

Reducing bycatch of marine megafauna



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Threats to dugong

Habitat degradation (Modification/loss;
contamination)

Predation

Disease

Direct take (fishing/hunting/poaching)

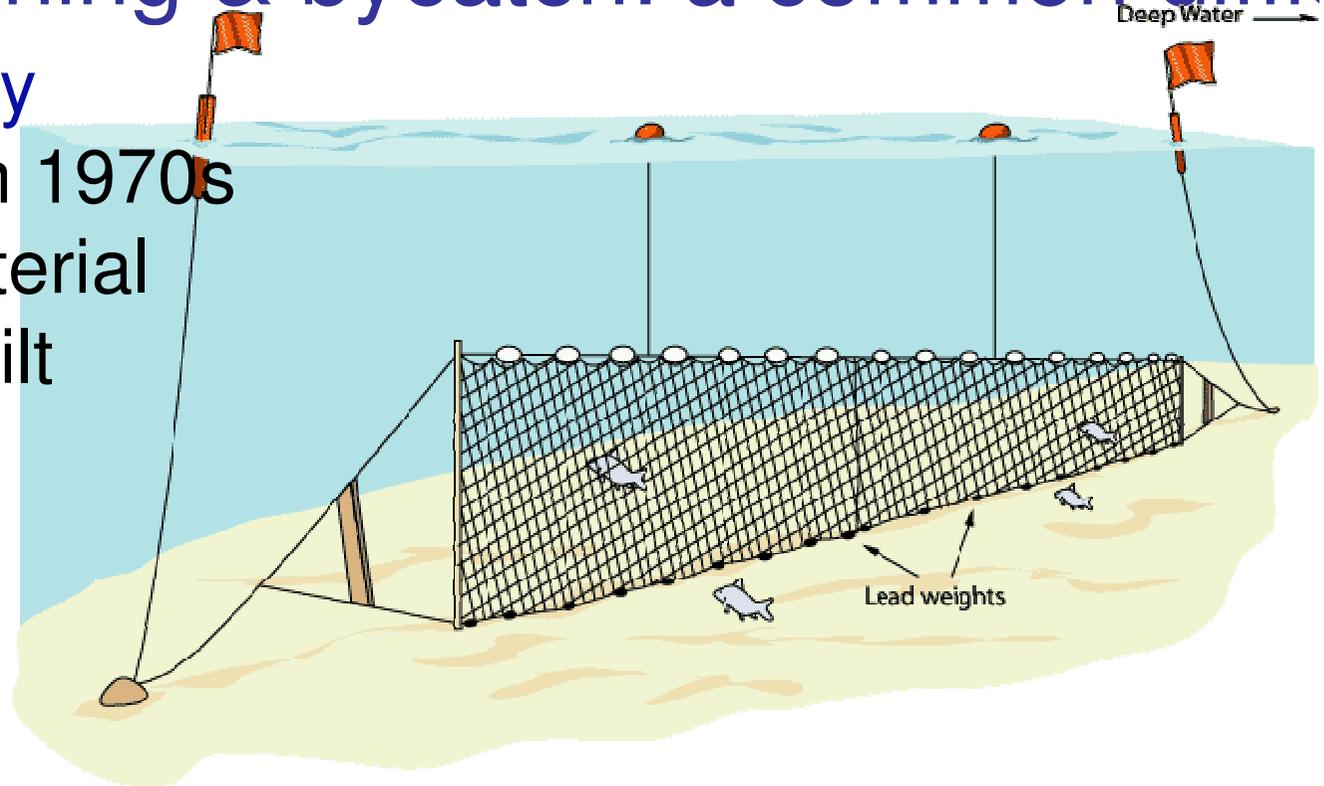
Indirect take (bycatch)

gravest threat: coastal gillnets (Marsh et al)

Gillnet overfishing & bycatch: a common difficult

ubiquitous globally

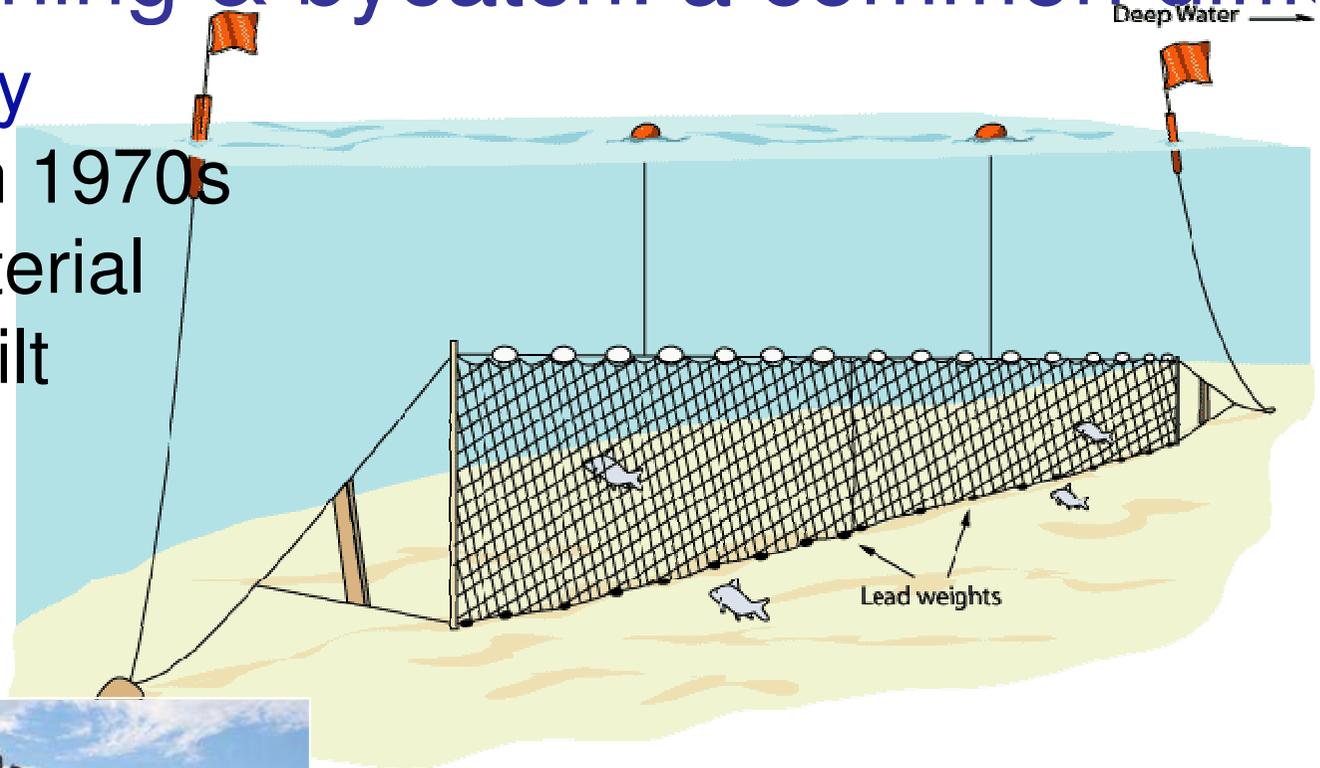
- proliferated from 1970s
- inexpensive material
- easily woven/built



