Preparatory Workshop on Data and Modeling for a Stock Assessment of Silky Shark, *Carcharhinus falciformis*, in the the Eastern Pacific Ocean

Inter-American Tropical Tuna Commission (IATTC)

La Jolla, USA, May 13-14, 2011

Workshop goals

- Identify and review of available data sources
- Build a preliminary *Stock Synthesis* model
- Identify future needs (data/modeling)

Topics

- Background
  - Silky shark issues in the EPO
  - Stock assessment modeling
- Review of data sources and assumptions
  - By gear/country/region
  - Catch/effort, CPUE, age/size composition, biology
  - Make some expert assumptions for missing information
- Modeling discussion
  - Data/model improvements

Background

- Silky shark issues in the EPO
  (C. Lennert-Cody's talk)

Background (cont.)

- Stock assessment modeling
  (Mark Maunder's talk)

Silky shark fisheries in the EPO

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

- Bycatch of tuna longline fisheries
  - High seas longline fleets

- Artisanal fisheries
  - Bycatch/target
  - EPO coastal nations

Fishery data

- Catch
- Fishing effort (total or index)
- Indices of abundance (CPUE)
- Composition (age, length, weight, stage/sex)

Tuna purse seine fishery – set types

Floating object sets

Dolphin sets

School (unassociated) sets

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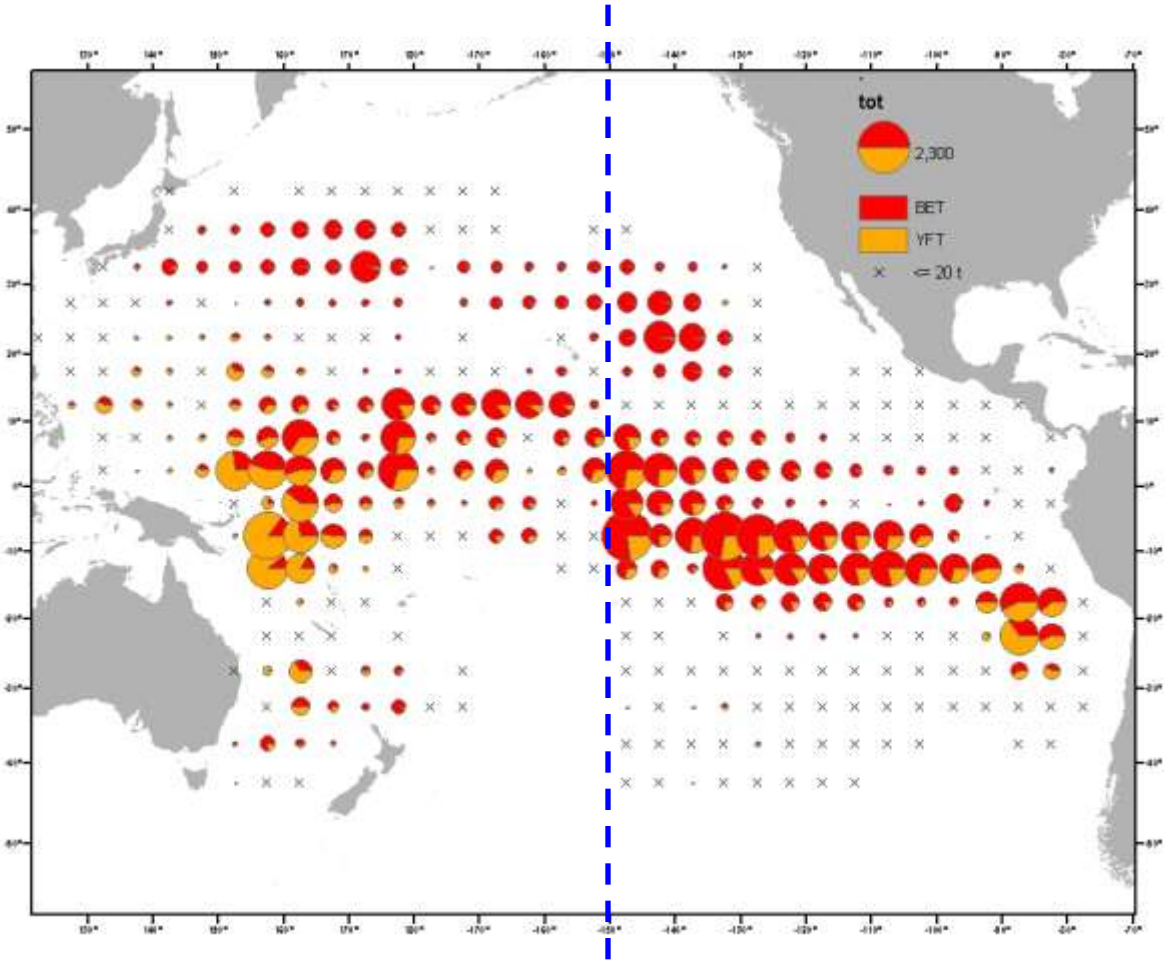
Presentation on PS

- (C. Lennert-Cody's talk)

Discussion on PS

Tuna longline fishery:
(Cleridy talk)



Average annual tuna catch, 2003-2007

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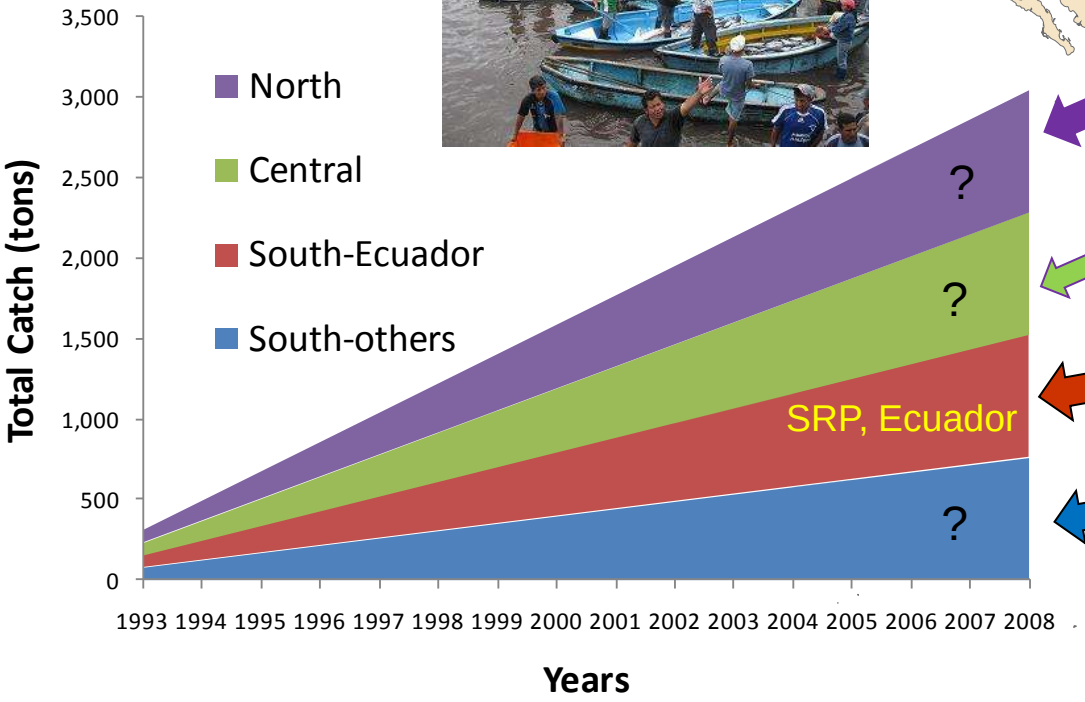
Presentation on LL

