HIGHLY MIGRATORY SPECIES MANAGEMENT TEAM REPORT ON DEEP-SET BUOY GEAR AUTHORIZATION

At its March 2018 meeting, the Pacific Fishery Management Council (Council) adopted a motion revising the range of alternatives (ROA) for the authorization of deep-set buoy gear (DSBG) and provided guidance to the Highly Migratory Species Management Team (HMSMT) on the scope of the analyses it wished to see at the June meeting. In this report, the HMSMT presents preliminary results from its spatial, economic, and biological analyses. Since the Council revised the area to be considered for limited entry (LE) permitting, from "South of a line due West from Point Conception" to "South and East of a line due South of Point Conception," the HMSMT revised its analyses presented in this report to accommodate this new definition. Lastly, the HMSMT proposes to integrate all three analytical components into a single model-based analysis.

Spatial Analysis

The HMSMT explained the limitations and caveats for the different data sources available to inform its analysis for a deep-set buoy gear ROA in its March 2018 report. Given these constraints, all available data streams were analyzed side-by-side to obtain the broadest spatial understanding of the drift gillnet (DGN) fishery. Unfortunately, at this time there is no established way to integrate data sets to provide a more complete and robust data set (i.e., logbook data cannot be matched to landings data reliably).

Additionally, since the March 2018 meeting, the HMSMT was able to obtain and summarize an additional source of recreational fishing data. These data are raw interview counts from private vessels launching from public ramps in Southern California and do not include private vessels departing from private marinas. While they do not provide estimates of effort, they provide an overview of private vessel fishing location. In Figure 3, the HMSMT mapped this data, which will supplement the Council's consideration of recreational fishing areas (i.e., in addition to the Commercial Passenger Fishing Vessel [CPFV] distribution derived from logbook data in Figure 2).

The HMSMT discussed analyzing spatial aspects of an authorized DSBG fishery using a general approach that focuses on the historical extent of the swordfish fishery in the Southern California Bight (SCB; as defined in the Council's March 2018 motion, above), as well as a consideration of catch-per-unit-effort (CPUE) to identify areas likely to yield successful DSBG fishing in the future.

There are several advantages to a more general analysis of spatial distribution of vessels in the SCB. In contrast to mainly depicting potential areas of high CPUE, the general spatial approach allows for differences in an individual's decisions as to fishing location, profit margins, concurrent gear use on trips, etc. without limiting the number of issued permits based on an anticipated catch level and predetermined threshold of profitability. The swordfish stock is highly mobile and migrates throughout the SCB during the extent of the fishing season. While swordfish aggregate around certain features (temperature breaks, etc.), historical high CPUE in an area does not necessarily indicate that that area is the only potential area of high CPUE in the SCB at any given time. With minimal DSBG EFP data, the HMSMT must rely on DGN observer, logbook and landings data as proxies for swordfish presence. With fewer than 50 DGN vessels fishing in the SCB in any given season since the opening of the Pacific Leatherback Conservation Area (PLCA:2001), it is likely that all areas of successful swordfish fishing were not exploited and therefore would not be accurately reflected in CPUE estimates.

Since data from the DGN fleet are the only long-term data sources available for analysis, their applicability to DSBG may only be marginal. DGN gear is used at night, at a different depth distribution, and is fished later in the season than DSBG has been to date. Additionally, DGN gear targets swordfish by location and not necessarily by feeding behavior, as with DSBG. Using a general approach examining data from a longer period would provide estimates based on broadly defined effort areas and would allow some amount of uncertainty/variability in the swordfish stock distribution and fishery participation.

Another major consideration when examining the spatial distribution of a swordfish targeting fleet is the proportion of authorized vessels fishing at any given time in a given space. Looking at historic DGN logbook data, the maximum number of vessels fishing in the SCB on any given day since the establishment of the PLCA was 23 (landings and observer data indicate a smaller number of vessels). At that time (2006/2007 season), the state of California had issued 88 DGN permits. This indicates that on the peak day of activity, only 26% of issued permits were active. In looking at all seasons since 2001, less than 50% of all issued permits were active in any one season, which can be considered when evaluating potential DSBG permit activity.

When considering the maximum spatial extent of the DGN fleet in the SCB, Figure 1 shows the cumulative maximum spatial extent of DGN fishery since establishment of the PLCA, as reported on landing receipts. It covers 163 unique California Department of Fish and Game (CDFG) blocks, with an area of 2,015,404.0 nm^2. This area would accommodate 102,695 five nm diameter DSBG footprints without overlap.

The largest number of unique CDFG blocks fished with DGN in any given season was 85 (landings data; 66 for logbook data), with an area of 6,492.7 nm^2 (5,700.2 nm^2 for logbook data). These areas would accommodate 330 (290 for logbook data) individual 5 nm diameter DSBG footprints to fish at any one time without overlap. At less than 50% participation in any season, this would equate to over 650 issued permits.

If conversely the minimum blocks (as reported on logbooks) were examined for the same time period, the fished area for any one season would accommodate 83 vessels without overlap of their footprints. If less than 50% of issued permits fished in any given season, that would still suggest over 165 permits could be issued.

Examining the spatial extent that DSBG EFPs have fished from 2015-2017, 67 unique blocks, with an area of 4,826.2 nm^2, would allow for 245 vessels to fish (Figures 1-3). Using the 5 nm diameter footprint (19.625 nm^2 area) for each fished set, 154 vessels would still be able to fish at any given time. The Council's highest alternative, 250 permits, would still give each vessel 12.1 nm^2 to fish without overlap with another vessel. At this point, it is unknown how many DSBG vessels could concurrently fish in a 5 nm diameter footprint without incident, or what a reasonable amount of overlap between vessel footprints could be accommodated. In estimating the available fishing areas to determine the number of DSBG footprints that could be accommodated, the area of the large block at the bottom of the Exclusive Economic Zone (EEZ) was not included. This block extends out to the southern and western extents of the EEZ and encompasses an extremely vast area. Data from both DGN and DSBG data indicate that the effort in this block is in the most northeasterly region and is small in comparison to the rest of the SCB. Including it in the calculations would vastly skew the results. Considering this information, it is reasonable to suggest that spatial constraints, at least within a DSBG fleet, would not be a limiting factor.

