

Angler Heterogeneity and Species-Specific Demand for Recreational Fishing in the Southeast United States

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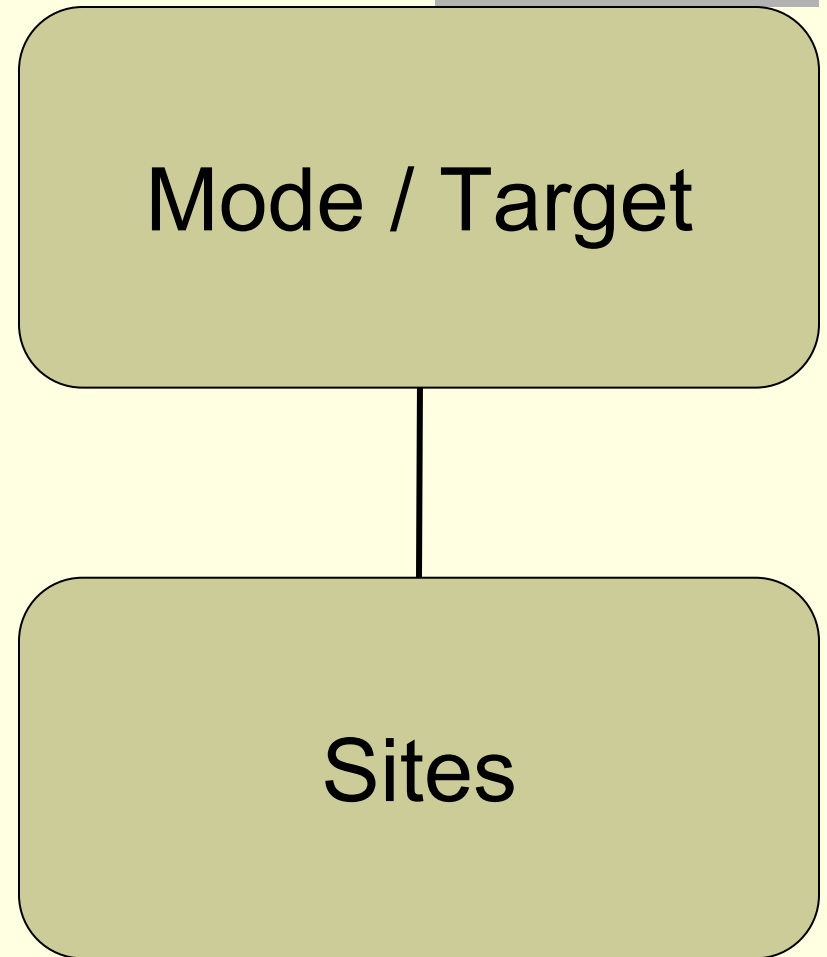
NAAFE Forum, May 18, 2009

Previous NMFS/MRFSS Recreational Valuation Research

- McConnell and Strand, 1994
- Hicks, Steinbeck, Gautam, Thunberg, 1999
- Haab, Whitehead, and Ted McConnell, 2000
- Haab, Hicks, Whitehead, 2004

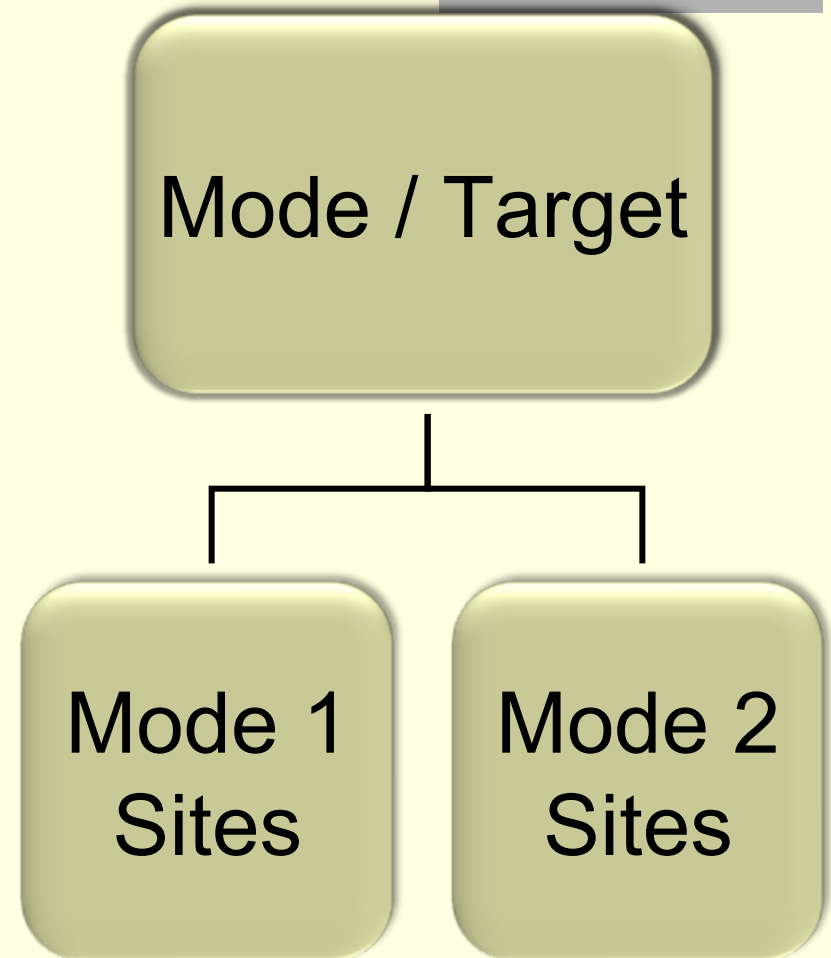
NMFS SE Nested Logit Model

- 3 Modes
- 4 Aggregate targets species
- 70 County level sites
- 1000+ alternatives
- Sequential estimation



