manage catch. Though EDM forecasting of CPUE could be an avenue to estimate future abundance, managing catch has more uncertainty and less assurance compared to managing effort or focusing on proportional egg escapement (PFMC, 2024). The challenges of managing catch or quotas in a changing climate stem from rapid squid population turnover (on average 6 months) and responsiveness to environment, and high natural mortality (CDFW, 2024). Daily catch or trip limits are also difficult to enforce.

Without the ability to establish a biomass estimate for squid and the fact that landings scale with effort (see Empirical Dynamic Modelling), temporal closures that allow uninterrupted spawning (i.e., the weekend closure) as opposed to catch controls (i.e., SCL or daily catch limits) are considered more effective when squid abundance is low. Based on dockside sampling data, squid landed immediately following the weekend closure have spawned more than squid landed later in the week (Leos, 1998). The increase in spawned squid early in the week provides evidence for the value of the weekend closure to facilitate uninterrupted squid spawning and greater proportional egg escapement. While a longer-term closure may allow squid aggregations to build at popular fishing sites, concern and uncertainty exists about the timing of such a closure given that the early part of the spawning window can vary seasonally and regionally.

The EDM harvest control analysis was used in an attempt to help understand how changes in fishing effort might impact fishery yields. Results from this analysis suggest that a reduction in fishing effort in the northern region of the fishery could provide improved yields and fishing efficiency. In the southern region, yields increased with increasing fishing effort and declined with a reduction in time spent fishing, though the greatest yields occurred earlier in the fishing week. Egg escapement monitoring shows a similar result. On quarterly and regional scales, relative escapement is lower and therefore relative fishing pressure is higher in the northern-most region on the central coast around the Monterey Bay area (Dorval et al., 2013).

Given the EDM results, monitoring findings, and feedback from the SFAC, an extension to the front end of the weekend closure Statewide provides an added buffer for sustainability, is unlikely to negatively impact overall yields, and is enforceable. In addition to a statewide extension, key differences between the northern and southern regions of the fishery drove the Department's recommendation to extend the closure longer at the back end for the Monterey Bay Area (using a reference line of latitude to be defined). Differences between the regions that guided the Department's rationale

include transit distance to spawning grounds, business operations, lighting dynamics, biogeography, relative egg escapement estimates, and forecasted landings and CPUE from the EDM harvest control analysis.

Current Regulation:
Statewide weekend closure from noon on Friday to noon on Sunday

Narrowed Options:

- Start time of weekend closure: Begin closure earlier on Friday at 7am
- End time of weekend closure: Extend closure to Sunday sunset or 7pm or Monday 12am or 7am
- Location of weekend closure:
    - Statewide
    - North of Point Conception (northern region)
    - District 16 and/or District 17
    - Monterey Bay Area – (using reference line of latitude)

Department Recommendation:

- Extend the weekend closure
    - Statewide – start time of weekend closure will begin 7am Friday
    - Monterey Bay Area (to be defined) – end time of weekend closure extended to Sunday at midnight

SMALL-SCALE FISHERY ACCESS

Since 1990, most commercial squid landings were made by seine vessels with upwards of 4,000 unique landings per year (CDFW, 2023). With support from a tender, seine vessels use purse or drum seine, also known as round-haul gear to encircle squid. Brail vessels use mechanical or handheld scooping, which leads to a smaller-scale operation. On average, very few landings are from brail-permitted vessels, though brail landings spiked in the 2010-2011 and 2011-2012 fishing seasons due to an unintentional 2-ton allowance loophole that allowed commercial brail operations to keep fishing after the seasonal catch limit was reached and the fishery was closed. The desire to land more squid using brail led to a two-fold increase in the number of brail permits through upgrades from lightboat permits (Figure 5). Inversely, lightboat permits have declined by half. Seine permits have steadily declined from 92 permits in 2005 to 69 permits in 2023, likely due to attrition, two-for-one permit transfers to increase overall tonnage on the vessel, latent permits, and lack of fishing opportunities.

While the MSFMP lays out capacity goals for the market squid commercial restricted access fleet (Figure 5), the goals are operational in nature. Results from the EDM harvest control analysis suggest that historical levels of fishing effort statewide, which scales with number of vessels, have not exceeded sustainable harvests. It is unlikely that exceeding the capacity goals, especially brailing activity, will negatively impact sustainability. Of the 69 vessel permits issued, only 59 reported squid landings, and of the 47 brail permits issued, only 10 reported commercial landings sold as dead squid in 2023.

SFAC members asked that the market squid fishery restricted access permit ownership and transfer process be more transparent. The Department generated summaries of permit transfers and use over time, which can be incorporated into the ESR for more routine updates (Figure 5). For confidentiality reasons, permit information must be summarized and the Department cannot provide specifics on individual permit ownership or use.

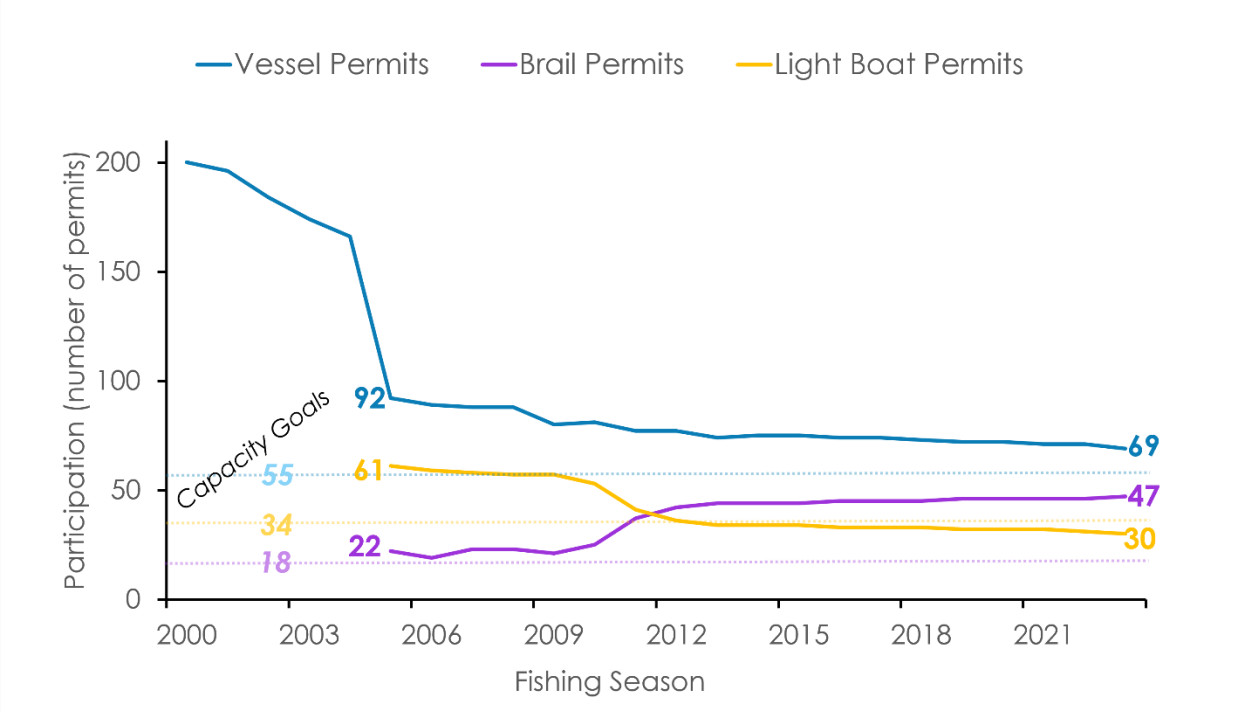


Figure 5. Participation (number of permits) in the commercial market squid restricted access fishery from 2000 to 2023. Capacity goals described in the MSFMP are delineated as dotted lines.

Discussion continued around underutilization of the brail permits, and an effort to understand and define the term "small-scale" for the California market squid fishery, which included reference to the Commission's recently developed Coastal Communities Policy.

Small-scale access was also a topic identified early in the SFAC process with a request to initiate discussions around fishery access sooner than the final topic meeting. Small-scale access was therefore incorporated as a topic over the course of multiple meetings through the SFAC process.

In terms of interest in improved small-scale access, various proposals were discussed:

- Experimental fishing permits (EFPs),
- Small-scale/low volume fishing,
- Developing local markets in smaller ports,
- Providing dead bait for other commercial fisheries,
- Selling local catch at farmers' markets or local restaurants,
- Use of low volume gear (i.e., hand jig and hand brail),

- Special allocations of up to 10 tons per day and 10,000 tons per season for specific port areas, and
- Establishing an open access small-scale allowance.

A primary concern raised was that if market squid aggregate near more remote fishing harbors (i.e., Fort Bragg), the fishable biomass is inaccessible to commercial boats in those harbors under the current restricted access policy. The market squid fishery is focused on a high-volume export market and the restricted access fleet has shown a propensity to develop infrastructure in response to squid presence. There is uncertainty in whether a different, economically viable, and small-scale avenue exists in regions where squid aggregate and are less accessible to the active fleet.

As an alternative to acquire a more expensive seine permit, multiple SFAC members pointed to the potential to purchase a brail permit as an existing opportunity to gain access to the commercial market squid fishery. Existing permit holders noted that the restricted access permit program was enacted to create a moderately productive and specialized fleet. Allowing others to create an open access portion of the fishery, particularly at high volume, is seen as unfair to those who have made substantial investments to follow the regulatory framework put in place by the MSFMP. Such a change would also call the entire Commission limited access policy into question and could have broad implications in other limited access fisheries.

The SFAC also discussed the possibility of commercial vessel operators interested in fishing squid using existing permits – purse seine or brail. There are ways to allow another captain to fish an existing limited entry permit, as the operator and the permit holder/vessel owner do not need to be the same individual or entity. Exploratory jigging and modifying regulations to allow for intermittent jigging was also discussed. Additionally, a suggestion to explore a fishery "pop-up" on the more isolated northern coast of California was mentioned.

Many of the proposed quota allocations and harbor-based options would be difficult to manage, challenging to enforce, and could create conflicts with existing commercial operations. The SFAC discussed that options for improved small-scale access should be explored as a new sector that is unique or outside of the business operations built under the restricted access program. The EFP would allow the Department a testing and evaluation period to determine feasibility, enforceability, and unforeseen negative impacts of a truly unique small-scale sector prior to moving forward with a new policy. The Commission

recently approved a new EFP process in which participants can apply for opportunities to fish.

Narrowed Options:

- Experimental Fishing Permit (EFP) –
    - Small-scale/low volume
    - Develop local markets
    - Dead bait, farmer markets, local restaurants
    - Low volume gear (i.e., hand jig and hand brail)
    - Outside current major fishing areas
- Open-Access Small-Scale – This would bypass the EFP described above and go straight into a policy for an open-access sector

Department Recommendation:

- Experimental Fishing Permit (EFP)

NETS AND SQUID SPAWNING HABITAT

In the California market squid fishery, bycatch is minimal and marine mammal interactions that lead to mortality or serious injury are rare (Marine Mammal Protection Act Category III). The low bycatch, in large part, is because seiners are specifically targeting squid aggregations and the action of pursing a seine net allows for mammals or large predators to jump in and out of nets or for the active release of an animal by dipping the side of the net as it gets closer to the vessel. Most of the bycatch observed are other incidentally caught CPS such as Pacific sardine, Pacific mackerel (*Scomber japonicus*), and northern anchovy because CPS will occasionally school with market squid.

Benthic species are, however, observed in small amounts during dockside sampling and fishery offloads, which indicate that nets contact spawning habitat (i.e., nearshore sandy bottom). Squid eggs are also present in offloads about 30% of the time though eggs can be laid in the net during transit or come from the egg bed. Squid eggs serve no benefit to the fishery and the presence of squid eggs can be cumbersome to processing.

The Department has heard interest expressed from various stakeholders and SFAC members to consider net restrictions as a method to mitigate impacts to spawning habitat and egg beds. No requirements or specifications currently exist for seine net use while fishing market squid in California. The market squid logbooks were designed to gather information about fishing gear including nets. However, the Department does not have a strong understanding of net metrics and changes over time due to extremely low compliance rates for vessel profile page submittals (only four seiners reported this information in 2022). The data collected from interviews with vessel operators during the Department's dockside sampling are more robust and provide a more accurate understanding of net specifications and changes over time. Since 2019, net depth is, on average, longer in the northern region of the fishery compared to the southern region. Conversely, the average fishing depth is routinely deeper in the south and shallower in the north. As a result, fishing grounds are shallower, but nets are deeper in the northern region.

While not common, Department data show nets are interacting with bottom habitats, egg beds, benthic species, and prohibited species. As a result, the Department determined it prudent to consider additional measures to minimize adverse effects on habitat caused by fishing as guided by the MLMA. Some ideas proposed included prohibiting the use of chains or heavy cable lines, requiring the use of a ribline to modify how the seine purses, prohibiting submerged lights, and establishing a maximum net depth or minimum fishing

depth. Some members of the seine fleet voiced a strong reluctance to pursue net depth or fishing depth restrictions given logistical and financial constraints.

As an alternative measure, many vessel operators have employed the use of a ribline, which creates a "ribbing" or additional webbing between the lead line and the purse line. SFAC members and members of the public explained that this causes the net to flutter or bounce when it does contact the bottom as opposed to dragging. The ribline is intended to reduce the likelihood of pursing benthic bycatch, including squid eggs, and to reduce the impact on the sandy bottom habitat, while simultaneously strengthening the integrity of and preventing damages to the net. The Department conducted a survey in 2020 and discovered that roughly 40% of the 56 vessel operators interviewed had switched to a ribline, which was up from an estimated 15% in 2016 (Figure 6). Since the 2020 interviews, more operators/owners have switched to a ribline including members of the SFAC. The Department estimates that more than 50% of the fleet is now using a ribline.