The Council has heard public comment over the course of DSBG development that too many vessels participating in the fishery will have unintended conflicts with other fisheries, largely the recreational fishery off of southern California. While initial examination of the available CPFV and private vessel data indicate some areas of high recreational effort where such interactions may occur (Figures 2 & 3), the HMSMT feels that until actual conflicts arise, these concerns are speculative. Areas of high recreational effort, both private and CPFV, appear to be largely concentrated near the coast and around the Channel Islands, most likely in state waters (0-3 nm). This confirms that a large proportion of recreational effort is geared toward nearshore species, such as basses and yellowtail. DSBG's main target species inhabits a very different habitat than these nearshore species. While recreational anglers and CPFVs do sometimes target HMS species which may be found near bathymetric features frequented by swordfish, available data are too sparse to determine at this point whether interactions between the DSBG and recreational fisheries will be a tangible issue.

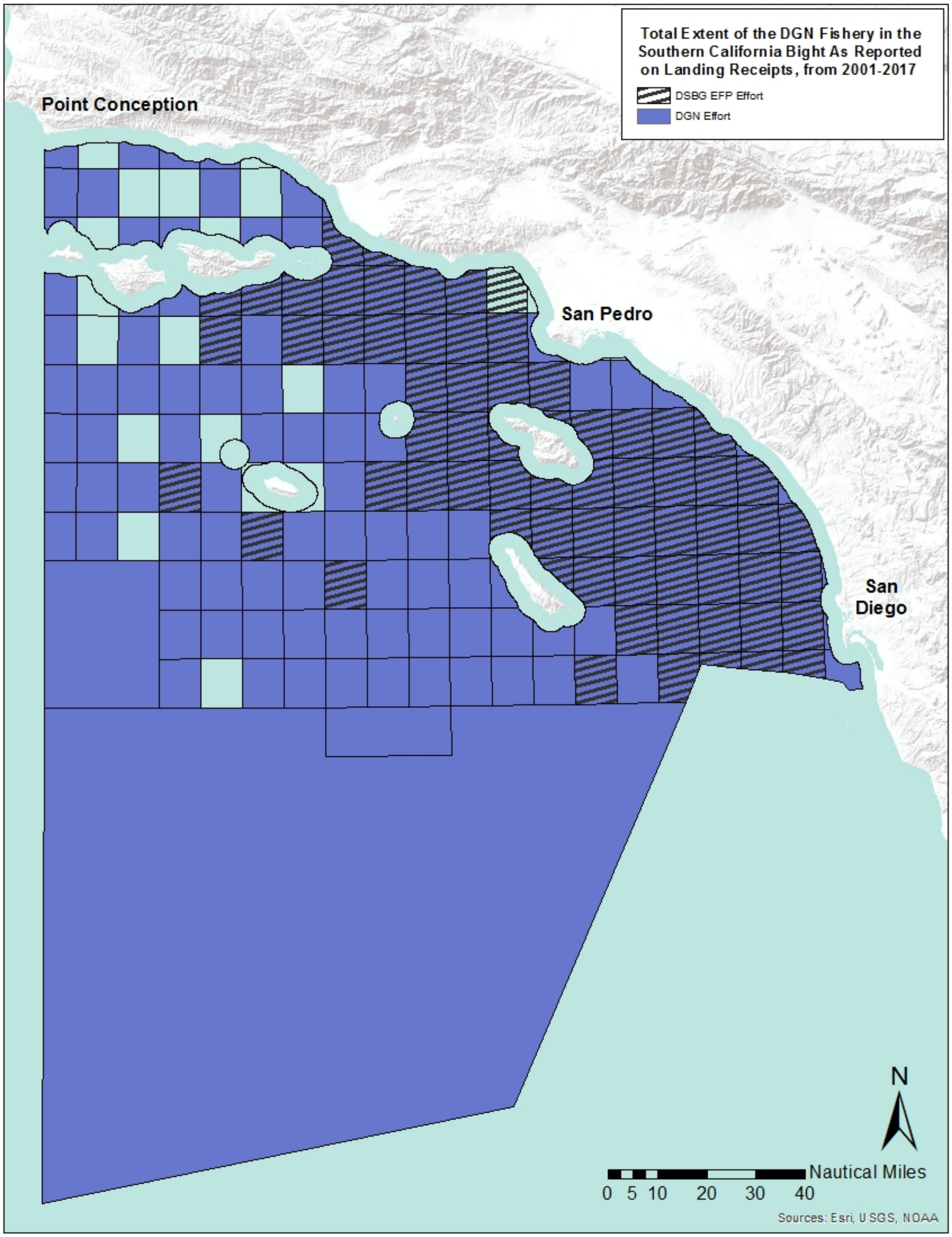

Figure 1. The total unique CDFG blocks fished by the DGN fleet, as indicated on California landing receipts, for 2001-2017 and CDFG blocks with DSBG EFP fishing effort for 2015-2017.

Data Source: CDFW Commercial Fisheries Information System (CFIS), extracted January 05, 2018

