Cost-Earnings Study of Hawaii’s Small Boat Fishery, 1995-1996

Marcia S. Hamilton and Stephen W. Huffman

SOEST 97-06
JIMAR Contribution 97-314
Pelagic Economic Projects

- **Hawaii Fishing Industry & Vessel Economics**
  - 1994 – present
    - Longline, Small-boat trolling and handline, Charter boats and Charter patrons
    - Pelagic seafood market dynamics

- **Hawaii pelagic fleets programming modeling**
  - 2000 – present

- **International management alternative approaches**
  - 2000 - present
<table>
<thead>
<tr>
<th>Sector</th>
<th>Sample Size</th>
<th>Published</th>
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<tbody>
<tr>
<td>Longline</td>
<td>95</td>
<td>1996</td>
</tr>
<tr>
<td>Troll-handline</td>
<td>569</td>
<td>1997</td>
</tr>
<tr>
<td>Charter boat</td>
<td>62</td>
<td>1998</td>
</tr>
<tr>
<td>Tournaments</td>
<td>7</td>
<td>---</td>
</tr>
<tr>
<td>Charter patrons</td>
<td>&gt; 300</td>
<td>Interim 2000</td>
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</table>
HIFIVE Activities

- Basic data for economic modeling
  - Collaboration with most other JIMAR economics projects
- Development of simple Excel cost-earnings simulators
- Preliminary longline production modeling
  - including effort allocation model
  - Fishing fleet capacity estimates
- Sociology dissertation project on small-boats
Applications

- Regulatory Flexibility Analysis
  - Impacts on small businesses
- Litigation
  - Costs and benefits of alternatives
- Environmental Impacts
  - Costs and benefits of alternatives
- Economic research
  - Production methodologies
Longline effort allocation model

- Model developed by former JIMAR associate researcher Rita Curtis (now at NMFS HQ)
  - Deals with fishermen’s spatial and target choices
  - Termed “Random utility models” (RUM), Multinomial Logit or Discrete Choice models
  - Accounts for net revenues, risk, and variability
Need for a dynamic model of economic behavior

- Fishermen incur large costs to access distant fishing sites that often outweigh the expected returns from single day of production.
- Fishermen decisions may be based upon stream of returns generated over course of a trip.
- Fishermen take multiple day trips and are highly mobile
  - May choose sites based upon whether neighboring sites are also high performing.
Context:
Longline Fishery Closure Alternatives
Court-ordered Closure

Court-ordered Closures 8/03/2000
RUM Data Management Process

1. Define “sites” and “fishery/target” choices.
2. Define fisherman’s choice set on each choice occasion.
3. Forecast returns to sites in next period; stream of returns.
4. Forecast returns to fishing regions/target choices.
5. Calculate travel costs to sites, fisheries.
6. Calculate “targeting” costs.
7. Determine catch deterioration costs for accessing different choices.
8. Miscellaneous tasks: estimating boat values; determining vessel entry/exit to California fishery.
Choice structure for analyzing fisherman’s choice of location and targeting strategy for multiple-day fishing trip.
### Choice Structure

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<th>S2</th>
<th>S3</th>
<th>S4</th>
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<th>S9</th>
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Conclusions

- Fishermen respond positively to expected benefits
- Fishermen are risk averse
- Fishermen use other vessels’ activity as an indicator of site “quality”
Economic welfare estimates
(change in owner wealth over time)

- Area and seasonal closures
  - Swordfish trips
    - $43,000 per trip
  - Mixed target trips
    - $20,400 per trip
  - Tuna target trips
    - $4,000 per trip

-- indicative results only!
Longline effort allocation model application

- Publication forthcoming in Economics journal
- NMFS exploring extension of RUM model to current applications
  - Cost of movement and changes in targeting
  - Cost of entry and exit from fisheries
## Bigeye price determination
(1994-96 weekly)

<table>
<thead>
<tr>
<th>Weekly BE Price =</th>
<th>$8.65*</th>
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<tbody>
<tr>
<td>- 0.0038 Qbe*</td>
<td>+ 0.28 Pt-1*</td>
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<td>-0.0056 Qyf*</td>
<td>-0.0056 Qaku*</td>
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<tr>
<td>+0.56 D</td>
<td>-0.21T*</td>
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D = holidays  
T = SST

| R2 = 0.50 | DW = 1.89 |
Bigeye Landings and Prices with & without Longline Fishery Closure
(April-May Closure)

- Lb (1,000)
- Price ($/lb)

Month

- Lb (without)
- Lb (with)
- Price (without)
- Price (with)
Pelagic Fleet Programming

Further development of PingSun Leung’s JIMAR project model:

- A Multilevel and Multiobjective Programming Model for the Hawaii Fishery

  ✓ Minling Pan, PingSun Leung, Fang Ji, Stuart T. Nakamoto, and Samuel G. Pooley

- JIMAR Contribution # 99 (1999)
Pelagic fleet model extension

- Improved spatial structure
- Updated longline and small-boat data
  - Creating more flexibility and therefore more realistic results for regulatory analysis
- Identification of shadow prices of recreational fishing: trade-off analysis

--- New project staff beginning 10/2000
Pelagic fleet model parameters

- **Inputs**
  - Policy goals: fleet profit, recreational participation
  - Policy instruments: Area and seasonal closures
  - Biological conditions: Stock abundance & CPUE
  - Market conditions: Prices and costs
  - Fleet characteristics: Number of vessels

- **Individual vessel criteria**
  - Owner, crew and trip *entry*
Pelagic fleet model parameters

 Outputs:

✅ Fleet profits and Recreational activity levels
✅ Fishing effort and Catch Levels
  - by fleet, location and season
✅ Nine fleet categories
  - 3 longline; 3 other commercial; 3 recreational
✅ Five areas
  - MHI (2); NWHI, High-Seas (2)
✅ Four seasons
✅ 14 species groups
Original spatial Structure

Area 5

Area 4

Area 3
NWHI

Areas 1-2

Area 5
Modified Spatial Schema

Hawaii
International Management Alternatives

- Exploration of corporate and community-based management alternatives to international management
  - Development of extensive bibliographical library
  - Exploration of game theory applications

-- Analytical project delayed due to conflicting schedule with co-PI