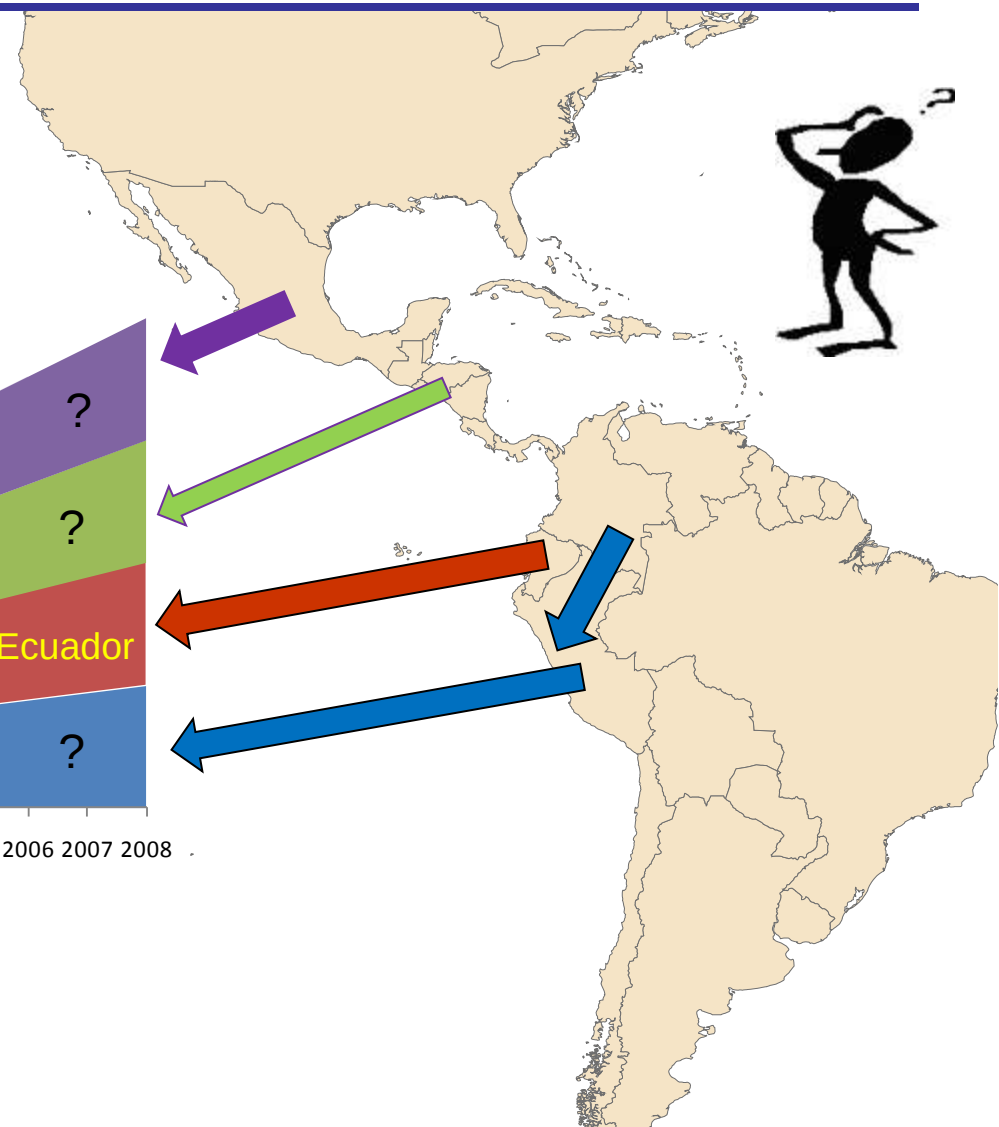
- (C. Lennert-Cody's talk)

Discussion on LL

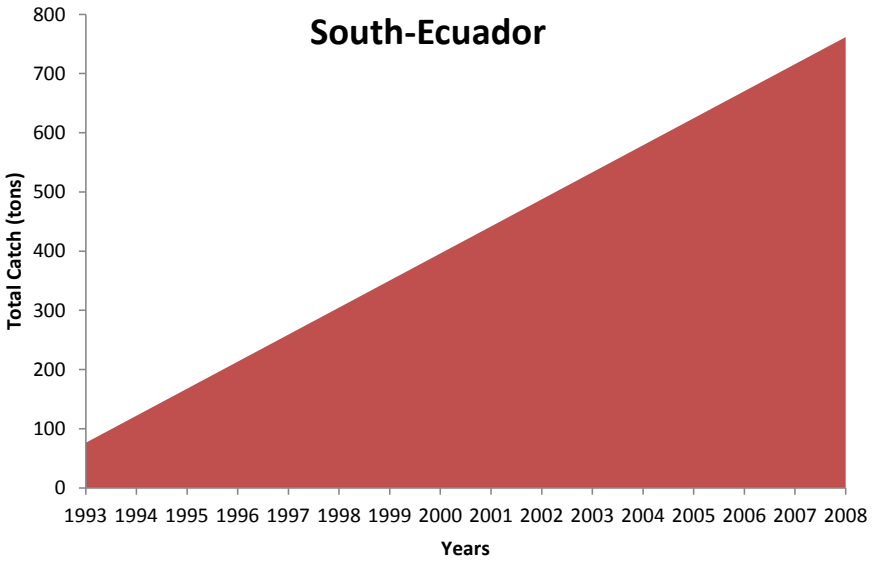
Artisanal fisheries:

catch assumptions



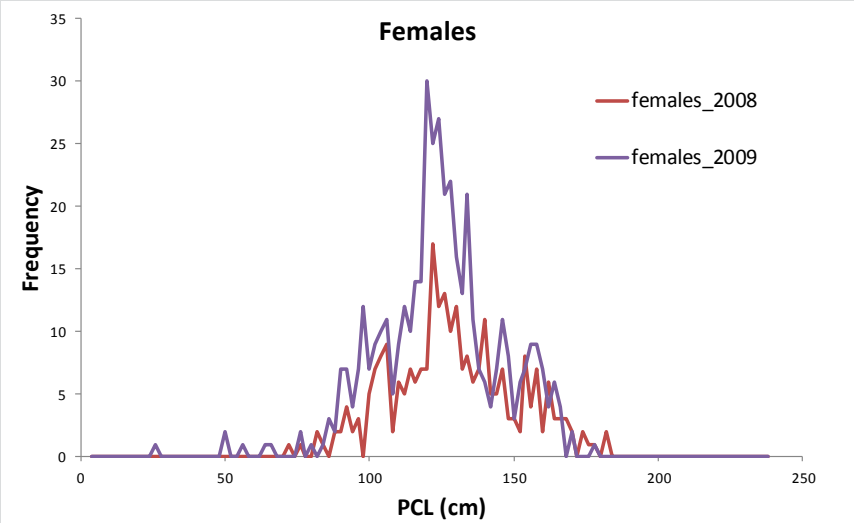


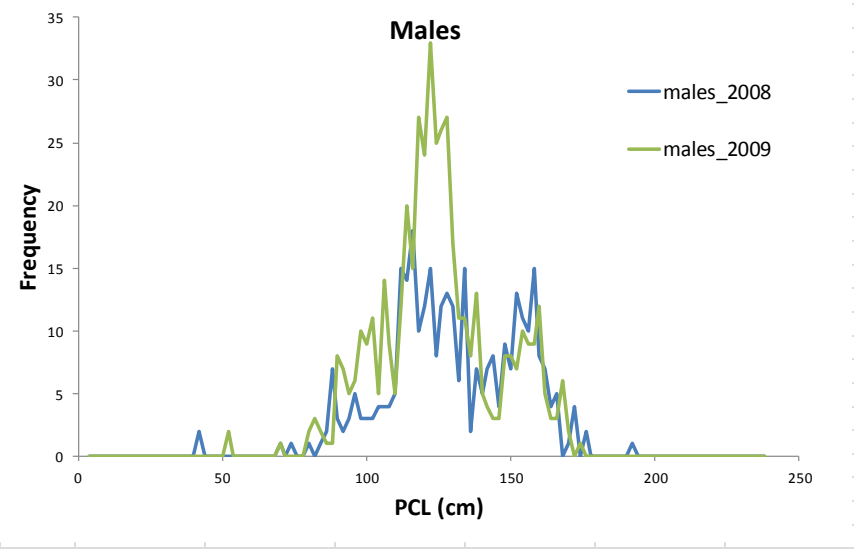
Catches - Ecuador



INSPECTORIAS		Tiburón mico (*Carcharhinus falciformis*)											
		2007				2008							
		SEPTIEMBRE	OCTUBRE	NOVIEMBRE	DICIEMBRE	ENERO	FEBRERO	MARZO	ABRIL	MAYO	JUNIO	JULIO	AGOSTO
MANTA		32167	44571	20848	21887	13684	14584	28133	62423	58667	72530	54673	59463
POSORJA		942	472	1809	991	2012	424	46586		1098	322	1928	1002
ESMERALDAS		590	1360	3640	3099	1083	809	294	7374	4448	8178	10471	6000
PTO, LOPEZ		0	95	0	0	55	32	10	37		32	3	
PTO. BOLIVAR		0	0	0	0								
BAHIA		0	0	0	0								
PEDERNALES		12	150	50	234						236	11	11
SALINAS	ANCONCITO	332	557	279	389	92	5	5855	6767	4929	26953	16736	8580
	SANTA ROSA	105	32	60	80	0	2055	657	47	18	691	1792	600
TOTALES		34148	47238	26686	26680	16926	17909	81535	76647	69160	108942	85615	75656

Size compositions - Ecuador





SRP-Ecuador, Jimmy Martinez

Discussion on Ecuador

Catches - México

Instituto Nacional de Pesca

Tiburón del Golfo de Tehuantepec

Responsable: Biól Sandra Rita Soriano Velásquez
Colaboradores: M. En C. Donaldo E. Acal Sánchez
Biol. J. Leonardo Castillo Geniz
Biól. Norberto Vázquez Gómez
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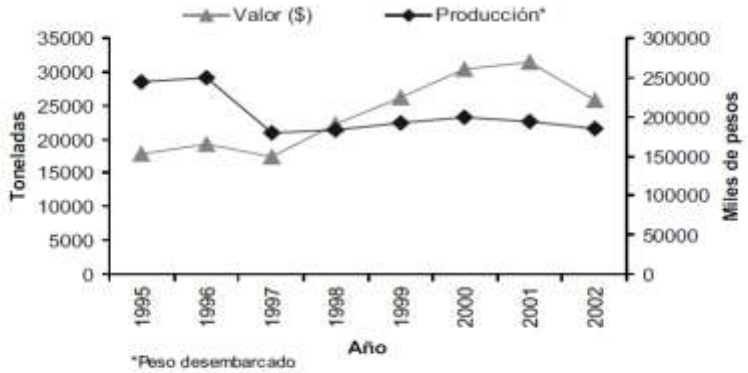
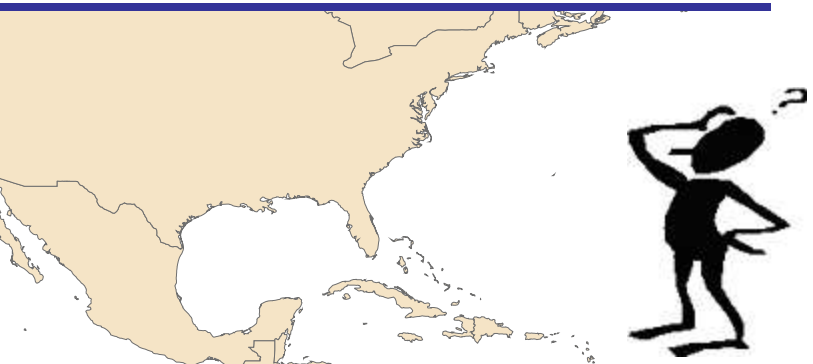


Figura 1. **Producción en peso desembarcado y valor nacional de tiburón y cazón.**

Discussion on México

Central America



OSPESCA

Organización del Sector Pesquero y Acuícola del Istmo Centroamericano

Sistema de la Integración Centroamericana | Economía

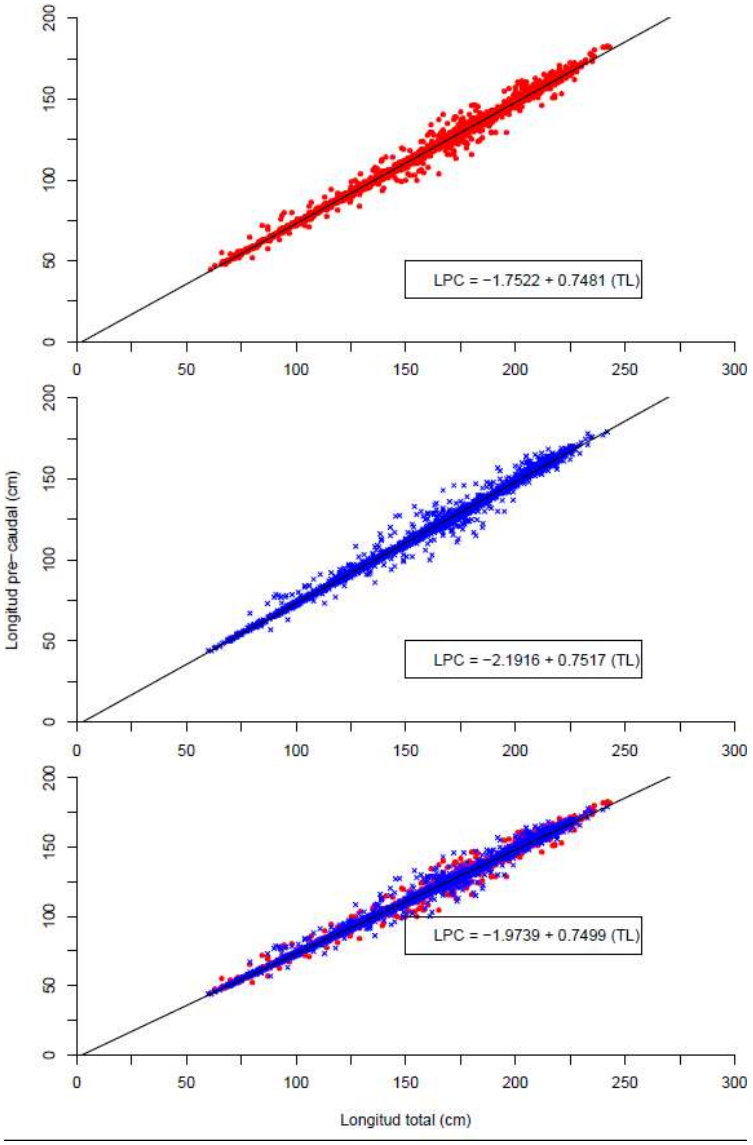
Discussion on CA

Discussion on South America

Biology

- Length-weight
- Growth
- Natural mortality
- Reproduction (maturity, fecundity, frequency)
- Stock structure
- Tagging

Length conversion relationship



SRP-Ecuador, Jimmy Martinez

Length-weight relationship

FISHERIES SCIENCE 2003; 69: 456–464

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

SHUNGO OSHITANI,[1] HIDEKI NAKANO[2] AND SHO TANAKA[1]

