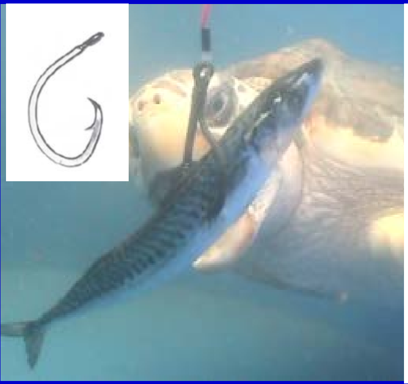
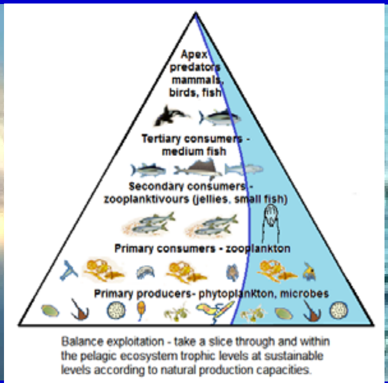
Mitigating Direct and Collateral Adverse Ecological Effects of Tuna Fisheries

Mitigation Techniques Thematic Session, Transitioning to Ecosystem-based Management of Tuna Fisheries, October 2012, Montpellier



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- Objectives of governing bycatch and collateral effects
- Methods to mitigate bycatch of species groups relatively vulnerable to fisheries overexploitation, focusing on gear technology approaches
- Estimating, accounting for and mitigating indirect, broader, community-level effects of fishing operations
- Performance of tuna RFMOs in governing bycatch, and in transitioning to an ecosystem approach to fisheries management
- Priorities for bycatch R&D and filling governance deficits

Bycatch

INTERNATIONAL GUIDELINES ON BYCATCH MANAGEMENT AND REDUCTION OF DISCARDS

Bycatch: Retained non-targeted catch + discards + unobservable mortalities (ghost fishing, pre-catch, post-release, collateral, cumulative, synergistic).

Responsible fisheries conduct requires the effective governance of all sources of fishing mortality, including from bycatch.

Ecological Objectives of Governing Bycatch and Collateral Effects of Fishing

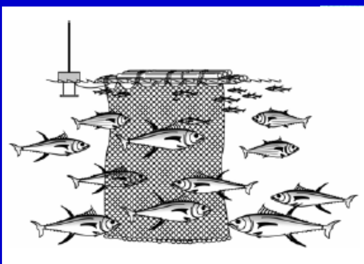
Aim - do not increase ecosystem susceptibility of exceeding regime shift tipping points nor compromise sustained ecosystem services. Main ecological objectives:

- Sustainably produce maximum multispecies yields of market species.
- Mitigate bycatch of species relatively vulnerable to fisheries exploitation - to avoid causing population-level declines and allow rebuilding and recovery.
- Minimize indirect and broader effects, e.g., altering community and food web structure and processes (e.g., selective fishing), reducing diversity (e.g., loss of phylogenetically distinct species) and altering population evolutionary characteristics via selective gear.

Socioeconomic Objectives of Bycatch Governance

- Reduce waste from discards and unobservable losses.
- Minimize fishing mortality of flagship species.
- Minimize reductions in fishing communities' revenue and food security from unsustainable bycatch mortality, including by managing the allocation of fishery resources subject to bycatch (through measures that meet scientific advice).
- Reduce economic and operational inefficiency of catching and discarding unwanted species and sizes of catch.

Primary Sources of Tuna Products



Purse Seine

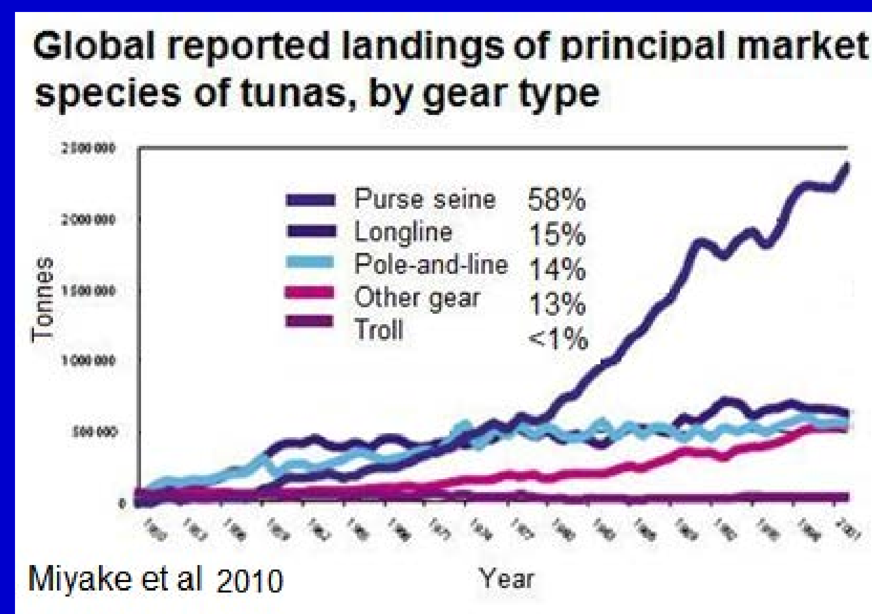
~1.7 million tonnes annually associated sets
~~1 million tonnes annually free school sets
Floating object sets supply predominantly skipjack; free school sets predominantly skipjack in the Pacific, yellowfin in the Indian & Atlantic; for canning
Challenges & costs with tracing product to set type

Pole & Line

~500,000 tonnes annually
Supply predominantly skipjack for canning

Longline

~~650,000 tonnes annually
Supplies fresh/frozen bigeye and yellowfin and albacore for canning



