

# ESTIMATING ATLANTIC FISHING EFFORT BY TIME-AREA STRATA

Doug Beare with assistance from the ICCAT Secretariat

24 July 2015

# SHORT-TERM CONTRACT: A MODELING APPROACH TO ESTIMATE OVERALL ATLANTIC FISHING EFFORT BY TIME-AREA STRATA (EFFDIS)

# Objectives

- ▶ Develop a robust statistical modeling approach to estimate overall Atlantic fishing effort stratified by flag/fleet, gear, area ( $5^{\circ} \times 5^{\circ}$  degree square grid), year and month (starting in 1950).
- ▶ Update the current EFFDIS estimations for longline gear (1950 to 2014) using the new approach, and then develop estimation procedures for baitboat and purse-seine with the appropriate effort units.

The SGECO Working group made a series of recommendations for improving EFFDIS, ie.to:

- ▶ Consider seasonal and spatial patterns and their interactions
- ▶ Understand how information from species composition can best be used in this context
- ▶ Combine bait boat and purse-seine estimates with long-line
- ▶ Estimate uncertainty/variance
- ▶ Exploit other relevant information where available, e.g. VMS data, depth, sea temperature, primary production

# Overall workplan

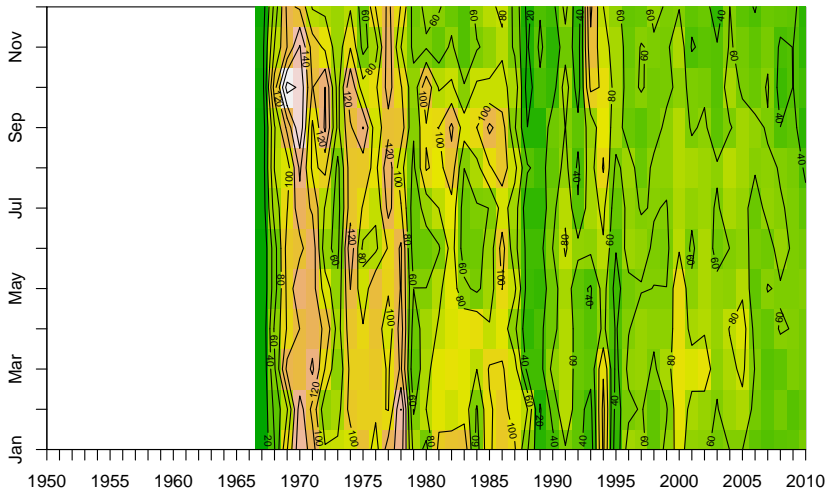
- ▶ Obtain all the relevant data and review the current methods for EFFDIS estimation
- ▶ Write documented R code to mimic the current procedure
- ▶ Develop 'strawman' methodologies for estimating fishing effort for a single fleet/flag country
- ▶ Once a method is approved for one fleet the Contractor will then adapt it to other fleets to produce global estimates
- ▶ Use an online SQL relational database linked to R-scripts

# Talk plan

- ▶ Exploring data for non-random, non-representative sampling (data catalogue)
- ▶ Investigating the relationship (sum of products) between Task 1, which focuses on the total catches of 9 major tuna & tuna-like species (Albacore, Bluefin, Yellowfin, Bigeye, Skipjack, Swordfish, Blue Marlin, White Marlin, Sailfish), and Task 2 data which is more detailed containing more detailed information on location, season, etc.
- ▶ Exploring the relationship between weight and numbers. Note: some countries supply only numbers, some both and some just weights for Task 2
- ▶ Developing multi-variate models (e.g. GAMs) for interpolation
- ▶ Integrating activities with an online geographic database system (based on Postgis)

