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

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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

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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

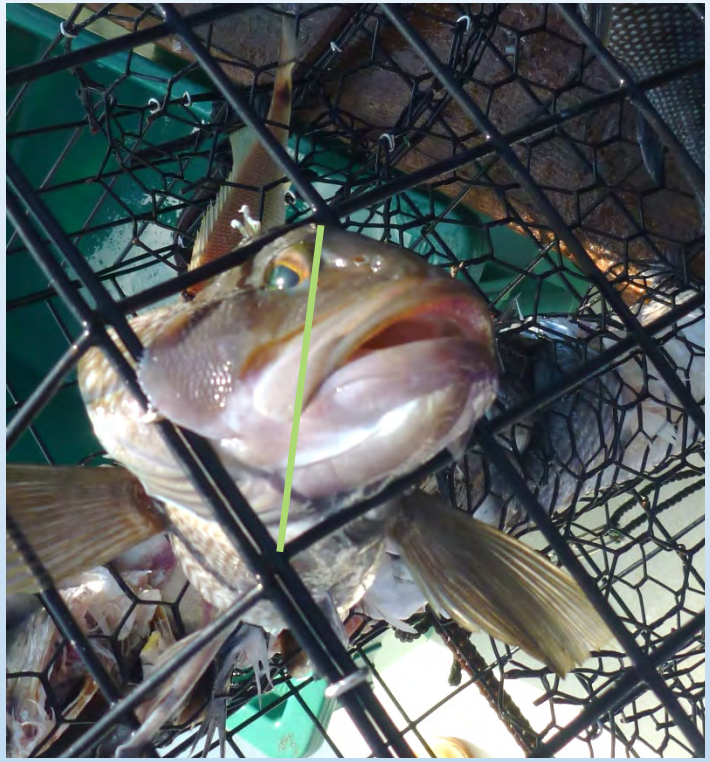
1999: 10” (254 mm) TL

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

Body Depth = 0.942 + 0.272*Total Length

Rudershausen et al. NAJFM 2008

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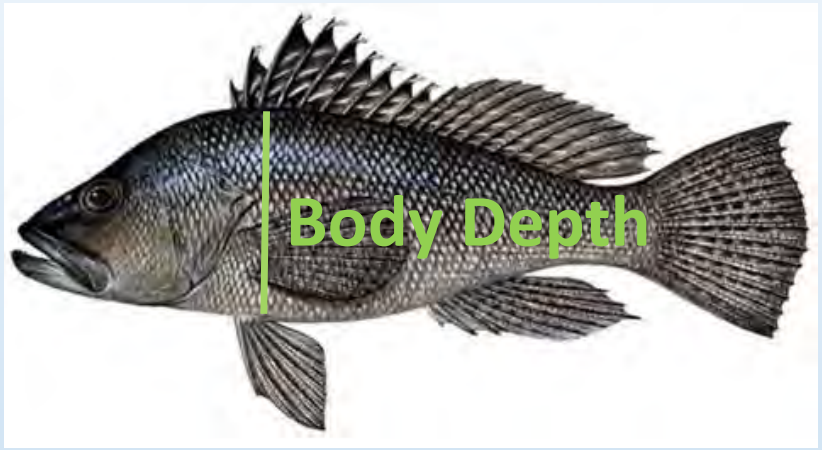

