

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

MARFIN #NA06NMF4330055

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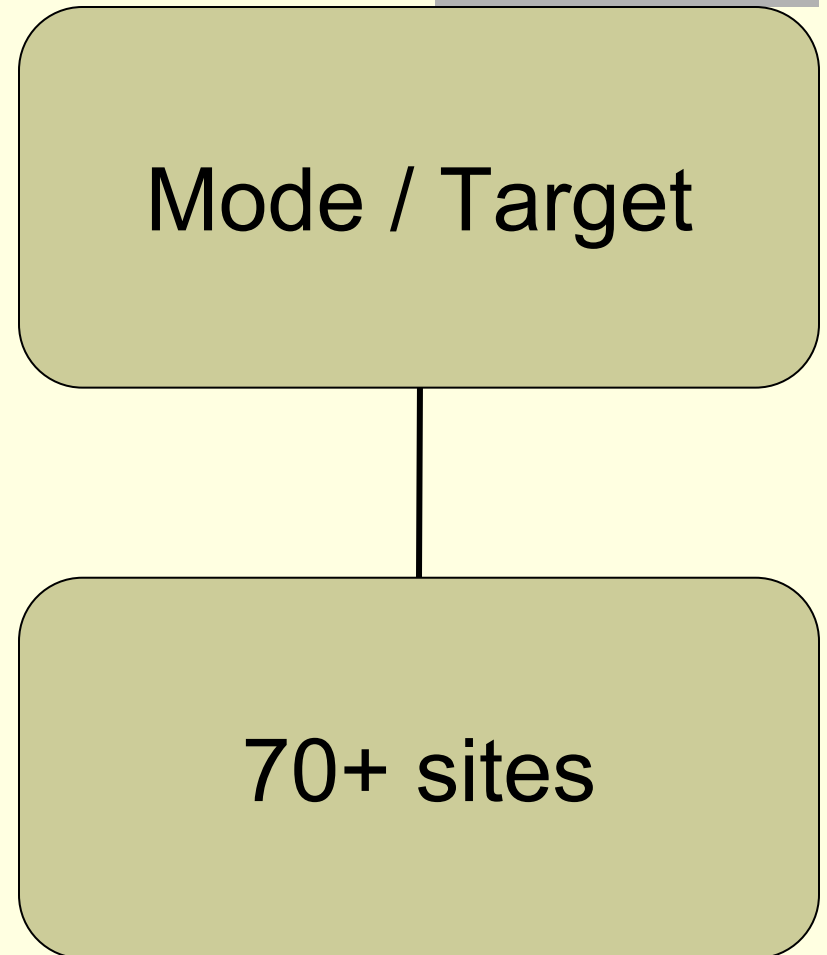
Draft final report: December 29, 2008

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

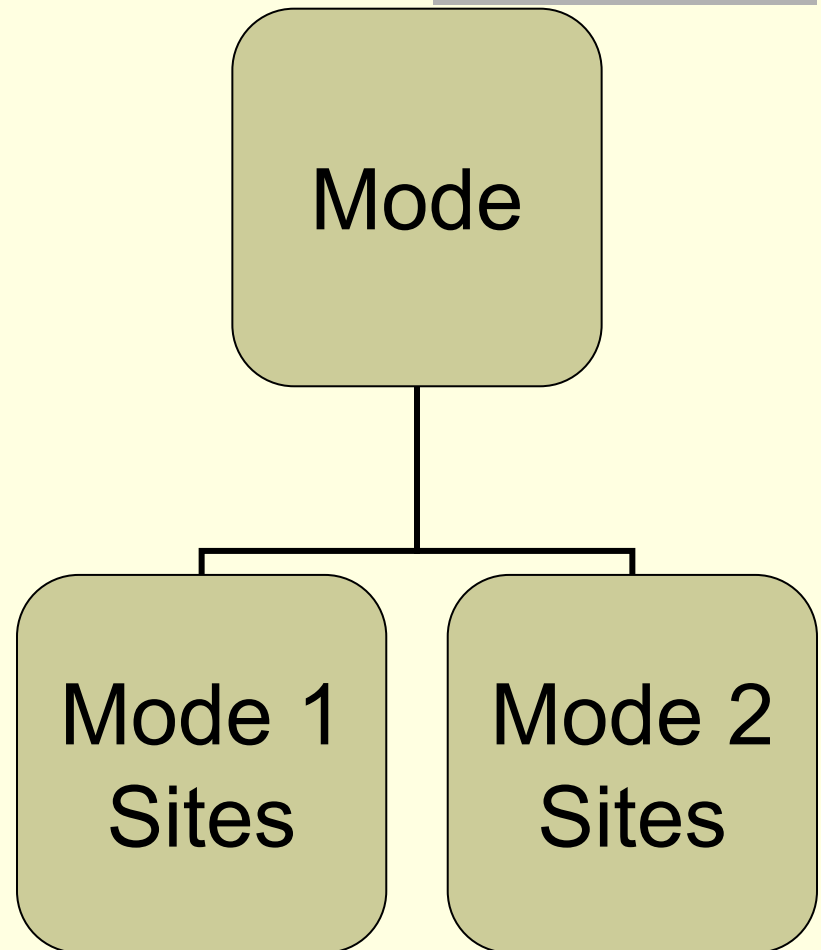
NMFS Model

- Modes: Shore, Private/Rental, Party Charter
- Targets: Big game fish, small game fish, flat fish, bottom fish, other/no target
- County level sites
- Sequential estimation
- 1000+ alternatives



This project

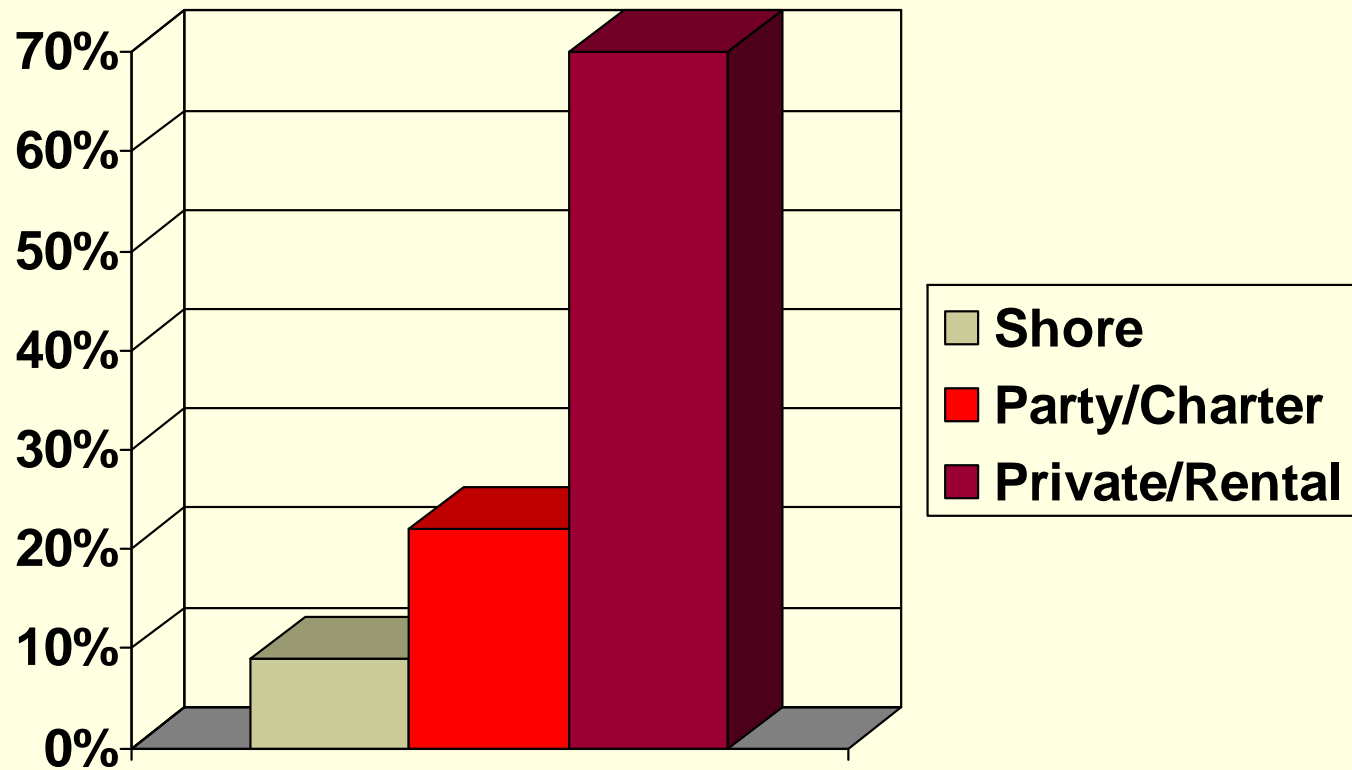
- Single species
- Species groups substitutes
- Preference heterogeneity
- Targeted catch
- County level sites
- Full information maximum likelihood estimation
- 70+ alternatives