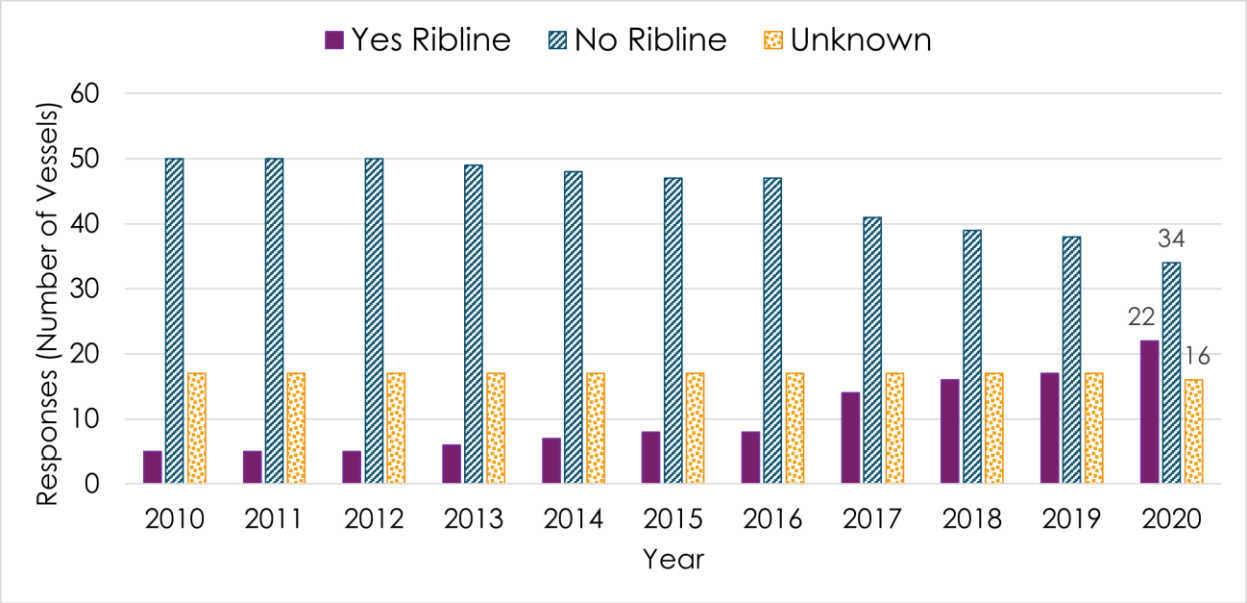


Figure 6. The results of a survey conducted by the Department in 2020. Responses from vessel operators, described by year as yes to using a ribline, no ribline, or unknown if the operator could not be reached.

Dockside sampling data were used to evaluate the extent that nets disturb egg beds in relation to proposed net modifications. Observations of squid eggs in the offloads were roughly half as likely when vessels had a ribline. The Department used the following two conditions as indicators of seine nets touching the bottom: (1) the presence of eggs aged past 24 hours and (2) the presence of benthic bycatch. In the northern region, a 10% decrease in benthic habitat

interactions was observed when the vessel had a ribline. While a positive impact with riblines was not detected in the southern region during this timeframe, discerning these effects was difficult as dockside sampling efforts were minimal at southern region ports due to challenges posed by the COVID-19 pandemic, staffing shortages, and a lack of fishing activity. Statewide, the likelihood of observing a specific benthic species declined when a ribline was employed for almost all documented benthic species.

As guided by the MLMA, mitigating habitat impacts and minimizing bycatch remains a high priority for the Department. In addition to pursuing gear modifications, improved data quality and monitoring through the use of e-logs should clarify the interactions between net depth, fishing depth, bycatch, and habitat. A better understanding of these interactions could inform future management actions and additional regulatory changes, if needed.

Narrowed Options:

- Require a ribline.
- Require a ribline when fishing shallower than a specified depth boundary.
- Require rope purse lines, no cable or chains (i.e., no metal lines).

Department recommendation:

- Require a ribline and rope purse line.

LIGHTING AND SEABIRD HABITAT

In addition to evaluating direct potential impacts to spawning habitat, discussions occurred around the use of lights over time and the potential impacts to land-based wildlife and the public. Current lighting regulations include:

- Permit required to light for squid for the purpose of commercial take
- Logbook required
- No more than 30,000 watts of lights to attract squid per vessel
- Entire filament of each light shielded
- Lower edges of shields parallel to the deck of the vessel

The SFAC was interested in improving our understanding of the dynamics between daytime and nighttime fishing and looking at the use of lights and lightboats over time. Stakeholder interest in spatial closures was primarily focused on restricting lighting activity around nocturnal seabirds during particularly sensitive life stages and to improve visitor experience at the Channel Islands National Park (Park), with an initial suggestion to close the Park to all squid lighting year-round. Some SFAC members also expressed interest in additional lighting restrictions, specifically that the light bulb (not only the filament) be shielded. Using logbook data, the Department provided various maps and summaries to give context to historical fishing and lighting activity, as well as MPA development over time and space.

According to set times reported on fishing logs, the proportion of fishing sets made at night is greater in the southern region (75%) relative to the northern region (59%). Furthermore, smaller sets are more common in the daytime in the North. SFAC members expressed that they are more likely to encounter squid during the day in the North and suggested that this is due to differences in spawning behavior between the regions. The seiners are more reliant on nighttime fishing and lightboats in the South.

The MPAs on the northern Channel Islands were implemented in 2003 and considered seabird activity as well as market squid spawning during the designation process. The SFAC discussed relative fishing activity in the northern Channel Islands MPA areas leading up to the development of the MSFMP. From 1999 to early 2003, approximately 25% of overall squid catch for this region came from fishing sets made in areas that subsequently were closed to commercial market squid fishing and lighting. Members of the fishing fleet referenced the closure of the north side of Anacapa Island as a substantial loss of fishing grounds at the time. The current lighting regulations were also

implemented, in large part, using results from lighting research on impacts to nocturnal seabirds conducted during the 1999 to 2005 timeframe (CDFW, 2005).

Most vessels and lightboats continue to use metal halide as the predominant attracting light type, which is listed on approximately 75% of logbook profile pages since 2005. In order of most prevalent to least, the other attracting light types used include high pressure sodium, incandescent, and halogen. To support SFAC discussions around lighting, Department staff took photos of light configurations and summarized compliance in the three major port areas (Monterey, Ventura, and San Pedro) in 2023. Almost all vessels in Monterey and San Pedro had 95% to 100% of their bulbs fully shielded, while shielding compliance was more ambiguous for a subset of Ventura-based vessels. Some vessels also had unshielded forward-facing lights, which are illegal to use during squid fishing because they can attract and aggregate squid. The SFAC and members of the public explained that current shielding requirements are set up to provide some light spread on the water to improve the capacity to aggregate squid. SFAC members also mentioned that forward-facing lights are useful for safety and navigation.

Because the historical research that went into the existing lighting regulations is still relevant today and most commercial squid fishing lights are compliant with those regulations, the SFAC suggested that a "Best Practices" for the fishery could be a useful management tool and more appropriate than a regulation change. A Best Practices could inform the fleet of how to employ precautionary conservation measures near shorelines and be used to mitigate less desirable or unenforceable lighting behaviors. Using scientific literature provided by SFAC members and mitigation strategies summarized by Dr. Travis Longcore out of the University of California, Los Angeles, the Department expanded on the body of research used to develop the MSFMP, and with advice from the SFAC, drafted a Best Practices throughout the course of the SFAC meetings (Appendix II).

At the final SFAC meeting, a proposal was made to close Anacapa, San Miguel, and Santa Barbara Islands to night-time squid fishing from February to October, which is considered a key nesting and breeding period for the California listed (Threatened) Scripp's murrelet (*Synthliboramphus scrippsi)*. Most of the commercial squid fishing and lighting activity takes place in the fall and winter at these islands and does not overlap with known nesting and breeding seasons, though there are occasionally landings from February to October that add considerable ex-vessel value to the fishery. A strong opposition was voiced from many SFAC members, who explained that lighting in the areas of concern has already been reduced over the last 25 years, and that the status of the Scripp's

murrelet has improved, which is largely attributed to the eradication of land-based predators on the Channel Islands. SFAC members that opposed the proposal stated a lack of evidence for lighting impacts. Given the considerations, the SFAC voiced broad-based support for research to improve the understanding of potential interactions between lighting operations and nocturnal seabird activity at the Park.

Narrowed Options:

- Develop a Best Practices for the commercial squid fishery
- Close Anacapa, San Miguel, and Santa Barbara Islands to squid fishing from February to October (key nesting and breeding period for the Scripp's Murrelet)
- Evaluate potential wildlife interactions (primarily nocturnal seabirds at the Park) using squid fishery log data

Department Recommendation:

- Develop a Best Practices for the commercial squid fishery – draft included (Appendix II)
- Evaluate potential wildlife interactions (primarily nocturnal seabirds at the Park) using squid fishery log data

CLIMATE CONSIDERATIONS

The California market squid fishery still faces many unknowns. Continued research into climate drivers using long-term monitoring in conjunction with physiological studies is fundamental to improving our understanding of how market squid will continue to respond to environmental change. Squids and other cephalopods have high adaptive capacity and the propensity to modify their own physiology through protein-altering ribonucleic acid editing, which could help with acclimating to variable ocean conditions and temperature changes (Voss and Rosenthal, 2023). These physiological advantages paired with a changing ocean environment may result in shifts in suitable habitats for market squid, including an expansion or shift of fishable biomass to more northern latitudes north of Point Conception (Suca et al., 2022).

A few questions arise if the market squid population is expected to acclimate and adapt to climate changes that impact the CCE. How will the fishing industry and coastal communities adapt along with the market squid resource? How can fisheries managers effectively plan, prepare, and sustainably manage the market squid resource with such a high level of climate uncertainty?

The SFAC explored some of the above questions in the context of the MSFMP and the prevailing topics described in this report. Representatives of the fishing industry expressed a common understanding that market squid landings have always fluctuated, but also that more opportunities existed in the past to redirect fishing effort to other species, such as Pacific sardine, when squid abundance was low. Now, with a greater reliance on and higher value for squid, fishing can be more concentrated, and operators are investing more effort into finding squid when squid is available. It also seems that while the various sectors within the commercial squid fleet are facing different challenges, vessel operators and commercial businesses agree that having flexibility in fishing operations such as easily switching targets is of the utmost importance.

Given the questions around small-scale access, a need exists to understand how local economies may respond to shifts in timing, location, and frequency of squid aggregations under climate change. An EFP could provide valuable insight as to the viability of commercial squid fishing outside the restricted access policy (i.e., low volume or local markets) in the future.

The Department sought support from the EDM team to better understand how climate drivers might directly impact fishery and management performance. EDM efforts were informed by the market squid fishery logbook data and insight from members of the commercial fleet as an iterative process. The long-term goal for continuing work with EDM is to advance climate resiliency for the fishery as forecasting may provide an avenue to buffer uncertainty for fishing

operations and management. The SFAC and the modelling team agreed that forecasting by quarter with max of one year is appropriate, and any forecasts beyond that timeframe are less reliable and not as useful. Real-time monitoring through electronic logs will be essential to forecast at biologically relevant scales and to assess management strategies in the future.

SUMMARY AND DEPARTMENT RECOMMENDATIONS

During the final meeting, the Department presented draft recommendations to the SFAC and adjusted the recommendations to reflect discussion points and expression of support from members. Given the broad topics the SFAC covered and the various potential regulatory changes, the Department is also proposing that an amendment to the FMP be initiated, which would allow for incorporation of new information regarding climate change, revisions to pertinent chapters of Section 1, and removal of regulatory text in Section 2 that is redundant with the California Code of Regulations Title 14. Proposed Department recommendations are listed below with the necessity for associated rulemakings noted:

MONITORING

Department Recommendation: Develop an electronic logbook (e-log) for the California market squid commercial fishery.
Far-term Rulemaking: This would eventually lead to a regulatory change to section 149(e) to revise text pertinent to logbook requirements.

EMPIRICAL DYNAMIC MODELING

Department Recommendation: Continue forecasts with EDM (2024 onward):

- Test forecasting for industry and management planning
- After testing period and development of electronic log, explore the potential use of EDM for management procedures and further evaluation under climate change

FISHING EFFORT AND TEMPORAL CLOSURES

Department Recommendation: Extend the weekend closure

- Statewide – start time of weekend closure will begin 7am Friday
- Monterey Bay Area – end time of weekend closure extended to Sunday midnight

Near-term Rulemaking: Revise hours in 149(c)(1); add times for specific locations.

SMALL-SCALE FISHERY ACCESS

Department Recommendation: Those interested in pursuing small-scale opportunities should utilize the newly established EFP program.

NETS AND SQUID SPAWNING HABITAT

Department Recommendation: Require commercial purse seiners to use ribline and rope purse line.
Near-term Rulemaking: Add a regulatory paragraph to section 149 specific to nets.

LIGHTING AND SEABIRD HABITAT

Department Recommendation:

- Provide a fishery "Best Practices" in 2024
- Evaluate potential wildlife interactions (primarily nocturnal seabirds at the Channel Islands National Park) with squid fishery log data

PROPOSED FMP AMENDMENT

The 2005 MSFMP contains four sections, which are listed below. Preliminary Department proposed revisions for an amendment are noted for each section:

- **Section 1** presents background on the California market squid fishery. It also provides a range of alternatives for management of California's market squid fishery and the Department's Proposed Project.

  Proposed revision:

  Chapter 1 – minimal changes, Department can revise as needed

  Chapters 2 and 4 – could point to ESR

  Chapter 3 – Pertinent sections would be revised

  Chapter 5 – Update costs

- **Section 2** includes the environmental analysis (see California Code of Regulations Title 14 15250-15253), including a review of alternatives and options, some of which were recommended by constituents in the review of the preliminary draft MSFMP.

