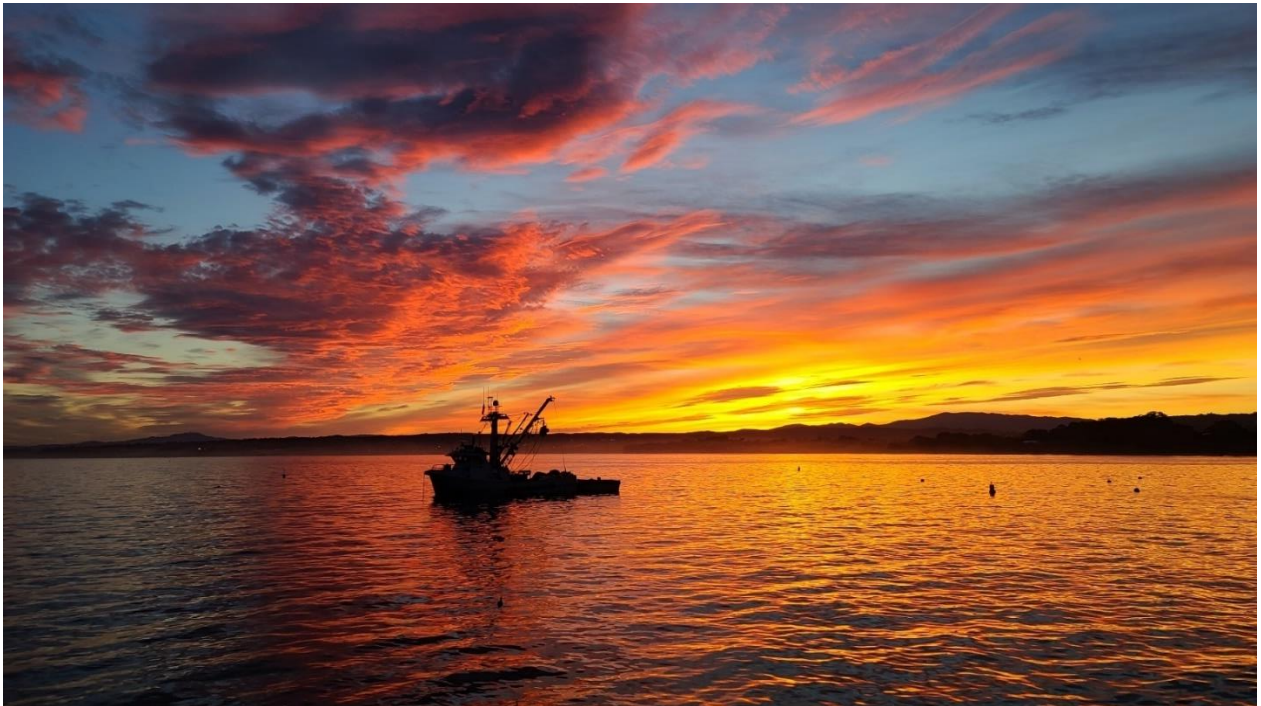


Squid Fishery Advisory Committee Review of California Market Squid Fishery Management and Proposed Recommendations

California Department of Fish and Wildlife



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

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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.

