Catch and Discard Characterization for Red Snapper, Warsaw Grouper and Speckled Hind:
The Snapper-Grouper Vertical Hook-and-Line Fishery of the South Atlantic United States

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Personnel

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Objectives

1. Develop a way to accurately quantify effort for the South Atlantic snapper/grouper bandit reel fishery

2. Describe effort across the depth range targeted by this fishery

3. Characterize catch and discards in in terms of CPUE

4. Expand estimates of observer CPUEs to the entire fishery
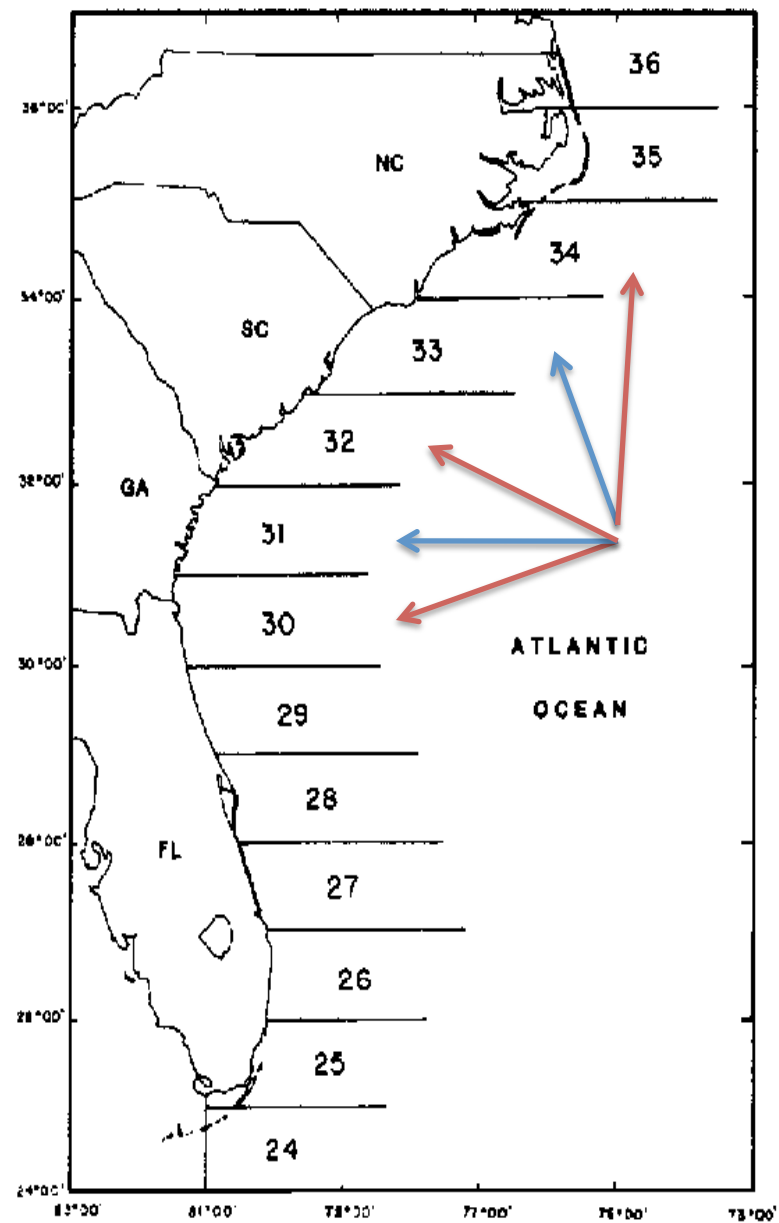
Study Design

- Vessel participation was voluntary and therefore nonrandom
- Observer placement for each sampling trip was randomized among participating vessels
- All observers underwent detailed training prior to deployment
- Vessels were asked to fish under "normal" conditions
- Onboard data collection conducted from January 2007 to December 2011
- 59 trips comprising 357 sea days

Observer coverage

- From 2003 to 2007 there were on average 890 vessels per year where at least one pound of snapper-grouper species was landed; 397 vessels landed at least 1,000 pounds
- As of July 2011, there were 693 vessels with permits
- We sampled 27 different vessels

