Ecosystem-based Governance of Bycatch & Collateral Effects of Pelagic Longline Fisheries

Workshop on Offsetting Ecosystem-level Effects of Megafauna Fisheries Bycatch

Gland, 7-10 October 2013

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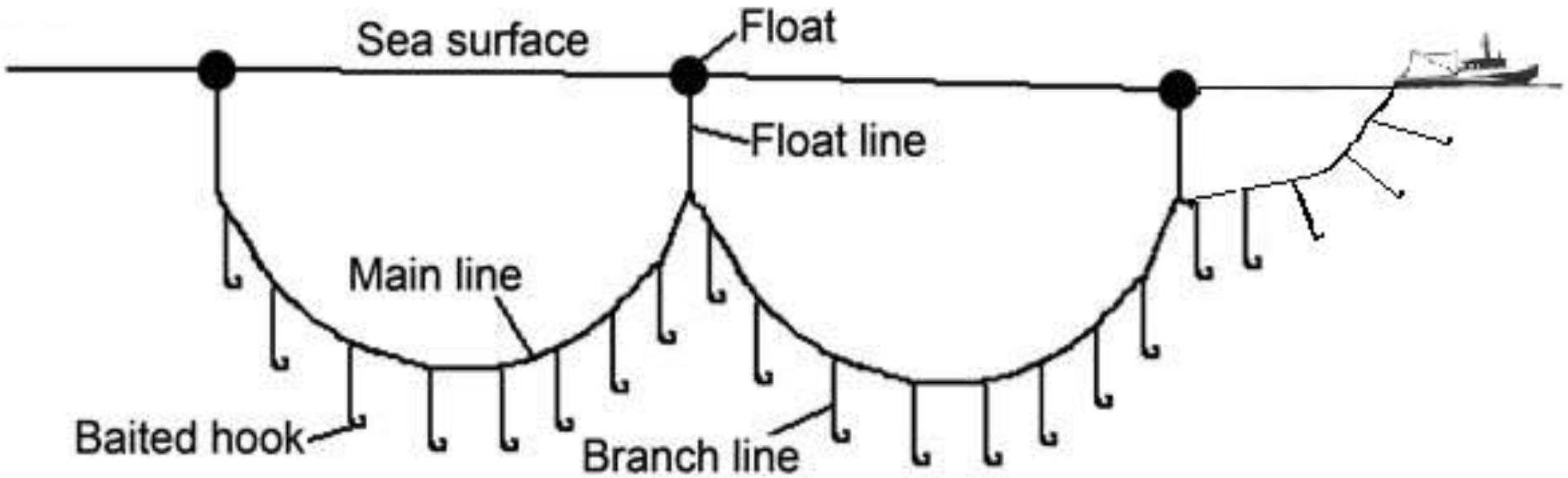
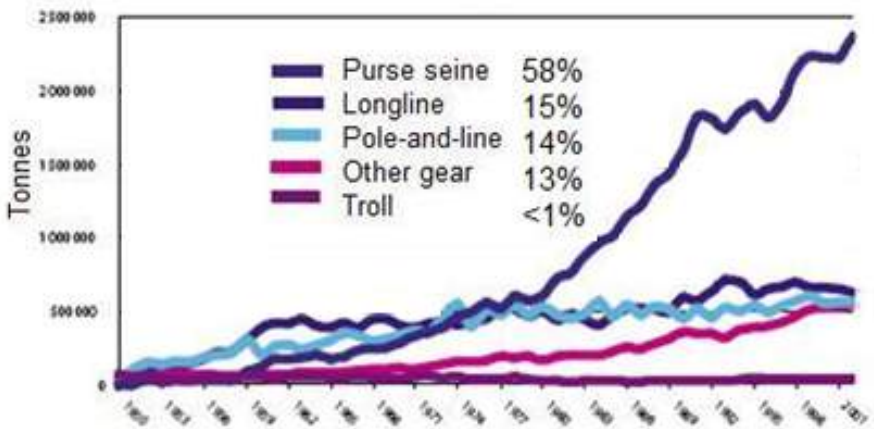
- Longline tuna fisheries & products
- Aim & ecological objectives of pelagic longline EBFM
- Problematic bycatch & mitigation options
- The importance of assessing cross-taxa relative risks in ERAs
- Collateral effects of longline fisheries & management options
- Performance assessment of tuna RFMOs' EBFM

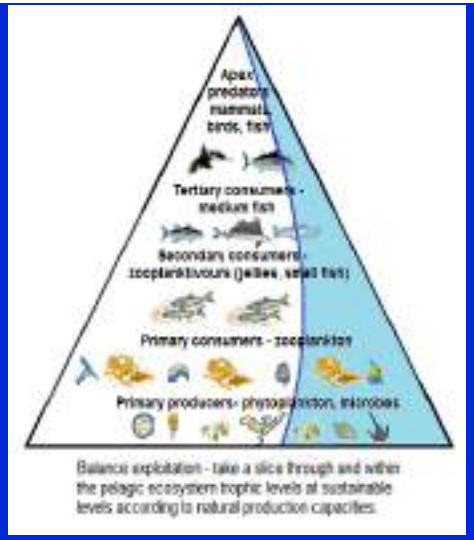


Global reported landings of principal market species of tunas, by gear type



Miyake et al 2010

~~650,000 tonnes annually
Supplies fresh/frozen tuna and tuna-like species (e.g., bigeye and yellowfin tuna, swordfish) and albacore for canning.



EBFM Aim: Sustain both ecosystem integrity, from genetic diversity to broad ecosystem-level structure and function, & marine ecosystem services, including fisheries yields, while balancing competing societal objectives and striving to equitably distribute benefits.

Ecological Objectives:

- Prevent population extirpations and species extinctions, including of phylogenetically unique species.
- Mitigate habitat degradation and loss from fishing operations (minimal risk from pelagic longlining).
- Minimize collateral effects, e.g., altering food web structure & processes, reducing diversity, altering population evolutionary characteristics.
- Stay w/in ecosystem-level limit reference points to avoid exceeding regime shift tipping points, where protracted or irreversible changes to ecosystem structure & processes occur.

