# A Regional Evaluation of the Impact of Fish Consumption Advisories on Marine Recreational Fishing

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*The views expressed in this presentation are those of the authors and do not necessarily reflect those of the National Oceanic and Atmospheric Administration*

# Motivation

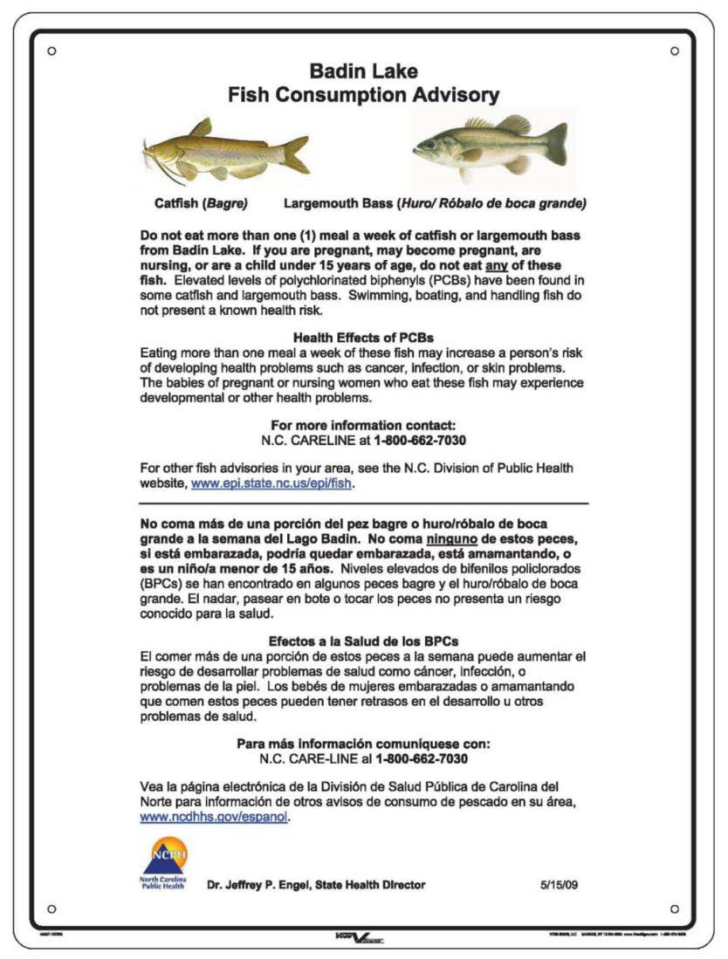
## Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

**Section 107:**

- establishes liability for injury to, destruction of, or loss of natural resources
- authorizes natural resource trustees to recover compensatory damages for injury to natural resources as well as reasonable costs of assessing injury
- mandates that all sums recovered as damages be used only to restore, replace or acquire the equivalent of such natural resources

# Motivation

## Fish Consumption Advisories



**Badin Lake**
**Fish Consumption Advisory**





**Catfish (*Bagre*)** **Largemouth Bass (*Huro/ Róbalo de boca grande*)**

**Do not eat more than one (1) meal a week of catfish or largemouth bass from Badin Lake. If you are pregnant, may become pregnant, are nursing, or are a child under 15 years of age, do not eat any of these fish.** Elevated levels of polychlorinated biphenyls (PCBs) have been found in some catfish and largemouth bass. Swimming, boating, and handling fish do not present a known health risk.

**Health Effects of PCBs**

Eating more than one meal a week of these fish may increase a person's risk of developing health problems such as cancer, infection, or skin problems. The babies of pregnant or nursing women who eat these fish may experience developmental or other health problems.

**For more information contact:**
N.C. CARELINE at **1-800-662-7030**

For other fish advisories in your area, see the N.C. Division of Public Health website, www.epi.state.nc.us/epi/fish.

