

Untangled Catch: Estimating Shark and Ray Capture in Tuna Fisheries to Inform Assessment and Conservation

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Oceanic sharks and rays (elasmobranchs)

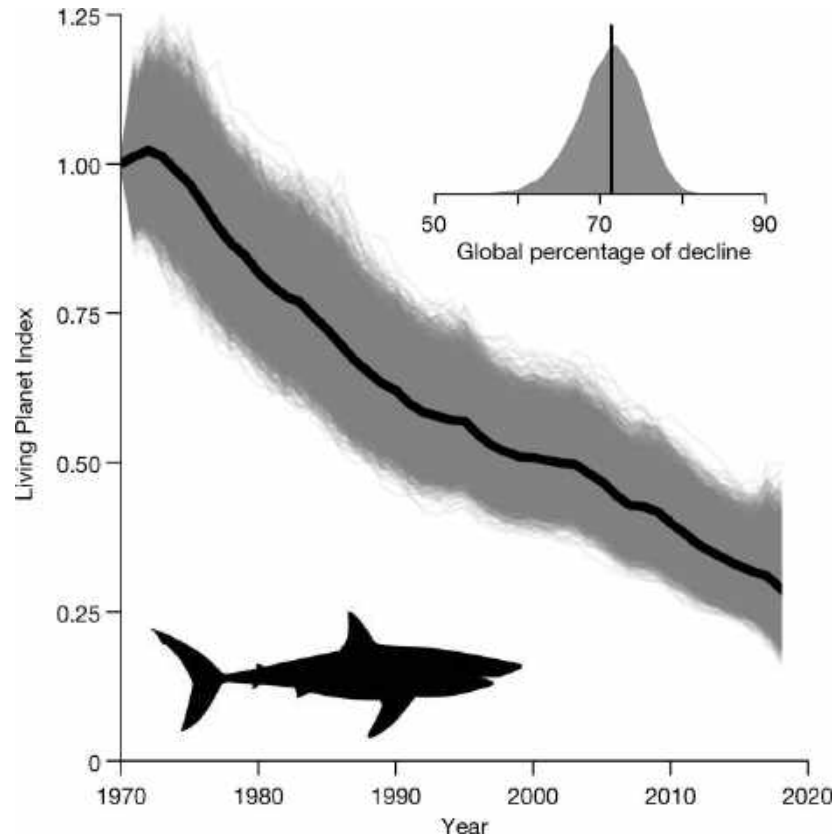


Why do elasmobranchs matter?

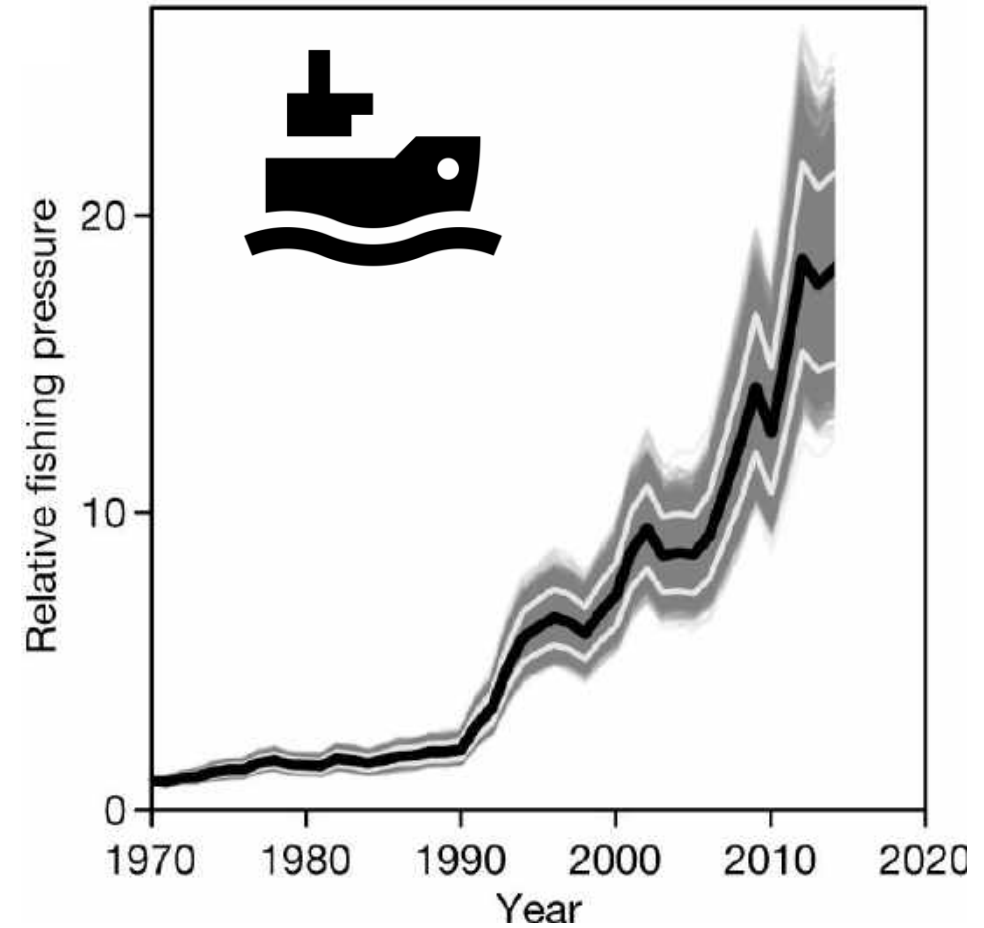
- Functionally important predators
- Ecotourism value > \$300 million, 10,000 jobs
- Food + livelihood in some low-income coastal countries
- Cultural + spiritual value