This project

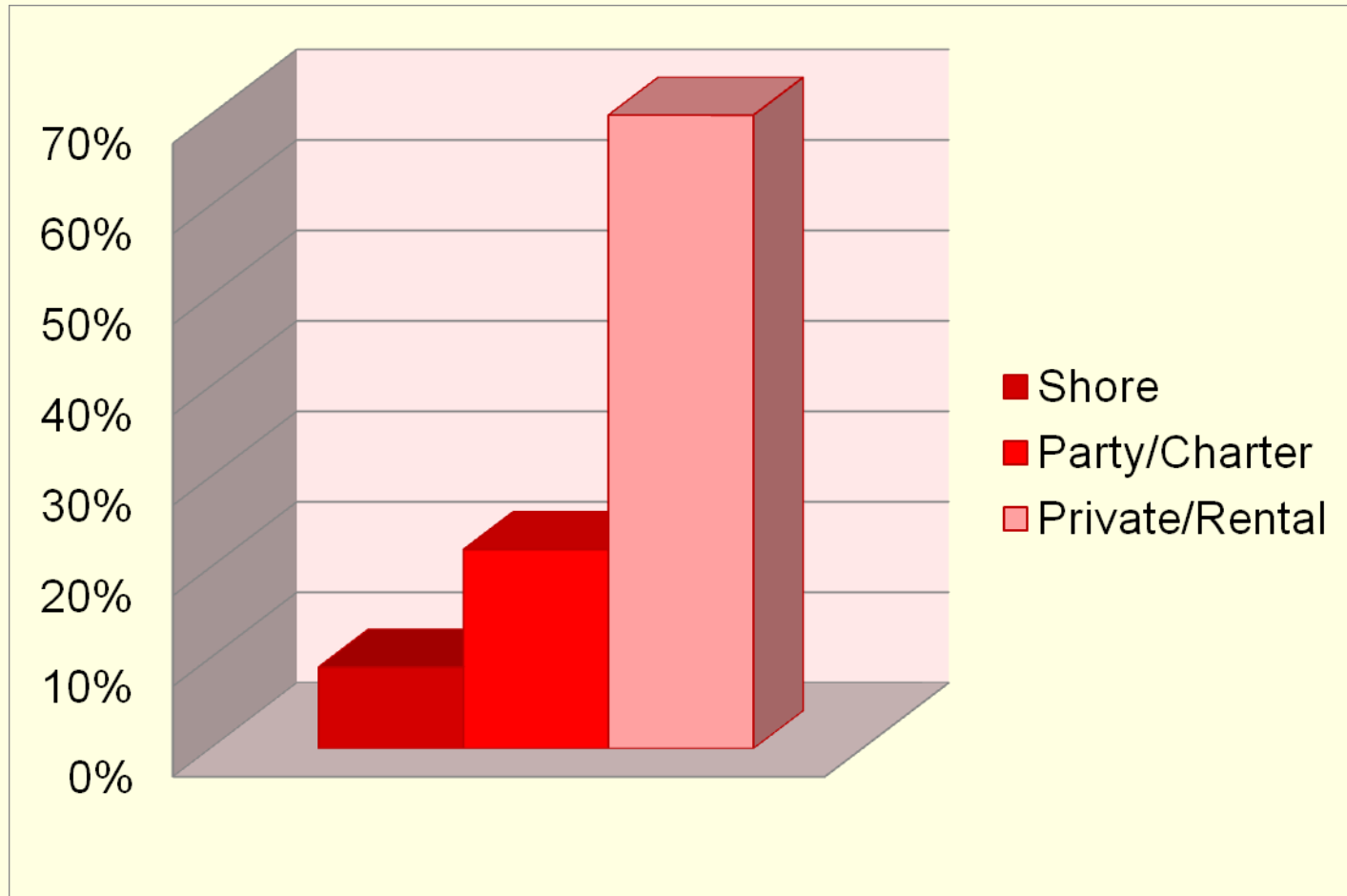
- Single species
- Preference heterogeneity
- 70+ alternatives
- Full information maximum likelihood estimation



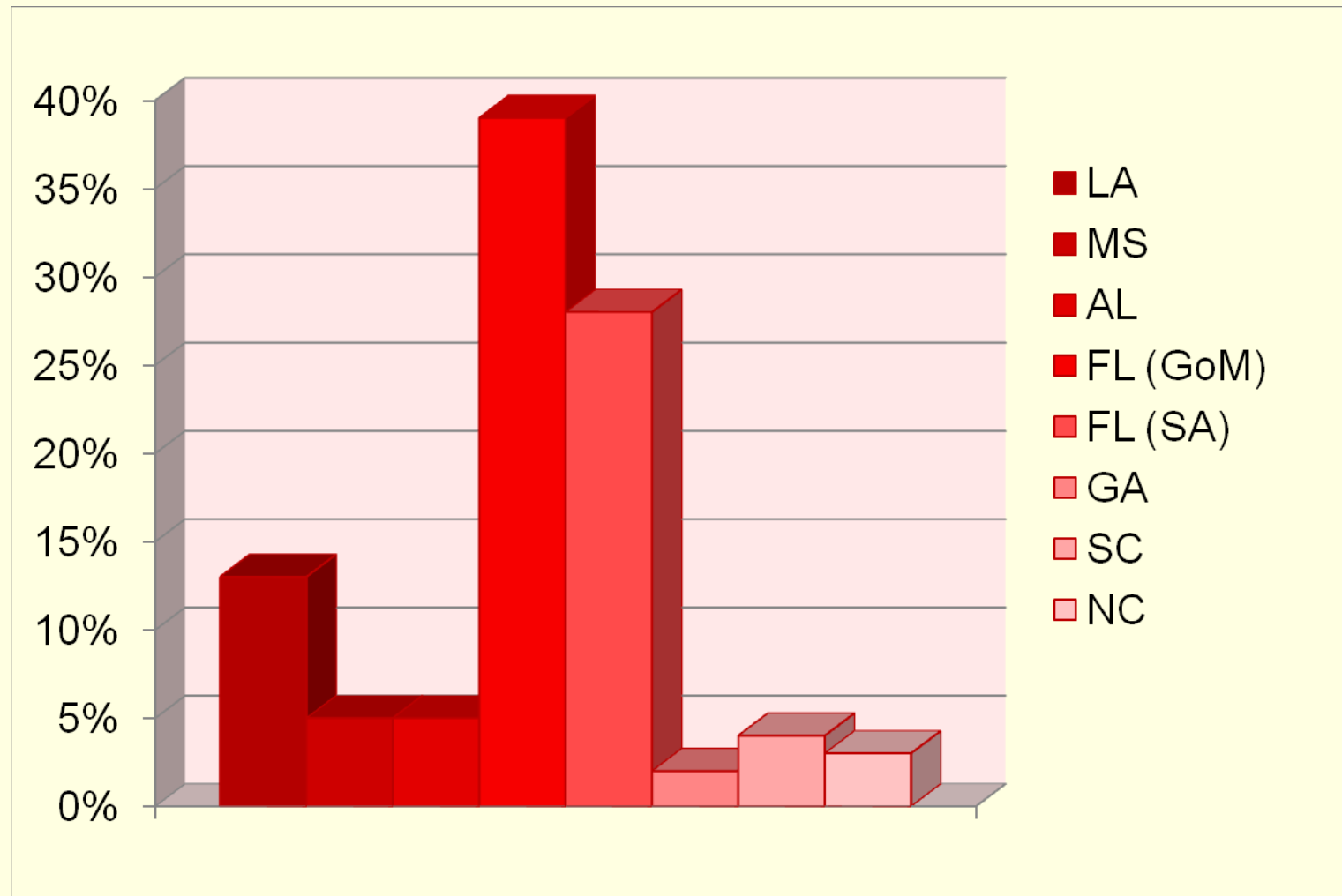
MRFSS 2000 Add-on

- LA to NC
 - n = 70,781
- Southeast 2000 (Limited Valuation Round)
 - n = 42,079
- Hook and line trips only (99%), day trips only (67%)
[self-reported and < 200 miles one-way distance],
delete missing values on key variables (28% PRIM1
is missing)
 - n = 18,709
- Targets a species
 - n=11,257

