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Sustaining California's Catch: Insights for the new Experimental Fishing Permit (EFP) Program

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Sustaining California's Catch: Insights for the new Experimental Fishing Permit (EFP) Program

Final Capstone Report
June 2020

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Photo by: Chrissy Villianos

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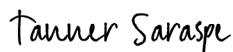


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EXECUTIVE SUMMARY

As ocean conditions continue to be altered by climate change, California's fishing industry and fisheries management must adapt and find new ways of progressing into the future. California's waters support valuable economic resources for both food security and job stability. Because of this, new state fishing regulations seek to provide opportunities to both the fishing industry and fisheries managers while protecting the future of these valuable marine resources. Assembly Bill 1573, the California Fisheries Innovation Act of 2018, set standards for creating a formalized and expansive Experimental Fishing Permit (EFP) Program that would promote collaborative research in exploring emerging or underutilized fisheries and testing new or modified fishing gear types through conservation engineering across both the recreational and commercial fishing industry sectors. The new California EFP Program, expected to begin in 2021, stands to have great success in fostering fisheries collaboration, sustainability, scientific research, and more adaptive fisheries management strategies. However, there are regulatory hurdles, prohibitive costs, and barriers to collaboration that should be addressed before the program begins.

The following Capstone Report provides background research for the new EFP Program by investigating past successful federal Exempted Fishing Permits, the current California box crab EFP, potential future California EFP projects as well as the expected benefits and limitations of the permit program. The intention of this project is to assess state research needs and prepare the EFP Program for successful implementation in 2021. In the concluding section of the report, recommendations are made for the EFP Program procedural guidelines which will be drafted by the California Department of Fish and Wildlife later this year.



Figure 1: Fishermen's Wharf, San Francisco, CA

Photo by: Fabien CAMBI/Flickr

INTRODUCTION

With 3,427 miles of shoreline¹ and the fifth biggest economy in the world², California's waters support valuable marine resources that provide food security and economic stability. The commercial and recreational fishing industry in California generated \$24.9 billion sales in 2016 (Fig. 2) and provided over 140,000 jobs illustrating this industry's importance to the state economy.³ However, the fishing industry and fisheries management are facing new challenges and opportunities as they seek to adapt to changing environmental, regulatory, and economic conditions.

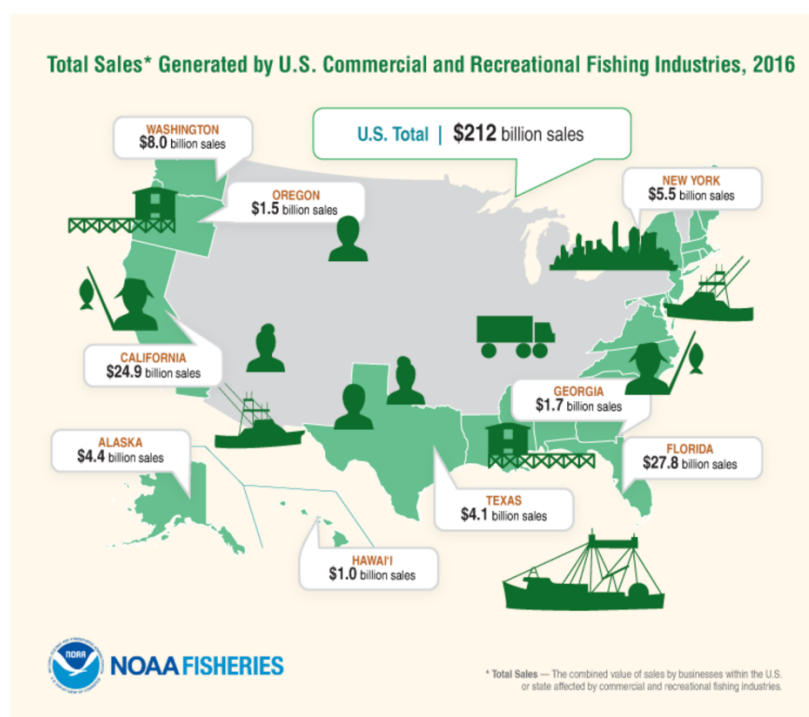


Figure 2: Total sales generated by U.S. commercial and recreational fishing industries

For example, fisheries are being impacted by carbon dioxide (CO₂) that is being released into the atmosphere globally at increasing rates from human uses such as fossil fuel and other activities. CO₂ that is absorbed by the ocean raises water temperatures, reduces the amount of dissolved oxygen, and leads to ocean acidification.⁴ The Intergovernmental Panel on Climate Change (IPCC) reported in 2013 that the ocean “had absorbed more than 93% of the excess heat from greenhouse gas emissions since the 1970s.”⁵ Additionally, sea surface temperature data from the summer of 2019 indicated an oceanographic warming event on the West Coast, similar to the marine heatwave, “the Blob,” that occurred in 2013-2015 causing devastating impacts to fisheries,⁶ particularly to the Dungeness crab industry in California. Deoxygenation and increased temperatures have also resulted in marine species migration northward towards cooler waters.⁷ These geographic distribution shifts could have alarming impacts on California's fisheries. Alternatively, these shifts could provide opportunities for fishermen to target new species as some fisheries have expanded their ranges because of climate change as seen by the California market squid.⁸

COVID-19 has also added a new element of uncertainty for fishing communities in California. Closed processors and restaurants in addition to reductions in other markets, have affected profits and supply chains worldwide. Dungeness crab prices fell from \$6-7 per pound to less than \$3 per pound⁹ and

California spiny lobster prices dropped from almost \$40 a lobster to as low as \$17 per lobster.¹⁰ This has left fishermen without viable economic options as they are limited to certain fisheries per mandated regulations. Socially distancing instructions have also further complicated fishing operations forcing some fishermen to shut down temporarily because they cannot have another person on board to help them. Depending on the fishery, some fishermen require deckhands to operate safely and/or observers to collect mandated scientific data. However, those still fishing, have shifted to more direct marketing business models which have opened the doors to “rebuild the local food system and shift dependency off imports.”¹¹ Previously, California exported roughly 90% of their seafood,¹² but with the current situation requiring fishermen to sell more directly and locally, there have been increases in local demand, keeping this valued resource close to our home waters and hopefully, for the long-term.

The ability of the fishing industry and fisheries management to adapt to climate change effects is further restricted by complex federal and state regulations. These regulations mandate gear types, species, and locations of fisheries in California and across the nation. Limited, expensive permits and strict regulatory requirements only add to the complexity and further affect small-scale fishing operations and newcomers to the industry. Fishermen become highly specialized because of this, weakening their ability to adjust to new opportunities making them more vulnerable to changing conditions.¹³

In light of the many changes occurring in fisheries, it has become apparent that steps are needed to ensure the future of California’s fishing communities. The United Nations Sustainable Development Goal 14 aims to protect viable ocean resources while allowing for sustainable growth in our world’s fisheries.¹⁴ Giving fishermen new options or ways to fish in addition to adopting more adaptive fisheries management strategies, will only ensure resiliency in the midst of climate change. California’s new Experimental Fishing Permit (EFP) Program provides a timely opportunity for fishermen to innovate by targeting underutilized fish and invertebrate species as well as exploring other sustainable fishing methods in state waters.

BACKGROUND AND SCOPE

With support from The Nature Conservancy, Assembly Bill 1573 (AB 1573), also known as the California Fisheries Innovation Act of 2018, was signed into law in the fall of 2018 which repealed the state’s experimental gear permit (EGP).¹⁵ Under Fish and Game Code (FGC) 8606, EGPs allowed for experimentation outside of normal fishing regulations with novel fishing gear, modified existing fishing gear, and new fisheries as a means to provide fishermen with opportunities while also collecting data for fisheries management. Although well intended, the EGP provision was underutilized and restricted to commercial fishing use only. Additionally, there were no clear guidelines and definitions.

The new statute, effective January 1, 2019, replaced FGC Section 8606 with FGC Section 1022 which set standards for creating a formalized state-led Experimental Fishing Permit (EFP) Program that will be expansive enough to cover the needs of various stakeholders, including recreational fishing activities.¹⁶ The goal of the new program promotes sustainable fishing through the innovation of not only different fishing gear types and methods, but also exploratory fisheries, and collaboration amongst scientists and both commercial and recreational fishermen.¹⁷ Federal Exempted Fishing Permits, implemented in 1996 under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), provide a useful model for the new EFP program in advancing research that has the potential to benefit fisheries and the environment.¹⁸ These federal permits allow for experimentation in “data collection, exploratory fishing, conservation engineering, health and safety surveys, environmental cleanup, or hazard removal.”¹⁹

The California EFP Program is a joint effort by the California Department of Fish and Wildlife (Department) and the California Fish and Game Commission (Commission). The Commission will be the approving body of the permits, while the Department will issue and manage the permits. The Department and the Commission have taken a phased approach to developing the EFP program. The first phase (Phase 1), effective March 2020, produced a process for the continuation of the box crab experimental gear permit as an EFP project (Section 90, Title 14, CCR).²⁰ The second phase (Phase II), currently in motion, is the development of a comprehensive EFP program which includes a variety of different activities. Pursuant to FGC Section 1022, activities approved under the EFP program must be in compliance with policies under the California's Marine Life Management Act (MLMA) and applicable management plans. It is anticipated that the proposed regulations for Phase II will be adopted by the Commission in December 2019 and implemented by 2021.

PRIMARY OBJECTIVES

This Capstone Project serves as a research report to be delivered to the Department to help inform the development of the EFP program procedural guidelines later this year, as well as assess some of the current EFP ideas and research needs across California. The procedural guidelines will serve as the "user manual" for interested EFP applicants, helping them better navigate through the program and application process. Additionally, they will help ensure consistent review, approval, and issuance procedures for the Department and the Commission. The outcome of this Capstone Report could also serve as a useful framework to help other states develop similar programs by aligning the fishing industry with scientific and state interests.

RESEARCH QUESTIONS

The following are some of the research questions answered in this Capstone Report.

- What projects are stakeholders envisioning?
- What are some of the research needs that EFPs could address?
- What are the potential benefits and limitations of this program for the fishing industry and fisheries management?
- What guidelines are needed to maximize the usefulness of the EFP program?

METHODOLOGY

Informal Interviews

Informal, open ended interviews were conducted over the phone or video conference during the months of April and May 2020 with twenty-eight recreational and commercial fishermen and thirty-one scientists from California NGOs and nonprofits, universities, state agencies, NOAA's Northwest Fishery Science Center, and Alaskan fishing industry organizations. Responses were transcribed and synthesized. Topics concerning potential EFP projects (emerging fisheries, gear innovations, or other new methods of fishing), research needs and priorities, participation in the new EFP program, and suggestions for application guidelines and process implementation were discussed.

