

Early steps in the construction of a stock assessment for the silky shark, *Carcharhinus falciformis*, in the Eastern Pacific Ocean

A. Aires-da-Silva, M. Maunder and C. Lennert-Cody
Inter-American Tropical Tuna Commission (IATTC)

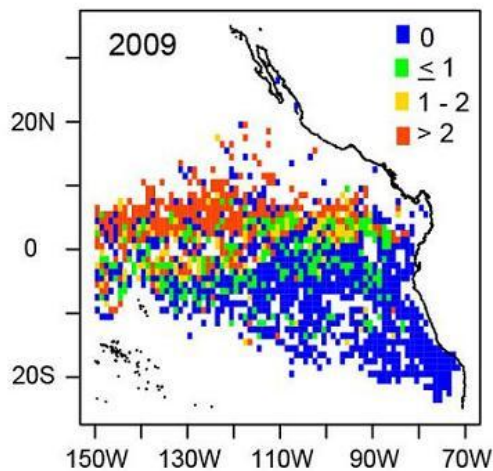
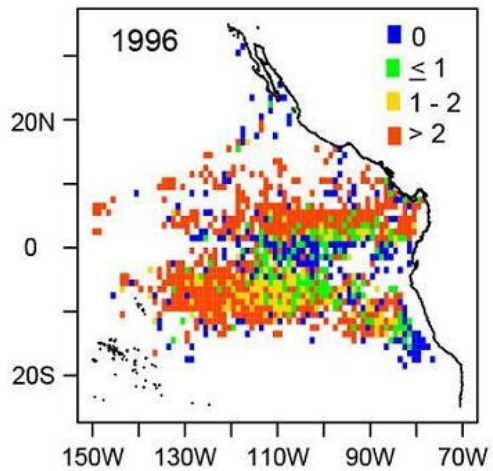


IATTC Technical Meeting on Sharks
La Jolla, USA, August 30, 2010

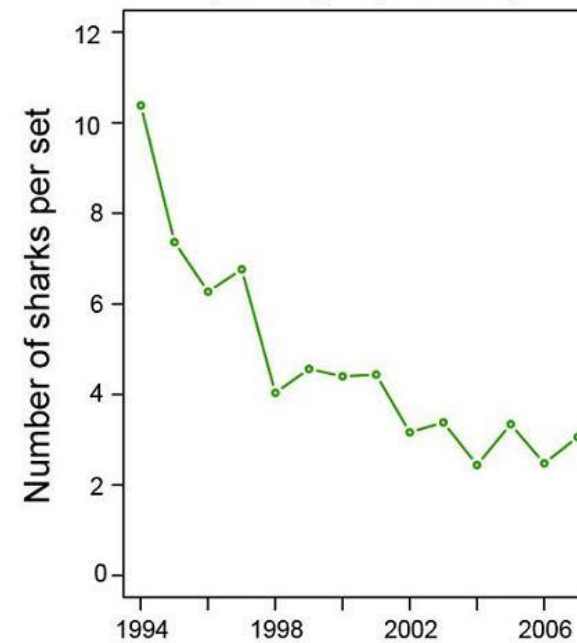
Background



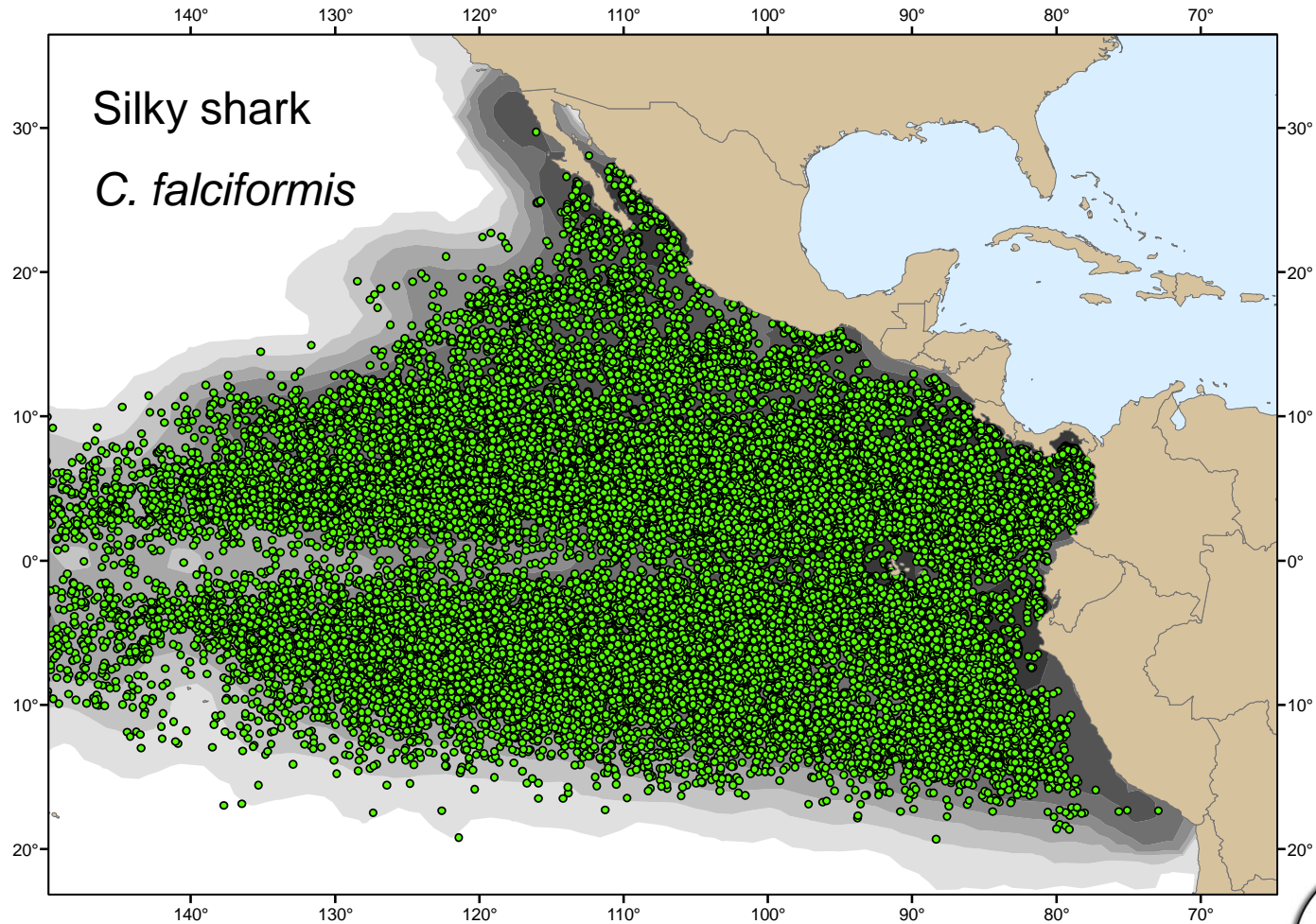
Average silky shark bycatch per set
(number sharks per floating-object set)



