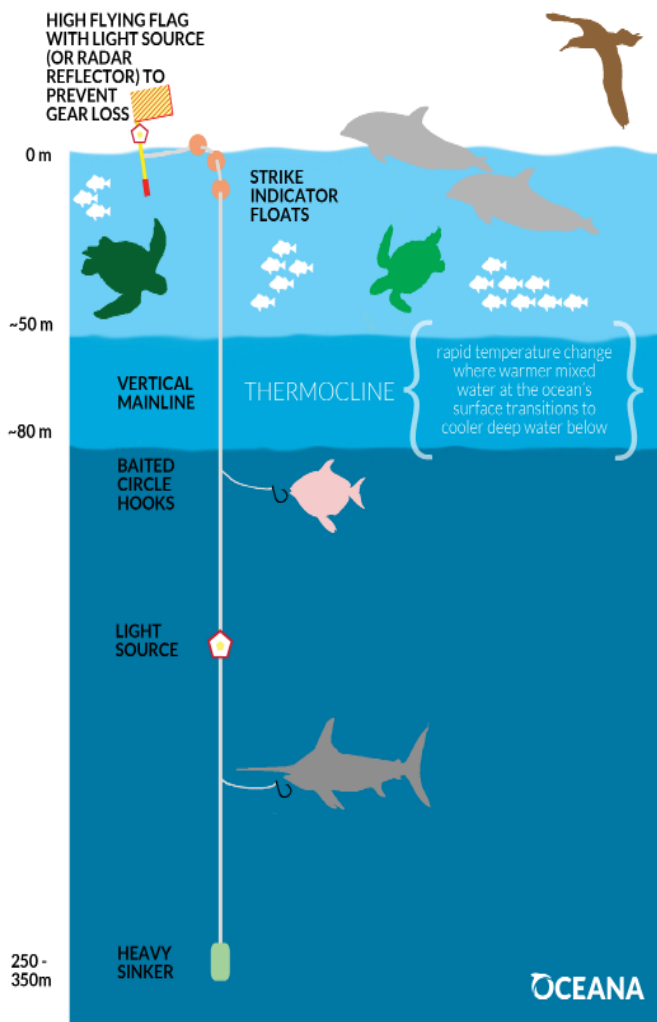


ENSURING A SUSTAINABLE U.S. WEST COAST SWORDFISH FISHERY: Benefits of Deep-Set Buoy Gear

Recent experiments with deep-set buoy gear targeting swordfish demonstrate it is a far cleaner gear type compared to drift gillnets or pelagic longlines. Buoy gear can be profitable, can be fished in combination with harpoon gear, and provides a valuable solution in a transition from indiscriminant drift gillnets to a clean U.S. West Coast swordfish fishery.

Recent experiments with deep-set buoy gear off California, have confirmed that:

- Swordfish can be selectively targeted at depth during the day.
- Non-target catch (i.e. shark) rates are significantly lower than with drift gillnets or pelagic longlines.
- There were few discards, no sea turtle takes, and only one marine mammal interaction.
- There were no interactions with species of concern like whales, dolphins, or sea turtles.
- The gear is actively tended—strikes are detected immediately— and all catch is retrieved in a matter of minutes. This allows a quick release of non-marketable species, avoiding long-term or serious injury, and allows the marketable product to be landed more quickly in a fresher and pristine condition.
- 94 percent of fish caught with buoy gear from 2011-2014 off California were marketable fish species.



The Buoy Gear Design

Deep-set buoy gear is a type of fishing gear consisting of a floating buoy supporting a single vertical line to which a baited hook or hooks are attached. This type of fishing gear is currently used to target swordfish in the Atlantic and is now being used for the first time commercially off California on a limited basis. Off southern California, deep-set buoy gear is being used to target swordfish during the day. Hooks are deployed at depths below the thermocline between 250 meters and 350 meters (820 feet-1148 feet). Buoy gear is more effective at catching the target species relative to drift gillnets or pelagic longlines that are set at night near the surface where many ocean wildlife species congregate. Each buoy gear deployment consists of simultaneously setting ten individual buoys, each with one to two hooks.

Figure 1: Deep-set buoy gear targets swordfish and secondary species like opah, thresher sharks, and mako sharks below the thermocline during the daytime, depths that greatly reduce interactions with marine mammals and sea turtles.

Deep-set Buoy Gear is Highly Selective in Targeting Swordfish with Minimal Bycatch

The catch is primarily swordfish (approximately 60 percent), followed by opah (approximately 20 percent), and the remainder is various shark species (mako, common thresher and bigeye thresher). Non-marketable catch (i.e. blue shark) was low and all non-marketable species were released alive.