Online Research

An online search was conducted on current state and/or federal fishing regulations; fisheries information and data; federal Exempted Fishing Permit guidelines and projects; news articles; scientific research literature; and information on marine fish and invertebrate species.

RESULTS AND DISCUSSION

FEDERAL EXEMPTED FISHING PERMITS

Regions throughout the United States have issued federal Exempted Fishing Permits for fishing activities outside of federal regulations for projects benefitting both the environment and fisheries. Some of the projects include testing salmon excluder devices in the Alaska region, deep-set buoy gear in the swordfish fishery to reduce sea turtle and marine mammal bycatch in California, and offshore longleader gear to target midwater fish species in Oregon's recreational rockfish fishery. Currently, Exempted Fishing Permits are issued and managed by the National Marine Fisheries Services (NMFS) within the National Oceanic and Atmospheric Administration (NOAA) with recommendations from the Pacific Fishery Management Council (PFMC). While AB 1573 points to the federal program as a model for the state EFP program, the process for submittal, review, and timelines must adhere to the California Administrative Procedure Act.

The following subsections summarize two recent and successful federal Exempted Fishing Permits along the West Coast.

Deep-set buoy gear in California

On the West Coast, the majority of swordfish is harvested by the Drift Gillnet (DGN) fishery. However, encounters with marine mammals, sea turtles, and other nontarget species were occurring within the fishery raising environmental concerns. The East Coast also saw similar problems and in 2001, pelagic longline fishing gear was banned in the swordfish fishery.²¹ As an alternative to longlining, swordfish shallow-set buoy gear was first tested in Florida in the 2003.²² This type of fishing gear contains a buoy configuration that signals when catch is on the line, allowing fishermen to act quickly in retrieving their catch and releasing any nontarget species.

Over the past decade, the California swordfish DGN fishery has seen reduced numbers of participants effecting fishing communities, while leaving swordfish underutilized.²³ To offset these factors, deep-set buoy gear (DSBG) was developed and tested by the Pflieger Institute of Environmental Research (PIER) off California's waters in 2010 to 2014 (Fig. 3).²⁴ The DSBG used in California was modified from the shallow-set buoy gear utilized in Florida and from the vertical long-line gear used in the South Pacific. It consists of a three-float buoy system along with other specifications.²⁵

In 2015, a federal Exempted Fishing Permit was issued to PIER for DSBG testing within the California commercial fishing industry. Participants of the PIER-DSBG Exempted Fishing Permit were selected based on availability during the swordfish season (July-December), their experience, current possession of a swordfish permit, violation history, as well as their willingness to cooperate, commit to participating for the duration of the study, and comply with observer coverage expectations.²⁶ To conduct this testing properly and successful, Chukey Sepulveda, the principal investigator at PIER, required vessel captains to check in with the Department, PIER, and NMFS on all gear deployments and returns. Additionally, daily catch reports, vessel log sheets and landings recordings were completed. This third-party management

system allowed for a more organized approach in collecting the necessary scientific data which supported the approval and designation of a limited entry DSBG fishery by the PFMC in September 2019.²⁷



Figure 3: Deep-set buoy gear testing in the swordfish fishery off California **Photo by:** Ralph Pace

Longleader gear in Oregon

The West Coast groundfish fishery was declared collapsed by NOAA in 2000 and thousands of square miles of area closures followed in 2002, banning the take of groundfish.²⁸ Similar closures also affected the sport fishing industry in Oregon, which generates more than \$14 million a year,²⁹ with limits set to shallow depths during peak summer months in 2004.³⁰ However, in 2008, Wayne Butler and John Holloway, both sport fishermen in Oregon, looked to alternative methods for targeting healthy populations of suspended rockfish, putting less pressure on nearshore reefs. Holloway came up with the idea of using longleader gear to target yellowtail rockfish, widow rockfish, and canary rockfish while avoiding yelloweye rockfish and other catch prohibited at the time.³¹

To explore the potential of longleader gear, a type of hook and line fishing, Holloway applied for a federal Exempted Fishing Permit that would allow testing outside the 40-fathom curve using 30-foot drop sinks. This ensured that only species higher in the water column would be targeted rather than bottom-dwelling, rebuilding species like yelloweye. After almost two years of petitioning the PFMC, a federal Exempted Fishing Permit was approved for yellowtail rockfish using longleader gear in 2009.³² Over the course of the permit, 30 charter boat trips were completed with 6 metric tons of rockfish caught and only 2 yelloweye. Data collection, analysis, and observer coverage was funded by the Oregon Department of Fish and Wildlife (ODFW). John Holloway designed the experiment and managed the permit with participating charter vessels and the U.S. Coast Guard and ODFW for enforcement.³³ Per John Holloway, having the support of ODFW ensured the success of this project but, policy constraints and lagging approval timeframes inhibited the progress of the federal Exempted Fishing Permit.

After 10 years of pushing for regulations and implementation, Holloway's idea for a recreational longleader gear fishery off the coast of Oregon was approved by NOAA and the PFMC in 2018.³⁴ Since its implementation, this new fishery has had very little bycatch and has benefited the coastal economy by

providing charter vessels with an alternative to salmon fishing in low harvest years. This gear type was also presented to both Washington and Oregon as an option for mitigating near-shore fishing pressure, but was denied. Despite this, “longleader gear could serve as a future potential safety valve and allow for the spread of effort within the sport fishing industry.”³⁵ Following the success of the recreational longleader gear, a federal Exempted Fishing Permit was approved for commercial midwater hook-and-line rockfish in rockfish conservation areas off the Oregon this past November by the PFM. The permit is awaiting public review and final action in summer 2020.³⁶

CALIFORNIA EXPERIMENTAL FISHING PERMITS (EFPs)

The following section describes the current state-led box crab experimental fishing permit.

Box crab EFP

Prior to 2018’s California’s Fisheries Innovation Act, EGPs authorized commercial fishermen to test new or modified gear types and experiment with new fisheries outside of mandated regulations. Once this statute took effect in 2019, it repealed the previous permit regulations, making way for the new EFP program. However, prior to the repeal of FGC Section 8606, the Commission approved EGPs for a collaborative fisheries research program on box crab (Fig. 4) within California waters.³⁷ The box crab EGP was the combined result of increased landings of box crab in California in 2014 and inquiries for box crab gear permits beginning in 2017.³⁸ Box crab was also identified as an underutilized fishery species in 1983 when Oregon fishermen were looking for fishery alternatives during El Niño conditions³⁹ and although box crab was seldom marketed in California until recently, these factors influenced discussions between the Department and Commission to propose a new fishery.



Figure 4: Box crab at Tuna Harbor Dockside Market in San Diego, CA

Source: San Diego City Official Blog

In early 2018, the Commission approved 8 EGPs to fish for box crab (3 permits north of Point Conception and 5 south of Point Conception) valid for 1 year from April 1, 2019 and may be renewed annually for a total project span of 4 years.⁴⁰ Persons interested in participating in the box crab program completed a questionnaire about their experience, prior fishing violations, current trap fishery permit(s), and agreement to the terms and conditions set forth by the Commission. For those approved, they entered

into a lottery for the 8 permits.⁴¹ If any permit holder subsequently declined to participate in the box crab project, the permit would then be offered to the next person on the list, based off the initial lottery draw. Effective March 24, 2020, Phase I of the new EFP program development created a process for the continuation of the box crab EGP as an EFP.

Utilizing trap gear, current box crab EFP holders are authorized to harvest up to 36,000 pounds of box crab a year to be weighed and recorded on landings receipts and logbooks. Box crab can be fished using rock crab or Dungeness crab fishing gear, but must meet certain mandated requirements such as service intervals no more than 96 hours (standard for trap fisheries) and other special conditions approved by the Commission.⁴² Being an exploratory fishery, a lot of research and data collection is required to assess the species biology, population status, and ecological impacts of a potential box crab fishery, and as such, the Department included a mandate requiring permit holders to collaborate with data collection. The Department is working with fishermen on documenting catch characteristics, including sizes of crab caught and retained, bycatch, and population status. Data on essential fishery information such as growth, reproduction, maturation and movements of box crab are being collected by California Sea Grant in collaboration with fishermen (e.g. fishing/trap surveys) and scientists at the Department (e.g. tag-recapture). In order to meet requirements of the EFP, human observers also board vessels, for a required 10 days during the season, to ensure safety, catch, and U.S. Coast Guard compliance.⁴³

Under this collaborative research partnership, there is also the opportunity to test new management tools such as data collection systems (e.g. electronic monitoring) and bycatch reduction.⁴⁴ The Department is evaluating the use of two electronic monitoring systems that collect information on vessel position, time, and trap location as well as target and bycatch species. One system contains camera units which turn on during hydraulic use, usually indicative of gear retrieval, while the other system uses electronic trap tags and a handheld logger.⁴⁵

Fishermen in the first year of the program were required to pay a EGP fee of \$4,487.75, which is subject to annual adjustments pursuant to Section 699, to participate in the box crab project.⁴⁶ If this experimental fishery becomes a future fishery, there is no admittance guarantee for EFP participants, under subsection 90(c), Title 14, CCR. "If permits are to be issued in a new fishery, it will be under conditions fair to all interested parties."⁴⁷

EFP PROJECT CHARACTERIZATION

The following section describes the results of the informal interviews. The information provided by individual participants has been combined and synthesized by location in California and project type. It includes summaries of potential EFP project ideas that were identified by fishermen alongside supplementary information provided by scientists and online research. Descriptions of project ideas, justifications, and/or potential ecological impacts are also included. It should be noted that these ideas need to be further developed and assessed to determine if an EFP is the best course of action.

This portion of the capstone project is intended to inform EFP research needs and expectations for consideration by the Department. Summary sheets of these potential EFP projects can be found in the *Appendix*.

BY CALIFORNIA REGION



Figure 5: Map of regions where interviewees are located

Map source: ArcGIS Online

(Note: Fishermen and scientists in the Los Angeles area were contacted for this project, but no interviews were conducted.)

Humboldt/Eureka

The Port of Eureka, also known as the Port of Humboldt Bay, is home to an active fleet of a few hundred fishing vessels.⁴⁸ The biggest concerns facing the fishing industry here are options for small-scale fishermen, opportunities for new fishermen trying to enter the industry, more diversification in fishing catch, pending offshore energy development, and lack of proper infrastructure.⁴⁹ As weather conditions rapidly change in Eureka/Humboldt area, pop-up gear in the Dungeness crab fishery was not considered as a potential EFP project at this time.

