

# 21 November 2013 CAC Meeting

A photograph showing two researchers wading in a bay. They are handling a net with orange floats. The background shows a large body of water and a distant shoreline with trees and buildings. A wooden pier with white-tipped posts is visible on the right side of the image.

Center for the Inland Bays  
INSHORE FISH STUDY PROGRAM  
INITIATED 2011

April 2013 – Sandy Beach

Stretch that net...and PULL!



The Peninsula

# Turning the seine towards home...



Sometimes the water levels are manageable...

Sometimes you gets up to your neck in this fishy business...



Hey-Look out for that hole...





More hands  
make the count  
go faster...



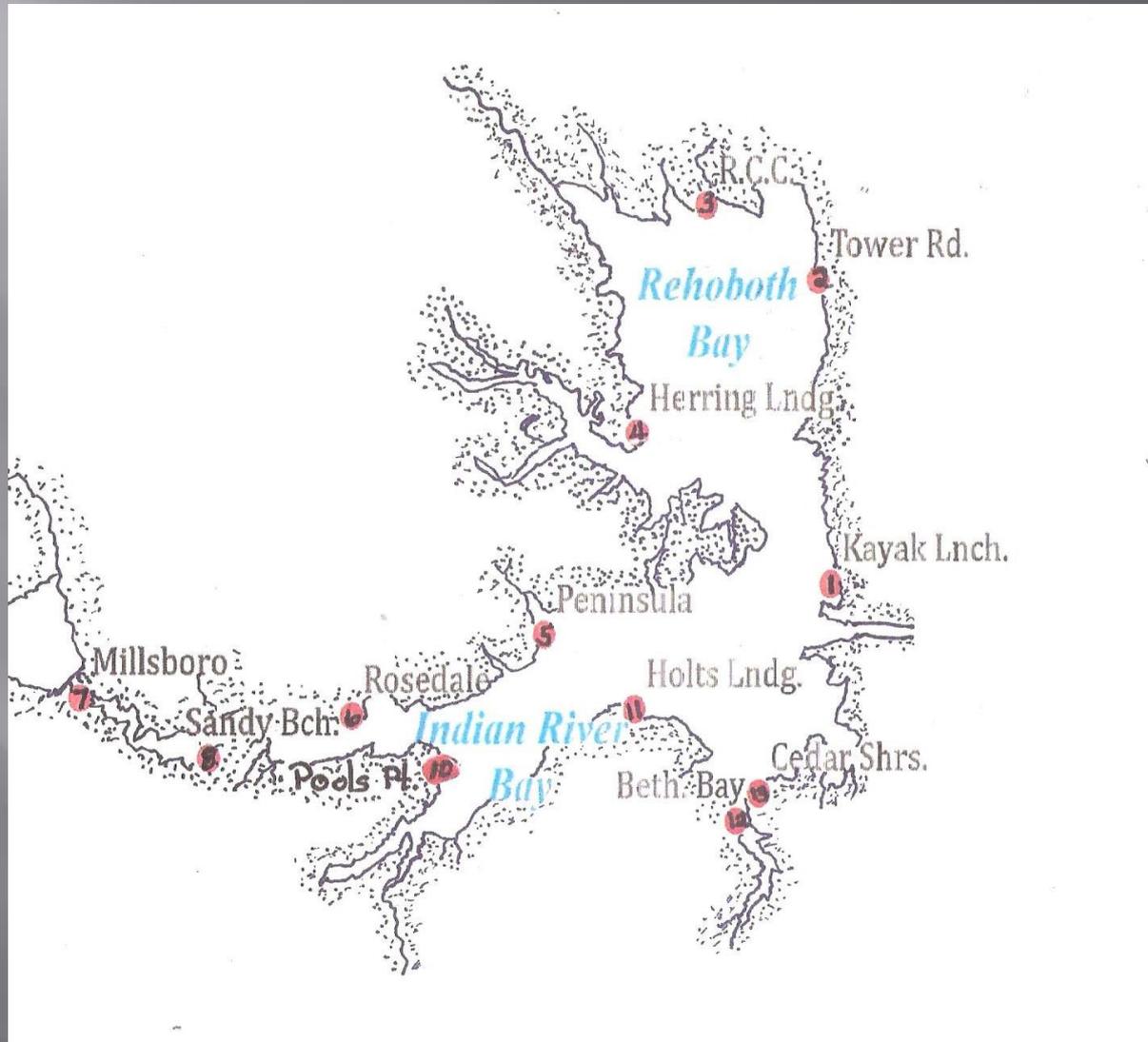
Mostly the critters cooperate...But Oh, not the American eel...