Fishing mode



State of intercept



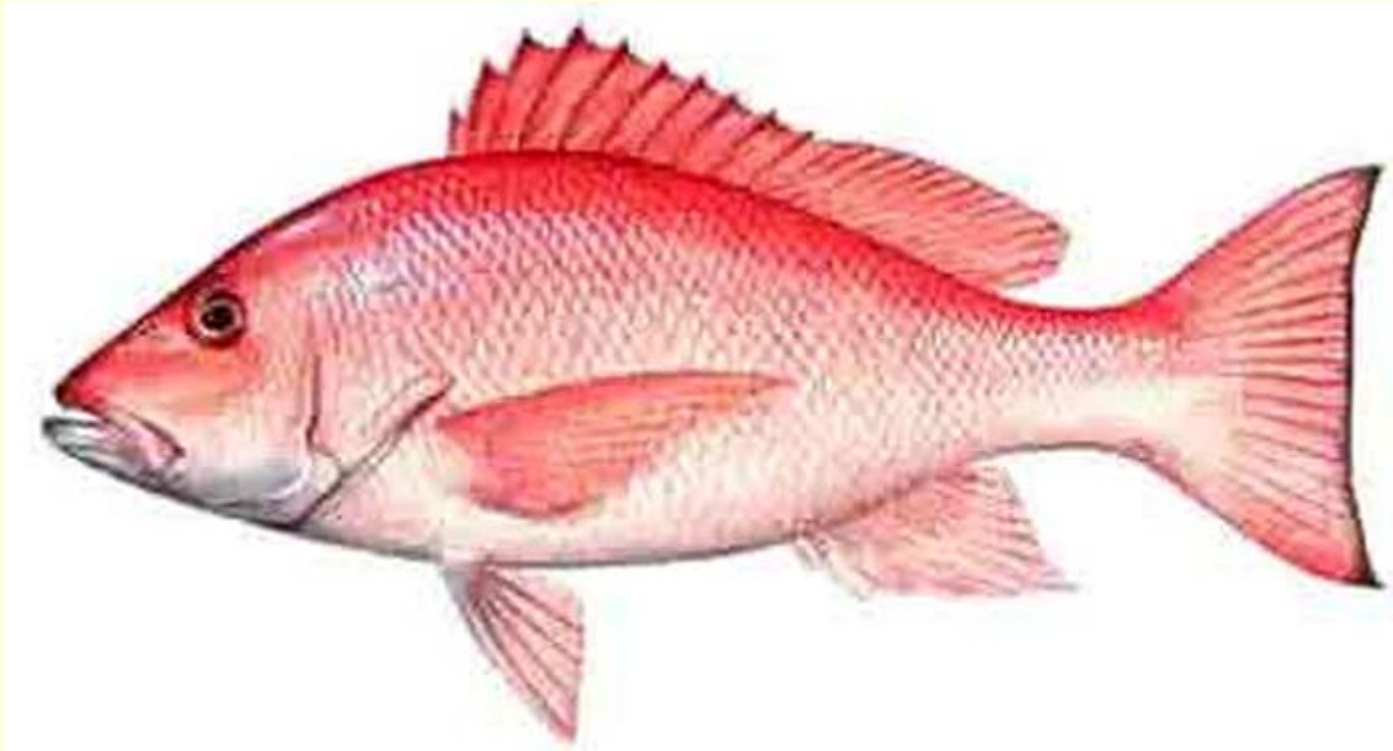
Species

- 425 unique species caught by recreational anglers sampled by the MRFSS
- 15 species account for 82% of the targeting activity and 38% of the (type 1) catch