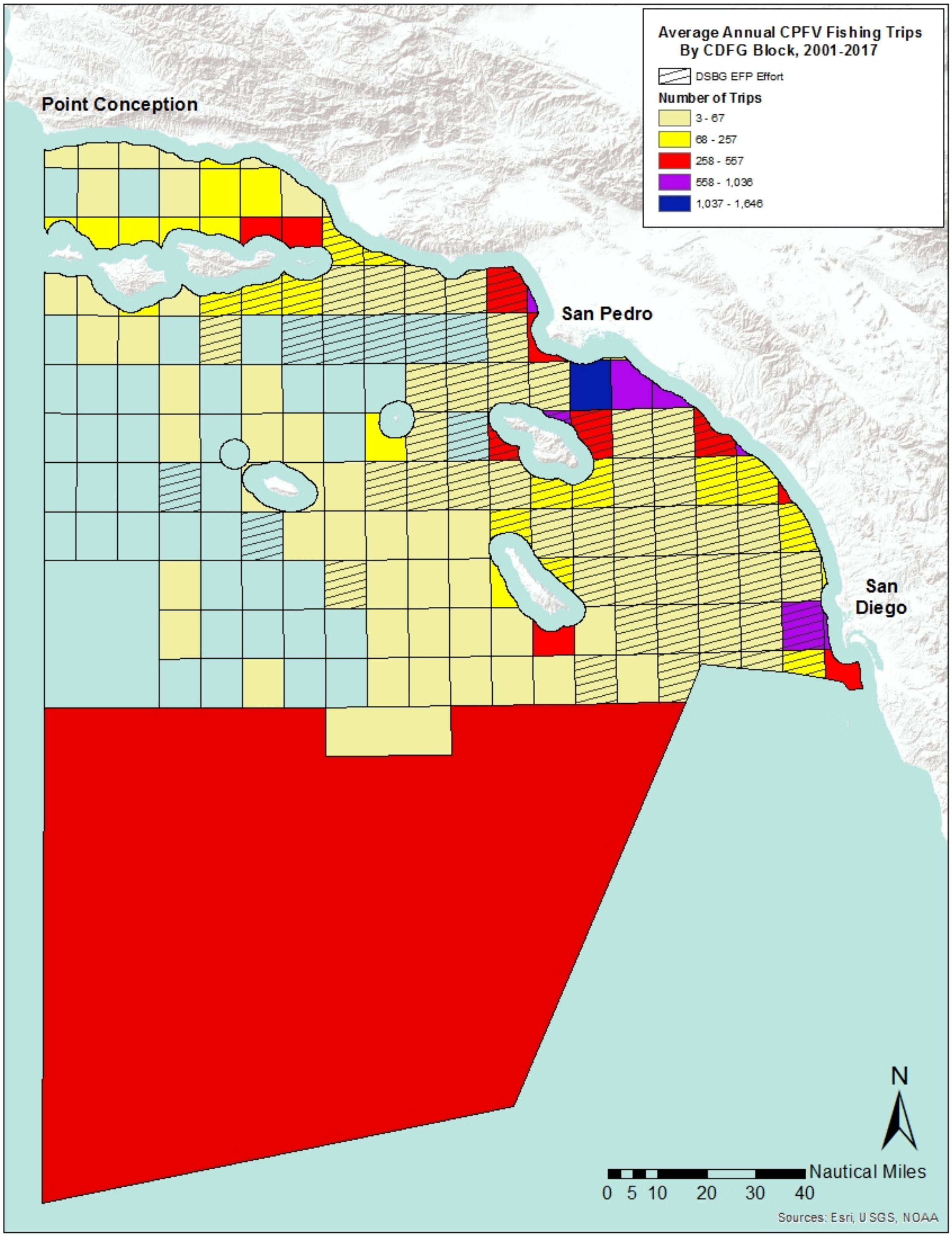

Figure 2. The average annual number of CPFV fishing trips by CDFG block for 2001-2017 and CDFG blocks with DSBG EFP fishing effort for 2015-2017.

Data Source: CDFW Marine Logbook System (MLS), CPFV Logbook, extracted January 19, 2018

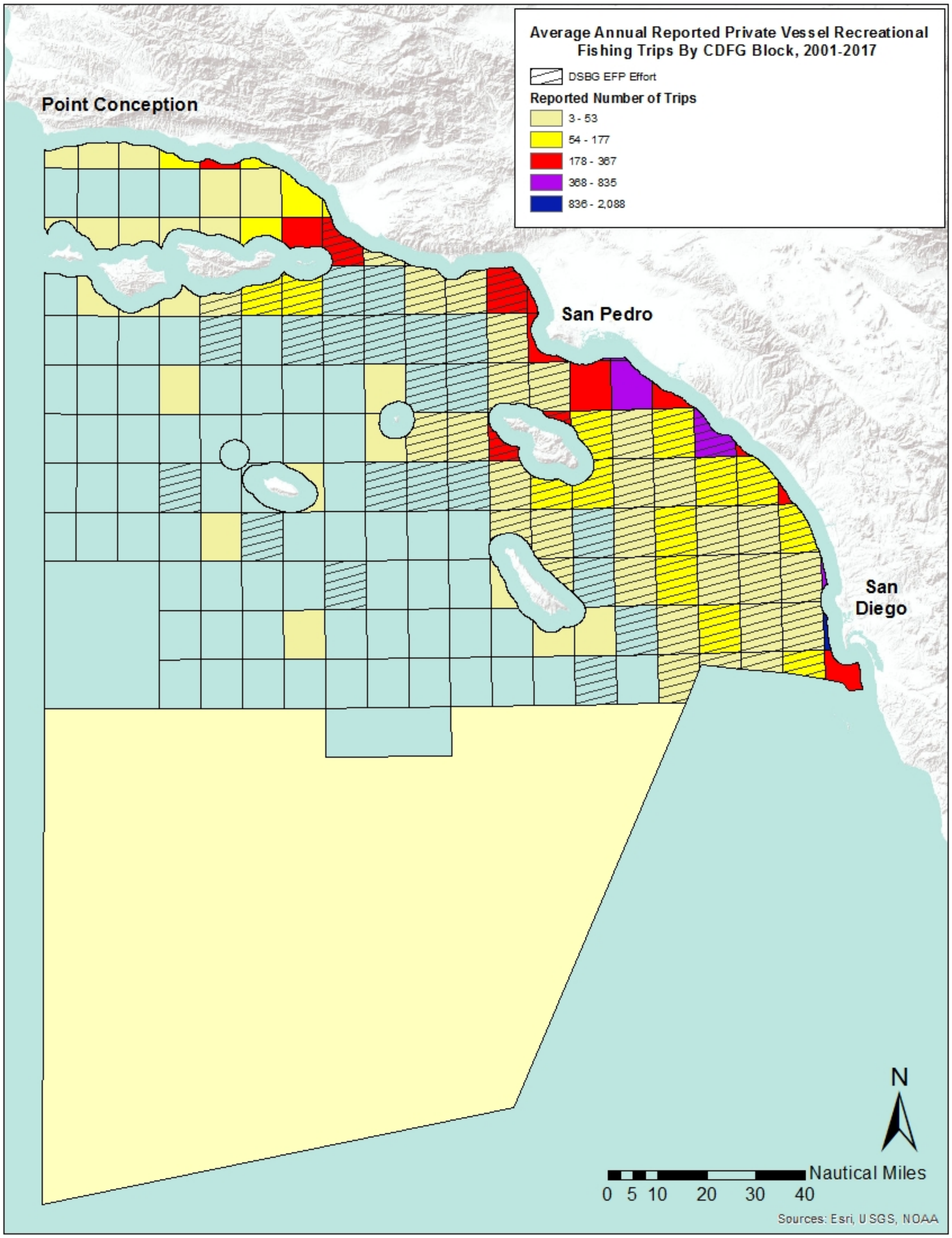

Figure 3. The average annual number of reported private vessels fishing trips by CDFG block for 2001-2017 and CDFG blocks with DSBG EFP fishing effort for 2015-2017.