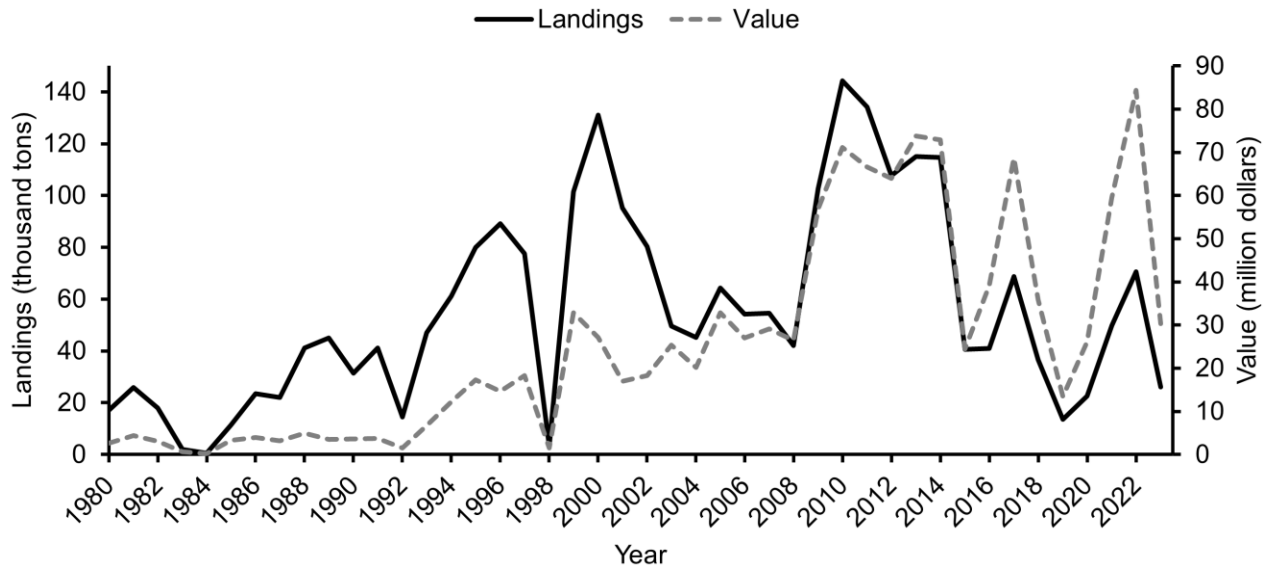


Figure 1. Market squid fishery landings (thousand tons) and value (million dollars) by calendar year from 1980 to 2022.

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).

