Managing for fishermen exit and alternative livelihoods in small scale fisheries: the role of fishermen interrelations and relevant socioeconomic factors

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Motivation

- To explain fishermen exit behavior, the literature has addressed the role of:
  - Crowding externalities , imperfect capital malleability
  - Opportunity costs, profitability, subsidies
  - Ownership, skills, fishing experience, location

In particular, for small scale fisheries, what is the role of:

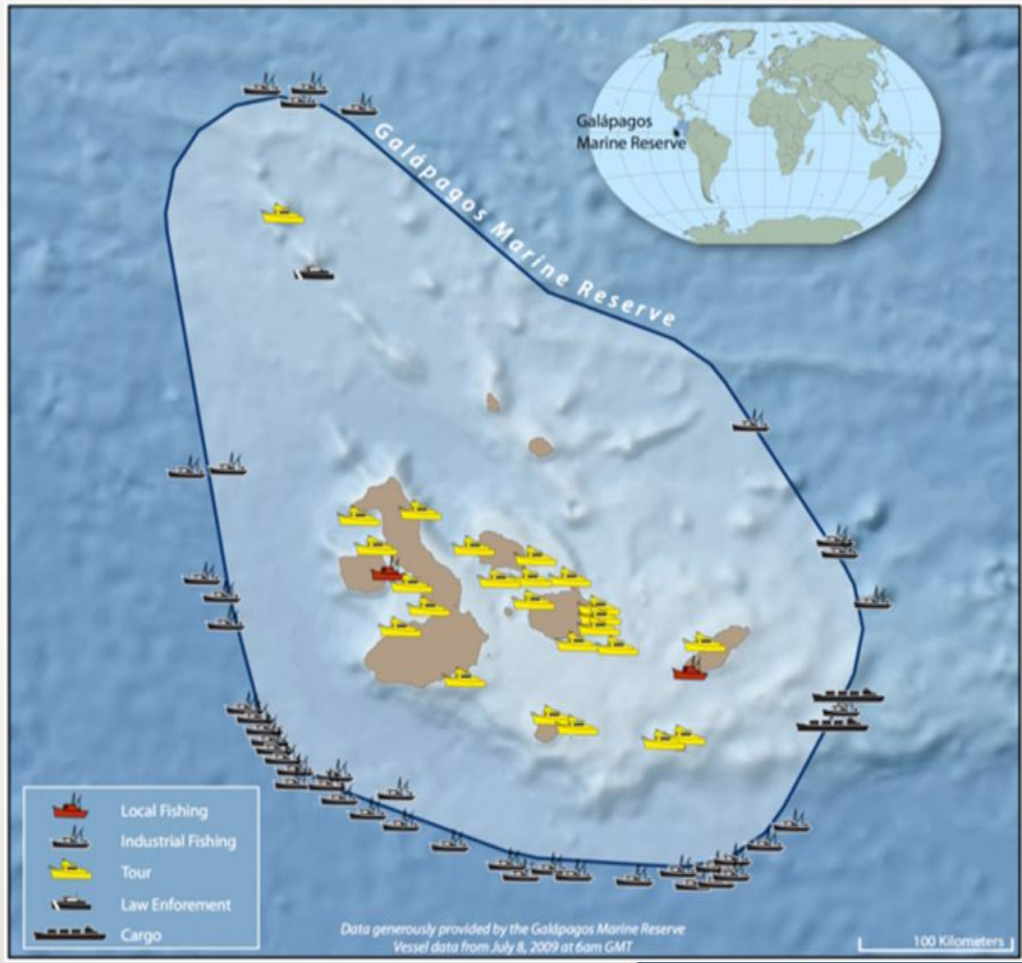
- Availability of alternative livelihoods ?
- Individual/ vessel interdependence ?

Study case: The Galapagos Marine Reserve

- Characteristics
  - 1052 registered fishermen (owners and crew) & 446 vessels
  - Three main ports, different dynamics

- Fleet reduction program (2008)
  - Permanent and voluntary exchange of individual/vessel licenses for tour permits
  - Greater incentives for owners of larger (mother) boats

- Tour options:
  - Standard cruise (multiday marine and terrestrial)
  - Diving cruise (multiday, marine)
  - Bay and diving cruise (single day, local)



Objectives

- To explore the role of individual and vessel interdependence on exit behavior
- To identify significant socioeconomic and occupational factors that help explain fishermen decisions to permanently switch from fishing to tourism
- To examine implications for the design of capacity management policies