Gillnet overfishing & bycatch: a common difficult

ubiquitous globally

- proliferated from 1970s
- inexpensive material
- easily woven/built



low profile, but big impacts

- high catch rates
- low selectivity/high bycatch
mammals, turtles, sharks, birds, fish, invertebrates

Outline

- conceptual framework
- reducing catchability in gillnets
- conservation mosaic
- case 1: solutions from Mexico
- case 2: solutions from Japan



Conceptual framework for reducing fisheries impact

Behavioral Incentives

- Regulatory: input and output controls (effort, capacity, and catch)
- Economic: market-based mechanisms (J. Donlan)
- Social: outreach/education

Fishing interventions

- Availability of nets: spatial and temporal restrictions
(MSP and MPAs: A. Grech)
- Selectivity of nets: modification of gear & methods (catch to reduce dugong catch)

Increasing gillnet selectivity: how to catch fish, not dug

Extensive experimental research on turtles and cetaceans

Selective signaling: fish and megafauna see and hear differently (eg. Gilman et al 2009, Read 2008)

- colored and/or illuminated nets deter turtles (Wang et al 2010)
- acoustic pingers deter porpoises (Kraus et al 1997)
- magnetic fields deter sharks (Wang et al 2010)

Behavioral cues: fish and megafauna respond differently

- shark scarecrows deter turtles, not fish (Wang et al 2010)

Increasing gillnet selectivity

Habitat use: megafauna use different microhabitats

- low profile nets: catch groundfish, not turtles (Salisbury et al 2005)
- surface lowpro nets: catch turtles where they can breathe

(Eckert et al 2008)

Scaling: megafauna are stronger and bigger

- smaller mesh: megafauna doesnt entangle
- weaker mesh: megafauna breaks free

Increasing gillnet selectivity

Dugongs

- Limited experimental research to date
 See Appendix 7 (A. Grech)
- Opportunity for future research

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Context: under-regulated small-scale fisheries

- isolated villages and camps
- fisheries are major employer
- poverty
- drug abuse
- fishery organization weak
- wide range of fisheries
- stocks declining
- management & enforcement limited

In the absence of management resources, conservation depends on local fishers

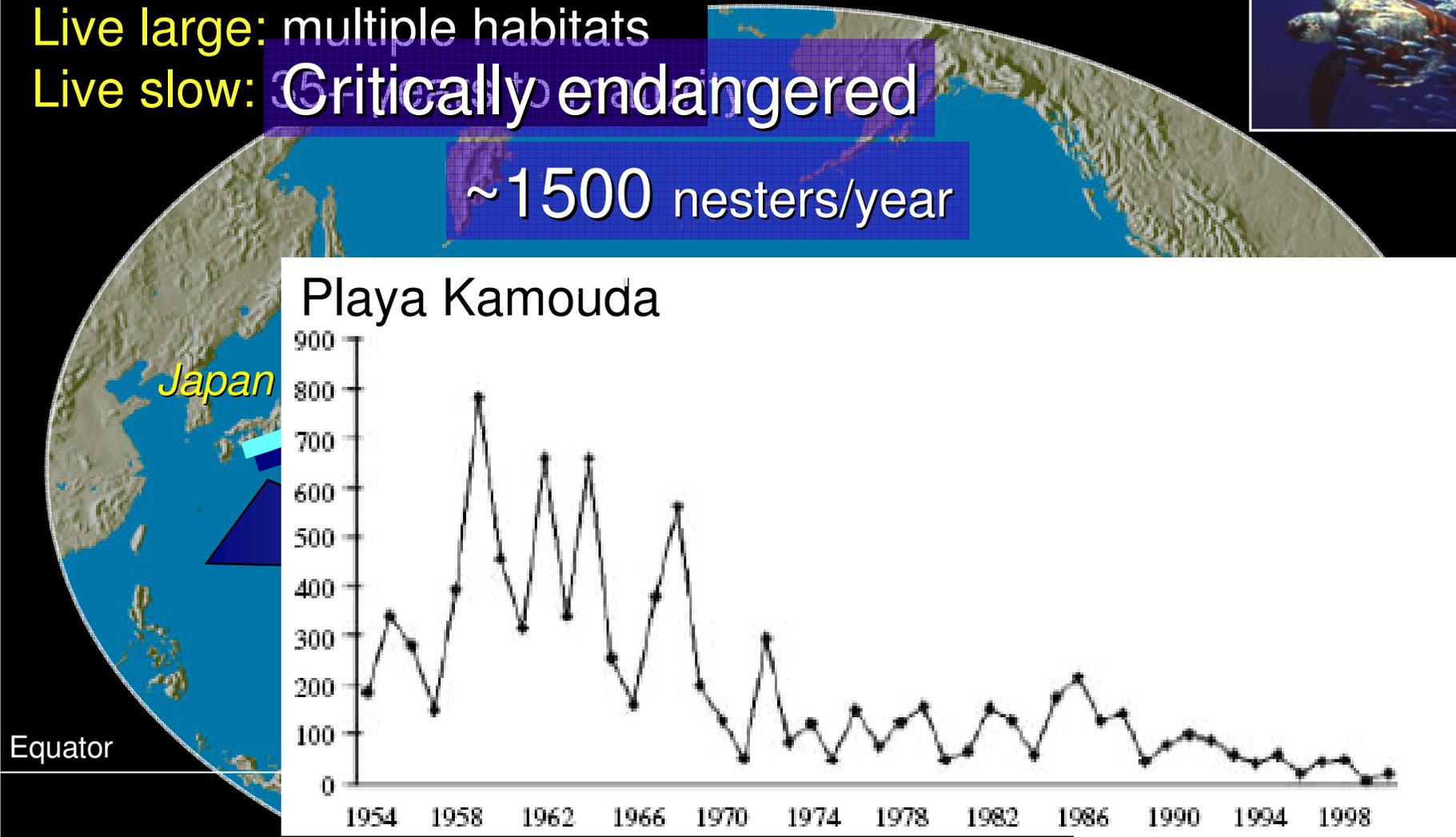


Loggerhead turtle

Live large: multiple habitats

Live slow: Critically endangered

~1500 nesters/year



Kamezaki et al. 2003

Bycatch - local perception



*¿How can loggerheads be endangered?
I caught **forty** in my net just this morning...*

halibut gillnetter
Puerto Lopez Mateos, Agosto 2003

Proyecto Caguama (Operation Loggerhead)

Objective

- partner with fishers to reduce bycatch
- maintain fishing & community wellbeing

Goals

- raise awareness (enable to answer question themselves)
- assess bycatch with fishers
- partner to develop & implement solutions
- empower fishers to augment sustainability