Population-level Bycatch Problems in Longline Tuna Fisheries

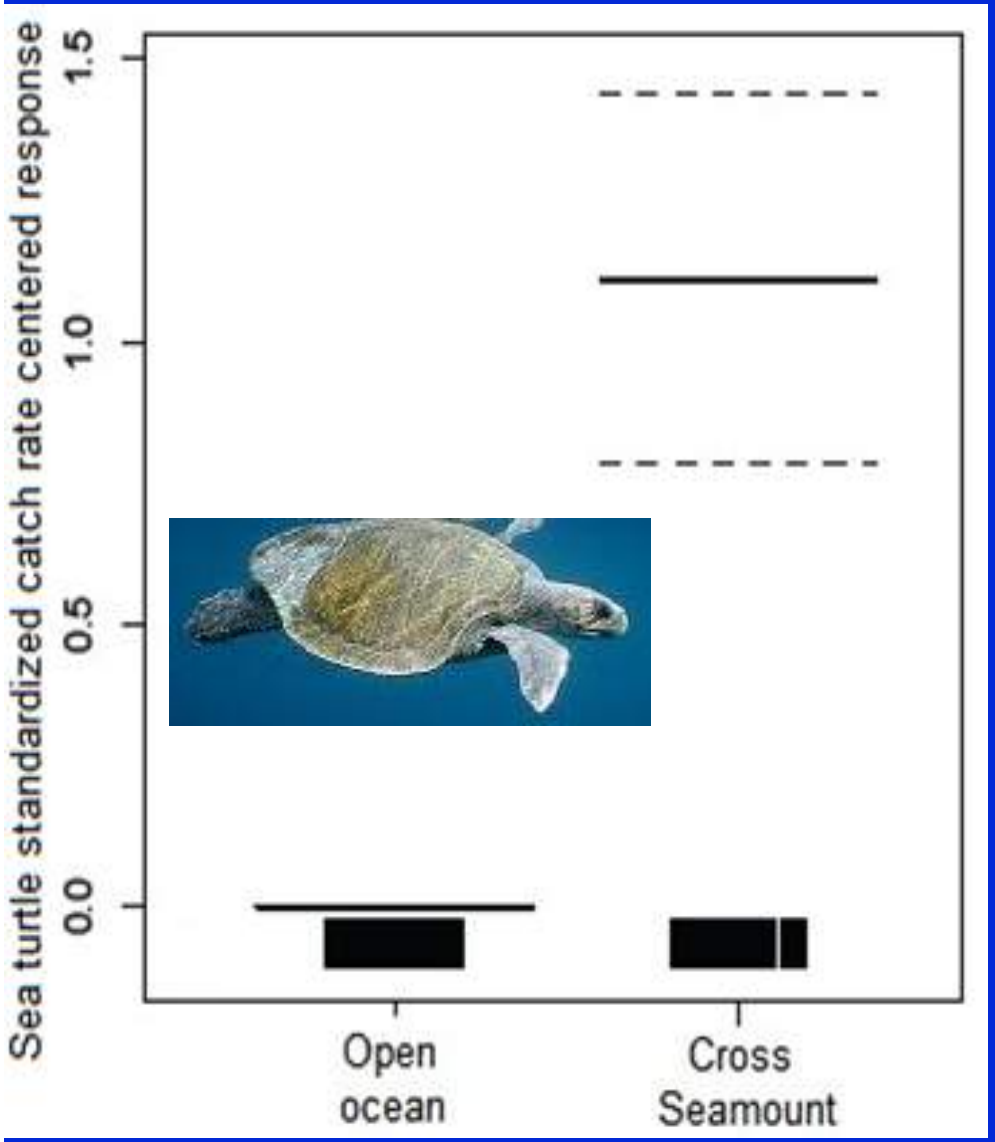
SPECIES GROUP	BYCATCH PROBLEM
SEABIRDS	Primarily in higher latitudes. Threatening the viability of some populations of albatrosses, petrels, shearwaters, other species.
SEA TURTLES	In tropics and subtropics, contributes to the poor conservation status of populations and regional management units.
ELASMOBRANCHS	Conservation status available for a small proportion of elasmobranch stocks. Blue shark predominant, but also silky and oceanic white tip.
MARINE MAMMALS	Primarily toothed whales (also baleen whales and pinnipeds). Isolated populations may be most at risk.
BONY FISH OTHER THAN TUNAS & BILLFISHES	Not well understood (poor data quality, few stock assessments).