Data Source: CDFW California Recreational Fishing Survey (CRFS), accessed April 16, 2018

In its March 2018 motion, the Council asked the HMSMT to analyze potential spatial and/or temporal closures for the DSBG fishery to address concerns over potential interactions with the recreational fishery. While it is feasible to analyze this economically, it is difficult to spatially evaluate such closures. The HMSMT suggests that at a later date, when additional EFP effort has been completed and supplemental data have been collected, the Council may wish to consider reexamining the idea of DSBG closures, such as temporary closures only on weekends during the summer months when the larger weekend billfish tournaments are being held. This would allow for these important events to operate without concern of interaction during times of high tournament effort, but also provide minimum limitation and lost opportunity to the DSBG fleet.

Economic Analysis

Currently active DSBG EFP participants have expressed concern at recent Council meetings that the potential increased volumes of swordfish landings that may occur with a larger number of active DSBG fishing vessels operating at a similarly high productivity level would reduce the market price of swordfish and profitability of DSBG fishery participation. As a first step to exploring this potential consequence of DSBG fishery expansion, the HMSMT conducted an analysis to investigate the relationship between the prices received for DSBG landings and the amount of swordfish supplied by domestic gear type, swordfish imports, and domestic landings of potential substitute species.

Exploratory Data Analysis

As a first step towards developing a preliminary version of the demand analysis, an exploratory data analysis was conducted to compare landings and prices for DSBG-caught swordfish to other sources of swordfish and potential substitute species (see Figure 4) in production or consumption. Data used to develop the demand analysis include landings records for swordfish and closely-related species from PacFIN[1], and import data from the National Oceanic and Atmospheric Administration (NOAA) Office of Science and Technology for the period when the DSBG EFP fishery made landings to Southern California ports.

[1] The data were extracted from PacFIN on April 12, 2018. PacFIN data will continue to be updated with additional information from DSBG EFPs as it becomes available.

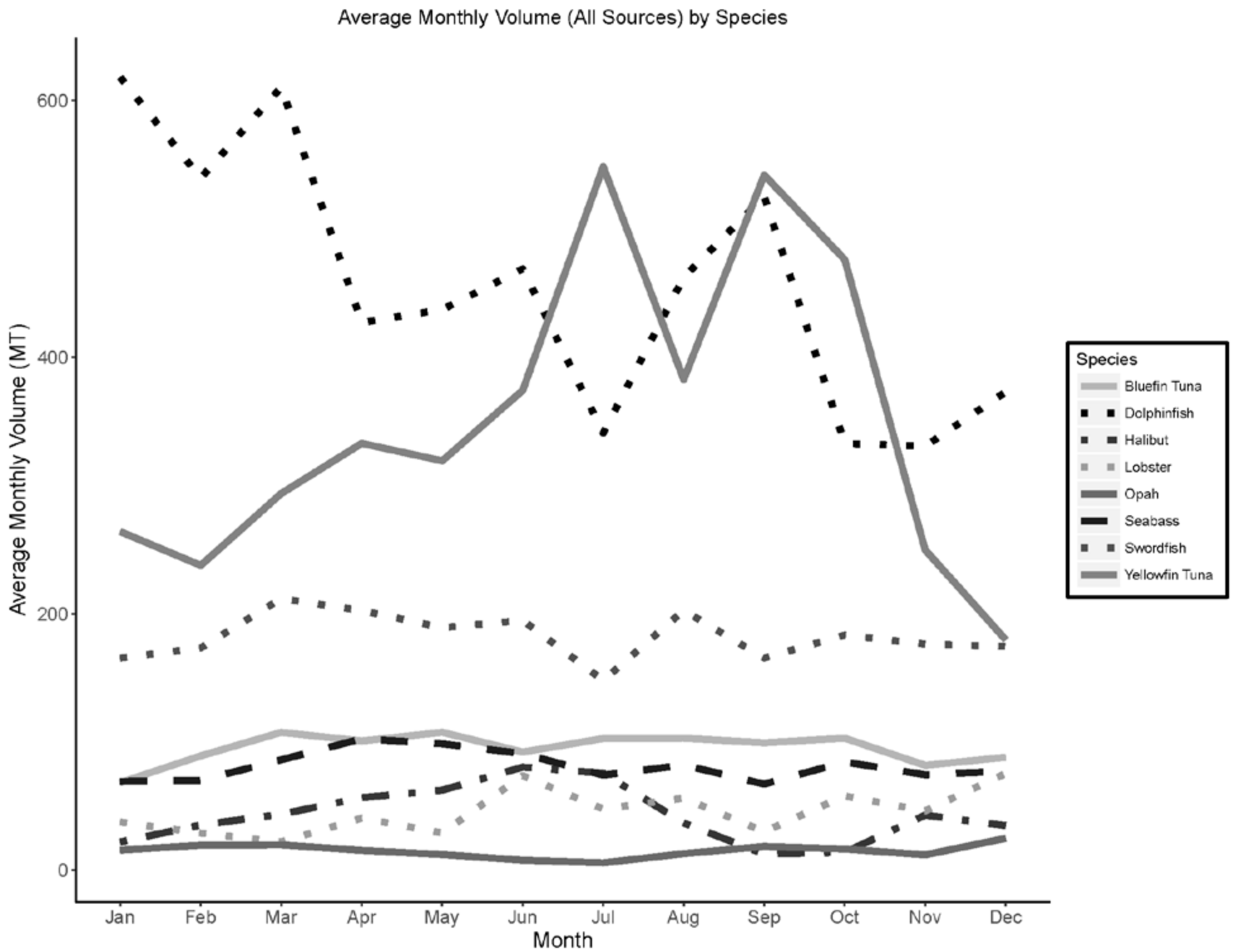

Figure 4. The average monthly volume of swordfish and potential substitute species supplied to Southern California.

Figure 4 displays monthly volumes of supply for swordfish and potential substitute species to Southern California ports from all sources, including domestic production and imports, averaged over the time period when DSBG was landed. Candidate species for this analysis were chosen from a group of high-value market species either landed or imported to Southern California which might plausibly act as swordfish substitutes in either production or consumption.

The supply of swordfish from all domestic and import sources to Southern California ports is relatively level at around 200 metric tons per month, with slight dips below trend in July and September. Based on the large volume and seasonal trends for yellowfin tuna and mahi-mahi (dolphinfish; MH), these species were considered as potential substitutes for swordfish.