Population-level Bycatch Problems in Tuna Fisheries

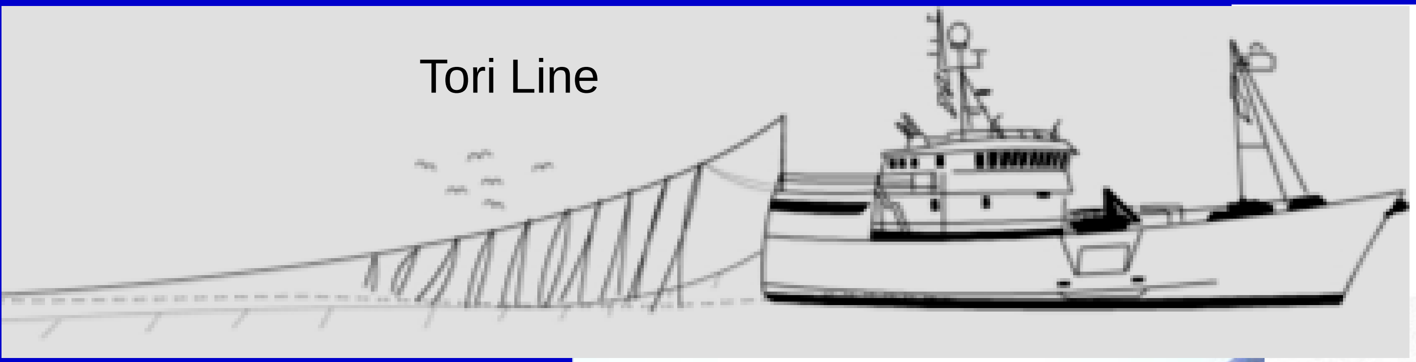
SPECIES GROUP	PELAGIC LONGLINE	PURSE SEINE
SEABIRDS	In higher latitudes.	NA
SEA TURTLES	In tropics and subtropics.	Nominal population-level risk. Entangled in FADs & caught in pursed net.
SHARKS	Blue shark predominant.	Silky & oceanic white tip predominant in associated sets (variable regionally). Bycatch of whale sharks and pelagic rays in targeted sets and inadvertently. Bycatch of manta rays in unassociated sets.
MARINE MAMMALS	Toothed whales. Isolated populations may be most at risk.	Sets on baleen whales can result in mortality. FAD and log sets occasionally result in cetacean and dolphin bycatch.
JUVENILE & UNDERSIZED FISH	Undersized swordfish; catch of juveniles is higher at seamounts.	Juvenile bigeye and yellowfin tunas in associated sets – variable regionally.

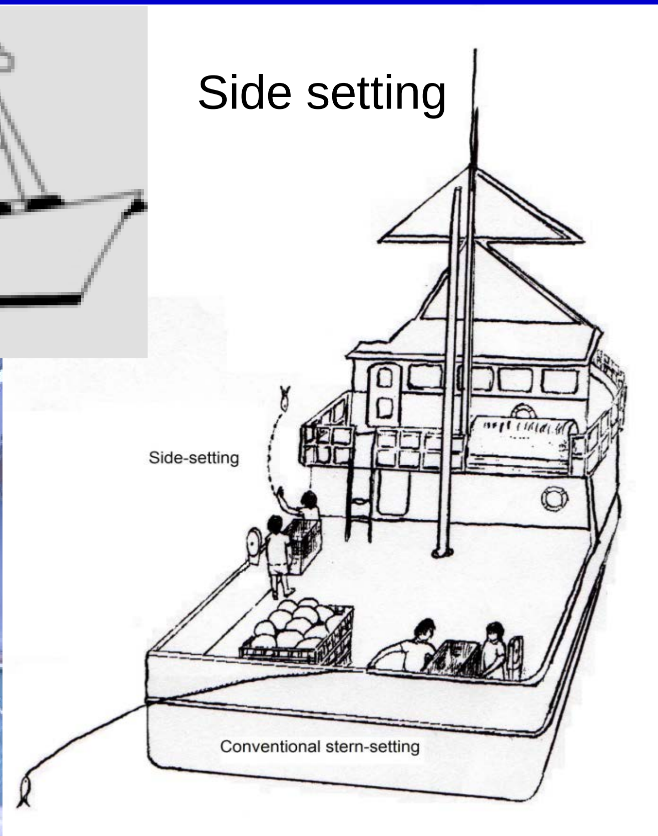
Gilman, E. 2011. Bycatch governance and best practice mitigation technology in global tuna fisheries. *Marine Policy* 35: 590-609.

Approaches to Reduce Unwanted Bycatch & Mortality

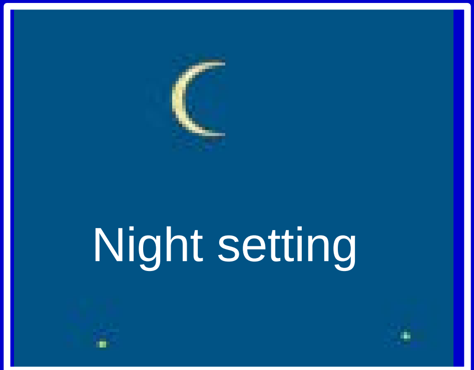
- **Input & Output Controls** Limits on effort & catch
- **Gear Technology** Modifications to fishing gear & methods
- **Changing Gear** To reduce ecological risks, including from bycatch
- **Compensatory Mitigation** E.g., offset bycatch through predator control at nesting colonies – out-of-kind
- **Time/Area Restrictions** Avoid predictable bycatch hotspots , e.g., at seamounts
- **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, buyer procurement specs, improvement projects