California Deep Set Buoy Gear Trials 2011-2014

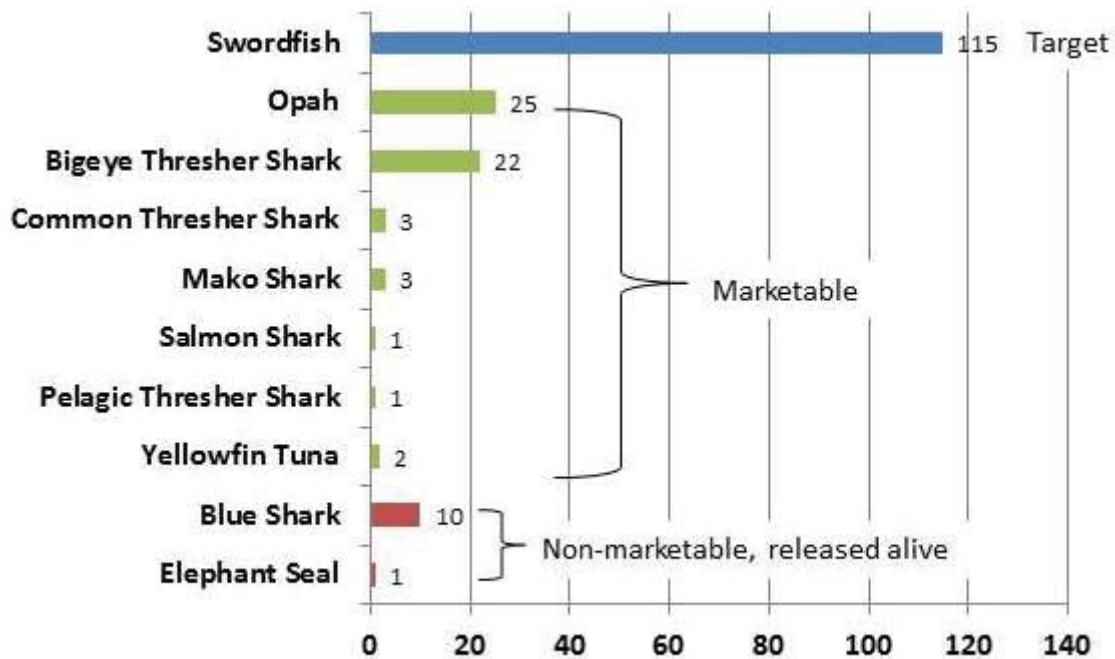


Figure 2: Collective catch from all deep-set buoy gear experiments to date. Data is from 130 8h fishing days in which a full 10-buoy set was made. Of the more than 150 sets of buoy gear deployed in three seasons, one interaction with a protected species was observed. One elephant seal was caught and released alive in good condition within five minutes of the initial interaction.

	Deep-Set Buoy Gear	Harpoons	Drift Gillnets	Pelagic Longlines
Percent Swordfish Catch	63	100	13	35
Percent Retained, Marketable Catch	94	100	36	56
Percent Discards	6	0*	64	44
Endangered Species Injured or Killed	No	No	Yes	Yes

Figure 3: Comparison of marketable catch and bycatch among experimental deep-set buoy gear trials, harpoon fishery, and drift gillnet fishery. Sources: NOAA CA Swordfish Drift Gillnet observer program 2004-2014; NOAA shallow set longline observer program, 2007-2014; NOAA Hawaii shallow-set longline Observer Program Data, 2007-2013.* Note, some swordfish strikes with harpoons may injure the swordfish yet do not result in a successful catch, however, we are not counting that as "bycatch" here.

Deep-Set Buoy Gear Holds the Potential for the Economic Advancement of the Fishery

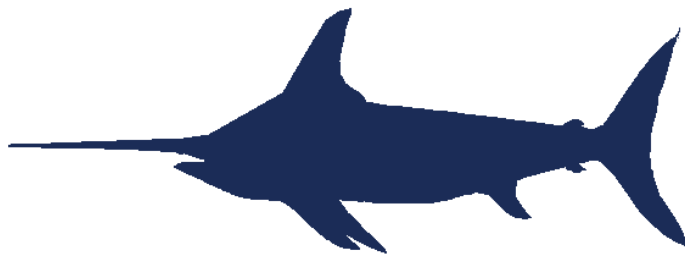
Swordfish caught by deep-set buoy gear will be a higher value product pound for pound than drift gillnet or pelagic longline-caught swordfish (imported and domestic), due to greater freshness, quality, and market demand for sustainable seafood. Initial market research in California indicates that buoy gear caught swordfish is likely to garner a market price greater than twice that of drift gillnet swordfish.

Deep-set buoys may provide fishermen with additional opportunities to fish in locations that are off limits to drift gillnets per existing regulations and where pelagic longlines are banned due to bycatch interactions. Additionally, a high market value, and the ability to be supplemented with opportunistic harpoon landings, indicates the potential for a profitable fishery with the likelihood of increased landings as fishermen develop expertise using this new gear type.

According to the Pflieger Institute of Environmental Research (PIER):

Based on trip expenses calculated in 2014, swordfish fishers using a two-person operation (captain and one crew member) had average trip expenses around \$500/day. With the capture and sale of one average sized swordfish (200-pound dressed weight) at the average market price of 2014 (\$8.75), the 2-person operation could result in a net gain of \$1,250/day. Given that PIER and cooperative fisher catch rates ranged from 0.6 to 1.75 swordfish/day in 2014, we propose that deep-set buoy gear can be profitable.

In 2015, the National Marine Fisheries Service approved three Exempted Fishing Permits enabling seven vessels to commercially use deep-set buoy gear to catch swordfish in both the current season and next season to provide additional information on the economic viability of the gear and to inform future management.



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