

**Appendix D3: Unilateral Conservation of Transboundary Resources:
West Coast Swordfish and Pacific Sea Turtles**

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Outline

- 1. Introduction
- 2. Background
- 3. Changes in Net Benefits: Cost-Benefit Analysis
- 4. Components of the Analysis
- 5. Empirical Results
- 6. Concluding Remarks

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1. Introduction



A Tale of Good Intentions...

- Unilateral conservation of transboundary resources
- Application of ESA
- Close fishing area to lower bycatch of Pacific leatherback & loggerhead sea turtles
- Drift gillnet fishery off west coast USA.

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...with an Unanticipated Ending...(1)

- Induced:
- (1) reduced domestic production of fresh, locally caught swordfish
- (2) transfer of swordfish production abroad - "production leakage"
- (3) imports back into U.S. - "trade leakage"
- (4) increased foreign sea turtle mortality
 - "Transfer effect" / "conservation leakage"

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...with an Unanticipated Ending...(2)

- Lead to decrease in net economic benefits for west coast U.S. vessels, firms in supply chain, and consumers
- Plus....
- Net increase in sea turtle bycatch that further reduces U.S. west coast net economic benefits.
- *Ex-post* cost-benefit analysis to measure change in net benefits.

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2. Background



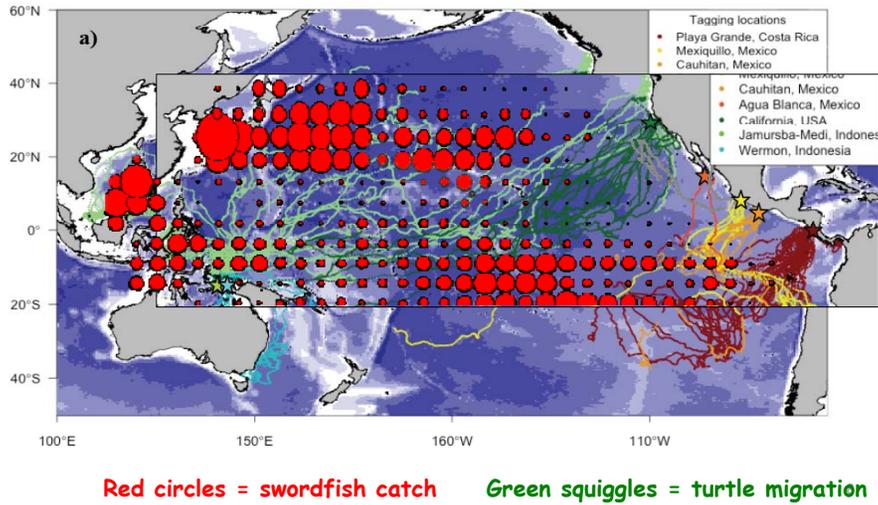
Transboundary Resource & Imports

- U.S. west coast consumer demand for swordfish filled by both U.S. west coast production and Hawaiian and foreign production & imports.



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Leatherback Turtles Running the Gauntlet