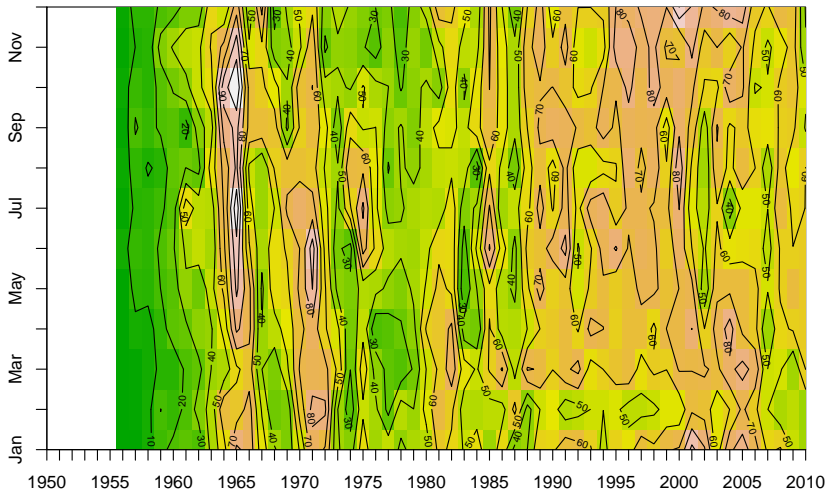
# Sampling by year and month - Chinese Taipei