Mitigating Seabird – Longline Bycatch

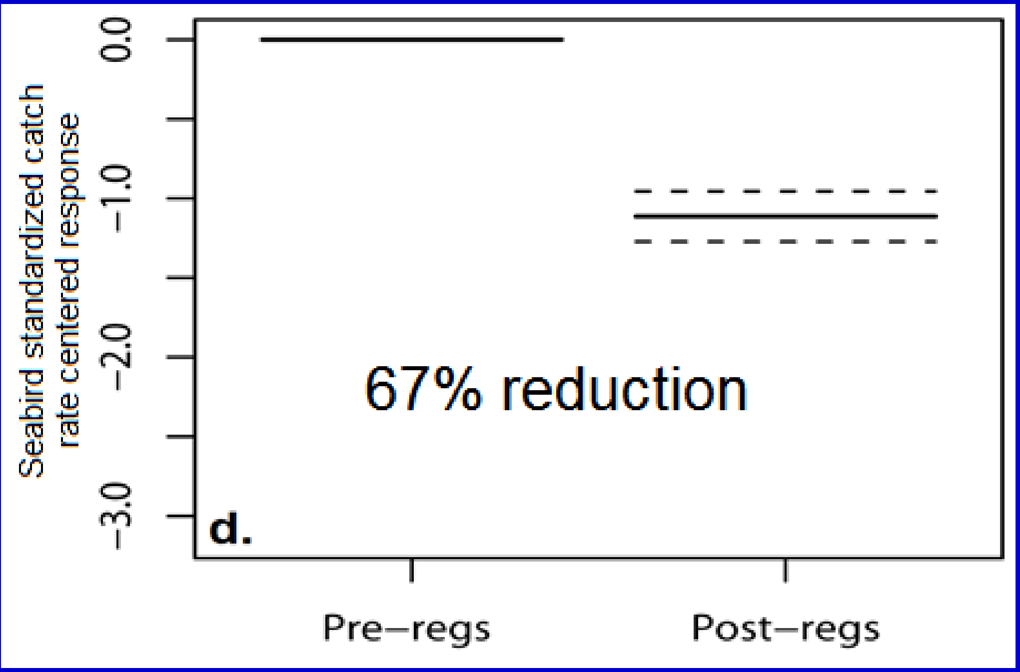




Numerous highly effective gear technology methods to reduced seabird bycatch in LL fisheries.
(Not shown - weighted branchlines, wider circle hooks).



Reducing Seabird Bycatch in the Hawaii Longline Tuna Fishery



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

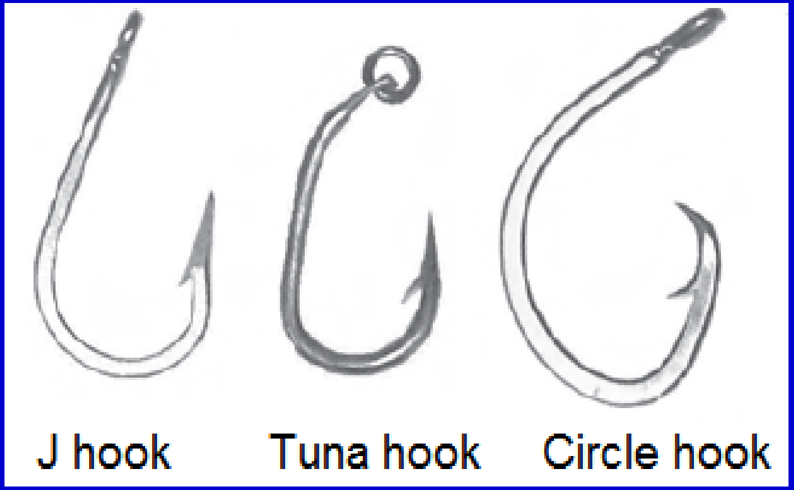
Mitigating
Sea Turtle Bycatch

Molina et al. 2005. WCPFC SC1.