Oceanic elasmobranch populations in global decline



~50% of global elasmobranch catch is **bycatch**



Megafauna bycatch in large-scale fisheries



Sharks and rays represent ~97% of megafauna bycatch



Research Questions



What data is available for elasmobranch catch in tRFMOs?



How many elasmobranchs do tRFMO data reports reflect?



What proportion of this catch is assessed and/or overfished?



Methods: Global harmonized **reported** catch database



Extracted country-
reported catch
data

Convert tonnes ->
individuals using
ocean- & gear-
specific length-
weight relationships

$$W = a * L^b$$

Length-weight conversion data

- Hierarchical decision process to extract length measurements and length-weight conversions from:

1) observer-collected length data for each species and gear (using only data for 2013–2019)

- available upon request from IATTC
- publicly available from IOTC and ICCAT for most species and gears

2) mean length was computed from available length estimates for that species and gear in other tRFMOs

3) review of scientific literature for gear- and species-specific parameters



- 77 length-weight conversion equations

Gear	Scientific Name	Region	L measure	L (cm)	Reference	a (intercept)	b (slope)	Mean weight (kg)	Reference
LL	<i>Lamna nasus</i>	Atlantic	FL	144.4	ICCAT Task 2 Size data	0.00001482	2.9641	37.3	Kohler et al. 1996
LL	<i>Prionace glauca</i>	Atlantic	TL	181.7	ICCAT Task 2 size data	0.00000318	3.1313	37.8	Kohler et al. 1996
LL	<i>Alopias</i>	Eastern Pacific	FL	139.1	IATTC Length Data	0.00000911	3.0802	36.4	Kohler et al. 1996
LL	<i>Carcharhinus falciformis</i>	Eastern Pacific	FL	136.9	IATTC Length Data	0.00000292	3.15	15.7	Branstetter 1987
LL	<i>Carcharhinus longimanus</i>	Eastern Pacific	FL	112.8	IATTC Length Data	0.0000166	2.82	10.2	Joung et al. 2016
LL	<i>Isurus</i>	Eastern Pacific	FL	150.9	IATTC Length Data	0.00000524	3.1407	36.5	Compagno 2001



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Extracted country-reported catch data