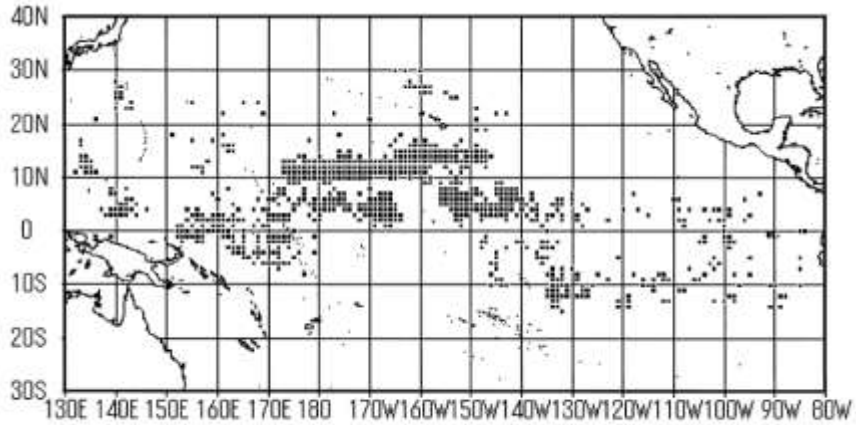
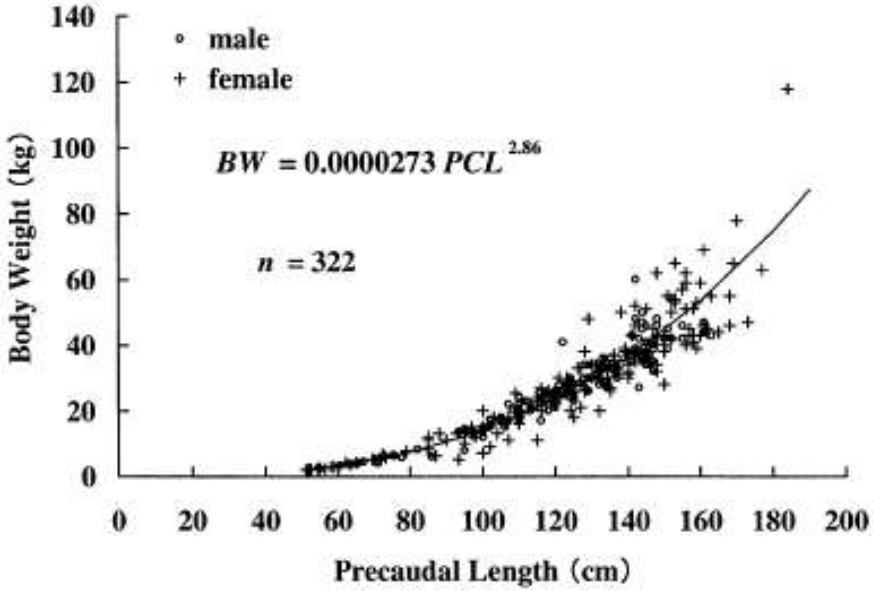


Fig. 1 Locations of sampling during the research cruise.



Age and growth

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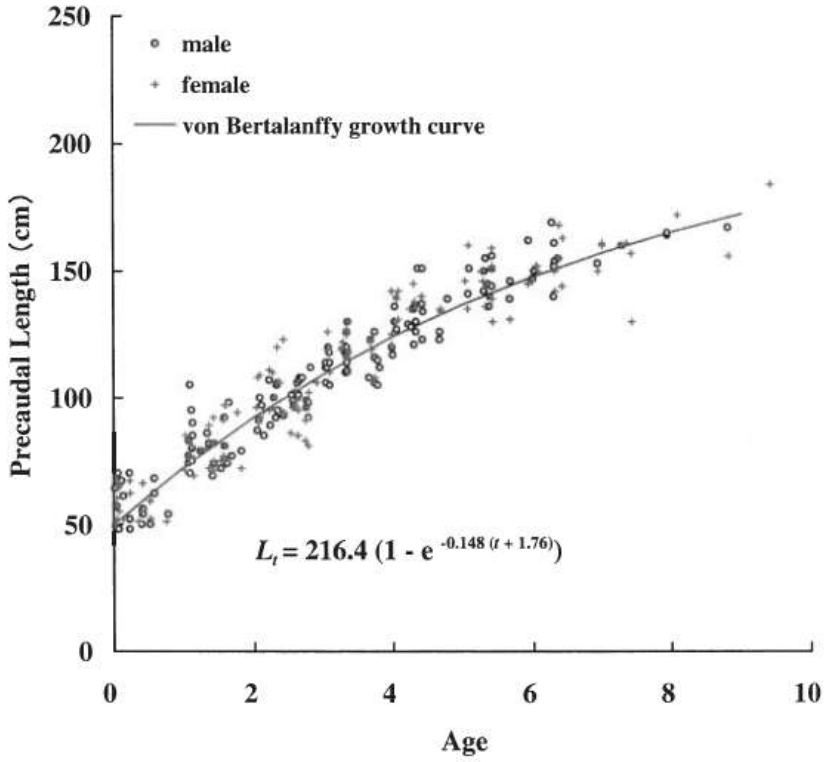

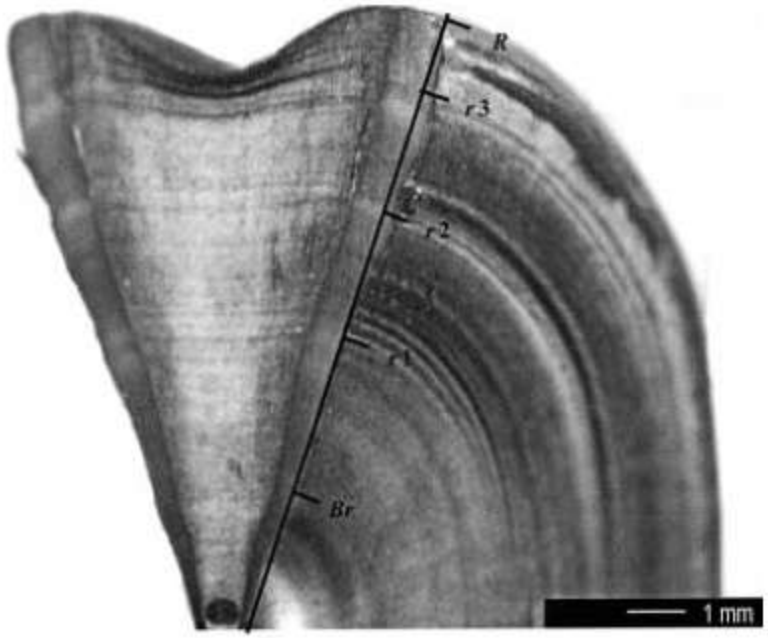

Age and growth (cont.)

