ILLUMINATED GILLNETS TO REDUCE BYCATCH IN THE SMALL-SCALE PERUVIAN FISHERY

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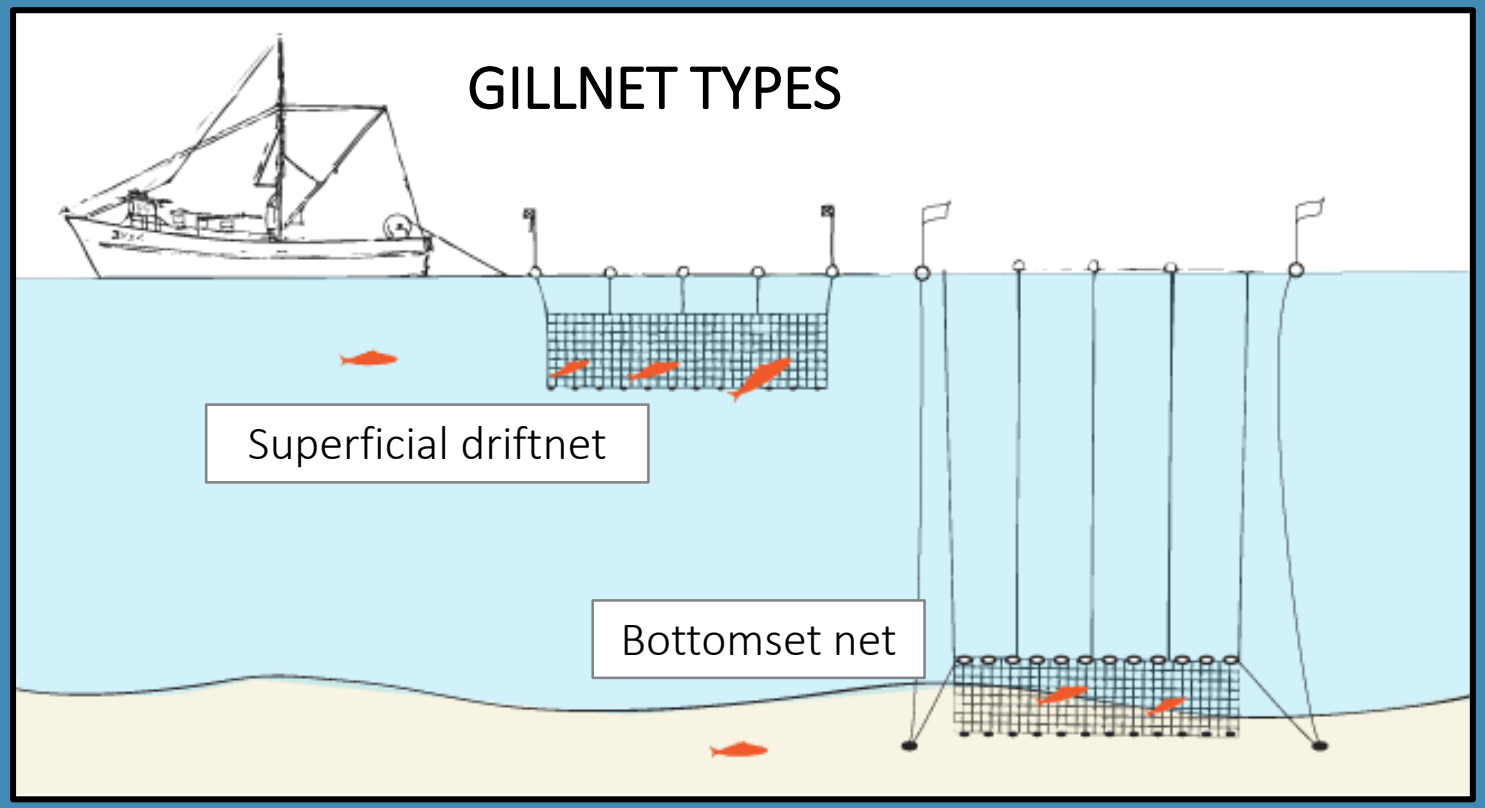


The fishery

- Vessels < 15 m
- Gillnets: driftnets and bottomset nets
- Opportunistic: sharks, rays, tuna, dolphinfish, mackerel, sailfish
- 100 000 km/year