Small-scale (artisanal) open access Market squid fishery, North of 38°57.5' Lat. (Point Area)

The proposed artisanal market squid fishery EFP would provide small-scale fishermen and young fishermen the opportunity to enter into a fishery with “non-transferable, non-salable state-owned fishing permits”⁵⁰ utilizing more ecologically friendly fishing gear such as minimal airborne illumination, hand and power brails, lampara nets, jigging, as well as eliminating mechanical fish pumps for lower volume squid catch.⁵¹ Allowing this prospective EFP could assist the Department with collecting real-time fishing reports on northern California market squid stocks.⁵² This could be used to test more dynamic management strategies within a smaller fleet or cooperative.⁵³ This fishery proposal was originally introduced in early January 2018, but with the current regulation change this request was denied until the state EFP program is implemented next year.

Currently, through the California Market Squid Fishery Management Plan (FMP), there is a restricted access harvest quota of 118,000 tons.⁵⁴ Market squid is the 5th largest fishery in California with a large portion of the catch exported from the limited entry purse seine permits.⁵⁵ This proposed small-scale EFP fishery would be directed at local specialty markets in the Humboldt/Eureka area. Prior to 2014, the Market Squid FMP allowed for a *de minimis* fishery with a harvest of less than 2 tons. However, this regulatory language was amended, and fishing was no longer permitted without a valid limited entry permit.



Figure 6: California market squid (*Doryteuthis opalescens*) **Photo by:** Brian Skerry

Limited open access spot prawn fishery, North of 40°10' Lat. (Cape Mendocino)

The spot prawn fishery in California currently has 25 participants and operates from Monterey Bay to Southern California, based off permit holder locations.⁵⁶ This is a limited access fishery requiring a permit that allows for a maximum of 300 traps within state waters and is managed by the Department.⁵⁷ As of October 2019, a California Spot Prawn permit (with gear included) is being sold for \$1 million on the open market.⁵⁸

The current spot prawn permits are allocated within a three-tiered system with a maximum of 150 to 500 traps. The proposed EFP for a limited open access spot prawn fishery off the north coast, would be restricted to a small number of fishing vessels and require minimal traps (50-75 traps total) as well as weekly or monthly spot prawn catch limits to minimize adverse impacts to the population. This EFP could provide an opportunity for the State to collect fisheries data about the species population within this region with tools such as at-sea monitoring and digital logbooks while helping inform new management decisions. This would also allow small-scale fishermen in the area to diversify their catch portfolio allowing for fishing pressure to be dispersed across different species. With all West Coast trap fisheries, the risk of whale entanglement with trap lines has increased over the last decade. However, with minimal traps and more real-time monitoring that this EFP project could provide, risk can be minimized while also testing different adaptive management strategies similar to the work currently being done in the Dungeness crab fishing fleet.⁵⁹

Freshwater invasive species fisheries

This proposed EFP would target freshwater invasive species such as striped bass, Chinese mitten crab, and crawdads. Striped bass live in both fresh and saltwater conditions with males reaching maturity in 2-3 years and females in 4-6 years.⁶⁰ There is a current California recreational fishery, managed by the Commission, for striped bass with a daily bag limit of 2 fish, but no commercial fishery exists.⁶¹ Chinese mitten crab, thought to have been introduced by ballast water, ranges from the San Francisco Bay to the Sierra Nevada Foothills. This species is not only a threat to native marine and freshwater species, but they have also caused damage to the commercial fishing industry by damaging nets and catch.⁶² Though targeting an invasive species would have conservation benefits, conflicts could arise in terms of the sustainability of this fishery and meeting long-term fisheries management goals.⁶³ Further research and consultation with the Department would be needed to verify if this would be best suited for an EFP or a state-led removal program.

Trap fishery for flatfish as an alternative to trawl flatfish fishery

This proposed EFP would target flatfish in state waters, such as Pacific sanddabs, utilizing trap gear instead of trawl nets. Development and testing of trap specifications are still in the development stage (i.e. traps and netting made coated steel wire vs. stainless steel). Most West Coast flatfish is harvested by bottom trawling and greater than 95% of the catch remains within the U.S. market.⁶⁴ Currently, the West Coast groundfish fishery is managed jointly by state and federal governments and thus, this project may require a federal Exempted Fishing Permit. This current fishery contains limited entry, open access, and nearshore participants.⁶⁵ Limited entry permit holders can be classified as trawl, fixed gear with sablefish endorsement, and fixed gear without sablefish endorsement.⁶⁶ Potential ecological risks associated with this fishery could be whale entanglement, gear loss, or mixing of gear with other trap fisheries. There has also been interest for this fishery along the Central Coast.

Snake gear within Rockfish Conservation Areas (RCAs)

Horizontal fixed trolled gear or 'snake gear' is already in use in the Alaskan groundfish fishery⁶⁷ and could be adapted to current California salmon fishing vessels as they are already equipped to handle this gear as current regulations allow a single point, single shank barbless hook with 6 lines.⁶⁸ This fishing method employs a horizontal line with 50-250 shrimp flies that is trailed behind a fishing vessel at a specific depth as to avoid illegal bottom dwelling species. Keeping the gear off the bottom would target midwater species such as widow, yellowtail, black, and chilipepper rockfish. This method of fishing has less bycatch because it can target specific sizes of fish which increases the catch quality. With fluctuations in salmon populations because of drought and other environmental factors, 'snake gear' could provide fishermen with a viable alternative to reallocate fishing pressure elsewhere.

There are already federal Exempted Fishing Permits allowing certain fishing activities within rockfish conservation areas (RCAs) such as hook-and-line gear for midwater rockfish species⁶⁹ and more recently, an updated Exempted Fishing Permit for targeting chilipepper rockfish off Monterey Bay with horizontal 'flyline' gear has been under consideration by the PPMC.⁷⁰ Given that fishermen have not been allowed to fish RCAs since 2003, this proposed EFP could provide considerable data on current rockfish populations and abundance in and around the Humboldt/Eureka RCAs.⁷¹ Potential ecological impacts could occur if the line becomes entangled on rocky substrates, causing loss of gear. However, scoping will take place to ensure appropriate placement before deployment of gear.

Recreational deep drop fishing outside RCAs to 100 fathoms

Longleader gear, also called deep drop, is currently in use in the Oregon groundfish recreational fishery (see subsection on *Federal Exempted Fishing Permits*). This proposed EFP would allow use of recreational longleader gear outside RCAs to 100 fathoms. As mentioned previously in this report, longleader gear has been successfully deployed in Oregon targeting midwater rockfish species while avoiding at-risk bottom dwelling species such as yelloweye rockfish.

Bay Area (Half Moon Bay to Bodega Bay)

The epicenter of most commercial and sport fishing in Northern California is the Port of San Francisco's Fishermen's Wharf, also home to booming seafood restaurants serving the iconic Dungeness crab. However, over the last decade, whale entanglements have become one of the biggest concerns in this area as it contains a large number of Dungeness crab fishing vessels.⁷² There were 142 whale entanglements in California from 2014 to 2017,⁷³ when fishing activity was altered due to environmental changes (e.g. "The Blob"), prompting a lawsuit by the Center for Biological Diversity in October 2017.⁷⁴

Pop-up gear in the Dungeness crab fishery

The Dungeness Crab Gear Working Group⁷⁵ alongside Ocean Protection Council (OPC), the Department, and Oceana⁷⁶ have previously tested alternative gear, specifically pop-up gear types (Fig. 7), outside of the regular fishing season. However, with high costs of new gear and laborious deployment on fishing boats, this new method will require further testing and trials to ensure feasibility within the Dungeness crab fishery. It is estimated that some pop-up gear types will cost upwards \$4,000-5,000 a piece, costing each fishing vessel around \$1-2 million dollars to upgrade current gear.⁷⁷ While the new EFP could provide fishermen the opportunity to test pop-up gear during the Dungeness crab season, current efforts from the Dungeness Crab Fishing Gear Working Group and the Department have been focused on what can be achieved "in the absence of an EFP."⁷⁸ For instance, the Risk Assessment and Mitigation Program (RAMP) has been created by the California Dungeness Crab Fishing Gear Working Group to monitor whale observations and foraging conditions before, during, and after crab seasons while providing recommendations to the Department about seasonal closures and start dates.⁷⁹

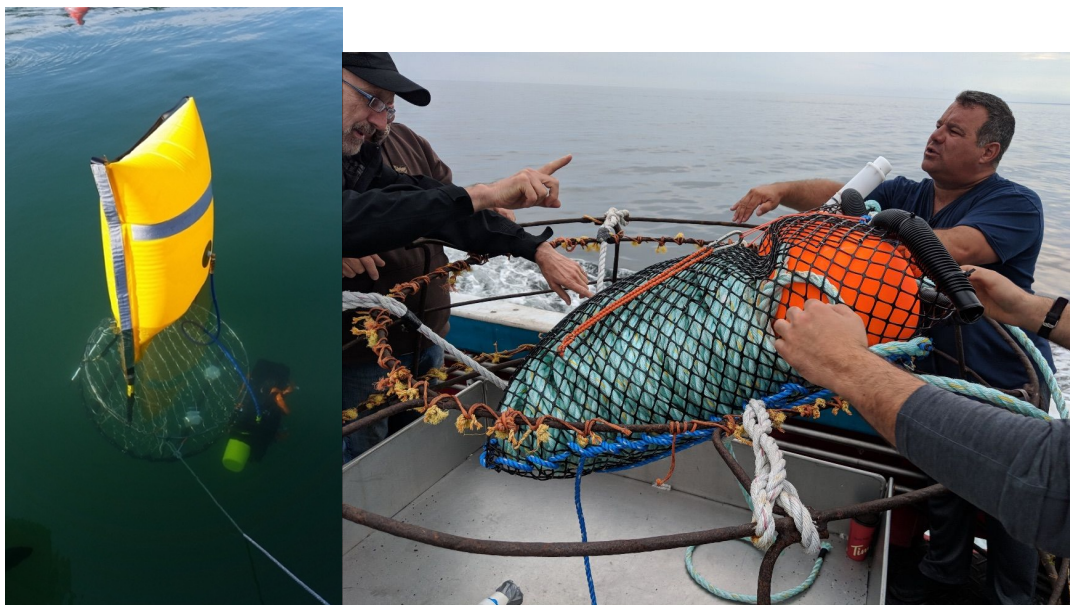


Figure 7: Pop-up Dungeness crab fishing gear

Sources: SMELTS and Desert Star

State-equivalent for the federal Dan Platte and Barbara Emley permit

There was also some interest in the Bay Area for developing a state permit equivalent to the federal Exempted Fishing Permit for yellowtail rockfish that uses a vertical jig within RCAs (Dan Platte and Barbara Emley Permit).