  Proposed revision: Analysis pertinent to weekend closures and gear (nets) would be revised/ incorporated, and logbook text would refer to modernization.

- **Section 3** includes regulations that would implement the MSFMP Project's management strategy.

  Proposed revision: Do not include this section in the amendment as the text is redundant with regulatory text that should only appear in the California Code of Regulations.

- **Section 4** includes public comments and Department responses to both the Preliminary Draft Market Squid Fishery Management Plan (released May 2002) and the Draft Market Squid Fishery Management Plan (released July 2003).

  Proposed revision: Replace with new public comment on amendment.

FUTURE REVISIONS

Five years after an amendment is complete and subsequent rulemakings have been approved, a future review is recommended. The review would serve as a check-in with stakeholders and include an evaluation of monitoring data, any new changes to the fishery, and any emerging issues either specific to climate change or other unforeseen variables. The ESR is the primary document to find

up-to-date information on California market squid fishery and fishery management.

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APPENDIX I

State of California - Department of Fish and Wildlife
MARKET SQUID VESSEL LOGBOOK
DFW 149a (Rev. 05/01/15) Previously DFG 149a

LOG #

Market Squid Vessel Profile

Vessel Name_____

Vessel ID Number_____

Vessel Permit Number_____

Captain's Name_____

Captain's ID Number_____

Attracting Lights Used:

Type:	Light Generated:	Number:
_____	_____ W L (circle one)	_____
_____	_____ W L (circle one)	_____
_____	_____ W L (circle one)	_____

Vessel Characteristics:

Boat Length (ft) _____

Hold Capacity (st)_____

Gross Tonnage _____

Purse Seine / Drum Seine / Lampara / Brail Net (circle one)

Net Depth (fm) _____

Net Length (fm) _____

Mesh Size (in) _____

Electronics Used:

Side-scan Sonar: Yes No (circle one)

Fathometer: Yes No (circle one)

Other: _____

Horsepower:

Main Engine _____

Generator _____

If Brail, scoop capacity (ft): Circumference _____Depth _____Average lbs per scoop _____

Fish Hold's Water System (circle one): **Brine** **RSW** **Dry** **CSW (live)** **Other** (please specify) _____

Crew members:

Name	ID Number	Name	ID Number

Captain's Signature_____Date_____

Certified under penalty of perjury as true and correct

State of California - Department of Fish and Wildlife
MARKET SQUID LIGHT/BRAIL BOAT LOGBOOK
DFW 149b (Rev. 05/01/15) Previously DFG 149b

LOG#

Market Squid Light/Brail Boat Profile

Vessel Name:_____

Vessel ID Number:_____

Light or Brail Boat Permit Number:_____

Captain's Name:_____

Captain's ID Number:_____

Attracting Lights Used:

Type:	Light Generated:	Number:
_____	_____ W L (circle one)	_____
_____	_____ W L (circle one)	_____
_____	_____ W L (circle one)	_____

Vessel Characteristics:

Boat Length (ft):_____

Gross Tonnage:_____

Hold capacity (st):_____

Electronics:

Side-scan Sonar: Yes No (circle one)

Fathometer: Yes No (circle one)

Other: _____

Horsepower:

Main Engine _____

Generator _____

Scoop capacity: Circumference (ft)_____Depth (ft)_____Average lbs per scoop _____

Fish Hold's Water System (circle one): **Brine** **RSW** **Dry** **CSW (live)** **Other** (please specify) _____

Crew Members:

Name	ID Number

Captain's Signature:_____Date_____
Certified under penalty of perjury as true and correct

State of California - Department of Fish and Wildlife
MARKET SQUID VESSEL LOGBOOK
DFW 149a (Rev. 05/01/15) Previously DFG 149a

LOG #

Vessel Name:_____ Vessel Permit Number:_____ Captain's Name:_____

Vessel ID Number:_____ Captain's ID Number:_____

Alpha Code	Date	Set Number (or B if using brail gear)	Set Time: hr:min AM or PM (circle one)		Set Position: decimal minutes to hundredths place				SST (°F)	Bottom Depth (fm)	Name of light boat set upon	Catch Estimate (Short Tons)	Was catch limited by market order? Y/N	Bycatch:		Landing Receipt(s)
					Latitude		Longitude									
			Start	End	Degree Ex. 34°	Minutes Ex. 05.15'	Degree Ex. 120°	Minutes Ex. 04.85'						Species	Amount (lbs)	
A			AM / PM	AM / PM												
B			AM / PM	AM / PM												
C			AM / PM	AM / PM												
D			AM / PM	AM / PM												
E			AM / PM	AM / PM												
F			AM / PM	AM / PM												
G			AM / PM	AM / PM												
H			AM / PM	AM / PM												

Comments: List by date any anecdotal information such as additional bycatch information, equipment problems, interference from other boats, weather-related problems, day set activity, etc.

Captain's Signature_____ Date_____

Certified under penalty of perjury as true and correct

State of California - Department of Fish and Wildlife
MARKET SQUID LIGHT/BRAIL BOAT LOGBOOK
DFW 149b (Rev. 05/01/15) Previously DFG 149b

LOG #

Vessel Name:_____ Light or Brail Boat Permit Number:_____ Captain's Name:_____

Vessel ID Number:_____ Captain's ID Number:_____

Date	Location: For brail activity enter latitude and longitude using decimal minutes to hundredths place. Ex. 34° 05.15', 120° 04.85' For light boat activity enter block code or lat/long if block code unknown.	Hours spent: Searching (includes day sets)	Hours spent: Lighting	Name of Seiner that set squid	Total tons (st) of squid caught by seiner	Estimated tonnage (st) remaining after fishing is completed	Were birds present? Y/N	Were mammals present? Y/N	**Your vessel's estimated BRAIL catch** Leave blank if you are a light boat permittee or a brail boat permittee operating solely as a light boat: Time of brailing: hr:min AM or PM (circle one) Start	Time of brailing: hr:min AM or PM (circle one) End	Bottom depth (fm)	Amount sold to Market (short tons)	Landing receipt #	Amount for Live Bait (lbs)	Brail Bycatch: Species	Brail Bycatch: Amount (lbs)
									AM/PM	AM/PM						
									AM/PM	AM/PM						
									AM/PM	AM/PM						
									AM/PM	AM/PM						
									AM/PM	AM/PM						
									AM/PM	AM/PM						
									AM/PM	AM/PM						

Comments: List by date any anecdotal information such as additional bycatch information, equipment problems, interference from other boats, weather-related problems, day set activity, etc.

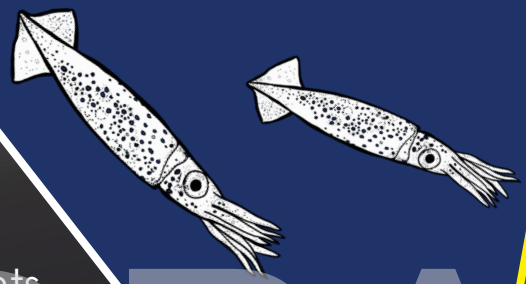
Captain's Signature:_____ Date:_____

Certified under penalty of perjury as true and correct

APPENDIX II

Best Practices for Market Squid Fishing

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE



ILLUMINATE only downward facing lights

INSPECT lights and shields for compliance annually

MINIMIZE deck lights when at anchor or close inshore overnight

CONFIRM that squid lights illuminate downward and do not illuminate the shoreline

TURN OFF unnecessary lights

TURN OFF squid lights when fishing not permitted

DO NOT illuminate shoreline

DO NOT use forward facing lights (ie. crab lights) when lighting for squid

MINIMIZE the amount of weight used to sink nets and don't add additional weight in shallow water

Sea Bird Avoidance Tips
https://www.fisheries.noaa.gov/national/resources-fishing/seabird-protection-and-avoidance-tips

Proposed guidelines for safely deterring marine mammals : https://www.regulations.gov/document/NOAA-NMFS-2020-0109-0001

Additional Information

- CCR T14 § 149 (h) Light Shields - Each vessel fishing for squid or lighting for squid will reduce the light scatter of its fishing operations by shielding the entire filament of each light used to attract squid and orienting the illumination directly downward, or providing for the illumination to be completely below the surface of the water. The lower edges of the shields shall be parallel to the deck of the vessel.

- Reducing lights when not in use will help limit wildlife interactions at night.

- Vessels using any light (Ex. squid lights, deck lights, or forward facing crab lights) that may attract/aggregate market squid while fishing is not permitted are in violation of FGC § 86 and CCR T14 §149.

- Keeping lights at a minimum when near the shoreline will reduce impacts to wildlife especially seabirds which can be negatively impacted by artificial lights.

- If near the shoreline, make sure that all extraneous lights are reduced so that seabirds and other wildlife are not affected.

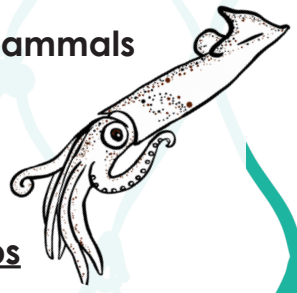
- It is ILLEGAL to use forward facing lights (ie. crab lights) when attracting squid because squid lights MUST have entire filament shielded and the squid light must be illuminating directly downward. CCR T14 § 149 (h).

- Using additional weights in shallow water may increase the interactions of the net and seafloor. CCR T14 § 149 (j) - Citations for violations of this Section [CCR T14 § 149] may be issued to the vessel operator, crewmembers, and/or the holder of a market squid permit issued pursuant to Section 149.1 of these regulations

- National Marine Fisheries Service has a proposed rule on Guidelines for Safely Deterring Marine Mammals and has specific guidance on proper use of Seal Bombs. More information can be found here: https://www.regulations.gov/document/NOAA-NMFS-2020-0109-0001

- If sea birds need to be released please visit this site for more information on proper release: https://www.fisheries.noaa.gov/national/resources-fishing/seabird-protection-and-avoidance-tips

- For more information on the market squid fishery, please visit https://marinespecies.wildlife.ca.gov/market-squid/



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Squid Fishery Advisory Committee

Review of California Market Squid Fishery Management and Proposed Recommendations

07 November 2024

Presented to:

Marine Resources Committee
Fish and Game Commission

Presented by:

Trung Nguyen
Environmental Scientist
Marine Region

Objectives

1. Review Squid Fishery Advisory Committee (SFAC) process and resulting Department recommendations
2. Address questions and discussion topics from July 2024 MRC Meeting
3. FMP Amendment/Rulemaking proposed timeline

Squid Fishery Advisory Committee (SFAC)

SFAC Charge

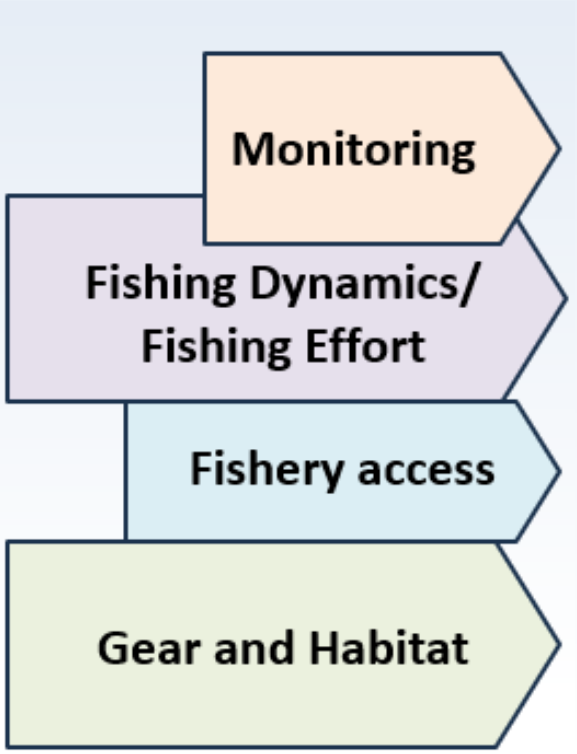
Review and advise the California Department of Fish and Wildlife (CDFW or Department) on potential changes to California market squid fishery management

SFAC Members

Fishing Community, Conservation, Non-Consumptive, Research

Squid Fishery Management Web Page
https://wildlife.ca.gov/Conservation/Marine/MSFMP

Recommendation Topics



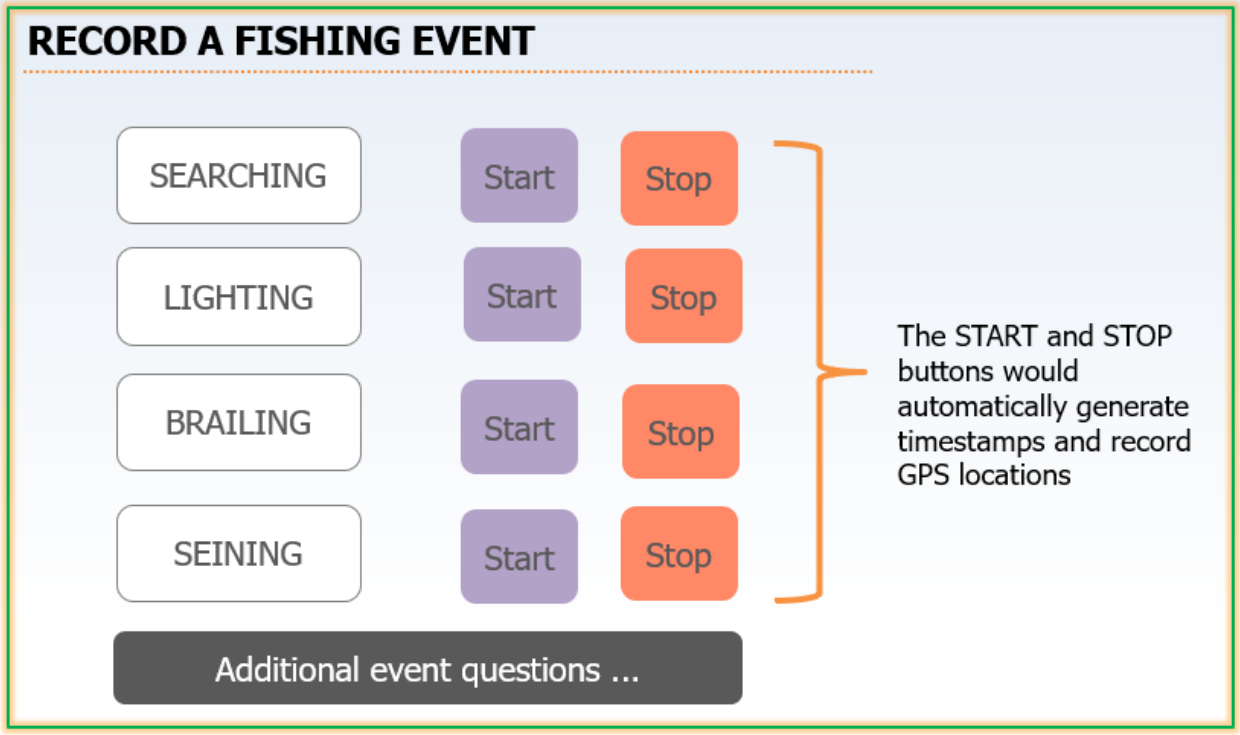
- Monitoring
- Empirical Dynamic Modelling (EDM)
- Fishing effort and temporal closures
- Small-scale fishery access
- Nets and squid spawning habitat
- Lighting and seabird habitat

Monitoring

Department Recommendation:

- Electronic logbook
  - Market squid e-logs as pilot for Department-wide effort
  - Once funded, ideally start pilot in 2025

Sample E-log Interface



Mockup by Kate Wing

How Existing Monitoring Data Are Used?