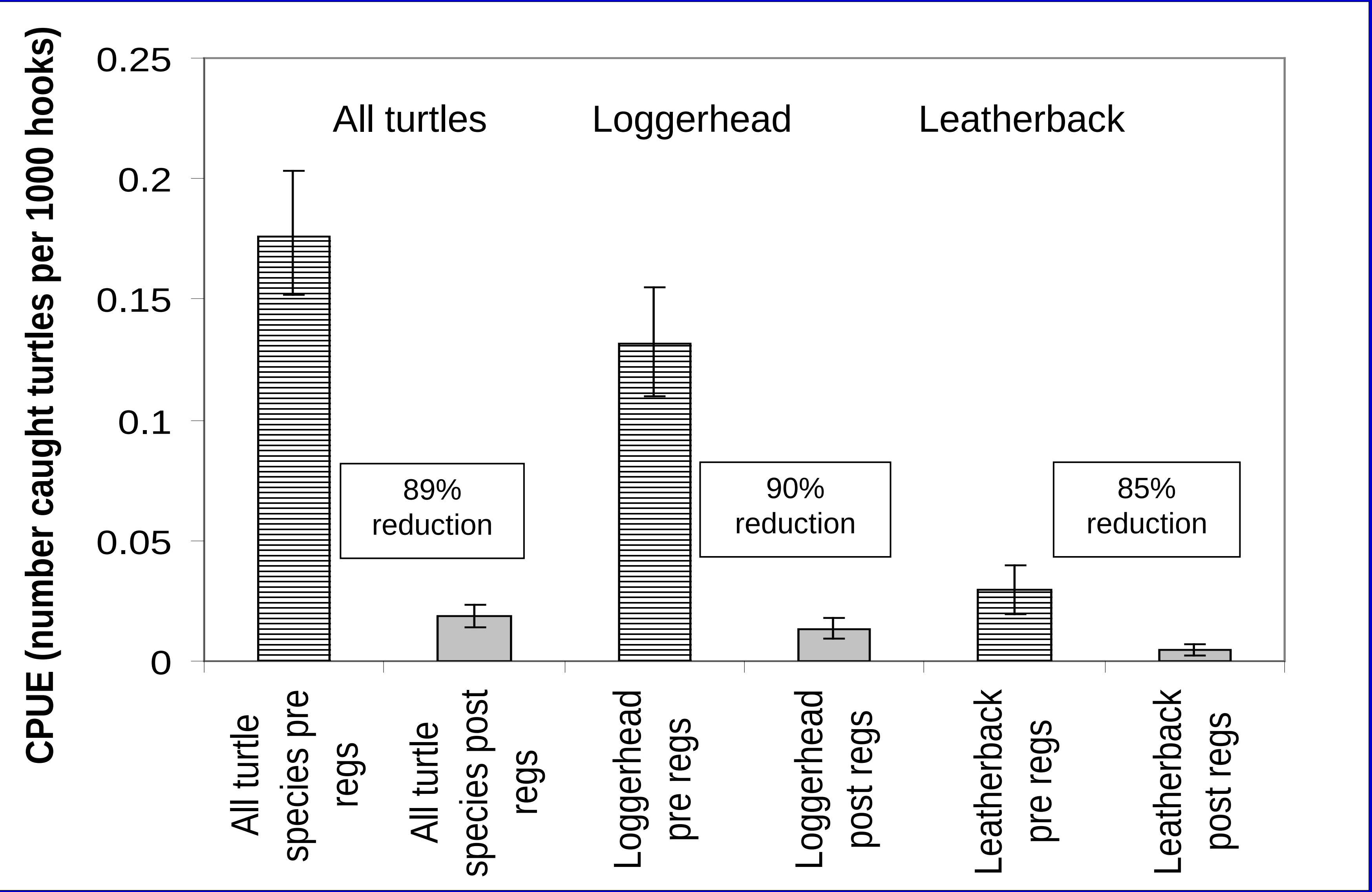
Gilman et al. 2006. *Fish and Fisheries* 7: 2-23.

Gilman et. 2007. *Biological Conservation* 139: 19-28.

Chanrachkij et al. 2008. SEAFDEC.



Nominal Turtle CPUE Pre- vs. Post- Regulations



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

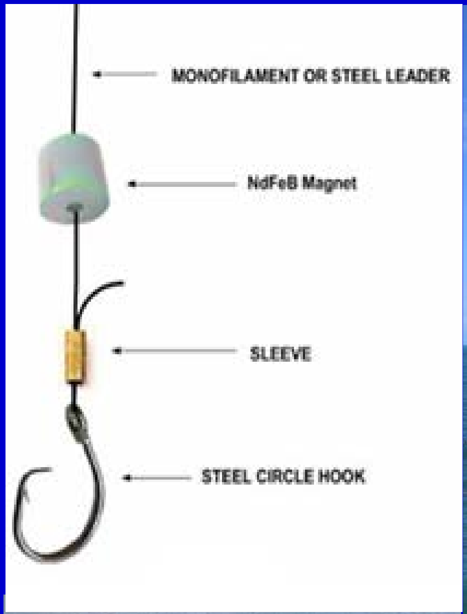
Mitigating LL & PS Shark Bycatch

- Use fish vs. squid for bait, reduces shark LL catch by ca. 30%.
- Prohibit wire leaders (sharks remove terminal tackle).
- Deeper setting.
- Time of day of setting.
- Chemical, magnetic, rare earth electropositive metals, & electrical deterrents – not cost effective.
- PS FAD night sets may separate target from juvenile silky sharks
- R&D in progress (Laurent Dagorn) on the use of attractants (lights, chemicals, chum) to separate target from shark species.

Filmalter , Dagorn, et al. 2011. *Bulletin of Marine Science* 87: 325-337.

Stoner & Kaimmer. 2008. *Fisheries Research* 92: 162-168..

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



Mitigating Cetacean Bycatch

Hall et al. 2000. Marine Pollution Bull. 41: 204-219.

Gilman et al. 2006. *Marine Policy* 30: 360-366.

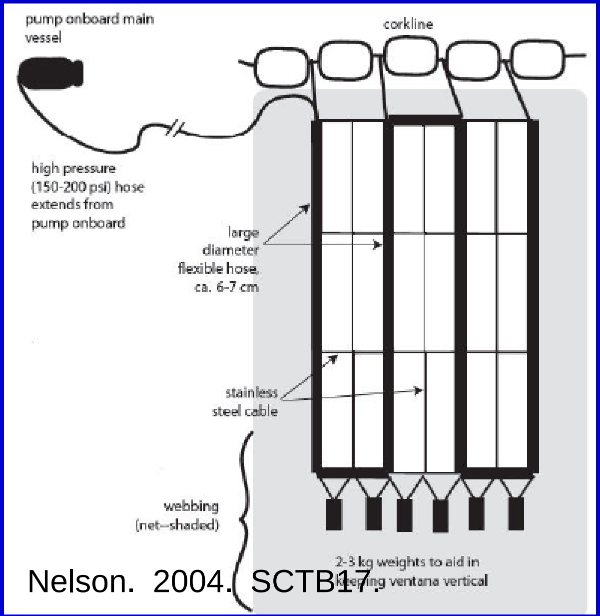
Gilman et al. 2006. *Journal of Cetacean Research and Management* 8(2): 215-223.

