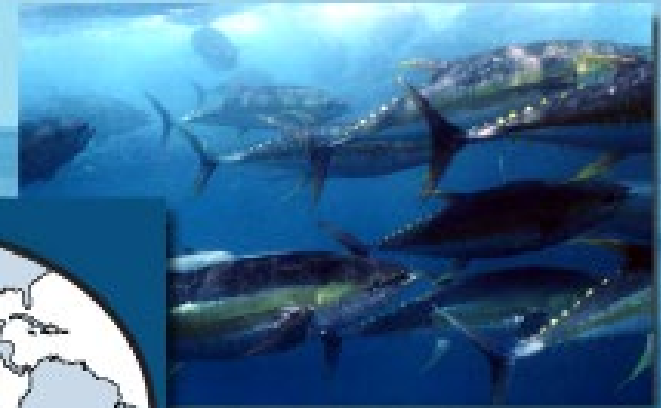
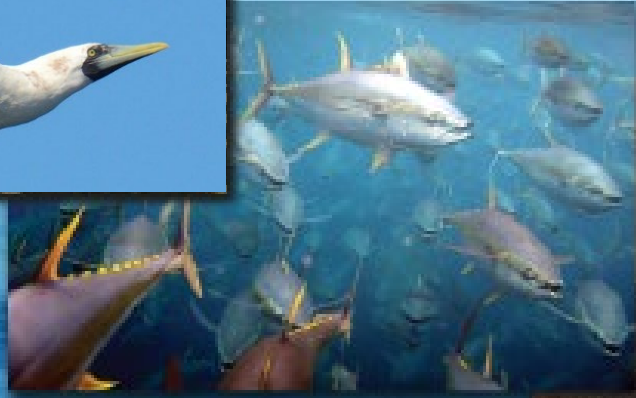


Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission

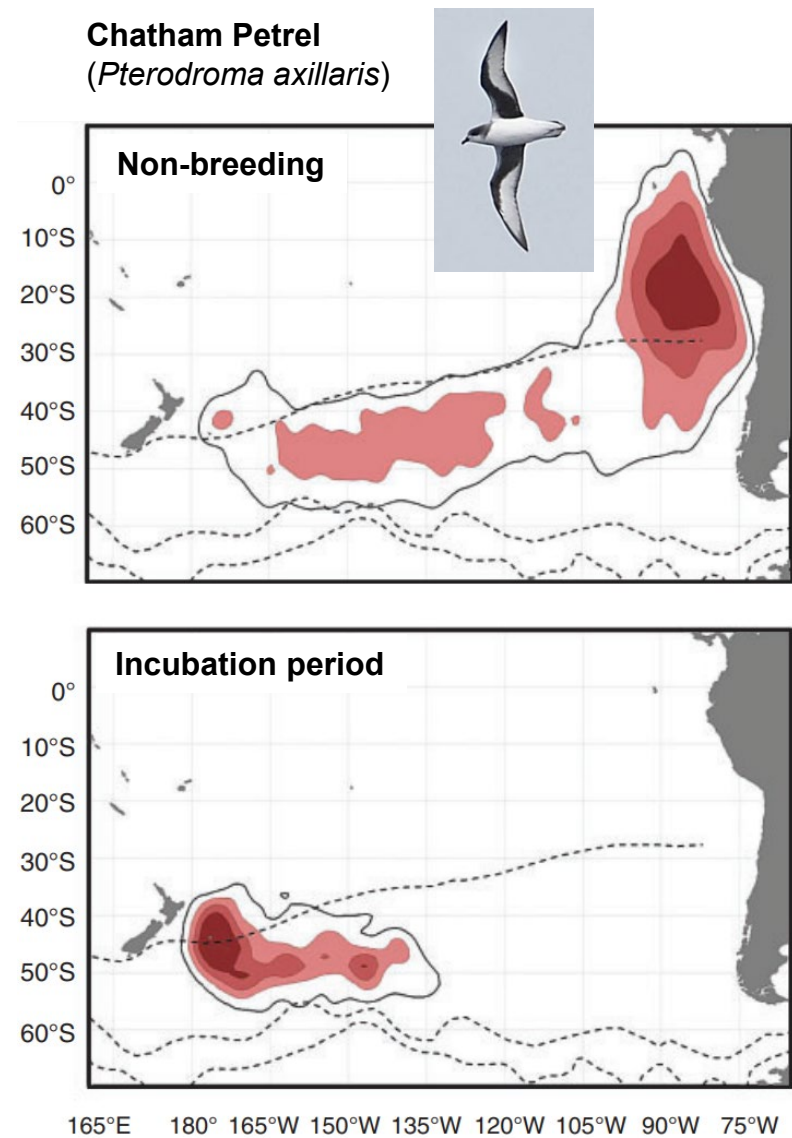


Preliminary analysis of spatial and temporal variation in seabird assemblages
in the eastern tropical Pacific Ocean

Shane Griffiths, **Peggy Loor-Andrade**, and Leanne Duffy

Seabirds in the EPO

- ~50 seabird species occur in the IATTC area
- Residents, seasonal residents, and migrants
- Petrels use the EPO to forage but breed elsewhere
- Close association with dolphins and tunas (feeding opportunity)
- Many seabirds caught as bycatch by fisheries, especially by longline
- Low reproductive capacity and destruction of breeding habitats add to population declines
- A renewed interest in seabirds by the IATTC?



IATTC responsibilities

- IATTC mandated to ensure ecological sustainability of its fisheries

1. Antigua Convention

- **Article II**, Objective: “...to ensure the long-term conservation and sustainable use of the fish stocks covered by this Convention.”
- **Article VII (f)** “...adopt, as necessary, conservation and management measures and recommendations for species belonging to the same ecosystem and that are affected by fishing...”

