Fisheries Bycatch Research in North Carolina

By

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November 2004

Outline:

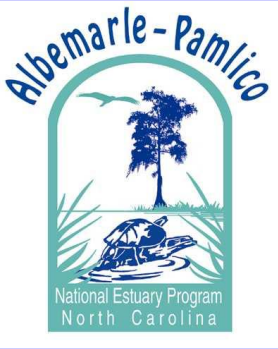
- APES Fishery Plan
  - Need for Bycatch Research
  - Management Tools Available
    - Example of Area Closure (PSGNRA)
- Gear Development Research (list)
    - Multiple Examples (Shrimp Trawl, Crab Trawl Fisheries)
    - Various modification designs, results (diagrams, tables)
  - Alternate Gears
  - Gear Development Research (overview)
- Accomplishments
- Research Needs
- Conclusion

Comprehensive Conservation and Management Plan

Fisheries Plan Goal:

Restore or maintain fisheries and provide for their long-term sustainable use, both commercial and recreational

Objective B: Promote the use of best fishing practices that reduce bycatch and impacts on fisheries habitats



Gear Development and Bycatch Reduction

Why?

Industry Growth – Overfishing Potential

Technology Improvements

Fishery Management Plan Compliance

Magnuson-Stevens Act, MMPA, ESA

Public Perception

Industry Ideas/Willingness for Participation

Bycatch Research –

Problem: Bycatch Represents Unknown Quantity/Quality

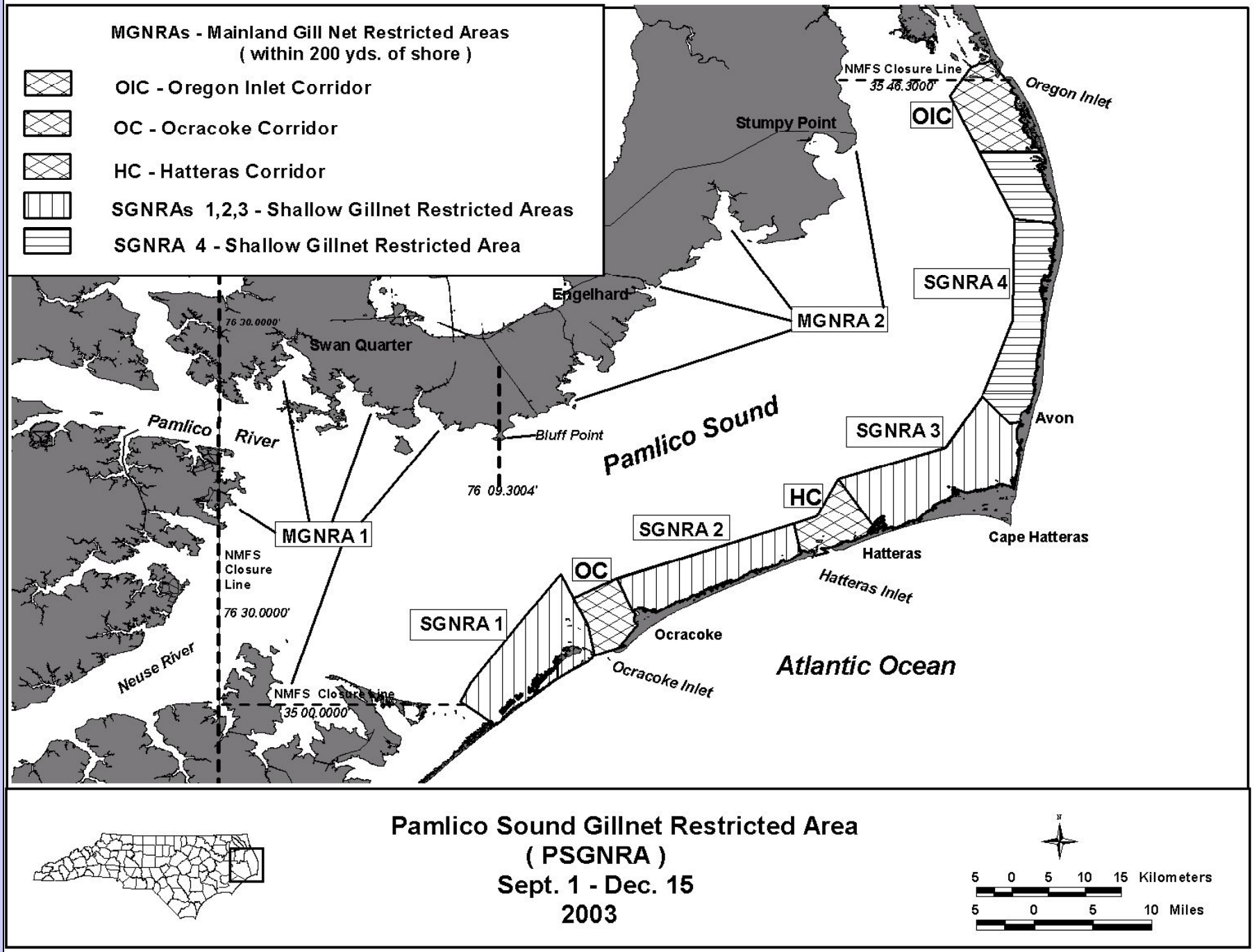
Management Tools

- Fishery Dependent Studies (i.e., observations)
- Fishery-Independent Studies
- Size Limits, Quota Monitoring
- Gear Restrictions
- Gear Modification Requirements (TED,s, BRDs)
- Time, Area, Seasonal Closures (i.e., PSGNRA)