Convert tonnes -> individuals using ocean- & gear-specific length-weight relationships

$$W = a * L^b$$

Harmonized reported catch database



Available catch data varies widely

tRFMO	Years	Gear	Source Category	Data Description
IATTC	1979 - 2019	Purse seine	Observer- recorded bycatch submitted by countries	Data provided by IATTC member governments on shark bycatch, in number of individuals or weight, by purse-seine vessels in the Eastern Pacific Ocean (1993-2021), recorded by on-board observers. Data also include number of sets, aggregated by year, month, flag or set type, and 1°x1° latitude/longitude. File is entitled, “Shark EPO purse seine catch and effort aggregated by year, month, flag or set type, 1°x1°”
		Longline	Retained catch submitted by countries	Data provided by Members and Cooperating Non-Members, on retained catch of sharks by year, month, flag, and 5°x5° latitude/longitude, by industrial longline vessels in the Eastern Pacific Ocean. File is entitled, “Shark EPO longline catch and effort aggregated by year, month, flag, 5°x5°”
ICCAT	1950 - 2019	Both	Submitted by countries	Task 1 catch data: nominal catches of Atlantic tunas and tuna-like fish (including sharks), by gear, region and flag
IOTC	1964 - 2019	Both	Submitted by countries	Reported aggregated annual catches for IOTC statistical areas, by species, gear in metric tons. We used catch for “Industrial fisheries” (Column J) within the file entitled “Nominal catches by fleet, year, gear, IOTC area and species” [IOTC-2022-WPEB18(AS)-DATA03]
WCPFC	2013 - 2019	Both	Observer programme	Observed aggregated catch based on Regional Observer Programme data by species, gear, region. We used the file entitled “Bycatch data Excel file (BDEP)”

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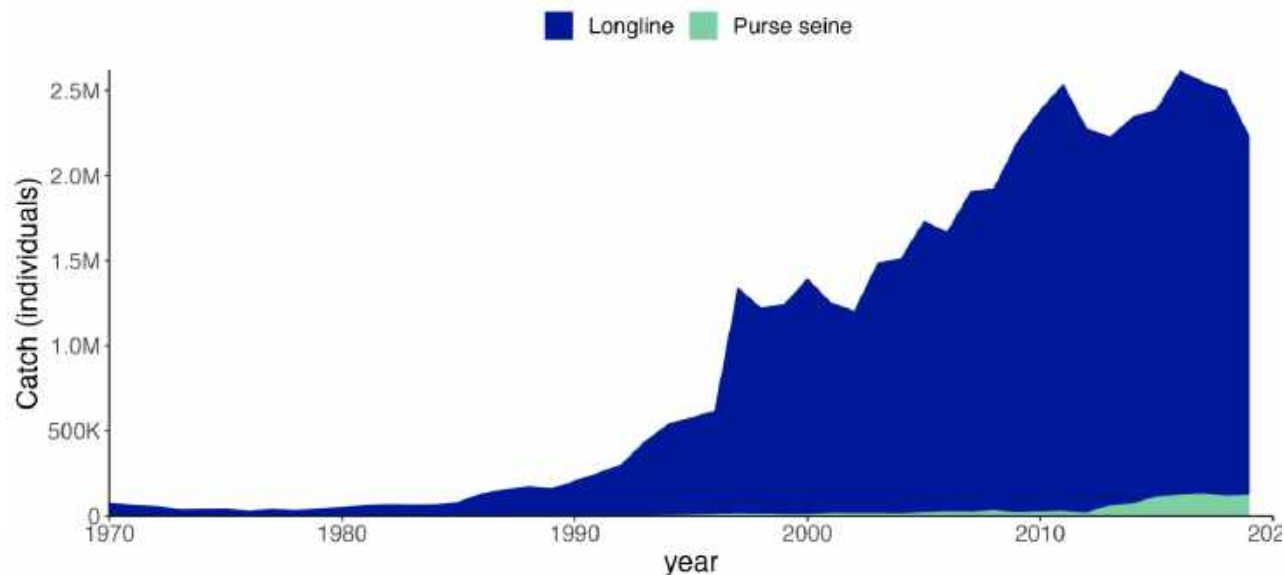


What proportion of this catch is assessed and/or overfished?