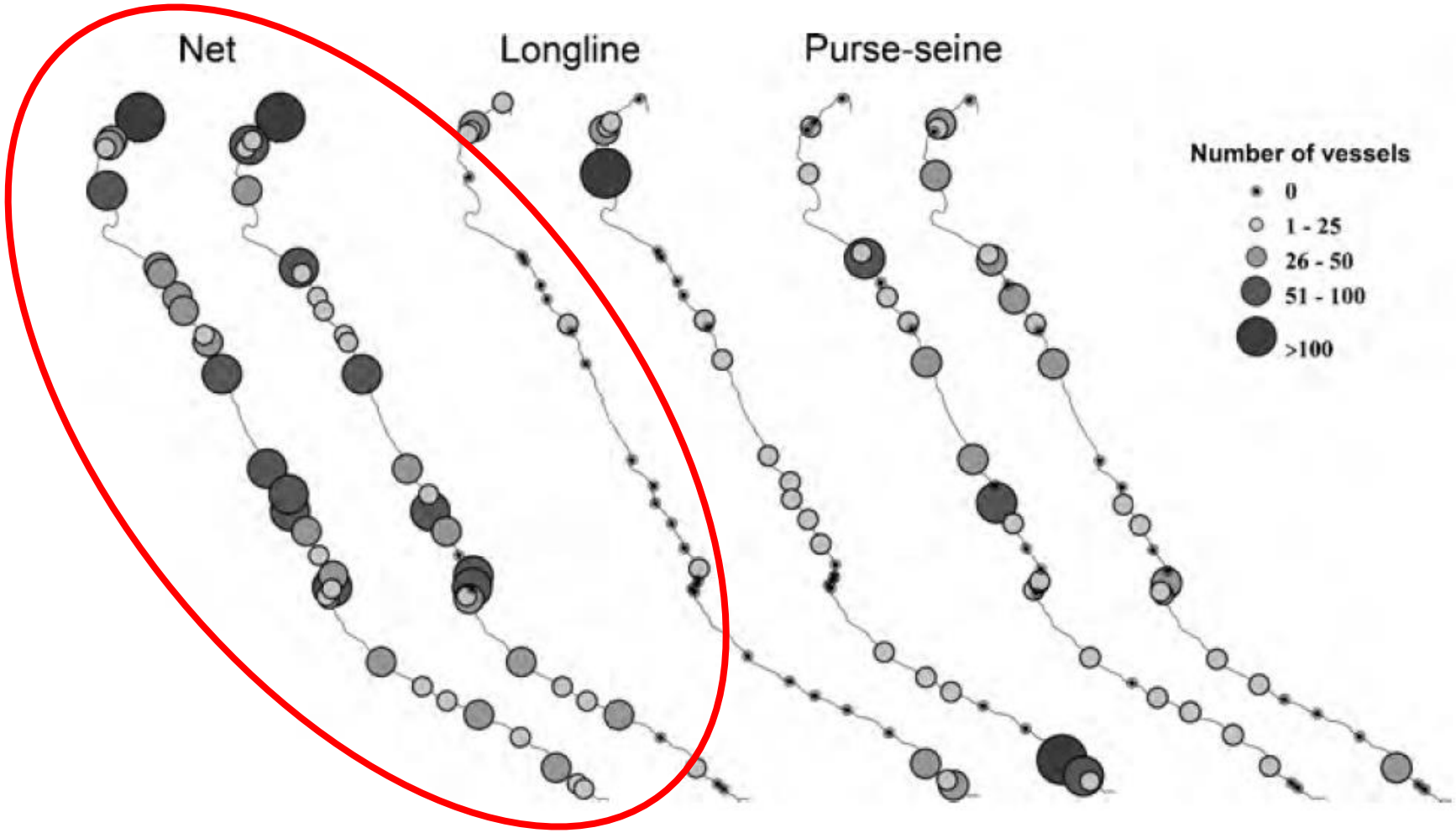


Fig. 2. Coastline maps of Peru showing the change in distribution of net, longline, and purse seine vessels at each sampled port ($n = 30$; cf. Appendix 1) from 1994–1995 (Escudero, 1997; left map of each pair) to 2004 (this study; right map of each pair). Number of vessels is indicated by the scaled bubbles.

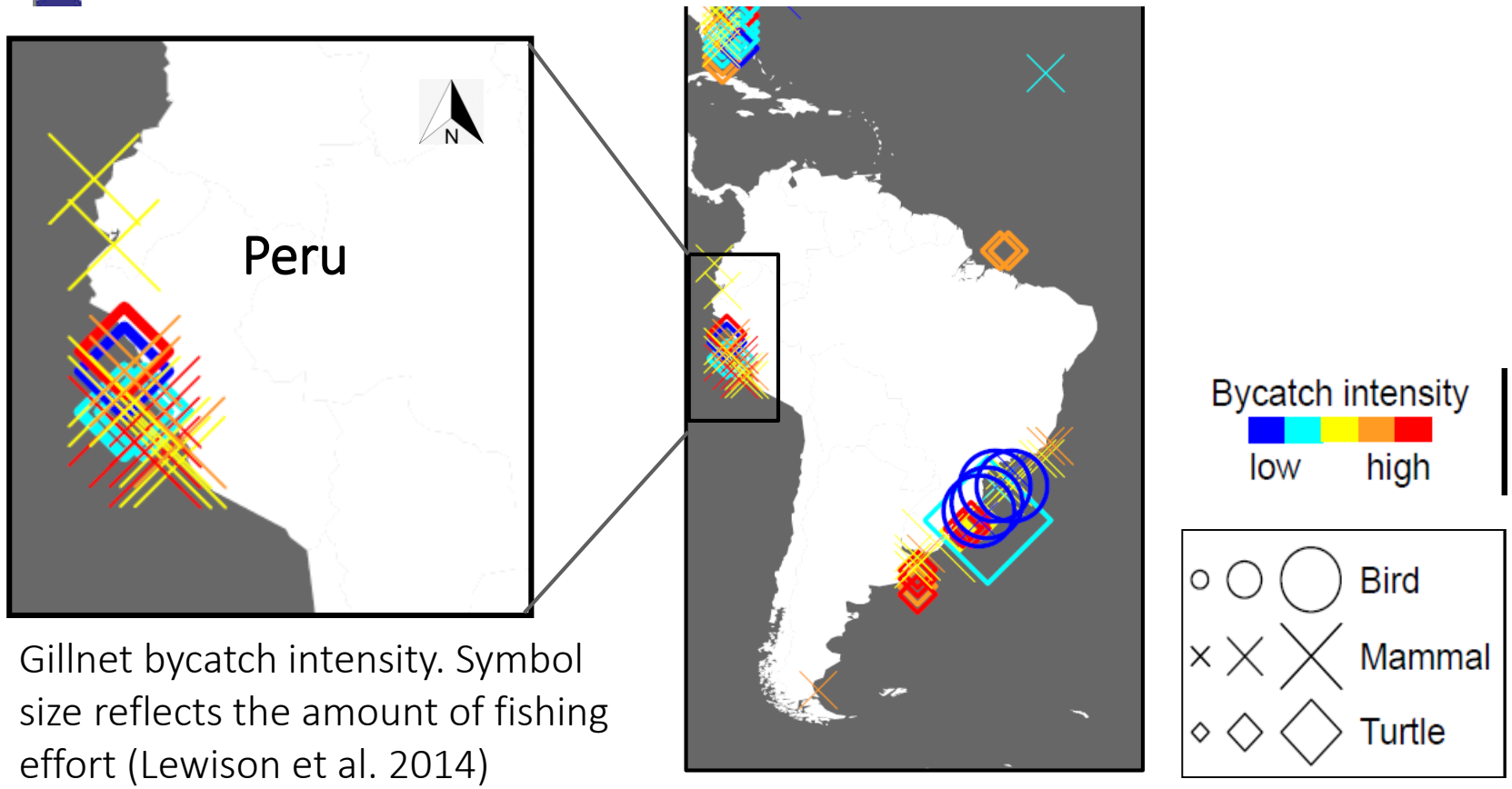
(Alfaro-Shigueto et al. 2010)