Example: Seasonal Area Closure

Pamlico Sound Gillnet Restricted Area (PSGNRA) – Figure 1

- Federal, Seasonal Area Closure from September 1 – December 15
- Established by NMFS in 1999 To Protect Sea Turtles
- Goal: To Reduce Strandings By At Least 50%
- Section 10 (ESA) Permit
    - allows limited fishery with many stipulations
        - mandatory observer coverage (10% goal)
        - weekly reporting by fishermen
        - weekly reporting by NCDMF
        - mandatory closure if threshold (interactions) reached
        - sea turtle sampling, tagging, reporting


MGNRAs - Mainland Gill Net Restricted Areas
(within 200 yds. of shore)
OIC - Oregon Inlet Corridor
OC - Ocracoke Corridor
HC - Hatteras Corridor
SGNRAs 1,2,3 - Shallow Gillnet Restricted Areas
SGNRA 4 - Shallow Gillnet Restricted Area
NMFS Closure Line
35 46.3000'
Oregon Inlet
OIC
Stumpy Point
SGNRA 4
Engelhard
MGNRA 2
76 30.0000'
Swan Quarter
Pamlico River
Bluff Point
Pamlico Sound
SGNRA 3
Avon
76 09.3004'
HC
SGNRA 2
MGNRA 1
Cape Hatteras
Hatteras
NMFS Closure Line
76 30.0000'
OC
Hatteras Inlet
SGNRA 1
Ocracoke
Neuse River
Atlantic Ocean
Ocracoke Inlet
NMFS Closure Line
35 00.0000'
Pamlico Sound Gillnet Restricted Area
(PSGNRA)
Sept. 1 - Dec. 15
2003
5 0 5 10 15 Kilometers
5 0 5 10 Miles

Gear Development Research (list)

- Trawl Fisheries (i.e., shrimp trawls)
- Long Haul Seine Fisheries
- Pound Net Fisheries
- Pot Fisheries
- Gillnet Fisheries *

  - past/current in response to protected species interactions

Trawl Fisheries

- Bycatch Reduction Device (BRD), Turtle Excluder Device (TED), Flounder Fish Excluder (FFE) Testing in Shrimp Fishery
  - Examples

- TED Testing in Flounder Trawl Fishery

- Tailbag Mesh Size Testing in Crab (APES) and Flounder Trawl and Flynet Fisheries

Example: Shrimp Trawl Bycatch Research

Gear Modifications

+	**Reduce bycatch.**
+	**Possibly increase numbers of bycatch species by delaying age at entry into the fishery.**
-	**Potential economic burden on fishermen (loss of shrimp and incidental catch).**

Options

1. Tailbag Mesh Size
2. Bycatch Reduction Devices
3. Alternate Gears

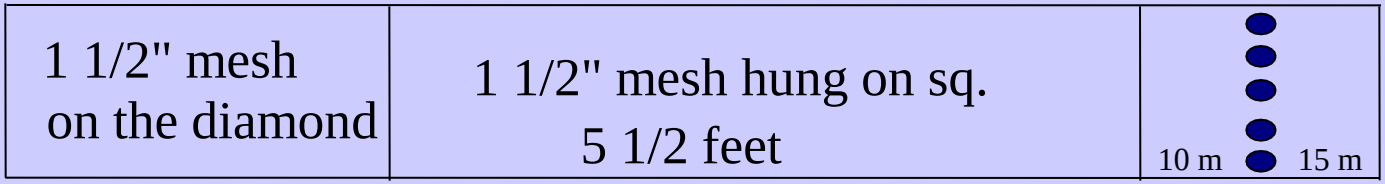
Results of 1 ½” vs. 1 5/8” stretched mesh diamond tailbags tested in Pamlico Sound, July 1991.

