Exempt Fishery Permit Application for Extended Deep-Set Linked Buoy Gear (XLBG)

1. *Date of application*: 04/30/2022

2. *Applicant*: Pfleger Institute of Environmental Research (PIER), 315 S. Harbor Drive, Oceanside CA 92054

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3. *A statement of the purpose and goals of the experiment for which an EFP is needed, including a general description of the arrangements for the disposition of all species harvested under the EFP.*

The Pacific Fishery Management Council (PFMC) has expressed interest in the development and design of alternative swordfish gears for the U.S. west coast that expand domestic production and opportunity while minimizing bycatch (i.e., turtles and marine mammals). Recent work by the PFMC, NOAA and collaborators has resulted in increased fishing opportunity within the Southern California Bight (SCB) and the preliminary authorization of Deep-set Buoy Gear (DSBG) and Linked Buoy Gear (LBG)[1]. Although shown to be highly selective, these gears are relatively artisanal in nature and only rely upon a maximum of 30 hooks fished simultaneously. To date the bulk of all exempted testing of DSBG and LBG has been performed close to shore within the SCB, from Santa Cruz Island to the Mexican border. The limited EFP effort footprint is partially due to the small size of the vessels operating in the deep-set fleet and the increased costs associated with offshore and exploratory fishing. This has left a large portion of the California coastline with no fishing activity, while several of the larger boats that once relied heavily upon the swordfish resource remain tied to the dock. These vessels are larger than typical DSBG boats, they are capable of extended trips and familiar with waters outside of the SCB. These are also the same vessels that historically produced the bulk of the swordfish landings from within the CA EEZ.

Several of the larger CA swordfish vessels do not currently participate in the new deep-set fishery because it is not considered to be financially viable given their size, higher operating costs and the artisanal nature of the current deep-set gear designs.

This EFP will incorporate the bycatch mitigation advancements developed under previous NOAA funded research[2] and expand the spatial footprint of deep-set linked buoy gear to accommodate larger vessels and offshore fishing. This EFP will focus on (1) expanding current deep-set effort to areas outside of the primary DSBG activity footprint, (2) building an inclusive fishery that accommodates larger vessels, (3) meeting California’s swordfish demand and (4) increasing local fishing opportunities and swordfish production using selective, deep-set methods.

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[1] https://www.pcouncil.org/actions/deep-set-buoy-gear-action/
[2] NOAA Award #’s; NA17NMF4270216; NA15NMF4720380

This EFP will test the following hypotheses:

1. Extended deep-set linked buoy gear (XLBG) results in similar catch composition and selectivity as DSBG and LBG.
2. XLBG is economically viable off California
3. XLBG will compliment and expand the deep-set fishery and provide increased opportunity off California.

Disposition of Catch: During the proposed exempted trials, all marketable catch will be sold by cooperative fishers to offset fishing costs and used to assess the economic viability of XLBG.

This submission requests to test "Extended Linked Buoy Gear" under an exempted fishing permit (EFP). A detailed description of Extended Linked Buoy Gear is provided in subsequent sections of this proposal. We have also included a detailed description of the bycatch mitigation features and tools proposed for use during the exempted testing efforts (*Section 12.a*).

4. Valid justification explaining why issuance of an EFP is warranted

This EFP application is the next step in the line of experiments focused on the development and trial of deep-set techniques for targeting swordfish off the California coast (Sepulveda et al., 2010; 2015; 2018). The proposed work expands upon successful DSBG and LBG trials and tests a configuration that is specifically designed for mid-sized (CA DGN type) vessels off the U.S. West Coast. Despite the success of DSBG trials to date, there is still a need to identify ways to increase west coast fishing opportunities and landings while maintaining conservation and selectivity goals.

Given that California has historically supported two markets, a higher-value harpoon industry and a larger-volume DGN fishery, PIER has focused revitalization efforts in two phases. Phase I focused on the use of DSBG to augment the harpoon fishery (a low-volume industry). Phase II built upon the DSBG concept and developed an expanded design that has been referred to as Linked Buoy Gear (LBG). During research and EFP testing performed to date, LBG has yielded similar catch composition as DSBG (Council EFP reports 2019, 2020; Sepulveda et al., submitted). Catch rates using LBG are slightly higher than DSBG, but to date have not offered enough added catch to support widespread use. This is likely due to the greater set-up costs and the need for a third crewmember when fishing with LBG. In the proposed next step plan we propose to expand the LBG footprint to attain the catch that is needed to support economic viability. Based on the catch rates to date, we propose that increasing the gear footprint to a maximum of 10nm and offering fishers the ability to use a greater hook-count (≤100 hooks/set) should result in an average daily catch rate that supports economic viability[3] (i.e., >3 swordfish/day).

