Squid Fishery Advisory Committee Meeting 2
April 18, 2023, 10am-3pm

NOAA Southwest Fisheries Science Center
110 McAllister Way., Santa Cruz, CA 95060

KEY OUTCOMES MEMORANDUM

OVERVIEW

The Squid Fishery Advisory Committee (SFAC or Committee) held its second meeting on April 18, 2023 at the NOAA Southwest Fisheries Science Center in Santa Cruz, CA. The goals of the meeting were to:

- Review the context of market squid fishery management in California;
- Review and discuss market squid fishery dynamics, with a focus on experience and observations since FMP implementation; and
- Review and discuss Empirical Dynamic Modeling (EDM), data analysis and preliminary forecasting results, and potential harvest strategies to forecast

PARTICIPANTS

The following SFAC members attended: Anna Weinstein, Anthony Vuoso, Brian Susi-Blair, Corbin Hanson, Dan Yoakum, David Crabbe, Greg Helms, Joe Cappuccio, Joe Villareal, John Barry, Ken Bates, Mark Fina, Porter McHenry, Richie Ashley, Ryan Augello, Tom Noto, Russell Galipeau. Caitlin Allen Akselrud and Ken Towsley were absent.

Katie Grady, Briana Brady, John Ugoretz, Dianna Porzio, Julia Coates, Chelsea Protasio and Trung Nguyen with the CDFW convening team participated. Scott McCreary and Debbie Schechter with CONCUR served as neutral facilitators. Stephan Munch and Lucas Medeiros with UC Santa Cruz (UCSC) and the National Oceanic and Atmospheric Administration (NOAA) participated as scientific support. Lt. Kevin Hare of CDFW participated as a law enforcement representative.

MEETING MATERIALS

Materials provided for the meeting included:

- SFAC Meeting 2 Agenda
- SFAC Meeting 2 Outline

KEY OUTCOMES

Below is a summary of the main topics and issues discussed during the SFAC meeting. This summary provides an overview of the main topics, primary points and options raised in discussions, and next steps.

1. Welcome, Introductions, Agenda Review, Schedule Review

Katie Grady welcomed SFAC members and reminded them of their charge to review and advise CDFW on market squid management. She emphasized that the goal of the effort is to share collective knowledge and experience and learn together. The focus for this meeting was to provide the management context for market squid, review fishery dynamics and hear about experience since the FMP implementation, review EDM and preliminary forecasting results and identify what should be forecasted in the future. CONCUR facilitators Scott McCreary and Debbie Schechter reviewed the agenda and reminded the SFAC of some of the ground rules focusing on their role to communicate with their constituencies, generate ideas and give advice. CDFW staff, scientists and SFAC members introduced themselves. Katie shared the schedule of SFAC meeting dates and topics.

2. Review the Marine Life Management Act (MLMA) Master Plan, the Market Squid Enhanced Status Report (ESR), and Fishery Effort Controls as Guided by the Market Squid Fishery Management Plan (FMP) (CDFW)

Katie reviewed state fishery management and summarized the FMP and the ESR, noting that market squid is also managed under the federal Coastal Pelagic Species (CPS) FMP. Fishery management in the state is regulated under the California Marine Life Management Act (MLMA), which requires the development of a Master Plan to guide implementation of fishery management. The Master Plan was updated in 2018 and required an Enhanced Status Report. The Market Squid FMP was finalized in 2005.

FMP goals are to:

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 SFAC process shares these goals and is focused on evaluating what has changed since the FMP and identifying potential opportunities for improving management to ensure the fishery continues to be sustainable.

Katie reviewed the Harvest Control Rules (HCR) in the FMP that regulate catch and effort:

- Seasonal catch limit of 118,000 tons: This is a proxy for Maximum Sustainable Yield (MSY) based on historical catch.
- Restricted access permit program: Entry is based on historical fishing activities and is intended to provide for a "moderately productive and specialized fleet." Since 2000, seine and lightboat permits are declining while brail permits have doubled (though brail boats are primarily acting as lightboats).
- Weekend closure: From noon Friday to noon Sunday. Research shows the weekend closure is effective for allowing periods of uninterrupted spawning. Egg escapement target is 30% for optimum yield. The closure also minimizes recreational conflicts on weekends.
- Lighting restrictions

In response to a question, Katie explained that the ESR is intended to capture new research, provide a status update on the fishery (landings, permits, observations, etc.) and identify future management needs and priorities.

