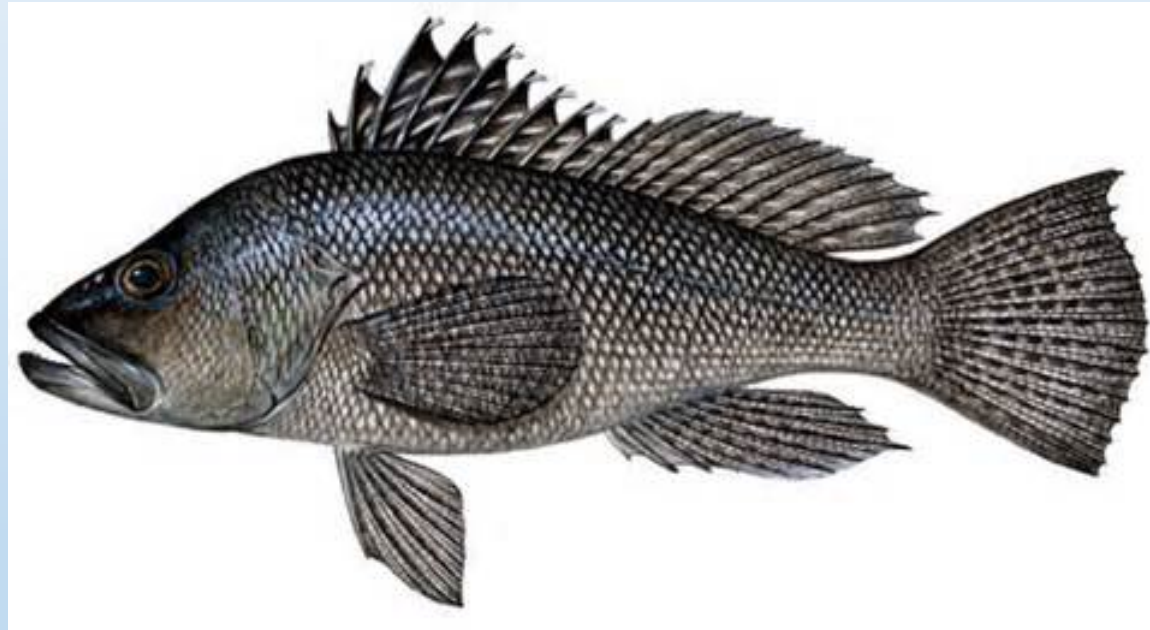


# Size selectivity by old and new trap mesh sizes in the US South Atlantic black sea bass trap fishery

P.J. Rudershausen, J.A. Buckel & J.E. Hightower  
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# Motivation

Traps: main commercial gear used to harvest BSB in US South Atlantic

Mesh size regs have not evolved with fish size regs



# Motivation

Traps: main commercial gear used to harvest BSB in US South Atlantic



Mesh size regs have not evolved with fish size regs

## Goals

Determine whether larger trap mesh would better match fish size regs

Determine whether an optimal mesh size could be predicted from fish morphometry

# English-Metric conversions for commercial bass fishery

| Description                                  | English | Metric  |
|----------------------------------------------|---------|---------|
| Previous minimum bass total length           | 10"     | 254 mm  |
| Current minimum bass total length            | 11"     | 279 mm  |
| Smallest square mesh on minimally legal trap | 1 ½"    | 37.5 mm |
| Largest square mesh on minimally legal trap  | 2"      | 50.8 mm |
| New square mesh size tested                  | 2 ¼"    | 57.2 mm |
| New square mesh size tested                  | 2 ½"    | 63.5 mm |

