Appendix S1.

Figure S1. Schematic of pelagic longline gear used in the Hawai‘i deep-set fishery.

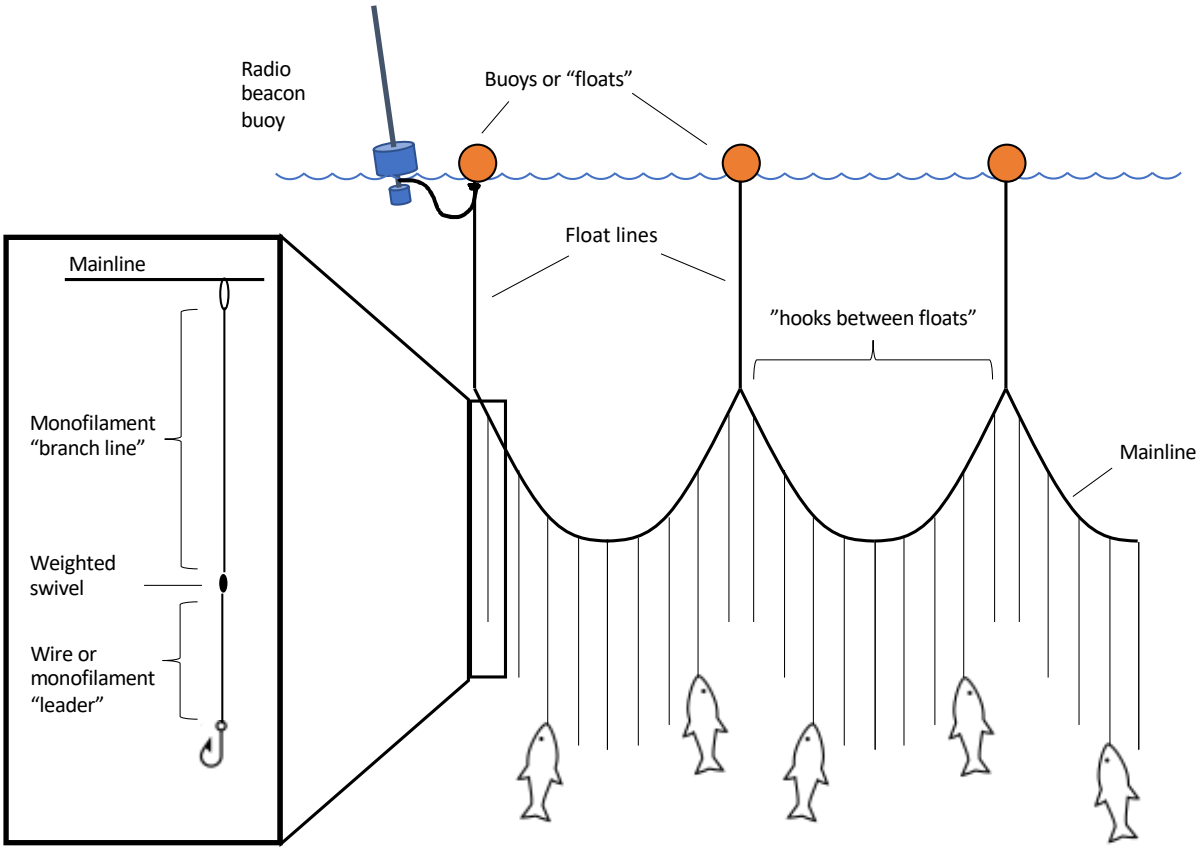

TABLE S1. Variables considered in the fully-saturated generalized additive mixed model of probability of presence/absence of depredation. All variables represent characteristics relative to a single, observed longline deployment or environmental conditions at the haul-begin location of that set.