Index of relative abundance
for the silky shark
(floating-object sets)



Shark stock assessment: a regional task...



1993-present



Objectives



- Evaluate the feasibility of developing a stock assessment model for silky shark in the EPO
 - Integrated stock assessment (Stock Synthesis)
- Identify data requirements
 - What data we have available?
 - What data are we missing?
- How could we deal with “data gaps”?

Stock assessment process



INFORMATION FOR MANAGEMENT

- Target and limit reference points
- Fishery impacts
- Spatial closures, etc...

STOCK ASSESSMENT MODEL (Stock Synthesis)

LIFE-HISTORY INFORMATION

- Age and growth
- Length-weight relationship
- Reproduction (maturity and fecundity)
- Survivorship (natural mortality)

FISHERY DATA

- Catch (retained, discards, bycatch)
- Fishing effort
- Catch-per-unit-effort (CPUE) – **rel. abundance**
- Age/length composition data – **selectivity, growth, mortality and recruitment.**
- Tagging – **growth, mortality, movement**

Silky life-history information?



FISHERIES SCIENCE 2003; 69: 456-464

Age and growth of the silky shark *Carcharhinus falciformis* from the Pacific Ocean

SHUNGO OSHITANI,¹ HIDEKI NAKANO² AND SHO TANAKA¹

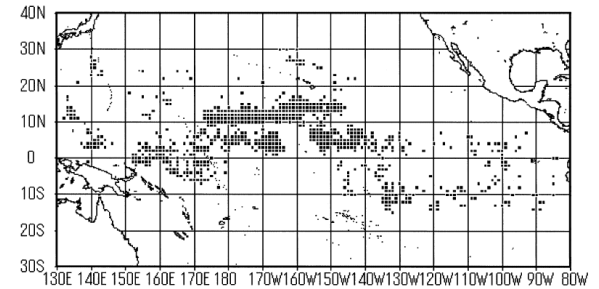
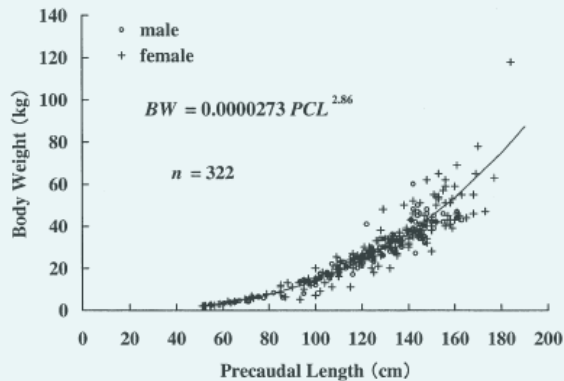
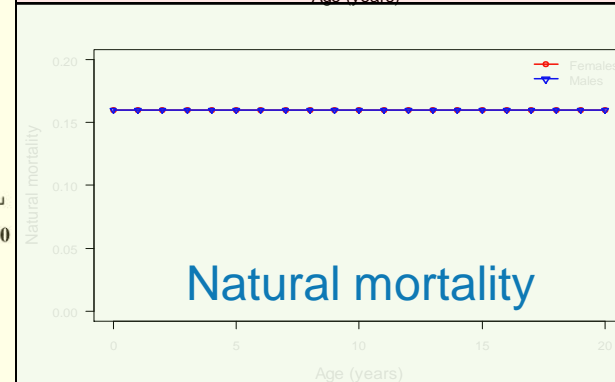
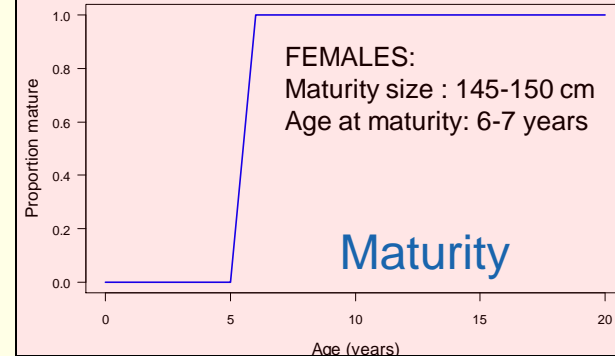
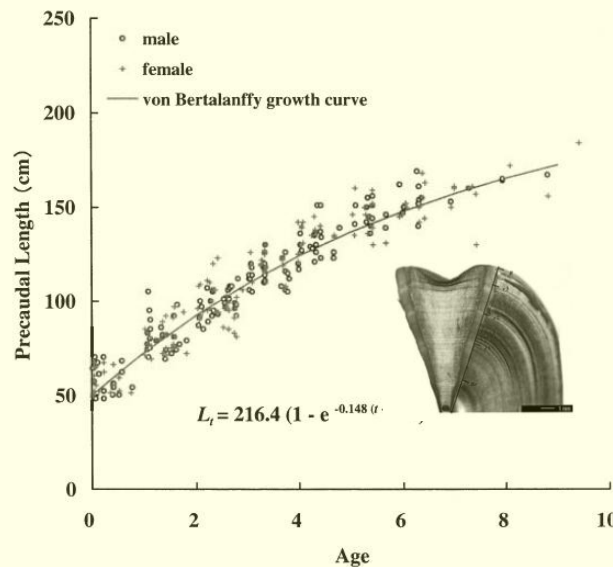


