

Economic Incentives to Address Bycatch

Dale Squires

Agnostic Approach

- *"Whether a cat is black or white makes no difference. As long as it catches mice, it is a good cat."*
 - Deng Xiaoping

Organization

- I. General Issues
- II. Potential Policy Instruments
- III. Key Results



I. General Issues



A sea turtle is swimming in clear blue water, surrounded by a school of yellow and black fish. The turtle is moving towards the left, and the fish are following it. The background is a deep blue ocean with some coral visible at the bottom.

I.1. Incentives

Incentives

- Bycatch is both technological and behavioral problem.
- Incentives induce changes in:
 - location and timing of fishing to avoid bycatch
 - bycatch handling
 - technology (e.g. FAD design)
 - investment
 - gear
 - FADs vs free schools
 - consumer behavior
 - etc.

Incentives

- Incentives as judo!
- Positive ("carrots")
 - Reward favored behavior
- Negative ("sticks")
 - Penalize unfavorable behavior
- Perverse
 - Behavior undesired by society
- Direct
- Indirect



All Parties Address All Costs

- Fishers, processors, and consumers.
- Includes costs not presently captured by market values (externalities).



"Price" Bycatch

- Increases bycatch cost
- Pressures participants to innovate and reduce bycatch efficiently.
- Incentive approaches more economically efficient than "command-and-control" top-down regulations.



Practice vs. Performance...(1)

- Incentives on Practice
 - Harvest process (e.g. backdown, no sundown sets)
 - Investment (e.g. Tori lines, FAD design)
 - Where most current emphasis lies



Practice vs. Performance...(2)

- Incentives on Performance
 - Outcomes (e.g. bycatch quotas, credits)
 - Incentives stronger because more direct
- Incentives to innovate in long run focus on harvest process, & are probably most important.

Industry-Wide Bycatch Cap

- Perverse incentive: "race for bycatch"



Two Approaches to Create Incentives Devolving to Individual Vessels...(1)

- (1) Directly implement policies at individual vessel level.

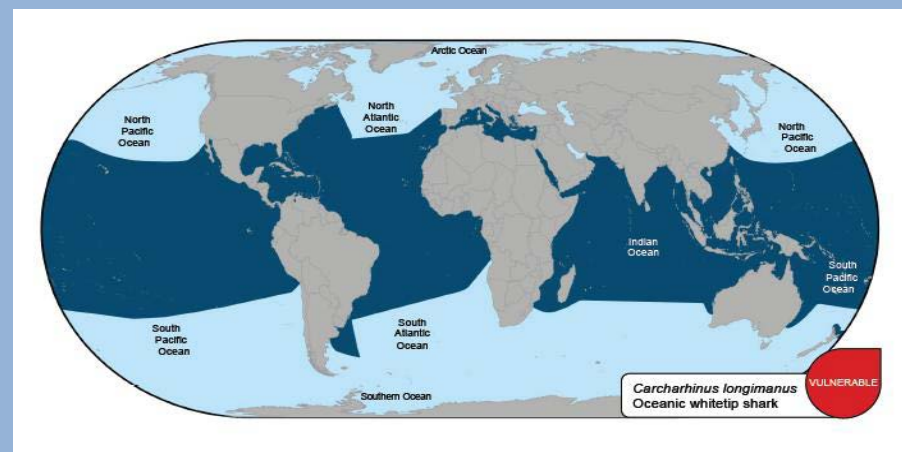
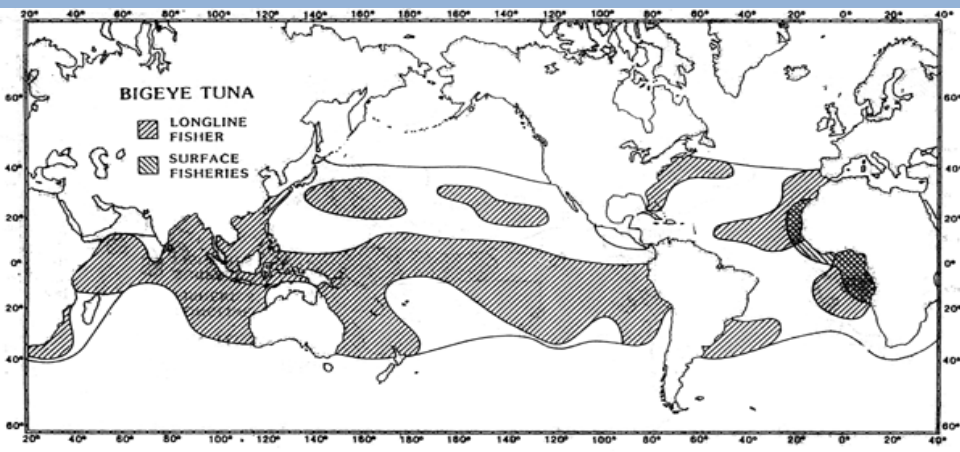


Two Approaches to Create Incentives Devolving to Individual Vessels...(2)

- (2) Implement on groups
 - Sufficiently small to devise and self-manage their own bycatch reduction scheme.
 - Example: group insurance or group bycatch quota.