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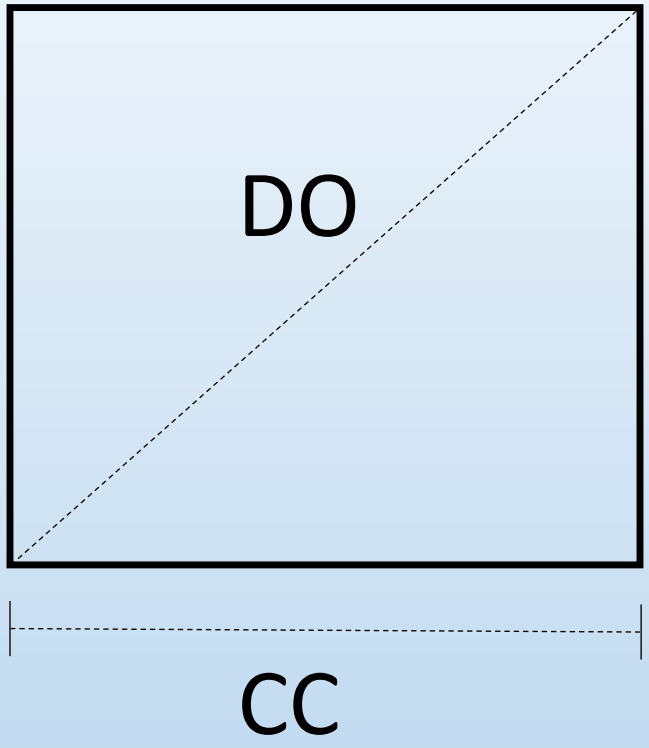

$DO = (2(CC \times 0.925)^2)^{0.5}$

Actual diagonal opening of two inch mesh: 66.5 mm

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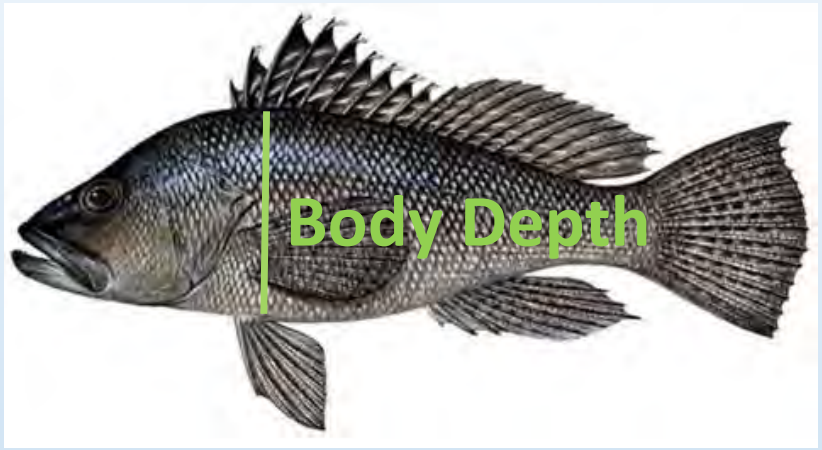

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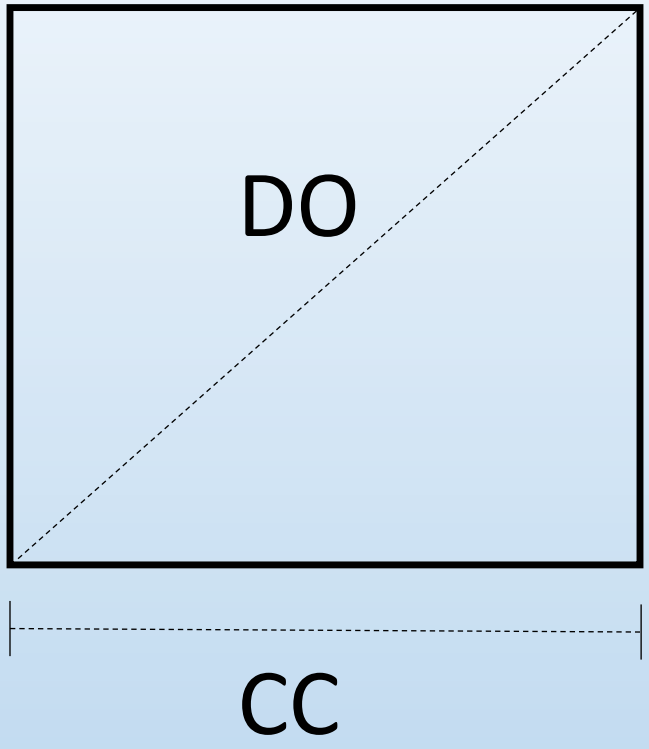