Conservation Mosaic

Integrate bycatch awareness, research, adoption, and incentivization

Networks

Social Networking

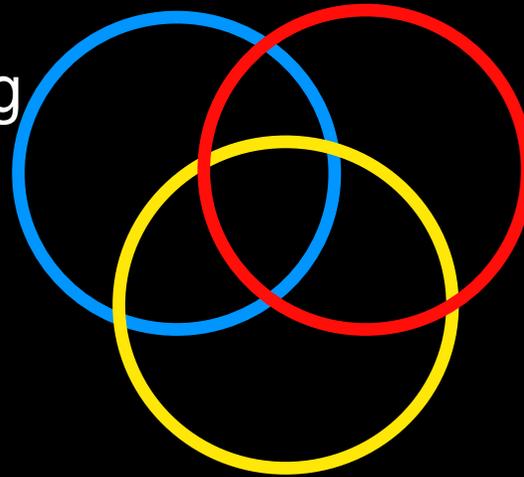
Barabasi 2002



Knowledge

Participatory research

Fortmann et al. 2008



Communication

Social Marketing

Mackenzie-Mohr 1999

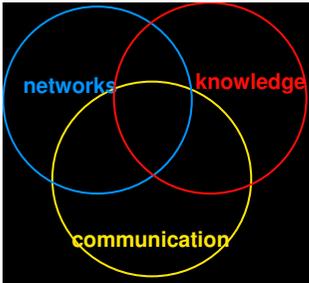
Jacobson 1999

Nichols 2003; Peckham & Maldonado, In Press

ProCaguama 2010

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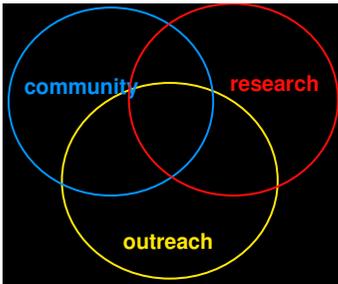


Networking

Bycatch workshops (expert consultations)

- engage highliners
- assess bycatch
- brainstorm solutions
- organize experiments



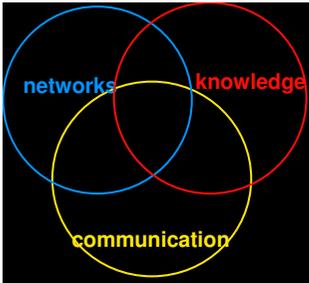


Networking

capacity building
& broadening perspectives

Local, regional, & intl meetings & exchanges
Leadership training
Internships & externships