The purpose of the proposed EFP is to test the performance and economic viability of

[3] Proposed based on logbook records for the primary swordfish season, as this resource is not present year round off the US west Coast.

XLBG and assess if this gear configuration can be used to augment current swordfish operations off the US west coast. The proposed EFP will be managed by PIER and headed up by PI Sepulveda. This work will bring together a team of fisherman and scientists with a proven performance record working towards increasing sustainable west coast swordfish harvest and domestic fishing opportunities.

5. A statement of whether the proposed experimental fishing has broader significance than the applicant's individual goals

This EFP has been developed as part of a larger plan to revitalize California's west coast swordfish fishery. Over the past 40 years, California's primary swordfish fishery has declined severely, primarily because of restrictions and bycatch mitigation mandates placed upon the CA DGN fishery. Subsequently, California has lost revenues and fishing opportunities while simultaneously increasing its reliance upon foreign sourced seafood.

PIER and several partners have worked closely with industry to find ways to reverse this trend and identify a low-impact fishing method that can be used to target the west coast swordfish resource. The continued goal of this work is to promote sustainable domestic swordfish operations, revitalize west coast ports and fishing communities, and increase gear selectivity for swordfish.

6. An expected total duration of the EFP (i.e., number of years proposed to conduct exempted fishing activities)

We request an initial EFP trial period of two years.

7. Number of vessels covered under the EFP

We request a minimum of 3 and maximum of 5 vessels during the first year of EFP activity. Upon demonstration of adequate performance (i.e., economic viability and gear selectivity) the proposed EFP may request the inclusion of additional vessels.

We also propose the inclusion of alternate vessels in case an EFP participant cannot fish for one reason or another. During past EFP trials valuable time has been lost due to valid, real-life excuses (i.e., health, financial obligation, family). In this EFP we would like to request the inclusion of at least two alternate vessels that would allow for quick in-season changes to the fishing roster. This would allow the EFP activity to continue despite any setbacks a particular vessel may experience.

8. A description of the species (target and incidental) to be harvested under the EFP and the amount(s) of such harvest necessary to conduct the experiment, including harvest estimates of overfished species and protected species.

Given that the proposed EFP will use techniques that have already been tested under research and exempted efforts, we hypothesize that the species composition will be similar to that documented during previous exempted activity (Sepulveda and Aalbers, 2018).

Species to be targeted: Swordfish (*Xiphias gladius*)

Incidental species: Opah (*Lampris guttatus*), Blue shark (*Prionace glauca*), bigeye thresher shark (*Alopias superciliosus*), escolar (*Lepidocybium* spp.), oilfish (*Ruvettus spp.*).

We propose that the catch will consist mainly of swordfish, opah and bigeye thresher sharks (BETS). Swordfish and opah are marketable species that are currently harvested under the West Coast HMS Fishery Management Plan. The BETS is a marketable species that is often released by deep-set fishers due to its low market value (Sepulveda and Aalbers, 2018). Recent work on assessing post-release disposition of BETS has shown high survival rates (>90%) when released from both DSBG and LBG (Sepulveda et al., 2019; Aalbers et al., 2021). Additionally, we propose BETS catch will be reduced compared to that of the previous EFP trials based on the proposed EFP action area which is outside of the areas that have produced the highest BETS catches (i.e., inshore banks; Sepulveda et al., 2018).

To date LBG catch has not included any species of special management concern (i.e., overfished or restricted species). The northern elephant seal (*Mirounga angustirostris*) is the only protected species that we foresee any potential XLBG interaction with. Because XLBG can be serviced similar to DSBG and LBG, we anticipate that such interactions can be detected resulting in a live, healthy release. Additionally, because gear servicing times will be greater than that of DSBG or LBG (due to the larger horizontal footprint), this work has proposed the use of lighter descending weights which we propose will reduce the stress imparted on any unwanted catch.