# Timeline of trap mesh size and black sea bass commercial size regs in US South Atlantic

1999: 10" (254 mm) TL

2006: Two inch (50.8 mm) back panel

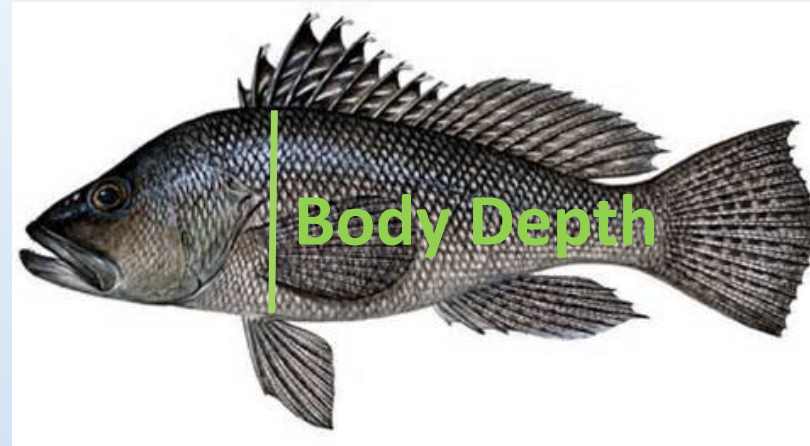
2011: 11" (279 mm) TL



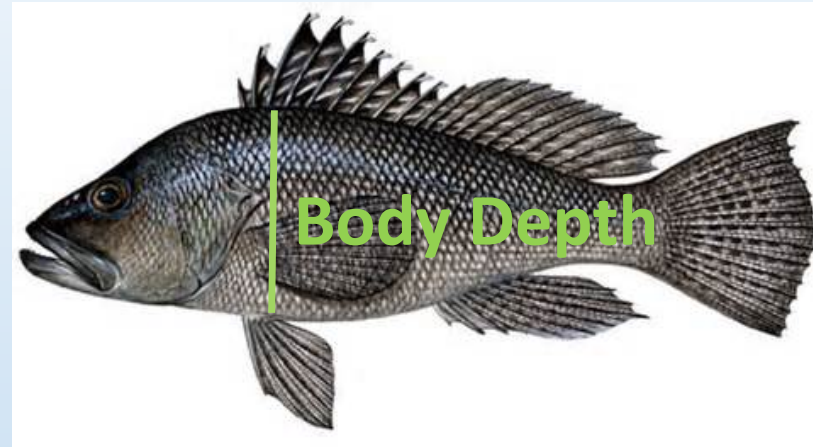
# Background: Trap construction and culling devices



Using morphometry to predict fish length at which  
50% of individuals are retained by a mesh size



Using morphometry to predict fish length at which  
50% of individuals are retained by a mesh size

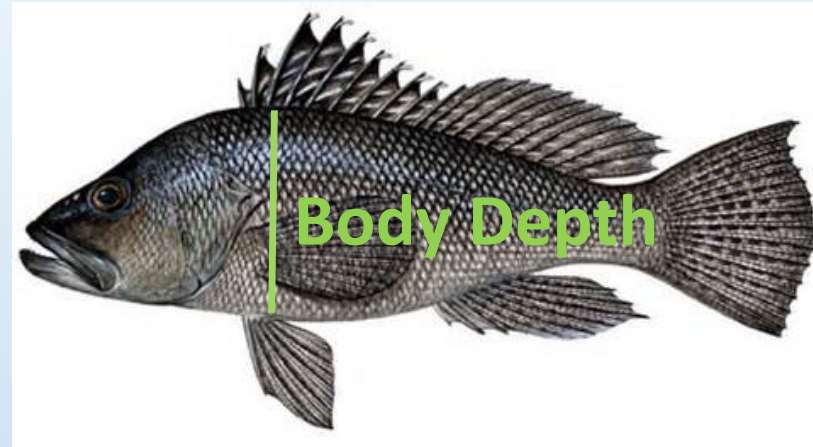


$$\text{Body Depth} = 0.942 + 0.272 * \text{Total Length}$$

Rudershausen et al. NAJFM 2008



Using morphometry to predict fish length at which  
50% of individuals are retained by a mesh size