Bycatch in Peru

PNAS

Global patterns of marine mammal, seabird, and sea turtle bycatch reveal taxa-specific and cumulative megafauna hotspots

Rebecca L. Lewison[a,1], Larry B. Crowder[b], Bryan P. Wallace[c], Jeffrey E. Moore[d], Tara Cox[e], Ramunas Zydelis[f], Sara McDonald[g], Andrew DiMatteo[h], Daniel C. Dunn[i], Connie Y. Kot[i], Rhema Bjorkland[j], Shaleyla Kelez[k], Candan Soykan[l], Kelly R. Stewart[d,m], Michelle Sims[n], Andre Boustany[g], Andrew J. Read[i], Patrick Halpin[g], W. J. Nichols[o], and Carl Safina[p]



Gillnet bycatch intensity. Symbol size reflects the amount of fishing effort (Lewison et al. 2014)

Bycatch in Peru

- **Sea turtles**
- Small cetaceans
- Seabirds

838 km of nets observed in which 172 turtles caught

Tens of thousands/year

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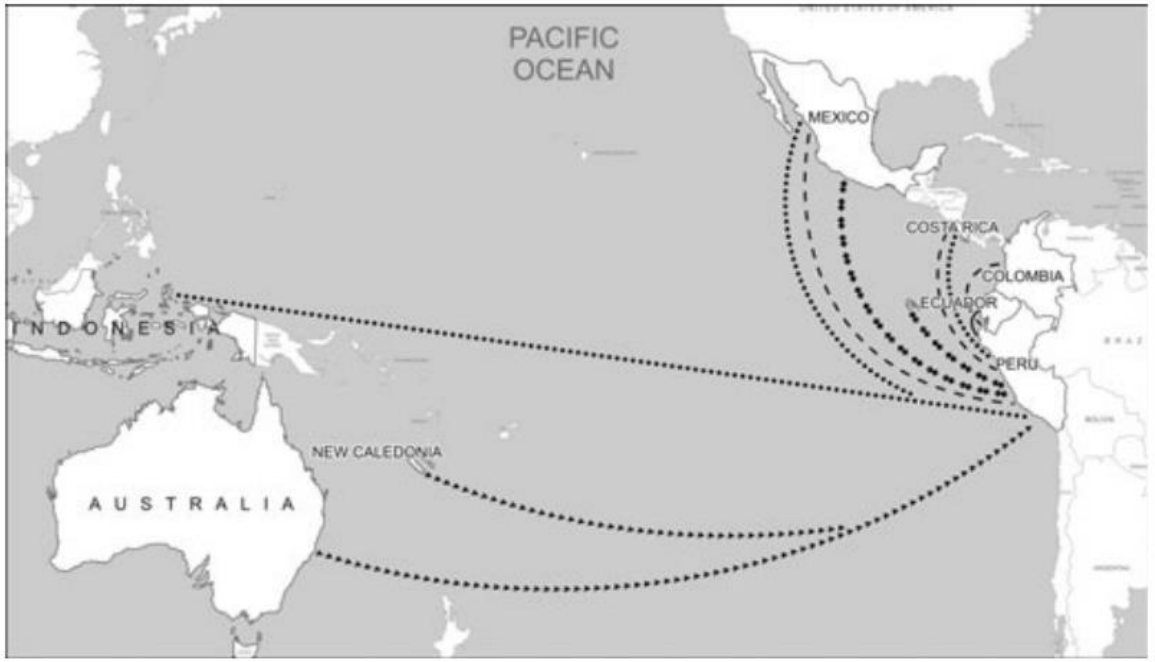
British Ecological Society
Journal of Applied Ecology 2011, **48**, 1432–1440 doi: 10.1111/j.1365-2664.2011.02040.x

Small-scale fisheries of Peru: a major sink for marine turtles in the Pacific

Joanna Alfaro-Shigueto[1,2], Jeffrey C. Mangel[1,2], Francisco Bernedo[2], Peter H. Dutton[3], Jeffrey A. Seminoff[3] and Brendan J. Godley[1]*