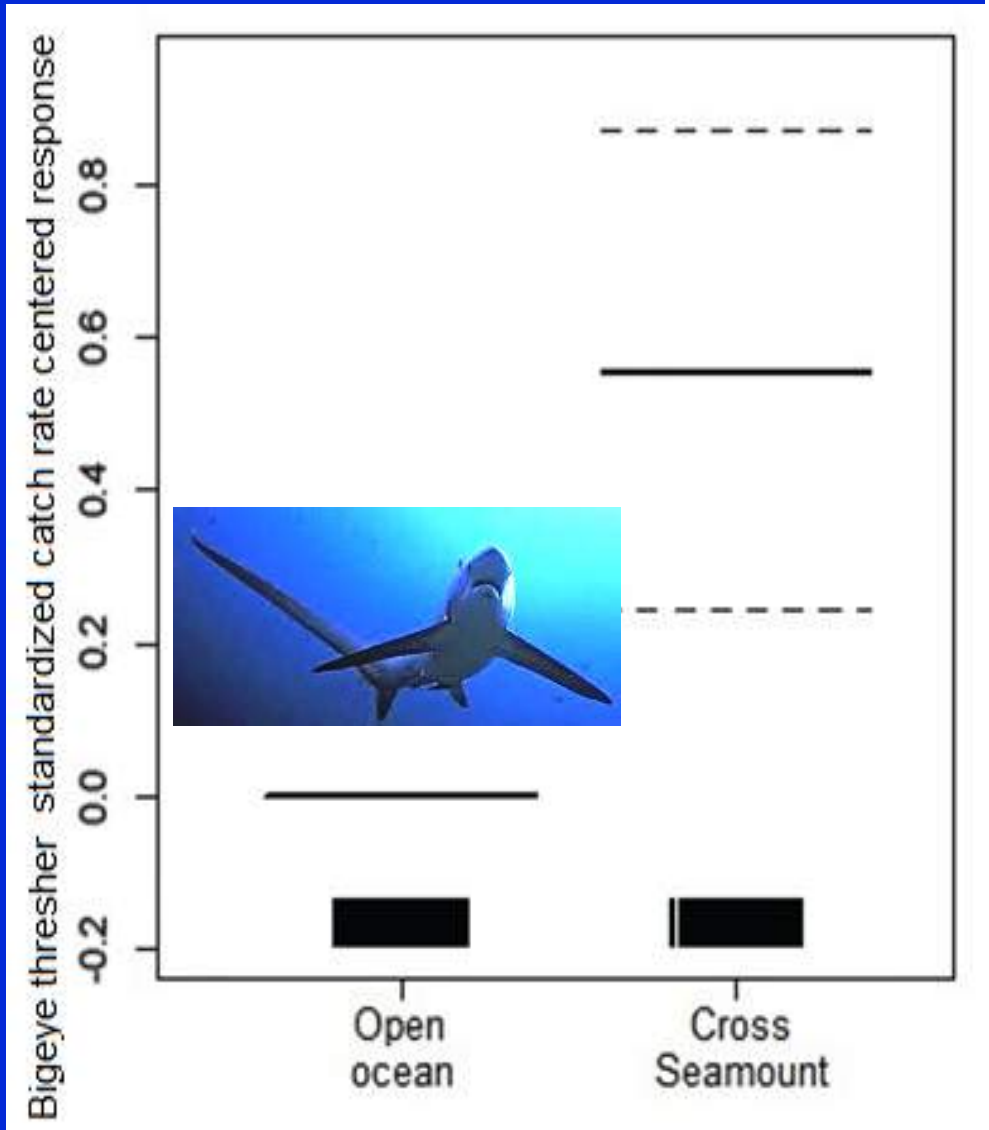
Gilman, E. 2011. Bycatch governance and best practice mitigation technology in global tuna fisheries. *Marine Policy* 35: 590-609.

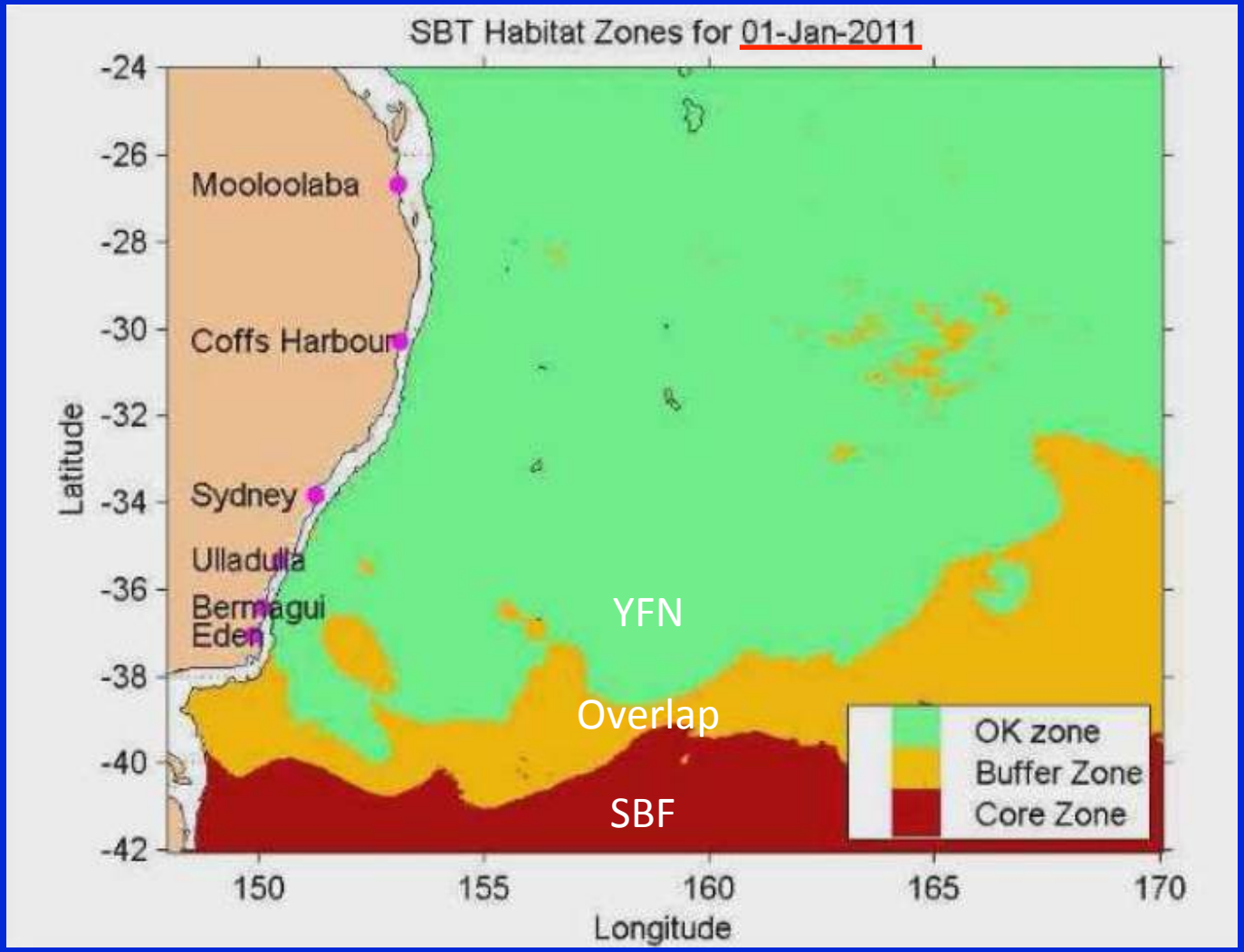
Approaches to Reduce Unwanted Fishing Mortality