Fig. 1 Locations of sampling during the research cruise.

Length-weight



Age and growth



Silky fisheries in the EPO



- Bycatch of tuna purse seine fishery
 - Large vessels (class 6, >363 tons)
 - Medium-size vessels (class 1-5, \leq 363 tons)



- Bycatch of tuna longline fishery
 - High seas longline fleets



- Artisanal fisheries
 - Bycatch/target
 - EPO coastal nations



Tuna purse seine fishery – set types

Floating object sets



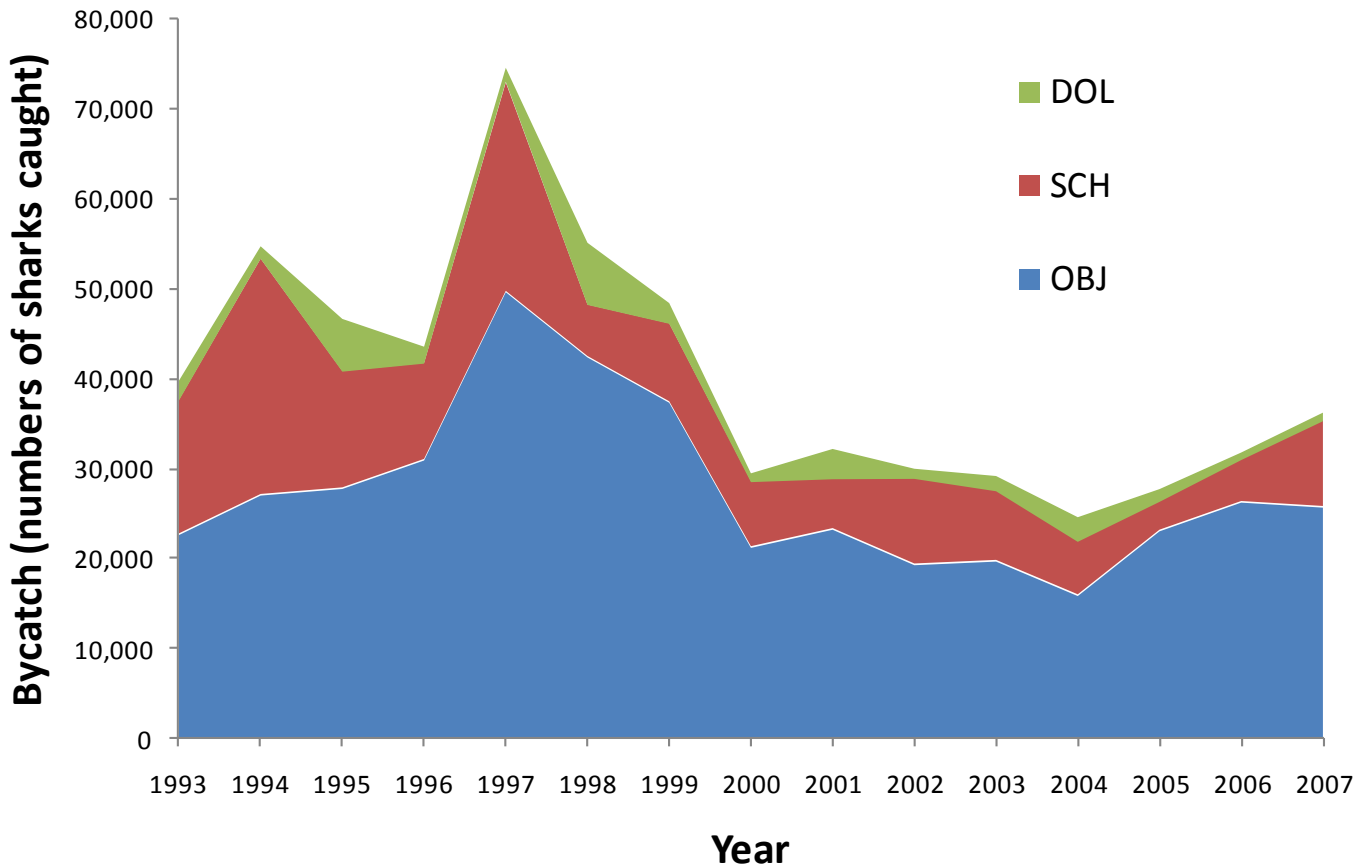
Dolphin sets



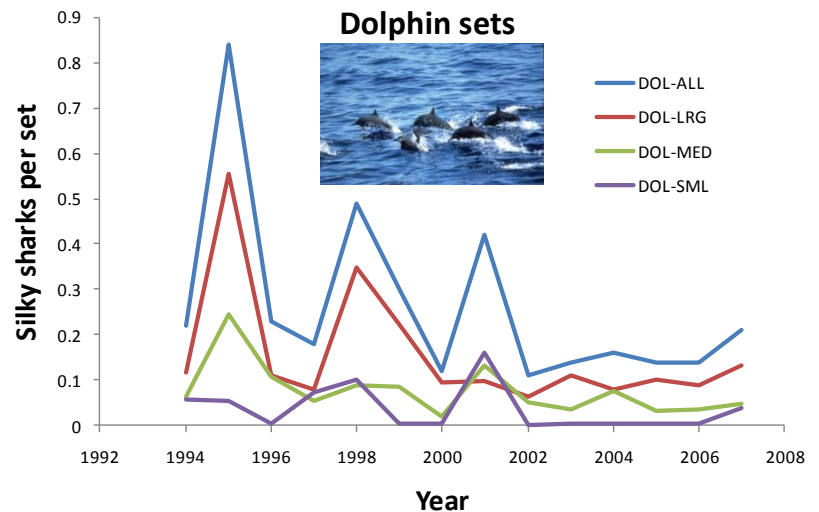
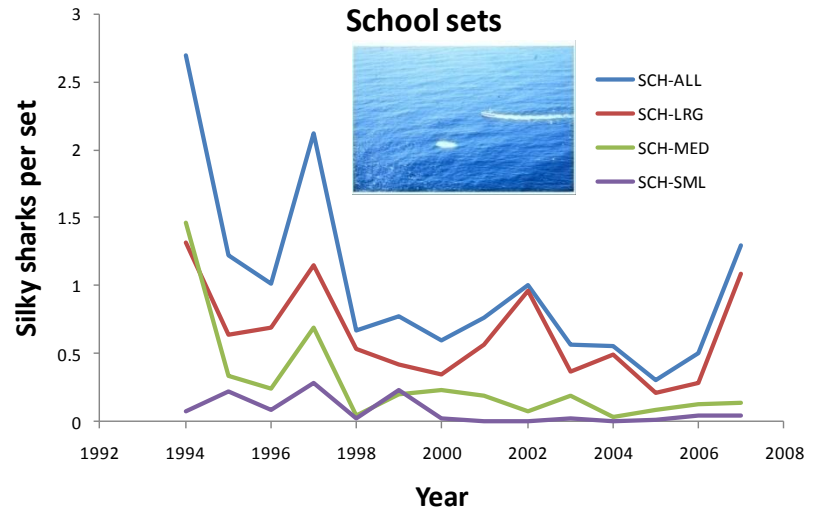
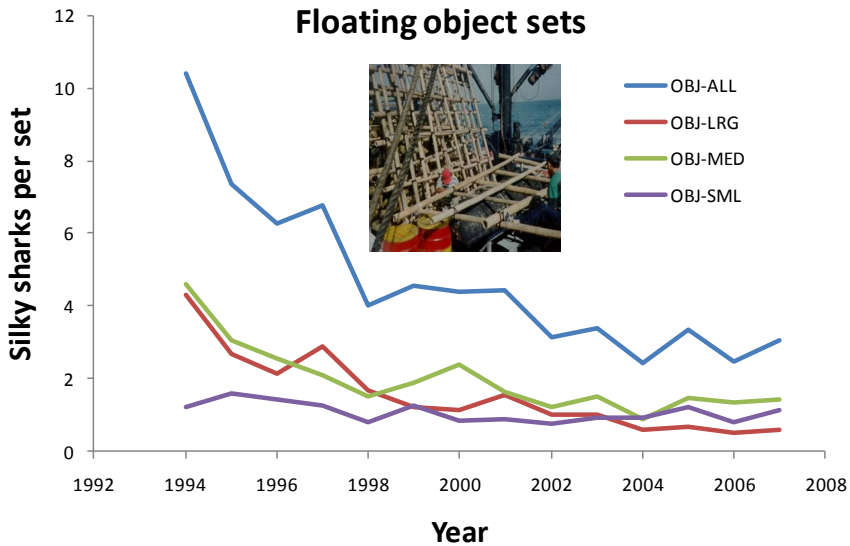
School (unassociated) sets