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2. IATTC Resolutions, Memoranda, and Strategic Science Plan

- Current resolution specific to seabirds: **C-11-02**
 - FAO International Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries (“IPOA-Seabirds”)
- MoU with the Agreement on the Conservation of Albatrosses and Petrels (ACAP)
- 5-year Strategic Science Plan (SSP): **Objective 4 - Ecological impacts of fisheries**



Resolution on seabirds C-11-02

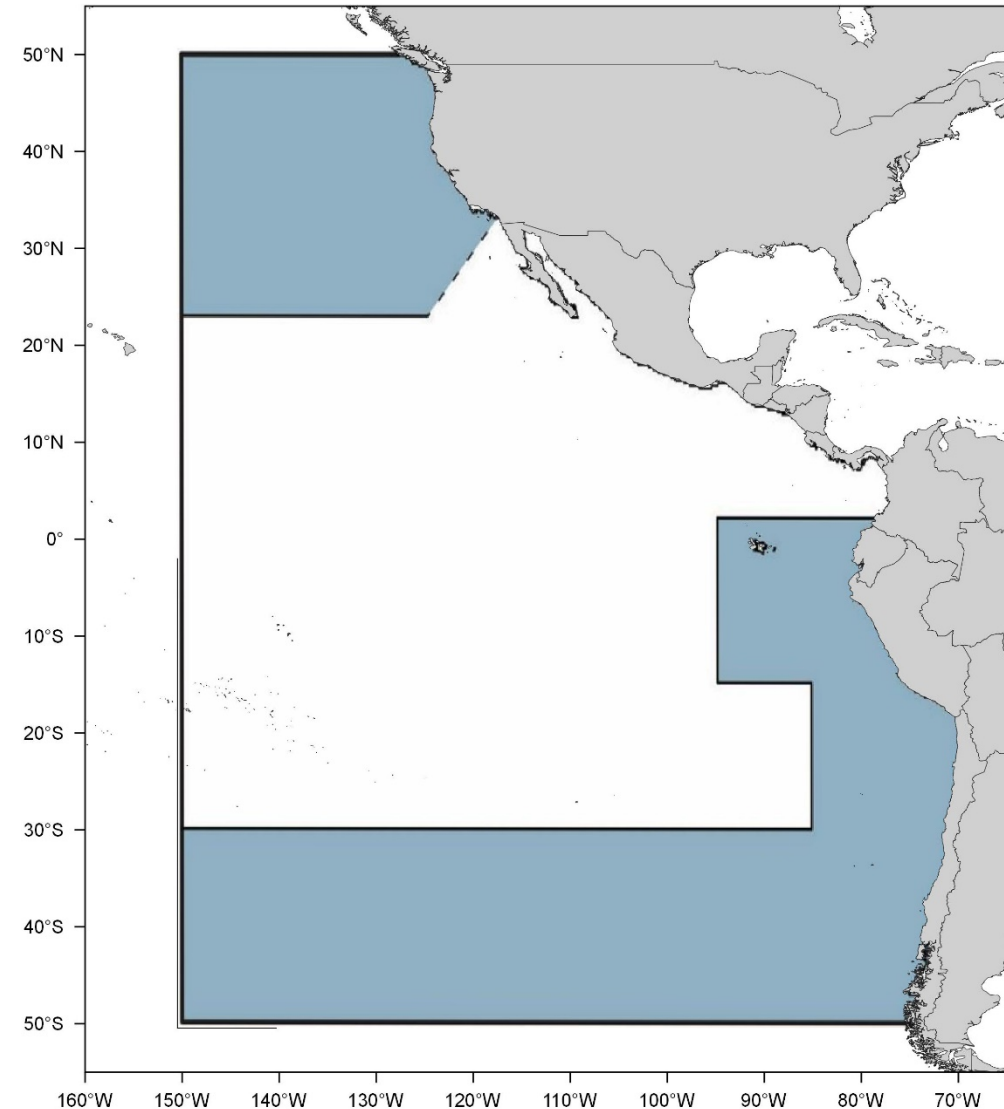
C-11-02 “Resolution to mitigate the impact on seabirds of fishing for species covered by the IATTC”

- Longliners >20 m require use of at least 2 seabird mitigation measures

- Side-setting with bird curtain and weighted lines
- Night setting with minimal deck lighting
- *Tori* line
- Weighted branch lines

And

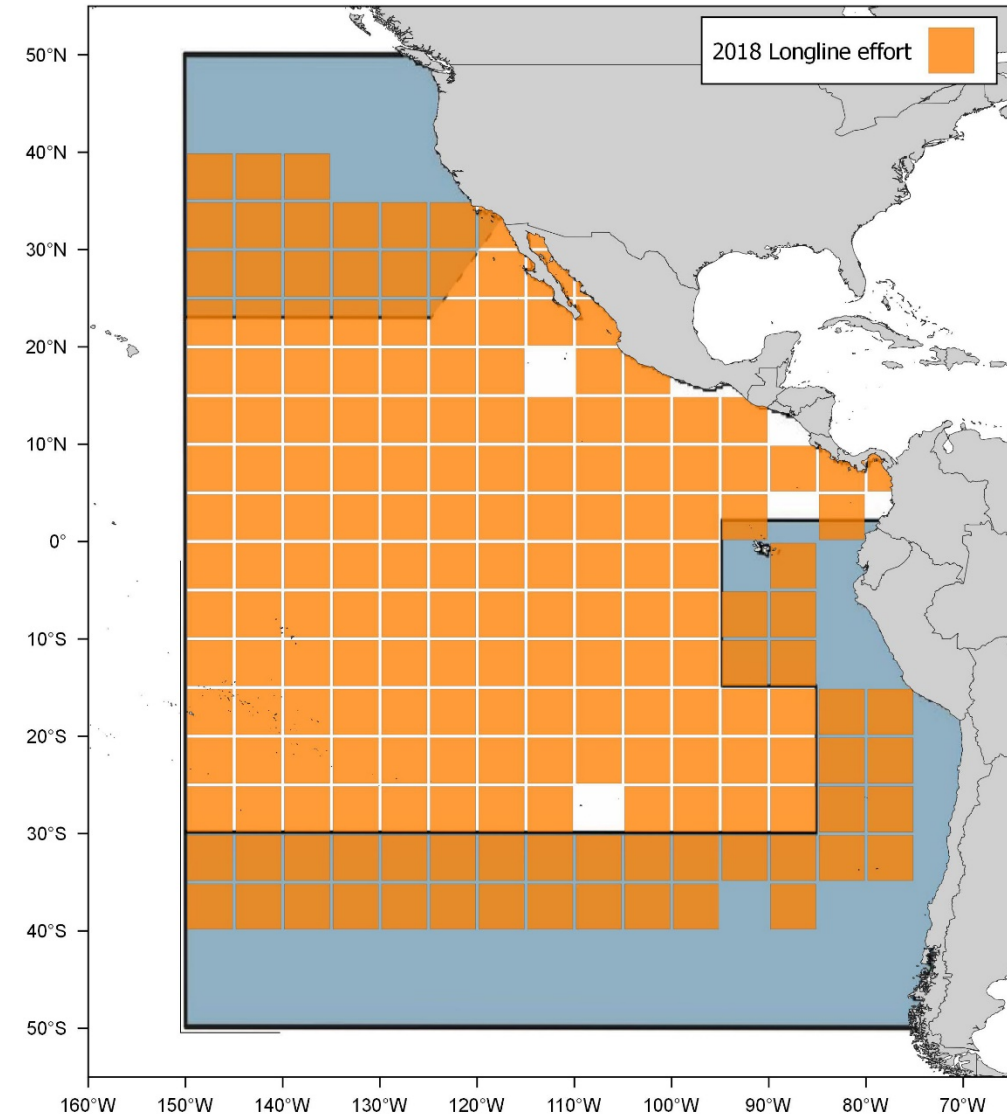
- Blue-dyed bait
- Deep-setting line shooter
- Underwater setting chute
- Management of offal discharge