# 4 REHOBOTH AND 7 INDIAN RIVER BAY SITES



# 5 LITTLE ASSAWOMAN BAY SITES



## **CITIZEN SCIENCE AT WORK**

### **FISH COLLECTED**

**2011 – 55,908 OF 37 SPECIES**

**2012 – 46,043 OF 45 SPECIES**

**2013 - 26,059 OF 49 SPECIES**

**TOTAL – 127,753 OF 61 SPECIES**

### **BLUE CRABS COLLECTED**

**2012 – 5,050**

**2013 – 4,0897**

**TOTAL - 9,147**

### **IN-FIELD VOLUNTEERS**

**2011 – 32**

**2012 – 66**

**2013 – 115**

### **IN-FIELD VOLUNTEER HOURS – 2013**

**1,049.5 (26.2 WORK WEEKS)**



# Overall Catch for Each Year of Study

2011 – 55,908 of 37 SPECIES

2012 – 46,043 OF 45 SPECIES

2013 – 25, 802 OF 49 SPECIES

TOTAL – 127,753 OF 61 SPECIES

## BLUE CRABS COLLECTED

2012 – 5,022

2013 – 4,097

TOTAL BLUE CRABS – 9,119

# NEW SPECIES FOR 2013

BLUEGILL  
GIZZARD SHAD  
ATLANTIC MOONFISH  
POLLOCK  
REDFIN PICKEREL  
SKILLETFISH  
SMALLMOUTH FLOUNDER  
STRIPED SEAROBIN  
WINDOWPANE

# BLUEGILL



# GIZZARD SHAD



# ATLANTIC MOONFISH



# POLLOCK



# REDFIN PICKEREL



# SKILLETFISH



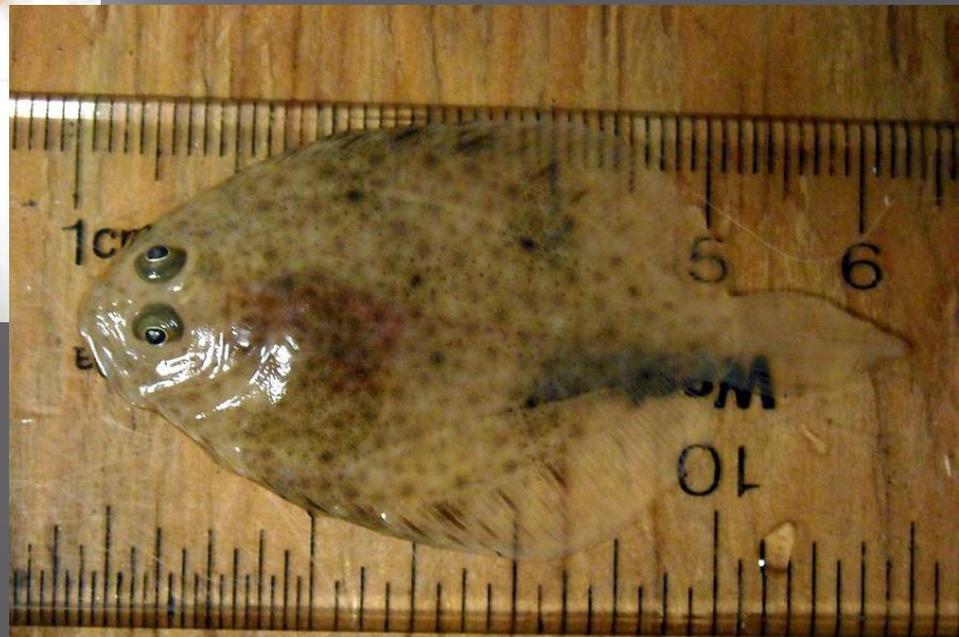
# SMALLMOUTH FLOUNDER



# STRIPED SEAROBIN



# WINDOWPANE



**COMPARISON OF 2013 TO 2011 AND 2012  
SPECIES ABUNDANCES**

	<u>2011&gt;2013</u>	<u>2011&gt;2013</u>
<b>TOTAL SPECIES</b>	<b>26</b>	<b>28</b>
<b>SPECIES WITH AT LEAST 25 SPECIMENS IN A YEAR</b>	<b>17</b>	<b>9</b>
<b>TARGET SPECIES</b>	<b>8</b>	<b>6</b>
	<u>2012&gt;2013</u>	<u>2013&gt;2012</u>
<b>TOTAL SPECIES</b>	<b>25</b>	<b>24</b>
<b>SPECIES &gt; 25 IN EITHER YEAR</b>	<b>11</b>	<b>10</b>
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**TOP 10 SPECIES – 2011-Draft 2013**