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Age and growth of the silky shark *Carcharhinus falciformis* from the west coast of Baja California Sur, Mexico

By J. A. Sánchez-de Ita, C. Quiñónez-Velázquez, F. Galván-Magaña, N. Bocanegra-Castillo and R. Félix-Uraga

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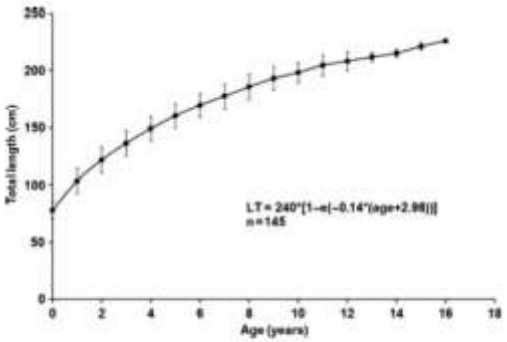
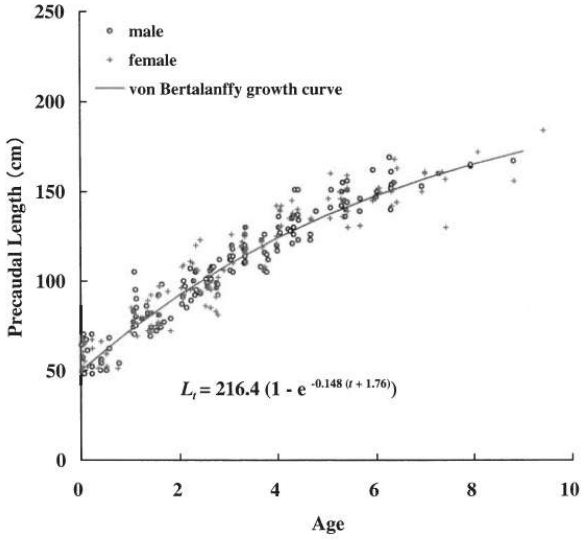
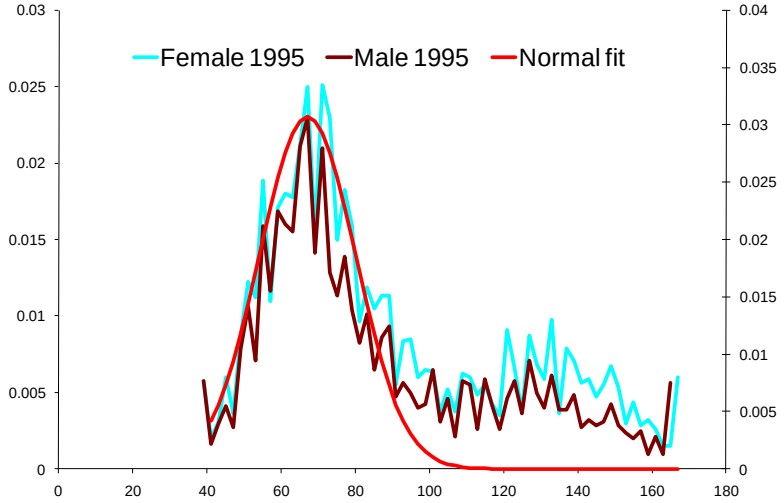


Fig. 6. Von Bertalanffy growth curve constructed with back-calculated data for *Carcharhinus falciformis*, sexes combined. Dots, mean length at age; vertical lines, standard deviation; n, number of total sample size

Variability of length-at-age





CV=0.2

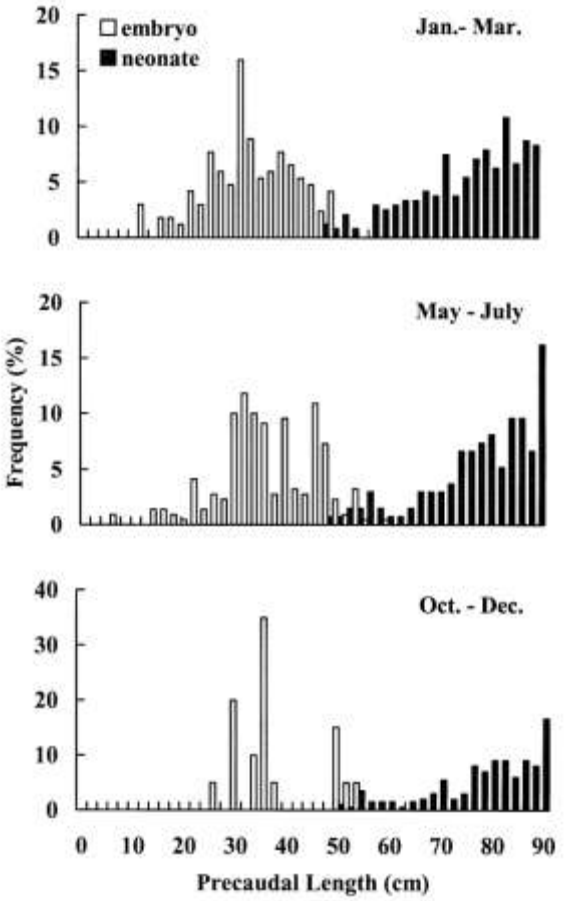


Fig. 6 Seasonal length–frequency distributions of embryos and neonates.

Reproductive biology

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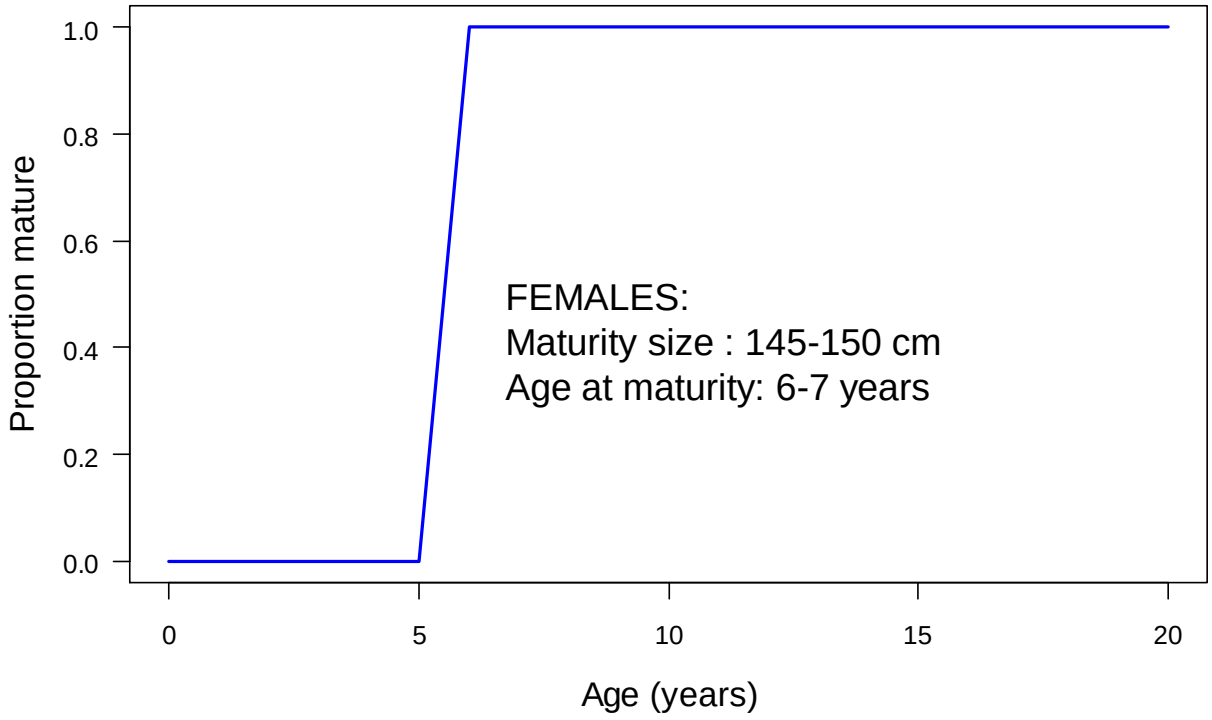

Reproductive biology (cont.)

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Centro Interdisciplinario de Ciencias Marinas

CICIMAR

BIOLOGÍA REPRODUCTIVA DEL TIBURÓN PILOTO
Carcharhinus falciformis (BIBRON, 1839) DE
BAJA CALIFORNIA SUR.