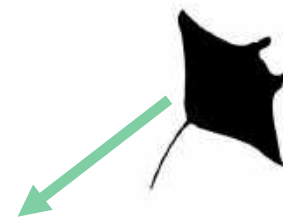
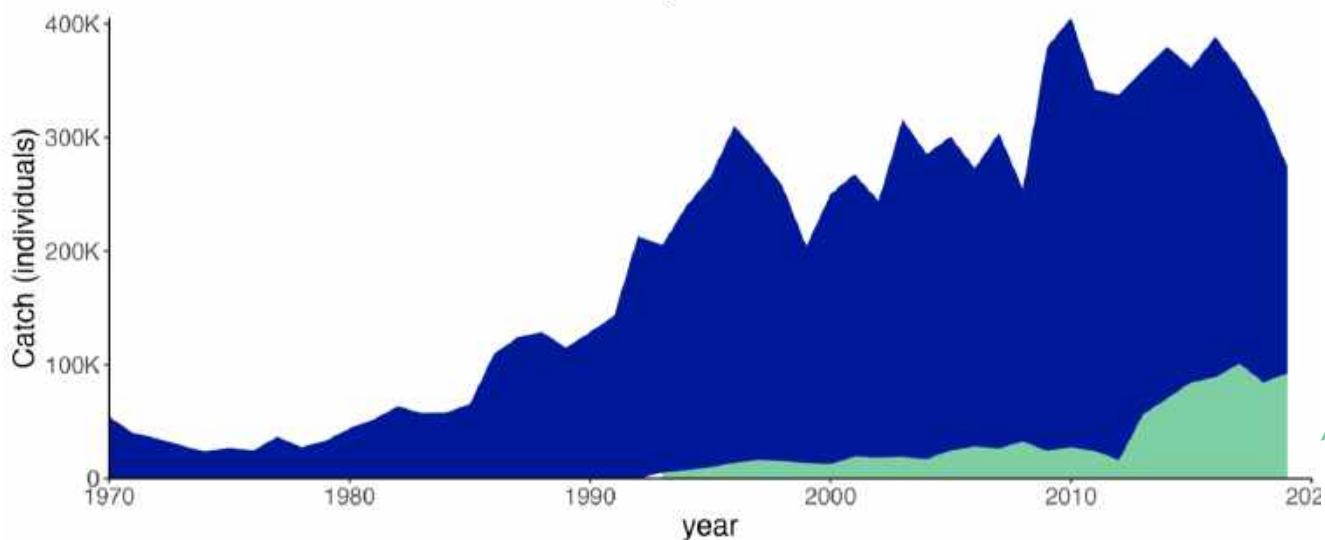


Data reports total 2.4 million individuals / year (mean 2013-2019)