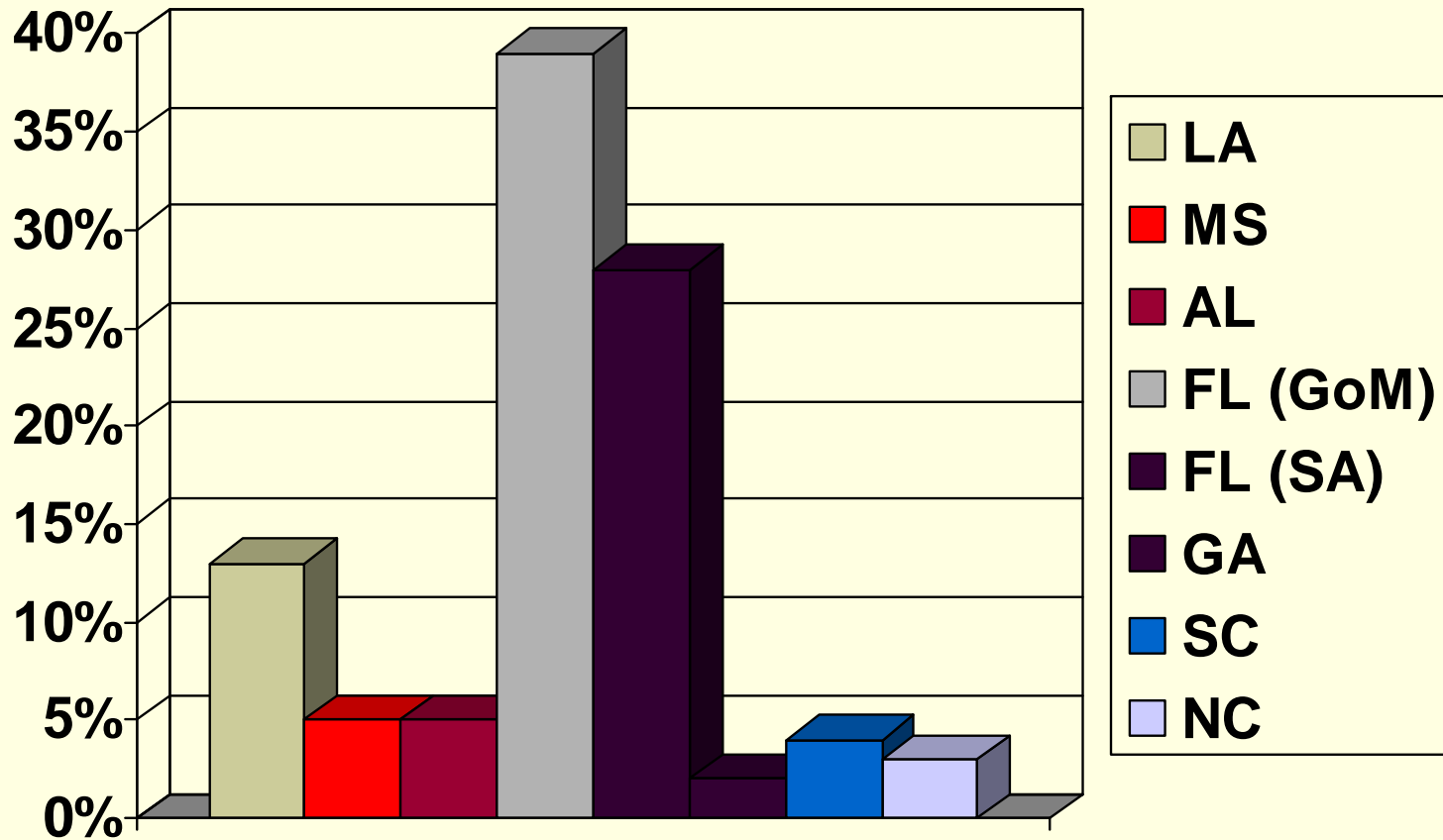
MRFSS 2000

- 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

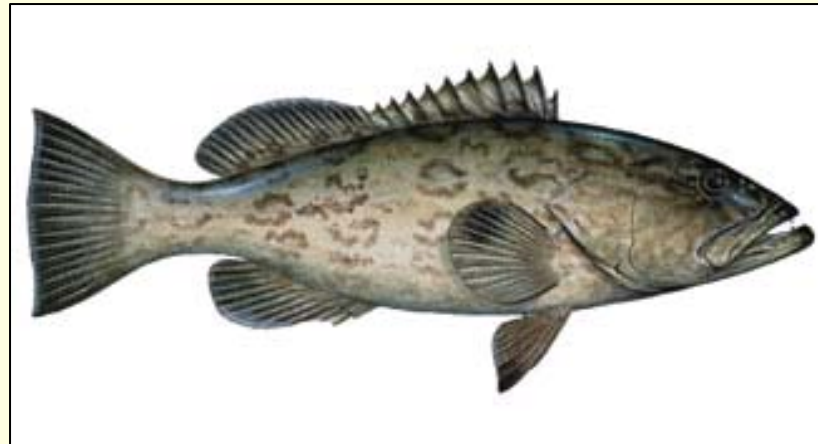


State of intercept



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



Logit Results for “Target a Species” (Prim1)

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	0.3216	0.0511	39.5889	<.0001
YEARFISH	1	0.0113	0.00107	110.9430	<.0001
boatown	1	0.0953	0.0382	6.2197	0.0126
shore	1	-1.2027	0.0448	721.5114	<.0001
charter	1	-0.0700	0.0601	1.3559	0.2442
FFDAYS2	1	0.0242	0.00184	173.5673	<.0001
wave4	1	-0.0415	0.0418	0.9851	0.3209
wave5	1	0.2106	0.0428	24.1787	<.0001
wave6	1	0.2482	0.0462	28.8347	<.0001
gulf	1	-0.3401	0.0326	108.6438	<.0001