Resolution on seabirds C-11-02

C-11-02 “Resolution to mitigate the impact on seabirds of fishing for species covered by the IATTC”

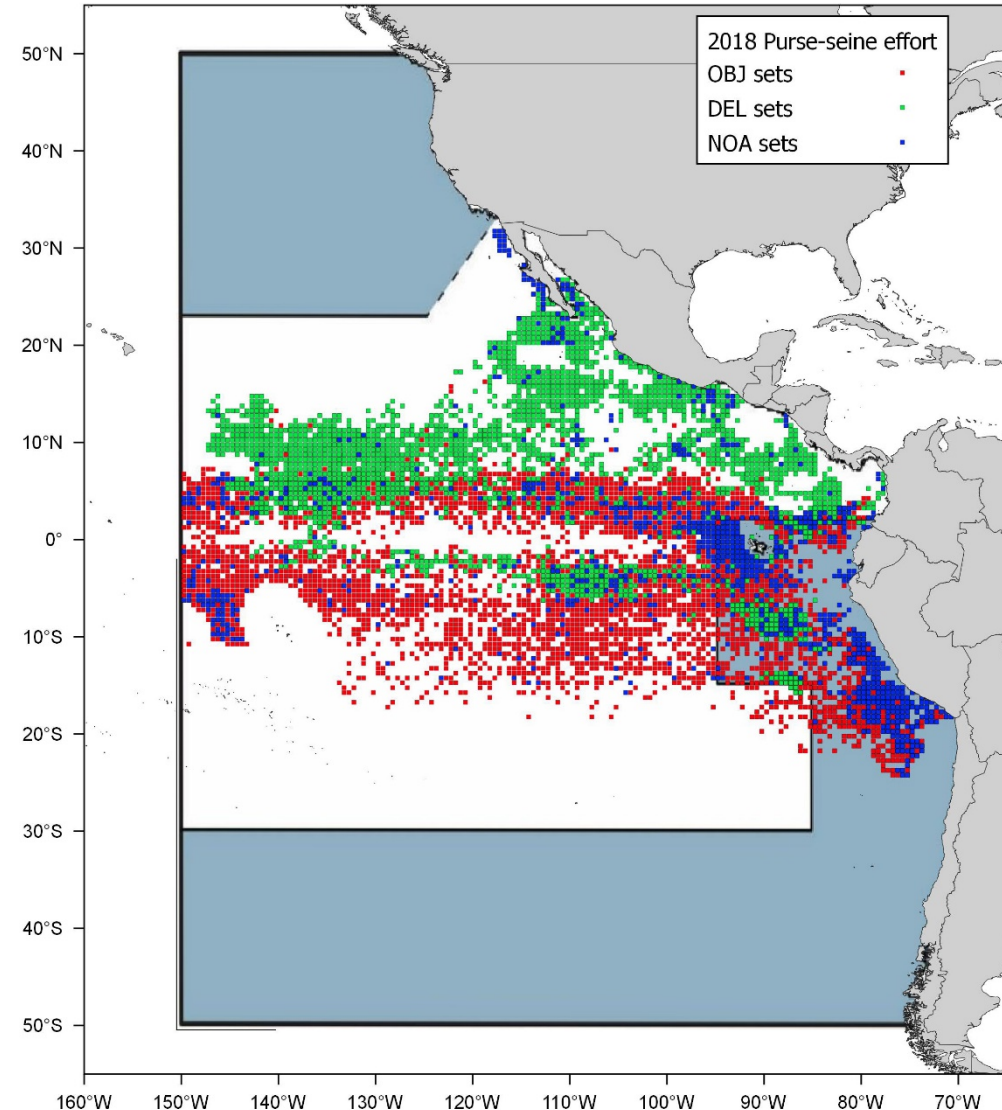
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- And
 - Blue-dyed bait
 - Deep-setting line shooter
 - Underwater setting chute
 - Management of offal discharge
- CPCs required to report annual interactions
 - IATTC longline data review showed little compliance¹
 - CPCs now required to provide set-by-set observer data



¹ Preliminary metadata review for the high-seas longline fishery (SAC-08-07b)

IATTC seabird data collection

- AIDCP dolphin observer program has 100% coverage of purse-seine vessels >363 mt
- Almost zero seabird mortality in purse-seine fishery history
- Since 1981, observers record seabird species and numbers associated with sets
- Due to methodological changes, data are suitable for analysis from 1993-2019
- Due to issues with standardizing relative abundance, analyses use presence-absence



IATTC seabird data

- 12,956,251 seabirds sighted from 289,954 sets for 1993-2019
 - OBJ – sets made in association with floating objects (e.g. FADs, logs)
 - DEL – sets made in association with dolphin schools
 - NOA – sets made on unassociated schools of tunas

Species/group	Common name	Total
<i>Sula leucogaster</i>	Brown booby	2,209,768
Procellariiformes	Petrels and shearwaters	1,693,545
<i>Puffinus pacificus</i>	Wedge-tailed shearwater	1,609,712
<i>Sula dactylatra</i>	Masked booby	1,480,456
<i>Puffinus spp.</i>	Shearwaters	1,184,523
<i>Sula spp.</i>	Boobies	1,180,615
<i>Puffinus puffinus / P. lherminieri</i>	Shearwaters	1,012,187
<i>Sterna spp.</i>	Black and white terns	945,005
<i>Fregata spp.</i>	Frigatebirds	687,131
<i>Sula sula</i>	Red-footed booby	452,453
Procellariiformes	Petrels	347,783
<i>Stercorarius spp.</i>	Jaegers	112,734
<i>Larus spp.</i>	Sea gulls	27,031
<i>Pelecanus spp.</i>	Pelicans	6,764
<i>Diomedea spp.</i>	Albatrosses	3,535
<i>Phaethon spp.</i>	Tropicbirds	2,327
Ardeidae	Herons	682