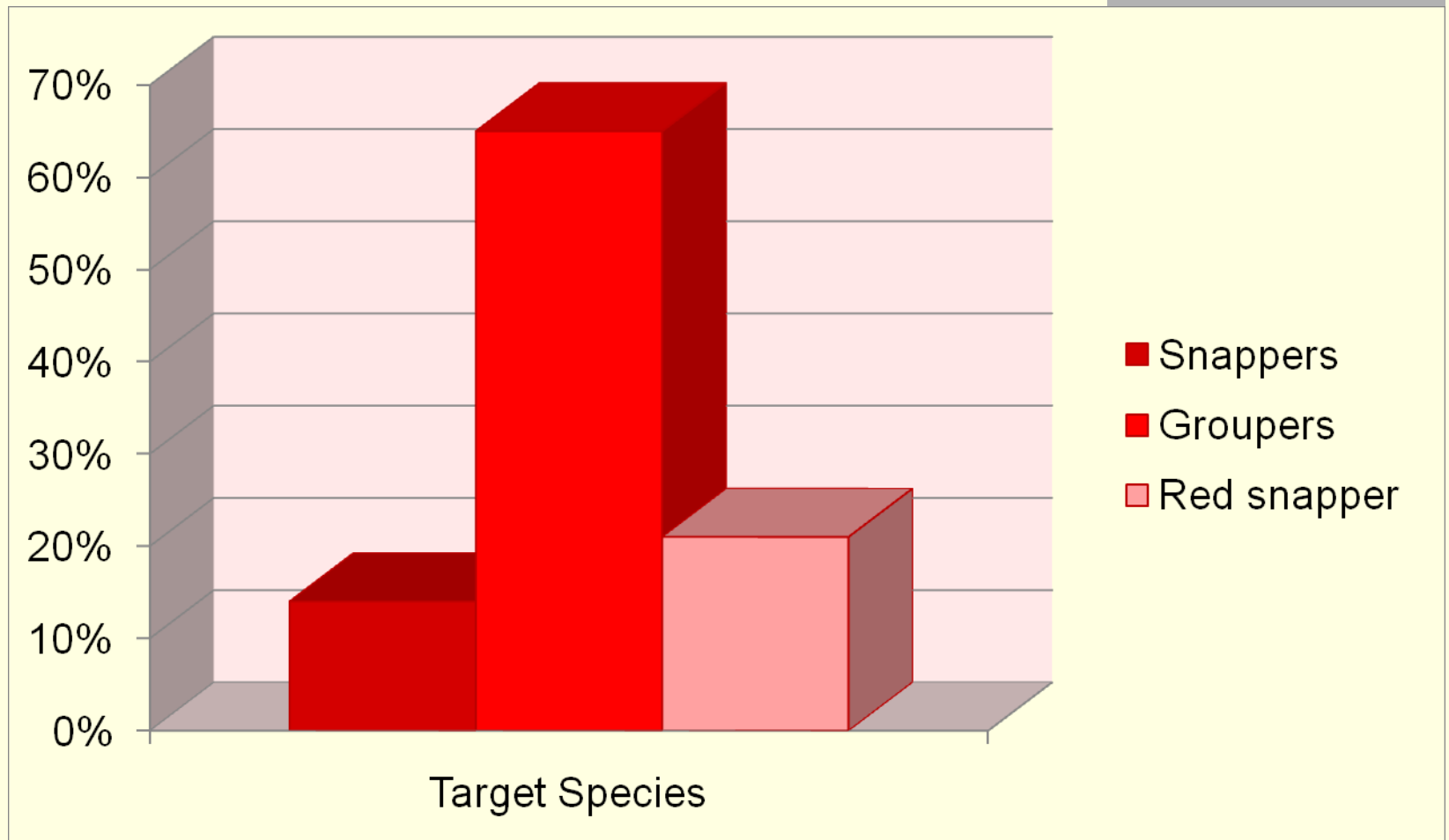
Four sets of demand models

- Gulf of Mexico Reef Fish ($n = 1086$)
 - “Snappers”
 - Shallow water groupers
 - Red snapper
- Florida Atlantic Big Game: Dolphin, big game ($n = 823$)
- Inshore small game: Red drum, spotted seatrout, small game ($n=4353$)
- Offshore small game: King mackerel, spanish mackerel, small game ($n = 1531$)

Red Snapper



Target Species



Target species (groups)

Snappers (n=122)

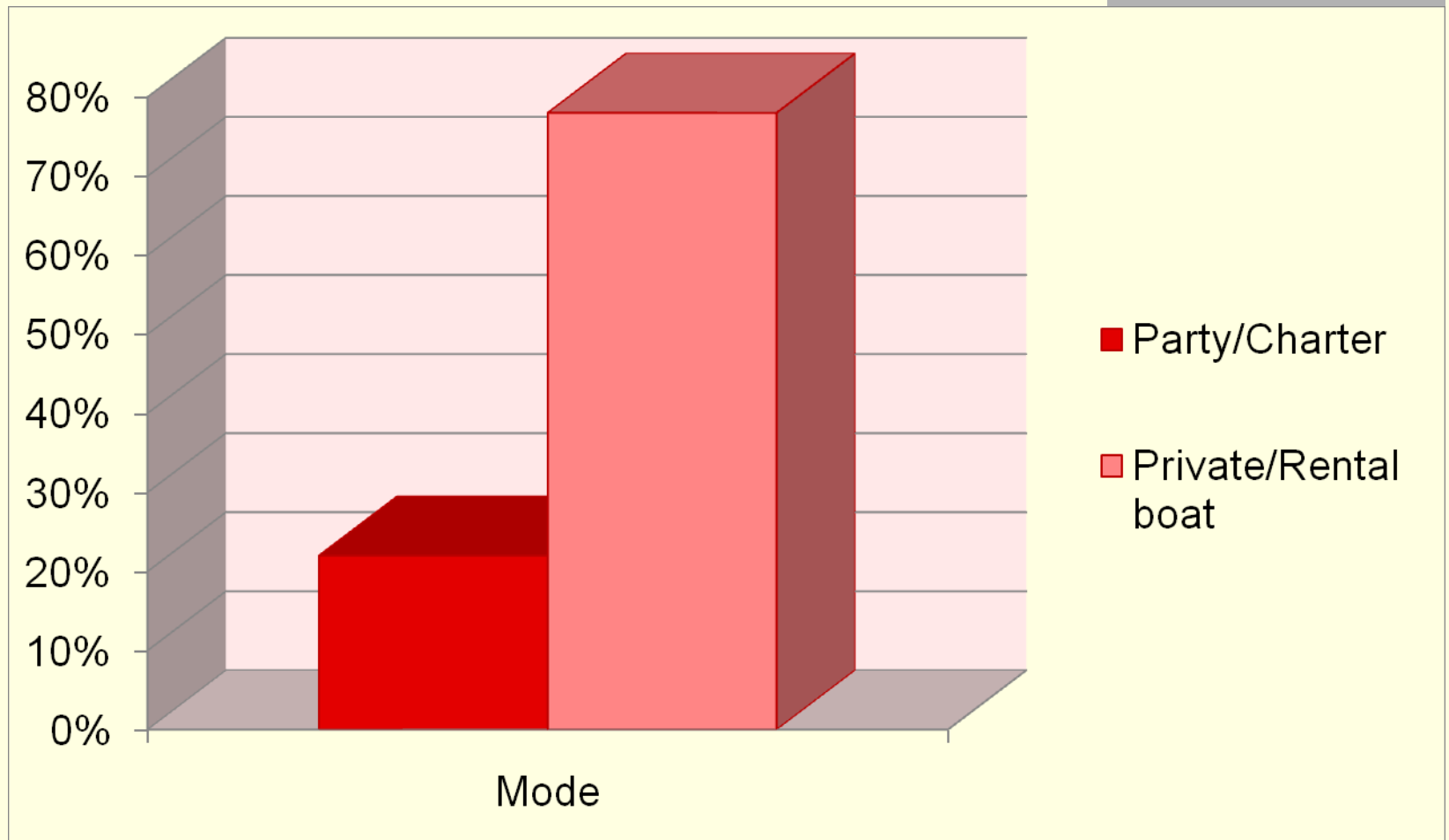
gray snapper	48.13%
sheepshead	23.75%
white grunt	11.88%
black sea bass	3.75%
crevalle jack	3.75%
amberjack genus	1.88%
gray triggerfish	1.88%
snapper family	1.25%
yellowtail snapper	1.25%
atlantic spadefish	0.63%
blackfin snapper	0.63%
blue runner	0.63%
vermilion snapper	0.63%

Groupers (n=725)

unidentified grouper	73.38%
gag	17.38%
red grouper	6.07%
grouper genus Mycteroperca	2.9%
black grouper	0.28%