Participatory research

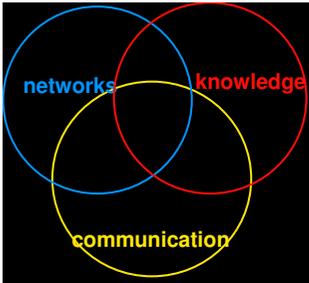
Assess bycatch

- observe rates
- extrapolate fleet-wide mortality

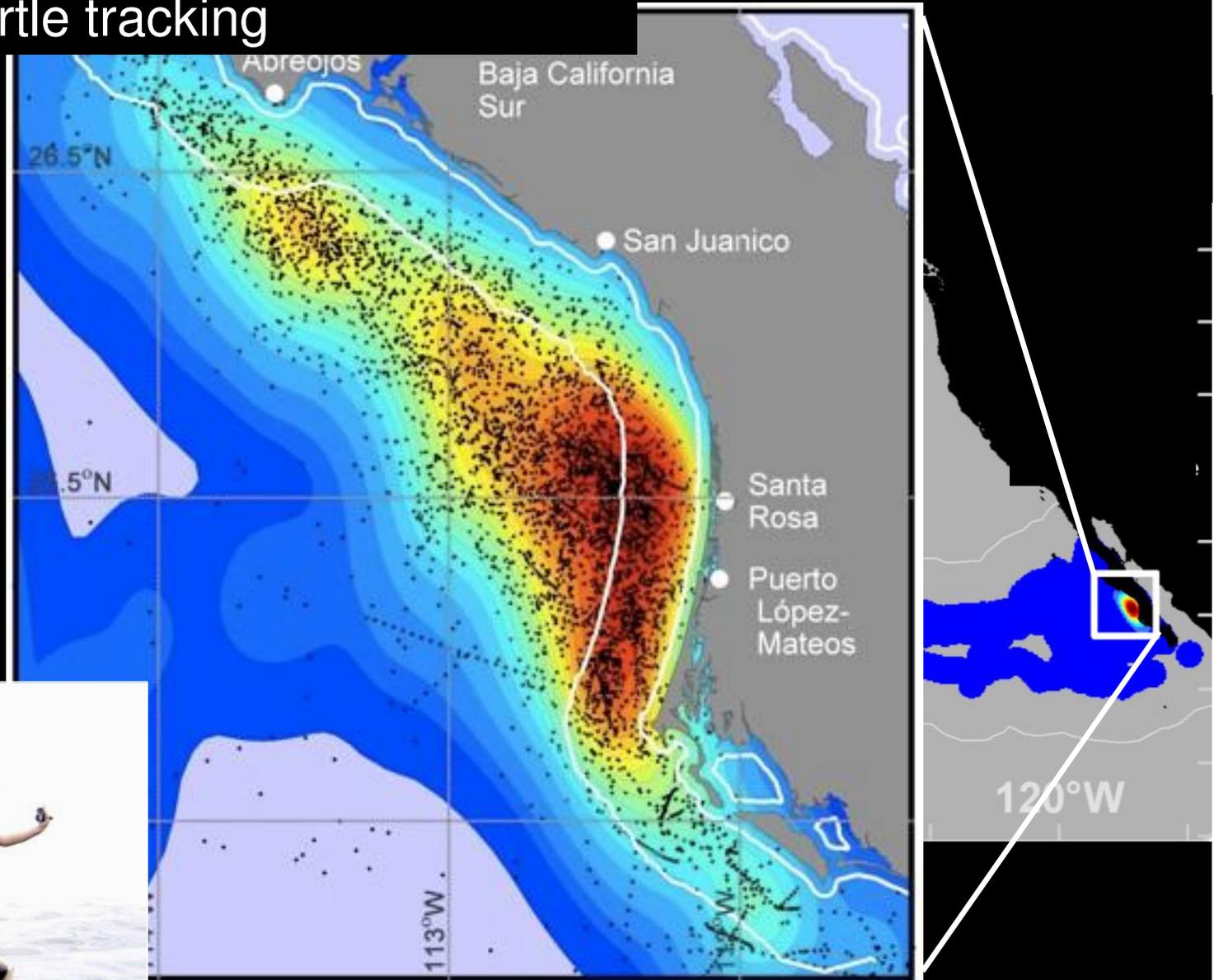
Regional ecology

- identify turtle hotspots
- track fish landings

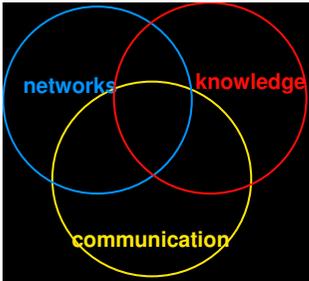




Participatory research turtle tracking



44 satellite tracks; 1996-2006 Peckham et al 2007a



Participatory research bycatch assessment



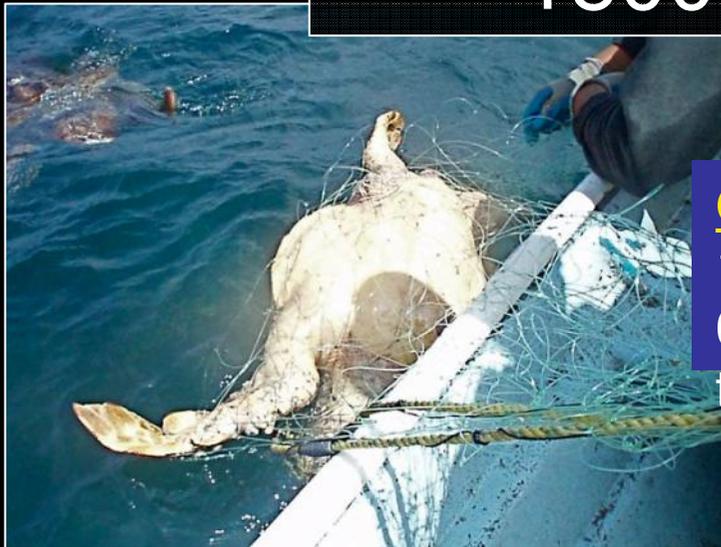
Longline fleet

5-8 boats

6.0

turtle/boat/day

highest bycatch rates documented
~1500-2950 turtles killed/yr

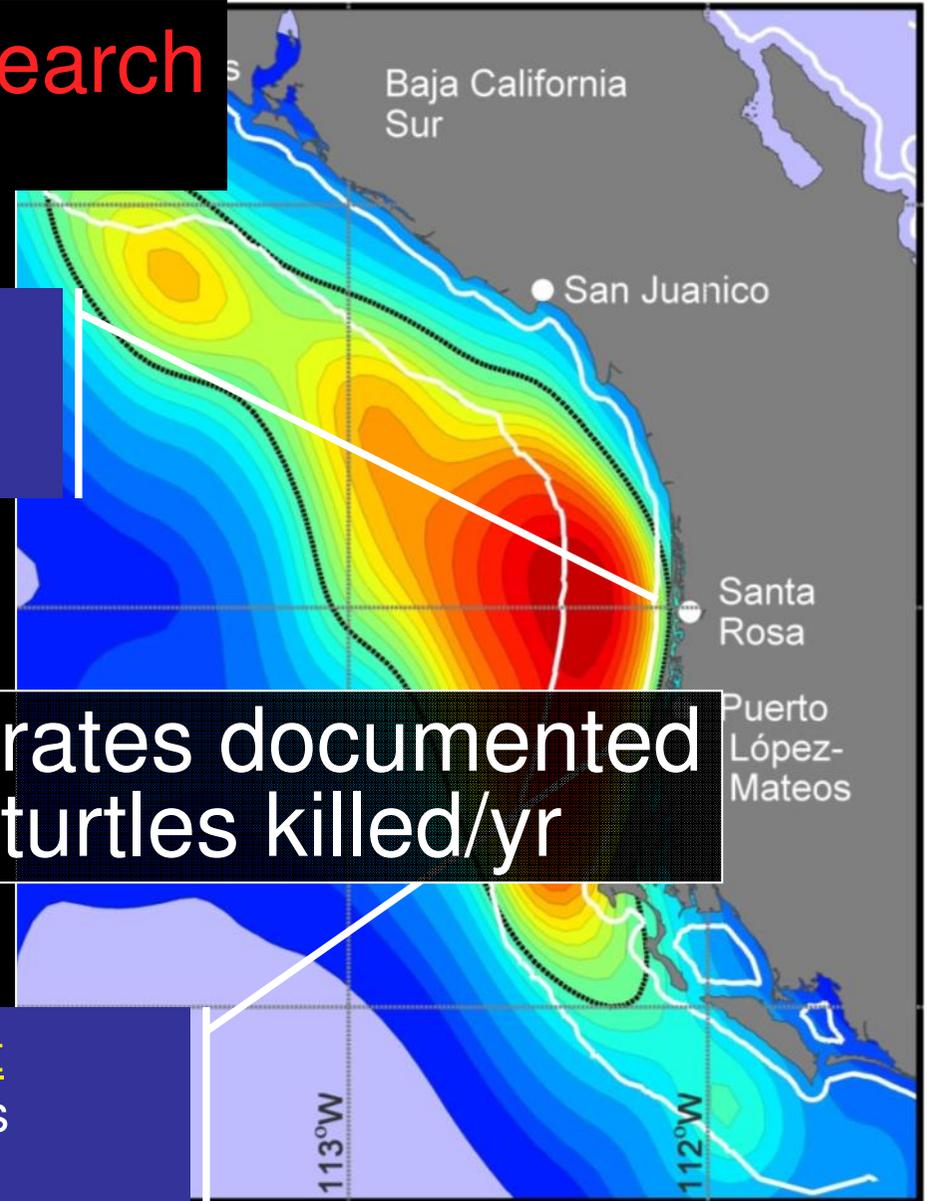


Gillnet fleet

12-50 skiffs

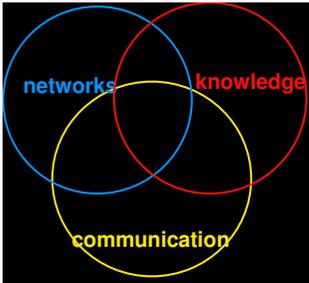
0.8

turtles/boat/day



Peckham et al 2007 PLOS One

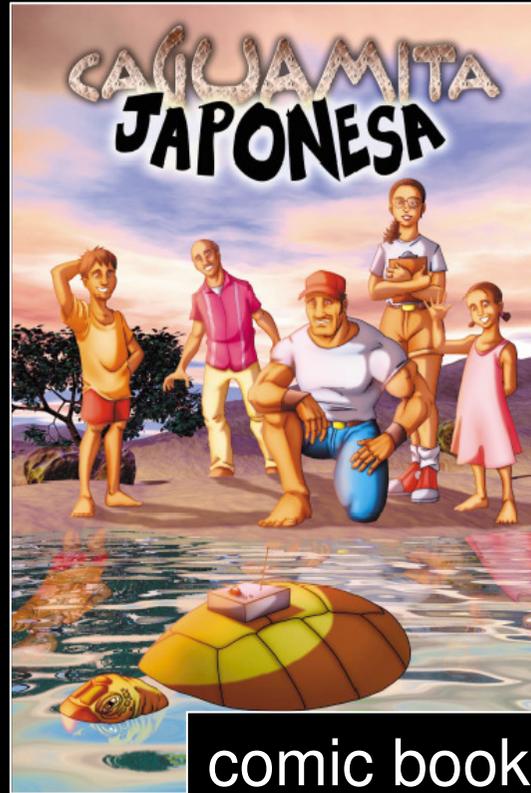
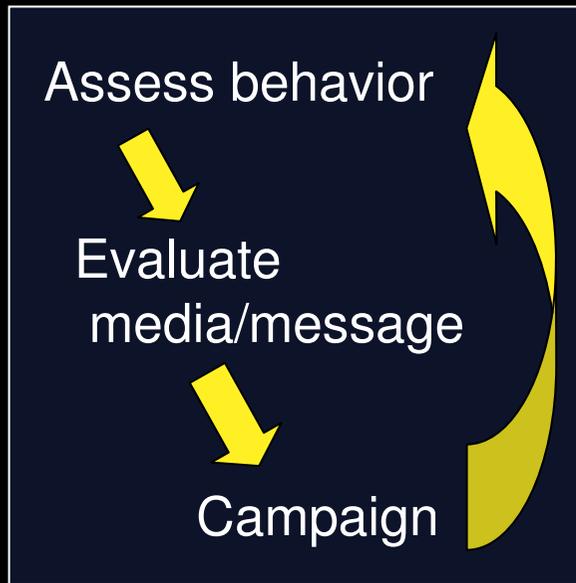
Peckham et al 2008 ESR