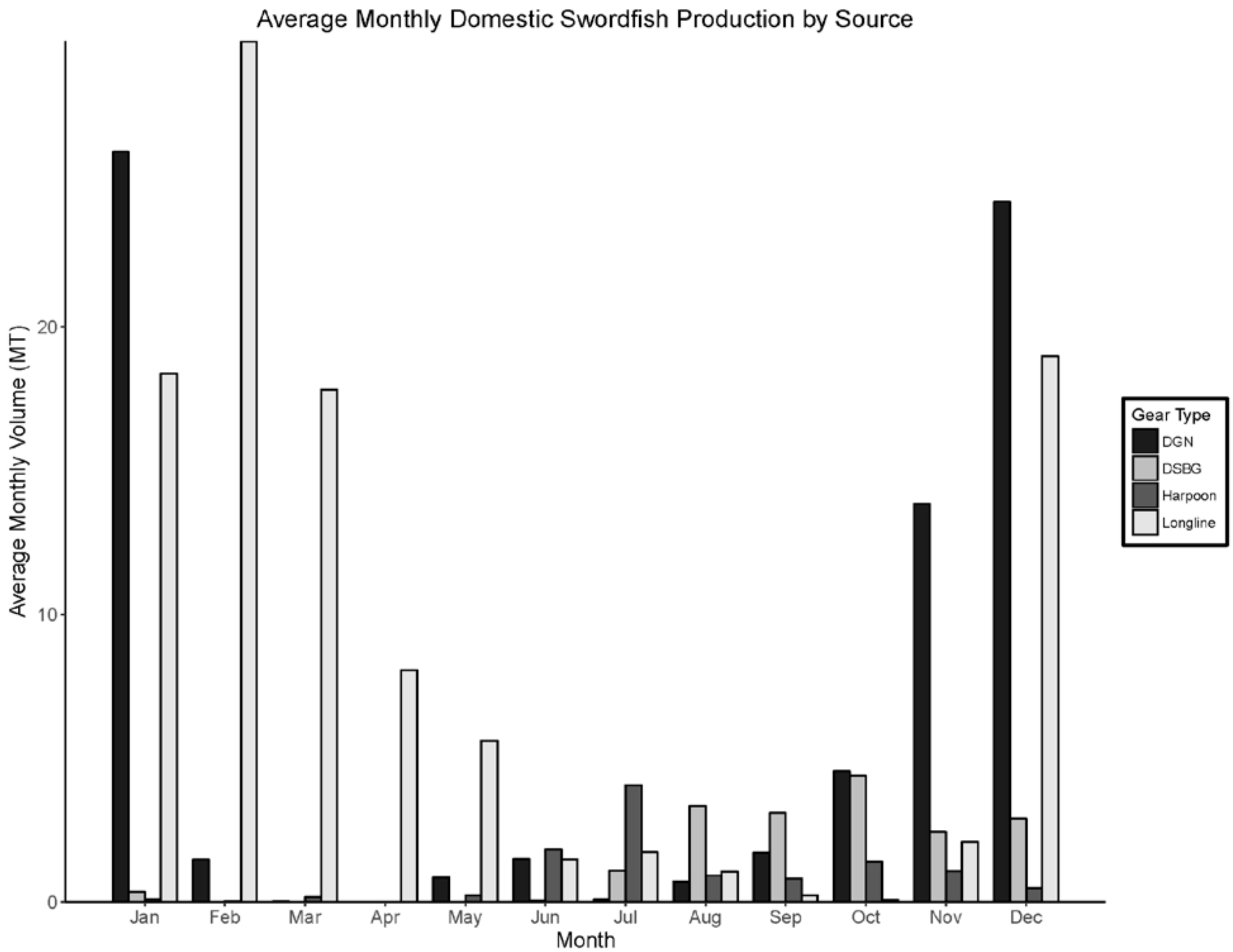

Figure 5. The average monthly production of swordfish landed to Southern California ports, for each domestic gear type.

Figure 5 shows average monthly volume of landings to Southern California ports for various domestic swordfish gear types. DGN and longline (LL) are the highest volume sources of landings to Southern California, particularly from November to May. By contrast, average DSBG landings peak in October, and taper off through January. Comparison of DGN to DSBG volume of production in months where both were active may be misleading, as the participants in DSBG testing were for the most part experienced DGN fishermen who would normally be engaged in DGN fishing over the period.

Given that there has been little DSBG effort in the late fall and early winter (December and January) it is unclear how landings will increase with a larger number of DSBG permits. Preliminary data from the past three EFP seasons suggests that DSBG catch performance may decline during periods of heightened catch with DGN gear. This trend is difficult to fully interpret given that market price may have a negative impact on DSBG effort, especially during periods of heightened DGN activity (Dr. Chugey Sepulveda, personal communication). Thus it remains unknown whether DSBG could produce comparable landings during this period even if the number of permits were substantially increased.