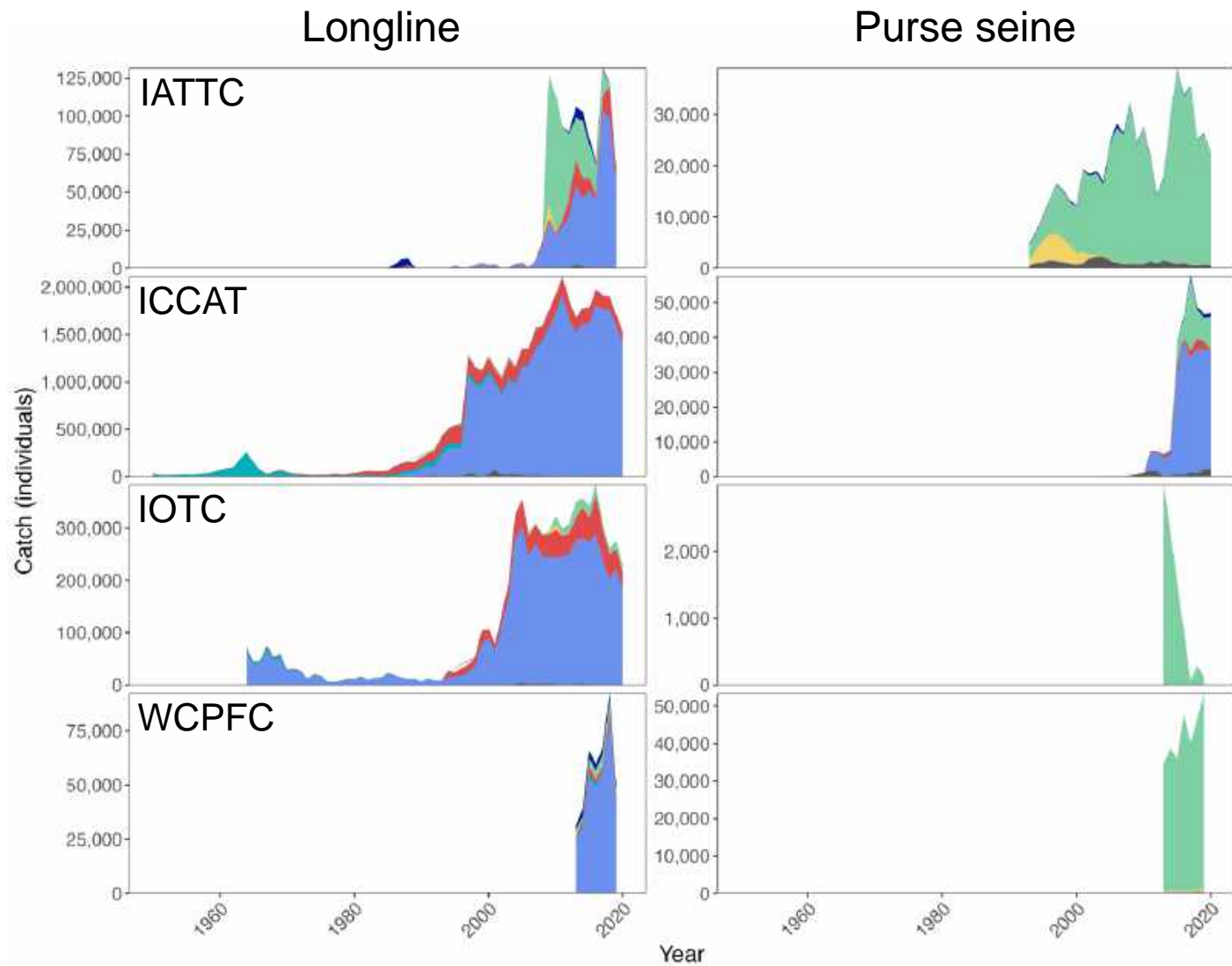
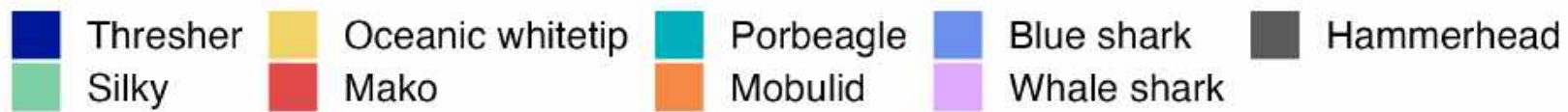
With blue shark