	Total weight (lbs)		
n=5	Control	Experimental	Percent difference
Spot	148.46	166.63	12.24
Atlantic croaker	81.65	79.51	-2.62
Summer flounder	6.24	6.48	3.89
Southern flounder	2.56	1.28	-50
Weakfish	5.51	8.45	53.2
Market fish	18.19	20.73	13.94
Miscellaneous fish	23.75	32.88	38.44
Total fish	286.36	315.93	10.33
Crabs	143.33	164.27	14.62
Brown shrimp	11.36	11.03	-2.91
Pink shrimp	5.16	6.02	16.67
Total shrimp	16.52	17.04	3.2
Total	446.20	497.25	11.44

Results of 1 1/2” vs. 2” stretched mesh diamond tailbags tested in Pamlico Sound, July 1991

	Total weight (lbs)		
n=5	Control	Experimental	Percent difference
Spot	156.78	84.85	-45.88
Atlantic croaker	46.55	36.23	-22.17
Summer flounder	8.80	6.64	-24.56
Southern flounder	0.24	0.77	218.18
Weakfish	0.68	0.20	-70.97
Market fish	7.19	7.74	7.67
Miscellaneous fish	33.76	22.60	-33.05
Total fish	254.02	159.00	-37.4
Crabs	147.74	168.68	14.18
Brown shrimp	2.56	3.13	22.41
Pink shrimp	1.21	0.90	-25.45
Total shrimp	3.77	4.04	7.02
Total	405.52	331.72	-18.2

1 1/2" & 1 15/16" sq. mesh tailbags tested in 2000



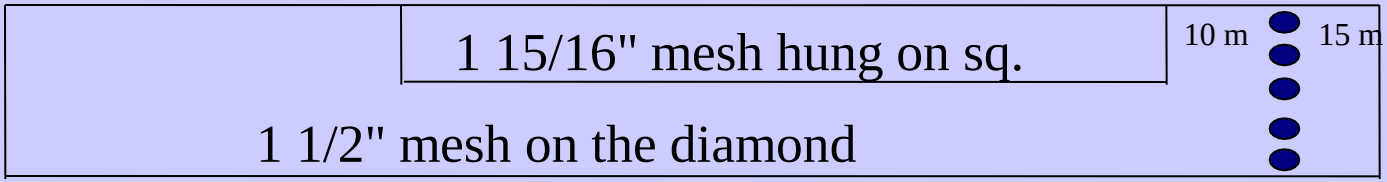
150 mesh tailbag

#1

1 1/2" mesh
on the diamond

#4

Top half of bag and 5 1/2 feet long



Reduction rates for square mesh tailbags tested in 2000.

	1 1/2" full	1 15/16" full	1 15/16" top
Atlantic croaker	3.67		
Spot	-8.33		
Weakfish	**-51.04**	**-89.35**	**-87.38**
Shrimp	**-2.82**	**-18.93**	**-2.12**
Total finfish	-1.15	-70.85	-55.74
Southern flounder	-47.28		

