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**FISHERIES**

Northeast  
Fishery  
Science Center

# Ecosystems Surveys Branch Data Collection Programs Multispecies Bottom Trawl Survey

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# Ecosystems Surveys Branch Programs

Autumn Multispecies Bottom Trawl Survey

Spring Multispecies Bottom Trawl Survey

Sea Scallop Survey

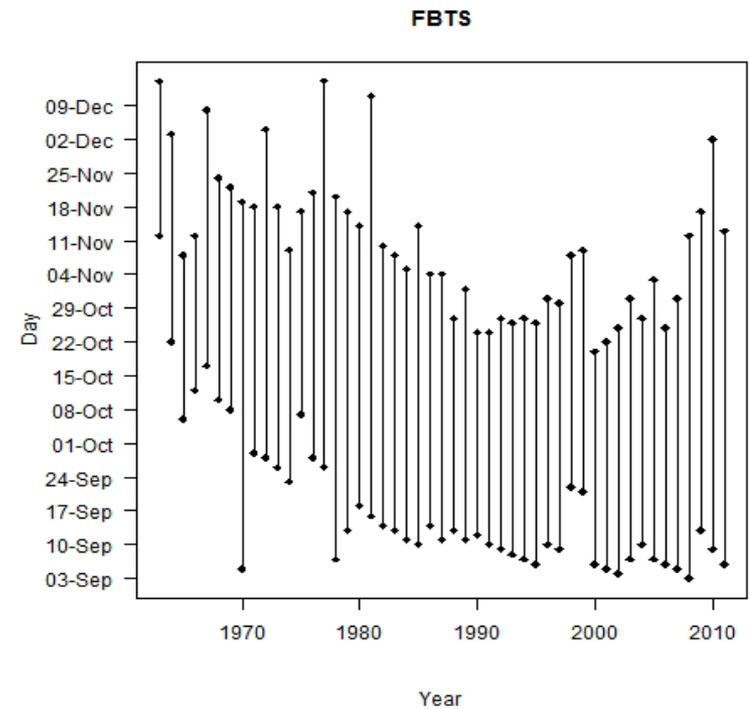
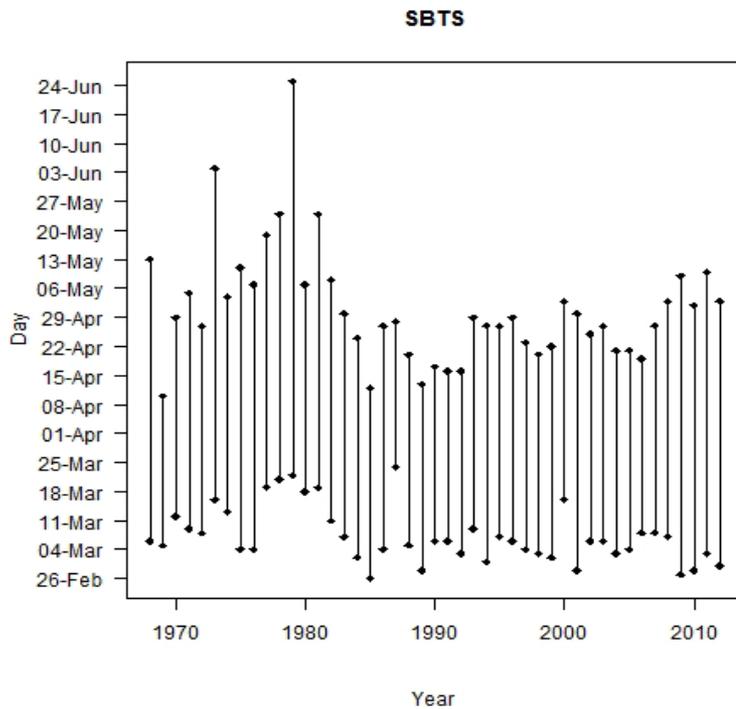
Surf Clam/Ocean Quahog Survey