I.2. Transboundary Resources and Multiple International Fleets



Implications...(1)

- (1) Requires multilateral cooperation and coordination among different players
 - Often states through tuna-RFMOs.
 - Civil society & firms through ISSF
- (2) Issues of national sovereignty
 - Bycatch rights include both right to bycatch and access right

Implications...(2)

- (3) Unique opportunities to mitigate bycatch across life history, fleets, gears, and areas to achieve least-cost conservation



Implications...(3)

- (4) Unilateral conservation by single nation or single gear type not necessarily effective
 - Free riding
 - Transfer effects
 - Shut down/reduce a fishery to stop/reduce bycatch
 - Foregone profits
 - Transfer target catch opportunities and bycatch to other nations & gears
 - Then import fish with no net conservation gain

I.3. Social Norms



More Than Just Incentives

- Social norms are explicit or implicit rules specifying what behaviors are acceptable within a society or group
- Norms help define property rights
- Norms increase and sustain participation in conservation.
- Examples: awareness and education campaigns
 - Skipper workshops

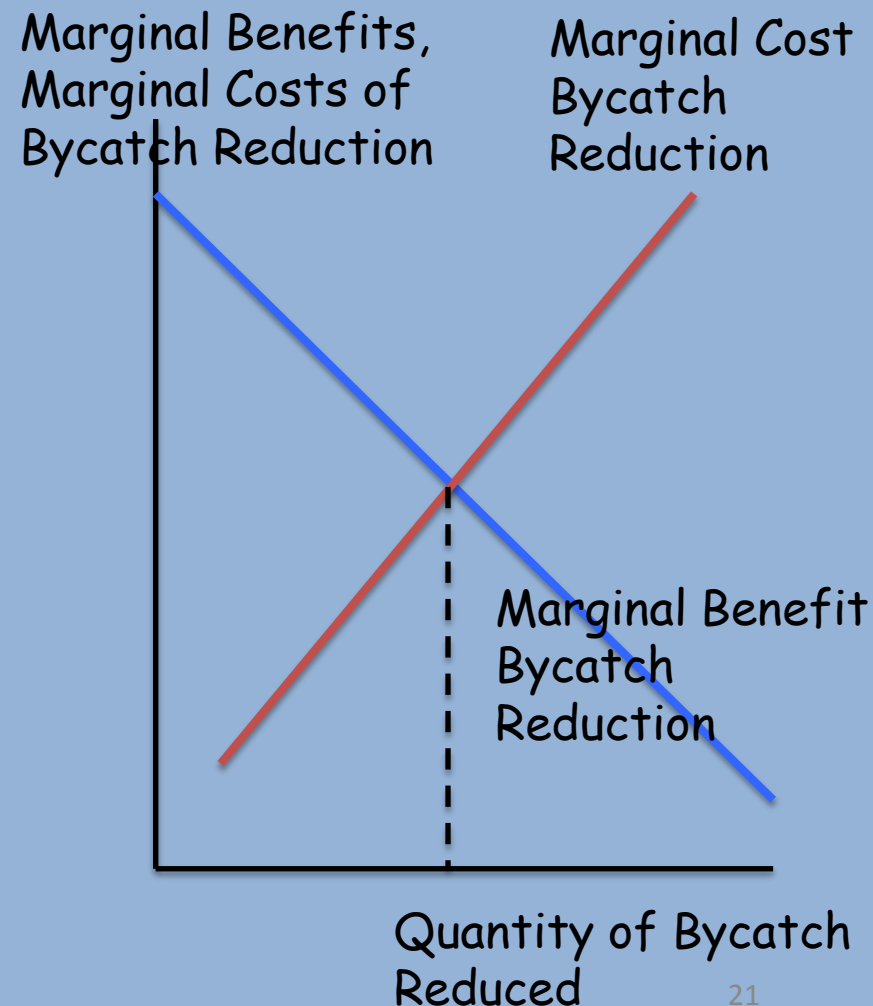
I.4. Economically Efficient Conservation

An underwater photograph showing a large school of fish, possibly snappers or groupers, swimming in clear blue water. A vertical, dark structure, likely a piling or part of a pier, runs through the center of the frame. The fish are of various sizes and are densely packed in some areas, particularly around the structure. The lighting is bright, suggesting a shallow depth.

Copyright © SeaPics.com

Optimum Level of Bycatch is Not Zero!

- Reduce bycatch to level at which additional reductions increase costs of foregone profits more than benefits of bycatch reduction.



In Practice, Cost-Effective Conservation

- Lowest cost method of achieving given reduction in level of bycatch
- Concentrate conservation where costs are lowest
- Least cost across different gear types, areas, fleets, life history of species.