Strategic Communication

locally resonant media

Social marketing



comic books



murals

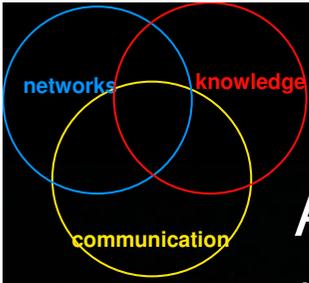
local & VHF radio



neighborhood film

positive messaging

“the future of loggerheads lies in your hands (BCS fishermen)”



Strategic Communication

Annual Caguama Festival

- community organized
- regional phenomenon

QuickTime™ and a decompressor are needed to see this picture.



QuickTime™ and a decompressor are needed to see this picture.

Bycatch reduction trials

Participatory research
Gillnet selectivity

Fisher workshops

¿How can we reduce gillnet bycatch and maintain fishing?



Rejected by fishermen

- decrease mesh size
- reduce soak time
- reduce net size

Tested

- net height (low profile)
- buoyless nets
- hook & line

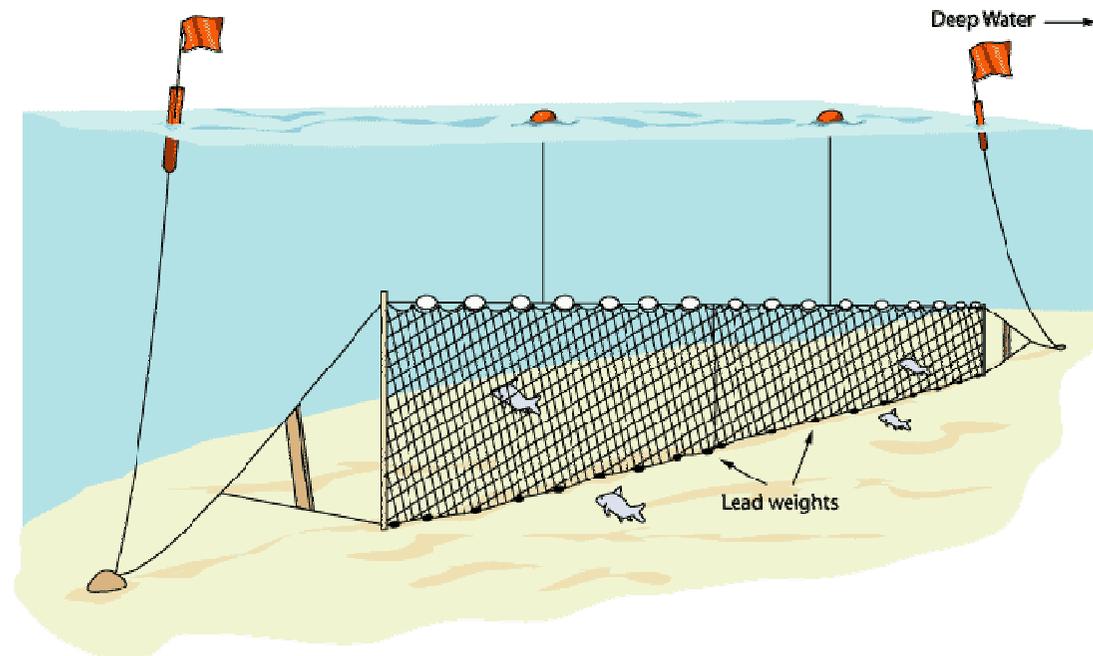
Buoyless nets 2007-9

Participatory research Gillnet selectivity

Design

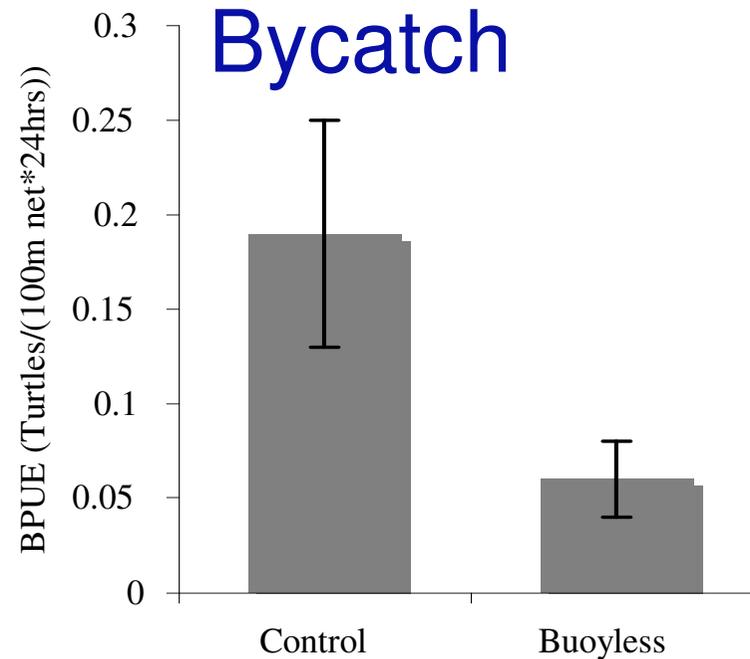
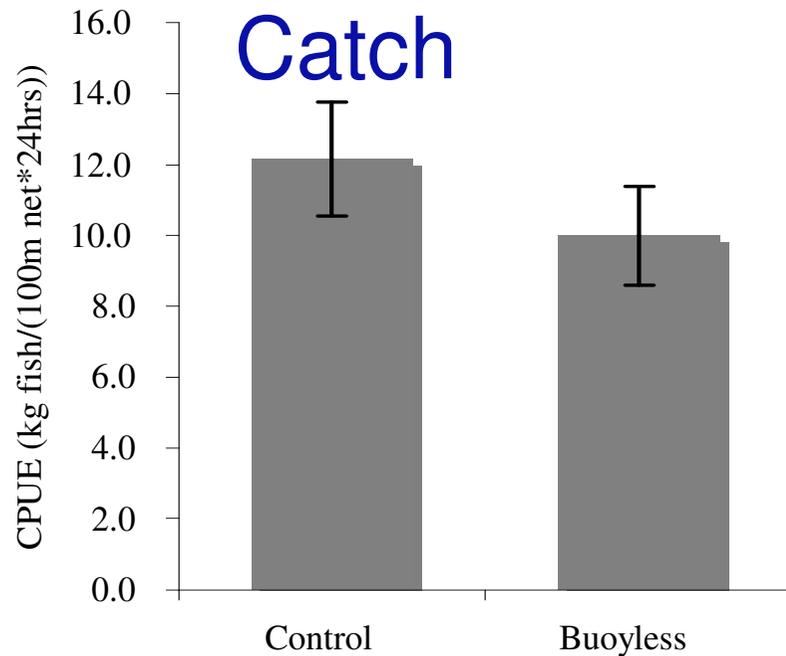
- (buoyless = no buoys on float line)
- 135 paired sets in turtle hotspot
- conventional vs buoyless nets

supported by:
WPRFMC
NFWF



Buoyless nets

Participatory research Gillnet selectivity



- similar catch ($p = 0.092$)
- 68% fewer turtles caught in buoyless ($p = 0.002$)