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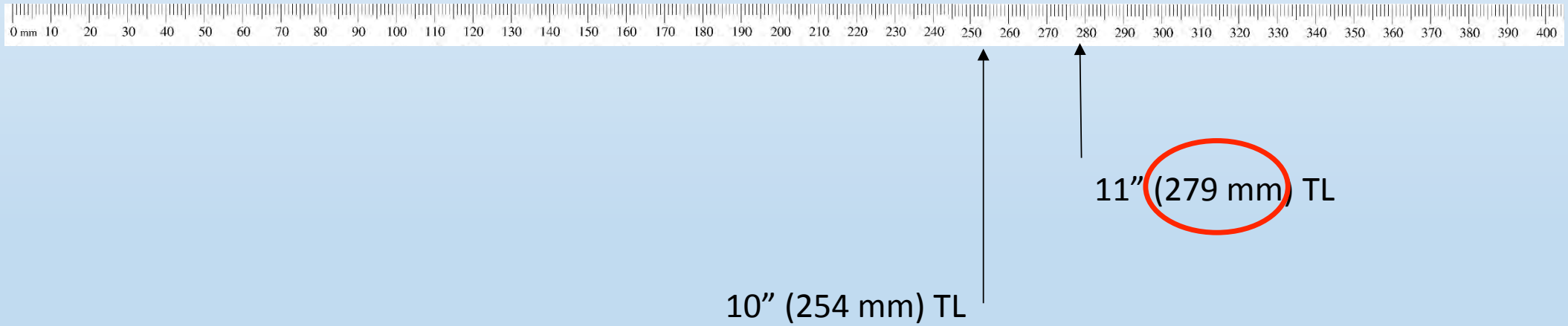
Using morphometry to predict fish length at which 50% of individuals are retained by a mesh size

Square mesh size (mm)	Actual diagonal opening (mm)	Predicted 50th 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



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)

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

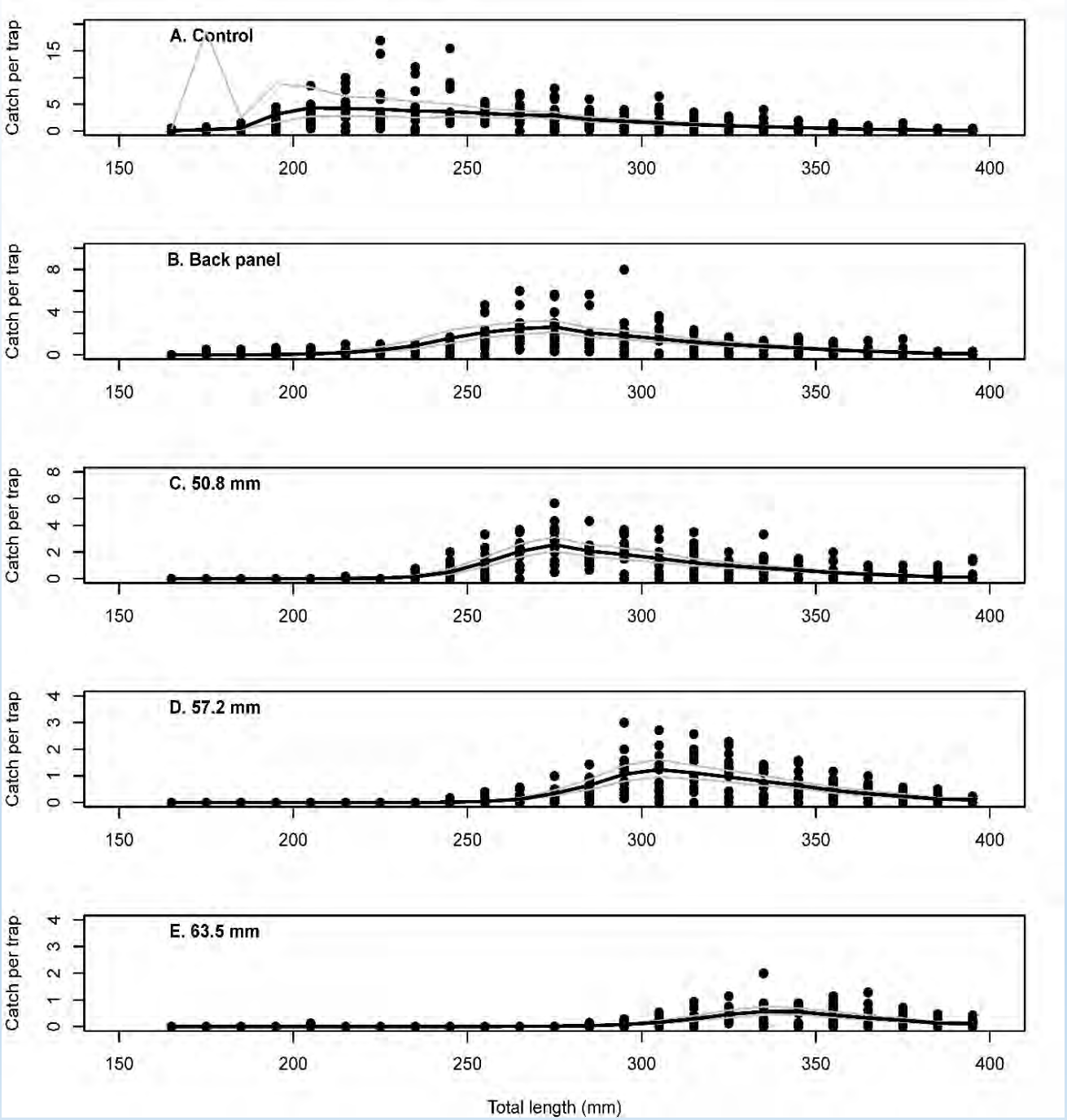
Calculated l_{50} (50^{th} percentile size of retention, a.k.a. size where 50% of bass are retained): $-a/\ b$