Amounts of harvest: Based on LBG trials to date, we anticipate total harvest of swordfish to be dependent on fishing activity. We estimate approximately 3 swordfish per 8h soak period. Based on the low amount of incidental catch in our DSBG and LBG trials to date, we anticipate total harvest of other species to be minimal. Based on 3 vessels operating a minimum of 50 days each, we estimate annual swordfish harvest to be ≤450 individuals. For reference the PIER EFP has averaged ~370 SF/year using DSBG. Due to the learning curve associated with new gear types, we also propose that Year1 totals may be slightly lower than Year 2.

9. *A description of a mechanism, such as at-sea fishery monitoring, to ensure that the harvest limits for targeted and incidental species are not exceeded and are accurately accounted for*.

The proposed EFP will use a combination of electronic monitoring (EM), physical observation, fisher logbooks and landing receipts to assess catch and performance metrics.

EM will be used to document fishing activities on all EFP trips. EM techniques have been recently tested and compared with physical observation using both DSBG and LBG gear. Preliminary data show EM to be an adequate monitoring tool for assessing catch and gear performance in the deep-set fishery (Sepulveda et al., in preparation[4]). Additionally, EM techniques are currently being used to monitor other similar pelagic fisheries across the Pacific (Brown et al., 2021).

In addition to EM, this EFP will also use the same monitoring protocols developed and utilized under the PIER-DSBG and LBG EFP's. All XLBG sets will also be monitored through check in/out procedures for each trip, daily communication among EFP participants (via radio or satellite text), daily fisher logbook entries, observer logbook records and landings receipts (Sepulveda and Aalbers, 2018). Similar the previous efforts, the PIER team will work closely with each applicant to log fishing effort, substantiate log books and manage EFP fishing operations.

Fisher logbooks will be verified by an audit comparison with EM records following previously published methods (Stanley et al., 2011; Emery et al., 2019). In the event that the EM records do not directly support fisher logbook entries, that fisher will be put on conditional terms which may result in removal from the EFP. All EM and logbook records will be maintained in a PIER database and provided to the PFMC and WCR upon request.

The proposed EFP will procure and cover all EM monitoring and review costs. The EFP will take physical observers when supplied by the NOAA WCR Observer Program.

10. A description of the proposed data collection and analysis methodology.

The at sea sampling protocol will follow closely the procedures and guidelines used by PIER to monitor and document previous EFP efforts (Sepulveda and Aalbers, 2018). This entails aligning all data fields and fisher log book entry forms with the NMFS Observer Program database. The cooperative fishers will be responsible for the daily completion of detailed logbook entries that will be collected each month throughout the fishing season. The logbook data fields will include target and non-target catch, size, disposition, hook depth, bait type, set and haul position, soak time, sea surface temperature, and any additional observations. All data will be maintained in an Access database (Microsoft 2010) and metadata will be provided directly to the PFMC HMS advisory bodies and the California Department of Fish and Wildlife (CDFW). Landings receipts, vessel expense information and EFP participation will be used to assess economic viability.   Findings will be periodically presented to the PFMC and its advisory bodies and upon termination of the EFP trials, findings will be published in a peer reviewed scientific journal.

11. A description of how vessels will be chosen to participate in the EFP

[4] https://em4.fish/projects-in-the-field-testing-electronic-monitoring-and-addressing-observation-constraints-in-a-developing-deep-set-fishery-for-swordfish-in-california/

Vessel selection will be based upon:

1. Interest in participation and success of XLBG experiments
2. Possession of a valid swordfish fishing permit (i.e., harpoon or DGN)
3. Experience fishing for swordfish within the EFP target area
4. Past DGN, deep-set or longline experience
5. Willingness to work as a team and respect PIER's role as the EFP manager
6. Willingness to comply with all EFP terms and conditions
7. Availability during the primary swordfish season

Similar to past deep-set EFP experiments, the goal of this work will be to test XLBG while trying to minimize variability in the experimental design. Therefore, this project will try to use experienced fishermen with a history of targeting swordfish within the EFP action area. The incorporation of captains with no previous west coast experience may not reveal the true potential of XLBG. We anticipate all cooperative fishers to exhibit some form of a "learning curve", thus season one objectives will be more focused on assessing catch composition and selectivity while subsequent years will be more focused on assessing catch potential and economic viability.