Conclusions

Partial solution for turtle bycatch reduction

BUT, decrease in Cc bycatch may not be enough

Hook trials

Participatory research Hook fishing

- crews equipped with rods, sounders, etc.
- onboard training by international experts
- comparison of bycatch, catch and earnings



Results: hook trials

Participatory research
Hook fishing

- hooks: yield more of valuable finfish
- hooks: zero bycatch of turtles and other spp.
- hooks: preferential market for added value
Hooked fish = 100-400% more \$/kg

Conclusions

- Hooks economically viable (¿preferable?)
- Hooks may increase sustainability
(catch fewer fish, no turtles, earn more \$\$)
- market-based solution
(fueled by demand, not NGO or govt)

Conceptual framework for reducing fisheries impact (In México - loggerheads)

Behavioral Incentives

- Regulatory: input and output controls (no: low resources, political will)
- Economic: market-based mechanisms (yes - cultivate preferential mkt)
- Social: outreach/education (yes - conservation mosaic)

Fishing interventions

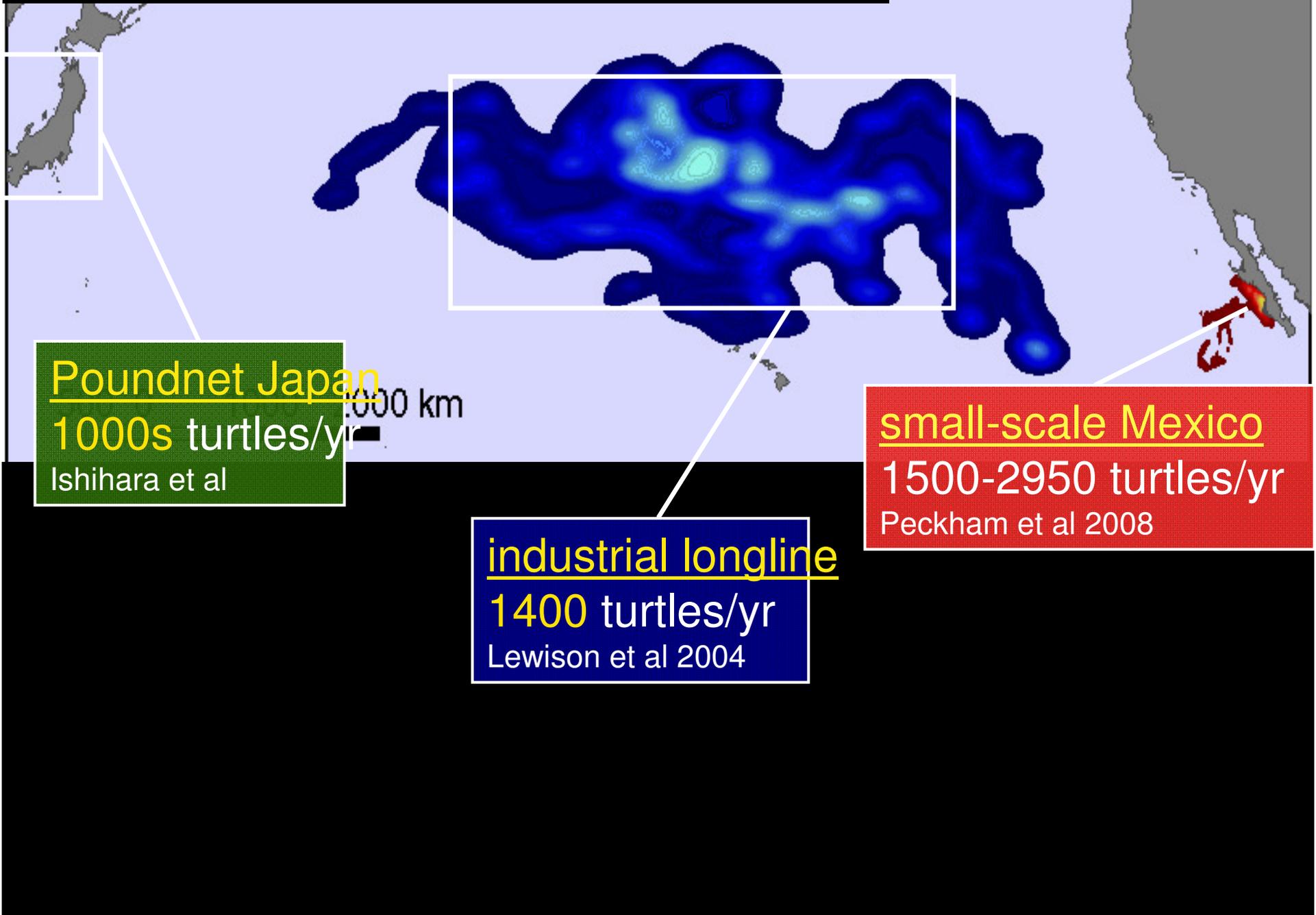
- Availability of nets: spatial and temporal restrictions MSP & MPA (no: low resources, political will)
- Selectivity of nets: modification of gear & methods (catchability)
buoyless nets + hook & line

Outline

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Loggerhead conservation opportunity



Reducing poundnet bycatch

Japanese coastal waters
100s-1000s of loggerheads killed
Gov't and fishermen deny issue



