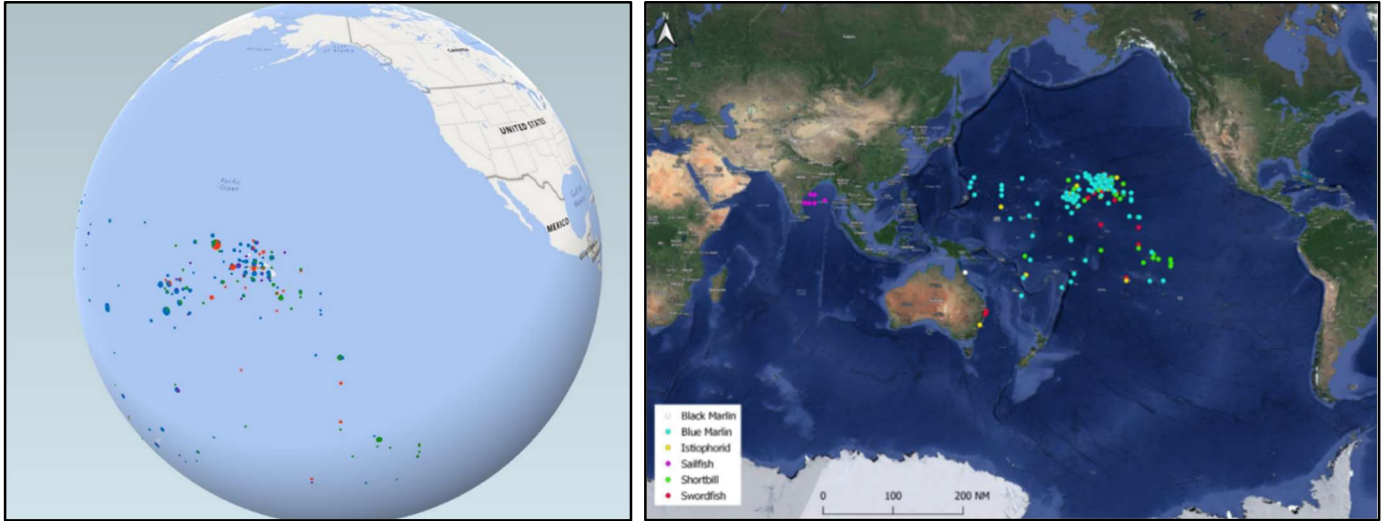


# Kona Project Phase I-Interim Report #1



***Initial data collected and plotted clearly shows the significance of Hawaii!***

1. The Project represents a blend of historical data from the meta-analysis (Phase 1) and forthcoming modeling/simulations (Phase 2) to get an idea of the overall spatial-temporal extent of spawning habitat with an emphasis on Kona. The culmination of Phase 1 will be a peer-reviewed submission detailing the study and the possibility of discovering new spawning sites in the Pacific.
2. To date the Project has collected over 12,000 occurrences of billfish larvae in the Pacific from the literature but most were reported from ~1950s to 1980s and are at varying spatial scales. Some of these data have accompanying measurements for temperature, salinity and length. Additional papers from Japanese literature have been requested and may contain another ~1500 records to include in the database. The Nishigawa et al. (1985) report represents the most authoritative compilation on data on larval billfishes in the Pacific and Atlantic, but these data were collected from 1956-1981. These data have been recently re-analyzed by Japanese scientists and a forthcoming manuscript will be submitted for publication.
3. The immediate next steps are to enter the remaining data into the database, clean the data as needed, convert growth models/parameters to get an estimate of age by standard lengths, and try to get an estimate of effort. The project anticipates compiling the final database in the next couple of months which will be suitable for various analyses to look for patterns and trends. We have already begun identifying cooperating scientists to assist with modeling in Phase 2, as well as an inventory of innovative computer models under consideration.
4. In the process of adding about ~200 more samples of which includes ~130 from Kona. Project scientists believe we have enough targets from data sources around Hawaii to get a sense of where larvae are found, but adding samples to the data base is an ongoing process. Computer modeling will inform us of the likely point of origin whether it be Kona or elsewhere (e.g., Johnston Atoll, Cross Seamount, etc.).

5. Sampling in the near future will also be needed to confirm if striped marlin continue to spawn in areas of the Kona Gyre today - as well as to confirm if swordfish, blue marlin and spearfish continue to spawn in sectors of the Kona Gyre as the conditions of the region are effected by ENSO events (e.g., La Nina) and climate change. Modeling may also show more detailed and nuanced conditions that contributed to confirmed striped marlin spawning in Kona waters in 2005.
6. **Some of the notable findings pertaining to the Hawaii region from the literature so far:**
  - a. **1997-2006:** Large scale larval net tow sampling by NOAA off the Kona Coast that targeted billfish eggs and larvae during 1997-2006 have collected several hundred larvae and eggs of swordfish, blue marlin, and shortbill spearfish. (*various NOAA reports, Hyde et al. 2005,2006*).

Evidence of striped marlin spawning in waters adjacent to the main Hawaiian Islands remained unknown until 2005 when seven larvae were collected off the Kona Coast of Hawaii Island in late May. (*Hyde et al. 2006*)

As noted by Hinton and Bayliff (2002), the mean size modes of longline caught striped marlin have declined dramatically in the northeastern Pacific over the past 30 yrs. Fishing pressure has been shown to cause shifts in life history parameters favoring fish that mature younger and at smaller sizes (Olsen et al., 2005). It may be that the observed spawning activity near Hawaii is a result of such fishery-induced early maturation and warrants further investigation. (*Hyde et al. 2006*)

**\* *Wild Oceans Kona Project lead scientist Dr. Mike Musyl was on board for many of the larvae and egg sampling cruises between 1997 – 2006.***

- b. **2008-2012:** Contracted fishery observers trained and monitored by the NOAA Pacific Islands Regional Office in Honolulu, Hawaii, collected sub-samples of striped marlin gonads at-sea onboard Hawaii-based commercial pelagic longline vessels. The collection period ranged from March 2008 through July 2012 and included 399 vessel fishing trips for which collected gonads were evaluated in this study. Histological determination of gender, reproductive phase, and maturity status was successfully conducted on 1,128 gonad histology preparations yielding 598 female and 530 male samples with complete measurement and capture data. The median spatial distribution of ovary sample collections was centered at 25.5° N latitude and 160.2° W longitude. However, mature females tended to occur at a higher median latitude than immature females (27.0° N and 24.4° N, respectively). (*Humphreys, Brodziak, 2019*)

**\* *It appears that the spawning season for striped marlin may extend from March through July in this zone with peak spawning occurring from May to July. Additionally, these mature fish carrying eggs can cover ~60 nmi in one day and they are indeterminate spawners.***

- c. **2017-2019:** <https://www.frontiersin.org/articles/10.3389/fmars.2022.879463/full>  
A recent tagging publication (See Fig 4 in *Connectivity of Striped Marlin from the Central North Pacific Ocean study - **weblink above***) documented trans-Pacific movements with some of the deployments indicating fidelity to Hawaii. It is possible some of these striped marlin may spawn near Hawaii.