Federal Leatherback Conservation Closed Area

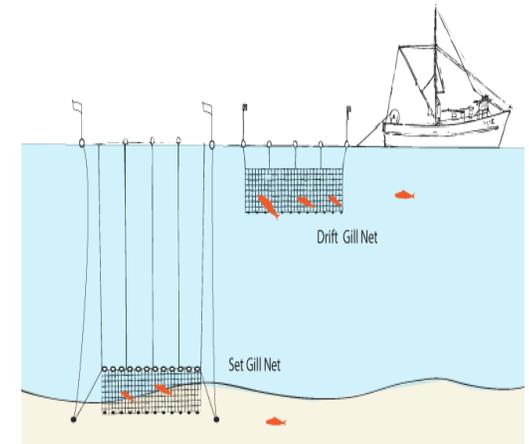


3. Changes in Net Benefits: Cost-Benefit Analysis



With and Without

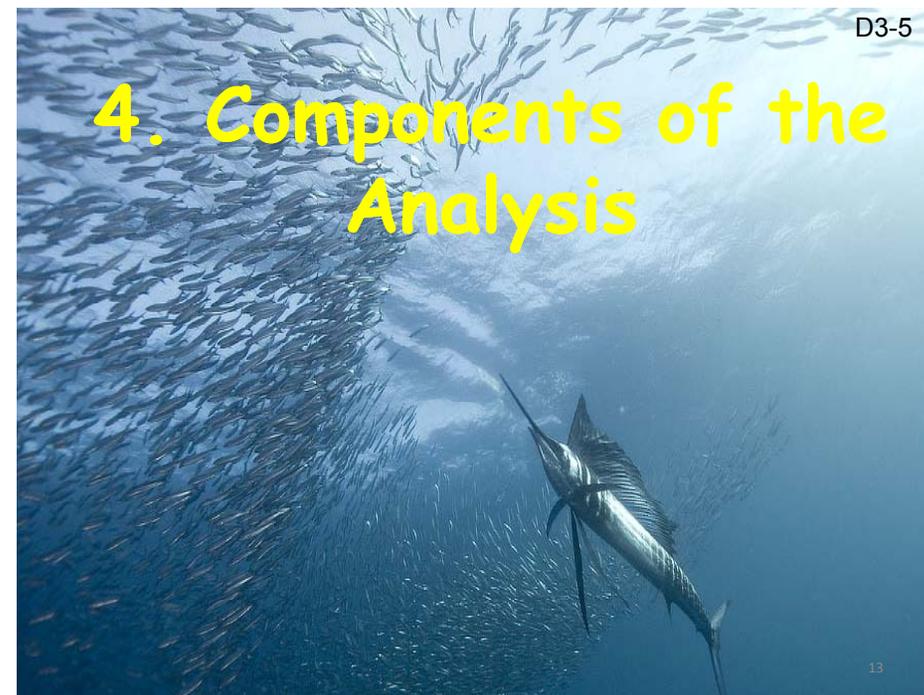
- With = with ESA action
 - Observed
- Without = without ESA action
 - Need counter-factuals



Changes in Net Benefits From:

- (1) Loss in producer surplus west coast DGN vessels
- (2) Loss in consumer and producer welfare in supply chain from reduced DGN production
- (3) Gain in producer and consumer welfare in supply chain from HI & foreign imports
- (4) Gain in producer and consumer welfare from potential increase in longline catches
- (5) Gain in consumer welfare from reduced domestic DGN sea turtle mortality but potential increase in domestic LL sea turtle mortality
- (6) Loss in consumer welfare from increased foreign sea turtle mortality

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4.1. Counterfactual Drift Gillnet Swordfish Production & Fleet Size

- Hazard (duration) model
- Estimate California DGN swordfish landings
- Estimate California DGN fleet hazard rate
 - Rate of vessel exit



4.2. Inverse Demand Model...(1)

- Econometric estimation of system of equations
- Monthly data from January 1997 to December 2008
- Calculate compensating variation losses for consumers and firms in supply chain

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4.3. Inverse Demand Model...(2)

- Equilibrium functions allow adjustments to declines in local production of swordfish and sharks through:
- (1) increased foreign imports & Hawaiian imports,
- (2) substitution to domestic west coast longline and harpoon-caught swordfish,
- (3) substitution to west coast albacore tuna

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4.4. Estimate Increased Imports

- Vector autoregression model / transfer function
- Translates price increase for swordfish imports due to lower domestic swordfish landings into increase in imports

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4.5. Counterfactual Estimate of Sea Turtle Bycatch

- Kalman-filter based estimate of leatherback interaction rates inside and outside of time-area closure.
- Produced counterfactual prediction of additional drift gillnet fishery leatherback turtle interactions that would have occurred for years since 2001 had closure not been implemented.