Example of Cost-Effective Bycatch Reduction

Table 3. Annual cost per adult female of leatherback protection strategies

	Annual cost of intervention per adult female	Ratio of cost of fisheries interventions relative to nesting beach intervention
Jamursba Medi/Warmon nesting beach	\$1,858	$\$1,858/\$1,858=1$
Hawaii-based shallow-set longline	\$28,054	$\$28,054/\$1,858=15$
California drift gillnet	\$205,363	$\$205,363/\$1,858=111$

Nesting site protection yields the greatest conservation bang for the buck and leaves profits to finance conservation.

Gjertsen in Dutton, Squires, Ahmed, eds. 2011. *Conservation of Pacific Sea Turtles*. U. Hawaii Press.

I.5. Technological Change



A Laysan Albatross is shown in flight over a dark blue ocean. The bird has white plumage on its head and neck, with dark feathers on its wings and back. Its wings are spread wide, and it is looking towards the right. The background consists of a cloudy sky and distant, hazy mountains.

Probably most important
conservation measure in long run

Incentives and Innovation

- Imperative to reduce bycatch creates economic incentive to innovate



Circle Hook

J Hook

Both Disembodied & Embodied

- Disembodied:
 - Best-practices in bycatch mitigation
 - Backdown procedure
 - Avoid catching bycatch
 - Releasing bycatch alive
 - Dyeing bait
 - Learning by doing
- Embodied in Capital:
 - Requires investment
 - FAD design
 - E.g., Non-mesh below FAD
 - Medina panel
 - Tori lines
 - Circle hooks
 - Pingers



Technical Change Can Also Alter:

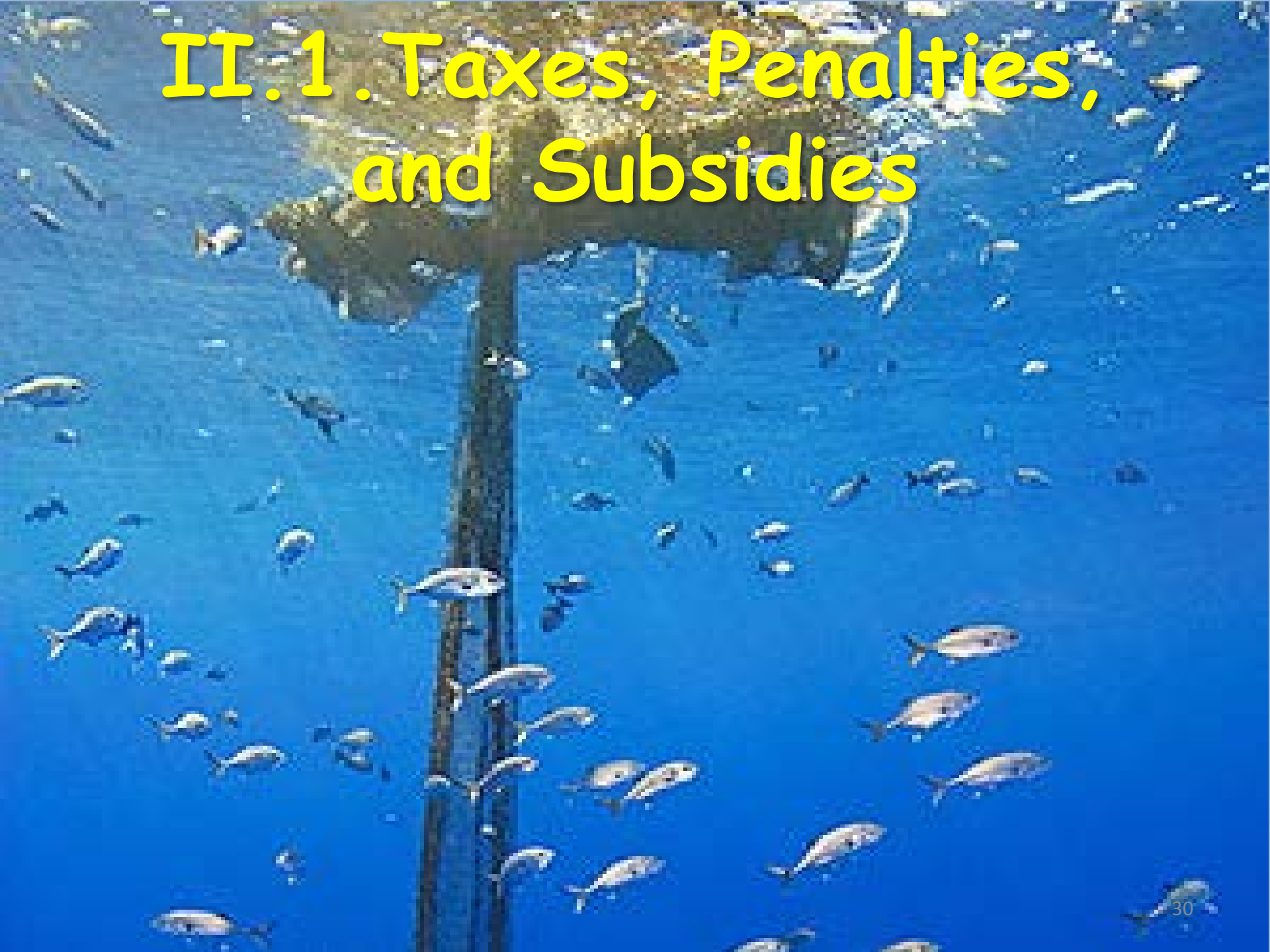
- Bycatch species mix
- Mortality of bycatch
 - Handling practices



