Agenda Item I.4.a
NMFS Report 1
September 2019

Amendment 6 to the Fishery Management Plan for West Coast Highly Migratory Species Fisheries: Authorization of Deep-set Buoy Gear

Preliminary Draft Environmental Impact Statement

Executive Summary

This document provides a preliminary summary of a draft National Environmental Policy Act (NEPA) analysis regarding a Proposed Action to authorize a deep-set buoy gear (DSBG) fishery under the Fishery Management Plan for West Coast Fisheries for Highly Migratory Species (HMS FMP). Under this Proposed Action, DSBG would be identified as a legal commercial fishing gear in the HMS FMP and pursuant regulations. Management measures for the fishery would be established in the HMS FMP or in federal regulations under the HMS FMP's management framework.

Section 1 of this document provides an introduction and background information on the Proposed Action, including a description of the purpose and need and the Proposed Action Area. It also summarizes public comments received on the Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS), which NMFS published on March 4, 2019.

Section 2 summarizes the alternatives under the Proposed Action. Alternative 1 is the No Action alternative. Alternative 2 is to authorize DSBG under an Open Access regime, and includes specifications regarding gear description, gear tending, gear deployment and retrieval, use of multiple gear configurations on a single trip, permitting, fishing area, timing of fishing, species retention, and fishery monitoring. Alternative 3 is to authorize DSBG under a limited entry (LE) regime, including the same specifications as Alternative 2 along with five sub-options for the timing and number of LE permits to be issued. Alternative 3 also includes options discussed by the Pacific Fishery Management Council (Council) regarding qualifying criteria for obtaining LE permits. Section 2 closes with a discussion of other alternatives which have been considered during the process of developing the Proposed Action, but which are not being analyzed in detail in the NEPA process as they are not part of the Council's Range of Alternatives (ROA) for authorizing DSBG.

Section 3 describes the affected environment. This includes fisheries in or near the Action Area, target and non-target fish species, prohibited fish species, protected species (including marine mammals,

reptiles, and seabirds), essential fish habitat and critical habitat, and the socioeconomic environment. Components of the affected environment are discussed in terms of their likelihood of being affected by the Proposed Action. Components which are not likely to be affected (e.g., certain fish species and protected species, essential fish habitat, and critical habitat) are not discussed further in the document.

Section 4 analyzes the impacts of the alternatives on components of the affected environment which are likely to be affected, or may be affected, by the Proposed Action. This includes a biological impact analysis for species which have interacted with DSBG during exempted fishing permit (EFP) trials to-date, and qualitative discussion of species which may be affected by the Proposed Action but which have not been known to interact with DSBG. Section 4 also includes a socioeconomic analysis of impacts to fisheries in the Action Area, to HMS fishers and fishing communities involved with DSBG fishing, and to downstream users of DSBG-caught swordfish (e.g., processors, restaurants, and consumers).

Our analysis indicates that authorizing DSBG would result in a net increase in the number of domestically caught swordfish off the U.S. West Coast. The most likely annual DSBG swordfish catch under an Open Access regime, as indicated by our analysis, is 6,635 individual fish per year. The most likely annual catch under an LE regime, once the maximum number of LE permits is made available, is 4,030 fish per year. Impacts to non-target species do not appear likely to negatively affect stocks of these species. We also project that authorizing DSBG would result in a net increase in annual landings and revenues to regions where DSBG swordfish has been landed to date, but that increases in revenues will be attenuated by a negative price effect (i.e., increased landings of DSBG swordfish is associated with a decrease in DSBG swordfish price).

A forthcoming Draft EIS will include two additional sections. Section 5 will discuss cumulative impacts to the affected environment which result from synergistic effects of the Proposed Action along with other past, present, and future foreseeable actions. Section 6 will describe the applicable laws and mandates, including the Magnuson-Stevens Act (MSA), Coastal Zone Management Act (CZMA), Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA) in federal review of the Proposed Action. These sections are not drafted in detail in this preliminary document, but are outlined so as to enumerate their respective topics and subsections.

This document closes with a list of references cited, and placeholders for indexes and appendices which may be added as part of the ongoing work to prepare a draft NEPA analysis.

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Acronyms

This section will be completed as part of the ongoing draft EIS.

Glossary of Key Terms

This section will be completed as part of the ongoing draft EIS.

1. INTRODUCTION

1.1. Background

Since the early 20th century, fishers have harvested swordfish off the U.S. West Coast using a variety of methods. Traditionally, gear types have included harpoon, hook and line, drift gillnet (DGN), and longline gear. In recent decades, interest has mounted in the development of new gear types for targeting swordfish while minimizing interactions with protected species and bycatch of non-target finfish. Deep-set buoy gear (DSBG) is a type of fishing gear which has shown promise in addressing the desire for a productive, profitable swordfish gear type with minimal environmental impacts.

Since 1985, U.S. West Coast swordfish catch has declined 96 percent, from 3,073 metric tons (mt) at a value of $11.9 million, to 120 mt valued at $717,000 in 2013. This is in large part due to attrition in the DGN fishery (NMFS 2014). At the current annual attrition rate of 10 percent, the fishery is expected to disappear (SWFSC 2010; NMFS 2014).

Between 2014 and 2017, 88 percent of the total swordfish supply on the U.S. West Coast came from foreign imports, with 12 percent supplied from domestic sources. This gap between domestic demand and domestic supply can be attributed to a number of factors, including attrition in the DGN fishery, the lower price of imports compared to artisanal domestic gears such as harpoon, and increased regulations in domestic fisheries such as the longline and DGN fisheries. Harvest by the harpoon and DSBG exempted fishing permit (EFP) trials is small, each accounting for less than 1 percent of the total U.S. West Coast swordfish production from 2014 through 2017, with the remainder produced by DGN and Hawaii-based longline fisheries.

In recent years, interest in authorizing DSBG has grown, as fishers have gained more experience with the gear through both research and EFP trials primarily taking place in the Southern California Bight. DSBG employs a hook-and-buoy system to catch target species during the daytime in deep water, while they are feeding, with hooks commonly set at depths below 250 meters. This is in contrast to other gears such as DGN and shallow-set longline, which target swordfish near the surface at night, and are associated with higher rates of bycatch and protected species interactions. DSBG configurations include “standard” gear (SBG) and “linked gear” (also referred to as deep-set linked buoy gear (LBG)). Standard DSBG configurations consist of strike indicator buoys deployed at the surface, a vertical mainline, baited circle hooks at depth, and a weighted sinker to ensure that hooks reach depth rapidly. LBG additionally employs sub-surface branch lines connecting the various strike indicator buoys, and more hooks at depth.

DSBG initially developed off the U.S. West Coast through a series of research fishing trials which began in 2011. This initial research indicated that both standard and linked DSBG were effective gear types for selectively targeting swordfish, and potentially profitable to fishers. DSBG also demonstrated lower bycatch and protected species interactions than other common gear types such as DGN and longline. These promising results led to the Pacific Fishery Management Council (hereafter, the Council) to recommend that NMFS issue EFPs to fishers to expand testing of DSBG throughout the U.S. West Coast Exclusive Economic Zone (EEZ). EFP fishing began in 2015, with the most recent round of permits authorized through December 31, 2019 (84 FR 20108).

The Council initially adopted a range of alternatives (ROA) for recommending a federally-authorized DSBG fishery off the U.S. West Coast in June of 2018, but later (in November 2018) refined its ROA and adopted a preliminary preferred alternative (PPA).

1.2. Description of the Proposed Action

The Proposed Action is to authorize a DSBG gear-type targeting swordfish and other highly migratory species under the Fishery Management Plan for West Coast Fisheries for Highly Migratory Species (HMS FMP). DSBG would be identified as a legal commercial fishing gear in the HMS FMP and pursuant regulations. Management measures for the fishery could be established in the HMS FMP or in federal regulations under the HMS FMP's management framework.

1.3. Purpose and Need

Research and exempted fishing trials with DSBG have thus far indicated that this gear-type has infrequent protected species interactions and finfish bycatch. The purpose of the Proposed Action is to authorize the use of DSBG as an additional fishing gear in the West Coast commercial swordfish fishery that minimizes bycatch and bycatch mortality of finfish and protected species (including sea turtles, marine mammals, and seabirds) to the extent practicable while maximizing the potential for an economically viable fishery. If future experience demonstrates that DSBG is economically viable, it could help support a swordfish fishery conducted by vessels with West Coast home ports, and increase the availability of locally-caught swordfish in the market.

The Proposed Action is needed to authorize DSBG as a new gear type as a component of a West Coast swordfish fishery that effectively addresses the 10 National Standards for Conservation and Management included in the Magnuson Stevens Act, Section 301, in particular National Standards (NS) 1 (optimum yield) and 9 (minimize bycatch). DSBG may also help satisfy the need for commercially viable additions to the suite of legal swordfish gear types, to support sustained participation in the swordfish fishery by

West Coast fishing communities. In doing so, authorization of the fishery would also address NS 8 (take into account the importance of fishery resources to fishing communities).

1.4. Proposed Action Area

The Proposed Action Area includes all Federal waters offshore California and Oregon. "Federal waters" refers to the EEZ, beginning generally 3 nautical miles offshore and extending 200 nautical miles out to sea.

1.5. Scoping: Notice of Intent

On March 4th, 2019, NMFS published a notice of intent (NOI) to prepare an EIS (84 FR 7323) for authorizing DSBG. The NOI invited interested parties to provide comments on alternatives to be considered in an EIS, and to identify potential issues, concerns, and additional alternatives that might be considered. The public comment period closed on April 3rd, 2019.

1.5.1. Written Comments

NMFS received six comments on the NOI. The commenters requested that NMFS:

- Include a gear definition in the ROA that requires inclusion of tubing on surface lines to reduce the risk of entanglement;
- Analyze the benefits of incentivizing drift gillnet fishers to trade in their DGN permit through a DSBG limited entry (LE) program;
- Continue to consider dual authorization of both standard and linked configurations of DSBG;
- Evaluate DSBG data generated by researchers from the Pfleger Institute of Environmental Research (PIER) in addition to DSBG EFP data;
- Clarify in the EIS why active gear tending is a key regulatory requirement;
- Explore an alternative for a single DSBG gear endorsement on the General HMS permit, or clarify that DSBG fishers would receive both an SBG and an LBG endorsement on their General HMS permit;
- Clarify and justify an acceptable range of observer coverage for a DSBG fishery;
- Evaluate an LE program coastwide, not just one limited to Southern California;
- Consider whether modifying the LE qualifying criteria to include DSBG crewmembers before non-active fishers is more likely to achieve a goal of producing more swordfish;

- Consider using “highest landing of swordfish by weight” as the metric for determining who would qualify for an LE DSBG permit under the Council’s tiered criteria that would “[give] highest priority within a tier to those individuals with the highest landings”; and
- Clarify that “gear *may not* be deployed prior to sunrise” in the DSBG deployment and retrieval requirements consistent with the Council’s ROA. The NOI inaccurately stated that “gear *must* be deployed prior to local sunrise.”

Comments on the NOI also included copies of public comments regarding DSBG authorization made at previous Council meetings, and a PIER research manuscript. NMFS also received public comments during a public hearing on March 26th, 2019. Public comments made during the hearing were similar in nature and scope to the comments detailed above

2. ALTERNATIVES

NMFS manages fisheries under two broad permitting regimes, termed “open access” and “limited entry” (LE). In an open access fishery, any vessel owner or operator that is able to meet basic eligibility requirements (e.g., must list a registered or documented vessel) may obtain a permit to participate in the fishery. In an LE fishery, a finite number of permits are issued based on qualifying criteria for the LE program in addition to meeting basic eligibility requirements. These two regulatory regimes form the basis for the two action alternatives examined in this document. Key aspects of establishing an LE regime is determining the size of the program and specifying qualifying criteria. These aspects are discussed as sub-options in this document.

The alternatives described in this Section are based on the Council’s adopted ROA, including its preliminary preferred alternative (PPA). Both were adopted at the Council’s November 2018 meeting. NMFS drafted the Council’s ROA and PPA in a report for review and feedback during the March 2019 Council meeting (NMFS 2019). As its PPA, the Council adopted the action alternative that includes an LE permit program for vessels fishing in Federal waters east of 120° 28’ 18” W. longitude (i.e., Alternative 3 in this document). All other Federal waters offshore of California and Oregon would be “open access.” The Council’s PPA specifies a rate of growth in the number of LE permits to be considered and individuals could only possess one LE permit. The Council’s PPA prioritizes active DSBG EFP and DGN fishery participants. The other action alternative, which forgoes the LE regime and instead authorizes an open access fishery throughout the EEZ, is represented in Alternative 2. The ROA also includes alternatives for qualifying criteria for determining the order of applicants to whom a DSBG permit would be issued under an LE program.

2.1. Alternative 1—No Action

DSBG would not be authorized as a legal gear under the HMS FMP. In June 2019, the Council recommended that NMFS extend currently issued DSBG EFPs and issue 16 new two-year DSBG EFPs. The Council could continue to recommend that NMFS issue EFPs if DSBG is not authorized as a legal gear. However, future issuance of EFPs is speculative and not analyzed further in this EIS.

2.2. Alternative 2—Authorize an Open Access Fishery

Under this alternative, the fishery would be authorized with the following management measures.

Gear Description

DSBG refers to the overarching gear type that is actively tended in its multiple configurations. The umbrella of DSBG includes standard buoy gear (SBG) and linked buoy gear (LBG). Both of these gear types would be authorized initially.

Standard Buoy Gear (SBG) - An individual piece of SBG consists of a vertical monofilament mainline suspended from a buoy-array with a terminal weight. Up to three gangions with hooks may be attached to the mainline at a minimum depth of 90 meters. No more than 10 individual pieces of SBG may be deployed at any one time.

Linked Buoy Gear (LBG) - An individual piece (section) of LBG consists of a monofilament mainline which extends vertically from a buoy-array (either directly or from a minimum 50 foot poly-line extender) to a weight; then horizontally to a second weight; then vertically to a minimum 50 foot poly-line extender attached to a second buoy-array. Up to three gangions with hooks may be connected to each horizontal section of the mainline, all of which must be fished below 90 meters. The pieces may be linked together by the mainline, which is serviceable between each piece of LBG and must be suspended between links below a depth of 50 feet. No more than 10 sections of LBG may be deployed at any one time, with no more than 3 hooks per section.

Both DSBG configurations (SBG and LBG) must meet the following specifications:

1) Buoy-array: The surface buoy flotation and strike detection array consists of a minimum of three buoys (a minimum 45 lbs buoyancy non-compressible hard ball, a minimum 6 lbs buoyancy buoy, and a strike detection buoy) with no more than 6 feet of line between adjacent buoys all connected in-line by a minimum of ⅜ inch diameter line. Use of buoy tether attachments (e.g., non-streamlined gear with loops and/or dangling components) is prohibited. SBG and terminal LBG buoy-arrays must include a locator flag, a radar reflector, and vessel/fisher identification compliant with all current state requirements and regulations.
2) Weights must be a minimum of 3.6 kg.
3) Lines connecting surface buoys must be at least ⅜" diameter.
4) Minimum size 16/0 circle hooks with not more than 10 degrees offset.
5) No more than ten pieces of SBG or LBG may be deployed at one time, with no more than three hooks per piece.

Gear Tending

All pieces of gear must remain within 5 nm, and the vessel may be no more than 3 nm from the nearest piece of gear. These requirements allow for active tending, which is a key feature of this gear type.

Gear Deployment/Retrieval Timing

Gear may not be deployed prior to local sunrise and must be onboard the vessel no later than 3 hours after local sunset.

Use of Multiple Gears on a Single Trip

Gear types other than DSBG may be used on the same trip when DSBG is used, as long as the requirement to actively tend DSBG is met. This requirement will limit the gears with which fishers could concurrently fish with DSBG and maintain maneuverability to allow for active tending of DSBG and/or staying within the active tending boundary. Other gears could be set and retrieved on the way out to and returning from sea, and DSBG fished in between, potentially at a large distance from the other gear.

All landings must be tagged or marked to identify the gear used. This would facilitate properly attributing catch to the gear type used on a trip. Additional requirements may be necessary so that catch can be accurately recorded by gear configuration on the fish ticket/landings receipt. Any such identification would distinguish between fish caught with SBG versus LBG, as is required on landing receipts.

Permitting

New gear endorsements would be added to the existing Federal General HMS permit for both SBG and LBG (see gear definitions in section 1.2.1).

Geographic Area

The fishery would be authorized in all Federal waters offshore California and Oregon.

Fishery Timing

This fishery may operate throughout the year.

Species Retention

All species may be retained and landed unless prohibited by other law(s) or regulation(s).

Fishery Monitoring

Existing HMS FMP regulations governing observer coverage (50 CFR 660.719) establish a requirement that any HMS-permitted vessel must accommodate a NMFS certified observer when required by the agency. The level of observer coverage is determined by the agency.

HMS FMP regulations also require logbooks (50 CFR 660.708). NMFS, in consultation with the Council, would need to determine how to implement logbook and data submission requirements for the DSBG fishery.

2.3. Alternative 3—Authorize a Limited Entry Fishery

This alternative would include all the specifications described above for Alternative 2, and would in addition implement an LE permit, which would be required to fish DSBG in Federal waters east of 120° 28’ 18” W. longitude. The below parameters would apply to all LE permits. In addition, there are 5 options considered and analyzed regarding the timing of and number of permits to be issued. Section 2.3.1 describes these options in detail. In addition, two options were considered for establishing criteria to obtain LE permits. Those qualification criteria are discussed in section 2.3.2

Permit Possession

The HMS LE DSBG permit would be held by a person, as defined at 50 CFR 660.702, who must designate a vessel on the permit. The designated vessel need not be owned by the permit holder. The permit holder may change the vessel designation on the permit by written request to NMFS no more than one time per calendar year unless an extraordinary event renders the assigned vessel incapable of operation. The vessel owner must also hold a General HMS permit. A person may hold multiple DSBG LE permits, and multiple DSBG LE permits may designate the same vessel, but only one permit (10 pieces of gear) may be fished from any one vessel at a time. The permit holder would not be required to be onboard the vessel when DSBG is in use.

Permit Renewal

The HMS LE DSBG permit would be valid for one year and expire if not renewed. Such permits would revert to the issuing Agency and, if an LE program is in place, would be made available for reissuance.

Permit Transfer

HMS LE DSBG permits would not be transferable when the fishery is initially authorized. The Council may take action at some point after the fishery is authorized and the Council determines that transfer would benefit management. The Council may consider allowing permit transfers, and any related conditions, through the biennial management process.

2.3.1. Permit Issuance Options

A fixed number of permits would be issued under Alternative 3. Five options for the timing and number of permits issued are considered under the Council's ROA. Note that sub-option 3.5 has been identified as the Council's PPA. See Appendix A, Table A-2 for a visual comparison of the timing of permit issuance under each of these options.

2.3.1.1. Option 3.1

NMFS would issue up to 25 permits per year, not to exceed 300 total. If NMFS issues 25 permits per year, the maximum number of permits (300) would be reached in 12 years.

2.3.1.2. Option 3.2

NMFS would issue up to 50 permits per year, not to exceed 300 total. If NMFS issues 50 permits per year, the maximum number of permits (300) would be reached in 6 years.

2.3.1.3. Option 3.3

NMFS would issue up to 100 permits per year, not to exceed 300 total. If NMFS issues 100 permits per year, the maximum number of permits (300) would be reached in 3 years.

2.3.1.4. Option 3.4

NMFS would issue up to 300 permits maximum, beginning in the first year.

2.3.1.5. Option 3.5 (Council's PPA)

NMFS would issue up to 50 permits in the first year, with up to 25 permits issued annually in subsequent years until either a) a maximum of 300 permits are issued, b) NMFS determines that less than 300 are necessary to ensure compliance with the Endangered Species Act and Marine Mammal Protection Act, or c) the Council recommends to NMFS that less than 300 permits are necessary to meet stakeholder needs.

2.3.2. Limited Entry Permit Qualification Criteria Options

Five sub-options are considered for determining who would be eligible to receive an LE DSBG permit. The qualification criteria sub-options prioritize fishers with swordfish fishing experience. While there are some differences among the sub-options in the order of who would qualify earlier for a LE permit, those who would ultimately qualify is essentially the same population of fishers. The order of who would qualify is likely to have a very minor influence on the effects of the sub-options on the environment. For these reasons, we do not analyze these effects in detail further in this document. Table 2-1 presents the five sub-options for tiered criteria. Note that sub-options 1 through 4 would rank permit applicants based on tiered criteria related to past participation in swordfish fisheries. Sub-option 5 would rank permit applicants based on their historical possession of permits for other swordfish fisheries.

Table 2–1. LE qualifying criteria sub-options for permit issuance under Alternative 3.

Sub-Option 1

Ranking Category
1. Active EFP Recipients *"Active" EFP recipients are those with 10 observed DSBG days fished by a specified date. The Council could approve additional EFPs after this date, which could subsequently qualify as "Active."*
2. Active DGN Permit - Trade-in *"Active" DGN permits are those with at least 1 DGN landing between the 2013/14 and 2017/18 seasons. To qualify under this tier, the DGN permit in question must be surrendered as part of a State or Federal DGN permit trade-in or buy-back program.*
3. Active Swordfish (harpoon) Permit *"Active" harpoon permits require possession of a 2018/19 CA swordfish permit, and at least 1 harpoon landing between the 2013/14 and 2017/18 seasons.*
4. Active DGN Permit - No Trade-In *"Active" DGN permits are those with at least 1 DGN landing between the 2013/14 and 2017/18 seasons. No trade-in of a DGN permit is required to qualify under this tier.*
5. Inactive DGN Permit - Trade-in *"Inactive" DGN permits are those with no landings since 03/31/2013. To qualify under this tier, the DGN permit in question must be surrendered as part of a State or Federal DGN permit trade-in or buy-back program.*
6. Inactive DGN Permit - No Trade-In *"Inactive" DGN permits are those with no landings since 03/31/2013. No trade-in of a DGN permit is required to qualify under this tier.*
7. Inactive EFP Recipients *"Inactive" EFP recipients are those with at least 1, but less than 10 observed DSBG days fished by a specified date.*
8. Active Expired DGN & Swordfish Permits *"Active" DGN permits are those with at least 1 DGN landing between the 2013/14 and 2017/18 seasons. This tier includes DGN permits that have expired and are not currently valid.*
9. Inactive Expired DGN & Swordfish Permits *"Inactive" DGN permits are those with no landings since 03/31/2013. This tier includes DGN permits that have expired and are not currently valid.*
10. Other West Coast Swordfish Landings *To qualify under this tier, the applicant must have at least 1 swordfish landing between the 2013/14 and 2017/18 seasons, using a gear type other than DGN, harpoon, or DSBG.*
11. Other Applicants *Permits would be issued within this tier on a first-come, first-served basis.*

One permit or multiple permits could be issued per individual under this sub-option.

Sub-Option 2

Ranking Category
1. Active DGN Permit *"Active" DGN permits are those with at least 1 DGN landing between the 2013/14 and 2017/18 seasons.*
2. Active EFP Recipients *"Active" EFP recipients are those EFPs issued by 12/31/2018, and with 10 observed DSBG days fished by a specified date. The Council could approve additional EFPs after this date, which could subsequently qualify as "Active."*
3. Inactive DGN Permit *"Inactive" DGN permits are those with no landings since 03/31/2013.*
4. Active Swordfish (harpoon) Permit *"Active" harpoon permits require possession of a 2018/19 CA swordfish permit, and at least 1 harpoon landing between the 2013/14 and 2017/18 seasons.*
5. Crew Members with DSBG Experience *To qualify under this tier, applicants must have at least 1 day of DSBG fishing experience as a crew member before 11/7/2018.*
6. Other West Coast Swordfish Landings *To qualify under this tier, applicants must have at least 1 swordfish landing before 11/7/2018.*
7. Crew members w/ Swordfish Experience (non-DSBG) *To qualify under this tier, applicants must have at least 1 day of swordfish fishing experience as a crew member before 11/7/2018.*

One permit would be issued per individual under this sub-option.

Sub-Option 3

Ranking Category
1. a) Active DGN Permit - Trade-in*   *"Active" DGN permits are those with at least 1 DGN landing between the 2013/14 and 2017/18 seasons. To qualify under this tier, the DGN permit in question must be surrendered as part of a State or Federal DGN permit trade-in or buy-back program.*
b) Active EFP Recipients*   *"Active" EFP recipients are those with a DSBG EFP issued by 12/31/2018, and with 30 observed DSBG sets by the time DSBG is authorized by publication of a Final Rule in the Federal Register.*
2. Active Swordfish (harpoon) Permit   *"Active" harpoon permits require possession of a 2018/19 CA swordfish permit, and at least 1 harpoon landing between the 2013/14 and 2017/18 seasons.*
3. Active DGN Permit - No Trade-In   *"Active" DGN permits are those with at least 1 DGN landing between the 2013/14 and 2017/18 seasons. No trade-in of a DGN permit is required to qualify under this tier.*
4. Active EFP Recipients   *"Active" EFP recipients are those with a DSBG EFP issued after 12/31/2018, and with 30 observed DSBG sets by the time DSBG is authorized by publication of a Final Rule in the Federal Register.*
5. Inactive DGN Permit - Trade-in   *"Inactive" DGN permits are those with no landings since 03/31/2013. To qualify under this tier, the DGN permit in question must be surrendered as part of a State or Federal DGN permit trade-in or buy-back program.*
6. Inactive DGN Permit - No Trade-In   *"Inactive" DGN permits are those with no landings since 03/31/2013. No trade-in of a DGN permit is required to qualify under this tier.*
7. DSBG EFP crew   *To qualify under this tier, applicants must have at least 50 logged days as a crew member on DSBG EFP vessels.*

***Active EFP participants who also qualify as active DGN and trade in their permit would be eligible to receive 2 permits under this sub-option.**

Sub-Option 4: Council's PPA

Ranking Category
1. Active EFP Recipients *"Active" EFP recipients are those with 10 observed DSBG days fished by 12/31/2018.*
2. Active DGN Permit - Trade-in *"Active" DGN permits are those with at least 1 DGN landing between the 2013/14 and 2017/18 seasons. To qualify under this tier, the DGN permit in question must be surrendered as part of a State or Federal DGN permit trade-in or buy-back program.*
3. Active EFP Recipients *To qualify under this tier, the applicant must have at least 10 observed sets by the time DSBG is authorized by publication of a Final Rule in the Federal Register. EFPs already approved to fish after 12/31/2018, plus EFPs approved in the future, may qualify)*
4. Active Swordfish (harpoon) Permit *"Active" harpoon permits require possession of a 2018/19 CA swordfish permit, and at least 1 harpoon landing between the 2013/14 and 2017/18 seasons.*
5. Active DGN Permit - No Trade-In *"Active" DGN permits are those with at least 1 DGN landing between the 2013/14 and 2017/18 seasons. No trade-in of a DGN permit is required to qualify under this tier.*
6. Inactive DGN Permit - Trade-in *"Inactive" DGN permits are those with no landings since 03/31/2013. To qualify under this tier, the DGN permit in question must be surrendered as part of a State or Federal DGN permit trade-in or buy-back program.*
7. Inactive DGN Permit - No Trade-In *"Inactive" DGN permits are those with no landings since 03/31/2013. No trade-in of a DGN permit is required to qualify under this tier.*
8. Demonstrated Swordfish Experience *To qualify under this tier, the applicant must have some form of demonstrated swordfish fishing experience between 04/01/2013 and the time DSBG is authorized by publication of a Final Rule in the Federal Register.*
9. Other Applicants *Permits would be issued within this tier on a first-come, first-served basis.*

One permit could be issued per individual under this sub-option.

Sub-Option 5: Permit Possession

Ranking Category
DGN, Swordfish (harpoon) or DSBG permit (as of 11/16/2018)

Multiple permits could be issued per individual under this sub-option.

2.4. Alternatives Considered but Not Analyzed in Detail

During the course of Council discussion on DSBG authorization, reports by advisory bodies, and NMFS scoping a number of variations on the listed alternatives were presented and considered. Many of these alternatives dealt with different timing and amount of LE permit issuance, and different options for LE permit qualifying criteria.

- Phased-in approach with the Council re-evaluating information obtained from fishing operations once every 2 years.
- A lottery for the issuance of a limited number of permits in the first 2-year period.
- Authorization of an Open Access fishery until a specific concern is raised, at which time the Council could develop a Proposed Action to address the concerns (which may include altering the management scheme to LE, or using time/area closers or other measures instead).
- Extension of the Proposed Action area to include waters offshore Washington, rather than only California and Oregon.

These alternatives were ultimately excluded from the Council's ROA. Because NMFS is only analyzing the Council's ROA for DSBG authorization in this document, these alternatives are not analyzed further in detail.

3. AFFECTED ENVIRONMENT

3.1. Introduction

The components identified for evaluation and discussion in this section include fisheries in or near the Action Area, commonly caught species, other species in the Action Area (including protected species), essential fish habitat, critical habitat, and the socioeconomic environment.

3.2. Status of Target and Non-Target Fish Species

This section describes target and non-target fish species in the Action Area. All species observed caught in DSBG EFP fishing are included. Any species in the Action Area which are overfished or subject to overfishing, or prohibited under the HMS FMP are included as well. Non-target species considered likely to be caught include species caught in DSBG trials to date. Non-target fish species considered not likely to be caught include HMS in the Action Area that have not been observed or reported as caught in DSBG EFP fishing from 2015 through February 2019.