Sea Turtle Assoc. Japan

Ishihara et al 200

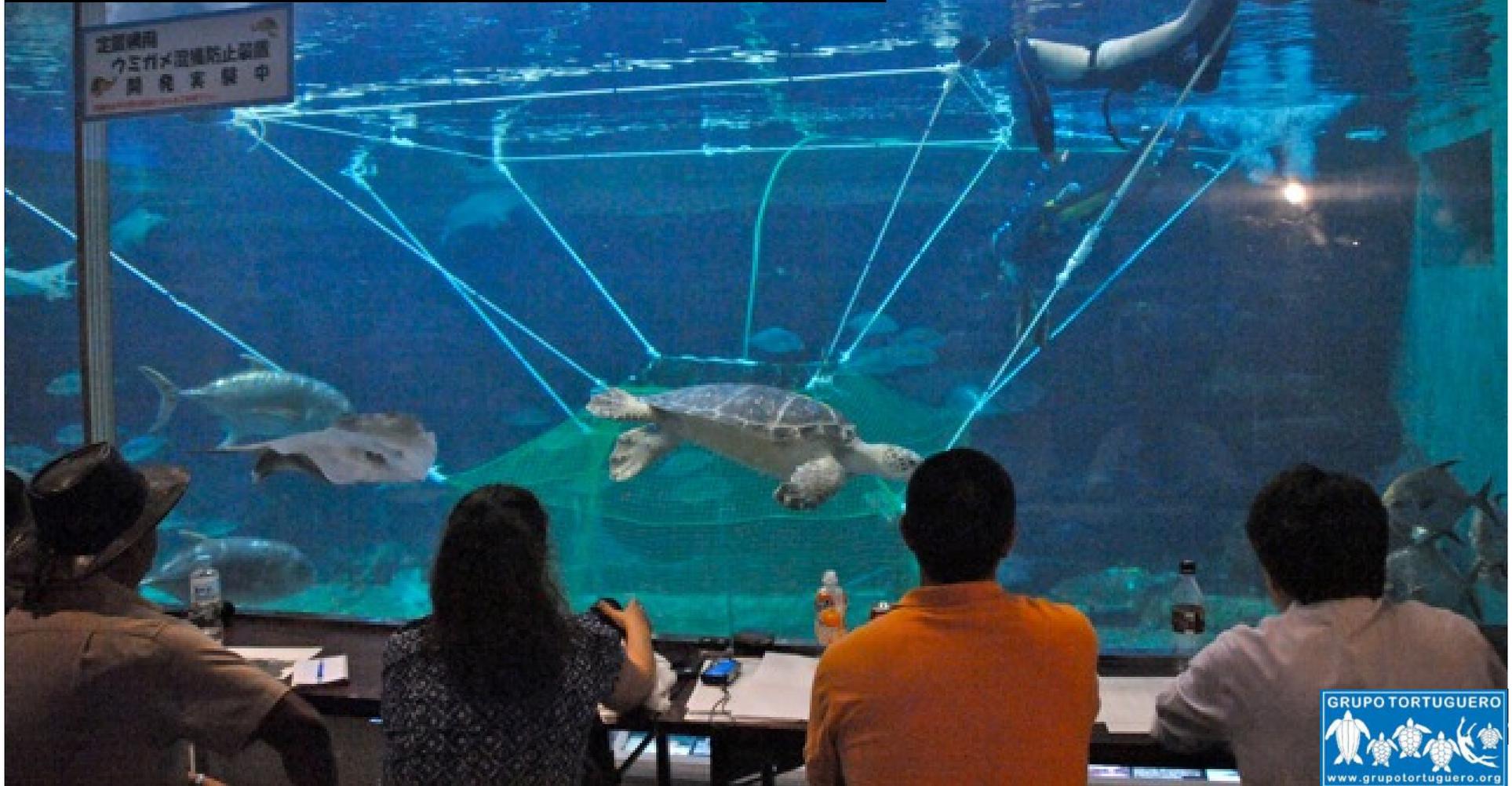
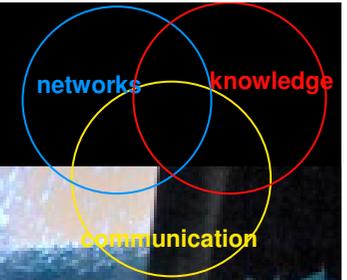
Bycatch mitigation workshop

Kobe Japan: 22Sep-5Oct 2010

Fishers, Govt, Net Companies, NGOs

Grupo Tortuguero, Sea Turtle Assoc Japan,

Ocean Foundation, Suma Aqualife Park



Bycatch mitigation workshop

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Ocean Foundation, Suma Aqualife Park



9 Poundnet Escape Devices designed & tested
Broad media coverage
Fishers and Gov't acknowledge solutions potential
(Future: 3 PEDs to be refined, fish tested, field trial)

Conceptual framework for reducing fisheries impact (In Japan - loggerheads)

Behavioral Incentives

- Regulatory: input and output controls (no: low political will)
- Economic: market-based mechanisms (yes? - PED implementation)
- Social: outreach/education (yes - conservation mosaic)

Fishing interventions

- Availability of nets: spatial and temporal restrictions MSP & (no: low political will)
- Selectivity of nets: modification of gear & methods (catchability) (yes - PED development)

Mitigating dugong bycatch

- identify bycatch hotspots
(rapid and onboard)
- select priority conservation sites
(criteria TBD)
- identify potential incentives & interventions
with govt, fishing, & NGO sectors
- ¿conduct bycatch experimental research?
- coordinate range of tailored incentives & interventions



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National Fish and Wildlife Fdn

National Marine Fisheries Service

MTCA- US Fish and Wildlife Service

FONMAR



Bycatch successes

Hawaii longline

Gilman et al 2006, 2007

Pacific tuna purse seine

Hall et al 2000

Similarities

- Fishers engaged from outset
- Fishers (co)develop solutions
 - Hall et al 2007
 - Jenkins 2007
- High revenue industrial fleets
- Strong regulation



But: unregulated fleets?

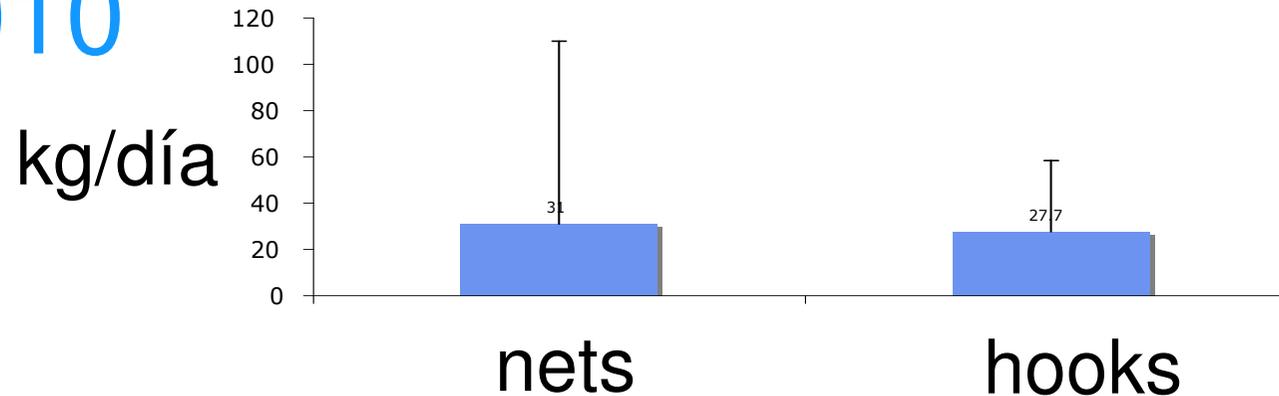
- Ubiquitous small-scale
- High BPUE
- Population level impacts
 - Godley et al 1998
 - Peckham et al 2007

Programa de Pesca Responsable

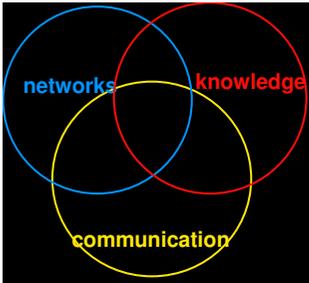
Métodos 2011-12

- Fleet consolidation
series of public meetings; self-ID; MOUs **GTC, CCC, Niparajá**
- Equipping and On-board training
equipos; entrenamiento captura y manejo abordo **GTC, SFP**
- Market cultivation **GTC, EDF, CAPSC, COBI, SFP**
- Facilitate management and enforcement
Covenios with **PROFEPA y CONAPESCA**