Bycatch in Peru

- Sea turtles
- **Small cetaceans**
- Seabirds

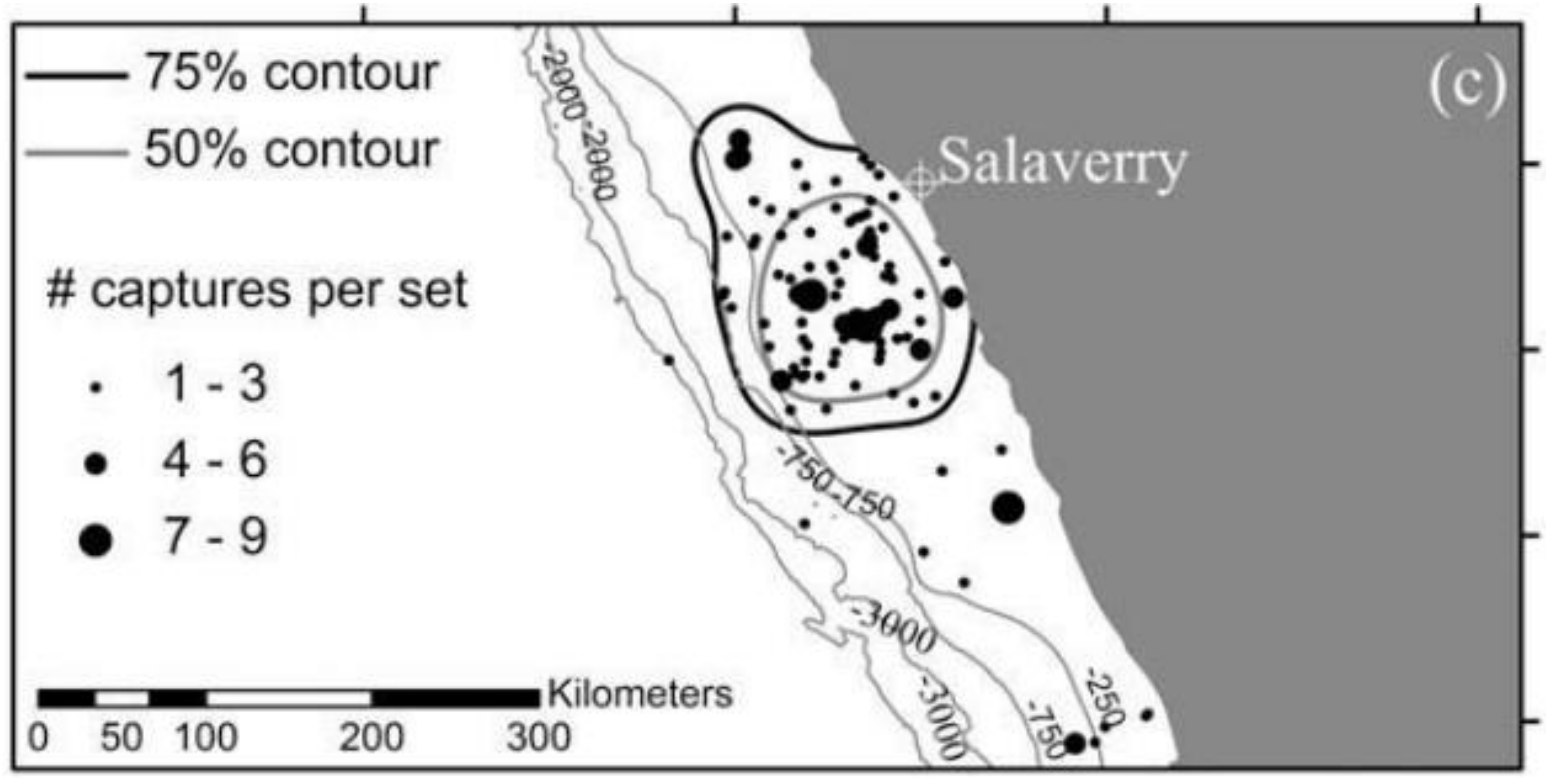
Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

Small cetacean captures in Peruvian artisanal fisheries: High despite protective legislation

Jeffrey C. Mangel [a,b,*], Joanna Alfaro-Shigueto [a,b], Koen Van Waerebeek [c], Celia Cáceres [a], Stuart Bearhop [b], Matthew J. Witt [b], Brendan J. Godley [b]



Bycatch in Peru

- Sea turtles
- Small cetaceans
- **Seabirds**

Conservation Biology

Catch and Bycatch of Sea Birds and Marine Mammals in the Small-Scale Fishery of Punta San Juan, Peru

Captura Accidental de Aves y Mamíferos Marinos en la Pesquería de Pequeña Escala en Punta San Juan, Perú

Patricia Majluf, Elizabeth A. Babcock, Juan Carlos Riveros, Milena Arias Schreiber, William Alderete

Net illumination

- Green turtles: ↘ 63.9% (Ortiz et al. 2016)
- Guanay cormorants: ↘ 85.1% (Mangel et al. 2018)
- Not only in Peru (Wang et al. 2010; Virgili et al. 2018)

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Research

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Illuminating gillnets to save seabirds and the potential for multi-taxa bycatch mitigation