NMFS has processed data from observer records and fisher logbooks for DSBG EFP activity, including both SBG and LBG, from January 2015 through February 2019. Table 3-1 displays reported total catch in DSBG EFP trials.

Table 3-1. Summary of Reported DSBG Trials Catch, in Number of Individuals

	2015	**2016**	**2017**	**2018**	**2019***	**TOTAL**
Swordfish	136	474	556	640	19	1825
Bigeye thresher shark	66	57	35	35	0	193
Pelagic thresher shark	0	0	0	2	0	2
Common thresher shark	0	0	0	1	0	1
Shortfin mako shark	0	1	0	2	0	3
Blue shark	3	4	2	3	0	12
Common mola	0	0	0	1	0	1
Opah	2	1	0	0	0	3
Escolar	4	4	3	4	0	15
Humboldt squid	0	0	1	0	0	1
Giant squid	0	0	1	0	0	1
Yelloweye rockfish	0	0	1	0	0	1
Northern elephant seal	1	0	0	1	0	2
Loggerhead sea turtle	0	0	0	1	0	1
Total Days Fished	132	280	326	606	30	1374

** Only includes January & February 2019*

3.2.1. Target Species

Swordfish (*Xiphias gladius*)

Stock assessments for swordfish in the North Pacific indicate two stocks in the Action Area and in the vicinity of the Action Area: a Western and Central North Pacific Ocean (WCNPO) stock and an Eastern Pacific Ocean (EPO) stock (ISC 2014a). The WCNPO stock is not overfished or subject to overfishing (ISC 2018a), while the EPO stock is subject to overfishing (ISC 2014a). The WCNPO stock off the U.S. West Coast is an underutilized domestic resource (Berube et al. 2015), and is not overfished or subject to overfishing (ISC 2018a). However, the EPO stock is subject to overfishing, but not overfished (ISC 2014a). The WCNPO stock has been in a healthy condition for over a decade (Sippel 2015). The Proposed Action and existing U.S. West Coast fisheries operations fall within the WCNPO stock area. For the WCNPO in 2016 (the terminal year of the assessment), the relative spawning stock biomass (SSB/SSB_{MSY}; where SSB is the biomass, MSY is the maximum sustainable yield, and SSB_{MSY} is the spawning stock biomass that would produce MSY) was estimated at 1.87. Additionally, spawning stock biomass was estimated to be greater than the minimum stock size threshold (MSST) specified in the HMS FMP by a factor of 2.4 (i.e., below MSST, the stock would be considered overfished). The relative fishing mortality rate (F_{2016}/F_{MSY}, where F_{2016} is the fishing mortality rate in 2016 and F_{MSY} is the fishing mortality rate would achieve MSY) was 0.47. The maximum fishing mortality threshold (MFMT) in the HMS FMP is specified as equal to F_{MSY}; above this level the stock would be considered subject to overfishing (PFMC 2018).

3.2.2. Non-Target Species

3.2.2.1. Non-Target Species Considered Likely to be Affected

Bigeye thresher shark (*Alopias superciliosus*)

There is little information available on the population dynamics or stock status of bigeye thresher shark in the Proposed Action area. Studies have found evidence to indicate that the species, in general, is vulnerable to exploitation at relatively low levels of fishing mortality, due to low levels of productivity and/or spawning biomass (Fu et al. 2016; Young et al. 2015). A 2016 report to the Western and Central Pacific Fisheries Commission (WCPFC)'s Scientific Committee presented a novel approach to evaluating stock status and fishing pressure for the Pacific-wide population of bigeye threshers, based on the risk of fishing pressure exceeding the population's ability to recover (Fu et al. 2016). Accounting for uncertainty in the available data and analytical methods, the study found that the average probability of total fishing impact exceeding a maximum impact sustainable threshold (MIST) ranged from 20 percent to 40 percent, depending on assumptions of post-release mortality.

Pelagic thresher shark (*Alopias pelagicus*)

There is little information available on the population dynamics or stock status of pelagic thresher shark in the Proposed Action area. Pelagic threshers are often misidentified as common threshers, resulting in uncertainty in the quality of existing data on this species (Young et al. 2015). A 2010 study in the northwestern Pacific found that pelagic threshers in that region had experienced a decrease in population due to fishing mortality, indicating overexploitation (Tsai et al. 2010). However, no comparable stock assessments or analyses of fishing pressure are available for the EPO.

Common thresher shark (*Alopias vulpinus*)

In August 2014, Friends of Animals requested common thresher sharks be listed as endangered or threatened under the ESA, or, alternatively, delineated as six distinct population segments (DPSs) with each segment being listed as endangered or threatened. Friends of Animals cited fishing pressure, life history characteristics, and the lack of regulatory mechanisms to protect the sharks as the reasons for the listing. In March 2015, NMFS determined the action described in the petition was warranted for the species globally, but not warranted for the DPS because of the failure to support the identification of discrete populations (80 Fed. Reg. 11379, March 3, 2015).

A stock assessment for common thresher shark off the west coast of North America was completed in 2016 using data through 2014, then peer reviewed in 2017 and revised in 2018. The assessment reported that the stock experienced a relatively large and quick decline in the 1970s and early 1980s, but that the population appears to have stabilized after DGN regulations were imposed in 1990 (Teo et. al 2018). Over the past 15 years, the stock recovered quickly and is currently close to the unexploited level. Based on the results of the assessment, the common thresher shark stock is not overfished (SSB_{2014} exceeds MSST by a factor of 1.4) and is not subject to overfishing (F_{2014} was estimated to be 0.21 of the MFMT) (PFMC 2019).

Shortfin mako shark (*Isurus oxyrinchus*)

Shortfin mako constitutes an important incidental catch to the DGN fishery, whose market quality and ex-vessel value are important components of the landed incidental catch (Cailliet and Bedford 1983; Holts et al. 1998). Shortfin mako is also caught in California's recreational fishery. A majority are caught by anglers fishing with rod-and-reel gear from private vessels in the Southern California Bight (SCB) from June through October, peaking in August. During the early 1980s, they increased in prominence as a popular game fish, and annual catch estimates peaked in 1987 at 22,000 fish. Since 2001, annual catch estimates have ranged from 2,000 to 6,000 fish, with a percentage of sharks successfully released by southern California fishers favoring catch-and-release versus harvest.

Based on the most recent stock assessment for shortfin mako in the North Pacific Ocean (ISC 2018b), which included data through 2016, NMFS determined that the stock is not overfished nor subject to overfishing. Spawning stock biomass in 2016 was greater than the MSST specified in the HMS FMP by a factor of 1.6. The relative fishing mortality rate in 2016 (F_{2016}/MFMT) was 0.47 (PFMC 2019).

Blue shark (*Prionace glauca*)

The most recent north Pacific blue shark stock assessment occurred in 2017 and included data through 2015 (ISC 2017). The assessment results indicate that, relative to status determination criteria specified in the HMS FMP (i.e., MSST and MFMT), the north Pacific blue shark stock is not overfished nor is it subject to overfishing. In 2015, spawning biomass exceeded MSST by a factor of 2.0 to 2.3 (and also exceeded MSY), and F_{2017} was estimated to be well below MFMT (ISC 2017; PFMC 2019).

Common mola (*Mola mola*)

There is little information available on the population dynamics for this species. The stock status of common mola has never been assessed, but there is no evidence that populations are in decline or that fishing rates are too high.

Opah (*Lampris guttatus*)

Between 1990 and 1999, over 660 mt of opah were landed in California, with annual landings ranging from 37 mt to 112 mt. The highest landings of the decade occurred in 1998, associated with the El Niño conditions in 1997 and 1998. Although the majority of opah landed in California since 1990 were landed from San Luis Obispo County south (about 50 percent from San Diego County alone), landings were reported as far north as Crescent City. Sport fishers targeting albacore from British Columbia to Baja California occasionally catch opah. Within California, many sport-caught opah are taken from the northern Channel Islands south to the Coronado Islands, just below the U.S.-Mexico border.

The stock status of opah has never been assessed, but there is no evidence that populations are in decline or that fishing rates are too high.

Escolar (*Lepidocybium flavobrunneum*)

The stock status of escolar has never been assessed, but there is no evidence that populations are in decline or that fishing rates are too high.

Humboldt squid (*Dosidicus gigas*)

Humboldt squid provide an economically important fishery in the Gulf of California, Mexico, with an estimated population size of 20.2 million squid in that region (Morales-Bojórquez et al. 2012). Humboldt squid are subject to fishing pressure in this area, with periodic declines in spawning biomass preceded by commercial catches above the estimated maximum sustainable yield (Urías-Sotomayor et al. 2018). Studies have noted an expansion of the range of Humboldt squid in the EPO, including off the California coast, likely driven by climate factors and decreased presence of predator species (Stewart et al. 2014, Zeidberg & Robison 2007). They are not a target species of any U.S. West Coast fishery, although they have been incidentally caught and marketed by certain fisheries, including the DGN fishery. No evidence suggests that the species is overfished or subject to overfishing within the Proposed Action area.

Giant squid (*Architeuthis dux*)

This species is not targeted by any U.S. fishery and is not managed under the HMS FMP. One study suggests that there may have been a recent population expansion globally, as specimens analyzed from many different regions display low levels of genetic diversity (Winkelmann et al. 2013). The same study suggests that giant squids may comprise a single, global stock, although details about the stock's spatial distribution or life history movement patterns are not available given the current lack of data. The stock status of giant squid has never been assessed, but there is no evidence that populations are in decline or that fishing rates are too high.

Yelloweye rockfish (*Sebastes ruberrimus*)

Yelloweye rockfish have historically been caught by trawl and hook-and-line gear types in commercial and recreational fisheries off of the West Coast. Catches of yelloweye rockfish peaked in the 1980s and 1990s, and reached 552 mt in 1982. In 2002, yelloweye rockfish were declared overfished, and total catches have been maintained at much lower levels in the years since. Currently, yelloweye are caught only incidentally in fisheries targeting other species that are found in association with yelloweye (Gertseva and Cope 2017).

A 2017 assessment of yelloweye rockfish stocks in state and Federal waters off the U.S. West Coast found that the stock is currently at 28.4 percent of its unexploited level. The large majority of catches are made in sport fisheries operating out of California, Oregon and Washington, with smaller incidental catches occurring in commercial fisheries (Gertseva and Cope 2017).

3.2.2.2. Non-Target Species Considered Not Likely to be Affected

Species listed in this Section include HMS that are known to be present in the Action Area, but have not been observed or reported as caught in the DSBG trials from 2015 through February 2019. These species are not likely to be affected by the Proposed Action alternatives but are discussed here because they are HMS species present in the Action Area which are overfished or subject to overfishing.

Yellowfin tuna (*Thunnus albacares*)

Yellowfin tuna in the Pacific Ocean are managed as two stocks: the WCNPO stock and the EPO stock. The yellowfin tuna stock in the Proposed Action area is the EPO stock. The latest assessment determined to be best scientific information available for the purposes of determining stock status was completed by IATTC scientific staff in 2018 using data through 2017 (Minte-Vera et al. 2018). The assessment results show that relative to status determination criteria of the HMS FMP (i.e., MSST and MFMT) the EPO stock is not overfished (e.g., estimated to exceed MSST by a factor of 2.1), but is subject to overfishing by a small margin (e.g., F_{2017} estimated to have exceeded MFMT by 0.01) due to excessive international fishing pressure (Minte-Vera et al. 2018; PFMC 2019b).

The United States' total contribution to EPO yellowfin tuna harvest is small, accounting for approximately 3 percent of the total catch of the EPO yellowfin tuna stock. Currently, no domestic annual catch limits are in place for yellowfin tuna caught in the EPO; however internationally adopted measures to reduce fishing effort in the EPO were implemented in 2018 (NMFS 2018b).

Pacific bluefin tuna (*Thunnus orientalis*)

Pacific bluefin tuna is a single Pacific-wide stock with trans-Pacific migratory patterns. The majority of U.S. West Coast catch is caught opportunistically by commercial purse seiners fishing in the SCB and recreationally by commercial passenger fishing vessels, which have typically fished in Mexico's territorial waters. Using fishery data through 2016, the Pacific bluefin tuna stock was last assessed in 2018 (ISC). The assessment results indicate that the stock is still overfished and subject to overfishing with respect to status determination criteria specified in the HMS FMP (i.e., SSB_{2016} was estimated as 0.21 of MSST and F_{2016} was estimated to exceed MFMT by 0.17). However, recent projections of harvest scenarios performed in addition to the stock assessment indicate that a continuation of current management measures under a low recruitment scenario would result in achieving the initial biomass rebuilding target by 2024 with 98 percent probability. Additionally, the projections also indicate that the second rebuilding target would be achieved 10 years after the initial rebuilding target (adjusting to an average recruitment scenario after the initial rebuilding target is met) with a 96 percent probability (ISC 2018c; PFMC 2019).

In accordance with IATTC Resolutions and in effort to rebuild the Pacific bluefin tuna stock, NMFS regularly implements catch and trip limits for U.S. commercial catch of Pacific bluefin tuna in the EPO (e.g., 84 FR 18409, May 1, 2019). Once these the catch limits are reached, NMFS prohibits U.S. commercial vessels from targeting, retaining on-board, transshipping, or landing of Pacific Bluefin tuna through the remainder of the calendar year.

Bigeye tuna (*Thunnus obesus*)

Bigeye tuna in the Pacific Ocean are managed as two stocks: the WCPO stock and the EPO stock. The bigeye tuna stock in the Proposed Action area is the EPO stock. The 2017 stock assessment completed by Inter-American Tropical Tuna Commission (IATTC) scientific staff using data through 2016 is the latest assessment determined to be best scientific information available for purposes of determining stock status (Aires-da-Silva 2017). The assessment results show that fishing effort has been below the level corresponding to MSY, and that the EPO stock is neither overfished (i.e., B_{2016} was estimated to be 2.9 times MSST) nor subject to overfishing (i.e., F_{2016} was estimated as 0.87 of MFMT) (NMFS 2018c).

3.2.3. Prohibited Fish Species

Table 3-1 below lists the prohibited non-HMS species designated under the HMS FMP. In general, prohibited species must be released immediately if caught, unless other provisions for their disposition are established, including for scientific study (76 Fed. Reg. 56327, September 13, 2011).

Table 3–1. Non-Target Fish Species Prohibited under the HMS FMP.

Common Name	Scientific Name
Great white shark	*Carcharodon carcharias*
Basking shark	*Cetorhinus maximus*
Megamouth shark	*Megachasma pelagios*
Pacific halibut	*Hippoglossus stenolepis*
Salmonids	*Onchorhynchus* spp.

No interactions with prohibited species have been observed in DSBG EFP fishing trials from 2011 through February 2019. These species are not likely to be affected by the Proposed Action alternatives but are listed here because they are designated as prohibited species in the HMS FMP.

3.3. Status of Protected Species

3.3.1. Marine Mammals

All marine mammals in the waters of the United States are protected under the Marine Mammal Protection Act (MMPA). The MMPA and its regulations set out strict guidance for monitoring marine mammal stocks and estimating human impacts on these stocks. NMFS produces an annual Stock Assessment Report (SAR) that provides updated status and population estimates for each marine mammal stock in a region, based on the most recent available information. In addition to estimating the stock's population, NMFS must identify sources of human-caused mortalities and calculate the maximum anthropogenic mortalities that can be sustained by the stock if the stock is to persist at its current population or increase. Potential biological removal (PBR) is the maximum number of animals, not including natural mortalities, which may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

Most of this information may be found in the most recent published United States Pacific Marine Mammal SARs (Carretta et al. 2018); however, not every species was updated or revised in the latest publication. Thus, some species are cited using previous SARs, so that the most recent data for each species is presented. Under the MMPA, strategic stocks are those marine mammal stocks that are: (1) listed as endangered or threatened under the ESA, (2) likely to become listed under the ESA, or (3) when annual human-caused mortality and serious injury is greater than sustainable levels (i.e., above PBR). Depleted status applies to those species or stocks that have been determined to be below their optimum sustainable population or are listed as endangered or threatened under the ESA.

3.3.1.1. Marine Mammals Considered Likely to be Affected

DSBG has never before been authorized under the HMS FMP for use in the U.S. West Coast EEZ. Therefore, this section covers marine mammals in the Action Area which might have some potential for interaction with DSBG as would be introduced to the environment under the Proposed Action. We rely on data from DSBG EFP trials to determine which marine mammal species are considered likely to be affected.

Northern elephant seal (*Mirounga angustirostris*)

The best estimate of population abundance for the California breeding stock is 179,000 from 2014 data, with a minimum population estimate of 81,368 animals. PBR for this stock is calculated to be 4,882 animals per year (Carretta et al. 2015). Threats to this stock include mortality and injury in fishing gear (greater than 4.0 mean annual takes per year, based on data from 2008 through 2012). Takes have been documented in the DGN fishery, the California halibut and white seabass set gillnet fishery, the California small-mesh drift gillnet fishery, and the California/Oregon/Washington groundfish trawl fishery. Other threats include shooting, entanglement in marine debris, power plant entrainment, tar, and boat collisions. The stock is not classified as a strategic stock under the MMPA (Carretta et al. 2015). Two interactions with northern elephant seals have been observed in DSBG EFP fishing, one in 2015 and one in 2018.

3.3.1.2. Marine Mammals That May be Affected

This section describes marine mammals which have no interactions to date in DSBG EFP fishing, but which we consider may be affected by the Proposed Action, based on technical discussions with NMFS Protected Resources Division (PRD) (Christina Fahy, NMFS PRD, pers. comm. April 2019). These species dive deep and/or feed on squid like those used as bait in DSBG fishing (i.e., Risso's dolphin, beaked whales, sperm whale), have been documented entangled by other fisheries that employ vertical lines (i.e., humpback whale, gray whale), or are ESA-listed pinnipeds that have been caught by longline fishing near the action area (i.e., Guadalupe fur seal). Although data do not indicate that these species will interact with DSBG as would be authorized under the Proposed Action alternatives, we will discuss potential impacts qualitatively later in this document (see Section 4).

Risso's dolphin (*Grampus griseus*)

Risso's dolphins in California/Oregon/Washington waters are considered one stock in the SARs. The best estimate of population abundance for this stock is 6,272 (CV = 0.30), with a minimum population estimate of 4,913 animals. PBR for this stock is estimated to be 39 animals per year. The mean annual serious injury and mortality in commercial fisheries for this stock is estimated to be 1.6 (CV = 0.99) animals, based on data from 2004 through 2008. This stock is not classified as a strategic stock under the MMPA (Carretta et al. 2014).

Humpback whale (*Megaptera novaeangliae*)

Along the U.S. West Coast, NMFS currently recognizes one humpback whale stock that includes two separate feeding groups: a California and Oregon feeding group of whales that belong to the Central America and Mexico DPSs defined under the ESA, and a northern Washington and southern British Columbia feeding group that primarily includes whales from the Mexico DPS but also includes a small number of whales from the Hawaii and Central America DPSs (Calambokidis et al. 2008; Barlow et al. 2011; Wade et al. 2016; Carretta 2018). Abundance estimates from photographic mark-recapture surveys conducted in California and Oregon waters every year from 1991 through 2014 represent the most precise estimates (Calambokidis 2017). These estimates only include animals photographed in California and Oregon waters and not animals that are part of the separate feeding group found off Washington State and southern British Columbia (Calambokidis et al. 2009, 2017). California and Oregon estimates range from approximately 1,400 to 2,400 animals, depending on the choice of recapture model and sampling period. The most precise estimate of abundance for California and Oregon waters is the 2011 through 2014 Chao estimate of 2,374 (CV = 0.03) whales (Calambokidis 2017). With a minimum population estimate of 2,784 humpback whales, the PBR for this California/Oregon/Washington stock is 33.4 humpback whales per year; however, because this stock spends approximately 50 percent of its time outside U.S. waters, the PBR allocation for U.S. waters is 16.7 humpback whales per year (Carretta 2018). Because the Central America DPS is listed as endangered and the Mexico DPS is listed as threatened under the ESA, the stock is classified as strategic and depleted under the MMPA (Carretta et al. 2017).

NMFS recently completed a comprehensive status review of the humpback whale under the ESA, to determine whether an endangered listing for the entire species was still appropriate. On September 8, 2016, NMFS announced a final rule to revise the listing status of the species and divide the globally-listed endangered species into 14 DPSs, remove the current species-level listing, and in its place list four DPSs as endangered and one DPSs as threatened (81 Fed. Reg. 62259, September 8, 2016). The remaining nine DPSs are listed based on their current statuses. Three of the DPSs (the Mexico DPS, the Central America DPS and the Hawaii DPS) occur in the Action Area. The Mexico DPS is listed as threatened and the Central America DPS is listed as endangered; however, the Hawaii DPS is not listed under the ESA. Note that current DPSs and MMPA stocks do not line-up, and although there may be changes to the MMPA stock in the future, the population estimates above are the current best available science.

Sperm whale (*Physeter macrocephalus*)

The SARs divide sperm whales into three discrete groups for management purposes, including waters off California/Oregon/Washington, Hawaii, and Alaska. Previous estimates of sperm whale abundance from 2005 (3,140, CV = 0.40) (Forney 2007) and 2008 (300, CV = 0.51) (Barlow 2010) show a ten-fold difference that cannot be attributed to human-caused or natural population declines and likely reflect inter-annual variability in movement of animals into and out of the study area. New estimates of sperm whale abundance in California, Oregon, and Washington waters out to 300 nautical miles are available from a trend-model analysis of line-transect data collected from six surveys conducted from 1991 to 2008 (Moore and Barlow 2014) using methods similar to previous abundance trend analyses for fin whales (Moore and Barlow 2011) and beaked whales (Moore and Barlow 2013). Abundance trend models incorporate information from the entire 1991 through 2008 time series to obtain each annual abundance estimate, yielding estimates with less inter-annual variability. The best estimate of sperm whale abundance in the California Current is the trend-based estimate from the 2008 survey of 2,106 animals (CV = 0.58), which is corrected for diving animals not seen during surveys. The minimum population abundance estimate is 1,332 whales and the PBR for this stock is estimated to be 2.7 animals. The mean annual serious injury and mortality in commercial fisheries is less than 1.7 (CV = 0.95) sperm whales, based on data collected from 2001 to 2012. Fisheries documented to have taken sperm whales include the DGN fishery (average 1.3 per year over 12 years, based on the observed serious injury of 2 sperm whales in 2010) and IUU fisheries, based on stranded whales. Sperm whales are listed as endangered under the ESA, and consequently the California to Washington stock is automatically classified as a depleted and strategic stock under the MMPA (Carretta et al. 2015).

Ginkgo-toothed and Mesoplodont beaked whales (*Mesoplodon spp.*)

There are least 14 species in the genus *Mesoplodon*, but because of the difficulty in identifying the six species of Mesoplodont beaked whales found in the Action Area, including Hubbs' (*M. carlhubbsi*), pygmy beaked whale or lesser beaked whale (*M. peruvianus*), gingko-toothed (*M. gingkodens*), Blainville's (*M. densirostris*), Perrin's (*M. perrini*), and Stejneger's (*M. stejnegeri*) beaked whales, and the rarity of sightings, little species-specific information is currently available.

During the 2005 to 2008 surveys, the combined estimate of abundance for all species of *Mesoplodon* beaked whales in California, Oregon, and Washington waters out to 300 nautical miles is 1,024 (coefficient of variation or CV = 0.77) animals. This estimate does not include sightings of unidentified beaked whales made during 2005 and 2008, some of which may have included beaked whales of the genus *Mesoplodon* (Carretta et al. 2015). With a minimum population estimate of 389 animals, the estimated PBR for this group of species is 3.9 mesoplodont beaked whales per year and the average serious injury and annual mortality of mesoplodont beaked whales in U.S. commercial fisheries is estimated to be zero animals, based on data from 2004 through 2008 (Carretta et al. 2015). This group of species is not classified as a strategic stock under the MMPA (Carretta et al. 2015).

Gray whale (*Eschrichtius robustus*)

The population size of the Eastern North Pacific (ENP) gray whale stock has increased over several decades, despite an unusual mortality event in 1999 and 2000, and has been relatively stable since the mid-1990s. Abundance estimates of gray whales reported by Calambokidis et al. (2014) show a high rate of increase in the late 1990s and early 2000s, but have been relatively stable since 2003. In 2010, the International Whaling Commission (IWC) Standing Working Group on Aboriginal Whaling Management Procedure noted that different names had been used to refer to gray whales feeding along the U.S. West Coast. The group agreed to designate animals that spend the summer and autumn feeding in coastal waters of the Pacific coast of North America from California to southeast Alaska as the Pacific Coast Feeding Group (PCFG; IWC 2012). While the PCFG is recognized as a distinct feeding aggregation (Calambokidis et al. 2012; Mate et al. 2010; Frasier et al. 2011; Lang et al. 2011; IWC 2012), the status of the PCFG as a population stock remains unresolved (Weller et al. 2013). A NMFS task force charged with evaluating stock status of the PCFG noted that "both the photo-identification and genetics data indicate that the levels of internal versus external recruitment are comparable, but these are not quantified well enough to determine if the population dynamics of the PCFG are more a consequence of births and deaths within the group (internal dynamics) rather than related to immigration and/or emigration (external dynamics)." Further, given the lack of significant differences found in nDNA (or nuclear deoxyribonucleic acid) markers between PCFG whales and other ENP gray whales, the task force found no evidence to suggest that PCFG whales breed exclusively or primarily with each other, but interbreed with ENP whales, including potentially other PCFG whales. Additional research is needed to better identify recruitment levels in the PCFG and further assess the stock status of PCFG whales (Weller et al. 2013). In contrast, the task force noted that Western North Pacific (WNP) gray whales should be recognized as a population stock under the MMPA, and NMFS prepared a separate report for WNP gray whales in 2014.

At this time, given the lack of evidence to support the PCFG as a separate stock, the most recent estimate of abundance for the ENP whales based on a 2010/2011 southbound survey is estimated to be 20,990 (CV = 0.05) animals, with a minimum population estimate of 20,125 animals. The PBR for this stock is 624 animals per year. The mean annual serious injury and mortality in known commercial U.S. fisheries is greater than 4.4 gray whales, based on data from 2008 through 2012 (Carretta et al. 2015). The gray whale was removed from the endangered species list in 1994 as a result of its strong recovery, and it is not classified as a strategic stock under the MMPA (Angliss and Outlaw 2005).

Baird's beaked whale (*Berardius bairdii*)

The SARs designate Baird's beaked whales in the EEZ waters off the coasts of California, Oregon, and Washington as one stock. Sightings of Baird's beaked whales have been rare, even during ship and aerial transect surveys. The best population estimate, based on ship surveys from 2005 and 2008, was 907 (CV = 0.49) animals, with a minimum population estimate of 466. There is no information on trends in abundance, and the PBR for this stock is 4.7 animals per year. Mean annual take levels by U.S. commercial fisheries are estimated to be zero animals, based on data from 2007 through 2011. There have been zero observed beaked whales interacting with the DGN fishery since the pinger regulations were put in place in 1997 (NMFS 2015). Additional threats may be anthropogenic noise, especially military sonars, or other commercial and scientific activities involving the use of air guns. The total fishery mortality and serious injury for this stock can be considered insignificant and approaching zero and it is not classified as a strategic stock under the MMPA. Baird's beaked whales are not listed as threatened or endangered under the ESA nor is it classified as a depleted stock under the MMPA (Carretta et al. 2014).

Cuvier's beaked whale (*Ziphius cavirostris*)

The SARs designate the Cuvier's beaked whales in the EEZ waters off California/Oregon/Washington as one stock. Sightings of Cuvier's beaked whales off the U.S. West Coast have been infrequent, although they are the most commonly encountered beaked whale in this region. Seasonal trends are not apparent from stranding records. Early abundance estimates were imprecise and biased low by an unknown amount because of the large proportion of time this species spends submerged, and because ship surveys before 1996 covered only California waters and thus did not include animals off Oregon and Washington. A trend-based analysis of line-transect data from surveys conducted between 1991 and 2008 yielded new estimates of Cuvier's beaked whale abundance. The new estimate is substantially higher than the previous estimate, in part because it accounts for unidentified beaked whale sightings likely to be Cuvier's beaked whales, and because of a correction factor for individuals missed by observers in rough observing conditions. The best estimate of abundance is represented by the model-averaged estimate for 2009 of 6,590 (CV = 0.55) animals, with a minimum population estimate of 4,481 animals. The estimated PBR for this stock is 45 animals per year, and the average annual estimated take (serious injury and mortality) in the U.S. commercial fisheries is zero animals based on data from 2007 to 2011. As mentioned above, since 1996 when pingers were first used in this fishery, no beaked whales have been observed taken in the DGN fishery. As with other beaked whales, anthropogenic noise may also threaten the Cuvier's beaked whale, particularly mid-frequency active sonars, although the extent of this threat is unknown. Because the estimated annual average incidental mortality of this stock of Cuvier's beaked whale does not exceed its PBR level, it is not classified as a strategic stock under the MMPA (Carretta et al. 2015).

Guadalupe fur seal (*Arctocephalus townsendi*)

In 2010, the abundance of Guadalupe fur seals was estimated to be 20,000 animals, with a minimum population of 15,830 animals (García-Capitanachi, B. 2011). The estimated PBR is 542 animals per year, the vast majority of which would apply towards incidental mortality in Mexico as most of the population occurs outside of U.S. waters (Carretta et al. 2017). Incidental take in Mexican fisheries is unknown. This species is listed as a threatened species under the ESA and it is therefore considered strategic and depleted under the MMPA (Carretta et al. 2017).