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

Compared mean estimated mass of legal bass among trap types.

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

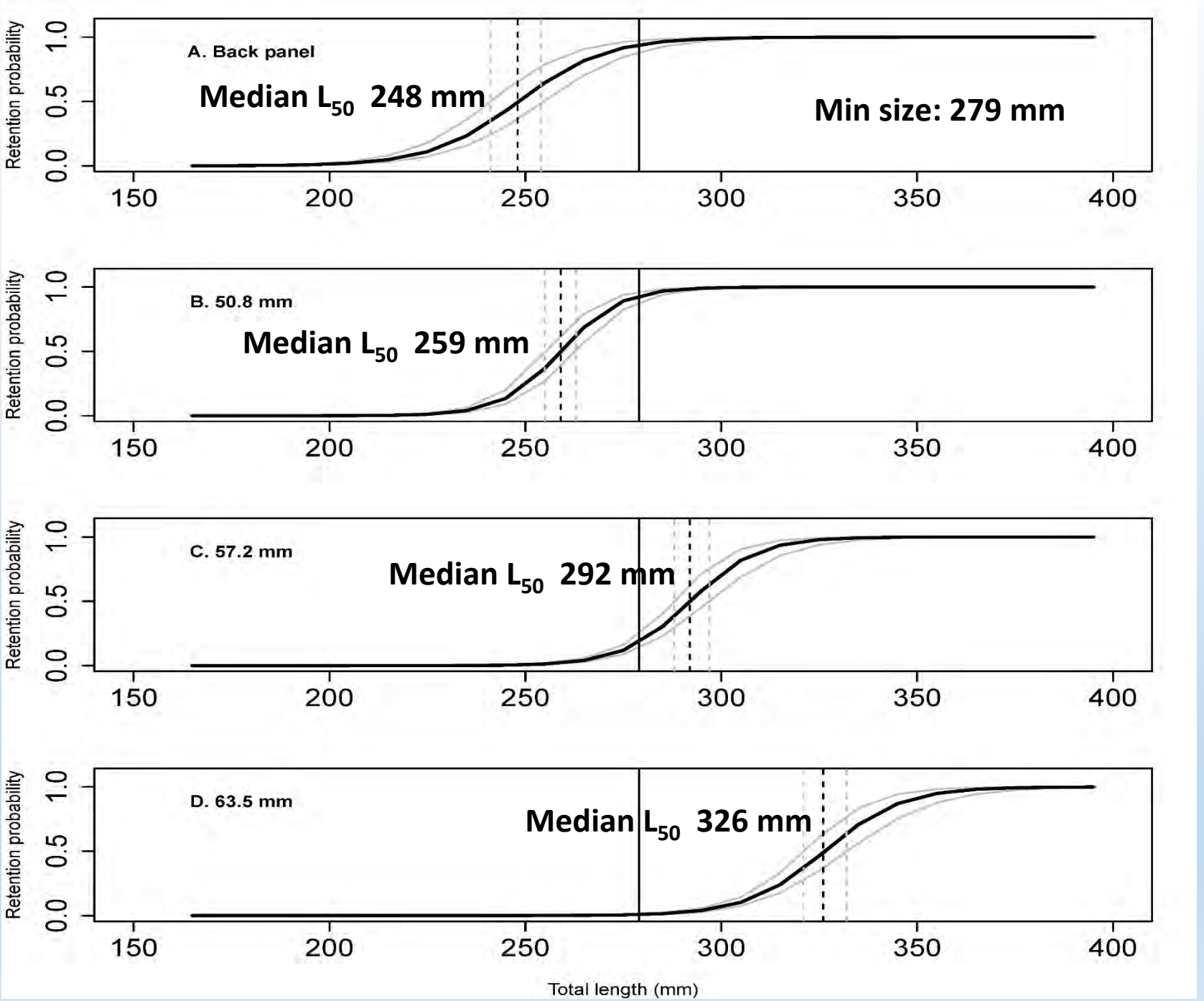
Results