- Gear Technology Modifications to fishing gear & methods to increase selectivity
- Time/Area Restrictions Avoid predictable bycatch hotspots, e.g., at seamounts
- Changing Gear To reduce ecological risks, including from bycatch
- Input & Output Controls Limit effort & catch – such as caps on levels or rates of bycatch species, or number of annual purse seine FAD sets
- Compensatory Mitigation E.g., offset bycatch through predator control at nesting colonies – out-of-kind
- Fleet Communication Communicate locations of real time bycatch hotspots
- Industry Self-policing E.g., Alaska demersal LL fleet shares vessel-based seabird bycatch levels
- Handling and Release Practices To increase post-release survival rates
- Gear Restrictions E.g., net mesh size, degradable gear
- Gear Marking, Technology to Track Gear Position, Technology to Avoid Gear Contact w/ Seabed In part, to mitigate ghost fishing
- Market-based Measures E.g., eco-labeling, retailer sourcing policy, buyer procurement specs, Fisheries Improvement Projects

Longline Problematic Bycatch is Higher at Shallow Seamounts Relative to the Open Ocean

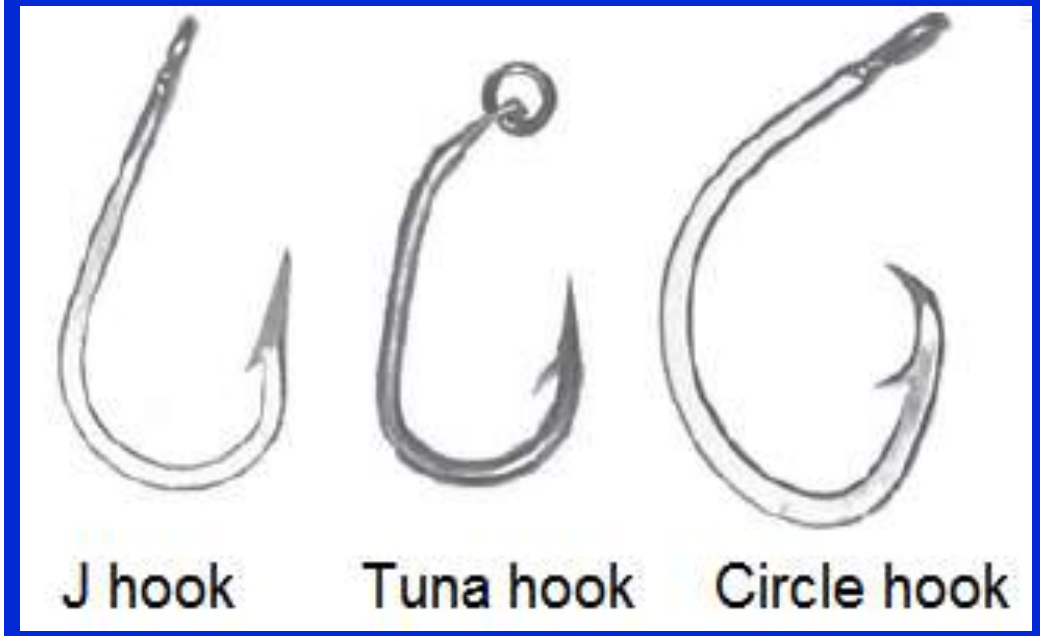


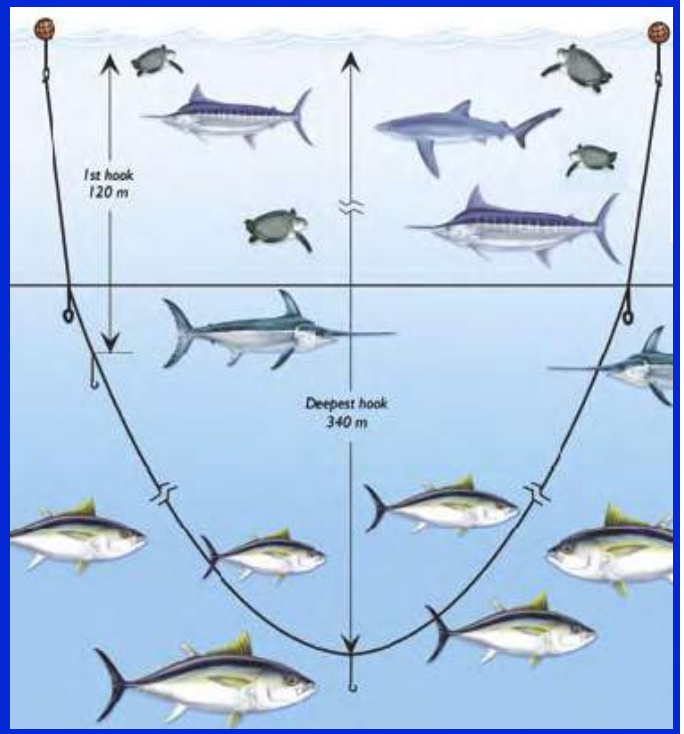




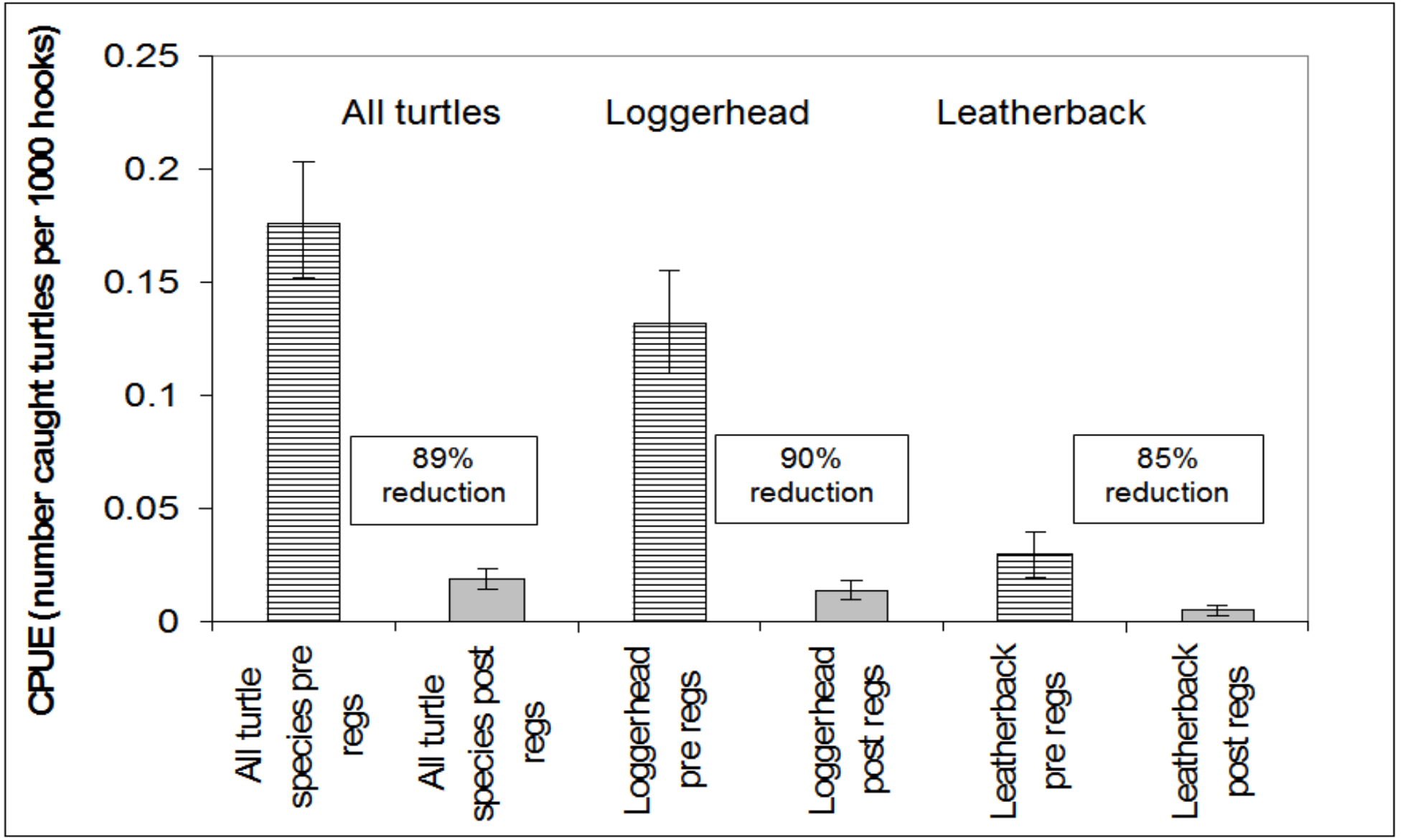
The eastern Australian yellowfin tuna and billfish longline fishery - example of a dynamic management system to avoid bluefin bycatch by predicting temporally/spatially mobile bluefin and yellowfin habitats (Hobday and Hartmann, 2006; Hartog et 2011).

Mitigating Sea Turtle LL Bycatch



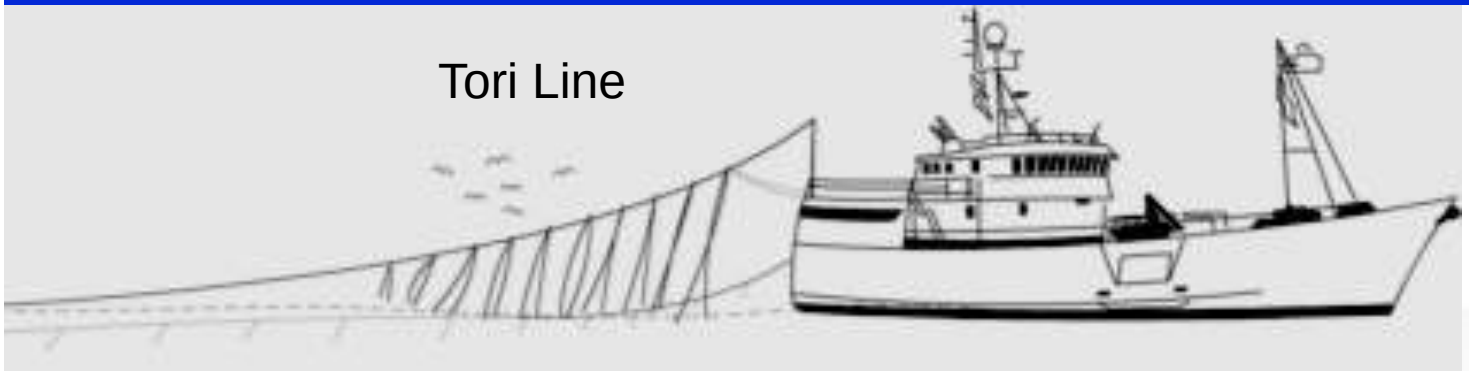


Nominal Turtle CPUE Pre- vs. Post- Regulations

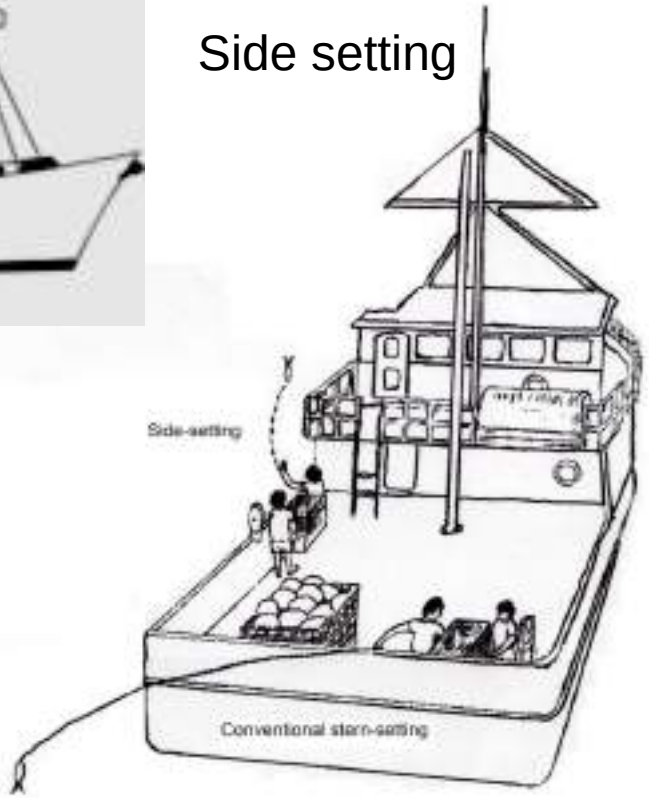


Gilman *et al*. 2007. *Biological Conservation* 139: 19–28.