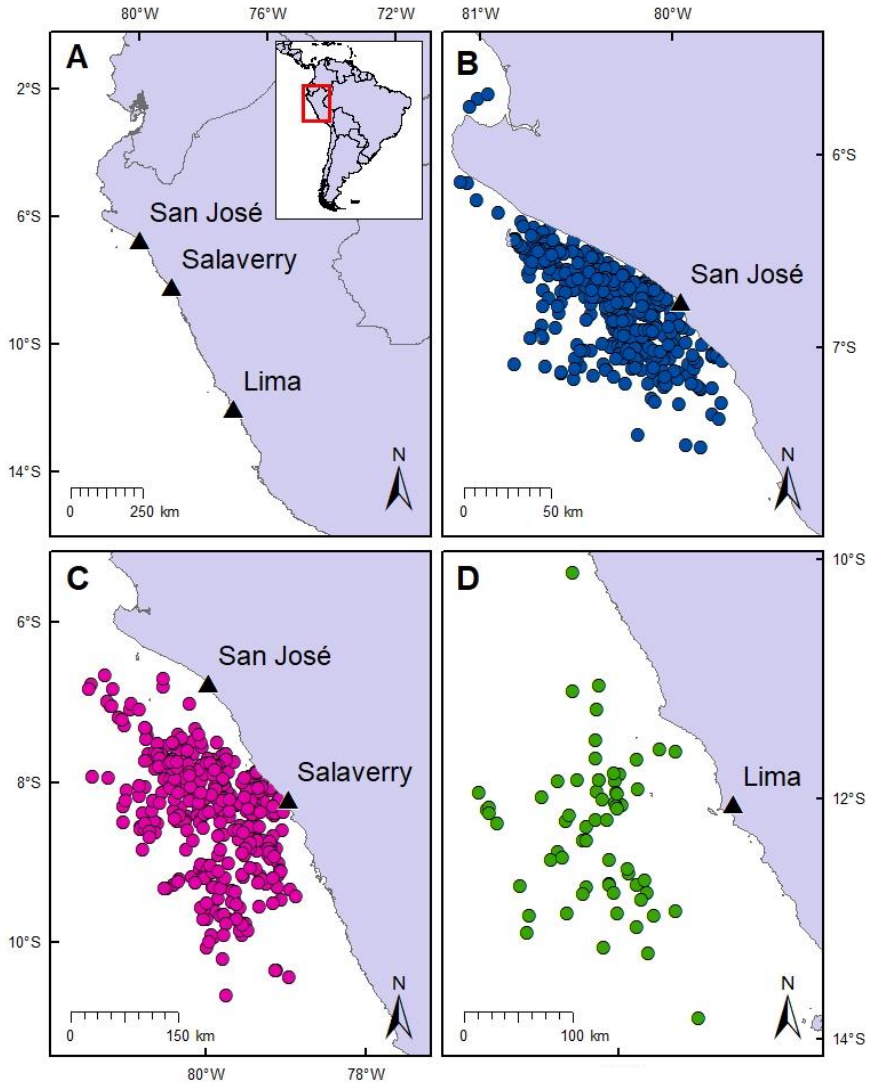
Jeffrey C. Mangel[1,2], John Wang[3], Joanna Alfaro-Shigueto[1,2,4], Sergio Pingo[1], Astrid Jimenez[1], Felipe Carvalho[3], Yonat Swimmer[3] and Brendan J. Godley[2]

Reducing green turtle bycatch in small-scale fisheries using illuminated gillnets: the cost of saving a sea turtle

Natalia Ortiz[1], Jeffrey C. Mangel[1,2,*], John Wang[3], Joanna Alfaro-Shigueto[1,2,4], Sergio Pingo[1], Astrid Jimenez[1], Tania Suarez[1], Yonat Swimmer[3], Felipe Carvalho[3,5], Brendan J. Godley[2]

LEDs – Bielli et al. 2019

Under review



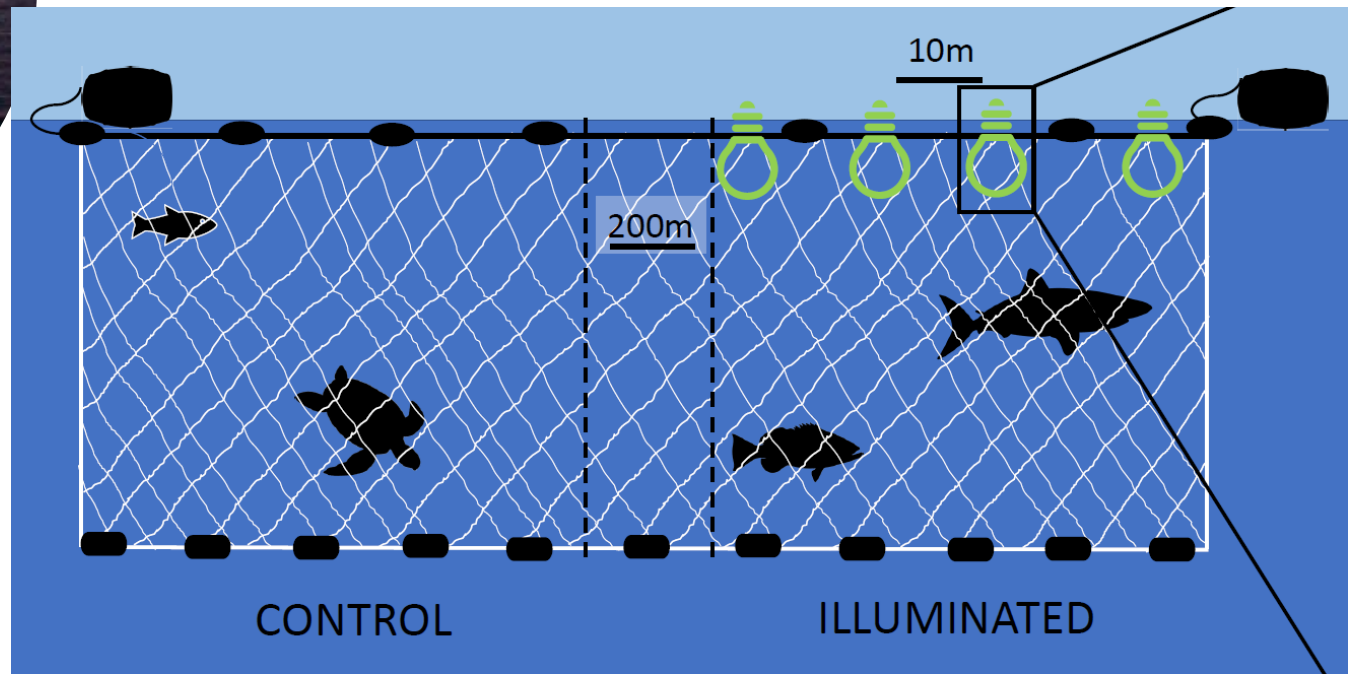
Fishing set locations.