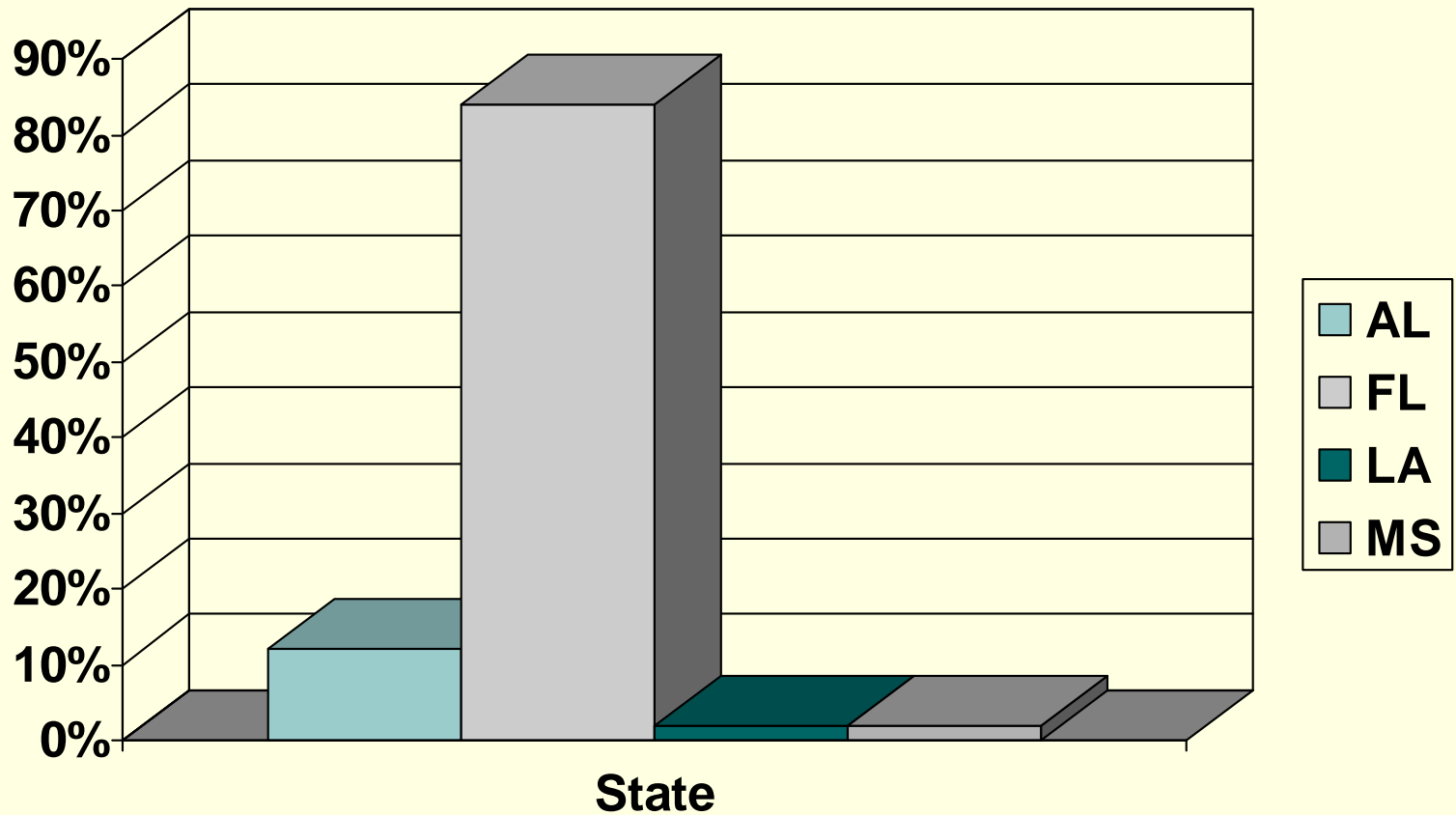
The SAS System

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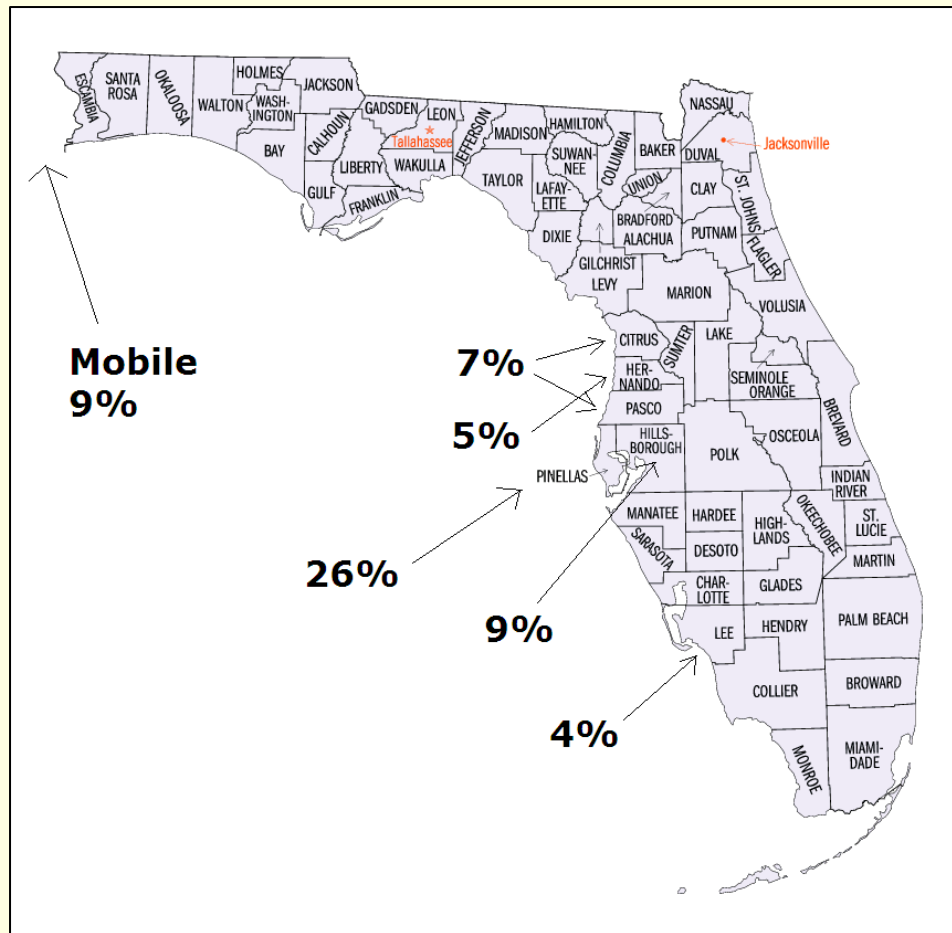
Four sets of demand models