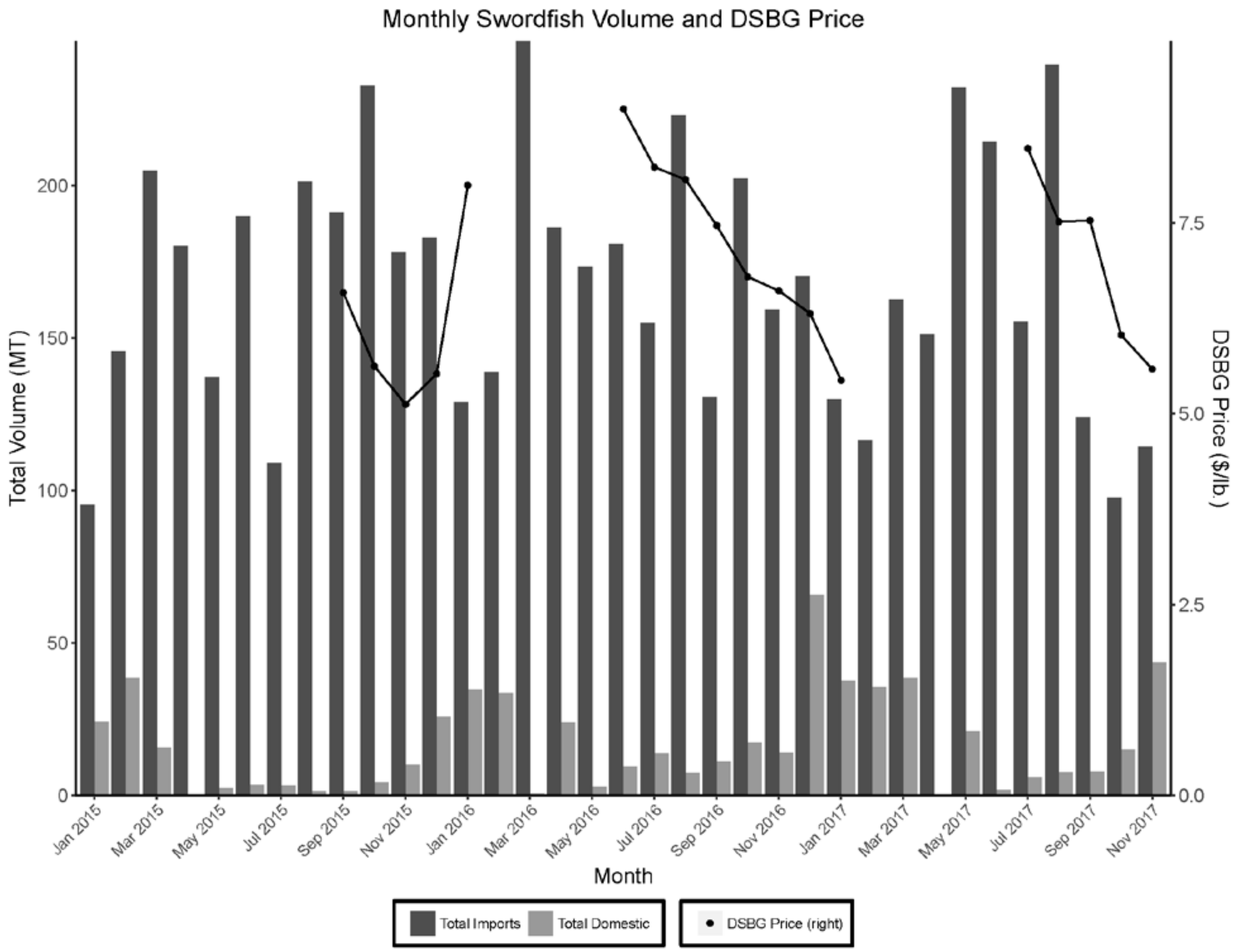

Figure 6. The total volume of imported and domestically-landed swordfish in Southern California (left axis) and the ex-vessel price of DSBG-caught swordfish (right axis).

The monthly volume of swordfish supply to Southern California from domestic and imported sources is shown in Figure 6 (left scale) along with monthly average DSBG prices for months when landings were made (right scale). The figure demonstrates the relatively heavy reliance on imports as source of swordfish supply, indicative of a large seafood trade deficit in swordfish in Southern California, and also suggests market integration (substitutability) between domestic landings and imports, as import volume tends to decrease in months when domestic supply is highest (late fall through early spring). Though hard to generalize with the available landings data from a limited number of vessels fishing, the DSBG price seems to exhibit a downtrend from the summer months, when other domestic sources of supply are lowest, through the winter months, when LL and DGN landings increase.

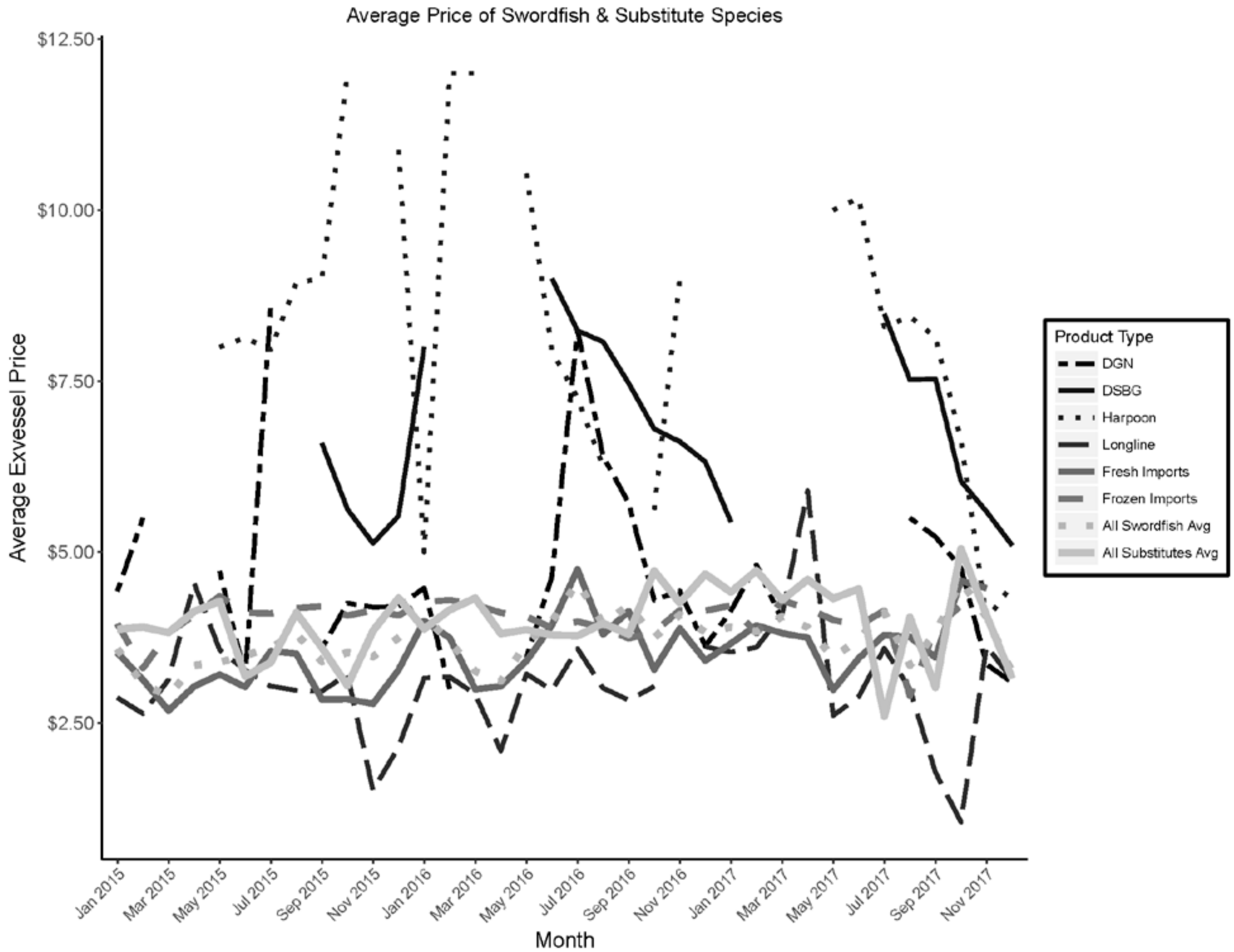

Figure 7. The average price of swordfish and potential substitute species, by product type, for each month from January 2015 to December 2017.