2015 – 2018

864 sets

Real fishery conditions

LEDs – light emitting diodes



Experimental design, not to scale

Analysis

Generalized linear mixed-effect models (GLMM)

- Full models:

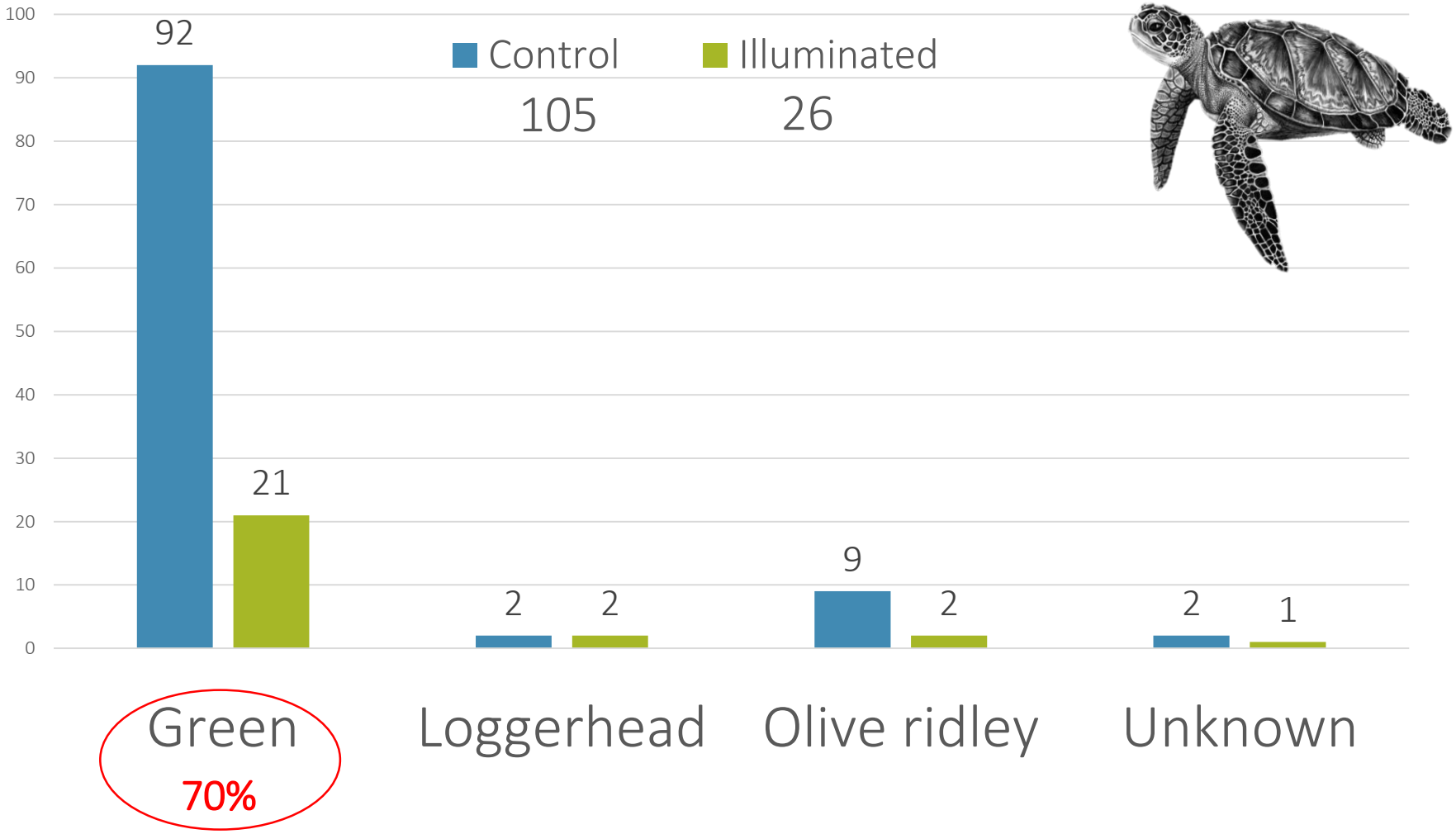
Bycatch probability ~ Effort + Treatment + Net type



Target catch ~ Treatment + Net type + offset(log(Effort)