Scientific Basis for Squid Fishery Management, 2005:

- Egg Escapement Method
  - Department dockside biological sampling (1998 – present)
  - Proportional eggs escaped with proxy for Maximum Sustainable Yield (MSY) set at 30% escapement (Dorval et al. 2024)

New Use for Monitoring Data

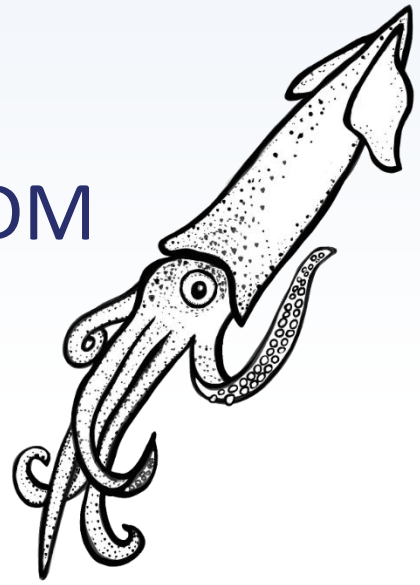
Exploring Predictive Modelling, 2022:

- Empirical Dynamic Modelling (EDM)
  - Fishery logbook and Sea Surface Temperature (SST) data (1999 – present)
  - Informed extension to weekend closure

EDM and Future Planning

Department Recommendation:

- Continue forecasts with EDM (2024 onward):
  - Test forecasting for industry and management planning
  - After testing period and development of electronic log explore the potential use of EDM for management procedures and further evaluation under climate change



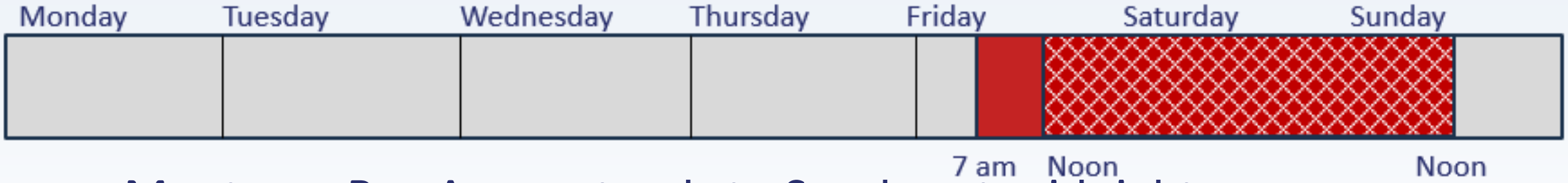
Fishing Effort Recommendation

Department Recommendation:

Current Closure

Proposed Closure

- Extend weekend closure
  - 7am Friday to noon Sunday, Statewide



  - Monterey Bay Area extends to Sunday at midnight
    - Alternative Areas: (A) Include Half Moon Bay (B) North of Point Conception

Northern Weekend Closure – Potential Areas

Department Proposed:

"Monterey Bay Area"

Point Lobos to Pigeon Point

Alternative A:

Point Lobos to Point Arena

Alternative B:

North of Point Conception

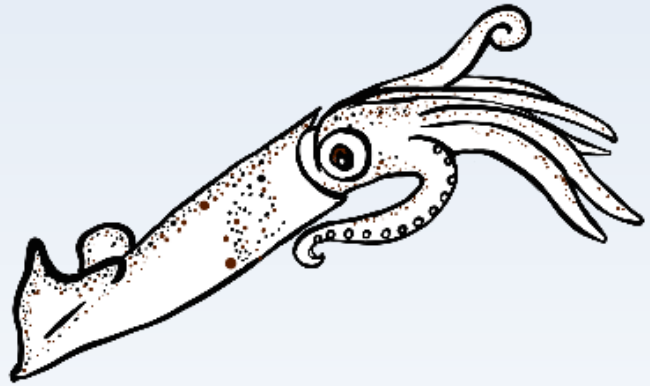
Gears Currently Allowed/Used

Restricted Access Program Permit Types:

- Seine
  - Can seine, light, and brail
- Brail (hand or power)
  - Can brail and light
- Light
  - Can only light
  - No landings

Small-Scale Fishery Access

Department Recommendation:

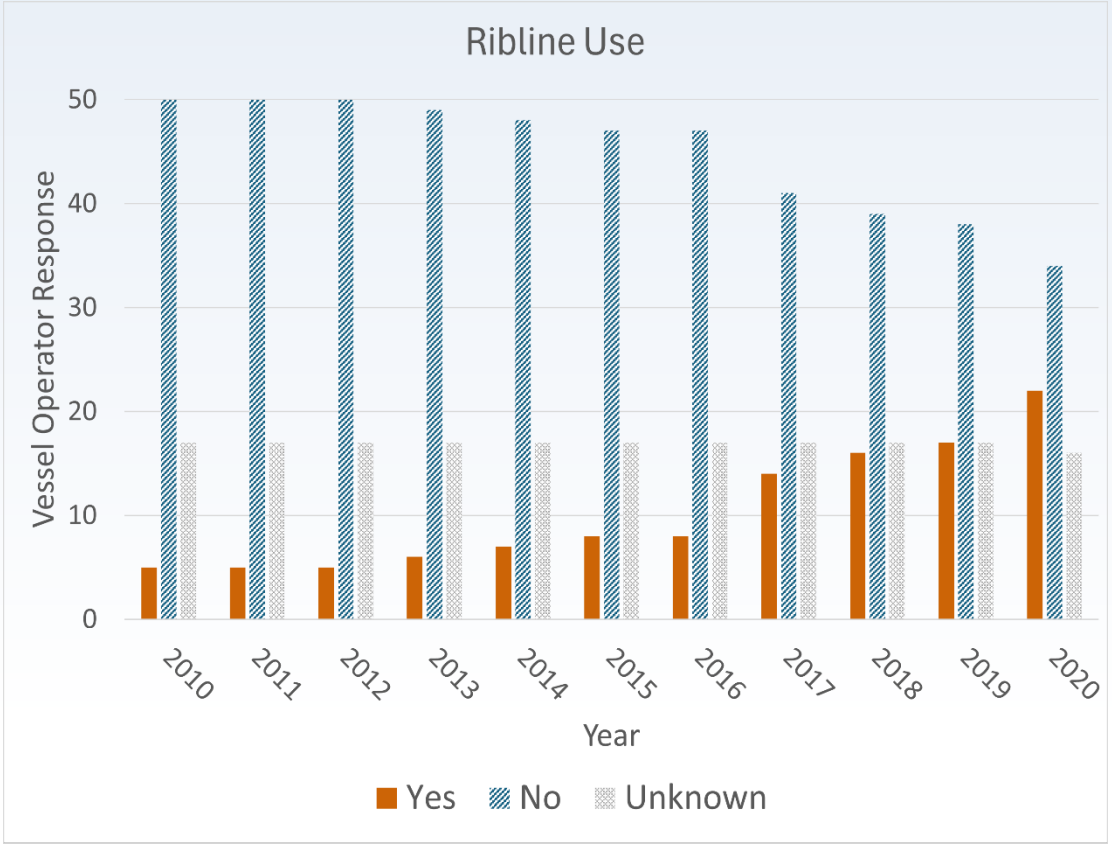


- Experimental Fishing Permit (EFP)
  - Small scale/low volume
  - Develop local markets
  - Dead bait, farmers markets, local restaurants
  - Outside current major fishing areas

Nets and Squid Spawning Habitat

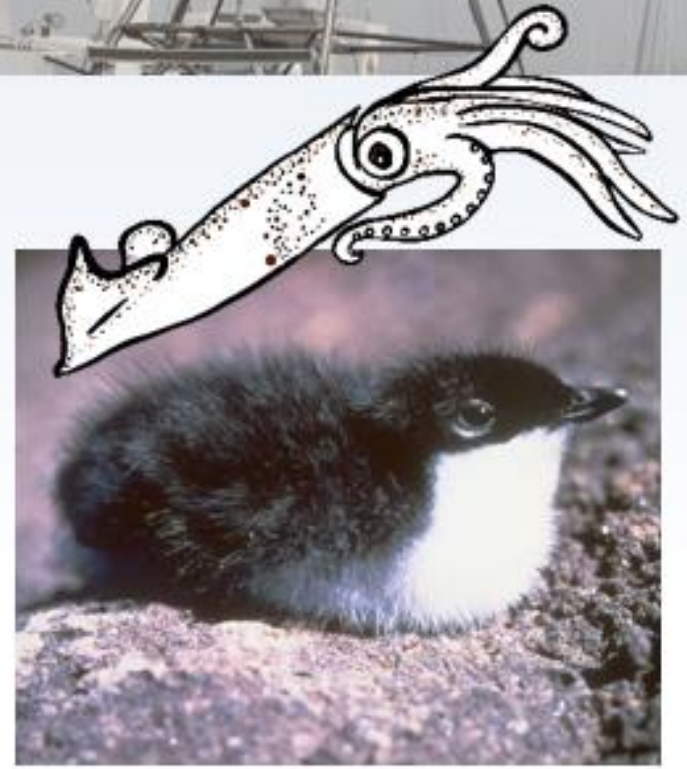
Department Recommendation:

- Require a ribline AND rope purse line.
  - Ribline use continues to increase in the fleet
  - Department dockside sampling indicates that riblines reduce the incidence of bycatch for most benthic species