Monterey (North of Morro Bay to Monterey and Santa Cruz)

Monterey's famous Cannery Row was once home to a booming sardine industry in the mid-20th century. After the sardine fishery collapsed, fishermen targeted other coastal pelagic species (e.g. squid, mackerel, bonito) as well as salmon, groundfish, and Dungeness crab.⁸⁰ Similar to the Bay Area, whale entanglements in Dungeness crab fishery is of the utmost concern. Fishermen in this area will be collaborating with the Dungeness Crab Gear Working Group, OPC, the Department, and Oceana for further testing of pop-up gear and a possible future EFP.

In January 2020, an updated application was submitted for a federal Exempted Fishing Permit for targeting chilipepper rockfish off Monterey with use of horizontal 'flyline' gear.⁸¹ During the informal interviews, there were several general suggestions for similar EFPs in California looking to target rebuilt species within RCAs in state waters. The EFP program could offer fishermen the ability to test out more selective and eco-friendly fishing gear such as this on the groundfish populations off California's coast. As ocean conditions continue to change with climate change, diversifying catch and balancing fishing pressure will only ensure more sustainable fisheries into the future.

South-Central Coast (Ventura to Morro Bay)

Morro Bay Harbor, Port San Luis, Santa Barbara Harbor, Ventura Harbor, Channel Islands Harbor (Port of Oxnard), and Port of Hueneme are some of the main areas home to commercial fishing vessels along the South-Central Coast. Some of the main concerns in the fishing community here are hurdles for small-scale fishermen, young fishermen trying to enter the industry, whale entanglements with Dungeness crab gear (areas north of Point Conception), and securing a variety of catch.

Trap fishery for Pacific sanddabs

The proposed EFP for a trap fishery targeting sanddabs would utilize a small mesh size; 2" x 2" or 1"x1". This method would provide an alternative to bottom trawling for this flatfish. The existing Federal Pacific Coast Groundfish Fishery Management Plan regulates both groundfish and flatfish, but the state's Nearshore Fishery Management Plan (NFMP) regulates only 19 species of groundfish, not including flatfish.⁸² Because of this, an EFP would be required for this project. Nearshore fisheries with modified fishing gear types such as in this perspective EFP, can provide low investment opportunities for local small-scale fishermen. This proposed EFP may require federal approval since flatfish is a federally managed species, but further research and consultation with the Department is needed.

Commercial spearfishing for yellowtail, halibut, and seabass

Another EFP idea was for a commercial spearfishing fishery for yellowtail, California halibut, and/or seabass. Spearfishing is already legal for recreational take of California halibut, white seabass, and yellowtail with current bag limits and size restrictions for each species.⁸³ This proposed EFP would provide an opportunity to supplement the sea urchin diver fishery as an artisanal fishery and offer an alternative fishery during low catch seasons. With the high selectivity of spearfishing, there would be zero bycatch. However, this could also pose a potential risk of overfishing if inadequate take limits are set. The proposed EFP, if implemented soundly, could also incorporate social science research on the decision-making process involved with fishing similar to the study conducted in coral reefs in the

Dominican Republic.⁸⁴ Spearfishing, unlike traditional boat fishing, offers fishermen the ability to individually select every fish. This could be based on the fishermen's current needs and limitations illustrating the socioeconomic side of fishing which in turn, could better influence fisheries management.

Nearshore octopus fishery with clay pots

Octopus is currently managed by the Department as incidental take within the California crab and spiny lobster trap fisheries.⁸⁵ There are potentially three different octopus species that could be harvested with this method off the coast of California: red octopus and 2 types of two-spot octopus (*bimaculoides* and *bimaculatus*).⁸⁶ Octopus species have fast reproduction rates and short lifespans of 1-2 years making them a potentially sustainable seafood option for California fisheries.⁸⁷ The proposed EFP would employ clay pots as the harvest method similar to those used in ancient Japan during the mid-Yayoi period (100 BC to 100 AD).⁸⁸ This sustainable method consists of vase-like pot structures with no bait or lure as it takes advantage of octopus' ability to seek refuge. Currently, more research and data are needed by fisheries managers to better understand octopus populations along California's coast. This EFP project, alongside the Department, could allow for scientific research on the abundance, behaviors, and predation of octopus populations off California's coast. There has also been interest in the San Diego area for this fishery.

Other EFP project ideas

Other, more general ideas for EFP fisheries included: a trap fishery for seabass or halibut; harvesting of Kellet's whelk and keyhole limpets; lingcod traps; and a tuna crab fishery alongside spot prawn. These ideas were still in the beginning stages of development.

San Diego (Imperial Beach to San Clemente)

The Port of San Diego was once "The Tuna Capital of the World"⁸⁹ and currently today, over 130 fish species are caught by local fishers.⁹⁰ The biggest concerns of this fishing community are "greying" of the fleet and fisheries diversification.

Pink urchin trap fishery

Pink urchin (Fig. 8) is being found in box crab and spot prawn traps along the coast of California. Unlike the popular "uni" from red urchins, pink urchins are more fragile and usually smaller in size. Although less robust in size, pink urchins have inhabited low pH and highly acidic environments making them less vulnerable to climate change conditions.⁹¹ Studies also indicate there is a large spatial distribution of pink urchin along California's coast with the highest densities occurring in similar depths to the spot prawn fishery (800-1,000ft water depth).⁹² Since 2000, the red urchin fishery has seen decreased landings due to kelp forest decline and other climate change impacts, so this proposed EFP could offer a future alternative for market demand.⁹³ A pink urchin fishery could be combined with the current spot prawn and box crab trap fisheries without the need for gear modifications. It should be noted that no current market exists for this species as incidental take is currently illegal within the spot prawn fishery.⁹⁴ As such, research for marketability would need to be considered when determining appropriate EFP permit fees as fishermen would not have a ready market to recoup costs. There has also been some interest for this EFP along the south-central coast amongst red urchin diver fishery participants.



Figure 8: Pink urchin (*Strongylocentrotus fragilis*)

Source: NOAA/Ed Bowlby

Deep-set buoy gear (BSBG) for swordfish in state waters

With the recent success of the DSBG (Fig. 9) federal Exempted Fishing Permits in the swordfish fishery, as mentioned earlier in this report (see subsection on *Federal Exempted Fishing Permits*), many Californian fishermen have wanted to test out their luck in state waters. This fishing method has been supported by environmental groups such as Oceana and Pew Charitable Trusts as a viable, sustainable option for harvesting swordfish.⁹⁵ This method keeps the swordfish in pristine condition and since it can be harvested quickly, it's fresher and can bring in higher prices per pound.⁹⁶ Prior to BSBG, roughly 64% of species harvested from drift gillnets was discarded from 2004 to 2014 causing waste and other environmental impacts.⁹⁷ The U.S. also imports over 20 million pounds of swordfish each year⁹⁸ so in issuing a state equivalent EFP for this fishery, California could increase local demand and keep this sustainable catch for local consumption.

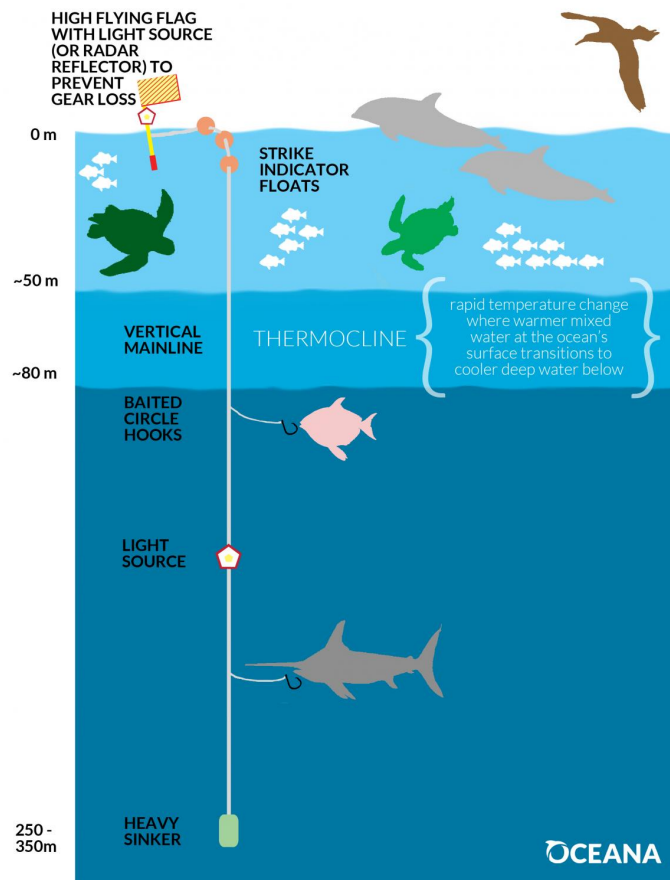


Figure 9: Deep-set buoy gear setup

Source: Oceana

DSBG for thresher and Mako shark

The success of DSBG in the swordfish fishery has prompted interest in the use of this gear for other species. The proposed EFP project would target thresher and mako shark off the coast of San Diego at 75-100ft. Thresher sharks, mako sharks, and swordfish are normally caught in the drift gillnet fishery. However, in 2018, Governor Jerry Brown signed Senate Bill 1017 to phase out the swordfish and shark drift gillnet fishery over the next four years.⁹⁹ As the commercial fishing industry continues to look for more ecological friendly methods of harvest, DSBG could be used or modified to target species other than swordfish.

Shallow-set buoy gear for white seabass

Once again utilizing methods similar to DSBG, this EFP would target white seabass populations at 40-60ft with a single line, jig, and hook. The existing California commercial fisheries for white seabass currently utilize drift gill nets, with some taken by hook-and-line, and are managed under the White Seabass Fishery Management Plan.¹⁰⁰ Hubbs-Sea World Research Institute has been releasing raised juvenile white seabass into Southern California waters since 1986 to enhance natural populations.¹⁰¹ Per the 2016-2017 White Seabass Fishery Management Plan review, total catch is below optimum yield.¹⁰² The benefits of this EFP could be reduction of bycatch due to high selectivity of the gear type and less ecological impacts while targeting an underutilized species.