Objective 1: Quantifying Effort

- Effort estimated as Hook hours (HH)
- Example:
  - 10 HH = 1 hook fished for 10 hours
  - 10 HH = 10 hooks fished for 1 hour
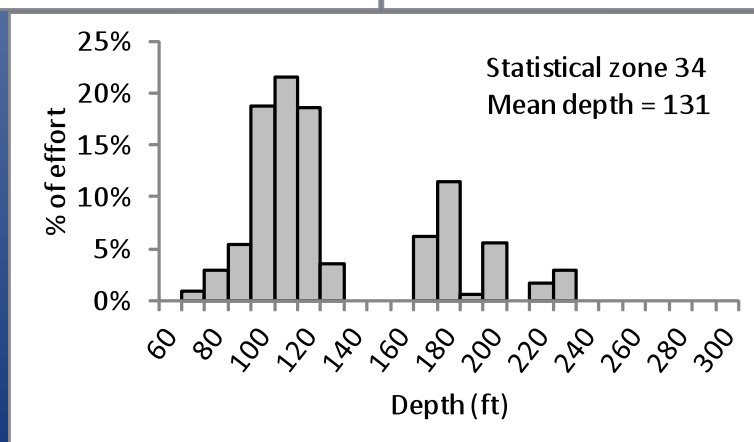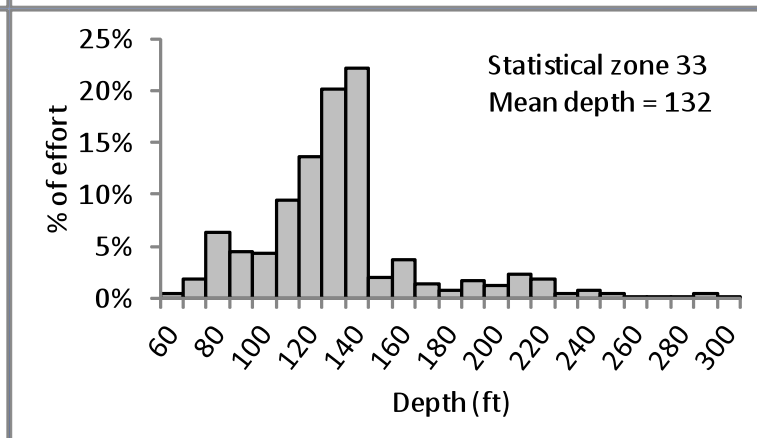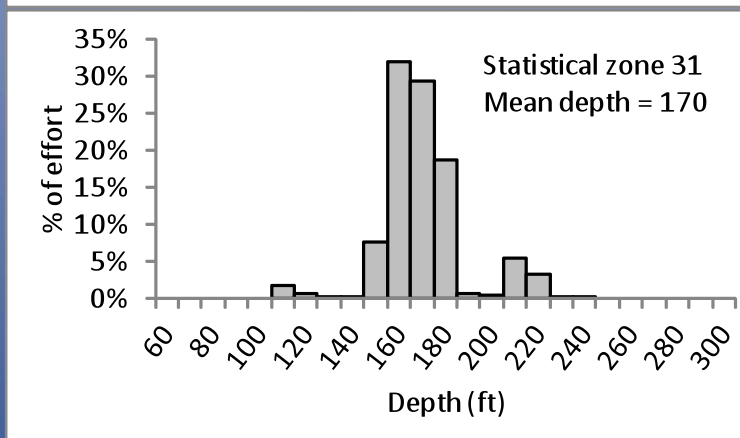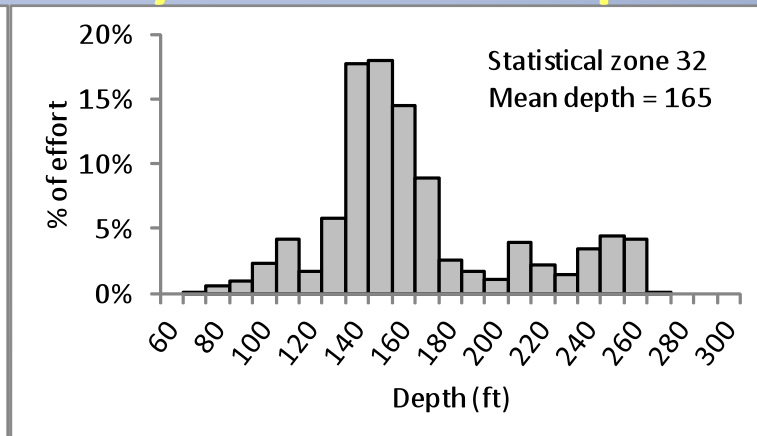 - 10 HH = 5 hooks fished for 2 hours
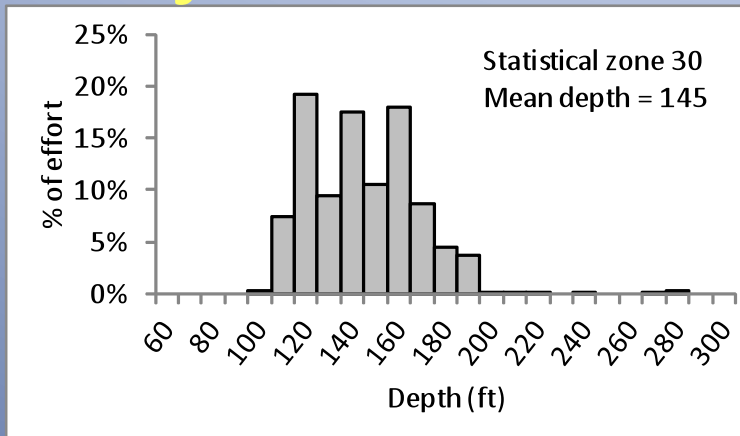 - Etc…

Estimating HH

- HH was estimated for each station—algorithm used:
    - No. of reels being fished (mean=3)
    - Total fishing time (mean=0.6 hrs)
    - No. of sets (mean=21)
    - Total number of hooks set (mean=46—about 2 hooks per reel set)
- Mean HH per station = 4 HH