A few SFAC members asked about egg escapement and the graph that was shown. Agency staff explained that egg escapement means the percentage of eggs that escape prior to harvest. There is an assumed inverse relationship between egg escapement and fishing mortality that represents the fraction of squid that are removed per day.

The following comments were provided by SFAC members. CDFW responses are indicated below in italics:

- Closed areas should be considered effort controls: *Closed areas are important and should be considered in reviewing the FMP.*
- How to address open access/changes in access: *Results from the modeling may inform this discussion and effort impacts on the squid population. This topic will be addressed in a future meeting.*
- Squid populations are variable due to environmental influences: *Environmental drivers will be built into the EDM model (e.g., temperature increases, rainfall).*
- Permits don't necessarily indicate that people are fishing—how is this accounted for? *CDFW staff will be looking at different metrics such as number of vessels and number of permits that are being used and will consider these metrics in calculating effort.*

3. SFAC Review of Fishing Effort Dynamics

Katie reviewed the data sets that are available to use with EDM, which include fishery dependent data (landings, logbook records, and biological sampling) and fishery-independent data that measure squid directly or indirectly and reflect environmental conditions. Katie briefly reviewed these data (see powerpoint). Logbook templates can be provided to SFAC members in the future for discussion during the summer.

Katie explained that CDFW would like to hear about SFAC members' experiences and observations regarding fishing effort dynamics such as regional differences in fishing activity, fishing site consistency, economic impacts/market dynamics, infrastructure/processing and product quality, use of lightboats, and safety at sea/site crowding.

SFAC members provided the following input regarding fishing dynamics:

- Block level data prior to adoption of the FMP is not accurate. It became more accurate with the switch to logbooks. In particular, fish block data above Pt. Arena is inaccurate. Distinctions in effort data between north and south are likely to be accurate.
- Effort is not constrained by squid biomass but rather is impacted by a number of economic/market factors:
    - Trade wars impact the volume of squid that can be sold: there were four months of little effort this year due to tariffs and market price declines.
    - Processing capacity is constrained and has been reduced due to recent labor shortages and opportunities for workers to earn higher pay in other jobs. This limits what is caught and sold.
    - Freight costs are high and in some cases equal the value of the product (anchovies).
    - Lack of cold storage constrains what can be caught.
    - Market demand must be accounted for to get a sense of how landings have changed.
- Bad weather this year impacted effort.
- In San Pedro, there were squid landings every month in some years but typically the most landings are November through February.
- Squid fishing effort is increasing because fishers can't pursue mackerel or tuna
- Squid is often mixed with other species (e.g., sardine and mackerel) and cannot be harvested because of incidental catch limits on those other species.

- Marine reserves and protected areas have reinforced sustainability and squid spawn in these areas. Impact of these areas should be accounted for in the modeling.
- Consider how to evaluate and reflect in the model the impact of daytime fishing in Monterey Bay, particularly setting of nets in deeper water that may intercept squid before they enter egg beds.
- Record and use bottom temperature data and temperature at depth, especially in Southern California, which is a deeper water fishery.
- The fishery has a derby quality in Monterey when it opens at noon, posing safety concerns.

4. Empirical Dynamic Modeling

Katie Grady explained that CDFW wants to use EDM for forecasting to predict future yield, look at the relationship between catch and effort, and test performance of potential regulatory mechanisms. EDM is meant as a tool to examine management options and see what impact they have on squid abundance.

Lucas Medeiros of UCSC/NOAA provided a review of EDM and how it can be used to forecast future yield and test management scenarios. In summary, squid abundance changes as a function of many variables. EDM methods learn from past data about what might happen in the future and uses time lags to predict the future state of variables. EDM has been used to forecast abundance of a number of marine species including shrimp in the Gulf of Mexico, blue crab in the Atlantic and other short-lived marine species. In response to a question about the effectiveness of EDM, Steve responded that EDM performed three to four times better than typical fishery assessment models, especially for short-lived species.

Lucas invited SFAC members to share their ideas of what factors should be considered in devising EDM models to evaluate future yield. SFAC members provided the following comments and questions regarding the use of EDM (responses from CDFW and scientists are indicated in italics):

- Would like to see EDM incorporate economic/market data
- Look at temperature at depth
- Is there an ideal temp for squid spawning? *There is no assumed relationship. We are asking the data to tell us those relationships.*
- Have you looked at Fishery independent data? *The scientists have not yet analyzed that. This data has gaps and is only collected once a year. It could potentially be grouped into 6-month periods for north and south.*

- Consider looking at whether prior landings from the south influence landings from the north.
- Effort does not seem to be a factor in determining the biomass. If there are squid, we make an effort. *We need a way of separating what we do from what the squid are doing. Other than hours spent fishing, what is a proxy for how hard it is to catch squid? Looking for fishery dependent things.*
- For this to be successful, you need an accurate model that is developed collaboratively and accepted by the fishermen.
- Squid as a food resource for predators has not been addressed.
- Consider the status quo as a management option.