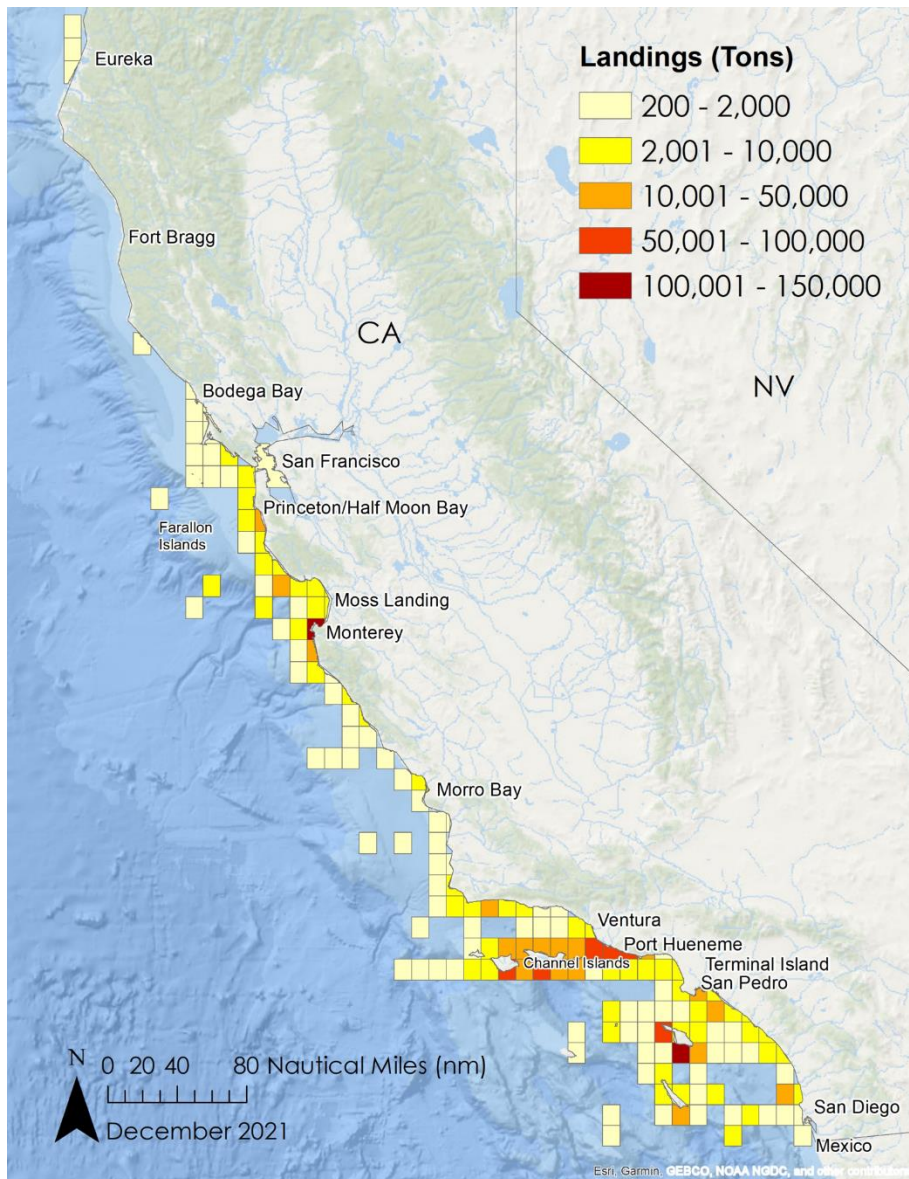


Figure 2. Market squid fishery landings (tons) summarized as a heat map by CDFW fishing block from 2005 to 2021.

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-fix. 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).

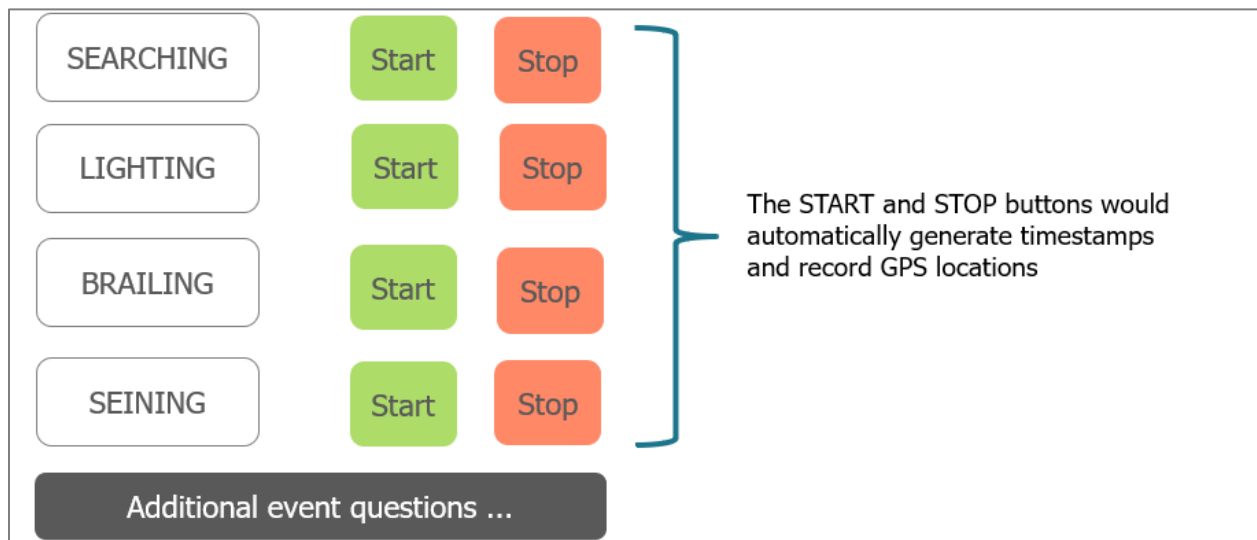


Figure 3. Example of a potential electronic log form with start and stop buttons for various fishing events. Mock-up designed by Kate Wing.

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.