Offshore octopus trap fishery

Currently, Tanner crab, southern rock crab, and lobster permit holders are authorized to harvest octopus as incidental take per California's regulations.¹⁰³ California Spot prawn permit holders also see different varieties of octopus in their traps, but state regulations mandate release of all bycatch from spot prawn fisheries.¹⁰⁴ Giant Pacific octopus are thought to be the main species harvested in these fisheries and could be worth exploring more as a potential fishery and collaborative research study. A small market for octopus has already been developed at Tuna Harbor Dockside Market so fishing this species could help offset some of the costs associated with this EFP project. This perspective EFP project could also allow for more scientific research on octopus abundance, behaviors, and predation as very little is still known about the species.

Open access trap fishery for moray eels

The California moray eel was previously harvested in the 1990s as a part of live-trap fishery implemented in 1989 which included California sheephead, California scorpionfish, cabezon, and shallow-water rockfish.¹⁰⁵ Serving as an alternative fishery, small-scale fishermen in San Diego could modify current lobster or crab fishing gear to accommodate different mesh sizes for moray eel capture. The proposed EFP would utilize 1" x 1" mesh with 2" x 2" mesh along the funnel cover. This would minimize crab bycatch. Traps would be set at approximately 10-30ft in shallow reefs. Conflicts with other commercial gear as well as overharvesting are some of the potential ecological concerns with this EFP so determining appropriate areas to harvest would take priority in further developing this EFP proposal. Per the Department's report on commercial fish landings in 2019, 115 pounds of moray eel were harvested off state waters, most likely harvested as bycatch or incidental take.¹⁰⁶ There is also a select local Asian market in San Diego for this catch.

Modified swordfish nets for Pacific whiting/hake

Per NOAA Fisheries, the migratory coastal stock of Pacific whiting or hake is the most abundant commercial fish stock along the Pacific Coast.¹⁰⁷ Pacific whiting, or hake, is managed in conjunction with Canada through the Pacific Whiting Agreement.¹⁰⁸ The dominant mode of harvest in federal waters is

through midwater trawl gear types mandated by the Federal Groundfish Fishery Management Plan. The proposed Pacific whiting EFP would include a modified swordfish gillnet or shad trawl net (3.5" mesh) to be utilized in the summer months at 600-800ft deep. Exact mesh size of the modified gillnet would be determined following testing during the EFP project. Stores in San Diego already carry frozen Pacific whiting from Oregon and Washington, but this fishery could provide more local catch for consumption. Mickey mouse fish, ratfish, spiny dogfish, and bay rays are some of the expected bycatch with this EFP project. Additionally, per Pacific whiting's stock assessment in 2018, there is need for research of biomass and distribution making this a viable option to collect more scientific data using an EFP.¹⁰⁹ Given Pacific whiting is managed as a federal species under Pacific Coast Groundfish Fishery Management Plan, this EFP may require a federal Exempted Fishing Permit before obtaining a state equivalent permit. However, that has yet to be resolved at this time until official implementing regulations are approved for the California EFP Program.

Sanddab nets

This EFP calls for a smaller net to be deployed in deeper waters, targeting sanddabs. The net would consist of 3.25" to 3.5" mesh (exact mesh size yet to be determined as to not interfere with rockcod populations) and rest 7-8ft off the bottom where set. Potential bycatch with this proposed fishery could be sand sharks, ratfish, and Pacific whiting. The Pacific sanddab is usually caught along with other groundfish by bottom trawling and are most abundant off North-central and Southern California.¹¹⁰ Per the 2013 stock assessment, one of the research needs is to investigate methods for calculating the abundance of nearshore sanddabs.¹¹¹ Trawl surveys for this assessment were not conducted in waters less than 180ft so this EFP could provide an opportunity to fill this scientific data gap.¹¹² The permit may be required to have federal approval before being used in state waters.

BY PROJECT TYPE

The above EFP ideas have been further characterized by EFP project type to assist the Department with anticipated research needs. Three different EFP project types are defined below and the potential California EFP projects are categorized in Figure 11.

New / modified fishing gear	EFP project idea utilizes novel fishing gear or modified existing fishing gear not currently in regulation
New fishery	EFP project idea targets a new species of marine fish or invertebrate not currently managed
Both: New fishery and new/modified fishing gear	EFP project idea utilizes novel fishing gear or modified existing fishing gear on a new species

Figure 10: EFP project type definitions

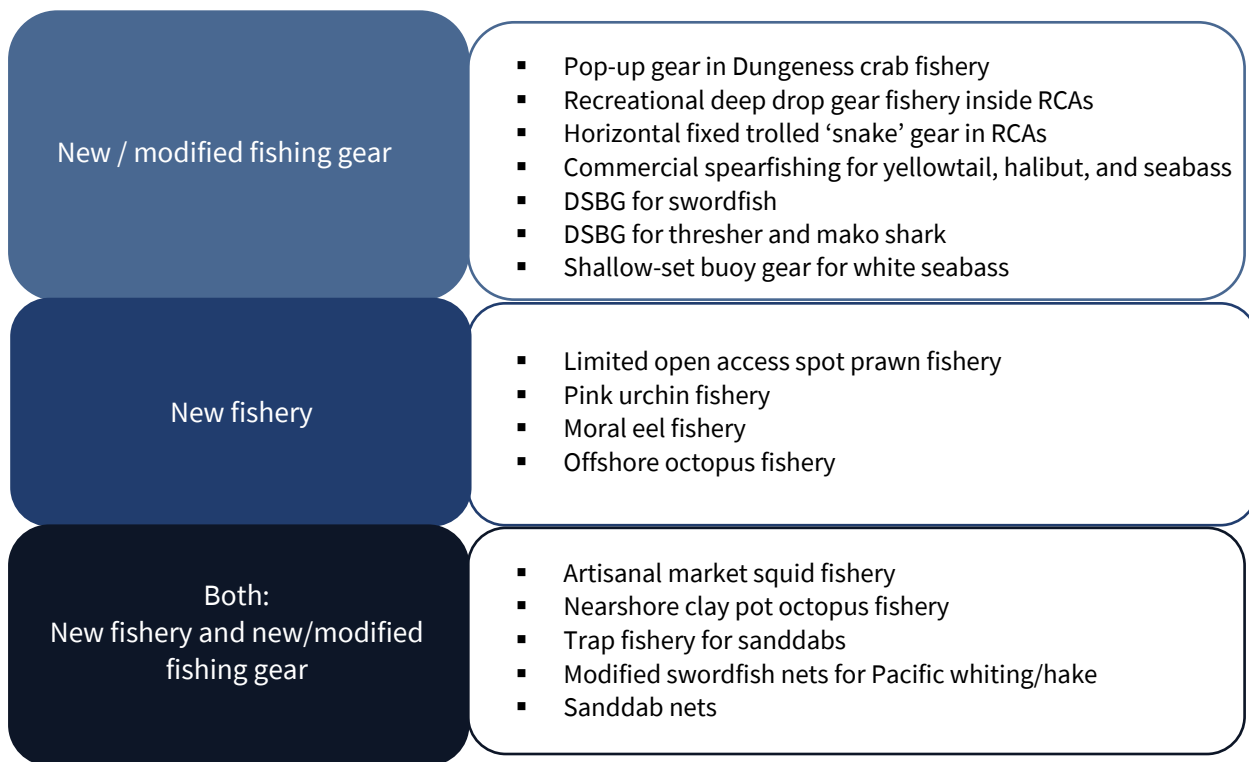


Figure 11: EFP project characterized by project type

IMPLICATIONS AND FUTURE BENEFITS

The new EFP program stands to provide short and long-term benefits to the fishing industry and fisheries managers throughout California. As climate change continues to affect ocean conditions, sustaining fisheries is of the utmost concern. A combination of new data streams, collaborative research efforts, and new management practices tested through the new EFP program could provide both the fishing industry and resource managers with the tools needed to advance into the future.

Fisheries Sustainability

Under the California Marine Life Management Act (MLMA), one of the goals is to ensure sustainability within current and future fisheries.¹¹³ The new California EFP Program will provide the fishing industry with opportunities to harvest more diverse, locally caught species through use of new or modified fishing gear or by targeting new marine species. Fishing locally releases fewer fuel emissions and greenhouse gases into the atmosphere because the catch is harvested closer to the port and these emissions are further decreased if the catch is sold locally rather than exported to international markets. Allowing fishermen to fish over a variety species will not only distribute fishing pressure from one species to multiple species, but combined with science guided regulations, it will allow stocks to maintain maximum sustainable yields.

As ocean conditions and species distributions alter with climate change, looking to other, more plentiful fish populations or new species can benefit fishermen looking to diversify their catch portfolios. Some warmer water species are moving northward as conditions become more suitable. This 'tropicalization' of species will increase over time as ocean temperatures increase.¹¹⁴ Through the use of an EFP,

fishermen can explore these new and underutilized fisheries, while also providing scientific information for management purposes similar to the current box crab EFP. Additionally, EFPs encourage more innovation and adoption of ecologically friendly fishing gear such as seen by the deep-set buoy gear in the swordfish fishery and the longleader gear for targeting rockfish off the coast of Oregon. Less ecological impacts mean healthier, more resilient habitats for fish populations off California's coast.

Fishing is also an important part of the food system in California and offers a compliment to the agricultural industry. By having more locally caught fish off state waters through EFPs, more local demand could be generated. For instance, the Monterey area is home to several community-supported fisheries (CSFs), modeled after the community-supported agriculture program. Examples of CSFs in Monterey include Real Good Fish, Ocean2Table, and H&H Fresh Fish. This model has given fishermen the opportunity to create more local market demand, keeping California caught fish close to home. The Monterey CSFs as other CSFs across California have grown in size over the last decade and are seeing heightened increases in boat- to-door sales since the implementation of COVID-19 stay-at-home orders (Fig. 12).¹¹⁵ With increased fisheries diversification and local catch because of the new EFP program, fishermen could continue this trend if consumers maintain their demand for more sustainability caught, fresh, and accessible options for food sources.



Figure 12: Sign for dock sales on Woodley Island in Eureka, CA **Photo by:** Cerise Ibach (May 2020)

As a handful of young fishermen are entering the commercial fishing industry, the bulk of current fishermen are retiring. Many fishing communities across California are faced with the same socioeconomic concerns such as prohibited costs, "greying" of the fleet, and climate change adaptation. Permit prices for some of the limited entry permits can reach upwards \$1 million for specialty fisheries such as lobster and spot prawn.¹¹⁶ Younger fishermen starting out in the industry already carry the burden of boat fees and payments, insurance, crewmembers, and other overhead costs leaving little room for costly permits. The new EFP program could provide a means for younger fishermen to innovate with gear types or explore underutilized species without exorbitant limited entry permit fees.