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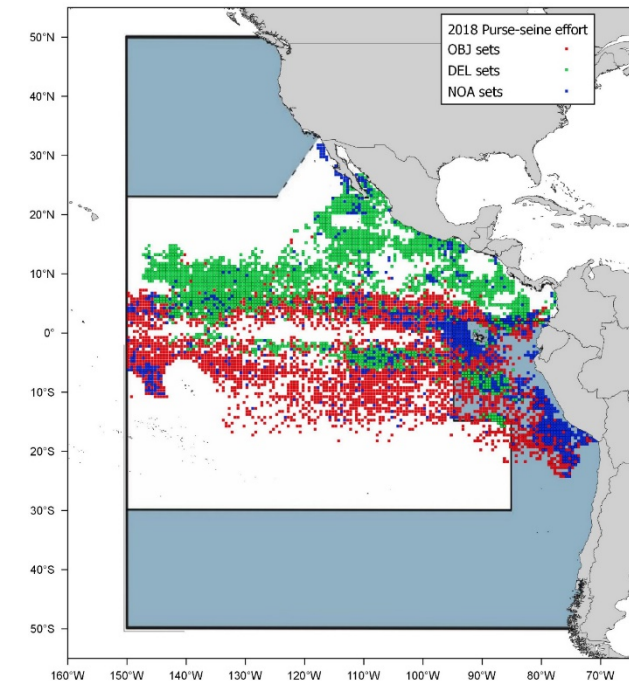
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Boobies & Shearwaters

IATTC seabird data

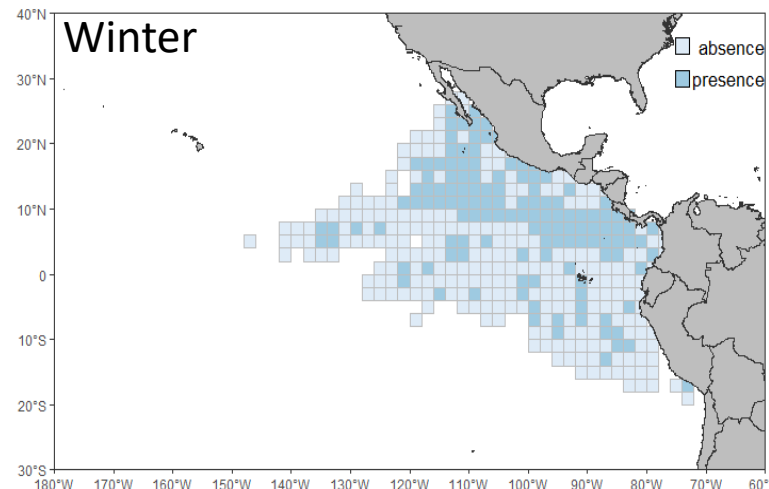
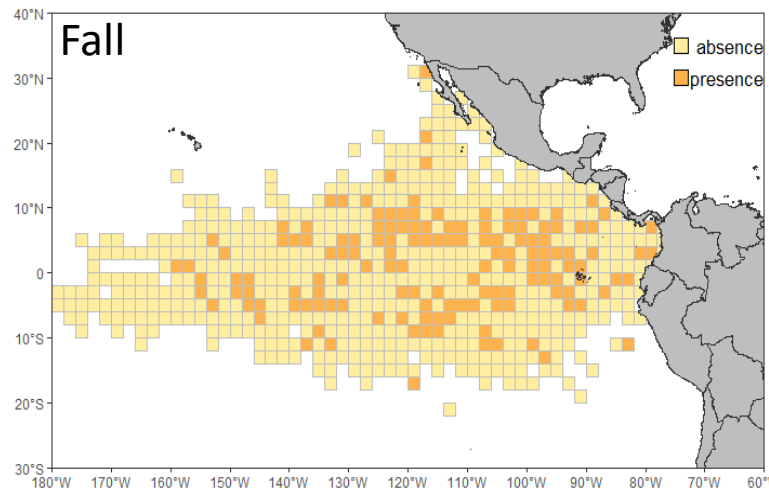
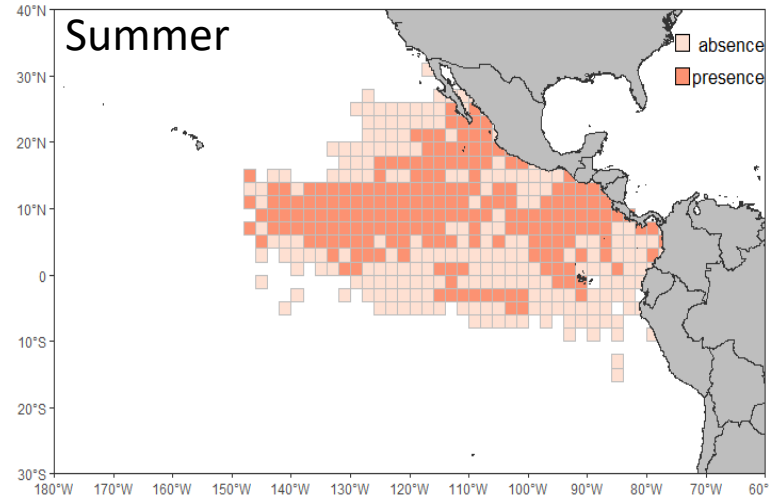
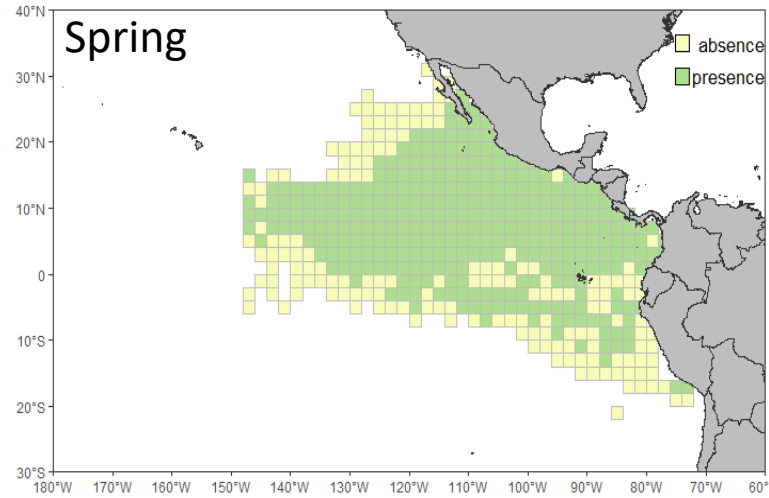
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Spatial distribution of seabirds by season