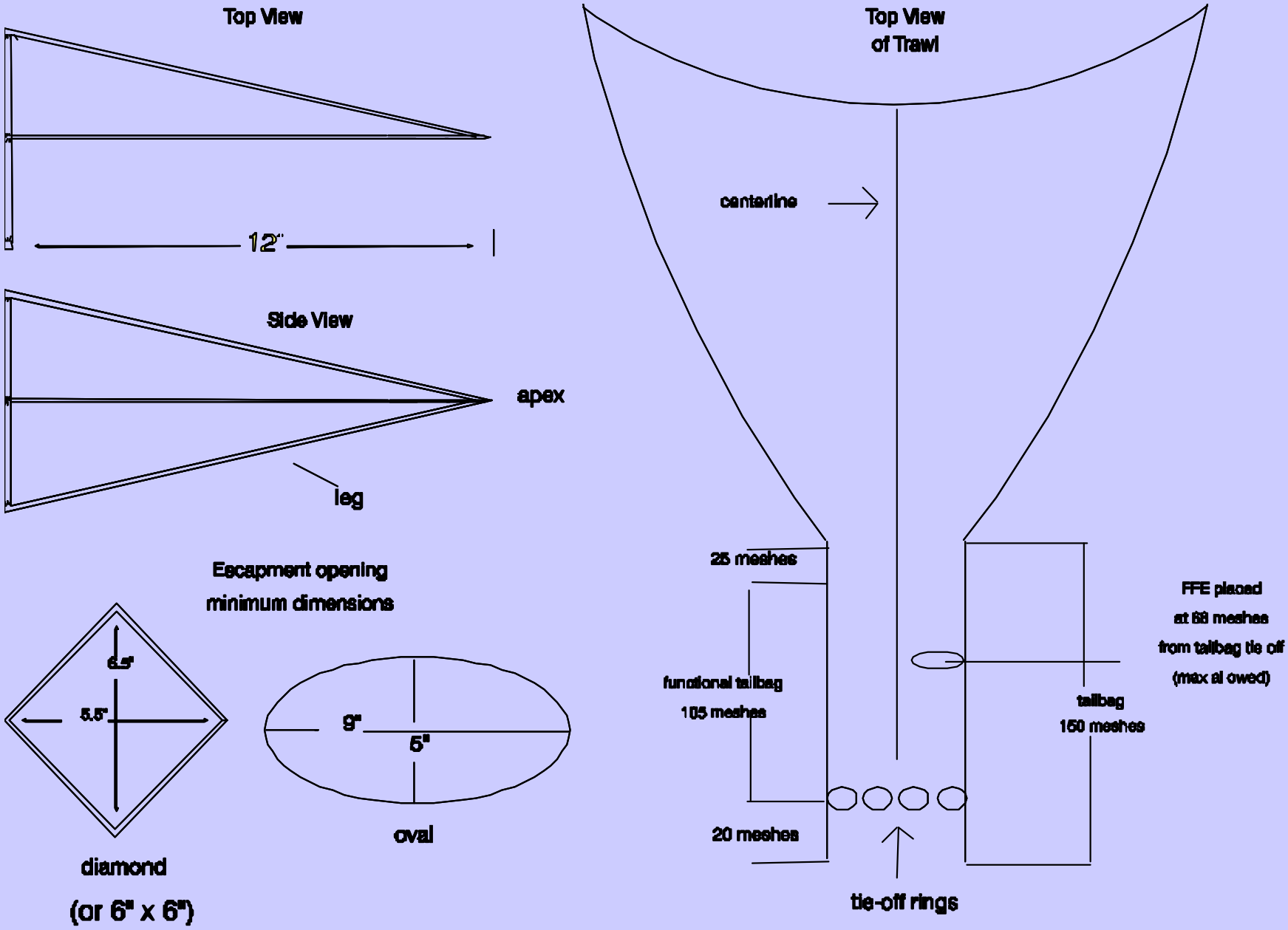


Diagram of Florida Fish Excluder (FFE).

Reduction rates (KG) for selected species and groups for various sizes of FFE's.

	9" X 9"	5 ½ X 6 ½"	6 ½ X 3 ½ "
n	97	38	48
Atlantic croaker	-61.1*	-40.8	-25.6*
Spot	-55.2*	-49.0	23.2*
Weakfish	**-64.8***	**-71.3**	**37.41**
Spanish mackerel	-42.7	N/C	-38.3
Southern flounder	-54.5*	25.79**	-18.1
Shrimp	**-8.5***	**-6.0**	**-5.8**
Total finfish	-47.2*	-32.61*	-19.0
Total catch	-36.2*	-21.43*	-1.2

*Significant difference at the p<=0.05 level or less.
**=control 2.56 kg; test 3.22
N/C=No catch

Reduction rates (KG) for selected species and groups for various FFE/BRD ratios (FFE's GE 5 ½ X 6 ½ ").

	0.4 – 0.5	0.5 – 0.6	0.6 – 0.65
n	64	31	34
Atlantic croaker	-59.5*	-67.9*	-34.8
Spot	-61.4*	-57.8*	-25.5*
Weakfish	**-73.9***	**-56.5**	**-49.7**
Spanish mackerel	-73.0	87.3	-4.8
Southern flounder	-62.1*	7.85	N/C
Shrimp	**-8.1***	**-11.6***	**-4.9***
Total finfish	-47.9*	-55.5*	-22.0*
Total catch	-36.6*	-38.9*	-15.5*

*Significant difference at the p<=0.05 level or less.
N/C=No catch

Reduction rates (KG) for selected species and groups for various FFE placements (FFE's GE 5 ½ X 6 ½ ").

	15 meshes	30 meshes	Bottom
n	118	17	10
Atlantic croaker	-54.9*	-84.2*	-25.5
Spot	-49.3*	-66.2*	-52.0
Weakfish	**-67.1***	**-39.6**	**-57.4**
Spanish mackerel	-35.5	N/C	N/C
Southern flounder	-55.1*	121.8	-26.6
Shrimp	**-7.9***	**-6.3**	**-11.1**
Total finfish	-39.5*	-56.9*	-40.3
Total catch	-29.1*	-36.6*	-12.3