3.3.1.3. Marine Mammals Considered Not Likely to be Affected

A number of additional marine mammal species are known to occur in the Action Area, but have no interactions to date in DSBG EFP fishing, and no additional concerns based on technical discussions with NMFS PRD (Christina Fahy, NMFS PRD, pers. comm. April 2019). Table 3-2 displays a list of these species.

Table 3-2. Marine Mammals Considered Not Likely to be Affected by the Proposed Action

Bottlenose dolphin (*Tursiops truncatus*)—California/Oregon/Washington offshore stock
Short-beaked common dolphin (*Delphinus delphis*)—California/Oregon/Washington stock
Striped dolphin (*Stenella coeruleoalba*)—California/Oregon/Washington stock
Harbor porpoise (*Phocoena phocoena*)
California sea lion (*Zalophus californianus*)
Northern fur seal (*Callorhinus ursinus*)
Harbor seal (*Phoca vitulina*)
Short-finned pilot whale (*Globicephala macrorhynchus*)
Minke whale (*Balaenoptera acutorostrata*)
Long-beaked common dolphin (*Delphinus capensis*)—California stock
Northern right-whale dolphin (*Lissodelphis borealis*)
Pacific white-sided dolphin (*Lagenorhyncus obliquidens*)
Dall's porpoise (*Phocoenoides dalli*)
Dwarf sperm whale (*Kogia sima*)
Pygmy sperm whale (*Kogia breviceps*)
Fin whale (*Balaenoptera physalus*)
Blue whale (*Balaenoptera musculus*)
Sei whale (*Balaenoptera borealis*)
Killer whale (*Orcinus orca*)
Northern fur seal (*Callorhinus ursinus*)
Steller sea lion (*Eumetopias jubatus*)

3.3.2. Reptiles

Four species of marine turtles may be found in the Proposed Action area.

3.3.2.1. Reptiles Considered Likely to be Affected

This section describes marine reptiles in the Action Area which might have some potential for interaction with DSBG as would be introduced to the environment under the Proposed Action. We rely on data from the DSBG EFP trials to determine which species are considered likely to be affected.

Loggerhead sea turtle (*Caretta caretta*)—North Pacific Ocean DPS

On September 22, 2011, the U.S. Fish and Wildlife Service (USFWS) and NMFS published a final rule listing nine DPS of loggerhead sea turtles (76 FR 58868). Loggerhead sea turtles in the Proposed Action area are considered part of the North Pacific Ocean DPS, which was listed as endangered

The North Pacific loggerhead DPS nests primarily in Japan (Kamezaki et al. 2003), although low level nesting may occur outside of Japan in areas surrounding the South China Sea (Chan et al. 2007; Conant et al. 2009). Nesting beach monitoring in Japan began in the 1950s on some beaches, and grew to encompass all known nesting beaches starting in 1990 (Kamezaki et al. 2003). Along the coast of Japan, nine major nesting beaches (greater than 100 nests per season) and six “submajor” beaches (10 to 100 nests per season) exist, including Yakushima Island where 40 percent of nesting occurs (Kamezaki et al. 2003). Census data from 12 of these 15 beaches provide composite information on longer-term trends in the Japanese nesting assemblage. As a result, Kamezaki et al. (2003) concluded a substantial decline (50 to 90 percent) in the size of the annual loggerhead nesting population in Japan since the 1950s. As discussed in the 2011 final ESA listing determination, current nesting in Japan represents a fraction of historical nesting levels (Conant et al. 2009; 76 FR 58868). Nesting declined steeply from an initial peak of approximately 6,638 nests in 1990 to 1991, to a low of 2,064 nests in 1997. During the past decade, nesting increased gradually to 5,167 nests in 2005 (Conant et al. 2009), declined, and then rose again to a record high of 11,082 nests in 2008, and then 7,495 and 10,121 nests in 2009 and 2010, respectively (Matsuzawa 2008, 2009, 2010). At the November 2011 Sea Turtle Association of Japan annual symposium, the 2011 nesting numbers were reported to be slightly lower at 9,011 (NMFS 2012, Asuka Ishizaki, pers. comm. November 2011).

Thus, for the 20-year period of 1990 to 2010, the total number of nests per year for the North Pacific DPS ranged between 2,064 and 11,082 nests. Assuming a clutch frequency of four nests per female per year (Van Houtan 2011), the number of nesting females recorded per year between 1990 and 2010 ranged between 516 and 2,771. The total number of adult females in the population was estimated at 7,138 for the period of 2008 to 2010 by Van Houtan (2011).

Loggerheads that have been documented off the U.S. West Coast are primarily found south of Point Conception, California in the SCB. In Oregon and Washington, records have been kept since 1958, with nine stranded turtles recorded over approximately 54 years. This equates to less than one stranding every six years (NMFS Northwest Region stranding records database, 1958 to 2012, unpublished data).

One loggerhead turtle has been observed caught in DSBG EFP fishing. The turtle became entangled in surface lines, and was disentangled and released alive. Following this event, NMFS amended the terms and conditions of its DSBG EFPs in an effort to eliminate sea turtle interactions of this nature. The gear specifications for the Proposed Action are consistent with the amended EFP terms and conditions.

3.3.2.2. Reptiles That May be Affected

This section describes marine reptiles which have no interactions to date in DSBG EFP fishing, but which present additional concerns based on their presence in the Action Area, interactions with other HMS gear types, and technical advice of NMFS PRD. While projections of potential interactions between these species and DSBG (which are based on data from EFP trials) do not indicate that these species will interact with DSBG as would be authorized under the Proposed Action alternatives, we will discuss potential impacts qualitatively later in this document (see Section 4).

Leatherback sea turtle (*Dermochelys coriacea*)

The leatherback turtle is listed as endangered under the ESA throughout its global range. Leatherbacks are found throughout the world. Populations and trends vary in different regions and nesting beaches. In 1980, one study estimated the global leatherback population at approximately 115,000 adult females globally (Pritchard 1982). By 1995, one estimate claimed this global population of adult females had declined to 34,500 (Spotila et al. 1996). A current global population estimate is not available at this time, but details on what is known of populations are provided below.

In the Pacific, leatherback populations are declining at all major Pacific basin nesting beaches, particularly in the last two decades (Spotila et al. 1996; Spotila et al. 2000; NMFS and USFWS 2007a; Tapilatu et al. 2013). Migratory routes of leatherback turtles originating from eastern and western Pacific nesting beaches are unknown for the entire Pacific population; however, satellite tracking of post-nesting females and foraging males and females, as well as genetic analyses, indicate that the leatherbacks found off the U.S. West Coast are from the western Pacific nesting populations, specifically boreal summer nesters. Unlike western Pacific leatherbacks, which nest year-round, eastern Pacific leatherbacks nest in the winter (December through March), and post-nesting movements indicate that they stay within the eastern South Pacific (Eckert and Sarti 1997; Shillinger et al. 2008). Therefore, eastern Pacific leatherbacks are not expected to be found within the Proposed Action area.

Based on satellite tracking data from leatherbacks nesting on Western Pacific beaches or foraging off California, some leatherbacks will move into U.S. coastal waters as early as the spring, often coming directly from foraging areas in the eastern equatorial Pacific (Benson et al. 2011). Leatherbacks will move into areas of high abundance and density of gelatinous prey (e.g., *Chrysaora fuscescens* and *Aurelia* spp.) along the U.S. West Coast, when upwelling relaxes and sea surface temperatures increase, leading to the development of foraging areas (Benson et al. 2011). These coastal foraging areas are primarily upwelling "shadows," or regions where larval fish, crabs, and jellyfish are retained in the upper water column during the relaxation of upwelling.

Three main areas of foraging have been documented on the U.S. West Coast: in California over the coastal shelf in waters of 14 to 16° C, particularly off of central California; along the continental shelf and slope off of Oregon and Washington, particularly off the Columbia River plume; and offshore of central and northern California at sea surface temperature fronts in deep offshore areas, although this area was not regularly used (Benson et al. 2011). Researchers estimated an average of 178 leatherbacks (CV=0.15) were present between the coast and roughly the 50-fathom isobath off California. Abundance over the study period was variable between years, ranging from an estimated 20 to 366 leatherbacks (Benson et al. 2007). Bioenergetics studies reveal that adults consume between 65 and 117 kilograms of jellyfish per day to meet their energetic demands (Jones et al. 2012). With jellyfish populations increasing in the Pacific, leatherbacks are likely not resource limited (Jones et al. 2012), although the distribution of these dense prey patches may cause leatherbacks, which are prey specialists, to concentrate in particular hot spots, as described above.

From the 2001/2002 through 2015/2016 fishing seasons, there have been two leatherback sea turtles observed caught in the DGN fishery. Both were released alive. Estimated mean annual M&SI in the DGN fishery is 0.30 animals, based on data from 2011 to 2015 (Carretta, et al. 2017).

3.3.2.3. Reptiles Considered Not Likely to be Affected

Two species of marine reptiles are known to occur in the Action Area, but have had no interactions to date in DSBG EFP fishing, and present no additional concerns based on their low presence in the Action Area and extremely low rates of interaction with other fisheries in the Action Area. These species include olive ridley sea turtles (*Lepidochelys olivacea*) and green sea turtles (*Chelonia mydas*). These species are not discussed further, as we anticipate no impacts resulting from any of the Proposed Action alternatives.

3.3.3. Seabirds

The U.S. Fish and Wildlife Service (FWS) maintains a list of endangered species by state, including bird species. Of the species of seabirds occurring in the Action Area, only the short-tailed albatross is listed as endangered. Short-tailed albatross are not likely to be caught by DSBG because baits are deployed and retrieved close to the vessel and sink rapidly to depth. This species is not discussed further, as we anticipate no impacts resulting from any of the Proposed Action alternatives.

3.4. Essential Fish Habitat and Critical Habitat

Essential fish habitat (EFH) for HMS species is described in Appendix F of the HMS FMP. EFH consists of the epipelagic and mesopelagic zones of neritic and oceanic waters (PFMC 2003). DSBG is pelagic fishing gear deployed in open water from the surface to 350 m depth, and is not designed to contact the ocean bottom. Given the biophysical characteristics of the water column and the components of the fishing gear (i.e., lines, hooks, weights, lights, floats, radar reflectors), the gear does not affect biophysical habitat. For this reason, it is not likely that the action alternatives would impact EFH.

Critical habitat has not been designated or proposed within the Action Area for most ESA-listed marine mammals, sea turtles, fish or invertebrates. Designated critical habitat for Steller sea lions (eastern DPS) is within the Action Area, including waters surrounding Año Nuevo Island, Sugarloaf Island, and the southeast Farallon Islands in California, and Pyramid Rock at Rogue Reef, and Long Brown Rock and Seal Rock at Orford Reef in Oregon (50 CFR 226). Critical habitat includes associated aquatic zones 3,000 feet seaward in state and federally managed waters from the baseline of each rookery (50 CFR 226.202(b)). All of the DSBG effort to-date has occurred well south of the islands that are designated as critical habitat. The Proposed Action is not likely to affect Steller sea lion critical habitat because DSBG fishing is not likely to occur very close to shore (i.e., within 3,000 feet of these rookeries), and it will not be considered further in this document.

Critical habitat was recently designated off the U.S. West Coast for leatherback sea turtles (77 FR 4170, January 26, 2012), which includes areas that would be open to the proposed DSBG fishery off the central coast of California. In the final rule designating leatherback critical habitat, NMFS identified one primary constituent element essential for the conservation of leatherbacks in marine waters off the U.S. West Coast: the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (e.g., Chrysaora, Aurelia, Phacellophora, and Cyanea), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks. However, the critical habitat designation does not specifically define or develop standards or measurable criteria for any of these particular aspects of prey occurrence. The critical habitat designation emphasizes that the preferred prey of leatherbacks off the California coast is jellyfish, with other gelatinous prey, such as salps (a pelagic tunicate), considered of lesser importance (77 FR 4170). It is highly unlikely that jellyfish bycatch would occur in DSBG fishing, due to the physical structure of the gear and the fact that jellyfish are not known to prey on baited hooks.

The Proposed Action is not likely to affect essential fish habitat or critical habitat, and they will not be considered further in this document.

3.5. Socioeconomic Environment

Socioeconomic impacts of the Proposed Action will occur to three main distributional groups: fisheries in or near the Action Area, HMS fishers and fishing communities, and downstream users of swordfish such as processors, restaurants, and consumers.

3.5.1. Fisheries in or Near the Action Area

Currently, landings of swordfish into U.S. West Coast ports come from the West Coast DGN and harpoon fleets that fish in the U.S. EEZ, from DSBG EFP vessels, and from U.S. longline vessels that fish on the high seas. However, the large majority of swordfish on the West Coast is supplied by imports from other nations.

Overall, swordfish fishing effort and landings have significantly declined on the U.S. West Coast. In 2018, 61 Federal DGN permits were issued, but only 19 of the permittees were active in the fishery. Much of the attrition in the DGN fleet is attributed to the closure of the Pacific Leatherback Conservation Area (PLCA) in 2001, which closes off large areas of the EEZ to DGN fishing from August 15 to November 15 each year. Following this closure, attrition in the fishery reached 100 percent in northern California ports and ranged from 55 to 75 percent in southern California ports. One source of uncertainty regarding the future of the DGN fishery is the existence of California state legislation which would implement a trade-in program for DGN permits, contingent on funding.

In recent years, the majority of swordfish landings in California have been from Hawaii longline vessels. In 2018, Hawaii longline vessels landed 120.3 mt of swordfish in southern California ports, while DGN landed 78.5 mt. DSBG EFP trials also landed 45.4 mt in 2018. The harpoon fishery is a low volume fishery, with landings of 5.4 mt in 2018. The remaining demand, over 1930 mt, was met by imports.

3.5.1.1. U.S. West Coast Deep-set Buoy Gear Trials

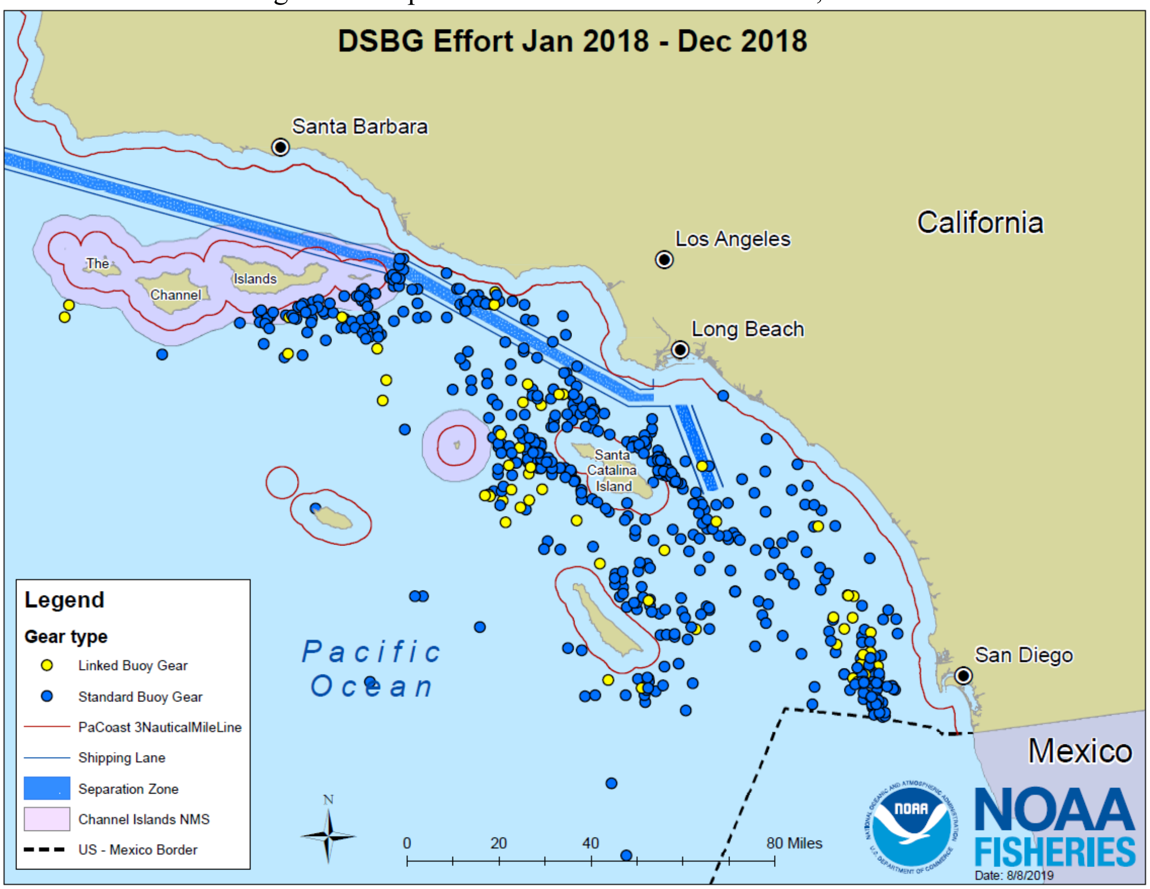
DSBG was first used off the U.S. West Coast in a series of research fishing trials which began in 2011. These trials were conducted by PIER, in consultation with the NMFS Southwest Fisheries Science Center (SWFSC). These research trials indicated that DSBG could be used to selectively target and harvest swordfish with minimal bycatch and protected species interactions. However, uncertainty remained regarding optimal gear configurations, timing of deployment, seasonality, and other factors. In 2015, NMFS issued five EFPs to PIER to further test DSBG. This preliminary Draft EIS relies on data from EFP trials from 2015-2019.

In 2017, a total of five vessels fished DSBG in waters off Southern California, landing 41.1 mt of swordfish worth $408,874. Other marketable species landed in DSBG EFP trials in 2017 included escolar, louvar, bigeye thresher shark, and common thresher shark.

In 2018, NMFS issued 60 EFPs to fish DSBG (both SBG and LBG) in the waters off Southern California. For SBG EFPs, 100 percent observer coverage was required for at least the first ten days of fishing, after which observer coverage was reduced to 30 percent of trips. The West Coast Region Observer Program inspects all DSBG vessels to ensure adequacy of safety equipment, accommodations, and general vessel safety. Some vessels are limited to single-day trips due to lack of bunk space for an observer. For LBG EFPs, observers are currently required on 100 percent of LBG trips during the first year of fishing activity, after which observer coverage may be reduced to a minimum of 30 percent of trips.

Figure 3-1 shows the spatial distribution of DSBG trial effort from January through December 2018. Note that, to date, all DSBG effort has been in waters off Southern California. Although Northern California and Oregon are within the action area, no effort or landings have taken place in these regions.

Figure 3–1. Spatial Distribution of DSBG Trials, 2018.



SBG EFPs issued in 2018 were considered valid for one year, after which they could be renewed for another year. LBG EFPs issued in 2018 were considered valid for two years. Table 3-3 displays information on DSBG EFPs in 2018, including number of permits issued, levels of observed effort, and incidences of observed protected species interactions.

Table 3–3. Information on DSBG EFPs for Calendar Year 2018.

Standard Deep-Set Buoy Gear (SBG)

# of Vessels	24	
# of Days Fished	538	
Avg. Days Fished per Vessel	22.42	
Overall Observer Coverage	57%	
Catch Composition		
Swordfish	556	
Bigeye Thresher Shark	33	
Pelagic Thresher Shark	2	
Common Thresher Shark	1	
Shortfin Mako Shark	1	
Blue Shark	1	
Escolar	2	
Common Mola	1	
Northern Elephant Seal	1	
Loggerhead Sea Turtle	1	
Swordfish	556	*92.8%*
Bigeye Thresher Sharks	33	*5.5%*
Other Sharks	5	*0.8%*
Other Finfish (Released)	3	*0.5%*
Northern Elephant Seal Released Alive	1	*0.2%*
Loggerhead Sea Turtle Released Alive (Entangled in surface gear)	1	*0.2%*

**Shaded fields are estimates based on partial observer coverage*

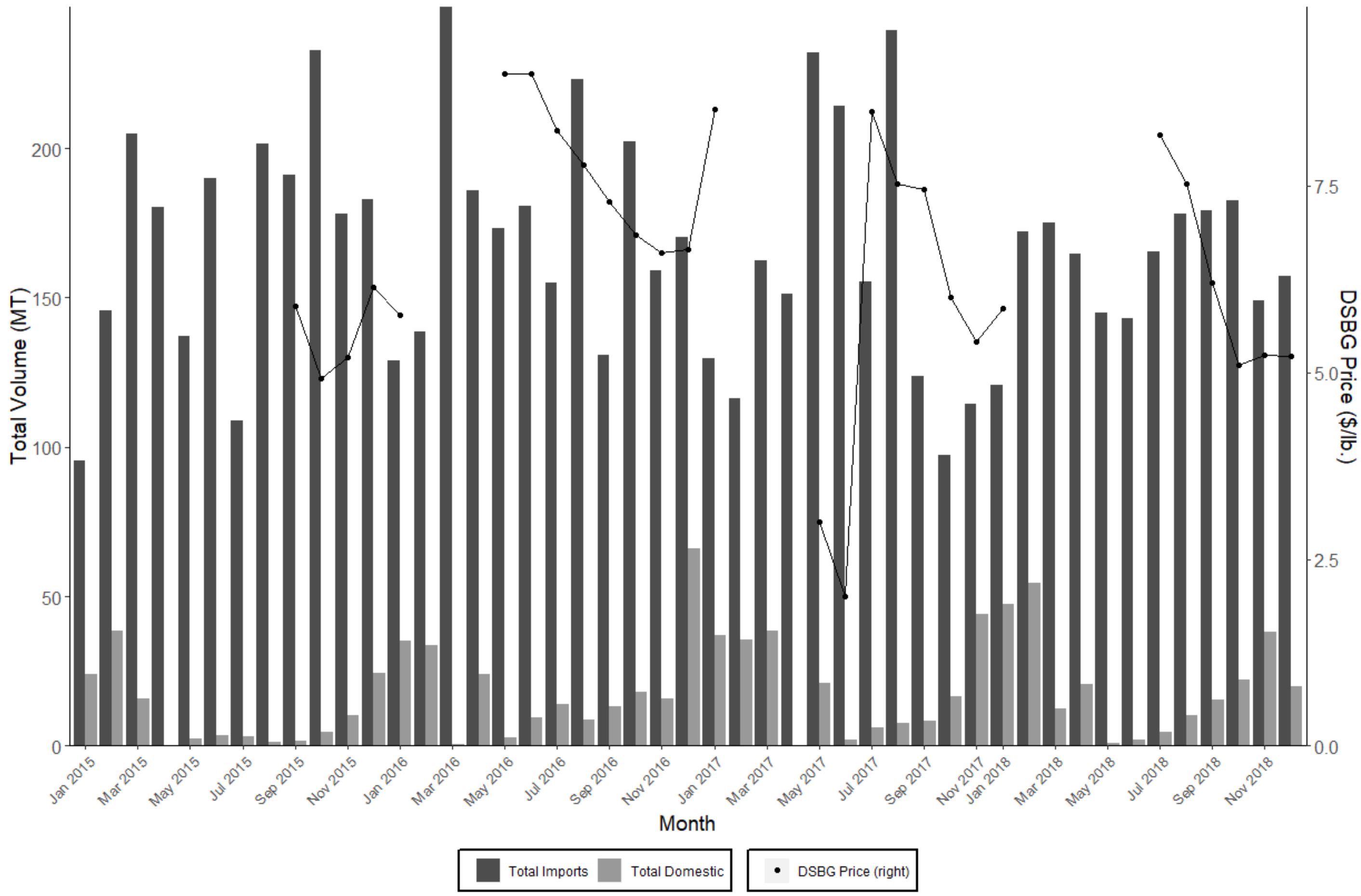
Linked Deep-Set Buoy Gear (LBG)

# of Vessels	5	
# of Days Fished	68	
Avg. Days Fished per Vessel	13.60	
Overall Observer Coverage	100%	
Catch Composition		
Swordfish	84	
Bigeye Thresher Shark	2	
Pelagic Thresher Shark	0	
Common Thresher Shark	0	
Shortfin Mako Shark	1	
Blue Shark	2	
Escolar	2	
Common Mola	0	
Northern Elephant Seal	0	
Loggerhead Sea Turtle	0	
Swordfish	84	*92.3%*
Bigeye Thresher Sharks	2	*2.2%*
Other Sharks	3	*3.3%*
Other Finfish (Released)	2	*2.2%*
Protected Species	0	*0.0%*

**Note that three vessels fished both standard and linked gear over the course of the season*

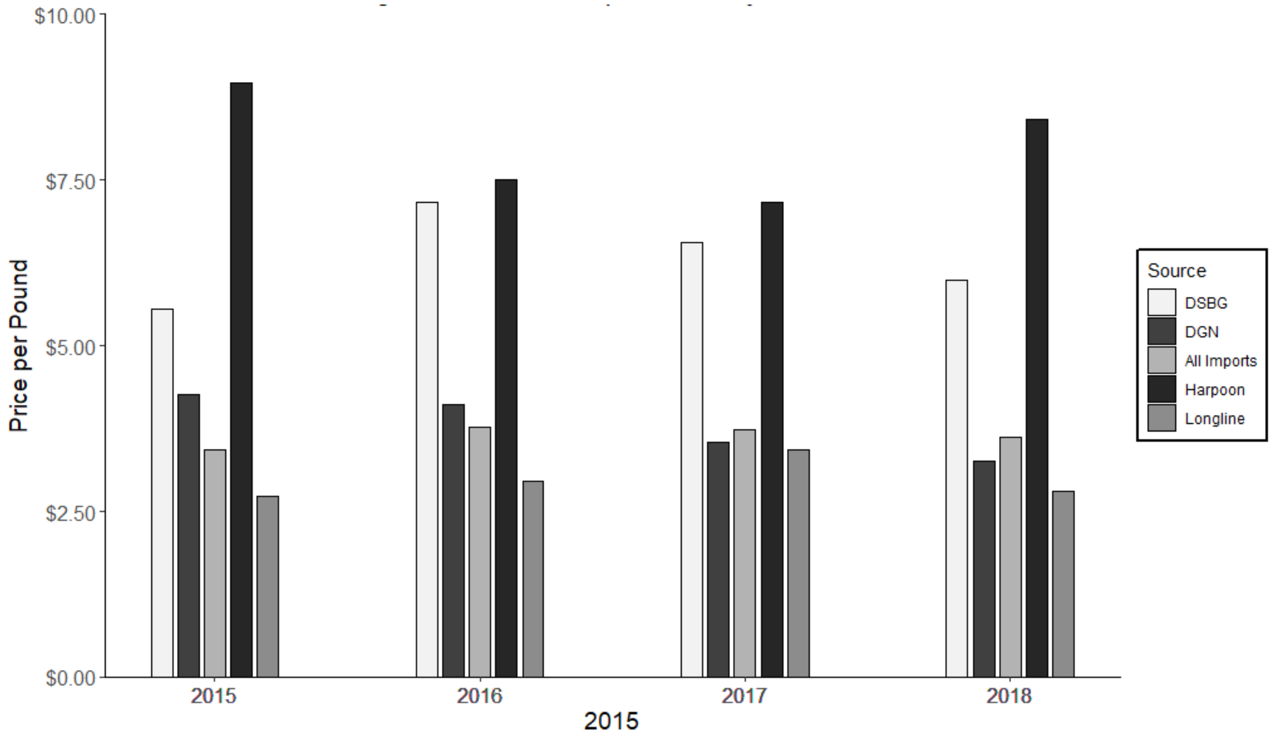
To date, DSBG-caught swordfish has fetched a high price compared to both imports and swordfish landed by other domestic HMS fisheries. There is some preliminary evidence to suggest that the price per pound for DSBG-caught swordfish tends to decline over the course of a given fishing season, as shown in Figure 3-2 below.

Figure 3–2. Landings and Price per Pound of DSBG-caught Swordfish, 2015-2018



In EFP fishing to date, DSBG-caught swordfish has fetched a higher price (on average) than DGN and longline-caught swordfish, but lower than harpoon-caught swordfish. Figure 3-3 shows the average price of swordfish from various sources for the years 2015-2018.

Figure 3–3. Average Price of West Coast Swordfish by Gear Type, 2015-2018



3.5.1.2. Other Commercial Fisheries

Commercial fisheries, authorized under the HMS FMP, that target swordfish in the Proposed Action area include large-mesh DGN and harpoon fisheries. With regards to the Proposed Action to authorize DSBG under the HMS FMP, the harpoon fishery is considered the most similar in terms of bycatch impacts and socio-economic characteristics, as it is an artisanal fishery selectively targeting swordfish and typically receiving a higher price for swordfish landings.

<u>Large Mesh DGN Fishery</u>

The DGN fishery developed in Southern California in the 1970's to target thresher sharks, and experienced periods of rapid growth and attrition thereafter. Swordfish replaced thresher shark as the primary target species of the DGN fishery in 1981 because of the fourfold higher price per pound of swordfish (NMFS 2015). DGN quickly replaced harpoon as the primary method for catching swordfish because of the greater catch-per-unit-effort (CPUE); DGN has a swordfish catch rate about 2 to 3 times higher and reduced cost of fishing (Coan et al. 1998). The fishery peaked in the mid-1980s with about 250 vessels participating. However, to reduce interactions with non-target fish, marine mammals, sea turtles, and sharks, regulations stipulating gear modification and area closures, such as the PLCA and the

Loggerhead Conservation Area (LCA), were enacted (50 CFR 660.713(c)((1) and (2)). In 2001, the PLCA time-area closure was put in place to protect leatherback sea turtles, and the LCA time-area closure (dependent on El Niño conditions) was put in place to protect loggerhead sea turtles (50 CFR 660.713(c)(2)). Since 2001, the number of active participants in the DGN fishery has remained under 50 vessels. Since 2013, fewer than 20 vessels have actively participated in the fishery annually. This fishery deploys gear in the U.S. EEZ off the coast of California and Oregon, with a fishing season that runs from May through January.