Northern Shrimp Survey

# Multispecies Bottom Trawl Survey: Longevity

Spring MBTS – annually since 1968

Autumn MBTS – annually since 1963



# Multispecies Bottom Trawl Survey: Vessel Changes

NOAA Ship Albatross IV  
1963 - 2008  
187' LOA  
33' Breadth  
16' Depth  
21 Officers and Crew  
14 Scientific Staff

NOAA Ship Delaware II  
Intermittent  
155' LOA  
30' Breadth  
17' Depth  
18 Officers and Crew  
14 Scientific Staff

NOAA FSV Bigelow  
2009 – present  
209' LOA  
49' Breadth  
30' Depth  
24 Officers and Crew  
16 Scientific Staff



# Multispecies Bottom Trawl Survey: Trawl and Protocols

Yankee 36:

2 - Seam, 2-Bridle Flat Net

Design Features:

- 80' Roller Sweep
- 60' Headrope
- 5" (12.7cm) Twine throughout
- 4.5" (11.4cm) Codend with 0.5" Liner
- Euronet 450 kg trawl doors

Nominal Fishing Characteristics:

- 23m Door Spread
- 11m Wing Spread
- 1.7m Headrope Height



Basic Protocols:

- 30 minute tow duration (winch lock to haulback)
- 3.7 knots
- Average tow distance of 1.7 nm
- Generally towed in direction of next station
- Tow success often determined after completion

# Multispecies Bottom Trawl Survey: Trawl and Protocols

Bigelow Trawl:

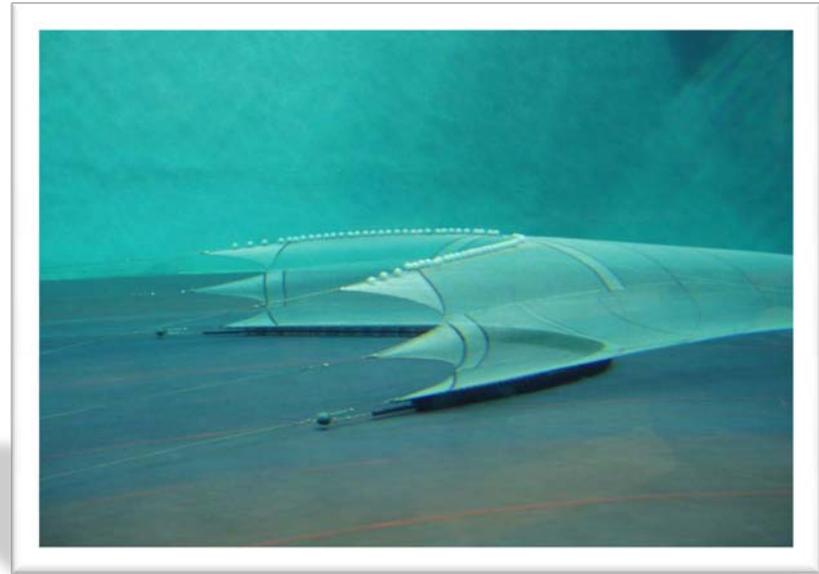
4 - Seam, 3-Bridle Box Net

Design Features:

- 86' Rock-hopper Sweep
- 68' Headrope
- 4.7' (12cm) Twine in Wings
- 2.4' (6cm) Twine in Balance
- 4.7' (12cm) Codend with 1" Liner
- Icelandic oval 550 kg trawl doors

Nominal Fishing Characteristics:

- 32m Door Spread
- 13m Wing Spread
- 4m Headrope Height



Basic Protocols:

- 20 minute tow duration (bottom contact to haulback)
- 3.0 knots
- Average tow distance of 1.0
- Towed along contour
- Tow success often determined during haul

# Multispecies Bottom Trawl Survey: Calibration Effort

In 2000, we learned that the F/V Albatross IV would be retired.