12. For each vessel covered by the EFP, the approximate time(s) and place(s) fishing will take place, and the type, size, and amount of gear to be used

Time and Place: This EFP will focus on targeting swordfish during the seasonal migration off the U.S. west coast which occurs from May through January each year (Hanan et al., 1993). Although we do not anticipate sets to occur in the winter or spring months we are requesting that there be no seasonal restrictions. Precise set locations will be determined based on ocean conditions (i.e., SST and chlorophyll concentration), weather, historic catch records and fisher experience. The proposed EFP requests to fish in federal waters from the Oregon-Washington border to the Mexican border and out 200nm. Off California we are proposing a 30nm coastal no XLBG corridor that would limit overlap with DSBG, Sportfishing operations and sensitive species aggregation areas (discussed further in section 12.a.).

Because XLBG deployment is considerably more time consuming than DSBG, we propose deployments to be initiated 2h before sunrise to capitalize upon dawn hours and that haul-back procedures commence by sunset. Because all hooks will be fished below the thermocline at all times, the early morning deployments should not pose any additional conservation risk/concerns (based on depth distribution of target and non-target catch, Sepulveda et al., 2010). Additionally, because the setting procedures will take up to 2.5h, the early morning deployments will not impact servicing protocols as it will be daylight by the time the vessels finishes setting.

General Gear Description: Extended Linked Buoy Gear (XLBG) is very similar to the current LBG design, however, it includes additional hooks and a larger horizontal footprint (Table 1). XLBG gear will include all of the bycatch mitigation features of LBG as well as additional safeguards proposed to increase accountability and minimize non-target interaction (Discussed under 12.a *Bycatch Mitigation Features*).

Description of LBG for Reference: Currently LBG can use up to 10 sections of gear with a maximum of 30 hooks deployed at any one time (3 hooks/section; Table 1). Similar to DSBG, the horizontal footprint of LBG must be maintained within 5nm and fishers must remain proximal to their gear to mitigate any potential non-target interactions. LBG uses the same strike indication system as DSBG and catch can be detected and removed without hauling the entire string. As currently configured, each LBG section is approximately 500m in length with a ~100m horizontal "servicing link" that is maintained 50 feet below the surface with two suspenders. When settled in the fishing position, the current end to end measurement of 10 sections of LBG is approximately 3.7nm (~6,000m).

Table 1 describes LBG, XLBG and for comparison shallow-set Longline gear.

Gear Attributes	PIER LBG	PIER XLBG	Traditional (shallow-set LL)
Footprint	3-5nm	6-10nm	35-50nm
Hook Count	$\leq$30	$\leq$100	900-1,200
Target Depth	Below thermocline	Below thermocline	Surface waters
Serviceability	Yes	Yes	No
Time of Set	Daytime	Daytime	Night
Tending	Yes	Yes	No
Weighted vertical legs	Yes	Yes	No
Line Shooter	Yes	Yes	Not always

Proposed gear changes (LBG to XLBG): In this study we propose to increase the hook-count from 30 to a maximum of 100. We also propose to increase the maximum fishing footprint from 5 to 10nm (Table 1). Given that increasing the number of deep-set hooks does not necessarily pose any increased conservation concerns, we are also proposing that fishers can, if they choose to do so, increase the number of hooks/section so long as the hook maximum/set does not exceed 100. Other proposed changes include the option to use descending weights that range from 4-8lbs instead of a mandated 8lb weight. XLBG section lengths will remain the same as that currently used in LBG operations (500m and a 100m subsurface horizontal) and each link will retain strike indication and servicing ability (Discussed under 12.a *Bycatch Mitigation Features*).

Rationale for proposed changes: Currently the catch rates for LBG are approximately 0.2 swordfish/section of LBG (Sepulveda et al., in preparation). Because a full LBG deployment consists of 10 sections, this equates to approximately 2 swordfish/set. Given the higher costs associated with offshore fishing and larger vessel operating expenses, we propose that fishers need to harvest a daily average that ranges between 3 to 5 swordfish in order to reach economic viability (based on current market price and estimated vessel operating costs). Based on 2016-2021 data, we propose that fishers will need to deploy between 15 and 25 sections to meet this target. This is based on the assumption that catch will scale linearly with increased gear deployments, an assumption we will test in this EFP. As currently configured a full 10nm deployment of XLBG could theoretically consist of ~26.8 sections, however, fishers must be able to account for stretch and expansion of the gear. Thus, based on previous LBG deployments we estimate that a full "set" will most likely consist of ~25 sections to consistently maintain gear within the proposed 10nm footprint.