<b>2011</b>	<b>2012</b>	<b>Draft 2013</b>
<b>1. Atlantic silverside</b> 22,448; 44.1%	<b>Mummichog</b> 17,239; 37.5%	<b>Atlantic silverside</b> 9,371; 36.0%
<b>2. Mummichog</b> 13,013; 25.5%	<b>Striped killfish</b> 9,196; 20.0%	<b>Mummichog</b> 9,078; 34.8%
<b>3. Striped killfish</b> 9,338; 18.4%	<b>Spot</b> 8,219; 17.9%	<b>Striped killfish</b> 2,397; 9.2%
<b>4. Silver perch</b> 2,447; 4.8%	<b>Atlantic silverside</b> 5,304; 11.5%	<b>White mullet</b> 1,259; 4.8%
<b>5. Atlantic menhaden</b> 768; 1.5%	<b>Sheepshead minnow</b> 2,304; 5.0%	<b>Bay anchovy</b> 853; 3.3%
<b>6. Sheepshead minnow</b> 744; 1.5%	<b>Atlantic menhaden</b> 1,427; 3.1%	<b>Summer flounder</b> 650; 2.5%
<b>7. Bay anchovy</b> 511; 1.0%	<b>Silver perch</b> 647; 1.4%	<b>Sheepshead minnow</b> 556; 2.1%
<b>8. White mullet</b> 501; 1.0%	<b>Bay anchovy</b> 570; 1.2%	<b>Atlantic menhaden</b> 409; 1.6%
<b>9. Atlantic croaker</b> 99; 0.2%	<b>White mullet</b> 474; 1.0%	<b>Winter flounder</b> 367; 1.4%
<b>10. Oyster toadfish</b> 62; 0.1%	<b>Pinfish</b> 112; 0.2%	<b>Striped mullet</b> 164; 0.6%
<b>Top 5 Species – 94.3%</b>	<b>91.9%</b>	<b>88.1%</b>
<b>Top 10 - 98.1%</b>	<b>98.8%</b>	<b>96.3%</b>

# ATLANTIC CROAKER



# BLUEFISH



# SILVER PERCH



# STRIPED BASS



# SUMMER FLOUNDER



# WEAKFISH



# WINTER FLOUNDER



# ATLANTIC MENHADEN



# ATLANTIC SILVERSIDE



# BAY ANCHOVY



# MUMMICHOG



# SHEEPSHEAD MINNOW



# STRIPED KILLIFISH



# WHITE MULLET



# Annual Ranks (#collected) of Target Species of Fishes 2011-2013

## PREDATORY SPECIES

	2011	2012	2013
Atlantic croaker	9(99)	32(5)	17(38)
Bluefish	20(33)	25(13)	13(82)
Silver perch	4(2447)	7(647)	11(139)
Striped bass	16(45)	19(22)	18(27)
Summer flounder	18(40)	12(62)	6(650)
Weakfish	11(57)	27(10)	29(3)
Winter flounder	20(34)	16(33)	9(367)

# Annual Ranks (#collected) of Target Species of Fishes 2011-2013

## FORAGE SPECIES

	2011	2012	2013
Atlantic menhaden	5(768)	6(1427)	8(404)
Atlantic silverside	1(22448)	4(5304)	1(9371)
Bay anchovy	7(511)	8(570)	5(853)
Mummichog	2(13013)	1(17239)	2(9078)
Sheepshead minnow	6(744)	5(2304)	7(556)
Striped killifish	2(9338)	2(9196)	3(2397)
White mullet	8(501)	9(474)	4(1259)

# In 2013 we had 9 newbies and some failed to repeat

## Newbies:

Bluegill

Gizzard shad

Moonfish

Pollock

Redfin pickerel

Skilletfish

Smallmouth flounder

Striped Searobin

Windopane

## Not recollected:

Atlantic herring

Gray snapper

Inland silverside

Lined seahorse

Northern puffer

Sheepshead

Spotfin killifish

Striped blenny

Striped blenny

Striped cusk-eel

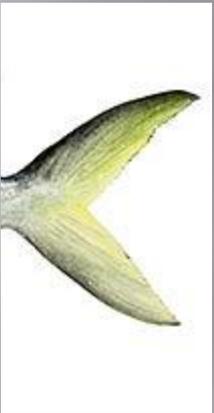
# **NEW FINDINGS IN 2013**

1. RAINFALL – Too much, too often
2. STRIPED BASS – Spawning in both systems
3. SUMMER FLOUNDER – Everywhere!!
4. WINTER FLOUNDER – See summer flounder
5. BLUEFISH – Watch your toes in Florida
6. WEAKFISH – Nearly absent
7. MULLET – Happy predators
8. BLUE CRABS - ?????????????????????????????????
9. SITES1 & 1A - Comparative sample