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**No coma más de una porción del pez bagre o huro/róbalo de boca grande a la semana del Lago Badin. No coma ninguno de estos peces, si está embarazada, podría quedar embarazada, está amamantando, o es un niño/a menor de 15 años.** Niveles elevados de bifenilos policlorados (BPCs) se han encontrado en algunos peces bagre y el huro/róbalo de boca grande. El nadar, pasear en bote o tocar los peces no presenta un riesgo conocido para la salud.

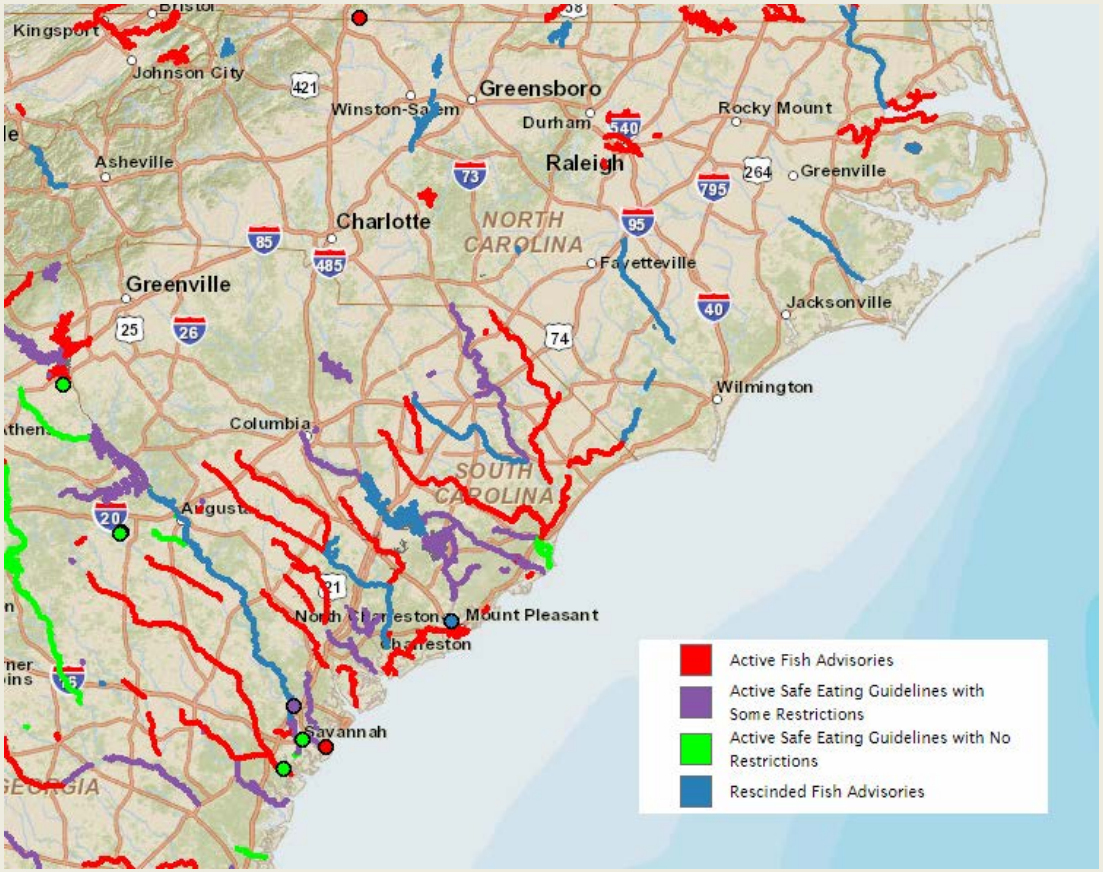
**Efectos a la Salud de los BPCs**

El comer más de una porción de estos peces a la semana puede aumentar el riesgo de desarrollar problemas de salud como cáncer, infección, o problemas de la piel. Los bebés de mujeres embarazadas o amamantando que comen estos peces pueden tener retrasos en el desarrollo u otros problemas de salud.