<u>Dolphins in purse seines</u>: 98% reductions in direct dolphin mortality in EPO (where dolphins are commonly associated with tunas) through annual mortality limits, backdown procedure (lower net below dolphins), Medina panel (fine mesh sewn into seine where conduct backdown) and deploying rescuers.

<u>Cetaceans on longlines</u>: Circle hooks, 'weak' hooks, move location, fleet communication. R&D needed on deterrents, encasement, hydrophones, etc.

Gear Technology Mitigation of PS FAD Bycatch of Juvenile Tunas

Rios and Sondheimer. 2011. MALAF, Ecuador.

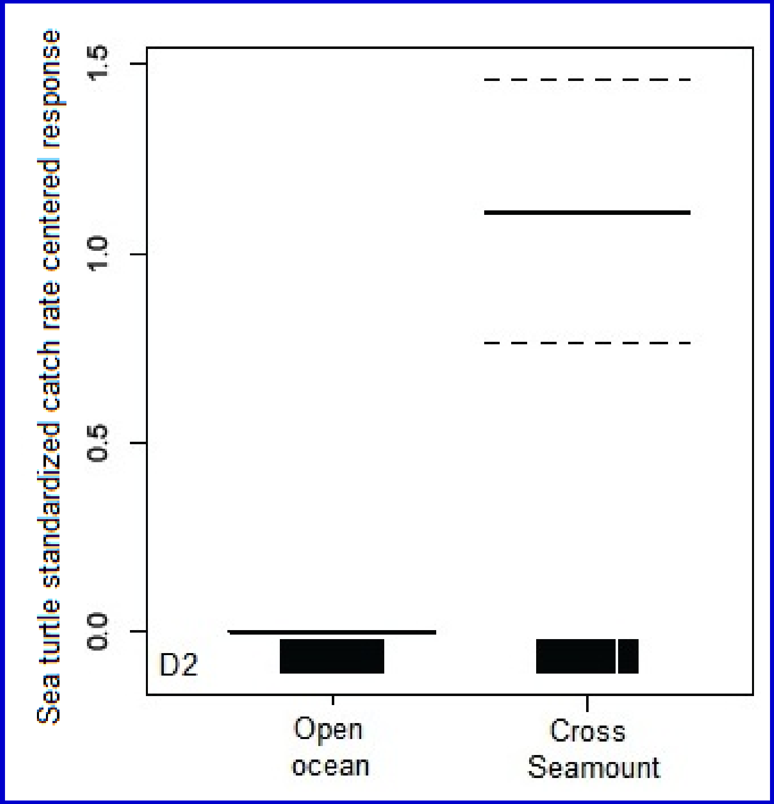


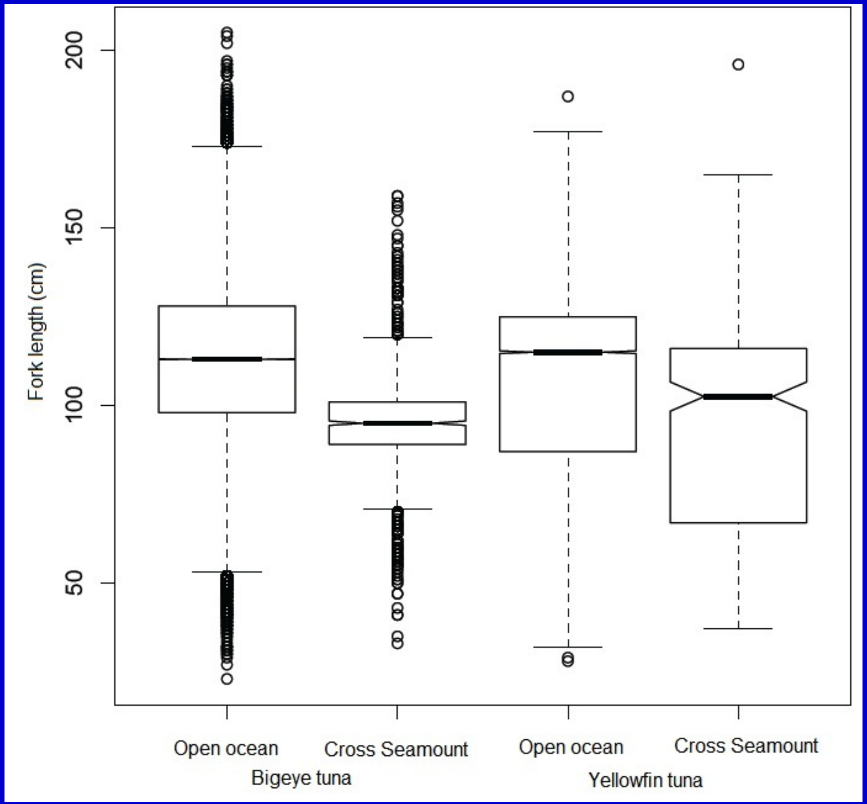
Nelson. 2004. SCTB17.

More R&D needed on:

- Towing FAD out of seine
- Sorting grids
- Separating target and unwanted species/sizes w/in the net
- Depth of FAD appendage
- Distinguish acoustic signatures or sounds
- Stacked and paired FADs
- Time of day of setting
- Methods to increase pre-catch and post-release survival rates.

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





Significantly higher sea turtle catch rate and larger proportion of catch comprised of juvenile tunas at a shallow seamount relative to open ocean catches, Hawaii longline tuna fishery, 1994-2010 (Gilman et al., 2012).