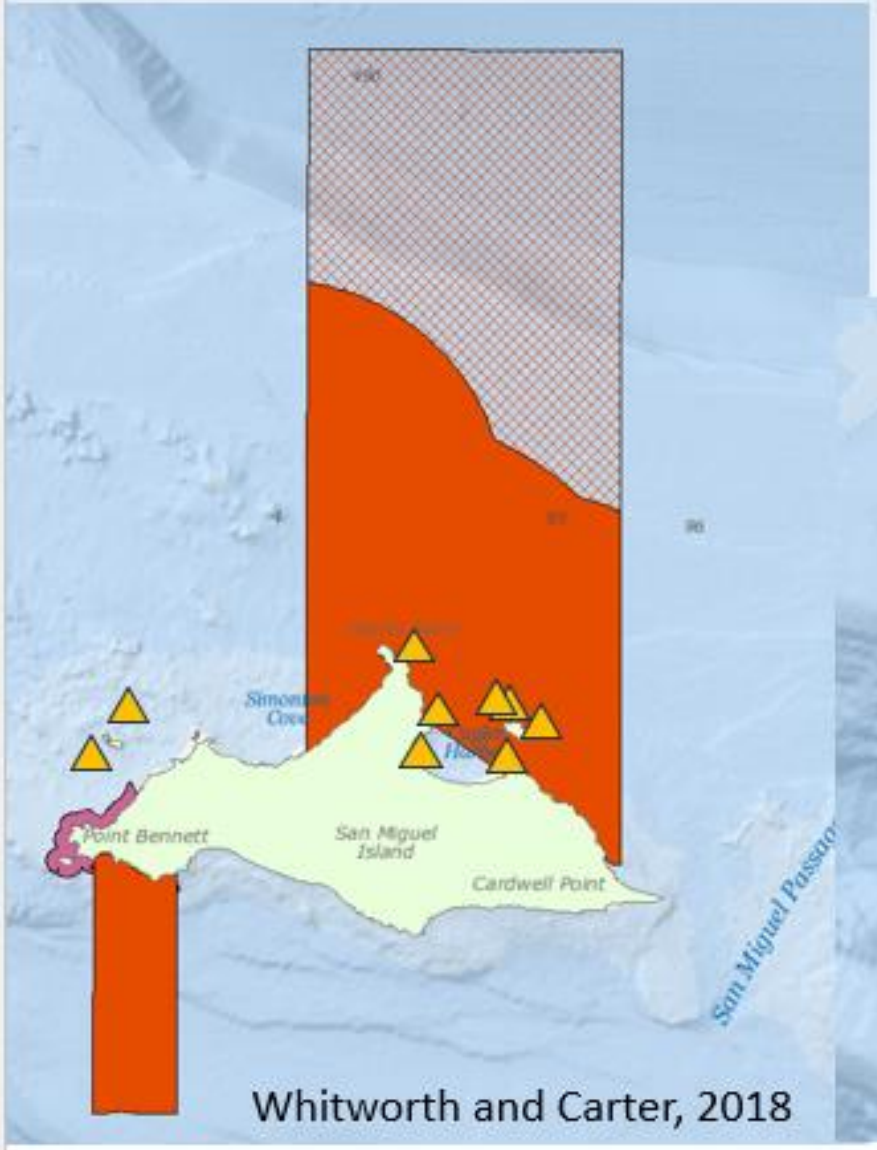


Lighting and Seabird Impacts

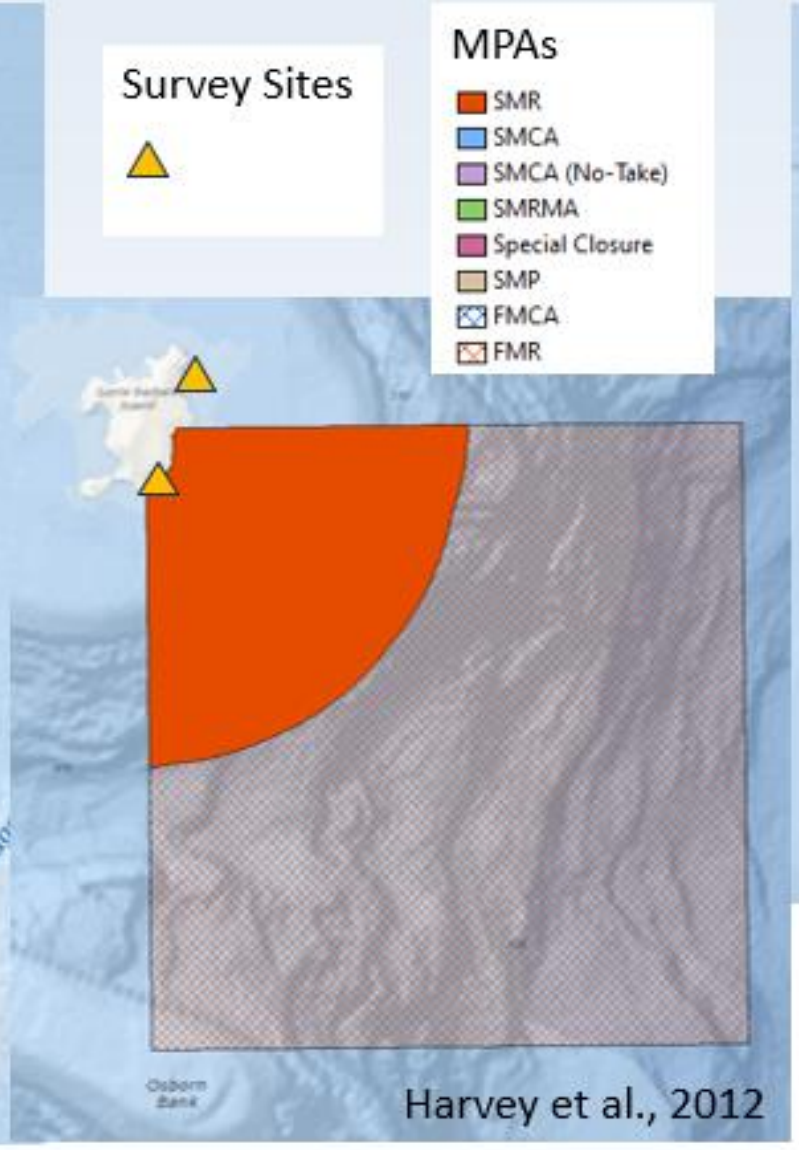
- Lighting regulations (wattage and shielding requirements) established during market squid FMP development late 1990's to 2005
- 2024 proposal to close night-time fishing on Anacapa, San Miguel, and Santa Barbara islands from February through October to provide additional protection for the breeding State-listed (Threatened) Scripps's murrelet.
- Scripps's murrelet population counts increased 150% and occupied nests increased over 5-fold on Anacapa from surveys in 2001 and 2014.



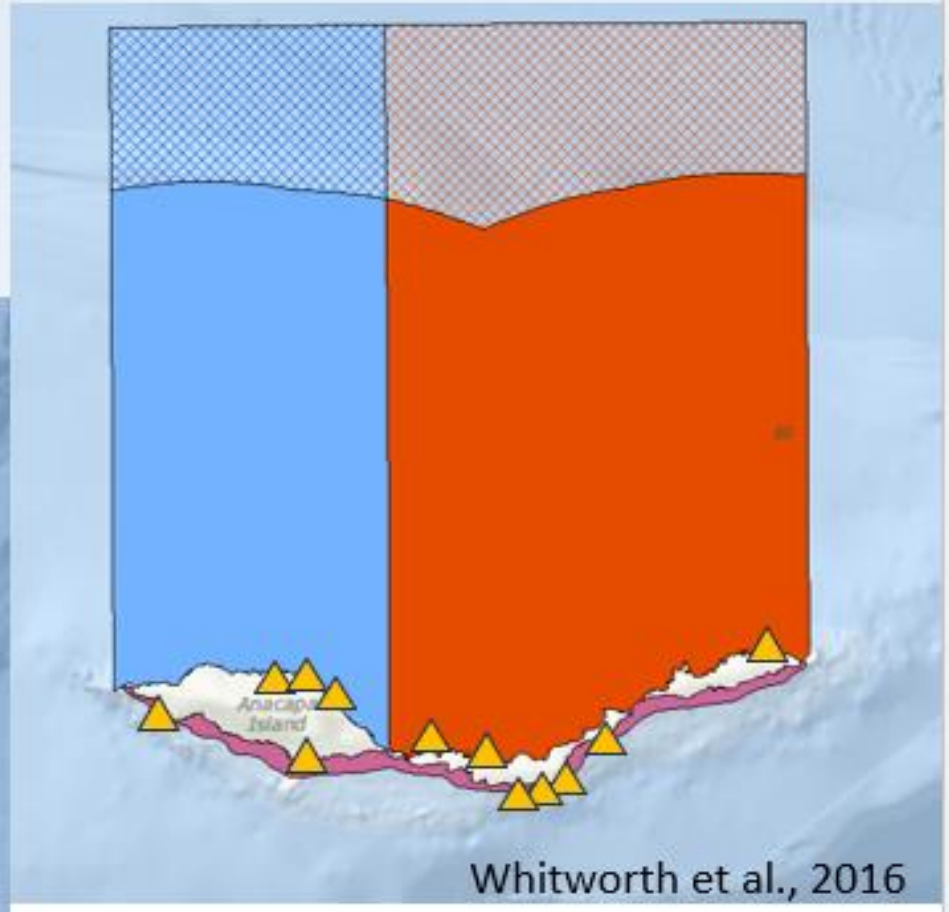
Scripp's Murrelet Cont.



Whitworth and Carter, 2018



Harvey et al., 2012



Whitworth et al., 2016

Lighting and Seabird Habitat Recommendation

Department Recommendation:

- Fishery “Best Practices”
- Evaluate potential wildlife interactions (primarily nocturnal seabirds at the Channel Islands National Park) with fishery logbook data

Marine Mammal Deterrents

- Marine Mammals managed by the federal government
  - NOAA allows the use of pyrotechnics to deter marine mammals
  - NOAA has proposed regulations that further restrict that use
- Fish and Game code 5500 prohibits explosives except under terms and conditions set by the Commission
- Title 14 Section 225.1 allows the use of agricultural and wildlife fireworks
  - Health and Safety Code, Sections 12503 – 12678 describe and define the use of agricultural and wildlife fireworks

Summary – Department Recommendations

Proposed FMP Amendment and/ or Regulatory Changes

- Electronic logbook
- Extend weekend closure Statewide to begin at 7am on Friday / Monterey Bay Area to Sunday midnight
- Require rib line and rope purse line

Outreach

- Provide a fishery “Best Practices” in 2024

Continued Research

- Small-scale opportunities through EFP
- Continue forecasts with EDM (2024 onward)
- Evaluate potential wildlife interactions (primarily nocturnal seabirds) with squid fishery log data

FMP Amendment/Rulemaking

First Ever Commission FMP Amendment

Proposed Timeline:

FGC Meeting
April 16-17, 2025

- Notice Hearing
  - FMP Amendment/Rulemaking goes to notice

FGC Meeting
June 18-19, 2025

- Discussion Hearing

FGC Meeting
August 13-14, 2025

- Adoption Hearing

Thank You

For questions please contact:
SFAC@wildlife.ca.gov

From: Shester, Geoff <GShester@oceana.org>
Sent: Wednesday, October 23, 2024 11:31 PM
To: FGC <FGC@fgc.ca.gov>;
Cc: Birch, Caitlynn <cbirch@oceana.org>
Subject: submission for MRC briefing materials - agenda item 4 - market squid fishery review

Good evening Commission staff,

We would like to submit the two attached reports for the MRC briefing materials under Agenda Item 4: Market squid fishery management and fishery management plan review.

These reports provide **two independent analyses of the use of seal bombs in California fisheries with a focus on the market squid fishery**. One is by former Oceana research intern Leah Davis and the other is by Aimee Kerr and Jason Scorse from the Center for the Blue Economy. While these reports were written in 2018 and there have been some developments since then, their findings remain relevant as this issue has not been meaningfully addressed to date. Given the Commissioners' interest in this topic and request for additional information at the July 2024 MRC meeting, we hope the MRC finds these reports helpful in understanding the background of this important issue. We look forward to further discussions with the MRC regarding potential management improvements to address ongoing concerns over the use of explosives in the market squid fishery.

Thank you,

Geoff Shester

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The Use of Seal Bombs in California Fisheries

Unknown Impacts Point to an Urgent Need for More Research

By Aimee Kerr and Jason Scorse*
Center for the Blue Economy, 2018

Abstract

Commercial fishing in California is a significant source of jobs and incomes. The industry can also produce detrimental environmental impacts, including injuries to threatened and endangered marine mammals and damage to marine ecosystems. There are a host of state and federal legal and regulatory mechanisms in place to protect marine mammals and their habitat. Some of these are more effective than others, and all exist within a continually evolving political and economic landscape. Seal bombs are incendiary devices used by some fishers to deter sea lions, seals, and other mammals from fish nets and fishing grounds. Measures to allow the use of seal bombs were adopted in part to protect fishermen from mammal depredation, but there is increasing evidence that the devices are being used off the coast of California at higher levels than previously realized. The available evidence indicates that seal bombs may pose a significant risk to marine life, both due to risk of direct injury from the blasts and the large number of intense noise impulses being introduced into marine ecosystems filled with animals that depend on the natural soundscape to live and thrive. The current regulation of these devices is weak, informed by outdated and incomplete research. Further, the monitoring and enforcement of their use is minimal, and their direct consideration by seafood certification organizations is practically nonexistent. Therefore, the authors recommend that the state and federal agencies tasked with monitoring and enforcing the use of seal bombs in California immediately review their policies, and consider significant investments in seal bomb research and monitoring to ensure that they are being used according to the law and not producing significant harm to marine mammals.

I. California's Fishing Industry & the Use of Explosive Deterrents

The fishing and harvesting of marine resources has played an important role in California's history and economy. In 2016, the value of commercial fish landed in California totaled almost $200 million,[1] and in 2015, the industry supported over 122,000 jobs.[2] California's coasts host an incredibly rich assortment of marine mammals; over 34 species of pinnipeds, whales, otters, and other marine mammals can be found in Monterey Bay National Marine Sanctuary (MBNMS) alone.[3] As marine mammals such as whales, dolphins, and sea lions subsist on fish, commercial fishing activities off the coast sometimes lead to conflicts between humans and marine mammals.[4]

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In order to deter and chase pinnipeds away from fishing activity—which can damage gear, scare fish and diminish fish catch—fishermen in multiple fisheries in California use explosives such as "seal bombs" or "cracker shells".[4] Seal bombs used in California waters are firecrackers that contain approximately of 2-2.5g of explosive charge and sink and explode 1-4 meters[5] under the water's surface, producing a loud noise that can travel for kilometers underwater.[6] "Cracker shells are 12 gauge shotgun shells containing a sound and flash explosive charge that is designed to explode in the air or on the surface of the water at a distance of 75 to 100 yards from the point of discharge."[7]

Image 1: An example of a "seal bomb"

Photo credit: Anna Krumpel (formerly Meyer-Loebbecke)

These types of explosives are used in large numbers during times of intense fishing activity off the coast of California, with hydrophones recording a maximum of "37,500 [explosions] per month and 3,740 per day" near Catalina Island between 2005 and 2014.[8] As many as 500 blasts have been recorded in one hour during peak fishing season.[8] The blasts were found to occur primarily at night, strongly correlating with fishing activity targeting squid.[8] The hydrophone operated by the Monterey Bay Aquarium Research Institute (MBARI) in the Monterey Bay recorded over 3,000 explosions in the span of about a year, from mid-2015 to mid-2016,[9] with a maximum of almost 1,000 in a single month.[10] The hydrophone can pick up some sounds up to 500 kilometers away depending on intensity, frequency, seafloor topography, and other factors, though it is likely that these blasts are occurring within the Monterey Bay.[10]

Seal crackers are considered "high explosives" by the U.S. Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) because they contain flash powder;[11] they can be compared to M-80s or cherry bombs.[12] As a result of misuse of these devices, in 2011 ATF began to more heavily enforce the Safe Explosives Act of 2002, mandating that those wishing to purchase seal bombs obtain a permit and clear a background check.[11] These devices have the potential to harm humans, marine mammals, other species, and the marine environment.[12] They have been shown to shatter bones of marine mammals[5] and to kill fish within the blast vicinity.[13]

Experiments done in California indicated that the use of cracker shells only deterred pinnipeds from boat activity for roughly 4 minutes, a timespan that increased to 6 minutes when combined

with acoustic harassment devices. The inadequate number of controlled scientific experiments on the use of seal bombs has made it difficult to determine their true effectiveness as a type of deterrent.[4] More data is needed on the effect of seal bombs on various marine mammals as well as on their exposure and risk.

