Rent Dissipation in Chartered Recreational Fishing: Inside the Black Box

Joshua Abbott
School of Sustainability
Arizona State University

James Wilen
Department of Agricultural and Resource Economics
University of California, Davis
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 noncatch quality in a quite general fashion
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:
  \[ c(z_q, z_s, N, \text{NumTrips}, w, r) = [(w_{VN} ' z_{VN})N + w_V ' z_v] \cdot \text{NumTrips} \]
  \[ + [(r_{FN} ' z_{FN})N + (r_F ' z_F)] + \Psi. \]

- To integrate dynamics into the model we need a biomass dynamic equation:
  \[ \dot{X} = g(X) - D^*(\phi(H(X, q(z_q, N)) - L) + L) \]
  Number of angler-days demanded
  Discard Mortality
  Landings
The Optimal Program

\[
\max_{D^*, L, N, N_V, z} \quad \int_0^\infty e^{-\delta \tau} \left[ \int_0^{D^*} MB \left( D, H \left( X, q(z_q, N) \right), L, S(z_s, N) \right) dD - N_V * c(z_q, z_s, N, NumTrips, w, r) \right] d\tau
\]

subject to:

\[
\dot{X} = g(X) - D^* \left( \phi \left( H \left( X, q(z_q, N) \right) - L \right) + L \right)
\]

\[
L \leq H \left( X, q(z_q, N) \right), \quad NumTrips \leq D_{MAX}, \quad NumTrips = \frac{D^*}{N_V N}
\]
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

\[
\begin{align*}
\left[ \int_{0}^{D^*} MB_H(\cdot) H_q \, dD - \lambda D^* \phi H_q + \mu_1 H_q \right] q_{z(i)} &+ \left[ \int_{0}^{D^*} MB_S \, dD \right] S_{z(i)} \\
=& \left[ w_{VN(i)} N + w_{V(i)} \right] \frac{D^*}{N}. \\
\hline
\frac{\chi_q q_{z(i)} + \chi_S S_{z(i)}}{\chi_q q_{z(j)} + \chi_S S_{z(j)}} &= \frac{w_{VN(i)} N + w_{V(i)}}{w_{VN(j)} N + w_{V(j)}}.
\end{align*}
\]
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 substitutability 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.
Acknowledgements

- Environmental Defense
  - Vishwanie Maharaj