II. Potential Policy Instruments

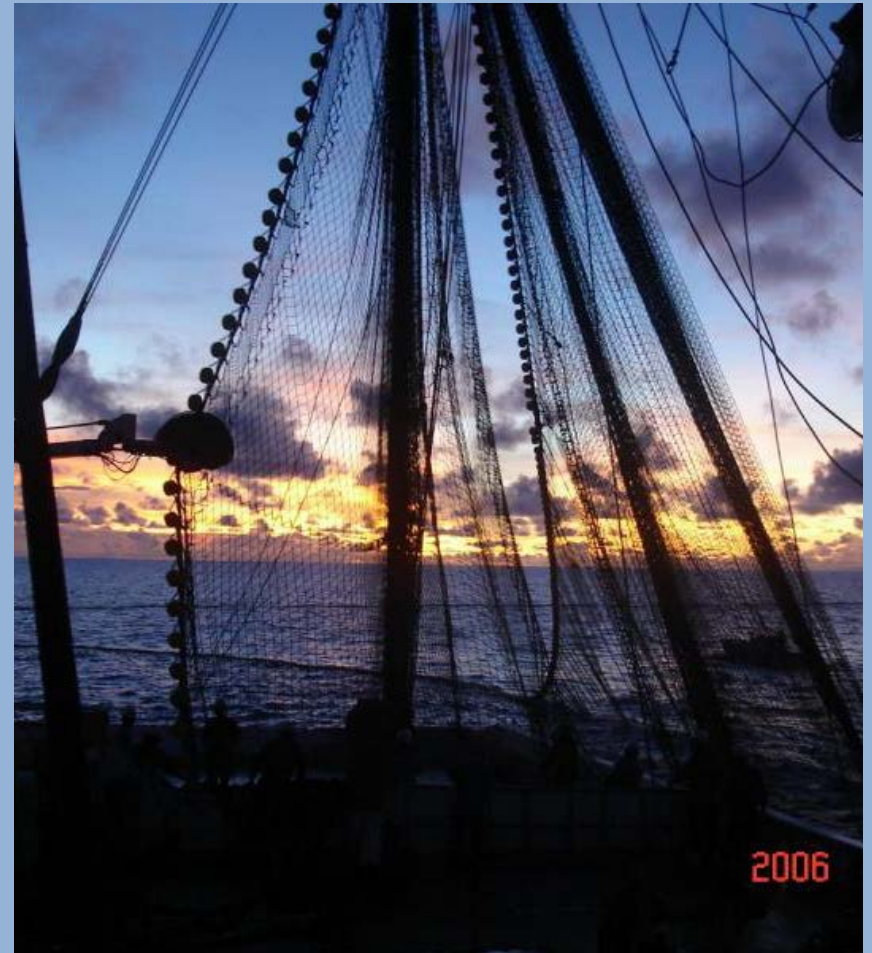


II.1. Taxes, Penalties, and Subsidies



Direct Tax on Bycatch

- Alters fishers' behavior away from bycatch by raising costs
- Hard to calculate
- Deeply unpopular



Tax Target Species Landings at Bycatch Rate

- Less accurate & weaker incentives because on landings of target species.
- Easier to implement.
- Periodic sampling of catches & recalibrate tax.

Double Dividend Taxes

- Tax revenues used to finance additional mitigation
- ISSF, tuna processors, and turtles



Taxes & Fiscal Effects

- Fiscal effects can be mitigated by lump sum rebate.
- Must avoid canceling incentive effects by making lump sum dependent on incentive penalty.



Penalties & Fines

- Raises costs, creating incentives.
- Fines levied on bycatch exceed target levels.
- Fines set high enough that vessel receives higher profits by complying than not complying.
- Difficult with rare events like turtles.

Penalties & Rewards

- Reward vessels when bycatch quota not reached
- Rewards can be:
 - Bycatch credits used in future years
 - Payments.
- Fines when bycatch is high to finance incentive payments when bycatch is low.
- Fines = rewards means no revenue generation or overall cost.