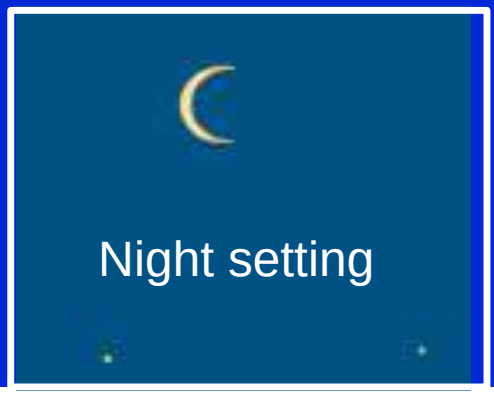
Mitigating Seabird – Longline Bycatch



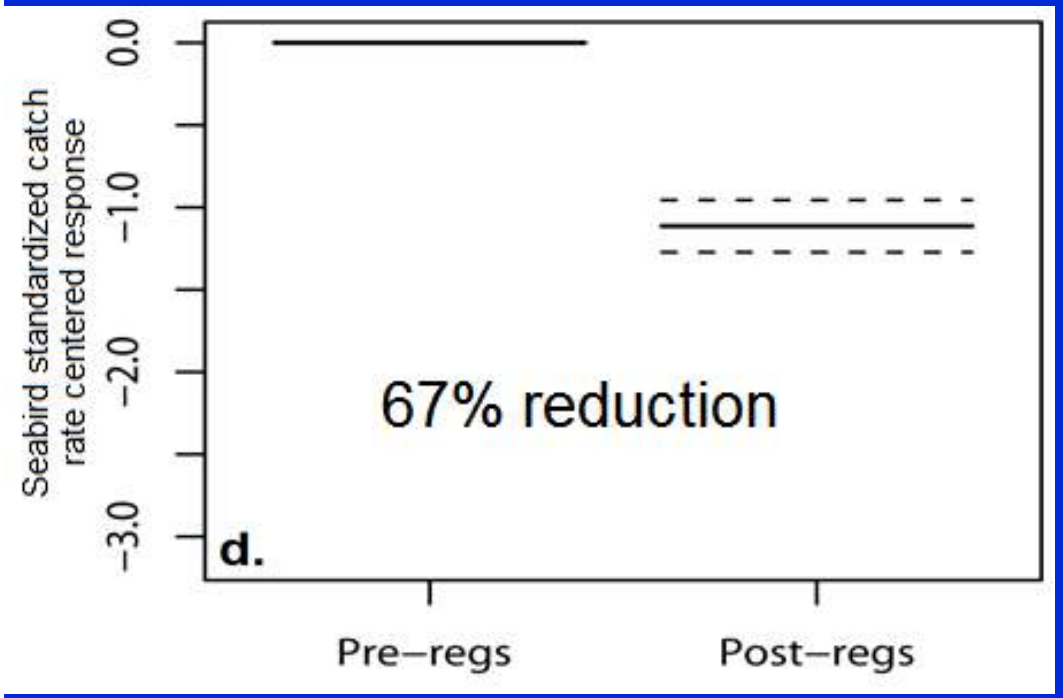
Side setting



Numerous highly effective gear technology methods to reduced seabird bycatch in LL fisheries.
(Not shown - weighted branchlines, wider circle hooks).

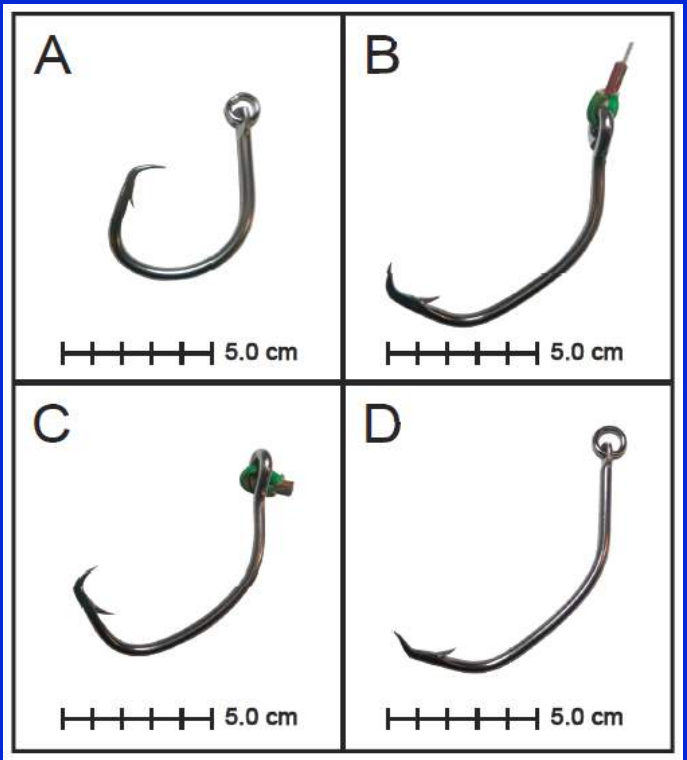


Reducing Seabird Bycatch in the Hawaii Longline Tuna Fishery



Gilman et al. 2008. *Endangered Species Research* 5(2-3): 309-323.

Mitigating Cetacean Bycatch



- Circle hooks
- ‘Weak’ hooks
- Avoid shallow features
- Fleet communication.

R&D needed on deterrents, encasement, hydrophones, etc.

Bigelow et al. 2012. *Bull Mar Sci* 88: 425-447.

Gilman et al. 2006. *Journal of Cetacean Research and Management* 8(2): 215-223.

Mitigating LL & PS Shark Bycatch

- Use fish vs. squid for bait, reduces shark LL catch by ca. 35%.
- Prohibit wire leaders (sharks remove terminal tackle).
- Deeper setting.
- Time of day of setting.
- Avoid fishing at shallow features.
- J-shaped instead of circle hook.
- Chemical, magnetic, rare earth electropositive metals, & electrical deterrents – not cost effective.