Red Snapper (n=239)

Mode



Choice Frequencies

Mode	Target	Frequency
Party/charter	Snappers	14
Party/charter	Groupers	150
Party/charter	Red snapper	84
Private/rental	Snappers	108
Private/rental	Groupers	575
Private/rental	Red snapper	155

Variables

- 71 Species/Mode/Site choices
- Travel cost
 - [party/charter] TC = charter fee + driving costs + time costs
 - [private/rental] TC = driving costs + time costs
- Quality
 - 5-year historic (type 1) targeted catch rate
- Number of MRFSS interview sites in the county

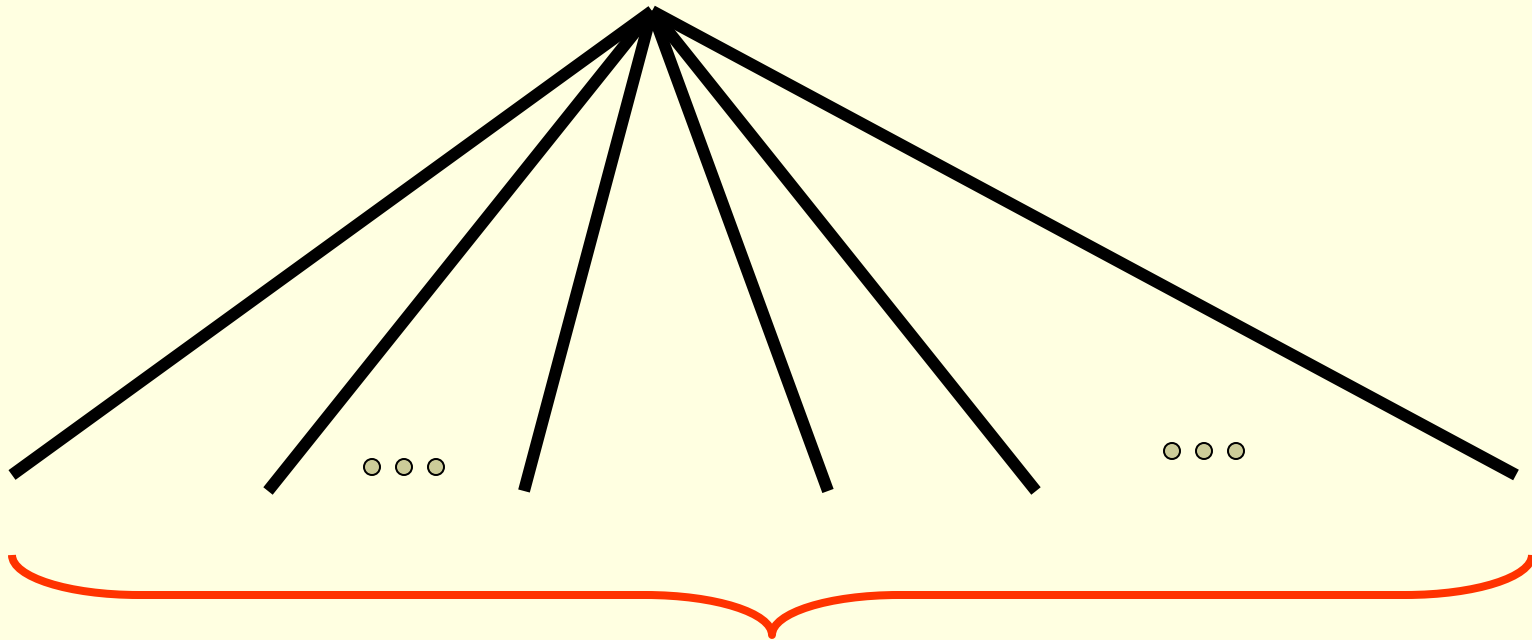
Data Summary (n = 77,106)

Variable	Mean	SD	Min	Max
tc	193.66	143.55	0.6	670.14
tcfee	234.37	157.03	0.6	777.20
lognsite	2.85	0.68	1.39	4.98
snapper	0.06	1.32	0	94.00
grouper	0.14	0.55	0	6.43
redsnapper	0.09	0.75	0	10.65
fee	40.71	51.97	0	107.06

Random Utility Models

- Snapper-Grouper
 - Conditional Logit (with and w/out ASC)
 - Nested Logit (with and w/out ASC)
 - Latent Class Logit
 - Random Parameter Logit [TCFEE]
- Snapper-Grouper
 - Conditional Logit
 - Nested Logit
 - Latent Class Logit
 - Random Parameter Logit [20" dolphin]