Tuna purse seine fishery: Silky shark bycatch



Tuna purse seine fishery (large vessels): standardized CPUE for silky shark



Tuna purse seine fishery (large vessels): silky shark size frequency data



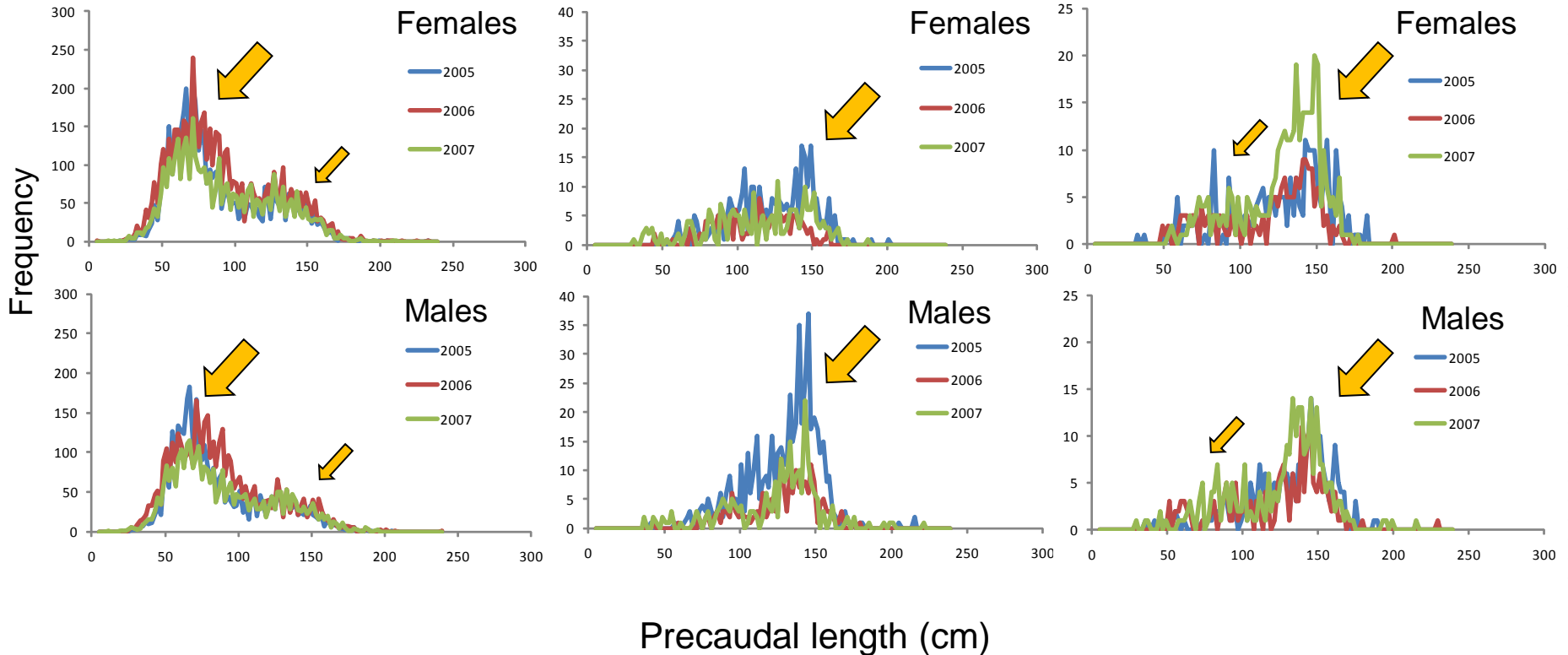
Floating object sets