Direct Tax (or Limits) on FADs

- Two Effects on Incentives:
- (1) Creates incentive to reduce overall level of effort by raising costs
 - Reduces both bycatch & target species catches
- (2) Creates incentive to shift to unassociated sets or dolphin sets

Full Retention: An Indirect Tax

- Creates direct & indirect costs that create indirect incentives to alter behavior
- Direct Costs:
 - sorting, handling, marketing, disposal of bycatch
- Indirect Costs:
 - Retention reduces hold space for target species
 - Net cost = Bycatch profit - reduced target profit < 0

Bycatch Reduction Subsidies

- Lowers costs of adopting new technology.
- How to finance?
- Perhaps useful for small-scale fishers
 - Example: circle hooks for coastal Latin American longliners

II.2. Tournaments and Prizes



Tournaments & Prizes

- Payment (prizes) to skippers at end of year related to ranked bycatch performance.



II.3. Conservation Easements & Concessions



Basic Idea

- Owners agree to restrict fishing practices or areas fished in exchange for a payment.
- Example: "land trust" \approx privately imposed MPA
- Property right is retained by original owner.
- Difficult to apply without property rights & financing.

II.4. Property Rights on Bycatch Species

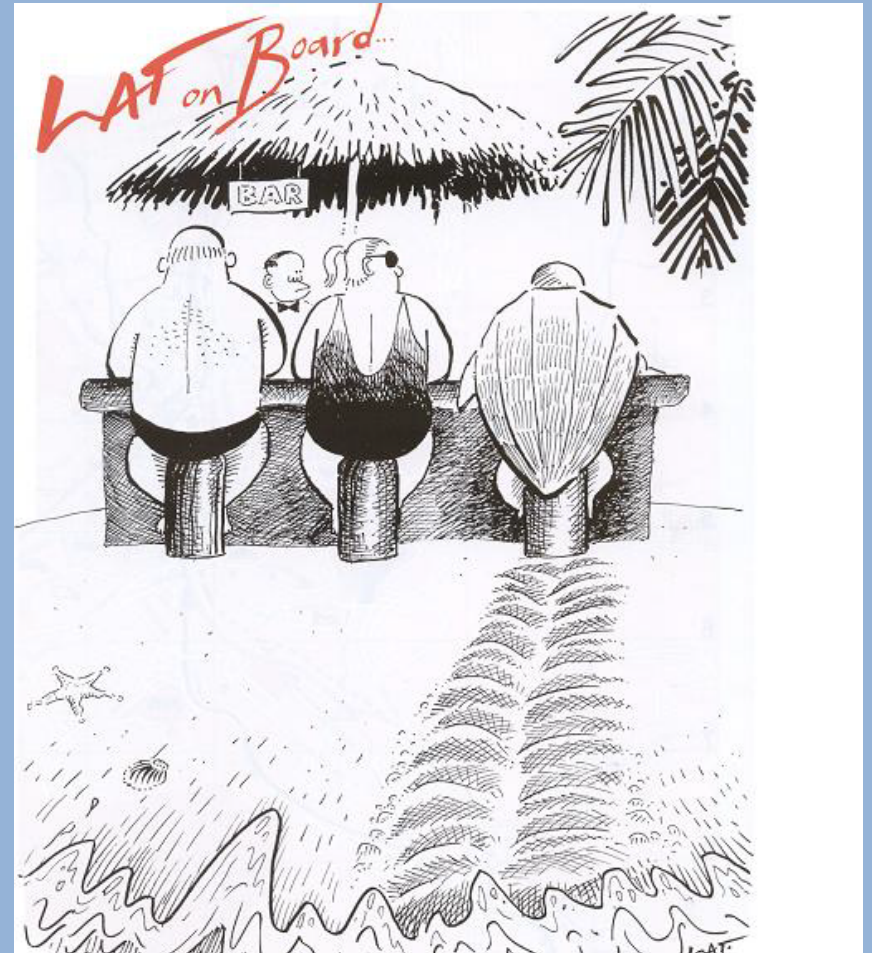


Basic Idea

- Example: Dolphin Mortality Limits (DMLs)
- Depends, in part, if bycatch species is common or rare event such as turtles.
- Requires TAC or target for bycatch.
- Requires observer or electronic observer program

Transferability

- Rewards vessels that avoid bycatch or penalizes vessels that fail to avoid bycatch.
- Creates incentives to avoid bycatch
- Gives flexibility.



Individual Rights

- Rights can be held by individual vessels or groups of vessels
- Individual bycatch quotas require markets to emerge to generate prices and hence bycatch costs.

Group Rights

- Share bycatch risk across vessels.
- Allow vessels to “trade” within group and reorganize harvesting among vessels.
- Creates positive incentives:
 - for self-regulation
 - fosters collaboration through information sharing to avoid bycatch
- Can create perverse incentives for “race to fish”.

Group Rights with Penalties & Rewards

- Proportional penalty on all vessels when industry exceeds limit.
- Proportional reward on all vessels when industry falls short of limit.
- Potentially revenue/cost neutral.