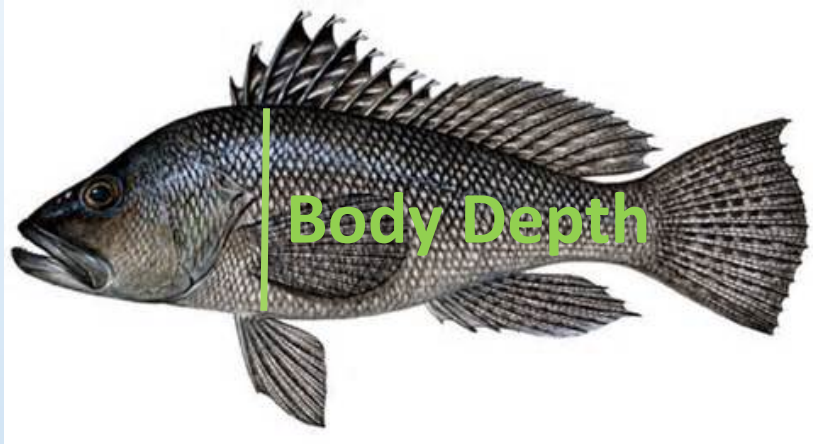


$$\text{Body Depth} = 0.942 + 0.272 * \text{Total Length}$$

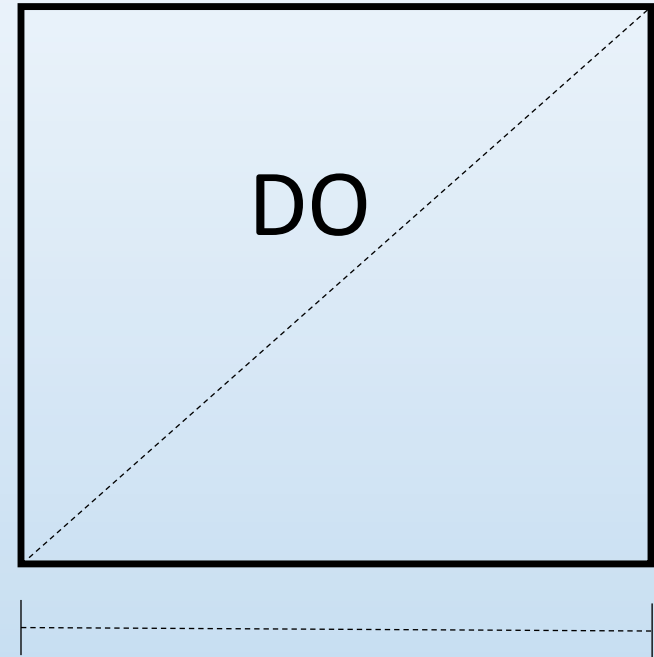
Rudershausen et al. NAJFM 2008

$$279 \text{ mm Total Length} = 76.8 \text{ mm Body Depth}$$

Using morphometry to predict fish length at which  
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**279 mm Total Length = 76.8 mm Body Depth**

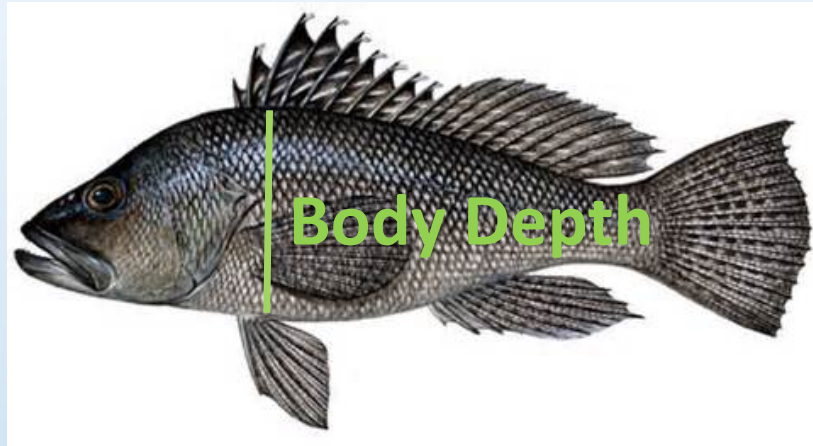


**CC**

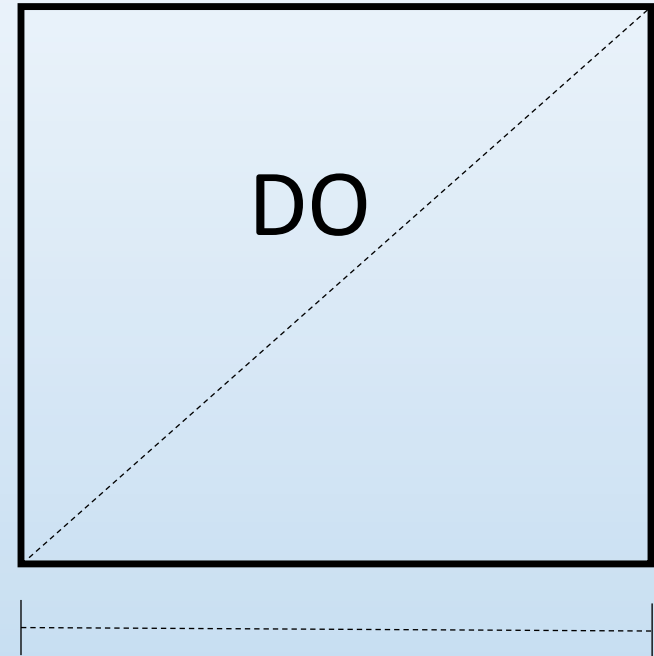
$$DO = (2(CC \times 0.925)^2)^{0.5}$$

**Actual diagonal opening  
of two inch mesh: 66.5 mm**

Using morphometry to predict fish length at which  
50% of individuals are retained by a mesh size



279 mm Total Length = 76.8 mm Body Depth



CC

$$DO = (2(CC \times 0.925)^2)^{0.5}$$

Actual diagonal opening  
of two inch mesh: 66.5 mm

# Using morphometry to predict fish length at which 50% of individuals are retained by a mesh size

| Square mesh size (mm) | Actual diagonal opening (mm) | Predicted 50 <sup>th</sup> percentile retention: total length (mm) |
|-----------------------|------------------------------|--------------------------------------------------------------------|
| 50.8 (2 inch)         | 66.5                         | 240.8                                                              |
| 57.2 (2.25 inch)      | 74.8                         | 271.6                                                              |
| 63.5 (2.5 inch)       | 83.1                         | 301.9                                                              |