HH versus Actual Fishing Time
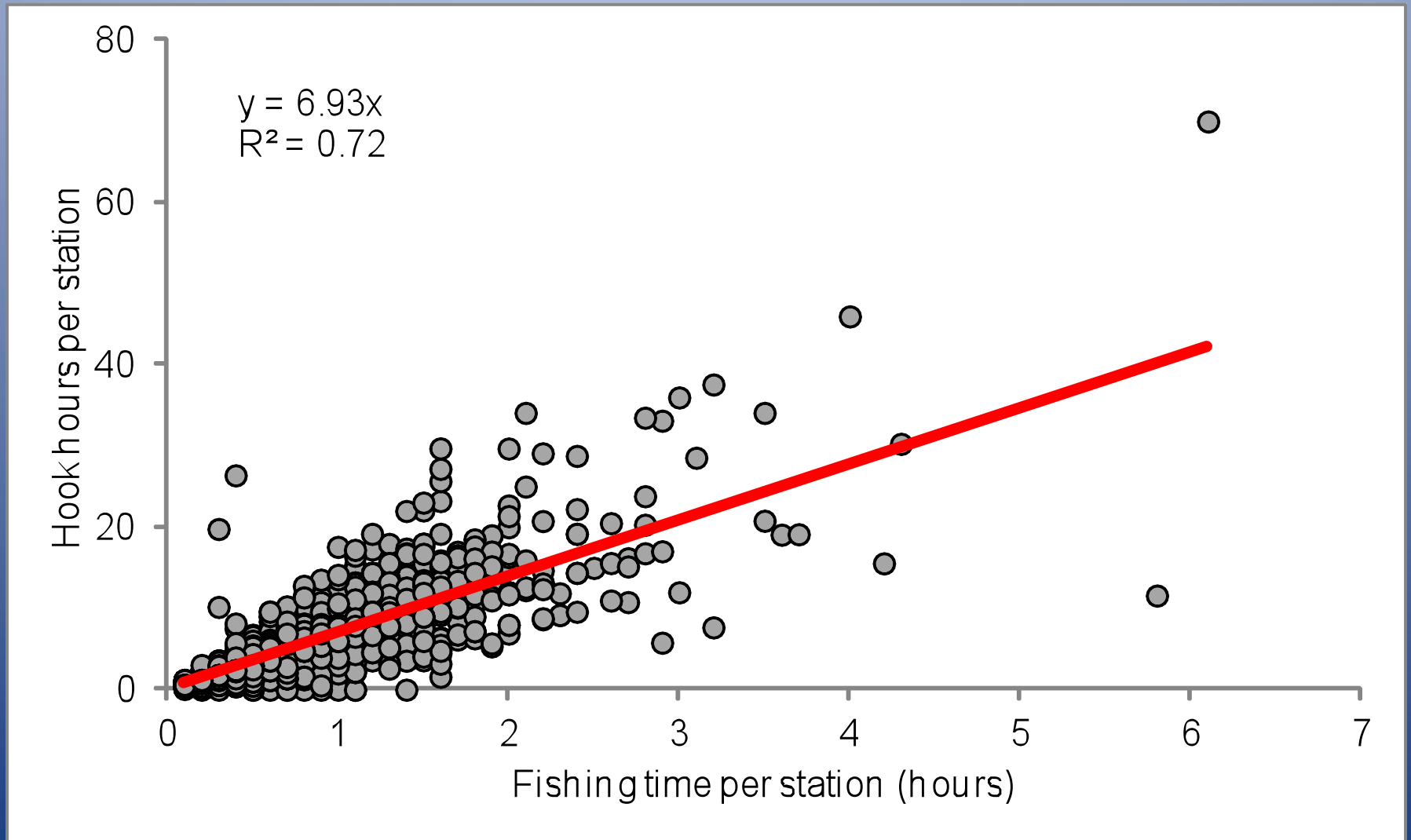
# Objective 2: Effort by water depth

Objective 3: Characterizing catch

- Total catch by species and HH were tabulated for each station within a trip number
- Catch-per-unit-effort (CPUE)= individuals per 10 HH
- CPUE for selected species modeled with negative binomial regression

143 species were caught—total individuals sampled given below

Common	Discards	Kept	Common	Discards	Kept
Porgy, Red	2253	3452	Grouper, Yellowmouth	5	42
Snapper, Vermillion	1832	15863	Barracuda, Great	5	10
Scamp	531	1745	Grouper, Warsaw	5	10
Shark, Atlantic Sharpnose	456	50	Shark, Spinner	5	7
Snapper, Red	440	265	Porgy, Knobbed	3	292
Seabass, Black	431	871	Grouper, Snowy	3	75
Tomtate	332	264	Graysby	3	47
Hind, Speckled	182	166	Grouper, Black	3	21
Amberjack, Greater	158	294	Bigeye	3	8
Gag	109	664	Pinfish	2	15
Squirrelfish	99	35	Snapper, Blackfin	2	14
Moray, Spotted	85	3	Dolphin	1	107
Triggerfish, Gray	61	4875	Pigfish	1	42
Jack, Almaco	57	591	Snapper, Yellowtail	1	35
Sharksucker	57	2	Snapper, Mutton	1	29
Shark, Tiger	55	0	Mackerel, King	1	22
Bass, Saddle	53	3	Cobia, Ling	1	11
Grouper, Red	47	1072	Hind, Rock	0	234
Pinfish, Spottail	40	42	Hind, Red (Strawberry Grouper)	0	147
Remora	40	1	Triggerfish, Queen	0	78
Seabass, Bank	34	18	Grouper, Yellowfin	0	36
Rudderfish, Banded	33	137	Scad, Round	0	32
Dogfish, Spiny	31	2	Porgy, Whitebone	0	30
Tilefish, Sand	22	53	Hogfish	0	27
Amberjack, Lesser	22	24	Creole-Fish	0	23
Shark, Silky	20	5	Grouper, Yellowedge	0	20
Sharks Grouped	17	0	Porgy, Longspine	0	20
Perch, Dwarf Sand	15	12	Snapper, Silk	0	19
Perch, Sand	15	11	Coney	0	14
Moray, Reticulate	15	0	Runner, Blue	0	13
Shark, Smooth Dogfish	13	0	Snapper, Gray	0	12
Grunt, White	12	991	Bluefish	0	11
Shark, Nurse	11	0	Cottonwick	0	11
Shark, Sandbar	11	0	Porgy, Jolthead	0	10