Bigeye Catch Rights

- Numerous studies show greater overall profit (rent) if more longline bigeye catch.
- Longliners can buy bigeye rights from purse seiners.
- Both parties gain through trade plus higher MSY



Rights (Licenses) on FADs

- Incentives to:
- (1) Cap or reduce level of effort
- (2) Increase FAD productivity
- (3) Shift to unassociated sets
 - Or dolphin sets in ETP
 - Generally, lower levels of bycatch



II.5. Individual Tradable Encounter Credits



How Credit System Works

- Variation of cap-and-trade that includes banking into future.
- Variant of penalties-and-rewards systems.
- Vessels are allocated ITEC at beginning of each fishing season
- For each bycatch fish caught, vessels must "pay" 1 ITEC
- Vessels without ITEC cannot fish
- Vessels with bycatch > ITEC supply must buy additional ITEC

"Carrots"

- Rewards individual vessels with comparatively low bycatch levels, by:
- (1) providing higher credits allocations in subsequent year
- (2) creating an additional source of revenue, through selling of excess credits to vessels that need them.

"Sticks"

- Penalizes vessels with high bycatch by:
- (1) decreasing credit allocations in subsequent year
- (2) requiring vessels that have run out of credits to either buy credits (cost) or lease their bycatch to cleaner vessels having extra ITEC (revenue).

Incentive Creation

- Short-Run Incentives.
 - Alter timing and location of fishing, etc.
- Long-Run Incentives
 - Technical change and fleet reconfiguration.

II.6. Biodiversity Offsets (Compensatory Mitigation) (Credit System)



Basic Idea

- Vessels finance lower-cost conservation elsewhere that increases bycatch population & vessels fish more
- Offsets vessels' bycatch mortality.
- Problem of additionality (adverse selection/money for nothing)



Sea Turtle Examples

- Nesting site conservation is least-cost
 - Up to 1% of at-sea cost
- Large-scale longliners finance circle hooks for small-scale coastal longliners
- California drift gillnet fleet & Baja California turtles
- Radio broadcasting to reduce artisanal Peruvian bycatch
 - ISSF/US tuna processors financed

Sea Birds Example

- Rookery conservation (rat eradication) is 10% cost of at-sea conservation.
- Finance tori lines small-scale longliners.



II.7. Combine Biodiversity Offsets with Payments for Ecosystem Services



Payments for Ecosystem Services

- Voluntary payments from one party to another to reduce environmental harm.
- Increasingly used to conserve terrestrial biodiversity and sequester carbon (REDD⁺)

PES Examples

- Phoenix Islands Protected Area
- Sea turtle nesting site direct conservation payments in Rendova, Solomon Islands and Kenya
 - ISSF/US processors-financed in Solomons'



Potential Applications...(1)

- Longliners pay purse seiners to reduce bigeye catch.
 - Longliners still make profit through more bigeye catch and higher bigeye MSY



Potential Applications...(2)

- More profitable industrial fleets pay artisanal/small-scale to:
 - not fish hot spots or
 - skipper-community workshops or
 - use more conservation-friendly gear.



Generalize across
processors & fleets &
gears



Sea Turtle Conservation

- Nesting site conservation,
- Artisanal fleets at choke points, hot spots, and off nesting beaches
 - Baja California & loggerheads
- Finance circle hooks for small-scale longline fleets
- Community workshops

Sea Bird Conservation

- Rat eradication in rookeries
- Finance tori lines, etc. for small-scale longline fleets
- Skipper workshops



Shark Conservation...(1)

- Pay to protect pupping grounds by not fishing
- Pay for best practice workshops



Shark Conservation...(2)

- Pay to not fin sharks or to enforce shark finning bans or to insure international trade consistent with Convention on International Trade in Endangered Species (CITES)
- Consistent with Memorandum of Understanding on the Conservation of Migratory Sharks under UN Convention on Migratory Species (CMS)

Least-Cost Conservation

- Mitigate where costs are lowest.



Costs Shared Throughout Value Chain

- Vessels,
- Processors,
- Consumers.

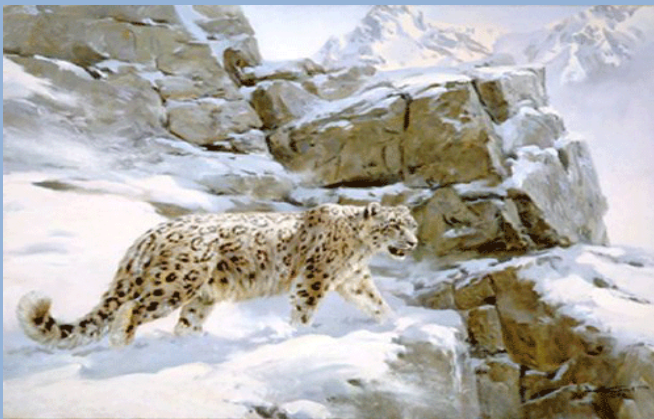


II.8. Insurance Schemes



Pool Bycatch Risk Across Vessels

- Similar to group bycatch quotas.
- Especially useful for rare event / highly uncertain species such as sea turtles.
- Moral hazard and adverse selection problems.
- Used in terrestrial: snow leopards!