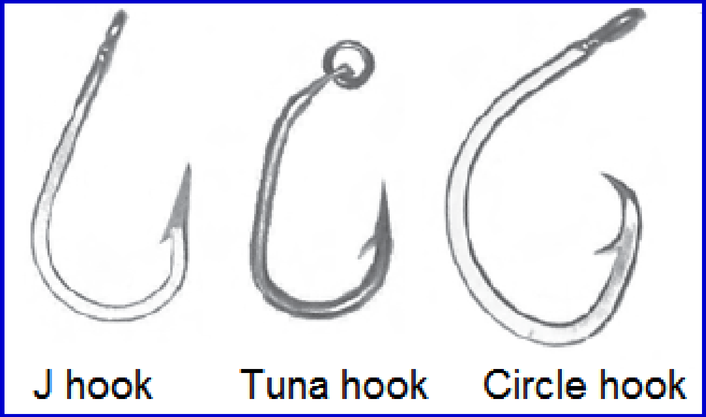
State of Progress in Gear Technology Bycatch Mitigation

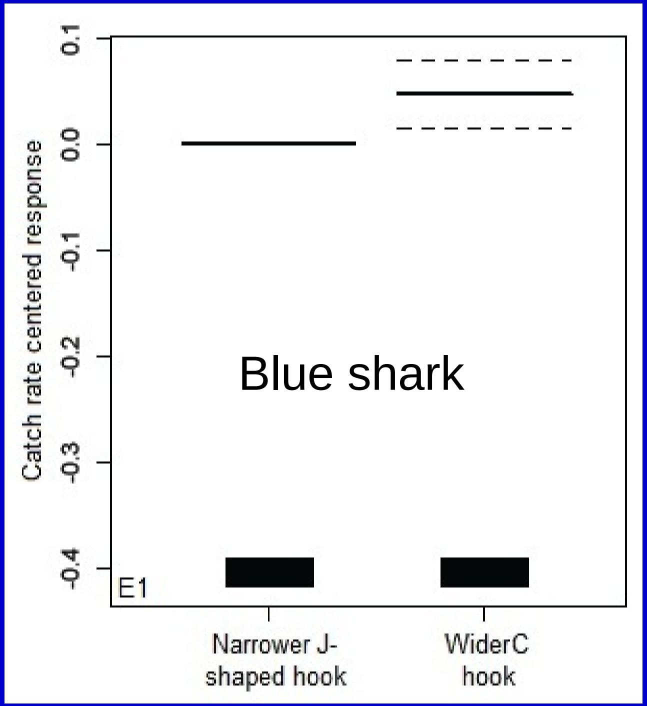
SPECIES GROUP	PELAGIC LONGLINE	PURSE SEINE
SEABIRDS	Large number of effective methods (e.g., night setting, tori lines, underwater setting, side setting, branchline weighting).	NA
SEA TURTLES	Wider hook, circle hook, large fish bait, set > 100m.	Avoid encircling turtles, monitor FADs, recover FADs when not in use, release when in net. R&D on modified FAD designs.
SHARKS	Fish instead of squid for bait, prohibit wire leaders, deeper setting. R&D on repellents.	R&D on separating sharks from FADs at night, attractants (lights, chemicals), repellents. Prohibit intentional sets on whale sharks, rays..
MARINE MAMMALS	Circle hooks, 'weak' hooks. R&D on encasement, hydrophones, taste deterrents.	Medina panel, backing down, deploy rescuers, day sets. Restrict setting on live whales.
JUVENILE & UNDERSIZED FISH	Deeper setting, circle hooks, restricted use of lightsticks, avoid fishing at shallow submerged features.	R&D on towing FAD out of seine, sorting grids, depth of FAD appendage, distinguish acoustic signatures, stacked and paired FADs.

Process Considerations for Effective Gear Technology Research & Bycatch Mitigation Interventions

- Fishery-specific assessment: E.g., underwater setting in Hawaii vs. Australia.
- Cooperative research: Industry knowledge and buy-in.
- Commercial viability: Limited surveillance and enforcement means effective methods will be employed only if they are safe, practical & economically viable – methods that don't rely on crew behavior preferred.
- Effects on multiple species groups: E.g., fish bait avoids turtles & sharks; night setting avoids albatrosses but not nocturnal foragers; circle hooks decrease turtle and seabird catch rates but increase shark catch rates.

Example – Holistic Bycatch Management – Relative Longline Risks to Sea Turtle and Shark Populations





Catch rates on wider circle hooks significantly higher for tunas and some pelagic sharks, and lower for sea turtles and billfishes, relative to narrower J-shaped hooks.

Gilman et al. 2007. *Biol Cons* 139: 19-28.

Gilman et al. 2012. *Aquatic Cons*

Watson et al. 2005. *CJFAS* 62: 965-981.

Indirect Ecological Effects of Pelagic Fisheries and Mitigation Methods

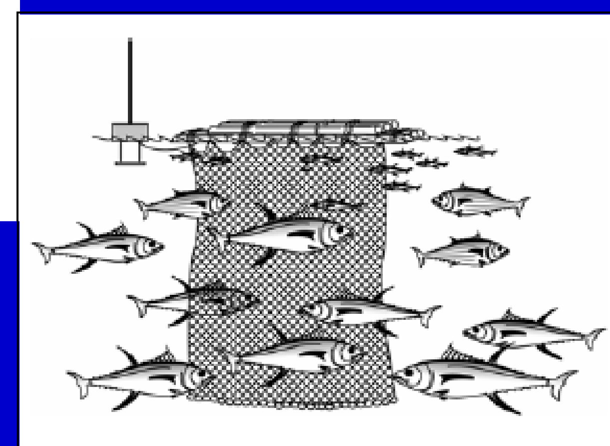
Example – dFADs community-level effects & ecological trap hypothesis

FISH and FISHERIES

DOI: 10.1111/j.1467-2979.2012.00478.x FISH and FISHERIES

Is it good or bad to fish with FADs? What are the real impacts of the use of drifting FADs on pelagic marine ecosystems?