Harpoon Fishery

California's modern harpoon fishery for swordfish developed in the early 1900s. Prior to 1980, harpoon and hook-and-line were the only legal gears for commercially harvesting swordfish. At that time, harpoon gear accounted for the majority of swordfish landings in California ports. Like DSBG, harpoon is a highly selective gear type. Harpoon fishers typically target one swordfish at a time, resulting in virtually zero bycatch.

In the early 1980s, DGN replaced harpoon as the primary gear type for catching swordfish. The number of harpoon permits subsequently decreased from a high of 1,223 in 1979 to a low of 25 in 2001. Between 2013 and 2017, an average of 15 harpoon vessels actively fished each season, landing an average of 13.6 mt of swordfish annually. Some vessel operators work in conjunction with a spotter airplane to increase the search area and to locate swordfish difficult to see from the vessel. This practice tends to increase the CPUE compared to vessels that do not use a spotter plane, but at a higher operating cost. Harpoon fishing takes place inside the SCB exclusively typically from May to December, and peaking in August, depending on weather conditions and the availability of fish in coastal waters.

Hawaii and West Coast-Based High-Seas Longline Fisheries

The Hawaii longline fishery developed in the early 20th century. This fishery targets swordfish and tuna, and incidentally captures other marine species. This fishery deploys deep-set and shallow-set gear and operates mainly in the Northern Central Pacific Ocean. Although fishing activity by this fishery does not occur in the Action Area, it does land swordfish to Southern California ports. The Hawaii longline fishery landed between 83.1 and 164.2 mt of swordfish to Southern California between 2015 and 2018. The fishery typically targets swordfish using shallow-set gear, and bigeye tuna using deep-set gear year round.

A small West Coast-based longline fishery, historically including fewer than three vessels, targets tunas and other HMS outside of the West Coast EEZ using deep-set longline gear. This fishery incidentally landed small amounts of swordfish to Southern California ports between 2015 and 2018.

Recreational Fisheries

A large and economically important recreational and sport fishery is active in the Proposed Action area. In 2017, marine recreational anglers in California and Oregon undertook 3.7 million trips, 95 percent of which took place in California. These trips resulted in a harvest of 8.4 million individual finfish, of which 5.4 million (63 percent) were released (NMFS 2018a). Albacore is a common target of U.S. West Coast recreational fisheries, primarily using rod-and-reel gear. Recreational anglers in California take the entire suite of HMS FMP management unit species (MUS), using rod-and-reel gear almost exclusively. In addition, a nominal amount of fish, primarily tunas and dolphinfish, are taken by free divers using spear guns. In Oregon, anglers only occasionally take HMS species other than albacore, including blue sharks (PFMC 2018). Approximately 11 percent of the total West Coast recreational catch came from trips that fished primarily in Federal waters of the EEZ (i.e., within the Proposed Action area), with the remainder coming from state territorial waters or inland waters (NMFS 2018a). Swordfish fishing is open year-round to commercial passenger fishing vessels and private recreational boats, both of which may catch a small amount of swordfish recreationally.

3.5.2. Fishers and Fishing Communities

HMS fishers include all persons involved with commercial fishing for HMS species off the U.S. West Coast. This includes HMS permit holders, vessel operators, and crewmembers. These persons earn some or all of their annual income through HMS fishing in the Proposed Action area, using gears which target swordfish. As such, their livelihoods are affected by factors such as stock status of target species, permitting of HMS gear types and associated management measures, the fixed and variable costs of HMS fishing, catchability and CPUE of target species, and the ex-vessel price of landed species.

This EIS focuses on DSBG swordfish price as a key indicator of the socioeconomic impacts of the Proposed Action. Although the Proposed Action would authorize permits to fish DSBG under the HMS FMP, fishers will only choose to fish this gear if it is profitable, a factor which directly relates to the price they will receive for DSBG-caught swordfish. The price of landed swordfish is variable across time and is influenced by a number of factors, including gear type. The price of swordfish caught using DSBG is related to the quantity of swordfish landed, as well as the quantity landed by other gear types, or imported from foreign countries. The quantity landed of substitute species (i.e., species which restaurants or consumers might consider purchasing in lieu of swordfish) is another relevant factor influencing DSBG price. The price also varies from month to month and from year to year.

Table 3-4 presents summary statistics and data descriptions for all variables thought to impact DSBG swordfish price. The data source for all variables is from the confidential PacFIN HMS landings database, except for the imports data, which were sourced from NOAA Office of Science & Technology. Data are aggregated by month and refer to swordfish landings to Southern California ports, as DSBG has not been landed elsewhere to date.[1]

Table 3-4. Data Summary for DSBG Price Analysis

Variable	Mean	Min	Median	Max	Description
DSBG Price	$6.87	$5.04	$6.88	$8.60	Average price per pound paid for DSBG-supplied swordfish in a given month.
DSBG Landings	7,886	67	5,717	27,190	Total volume (in pounds) of DSBG-supplied swordfish in a given month.
DGN Landings	22,578	164	9,395	88,706	Total volume (in pounds) of DGN-supplied swordfish in a given month.
Harpoon Landings	3,582	122	1,555	25,606	Total volume (in pounds) of harpoon-supplied swordfish in a given month.
Longline Landings	11,573	36	2,305	111,028	Total volume (in pounds) of longline-supplied swordfish in a given month.
Fresh Imports	202,804	107,742	202,203	272,908	Total volume (in pounds) of fresh swordfish imports in a given month.
Yellowfin Tuna Landings	3,186	18	1,844	16,922	Total volume (in pounds) of yellowfin tuna landings from all domestic sources.
Dolphinfish Landings	2,745	169	2,543	12,834	Total volume (in pounds) of dolphinfish landings from all domestic sources.
Soak Hours	3,262	80	3,043	11,465	Total soak time (in hours) of DSBG in a given month.
Month		January		December	Month in which DSBG was landed.
Year		2015		2018	Year in which DSBG was landed.

Fishing communities affected by the Proposed Action include regions with significant economic activity derived from swordfish fishing. At the regional level, landings and revenues from DSBG EFP fishing have been concentrated in Southern California, with the majority of revenues to San Diego County, Los Angeles County, and Orange County. Lower volumes of landings and associated revenues have occurred in Ventura and Santa Barbara Counties. No landings of DSBG caught swordfish have occurred north of

[1] Ports with DSBG landings include Long Beach, Newport Beach, Oceanside, Oxnard, Santa Barbara, San Diego, San Pedro, Ventura, and a grouping of other Los Angeles/Orange County ports.

these regions. For the purposes of this document, we consider DSBG landings and revenues in three regions (Los Angeles & Orange County, San Diego County, and Ventura & Santa Barbara County). Figure 3-4 displays total annual round weight deliveries for the three regions where DSBG has been landed, and Figure 3-5 displays total ex-vessel revenues.

Figure 3–4. Total DSBG Landings (Round Weights) by County/Region, 2015-2018

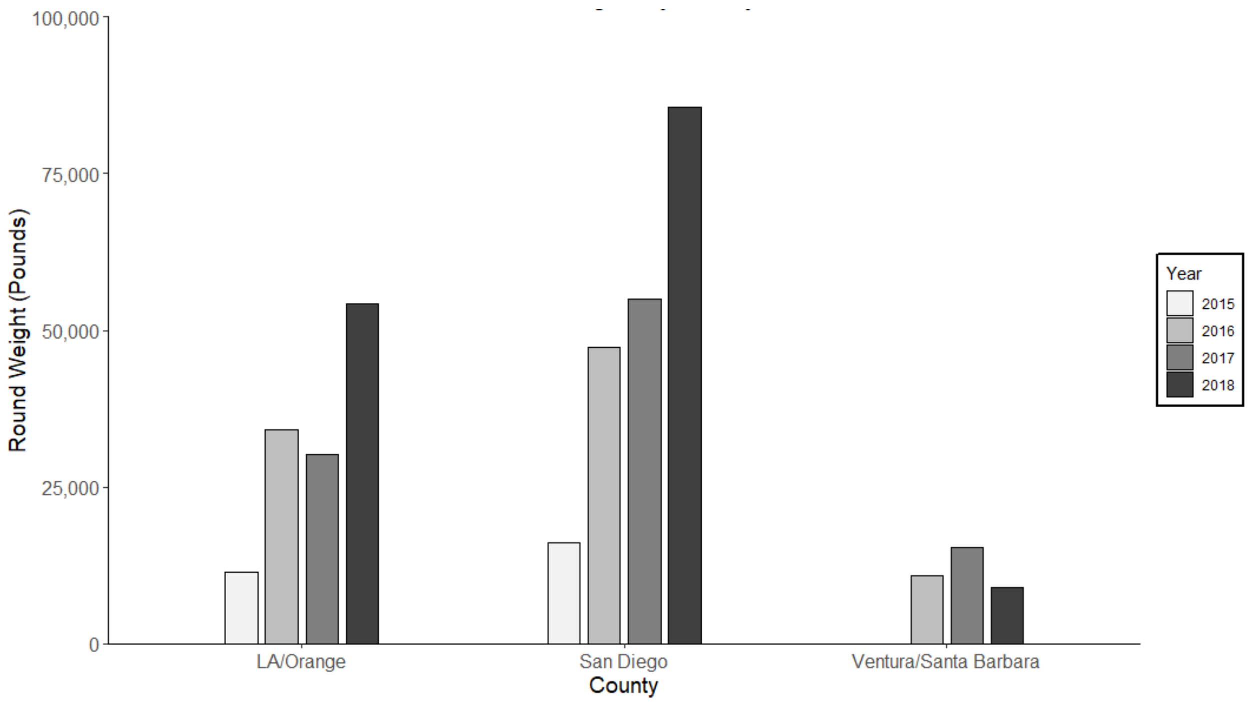
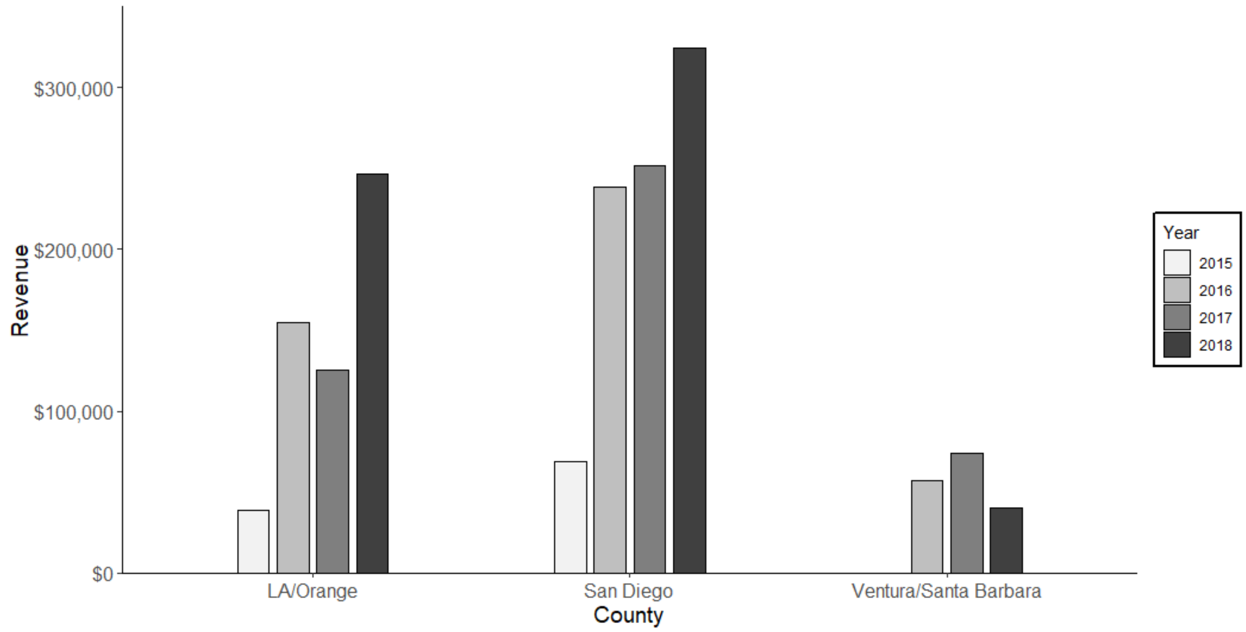


Figure 3–5. Total DSBG Revenues by County/Region, 2015-2018



3.5.3. Processors, Restaurants, & Consumers

Commercially-caught swordfish, once landed, is purchased, processed, and/or consumed by downstream users, including processors, restaurants, and consumers. Seafood processing companies purchase swordfish from HMS fishers to prepare and package it for users further down the supply chain (i.e., restaurants and consumers). Restaurants and some consumers may themselves purchase swordfish directly from fishers as well.

Different sources of swordfish are perceived as having varying levels of quality, as reflected by the range of average swordfish prices by source in Figure 3-3. For example, harpoon and DSBG-caught swordfish are generally considered higher quality products than DGN or longline-caught swordfish. Some consumers are also willing to pay a higher price for swordfish caught by more environmentally sustainable methods, such as harpoon or DSBG, which have been shown to produce markedly lower rates of non-target fish bycatch and protected species interactions compared to DGN or longline.

4. ENVIRONMENTAL CONSEQUENCES AND OTHER IMPACTS

4.1. Introduction

This section analyzes the effects of the Proposed Action alternatives on the resources described in Section 3, Affected Environment, including fisheries, fish species, protected species, and the socioeconomic environment. These analyses are based on expected fishing effort under each of the alternatives. The analysis relies on observer and logbook records at the days-fished level from the DSBG EFP trials, from September 2015 through February 2019, to evaluate potential catch of target and non-target fish species, and potential interactions with protected and prohibited species. In order to maximize the accuracy of our estimates, we employ NMFS observer data wherever possible, and logbook data for those days fished where an observer was not present on board the vessel.

We estimate potential catch rates of species likely to be affected by the Proposed Action, under each alternative, using a statistical methodology that accounts for uncertainty to produce a range of possible catch counts and the most likely value in a given year. We develop these estimates both for the twelve-year "ramp up" period, and for each single year once the maximum number of permits is issued under each alternative. See Appendix A for details on the methodology used for the biological analysis.

We estimate socioeconomic impacts of the Proposed Action using a statistical model which estimates the effect of various factors on DSBG price. We then use this estimated "price effect" to project the average price per pound of DSBG caught swordfish under each of the alternatives. We also project landings and revenues under each of the alternatives for three regions where DSBG has been landed to date. See Appendix B for details on the methodology used for the socioeconomic analysis.

4.2. Alternative 1—No Action

Under the No Action alternative, DSBG would not be authorized under the HMS FMP, and no DSBG permits would be issued under the FMP. The status quo of HMS fisheries off the U.S. West Coast would continue in the manner summarized in Section 3. Swordfish would continue to be supplied by other domestic HMS fisheries and foreign imports, and NMFS may continue exploring DSBG fishing through the issuance of EFPs rather than authorization under the HMS FMP.

4.2.1. Target Species

While DSBG trials to target swordfish in the Action Area could continue under EFPs in the Action Area under the No Action Alternative, any possible issuance of DSBG EFPs beyond those currently recommended by the Council is speculative. Issuance of EFPs is a lengthier and more labor-intensive process than issuance of permits for fishing gear legally authorized under the HMS FMP. It is unlikely that levels of permit issuance and annual DSBG fishing effort under EFP fishing would approach the levels expected under an authorized fishery. Therefore, it is expected that fewer swordfish would be caught in the Action Area and landed to the U.S. West Coast than under Action Alternative 2 or Alternative 3. As a result, the yield from the WCNPO swordfish stock found in the Action Area will likely continue to be suboptimal.

4.2.2. Non-Target, Prohibited, and Protected Species

Under the No Action alternative, impacts to non-target, prohibited, and protected species would remain at the levels expected under the status quo. It is unlikely that biological impacts from continued EFP fishing would approach those projected under an authorized fishery.

4.2.3. Socioeconomic Impacts

4.2.3.1. Impacts to Fisheries in or Near the Action Area

Under the No Action alternative, fisheries in or near the Action Area would continue to operate under status quo conditions (see Section 3.5.1). It is unlikely that levels of permit issuance and annual DSBG fishing effort under EFP fishing would approach the levels expected under an authorized fishery. U.S. West Coast swordfish fishers who do not obtain DSBG EFPs could continue to fish with DGN and harpoon inside the EEZ, and longline outside of the EEZ under existing regulations.

4.2.3.2. Impacts to Fishers & Fishing Communities

Under the No Action alternative, U.S. West Coast commercial fishers may continue to fish with DSBG in the Action Area under EFPs. The Council may recommend that NMFS issue additional DSBG EFPs in the absence of authorization; however, because fewer DSBG fishing trips are likely under EFP fishing than in an authorized DSBG fishery, fewer opportunities for targeting and landing swordfish using DSBG are expected in comparison to an authorized fishery. The majority of swordfish supply to the U.S. West Coast would continue to come from other domestic HMS fisheries and foreign imports.

4.2.3.3. Impacts to Processors, Restaurants, & Consumers

Under the No Action alternative, processors, restaurants, or consumers are likely to continue to rely on foreign imports rather than locally-caught swordfish to meet demands.

4.3. Alternative 2—Authorize an Open Access Fishery

Under Alternative 2, there would be no limit on the number of permits issued. Based on recommendations of the Council and its Highly Migratory Species Management Team (HMSMT), we use 500 permits as the basis for analysis.[2]

4.3.1. Target and Non-Target Species Considered Likely to be Affected

The tables below display the projected impacts to species likely to be affected by Alternative 2, based on our biological analysis (see Appendix A for detail on how these estimates were calculated). The results for the open access alternative are left unshaded for emphasis. Results are given as a range of possible catch counts with a 95 percent credible interval (i.e., the range with a 95 percent probability of containing the true catch value). The tables display the mean, median, and mode of the calculated distributions of possible catch values under each alternative, as well as the range of the 95 percent credible interval. The mode is the most likely value in any one given year, based on the probability distribution of possible catch counts.

4.3.1.1. Target Species

Swordfish (*Xiphias gladius*)

Table 4-1 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

[2] The HMSMT recommended 500 permits as the basis of analysis because this number is similar to the highest number of swordfish fishery participants in the past, when DGN and harpoon were at their peak.

Table 4–1. Swordfish Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.01929*	*0.01842*	*0.01928*	*0.02018*	
	Per Day Fished	*1.32163*	*1.26225*	*1.32131*	*1.38274*	
12 Year Ramp Up	Open Access	80,156	76,411	80,133	83,953	80,169
	LE 3.1	26,051	24,824	26,044	27,306	26,023
	LE 3.2	38,071	36,260	38,063	39,897	37,970
	LE 3.3	44,087	42,014	44,073	46,199	43,774
	LE 3.4	48,094	45,825	48,082	50,384	47,893
	LE 3.5	29,725	28,315	29,719	31,143	29,939
Ongoing Annual	Open Access	6,678	6,328	6,676	7,030	6,635
	LE (All)	4,008	3,786	4,007	4,234	4,030

Under the Open Access alternative, the most likely total swordfish catch during the twelve year ramp up period is 80,169 individuals. The most likely catch in a given year is 6,635. Because the swordfish stock off the U.S. West Coast is underutilized, and the WCNPO stock is not overfished or subject to overfishing, effects to the swordfish population are likely to be minor and not affect the sustainability of the stock.

4.3.1.2. Non-Target Species

<u>Bigeye thresher shark (*Alopias superciliosus*)</u>

Table 4-2 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2. The results for the open access alternative are left unshaded for emphasis.

Table 4–2. Bigeye Thresher Shark Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00206*	*0.00178*	*0.00205*	*0.00235*	
	Per Day Fished	*0.14105*	*0.12194*	*0.14079*	*0.16123*	
12 Year Ramp Up	Open Access	8,516	7,357	8,502	9,758	8,460
	LE 3.1	2,768	2,381	2,764	3,185	2,783
	LE 3.2	4,045	3,489	4,038	4,638	4,009
	LE 3.3	4,684	4,043	4,675	5,374	4,609
	LE 3.4	5,110	4,411	5,100	5,863	5,029
	LE 3.5	3,157	2,716	3,150	3,632	3,208
Ongoing Annual	Open Access	709	601	708	825	686
	LE (All)	426	357	425	501	427

Under the Open Access alternative, the most likely total bigeye thresher shark catch during the twelve year ramp up period is 8,460 individuals. The most likely catch in a given year is 686. Because this species is vulnerable to exploitation at relatively low levels of fishing mortality (Fu et al. 2016; Young et al. 2015), this may imply a significant impact at the population level. However, preliminary post-release mortality studies conducted by PIER have indicated that over 90 percent of bigeye thresher sharks caught and released in DSBG fishing survive the acute effects of capture (Sepulveda and Aalbers 2019).

Pelagic thresher shark (*Alopias pelagicus*)

Table 4-3 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–3. Pelagic Thresher Shark Catch (in Number of Individuals) Under Alternative 2

		Mean	**CI 2.5%**	**Median**	**CI 97.5%**	**Mode**
CPUE	*Per Buoy Hour*	*0.00002*	*0.00000*	*0.00002*	*0.00006*	
	Per Day Fished	*0.00156*	*0.00020*	*0.00133*	*0.00423*	
12 Year Ramp Up	Open Access	95	11	80	262	49
	LE 3.1	31	3	26	86	20
	LE 3.2	45	5	38	126	24
	LE 3.3	52	6	44	144	31
	LE 3.4	57	6	48	157	30
	LE 3.5	35	4	30	98	17
Ongoing Annual	Open Access	8	0	6	23	4
	LE (All)	5	0	4	15	2

Under the Open Access alternative, the most likely number of pelagic thresher shark takes during the twelve year ramp up period is 49 individuals. The most likely catch in a given year is 4. The effects of this level of catch to the stock are likely to be minor.

This species' presence off Southern California is highly seasonal. It is possible that the probability of catching this species in DSBG is dependent on seasonal conditions such as water temperature, and that the likelihood of its catch in a given year may be higher or lower than that reflected by the single interaction in the current dataset.

Common thresher shark (*Alopias vulpinus*)

Table 4-4 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–4. Common Thresher Shark Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00086*	*0.00003*	*0.00062*	*0.00298*	
12 Year Ramp Up	Open Access	51	1	37	182	12
	LE 3.1	17	0	12	60	2
	LE 3.2	24	0	17	87	1
	LE 3.3	28	0	20	101	5
	LE 3.4	31	1	22	110	6
	LE 3.5	19	0	13	68	5
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0

Under the Open Access alternative, the most likely number of common thresher shark takes during the twelve year ramp up period is 12 individuals. The most likely catch in a given year is 0. The effects of this level of catch to the stock are likely to be minor.

Shortfin mako shark (*Isurus oxyrinchus*)

Table 4-5 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–5. Shortfin Mako Shark Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00003*	*0.00001*	*0.00003*	*0.00008*	
	Per Day Fished	*0.00231*	*0.00050*	*0.00205*	*0.00543*	
12 Year Ramp Up	Open Access	140	28	125	333	96
	LE 3.1	45	8	40	110	28
	LE 3.2	66	13	59	160	44
	LE 3.3	77	15	69	185	57
	LE 3.4	84	16	75	200	57
	LE 3.5	52	10	46	125	32
Ongoing Annual	Open Access	12	1	10	29	8
	LE (All)	7	1	6	18	4

Under the Open Access alternative, the most likely number of shortfin mako shark takes during the twelve year ramp up period is 96 individuals. The most likely catch in a given year is 8. The effects of this level of catch to the stock are likely to be minor.

Blue shark (*Prionace glauca*)

Table 4-6 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–6. Blue Shark Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00012*	*0.00006*	*0.00011*	*0.00020*	
	Per Day Fished	*0.00808*	*0.00404*	*0.00785*	*0.01346*	
12 Year Ramp Up	Open Access	495	246	480	830	416
	LE 3.1	161	78	156	272	150
	LE 3.2	235	115	228	396	220
	LE 3.3	272	134	264	457	233
	LE 3.4	297	146	288	500	265
	LE 3.5	184	90	178	309	165
Ongoing Annual	Open Access	41	18	40	72	37
	LE (All)	25	10	24	45	22

Under the Open Access alternative, the most likely number of blue shark takes during the twelve year ramp up period is 416 individuals. The most likely catch in a given year is 37. The effects of this level of catch to the stock are likely to be minor.

Common mola (Mola mola)

Table 4-7 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–7. Common mola Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00084*	*0.00003*	*0.00061*	*0.00294*	
12 Year Ramp Up	Open Access	52	2	38	180	8
	LE 3.1	17	0	12	60	4
	LE 3.2	25	0	18	86	4
	LE 3.3	29	1	21	100	7
	LE 3.4	31	1	23	109	4
	LE 3.5	19	0	14	68	4
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0

Under the Open Access alternative, the most likely number of common mola takes during the twelve year ramp up period is 8 individuals. The most likely catch in a given year is 0. The effects of this level of catch to the stock are likely to be minor.

Opah (*Lampris guttatus*)

Table 4-8 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–8. Opah Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00003*	*0.00001*	*0.00003*	*0.00008*	
	Per Day Fished	*0.00231*	*0.00049*	*0.00207*	*0.00543*	
12 Year Ramp Up	Open Access	141	29	127	334	90
	LE 3.1	46	9	41	110	30
	LE 3.2	67	14	60	159	40
	LE 3.3	78	16	69	183	55
	LE 3.4	85	17	76	201	56
	LE 3.5	52	10	47	125	34
Ongoing Annual	Open Access	12	1	10	30	8
	LE (All)	7	1	6	18	5

Under the Open Access alternative, the most likely number of opah takes during the twelve year ramp up period is 90 individuals. The most likely catch in a given year is 8. The effects of this level of catch to the stock are likely to be minor.

Escolar (*Lepidocybium flavobrunneum*)

Table 4-9 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–9. Escolar Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00016*	*0.00009*	*0.00016*	*0.00025*	
	Per Day Fished	*0.01105*	*0.00624*	*0.01081*	*0.01731*	
12 Year Ramp Up	Open Access	671	374	656	1,055	617
	LE 3.1	218	119	213	346	200
	LE 3.2	319	176	312	503	278
	LE 3.3	369	204	361	581	366
	LE 3.4	403	223	393	635	358
	LE 3.5	249	136	243	394	240
Ongoing Annual	Open Access	56	28	55	92	50
	LE (All)	34	16	33	56	29

Under the Open Access alternative, the most likely number of escolar takes during the twelve year ramp up period is 631 individuals. The most likely catch in a given year is 50. The effects of this level of catch to the stock are likely to be minor.

Humboldt squid (*Dosidicus gigas*)

Table 4-10 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–10. Humboldt Squid Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00084*	*0.00003*	*0.00061*	*0.00295*	
12 Year Ramp Up	Open Access	52	1	37	183	6
	LE 3.1	17	0	12	60	1
	LE 3.2	25	0	17	87	1
	LE 3.3	28	0	20	101	3
	LE 3.4	31	1	22	110	2
	LE 3.5	19	0	14	69	2
Ongoing Annual	Open Access	4	0	3	17	0
	LE (All)	3	0	2	10	0

Under the Open Access alternative, the most likely number of Humboldt squid takes during the twelve year ramp up period is 6 individuals. The most likely catch in a given year is 0. The effects of this level of catch to the stock are likely to be minor.

Giant squid (*Architeuthis dux*)

Table 4-11 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–11. Giant Squid Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00085*	*0.00003*	*0.00062*	*0.00297*	
12 Year Ramp Up	Open Access	51	1	37	181	12
	LE 3.1	17	0	12	60	2
	LE 3.2	25	0	18	88	5
	LE 3.3	28	0	20	101	4
	LE 3.4	31	1	22	108	3
	LE 3.5	19	0	14	68	2
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0

Under the Open Access alternative, the most likely number of giant squid takes during the twelve year ramp up period is 12 individuals. The most likely catch in a given year is 0. The effects of this level of catch to the stock are likely to be minor.

Yelloweye rockfish (*Sebastes ruberrimus*)

Table 4-12 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–12. Yelloweye Rockfish Catch (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00087*	*0.00003*	*0.00063*	*0.00303*	
12 Year Ramp Up	Open Access	51	1	37	182	4
	LE 3.1	17	0	12	60	1
	LE 3.2	24	0	17	87	1
	LE 3.3	28	0	20	101	6
	LE 3.4	31	1	22	110	2
	LE 3.5	19	0	13	69	3
Ongoing Annual	Open Access	4	0	3	17	0
	LE (All)	3	0	2	10	0

Under the Open Access alternative, the most likely number of yelloweye rockfish takes during the twelve year ramp up period is 4 individuals. The most likely catch in a given year is 0. The effects of this level of catch to the stock are likely to be minor.

Note that the single catch of a yelloweye rockfish to date occurred due to an inappropriate application of the gear to the environment. DSBG is not designed to be fished close to the ocean floor, and proper use of DSBG would make future catch of this species unlikely. The interaction rate with yelloweye rockfish the future may be lower than that indicated by the current analysis.