# New Findings Cont'd: Pigfish- Interbreeding or Mutation? Only Roy Miller knows...



# Finis



The End of Our Tail







## Annual Ranking of Target Species in Top 10 Species Collected

Species	2011	2012	2013
Atlantic croaker	9	-	-
Bluefish	-	-	-
Silver perch	4	7	-
Striped bass	-	-	-
Summer flounder	-	-	6
Weakfish	-	-	-
Winter flounder	-	-	9
Atlantic menhaden	5	6	8
Atlantic Silverside	1	4	1
Bay Anchovy	7	8	5
Mummichog	2	1	2
Sheepshead minnow	6	5	7
Striped killifish	3	2	3
White mullet	8	9	4

## Annual Ranking of Target Species in Top 10 Species Collected

Species	2011	2012	2013
Atlantic croaker	9	-	-
Atlantic menhaden	5	6	8
Atlantic silverside	1	4	1
Bay Anchovy	7	8	5
Bluefish	-	-	-
Mummichog	2	1	2
Sheepshead minnow	6	5	7
Silver perch	4	7	-
Striped bass	-	-	-
Striped killifish	3	2	3
Summer flounder	-	-	6
Weakfish	-	-	-
White mullet	8	9	4
Winter flounder	-	-	9















# What we do.....



One 100 ft. pull with 30' seine per site  
twice a month - April through October

Count every fish and  
measure 25 of each species



Seining ain't easy...but It's fun...



## CIB FISH SPECIES LIST FOR 2012

American eel	Northern pipefish
Atlantic croaker	Northern puffer
Atlantic menhaden	Northern sennet*
Atlantic needlefish	Oyster toadfish
Atlantic silverside	Permit*
Atlantic silverstripe halfbeak*	Pinfish
Banded killifish	Rainwater killifish
Bay anchovy	Sheepshead
Blackcheek tonguefish*	Sheepshead minnow
Black drum	Silver perch
Black sea bass*	Spot
Bluefish	Spotfin mojarra
Bluntnose stingray	Spotted hake*
Crevalle jack	Striped anchovy
Florida pompano*	Striped bass
Grey snapper*	Striped blenny
Hogchoker	Striped killifish
Inland silverside	Striped mullet*
Largemouth bass	Summer flounder
Mummichog	Weakfish
Naked goby	White mullet
Northern kingfish	Winter flounder

44 TOTAL SPECIES COLLECTED

\*Species first collected in 2012

# In the 2011 & 2012 Surveys 55 species of fish were collected

Alewife  
American eel  
Atlantic croaker  
Atlantic herring  
Atlantic menhaden  
Atlantic needlefish  
Atlantic silverside  
Atlantic silverstripe halfbeak  
Banded killifish  
Bay anchovy  
Black crappie  
Blackcheek tonguefish  
Black drum  
Black seabass  
Bluefish  
Bluegill  
Bluntnose stingray  
Cownose ray

Crevalle jack  
Florida pompano  
Fourspine stickleback  
Gray snapper  
Hogchoker  
Inland silverside  
Largemouth bass  
Lined seahorse  
Mummichog  
Naked goby  
Northern kingfish  
Northern pipefish  
Northern puffer  
Northern sennet  
Oyster toadfish  
Pinfish  
Pumpkinseed  
Rainwater killifish

Sheepshead  
Sheepshead minnow  
Silver perch  
Spot  
Spotfin killifish  
Spotfin mojarra  
Striped anchovy  
Striped bass  
Striped blenny  
Striped hake  
Striped cusk-eel  
Striped killifish  
Striped mullet  
Summer flounder  
Weakfish  
White mullet  
White perch  
Winter flounder  
Yellow perch

# In 2012 we had some newbies and some failed to repeat

## Newbies:

Atlantic silverstripe halfbeak  
Blackcheek toungefish  
Black sea bass  
Florida pompano  
Grey snapper

Largemouth bass  
Northern puffer  
Northern sennet  
Permit  
Spotted hake

## Not recollected:

Alewife  
Atlantic herring  
Cownose ray  
Fourspine stickleback  
Lined seahorse  
Pumpkinseed  
Spotfin killifish  
Striped cusk-eel  
White perch

# 2012 Bluntnose Stingray - in a different league altogether

JUST A BIT CAUTIOUS...

REASON WHY !