10" (254 mm) TL

11" (279 mm) TL

## **Trap types and field sampling**

Five square mesh trap types:

- Uniform 37.5 mm mesh (control)

- Uniform 37.5 mm mesh w/ 50.8 mm mesh backpanel (min. legal mesh size)

- Uniform 50.8 mm mesh

- Uniform 57.3 mm mesh

- Uniform 63.5 mm mesh

Fished offshore NC in 2013

Fished all trap types simultaneously in the same area



# Analysis

Fit a negative binomial catch model.

Control trap type: catch per trap represents fish sizes available to- and retained by traps, retention probability is 1 for length bins in control trap.

Modeled retention probability of experimental traps as a logistic selection curve (Millar and Fryer 1999)

$$r(l) = \exp(a+bl) / 1 + \exp(a+bl)$$

Calculated  $l_{50}$  (50<sup>th</sup> percentile size of retention, a.k.a. size where 50% of bass are retained):  $-a / b$

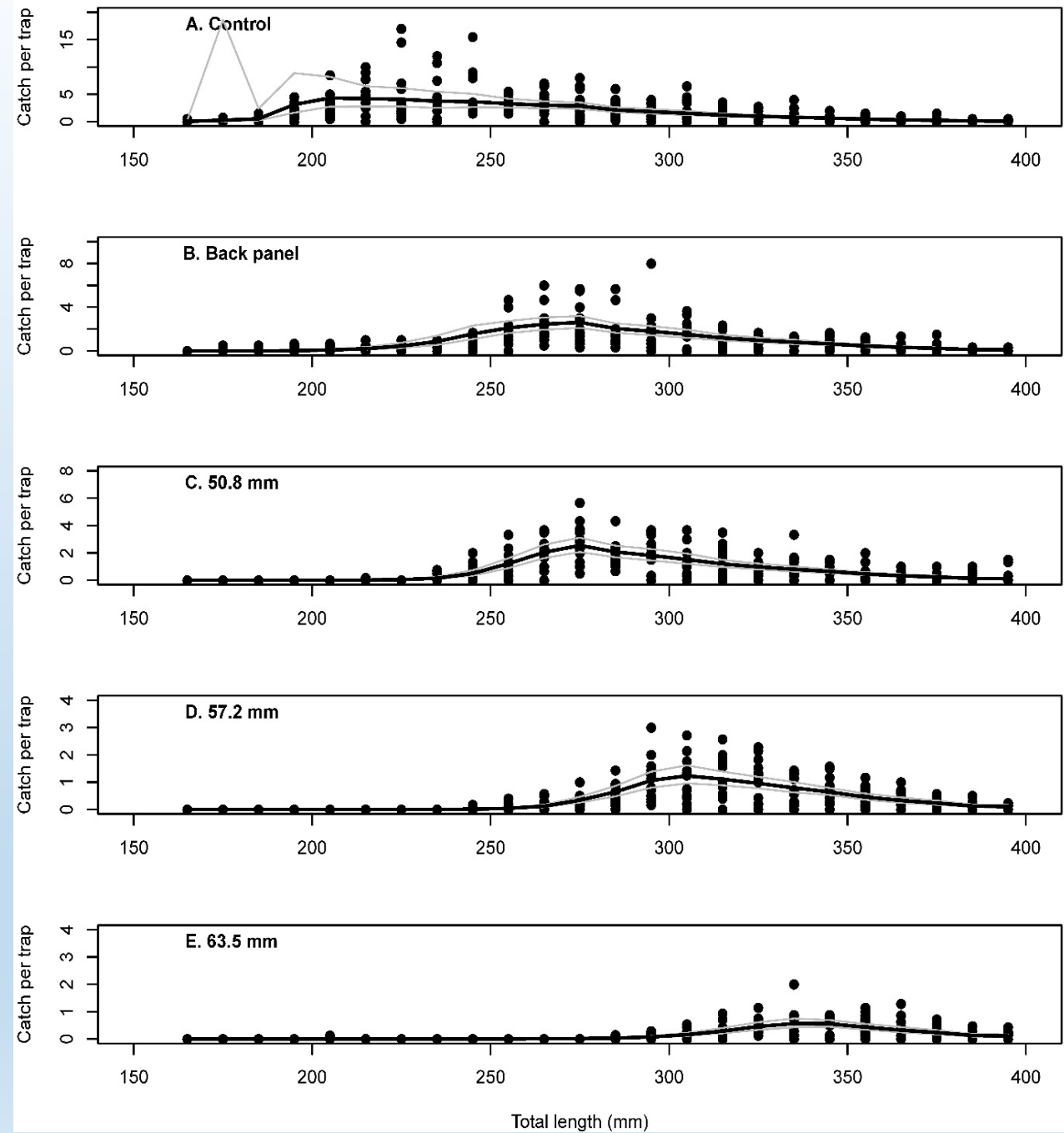
Calculated  $l_{10}$  (10<sup>th</sup> percentile size of retention, a.k.a. size at initial retention):  $(\text{logit}(0.1) - a) / b$

Compared mean estimated mass of legal bass among trap types.