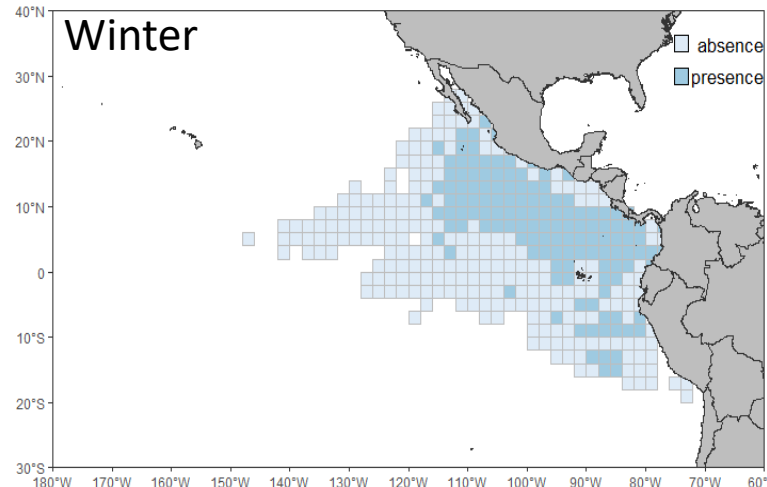
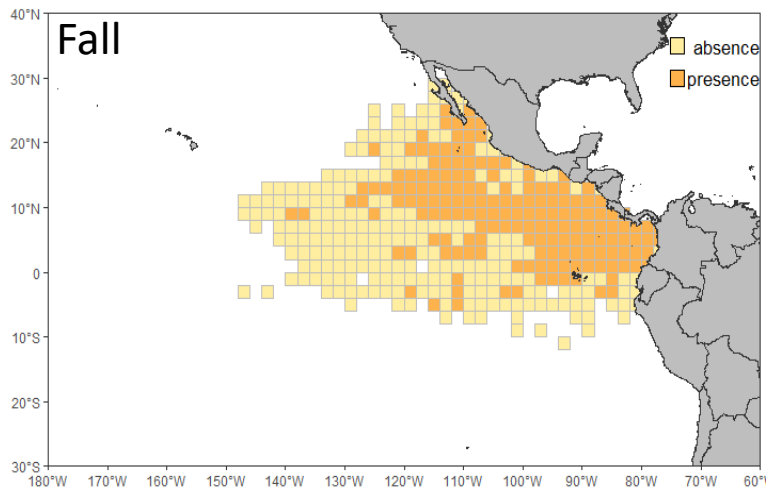
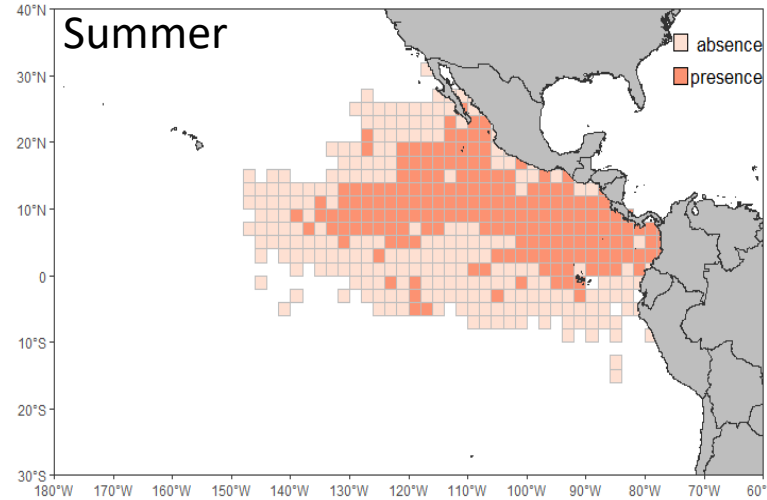
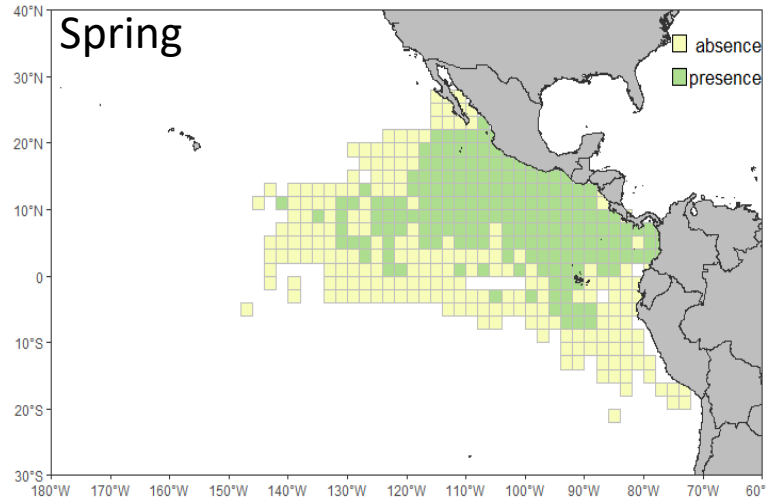
Wedge-tailed shearwater, *Puffinus pacificus* (DEL)



- Mostly observed in spring & summer (summer breeding)
- Breed on islands or isolated locations, perform long distance movements
- Forage in areas with higher primary production