TESIS

Que para obtener el grado de Maestro en Ciencias con especialidad en Manejo de Recursos Marinos

Presenta:

Biól. Edgar Mauricio Hoyos Padilla

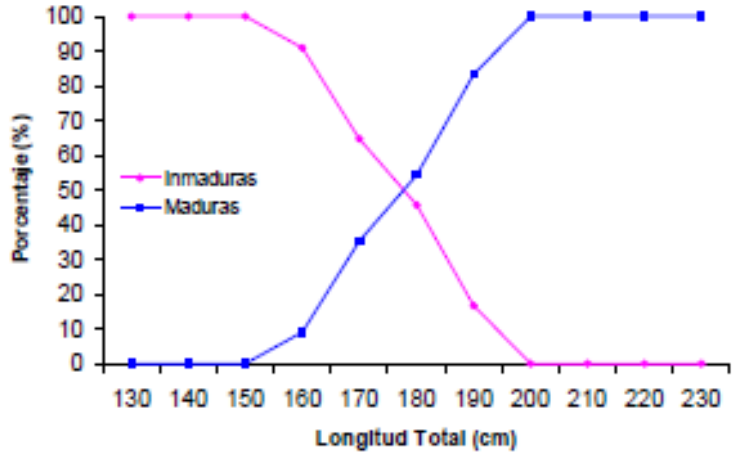

Figura 7. Talla a la cual el 50% de las hembras en la frecuencia de clase están maduras (Pratt & Otake, 1990).

Reproductive biology (cont.)

Posgrado en Ciencias del Mar y Limnología
UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO
UNAM POSGRADO Ciencias del Mar y Limnología

BIOLOGÍA REPRODUCTIVA DEL TIBURÓN ALETA DE CARTÓN *Carcharhinus falciformis*, CAPTURADO EN EL GOLFO DE TEHUANTEPEC.

T E S I S

que para obtener el grado académico de

MAESTRO EN CIENCIAS
(BIOLOGÍA MARINA)

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Dr. Oscar Sosa Nishizaki
Dr. Felipe Amezcua Martínez
Dr. Agustín Hernández Herrera

AGOSTO 2007

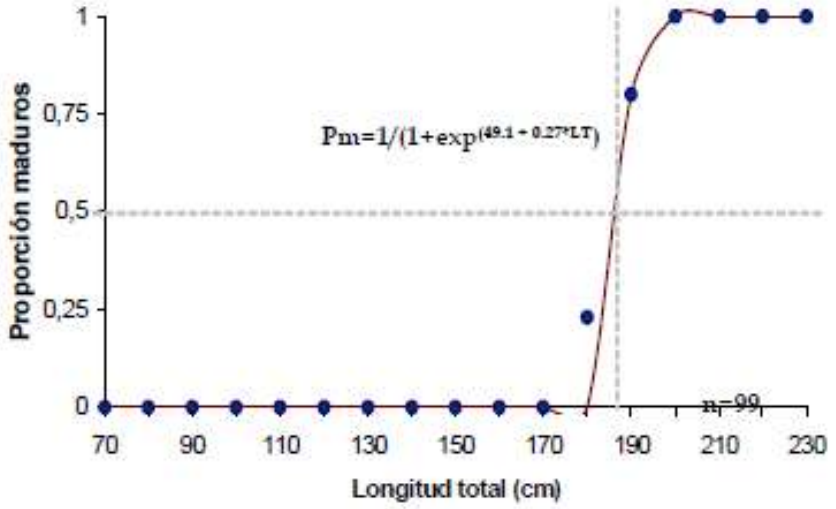
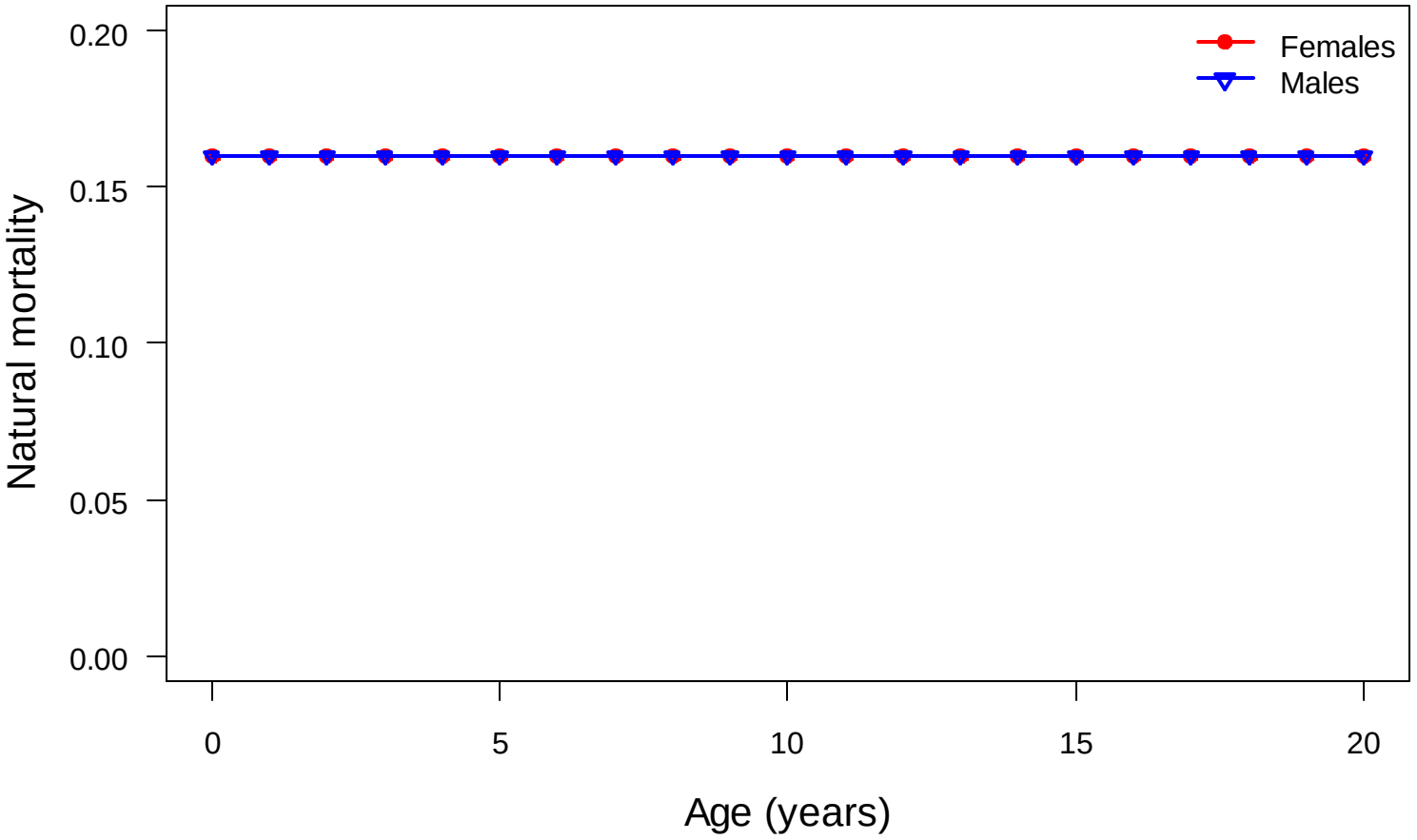