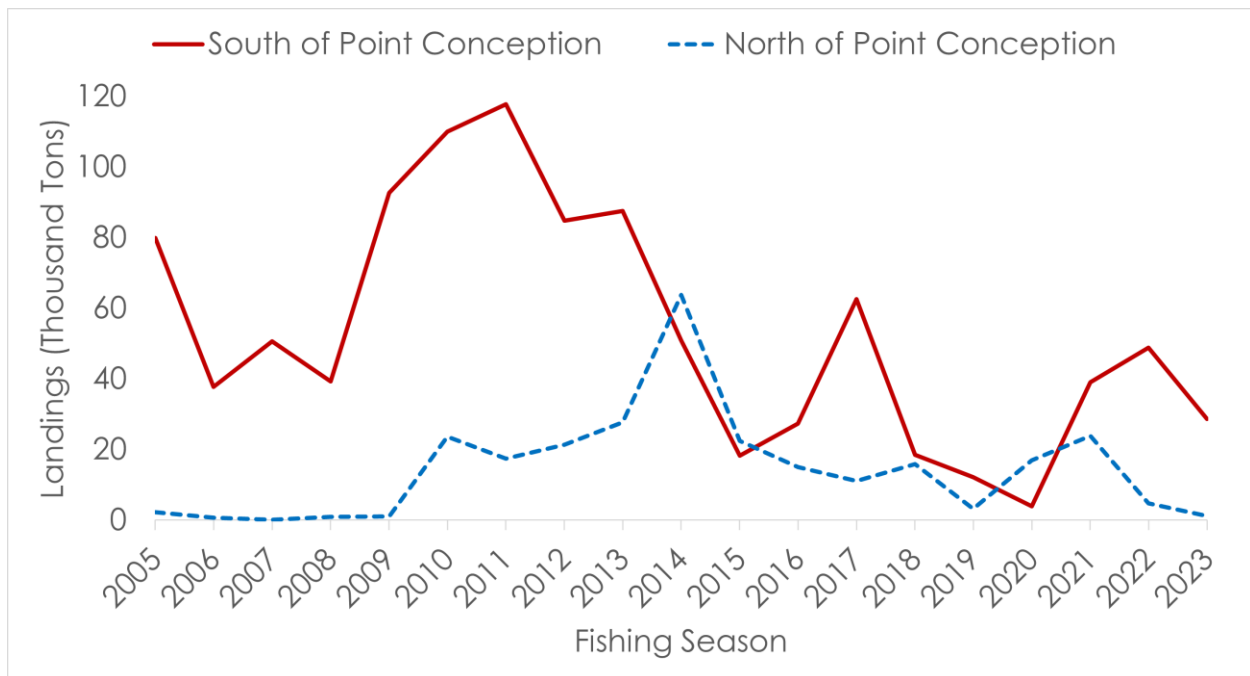


Figure 4. Market squid fishery landings (thousand tons) by regions south and north of Point Conception and fishing season (April 1 to March 31 of the following year).

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.