## Most Abundant Species in 2012 and 2011

### For the Same 16 Sites

2012 (Draft)		Rank	2011
15,668	Mummichog	1	22,448 Atlantic silverside
9,855	Spot (57 in 2011)	2	13,013 Mummichog
9,130	Striped killifish	3	9,338 Striped killifish
6,533	Atlantic silverside	4	2,447 Silver perch
2,260	Sheepshead minnow	5	768 Atlantic menhaden
1,429	Atlantic menhaden	6	744 Sheepshead minnow
570	Silver perch	7	571 Bay anchovy
545	Bay anchovy	8	501 White mullet
471	White mullet	9	99 Atlantic croaker (9 in 2012)
110	Pinfish (8 in 2011)	10	62 Oyster toadfish (76 in 2012)
44	# OF SPECIES		39
47,144	TOTAL SPECIMENS		50,883
92.2%	SPECIES 1-5		94.4%
98.8%	SPECIES 1-10		98.1%

# Most Abundant Catches in 2011: Atlantic silverside, mummichog, striped killifish & silver perch (90%) of catch



Atlantic silverside

Mummichog



# Striped Killifish



# Silver Perch



Most Abundant Catches in 2012:  
Mummichog, spot, striped killifish &  
sheepshead minnow(92.2%) of catch



MUMMICHOG

Spot



# Striped Killifish



# Sheepshead Minnow



In 2011 Atlantic Silverside, silver perch, and Atlantic croaker were substantially more abundant



In 2012 Spot, pinfish, and Atlantic menhaden and sheepshead minnow were more abundant



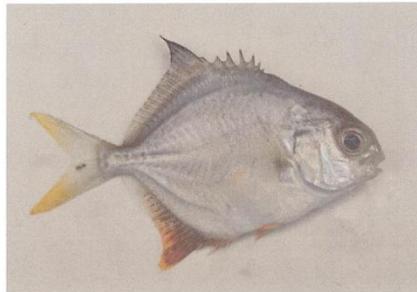
## Catch Comparisons of 2011 and 2012

Month	Monthly Catch*		Running Totals*		Difference* from 2011
	2011	2012	2011	2012	
April	2,076	9,911	2,076	9,911	+7,200
May	7,432	15,663	9,508	25,574	+16,000
June	7,967	7,369	17,475	32,943	+15,500
July	9,933	4,868	27,408	37,811	+10,400
August	6,610	4,469	34,018	42,280	+8,262
September	11,557	2,361	45,269	45,168	-120
October	5,313	2,006	50,582	47,139	-3,450

\*Data from the same 16 sites sampled in each year

THE DELAWARE CENTER FOR THE INLAND BAYS

INSHORE FISH SURVEY OF REHOBOTH BAY,  
INDIAN RIVER AND BAY AND LITTLE  
ASSAWOMAN BAY  
FOR 2011



RONNIE J. KERNEHAN, DENNIS H. BARTOW,  
CAROLYN KELLY, LYNN LAMBERTSON AND  
COLLEEN KERNEHAN BEST

OCTOBER 2012

Report may be accessed via [www.inlandbays.org](http://www.inlandbays.org)

## New Fish Findings from 2011 and 2012 CIB Fish Studies

### I. Striped bass

- A. Successful spawning Indian River and Little Assawoman in 2011
- B. Limited success Indian River in 2012, not Little Assawoman

### II. Atlantic silverside

- A. Substantially lower abundance by nearly 75% IN 2012
- B. Not lower in Delaware Bay at Cape Henlopen

### III. Spot

- 2012 year class very strong, substantially more at all 16 sites

### IV. Pinfish

- 2012, 12X collected than 2011, smaller specimens

### V. Weakfish

- very few young of 2012 year class, 1/7 of 2011 catch

VI. **Largemouth bass**

- young found at 25ppt salinity, no recorded presence > 10ppt

VII. **Black drum**

- 5X higher catch in 2012

VIII. **Blue crab**

- 4,750 in 2012; 3,650 < 1 year old; 1,000 1-2 yrs; 100adults

IX. **Important Nursery Areas**

- certain sites identified for consistently higher abundance
- Atlantic menhaden, bay anchovy, silver perch, weakfish

X. **Dissolved oxygen**

- not as limiting for fish abundance as expected in many locations

# Forage Fish:



# PREDATORS

STRIPED BASS



WEAKFISH



# ATLANTIC CROAKER



**BLUEFISH**

# Quiz

**Now Let's Play That Game ....**

**ARE YOU SMARTER THAN A 5<sup>TH</sup> GRADER?**

NAME

THAT

FISH

1





3



4



5



6



37|0

38|0

39|0

40|0mm 41|0



AND THE WINNER IS.....