Stoner & Kaimmer. 2008. *Fish Rsrch* 92: 162-168..

Gilman et al. 2008. *Marine Policy* 32: 1-18.

Afonso et al. 2012. *Fish Rsrch* 131: 9-14.

Afonso *et al*. 2012. *Fisheries Research* 131-133: 9-14.

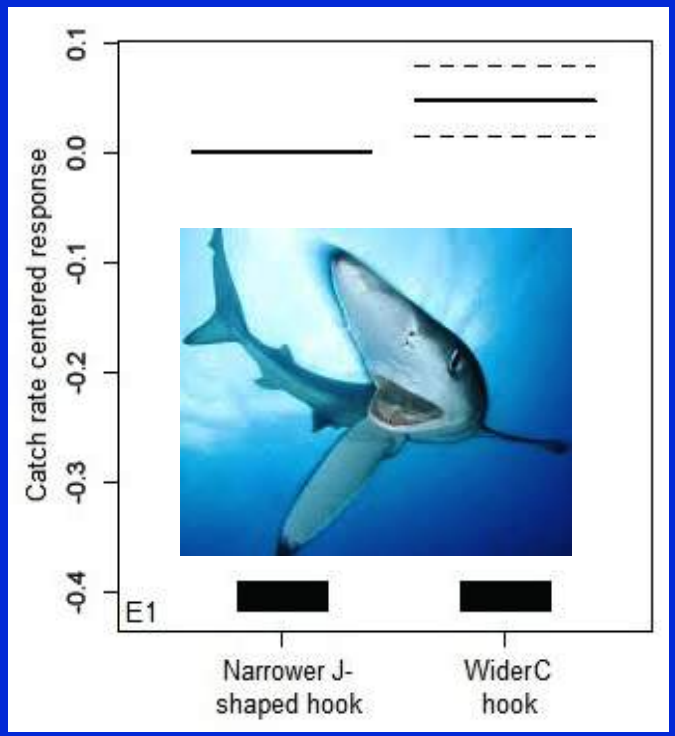
Ward *et al*. 2008. Fisheries Research 90:100-108.

State of Progress in Gear Technology Bycatch Mitigation

SPECIES GROUP	GEAR TECHNOLOGY SOLUTION
SEABIRDS	Large number of effective methods (e.g., night setting, tori lines, underwater setting, side setting, branchline weighting, avoid shallow features).
SEA TURTLES	Wider hook, circle hook, large fish bait, set > 100m, no lightsticks, single baiting, avoid shallow features.
SHARKS	Fish instead of squid for bait, prohibit wire leaders, deeper setting, J-shaped hooks, avoid shallow features. R&D on repellents.
MARINE MAMMALS	Circle hooks, 'weak' hooks. R&D on encasement, hydrophones, acoustic and taste deterrents.
BONY FISH	Circle hooks to increase post-release survival probability. Deeper setting, no lightsticks, avoid shallow submerged features to reduce catch of unwanted species and sizes of billfishes.

Holistic Bycatch Management

Through ERAs identify relative risks across taxa, and account for fishery-specific effects of alternative bycatch mitigation methods across affected species – through ERAs on relative risks across taxa. E.g., in some longline fisheries there can be a conflicting effect of hook design on catch rates of sea turtles and elasmobranchs.



Estimating & Accounting for Collateral Effects

Collateral effects of pelagic longline fishing are not routinely accounted for in fisheries management due to a lack of adequate data and accurate estimation methods. Range from altered evolutionary characteristics of populations via selective removal within populations, to altered ecosystem structure and processes via removal of a subset of apex predator species (e.g., Polovina and Woodworth-Jefcoats, 2013, PLOS ONE).

Gilman et al 2013. *Journal of Fish Biology*

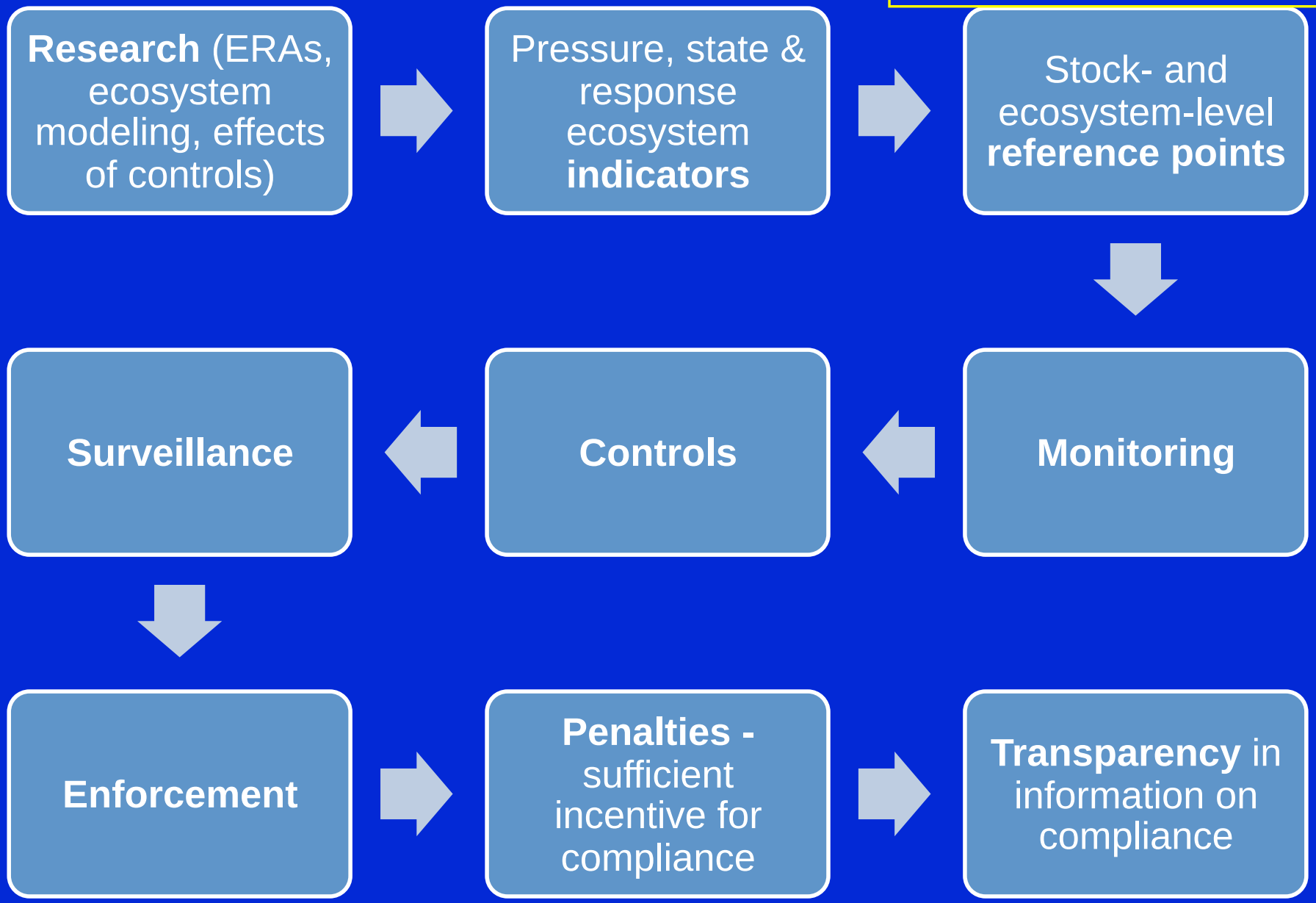
E.g., reduced tuna abundance collateral effect on seabirds via reduced baitfish availability at seasurface.