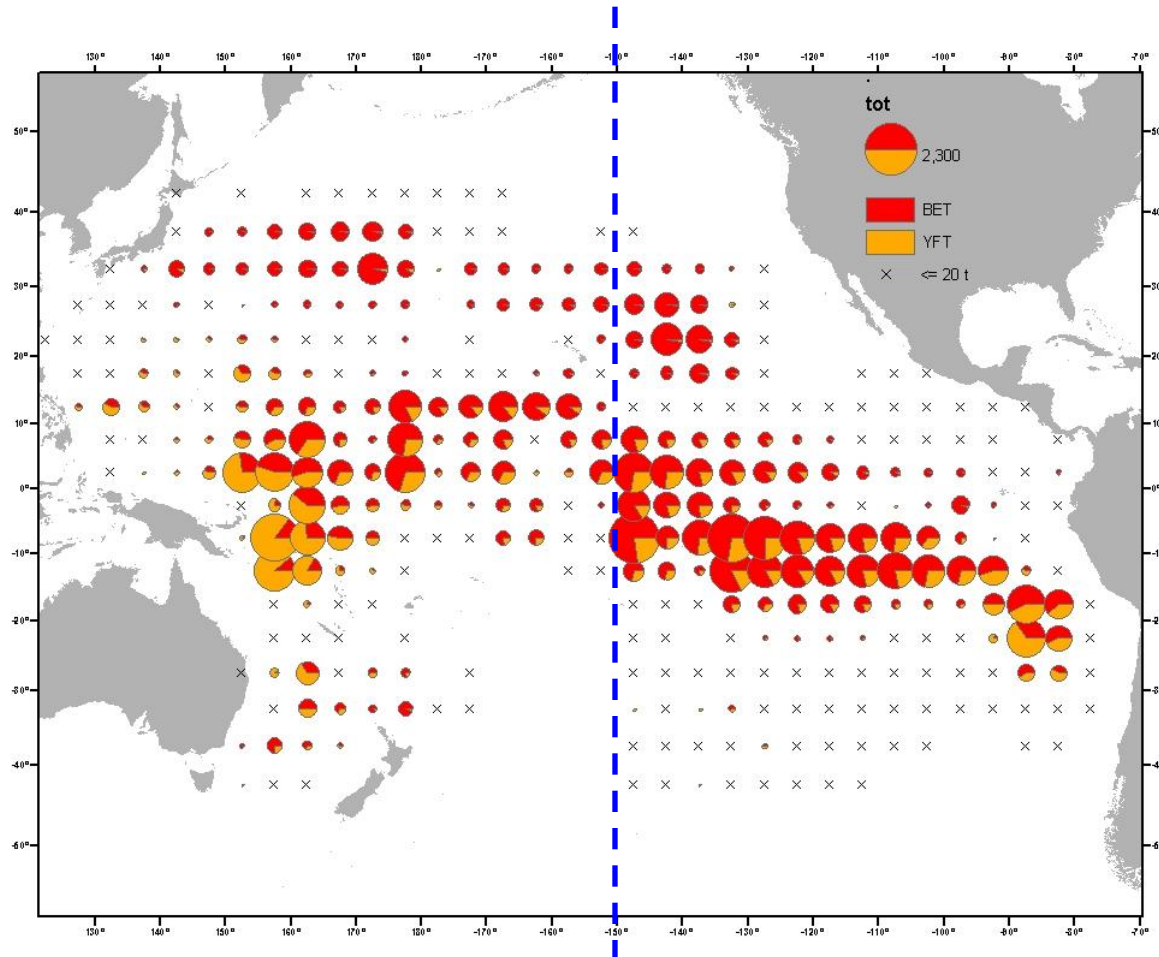
Dolphin sets



School sets



Tuna longline fishery: spatial distribution



Average annual tuna catch, 2003-2007



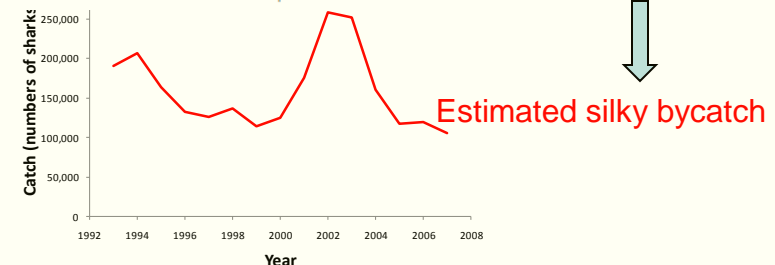
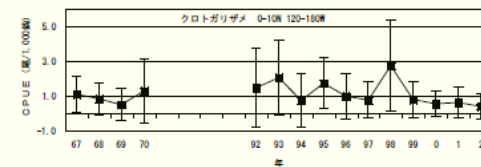
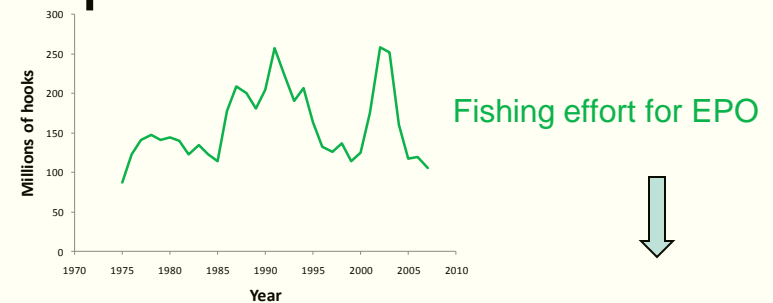