# Check out the Back Counter for the Following:

- 1. FISH REFERENCES**
- 2. TEAM SIGN-UPS (NEW VOLUNTEERS)**
- 3. LIST OF ITEMS VOLUNTEERS NEED**
- 4. MAPS OF SAMPLING SITES**
- 5. DESCRIPTION OF LOCATION OF SITES**
- 6. INLAND BAYS ID MANUALS**
- 7. CLIPBOARD CASE**
- 8. 2011 Report**

FINIS



*THE END OF OUR TAIL*

QUESTIONS

?





THE DELAWARE CENTER FOR THE INLAND BAYS

INSHORE FISH SURVEY OF REHOBOTH BAY,  
INDIAN RIVER AND BAY AND LITTLE  
ASSAWOMAN BAY  
FOR 2011



APPENDIX  
CUMULATIVE DATA – ALL SITES APRIL  
THROUGH OCTOBER/NOVEMBER 2011

**ARCHIVAL COPY – SPECIES SORT**

RONNIE J. KERNEHAN, DENNIS II. BARTOW,  
CAROLYN KELLY, LYNN LAMBERTSON AND  
COLLEEN KERNEHAN BEST

OCTOBER 2012

# **TOUGHIES**

- 1. ATLANTIC / INLAND / ROUGH SILVERSIDES**
- 2. ATLANTIC SILVERSIDE/BAY AND STRIPED ANCHOVIES**
- 3. SPOT AND ATLANTIC CROAKER**
- 4. SILVER PERCH AND WEAKFISH**
- 5. WINTER AND SUMMER FLOUNDER**
- 6. MUMMICHOG AND STRIPED KILLIFISH**
- 7. MUMMICHOG AND BANDED KILLIFISH**
- 8. MUMMICHOG AND RAINWATER KILLIFISH**
- 9. PERMIT AND FLORIDA POMPANO**
- 10. WHITE AND STRIPED MULLET**

**APRIL SAMPLING – COMBINED TEAMS**  
**SECOND HALF OF MONTH**

**1 & 5 – REHOBOTH BAY**

**2 & 6 – INDIAN RIVER AND BAY (THE PENINSULA TO  
SANDY BEACH NEXT TO IRPP**

**3 & 7 – INDIAN RIVER BAY SOUTH (BETHANY TO  
DAGSBORO**

**4 & 8 – LITTLE ASSAWOMAN BAY**

**2013 INLAND BAYS INSHORE FISH SAMPLING PROGRAM**

Oh My - A New form.....

Spaces provided for the 1<sup>st</sup> 25 fish measured; over 25 counts go in the gray area.

<b>DATE:</b>		<b>SAMPLING SITE: #1 Kayak Launch</b>					
<b>Time of Collection: START:</b>			<b>TIDE (Circle): HF MF LF HE ME LE</b>				
<b>STOP:</b>							
<b>WEATHER: (circle)</b>		1. Sunny/clear		2. Partly Cloudy			
		3. Overcast		4. Raining			
<b>DO (ppm):</b>		<b>SALINITY (ppt):</b>		<b>WATER TEMP (°C):</b>			
<b>TEAM #:</b>		<b>Team Leader:</b>					
<b>TEAM MEMBERS:</b>							
PLACE ALL DATA INSIDE BOXES BELOW TO FACILITATE SCANNING OF DOCUMENT Measure 1st 25 of each species and record # counted above 25 in 25+ tally box							
<b>SPECIES: BLUE CRABS</b>							
<b>&lt;40 MM</b>		<b>40-140 MM</b>		<b>&gt;140 MM</b>			
				<b>TOTAL COLLECTED:</b>			
<b>SPECIES:</b>							
<b>25+ Tally:</b>				<b>TOTAL COLLECTED:</b>			
<b>SPECIES:</b>							
<b>25+ Tally:</b>				<b>TOTAL COLLECTED:</b>			
<b>SPECIES:</b>							
<b>25+ Tally:</b>				<b>TOTAL COLLECTED:</b>			

Return Data Sheets to: Ron Kernehan or Loretta Smith/Receptionist at  
DE Center for the Inland Bays

**SUMMER FLOUNDER**



**WINTER FLOUNDER**

# Mummichog and Striped Killifish



# Mummichogs & Rainwater Killifish



Female



Rainwater killifish  
to 2.4 in.



Mummichog  
to 4.7 in.