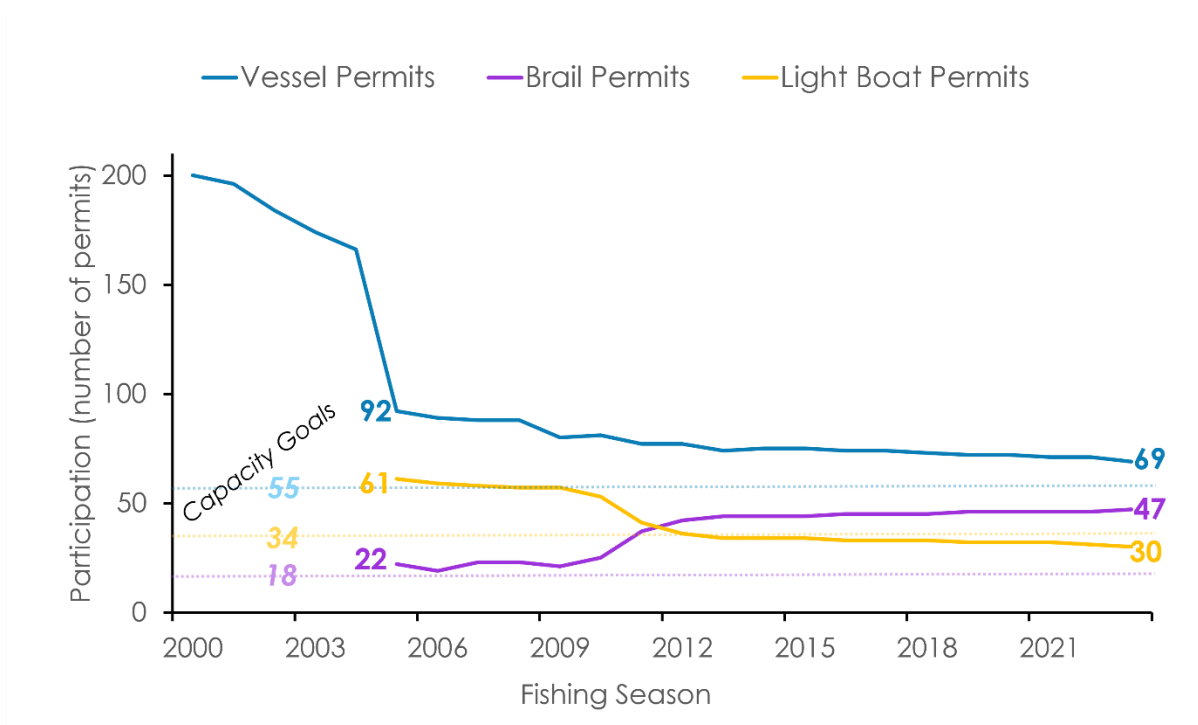


Figure 5. Participation (number of permits) in the commercial market squid restricted access fishery from 2000 to 2023. Capacity goals described in the MSFMP are delineated as dotted lines.

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 pursuing 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.

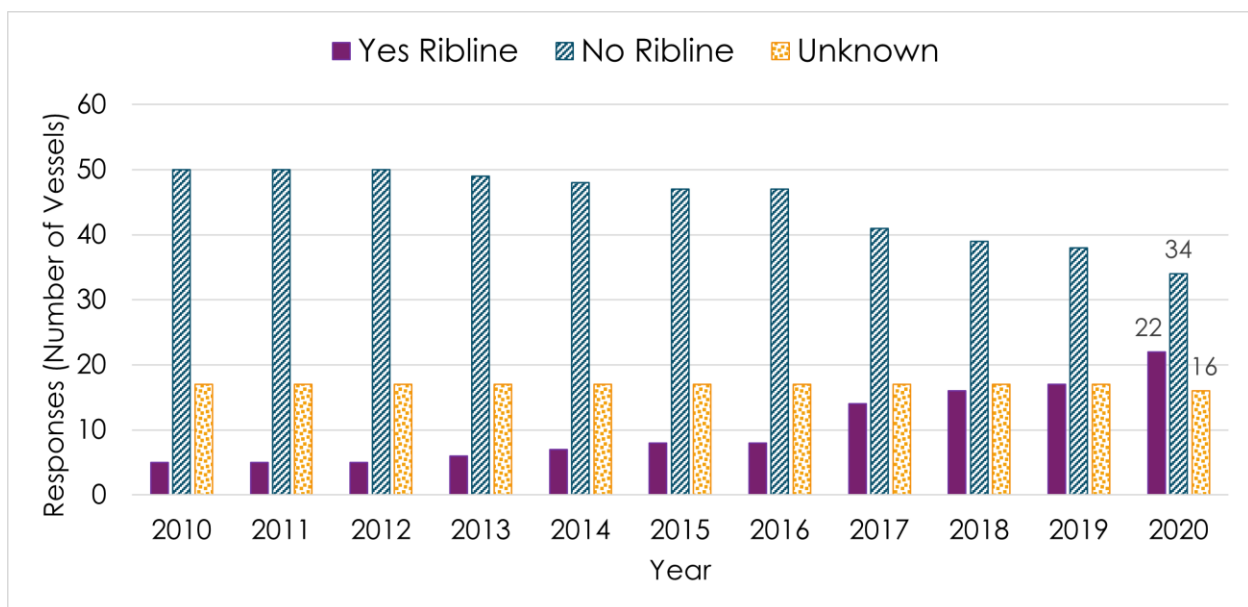


Figure 6. The results of a survey conducted by the Department in 2020. Responses from vessel operators, described by year as yes to using a ribline, no ribline, or unknown if the operator could not be reached.