*Significant difference at the p<=0.05 level or less.
N/C=No catch

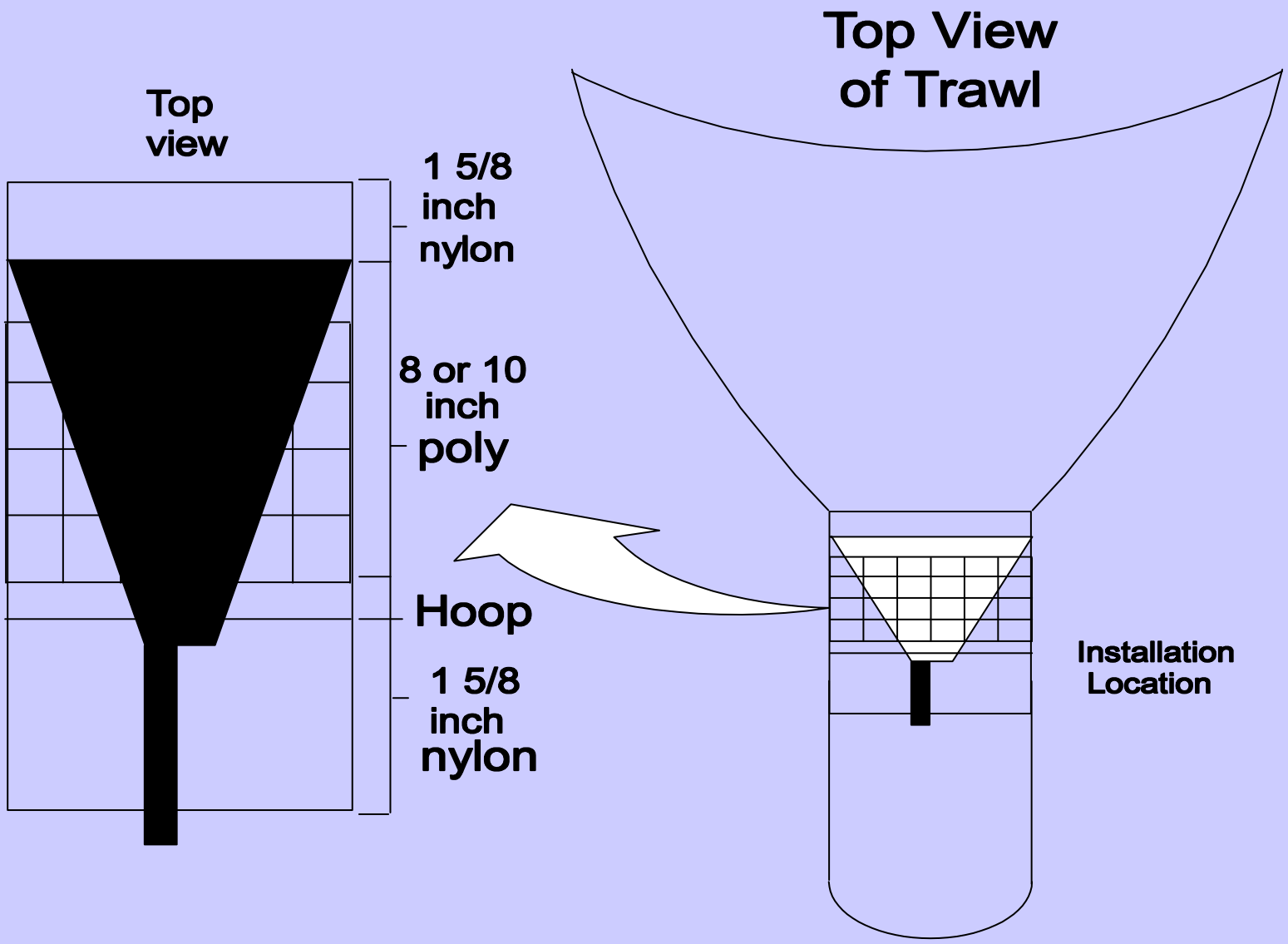


Diagram of large mesh extended funnel BRD (LMEF).

Reduction rates (KG) for selected species and groups for The LMEF tested in 1994.

	LMEF
n	36
Atlantic croaker	-63.1*
Spot	-71.4*
Weakfish	**-50.3***
Spanish mackerel	-83.3
Southern flounder	-12.6
Shrimp	**-2.1**
Total finfish	-54.7*
Total catch	-38.9*

*Significant difference at the p<=0.05 level or less.