Spatial distribution of seabirds by season

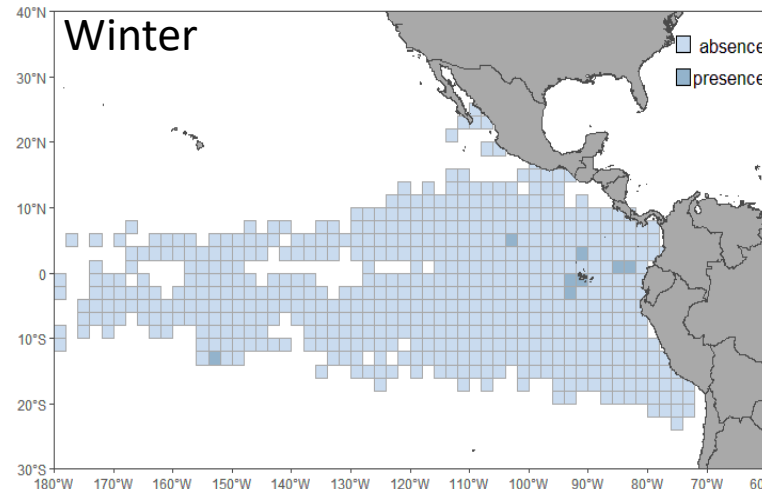
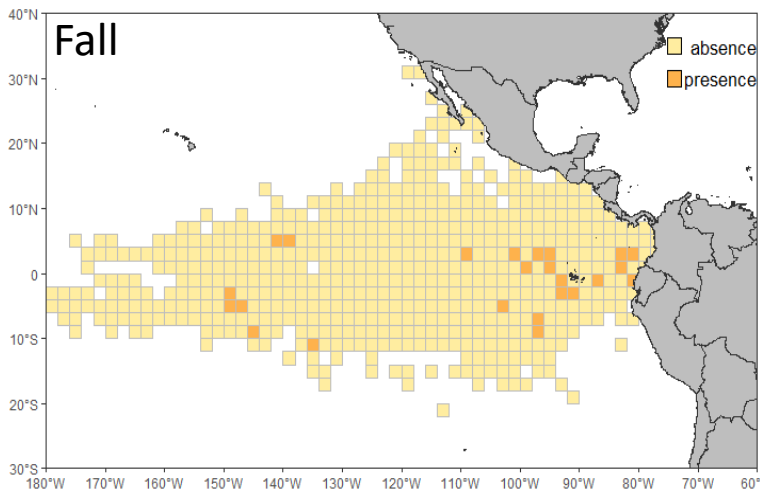
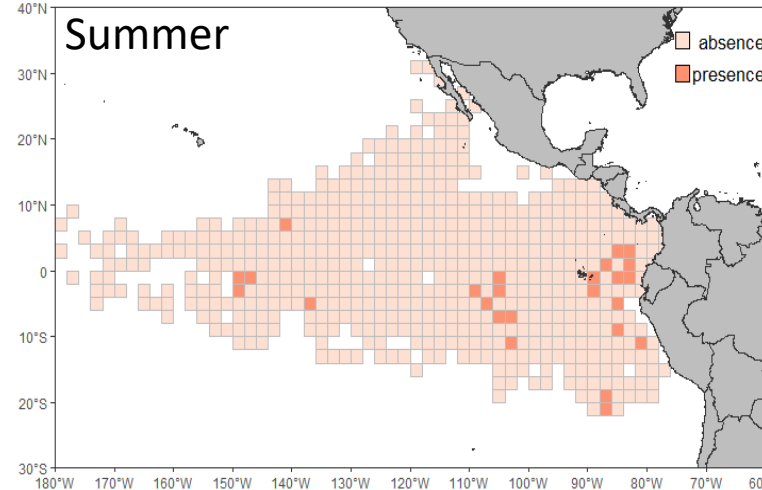
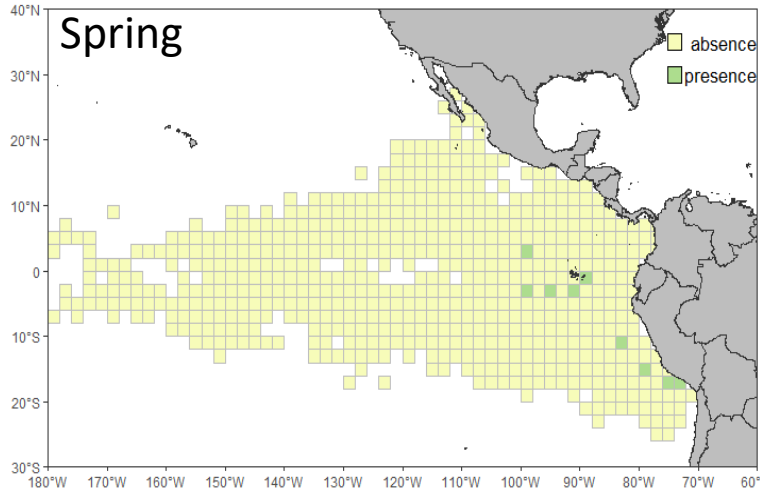
Red-footed booby, *Sula sula* (DEL)



- Westward presence in spring-summer
- Laying can occur throughout the year
- Peak of chick-rearing fall-winter closer to the continent

Spatial distribution of seabirds by season

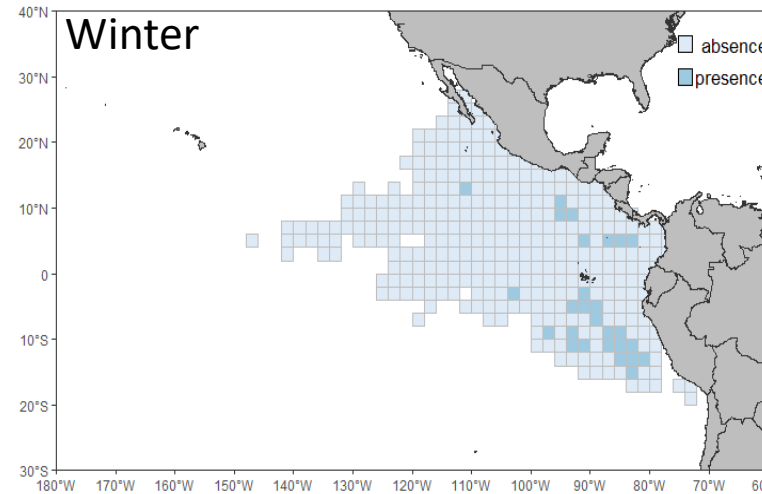
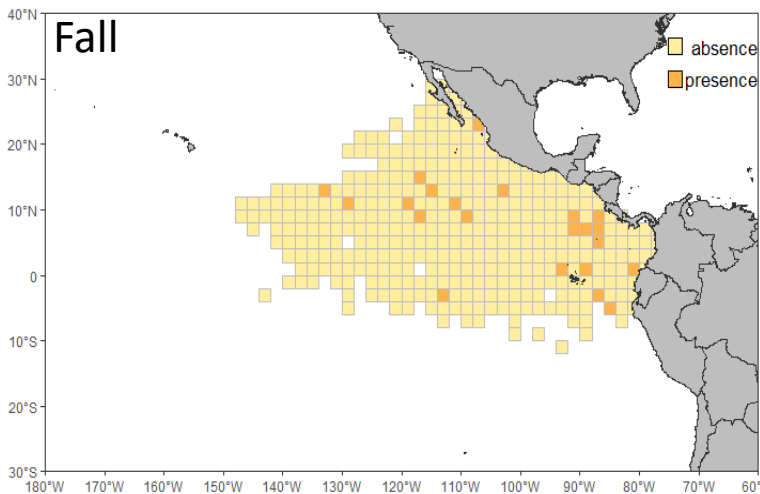
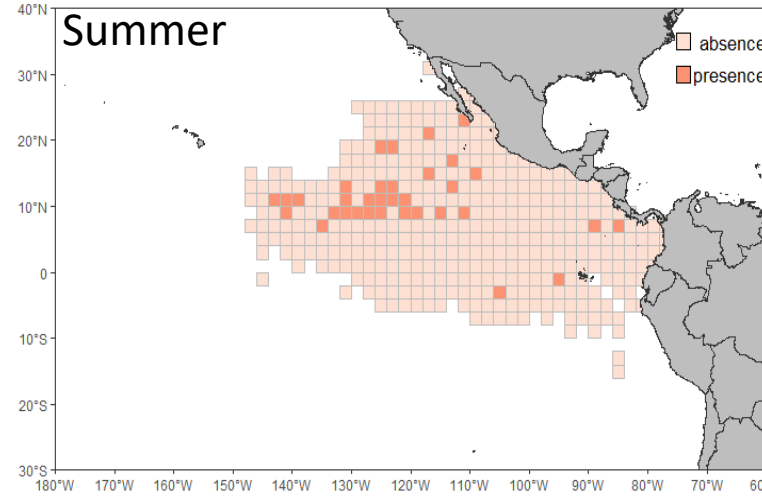
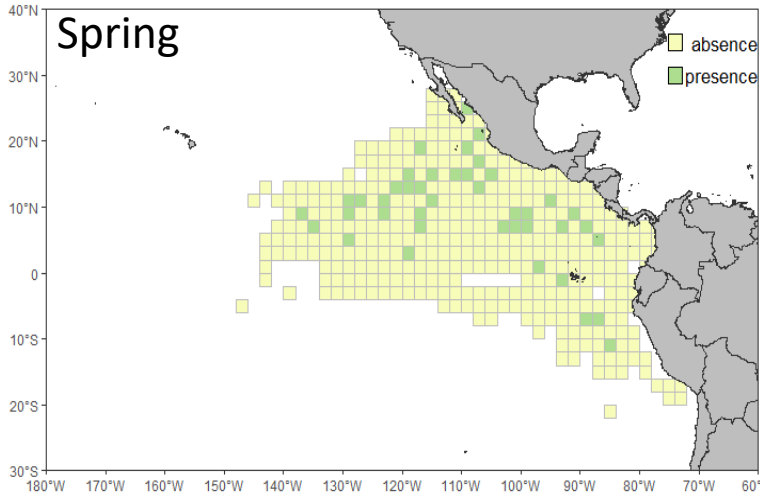
Albatrosses, *Diomedea spp.* (NOA)