4.3.2. Protected Species Considered Likely to be Affected

Northern elephant seal (*Mirounga angustirostris*)

Table 4-13 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–13. Northern Elephant Seal Interactions (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00002*	*0.00000*	*0.00002*	*0.00006*	
	Per Day Fished	*0.00160*	*0.00021*	*0.00136*	*0.00432*	
12 Year Ramp Up	Open Access	96	12	81	264	52
	LE 3.1	31	3	27	87	16
	LE 3.2	46	6	39	126	27
	LE 3.3	53	6	45	146	27
	LE 3.4	58	7	49	158	29
	LE 3.5	36	4	30	98	17
Ongoing Annual	Open Access	8	0	7	24	5
	LE (All)	5	0	4	15	2

Under the Open Access alternative, the most likely number of Northern elephant seal interactions during the twelve year ramp up period is 52 individuals. The most likely number of interactions in a given year is 5. Because PBR for this stock is calculated to be 4,882 animals per year (Carretta et al. 2015), the effects of this level of interactions to the stock are likely to be minor.

Loggerhead sea turtle (*Caretta caretta*)—North Pacific Ocean DPS

Table 4-14 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 2.

Table 4–14. Loggerhead Sea Turtle Interactions (in Number of Individuals) Under Alternative 2

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00084*	*0.00003*	*0.00061*	*0.00298*	
12 Year Ramp Up	Open Access	51	1	37	176	3
	LE 3.1	17	0	12	58	3
	LE 3.2	24	0	17	84	4
	LE 3.3	28	0	20	98	5
	LE 3.4	31	1	22	106	3
	LE 3.5	19	0	14	67	2
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0

Under the Open Access alternative, the most likely number of loggerhead sea turtle interactions during the twelve year ramp up period is 3. The most likely number of interactions in a given year is 0. The effects of this level of interactions to the stock are likely to be minor, because any loggerhead sea turtle caught is likely to be released alive and in good condition. Strike detection, active DSBG tending, and required circle hooks would minimize the severity of any future interactions and increase the likelihood of animals being released alive and in good condition.

Note that the projections for loggerhead sea turtle are based on a single interaction which occurred in 2018, when a turtle was entangled in surface lines under a configuration of DSBG which is no longer allowed. The turtle was released alive and uninjured. NMFS modified the Terms and Conditions of the DSBG EFPs in response to this incident, including requirement of shorter and stiffer surface lines. The impact of this change to the EFP Terms and Conditions to the loggerhead interaction rate is not captured by the current analytical methodology, and we expect the interaction rate with loggerhead sea turtles in the future may be lower than that indicated by the current analysis.

4.3.3. Protected Species That May be Affected

Catch predictions are not provided for protected species that may be affected by the Proposed Action alternatives, as these species have not been reported caught in DSBG to date. These species are included based on technical discussions with NMFS PRD (Christina Fahy, NMFS PRD, pers. comm. April 2019). These species dive deep and/or feed on squid like those used as bait in DSBG fishing (i.e., Risso's dolphin, beaked whales, sperm whale), or have been documented entangled by other fisheries that employ vertical lines (i.e., humpback whale, gray whale). Interactions with these species could include hooking while feeding on bait, or entanglement in vertical lines of SBG and LBG or the horizontal lines linking sections of LBG. Strike detection and active DSBG tending would minimize the severity of any future interactions and increase the likelihood of animals being released alive and in good condition. Required circle hooks would reduce the severity of any hooking for the species in question (Sales et al. 2010, Cooke & Suski 2004).

4.3.4. Socioeconomic Impacts

The socioeconomic impacts of the Proposed Action are considered in three categories: impacts to other fisheries in the Action Area, impacts to fishers and fishing communities, and downstream impacts to processors, restaurants, and consumers. Due to lack of data representative of the expected larger scale of operation of a fully-authorized DSBG fishery, impacts to fisheries in the Action Area are considered qualitatively with regards to the theoretical effects of authorizing an open access DSBG fishery, as are downstream impacts. Impacts to fishers and fishing communities are analyzed both qualitatively and quantitatively, using data from HMS fisheries imports and landings during the period for which DSBG EFP fisheries have been active.

4.3.4.1. Impacts to Fisheries in or Near the Action Area

Other fisheries operating in or near the Action Area which may be impacted by the authorization of DSBG include other U.S. domestic swordfish fisheries with landings to Southern California ports (the California-based harpoon and DGN fisheries, and the Hawaii and West Coast-based longline fisheries), as well as the Southern California recreational fishing fleets. Note that because there has been no DSBG fishing to date in either Northern California or Oregon, we do not have data for these regions.

DSBG-caught swordfish are a close substitute for swordfish caught by other domestic fisheries. Therefore, the predicted decrease in the price received for DSBG-caught swordfish under alternatives with significant predicted increases in swordfish landings may negatively impact the revenues generated by other fisheries with landings to the same ports. The negative price effect may be more pronounced on harpoon-caught swordfish, which is a close substitute for high-quality fresh DSBG-caught swordfish, due to the way it is caught and the limited time between catching and landing the fish.

Depending on how DSBG effort distributes spatially over the Action Area at larger scales of operation, there is a potential for overlap with fishing areas of recreational fleets. Given that the DSBG EFP trials have thus far only operated at small scale, there is no way to predict how effort might distribute at larger scale of operation. Any economic impact of DSBG operation on recreational fishing in the Action Area is anticipated to be negative but minimal, due to limited spatial overlap between locations where recreational fisheries operate and areas currently shown to be favorable for DSBG fishing for swordfish.[3]

4.3.4.2. Impacts to Fishers & Fishing Communities

NMFS conducted an analysis of DSBG price to estimate the influence of several factors on the price per pound of DSBG caught swordfish. Factors thought to influence DSBG price include landings (in pounds) of DSBG-caught swordfish; the volume of swordfish landings by DGN, harpoon, and longline fisheries; the volume of fresh swordfish imports to Southern California ports, and landings of potential substitute

[3] It is possible that popular recreational and sport fishing areas, and areas which are favorable for DSBG fishing, may shift spatially over time, which may affect the potential impact of the Proposed Action alternatives on recreational fishing.

species including yellowfin tuna (YF) and dolphinfish (DF). The analysis also controls for variation in DSBG from month to month, and from year to year.

Based on this analysis, we estimate a weak negative price effect of increased DSBG landings, holding all other factors constant. Our analysis indicates that increasing DSBG landings by one percent would result in a drop in DSBG price of 0.03 percent. See Appendix B for detail on the price analysis.

In 2018, 640 swordfish were recorded caught in DSBG EFP fishing, and a total landed weight of 45.35 mt was delivered to Southern California ports. The average weight of a DSBG-caught swordfish in 2018 was 0.07 mt. Based on the results of our Bayesian biological analysis (see Section 4.3.1), DSBG swordfish catch in a given calendar year would increase to an ongoing annual mean of 6,678 swordfish under Alternative 2. Assuming that the average weight of a DSBG-caught swordfish is constant, we project an ongoing annual mean of 467.32 mt in landed swordfish weight under Alternative 2.

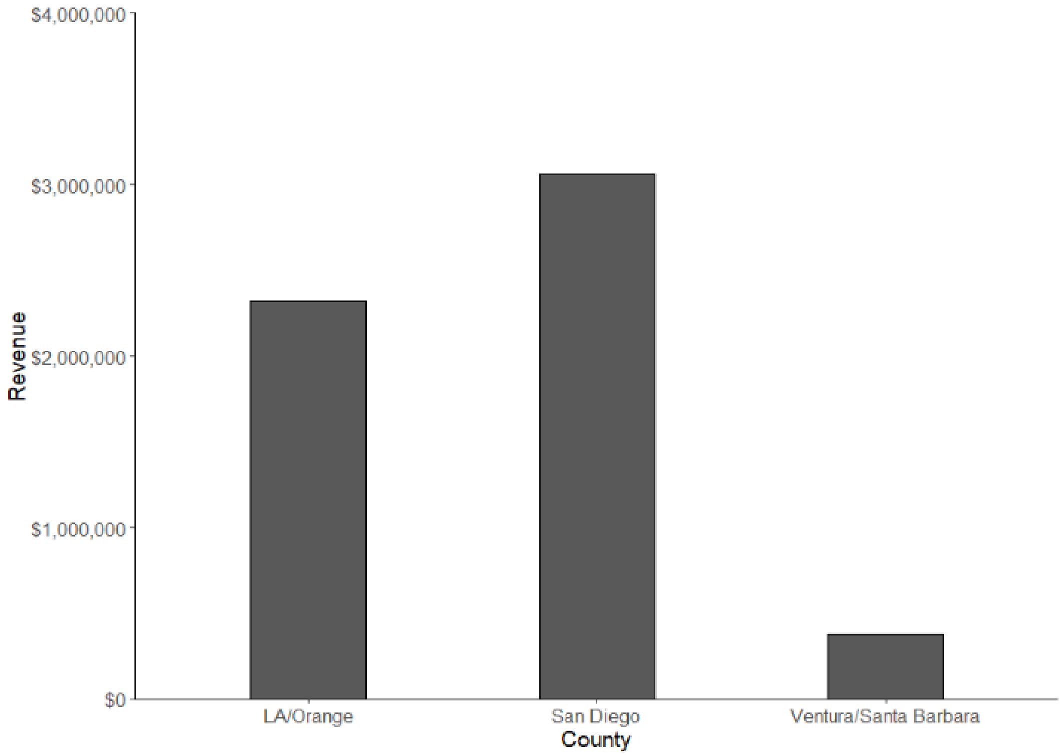
Based on the estimated price effect, and on the projected landings estimated using the biological analysis, we calculate an estimated average annual price of $5.58 per pound under Alternative 2, which is $0.41 lower than the average price in 2018.

Note that this estimate is dependent on the effort assumptions of the biological analysis (i.e., the ratio of active to inactive DSBG permits, and the average days fished per active permit) holding constant under the Proposed Action. It also relies on the assumption that DSBG swordfish CPUE (and, therefore, landings) scale proportionally with effort.[4] If actual DSBG effort under the Proposed Action is less than that projected by assumptions based on 2018 levels, or if CPUE declines with increasing fishing effort, annual landings would be less than that predicted by the biological analysis, and DSBG swordfish price would be higher than the above estimate.

At the regional level, we estimate revenues under Alternative 2 by distributing projected DSBG swordfish landings under the Proposed Action (467.32 mt) to three regions, in the same proportions seen in 2018, and multiplying by the estimated average price per pound ($5.58) to arrive at average annual revenues. Figure 4-1 displays the results of these projections.

[4] Based on very limited data, CPUE did in fact decline with increased effort during the most recent two years of DSBG EFP fishing. From 2017 to 2018, effort increased from 326 days fished to 613 days fished, while swordfish CPUE declined from 1.70 individual fish per day to 1.06 individual fish per day, representing a "CPUE elasticity" of -0.43%.

Figure 4-1. Projected Annual Average Revenues under Alternative 2



These estimates account for the price effect estimated in the price analysis; however, they rely on the assumption that effort and swordfish CPUE will remain constant from year to year in a fully-authorized fishery. The estimates also assume that the distribution of landings by region will remain the same as what was recorded in 2018. Actual revenues occurring under the action alternatives will vary based on these factors. Projections based on inferences that use a limited amount of data from DSBG EFP trials may not accurately represent the eventual operating characteristics of a large-scale fully-authorized DSBG fishery. However, it is likely that the action alternatives will result in some net increase in DSBG revenues to all three regions analyzed, despite the negative price effect of increased landings.

4.3.4.3. Impacts to Processors, Restaurants, & Consumers

Authorizing a DSBG fishery is anticipated to have positive impacts on processors, restaurants, and consumers in the Action Area, due to increased availability of locally-sourced, high-quality fresh swordfish. Processors will benefit from the increased landings projected under Alternative 2, by acquiring an additional source of high-quality swordfish to process, package, and sell to retail outlets and restaurants. Restaurants will benefit due to the increased availability of high-quality raw swordfish which provides the principal ingredient in high-value seafood entrées. Consumers will benefit due to the availability of an additional source of fresh swordfish, whether for purchase at a retail outlet to support home meal preparation, or as an entrée selection at a restaurant. To the extent that fishers are able to profitably catch and land DSBG-caught swordfish, the additional supply will generate positive economic benefits at all stages of the supply chain, including producer surplus for processors and restaurants, and consumer surplus for retail shoppers and restaurant diners.

4.4. Alternative 3—Authorize a Limited Entry Fishery

Under Alternative 3, NMFS would issue a limited number of permits to fish DSBG in the SCB, under one of the five options for permit issuance described in Section 2. DSBG fishing would be open access outside of the SCB; however, our analysis of Alternative 3 does not account for any additional open access fishing. This is because no DSBG fishing has occurred outside of the SCB to date, and therefore there are no data to support analysis of catch outside of the SCB. This subsection details the projected impacts to species likely to be affected by the Proposed Action, for Alternative 3.

The tables below display the results of our biological analysis (see Appendix B) in the same manner as the tables in Section 4.3.1. The projections for Alternative 3 are left unshaded for emphasis. The mode is the most likely value in any one given year, based on the probability distribution of possible catch counts. Note that the ongoing annual catch after the twelve year ramp up period is the same for all LE options.

4.4.1. Target and Non-Target Species Considered Likely to be Affected

Swordfish (*Xiphias gladius*)

Table 4-15 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–15. Swordfish Catch (in Number of Individuals) Under Alternative 3

		Mean	**CI 2.5%**	**Median**	**CI 97.5%**	**Mode**
CPUE	*Per Buoy Hour*	*0.01929*	*0.01842*	*0.01928*	*0.02018*	
	Per Day Fished	*1.32163*	*1.26225*	*1.32131*	*1.38274*	
12 Year Ramp Up	Open Access	80,156	76,411	80,133	83,953	80,169
	LE 3.1	26,051	24,824	26,044	27,306	26,023
	LE 3.2	38,071	36,260	38,063	39,897	37,970
	LE 3.3	44,087	42,014	44,073	46,199	43,774
	LE 3.4	48,094	45,825	48,082	50,384	47,893
	LE 3.5	29,725	28,315	29,719	31,143	29,939
Ongoing Annual	Open Access	6,678	6,328	6,676	7,030	6,635
	LE (All)	4,008	3,786	4,007	4,234	4,030

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of swordfish takes during the twelve year ramp up period is 26,023 individuals.
- Under the LE 3.2 option, the most likely number of swordfish takes during the twelve year ramp up period is 37,970 individuals.
- Under the LE 3.3 option, the most likely number of swordfish takes during the twelve year ramp up period is 43,774 individuals.
- Under the LE 3.4 option, the most likely number of swordfish takes during the twelve year ramp up period is 47,893 individuals.
- Under the LE 3.5 option, the most likely number of swordfish takes during the twelve year ramp up period is 29,939 individuals.
- Under all LE options, the most likely number of swordfish takes in each year once the maximum number of permits is issued is 4,030 individuals.

Because the swordfish stock off the U.S. West Coast is underutilized, and the WCNPO stock is not overfished or subject to overfishing, effects to the swordfish population are likely to be minor and not affect the sustainability of the stock under any LE option.

Bigeye thresher shark (*Alopias superciliosus*)

Table 4-16 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–16. Bigeye Thresher Shark Catch (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00206*	*0.00178*	*0.00205*	*0.00235*	
	Per Day Fished	*0.14105*	*0.12194*	*0.14079*	*0.16123*	
12 Year Ramp Up	Open Access	8,516	7,357	8,502	9,758	8,460
	LE 3.1	2,768	2,381	2,764	3,185	2,783
	LE 3.2	4,045	3,489	4,038	4,638	4,009
	LE 3.3	4,684	4,043	4,675	5,374	4,609
	LE 3.4	5,110	4,411	5,100	5,863	5,029
	LE 3.5	3,157	2,716	3,150	3,632	3,208
Ongoing Annual	Open Access	709	601	708	825	686
	LE (All)	426	357	425	501	427

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of bigeye thresher shark takes during the twelve year ramp up period is 2,783 individuals.
- Under the LE 3.2 option, the most likely number of bigeye thresher shark takes during the twelve year ramp up period is 4,009 individuals.
- Under the LE 3.3 option, the most likely number of bigeye thresher shark takes during the twelve year ramp up period is 4,609 individuals.
- Under the LE 3.4 option, the most likely number of bigeye thresher shark takes during the twelve year ramp up period is 5,029 individuals.
- Under the LE 3.5 option, the most likely number of bigeye thresher shark takes during the twelve year ramp up period is 3,208 individuals.
- Under all LE options, the most likely number of bigeye thresher shark takes in each year once the maximum number of permits is issued is 427 individuals.

Because this species is vulnerable to exploitation at relatively low levels of fishing mortality (Fu et al. 2016; Young et al. 2015), these catch counts may imply a significant impact at the population level. However, preliminary post-release mortality studies conducted by PIER have indicated that over 90 percent of bigeye thresher sharks caught and released in DSBG fishing survive the acute effects of capture (Sepulveda and Aalbers 2019).

Pelagic thresher shark (*Alopias pelagicus*)

Table 4-17 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–17. Pelagic Thresher Shark Catch (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00002*	*0.00000*	*0.00002*	*0.00006*	
	Per Day Fished	*0.00156*	*0.00020*	*0.00133*	*0.00423*	
12 Year Ramp Up	Open Access	95	11	80	262	49
	LE 3.1	31	3	26	86	20
	LE 3.2	45	5	38	126	24
	LE 3.3	52	6	44	144	31
	LE 3.4	57	6	48	157	30
	LE 3.5	35	4	30	98	17
Ongoing Annual	Open Access	8	0	6	23	4
	LE (All)	5	0	4	15	2

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of pelagic thresher shark takes during the twelve year ramp up period is 20 individuals.
- Under the LE 3.2 option, the most likely number of pelagic thresher shark takes during the twelve year ramp up period is 24 individuals.
- Under the LE 3.3 option, the most likely number of pelagic thresher shark takes during the twelve year ramp up period is 31 individuals.
- Under the LE 3.4 option, the most likely number of pelagic thresher shark takes during the twelve year ramp up period is 30 individuals.
- Under the LE 3.5 option, the most likely number of pelagic thresher shark takes during the twelve year ramp up period is 17 individuals.
- Under all LE options, the most likely number of pelagic thresher shark takes in each year once the maximum number of permits is issued is 2 individuals.

The effects of this level of catch to the stock are likely to be minor.. A discussion of factors that could affect catch rates of pelagic thresher shark is provided in Section 4.3.1.

Common thresher shark (*Alopias vulpinus*)

Table 4-18 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–18. Common Thresher Shark Catch (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00086*	*0.00003*	*0.00062*	*0.00298*	
12 Year Ramp Up	Open Access	51	1	37	182	12
	LE 3.1	17	0	12	60	2
	LE 3.2	24	0	17	87	1
	LE 3.3	28	0	20	101	5
	LE 3.4	31	1	22	110	6
	LE 3.5	19	0	13	68	5
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of common thresher shark takes during the twelve year ramp up period is 2 individuals.
- Under the LE 3.2 option, the most likely number of common thresher shark takes during the twelve year ramp up period is 1 individuals.
- Under the LE 3.3 option, the most likely number of common thresher shark takes during the twelve year ramp up period is 5 individuals.
- Under the LE 3.4 option, the most likely number of common thresher shark takes during the twelve year ramp up period is 6 individuals.
- Under the LE 3.5 option, the most likely number of common thresher shark takes during the twelve year ramp up period is 5 individuals.
- Under all LE options, the most likely number of common thresher shark takes in each year once the maximum number of permits is issued is 0 individuals.

The effects of this level of catch to the stock are likely to be minor.

Shortfin mako shark (*Isurus oxyrinchus*)

Table 4-19 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–19. Shortfin Mako Shark Catch (in Number of Individuals) Under Alternative 3

		Mean	**CI 2.5%**	**Median**	**CI 97.5%**	**Mode**
CPUE	*Per Buoy Hour*	*0.00003*	*0.00001*	*0.00003*	*0.00008*	
	Per Day Fished	*0.00231*	*0.00050*	*0.00205*	*0.00543*	
12 Year Ramp Up	Open Access	140	28	125	333	96
	LE 3.1	45	8	40	110	28
	LE 3.2	66	13	59	160	44
	LE 3.3	77	15	69	185	57
	LE 3.4	84	16	75	200	57
	LE 3.5	52	10	46	125	32
Ongoing Annual	Open Access	12	1	10	29	8
	LE (All)	7	1	6	18	4

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of shortfin mako shark takes during the twelve year ramp up period is 28 individuals.
- Under the LE 3.2 option, the most likely number of shortfin mako shark takes during the twelve year ramp up period is 44 individuals.
- Under the LE 3.3 option, the most likely number of shortfin mako shark takes during the twelve year ramp up period is 57 individuals.
- Under the LE 3.4 option, the most likely number of shortfin mako shark takes during the twelve year ramp up period is 57 individuals.
- Under the LE 3.5 option, the most likely number of shortfin mako shark takes during the twelve year ramp up period is 32 individuals.
- Under all LE options, the most likely number of shortfin mako shark takes in each year once the maximum number of permits is issued is 4 individuals.

The effects of this level of catch to the stock are likely to be minor.

Blue shark (*Prionace glauca*)

Table 4-20 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–20. Blue Shark Catch (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00012*	*0.00006*	*0.00011*	*0.00020*	
	Per Day Fished	*0.00808*	*0.00404*	*0.00785*	*0.01346*	
12 Year Ramp Up	Open Access	495	246	480	830	416
	LE 3.1	161	78	156	272	150
	LE 3.2	235	115	228	396	220
	LE 3.3	272	134	264	457	233
	LE 3.4	297	146	288	500	265
	LE 3.5	184	90	178	309	165
Ongoing Annual	Open Access	41	18	40	72	37
	LE (All)	25	10	24	45	22

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of blue shark takes during the twelve year ramp up period is 150 individuals.
- Under the LE 3.2 option, the most likely number of blue shark takes during the twelve year ramp up period is 220 individuals.
- Under the LE 3.3 option, the most likely number of blue shark takes during the twelve year ramp up period is 233 individuals.
- Under the LE 3.4 option, the most likely number of blue shark takes during the twelve year ramp up period is 265 individuals.
- Under the LE 3.5 option, the most likely number of blue shark takes during the twelve year ramp up period is 165 individuals.
- Under all LE options, the most likely number of blue shark takes in each year once the maximum number of permits is issued is 22 individuals.

The effects of this level of catch to the stock are likely to be minor.

Common mola (*Mola mola*)

Table 4-21 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–21. Common Mola Catch (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00084*	*0.00003*	*0.00061*	*0.00294*	
12 Year Ramp Up	Open Access	52	2	38	180	8
	LE 3.1	17	0	12	60	4
	LE 3.2	25	0	18	86	4
	LE 3.3	29	1	21	100	7
	LE 3.4	31	1	23	109	4
	LE 3.5	19	0	14	68	4
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of common mola takes during the twelve year ramp up period is 4 individuals.
- Under the LE 3.2 option, the most likely number of common mola takes during the twelve year ramp up period is 4 individuals.
- Under the LE 3.3 option, the most likely number of common mola takes during the twelve year ramp up period is 7 individuals.
- Under the LE 3.4 option, the most likely number of common mola takes during the twelve year ramp up period is 4 individuals.
- Under the LE 3.5 option, the most likely number of common mola takes during the twelve year ramp up period is 4 individuals.
- Under all LE options, the most likely number of common mola takes in each year once the maximum number of permits is issued is 0 individuals.

The effects of this level of catch to the stock are likely to be minor.

Opah (*Lampris guttatus*)

Table 4-22 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–22. Opah Catch (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00003*	*0.00001*	*0.00003*	*0.00008*	
	Per Day Fished	*0.00231*	*0.00049*	*0.00207*	*0.00543*	
12 Year Ramp Up	Open Access	141	29	127	334	90
	LE 3.1	46	9	41	110	30
	LE 3.2	67	14	60	159	40
	LE 3.3	78	16	69	183	55
	LE 3.4	85	17	76	201	56
	LE 3.5	52	10	47	125	34
Ongoing Annual	Open Access	12	1	10	30	8
	LE (All)	7	1	6	18	5

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of opah takes during the twelve year ramp up period is 30 individuals.
- Under the LE 3.2 option, the most likely number of opah takes during the twelve year ramp up period is 40 individuals.
- Under the LE 3.3 option, the most likely number of opah takes during the twelve year ramp up period is 55 individuals.
- Under the LE 3.4 option, the most likely number of opah takes during the twelve year ramp up period is 56 individuals.
- Under the LE 3.5 option, the most likely number of opah takes during the twelve year ramp up period is 34 individuals.
- Under all LE options, the most likely number of opah takes in each year once the maximum number of permits is issued is 5 individuals.

The effects of this level of catch to the stock are likely to be minor.

Escolar (*Lepidocybium flavobrunneum*)

Table 4-23 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–23. Escolar Catch (in Number of Individuals) Under Alternative 3

		Mean	**CI 2.5%**	**Median**	**CI 97.5%**	**Mode**
CPUE	*Per Buoy Hour*	*0.00016*	*0.00009*	*0.00016*	*0.00025*	
	Per Day Fished	*0.01105*	*0.00624*	*0.01081*	*0.01731*	
12 Year Ramp Up	Open Access	671	374	656	1,055	617
	LE 3.1	218	119	213	346	200
	LE 3.2	319	176	312	503	278
	LE 3.3	369	204	361	581	366
	LE 3.4	403	223	393	635	358
	LE 3.5	249	136	243	394	240
Ongoing Annual	Open Access	56	28	55	92	50
	LE (All)	34	16	33	56	29

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of escolar takes during the twelve year ramp up period is 200 individuals.
- Under the LE 3.2 option, the most likely number of escolar takes during the twelve year ramp up period is 278 individuals.
- Under the LE 3.3 option, the most likely number of escolar takes during the twelve year ramp up period is 366 individuals.
- Under the LE 3.4 option, the most likely number of escolar takes during the twelve year ramp up period is 358 individuals.
- Under the LE 3.5 option, the most likely number of escolar takes during the twelve year ramp up period is 240 individuals.
- Under all LE options, the most likely number of escolar takes in each year once the maximum number of permits is issued is 29 individuals.

The effects of this level of catch to the stock are likely to be minor.

Humboldt squid (*Dosidicus gigas*)

Table 4-24 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–24. Humboldt Squid Catch (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00084*	*0.00003*	*0.00061*	*0.00295*	
12 Year Ramp Up	Open Access	52	1	37	183	6
	LE 3.1	17	0	12	60	1
	LE 3.2	25	0	17	87	1
	LE 3.3	28	0	20	101	3
	LE 3.4	31	1	22	110	2
	LE 3.5	19	0	14	69	2
Ongoing Annual	Open Access	4	0	3	17	0
	LE (All)	3	0	2	10	0

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of Humboldt squid takes during the twelve year ramp up period is 1 individuals.
- Under the LE 3.2 option, the most likely number of Humboldt squid takes during the twelve year ramp up period is 1 individuals.
- Under the LE 3.3 option, the most likely number of Humboldt squid takes during the twelve year ramp up period is 3 individuals.
- Under the LE 3.4 option, the most likely number of Humboldt squid takes during the twelve year ramp up period is 2 individuals.
- Under the LE 3.5 option, the most likely number of Humboldt squid takes during the twelve year ramp up period is 2 individuals.
- Under all LE options, the most likely number of Humboldt squid takes in each year once the maximum number of permits is issued is 0 individuals.

The effects of this level of catch to the stock are likely to be minor.

Giant squid (*Architeuthis dux*)

Table 4-25 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–25. Giant Squid Catch (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00085*	*0.00003*	*0.00062*	*0.00297*	
12 Year Ramp Up	Open Access	51	1	37	181	12
	LE 3.1	17	0	12	60	2
	LE 3.2	25	0	18	88	5
	LE 3.3	28	0	20	101	4
	LE 3.4	31	1	22	108	3
	LE 3.5	19	0	14	68	2
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of giant squid takes during the twelve year ramp up period is 2 individuals.
- Under the LE 3.2 option, the most likely number of giant squid takes during the twelve year ramp up period is 5 individuals.
- Under the LE 3.3 option, the most likely number of giant squid takes during the twelve year ramp up period is 4 individuals.
- Under the LE 3.4 option, the most likely number of giant squid takes during the twelve year ramp up period is 3 individuals.
- Under the LE 3.5 option, the most likely number of giant squid takes during the twelve year ramp up period is 2 individuals.
- Under all LE options, the most likely number of giant squid takes in each year once the maximum number of permits is issued is 0 individuals.

The effects of this level of catch to the stock are likely to be minor.

Yelloweye rockfish (*Sebastes ruberrimus*)

Table 4-26 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–26. Yelloweye Rockfish Catch (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00087*	*0.00003*	*0.00063*	*0.00303*	
12 Year Ramp Up	Open Access	51	1	37	182	4
	LE 3.1	17	0	12	60	1
	LE 3.2	24	0	17	87	1
	LE 3.3	28	0	20	101	6
	LE 3.4	31	1	22	110	2
	LE 3.5	19	0	13	69	3
Ongoing Annual	Open Access	4	0	3	17	0
	LE (All)	3	0	2	10	0

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of yelloweye rockfish takes during the twelve year ramp up period is 1 individuals.
- Under the LE 3.2 option, the most likely number of yelloweye rockfish takes during the twelve year ramp up period is 1 individuals.
- Under the LE 3.3 option, the most likely number of yelloweye rockfish takes during the twelve year ramp up period is 6 individuals.
- Under the LE 3.4 option, the most likely number of yelloweye rockfish takes during the twelve year ramp up period is 2 individuals.
- Under the LE 3.5 option, the most likely number of yelloweye rockfish takes during the twelve year ramp up period is 3 individuals.
- Under all LE options, the most likely number of yelloweye rockfish takes in each year once the maximum number of permits is issued is 0 individuals.