II. Impacts on Marine Life

The impacts of seal bombs on the area's various marine mammals have yet to be clearly determined, but initial evidence points to the potential for significant risk of harm for many species. A 1989 study done by the National Oceanic and Atmospheric Administration (NOAA) Southwest Fisheries Science Center indicated that one of the many types of seal bombs (albeit larger than the majority of bombs currently used in California) detonated within half a meter of a dolphin carcass can shatter its bones and is likely to cause moderate to severe injury within that distance.[5] This is concerning given that these devices are only effective as seal deterrents when detonated near the offending pinnipeds.[4] Scientific research on seal bombs has been lacking in recent years, but studies examining the effects of seal bombs on marine mammals are currently underway.[9]

According to Shawn Johnson, Director of Veterinary Services at the Marine Mammal Center, whether or not a seal has been killed by the immediate or delayed effects of a seal bomb would be difficult to determine once a carcass is found. However, over the past decade the Marine Mammal Center has recovered two sea lion carcasses displaying "evidence of intra-oral explosion, including traumatic injury to bone of maxilla and mandibles, soft tissue burns and prolapsed eye balls" (see Image 2 & 3 below), injuries that the Center believes were likely caused by seal bombs. It is important to note that it is likely that a seal that was severely injured by a seal bomb at sea would die and decompose offshore, and never be observed by Marine Mammal staff or other enforcement agencies.

Images 2 & 3: Dead sea lions recovered by Marine Mammal Center, whose deaths were likely caused by seal bombs

Credit: Shawn Johson, Marine Mammal Center

Other marine animals such as fish can also be injured or killed by seal bombs; dead fish have been immediately observed in the vicinity of seal bomb blasts.[12] A single accidental human death has also been recorded and retrospectively studied; a swimmer was killed when a bomb—containing 3.0g of explosive charge—exploded within 0.3 meters of his body. The explosion "ruptured both eardrums, herniated brain tissue through ruptured areas in the cribriform plates, fractured cranial bones including the wings of the sphenoid and the left petrosal, and caused a 1.5-cm-deep wound above the scapula".[5]

Exploding seal bombs produce intense impulsive and broadband noise with energy at a wide range of frequencies, some of which can carry for tens of kilometers across the ocean. Researchers at the Scripps Acoustic Ecology Laboratory estimate that the bombs can be heard by whales and dolphins from up to 80 kilometers away.[6] The sound pressure levels of explosions from these devices can be detected from kilometers away; unpublished preliminary results from analyses of experiments conducted by researchers at MBARI and Scripps show that they can be higher than the 160 dB re 1 uPa received sound levels needed to initiate an avoidance response in gray whales in California's waters within a kilometer or more from the blast area.[14] As these devices are used typically in large quantities concentrated in short time periods, and across different locations, the aggregate potential for noise disturbance is an issue that warrants further research. There have been several reports of explosives driving whales away from whale-watching sites, and SCUBA divers too, have felt the impacts of seal bombs; divers in Monterey have described being driven out of the water by the noise and pressure waves from the blasts.[6]

Toothed whales are extremely sound-sensitive, and they are consequently likely to suffer adverse effects from underwater noise[14] Many types of toothed whales, including the sperm whale, killer whale, beaked whales, Pacific White-Sided dolphin, Risso's dolphin and Dall's porpoise, are found off the coast of California.[15] All species of whales are protected under the 1972 Marine Mammal Protection Act (MMPA) and many, including the gray whale, blue whale, and fin whale, are also protected under the 1973 Endangered Species Act (ESA). Whales in marine sanctuaries are also covered by the 1972 Marine Protection, Research, and Sanctuaries Act (MPRSA). Many

marine mammal species, notably large whales, rely on sound for communication, navigation, and food location and acquisition.[4] With up to tens of thousands of underwater explosions occurring during some months on California's coast, it is very possible that a number of these marine mammals are being adversely affected by the noise alone.

Over the past few years, acoustic pollution in the marine environment has become a topic of widespread concern within the marine conservation community. For example, the Natural Resources Defense Council (NRDC) has a program focused on acoustic pollution in the ocean and helped produce the Emmy Award-winning documentary, Sonic Sea, which brought the issue to the attention of the public in 2016. National and international bodies including the National Research Council of the National Academies, the International Maritime Organization, and the United Nations have also recently given extensive consideration to this issue.† Commercial shipping traffic represents the greatest contribution to acoustic ocean pollution,[16] but anthropogenic sources of noise in the marine environment also include fishing activities, recreational and commercial boats, aerial activity,[17] sonar systems for military purposes, fishing, and research, and seismic surveys for oil and gas exploration.[18]

The background noise intensity in some areas of California's marine environment that have been systematically measured has increased drastically since the mid-1960's.[16] Marine mammals use sound for feeding, "communication, individual recognition, predator avoidance, prey capture, orientation, navigation, mate selection, and mother-offspring bonding".[18] Anthropogenic noise can lead to behavior changes in marine mammals; responses vary depending on the species, sound, and source.[17] Potential effects of noise pollution on marine mammals include physical injury, temporary and permanent noise-induced hearing loss, behavioral changes such as altered migration and foraging patterns, and inability to detect important sounds like those that assist with communication, food sourcing, and navigation.[19] Acoustic pollution such as sonar testing has been linked to acute decompression sickness in marine mammals, which may lead to death through beaching.[16] Long-term, cumulative impacts are not well-known, but given the noise produced by tens of thousands of seal bombs over many months, it is likely a significant source of additional acoustic pollution in California waters.

III. Existing Regulation of Seal Bombs

Regulation of the use of seal bombs in California's commercial fishing industry is complicated. On a federal level, sale of the devices is regulated by ATF. National Marine Fisheries Service (NMFS) collaborates with the State of California and the Pacific Fishery Management Council (PFMC),[20] "one of eight regional fishery management councils established by the Magnuson Fishery Conservation and Management Act of 1976"[21] to regulate fishing activities in California's

† Some of the recent efforts to understand the effects of ocean noise on marine mammals are presented in the following documents: National Academies of Sciences, E., and Medicine (2017). Approaches to Understanding the Cumulative Effects of Stressors on Marine Mammals. Washington DC: The National Academies Press. National Research Council (NRC) (2005). Marine mammal populations and ocean noise: determining when noise causes biologically significant effects. National Acadamies Press.
Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO). (2014). Noise from commercial shipping and its adverse effects on marine life, outcome of DE 57. MEPC 66/15/17.

waters. Federally, the 1972 MPRSA, the 1972 National Marine Sanctuaries Act (NMSA), the 1972 MMPA and the 1973 ESA are applicable to the use of seal bombs off the coast of California. On a state level, the California Department of Fish and Wildlife (CDFW) manages fishing in California's state waters, and the 1970 California Endangered Species Act applies to all endangered species which may be harmed by the use of seal bombs in California.

Federal Regulation

As seal bombs are explosives, their sale is federally regulated by ATF.[22] ATF conducts "inspections of applicants for licenses or permits as explosive material manufacturers, importers, dealers, and users, as well as periodic inspections" once every three years.[23] According to Ronald J. Borg, Senior Industry Operations Investigator at ATF's San Francisco Field Division, "We do not monitor the actual usage of the materials, only its accountability."[23] ATF does not approach vessels on the water; inspections are conducted once ships are docked. Borg adds, "We can, however, conduct inspections if we had reason to suspect or reasonable cause to believe that criminal activity was or is ongoing."[23]

Following the point of sale of seal bombs, information on their use and impacts is lacking. As of November 2017, "officials with both the California and the US federal governments say they do not know how many fishermen are using explosive deterrents, or whether they're being used appropriately."[6] Impacts on marine mammals and on the marine environment are also generally unknown.[24] Fisheries monitoring on the California coast has been performed with attention to other issues, and the issue of seal bombs has been largely overlooked. In a telephone conversation with the author on Feb 23, 2018, Kristy Long at NMFS stated that there are very few fisheries observers in relation to the number of fishing vessels. According to Robert Anderson, a pinniped expert with NMFS, "It would be impossible to watch every fisherman using an explosive device. It falls on you as a fisherman to make sure you're in compliance with the law."[6]

On the guidance document issued by NMFS, potential methods fishers can use to deter Pacific harbor seals, California sea lions, and eastern U.S. stock Steller sea lions from damaging their gear and catch include "pyrotechnics (e.g., bird screamers, bangers, underwater firecrackers, cracker shells)", yet exclude methods that have "an increased likelihood of causing injury or death".[25] Due to the lack of information on the deleterious effects of seal bombs on marine mammals, it is entirely possible that they may, in fact, cause such effects. The NMFS guidance document on distinguishing serious from non-serious injury of marine mammals does not provide guidance on noise-related injuries "because NMFS scientists making injury determinations are unlikely to detect noise related injuries in live animals and because the state of science on identifying noise-related injuries in live marine mammals is still developing."[26] The document only addresses the obvious physical impacts that might be immediately visible as a result of explosives, such as "body cavity exposure" or "visible blood loss".[26]

Fishing activities in California's national marine sanctuaries are managed by the State of California, NMFS, and PFMC. Fishing in California state waters is managed by CDFW, and fishing in federal waters is managed by NMFS and PFMC.[27] The national marine sanctuaries are mandated to "protect all sanctuary resources on an ecosystem wide basis" under the MPRSA. However, in MBNMS, commercial fishing activity is "not being regulated as part of the sanctuary regime and is not included [...] as an activity subject to future regulation." In fact, Sanctuary prohibitions that

may indirectly affect fishing activities have been written to explicitly exempt [...] traditional fishing activities",[20] although it is questionable whether the use of potentially harmful explosives should be considered part of this category. The NMSA (National Maritime Safety Administration) prohibits the destruction, loss of, or injury of sanctuary resources, but also excludes fishing activity.[28]

The MMPA is a federal law protecting California sea lions, pacific harbor seals, and other marine mammals, such as cetaceans.[29] Under the MMPA, NMFS is responsible for regulating activities that could seriously injure or kill marine mammals, and the taking of a marine mammal by a member of the public is punishable by a large fine.[20] The term "taking" in this case refers to all forms of harassment, including moving, injuring, or causing the loss of a marine mammal,[20] and "harassment" refers to "any act of pursuit, torment, or annoyance" which could lead to a marine mammal being injured, disturbed or having its behavioral patterns disrupted.[29] It is allowed under the MMPA, however, for commercial fishers to deter pinnipeds from damaging their gear or catch as long as this activity does not cause marine mammal mortality or serious injury.[29] However, the injurious effects of seal bombs have not been closely studied nor monitored, despite evidence that they have the potential to cause serious injury.

In the case that marine mammals are killed or injured as a result of commercial fishing activity, the MMPA also allows their "incidental take" as long as a permit has been issued.[29] The MMPA "mandates that all commercial fisheries be classified by the level of incidental marine mammal death and serious injury"[30] Fisheries are divided into three categories based on their record of incidental death or serious injury of marine mammals.[29] These figures are reported in the annual Marine Mammal Stock Assessment Reports.[30]

Many species that are found along the California coast—including the gray whale, killer whale, sperm whale, blue whale, Guadalupe fur seal, western Steller sea lion and sea otter—are also listed under the ESA. The Pacific harbor seal, the eastern U.S. stock of Steller sea lions, and the California sea lion were removed from the list of threatened species under the ESA in 2013.[31] Responsibility for implementing the ESA is shared by NMFS and the U.S. Fish and Wildlife Service (FWS). NMFS is responsible for endangered and threatened marine mammal species with the exception of a few, including sea otters, which are managed by FWS.[32] Under the ESA, a species listed as endangered cannot be legally harassed, injured, or killed.[32] However, the ESA, like the MMPA, allows owners of commercial fishing vessels the "incidental take" of endangered or threatened species, but requires the issuance of an incidental take permit and accompanying Habitat Conservation Plan.[33]

State Regulation

On a state level, fishing in California waters is managed by CDFW. According to CDFW, the department "does not track or record use of seal bombs"[22] as they are not a type of gear.[34] According to John Urgoetz, Environmental Program Manager for the CDFW:

> *"The California Fish and Game Commission regulations implementing State statutes regarding the use of explosives in State Waters specifically exempt explosives designated by the State Fire Marshall as agricultural and wildlife fireworks (Title 14, California Code*

of Regulations, Section 225.1). The State Fire Marshall considers Seal Bombs as this type of device and they are therefore allowed as a deterrent device for use in fisheries."

From what we can gather from state officials, there is no state program in place for monitoring the use of seal bombs or assessing their frequency or impacts, nor are any efforts currently underway to bring them under greater scrutiny and/or management.

IV. Connection between Seal Bombs and Seafood Certification

Consumers who seek out seafood that has been assessed by one of the many organizations that rate seafood sustainability do so for many reasons, including ethical and health concerns and to promote local fisheries. Currently, seafood caught using seal bombs is not automatically disqualified from being certified by any of the leading certification bodies, and it difficult to determine the extent to which these bodies are assessing potential seal bomb impacts on marine ecosystems. The result is that it is possible that seal bombs are used in some of the fisheries that receive positive sustainability ratings, and that consumers who do not want to purchase seafood from fisheries where seal bombs are used cannot rely on these rating bodies.

One of the most well-known and widely utilized sustainable seafood advisory tools, the Monterey Bay Aquarium's Seafood Watch Program, assigns a color-coded sustainability score for each fishery analyzed. Organizations and companies such as Fishwise and Real Good Fish base their sustainable seafood recommendations on this standard. According to Seafood Watch Program representative Peter Adame, there are currently no reports that specifically mention the use of seal bombs, as they are "not a common method for commercial fishing."[35] Adame says that the Seafood Watch Program would consider the impact of the explosives "under two criteria: Impacts on Other Species and Habitat Impacts."[35] These impacts, however, are currently unknown.