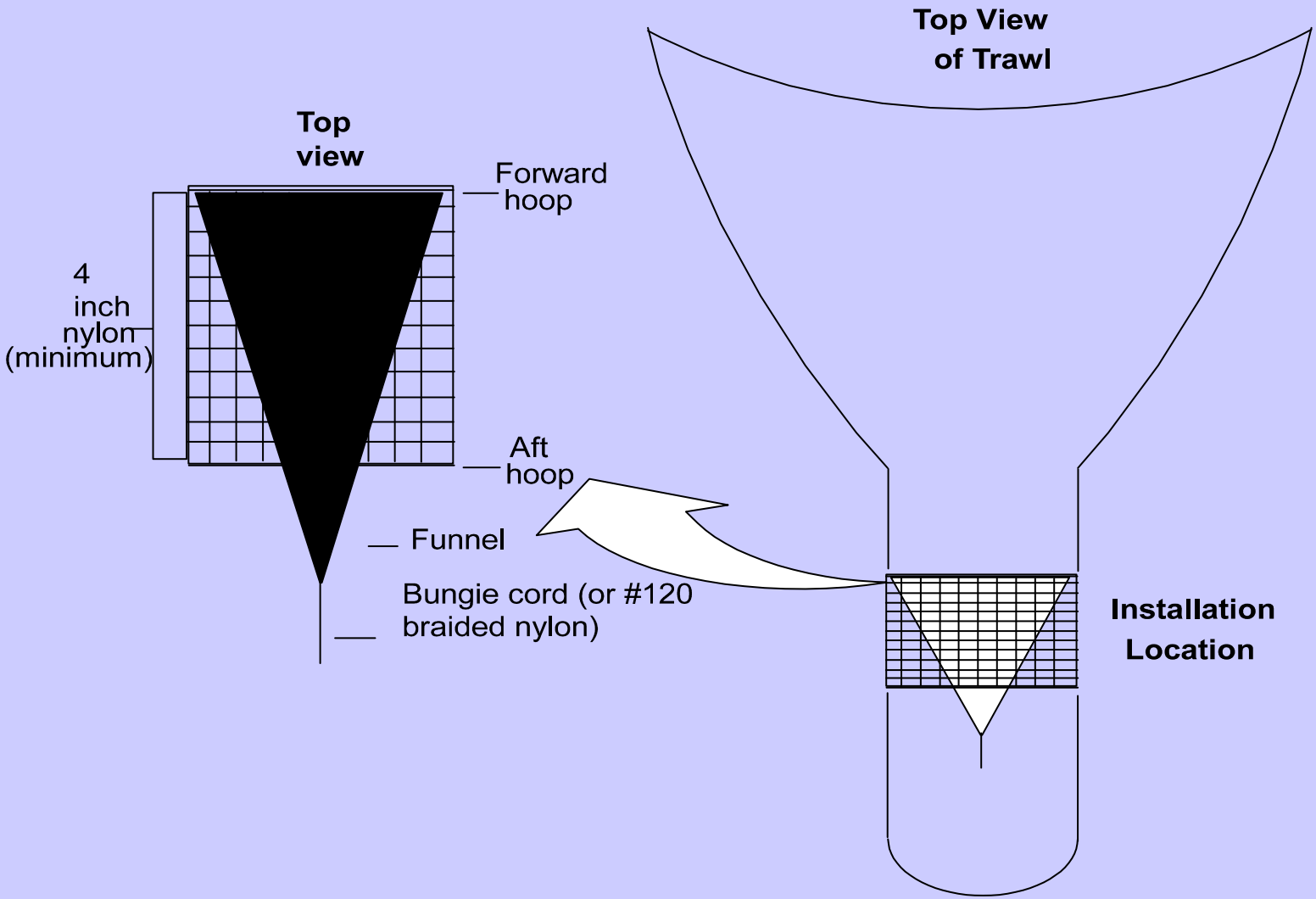


Diagram of large mesh funnel excluder.

Reduction rates for the modified LMEF tested in 1994 in North Carolina

Atlantic croaker	-35.96
Spot	-71.4
Weakfish numbers	-57.5
Shrimp	-7.9
Total finfish	-32.98