Red snapper LFD
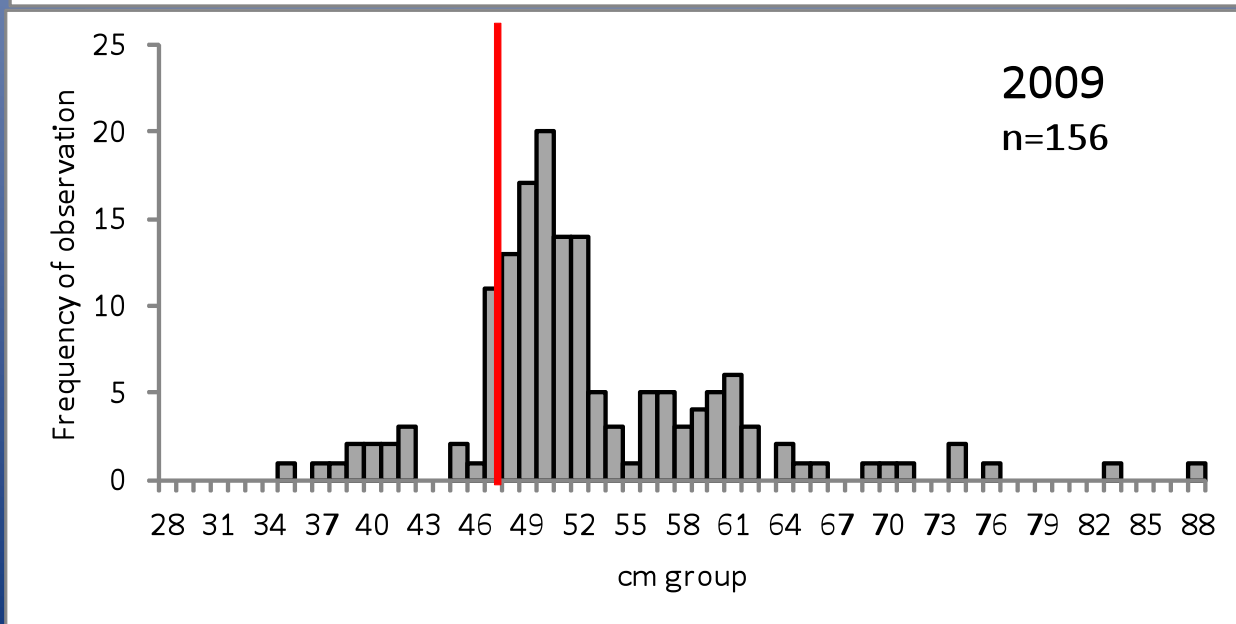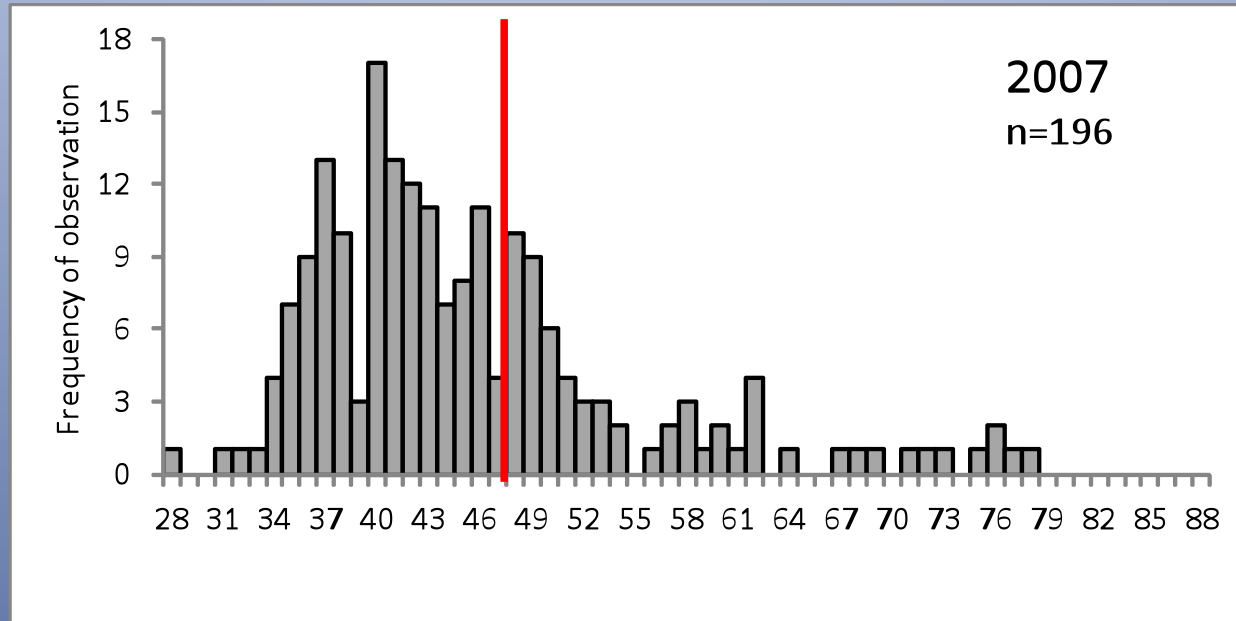
Negative binomial CPUE model