Figure 7 displays average prices by product type for swordfish and potential substitutes. It is clear from the figure that harpoon and DSBG caught swordfish command a price premium over most other swordfish products and potential substitutes, although DGN-caught swordfish sometimes commands a higher price than harpoon or DSBG-caught swordfish. This may reflect the observation made by processors that swordfish prices reflect the quality of the product rather than the method used to catch it.

Preliminary Demand Analysis

The available EFP data, along with other sources of domestic and import swordfish supply were used to conduct a preliminary analysis of the demand for DSBG-caught swordfish. The price of DSBG-caught swordfish was modeled as a function of swordfish landings by domestic gear type, swordfish imports, and domestic landings of substitute species. The relationship between DSBG-caught swordfish price and the amount of DSBG landings, as well as the degree of market integration[2] between alternative sources of swordfish and substitute species were examined.

[2] In this context, market integration refers to where the volume of one or more other sources of supply affects the price of DSBG-caught swordfish.

Preliminary results suggest the following:

1. Changes in the quantities of DGN- and LL-caught swordfish and MH are correlated with changes in the market price for DSBG-caught swordfish. This could reflect a combination of lower prices for DGN and LL-caught swordfish, due to lower operating costs per unit of swordfish landings for these gears, and higher volumes of swordfish of comparable quality to DSBG-caught swordfish when the DGN and LL fisheries were operating at the same time as DSBG. Increased volumes of supply from these alternative sources is expected to reduce the price received for DSBG (cross-price effect).

2. The very limited effect detected of higher DSBG swordfish landings on the DSBG swordfish price may indicate weak statistical power to detect an effect, due to limited volumes of DSBG swordfish landings relative to other sources of supply, rather than the volume of DSBG landings affecting the price received. It may also reflect the decision of DSBG fishermen to fish during periods when expected DSBG prices are high. This is consistent with information in the Pfleger Institute of Environmental Research (PIER) DSBG EFP update report (Agenda Item G.4, Attachment 1, June 2018) that EFP participants conducted less effort in periods when the price was low.

3. It is likely that an increase in DSBG-caught swordfish volume will have a larger negative effect on the DSBG swordfish price than a comparable increase in another related but distinct source of supply, such as DGN, LL or MH.

4. Some of the effects observed in the preliminary results could be attributed to fishermen reacting to market prices. Even with a more robust data set, DSBG fishermen's ability to fish more intensively during periods with a higher DSBG market price creates a challenge to estimating the own-price effect of DSBG landings. The theory of demand posits that a higher volume of DSBG landings would reduce the market price for DSBG-caught swordfish. However, the available data may more strongly reflect the price of DSBG landings influencing fisher behavior (such as fishing intensity), rather than demonstrating the effect higher levels of DSBG landings have on the market price.

5. At this stage, we tentatively conclude that increases in the supply of DSBG-caught swordfish are likely to affect the price, as evidenced by the cross-price effect of the volume of LL and DGN landings on the DSBG price we detected in the preliminary demand analysis. However our statistical results cannot yet detect a direct relationship between fishing effort, or number of active DSBG vessels, and DSBG-caught swordfish price. As more EFP data are gathered and we further develop our model it may be possible to measure an own-price effect of increased DSBG landings on the price and use the results to inform a decision on how many permits to issue.

Biological Analysis

The biological analysis was conducted using 2015 to 2017 EFP data, including PIER logbook data and Perguson observer data. These provide a full census of DSBG EFP trips and effort to date, but excluded research DSBG data as the intent of the research was development and testing of the gear. EFP catch rates are more representative of commercial fishing CPUE, and therefore more appropriate in analyzing a fully authorized fishery. Furthermore, DSBG sets conducted during the research stage did not result in catch of any species that are not represented in catch from EFP effort. It is important to note that fishing effort and success between the PIER and Perguson EFPs varied greatly and could likely be representative of the continuum of fishing behaviors in a legal fishery, from full-time participants to those occasionally utilizing the gear as a supplement to other gear types. From 2015 through 2017, eight individual vessels fished under DSBG EFPs. Five vessels fished in 2015, seven fished in 2016, and five fished in 2017. These vessels each fished an average of 45 days per year over the entire period. Annual average DSBG fishing days increased from 28 days per vessel in 2015, to 41 days per vessel in 2016, and 66 days per vessel in 2017.

Effects to Target and Non-Target Species

CPUE for all species caught in DSBG EFPs from 2015 through 2017 is presented in Table 1. These CPUEs are multiplied by the average annual number of DSBG trips per vessel (45) to estimate total potential annual catch in LE DSBG fisheries with up to 10, 50, 150, and 250 vessels, and an open access fishery which the HMSMT analyzes for up to 300 vessels. These calculations assume constant returns to scale as the number of DSBG permits increases and shows results as if CPUE and vessel effort remain constant in the future at different fishery sizes rather than attempting to correct for potential future changes in CPUE or fishing effort. The numbers presented here are most indicative of DSBG effects for a small number of vessels, similar to EFP activity to date. There are factors that may affect CPUE or total catch in the future, such as fisherman experience, swordfish availability, and changes in annual fishing effort.

Table 1. EFP Catch, CPUE, and Expanded Potential Annual Catch for Alternative Numbers of DSBG Permits.

	Swordfish	Bigeye Thresher Shark	Blue Shark	Shortfin Mako Shark	Pelagic Thresher Shark	Opah	Escolar	Yelloweye Rockfish	Giant Squid	Northern Elephant Seal	Unid. Misc.
Total Caught	1171	161	9	1	1	3	10	1	1	1	1
757 Total Days Fished											
Catch per Day	1.547	0.213	0.012	0.001	0.001	0.004	0.013	0.001	0.001	0.001	0.001
45 Days per Year per Vessel											
Annual Catch per Vessel	69.6	9.6	0.5	0.1	0.1	0.2	0.6	0.1	0.1	0.1	0.1
10 Vessel Annual Catch	696	96	5	1	1	2	6	1	1	1	1
50 Vessel Annual Catch	3481	479	27	3	3	9	30	3	3	3	3
150 Vessel Annual Catch	10442	1436	80	9	9	27	89	9	9	9	9
250 Vessel Annual Catch	17403	2393	134	15	15	45	149	15	15	15	15
300 Vessel Annual Catch	20883	2871	161	18	18	54	178	18	18	18	18

Swordfish and bigeye thresher shark are the primary species expected to be affected by a DSBG fishery, as other species are caught and retained at a very low rate or can be released alive if not kept. The HMSMT plans to convert potential swordfish catch numbers to weight and then compare the results to the harvestable surplus of the Western and Central North Pacific Ocean (WCNPO) swordfish stock. This may indicate whether any alternative number of DSBG permits might catch an amount of swordfish that could lead to overfishing at current effort levels or if average annual effort per vessel increases in the future. The most recent swordfish stock assessment indicates that the WCNPO swordfish stock is not overfished and overfishing is not occurring on the stock. A new swordfish stock assessment is expected to publish in July of this year. There is currently no bigeye thresher shark stock assessment for which to compare potential DSBG catches. Although bigeye thresher sharks are marketable, most of them have been released alive during DSBG fishing due to their low market value. PIER is currently studying the post-release survivorship of bigeye thresher sharks caught in DSBG fishing gear.