Results: Sustainable Fisheries Program 2010



- earnings similar between hooks & nets (28-31kg/day)
- preferential market promises increased profits
- zero turtle bycatch by 18+ boats
- ~140 nets voluntarily retired from loggerhead hotspot
- ~50% fewer strandings



Fishermen's exchanges: local & international

Japan



1. Share bycatch challenges
2. Co-develop solutions
3. Inspire fishermen back "home"



Mexico



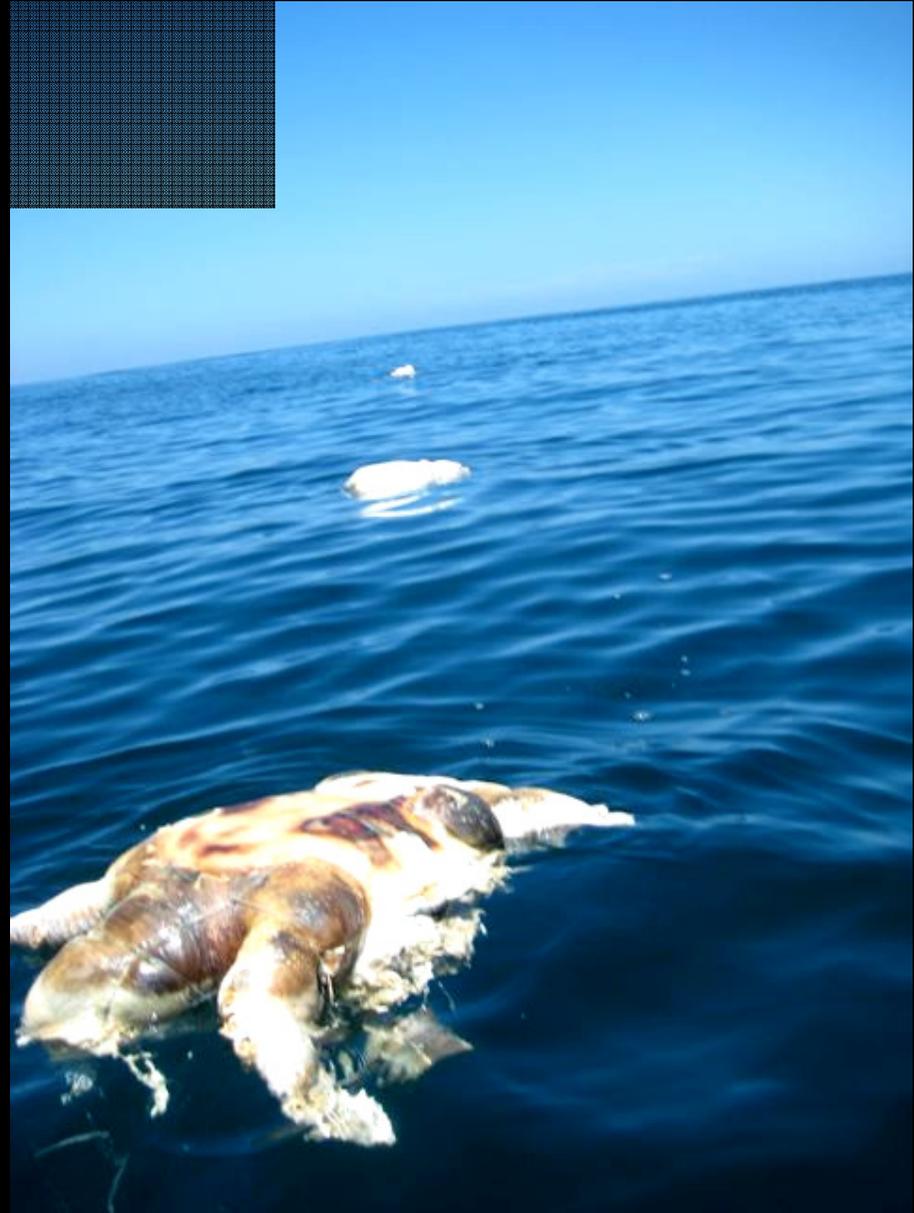
Hawaii

Rodgers 2008
Peckham & Maldonado *In Press*

Support: WWF, NMFS, Japan Fo

Ghost nets - lost gear keeps fishing

- dozens of nets encountered
- 1000s kg fish
- dozens of turtles



Fisheries regulation in the Bahía de Ulloa

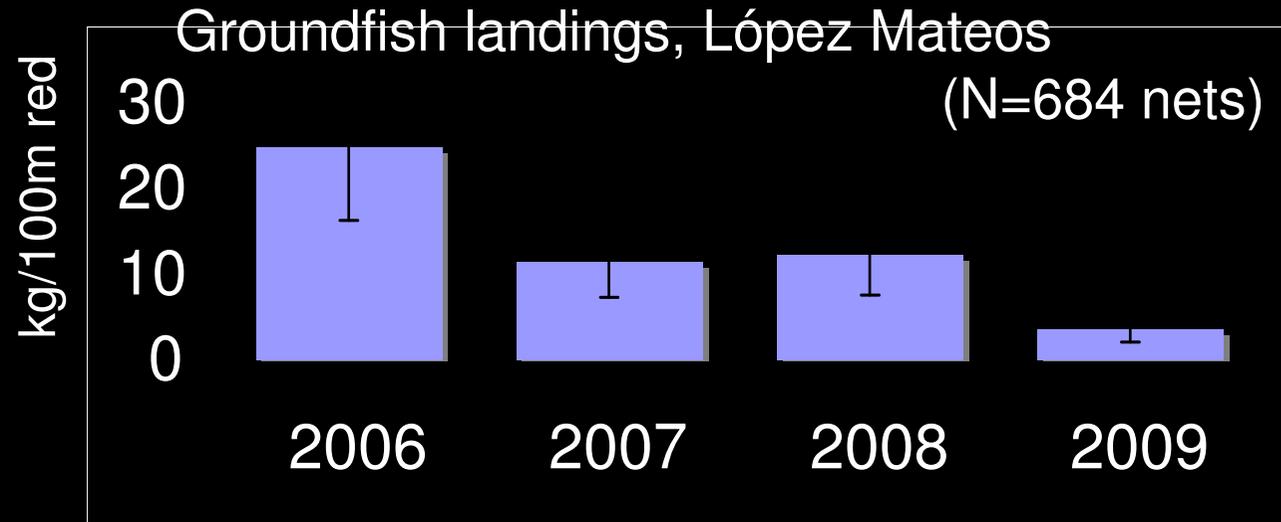
- low/scarce fisheries regulation
- low/scarce law enforcement

- fishing effort and techniques unregulated
- unpermitted fishing and poaching commonplace
- roving bandits

Groundfish fishery



Observations 2004-2009



- producción importante
- 40-80% de ingreso anual
- 10-60 pangas
(20-180 familias)