Modeling catch rates



Results

Retention probability of each experimental trap type:
2 parameter logistic model

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

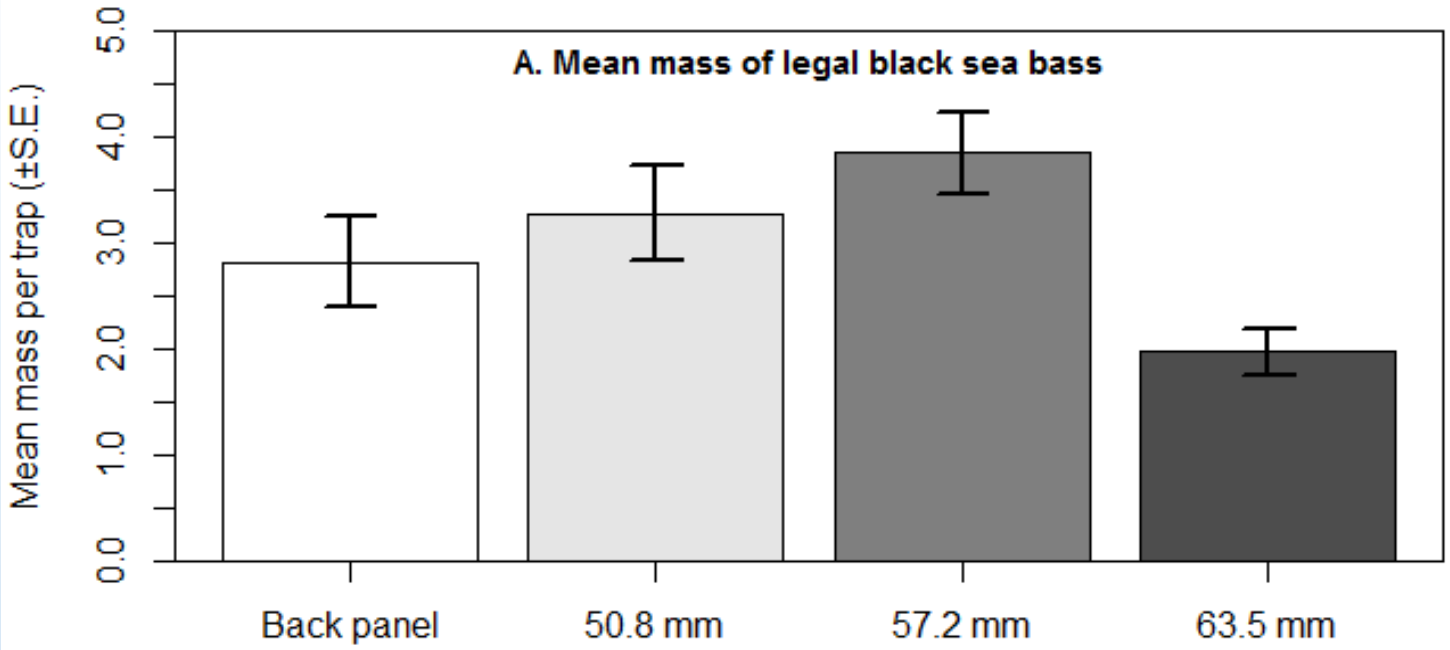