When coupled with a hydraulic line shooter 4lb weights can have similar sink rates and impart less drag upon the line during haul back (Sepulveda et al., unpublished). Reduced descending weight size will also decrease drag on any unwanted catch that fishers may want to release. Decreasing descending weight size has primarily been proposed to addresses safety concerns voiced by LBG EFP participants.

<u>Gear specifics</u>: One full set of XLBG will consist of a maximum of 100 individual hooks soaked simultaneously over a maximum horizontal foot-print of 10nm (Figure 2; Table 1). A full XLBG compliment will be comprised of ~25 sections that individually extend ~500m in horizontal length. Each section will exhibit a strike detection system similar to that currently used for LBG and DSBG. All vertical mainline legs will be maintained taught using ≥4lb descending weights (Figure 2.). Individual XLBG sections will be adjoined with a ~100 m horizontal subsurface mainline "link" that must be suspended at least 50 ft. below the surface. A flag with locating gear (i.e., radar reflector, strobe or satellite buoy) will be affixed to all terminal ends. In the event of a parting, or when servicing gear, all terminal ends will be outfitted with locating equipment (i.e., flag, radar reflector, strobe or satellite locator buoy).

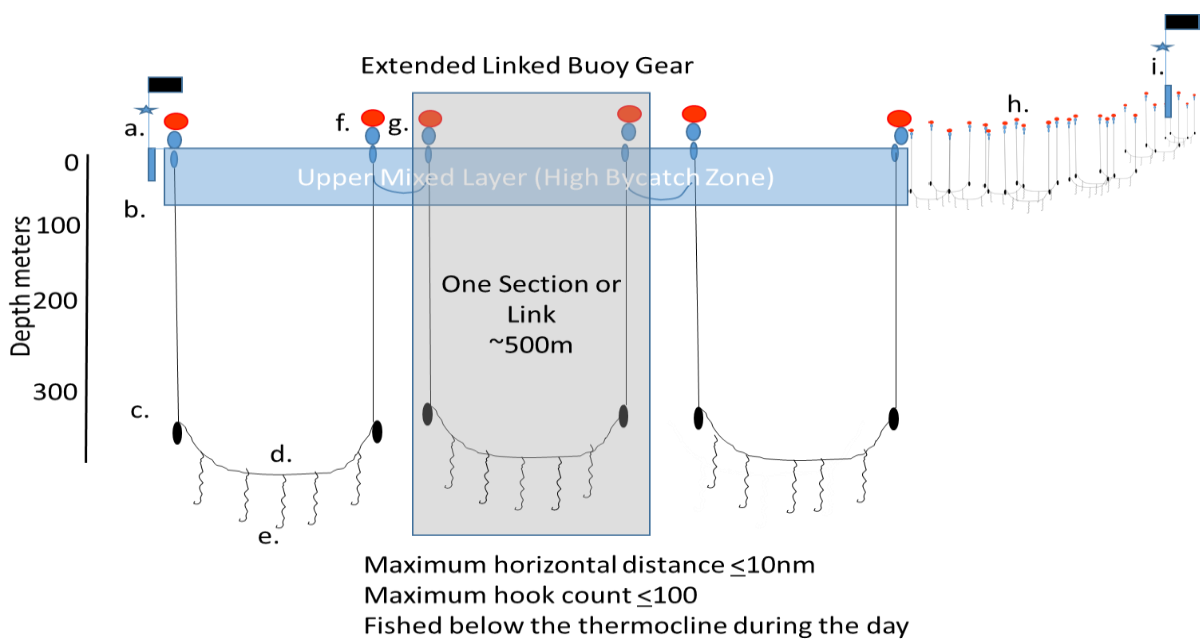

Figure 2. A drawing of Extended Linked Buoy Gear. Three terminal sections have been enlarged to visualize gear specifics.

Similar to previous PIER-EFP's, all hooks employed in the study will be either 16/0 or 18/0 circle hooks and bait will consist of either finfish (i.e. mackerel), squid, or artificial lures.   An illumination source (i.e., cyalume or power light) may be used proximal to each gangion. To increase sink rates, a hydraulic line-shooter must also be used.