Chinese Taipei - LL



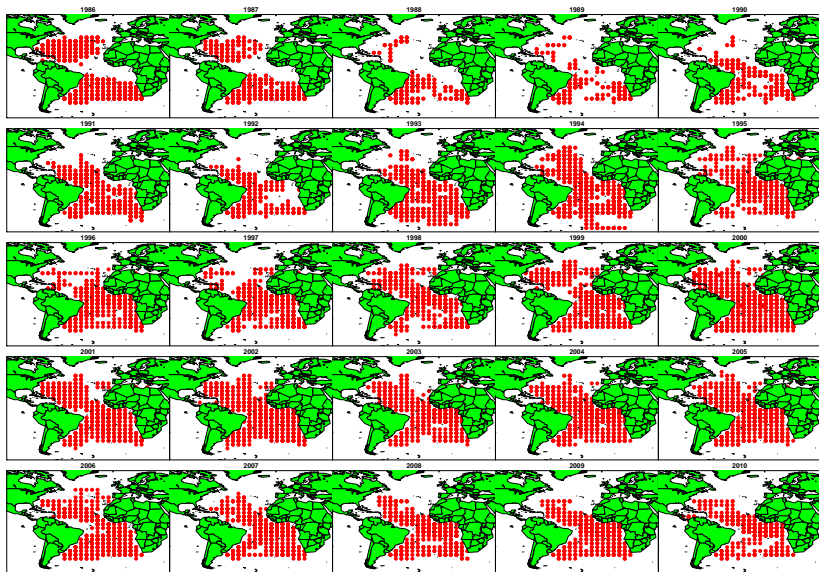
# Sampling by year and month - Japan

Japan - LL





# Sampling in space by year - Chinese Taipei

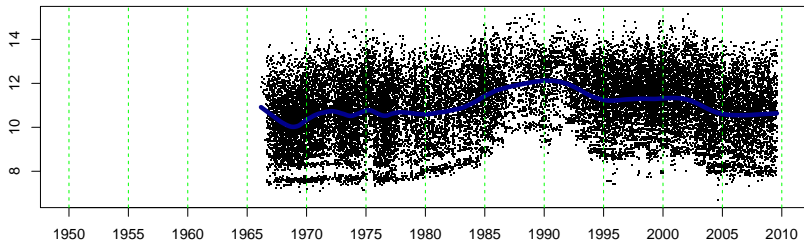


# No of hooks by year - Chinese Taipei and Japan

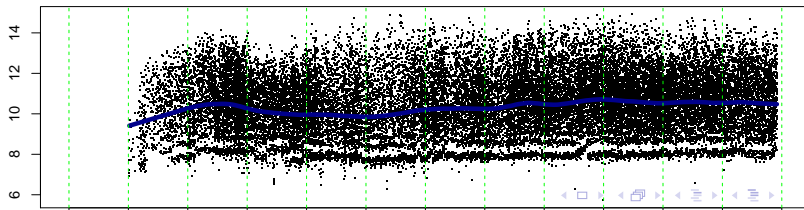
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## Warning in supsmu(fdata$trend, log(fdata$eff1)): 16 observations
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## NaNs and/or Infs deleted
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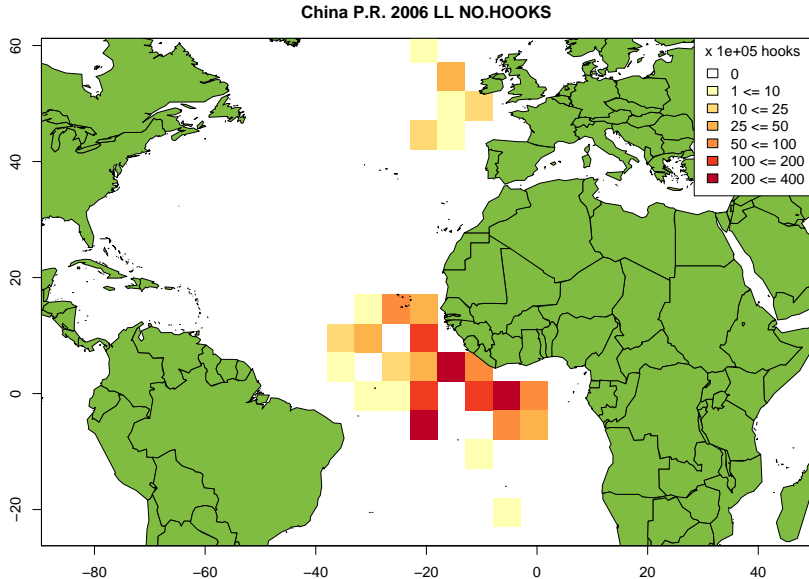
Chinese Taipei LL



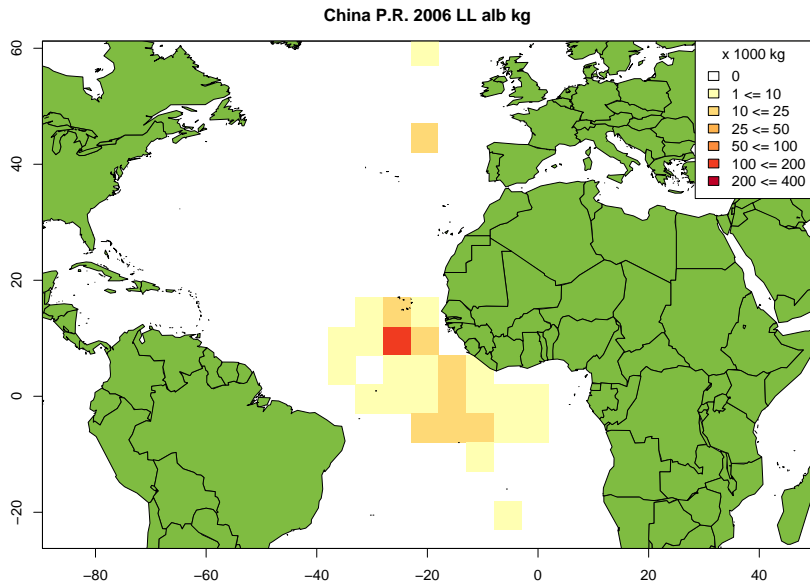
Japan LL



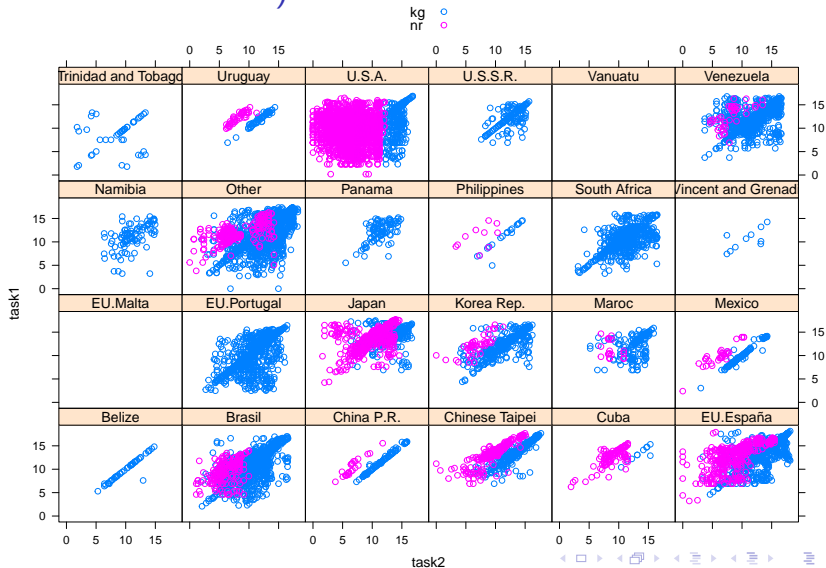
# No of hooks by year and location - China P.R.