Compared mean number of sub-legal bass among trap types.

# Results

## Modeling catch rates

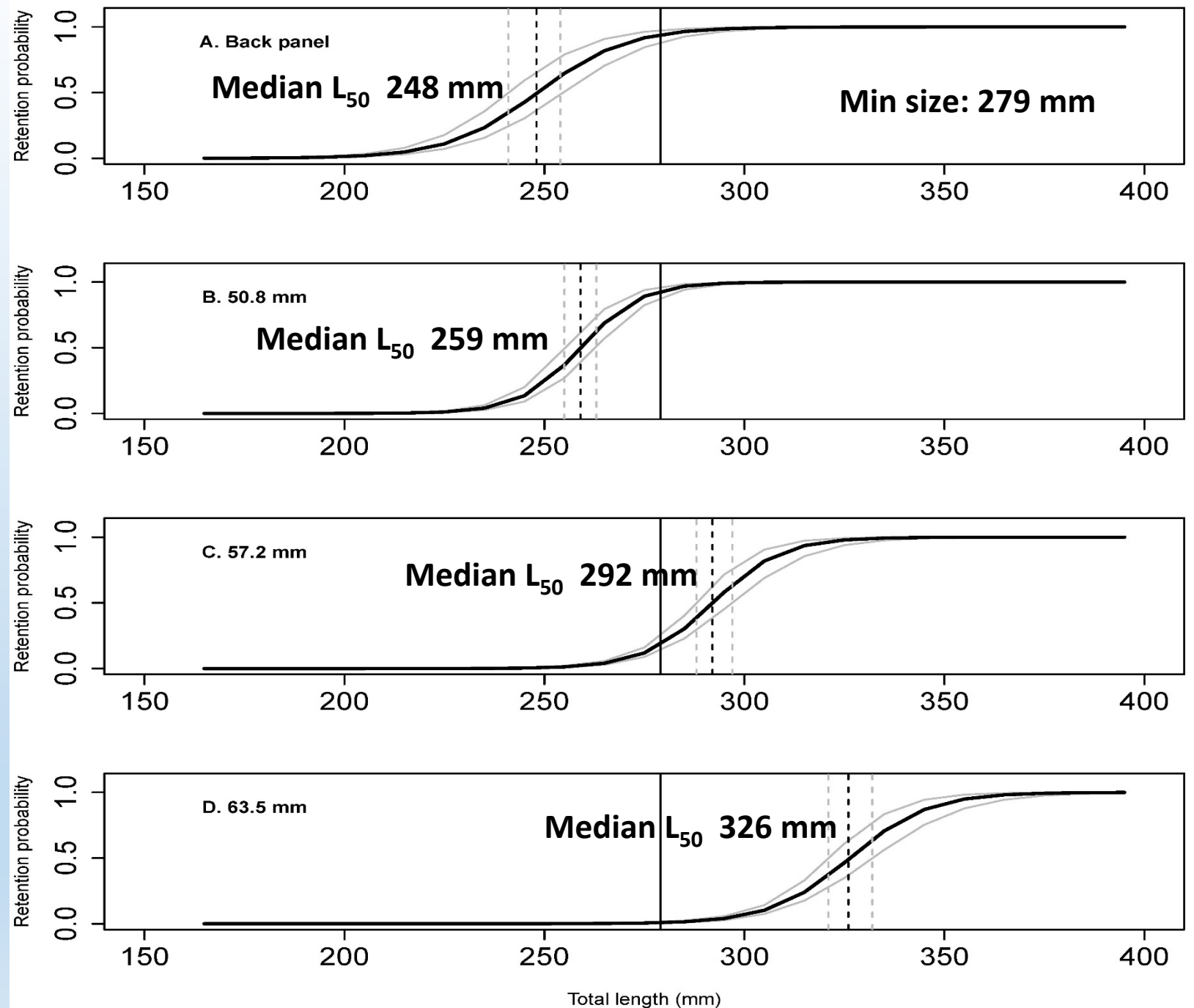


## Results

Retention probability  
of each experimental  
trap type:

2 parameter  
logistic model

$$r(l) = \exp(a+bl) / 1 + \exp(a+bl)$$

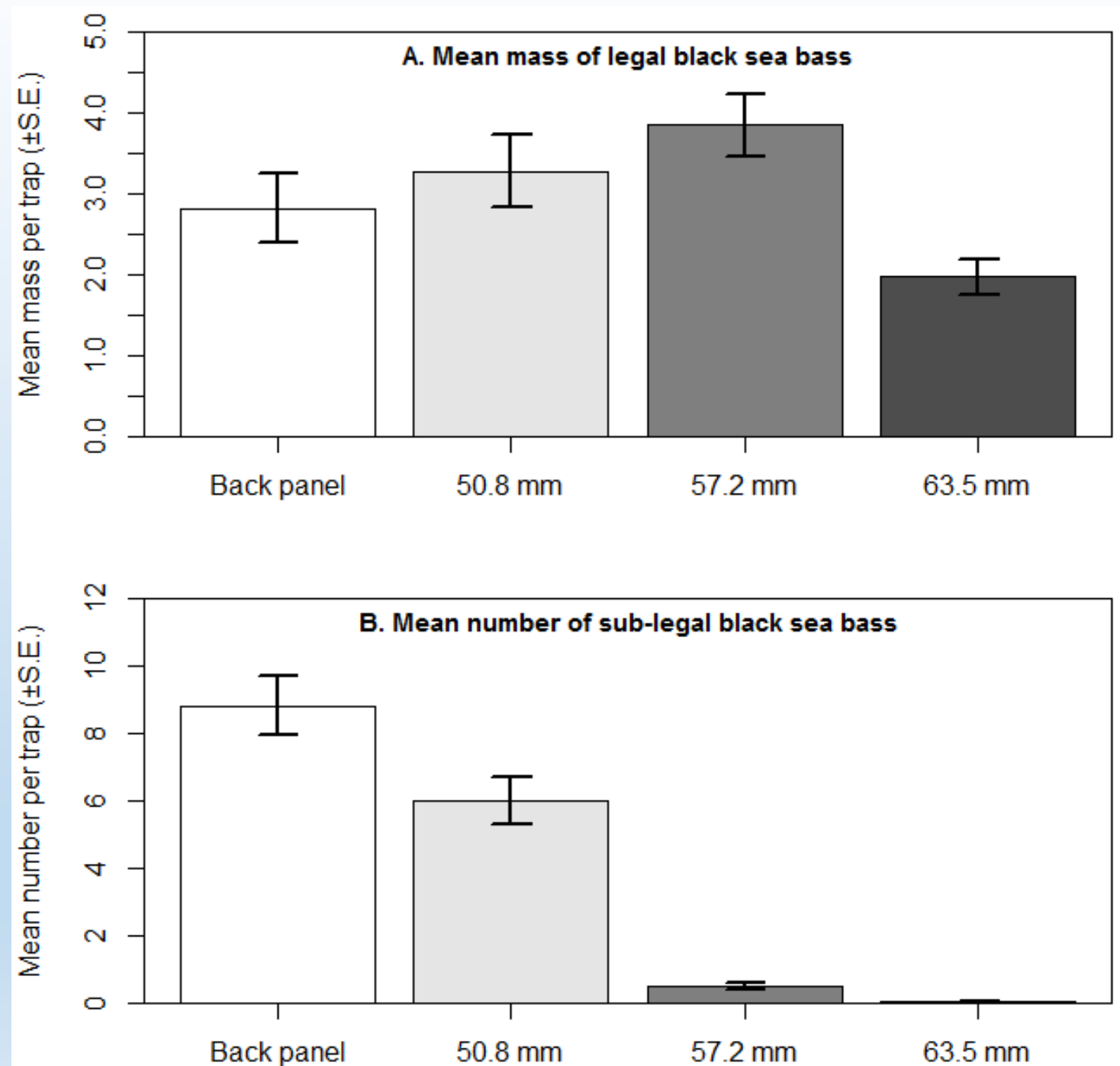


## Results

### Comparing catch rates

Mass legal bass: Non-significant

Numbers sub-legal bass: Significant

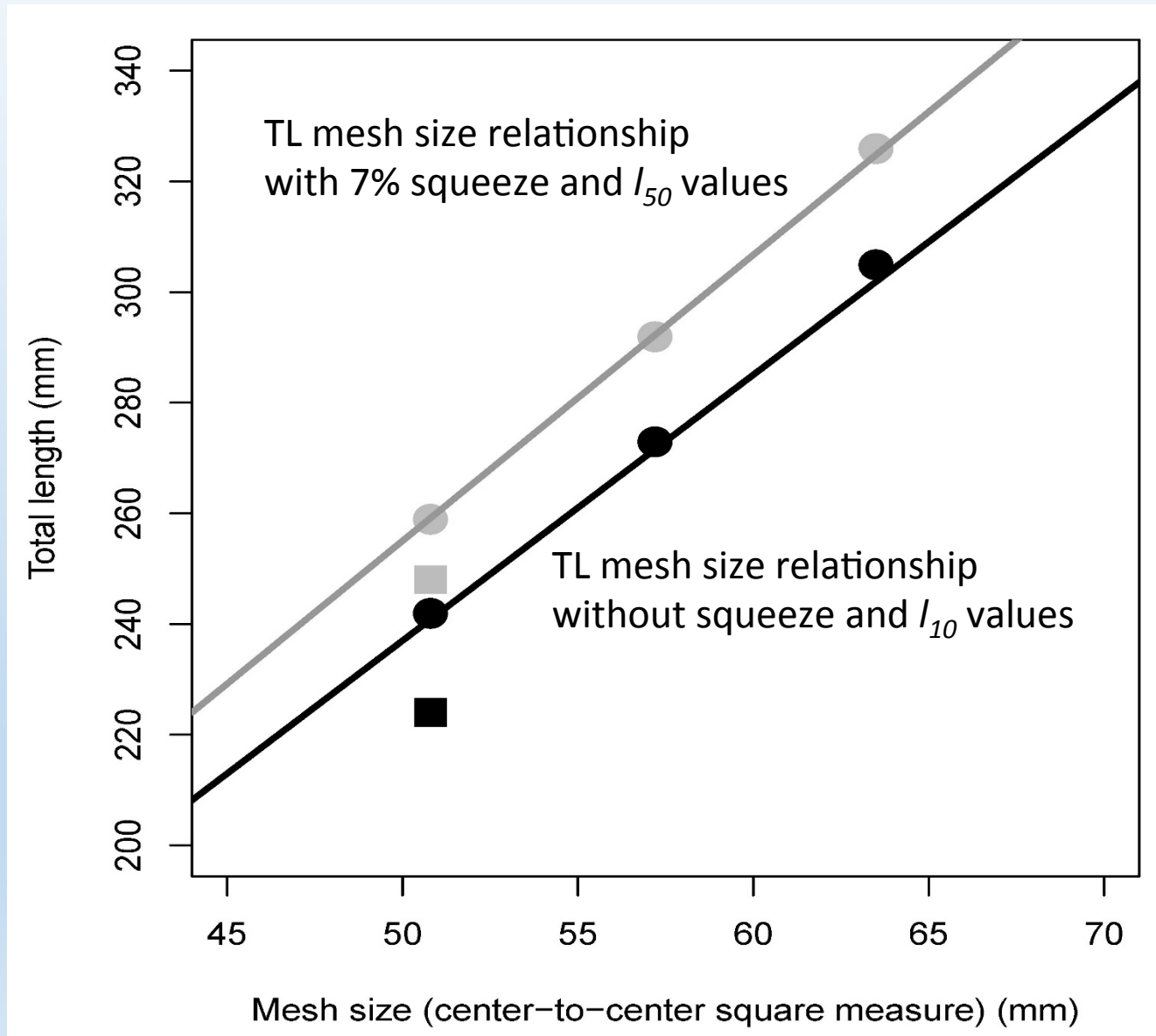


Results

Percentage of legal and sub-legal black sea bass in each experimental trap type

| Fish category | Backpanel | 50.8 mm | 57.2 mm | 63.5 mm |
|---------------|-----------|---------|---------|---------|
| Legal         | 51.9      | 65.5    | 94.5    | 99.8    |
| Sub-legal     | 48.1      | 34.5    | 5.5     | 0.2     |

Discussion: Was an  $l_{50}$  successfully predicted for experimental traps?  
Can fish morphometry predict optimal mesh sizes?





Discussion: Estimated annual reduction of sub-legal catch if  
switch from backpanel to 57.2 mm traps:  
US South Atlantic

| Backpanel   |                 | 57.2 mm    |                 | Annual percent<br>reduction of sub-legal<br>discards | References for discard/<br>discard mort              |
|-------------|-----------------|------------|-----------------|------------------------------------------------------|------------------------------------------------------|
| # Discarded | #Discarded dead | #Discarded | #Discarded dead |                                                      |                                                      |
| 208,000     | 35,400          | 11,000     | 1,900           | 95%                                                  | Rudershausen et al. CJFAS<br>2014, SAFMC effort data |