Space and time

- Haul begin location (Longitude, Latitude)
- Month

Gear and operational

- Vessel density (Number of <u>all</u> vessels within 200 km and ±3 days)
- Number of hooks set
- Soak time (Hours)
- Minimum depth of gear (length in m of float line + branch line + leader)
- Hooks between floats (number of hooks deployed between each pair of floats)
- Catch (# fish caught), each separately: Bigeye tuna, yellowfin tuna, mahi-mahi, wahoo, billfish, swordfish, sharks
- Catch per unit effort (CPUE, caught bony fish per 1,000 hooks)
- Nearby tuna CPUE –CPUE of tuna species across all observed vessels within 100 km and ±1 day
- Presence of depredation or false killer whale bycatch on previous set of same vessel
- Individual vessel (random effect)

Environmental

- Depth (m)
- Slope (m)
- Distance to seamount (km)
- SST range (difference between highest and lowest SST for all four fishing points, ºC)
- Chlorophyll-*a* ($mg \cdot m^{-}3$)
- Absolute dynamic topography (adt, m)
- Total kinetic energy (tke, $m^2 \cdot s^{-2}$)
- Distance to nearest eddy edge (km)
- Amplitude of nearest eddy (cm)
- Distance to nearest thermal Cayula-Cornelius front (km)
- Oceanic Niño Index (ONI)
  - Concurrent
  - 11-months prior to observed set
- Moon phase

Eqn. S1. Fully saturated model without interactions

$$
\begin{aligned}
(E(Y) = \alpha + \; & s(longitude) + s(latitude) + s(month) + s(vessel\ density) \\
& + s(num.\,hooks\ set) + s(soak) + s(min.\,gear\ depth) \\
& + s(hooks\ betw.\,floats) + s(\#\ bigeye\ tuna) + s(\#\ yellowfin\ tuna) \\
& + s(\#\ mahi\ mahi) + s(\#\ wahoo) + s(\#\ billfish) + s(\#\ swordfish) \\
& + s(\#\ sharks) + s(CPUE) + s(nearby\ CPUE) + prev.\,depredation \\
& + s(vessel\ ID, random) + s(depth) + s(slope) + s(seamount\ dist.) \\
& + s(SST\ range) + s(chl.\,a) + s(adt) + s(tke) + s(eddy\ dist.) \\
& + s(eddy\ amp.) + s(front\ dist.) + s(ONI) + s(ONI\ lag) + s(moon\ phase)
\end{aligned}
$$

Eqn. S2. Fully saturated model including interactions

$$
\begin{aligned}
(E(Y) = \alpha + \; & s(latitude\ x\ month) + s(latitude\ x\ ONI\ lag) + s(month\ x\ ONI\ lag) \\
& + s(longitude) + s(latitude) + s(month) + s(vessel\ density) \\
& + s(num.\,hooks\ set) + s(soak) + s(min.\,gear\ depth) \\
& + s(hooks\ betw.\,floats) + s(\#\ bigeye\ tuna) + s(\#\ yellowfin\ tuna) \\
& + s(\#\ mahi\ mahi) + s(\#\ wahoo) + s(\#\ billfish) + s(\#\ swordfish) \\
& + s(\#\ sharks) + s(CPUE) + s(nearby\ CPUE) + prev.\,depredation \\
& + s(vessel\ ID, random) + s(depth) + s(slope) + s(seamount\ dist.) \\
& + s(SST\ range) + s(chl.\,a) + s(adt) + s(tke) + s(eddy\ dist.) \\
& + s(eddy\ amp.) + s(front\ dist.) + s(ONI) + s(ONI\ lag) + s(moon\ phase)
\end{aligned}
$$

Eqn. S3. Final, best-fit model without interactions.

$$
\begin{aligned}
(E(Y) = \alpha + \; & s(latitude) + s(month) + s(num.\,hooks\ set) + s(soak) + s(\#\ bigeye\ tuna) \\
& + s(\#\ yellowfin\ tuna) + s(\#\ mahi\ mahi) + s(\#\ wahoo) + s(\#\ sharks) \\
& + s(CPUE) + s(nearby\ CPUE) + prev.\,depredation \\
& + s(vessel\ ID, random) + s(seamount\ dist.) + s(adt) + s(ONI\ lag)
\end{aligned}
$$

Eqn. S4. Final, best-fit model including interactions.

$$
\begin{aligned}
(E(Y) = \alpha + \; & s(latitude\ x\ month) + s(month) + s(num.hooks\ set) + s(soak) \\
& + s(\#\ bigeye\ tuna) + s(\#\ yellowfin\ tuna) + s(\#\ mahi\ mahi) \\
& + s(\#\ wahoo) + s(\#\ sharks) + s(CPUE) + s(nearby\ CPUE) \\
& + prev.depredation + s(vessel\ ID, random) + s(adt) + s(ONI\ lag)
\end{aligned}
$$