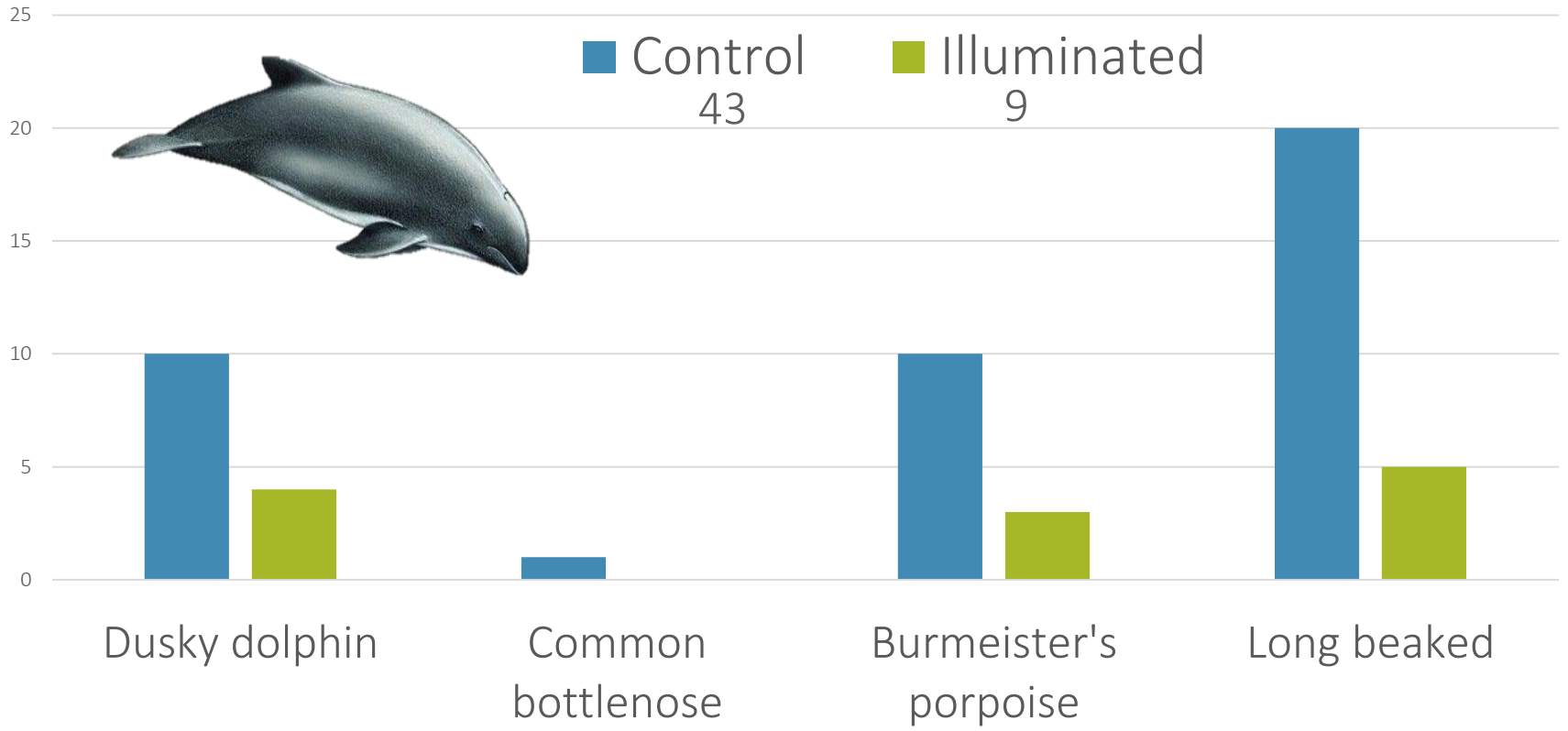


Results -bycatch



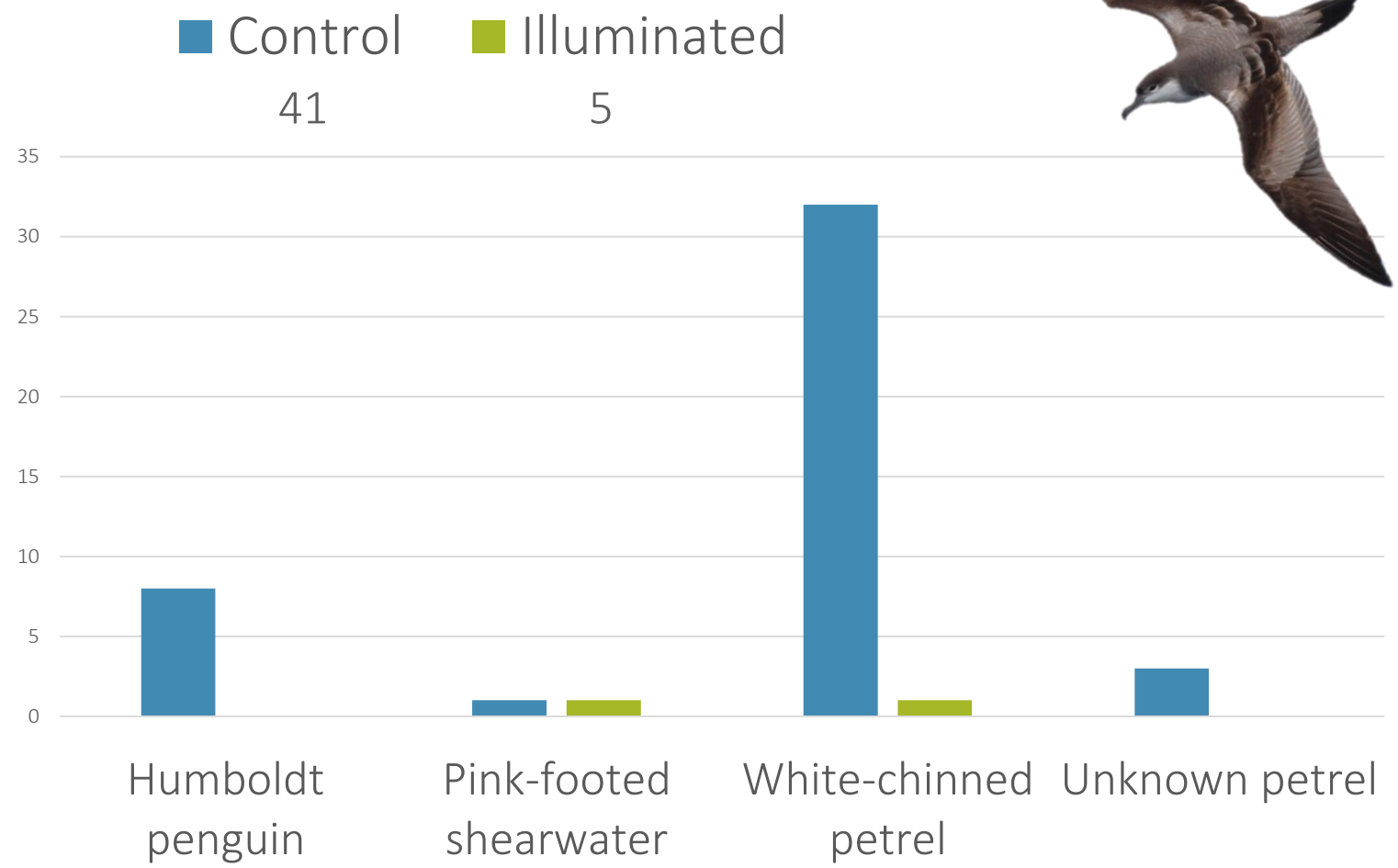
Number of individuals captured by species, in control and illuminated nets