Conditional Logit: Choice Framework

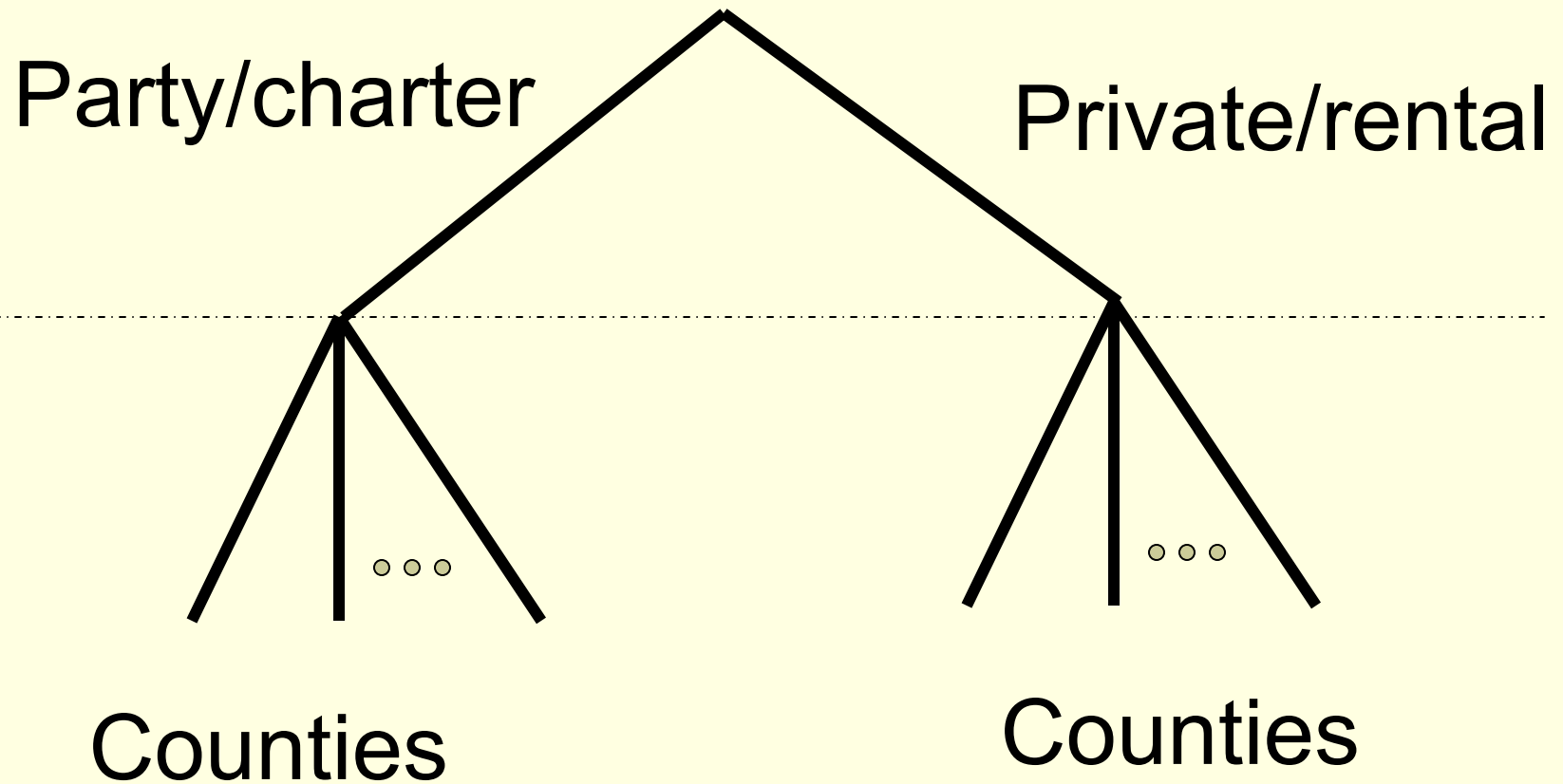


Party/charter boat, Private/rental boat
County sites

Conditional Logit: Results

Variable	Coeff.	t-ratio	Coeff.	t-ratio
TC	-0.04	-29.91	-0.04	-29.26
Snapper	0.89	10.21	1.86	11.19
Grouper	3.27	27.41	5.87	23.09
Red snapper	4.43	21.76	5.07	18.36
Ln(# sites)	0.91	17.02	1.18	13.75
ASC x FFDDAYS2	No		Yes	
χ^2 [df]			874[70]	

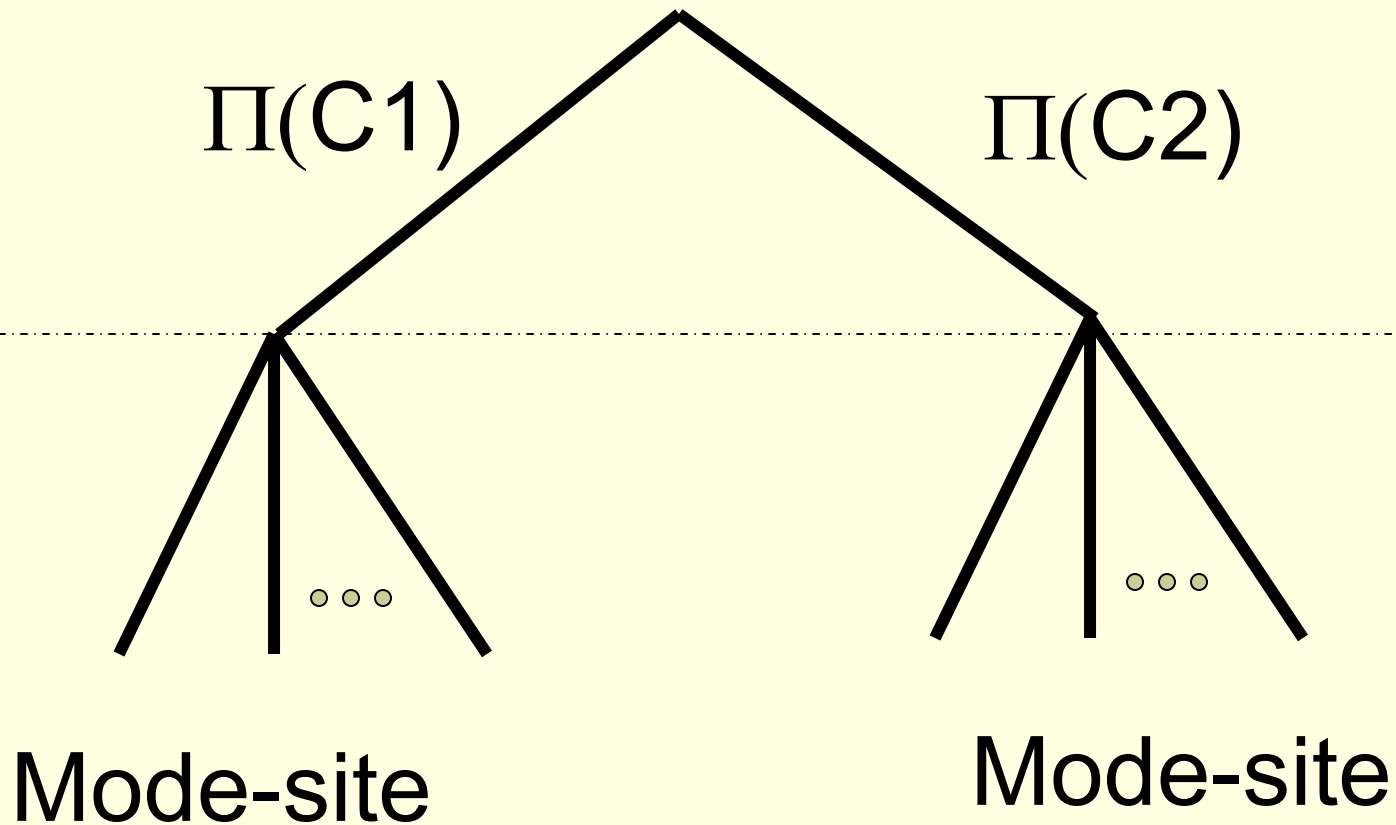
Nested Logit: Choice Framework



Nested Logit: Results

Variable	Coeff.	t-ratio	Coeff.	t-ratio
TC	-0.10	-26.91	-0.11	-24.87
Snapper	0.83	8.71	1.76	9.69
Grouper	3.11	15.83	5.28	12.13
Red snapper	3.82	13.93	4.27	11.47
Ln(# sites)	0.72	11.76	0.67	7.28
IV	0.14	14.79	0.14	13.42
ASC x FFDDAYS2	No		Yes	
χ^2 [df]			781[70]	