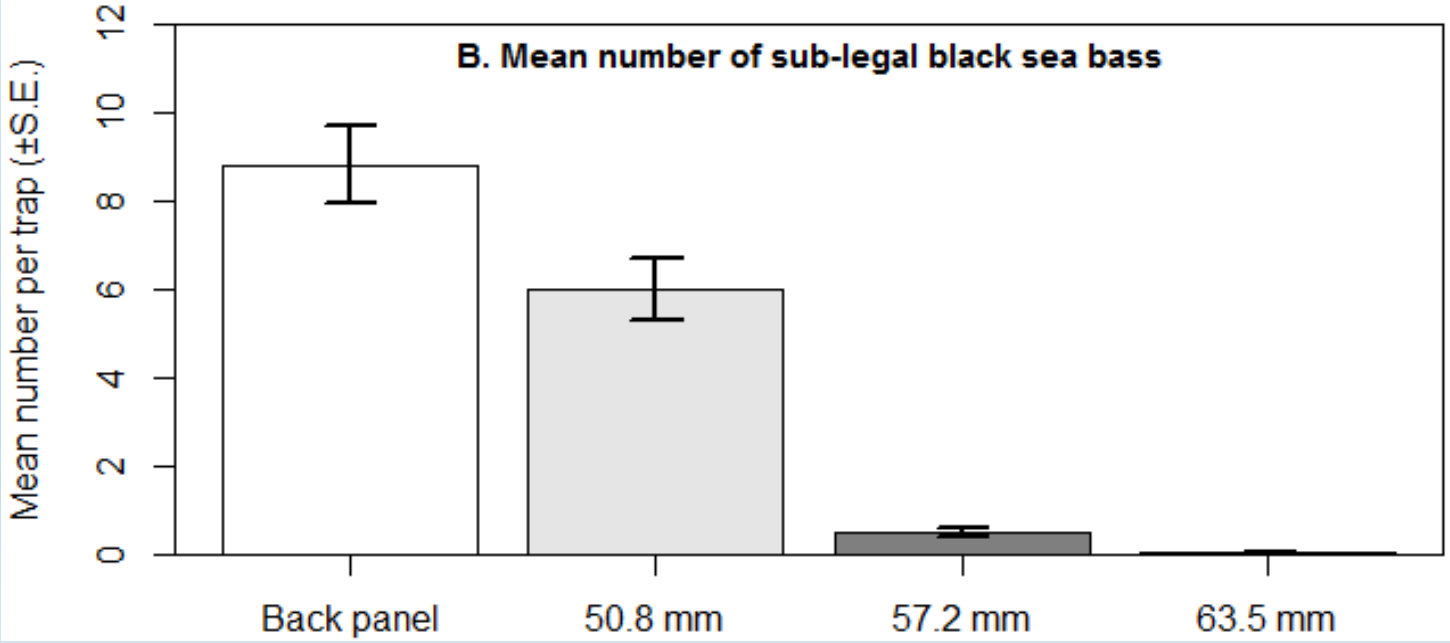
Results

Comparing catch rates

Mass legal bass: Non-significant

Numbers sub-legal bass: Significant



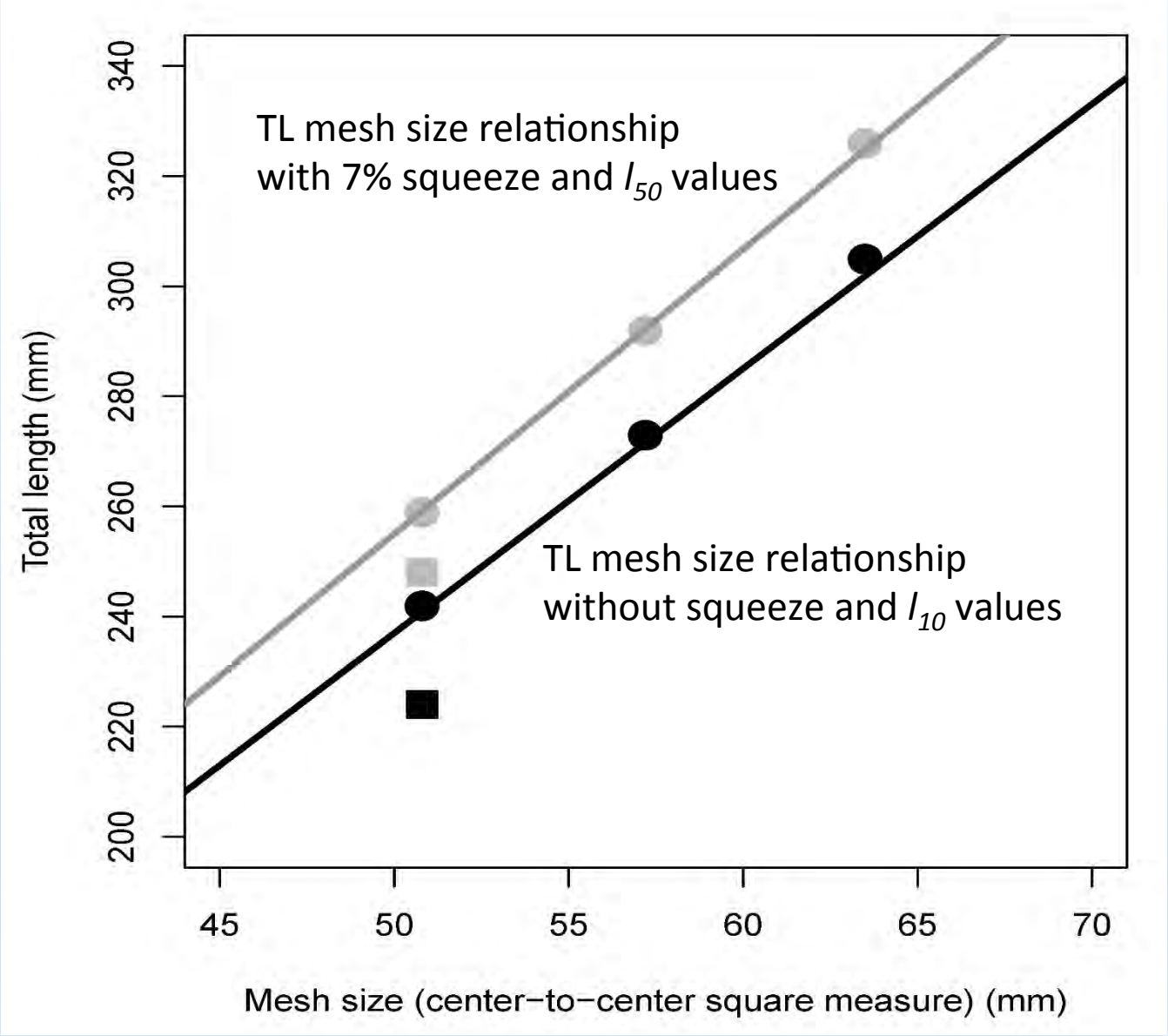


Results

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 reduction of sub-legal discards	References for discard/ discard mort
# Discarded	#Discarded dead	#Discarded	#Discarded dead		
208,000	35,400	11,000	1,900	95%	Rudershausen et al. CJFAS 2014, SAFMC effort data