Fisheries diversification contributes to sustainability as well as adaptation within fishing communities, but with changes in fisheries policy (e.g. limited entry permits, catch shares), and species shifts, some fishermen have reduced access to different fisheries. This becomes especially important for small-scale fishermen, who often, are unable to afford costly permits or possess multiple types of gear to switch between large fisheries. Fishermen are also heavily impacted by climate change conditions¹¹⁷ and because of this, there is substantial uncertainty in targeting one species. For example, the Dungeness crab fishery was hit with closures in 2015-2016 following an oceanographic warming event, which caused toxic algal blooms that resulted in high levels of domoic acid within the crab meat.¹¹⁸ Financial losses from this closure resulted in roughly 1,000 fishermen leaving the fleet.¹¹⁹ Furthermore, some tropical species are becoming more abundant along the California coast as ocean temperatures continue to rise, while others are migrating northward.¹²⁰ The new EFP program could provide fishermen with the flexibility to switch between overlapping or emerging fisheries by utilizing similar or modified gear types, while also equipping them with the adaptability needed to progress into the future.

Scientific Data

It is critical to conduct sound scientific research which could later influence ocean management strategies. EFPs allow for experimentation through systematic gear trials or exploratory fisheries,¹²¹ but they also can assess new data streams such as with cooperatives, community-based data management, real-time data collection, or other innovative tools. The synthesis of science and EFP fishing could provide information on new species, habitats, ecological impacts, and fill in the gaps from federal or state surveys, allowing for more adaptive management practices.

Cooperatives, community-based data management, and collaborative research utilize higher resolution fisheries-dependent data. In 2001, a community-based data collection program was started by the San Diego Watermen's Association (SDWA) in collaboration with scientists at the Department.¹²² This program collected more fisheries-dependent data that could be used to support stock assessments (fisheries independent data) for nearshore fisheries such as red urchin and other sedentary invertebrates. In 2009, The California Abalone Association proposed a cooperative fishery management plan to access some of the red abalone resources for commercial use at San Miguel Island and establish a Community-Based Harvest Cooperative.¹²³ This proposal could provide a small group of fishermen access to a limited portion of the red abalone stock at San Miguel Island, they could assess recommendations for total allowable catch for recreational or commercial take, regulations, management, enforcement, and monitoring.¹²⁴ The Bren School of Environmental Science and Management evaluated the economic and ecological feasibility of this co-management.¹²⁵ Their findings suggest this cooperative has the potential to contribute to innovative fisheries management, while offering more data streams to improve the scientific understanding of this fishery and as a bonus, increasing fishery stewardship.¹²⁶ Though never implemented, the data collection principles of this cooperative have been incorporated into a new proposal for the North Coast Recreational Red Abalone Fishery.¹²⁷ The proposal is currently being reviewed by the Commission. However, similar data collection and assessment techniques could be used by future EFP projects further allowing the Department to leverage this information into downstream adaptive fisheries management for a range of species.

Another example of fisheries-dependent data is seen by the successes of the collaborative at-sea sampling programs (CASPs) with rock-crab and lobster trap fishermen (Culver et. al 2010, Culver et. al 2017, Fitzgerald et. al 2019). In the case of the spiny lobster, the CASP resulted in the largest data collection effort throughout a range of the lobster fishery over time. Over 13,000 lobster traps sampled,

roughly 33,000 lobsters counted, and size and sex determinations made for over 10,000 lobsters.¹²⁸ The data was used in the FMP and integrated into data management models. The West Coast groundfish fishery catch shares program, implemented in 2011, also produced significant scientific data on population dynamics and stock biology as well as influencing more sustainable fishing practices.¹²⁹ The information provided by program such as these can be used to supplement landings receipts, logbooks, and other data collected by the Department further ensuring more data-rich management decisions. As fisheries continue to be impacted by climate change, information gathering will be at the forefront of scientific understanding.

While commercial fisheries document landings, the catch that is brought into port in California, there are shortcomings to the current system that may be addressed through the new EFP Program. There are often delays in obtaining landings data or misinformation transcribed on the paper tickets about fishing locations leading to lack of fine-scale spatial data. Real-time data such as automatic identification systems (AIS), digital logbooks, electronic monitoring (EM), or apps could fill in some of the missing pieces in fisheries management, especially concerning economics or spatial conservation. Moreover, this data could be used for socio-economic research on coastal communities and ports such as the project, “California Fisheries Data Explorer.”¹³⁰ Piloting a study with digital logbooks, the EFP program in real-time could track what commercial fishermen are catching and where. Studies such as these could also collect information within the recreational fishing industry to determine the value of sportfishing to California’s economy. Additionally, GPS location devices or apps can work offline, easily accommodating fishing vessel ranges,¹³¹ while also utilizing automated options for simplification. EM has also been tested by other fisheries along the West Coast and currently, is providing an alternative to observer coverage for the box crab EFP during the COVID-19 pandemic.

Species biology and population studies are also crucial components in understanding fisheries management especially in terms of harvest rates. Tagging studies such as those conducted on recreational yellowtail catch in La Jolla can provide information on a temporal scale about how much time this species stays in and out of reserves.¹³² The current box crab EFP is also employing tagging research to study population ranges, movements, and growth. In the West Coast groundfish fishery, a federal Exempted Fishing Permit was paired with a camera system to evaluate the effectiveness of the experimental gear while assessing species abundance for rebuilt species.¹³³ This Video Lander tool¹³⁴ (Fig. 13) can be used alongside the new California EFP Program as an assessment tool for understanding stock, population sizes, and estimates for allowable catch especially within current RCAs.



Figure 13: Video Lander tool

Source: Maregroup.org

Collaboration and Innovation

Stakeholder engagement and collaboration is one of the most vital aspects to the new EFP program. AB 1573, section 2(g), encourages “valuable and productive collaborative fisheries research in coastal waters.”¹³⁵ The MLMA also strategizes efforts to ensure public participation in management, research, and decision-making.¹³⁶ Prior to the 20th century, fisheries management came in the form of fishermen’s knowledge, but with advancements in technology and science, this historical ecological expertise was soon set aside for more empirical data. However, with the encouragement of the state EFP program to develop more collaborative research projects, this could change. During previous collaborative-at-sea sampling programs within the commercial rock crab and lobster fisheries, fishermen worked together with scientists and resource managers to develop robust data collection protocols that were feasible across the different fishing operations.¹³⁷

Fishing industry, technological, and scientific expertise will be required in order to tackle some of California’s fishing concerns. For example, in the Dungeness crab fishery, whale entanglement risk is prompting a look towards innovation for viable solutions.¹³⁸ Companies, NGOs, and fishermen alike have participated in various discussions and testing of new gear – pop-up gear – to address the issue.¹³⁹ However, continual work and partnerships will be needed to implement pop-up gear successfully along the West Coast. EFPs provide an opportunity and incentive to innovate which in turn, could help scale-up the manufacturing of these technologies, such as pop-up gear for the Dungeness crab fishery, making innovative gear more affordable and user-friendly. With multiple industries working together to formulate and execute technological advancements, fisheries harvest methods could advance rapidly and more sustainably into the future.

Experimenting with different gear innovation or “conservation engineering”¹⁴⁰ has shown great past successes and has also influenced fishing practices in the recreational fishery. DSBG in the swordfish fishery has reduced bycatch of threatened species such as sea turtles and marine mammals. Longleader fishing gear in Oregon has rejuvenated the recreational fishing by providing anglers with a mode to target midwater species while avoiding unbuilt stocks of bottom-dwelling species. The Environmental

Defense Fund has worked alongside fishermen, scientists, and fishing net manufacturers from the West Coast and Alaska on a project to improve trawl net designs.¹⁴¹ This modified trawl has up to 90% reduction in seafloor contact while allowing juvenile fish to exit the net safely.¹⁴² This work was also supplemented by a Trawl Gear Modifications Workshop where stakeholders shared expertise and information, facilitating more cooperation and collaboration. The state of Alaska has worked with fishing communities to develop and implement new gear types to address environmental concerns and new, high value fishing opportunities. One of the current federal Exempted Fishing Permits has developed a Chinook salmon excluder device for the Bering Sea pollock trawl fishery to tackle the increase in Chinook salmon bycatch.¹⁴³

Management Approaches

The scientific data collected in California's new EFP Program could influence more progressive fisheries management approaches. These strategies could provide the adaptability and flexibility needed for California's fisheries to progress into the future. Additionally, California has the chance of making an impact far greater than its own boundaries. If successful, the California EFP Program stands to provide a steppingstone to influencing more state-led experimental fishing programs throughout the nation.

Ecosystem-based management (ESBM) has been on the rise in recent years as a more holistic approach to fisheries management. After the collapse of the West Coast groundfish fishery in 2002, Oceana scientists, using remotely operated vehicles, discovered juvenile rockfish swimming around reefs and Christmas tree coral proving that habitat was also important for species health.¹⁴⁴ While integrating ecological concerns adds complexity to management, engaging fishermen in the management process enhances further understanding. An environmental risk assessment pilot study was conducted alongside the California MLMA Master Plan Amendment in 2018 to study this novel approach.¹⁴⁵ Input from fishermen, scientists, NGOs, and nonprofits were used in this study to assess collective ecological risks associated with a fishery (bycatch, habitat, and target species) rather than risks unique to target species alone.¹⁴⁶ Utilizing this strategy with information collected on EFP projects could better influence more trusted and collaborative ESBM within California.

Adaptive or dynamic management strategies offer better and broader data to inform real-time decision-making. Data collection from EM, digital logbooks, or solar loggers can provide fisheries managers with more latitude to move quickly as fisheries change by adjusting quotas, seasons, and closures in real-time. Climate change will affect species migration, distribution, and abundance and while the regulatory process is too lengthy to quickly adapt to a changing environment, more dynamic strategies can be utilized. In Alaska, Sea State Inc. monitors bycatch hotspots and rates using real-time NMFS observer data from fishing vessels.¹⁴⁷ This information is used by the fleet to avoid areas of concern for bycatch and to prevent premature closures of fisheries as well as by NMFS to evaluate performance and bycatch rates.¹⁴⁸ While participatory, this strategy offers fishermen an individual and collective economic incentive to reduce bycatch and stay within regulatory limits. Potential EFP projects, such as the artisanal market squid and limited open access spot prawn fisheries, could utilize real-time data to test more adaptive management strategies such as real-time closures.