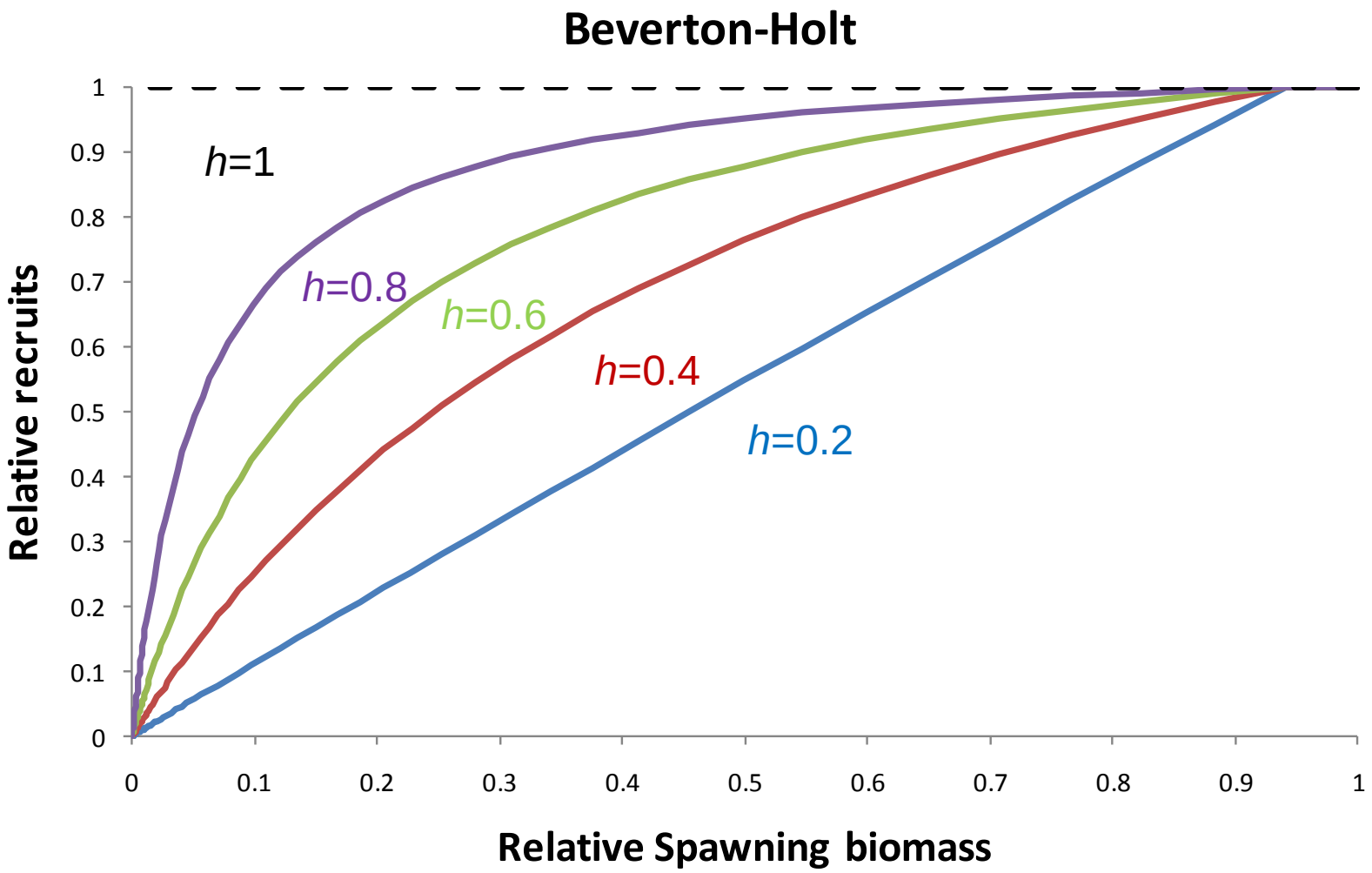
Figura 10. Talla de primera madurez sexual de hembras (• = datos observados, — = datos calculados, r=0.85 r^2=0.72)

Natural mortality



Based on indirect methods: Jensen

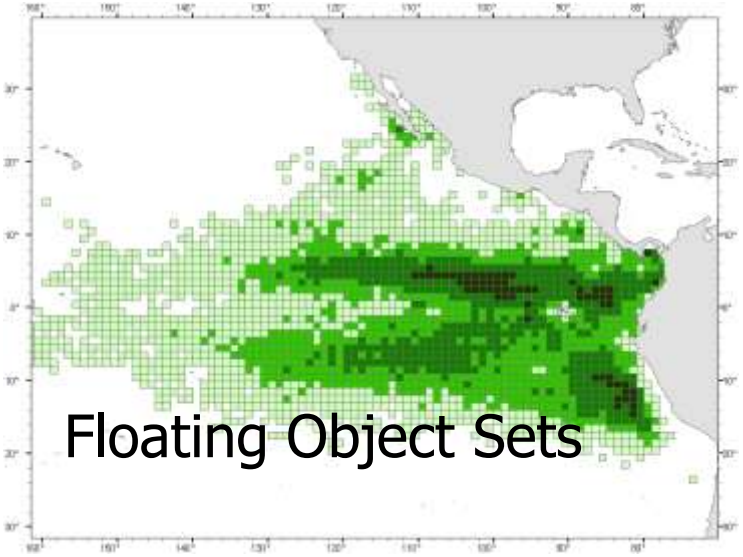
Stock-recruitment

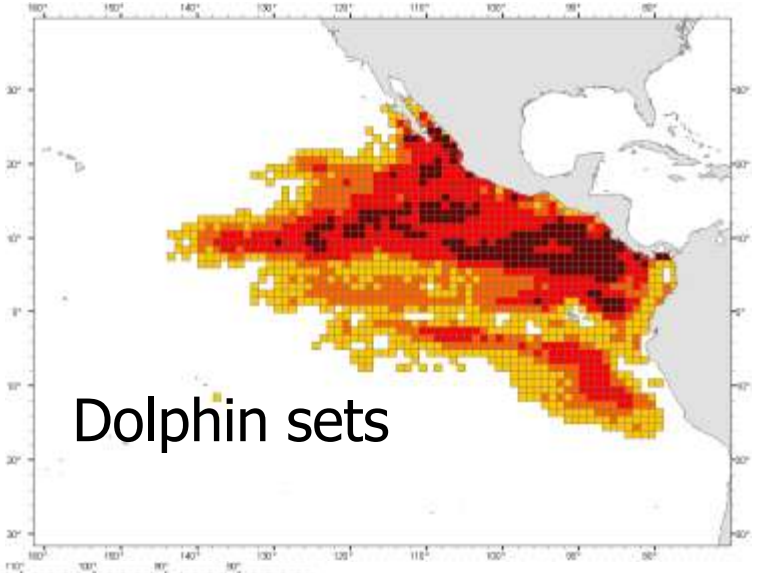


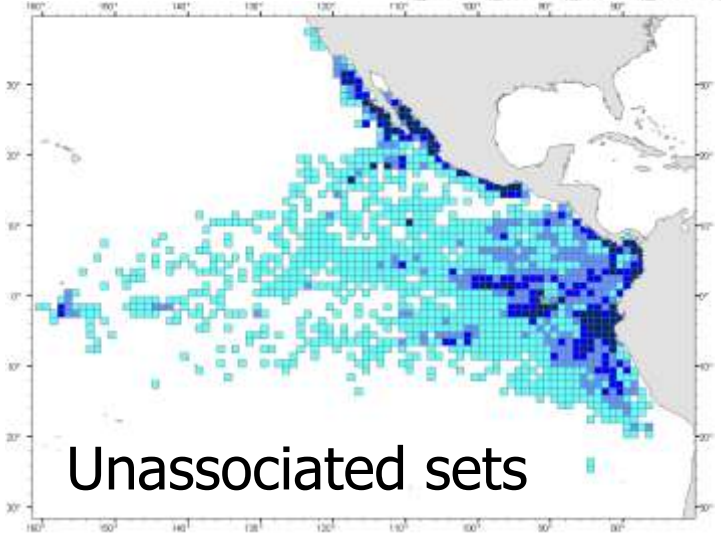
EXTRAS

Tuna purse seine fishery:

spatial distribution of fishing effort







1993 - 2003

No. Sets

(0, 10]