Discussion:  
Availability  
of new mesh



C. E. Shepherd Company, L. P.  
2221 Canada Dry St.  
Houston, Texas 77023  
713-924-4300  
713-928-2324 Fax

Please confirm your order by fax, mail, or email.  
Thank you,

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| 01               | 01 | 100.00               | 1/26/2016 | C125M0225125B        | 2.25X2.25X22.5X100 ' 12.5GA<br>CTD BLACK<br>THE ESTIMATED LEAD TIME IS<br>3.5 WEEKS A.R.O.<br>*****<br>PRICING BASED ON 100 ROLLS<br>***** | EA 113.30    | 11330.00       |
| 02               | 01 | 1.00                 | 1/26/2016 | S & H                | SHIPPING & HANDLING<br>PARTIAL DRY VAN<br>*****                                                                                            | EA 1100.00   | 1100.00        |

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# Conclusions

Uniform 57.2 mm mesh traps balances wire availability and optimal selectivity for the 279 mm TL limit.

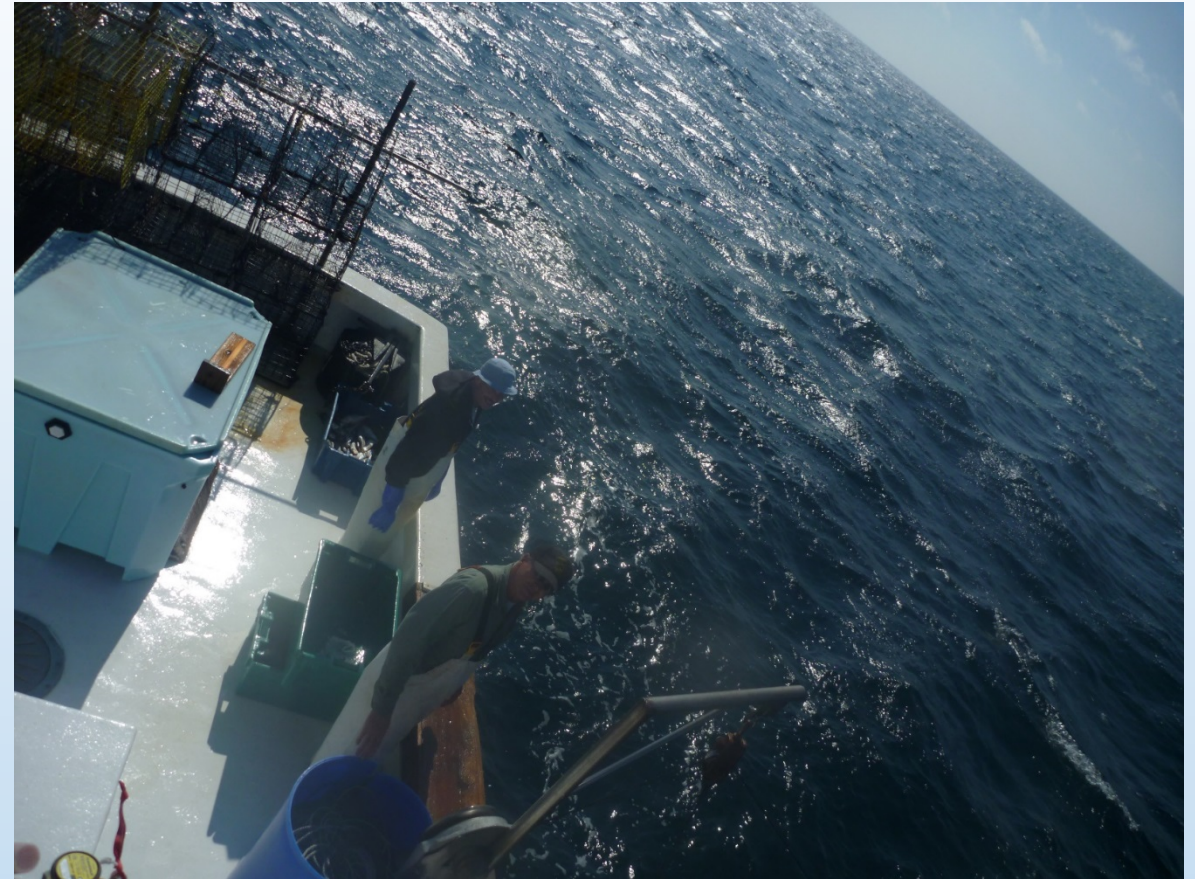
Mixed mesh traps (e.g. backpanel) do not optimize selection for any one fish size.

This study does *not* need to be repeated if fish size regs change.

Future predictions of optimal mesh size should be based on black sea bass squeezing.

## Acknowledgments

Tom Burgess (Sneads Ferry NC) (cooperator)  
North Carolina Sea Grant FRG Program (funding)  
CE Shepherd Co., Houston TX (wire)  
Chip Collier, SAFMC (effort data)



*Bass trap testing, F/V Barbara Lynne, Onslow Bay, NC*