12.a *Bycatch Mitigation Features of XLBG*

Similar to LBG, XLBG sections will be connected using a single mainline and will not rely upon the use of individual free-floating buoys. In the event that XLBG is cut or a section cannot be re-attached while servicing, each terminal end will be outfitted with a flag, radar reflector, strobe and satellite locator buoy. As with DSBG and LBG, fishing will occur during the day with hooks maintained below the thermocline to avoid non-target species. XLBG will retain strike detection capacity to minimize non-target impacts. Below we provide a detailed description of the bycatch mitigation features proposed and a brief explanation of their role in mitigating interactions. New conditions that were not present in previous EFP's are presented in bold.

1. <u>Marine Mammals</u>: The proposed EFP will test an expanded footprint of PIER's deep-set linked buoy gear (LBG), a gear configuration that was designed for use off Southern California and has been tested under research and exempted status since 2015. LBG has not resulted in any documented marine mammal interactions to date (Sepulveda et al.,2018; Aalbers et al., 2021; Annual PFMC reports). Expanded linked buoy gear (XLBG) will retain all of the existing mitigation features used in the current LBG configuration and also include additional attributes that should further reduce the risk of mammal interaction.

    a. *<u>Daytime fishing and depth segregation</u>*: As demonstrated in the trial and development of DSBG, positioning hooks below the thermocline during the day is a proven strategy to reduce bycatch and gear interaction with protected species, including marine mammals (Sepulveda et al., 2015; Sepulveda and Aalbers, 2018). XLBG will use heavy (4-8lb) weighting systems to descend gear rapidly through the water column and position hooks at depth throughout the entire deployment. No hooks will fish above the thermocline (~90m) at any time. Additionally, all sets will be performed during the day so that gear can be visually and electronically monitored.

    b. *<u>Strike indication and serviceability</u>*: Although past catch composition data suggests that active tending may not be necessary given the selective nature of daytime deep-setting (Sepulveda and Aalbers, 2018), in the rare event of a protected species interaction, XLBG will use the same strike detection system that is used in DSBG operations and also retain the ability to be easily serviced. Like DSBG, strikes are detectable by a change in the surface buoy orientation and catch can be removed/released without having to haul the entire string. As proposed during DSBG and LBG EFP fishing, fishers will patrol the mainline during a set to identify any non-target interactions and service the gear for quick release.

c. *Vertical lines and streamlined surface gear*: To reduce the potential for entanglement in the surface gear, all rigging will be smooth (i.e., no loops or knots) and streamlined to reduce the amount of gear at the surface. All vertical lines will be maintained taught with the heavy weighting systems and all horizontal lines will be maintained below 50 feet from the surface (similar to current LBG operations).

d. ***Satellite-based gear tracking***: In addition to standard gear tracking equipment (~3m'flags, radar reflectors and strobes) each piece of XLBG will also have at least two satellite tracking beacons on each section deployed (i.e., Blue Water Group or Satlink). The tracking buoys will help prevent gear loss, facilitate daytime servicing and provide additional safeguards in the rare event of a marine mammal entanglement. In the event the line is parted, fishers will maintain a satellite buoy on at least one of the ends of the gear. The satellite tracking system will also allow fisherman, EFP managers and resource managers to monitor the gear remotely from any location at any time.

e. ***Distance from shore***: To reduce gear overlap with ongoing DSBG and LBG operations, this work has proposed a 30 nm no-fishing corridor along the entire CA coast. This will also reduce gear overlap with protected and sensitive species that often aggregate in high densities along the shelf waters (Becker et al., 2020; Okuyama et al., 2021). The proposed spacing also provides EFP vessels access to the deep-water canyons and seamounts that have historically supported swordfish operations off the central California coast (Hanan et al., 1994). The proposed EFP testing areas along the central California coast align with the deployment and testing locations of previous DSBG and LBG research sets (Sepulveda et al., 2018; Sepulveda et al., unpublished). Using a precautionary approach for the waters above Point Conception, this EFP has also proposed to limit fishing to waters with depths >500m. This will further reduce the potential overlap with humpback aggregation areas which often occur along the shelf waters.

f. ***Mammal hotspot avoidance*****:** Although XLBG is designed to mitigate and reduce the potential for marine mammal and sea turtle interaction, this EFP will also include a provision that would prohibit fishing in any areas deemed by managers to be an area of heightened concern due to increased mammal density (i.e., seasonal or feeding aggregations). Additionally, the areas and conditions to be targeted in this EFP do not typically overlap with coastal shelf waters which are often associated with high humpback whale densities (Becker et al., 2020).