**Para más información comuníquese con:**
N.C. CARE-LINE al **1-800-662-7030**

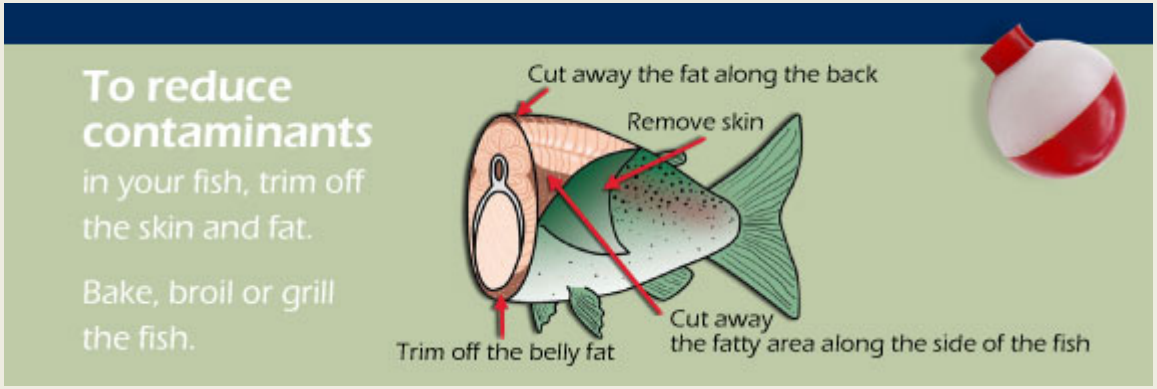
Vea la página electrónica de la División de Salud Pública de Carolina del Norte para información de otros avisos de consumo de pescado en su área, www.ncdhhs.gov/espanol.

**Dr. Jeffrey P. Engel, State Health Director** 5/15/09



# Motivation

## Fish Consumption Advisories




# Existing Research

**Fish Consumption Advisories:**

- MacNair, D. and W. Desvouges (2007)
- Breffle et al (1998)
- Jakus et al. (1997, 98, 99, 2003)
- Montgomery and Needelman (1997)

**Use of NOAA MRFSS/MRIP Data:**

- Strand et al (1991)
- McConnell et al (1994)
- Hicks et al (1999)
- Haab et al (2006)

# Data Sources

**National Listing of Fish Advisories – U.S. EPA**

– Database of all FCAs in the United States, available as GIS layer

**Marine Recreation Information Program – NMFS**

- Previously MRFSS; intercept interviews of anglers at marine access points
- Also includes telephone survey of coastal household residents

# Model

## Conditional Logit "Site Choice" Model

**Individual *i* chooses site *j* out of *J* alternatives**

$$u_{ij} = \beta_{TC} C_{ij} + \gamma' X_j + \varepsilon_{ij}$$

$$P_{ij} = \frac{\exp(\beta' X_{ij})}{\sum_j \exp(\beta' X_{ij})}$$

**Site attributes:**

- **Presence of FCA, Catch & Keep Rate, Others**

## Poisson Model:

**Predict the release for each site**

$$R_j = exp(\alpha + \delta' Y_j + \varepsilon)$$

**Site attributes:**

- **Presence of FCA, Others**

# Data Construction

**Fish Consumption Advisory Levels** (sites matched within 1/2 mile with maximum advisory):

1 = "Informational Health Advisory "

2 = "Restricted Consumption - Subpopulation(s)"

3 = "Restricted Consumption - General Population"

4 = "No Consumption - Subpopulation(s)"

5 = "No Consumption - General Population"

6 = "Public Fishing Ban" or "Commercial Fishing Ban"

**Catch and Keep Rate:** Site mean = “Number of fish available for inspection at time of interview”

**Catch and Release Rate:** Site mean = “Number of fish that were caught and released alive”

**Others:** # of car parking spaces

Is fee charged to the public for use of site?