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 _____

Attracting Lights Used:

Vessel ID Number _____

Type: _____ Light Generated: _____ Number: _____

Vessel Characteristics:

Vessel Permit Number _____

_____ W L (circle one) _____

Boat Length (ft) _____

Captain's Name _____

_____ W L (circle one) _____

Hold Capacity (st) _____

Captain's ID Number _____

_____ W L (circle one) _____

Gross Tonnage _____

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

Electronics Used:

Horsepower:

Net Depth (fm) _____

Side-scan Sonar: Yes No (circle one)

Main Engine _____

Net Length (fm) _____

Fathometer: Yes No (circle one)

Generator _____

Mesh Size (in) _____

Other: _____

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 |
|------|-----------|------|-----------|
| | | | |
| | | | |
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| | | | |
| | | | |

Captain's Signature _____ Date _____

Certified under penalty of perjury as true and correct



Market Squid Light/Braile Boat Profile

Vessel Name: _____

Vessel ID Number: _____

Light or Braile 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 fishing trail/beer) | 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) | |
|------------|------|---------------------------------------|--|-----------------------|--|-----------------------|-----------|--|----------|----------------------|--------------------------------|--------------------------------|---|----------|-----------------|--------------------|--|
| | | | Start | End | Latitude | | Longitude | | | | | | | Species | Amount (lbs) | | |
| | | | Degree Ex. 34° | Minutes Ex. 05.15' | Degree Ex. 120° | Minutes Ex. 04.85' | | | | | | | | | | | |
| 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

Vessel Name: _____

Light or Brail Boat Permit Number: _____

Captain's Name: _____

Vessel ID Number: _____

Captain's ID Number: _____

| Date | Location: <small>For brail activity enter latitude and longitude using decimal minutes to hundredths place. Ex. 34° 06.15', 129° 04.85'</small> <small>For light boat activity enter block code or lat/long if block code unknown.</small> | Hours spent: | | Name of Seiner that set squid | Total tons (st) of squid caught by seiner | Estimated porrage (st) remaining after fishing is completed | Were birds present? Y/N | Were mammals present? Y/N | Your vessel's estimated BRAIL catch <small>Leave blank if you are a light boat permittee or a brail boat permittee operating solely as a light boat</small> | | | | | | | | | | | | | | |
|------|--|-------------------------------|----------|-------------------------------|---|---|-------------------------|---------------------------|--|-------------------|------------------------------------|-------------------|----------------------------|----------------|-----|---------|--------------|--|--|--|--|--|--|
| | | Searching (includes day sets) | Lighting | | | | | | Time of trawling: hr:min AM or PM (circle one) | Bottom depth (fm) | Amount sold to Market (short tons) | Landing receipt # | Amount for Live Bait (lbs) | Brail Bycatch: | | | | | | | | | |
| | | | | | | | | | | | | | | Start | End | Species | Amount (lbs) | | | | | | |
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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: _____
Certified under penalty of perjury as true and correct

Date: _____

APPENDIX II

Best Practices for Market Squid Fishing

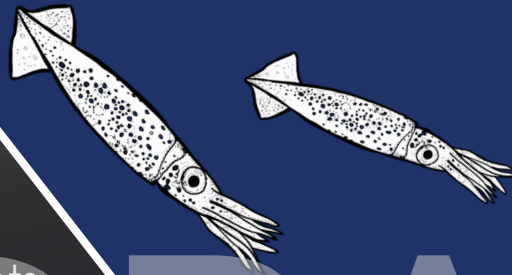


ILLUMINATE only downward facing lights

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

DRAFT



Sea Bird Avoidance Tips

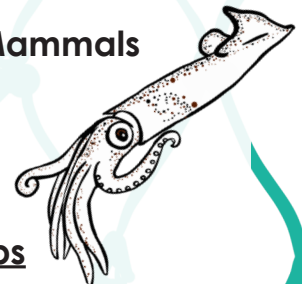
<https://www.fisheries.noaa.gov/national/resources-fishing/seabird-protection-and-avoidance-tips>



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/>



Squid Fishery Best Practices References

Marangoni, L. F. B., Davies, T., Smyth, T., Rodríguez, A., Hamann, M., Duarte, C., Pendoley, K., Berge, J., Maggi, E., & Levy, O. (2022). Impacts of artificial light at night in marine ecosystems-A review. *Global change biology*, 28(18), 5346–5367. <https://doi.org/10.1111/gcb.16264>

Montevecchi, W. A. (2006). Influences of Artificial Light on Marine Birds. T. Longcore & C. Rich (Eds.), *Ecological Consequences of Artificial Night Lighting* (pp. 94–113). Chapter 5, Island Press.

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