# Weight of albacore caught by year and location - China P.R.

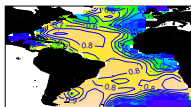


Relationship (sum of products) between Task 1 (the total catches of 9 major tuna & tuna-like species) and Task 2 (much more detailed) data for all fleet combinations

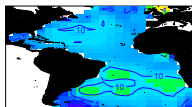


# Developing multivariate models.

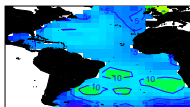
Probability of catch (P) Jan 2006



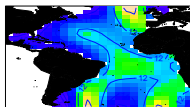
Catch without zeros (C1) Jan 2006



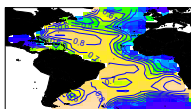
Catch  $P \times C1$  Jan 2006



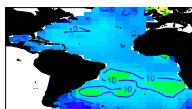
No of hooks Jan 2006



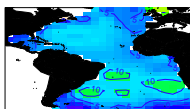
Probability of catch (P) Mar 2006



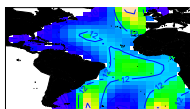
Catch without zeros (C1) Mar 2006



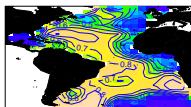
Catch  $P \times C1$  Mar 2006



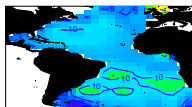
No of hooks Mar 2006



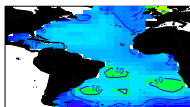
Probability of catch (P) Sep 2006



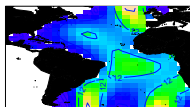
Catch without zeros (C1) Sep 2006



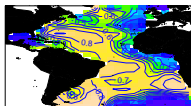
Catch  $P \times C1$  Sep 2006



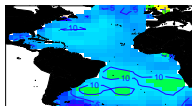
No of hooks Sep 2006



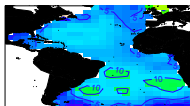
Probability of catch (P) Nov 2006



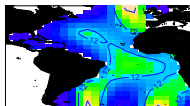
Catch without zeros (C1) Nov 2006



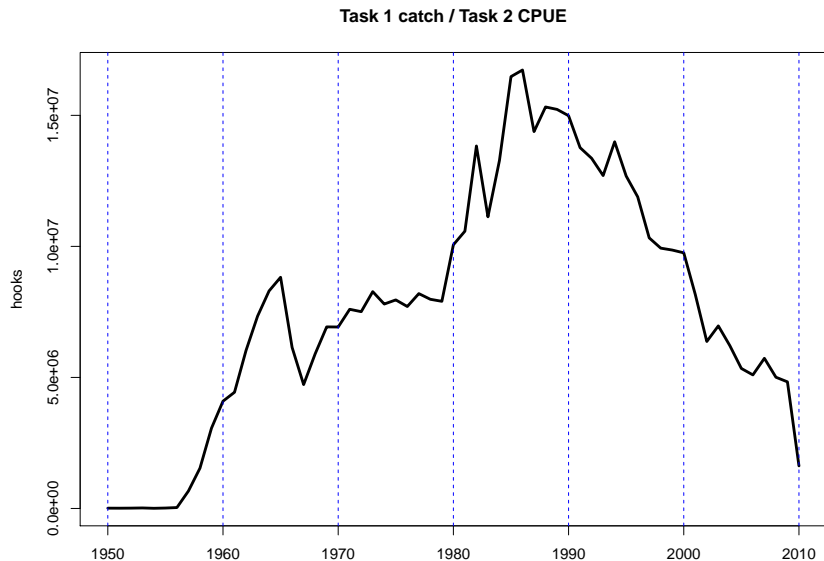
Catch  $P \times C1$  Nov 2006



No of hooks Nov 2006



# First estimate



# Conclusions

- ▶ The data are complex with changing fleet aggregations etc
- ▶ There is non-random, non-representative sampling
- ▶ There is a strong positive correlation between Task 1 and Task 2 data for most countries which is useful information
- ▶ Provision of numbers for Task 2 (instead of weights) by e.g. USA creates problems
- ▶ Regression modeling is a promising approach
- ▶ A series of models can be fitted to the data and used for interpolation and variance estimation
- ▶ Can effort realistically be estimated without any measure of capacity ?