Without blue shark



Note flexible y-axes



Note flexible y-axes

Research Questions



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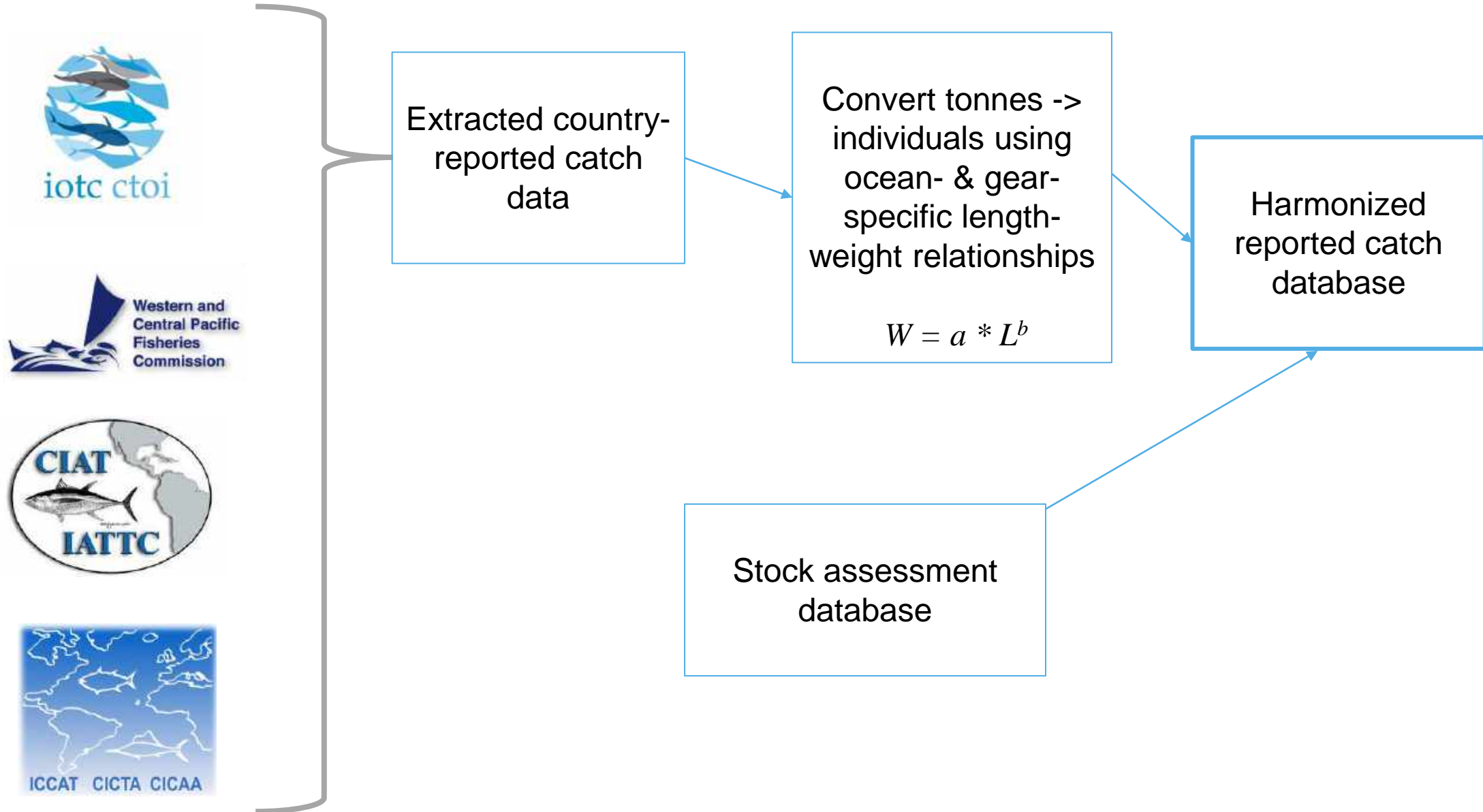