Tuna longline fishery: dealing with unknown bycatch



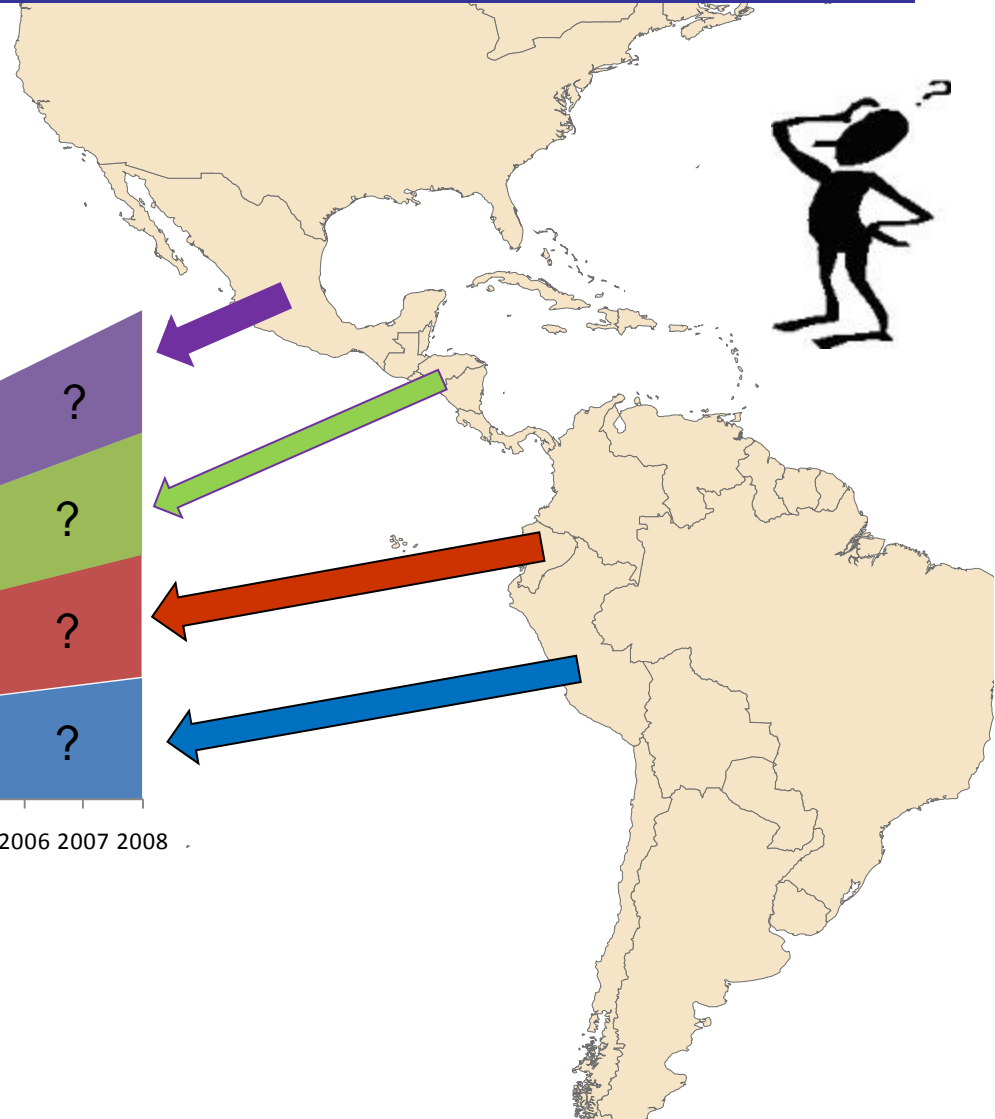
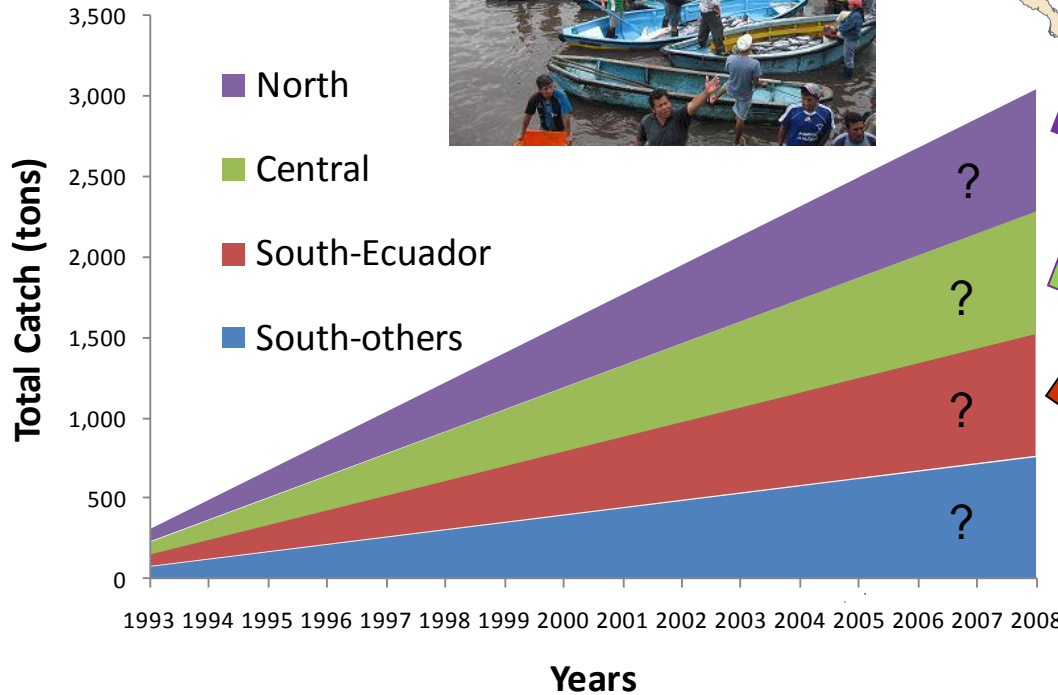
- Longline silky shark bycatch in EPO is **unknown**
- But estimates for total longline effort are **known**