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4.6. Counterfactual for Foreign Fleets

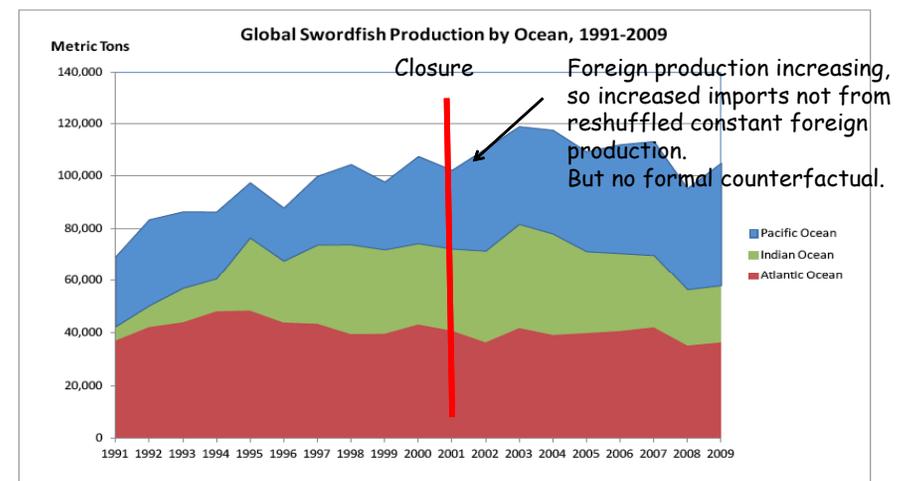


Figure 1.--Global Swordfish Production by Ocean, 1991-2009. Source: FAO Fisheries Global Information System. http://www.fao.org/figis/servlet/TabLandArea?tb_ds=Capture&tb_mode=TABLE&tb_act=SELECT&tb_grp=COUNTRY

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Pacific Swordfish Production Increasing

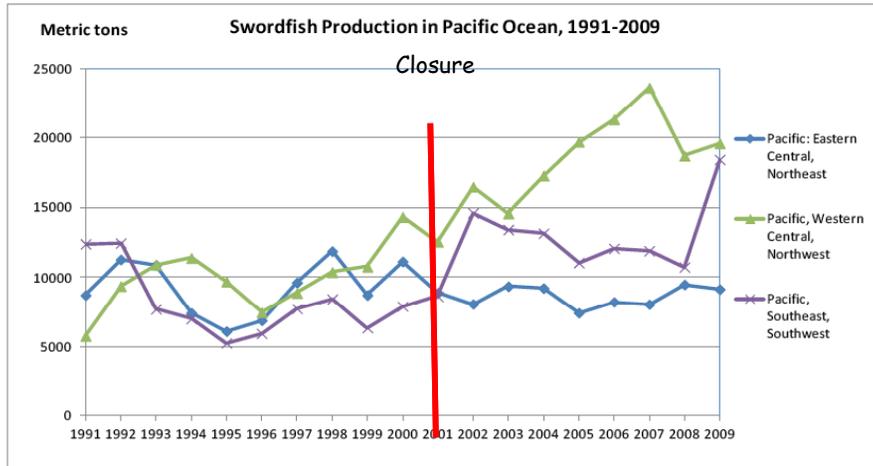


Figure 5.— Global swordfish production in Pacific Ocean by area, 1991-2009. Source: FAO Fisheries Global Information System.

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5. Empirical Results



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US Domestic Swordfish vs. Imports

- West coast consumers value west coast-caught swordfish (fresh) from all gears more than imported swordfish (largely frozen)
- Consumers place lower value on imports.
- (Source: Demand analysis)

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Harpoon-caught enter into different market

- Harpoons do not have sea turtle bycatch.
- Harpoon-caught swordfish are luxury good
- It does not substitute in consumption for drift gillnet-caught swordfish.
 - Cannot fill consumption gap.
- (Source: demand analysis and cost-and-earnings survey)

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Harpooning for swordfish is unprofitable

- Profits negative for 2008-2010.
- (Source: cost-and-earnings survey for 2008-2010)



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Small volume of swordfish landings from "clean" gear will not compensate for reduced drift gillnet landings

- Landings from buoys, hook-and-line, and harpoons very small proportion of total landings on west coast.
- Harpoon landings remain largely unchanged after 2001 closure.