Discussion: Availability of new mesh

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Conclusions

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

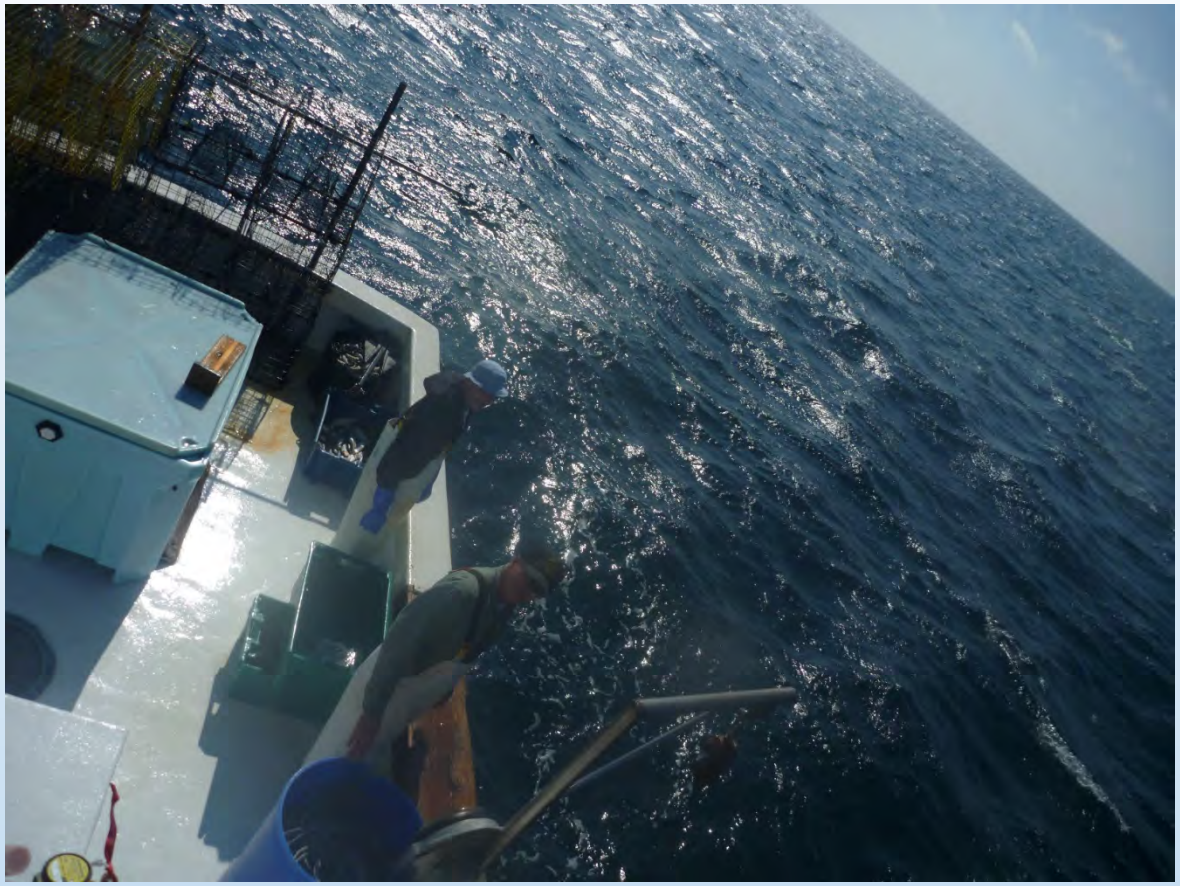
Mixed mesh traps (e.g. backpanel) do not optimize selection for any one fish size.

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