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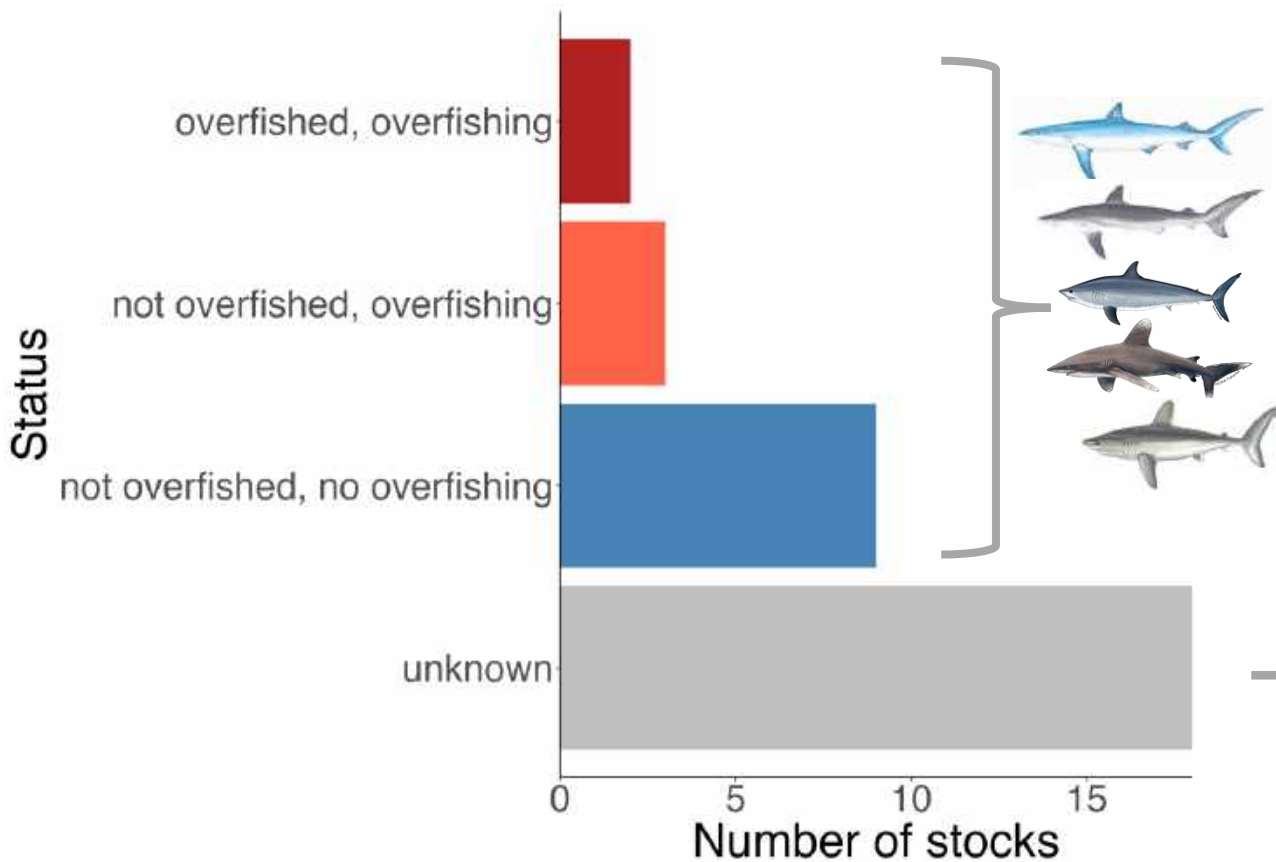
Methods: Global harmonized **reported** and **estimated** catch database