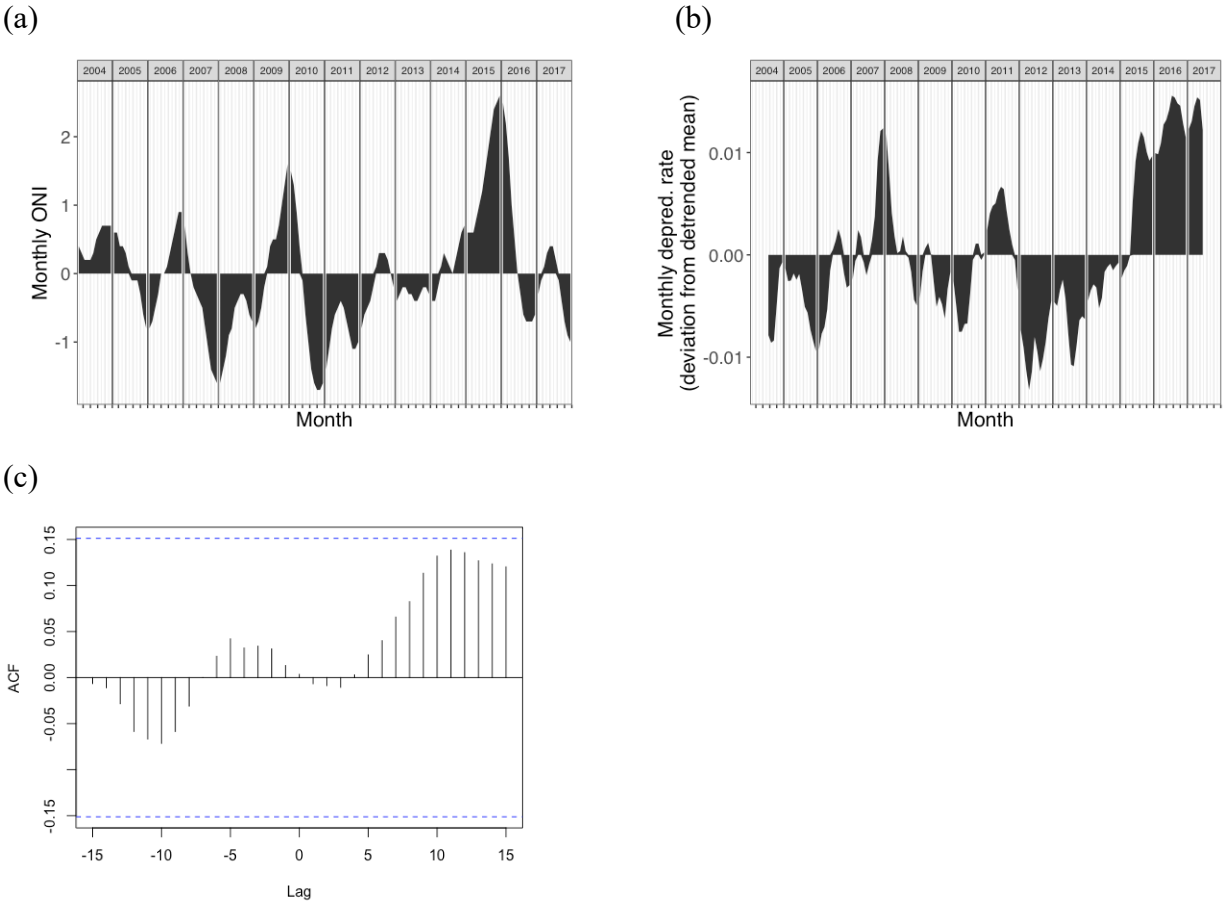

FIG. S2**.** (a) Monthly Oceanic Niño Indicator (ONI) from 2004-2017; (b) monthly deviation from mean depredation rate on Hawai‘i deep-set longline hauls after removing seasonal trend (i.e., ‘trend’ component in decompose function in RStudio, version 1.2.5033 (R Core Team 2018)); and (c) lag correlation analysis (auto-cross correlation function, ACF) between monthly ONI and average monthly depredation rate. The peak at 11 months following ONI was used in the GAMM models.