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

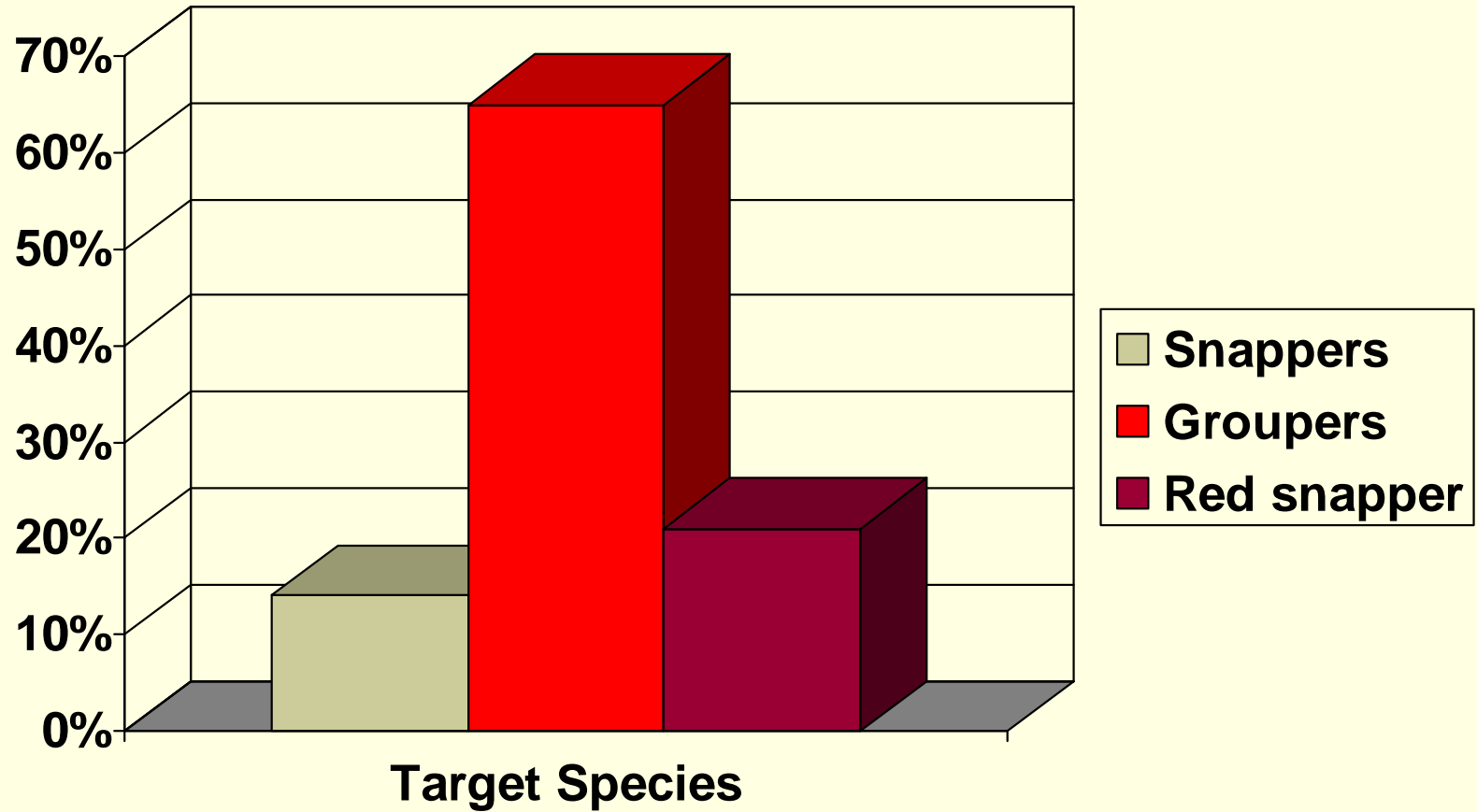
GoM Reef Fish Intercept Sites



58% of trips are from 6 FL counties



Target Species



Target species (groups)

Snappers (n=122)

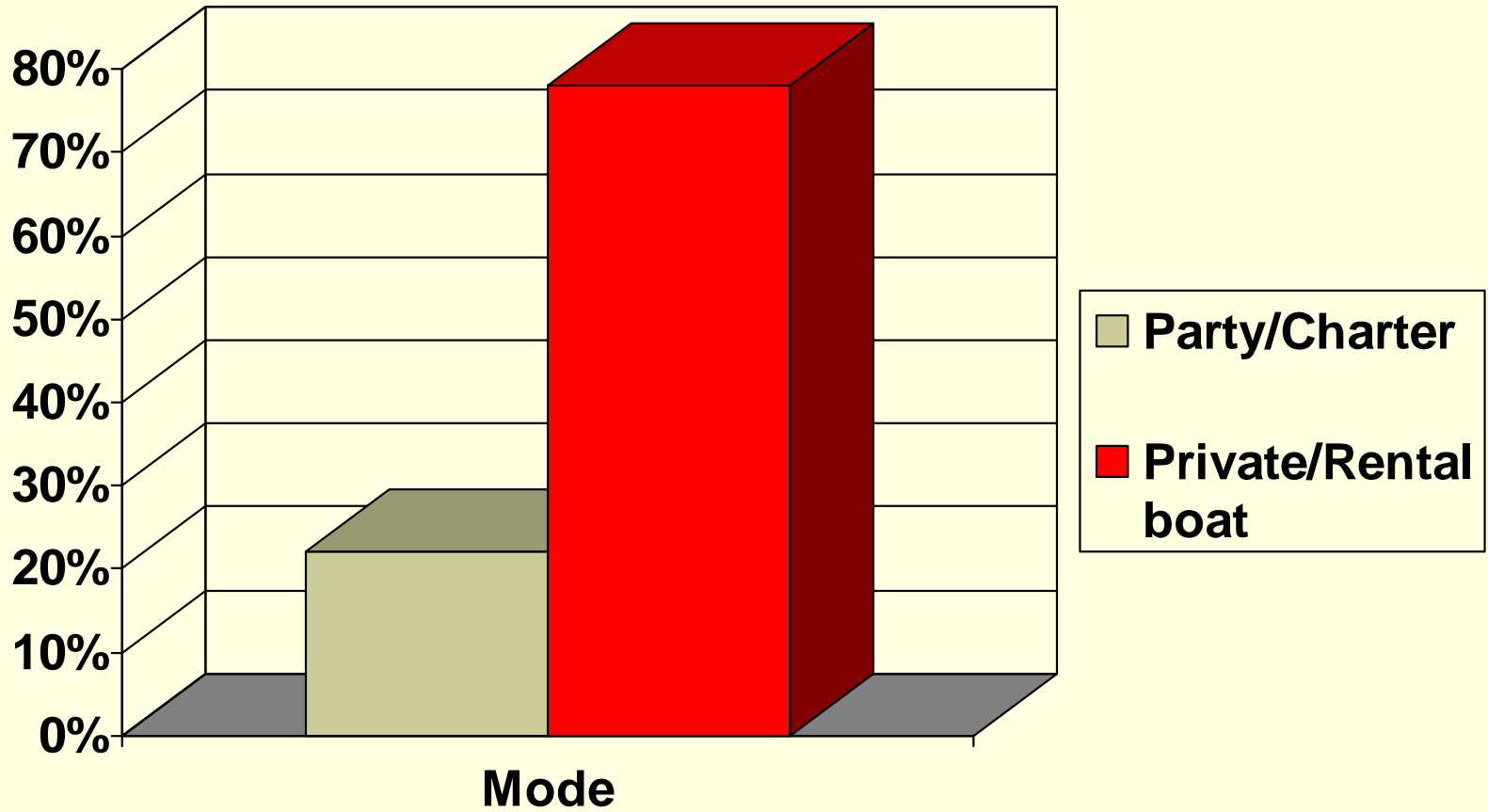
gray snapper	48.13%
sheepshead	23.75%
white grunt	11.88%
black sea bass	3.75%
crevalle jack	3.75%
amberjack genus	1.88%
gray triggerfish	1.88%
snapper family	1.25%
yellowtail snapper	1.25%
atlantic spadefish	0.63%
blackfin snapper	0.63%
blue runner	0.63%
vermilion snapper	0.63%

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



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)

<u>Variable</u>	<u>Mean</u>	<u>SD</u>	<u>Min</u>	<u>Max</u>
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