Management approaches fit to species biology provide a compelling argument to spatial conservation measures such as with Marine Protected Areas (MPAs), reserves, or RCAs. With the ICUN calling for 30% protection of world oceans by 2030,¹⁴⁹ this becomes ever more important as measures are passed worldwide. By modeling the average swimming speeds and distance of species against observed

presence or absence studies (i.e. tagging and recapture in yellowtail and box crab EFP), scientists and managers can better understand the distribution of species in relation to spatial management. Using this data alongside socioeconomic information, social scientists can also analyze marine conservation efforts parallel to fisheries resource exploitation.

California's coastline is the 3rd longest coastline in the U.S.¹⁵⁰ With vastly diverse terrestrial ecosystems, it is only reasonable to conclude California's marine ecosystems differ among regions with varying bottom substrates, weather, and species. Currently, the Department manages seven regions within the state: Northern, North Central, Bay Delta, Central, South Coast, Inland (no coastline), and Marine Regions.¹⁵¹ Fishermen have observed both extreme and moderate differences in species and catch numbers in other fisheries depending on whether they are fishing north or south of Point Conception, due to different oceanographic regimes. Data from the spiny lobster collaborative at-sea-sampling program identified three distinct fishing regions in Southern California with varying differences in catch size distributions, sex ratios, numbers of recruits, and effort.¹⁵² For instance, California fishing regulations could set trip limits off latitude coordinates similar to the federal West Coast groundfish fishery. Current trip limits within this fishery are based of coordinates south or north of Cape Mendocino, 40°10' Lat.¹⁵³

Additionally, the scientific data provided from more community-based or cooperative data collection programs, such as those described in the previous subsection, could provide the evidence needed to support more regional approaches to fisheries management.¹⁵⁴ Regional management with local stakeholders could prove more favorable and provide more appropriate harvest rates and information beyond state or federal surveys.

POTENTIAL LIMITATIONS

Although the new EFP program stands to have numerous benefits to both the fishing industry and fisheries management in California, several barriers exist that could inhibit its promising future. Costs of EFPs, management, and data collection could limit participation and success of future projects. Collaboration, the biggest part of EFPs, could be burdensome if biases remain and trust is not built. Furthermore, complex regulations could also pose constraints for the new EFP program as state and federal fisheries are often intertwined.

Costs and Funding Mechanisms

The potential costs such associated with EFPs, monitoring, and data collection combined with minimal dedicated funding mechanisms could hinder the success of future EFP projects as well as deter fishermen from participating. FGC section 1022 part (5)g of AB 1573 states, "The commission may charge a permit fee as necessary to fully recover, but not exceed, all reasonable implementation and administrative costs."¹⁵⁵ Depending on the degree of EFP complexity (e.g. data and monitoring requirements), increased Department staff time may be required raising the cost of the permit. Although the Department's goals are to establish fees that would be fair and equitable, having coordinated and collaborative scientific partners outside of the Department could minimize prohibitive costs. For example, the current box crab EFP project is led by the Department with funding by Ocean Protection Council and a competitive grant received by California Sea Grant.

The current box crab EFP costs participants \$4,487.75,¹⁵⁶ with many of the other costs covered by outside funding. This EFP is in its second year and already, fishermen have opted out of renewing due to permit costs and other unforeseen impacts due to COVID-19.¹⁵⁷ The box crab EFP terms and conditions also require electronic monitoring (EM) and 10 days of observer coverage.¹⁵⁸ Ocean Protection Council funded the EM portion of the study by providing \$300K, but without these supplemental funds, this EFP would not have been feasible for fishermen to bear the financial burden alone.¹⁵⁹ EM requires professional installation, equipment, and data review, all of which are normally paid for by permit holders within the fishing industry. Observer coverage is also at a premium with some observers costing upwards \$500-1,600/day.¹⁶⁰ Although variable, a typical fishing 'day' can be up to three 24-hour periods from time of departure to time of arrival at fishing harbor and for small-scale fishermen, this becomes an immense financial burden as some trips might only harvest \$2,000 fish on a good day.¹⁶¹ The Morro Bay Community Quota Fund has approximately \$2 million worth of shares to encourage younger fishermen entering the industry, but prohibitive costs in EM and observer requirements in some of California's fisheries have hindered participation.¹⁶² Although there are federal and NGO grants available, the application process and unforeseen costs might be burdensome to a single, small-scaled fisherman applying for an EFP project. The California lobster collaborative at-sea sampling program suggested using a combination of monetary and non-monetary incentives for fishermen participation as a means to incentivize participation such as waived permit fees, tax write-offs for state data collection, compensation for consultation, and coordinator fees.¹⁶³ Funding considerations such as these should be considered for the EFP program.

Marketing and economic impacts of fishery implementation also stand to prohibit current and future participation in a fishery. For example, emerging fisheries will require marketing in order to establish a consumer base. While catch increases in an exploratory fishery or a rebuilt fishery, the supply outpaces market demand causing decreased pricing. This ultimately leads to a devaluing of potentially sustainable fish catch and poor incentives for fishermen to continue harvesting. Positively Groundfish, a nonprofit organization, works with the local groundfish fishery and other stakeholders to develop market strategies.¹⁶⁴ Currently, only 20-25% of the groundfish quota is currently harvested due to lack of demand.¹⁶⁵

If an EFP project is successful, new regulations and fisheries could be implemented statewide. However, this could potentially increase costs for other fishermen turning them away from new sustainable fisheries so it's important to not only think about the benefits of the EFP project, but also, downstream implications. Economic impacts of mandating new gear types or requiring real-time data collection could leave fishermen, especially small-scale fishermen, withdrawing entirely from the commercial fishing industry. For example, the lampara net and herring purse seine fisheries in San Francisco were banned in the late-1990s converting all current permits to gillnet fishing gear.¹⁶⁶ A study by Pomeroy et. al. (2002), estimated the cost of switching to gillnet fishing gear at \$726,000 to \$751,000 per participant.¹⁶⁷ Prohibitive costs of EFP projects (e.g. permits, monitoring, data collection) as well as subsequent costs will deter fishermen participation in future fisheries innovation and sustainability. Furthermore, good data and science are relied upon for fisheries management and hinge upon economically feasible regulations and permit fees.

Scientific Data

The above proposed EFP projects as well as future proposals for the new California EFP Program will require data collection and management on various marine species to assess impacts, populations, and habitat. However, without clear guidance, protocols, or established goals, data could be deemed inadequate or incomplete. For example, electronic monitoring (EM) has been used in past projects for compliance monitoring and as a data collection tool. The most successful EM projects have separated these objectives such as the Alaskan hook and line groundfish fleet which operates under a regulated EM program for data collection only.¹⁶⁸ However, concerns lie in the rights and ownership over data, especially with that of real-time data collection such as EM, digital logbooks, or automatic identification systems (AIS). These devices collect information on a fishing vessel's identify, location, and onboard activities. Currently, Vessel Monitoring System (VMS) data is protected by NMFS under the NOAA Fisheries' Office of the Assistant Chief Information Officer and by the Office of Law Enforcement.¹⁶⁹ Incumbent upon clear state permissions or access rights to an individual user, the effectiveness of EM, digital logbooks, or AIS could falter until proper guidelines are established.

The topic of incorporating different data streams has been discussed previously in this report such as data collected by cooperatives, at-sea sampling, and other collaborative research efforts. Integrating this data, while novel and insightful, should be considered for more future fisheries projects especially within the new EFP program. This fisheries-dependent, detailed data can augment federal and state data, filling in gaps from fisheries-independent studies. The collaborative at-sea sampling program for lobster provided the Department with detailed size distribution and sex ratio data that could be used to inform more robust modeling to enhance management strategies.¹⁷⁰ Finding ways to incorporate, validate, and apply high resolution data from potential EFP projects into fisheries management will only improve scientific understanding of fisheries and enable managers to make more informed management decisions.

Collaboration

Collaboration is the biggest factor influencing future California EFP projects. Fishermen, scientists, and fisheries managers are all highly skilled experts and must set aside biases or barriers in order to fully execute EFP goals. For example, with more collaborative research EFPs, feedback from all parties is essential to ensure efficiency and feasibility of data collection methods. In the study by Schroeter et al. (2011), data collection methods created by both the Department and urchin divers were compared for accuracy and precision. This study illustrated the importance of involving fishermen early on in collaborative research efforts to ensure data accuracy and efficiency.¹⁷¹

Collaboration between multiple stakeholders is a complex and rather challenging task at times. However, another factor in the success of past federal Exempted Fishing Permits has been through the support of fishing vessel crew members.¹⁷² Lack of commitment from fishing crew members could potentially bring a project to a halt. Most of the fishermen contacted for this report also expressed concern for applying to the California EFPs as a single fisherman. Although allowed and highly encouraged, most fishermen would prefer to be recruited for bigger EFP projects, similar to the DSBG federal permits and current box crab EFP, rather than having to organize scientists and other collaborators on their own. On the other hand, there are several fishermen who have already worked alongside scientists for past projects and are eager to develop EFP ideas.

Furthermore, representation in governing bodies and other entities might factor into a fisherman's unwillingness to collaborate on EFP projects. Though unintentional, the absence of professional fishermen on the Commission and in the Department might inhibit industry participation. However, early education, outreach, and clear communication surrounding the EFP program could alleviate fears from the fishing industry and build trust around future fishery policy decisions.

Regulatory Hurdles

There are two tiers of regulation that will affect EFP approval. The federal agency NMFS, part of NOAA, has the authority over federal waters and federally managed species, such as those with federal Fishery Management Plans (FMPs), while the Commission regulates state coastal waters out to 3 nautical miles. However, federal jurisdiction can supersede the state's authority in some cases. Case in hand, is the West Coast groundfish fishery which is federally managed by NMFS and includes a number of the same species that also occur in state waters. Some of these species are also included under state regulation within the Nearshore Fisheries Management Act, but these state regulations can be superseded by the federal harvest quotas.¹⁷³ Depending on the fishery, discrepancies in federal and state regulations similar to the West Coast groundfish fishery could impact approval of future California EFPs.

The approval process for future EFPs could also prove burdensome and limit the implementation of some projects. In particular, the regulatory requirements of the California Environmental Quality Act (CEQA), categorical exclusions, and environmental impact statements are complex and costly. Back and forth discussions between state agencies and/or federal agencies could also cause delays in permit approvals similar to that of the federal Exempted Fishing Permit for recreational longleader gear in Oregon. The current Federal Exempted Fishing Permits are approved and issued by NMFS with guidance from the PFMC. However, the state EFP program will be carried out by the Department and the Commission. The Department will review EFP applications and provide recommendations to the Commission for approval. Although time from submittal to approval of EFP applications is anticipated to be 6-9 months, lengthy turnaround times and bureaucratic limitations could delay EFP projects.