5. Preliminary Data Exploration and Forecasting Results Using EDM

Data Analysis: Lucas analyzed available data from logbooks (catch, set times, searching times, lighting times), landings (landings, number of fishing vessels), dockside sampling (mantle condition, gonad weight) and satellites (sea surface temperature) and presented some findings including correlations among variables (see PowerPoint for details):

- Catch is typically higher earlier in the week.
- Catch is highly correlated with hours fishing/set times.
- There is a correlation of catch with hours searching or hours lighting, but the relationship is not as tightly correlated as hours fishing/set times.
- Catch estimates from logbooks and landings from landings dataset are highly correlated.
- Number of vessels is highly correlated with landings.
- There is a relative lack of biological data in the north compared to the south; one option would be to pool data in larger time periods (e.g., 6 months) .
- There is higher SST and more variability in temperature in the south vs. the north.

EDM Forecasting: Lucas explained that the overarching goal of using EDM is to achieve sustainability and optimum yield for market squid under a changing climate. The goals of forecasting with EDM are to (1) Provide accurate forecasts of different variables from the market squid fishery and (2) build a data-driven modeling framework to evaluate future yield.

Lucas forecasted future catch (landings) based on past landings and SST data for the north and the south and compared these with actual landings data. The model predicted a range of landings. Twelve out of 15 actual landings in the north and 11 out of 15 in the south were within the predicted range. Lucas'

model also forecasted landings for Q2 of 2023. Forecasts using EDM were 46% better than using the historical average in the north and 62% better in the south.

Lucas explained that there are nine different time series variables that can be combined and integrated into the EDM model to predict catch. Most of the best models have the variable of hours lighting or hours searching as an input. EDM can be used to predict abundance. The next step is to evaluate whether if we fix effort (via management strategies), can we predict abundance? If we change effort, can we see what happens with abundance and catch? This will enable us to infer MSY.

6. Potential Harvest Strategies to Evaluate

SFAC members were asked to provide input on harvest strategies to evaluate using EDM. The following ideas were shared:

- Leaving the harbor: this indicates a belief that squid are there
- Number of days not fished
- How track and reflect market demand
- Distance from port? Probably not valuable—could be many reasons for this
- Compare first quarter to first quarter instead of sequential quarters
- Look at fishery independent biological variables like temperature
- Number of sets: might be a useful indication of the number of squid out there; could get what you need in just one set
- Tabulate daily landing tickets divided by number of tons caught per day

Katie Grady requested that SFAC members continue to think about harvest strategies to evaluate and to send any additional ideas to CDFW well in advance of the next meeting.

7. Public Comment:

A couple of members of the public expressed concern that CDFW may be advancing the model in support of have a "hidden regulatory agenda" and noted that the use of inaccurate models has shut down some fisheries. They stated that fishery self-regulates and is healthy and can be well managed by the fishermen. CDFW staff acknowledged that it is unlikely the SFAC process will result in no regulatory changes. In response to petitions and because of squid's unique life history, the intent is to have informed discussions about how to ensure continued sustainability of the fishery.

SUMMARY, NEXT MEETING, NEXT STEPS

CDFW staff expressed appreciation for the candid feedback provided by SFAC members and the public and emphasized that CDFW has no agenda. Squid are short-lived and very responsive to the environment; thus they require different approaches than other fisheries. CDFW is interested in looking at options for evaluating management to make sure that the fishery remains sustainable and would like to learn from the SFAC members.

The next SFAC meeting will be held via Zoom on May 16 and will be a continuation of the discussion of effectiveness of effort controls.

Based on the Convening Team's deliberations, the following next steps were identified:

SFAC Members:

- Provide any additional ideas for harvest control strategies to consider in EDM modeling, in preparation for the next meeting.
- Review draft meeting summary when it is distributed and propose bounded edits to address key misstatements or omissions.

Facilitation Team/Conveners:

- Prepare and distribute draft meeting summary for review by SFAC members.
- Share meeting materials and presentations.

For questions regarding this meeting summary, please contact: sfac@wildlife.ca.gov