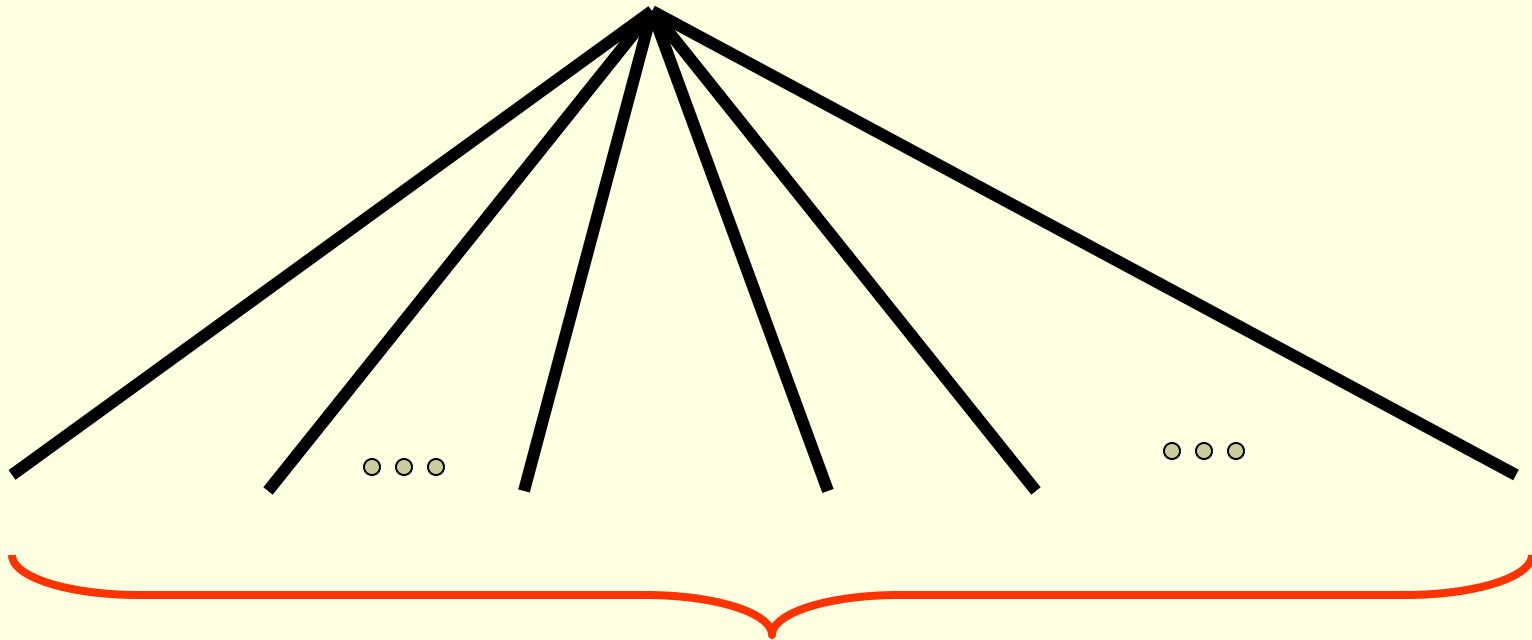
Choice Frequencies

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

Random Utility Models

- Conditional Logit
- Nested Logit
- Random Parameter Logit
- Latent Class Logit

Conditional Logit: Choice Framework (IIA)

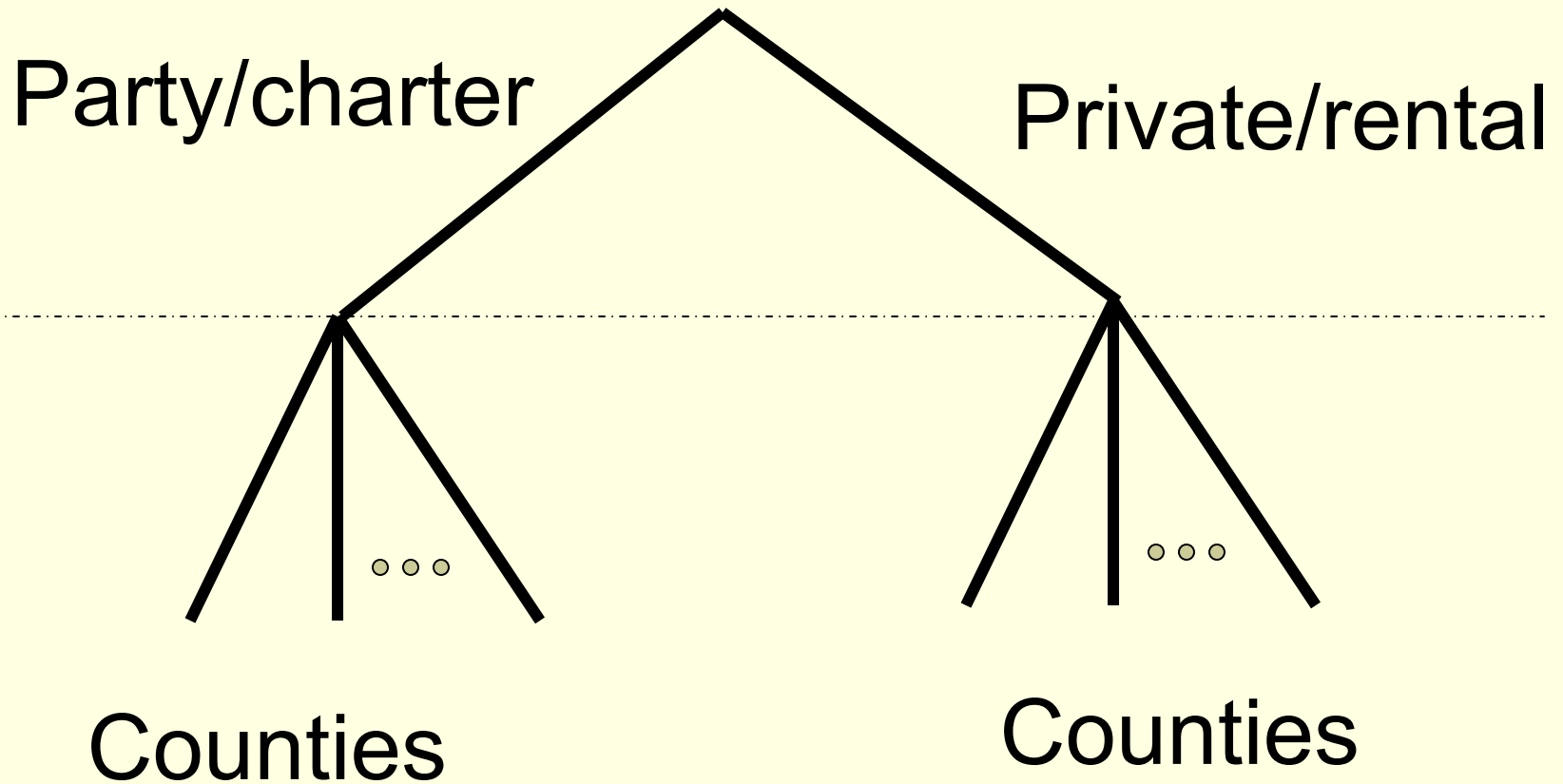


Party/charter boat, Private/rental boat
County sites

Conditional Logit: Results

<u>Variable</u>	<u>Coeff.</u>	<u>t-ratio</u>	<u>Coeff.</u>	<u>t-ratio</u>
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 FFDAYS2		No		Yes
χ^2 [df]				874[70]