Fish cleaning stations?

Tackle shops?

# Data Construction

**Travel Cost:** TC = Distance(rt)*32.7(AAA 2013) +Time(rt)*Hhincome(zip)/2080/3

**2013 and 2014 pooled together** (represents timeframe of switch from MRFSS to MRIP)

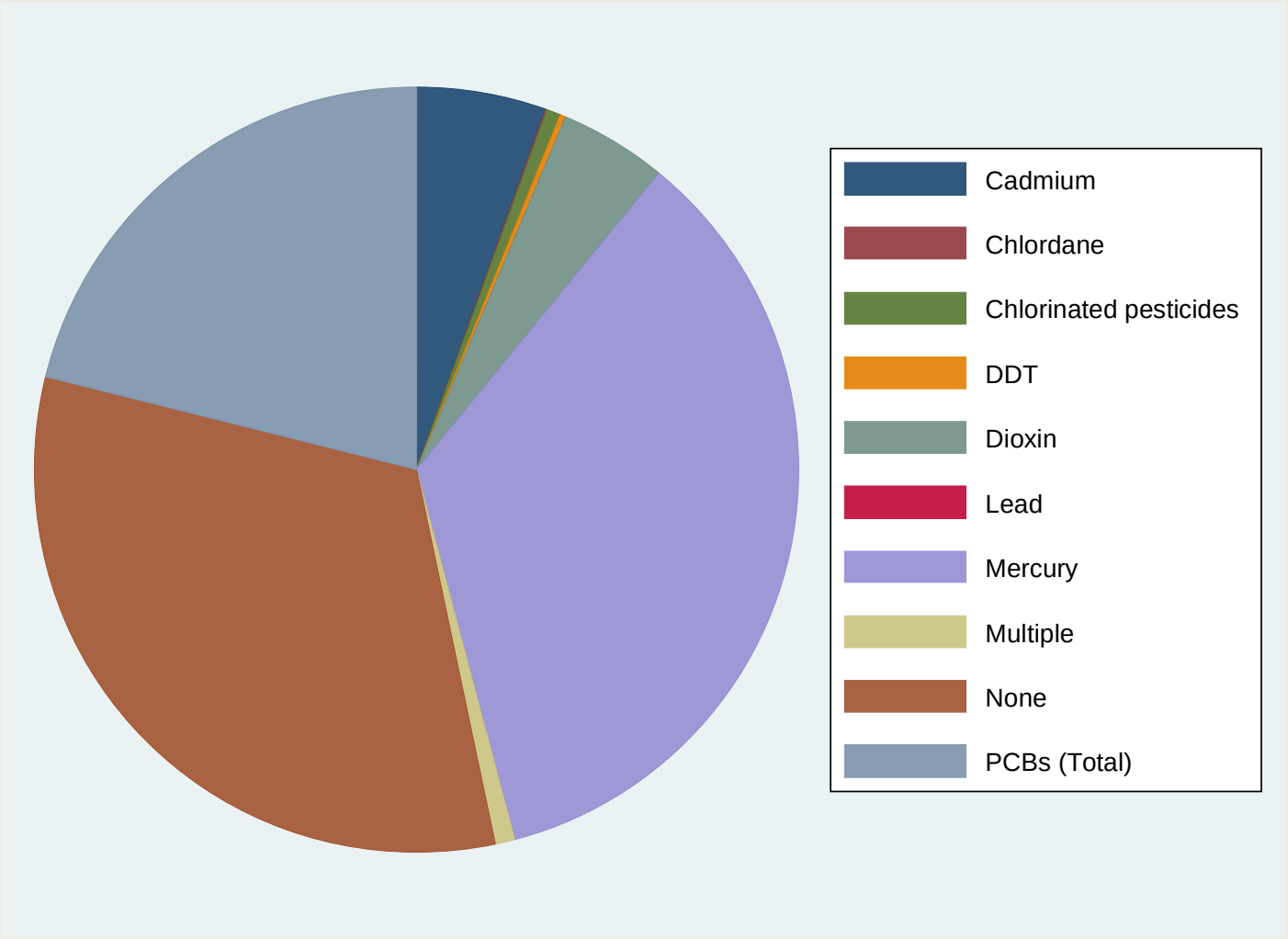
**wp_int** – individual specific weights from MRIP