Dependent variables

- Kept catch (includes bait)
- Discarded catch

Independent variables

- Year Categorical
- Trimester Categorical
- Statistical zone Categorical

- Raw catch per station was modeled with HH as an offset
- Model output returns predicted CPUE

Number of stations sampled

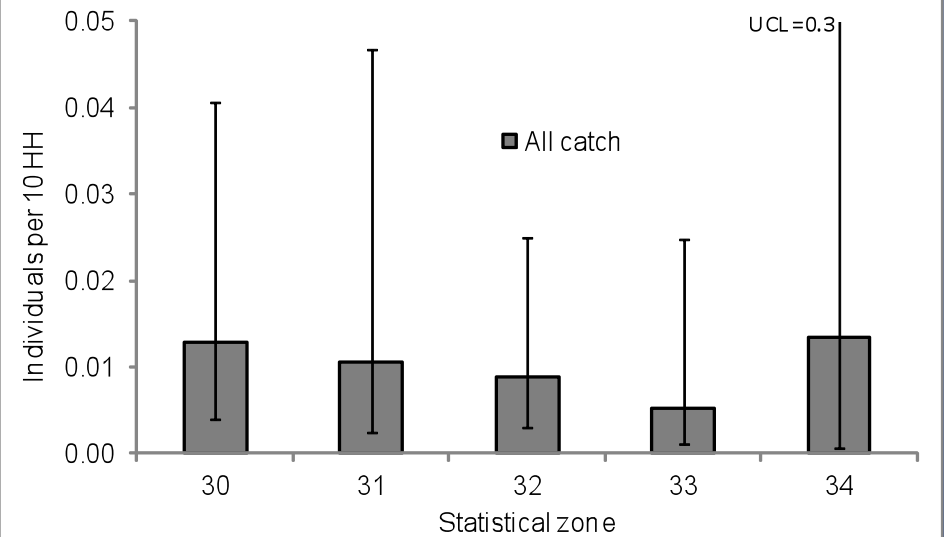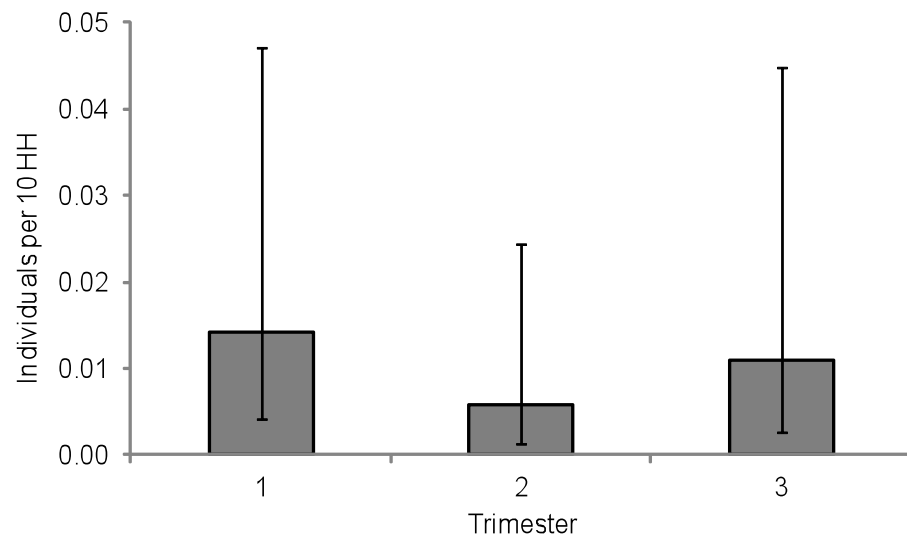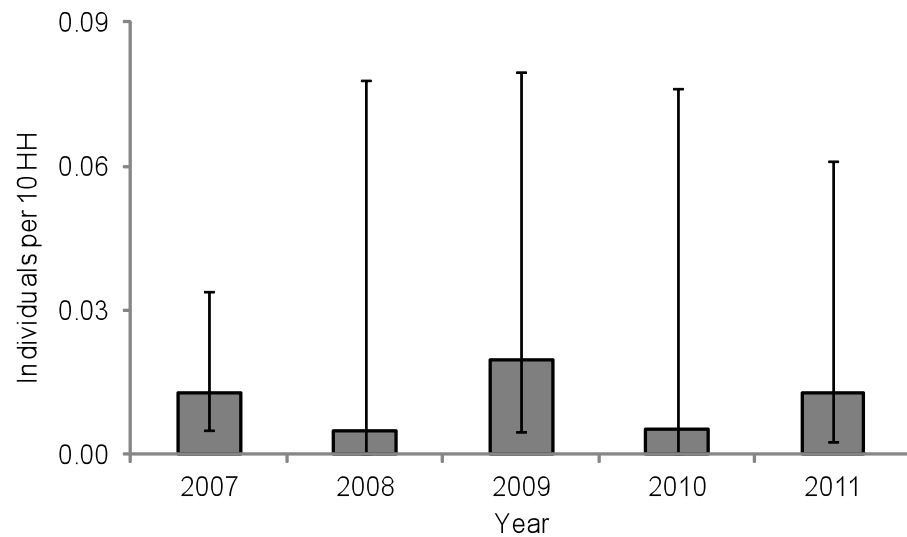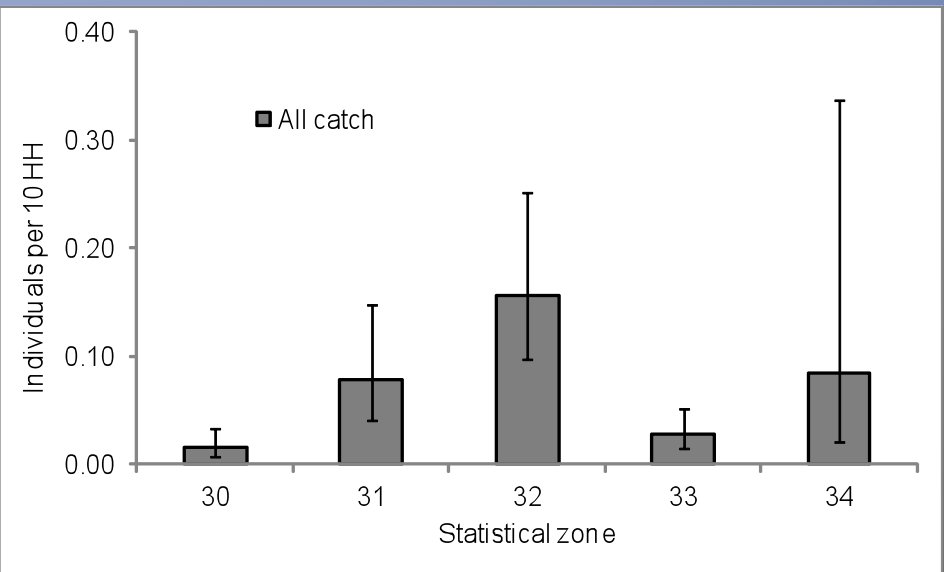| Year	Trimester	Statistical zone					
		30	31	32	33	34	Total
2007	1	78	72	382	149	18	699
	2	135	44	135	306		620
	3	245	38	21			304
2008	1			74			74
	2			52			52
	3		3	188			191
2009	1	124	40		67		231
	2			113	379		492
	3						
2010	1						
	2						
	3	55		282	32		369
2011	1	9	59		32	16	116
	2	106	4		103	85	298
	3				52		52
Total		646	256	1247	965	34	3148