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With only 2,000 to 7,000 individuals left in the wild across the Himalayas, the snow leopard is one of the rarest and most elusive creatures in the world.
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II.9. Assurance Bonds



How It Works

- Place sum of money into trust.
- Apply at industry (group) or individual vessel level.
- Bond is refundable, provided damage is:
 - not incurred or
 - repaired
 - e.g. through offsets or habitat restoration work.

Incentives for Groups

- Positive incentives to
 - Reduce bycatch
 - Share information to reduce bycatch
- Perverse incentives of race to fish

II.10. Indirect Incentives: Community Conservation & Integrated Development Conservation Projects



Integrate Conservation and Development

- Reward local communities for conserving habitat and reduce bycatch in ways that also improve their living standards
- Gives them a stake in conservation
- Creates indirect incentive to change behavior

Examples

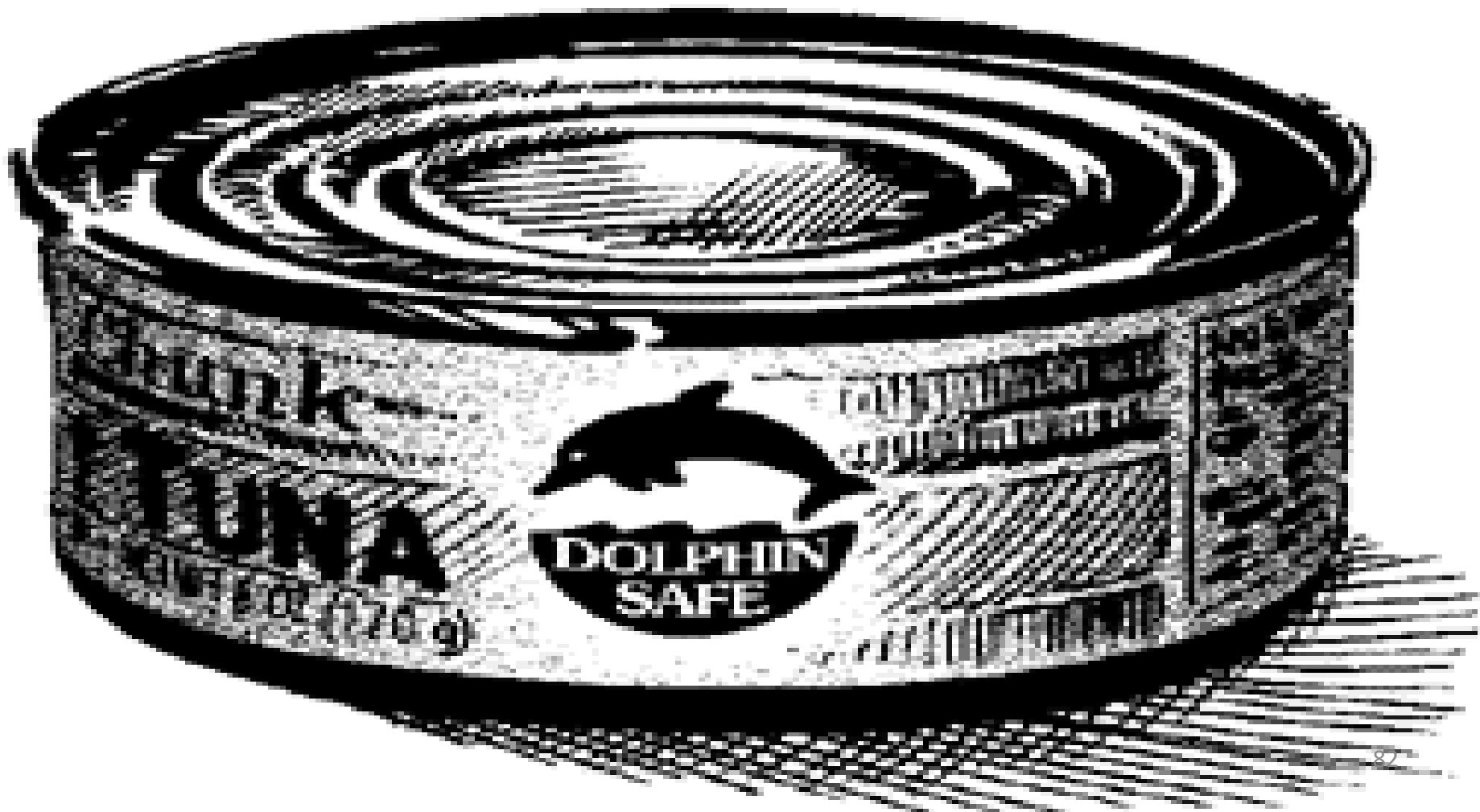
- Projecto TAMAR for Brazilian sea turtles
- Shark ecotourism in Polynesia
- Reduce leatherback harvests in Indonesia
- Beach patrols, in situ nurseries, reduce egg harvests for turtles for school k ,in Indonesia