- Breeding colonies in Galapagos islands travel to shelf waters during breeding-incubation period (winter-spring)
- Disperse in summer & fall

Spatial distribution of seabirds by season

Tropicbirds, *Phaethon spp.* (DEL)



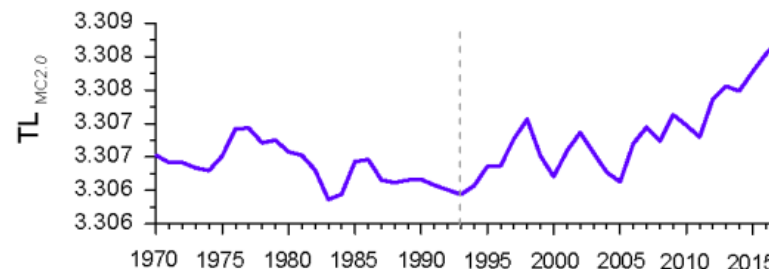
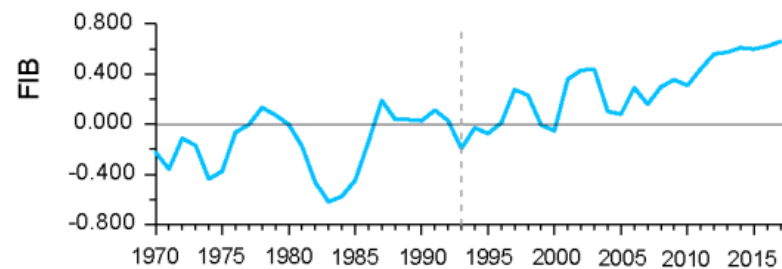
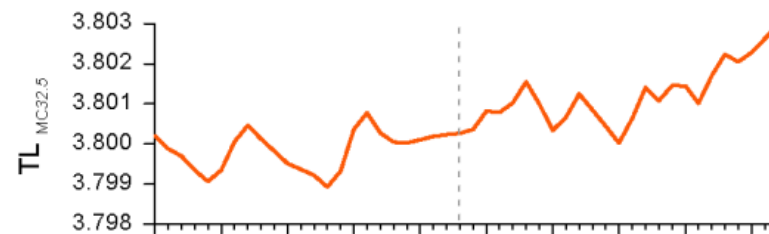
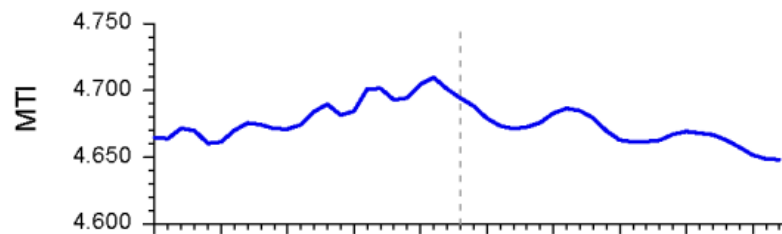
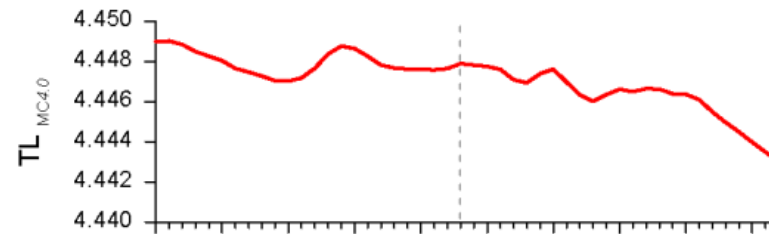
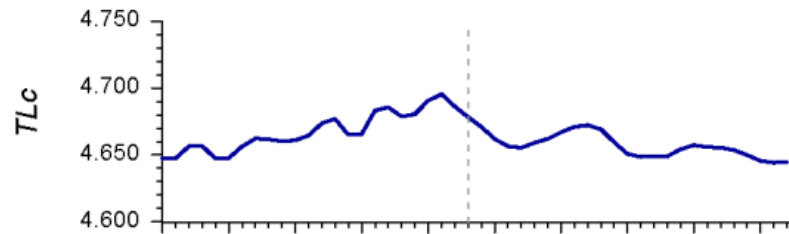
- Southward presence during winter (coast of Peru) to feed in productive waters
- Westward presence in spring and summer – island breeding?
- Red-tailed tropicbird (summer breeding)

Conclusions and future work

- Seabirds given little previous attention by IATTC – obvious tuna focus
- The first update on seabird data by IATTC since 2006: 25+ years of data
- Increasing obligations for IATTC and CPCs to report on all components of the ecosystem
 - Antigua Convention since 2010
 - Eco-labelling certification (e.g. dolphin-yellowfin tuna fishery)
 - CITES permits (e.g. sharks)
- Seabird presence varies widely in space and time, and by species
- IATTC's seabird data valuable for better understanding species population trends, community dynamics & climate impacts