Effects to Prohibited Species

Species prohibited for retention in the HMS FMP include the white shark, basking shark, megamouth shark, Pacific halibut, and salmon species. None of these species were caught during DSBG EFP fishing from 2015 through 2017. When fished as intended, DSBG is not likely to catch these species because DSBG hooks are set at depths where the species do not normally occur and the DSBG lines are unlikely to entangle these species. The megamouth shark may occur at DSBG fishing depths; however, it is a filter feeder and unlikely to feed on the large baits used in DSBG fishing.

Effects to Protected Species

One Northern elephant seal was caught during 757 DSBG EFP fishing days from 2015 through 2017. Even with a potentially higher number of vessels and increased total fishing effort in the future, a DSBG fishery would likely have minor effects to the elephant seal stock, since its current potential biological removal under the Marine Mammal Protection Act is 4,882 animals per year.

Elephant seals are the only protected species (i.e., marine mammals, sea turtles, and seabirds) that have been observed caught during DSBG EFP fishing. Therefore, the EFP data were not used to quantify potential effects of a DSBG fishery on other protected species. Rather, like with prohibited species, the HMSMT outlines potential threats to these species based on biology, behavior and DSBG's configuration and fishing strategy.

Dolphins and porpoise are not likely to be caught in DSBG because the hooks are set at depths where dolphins and porpoise do not normally occur and DSBG lines are unlikely to entangle them. Beaked whales and sperm whales may occur at DSBG fishing depths and could potentially feed on large squid bait used in DSBG fishing. Other whales are not typically found at DSBG hook depths, but could potentially become entangled in DSBG lines. The likelihood of whale entanglement may be higher in linked DSBG than in standard DSBG because linked DSBG deploys more vertical lines and also uses horizontal lines which are not present in standard DSBG.

Sea turtles are not likely to be hooked by DSBG because the hooks are set at depths where sea turtles do not normally occur. Leatherback sea turtles have the potential to become entangled in DSBG due to their large foreflippers. The likelihood of leatherback sea turtle entanglement may be higher in linked DSBG than in standard DSBG for the same reasons stated above for whales.

Seabirds are not likely to be caught by DSBG because hooks are deployed to depth rapidly near the vessel and taut lines minimize the chance of seabird entanglement.

Future Research Plans

The spatial, biological, and economic analyses described above are performed using limited data sets representative of both the DGN fishery and DSBG effort over the 2015–2017 period conducted by eight DSBG vessels fishing under EFPs. Given the finite amount of DSBG data currently available, each of these analyses has uncertainty surrounding outcomes for the DSBG economics, spatial crowding, and biological impacts which would result under different numbers of participating vessels. If uncertainty is considered, each of these factors has the potential to indicate a number of permits at which a DSBG fishery would not perform optimally. Therefore, the HMSMT proposes the development of a Bayesian analysis that integrates all three components into a single analysis, incorporating uncertainty, and running a simulation model to determine which factor (spatial, biological, or economic) is likely to be the constraining factor under varying permit number scenarios. This integrated approach will allow for a greater range of possible analyses and can help to provide further insights into profitability, biological impacts, and spatial crowding than are possible using individual analyses.

Appendix

To model price formation we constructed an inverse demand model where the price per pound paid by the processors for DSBG-caught swordfish is a function of the volume (pounds) of swordfish landings by DSBG and alternative gear types, including DGN, LL, and harpoon (HAR), and potential substitute species, including yellowfin tuna (YF) and mahi-mahi (MH), and the volume of fresh swordfish imports (IMP). The model also includes month (η_i) and year (ρ_j) effects to address seasonality in the level of processor demand, and yearly shocks to their demand, which would generate separate effects on the price of DSBG swordfish from the landings factors, which are our primary interest. The inverse demand model we estimate is presented below. Data are indexed for each month i in year j.

$$\log\left(P_{DSBG,ij}\right) \sim \mathrm{N}\left(\beta_1 \log\left(Q_{DSBG,ij}\right) + \beta_2 \log\left(Q_{DGN,ij}\right) + \beta_3 \log\left(Q_{LL,ij}\right) + \beta_4 \log\left(Q_{HAR,ij}\right) + \beta_5 \log\left(Q_{IMP,ij}\right) + \beta_6 \log\left(Q_{YF,ij}\right) + \beta_7 \log\left(Q_{MH,ij}\right) + \eta_i + \rho_j, \sigma^2_{P_{DSBG}}\right)$$

Data to estimate the model came from PacFIN records aggregated by fishing method to the monthly level, and monthly import data from the NOAA Office of Science and Technology. Because the DSBG fishery operates under an EFP system, observations were limited to those months during which DSBG landings were observed from 2014 to 2017. We estimated the model using Bayesian inference, which supports estimating a more complete model of DSBG fishery participation with a hierarchical structure. Non-Bayesian estimation techniques are unable to analytically solve for all the parameters of interest with the available data.

Parameter	Description	mean	se_mean	sd	2.50%	25%	50%	75%	97.50%	n_eff	Rhat	Pr(<0)
beta[1]	DSBG	-0.01	0	0.34	-0.68	-0.24	-0.01	0.22	0.65	8000	1	0.51
beta[2]	DGN	-0.10	0	0.29	-0.67	-0.29	-0.1	0.09	0.47	5380	1	0.64
beta[3]	LL	-0.35	0.01	1	-2.29	-1.02	-0.35	0.33	1.57	8000	1	0.64
beta[4]	HAR	0.11	0	0.2	-0.3	-0.02	0.11	0.24	0.49	8000	1	0.29
beta[5]	IMP	0.10	0	0.21	-0.33	-0.04	0.1	0.23	0.49	8000	1	0.32
beta[6]	YF	0.01	0	0.16	-0.3	-0.09	0.01	0.12	0.33	8000	1	0.46
beta[7]	MH	-0.70	0.01	0.57	-1.8	-1.08	-0.7	-0.32	0.43	5223	1	0.89

PFMC
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