The effects of this level of catch to the stock are likely to be minor. A discussion of factors that could affect catch rates of yelloweye rockfish is provided in Section 4.3.1.

4.4.2. Protected Species Considered Likely to be Affected

<u>Northern elephant seal (*Mirounga angustirostris*)</u>

Table 4-27 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–27. Northern Elephant Seal Interactions (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00002*	*0.00000*	*0.00002*	*0.00006*	
	Per Day Fished	*0.00160*	*0.00021*	*0.00136*	*0.00432*	
12 Year Ramp Up	Open Access	96	12	81	264	52
	LE 3.1	31	3	27	87	16
	LE 3.2	46	6	39	126	27
	LE 3.3	53	6	45	146	27
	LE 3.4	58	7	49	158	29
	LE 3.5	36	4	30	98	17
Ongoing Annual	Open Access	8	0	7	24	5
	LE (All)	5	0	4	15	2

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of Northern elephant seal interactions during the twelve year ramp up period is 16.
- Under the LE 3.2 option, the most likely number of Northern elephant seal interactions during the twelve year ramp up period is 27.
- Under the LE 3.3 option, the most likely number of Northern elephant seal interactions during the twelve year ramp up period is 27.
- Under the LE 3.4 option, the most likely number of Northern elephant seal interactions during the twelve year ramp up period is 29.
- Under the LE 3.5 option, the most likely number of Northern elephant seal interactions during the twelve year ramp up period is 17.
- Under all LE options, the most likely number of Northern elephant seal interactions in each year once the maximum number of permits is issued is 2.

Because PBR for this stock is calculated to be 4,882 animals per year (Carretta et al. 2015), the effects of this level of interactions to the stock are likely to be minor.

Loggerhead sea turtle (*Caretta caretta*)—North Pacific Ocean DPS

Table 4-28 above shows the estimated CPUE from our biological analysis, and projected catch counts for this species under Alternative 3.

Table 4–28. Loggerhead Sea Turtle Interactions (in Number of Individuals) Under Alternative 3

		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00084*	*0.00003*	*0.00061*	*0.00298*	
12 Year Ramp Up	Open Access	51	1	37	176	3
	LE 3.1	17	0	12	58	3
	LE 3.2	24	0	17	84	4
	LE 3.3	28	0	20	98	5
	LE 3.4	31	1	22	106	3
	LE 3.5	19	0	14	67	2
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0

Based on these projections, we estimate the impact of each LE option included under Alternative 3.

- Under the LE 3.1 option, the most likely number of loggerhead sea turtle interactions during the twelve year ramp up period is 3.
- Under the LE 3.2 option, the most likely number of loggerhead sea turtle interactions during the twelve year ramp up period is 4.
- Under the LE 3.3 option, the most likely number of loggerhead sea turtle interactions during the twelve year ramp up period is 5.
- Under the LE 3.4 option, the most likely number of loggerhead sea turtle interactions during the twelve year ramp up period is 3.
- Under the LE 3.5 option, the most likely number of loggerhead sea turtle interactions during the twelve year ramp up period is 2.
- Under all LE options, the most likely number of loggerhead sea turtle interactions in each year once the maximum number of permits is issued is 0.

The effects of this level of interactions to the stock are likely to be minor, because any loggerhead sea turtle caught is likely to be released alive and in good condition. Strike detection, active DSBG tending, and required circle hooks would minimize the severity of any future interactions and increase the likelihood of animals being released alive and in good condition.

A discussion of factors that could affect catch rates of loggerhead sea turtles is provided in Section 4.3.2.

4.4.3. Protected Species That May be Affected

Catch predictions are not provided for protected species that may be affected by the Proposed Action alternatives, but have not been reported caught in DSBG to date. These species are included based on technical discussions with NMFS PRD (Christina Fahy, NMFS PRD, pers. comm. April 2019). These species dive deep and/or feed on squid like those used as bait in DSBG fishing (i.e., Risso's dolphin, beaked whales, sperm whale), or have been documented entangled by other fisheries that employ vertical lines (i.e., humpback whale, gray whale). Interactions with these species could include hooking while feeding on bait, or entanglement in vertical lines of SBG and LBG or the horizontal lines linking sections of LBG. Strike detection and active DSBG tending would minimize the severity of any future interactions and increase the likelihood of animals being released alive and in good condition. Required circle hooks would reduce the severity of any hooking.

4.4.4. Socioeconomic Impacts

4.4.4.1. Impacts to Fisheries in the Action Area

Impacts to other fisheries in or near the Action Area under Alternative 3 are expected to be similar to those described for Alternative 2 (see Section 4.3.4.1). The lower amount of maximum effort under Alternative 3 may further mitigate potential negative impacts to other fisheries.

4.4.4.2. Impacts to Fishers & Fishing Communities

Our analysis indicates that increasing DSBG landings by one percent would result in a drop in DSBG price of 0.03 percent. See Appendix B for detail on the methodology and results of the price analysis.

Using the calculated price effect, we estimate the impact on DSBG price of authorizing an LE fishery under Alternative 3, on an ongoing annual basis (i.e., the effect each year once the maximum number of LE permits are issued). Based on the results of our Bayesian biological analysis (see Section 4.4.1), DSBG swordfish catch in a given calendar year would increase to an ongoing annual average of 4,006 swordfish under Alternative 3. Assuming that the average weight of a DSBG-caught swordfish is constant at 0.07 mt per fish (see Section 4.3.4.2), we project an ongoing annual average of 280.48 mt in landed swordfish weight under Alternative 3.

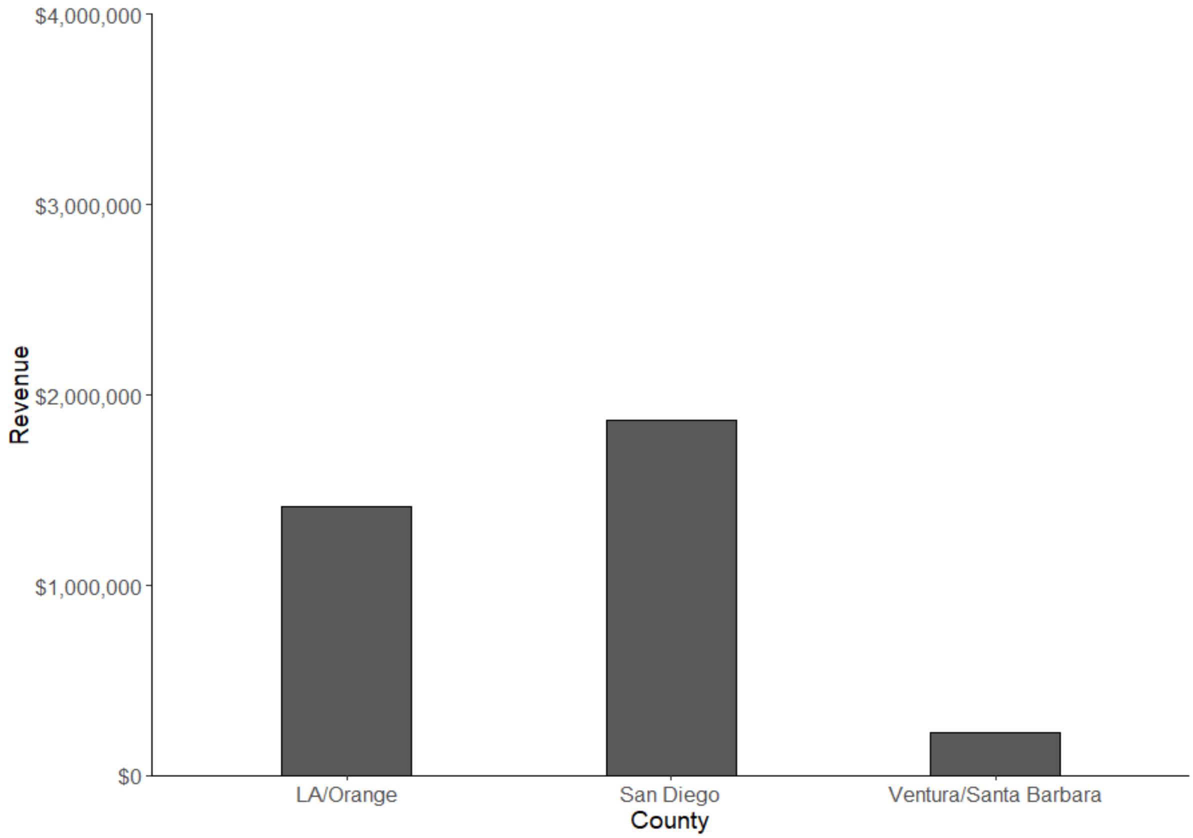
Based on the estimated price effect, and on the projected landings estimated using the biological analysis, we calculate an estimated average annual price of $5.67 per pound, which is $0.32 lower than the average price in 2018. Note that the five sub-options under Alternative 3 reach the maximum level of permit issuance, and associated DSBG price effects, on different timescales:

- LE option 3.1 may reach this maximum price effect after 12 years.
- LE option 3.2 may reach this maximum price effect after 6 years.
- LE option 3.3 may reach this maximum price effect after 3 years.
- LE option 3.4 may reach this maximum price effect after 1 year.
- LE option 3.5 may reach this maximum price effect after 11 years.

This estimate is dependent on the effort assumptions of the biological analysis (i.e., the ratio of active to inactive DSBG permits, and the average days fished per active permit) holding constant under the Proposed Action. It also relies on the assumption that DSBG swordfish CPUE (and, therefore, landings) scale proportionally with effort. If actual DSBG effort under the Proposed Action is less than that projected by assumptions based on 2018 levels, or if CPUE declines with increasing fishing effort, annual landings would be less than that predicted by the biological analysis, and the overall effect on average DSBG price would be mitigated.

At the regional level, we estimate revenues under Alternative 3 by distributing projected DSBG swordfish landings under the Proposed Action (280.48 mt) to three regions, in the same proportions seen in 2018, and multiplying by the estimated average price per pound ($5.67) to arrive at average annual revenues. Figure 4-2 displays the results of these projections.

Figure 4-2. Projected Annual Average Revenues under Alternative 3



Note that the five sub-options under Alternative 3 reach the maximum level of permit issuance, and associated potential annual average revenues on different timescales:

- LE option 3.1 may reach maximum annual revenues after 12 years.
- LE option 3.2 may reach maximum annual revenues after 6 years.
- LE option 3.3 may reach maximum annual revenues after 3 years.
- LE option 3.4 may reach maximum annual revenues after 1 year.
- LE option 3.5 may reach maximum annual revenues after 11 years.

These estimates are subject to the same assumptions, caveats, and uncertainties as those discussed in Section 4.3.4.2 for Alternative 2. We again stress that projections based on inferences that use a limited amount of data from DSBG EFP trials may not accurately represent the eventual operating characteristics of a large-scale fully-authorized DSBG fishery. However, it is likely that increased DSBG effort under Alternative 3 will result in some net increase in DSBG revenues to all three regions analyzed, despite the negative price effect of increased landings.

4.4.4.3. Impacts to Processors, Restaurants, & Consumers

Impacts to processors, restaurants, and consumers under Alternative 3 are expected to be similar to those described for Alternative 2 (see Section 4.3.3.3). The lower amount of maximum effort under Alternative 2 may result in lower positive impacts.

5. CUMULATIVE IMPACTS

This section will be completed and potentially modified as part of the ongoing Draft EIS.

5.1. Introduction

5.2. Past, Present, and Future Foreseeable Actions

5.2.1. Active and Pending Exempted Fishing Permits (EFPs)

5.2.2. High Seas Longline Fishery for Swordfish and Tuna

5.2.3. Other Fisheries that Catch HMS

- CA set gillnet
- Small mesh DGN
- IUU

5.2.4. Council Consideration of Hard Caps

5.2.5. California State Law SB 1017

5.2.6. Proposed Federal Bills S.906 and H.R.1979

5.2.7. Climate Change

Two mesoscale climate phenomena likely affect frontal activity and the distribution of tuna, other target and non-target finfish, and protected species found in the Action Area. The first is the El Niño-Southern Oscillation (El Niño), which is characterized by a relaxation of the Indonesian Low and subsequent weakening or reversal of westerly trade winds that cause warm surface waters in the western Pacific to shift eastward. An El Niño event brings warm waters and a weakening of coastal upwelling off the West Coast. Tunas and billfish are found farther north during El Niño years (Field and Ralston 2005). La Niña, a related condition, results in inverse conditions, including cooler water in the eastern tropical Pacific and California Current System (CCS).

The second mesoscale climate phenomenon likely to affect the distribution of species in the Action Area is the Pacific Decadal Oscillation (PDO), which has important ecological effects in the CCS. Regime shifts indicated by the PDO have a periodicity operating at both 15- to 25-year and 50- to 70-year intervals (Schwing 2005). The PDO indicates shifts between warm and cool phases. The warm phase is characterized by warmer temperatures in the northeast Pacific (including the West Coast), as well as cooler-than-average sea surface temperatures and lower-than-average sea level air pressure in the central north Pacific; opposite conditions prevail during cool phases.

Recent reports by the Intergovernmental Panel on Climate Change (IPCC) have made it clear that the Earth’s climate is changing, and with it the environmental conditions in the ocean are also changing (IPCC 2014). Climate change affects the marine environment by raising water temperatures, impacting the established hydrologic cycle (precipitation and evaporation rates), and increasing the incidence of disease in aquatic organisms (Roessig et al. 2004). Other climate change impacts to the marine environment include changes in ice cover, salinity, oxygen levels, and circulation (IPCC 2014). These effects are leading to shifts in the range of species; changes in algal, plankton, and fish abundance (IPCC 2014); and damage to coral reefs (Scavia et al. 2002). Plankton studies demonstrate that climate change is affecting phytoplankton, copepod herbivores, and zooplankton carnivores, which affect ecosystem services (e.g., oxygen production, carbon sequestration, and biogeochemical cycling). Fish, seabirds, and marine mammals will need to adapt to changing spatial distributions of primary and secondary production within pelagic marine ecosystems (Richardson et al. 2004).

The CCS has large natural variability in its oceanography and coastal pelagic species abundance, which may directly impact the abundance and location of Pacific bluefin in the EPO. Baumgartner et al. (1992) and Field et al. (2009) looked at deposits of coastal pelagic fish scales and were able to identify historic periods or regimes of anchovy and sardine abundance that they suggest are linked to large-scale climate phenomena. For example, during the 1930s through the 1950s when the California Current was undergoing a warm period as reflected in the PDO (Mantua et al. 1997), sardines were highly abundant; however, these populations experienced steep declines as the California Current and the North Pacific entered a cool period.

Studies conducted by Perry et al. (2005) indicate that climate change is affecting marine fish distributions in ways that impact fish as well as commercial fisheries. Impacts to commercial fisheries include: (1) increases in ocean stratification leading to less primary production, which leads to less overall energy for fish production; (2) shifts in mixing areas of water zones leading to decreases in spawning habitat and decreased stock sizes; and (3) changes in currents that may lead to changes in larval dispersals and retention among certain habitats, which could lead to decreases in stock sizes and availability of resources to certain fisheries (Roessig et al. 2004).

5.3. Effects from Future Actions

5.3.1. Fish and Wildlife

5.3.1.1. Target Species

5.3.1.2. Non-Target and Prohibited Fish Species

5.3.1.3. Marine Mammals

5.3.1.4. Reptiles

5.3.1.5. Seabirds

5.3.2. EFPs and Council Actions

5.3.3. Economics

5.3.3.1. Commercial Fisheries

5.3.3.2. Recreational Fisheries

5.3.3.3. Regional and Local Economic Impacts

6. CONSISTENCY WITH APPLICABLE LAWS AND MANDATES

This section will be completed and potentially modified as part of the ongoing Draft EIS.

6.1. MSA and the HMS FMP

6.1.1. FMP Goals and Objectives

6.1.2. MSA National Standards

6.1.3. Public Scoping Under MSA

6.2. Coastal Zone Management Act

Section 307(c)(1) of the Coastal Zone Management Act, as amended in 2006, requires all Federal actions that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone to be consistent with the enforceable policies of a coastal state's federally-approved coastal management program to the maximum extent practicable.

6.3. Endangered Species Act

Section 7(a)(2) of the ESA requires that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat. In addition, Section 7(a)(3) of the ESA requires that Federal agencies consult on any action authorized, funded, or carried out by such agency that may affect a species listed under the ESA or their designated critical habitat. When a consultation results in a biological opinion that concludes that the action is likely to affect an ESA-listed species, but not cause jeopardy (i.e., appreciably reduce the likelihood of survival and recovery of ESA-listed species), ESA-managing departments issue an incidental take statement (ITS) that details the amount and extent of anticipated incidental take (e.g., death, injury, harm, or harassment) that will be caused by the Proposed Action and any additional terms or conditions that must be met. ITSs provide an exemption from ESA Section 9 prohibitions on such take.

With regards to the Proposed Action, ESA consultation takes place between NMFS Sustainable Fisheries Division (SFD) and PRD, which is the division responsible for administering the provisions of the ESA and protecting ESA-listed species. Authorization of a DSBG fishery on the U.S. West Coast as outlined under the Proposed Action may impact certain species listed under the ESA.

6.4. Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 USC 1361) as amended, establishes a national policy designated to protect and conserve wild marine mammals and their habitats. This policy was established so as not to diminish such species or populations beyond the point at which they cease to be a significant functioning element in the ecosystem, nor to diminish such species below their optimum sustainable population. All marine mammals are protected under the MMPA. The MMPA prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. The term "take," as defined by the MMPA, means to "harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The MMPA further defines harassment as "any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing a disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild."

NMFS is responsible for reviewing Federal actions for compliance with the MMPA. Authorization of a DSBG fishery on the U.S. West Coast as outlined under the Proposed Action may impact marine mammals through incidental take and injury by fishing gear deployed in marine mammal habitats. Fisheries can also indirectly affect marine mammals by altering the availability of prey.

6.5. Executive Orders

6.5.1. EO 12866 Regulatory Impact Review (RIR)

6.5.2. EO 12898 Environmental Justice

6.5.3. EO 13132 Federalism

6.5.4. EO 13175 Consultation and Coordination with Indian Tribal Governments

6.5.5. EO 13186 Responsibilities of Federal Agencies to Protect Migratory Birds

6.5.6. EO 12114 Environmental Effects Abroad of Major Federal Actions

7. LISTS

This section will be completed and potentially modified as part of the ongoing Draft EIS.

7.1. List of Preparers

7.2. List of Agencies, Organizations, and Persons Contacted

7.3. Distribution List

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Indexes

This section will be completed as part of the ongoing draft EIS.

Appendices

Appendix A: Methods and Results of Biological Impact Analysis

To develop projections of catch under each of the Proposed Action alternatives, NMFS conducted a statistical analysis using data collected from DSBG EFP trials. NMFS processed data from observer records and fisher logbooks for DSBG EFP activity, including both SBG and LBG, from January 2015 through February 2019. These data are derived from an integrated dataset that includes observer records for observed trips, and logbook data for trips where an observer was not present. NMFS used this dataset to analyze the impact of the proposed alternatives on species which occur in the Action Area. Table A-1 displays reported total catch to date in DSBG EFP trials.

Table A-1. Summary of Reported DSBG Trials Catch, in Number of Individuals

	2015	**2016**	**2017**	**2018**	**2019***	**TOTAL**
Swordfish	136	474	556	640	19	1825
Bigeye thresher shark	66	57	35	35	0	193
Pelagic thresher shark	0	0	0	2	0	2
Common thresher shark	0	0	0	1	0	1
Shortfin mako shark	0	1	0	2	0	3
Blue shark	3	4	2	3	0	12
Common mola	0	0	0	1	0	1
Opah	2	1	0	0	0	3
Escolar	4	4	3	4	0	15
Humboldt squid	0	0	1	0	0	1
Giant squid	0	0	1	0	0	1
Yelloweye rockfish	0	0	1	0	0	1
Northern elephant seal	1	0	0	1	0	2
Loggerhead sea turtle	0	0	0	1	0	1
Total Days Fished	132	280	326	606	30	1374

** Only includes January & February 2019*

We used these data to estimate catch rates, and used the rates to predict catch under the proposed alternatives. However, because the Proposed Action would authorize much higher levels of DSBG fishing effort than have occurred to date in the EFP trials, any analysis of potential catch rates using EFP data introduces a large degree of uncertainty into the resulting estimates of biological impacts. Given this uncertainty, simple ratio estimates are not appropriate for predicting catch under the proposed alternatives. Instead, we adapt a methodology that addresses uncertainty, while producing a range of estimates for catch under each of the alternatives. We employ a statistical approach based on Bayesian inference which uses the existing catch data to estimate the posterior distribution of CPUE, and then simulates the posterior predictive distribution (PPD) of catch under assumed levels of effort for each alternative (Martin et al. 2015). The PPDs are calculated by simulating draws from the posterior distribution 20,000 times under the simulated levels of effort anticipated under each alternative. We then use these PPDs to produce a 95 percent credible interval for total catch (i.e., the range with a 95 percent probability of including the actual catch, given the effort assumptions and level of uncertainty in the analysis), as well as summary statistics such as the mean (i.e., expected annual average takes) and mode (i.e., most likely catch in a given year) for each species under each alternative.

Table A-2 shows the timing and maximum amount of permit issuance under each alternative of the Proposed Action. Note that 'LE 3.5' has been designated as the Council's preliminary preferred alternative (PPA). While the LE regimes under the Proposed Action only apply to the Southern California Bight (SCB), with Open Access allowed elsewhere in the Action Area, 100 percent of the total DSBG effort to date has been within the LE SCB area. Therefore, we analyze the maximum number of LE permits (i.e., 300) for these alternatives. We use 500 permits per year as our analytical basis for the Open Access alternative, based on Council recommendations. However, more than 500 permits could be issued under the Open Access alternative.

Table A-2. Maximum Annual Permit Issuance under the Proposed Action Alternatives

Alternative	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Open Access	500	500	500	500	500	500	500	500	500	500	500	500
LE 3.1	25	50	75	100	125	150	175	200	225	250	275	300
LE 3.2	50	100	150	200	250	300	300	300	300	300	300	300
LE 3.3	100	200	300	300	300	300	300	300	300	300	300	300
LE 3.4	300	300	300	300	300	300	300	300	300	300	300	300
LE 3.5 (PPA)	50	75	100	125	150	175	200	225	250	275	300	300

For each alternative, we estimate total catch during the 12 year "ramp-up" period following authorization (i.e., the length of time for the maximum number of permits to be issued under every alternative), as well as ongoing annual estimates for each year after the maximum number of permits is issued.

The levels of effort under each alternative rely on a number of assumptions. These assumptions are made using data from the 2018 year of DSBG EFP trials, which we regard as the fishing year which serves as the best available proxy for a year of authorized DSBG fishing. This is because 2018 saw the greatest amount of DSBG EFP applications, issued permits, and fishing effort in a complete year to-date. In 2018, the Council recommended 60 permits be issued, NMFS issued 29 permits, and 26 were ultimately fished (i.e., 43 percent of Council-recommended EFPs were actively fished), at an average effort rate of 23.31 days fished per active vessel for the year. For the purpose of estimating future catch, we assume that each active vessel will fish an average of 23.31 days per year (i.e., the average effort per active vessel during 2018). We also assume that 43 percent of all available permits will be fished in a given year, based on the ratio of active to Council-recommended permits for the 2018 DSBG EFP fishing season. Table A-3 summarizes our effort assumptions.

Table A-3. Effort Assumptions for Biological Analysis

Active Fishing	43%	of available permits will be acquired & fished
Average Effort	23.31	days fished per active vessel

These effort assumptions are dependent on factors such as gear preference, opportunity costs of fishing, availability of other sources of fishing and non-fishing revenue, the future status of other West Coast swordfish fisheries, and other unknown factors. It must be stressed that our range of predictions rely on data-limited assumptions from DSBG EFP fishing, which may not fully capture the overall uncertainty in fishing effort. As more data become available, we hope to update our analysis to improve the reliability of our assumptions and the resulting predictions.

Based on the aforementioned assumptions, we calculate a level of assumed effort for each alternative. For the purposes of comparing the LE alternatives, we analyze total effort over the 12-year "ramp up" period. To compare the proposed open access and LE regimes over the long term, we also analyze levels of ongoing annual effort in each year after the maximum number of permits is issued. Table A-4 displays our assumed levels of effort for each alternative, based on the aforementioned assumptions.

Table A-4. Assumed Effort (Days Fished) for Each Alternative

Alternative	12-Yr Ramp Up	Ongoing Annual
Open Access	60,606	5,051
LE 3.1	19,697	3,030
LE 3.2	28,788	3,030
LE 3.3	33,333	3,030
LE 3.4	36,364	3,030
LE 3.5	22,475	3,030

Sections 4.2 and 4.3 include our preliminary estimates of CPUE and total catch for each species, under each of the alternatives. Estimates of CPUE are derived using Hamiltonian Markov Chain Monte Carlo sampling on a Poisson likelihood model, and an uninformative gamma prior on the catch rate parameter (Martin et al. 2015). The estimates are based on data for both gear types, and control for variation in daily fishing effort, as measured in buoy-hours (i.e., the total soak time for all buoys deployed of a given gear type in a given fishing day). For comparison purposes, we provide predictions for both the entire 12-year ramp-up period, and for each year once the maximum number of permits are available. These predictions include the mean and mode of the probability distribution of predicted catch, as well as the quantiles at 2.5 percent, 50 percent, and 97.5 percent (i.e., the lowest, median, and highest values of the 95 percent credible interval of possible catch values).

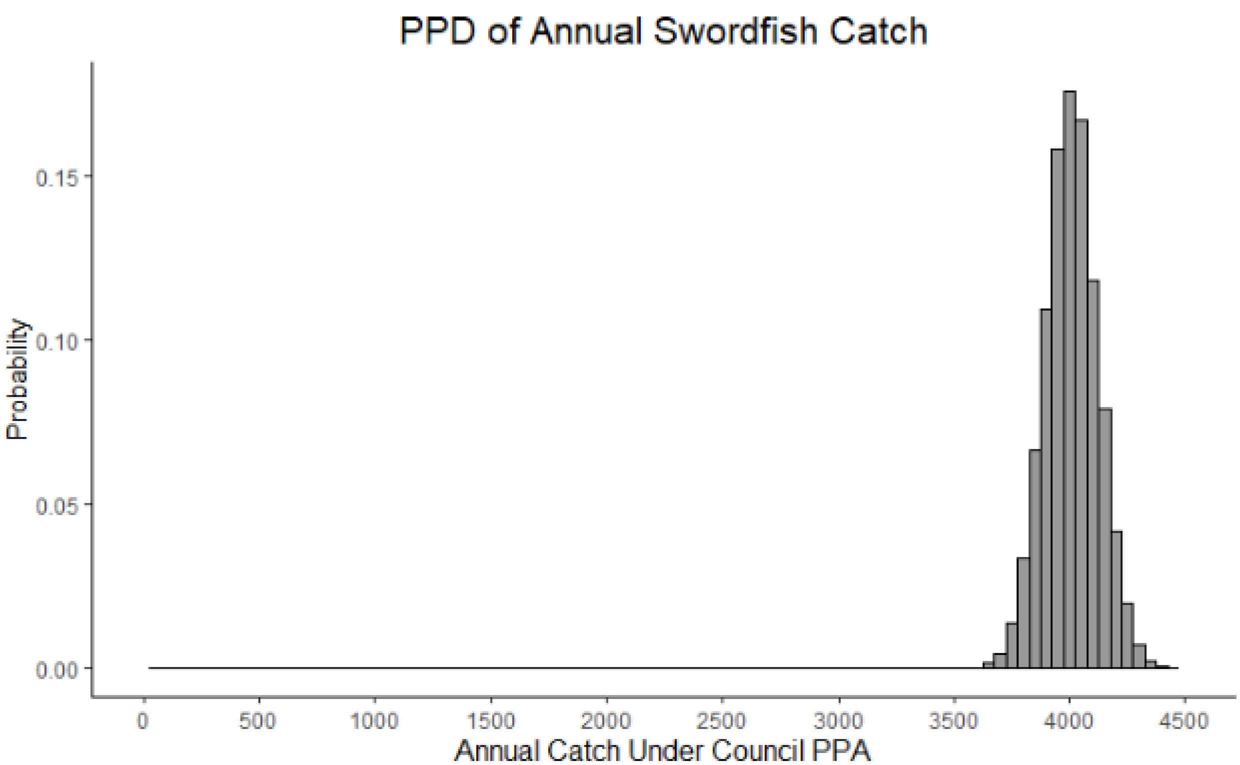
The catch predictions include total numbers of animals, but do not describe the disposition of the catch (i.e, kept, released alive, released dead, released unknown, released injured). Swordfish and other marketable fish species are most often kept, and experience mortality. Species that are released are most often alive, due to DSBG strike detection and active tending of the gear. Required circle hooks minimize injury to animals that are released alive.

The tables and figures below display the estimated CPUE from our biological analysis, projected catch counts for this species under each of the proposed alternatives, and a histogram of the posterior predictive distribution (PPD) of projected ongoing annual catch under Alternative 3 (i.e., under the projected annual catch under the Council's PPA, once the maximum number of permits are made available for issuance).