Rainwater



Male

# Permit and Florida Pompano



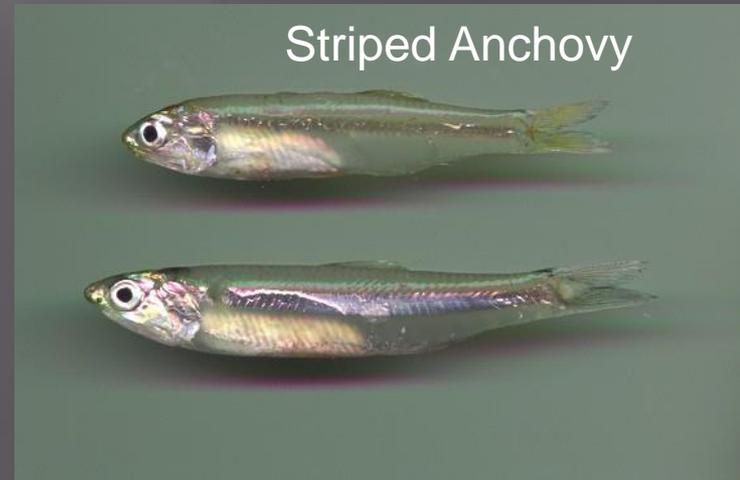
# White and Striped Mullet



# Silversides



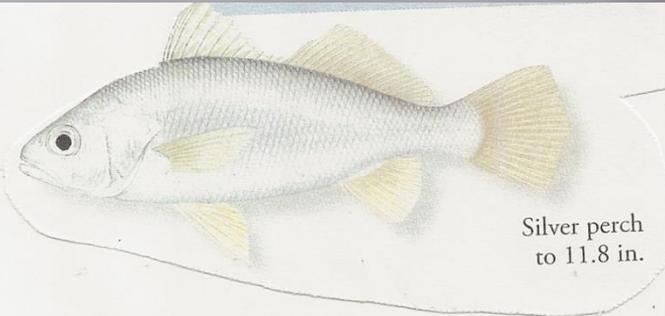
# Atlantic Silverside/Bay & Striped Anchovies