Hypotheses

- Vessel interdependence likely to influence exit behavior
- Owners are more likely to exit than crew
- Owners of smaller vessels are less likely to exit than owners of large ones
- Location likely to influence exit behavior

Methods: Random utility theory

Indirect utility

$$U_{jn} = V_{jn} + \varepsilon_{jn}$$

Deterministic component

$$V_{jn} = \sum_{i=1}^{I} \beta_j^i X_n^i$$

Choice Rule

$$P(Y_n = j | j,l) = P\,[(V_{jn}+\varepsilon_{jn}) > (V_{ln}+\varepsilon_{ln})]$$

Logit model

$$P(Y_n = j) = \frac{e^{Vjn}}{1+\sum_{l \in C} e^{Vln}}$$

Data

- Field surveys N = 1022 n= 355 (owners and crew) → choice data
    - Stratification by main fishing ports
- Vessel ownership records (GNP) → type of vessels
- Trip-level data (Charles Darwin Station) → vessel interdependence
- Final dataset n= 299

Variable definition and summary statistics

		Exit choice (N = 299)	
Variable	Definition	Mean	Std dev.
Profitability of fishing (X^1):			
CREW	1 if crew; 0 if owner	0.552	0.497
SBOAT	1 if works with or is a small boat, 0 otherwise	0.866	0.341
HIGHVAL	1 if fishes lobster and sea cucumber, 0 otherwise	0.856	0.351
FISHYRS	Fishing experience (years, range: 0 - 60)	18.07	9.321
DIVER	1 if worked as diver, 0 otherwise	0.411	0.492
SAFEREG	1 if concerned with safety regulations, 0 otherwise	0.198	0.395
Interdependence (X^2):			
ICLINK	1 if crew-owner relation observed, 0 otherwise	0.528	0.499
IMLINK	1 if 'mother boat' relation observed, 0 otherwise	0.147	0.354
Demographics (X^3):			
LOC_CR	1 if resides in San Cristobal, 0 otherwise	0.475	0.499
LOC_IS	1 if resides in Isabela, 0 otherwise	0.298	0.448
CHILD	Children living in household (number, range: 0-4)	0.916	0.956
INC2	1 if monthly income: USD$501- 1,000, 0 otherwise	0.405	0.491
INC3	1 if monthly income >USD$1000, 0 otherwise	0.237	0.426
ALTINC	1 if have alternative income, 0 otherwise	0.472	0.499
EDUC	1 if college graduate, 0 otherwise	0.055	0.225

Response Shares/Average Predicted Probabilities

- Switch decision:
  - No - 0.40
  - DN - 0.17
  - *Yes - 0.43*

- Tour Choice:
  - Standard cruise - 0.15
  - Diving Cruise - 0.36
  - *Bay and diving tours - 0.49*

Results – Multinomial logit (n=299)

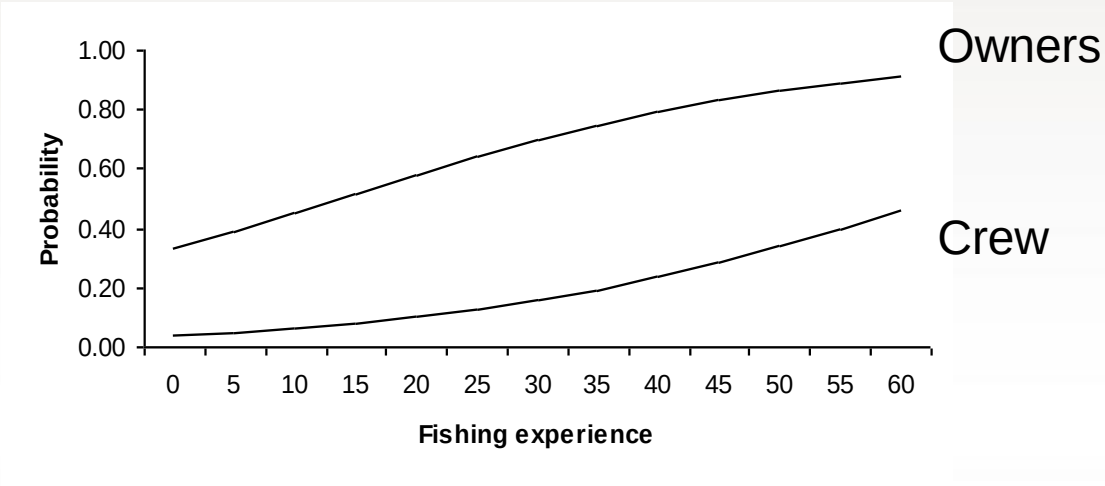
	Do not know		Yes	
Variable	Estimate	t-value	Estimate	t-value
Constant	-4.732	-2.742***	-1.125	-0.940
CREW	0.841	1.122	-2.501	-5.012***
SBOAT	0.559	0.936	-1.013	-1.726*
HIGHVAL	0.143	0.249	1.039	1.746*
FISHYRS	-0.049	-1.497	0.051	2.121**
DIVER	-0.346	-0.684	1.269	2.961***
SAFEREG	0.596	0.966	0.535	1.118
ICLINK	0.631	1.307	-0.068	-0.170
IMLINK	1.922	2.075**	0.634	0.944
LOC_CR	3.103	2.897***	-1.169	-2.291**
LOC_IS	-0.685	-0.459	-1.074	-1.927*
CHILD	-0.518	-1.911*	0.425	1.938*
INC2	1.147	2.135**	0.845	1.828*
INC3	1.243	1.830*	1.442	2.538**
ALTINC	0.402	0.873	1.296	3.022***
EDUC	1.387	1.377	-0.135	-0.151