We decided to modernize the entire sampling system including the survey net.

In 2003, a panel was convened to design the most appropriate net for the new vessel.

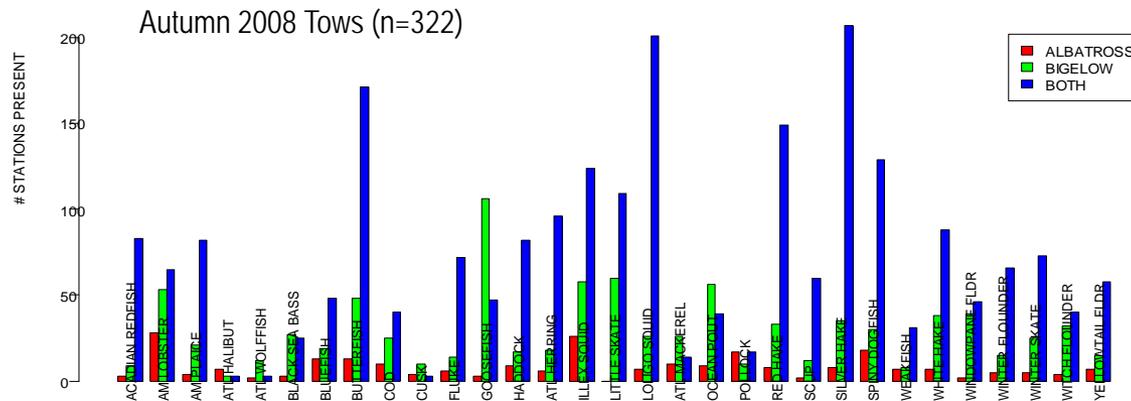
A 4-seam, 3-bridle box net with rock-hopper sweep was designed, built and tested between 2007 – 2009.

The FSV Bigelow arrived behind schedule in 2007, and successful calibration was accomplished in 2008.

636 successful paired tows were accomplished during 2008.

Calibration study design and analysis were peer-reviewed in 2007 and 2009 respectively.