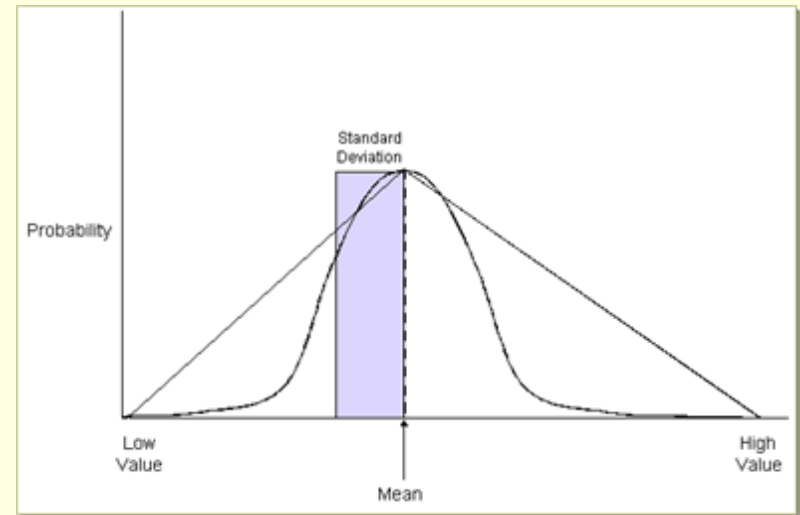
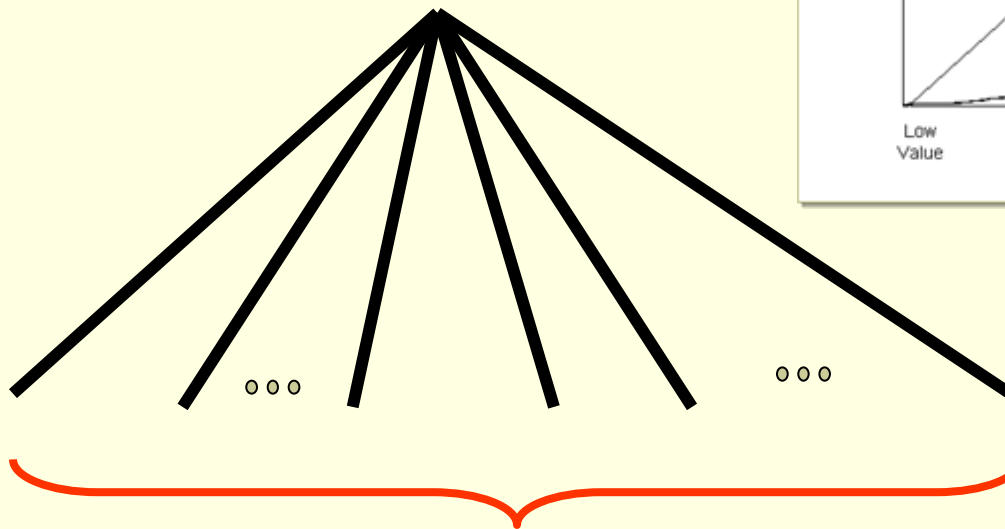
Latent Class Logit: Choice Framework



Latent Class Logit: Results

	C1		C2	
Variable	Coeff.	t-ratio	Coeff.	t-ratio
TC	-0.36	-11.84	-0.02	-21.75
Snapper	0.96	5.75	0.98	9.15
Grouper	14.36	13.36	2.26	24.18
Red snapper	3.59	7.76	3.15	20.92
Ln(# sites)	-0.31	-1.99	1.62	25.75
Class prob.	0.587		0.413	
Constant	-0.58	-3.18		
FFDAYS2	0.02	1.77		
BOATOWN	1.36	7.40		
YEARSFISH	0.00	-0.51		