Each station is a data point in the CPUE model
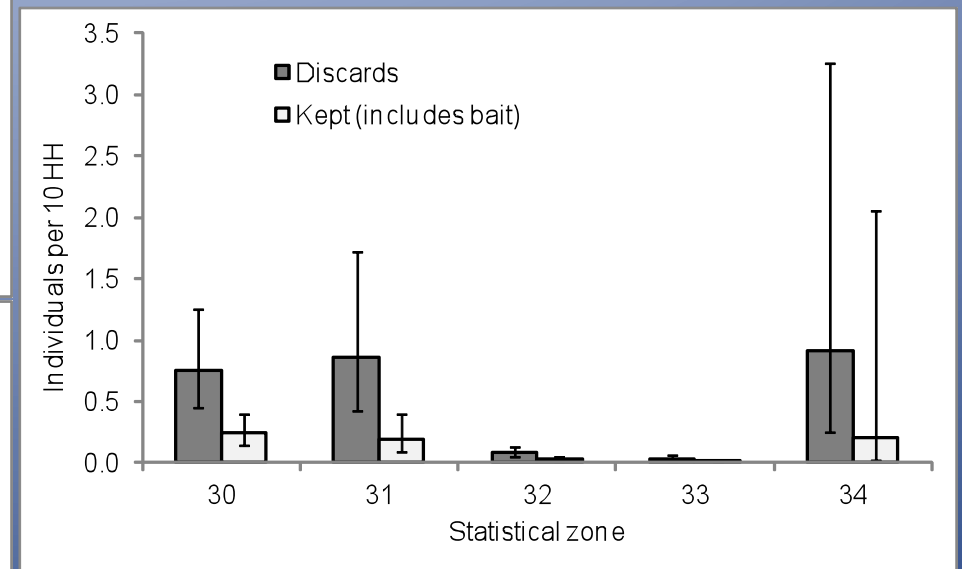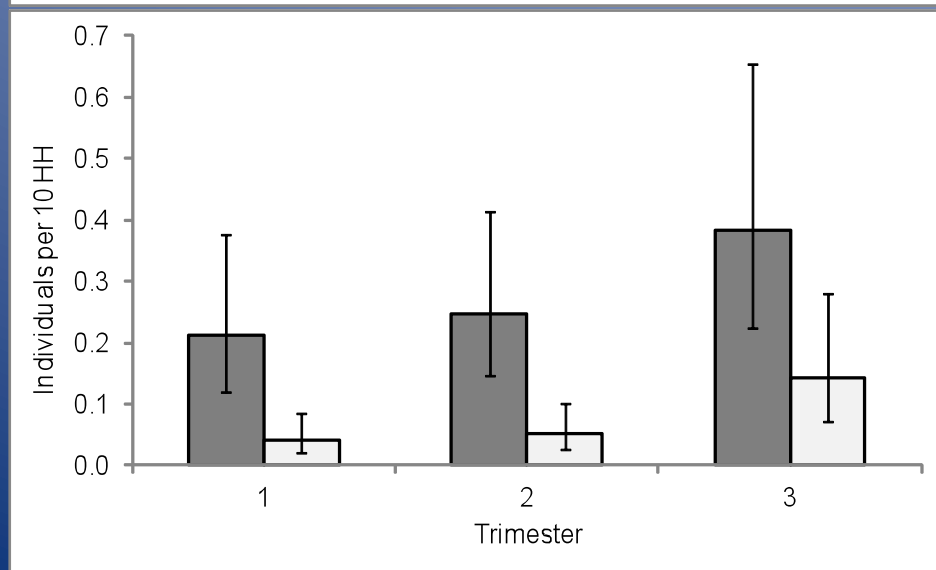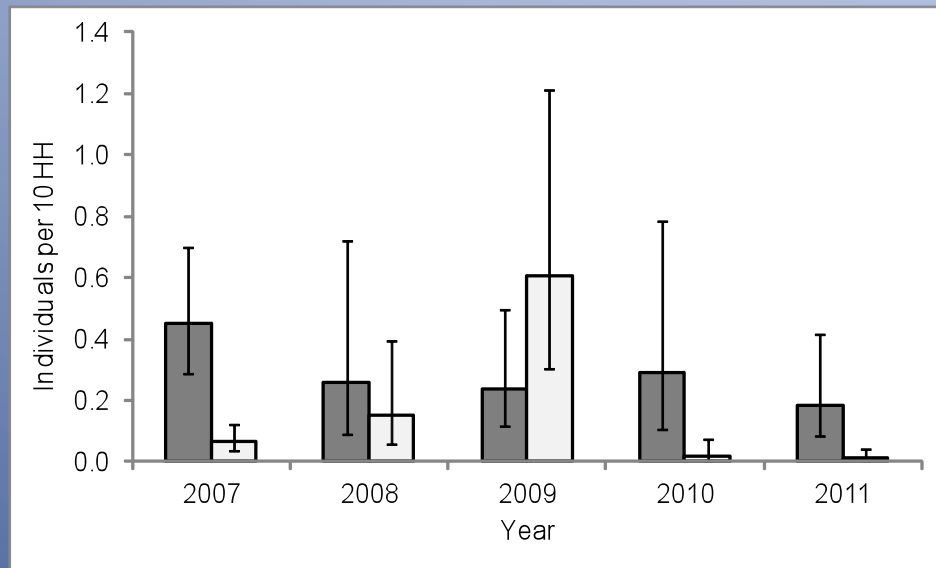