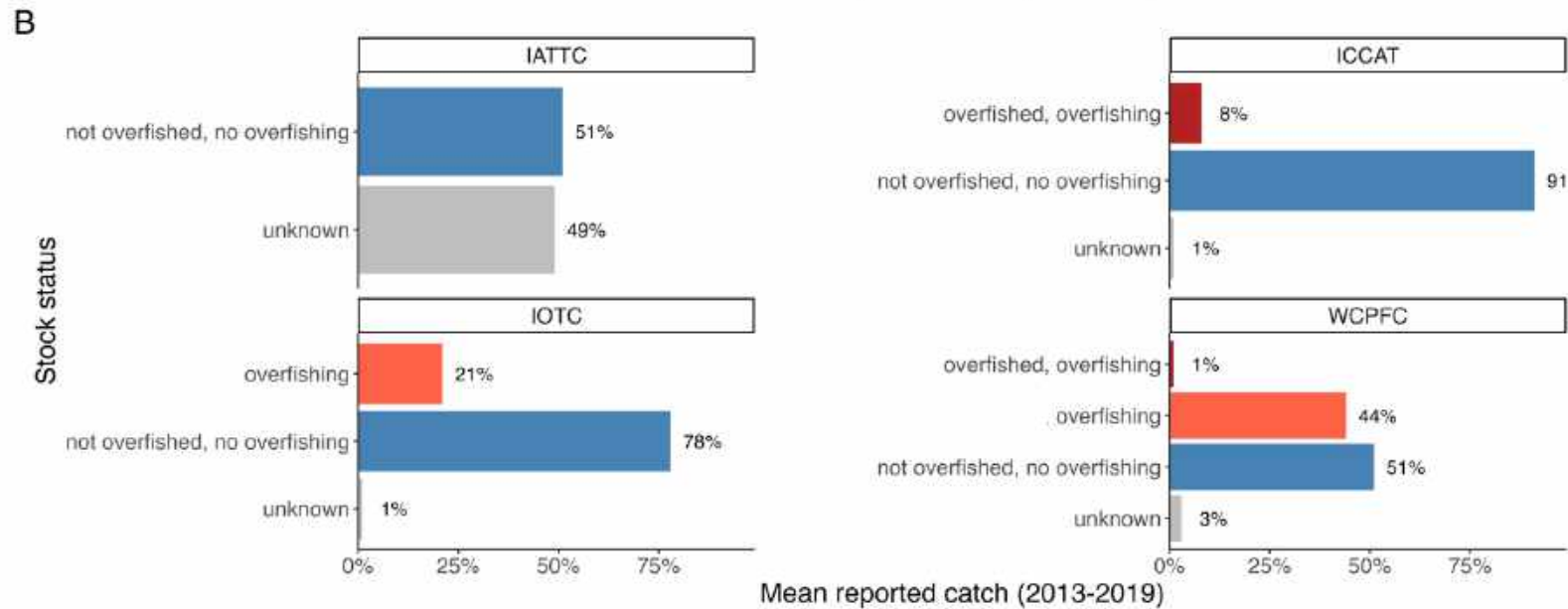
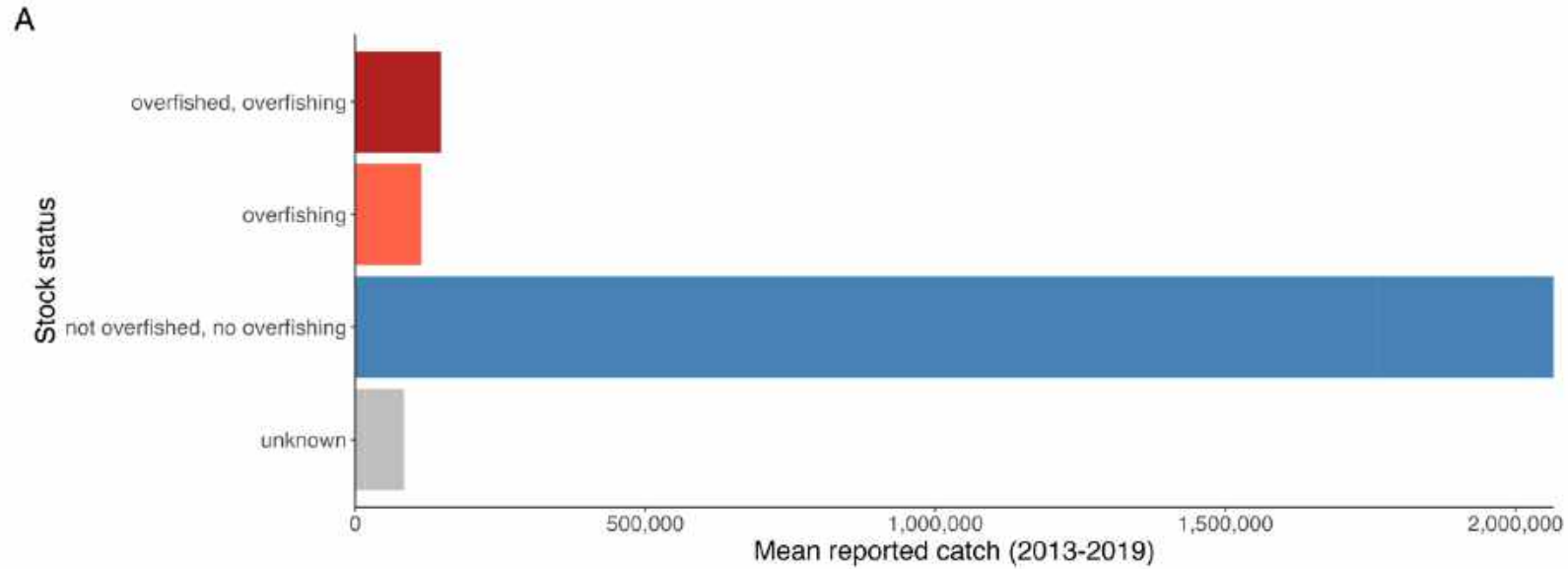
Most non-commercial stocks are not assessed

20% of stocks assessed





By biomass, most stocks are 'not overfished / no overfishing'



Conservation and management implications

- tRFMO data reports reflect ~2.4 million elasmobranch captures per year
- Data collection and reporting standardization efforts could help inform catch estimates
- New assessment methods can help fill gaps for non-commercial species



Thank you!

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