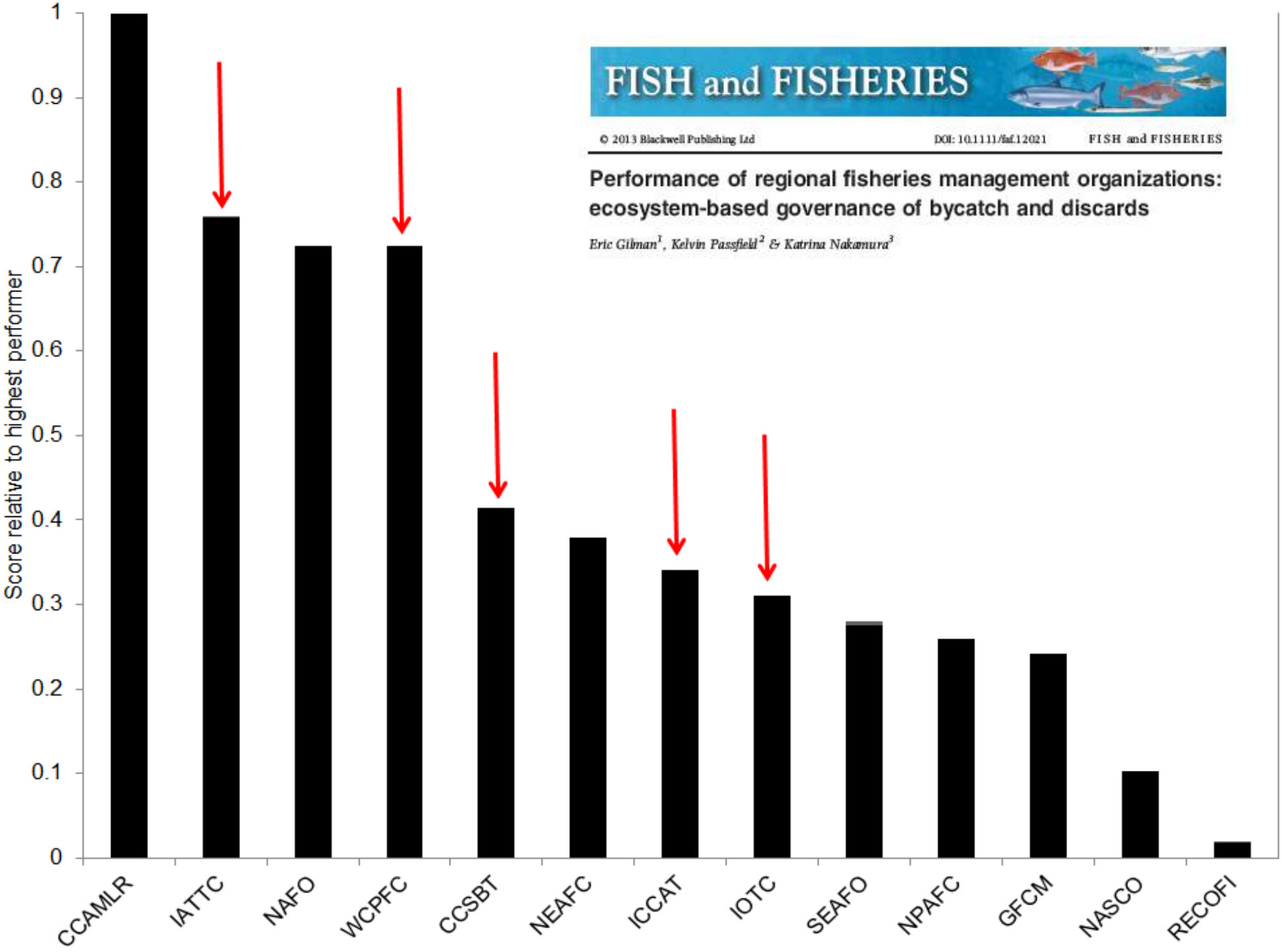
Au & Pitman, 1986; Ballance et al., 1997

Performance Assessment of RFMO Ecosystem-based Governance of Bycatch and Collateral Effects

Gilman et al. 2013. *Fish & Fisheries* doi: 10.1111/faf.12021.

Gilman & Kingma. 2013. *Ocean & Coastal Mgmt*. 84: 31-39.





FISH and FISHERIES

DOI: 10.1111/faf.12021 FISH and FISHERIES

Performance of regional fisheries management organizations: ecosystem-based governance of bycatch and discards

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Thank you!
For more information: http://bit.ly/EGilman