**Site Definition:**

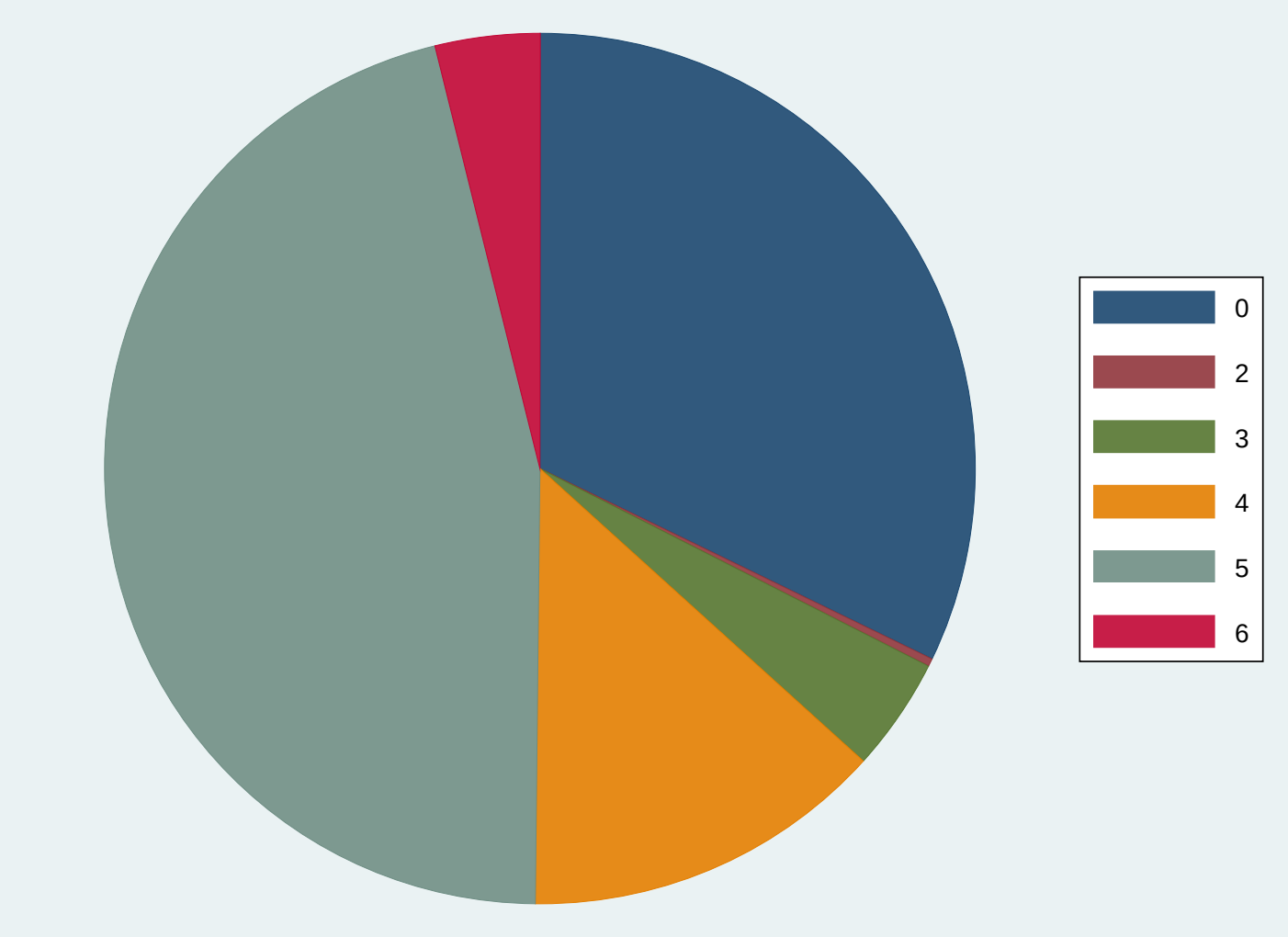
- Identify area of interest
- Specify impacted sites
- Identify all zip codes within X miles of ↑ impacted sites
- Identify all additional sites within X miles of ↑ zip codes
- X = 180 miles (Whitehead and Haab, 1999)
- Sample of alternatives in choice set