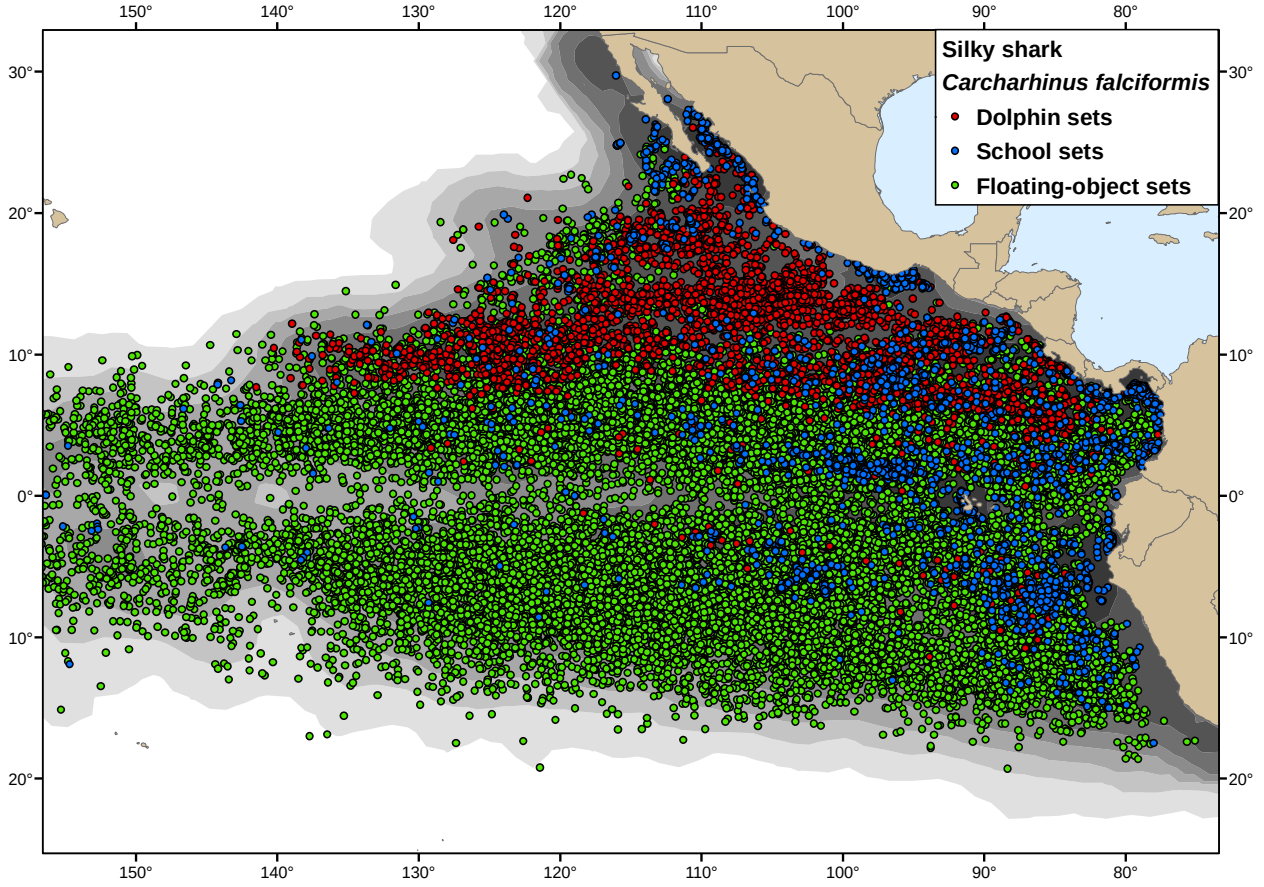
(10, 30]

(30, 100]

> 100

Tuna purse seine fishery:

spatial distribution of silky shark bycatch



1993-present

Tuna longline fishery:
information available

- Silky shark size selectivity information available from WCPO

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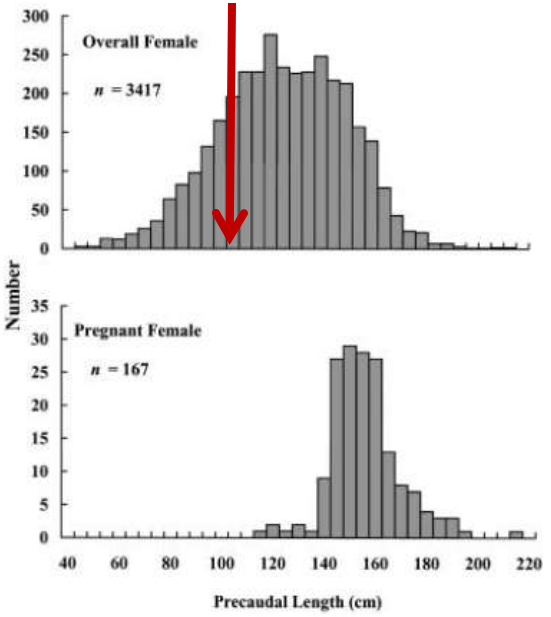

Fig. 5 The length–frequency distribution of females overall and pregnant females specifically.

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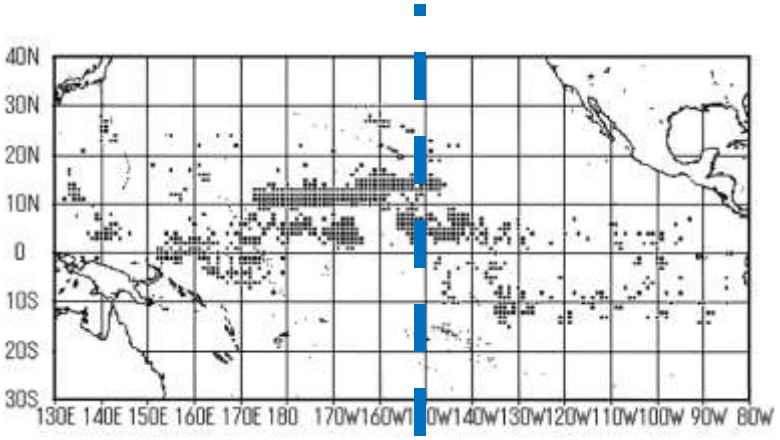

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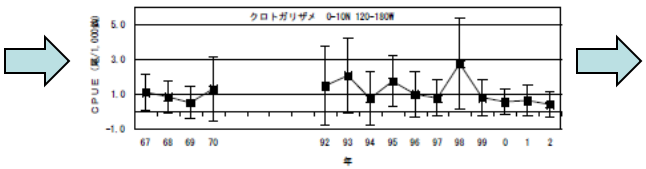
Tuna longline fishery:
dealing with unknown bycatch

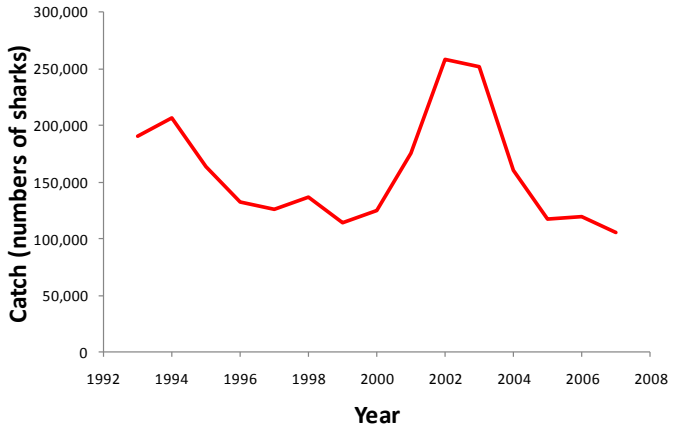
- Longline silky shark bycatch in EPO is unknown
- But estimates for total longline effort are known

Fishing effort for EPO

Silky shark CPUE in vicinity area of WCPO



Estimated silky bycatch



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Tuna longline fishery:
dealing with unknown bycatch

- Fitting to catch

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

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

CV=0.2

- Fitting to effort

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

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

CV=0.05