The Marine Stewardship Council (MSC), a sustainable seafood certification organization, does not specifically mention seal bombs in its guidance document on fisheries certification. MSC bars fisheries from certification that use explosives as a method of fishing.[36] However, there is no such ban for fisheries that use the explosives as a deterrent. According to Matt Gummery, fisheries certification manager for MSC, "There are several areas where fishery impacts on marine mammals would be addressed by a third-party scientist assessment team, even if there was a lack of data. The assessment team would be required to use data-limited assessment methods (a semi-quantitative approach that uses any available data and stakeholder input to determine precautionary scores) to assess the risk of a negative impact."[37] Fisheries are also scored by MSC on how frequently they review and implement alternative measures to minimize fishery-related mortality of endangered, threatened, or protected species.[37]

Ultimately, sustainable seafood listings and certifications are only as good as the information received by the organizations that produce them, and information on seal bomb impacts on marine mammals is practically nonexistent. MSC will not certify a fishery that specifically targets marine mammals,[37] but if the mammals are taken as a by-product of fishing activity, certification is possible.

Currently, Seafood Watch and MSC sustainability determinations do not preclude fisheries from using seal bombs as deterrents. It is hard to know how many fisheries positively rated by Seafood Watch or MSC use seal bombs, but Seafood Watch assigns a yellow rating to squid caught by the California squid fishery, which is one of the fisheries that likely uses the greatest number of seal bombs in its operations.[8]

V. The Need for More Research, Monitoring, and Dialogue on Seal Bomb Use in California Waters

The use of seal bombs in California fisheries presents a system almost completely lacking in data, monitoring, and enforcement. The regulatory system for seal bombs is broken if it requires the users of the devices to self-regulate without having any system in place to objectively assess the impacts of seal bombs, nor a data collection and monitoring program in place to correlate the use of seal bombs with marine mammal injury and death. Fishers who use seal bombs have no incentive to self-regulate, and there are no government or third-party entities directly monitoring their use of these devices.

The serious injury or death of a marine mammal, if caused by seal bombs, would have to be witnessed and proven before any action would be taken against those responsible, which is entirely backwards from a precautionary or incentive-based management standpoint. In addition, there is a paucity of fisheries observers in California waters who could collect the appropriate data and alert regulatory personnel of violations.

The issue of seal bomb use, however, has recently made its way into the California policy spotlight. The sanctuary's management plan is currently being updated, and there is public and Sanctuary Advisory Council interest in addressing seal bombs issues. According to the MBNMS program's Andrew DeVogelaere, the Sanctuary is "concerned about the potential incidental impacts of specific fishery technique on all sanctuary resources including benthic habitats or marine mammals".[20] If it is found that seal bombs "have a significant adverse effect on marine mammals, the Secretary of Commerce may prohibit such deterrent methods, after notice and opportunity for public comment, through regulation under this Act."[29] The responsibility for analyzing fishing activities for negative impacts falls to NOAA, who can make changes under the NMSA.[38] If seal bombs present issues, "NOAA would consult with the State, PFMC and NMFS as well as the industry to determine an appropriate course of action."[20]

Many California fishermen claim that the use of seal bombs is economically necessary, as without them, they would lose a lot of fish and gear to pinnipeds. Larry Collins, the president of the San Francisco Crab Boat Owner's Association, however, explained that when seal bombs are used, the seals "swim away, and they swim right back. It's probably more effective to throw raw potatoes at them."[11] Other than the California squid fishery, most other Californian fisheries do not use seal bombs. Due to the known adverse effects and the difficulties in effectually modifying or regulating their use, seal bombs were prohibited from use in the eastern tropical Pacific yellowfin tuna purse seine fishery (although these bombs were larger than the ones currently used in California).[39]

As with the overall uncertainty regarding the marine impacts of seal bombs in California, there is no way to objectively examine the overall economic impacts of seal bombs, since there is

insufficient supporting evidence on the potential losses to fishermen. An argument could be made that even if seal bombs provide a net economic benefit to fishermen, the damage inflicted on the marine environment does not justify their use; there is simply a lack of robust and consistent data with which to make any meaningful economic assessment at all.

Given the weak and uncertain regulatory environment, the authors recommend that the state and federal agencies tasked with monitoring and enforcing the use of seal bombs in California immediately review their policies and invest more resources in researching and creating dialogue around this issue. There is the potential that seal bombs pose a significant threat to marine life in California, both due to risk of direct injury from the blasts and the high level of acoustic pollution they generate.

Due to the potential unintended consequences of such a policy change, it is important that the state and federal agencies also review any likely changes in fishery practices that might accompany limits or a ban on the use of seal bombs. It is possible that fishers might resort to other practices that also have negative environmental impacts, or that they have ideas for improvements that could diminish environmental impacts. Fishers should be brought into the conversation from the beginning so that any regulatory changes produce sustainable outcomes.

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Fishing with Explosives: The Impact and Legality of Seal Bombs in California's Coastal Pelagic Species Fisheries

White Paper by Leah Davis, Oceana Research Intern

August 2018

Executive Summary

This report provides an analysis of the scientific and legal background of the use of seal bombs in California's Coastal Pelagic Species (CPS) fisheries.[i] A seal bomb is a small explosive device deployed as an acoustic deterrent against pinnipeds (seals, sea lions and walruses).[1] These devices are used in CPS fisheries to prevent sea lion entanglement and depredation of catch, particularly in the market squid, northern anchovy, and pacific sardine fisheries.

While seal bombs assist fishermen in these efforts, they also add anthropogenic noise to the ocean's soundscape. Marine mammals rely on sound for a variety of essential behaviors from reproduction to foraging.[2] Anthropogenic noise can affect an animal's ability to execute these behaviors effectively, resulting in harmful implications for an individual and potentially entire populations.[3] Despite the potential adverse effects of anthropogenic noise, various acoustic deterrents, including seal bombs, are commonly used off the U.S. west coast to deter pinnipeds from fishing operations.

In California, seal bombs are particularly common within the northern anchovy, pacific sardine and market squid fisheries in Monterey Bay and surrounding the Channel Islands in Southern California.[4] Seal bombs are highly prevalent in these fisheries and are often used as an integral part of the fishing method both to prevent bycatch mortality of sea lions and to prevent losses in catch. For example, data recorded by sixteen High-Frequency Recording Packages (HARPs) shows up to 37,500 seal bomb explosions occurring in just one month off Southern California.[5]

Seal bombs, often compared to cherry bombs and M80s,[6] produce a source level explosion of 205 (dB re 1 µPa @ 1 m).[7] This noise level is loud enough to cause permanent hearing loss to high-frequency cetaceans at the detonation site,[8] and temporary hearing loss and behavior changes, including changes in feeding and migration patterns, from those farther away. While the devices are targeted toward pinnipeds, seal bomb explosions may additionally affect feeding and migration patterns of protected cetaceans along California's coast, potentially causing population level effects. Cetaceans of particular concern include humpback whales, harbor porpoises, and Risso's dolphins,

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[1] Bland, A. (2017). California Fishermen are Throwing Explosives at Sea Lions. *Hakai Magazine*.

[2]Forney, K. A., Southall, B. L., Slooten, E., Dawson, S., Read, A. J., Baird, R. W., & Jr., R. L. B. (2017). Nowhere to go: noise impact assessments for marine mammal populations with high site fidelity *Endangered Species Research, 32*, 391-413. at 392.

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Management entities including the Monterey Bay National Marine Sanctuary and National Marine Fisheries Service (NMFS) Protected Resources have acknowledged these potential impacts and recommended further research focused on the seal bomb issue. This report summarizes the available evidence of potential impacts of seal bombs on target and non-target marine mammals.

The seal bomb issue is a complex problem with potential solutions at a variety of scales and differing timelines. This report evaluates and assesses the following potential management solutions:

1. Implement restrictions on seal bomb use.
2. Increase monitoring of seal bomb use for California's Coastal Pelagic Species Fisheries with onboard observers or electronic monitoring (i.e., video).
3. Increase seal bomb enforcement efforts under existing laws.
4. Establish federal regulations for the use of marine mammal deterrents.
5. Reduce the knowledge gap surrounding the use and impacts of seal bombs.

The findings in this report are limited by the availability of information regarding physiological and behavioral impacts of seal bombs on protected species off California. The recommendations are accordingly based on a precautionary approach to potential impacts to marine mammals. Much of the research that would further inform a course of action is underway and expected to be available within the next year.

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October 24, 2024

Commissioners Sklar and Murray
California Fish and Game Commission
Marine Resource Committee
P.O. Box 944209
Sacramento, CA 94244-2090

[via Electronic Mail to FGC@fgc.ca.gov]

RE: Market Squid Fishery Management and Fishery Management Plan (FMP) Review, MRC November 2024 meeting agenda item #4

Dear Co-Chairs Sklar and Murray:

Ocean Conservancy[1] offers the following comments regarding recommendations provided to the Marine Resources Committee (MRC) at its meeting in July 2024 by the Department of Fish and Wildlife (CDFW, or Department).[2]

Ocean Conservancy served as an appointed conservation representative on the Squid Fishery Advisory Committee (SFAC) with a particular interest in improved management of this most economically and ecologically important species. California market squid support a top California fishery by volume and value,[3] serve as important forage for an array of marine wildlife,[4] and are highly susceptible to changes in ocean conditions which are expected to increase.[5]

[1] Ocean Conservancy is working with you to protect the ocean from today's greatest global challenges. Together, we create evidence-based solutions for a healthy ocean and the wildlife and communities that depend on it.
[2] Staff Summary for July 17-18, 2024, Marine Resources Committee - Item 5 https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=224074&inline
[3] Enhanced Status Report, Market Squid. California Department of Fish & Wildlife 2024. https://marinespecies.wildlife.ca.gov/market-squid/the-fishery/
[4] Justin J Suca, Jarrod A Santora, John C Field, K Alexandra Curtis, Barbara A Muhling, Megan A Cimino, Elliott L Hazen, Steven J Bograd, Temperature and upwelling dynamics drive market squid (*Doryteuthis opalescens*) distribution and abundance in the California Current, *ICES Journal of Marine Science*, Volume 79, Issue 9, November 2022, Pages 2489–2509, https://doi.org/10.1093/icesjms/fsac186
[5] IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, Chapter5.2.2.2, available at https://www.ipcc.ch/srocc/chapter/chapter-5/ *Accessed October 8, 2024.*

1. Sustainable Squid Catches: Extend Weekend Closures and Prioritize Real-time Management

Managers do not know the abundance of the squid population and cannot confirm that fishing rates are sustainable.[6] Squid catch levels are currently managed under the existing Fishery Management Plan (FMP) adopted in 2005 in two primary ways: (1) a total allowable catch of 118,000 tons, and (2) a time-closure prohibiting squid fishing during specified weekend hours. These basic controls were meant to serve as a proxy for achieving maximum sustained yield,[7] but they do not support timely management decisions based on data about stock health and relevant ocean conditions.

The 118,000-ton harvest cap itself no longer appears applicable to current trends in the fishery discussed by the SFAC including recent catch history and available processing capacity. SFAC discussions indicated weekend time closures established with the 2005 FMP represent the only truly operational mechanism promoting sustainability of squid harvest. We therefore urge the MRC to recommend extended weekend closures at least as long as recommended by CDFW to provide additional uninterrupted squid spawning. Time closures show benefits to squid reproductivity according to data shared with the SFAC but should be viewed as interim measures contributing some protection pending more precise and updated means of linking squid management with observed stock health indicators.

Harvest control rules that link monitoring of stock health and ocean condition data to management measures are an important feature in recently adopted management plans for the California spiny lobster[8] and pink shrimp[9] fisheries, and an important element of fulfilling the active management vision of the Marine Life Management Act Master Plan.[10] They also offer special value in managing a highly conditions-dependent stock undergoing visible climate-driven changes and expected to experience more change. Current monitoring of the squid fishery to estimate egg escapement as a measure of whether sufficient squid spawning biomass escapes harvest can help evaluate management performance and detect problems after the fact. But it falls short of the real-time data needed to support responsive, timely management. As indicated by the 2003 Marine Stewardship Council Fishery Assessment Report that led to the fishery's conditional certification, this monitoring protocol "is not intended as a real-time

[6] NOAA Fisheries Species Directory, California Market Squid, available at https://www.fisheries.noaa.gov/species/california-market-squid

[7] Current and Past Management: Enhanced Status Report, Market Squid. California Department of Fish & Wildlife 2024. https://marinespecies.wildlife.ca.gov/market-squid/the-fishery/

[8] Overview of Rationale for Current Management, California Spiny Lobster Enhanced Status Report, CDFW 2019. https://marinespecies.wildlife.ca.gov/california-spiny-lobster/management/

[9] Past and Current Management, California Pink Shrimp Enhanced Status Report, CDFW 2023. https://marinespecies.wildlife.ca.gov/pink-(ocean)-shrimp/management/

[10] The MLMA envisions demonstrating sustainability of fisheries on an ongoing basis rather than assuming management success absent visible declines. See https://wildlife.ca.gov/Conservation/Marine/MLMA/Master-Plan/Harvest-Control-Rules

management tool to regulate annual harvest…" and "is not appropriate and effective in achieving the exploitation levels required by the [fishery's control measures]."[11]

Notably, the Department has actively and successfully begun exploring techniques to assess fishery and ocean condition indicators able to inform management action for "data-limited" stocks where formal stock assessments are infeasible or unattainable. In the case of squid, CDFW is working successfully with modelling and assessment experts to supply harvest planning and management information by analyzing available data sources—including collaborative data produced by fishery participants and interests. We urge the MRC to recommend CDFW prioritize the rapid implementation of these techniques once finalized to modernize squid fishery management and secure sustainable squid management into the future.