Laurent Dagorn[1], Kim N. Holland[2], Victor Restrepo[3] & Gala Moreno[4]



Indirect Ecological Effects of Pelagic Fisheries and Mitigation Methods

Example 2 – Community effects from fishery discharges

Gilman et al. In Prog. A new pressure indicator of the broad ecosystem-level effects of marine capture fisheries: estimating biomass transferred between pelagic and benthic ecosystems by pelagic and demersal fisheries.

Indirect Ecological Effects of Pelagic Fisheries and Mitigation Methods

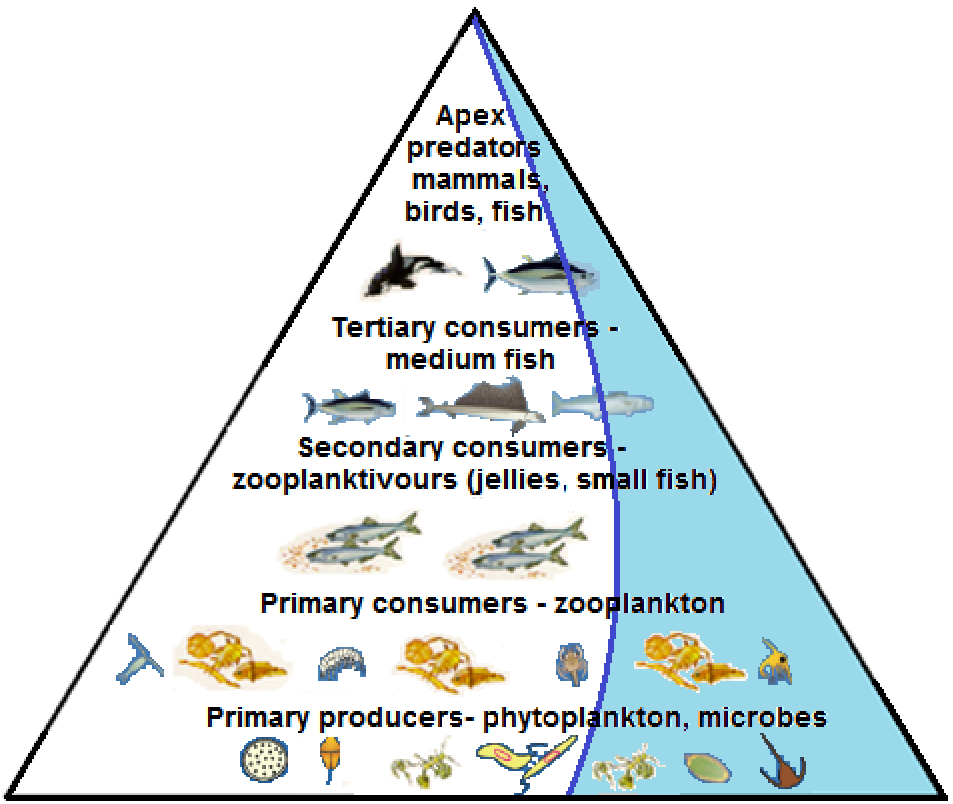
Example 3 – Suboptimal school size

Gilman et al. 2012. Unobservable Fishing Mortality. *Proceedings of the 6th World Fisheries Congress..*

Transitioning to Bycatch Governance via EBFM

Will t-RFMOs transition from the status quo of single-species stock assessments and biological reference points for a small proportion of incidental market bycatch species, and mixed progress in controlling bycatch of species and groups relatively vulnerable to overexploitation, to:

- Estimate and account for indirect effects of fishing mortality and unobservable losses.
- Multispecies ecosystem-level models, indicators and reference points.
- Balance fishing mortality across and w/in trophic levels at sustainable levels according to natural production capacities.
- Marine spatial planning – integrated management of all sectors using marine resources.



Balance exploitation - take a slice through and within the pelagic ecosystem trophic levels at sustainable levels according to natural production capacities.

Tuna RFMO Bycatch Governance

http://iss-foundation.org/rfmo-resolution-database/ - ISSF index to RFMO CMMs

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

Bycatch governance and best practice mitigation technology in global tuna fisheries

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ABSTRACT

Overexploitation of bycatch and target species in marine capture fisheries is the most widespread and direct driver of change and loss of global marine biodiversity. Bycatch in purse seine and pelagic longline tuna fisheries, the two primary gear types for catching tunas, is a primary mortality source of some populations of seabirds, sea turtles, marine mammals and sharks. Bycatch of juvenile tunas and unmarketable species and sizes of other fish in purse seine fisheries, and juvenile swordfish in longline fisheries, contributes to the overexploitation of some stocks, and is an allocation issue. There has been substantial progress in identifying gear technology solutions to seabird and sea turtle bycatch on longlines and to direct dolphin mortality in purse seines. Given sufficient investment, gear technology solutions are probably feasible for the remaining bycatch problems. More comprehensive consideration across species groups is needed to identify conflicts as well as mutual benefits from mitigation methods. Fishery-specific bycatch assessments are necessary to determine the efficacy, economic viability, practicality and safety of alternative mitigation methods. While support for gear technology research and development has generally been strong, political will to achieve broad uptake of best practices has been lacking. The five Regional Fisheries Management Organizations have achieved mixed progress mitigating bycatch. Large gaps remain in both knowledge of ecological risks and governance of bycatch. Most binding conservation and management measures fall short of gear technology best practice. A lack of performance standards, in combination with an inadequate observer coverage for all but large Pacific purse seiners, and incomplete data collection, hinders assessing measures' efficacy. Compliance is probably low due to inadequate surveillance and enforcement. Illegal, unreported and unregulated tuna fishing hampers governance efforts. Replacing consensus-based decision-making and eliminating opt-out provisions would help. Instituting rights-based management measures could elicit improved bycatch mitigation practices. While gradual improvements in an international governance of bycatch can be expected, market-based mechanisms, including retailers and their suppliers working with fisheries to gradually improve practices and governance, promise to be expeditious and effective.