II.11. Embargoes and Sanctions

- Includes CITES



II.12. Market Access & Ecolabeling

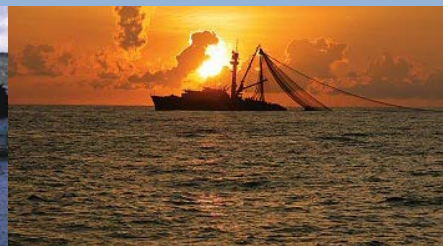


Incentives

- Consumer preferences
- Price premiums for niche processors & markets
- Defensive position for large processors
- Green pressure in consumer markets on FAD-caught tunas is one of most important economic incentives today.
 - Works back through value chain.
 - Analogous to dolphin-safe

Concrete Applications

- Processors don't purchase tunas, swordfish, other target species from vessels with persistently high bycatch.
- Processors purchase only certified tunas.
- ISSF ProActive Vessel Register.
- ISSF vessel best-practice record with price premium and/or market access.



III. Key Results



Incentives

- Incentives create costs and benefits for vessels to reduce bycatch.
- Least-cost conservation.



Governments, NGOs, & Consumer Markets

- Important economic incentive is pressures for FAD-caught tunas on consumer markets and hence processors and vessels.
- Government requirements.



Policies & Incentives

- Combination of approaches most likely.
- Create incentives at level of individual vessel or group (company, national fleet).
 - Both can be effective.
 - Group has great potential for large-scale tuna fishing.
- Least-cost conservation across life history, gears, areas, national fleets.

Unilateral Conservation

- Often ineffective
- Free riding
- Transfer effects.



Process vs. Performance

- Focus incentives on harvest process (inputs) or bycatch (output).
 - Bycatch requires stronger MCS & enforcement.
 - Bycatch more likely to require RFMO involvement.
- Incentives lead to innovation & fleet reconfiguration in long run
 - Probably most important.

Bigeye Catch Rights or Payments

- Longliners buy rights from purse seiners
- Longliner payments to purse seiners (PES)
- Both parties increase profits
 - Larger bigeye MSY
 - Gains from trade
 - Higher valued longline bigeye
- Bigeye is landed regardless, little or no need for explicit bigeye observer program
 - But already have in EPO & WCPO

Biodiversity Offsets & Payments

- Least-cost conservation
- Costs are shared throughout value chain.
- Turtles, sea birds, sharks



Bycatch Rights & Credit Systems

- Requires bycatch TAC/target
 - May not be fully scientifically set
- Observer programs required
- RFMO system makes "easy" implementation difficult
- Indian Ocean has large artisanal sector.

Consider Group Rights

- Simpler governance than individual rights.
- Let groups (companies, nations) figure out solutions for a given target.
- Compliance through companies & processors as well as governments & RFMOS.
- Consider with penalties & rewards.
 - Rewards can be bycatch credits or \$\$\$
 - Can be fiscal & revenue neutral.

Thanks!



That's all Folks!

II.14. Harvest Priority Programs



- Requires existing target catch quotas or seasons
- Harvest priority programs reserve part of target catch quotas or seasons for vessels that meet specific bycatch standards.

Relieve Import Taxes & Tariffs

- Taxes or tariffs could be eliminated for the import of bycatch reduction devices
 - Circle hooks, dehookers, etc.
- Reduces cost of bycatch reduction.



Deemed Values

- Charge vessels proportion of landed value for any catch of quota species for which they do not hold quota.
- Reducing discarding of over-quota catch by providing an incentive to land this catch, but ideally no incentive to continue to target it
- allows fishers to land and sell over-quota catch, but pay a fee (NZ\$/kg, varying by species and stocks) in order to do so without prosecution. The effective price received for the fish is then the market value less the deemed value
- The deemed value charged to the fisher increases as their level of unaccounted for (i.e. over-quota) catch increases (Peacey 2002). The objective of the deemed value fee is to provide sufficient incentive to land the over-quota catch, but not sufficient incentive to target the species (Sanchirico *et al.* 2006)
-

Basic Idea...(1)

- Measurable conservation outcomes, planned to balance any significant biodiversity losses.
- Achieve no net loss and preferably a net gain of biodiversity.
- Consistent with Convention on Biological Diversity.



A large sea turtle, likely a hawksbill, is the central focus, swimming towards the left. Its head is turned slightly towards the viewer, showing its eye and patterned skin. The turtle's shell is a mix of brown and tan with distinct scutes. It is surrounded by a large school of small, bright yellow fish, possibly parrotfish, which are swimming in a circular pattern around the turtle. In the background, there are several larger, dark-colored fish, possibly surgeonfish, swimming in the same direction. The water is a deep, clear blue, and the overall scene is vibrant and dynamic.

III. Appendix: Sources & Further Reading

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