Results -bycatch



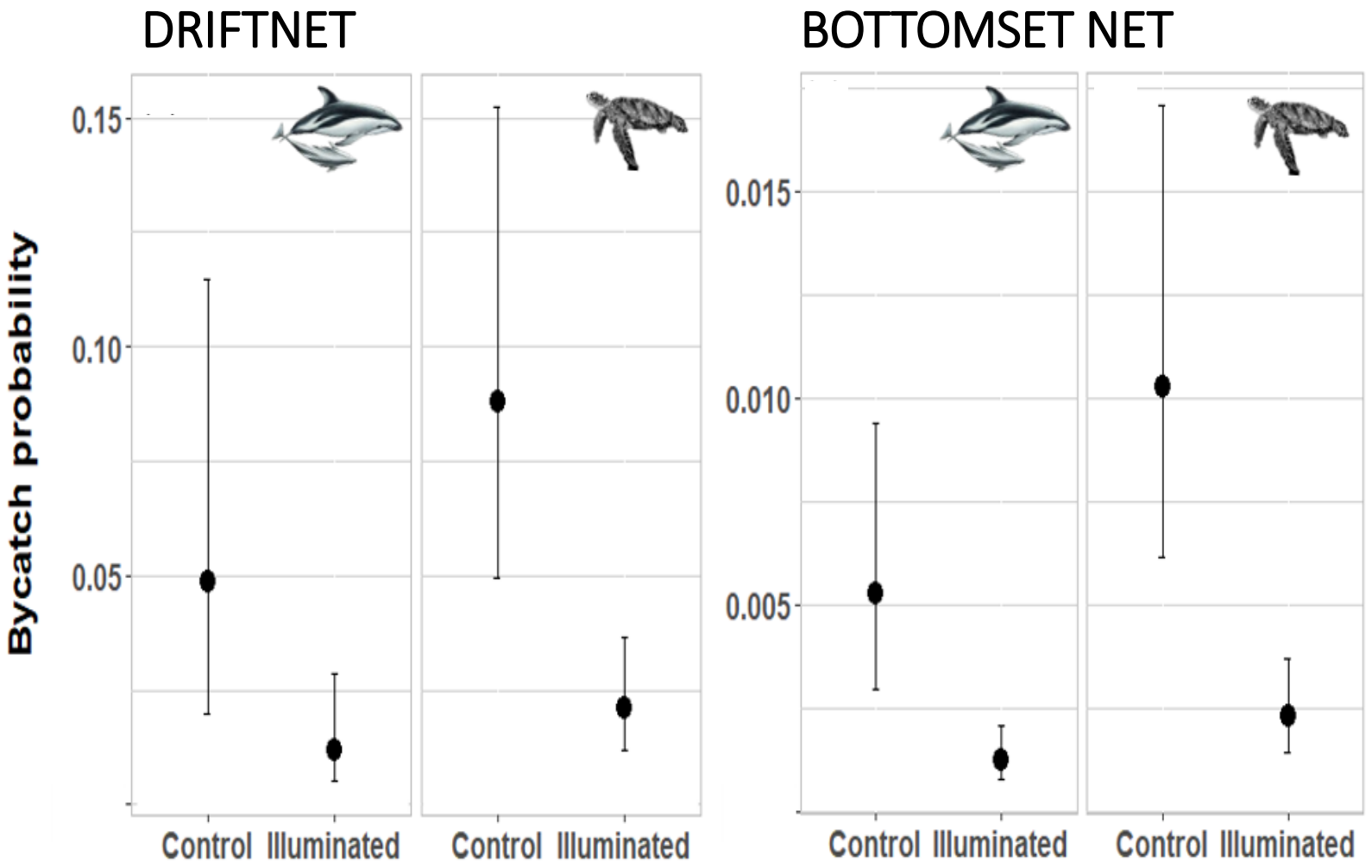
Number of individuals captured by species, in control and illuminated nets

Results -bycatch



Number of individuals captured by species, in control and illuminated nets

Best model: ~ Treatment + Net type



Expected bycatch probability per set estimated from the models.

Bycatch probability reduction

	Driftnet	Bottomset
Turtles	- 80.0%	- 76.1%
Small cetaceans	- 80.0%	- 75.0%

Bycatch probability reduction when LEDs applied

- Seabirds: no convergence

Results – target CPUE

SHARKS AND BONY FISH

Best model:

~ Net type + offset(log(Effort))

Treatment does not affect CPUE

RAYS

Best model:

~ Treatment + Net type + offset(log(Effort))

Presence of LEDs increases CPUE

- bottomset↗66.7%
- driftnets↗ 60.0%

Discussion

- LEDs – a successful multitaxa Bycatch Reduction Technology

	Driftnet	Bottomset
Turtles	- 80.0%	- 76.1%
Small cetaceans	- 80.0%	- 75.0%

- Target catch remained the same
- Promising method to reduce bycatch
- Encourage further testing in other locations, in collaboration with IATTC and IAC staff

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LAÚD OPO
RED LAÚD DEL OCÉANO PACÍFICO ORIENTAL

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