CALIFORNIA EFP PROCEDURAL GUIDELINE RECOMMENDATIONS

The following procedural guideline recommendations for the new California EFP Program have been drafted from the information and suggestions collected during the informal interviews and online research. These proposed recommendations will help inform the Department's development of EFP procedural guidelines later this year. They can also serve as a living document for future EFP program updates. A summary sheet of these guideline recommendations can be found in the *Appendix*.

- 1) **Utilizing tools to increase stakeholder trust through the EFP process.** Examples of this could include more stakeholder workshops, outreach materials, early education about permitting programs and processes, and communication about the Department's goals.
- 2) **Integrating new data streams** into the data collection portion of EFP projects such as at-sea sampling and citizen science from local fishing cooperatives.
- 3) Taking into consideration business costs of the fishing industry and the marketability of any catch obtained during the project when determining EFP fees. **Prohibitive costs will inhibit fishermen**

from participating in the development of innovative new gears and/or exploratory fisheries. Some fishermen have suggested flat fees based on the complexity of the project.

- 4) **Identify funding opportunities.** Most EFP projects will require observer coverage and/or electronic monitoring as well as partnerships and collaboration on data collection. Having available financial backing will ensure the success of any future EFP projects in California while minimizing financial burdens to the fishing industry. Alternatives to electronic monitoring and observer coverage should be considered such as requiring observers dockside (often referred to as port sampling). This type of monitoring could also be used to validate data collected during at-sea sampling. A summary sheet of potential funding mechanisms can be found in the *Appendix*.
- 5) **Obtaining or coordinating a third-party facilitator for EFP project management, if possible.** Some of the success in the California Deep-set Buoy Gear Exempted Fishing Permit has been attributed to having a third-party project manager. This neutral, non-regulatory, and fishery dependent management strategy not only allowed for a more organized project, but it also facilitated trust and participation among the different collaborators. The rock crab and lobster collaborative at-sea sampling programs also found this to be critical for success.
- 6) **Defining what past fishing experience is required for EFP applications** and what it means in relation to applying for an EFP. Landings might not be the most accurate determination of experience especially with new species that have not been targeted before. One suggestion was the possibility of requiring attendance at designed meetings (in-person or online) if project recruitment is taking place similar to the box crab EFP.
- 7) **Executing transparency and timeliness in the application and approval processes.** Some of the federal Exempted Fishing Permits have taken up to two years to be reviewed and approved. Given the unpredictability in the fishing industry, a potential project might not be as relevant if approval times are lengthy.
- 8) **Issuing EFPs fairly and adequately to fit fishing industry needs.** Younger fishermen should be considered in some of the EFP lotteries, if appropriate, particularly if participating in the EFP influences who receives permits if it becomes a fishery.
- 9) **Having a streamlined process for applications of previously approved federal Exempted Fishing Permits or for recreational EFPs** (i.e. establishing a linkage between federal and state permits). There have been suggestions for a state equivalent permit for the Dan Platte and Barbara Emley Federal Permit to harvest inside RCAs with a vertical jig.
- 10) **Providing information in an accessible and more user-friendly format.** The Department will be creating a dedicated website for the EFP program, but should also include tabs with supplemental information about current EFP applications, examples of proposals/applications, point of contact(s), current regulations for EFPs, potential funding mechanisms, a list of priority research projects, and calendar for stakeholder events.
- 11) **Setting clear objectives for data collection and how it will be used to evaluate EFP projects and/or future fishery management.** Proper trainings, equipment, and feedback from fishermen similar to that of the at-sea sampling program should be considered for any Department related

data collection. It should also be noted that with electronic monitoring, digital logbooks, or other forms of spatial data collection, rights over the data should also be discussed as well as processing and data analysis costs.

12) Managing EFPs to ensure active participation and establishing clear measures of success.

Permit holders should be tracked for activity during the EFP project to ensure fair and equitable participation. There have been cases of past participants purchasing permits, but not actively participating in data collection or other project needs. It is thought that this results from fishermen purchasing a permit as a guarantee that they will be included in the permit system should a new fishery be implemented. Indicators for EFP success should also be defined and if an EFP meets these requirements, there should be a clear pathway to implementing fishery regulations. Additionally, once a fishery has been established, priority should be given to active EFP participants.

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California Experimental Fishing Permit (EFP) Project Ideas

(By Region)



Humboldt & Eureka

- Artisanal market squid fishery
- Limited open access spot prawn fishery
- Recreational deep drop/longleader gear fishery inside RCAs
- Freshwater invasive species fishery***
- Horizontal fixed trolled gear in RCAs

Bay Area & Monterey

- Pop-up gear in Dungeness crab fishery



South-Central Coast

- Nearshore clay pot octopus fishery
- Pink urchin fishery alongside spot prawn and box crab
- Trap fishery for sanddabs
- Commercial spearfishing for yellowtail, halibut, and seabass

San Diego

- Deep-set buoy gear for swordfish in state waters
- Deep-set buoy gear for thresher and mako sharks
- Pink urchin fishery
- Offshore octopus trap fishery
- Nearshore clay pot octopus fishery
- Moral eel fishery
- Modified swordfish nets for Pacific whiting/hake
- Sanddab nets
- Shallow-set buoy gear for white seabass

*** To be determined if this qualifies as a potential EFP or removal project

California Experimental Fishing Permit (EFP) Project Ideas

(By Project Type)



New Fishery

- Limited open access spot prawn fishery
- Freshwater invasive species fishery ***
- Pink urchin fishery alongside spot prawn and box crab
- Moral eel fishery
- Offshore octopus trap fishery



New or Modified Fishing Gear

- Pop-up gear in Dungeness crab fishery
- Recreational deep drop/longleader gear fishery inside RCAs
- Horizontal fixed trolled gear in RCAs
- Commercial spearfishing for yellowtail, halibut, and seabass
- Deep-set buoy gear for swordfish in state waters
- Deep-set buoy gear for thresher and mako sharks
- Shallow-set buoy gear for white seabass

Both

- Artisanal market squid fishery
- Nearshore clay pot octopus fishery
- Trap fishery for sanddabs
- Modified swordfish nets for Pacific whiting/hake
- Sanddab nets



*** To be determined if this qualifies as a potential EFP or removal project

Experimental Fishing Permit (EFP) Program Guideline Recommendations

- 1) Utilizing tools to increase stakeholder trust through the EFP process. Examples of this could include more stakeholder workshops, outreach materials, early education about permitting programs and processes, and communication about the Department's goals.



- 2) Integrating new data streams from into the scientific portion of EFP projects such as with at-sea sampling and citizen science from local fishing cooperatives.
- 3) Setting reasonable EFP permit costs by taking into consideration overhead and other business costs of the fishing industry as well as the marketability of any catch obtained during the project.
- 4) Identify funding opportunities as most EFP projects will require data collection, monitoring, and management.
- 5) Obtaining or coordinating a neutral third-party facilitator for EFP project management, if possible.

- 6) Defining what past fishing experience is required for EFP applications and what it means in relation to applying for an EFP.
- 7) Executing transparency and timeliness in the application and approval process.
- 8) Issuing EFPs fairly and adequately to fit fishing industry needs.
- 9) Having a streamlined process for applications of previously approved federal Exempted Fishing Permits or for recreational EFPs.
- 10) Providing information in an easy, accessible, and more user-friendly format.
- 11) Setting clear objectives for data collection and how it will be used evaluate EFP projects and/or future management.
- 12) Managing EFPs to ensure active participation and establishing clear measures of success.



Experimental Fishing Permit (EFP) Potential Funding Sources

Ocean Protection Council

Funding varies

Potential to sponsor or co-sponsor an EFP project

Already providing funding for electronic monitoring in the Dungeness crab fishery with hopes of working on pop-up testing in 2021/2022

<http://www.opc.ca.gov/category/funding-opportunities/>



Resources Legacy Fund

Funding varies

Application by invitation only

<https://resourceslegacyfund.org/our-approach/>



Saltonstall-Kennedy Program (NOAA Fisheries)

Maximum funding \$300,000

Competitive federal grant

Application deadline varies

<https://www.fisheries.noaa.gov/grant/saltonstall-kennedy-grant-program>



Sea Grant

Funding varies

Competitive state and federal research grants

Various grants to apply to throughout the year, application deadlines vary

<https://caseagrant.ucsd.edu/grants-and-funding>



The David & Lucile Packard Foundation

Funding varies

Conservation and Science (Climate, Ocean, Land, Science) Grant

Submit online request on website

<https://www.packard.org/grants-and-investments/for-grantseekers/>

<https://www.packard.org/grants-and-investments/grants-database/>



The Nature Conservancy

Funding varies

Potential to sponsor or co-sponsor an EFP project

<https://www.nature.org/en-us/>





UNIVERSITY OF CALIFORNIA, SAN DIEGO
HUMAN RESEARCH PROTECTIONS PROGRAM

Date: March 11, 2020

To: Ms. Lindsay Bauman

Re: Project #200305SX
Insights into California's Experimental Fishing Permit (EFP) program

Dear Ms. Bauman:

Your project has been reviewed by the Director of the UCSD HRPP, IRB Chair, or IRB Chair's designee and is certified as not qualifying as human subjects research according to the Code of Federal Regulations, Title 45, part 46 and UCSD Standard Operating Policies and Procedures; and therefore, does not require IRB review.

In order for a project to be considered human subjects research, both of the following must be true:

1. The activity is a systematic investigation, including research development, testing and evaluation. A systematic investigation is an activity that attempts to answer a research question or questions that is methodology driven in that it collects data or information in an organized and consistent way, and the data or information is analyzed in some way, be it quantitative or qualitative data and conclusion or conclusions are drawn from the results.
2. The activity is designed to develop or contribute to generalizable knowledge. Generalizable knowledge is defined as an activity that is designed (with intent) to collect information about some individuals to draw general conclusions about other individuals that are predictive of future events and that can be widely applied as expressed in theories, principles, and statements and that enhance scientific or academic understanding.

In order for a project to involve human participants, the following must be true:

1. The investigator will obtain data about living individuals through intervention or interaction with the individual *or* the information is individually identifiable.

Though certified as not human subjects research, the investigator should ensure that the activities associated with the project are conducted in compliance with applicable UCSD and Rady Children's Hospital – San Diego policies and ethical standards as well as local, state, and federal regulations.

Should you have any questions, please contact the HRPP Office at 858-246-HRPP (858-246-4777).

Sincerely,

A handwritten signature in black ink, appearing to read 'Kip Kantelo', with a stylized, flowing script.

/la

Kip Kantelo

Director

UCSD Human Research Protections Program

858-246-HRPP (858-246-4777); hrpp@ucsd.edu