g. ***Monofilament marking**:* To provide increased accountability, this EFP will also use identifiable monofilament (specific colors) that differentiates XLBG from other fishing operations in the Pacific. Monofilament marking will be used to combat/reduce speculation over the source of monofilament in any potential entanglements that may be observed during the EFP period (i.e., ones that result from other gear types). This will also offer managers a way to trace any lost gear back to this EFP. Despite several years of LBG deployments (2015-2021; Sepulveda and Aalbers, 2018), PIER and its EFP participants have not lost any LBG monofilament. Nonetheless, we have included this provision as an added level of accountability.

h. *Hydraulic Line*-setter: To expedite sink rates and reduce hook-time in the upper water column, a hydraulic line-setter will be used for all deployments. The use of a line-setter has increased LBG sink rates by over five-fold and offer a way to reduce surface-oriented interaction with non-target species (i.e., sea birds, sea turtles, sharks, mammals).

2. Sea Turtle Interaction: Collectively, several of the California deep-set gear (DSBG, LBG and XLBG) attributes reduce the potential for sea turtle interaction (i.e., loggerhead, *Caretta*; and leatherback sea turtles, *Dermochelys coriacea)*. To date there have been no reported sea turtle interactions in the PIER-EFP's (2015-2021).

a. Daytime fishing and depth segregation: As discussed above (1.a), the strategic positioning of hooks below the thermocline can reduce sea turtle interaction (Polovina et al., 2003; Sepulveda et al., 2018). XLBG will use heavy (4-8lb) weighting systems to descend gear rapidly through the water column and position hooks below the preferred depth range of sea turtles (Polovina et al., 2003; Okuyama et al., 2021; Benson et al. 2007, Wallace et al. 2015). Hooks will be maintained at depth throughout the entire deployment and no hooks will fish above the thermocline (90m) at any time. Additionally, all sets will be performed during the day so that gear can be visually monitored to help reduce the severity of any potential interaction.

b. *Vertical lines and streamlined surface gear*: To reduce the potential for entanglement in the surface gear, all rigging will be smooth (i.e., no loops or knots) and streamlined to reduce the amount of gear at the surface. All vertical lines will be maintained taught with the heavy weighting systems and all horizontal lines will be maintained below 50 feet from the surface (similar to current LBG operations). For reference, in addition to the standard weighted swivel used in tuna deep-set longline operations (45g), the proposed XLBG system will also use descending weights that are at least 45-times heavier. This results in rapid and controlled descending rates which are key to reducing hook time at the surface, where most sea turtle interactions occur (Swimmer et al., 2020)

c. *Circle Hooks*: This EFP will continue to use the same circle hooks that have been used under the previous EFP's (18/0-16/0 Mustad Circle; Sepulveda et al., 2015; Sepulveda and Aalbers, 2018. To date there have been over 20,000 pieces of DSBG and LBG deployed in the Southern California Bight since 2011 and there have been no reported instances of hooked sea turtles.

3. Sharks: In the proposed EFP, the shark species likely to interact with XLBG are not considered to be of special management concern. However, several of the XLBG attributes will help reduce interaction, especially with those species that frequently inhabit the upper mixed layer (i.e., blue shark, *Prionace glauca*; mako shark, *Isurus oxyrinchus*).

a. The use of a hydraulic line-setter (1.h), the weighting system (1.a) and positioning of hooks below the thermocline (1.a) will all contribute to reducing shark interaction rates. The primary species of spatial overlap is the blue shark (*Prionace glauca*), a shark that is not considered to be at risk of overexploitation (ISC, 2015). Blue shark catch rates in all DSBG and LBG trials to date have been minimal due to their high frequency of occurrence in the upper portion of the water column (Sepulveda and Aalbers, 2018).

4. Seabirds: To date there have been no documented interactions with seabirds in the DSBG or LBG EFPs. Seabird interaction typically occurs upon the setting of gear when hooks are at the surface. The potential for seabird interaction can be reduced by decreasing the amount of time hooks spend at the surface.

a. XLBG will use circle hooks (2.c), a hydraulic line-setter (1.h), heavy descending weights (1.a) and active tending (1.b.).

13. *Signature of Applicant* 4/30/2022

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