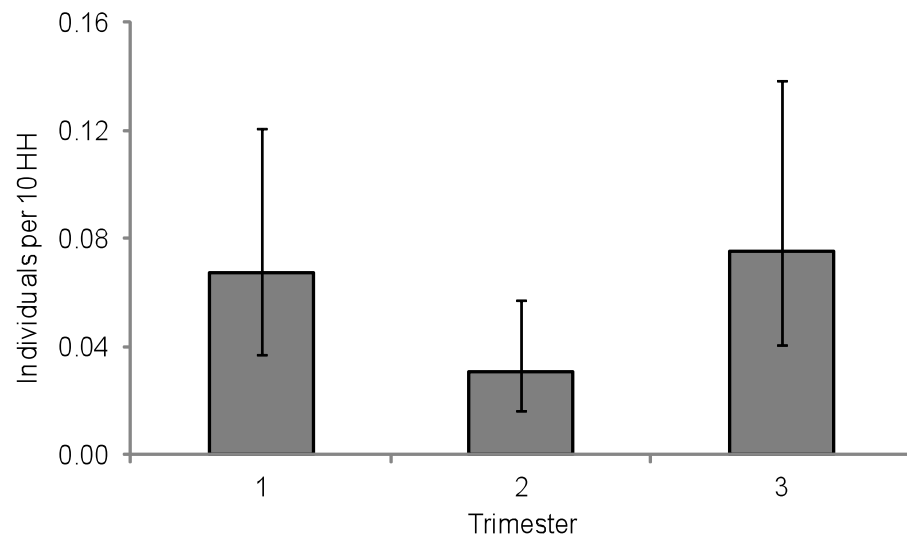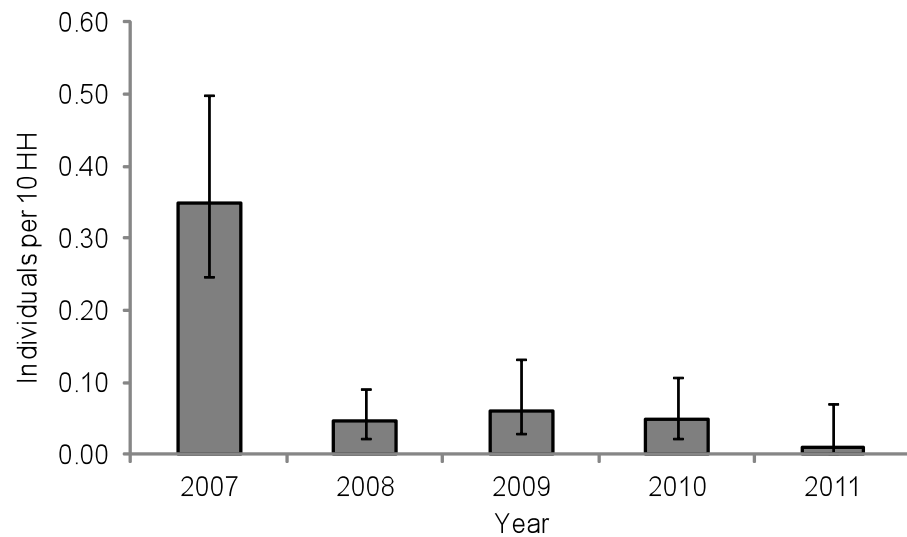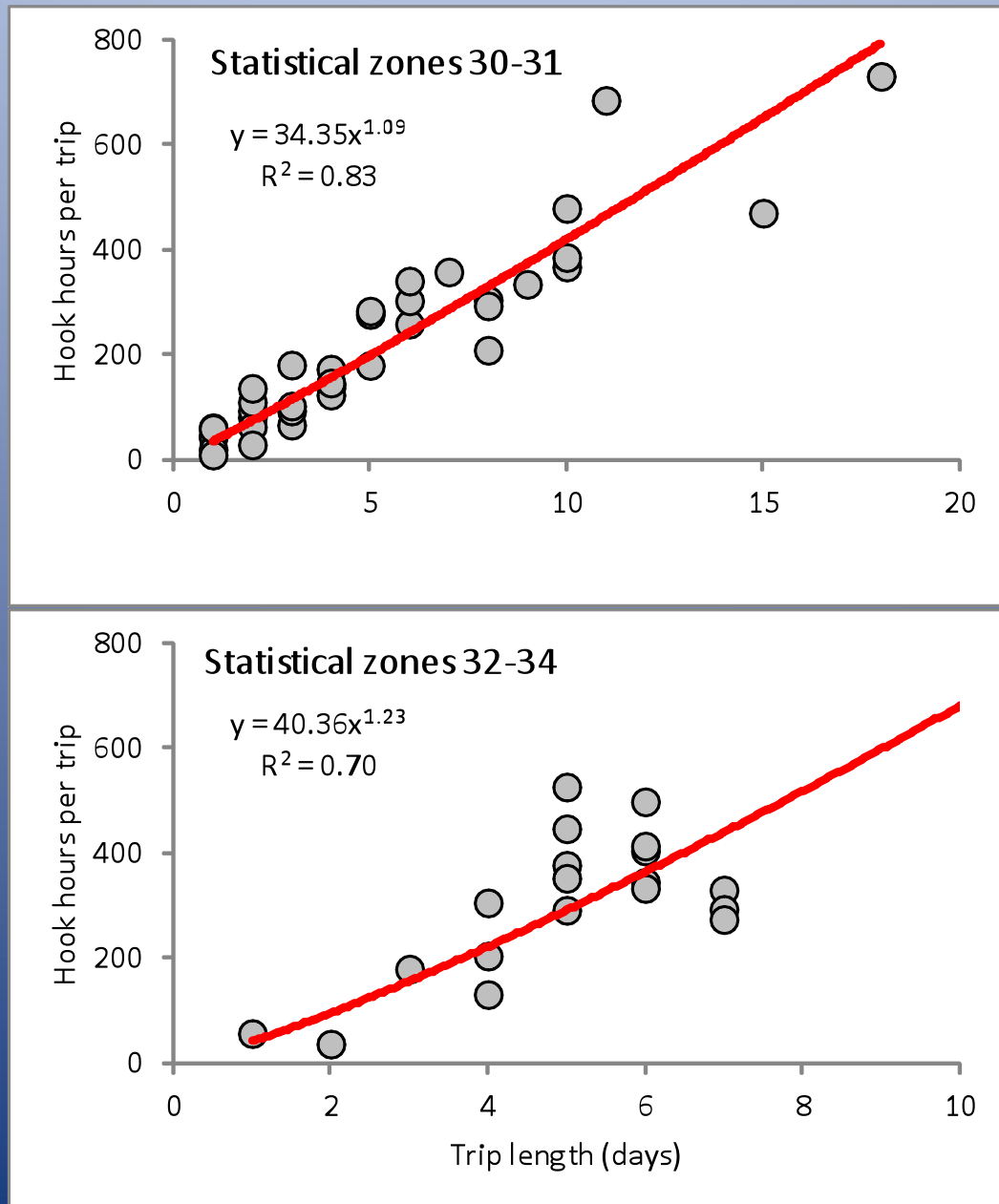Red snapper