# Spot and Atlantic Croaker



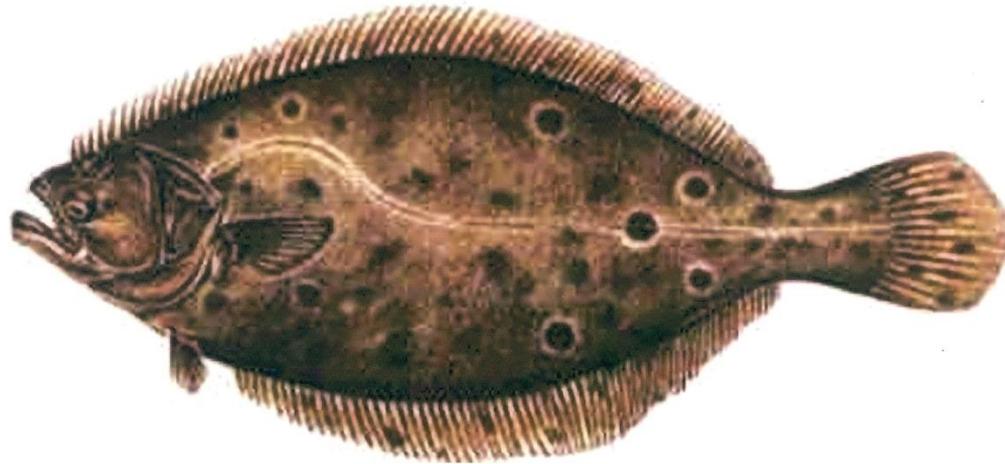
# SILVER PERCH & WEAKFISH



# We Advertise

Back of Shirt

## **INLAND BAYS**



## **INSHORE FISH SURVEY TEAM**





# A "SUMMER" SPECIES





**CENTER FOR THE  
INLAND BAYS INSHORE  
FISH STUDY PROGRAM  
INITIATED 2011**

**21 November 2013 CAC Meeting**

**SUMMER FLOUNDER**



**WINTER FLOUNDER**

**SUMMER FLOUNDER**



**WINTER FLOUNDER**

# WINTER FLOUNDER



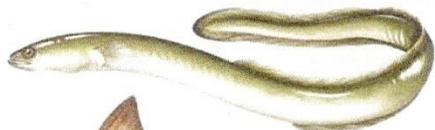


# Can You Match the Fish to its Facts?

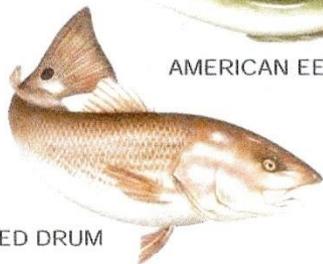
SPINY DOGFISH



ATLANTIC STURGEON



AMERICAN EEL



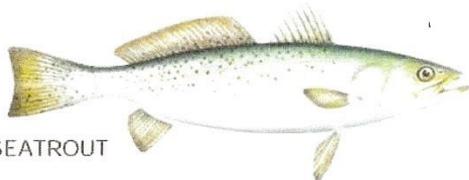
RED DRUM



BLUEFISH



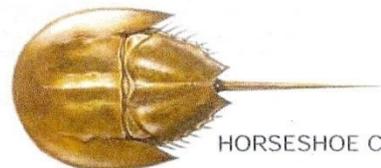
WEAKFISH



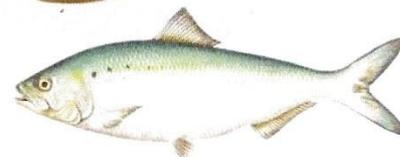
SPOTTED SEATROUT



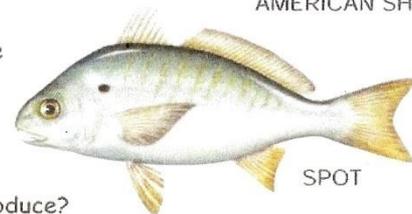
ATLANTIC CROAKER



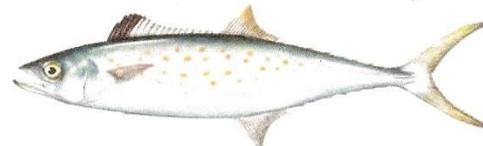
HORSESHOE CRAB



AMERICAN SHAD



SPOT



SPANISH MACKEREL

1. What fish lives most of its life in freshwater and returns to the ocean to reproduce?
2. What fish makes a "croaking" sound by vibrating its swim bladder?
3. What fish is nicknamed chopper because of its razor sharp teeth and powerful jaw?
4. What fish dates back to over 70 million years ago, and can reach a size of 15 feet in length and weigh over 800 pounds?
5. What fish is named for its color and the drum-like sound it makes?
6. What fast swimming fish forms large schools and travels great distances?
7. What fish gets its name from the dark spot behind its gills?
8. What fish throws up its food when excited, forming oil slicks on top of the water that smell like watermelon or freshly cut grass?
9. What fish's name refers to the tender, easily-torn part of the fish's mouth, rather than its fighting ability?
10. What fish lives most of its life in the ocean and returns to freshwater to reproduce?
11. What animal is more closely related to spiders than crabs, and has been around for over 200 million years?
12. What fish gives birth to live young instead of laying eggs?

Restoring Atlantic Coastal Fisheries ([www.asmfcr.org](http://www.asmfcr.org))





It's time to play that popular game show.....  
NAME THAT SPECIES.....



For 20 Points...



It's time to play that popular game show.....  
NAME THAT SPECIES.....



For 20 Points...



...REMEMBER TO PULL THEM  
HEAD FIRST THROUGH THE NET...



**IN 2012 SPOT AND SHEEPSHEAD  
WERE  
MORE ABUNDANT THAN IN 2011**



**SPOT**

**SHEEPSHEAD  
MINNOW**



Always surprises.....



Attack of the Alien  
Isopod.....

Attack of the Alien  
Copepod....



“Sandy” stirred up the sand and handfuls of lobsters (not) could be scooped up.



# PREDATORS

STRIPED BASS



WEAKFISH



**ATLANTIC CROAKER**



**BLUEFISH**

FINIS



*THE END OF OUR TAIL*





# SHEEPSHEAD MINNOW





# Mummichog



# Stripped Bass



# Summer Flounder

DORSAL VIEW



VENTRAL VIEW



**DRAFT COPY**

THE DELAWARE CENTER FOR THE INLAND BAYS

INSHORE FISH SURVEY OF REHOBOTH, INDIAN  
RIVER AND BAY AND LITTLE ASSAWOMAN BAY  
FOR 2011



RONNIE J. KERNEHAN, DENNIS H. BARTOW,  
CAROLYN KELLY, LYNN LAMBERTSON AND  
COLLEEN KERNEHAN BEST

OCTOBER 2012

# Bluefish



# Spot



# Atlantic Menhaden



# Pinfish



# Bluntnose Stingray at Peninsula in 2011



# Stripped Killifish

MALE

FEMALE



# Silver Perch



# Atlantic Silverside



# Spotfin Mojarra



# And Finally, a non-vertebrate: Grass Shrimp with Parasitic Isopod