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Closure induced DGN vessel numbers from vessel exit.

- About 11 fewer DGN vessels over 2001-2010 compared to what would have occurred without closure.
- Lower producer surplus
- Work-in-progress: producer surplus gained from alternative fishing for exiting DGN vessels
- (Source: Hazard-attrition model)



Closure induced smaller DGN swordfish landings than otherwise would have occurred.

- Reduced drift gillnet swordfish landings



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Closure induced lower annual DGN leatherback bycatch rate than otherwise would have occurred.

- Closure reduced drift gillnet leatherback bycatch rate by 3.78 turtles per year due to reduced effort (number of sets).
- Counterfactual annual leatherback bycatch rate: 1.51 turtles.
- (Source: Kalman filter model counterfactual and observer data.)

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Longline Counterfactual

- Work in progress to determine with and without impacts upon LL swordfish landings, producer surplus, sea turtle bycatch
- Cross-price flexibility for increase in LL swordfish price with lower DGN landings
 - From inverse demand model for
- Multiply by own-price swordfish supply elasticity for LL
 - From simple supply response model

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Not all sea turtle bycatch is created equal.

- Transfer effect has a greater bycatch impact for EPO imports than WCPO imports
- EPO leatherback populations are less healthy



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Mean willingness to pay for recovery of leatherbacks and loggerheads

- US estimates of mean annual willingness to pay for the recovery of:
- Leatherbacks: \$67.97
- Loggerheads sea: \$42.72.
- (US\$2011 per household every year for ten years.)
- (Source: Wallmo and Lew, *Conservation Biology* 2012)

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Total Loss Over 10 Years

- 2001-2010 (present value, US\$2012):
- (1) DGN vessel producer surplus loss: \$10,765,793
- (2) Consumer and supply chain compensating variation loss: \$15,030,957
- (3) Upper bound welfare loss (WTP) from higher net bycatch: \$75,339
- Need calculate longline fleet incremental (with and without) producer surplus & bycatch
- (OMB 10-year real discount rate of 1.00%)

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Economic Impact Multipliers: Economic Impacts upon Income and Employment

- In 2001 and measured in US\$2012:
- (1) revenue foregone: \$1,554,476
- (2) income foregone: \$761,585
- (3) number of jobs lost excluding vessels: 15.
- (4) with 11 vessels lost, number of crew-captain jobs lost: 37.

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6. Concluding Remarks

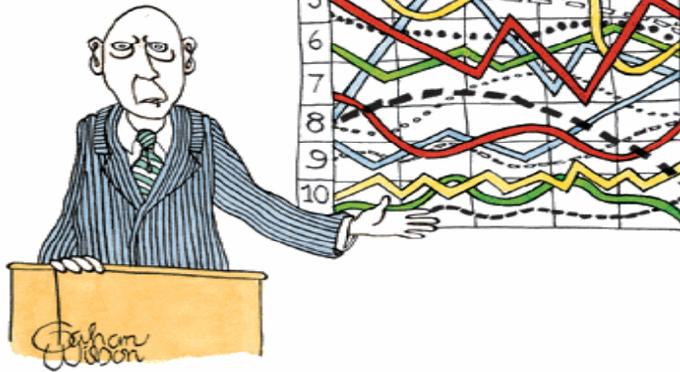


Two Externalities Require Two Policy Instruments

- Two externalities
- Each one requires a policy instrument
- Transnational requirement of multilateral cooperation is a second externality



Thanks!
Questions?



"I'll pause for a moment so you can let this information sink in."