Swordfish (*Xiphias gladius*)

Table A-5. Swordfish Catch (in Number of Individuals) Under Each Alternative

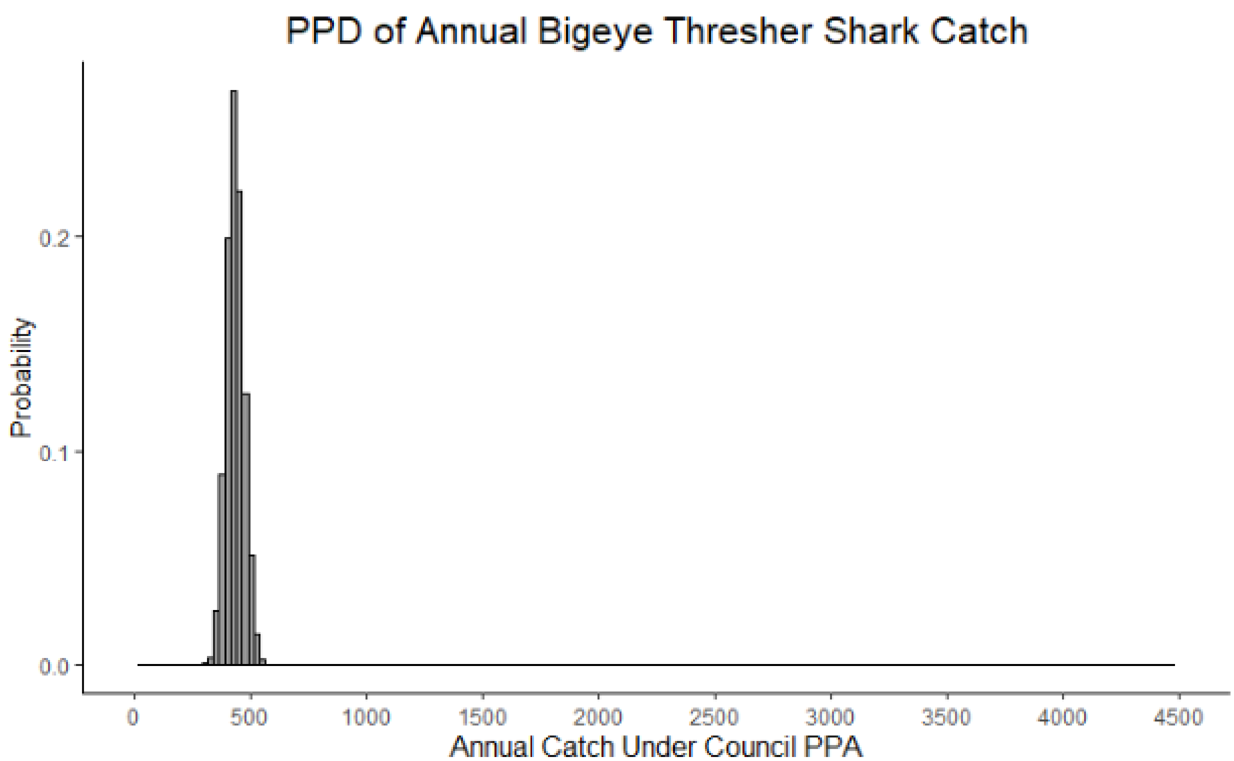
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.01929*	*0.01842*	*0.01928*	*0.02018*	
	Per Day Fished	*1.32163*	*1.26225*	*1.32131*	*1.38274*	
12 Year Ramp Up	Open Access	80,156	76,411	80,133	83,953	80,169
	LE 3.1	26,051	24,824	26,044	27,306	26,023
	LE 3.2	38,071	36,260	38,063	39,897	37,970
	LE 3.3	44,087	42,014	44,073	46,199	43,774
	LE 3.4	48,094	45,825	48,082	50,384	47,893
	LE 3.5	29,725	28,315	29,719	31,143	29,939
Ongoing Annual	Open Access	6,678	6,328	6,676	7,030	6,635
	LE (All)	4,008	3,786	4,007	4,234	4,030



Bigeye thresher shark (*Alopias superciliosus*)

Table A-6. Bigeye Thresher Shark Catch (in Number of Individuals) Under Each Alternative

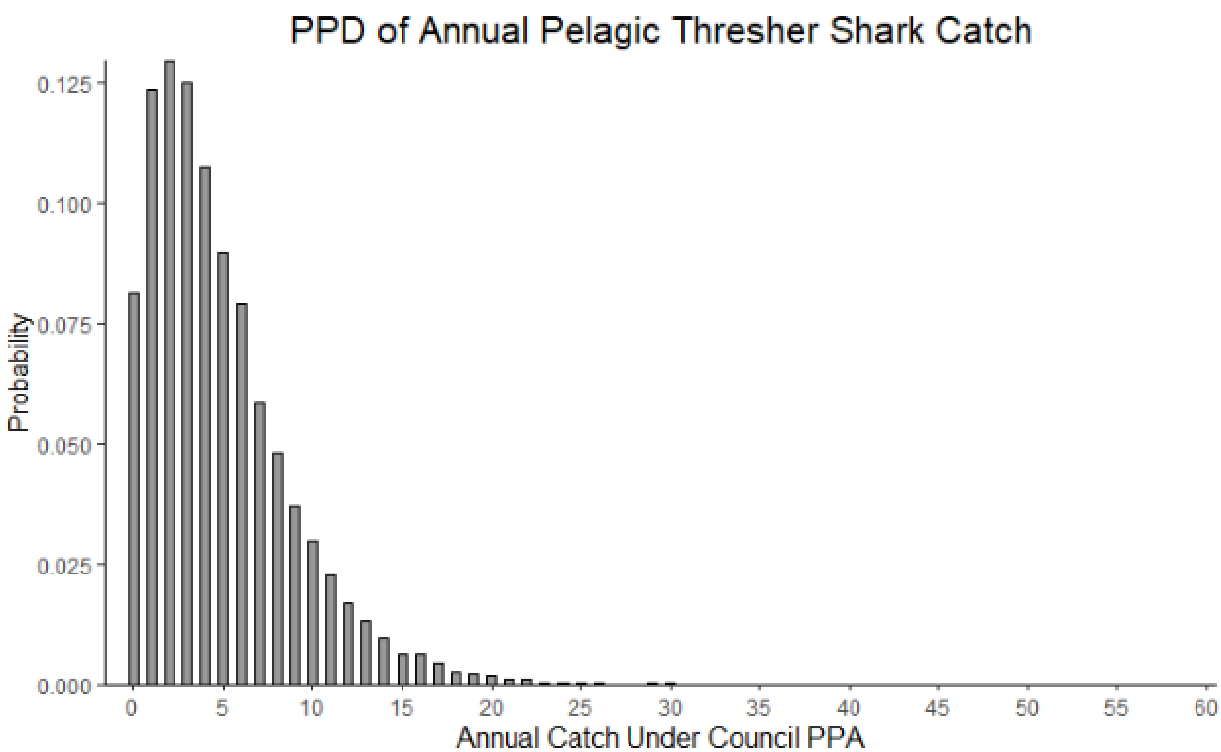
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00206*	*0.00178*	*0.00205*	*0.00235*	
	Per Day Fished	*0.14105*	*0.12194*	*0.14079*	*0.16123*	
12 Year Ramp Up	Open Access	8,516	7,357	8,502	9,758	8,460
	LE 3.1	2,768	2,381	2,764	3,185	2,783
	LE 3.2	4,045	3,489	4,038	4,638	4,009
	LE 3.3	4,684	4,043	4,675	5,374	4,609
	LE 3.4	5,110	4,411	5,100	5,863	5,029
	LE 3.5	3,157	2,716	3,150	3,632	3,208
Ongoing Annual	Open Access	709	601	708	825	686
	LE (All)	426	357	425	501	427



Pelagic thresher shark (*Alopias pelagicus*)

Table A-7. Pelagic Thresher Shark Catch (in Number of Individuals) Under Each Alternative

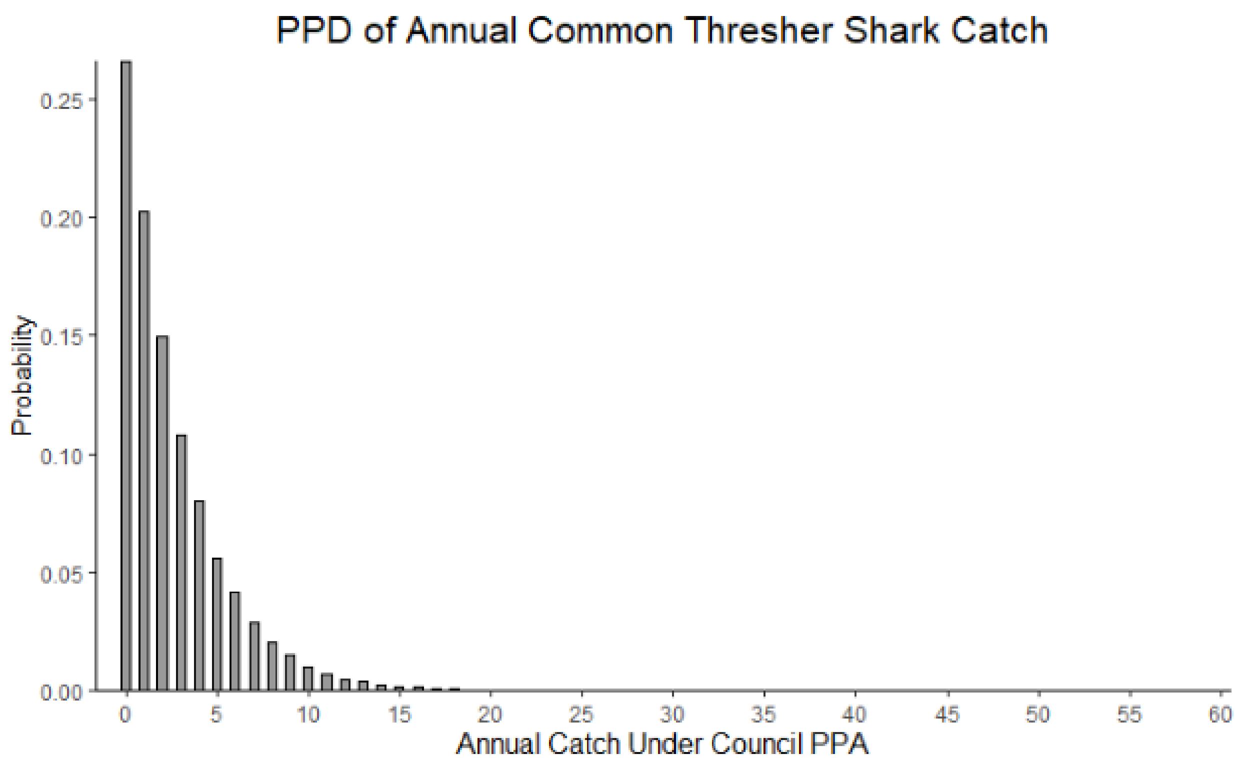
		Mean	**CI 2.5%**	**Median**	**CI 97.5%**	**Mode**
CPUE	*Per Buoy Hour*	*0.00002*	*0.00000*	*0.00002*	*0.00006*	
	Per Day Fished	*0.00156*	*0.00020*	*0.00133*	*0.00423*	
12 Year Ramp Up	Open Access	95	11	80	262	49
	LE 3.1	31	3	26	86	20
	LE 3.2	45	5	38	126	24
	LE 3.3	52	6	44	144	31
	LE 3.4	57	6	48	157	30
	LE 3.5	35	4	30	98	17
Ongoing Annual	Open Access	8	0	6	23	4
	LE (All)	5	0	4	15	2



Common thresher shark (*Alopias vulpinus*)

Table A-8. Common Thresher Shark Catch (in Number of Individuals) Under Each Alternative

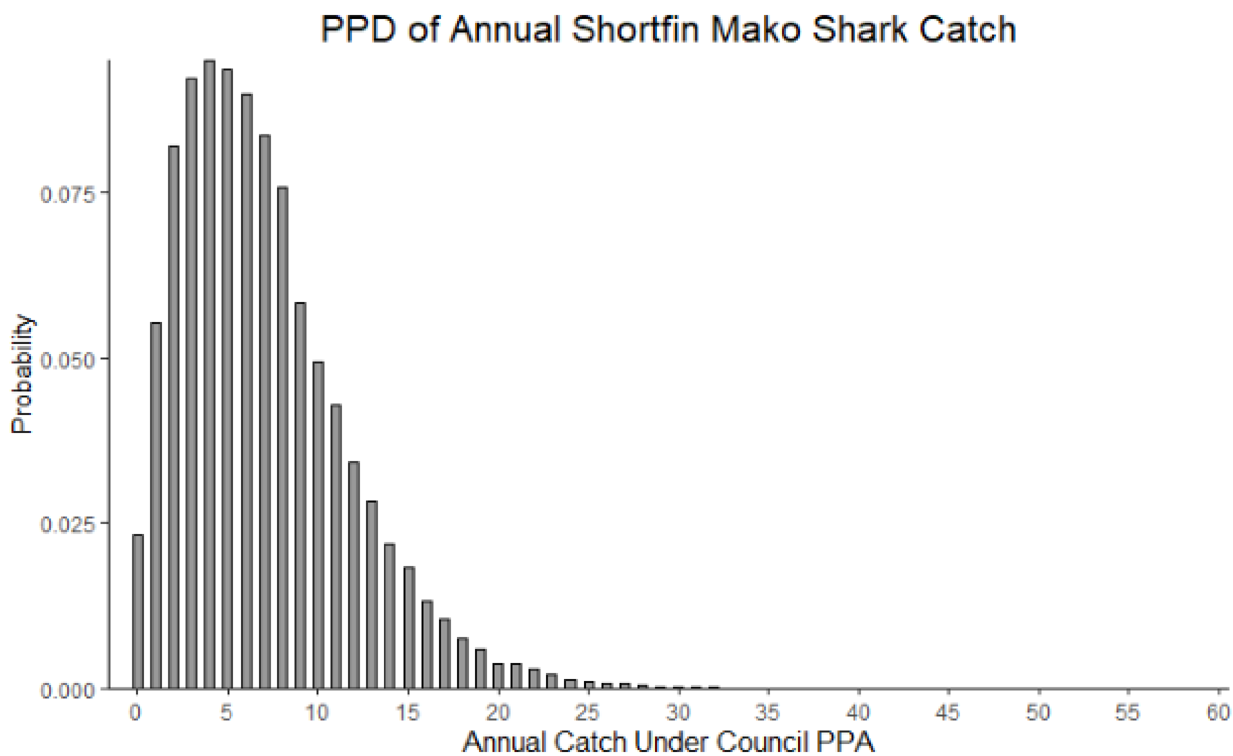
		Mean	**CI 2.5%**	**Median**	**CI 97.5%**	**Mode**
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00086*	*0.00003*	*0.00062*	*0.00298*	
12 Year Ramp Up	Open Access	51	1	37	182	12
	LE 3.1	17	0	12	60	2
	LE 3.2	24	0	17	87	1
	LE 3.3	28	0	20	101	5
	LE 3.4	31	1	22	110	6
	LE 3.5	19	0	13	68	5
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0



Shortfin mako shark (*Isurus oxyrinchus*)

Table A-9. Shortfin Mako Shark Catch (in Number of Individuals) Under Each Alternative

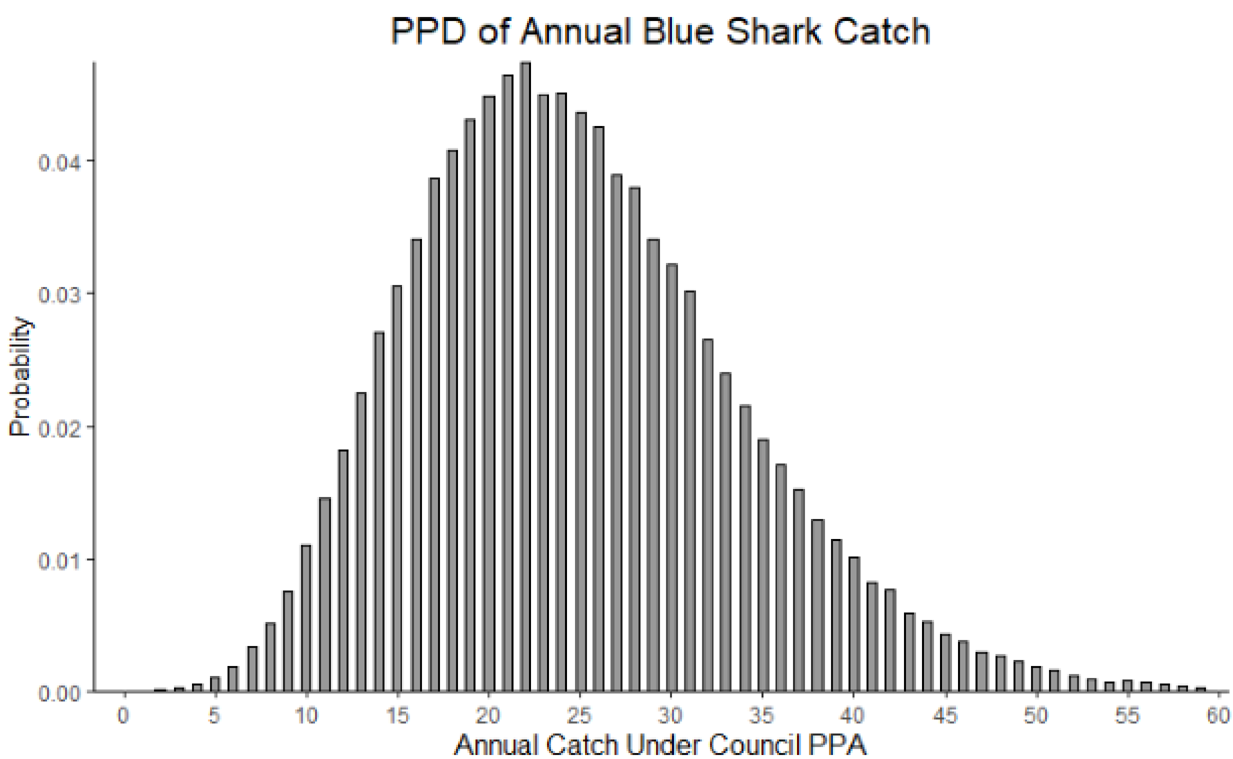
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00003*	*0.00001*	*0.00003*	*0.00008*	
	Per Day Fished	*0.00231*	*0.00050*	*0.00205*	*0.00543*	
12 Year Ramp Up	Open Access	140	28	125	333	96
	LE 3.1	45	8	40	110	28
	LE 3.2	66	13	59	160	44
	LE 3.3	77	15	69	185	57
	LE 3.4	84	16	75	200	57
	LE 3.5	52	10	46	125	32
Ongoing Annual	Open Access	12	1	10	29	8
	LE (All)	7	1	6	18	4



Blue shark (*Prionace glauca*)

Table A-10. Blue Shark Catch (in Number of Individuals) Under Each Alternative

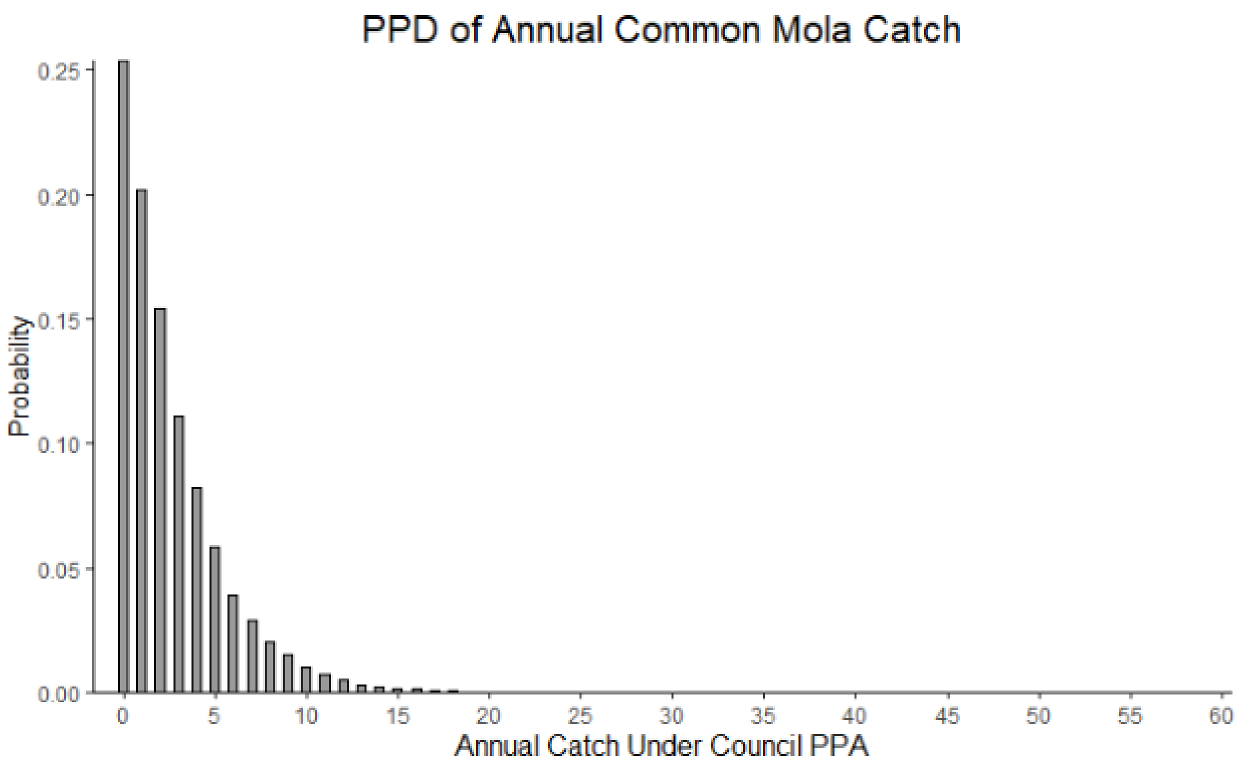
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00012*	*0.00006*	*0.00011*	*0.00020*	
	Per Day Fished	*0.00808*	*0.00404*	*0.00785*	*0.01346*	
12 Year Ramp Up	Open Access	495	246	480	830	416
	LE 3.1	161	78	156	272	150
	LE 3.2	235	115	228	396	220
	LE 3.3	272	134	264	457	233
	LE 3.4	297	146	288	500	265
	LE 3.5	184	90	178	309	165
Ongoing Annual	Open Access	41	18	40	72	37
	LE (All)	25	10	24	45	22



Common mola (*Mola mola*)

Table A-11. Common Mola Catch (in Number of Individuals) Under Each Alternative

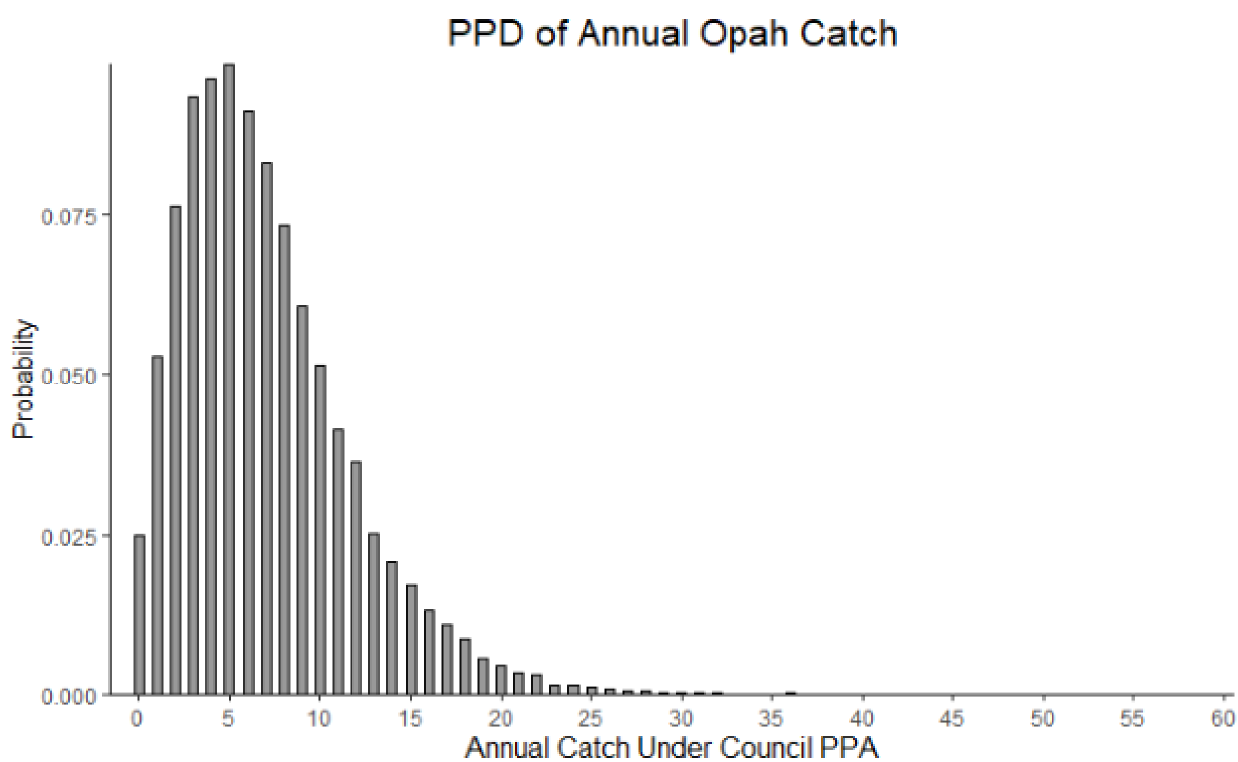
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00084*	*0.00003*	*0.00061*	*0.00294*	
12 Year Ramp Up	Open Access	52	2	38	180	8
	LE 3.1	17	0	12	60	4
	LE 3.2	25	0	18	86	4
	LE 3.3	29	1	21	100	7
	LE 3.4	31	1	23	109	4
	LE 3.5	19	0	14	68	4
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0



Opah (*Lampris guttatus*)

Table A-12. Opah Catch (in Number of Individuals) Under Each Alternative

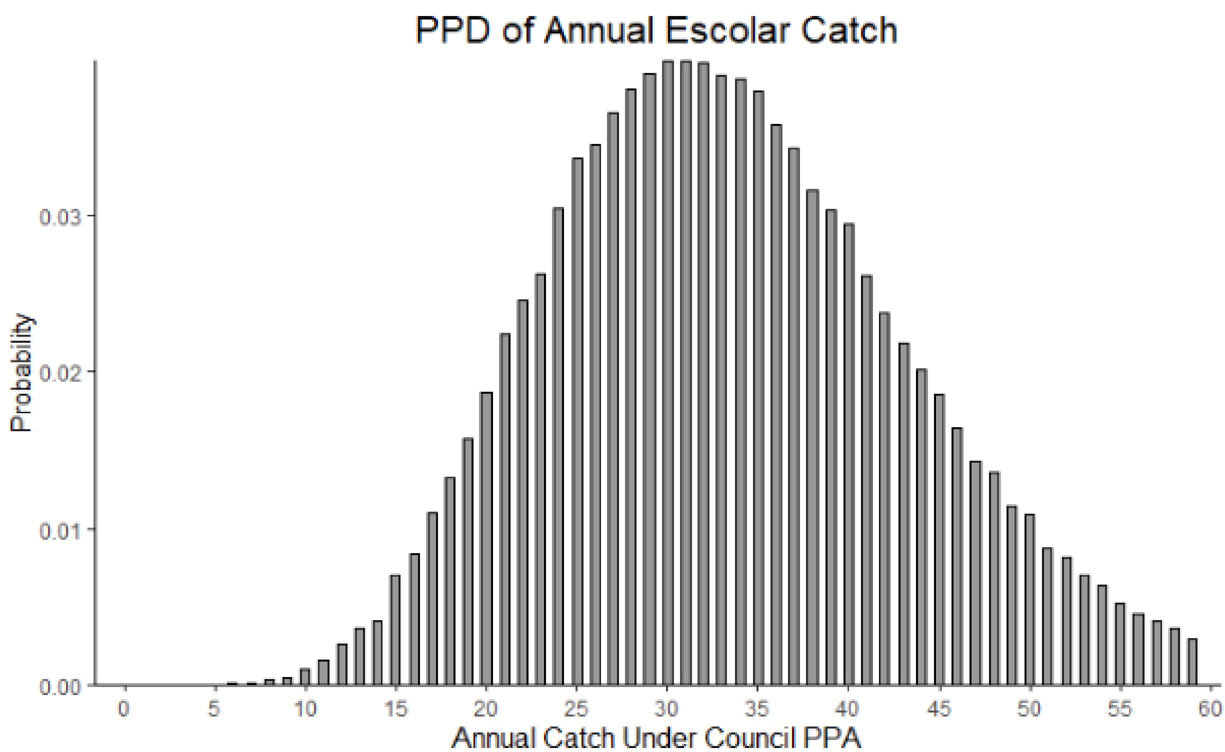
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00003*	*0.00001*	*0.00003*	*0.00008*	
	Per Day Fished	*0.00231*	*0.00049*	*0.00207*	*0.00543*	
12 Year Ramp Up	Open Access	141	29	127	334	90
	LE 3.1	46	9	41	110	30
	LE 3.2	67	14	60	159	40
	LE 3.3	78	16	69	183	55
	LE 3.4	85	17	76	201	56
	LE 3.5	52	10	47	125	34
Ongoing Annual	Open Access	12	1	10	30	8
	LE (All)	7	1	6	18	5