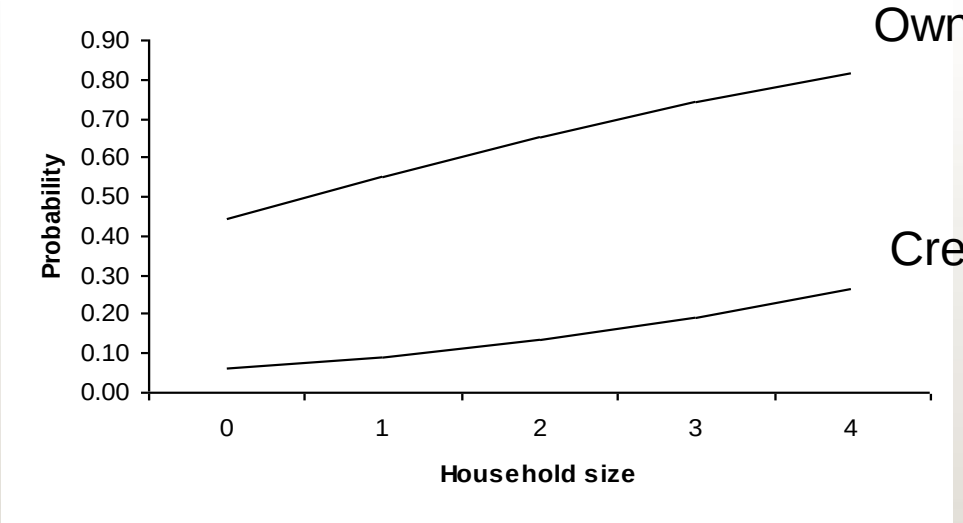
*Significant at the 0.10 level; **Significant at the 0.05 level; ***Significant at the 0.01 level.

Effects on Probability of exit

Variable	Owner (Base= 0.553)	Crew (Base = 0.091)
SBOAT	-0.240 (-43.9%)	-0.050 (-61.6%)
HIGHVAL	0.225 (40.6%)	0.130 (142.0%)
DIVER	0.262 (47.3%)	0.173 (188.2%)
LOC_CR	-0.284 (-51.4%)	-0.064 (-69.9%)
LOC_IS	-0.256 (-46.2%)	-0.058 (-63.5%)
INC2	0.188 (34.0%)	0.097 (105.7%)
INC3	0.286 (51.6%)	0.205 (223.4%)
ALTINC	0.266 (48.0%)	0.177 (193.2%)

Effects on Probability of exit





Conclusions

- Weak indication of interdependence effect, based on preliminary proxy

- Owners vs. crew
  - Vessel owners are more willing to exit than crew
  - “Smaller” vessel owners less willing to exit than larger ones
  - Crew willing to exit are more sensitive to variable changes than owners

- Higher fishing profitability and income increase willingness to exit

- Location effect

Implications

- Policy design matters!

  As a capacity management policy, providing higher incentives to owners of larger boats (motherboats) likely induce the behavior of the rest of fishermen

- Detect opportunistic behavior/ target active fishing effort only

- "One-size-fits-all" incentives not appropriate for everybody
  - Differentiate between fishermen groups for the design of incentives
  - Need alternative exiting incentives to entice "smaller" owners and crew
  - Tourism incentives/programs geographically tailored

Next steps

- Construct additional interdependence indicators
  - Kinship relationships within and across vessels
  - Social and production networks
  - Number of vessels worked on
  - Degree of dependence on motherboat system

Thank you

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