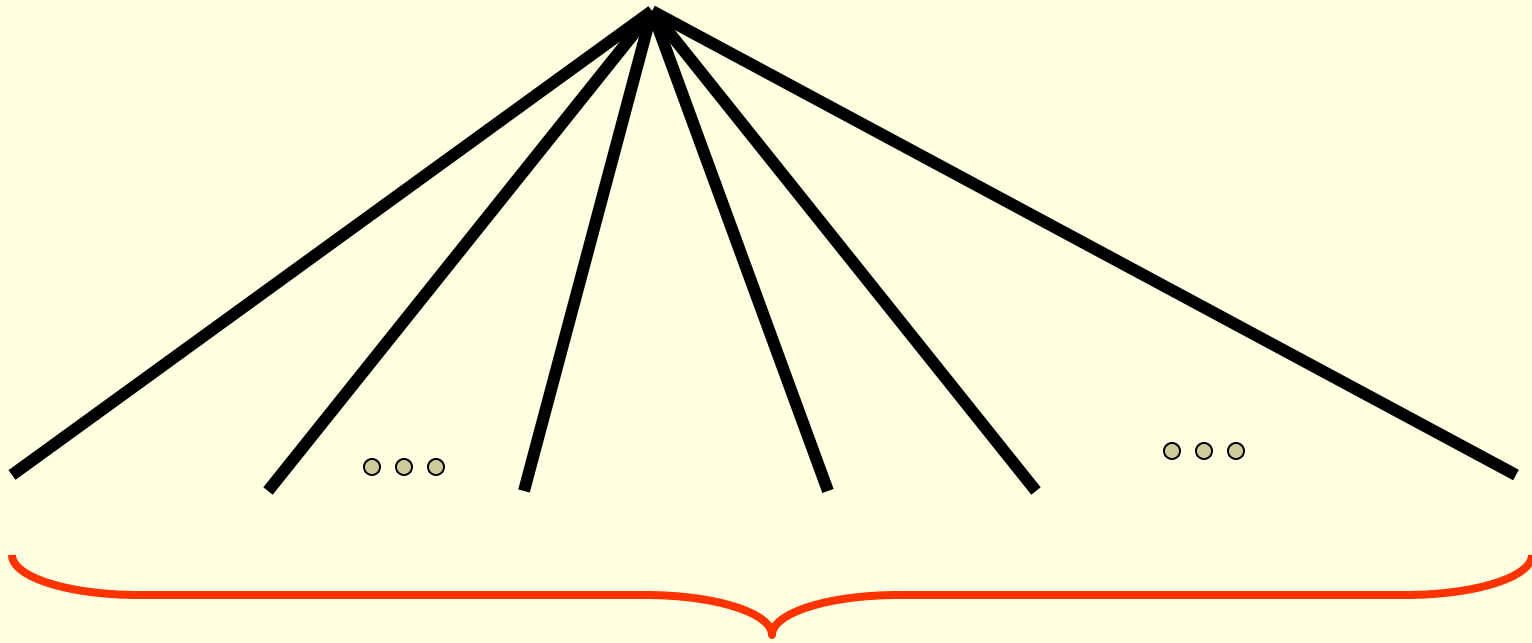
Nested Logit: Choice Framework



Nested Logit: Results

<u>Variable</u>	<u>Coeff.</u>	<u>t-ratio</u>	<u>Coeff.</u>	<u>t-ratio</u>
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 FFDAYS2		No		Yes
χ^2 [df]				781[70]

Random Parameter Logit: Choice Framework

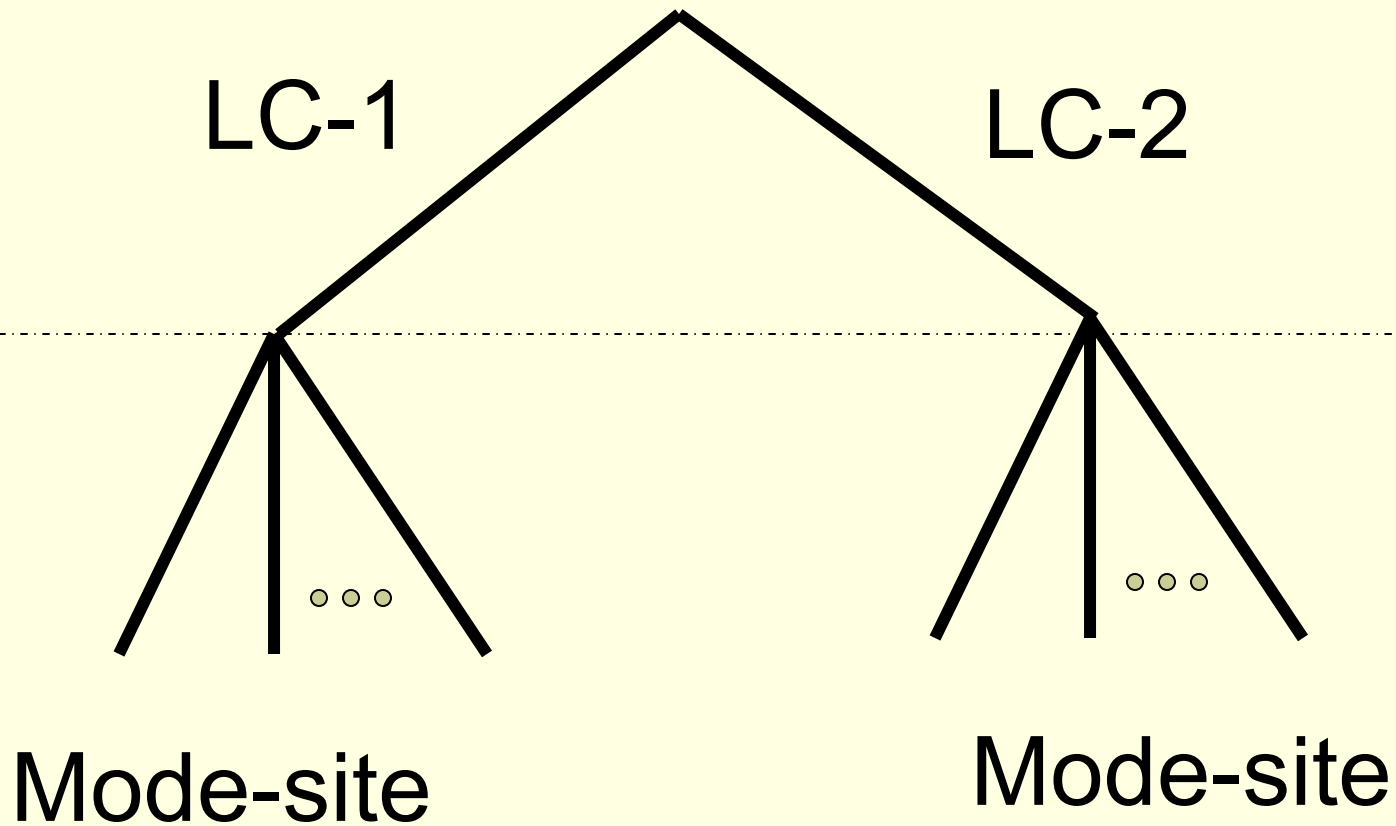


Party/charter boat, Private/rental boat
County sites

Random Parameter Logit: Results

	<u>Coeff.</u>	<u>t-ratio</u>	<u>Coeff.</u>	<u>t-ratio</u>
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 FFDDAYS2		No		Yes
χ^2 [df]				913[70]