2. Habitat and Gear: Require Use of Riblines and Rope Purse Lines

The SFAC was presented compelling CDFW data indicating that contact by squid nets on seabed habitat and squid egg beds occurs during shallow squid fishing. Consistent with the need to minimize a fishery's impact on habitat—and in this case a potentially significant impact on spawning success—CDFW recommends requiring use of gear modifications innovated by and currently used by many California squid fishermen: a ribline to control the extent of bottom habitat impact when fishing gear contacts the seafloor, and ropes—rather than metal cables—to serve as purse lines.

Ocean Conservancy strongly supports this recommendation, and urges requiring use of this gear as soon as practical. The recommendation received substantial support from the squid fleet and is consistent with requirements established by the State of Oregon in establishing a squid fishery there. We recognize that acquiring, maintaining and repairing squid nets is an ongoing part of participation in the squid fishery and poses a significant cost. Nevertheless, to ensure timely and effective reduction in habitat impacts from squid fishing, we urge the Commission to establish a near-term requirement to employ rib lines and rope purse lines in California's squid fishery.

3. Squid Lights and Sensitive Wildlife Protection: Enforce Regulations and Enact Time-Area Measures

The effects of powerful lights used by the squid fishery to attract and aggregate squid have been discussed before the Commission in several proceedings over the years. A requirement to utilize shields to direct illumination toward the sea surface currently exists. CDFW has reported uneven compliance with this requirement concentrated in 1-2 ports, which we request be addressed by the Law Enforcement Division as soon as possible. There is also uncertainty

[11] SCS Global Services, inc. *California Market Squid MSC Fishery Assessment*, *Public Certification Report,* August 2023. P 295.

among enforcement and fishing participants as to which lamp configurations meet the requirements due to imprecise language and interpretations of whether light shields must extend to the lamp filament itself versus the outer edge of the lamp bulb. We urge this uncertainty be addressed in amended regulations and/or FMP amendments to increase compliance and improve negative interactions between squid fishing and wildlife.

We also urge the Commission to recognize the limitations of existing light-shielding regulations in controlling light impacts. The fact remains that these lights can affect the natural patterns of light and darkness that, for sensitive species such as nocturnal seabirds, serve as habitat required for successful feeding and breeding. Rough seas routinely cause light to spread from its intended path; incomplete compliance likewise may reduce the effectiveness of light shields on sensitive wildlife and habitats. State and Federal agencies continue work to recover and protect sensitive nocturnal seabirds and their habitat[12] at protected public land areas bordering State waters and within active squid fishing grounds, and fishery measures should align with the important investments.

During and subsequent to SFAC meetings, seabird experts proposed measures to set aside key areas and times at Channel Islands National Park critical to threatened seabird recovery from lighted, nighttime squid fishing, refined to minimize overlap with periods of high value squid harvest. Ocean Conservancy urges the Commission to consider the input of these experts and enact reasonable time-area closures to aid public investment in recovery of imperiled wildlife affected by night lighting in the squid fishery.

4. Consideration of Small-Scale Fishery Access

Access to the market squid resource beyond traditional fishing grounds and by fishers outside the squid restricted access program is another topic discussed by the Commission over the years. Ocean Conservancy is supportive of a means of affording community-based harvest of periodically available squid to serve fresh, local markets in a way and of an amount that does not confound existing management or fleet dynamics. We unfortunately do not believe a proposal meeting these goals emerged during intensive discussions of the topic at the SFAC. We support the Experimental Fishing Permit (EFP) pathway recommended by the Department for exploring small-scale squid fishery opportunities. This option recognizes that existing squid restricted access permittees have historically and currently do harvest commercial quantities of market squid that appear outside focal areas of historic squid fishing, and that proposals offered by small-scale squid fishery advocates would target unduly large squid volumes for export to the same global markets served by the existing fishery. Ultimately, we hope the EFP option recommended by the Department can help identify a fresh market, community-based option for small-scale squid harvest that does not compete with existing harvesters or add to management complexity and risk.

[12] https://pacificseabirdgroup.org/wp-content/uploads/2023/04/SCMUGUMU_2022_tech_report_03Feb23.pdf

Conclusion

SFAC completed a thorough and broad-based review of the valuable and ecologically important market squid fishery, producing important recommendations for improved fishery performance. We recommend timely adoption of ribline and purse rope recommendations to protect seabed habitat and squid egg beds and extended weekend closures to aid precaution while more refined management procedures are made available. We urge the Commission adopt time-area restrictions on nighttime squid fishing to advance recovery of sensitive bird nesting sites. Finally, we support the use of EFP proposals to explore the goal of small-scale community fishers serving fresh, local seafood markets.

Sincerely,

Greg Helms
Manager, Fish Conservation Program
Ocean Conservancy
(805) 886-8645

Cc:
Katie Grady, CDFW
John Ugoretz, CDFW

From: Dennis Arguelles <[redacted]>
Sent: Monday, September 30, 2024 08:33 AM
To: FGC <FGC@fgc.ca.gov>
Subject: Support for Increased Protections for Scripps's Murrelet

Dear Fish and Game Commission,

Attached please find our letter supporting increased protections for the threatened Scripps's Murrelet in and around the waters of Channel Islands National Park.

Thank you.

Dennis G. Arguelles

Southern California Director | National Parks Conservation Association

[redacted] | [redacted] | **npca.org**

Your parks. Your turn.

September 25, 2024

Melissa Miller-Henson, Executive Director
California Fish and Game Commission
715 P Street, 16th Floor
Sacramento, CA 95814

Dear Director Bonham,

Since 1919, the National Parks Conservation Association ("NPCA") has been the leading voice of the American people in protecting and enhancing our National Park System. On behalf of our more than 1.3 million members and supporters nationwide, I would like to express our support for proposed actions *presented during the Squid Fishing Advisory Committee meetings* **to protect the breeding/nesting/fledging grounds of the Scripps's Murrelet, a State-threatened species.**

Specifically, **we support the closure of night-time fishing and the use of artificial lights around Santa Barbara, Anacapa, and San Miguel Islands for a distance 6 nautical miles seaward (within the boundaries of Channel Islands National Marine Sanctuary) during the months of February thru October annually to provide habitat protection for the breeding State-listed (Threatened) Scripps's murrelet**.

We understand the impact to the commercial fishery to be negligible, as these closures coincide with the least active period for the fishery.

The Scripps's murrelet only breeds on islands off California and Mexico. **Channel Islands National Park contains 80% of the U.S. breeding population** and primary nesting locations include Santa Barbara, Anacapa, and San Miguel Islands. Santa Barbara Island has the largest Scripps's murrelet colony in the United States, and possibly the world. **The Scripps's murrelet breeding grounds within the park represent the only protected colonies on the West Coast of the U.S.**

Ample research supports the impacts of human disturbances on the mortality of the species, including a 2000 study that categorized "attraction to bright lights from vessels and platforms at sea" as among the greatest threats[1]. The study found that "extremely bright sources of light, especially on offshore oil platforms and squid fishing boats, undoubtedly attract murrelets and may result in mortality."

[1] Carter, Harry R., Darrell L. Whitworth , John Y. Takekawa , Thomas W. Keeney , and Paul R. Kelly 2002. At-sea threats to Xantus' murrelets (Synthliboramphus hypoleucus) in the Southern California Bight.

Our national parks help to conserve some of our country's most prized marine and island natural resources. These parks protect key habitat for thousands of species, preserve our nation's maritime and cultural heritage, provide countless educational and scientific research opportunities and are critically important to the health of ocean ecosystems throughout the country. In particular, Channel Islands National Park's isolation over thousands of years has created a unique ecosystem found nowhere else on Earth and helps preserve a place where visitors can experience coastal southern California as it once was.

We urge you to adopt these proposed protections to ensure the protection of a critical species and the preservation of the greater Channel Islands National Park ecosystem.

Thank you for your consideration of these comments.

Sincerely,

Dennis G. Arguelles
Southern California Director

CC:

From: Lindsay Adrean <[redacted]>
Sent: Monday, September 30, 2024 02:26 PM
To: FGC <FGC@fgc.ca.gov>
Cc: Ugoretz, John@Wildlife <[redacted]>; Grady, Katherine(Katie)@Wildlife <[redacted]>
Subject: Squid Fishery Management comments

Hello California Fish and Game Commission,

Attached you will find comments from the Pacific Seabird Group regarding the Squid Fishery Management Review.

Thank you for your consideration,

--

Lindsay Adrean

Vice-Chair for Conservation

Pacific Seabird Group

Juliet Lamb
PSG 2024 Meeting Chair
Chair@pacificseabirdgroup.org

Dan Barton
PSG 2024 Meeting Chair-Elect and Scientific Program Chair
Programchair@pacificseabirdgroup.org

Richard Veit
PSG 2024 Meeting Past Chair and Awards Committee Chair
Pastchair@pacificseabirds.org

September 30, 2024

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

To: California Fish and Game Commission and the Marine Resources Committee

Subject: Market Squid Fishery Management Review: Seabird Protection within Channel Islands National Park and Channel Islands National Marine Sanctuary.

The Pacific Seabird Group supports the option developed during the Squid Fishery Management Review process to enact a seasonal prohibition of night-time fishing around Santa Barbara, Anacapa, and San Miguel Islands to protect the breeding grounds of the Scripps's Murrelet. As detailed below, the use of high intensity lighting during night squid fishing poses a distinct threat to this threatened nocturnal bird which relies on natural patterns of light and dark for essential breeding and rearing functions. California Fish and Game Commission has this rare opportunity to both maintain an economically sustainable squid fishery while protecting the natural diversity and abundance of marine life, and the structure, function and integrity of marine ecosystems.

The Pacific Seabird Group (PSG) is a society of professional seabird researchers and managers dedicated to the study and conservation of seabirds. PSG was formed in 1972 out of a need for increased communication among academic and government seabird researchers.

The principal goals of PSG are (1) to increase the quality and quantity of seabird research through facilitating exchange of information and (2) to identify and assess the importance of threats to seabird populations and provide government agencies and others with expert advice on managing the threats and populations.

Over the past year members of PSG have been in consultation with one of the members of the Squid Fishery Advisory Committee (SFAC). It is our understanding that a proposal was presented to the SFAC that called for the closure of night-time fishing within the Channel Islands National Park and Sanctuary.

We support this proposal for the following reasons:

1. The Scripps's murrelet is s State-listed threatened species. Eighty percent (80%) of the United States population nests within Channel Islands National Park. The primary nesting locations are Santa Barbara, Anacapa, and San Miguel Islands. Santa Barbara Island has the largest Scripps's murrelet colony in the United States, and possibly the world.
2. The National Park Service continues to invest significantly in protecting the Scripps's murrelet by eradicating invasive predators like the black rat, restoring nesting habitat on Santa Barbara and Anacapa islands, conducting seabird monitoring and reducing island-based lighting during nesting season. Partner agencies must contribute protections of their own also.
3. The Scripps's murrelet is a nocturnal seabird. Artificial lights at night cause high mortality of nocturnal seabirds, one of the most endangered groups of birds globally. There are two primary causes of mortality: 1) Fledglings of burrow-nesting seabirds, and to a lesser extent adults, are attracted to and then grounded (i.e., forced to land) by lights when they fly at night. 2) Increased predation by predatory birds (including barn owls and gulls) (Rodríguez et al. 2019). The Commission has taken action to require shielding around the high-powered lights used in the fishery, however these actions do not prevent the scattering of artificial lights, especially during periods of fog and varied sea-state. Shielding, even when the shields extend beyond the tip of the bulb, doesn't prevent the reflection and scattering of horizontally.
4. The proposed closure would have little to no effect on the squid fishery. The vast majority of commercial fishing occurs in California, traditionally in shallow waters, less than 70 m, and focuses on spawning adults (Zeidberg et al., 2006). The locations that have yielded the largest tonnage are near the islands of Santa Cruz, Santa Rosa, and Santa Catalina, and just offshore of Port Hueneme and Monterey. A significant amount of catch occurs within the boundaries of Channel Islands National Park and Channel Islands National Marine Sanctuary. Vessel participation is greatest during the late fall and early winter for southern California (Zeidberg et al. 2006). The southern portion of the fishery encompasses most of the Southern California Bight including the northern and southern Channel Islands southward along the coast to La Jolla and is most active from October to February. During this time there is less stratification of the water column and more mixing due to winter storms and colder air temperatures (Zeidberg et al. 2006). Current harvest information provided by the Department continues to reinforce the height of the season around the Channel Islands. The closure as called for:
    a. Only prohibits night-time fishing and the use of artificial lights around Santa Barbara, Anacapa, and San Miguel Islands. The critical period necessary to protect the breeding/nesting/fledgling period of the State-listed threatened Scripps's Murrelet is February through October.
        i. The prohibition would be in place (February through October) outside of the highest season of market squid harvest (late fall through early winter).

b. It does not prohibit daytime fishing around Santa Barbara, Anacapa, and San Miguel Islands.
c. The proposal does not call for prohibiting or restricting the fishery around Santa Cruz and Santa Rosa Islands where landings are the greatest.

Additionally, we have reviewed a draft version of a management plan for Synthliboramphus Murrelets currently in the final stages of preparation for publication by the Channel Islands National Park, California Institute of Environmental Studies, and other partners. This plan is the most comprehensive existing review of the threats to Scripps Murrelets and contains the same recommendations that we are supporting above.

In closing, we want to thank the Commission for actions they have taken to protect and manage California's marine ecosystems with the creation of marine protected areas and special closures. However, when it comes to protecting the Scripps's murrelet not enough has been done to protect this State-listed threatened species. In 2004, the Commission prohibited the take of market squid for commercial purposes using attracting lights in all waters of the Gulf of the Farallones National Marine Sanctuary. This regulation also applies to vessels pursuing squid for live bait purposes. It's time to do the same on a more limited basis to protect the State-listed threatened Scripps's murrelet within an area that we as American's set aside for future generations – Channel Islands National Park and Channel Islands National Marine Sanctuary.

Sincerely,

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