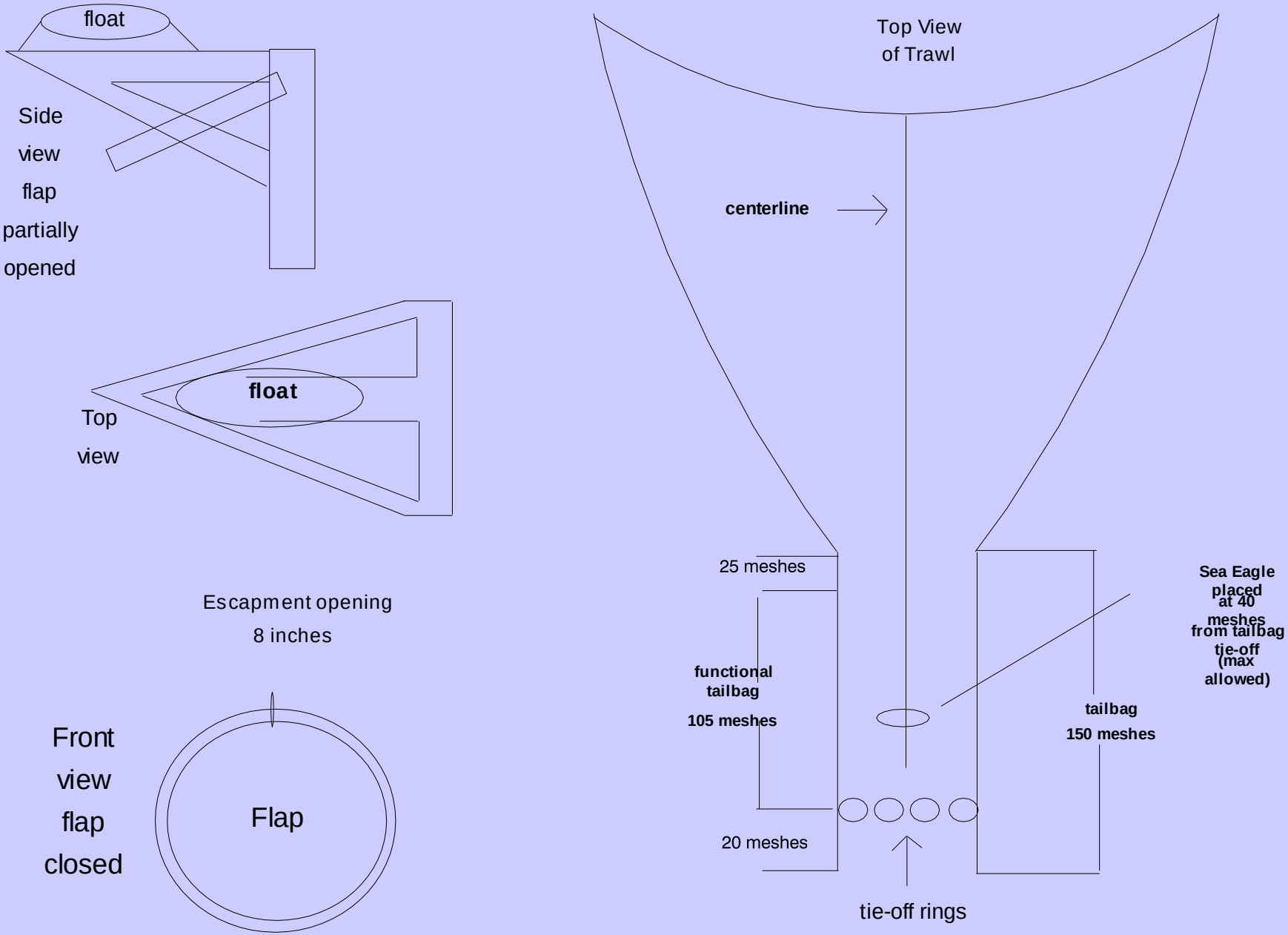


Diagram of "Sea Eagle" Fish Excluder.

Reduction rates for two "Sea Eagle designs tested in 1997 and 1998.

	6" "Sea Eagle"	8" "Sea Eagle"
Atlantic croaker	-36.87	-56.7
Spot	-35.61	-53.39
Weakfish weight	-38.11	-57.8
Weakfish numbers	-29.19	-50.53
Spanish mackerel	nc	nc
Shrimp	-6.58	-4.77
Total finfish	-39.97	-54.33

Southern flounder 6” –18.27 no data for 8”

Reduction rates for the "Sea Eagle II" design tested in 1998 and 1999.

	Other	Developer
Atlantic croaker	-19.9	
Spot	-20.3	
Weakfish weight	-37	
Weakfish numbers	-33.2	-62.6
Spanish mackerel	nc	-58.8
Shrimp	-8.8	-2.1
Total finfish	-16.6	-55.8

Reduction rates for the Parker soft TED tested in 1998 and 1999.

n=27	Parker soft TED
Atlantic croaker	-10.5
Spot	-10.5
Weakfish weight	-74.8
Weakfish numbers	-77.1
Spanish mackerel	nc
Shrimp	-27.4
Total finfish	-45.7

Crab Trawl Example:

Reduction rates for two tailbag sizes tested in the Pamlico and Neuse rivers, 1991-1992.

	4-inch	41/2inch
Sublegal flounder*	-39.5	-75.8
Legal crabs*	-7.3	-17.5
Sublegal crabs*	-12.6	-52.7
Atlantic craoker	-53.6	-93.9
Spot	-28.1	-89.3
Total finfish	-44.4	-79.6

*reductions based on numbers

Alternate Gears – Shrimp Fishery:

- Shrimp Pots
- Cast Nets

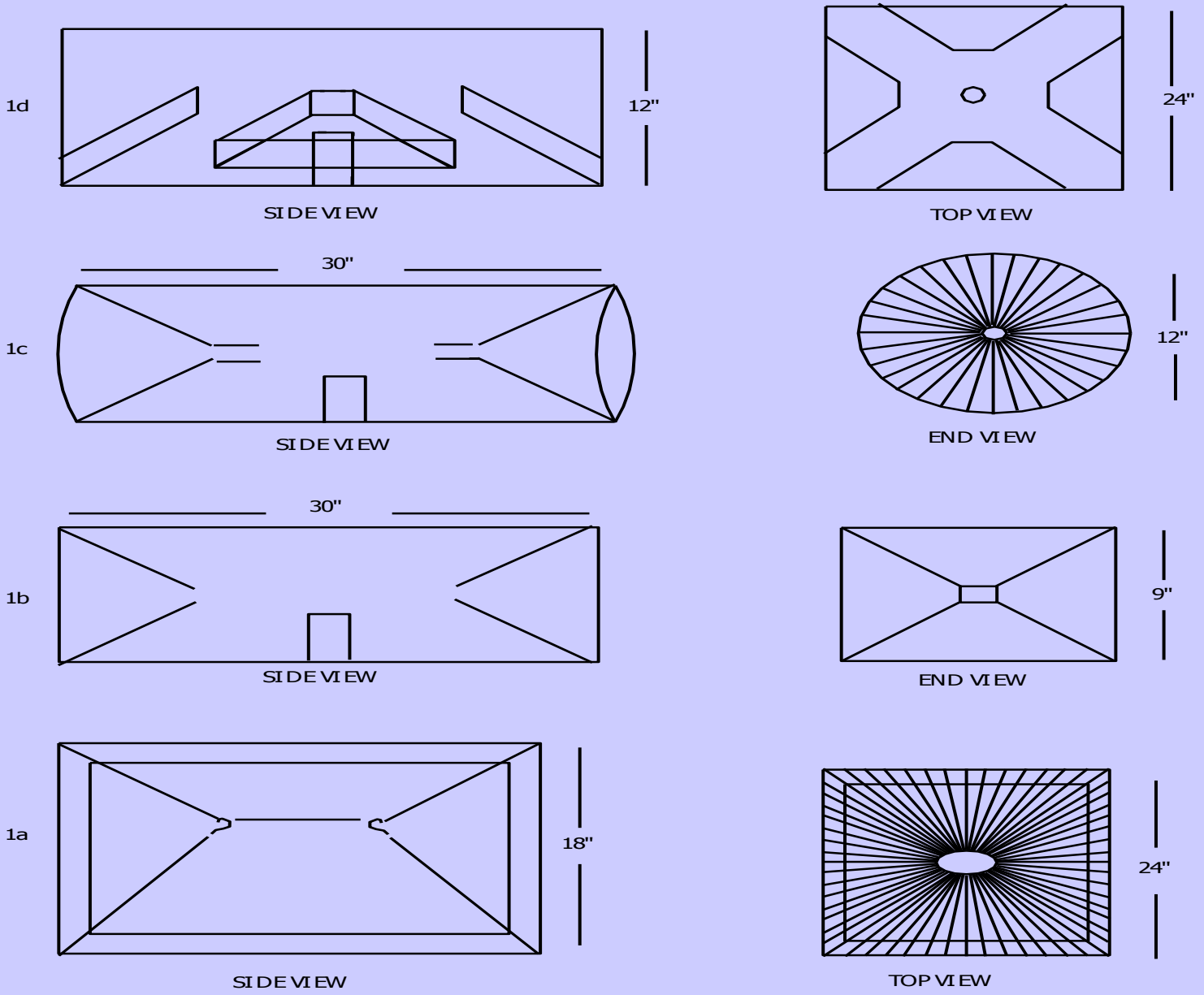


Figure 1. Schematic diagrams of shrimp pots tested in Western Pamlico Sound, North Carolina, 1992: a) Square nylon, b) plastic and metal rectangular, c) round metal, and d) square metal.

Other Restrictions:

- Catch Restrictions
- Harvest Restrictions
- Time Restrictions
- Area Restrictions

Generally, designed to:

- Maintain Stocks
- Decrease Bycatch (Bycatch Mortality)
- Protect Critical Habitats
- Reduce Potential User Conflicts

may have economic impact to fishing community
may increase law enforcement duties

Gear Development Research (overview):

Pound Net Fisheries

- Varying Mesh Size Hearts and Escape Panels in the Sciaenid Pound Net Fishery (APES)
- Escape Panel Testing in the Flounder Pound Net Fishery

Pot Fisheries

- Biodegradable Panel/Material Testing in Crab Pots
- Cull Ring Testing in Crab Pot Fishery
- Shrimp Pot Testing – Begin May 2005

Long Haul Seine Fishery

- Culling Device Testing (APES)
- Escape Panel Testing

Gillnet Fisheries

- Gillnet Selectivity
- Bycatch Monitoring Inshore/Offshore
- Varying Gear Configuration Testing – Response to Sea Turtle Interactions – Current Project (Low-Profile Net)

Accomplishments:

Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA)

Gear Development Team

~ 10 years funding

ACFCMA Research Examples (Past/Present):

Hook and Line Mortality Studies – Recreational Fisheries

Gillnet Mortality Studies – Commercial Fisheries

Double Leadline Gillnets

Low-Profile Gillnets

Long-Term Monitoring Program Proposed

Research Needs:

- Effort data (time fished/number of tows)
- Characterization studies
- Mortality estimates
- Standard protocol bycatch estimations
- Develop & test new reduction methods for shrimp & crab trawl fisheries
- Develop & test alternate gears for shrimp harvest

Conclusion – Future Outlook

- Continue Gear Testing, Working With Commercial Industry

- Establish Long-Term Monitoring Program in Multiple Fisheries

- Better Incorporate Fishermen Logbooks, Ideas, Knowledge Into Fishery Management

- Outreach to Federal, State Agencies, Commercial, Private Industries

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