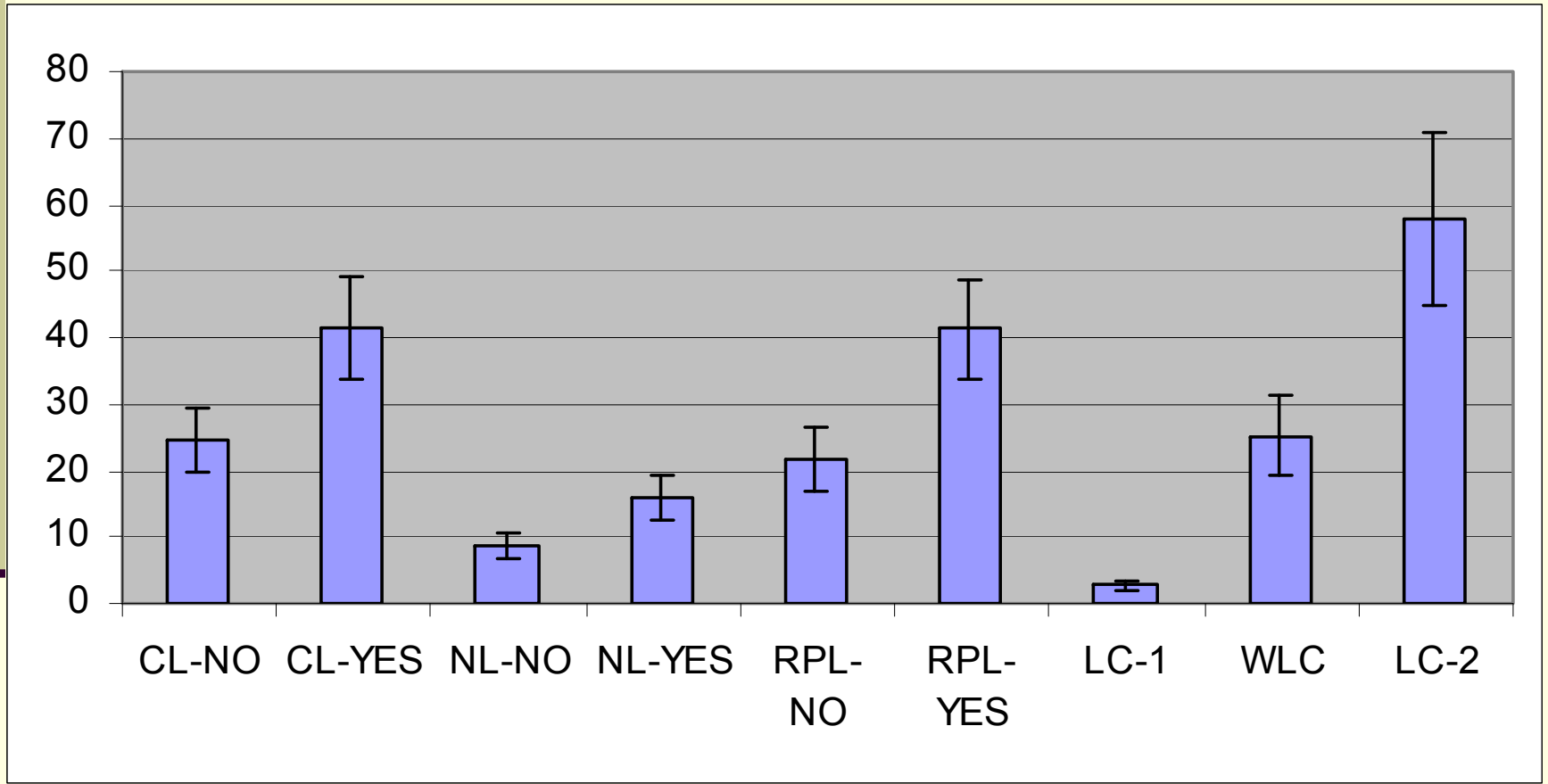
Latent Class Logit: Choice Framework



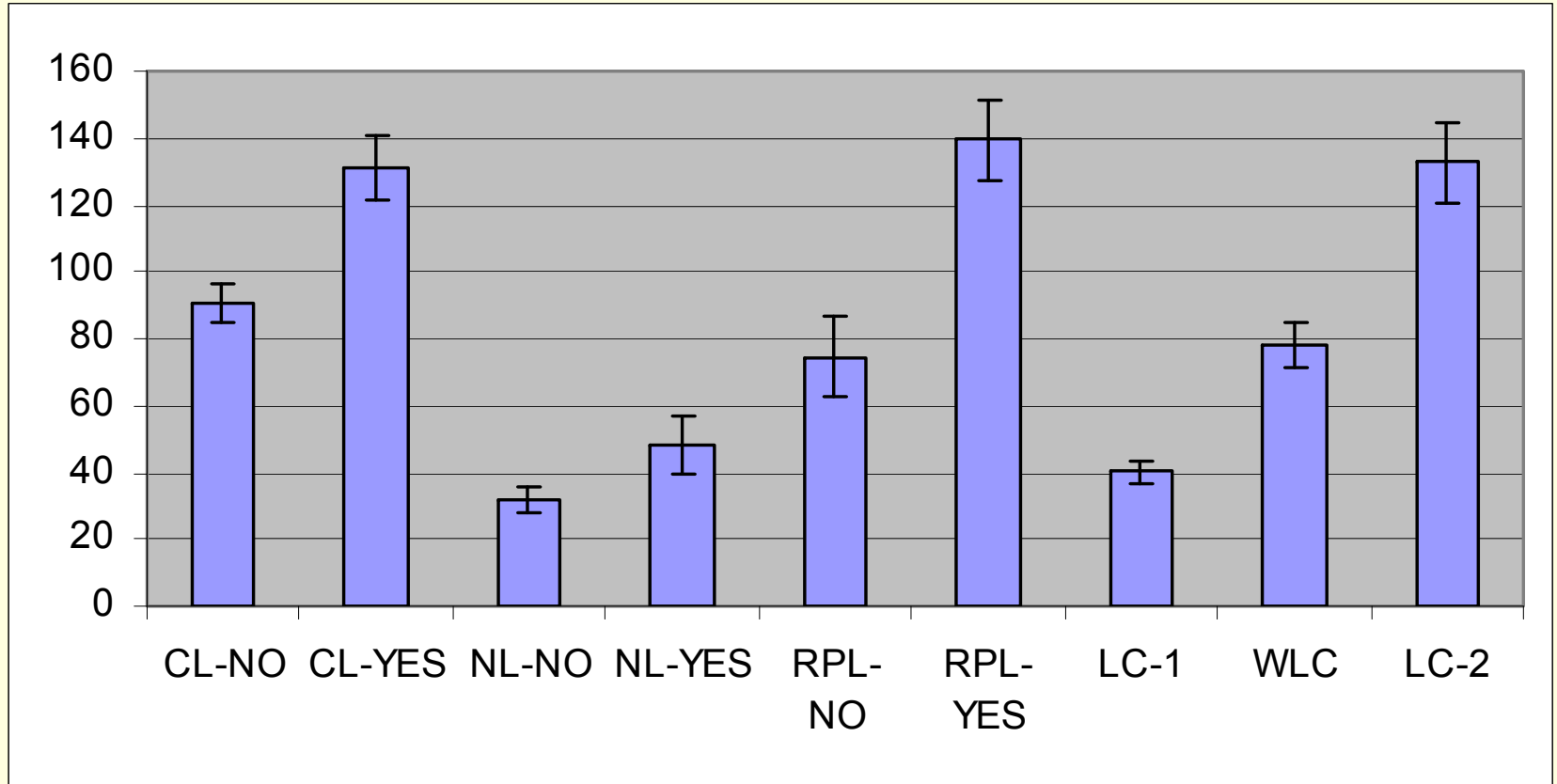
Latent Class Logit: Results

<u>Variable</u>	LC-1		LC-2	
	<u>Coeff.</u>	<u>t-ratio</u>	<u>Coeff.</u>	<u>t-ratio</u>
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		