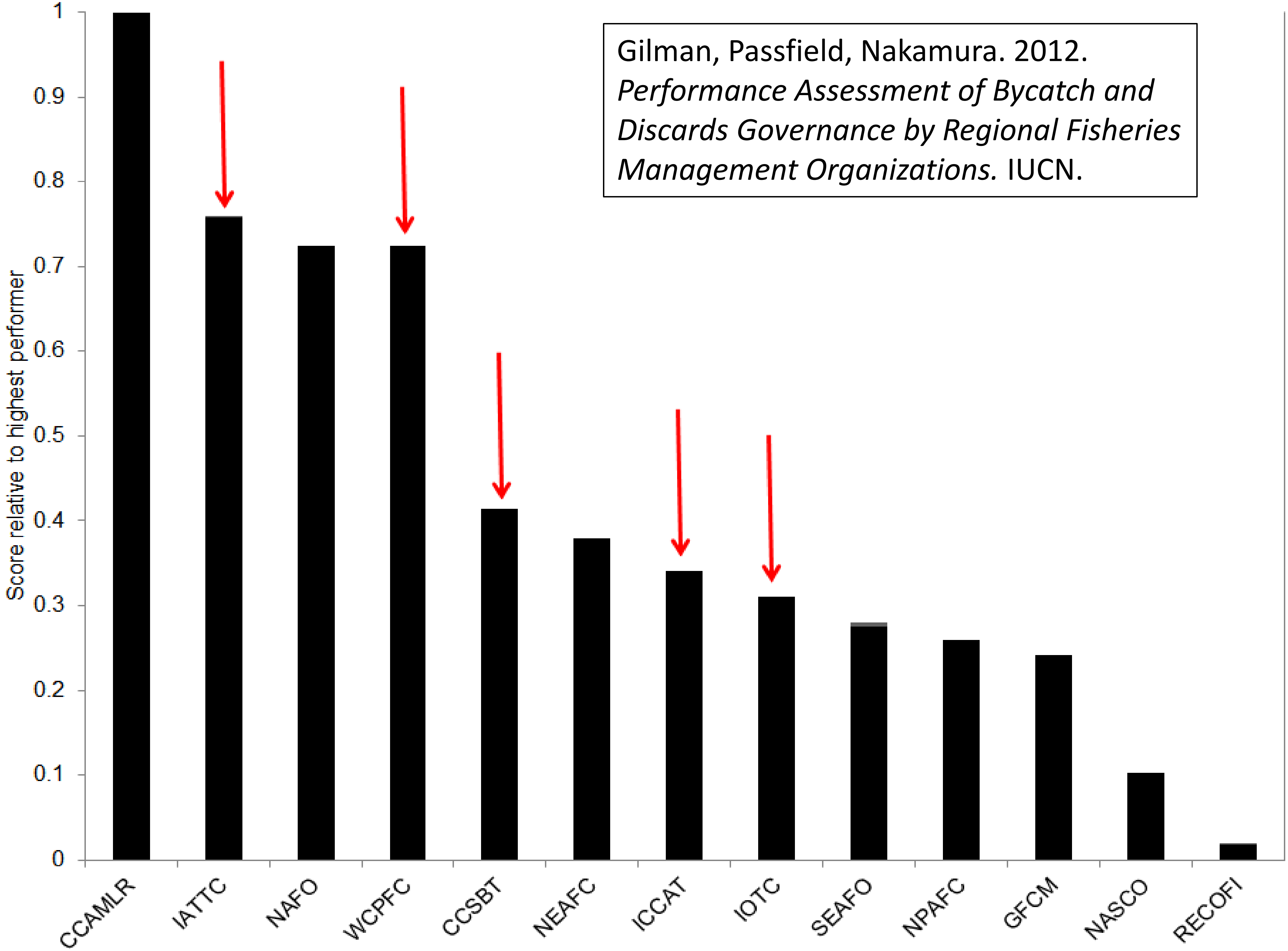
IUCN

Performance Assessment of Regional Fisheries Management Organization Governance of Bycatch and Discards in Marine Capture Fisheries

Eric Gilman, Kelvin Passfield, Katrina Nakamura

CEM

LENFEST OCEAN PROGRAM


Gilman, Passfield, Nakamura. 2012. *Performance Assessment of Bycatch and Discards Governance by Regional Fisheries Management Organizations.* IUCN.
Score relative to highest performer
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
CCAMLR
IATTC
NAFO
WCPFC
CCSBT
NEAFC
ICCAT
IOTC
SEAFO
NPAFC
GFCM
NASCO
RECOFI

Next Steps

1. Continue invest in bycatch mitigation gear technology R&D.
2. Address tuna-RFMO governance deficits:

(i) Monitoring: meet scientific requirements for observer coverage rates, international exchange of observers, comprehensive data collection.

(ii) ERA: Estimate & account for unobservable sources of fishing mortality. Assess collateral consequences of fishing operations.

(iii) Controls: Fill gaps, adopt best practice gear technology, stipulate performance standards. Transition to ecosystem-level reference points and controls. Manage collateral effects.

(iv) Surveillance, Enforcement, Sanctions: Surveillance sufficient to assess compliance, reporting, sanctions promote compliance, transparency.

3. Augment market-based mechanisms to gradually improve fishing practices & governance.

Luen Thai
Fishing Venture Ltd.

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For more information:
http://bit.ly/EGilman