**Mode:** only shore-base trips (no boating or charter fishing)

# Pollutant Distribution Across Sites in SE



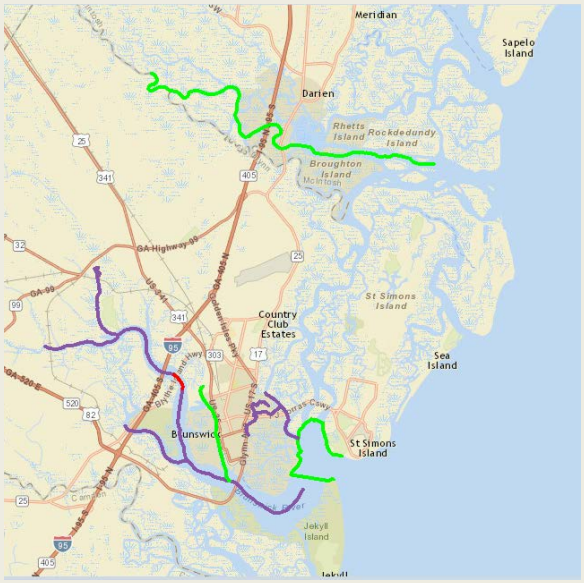
# Advisory Levels Across Sites in SE



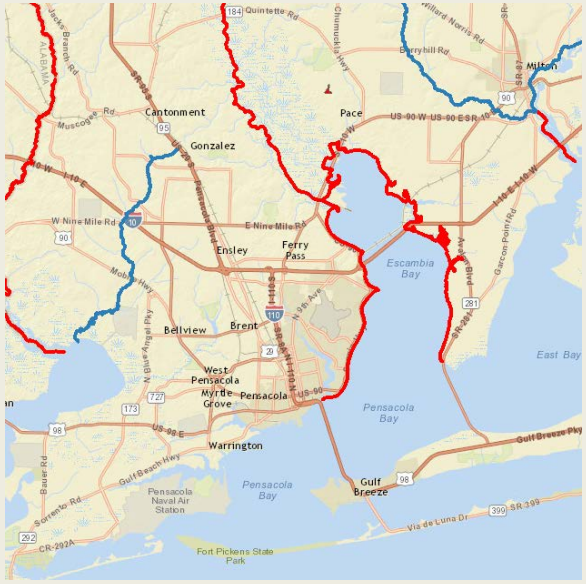
# Scenarios:

**Savannah, Georgia**


**Brunswick, Georgia**




**Pensacola, Florida**



# Summary Statistics

| | Savannah | Brunswick | Pensacola |
|---|---|---|---|
| **Observations** | 1837 | 1706 | 4346 |
| **Catch & Keep** | 0.74, 0.22 | 0.74, 0.22 | 0.79, 0.18 |
| **FCA 0** | 0.93, 0.08 (254) | 0.93, 0.08 (196) | 0.84, 0.13 (671) |
| **FCA 3** | 0.56, 0.20 (55) | 0.54, 0.18 (53) | 0.88, 0.03 (18) |
| **FCA 4** | 0.76, 0 (3) | | |
| **FCA 5** | 0.72, 0.21 (1525) | 0.72, 0.22 (1457) | 0.78, 0.19 (3657) |
| **Catch Rate** | 1.86, 0.81 | 1.82, 0.83 | 2.33, 4.43 |
| **# parking** | 90.5, 83.8 | 94.0, 86.3 | 129.0, 108.0 |
| **Fee?** | 0.43, 0.49 | 0.37, 0.48 | 0.32, 0.47 |
| **Fish Cleaning?** | 0.81, 0.39 | 0.79, 0.41 | 0.71, 0.45 |
| **Tackle Shops?** | 0.52, 0.50 | 0.51, 0.50 | 0.56, 0.50 |
| **Ocean?** | 0.50, 0.50 | 0.47, 0.50 | 0.25, 0.44 |
| **Travel Cost** | 30.67, 29.87 | 26.83, 23.90 | 25.15, 25.35 |

* Unweighted; Reported Mean, Standard Deviation, and (number of observations)

# Site Choice Model Results

| | Savannah | Brunswick | Pensacola |
|---|---|---|---|
| **Catch & Keep** | 2.02 (0.20) | 1.99 (0.20) | 0.91 (0.14) |
| **Catch Rate** | 0.21 (0.05) | 0.12 (0.05) | 0.02 (0.00) |
| **# parking** | 0.0038 (0.0007) | 0.0042 (0.0007) | 0.0027 (0.0001) |
| **Fee?** | -0.39 (0.17) | -0.46 (0.17) | 0.29 (0.07) |
| **Fish Cleaning?** | 2.25 (0.13) | 2.22 (0.13) | 1.44 (0.10) |
| **Tackle Shops?** | 0.39 (0.11) | 0.50 (0.12) | 0.46 (0.06) |
| **Ocean?** | -0.25 (0.12) | -0.42 (0.13) | -0.48 (0.8) |
| **Travel Cost** | -0.12 (0.01) | -0.11 (0.01) | -0.08 (0.00) |
| **FCA 3** | -1.63 (0.30) | -1.51 (0.31) | -1.85 (0.31) |
| **FCA 4** | 2.96 (0.70) | | |
| **FCA 5** | -1.15 (0.20) | -1.13 (0.22) | -0.30 (0.07) |

* Weighted; Standard errors in parentheses

# Poisson Model Results

| # of Fish not released | Savannah | Brunswick | Pensacola |
|---|---|---|---|
| **Ocean?** | 0.21 (0.05) | 0.11 (0.05) | 0.11 (0.05) |
| **Fish Cleaning?** | 0.09 (0.06) | 0.08 (0.06) | -0.27 (0.02) |
| **FCA 3** | -0.89 (0.17) | -0.92 (0.17) | -0.49 (0.14) |
| **FCA 4** | -0.37 (0.46) | | |
| **FCA 5** | -0.51 (0.05) | -0.53 (0.06) | -0.94 (0.02) |
| **Constant** | 0.52 (0.06) | 0.57 (0.07) | 1.56 (0.03) |

* Weighted; Standard errors in parentheses

# Measuring the Impact of FCAs

- **Removal of all FCAs:**

| | Savannah | Brunswick | Pensacola |
|---|---|---|---|
| WTPscenario1 | 7.24 | 7.96 | 3.15 |

- **Removal of FCA combined with change in Catch and Keep:**

| | Savannah | Brunswick | Pensacola |
|---|---|---|---|
| WTPscenario2 | 8.65 | 9.42 | 4.50 |
| WTPprediction | 0.37 | 0.30 | 0.48 |
| % change | 14.4% | 14.6% | 27.6% |

## Conclusion

- FCAs have an observable influence in marine recreational angling
- FCAs influence catch and keep rates, although a large amount of catch and keep still occurs despite FCAs
- FCAs and catch and keep rates are important variables in angler decision models

## Further Research

- Expand analysis to broader areas
- Additional analyses (participation, target species, angler heterogeneity)
- *"Unaffected"* angler population?