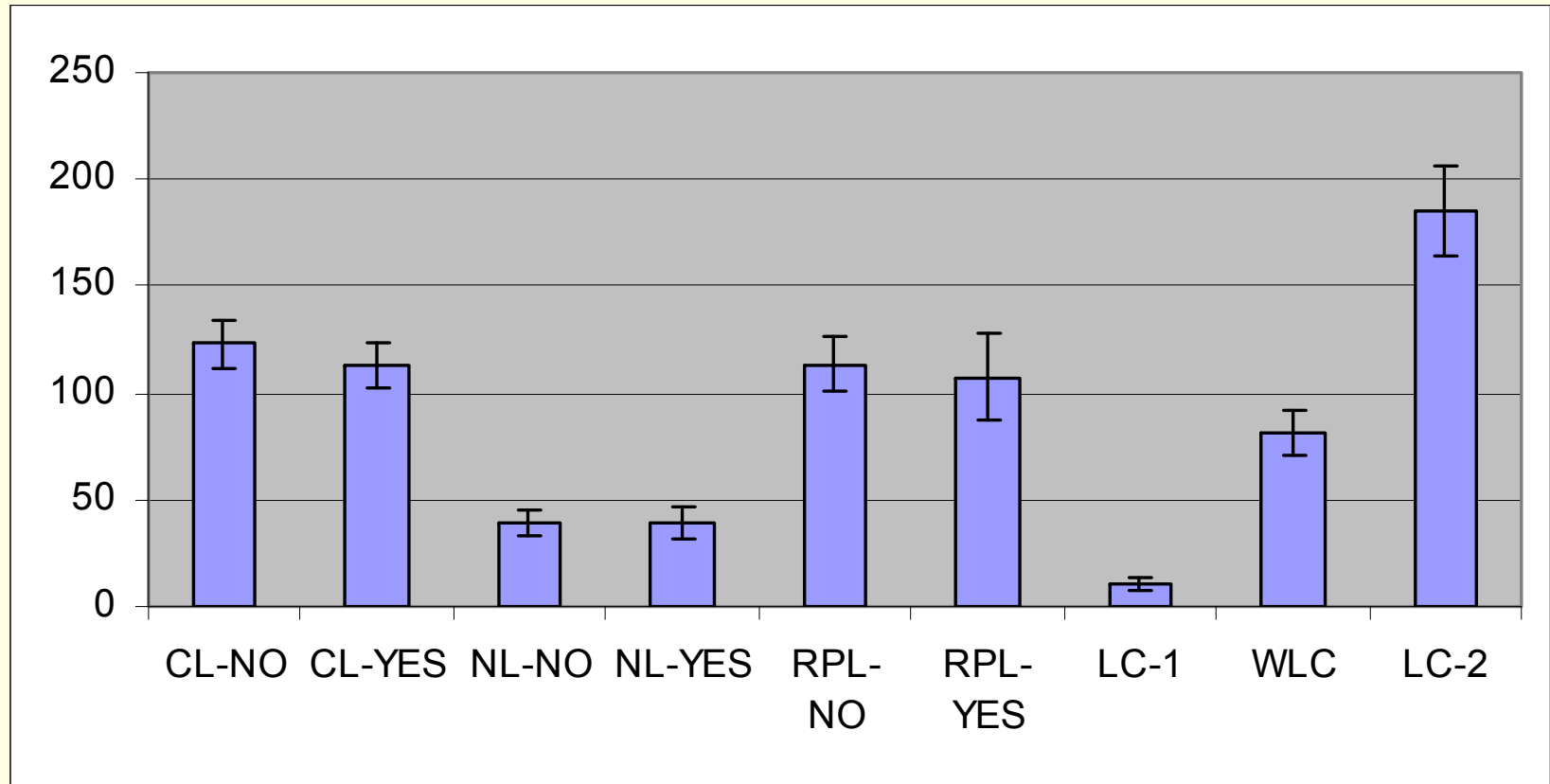
WTP for one additional fish: Snappers



WTP for one additional fish: Groupers



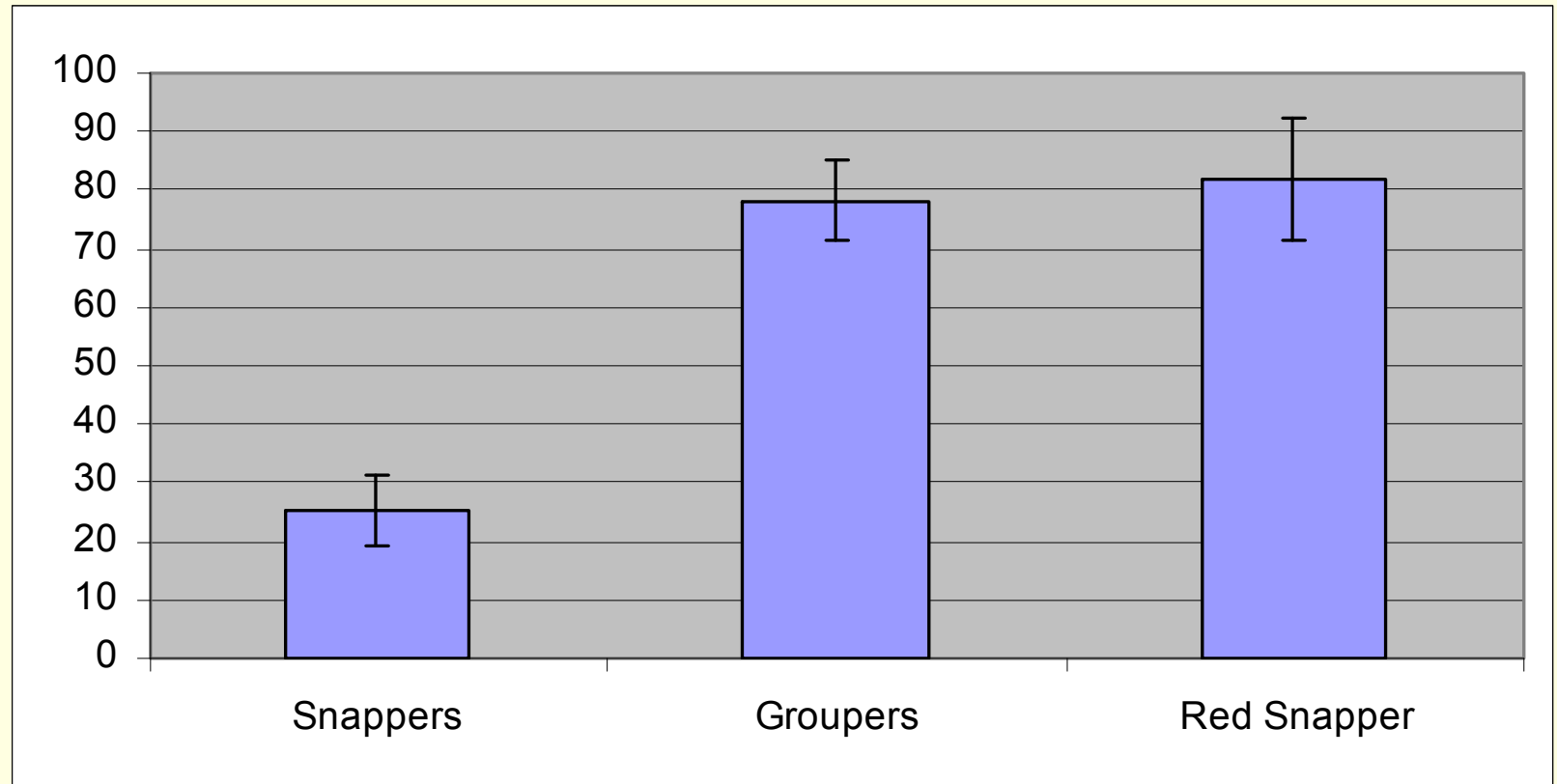
WTP for one additional fish: Red Snapper



Choosing across models

	$Y(=1) \times \Pi \times 100$
Conditional Logit	33%
Nested Logit	37%
Latent Class Logit	53%

WTP for one additional fish: WLC



Conclusions

- Species substitution lowers values.
- Models with preference heterogeneity statistically outperform baseline models.
- Preference heterogeneity tends to raise WTP.
- Latent class logit outperforms other models statistically.