Rent Dissipation in Chartered Recreational Fishing: Inside the Black Box

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The Importance of Recreational Fisheries

- A traditionally ignored source of mortality in fisheries management
- Recent research has demonstrated the biological significance of recreational takes for many species (Coleman, et al., 2004)
- Attempts at regulation have typically utilized bag & size limits and season restrictions to curb fishing mortality
  - Example: GOM red snapper

Rationalization for Recreational Fisheries?

- IFQs and other “market based” solutions to open access are increasingly advocated for recreational settings.
  - Guided by commercial fisheries experience
- Problems
  - Monitoring and enforcement
  - More complex pathways for rent dissipation
  - Theory has often proven inadequate in the commercial case!

Recreational Fishing: Theory

- Two key contributions
  - McConnell & Sutinen (1979)
  - Anderson (1993)
- “Demand side” focus of these papers does not help with the mixed commercial/recreational nature of a substantial sector of recreational fishing.

Our approach

- We take a unique approach that combines
  - Traditional bioeconomic modeling
  - A flexible and multidimensional theory of the choice of inputs for the for-hire fishing firm
- This unified approach allows us to examine the long run linkages between angler preferences and supply decisions of vessel owners.
- Understanding these linkages helps to:
  - Predict likely pathways for open access dissipation
  - Craft better corrective policies

The Model: Angler Demand

- Assume a population of (identical) anglers with the marginal benefit (demand) function:

$$MB(D, H, L, S)$$

Number of angler-days demanded over season (-)

Per-day harvest of targeted species (catch quality) (+)

Quantity of landed (retained) harvest (+/-)

Non-catch trip quality (+)

The Model: Catch and Noncatch Quality

- Per-angler harvest is a function of biomass and "catch effectiveness" – $H(X, q(z_q, N))$
  - Catch effectiveness is a function of the number of anglers on a vessel and "catch augmenting" labor and capital inputs
- Non-catch quality is a function of the number of anglers and a vector of labor and capital inputs – $S(z_s, N)$
- Inputs can jointly influence catch and non-catch quality in a quite general fashion

The Model: Vessel Expenditure Function

- Vessels face three types of costs:
  1. Those that vary with the # of trips
  2. Avoidable fixed costs
  3. Unavoidable (except by exit) fixed costs
- Some of the first two expenditures may also vary with the number of anglers aboard
- We assume trips (fixing quality & # anglers) are produced at constant variable cost

Model Specification

- The vessel expenditure relationship:

$$c(z_q, z_s, N, NumTrips, w, r) = \left[(w_{VN}' z_{VN})N + w_V' z_V\right] * NumTrips$$
$$+ \left[(r_{FN}' z_{FN})N + (r_F' z_F)\right] + \Psi.$$

- To integrate dynamics into the model we need a biomass dynamic equation:

$$\dot{X} = g(X) - D^*\left(\underbrace{\phi\left(H(X, q(z_q, N)) - L\right)}_{\text{Discard Mortality}} + L\right)$$

Number of angler-days demanded

Landings

The Optimal Program

$$\max_{D^*, L, N, N_V, z} \int_t^{\infty} e^{-\delta\tau} \left(\begin{array}{l} \int_0^{D^*} MB\Big(D, H\big(X, q(z_q, N)\big), L, S(z_s, N)\Big) dD - \\ N_V * c(z_q, z_s, N, NumTrips, w, r) \end{array} \right) d\tau$$

subject to:

$$\dot{X} = g(X) - D^*\Big(\phi\Big(H(X, q(z_q, N)) - L\Big) + L\Big)$$

$$L \le H\Big(X, q(z_q, N)\Big), \;\; NumTrips \le D_{MAX}, \;\; NumTrips = \frac{D^*}{N_V N}$$

Necessary Conditions: Findings

- Each vessel must be fully employed in every season.
- The marginal current benefit of an additional angler day must equalize the marginal cost of serving the marginal angler *and* the user cost of the associated mortality.
- Angler density should exceed its desirable short-run level due to its long-run benefits in reducing fishing mortality.
- The marginal benefits of retaining an additional fish should just equal its *in situ* value times the probability of survival upon discard.

Necessary Conditions: Inputs

$$\underbrace{\left[\int_0^{D^*} MB_H(\cdot)H_q\,dD - \lambda D^*\phi H_q + \mu_1 H_q\right]}_{\chi_q^*} q_{z(i)} + \underbrace{\left[\int_0^{D^*} MB_S\,dD\right]}_{\chi_S^*} S_{z(i)}$$

$$= \left[w_{VN(i)}N + w_{V(i)}\right]\frac{D^*}{N}.$$

$$\Downarrow$$

$$\frac{\chi_q^* q_{z(i)} + \chi_S^* S_{z(i)}}{\chi_q^* q_{z(j)} + \chi_S^* S_{z(j)}} = \frac{w_{VN(i)}N + w_{V(i)}}{w_{VN(j)}N + w_{V(j)}}.$$

Open Access Competition

- Anglers fail to internalize the dynamic costs of discards → an excessive discard rate
- There is excessive demand for angler days → excessive fishing mortality
- Quality competition drives angler density to *too low* a level → too many (total) trips
- Too many firms will enter the fishery, squandering cost reductions from declining average costs of trip provision → vessel (and factor) underemployment.

Open Access, cont.

- The (myopic) price of catch quality exceeds the optimal level.
- Results
  - Excessive catch effectiveness
  - Overuse of (some) catch augmenting inputs
  - Possible over or under-use of some non-catch quality exclusive inputs depending on sustitutability across quality types in consumer demand
  - Input mix for non-catch quality will be skewed toward “joint” inputs, including those that reduce non-catch quality.

Corrective Policies

- In principle we need to place taxes/subsidies on angler days, landings, angler density and all catch augmenting inputs equal to their LR marginal user cost
- However, properly set *ex post* instruments on both sources of fishing mortality ($\tau_L = \lambda_{SS}, \tau_{H-L} = \lambda_{SS}\phi$) achieves the same end.
- Interestingly, merely "getting the prices right" for fishing mortality is not enough to avoid dissipation:
  - A third instrument targeting entry is needed.

A Recreational IFQ for Charter Vessels?

- One possibility: allocate tradable *mortality* quota to vessel owners
  - Sold to anglers on the basis of their discards/landings
  - Discard quota sells at a fixed (mortality dependent) discount
- Advantages:
  - Leaves allocation of mortality to discard/landings to market
  - Vessels can adopt best practices to vie for certification as “low mortality” vessels
  - Ex post levies on mortality provide proper incentives to both anglers and vessel owners
  - Avoids “cat and mouse” game from targeting angler-days or catch augmenting inputs

Challenges

- Monitoring and enforcement – especially discards
  - Possible second best solutions
    - Mandated practices for minimizing discard mortality
    - Full landings requirements
  - Random audits with stiff penalties
- Allocation between recreational and commercial sectors?
- The non-charter recreational sector?
- Anglers are not necessarily clear winners under rationalization without transfers (even in the LR)

Conclusions

- Rent dissipation in charter recreational fisheries is a complex product of
  - Angler preferences
  - Input decisions of recreational service providers
  - Dynamic biological systems
- Models that integrate realism in the characterization of the supply decisions of recreational service providers with the insights of bioeconomic theory can yield valuable policy insights.

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