Escolar (*Lepidocybium flavobrunneum*)

Table A-13. Escolar Catch (in Number of Individuals) Under Each Alternative

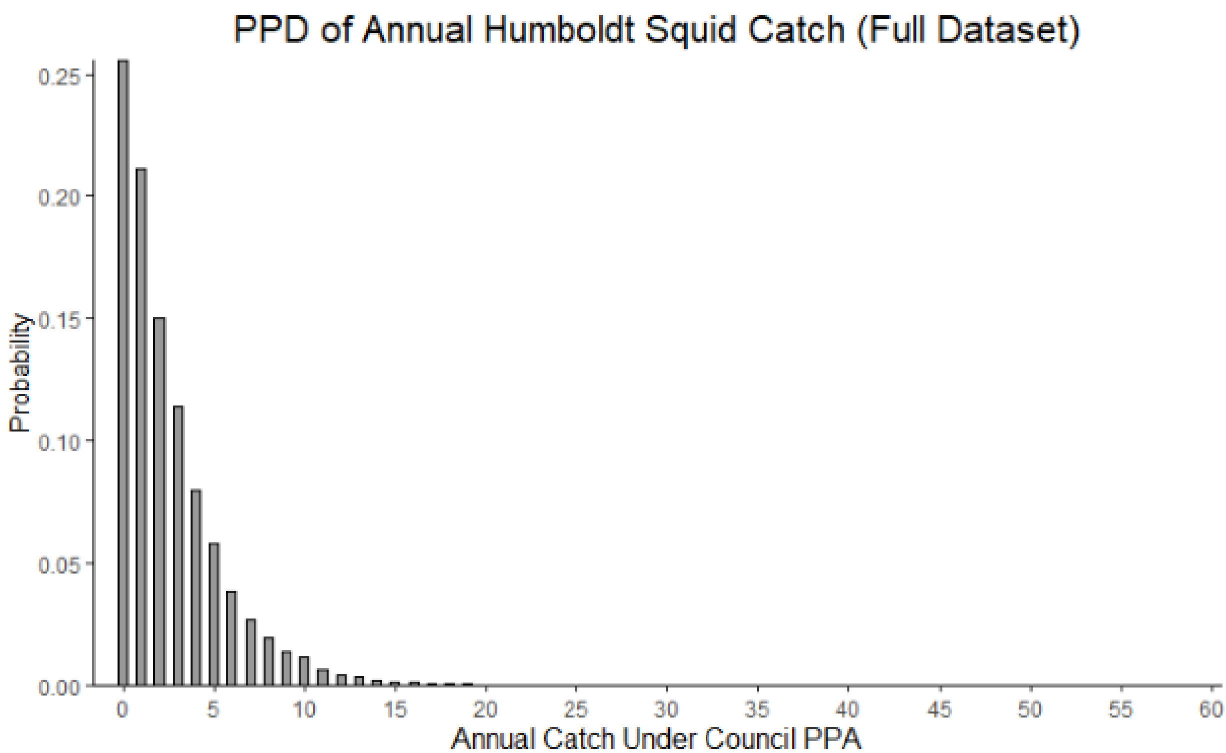
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00016*	*0.00009*	*0.00016*	*0.00025*	
	Per Day Fished	*0.01105*	*0.00624*	*0.01081*	*0.01731*	
12 Year Ramp Up	Open Access	671	374	656	1,055	617
	LE 3.1	218	119	213	346	200
	LE 3.2	319	176	312	503	278
	LE 3.3	369	204	361	581	366
	LE 3.4	403	223	393	635	358
	LE 3.5	249	136	243	394	240
Ongoing Annual	Open Access	56	28	55	92	50
	LE (All)	34	16	33	56	29



Humboldt squid (*Dosidicus gigas*)

Table A-14. Humboldt Squid Catch (in Number of Individuals) Under Each Alternative

		Mean	**CI 2.5%**	**Median**	**CI 97.5%**	**Mode**
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00084*	*0.00003*	*0.00061*	*0.00295*	
12 Year Ramp Up	Open Access	52	1	37	183	6
	LE 3.1	17	0	12	60	1
	LE 3.2	25	0	17	87	1
	LE 3.3	28	0	20	101	3
	LE 3.4	31	1	22	110	2
	LE 3.5	19	0	14	69	2
Ongoing Annual	Open Access	4	0	3	17	0
	LE (All)	3	0	2	10	0

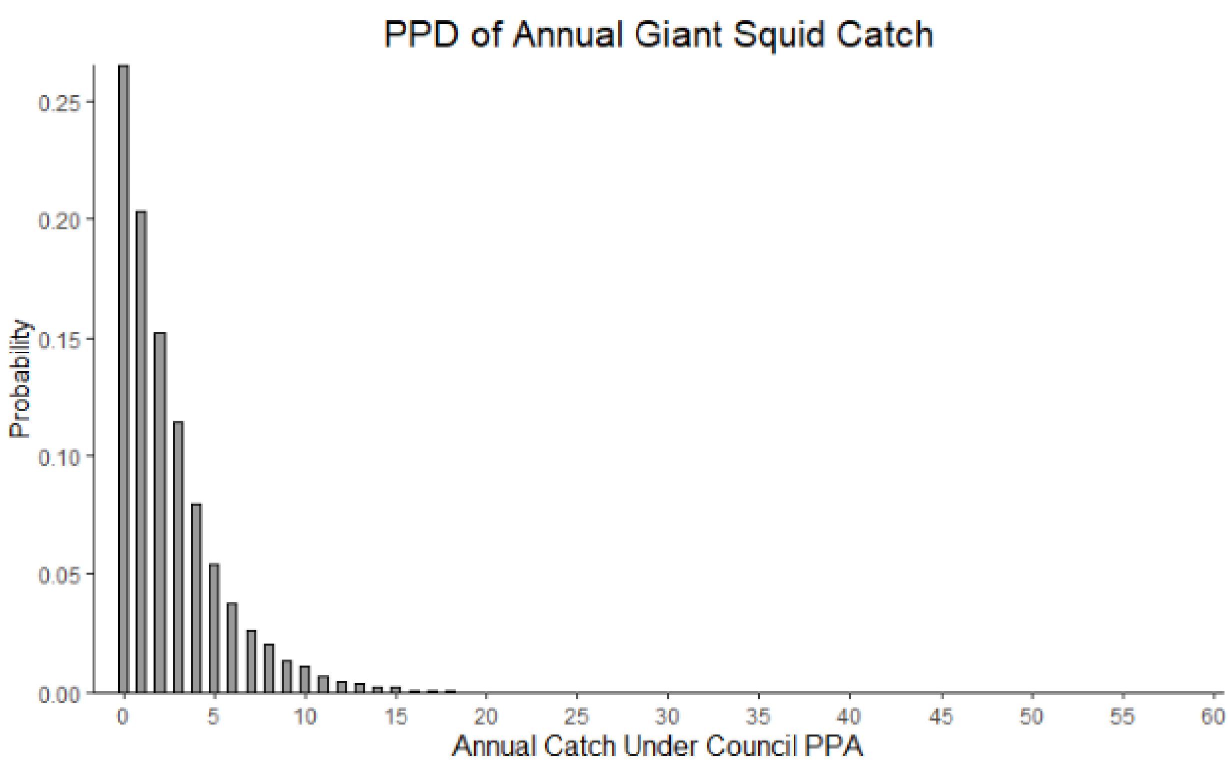


Giant squid (*Architeuthis dux*)

Table A-15 shows the estimated CPUE from our biological analysis, and projected catch counts for this species under each of the proposed alternatives.

Table A-15. Giant Squid Catch (in Number of Individuals) Under Each Alternative

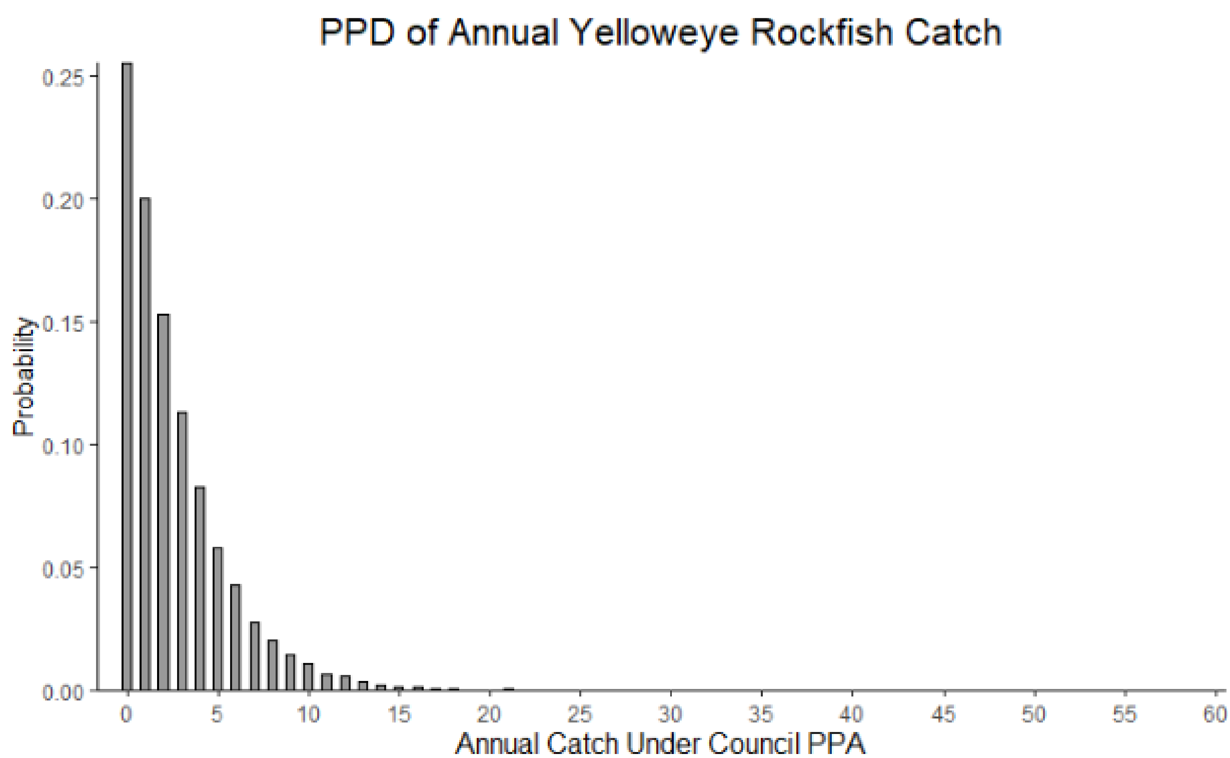
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00085*	*0.00003*	*0.00062*	*0.00297*	
12 Year Ramp Up	Open Access	51	1	37	181	12
	LE 3.1	17	0	12	60	2
	LE 3.2	25	0	18	88	5
	LE 3.3	28	0	20	101	4
	LE 3.4	31	1	22	108	3
	LE 3.5	19	0	14	68	2
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0



Yelloweye rockfish (*Sebastes ruberrimus*)

Table A-16. Yelloweye Rockfish Catch (in Number of Individuals) Under Each Alternative

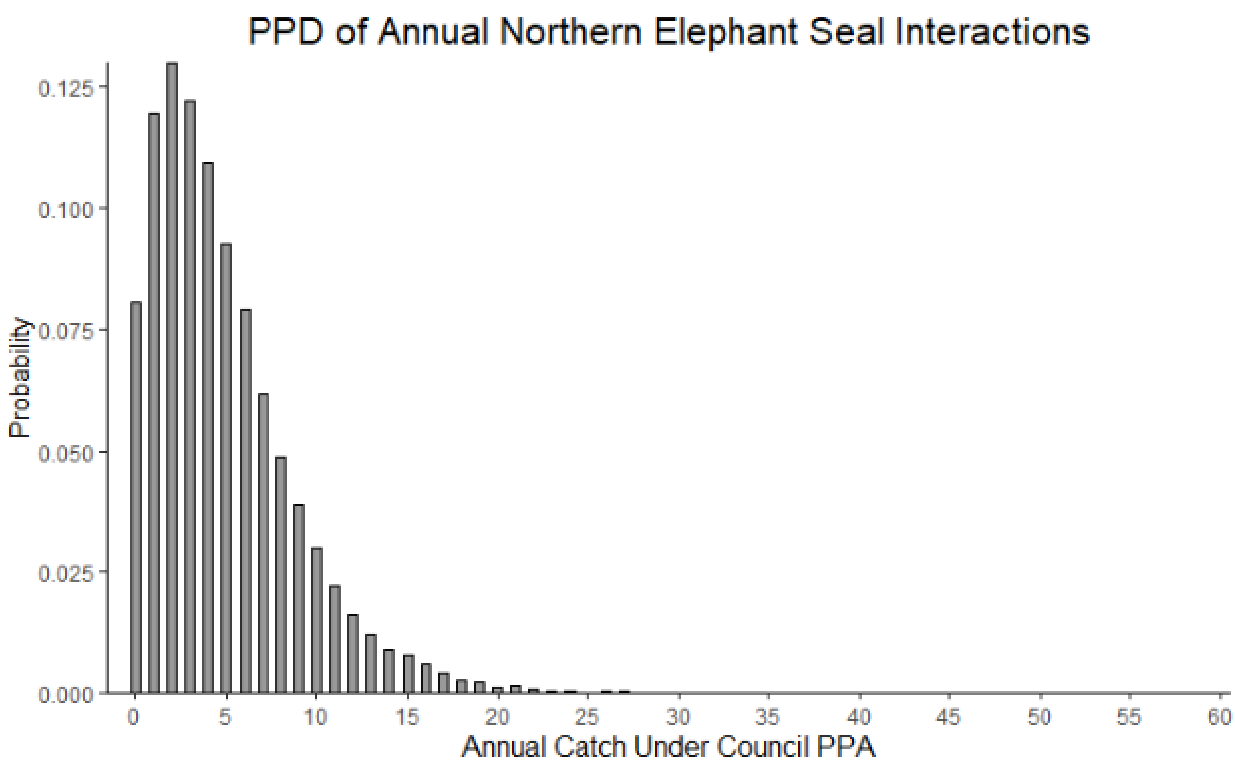
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00087*	*0.00003*	*0.00063*	*0.00303*	
12 Year Ramp Up	Open Access	51	1	37	182	4
	LE 3.1	17	0	12	60	1
	LE 3.2	24	0	17	87	1
	LE 3.3	28	0	20	101	6
	LE 3.4	31	1	22	110	2
	LE 3.5	19	0	13	69	3
Ongoing Annual	Open Access	4	0	3	17	0
	LE (All)	3	0	2	10	0



<u>Northern elephant seal (*Mirounga angustirostris*)</u>

Table A-17. Northern Elephant Seal Interactions (in Number of Individuals) Under Alternative 3

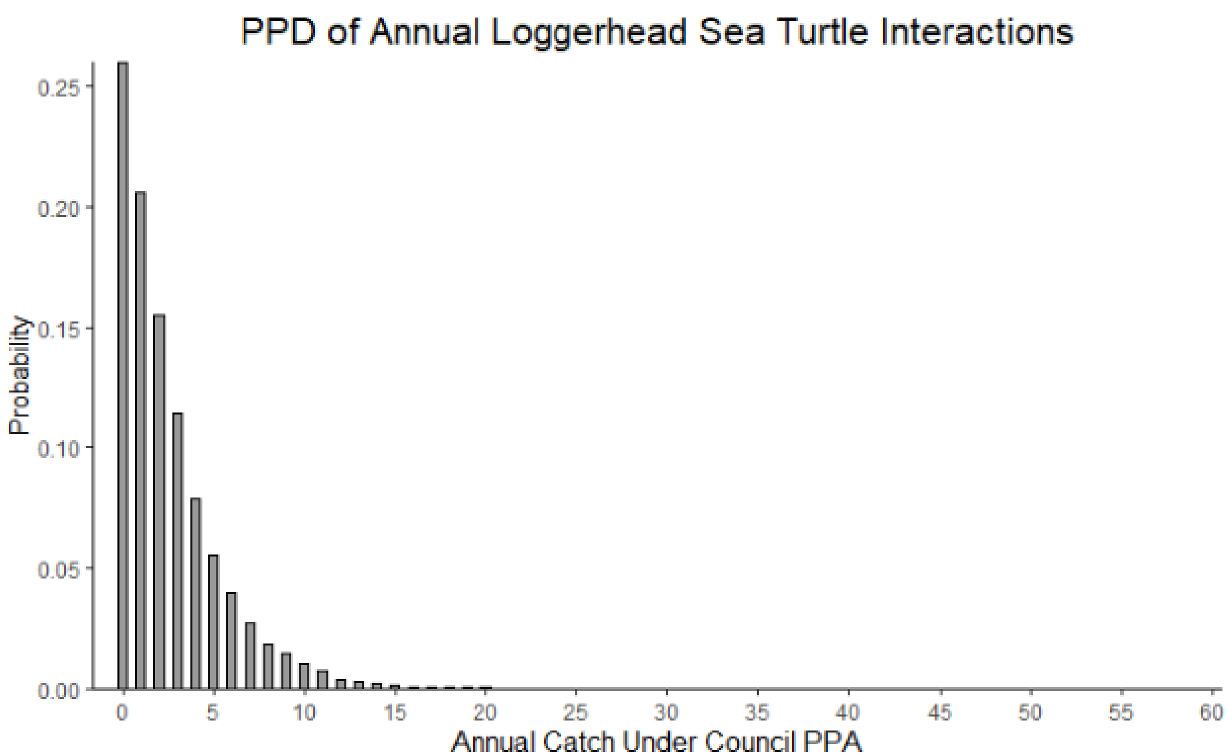
		Mean	CI 2.5%	Median	CI 97.5%	Mode
CPUE	*Per Buoy Hour*	*0.00002*	*0.00000*	*0.00002*	*0.00006*	
	Per Day Fished	*0.00160*	*0.00021*	*0.00136*	*0.00432*	
12 Year Ramp Up	Open Access	96	12	81	264	52
	LE 3.1	31	3	27	87	16
	LE 3.2	46	6	39	126	27
	LE 3.3	53	6	45	146	27
	LE 3.4	58	7	49	158	29
	LE 3.5	36	4	30	98	17
Ongoing Annual	Open Access	8	0	7	24	5
	LE (All)	5	0	4	15	2



Loggerhead sea turtle (*Caretta caretta*)—North Pacific Ocean DPS

Table A-18. Loggerhead Sea Turtle Catch (in Number of Individuals) Under Each Alternative

		Mean	**CI 2.5%**	**Median**	**CI 97.5%**	**Mode**
CPUE	*Per Buoy Hour*	*0.00001*	*0.00000*	*0.00001*	*0.00004*	
	Per Day Fished	*0.00084*	*0.00003*	*0.00061*	*0.00298*	
12 Year Ramp Up	Open Access	51	1	37	176	3
	LE 3.1	17	0	12	58	3
	LE 3.2	24	0	17	84	4
	LE 3.3	28	0	20	98	5
	LE 3.4	31	1	22	106	3
	LE 3.5	19	0	14	67	2
Ongoing Annual	Open Access	4	0	3	16	0
	LE (All)	3	0	2	10	0



Appendix B: Methods and Results of Socioeconomic Impact Analysis

The impact of the Proposed Action on the socioeconomic environment will depend on a number of economic factors including effort, catch rates, and the price of swordfish landed by DSBG. Because of the limited scope of DSBG EFP fishing contributing to the available data, it is difficult to estimate the relationship of increasing volumes of DSBG-caught swordfish to the overall socioeconomic environment. For DSBG-caught swordfish to effectively supplant imports to meet domestic demand, it must be competitive in price, or attain preferred status as a superior-quality product.

To estimate the effect of increasing DSBG-caught swordfish volume on DSBG-caught swordfish price, we undertake a Bayesian statistical analysis which controls for the volume of swordfish landed by other fisheries, the volume of swordfish imports, and the volume of landings of two common substitute species, dolphinfish and yellowfin tuna. This analysis consists of an inverse demand model where the monthly price per pound of DSBG-caught swordfish is a function of the landings (in pounds) of DSBG-caught swordfish; the volume of swordfish landings by DGN, harpoon, and longline fisheries; the volume of fresh swordfish imports to Southern California ports,[5] and landings of potential substitute species including yellowfin tuna (YF) and dolphinfish (DF). The model also controls for month to month variation in total effort, and for month (η_i) and year (ρ_j) effects. The functional form of this model is as follows:

$$\begin{aligned}\log(P_{DSBG,ij}) = {} & \beta_1 \log(Q_{DSBG,ij}) + \beta_2 \log(Q_{DGN,ij}) + \beta_3 \log(Q_{HAR,ij}) + \beta_4 \log(Q_{LL,ij}) \\ & + \beta_5 \log(Q_{IMP,ij}) + \beta_6 \log(Q_{YF,ij}) + \beta_7 \log(Q_{DF,ij}) + \beta_8 \log(Q_{SOAK,ij}) + \eta_i + \rho_j\end{aligned}$$

Table A-19 presents summary statistics and data descriptions for all variables thought to impact DSBG swordfish price. The data source for all variables is from the confidential PacFIN HMS landings database, except for the imports data, which were sourced from NOAA Office of Science & Technology. Data are aggregated by month and refer to swordfish landings to Southern California ports, as DSBG has not been landed elsewhere to date.[6]

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[5] We assume that fresh imports are a potential substitute for DSBG-supplied swordfish, but that frozen imports arrive at a later point on the supply chain and are not likely to crowd out processor capacity for receiving DSBG-caught swordfish.

[6] Ports with DSBG landings include Long Beach, Newport Beach, Oceanside, Oxnard, Santa Barbara, San Diego, San Pedro, Ventura, and a grouping of other Los Angeles/Orange County ports.

Table A-19. Data Summary for DSBG Price Analysis

Variable	Mean	Min	Median	Max	Description
DSBG Price	$6.87	$5.04	$6.88	$8.60	Average price per pound paid for DSBG-supplied swordfish in a given month.
DSBG Landings	7,886	67	5,717	27,190	Total volume (in pounds) of DSBG-supplied swordfish in a given month.
DGN Landings	22,578	164	9,395	88,706	Total volume (in pounds) of DGN-supplied swordfish in a given month.
Harpoon Landings	3,582	122	1,555	25,606	Total volume (in pounds) of harpoon-supplied swordfish in a given month.
Longline Landings	11,573	36	2,305	111,028	Total volume (in pounds) of longline-supplied swordfish in a given month.
Fresh Imports	202,804	107,742	202,203	272,908	Total volume (in pounds) of fresh swordfish imports in a given month.
Yellowfin Tuna Landings	3,186	18	1,844	16,922	Total volume (in pounds) of yellowfin tuna landings from all domestic sources.
Dolphinfish Landings	2,745	169	2,543	12,834	Total volume (in pounds) of dolphinfish landings from all domestic sources.
Soak Hours	3,262	80	3,043	11,465	Total soak time (in hours) of DSBG in a given month.
Month		January		December	Month in which DSBG was landed.
Year		2015		2018	Year in which DSBG was landed.

The purpose of this analysis is to estimate the price effect[7] of increasing DSBG landings, holding other factors which may influence DSBG price constant. The Proposed Action would authorize levels of DSBG fishing significantly higher than those seen in the DSBG EFP trials, and the increased participation and landings may result in an effect to the price of DSBG-caught swordfish. This could influence the economic viability of the fishery, as HMS fishers may choose not to participate if the price falls too low.

Because of the small sample size (a total of 32 months with DSBG landings between 2015 and 2018), traditional linear regression methods are not appropriate to estimate this demand model. Therefore, we employ a Bayesian approach which enables us to obtain estimates despite a limited number of observations. We began with a simple model which included only the DSBG price and DSBG quantity variables, and then added relevant covariates in a bottom-up approach. We apply the results of this analysis to both Alternative 2 and Alternative 3, with the assumption that higher levels of ongoing permit issuance (as in the Open Access Alternative 2) will perpetuate a greater overall price effect than would a lower number of permits (as in the LE Alternative 3).

[7] Price effect is reflected by the scale flexibility estimated by the inverse demand model; i.e., the percent variation in price expected from a one-percent increase in quantity.

Table A-20 displays the results of the price analysis. The coefficients labeled "mean" represent the average expected percent change in DSBG price given a one-percent increase in each of the variables thought to affect DSBG price. The other fields in the table represent the standard deviation, the quantiles of the distribution of the estimates, and model diagnostics.[8]

Table A-20. Results of DSBG Price Analysis

Variable	mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
DSBG	-0.03	0.03	-0.1	-0.05	-0.03	-0.01	0.04	3209	1
DGN	-0.01	0.03	-0.06	-0.02	-0.01	0.01	0.04	3171	1
Harpoon	0	0.01	-0.02	-0.01	0	0.01	0.02	4729	1
Longline	-0.01	0.01	-0.03	-0.02	-0.01	0	0.02	4740	1
Fresh Imports	0.17	0.12	-0.06	0.09	0.17	0.25	0.39	299	1.01
Yellowfin Tuna	0.01	0.01	-0.02	0	0.01	0.02	0.04	5109	1
Dolphinfish	-0.03	0.07	-0.17	-0.07	-0.03	0.02	0.11	2967	1
Soak Hours	0	0	0	0	0	0	0	2441	1

The mean coefficient for DSBG quantity (-0.03) suggests that increasing the quantity of DSBG landings by one percent lowers the price of DSBG by 0.03 percent on average. This suggests a weak negative price effect of increased DSBG landings.

In 2018, 640 swordfish were recorded caught in DSBG EFP fishing, and a total landed weight of 45.35 mt was delivered to Southern California ports. The average weight of a DSBG-caught swordfish in 2018 was 0.07 mt. Based on the results of our Bayesian biological analysis (see Section 4.3.1), DSBG swordfish catch in a given calendar year would increase to an ongoing annual mean of 6,678 swordfish under Alternative 2. Assuming that the average weight of a DSBG-caught swordfish is constant, we project an ongoing annual mean of 467.32 mt in landed swordfish weight under Alternative 2.

We estimate the average annual price under Alternative 2, given the projected increase in landings, using the following formula:

$$\log P_{OA} - \log P_{2018} = \beta_1 * (\log Q_{OA} - \log Q_{2018})$$

Where:

P_{OA} = Average annual price under Alternative 2;

[8] "n_eff" refers to the effective sample size which estimates the amount of independent information in the simulated sample from the posterior distribution. "Rhat" is a measure of convergence between four Markov Chains used to simulate the posterior distribution; Rhat < 1.1 is generally considered to indicate convergence of the chains.

P_{2018} = Average annual price in 2018 ($5.99);

β_1 = Price effect calculated in the price analysis (-0.03%);

Q_{OA} = Projected annual landings under Alternative 2 (467.25 mt);

Q_{2018} = Total annual landings in 2018 (45.35 mt).

Solving for P_{OA} returns an estimated average annual price of $5.58 per pound, which is $0.41 lower than the average price in 2018.

Note that these estimates are dependent on the effort assumptions of the biological analysis (i.e., the ratio of active to inactive DSBG permits, and the average days fished per active permit) holding constant under the Proposed Action. It also relies on the assumption that DSBG swordfish CPUE (and, therefore, landings) scale proportionally with effort.[9]

Based on the results of our Bayesian biological analysis (see Section 4.3.1), DSBG swordfish catch in a given calendar year would increase to an ongoing annual mean of 4,008 swordfish under Alternative 3. Assuming that the average weight of a DSBG-caught swordfish is constant, we project an ongoing annual mean of 280.48 mt in landed swordfish weight under the Proposed Action.

We estimate the average annual price under Alternative 3, given projected increasing landings, using the following formula:

$$\log P_{LE} - \log P_{2018} = \beta_1 * (\log Q_{LE} - \log Q_{2018})$$

Where:

P_{LE} = Average annual price under Alternative 2;

P_{2018} = Average annual price in 2018 ($5.99);

β_1 = Price effect calculated in the price analysis (-0.03%);

Q_{LE} = Projected annual landings under Alternative 2 (280.34 mt);

Q_{2018} = Total annual landings in 2018 (45.35 mt).

[9] Based on very limited data, CPUE did in fact decline with increased effort during the most recent two years of DSBG EFP fishing. From 2017 to 2018, effort increased from 326 days fished to 613 days fished, while swordfish CPUE declined from 1.70 individual fish per day to 1.06 individual fish per day, representing a "CPUE elasticity" of -0.43%.

Solving for P_{LE} returns an estimated average annual price of $5.67 per pound, which is $0.32 lower than the average price in 2018. Note that the five sub-options under Alternative 3 reach the maximum level of permit issuance, and associated DSBG price effects, on different timescales:

- LE option 3.1 may reach this maximum price effect after 12 years.
- LE option 3.2 may reach this maximum price effect after 6 years.
- LE option 3.3 may reach this maximum price effect after 3 years.
- LE option 3.4 may reach this maximum price effect after 1 year.
- LE option 3.5 may reach this maximum price effect after 11 years.

Note that these estimates is dependent on the same assumptions, limitations, and levels of uncertainty as the estimates for Alternative 2.

We also estimate socioeconomic impacts of the alternatives at the regional level, to determine the effect of the alternatives on fishing communities as a whole. Using 2018 DSBG landings and revenues, the calculated own-price effect of increasing DSBG landings, and the amount of projected swordfish catch under each alternative, we estimate aggregate landings and revenues for the three regions where DSBG swordfish has been landed to date: Ventura and Santa Barbara Counties, Los Angeles and Orange Counties, and San Diego County.