Preliminarily results of the relationship between capture to fishing operation parameters and environmental parameters in tuna purse seine fishery

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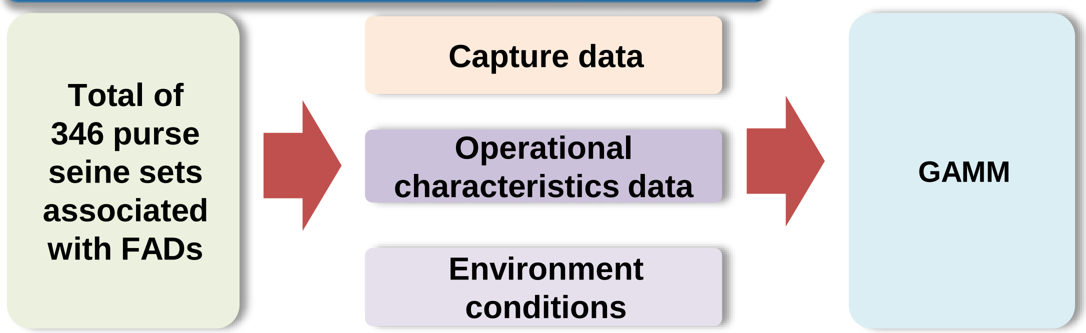
BACKGROUND

- Many pelagic species, including some tunas, sharks and rays, exhibit associative behavior underneath Fish aggregation devices (FADs);
- The selectivity of purse seine fishing is poor, especially when using FADs assisted, which impacts endangered, threatened and protected (ETP) species and recruitment of target species;
- Scientists and fishing gear technologist are collaborating with fishing industry to test solutions to reduce non-target species mortality;
- Therefore, this study employed a generalized additive mixed model (GAMM) to evaluate the relationship between capture of tuna, juvenile tuna and silky shark (*Carcharhinus falciformis*, FAL) to fishing operation parameters and environmental parameters .

MATERIALS AND METHODS



- Catch=s(Dvalue)+s(longitude)+s(latitude)+s(Stime)+s(SST)+s(SSS)+ s(phytoplankton)+random=~(1|season)+(1|FAD_depth
- Juvenile=s(Dvalue)+s(longitude)+s(latitude)+s(Stime)+s(SST)+ s(SSS)+s(phytoplankton)+random=~(1|season)+(1|FAD_depth
- FAL=s(Dvalue)+s(longitude)+s(latitude)+s(Stime)+s(SST)+s(SSS)+ s(phytoplankton)+random=~(1|season)+(1|FAD_depth)。

Result

Data collection

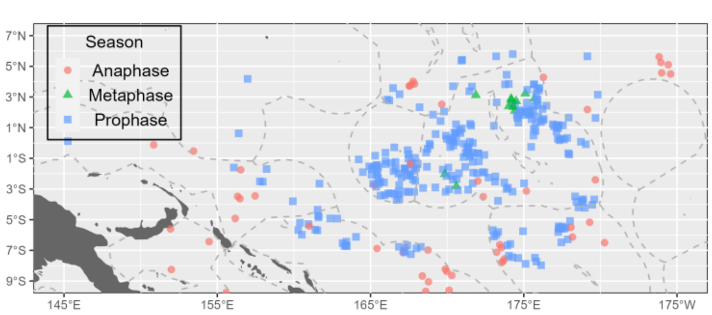


Fig.1 Spatial distribution of the 346 FAD-associated sets positions collected from logbooks in the Central and Western Pacific Ocean during 2021-2022.

Summary of fishing capture

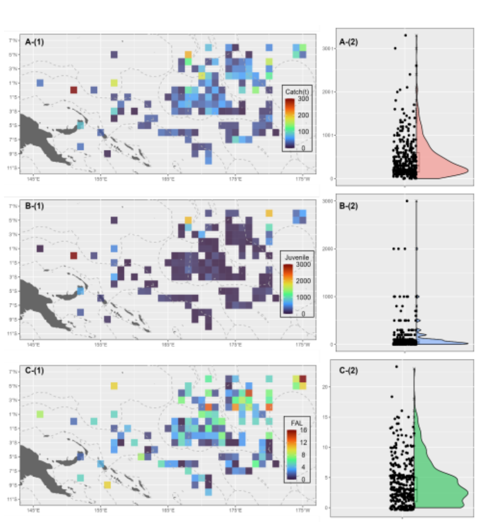


Fig.2 Spatial and biomass distributions grouped by capture class (A, Catch; B, Juv; C, FAL)

GAMM results

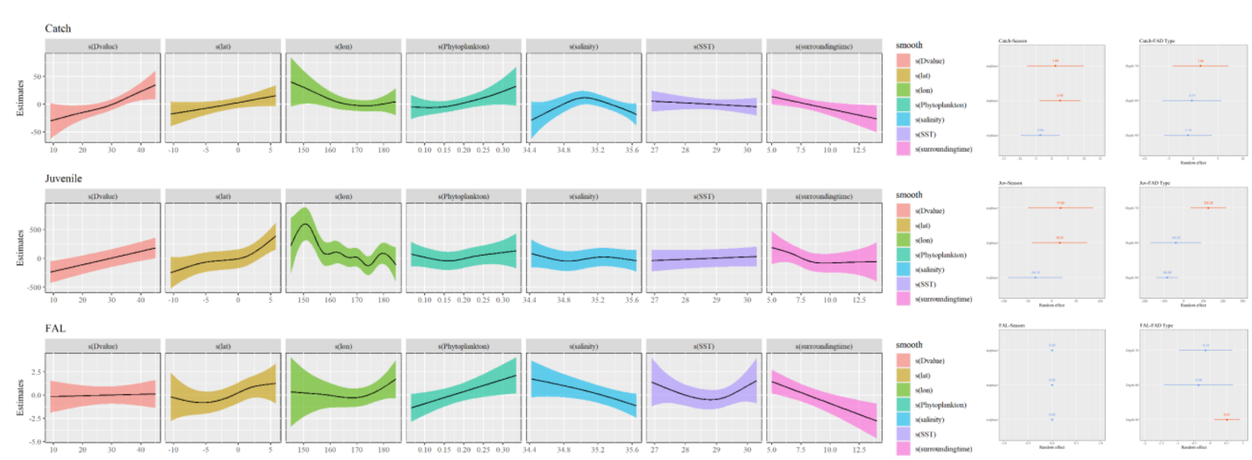


Fig.3 Effect of fishing operation parameters, environmental parameters and random effects on capture.

- *Dvalue* had a significant positive effect on Catch and Juvenile, but a negative effect on FAL, indicating that larger time differences benefit the former two but reduce FAL catches;
- *Latitude* showed a positive trend in both the Catch and Juvenile models, with higher latitudes associated with greater catches, while FAL catches were highest at mid-range latitudes;
- *Phytoplankton* concentration exhibited complex nonlinear relationships across all models, but higher levels were generally associated with increased Catch and FAL；
- *Salinity* had a nonlinear effect on Catch and Juvenile, with optimal catch rates at around 34.5‰, whereas FAL catches decreased with higher salinity；
- *Surrounding time* was negatively correlated with all catch rates, with longer surrounding times leading to reduced catch efficiency；
- For *random effects*, *season* had a significant impact on Catch and Juvenile, with the *metaphase season* showing the highest catch rates, while FAL catches were unaffected by season.