- Ideal situation
 - National programs
 - ISC

• Data-poor situation



Artisanal fisheries: catch assumptions



Conclusions



- *Stock Synthesis* offers potential as a stock assessment platform for silky and other shark species in the EPO
- But there are data shortcomings

Fishery component	Data Type					
	Catch	Effort	CPUE	Sex	Life-stage	Size comp.
Tuna Purse Seine	G					
Tuna longline	P	G	P	P	P	F
Artesanal	P	P	P	G	G	G

	G - Good/buena
	F - Fair/razonable
	P - Poor/pobre

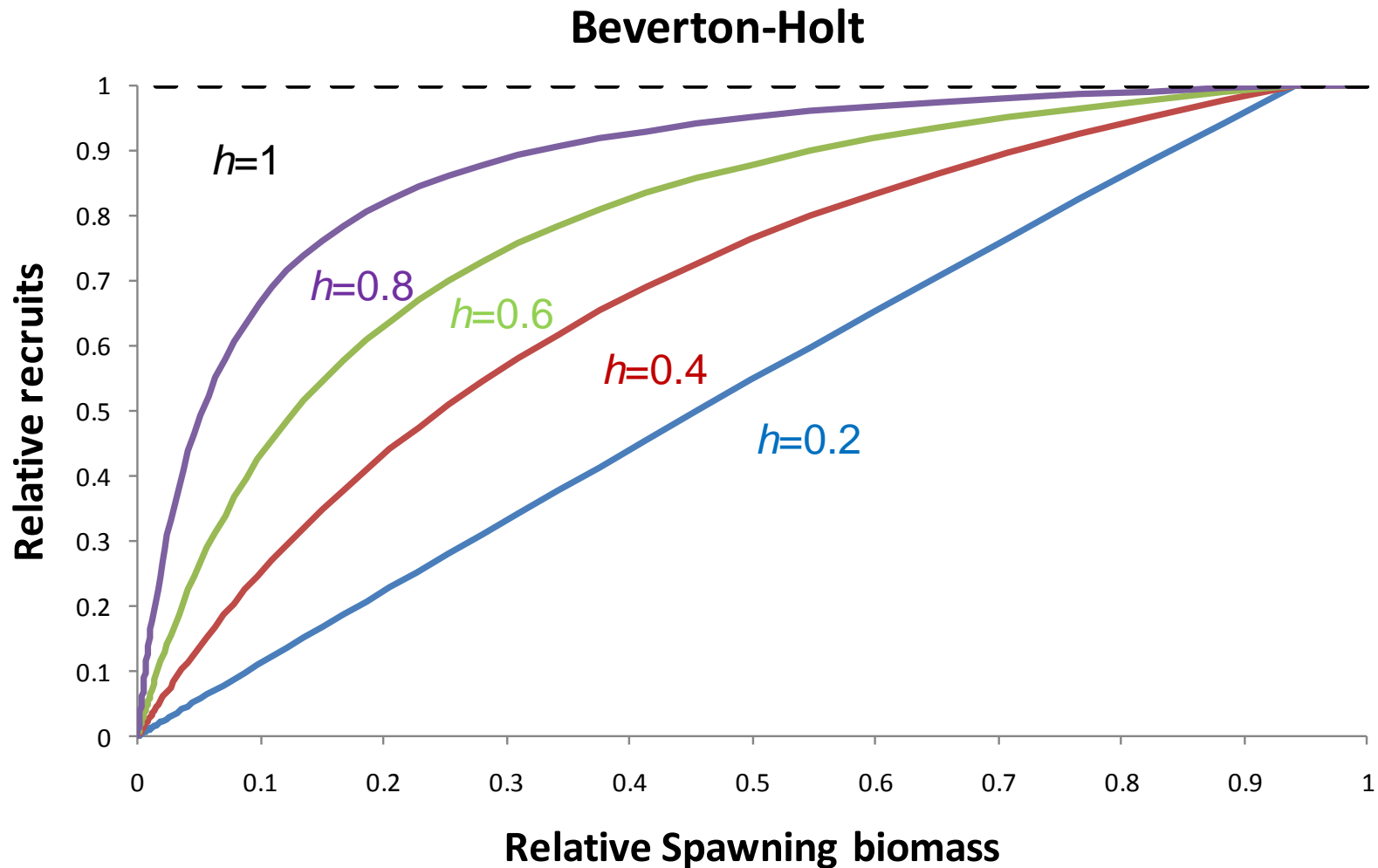
Data requirements - summary



- Size conversion and size-weight relationships
- Biological studies: age and growth, reproduction
- High seas tuna longline fishery in the EPO:
 - Shark bycatch statistics (by species)
 - Sex and length composition data
 - Standardized longline CPUE for sharks
- Artisanal fisheries in the EPO:
 - Shark catch/bycatch and effort data
 - Sex and size composition data

EXTRAS

Stock-recruitment for sharks?



Tuna longline fishery: dealing with unknown bycatch



- Fitting to catch

$$\hat{C}_y = \sum_a \frac{F_{a,y}}{M + F_{a,y}} N_{a,y} 1 - e^{-(M + F_{a,y})}$$

$$-\ln L = \frac{\ln C - \ln[\hat{C}]^2}{2cv^2}$$

CV=0.2

- Fitting to effort

$$E_y = \frac{F_y}{\hat{q}}$$

$$-\ln L = \frac{\ln E - \ln[\hat{E}]^2}{2cv_E^2}$$

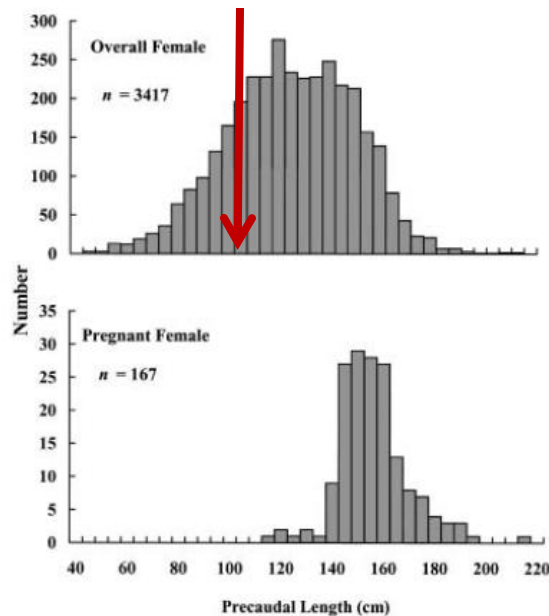
CV=0.05

Tuna longline fishery: information available



- Silky shark size selectivity information available from WCPO

FISHERIES SCIENCE 2003; 69: 456–464



Age and growth of the silky shark *Carcharhinus falciformis* from the Pacific Ocean

SHUNGO OSHITANI,¹ HIDEKI NAKANO² AND SHO TANAKA¹

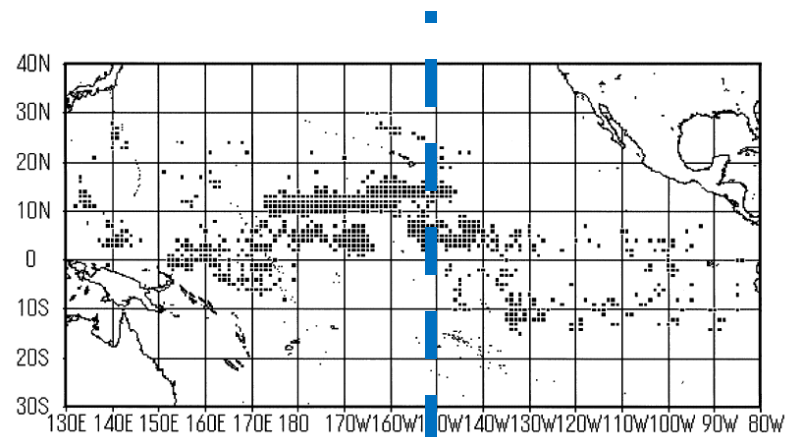


Fig.5 The length–frequency distribution of females overall and pregnant females specifically.