Speckled hind

Objective 4: Estimating discards for the entire fishery

- Need an index of effort available from trip ticket information that can be related to HH

- Total fishery HH must be estimated for each temporal-spatial stratum

- Modeled estimates of discards per HH from observer data can be multiplied by total HH to estimate total discards

Predicted Discards per 10 HH—Red snapper

Year	Trimester	Statistical zone				
		30	31	32	33	34
2007	1	1.0	1.1	0.1	0.0	1.2
	2	1.1	1.3	0.1	0.0	1.4
	3	1.8	2.0	0.2	0.1	2.1
2008	1	0.6	0.6	0.1	0.0	0.7
	2	0.6	0.7	0.1	0.0	0.8
	3	1.0	1.1	0.1	0.0	1.2
2009	1	0.5	0.6	0.1	0.0	0.6
	2	0.6	0.7	0.1	0.0	0.7
	3	0.9	1.1	0.1	0.0	1.1
2010	1	0.6	0.7	0.1	0.0	0.8
	2	0.7	0.8	0.1	0.0	0.9
	3	1.1	1.3	0.1	0.0	1.4
2011	1	0.4	0.5	0.0	0.0	0.5
	2	0.5	0.5	0.1	0.0	0.6
	3	0.7	0.8	0.1	0.0	0.9

Trip length may be a good available index of effort

Statistical zones 30-31

$y = 34.35x^{1.09}$
$R^2 = 0.83$

Hook hours per trip

Statistical zones 32-34

$y = 40.36x^{1.23}$
$R^2 = 0.70$

Hook hours per trip

Trip length (days)

Future work and funding needed to:

- Acquire trip ticket information from entire fishery to estimate discards using these data and models
- Refine effort index models
- Combine uncertainty from CPUE estimation with uncertainty from effort index models to bracket total fishery discard estimates with confidence intervals
- Increase sample size for relating HH to trip length