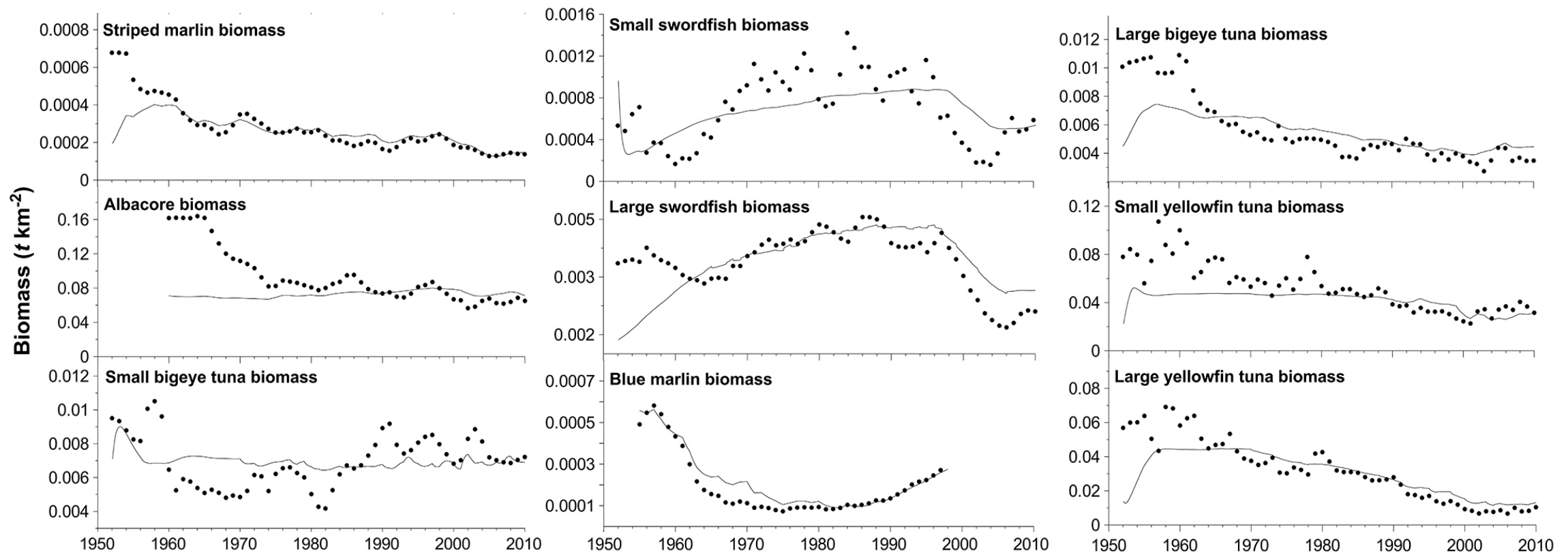
Conclusions and future work

- EBFM may be assisted by ecosystem models that can be used to monitor the structure and integrity of the EPO ecosystem
- From 2018, ecosystem indicators have been reported annually



Conclusions and future work

- Seabird data will improve calibrating ecosystem models using long time series of relative abundance data across various trophic levels



Conclusions and future work

- Data may allow annual reporting of relative abundance of “indicator” species in the IATTC “*Ecosystems Considerations*” report (SAC and FSR)
 - Mortalities and interactions of other TEPs (e.g. turtles, marine mammals)

TABLE 1. Incidental mortality of dolphins and other marine mammals caused by the purse-seine fishery in the EPO, 2018.

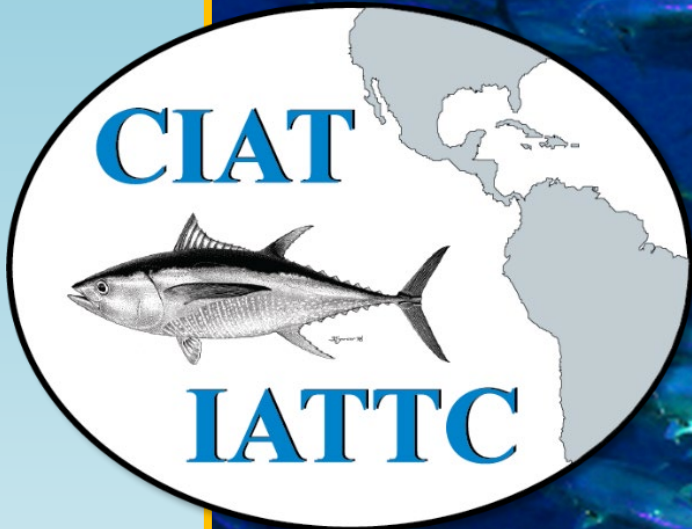
Species and stock	Incidental mortality	
	Numbers	t
Offshore spotted dolphin		
Northeastern	99	6.5
Western-southern	197	12.9
Spinner dolphin		
Eastern	252	11.2
Whitebelly	205	12.4
Common dolphin		
Northern	41	2.9
Central	1	0.1
Southern	18	1.3
Other mammals*	6	0.4
Total	819	47.5

TABLE 3. Preliminary catches, in tons, of sharks and rays in the EPO by large purse-seine vessels, by set type, 2018, and by longline vessels, 2017. *Longline sample data should be considered minimum catch estimates due to incomplete data reporting (see section 2.1)

Species	Purse seine				Long-line*
	OBJ	NOA	DEL	Total	
Silky shark (<i>Carcharhinus falciformis</i>)	400	11	20	431	2,626
Oceanic whitetip shark (<i>C. longimanus</i>)	3	-	<1	3	202
Hammerhead sharks (<i>Sphyrna</i> spp.)	24	<1	<1	26	186
Thresher sharks (<i>Alopias</i> spp.)	<1	4	2	7	724
Mako sharks (<i>Isurus</i> spp.)	1	<1	<1	2	1,606
Other sharks	31	4	1	36	1,430
Blue sharks (<i>Prionace glauca</i>)	-	-	-	-	6,908
Manta rays (Mobulidae)	16	20	13	49	-
Pelagic sting rays (Dasyatidae)	<1	<1	<1	1	-

Conclusions and future work

- Analyze oceanographic features driving seabird distribution - possible bycatch mitigation tool (e.g. ECOCAST)
- Limitations to current fishery-dependent sampling by observers
 - Observations only from regions fished by purse-seine vessels (Class 6), no longline
 - Sampling by observers having many dolphin- and tuna-related tasks may be 'opportunistic'
 - Species ID quality varies with observer competence and sighting distance
 - Standardizing abundance an issue as a result
- Comments and collaboration are very much welcome



Questions?