Random Parameter Logit: Choice Framework

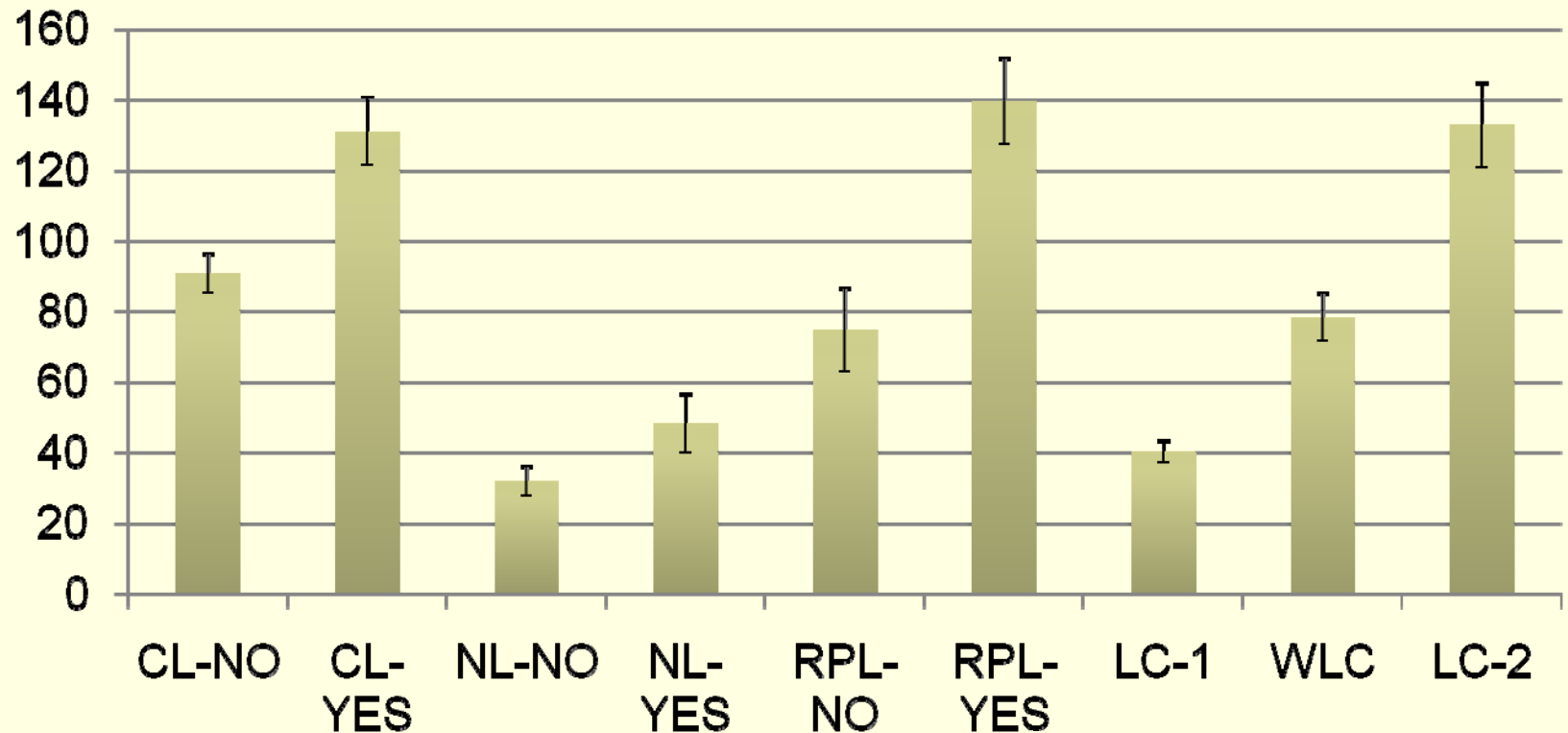


Party/charter boat, Private/rental boat County sites

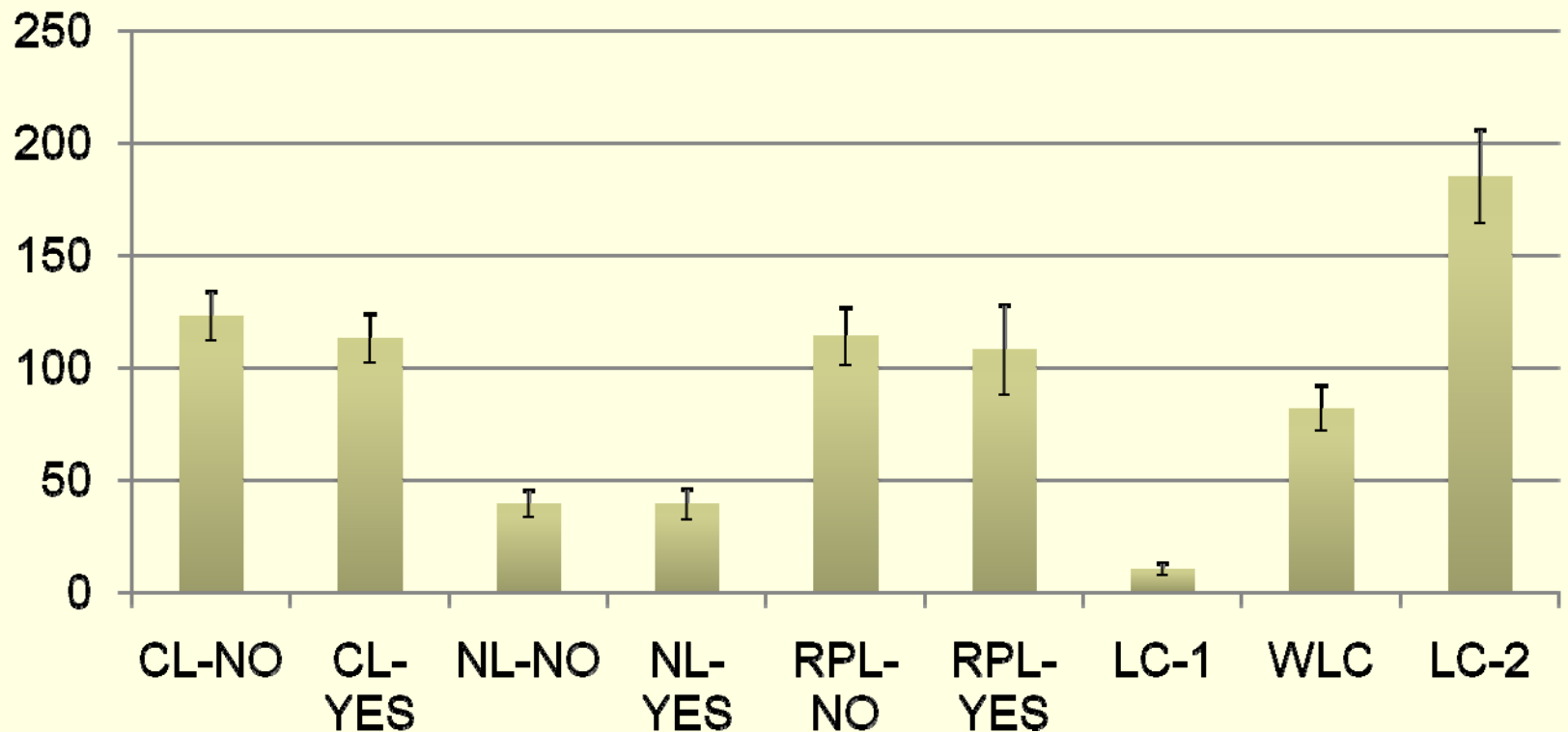
Random Parameter Logit: Results

Variable	Coeff.	t-ratio	Coeff.	t-ratio
TC	-0.04	-17.98	-0.04	-27.22
Snapper	0.88	10.11	1.82	11.12
Grouper	3.02	20.48	6.14	34.29
Red snapper	4.59	19.95	4.74	11.86
Ln(# sites)	0.91	16.89	1.15	13.76
SD(Travcost + fee)	0.01	4.14	0.00	1.33
ASC x FF DAYS2	No		Yes	
χ^2 [df]			913[70]	

WTP for one additional fish: Groupers



WTP for one additional fish: Red Snapper



Dolphin



Dolphin Results

Variable	CL	NL	RPL	LCL-1**	LCL-2
TC	-0.044	-0.057	-0.046	-0.18	-0.016
Pr(big)*	4.76	8.14	8.34 [8.05]	-2.60	11.32
Pr(small)	2.55	2.73	2.52	5.10	1.09
Big game	6.21	8.57	7.07	-6.51	6.21
Ln(# sites)	-0.06	-0.06	-0.025	-0.05	-0.32
*WTP	\$109 (17)	\$143 (17)	\$183 (21)	-\$14 (4)	\$697 (61)

**Tier 1 probability increases with boat ownership and avidity, decreases with fishing experience.

Choosing across models: $Y \times \pi$

Logit Model	Snapper-Grouper	Dolphin
Conditional	33%	29%
Nested	37%	31%
Latent Class	53%	45%
Random Parameter	24%	32%

Conclusions

- MRFSS supports only a few single species
- Models with preference heterogeneity statistically outperform baseline models
- Preference heterogeneity tends to raise WTP
- Latent class logit outperforms other models statistically based on a single criterion

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