# Multispecies Bottom Trawl Survey: Calibration Effort



# Multispecies Bottom Trawl: Survey Design

Spring - March through May

Autumn - September through November

Cape Lookout, NC to Scotian Shelf

370 stations

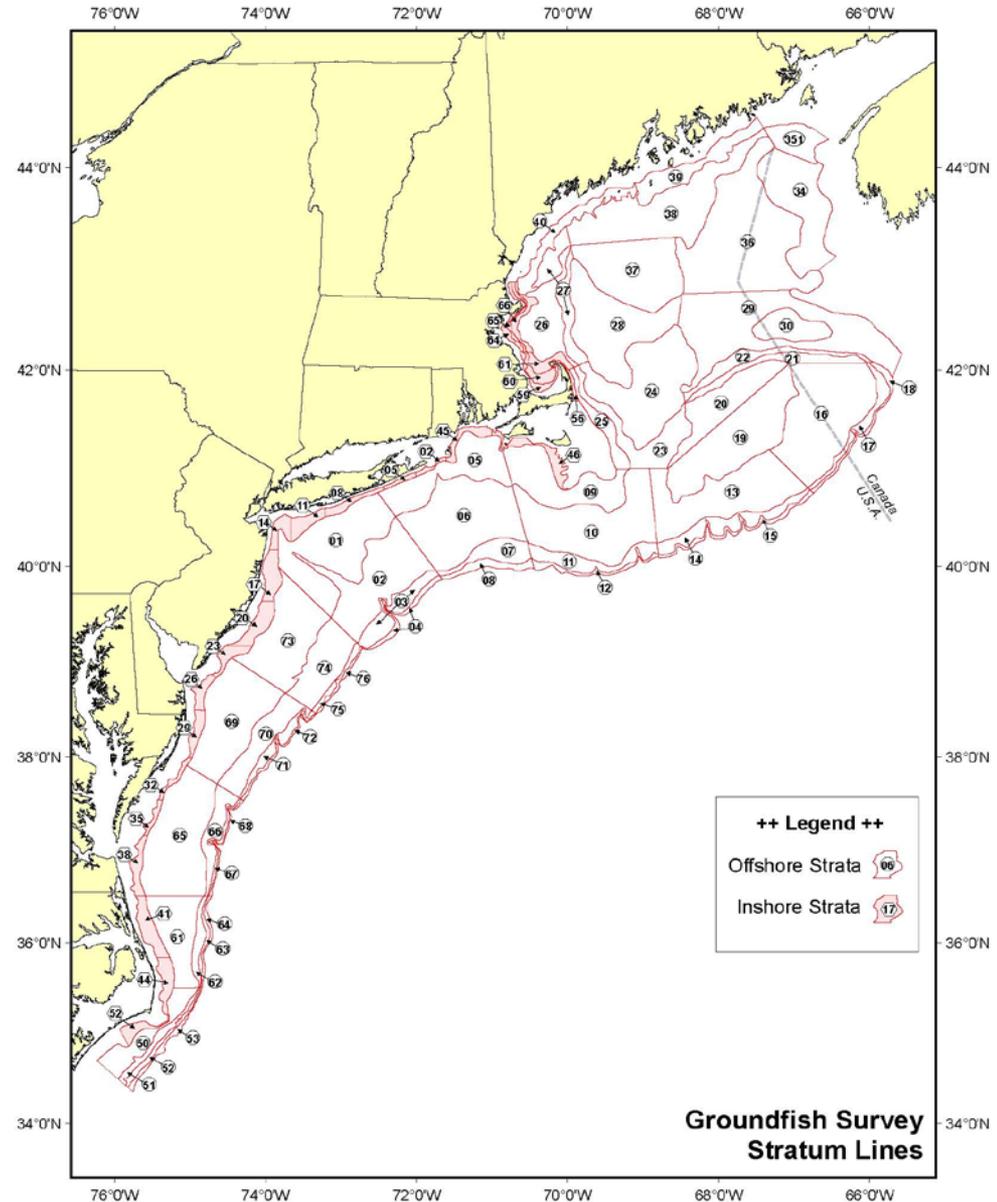
60 sea days

Stratified Random Design:

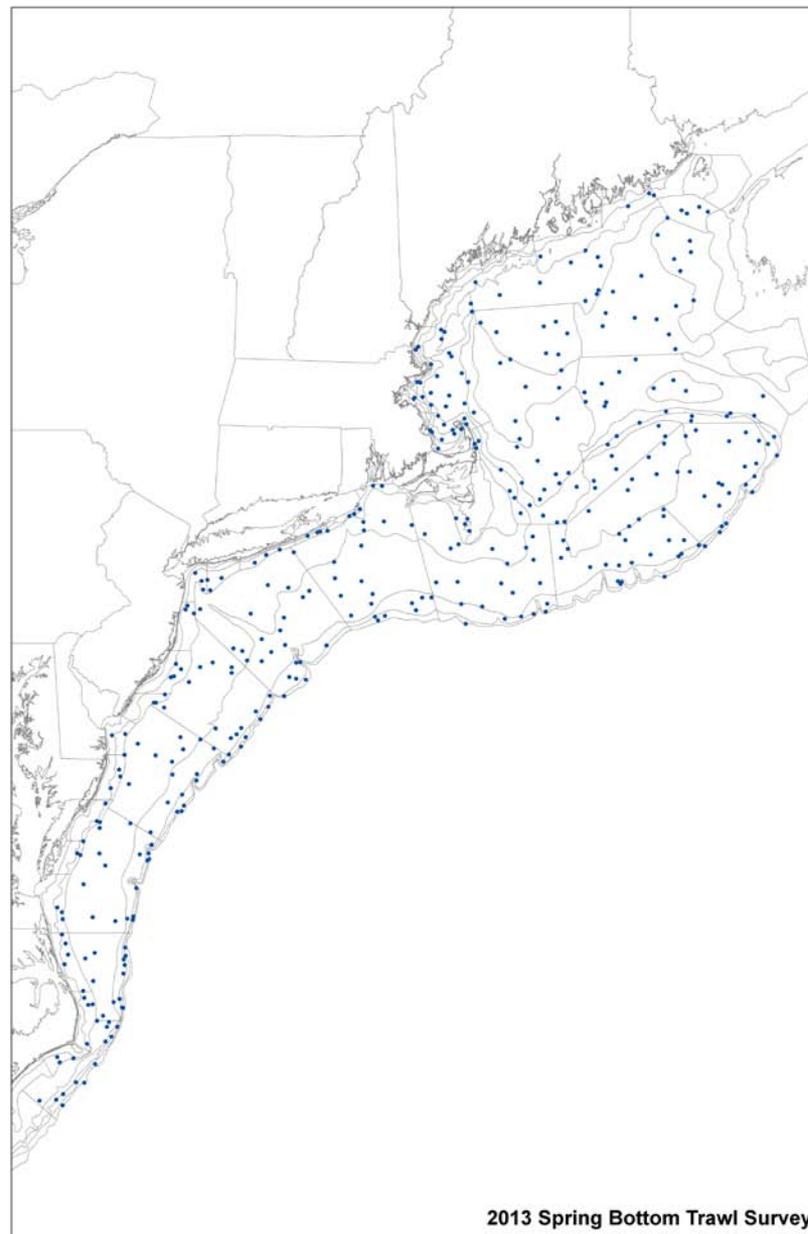
- Strata are delineated by depth and region
- Station locations are randomly selected within strata.

Strata depth ranges:

- 18 - 27 meters (10 - 15 Fm)
- 27 - 55 meters (15 - 30 Fm)
- 55 - 110 meters (30 - 60 Fm)
- 110 - 182 meters (60 - 100 Fm)
- 182 - 366 meters (100 - 200 Fm)



# Multispecies Bottom Trawl: Survey Design



# Multispecies Bottom Trawl Survey: Catch Sampling Processes

Generally every effort is made to weigh and measure every fish captured. When that is not practical we have several sub-sampling options.

## "By Weight" Sub-Sample Method

- Applied to single species
- Most frequently used sub-sample method

## "By Length" Sub-Sample Method

- Applied to single species
- With two or more distinct size categories

## "By Count" Sub-Sample Method

- Applied to single species or single sex
- Used when the number of animals is too large to get an actual weight



# Multispecies Bottom Trawl Survey: Catch Sampling Processes

## “Mix” Sub-Sample Method

- Used when there is insufficient time to sort and sample the entire catch
- Can be used to characterize entire tow or some portion of a tow
- Further sub-sampling is generally required

## “Remaining Weight” Sub-Sample Method

- Used when measuring has begun but must be suspended due to time constraints or when a sufficient LF has been achieved



# Multispecies Bottom Trawl Survey: Tow Standardization Efforts

Select Tow Settings Map Exit

**Representative Tow**

**T O G A**

1 1 1 1

**Tow Type**

Alternate  Random, Offshore Co  Random, within 1nm radius  Repeat  Random, outside 1nm within 3nm

Operation Auto-Generated Impact Codes

Gear Impact Codes

Acquisition Auto-Generated Impact Codes

(O1) Good Performan

(G1) No Damage/Mal

(A1) No Data Acq. Errors

1 2 3 4

# Multispecies Bottom Trawl Survey: Tow Standardization Efforts

Select Tow
Settings
Map
Exit

Representative Tow

T  
1

O  
1

G  
1

A  
1

**Tow Type**

Alternate     Random, Offshore Protocol     Random, Outside 1nm  
 Alternate, Offshore Protocol     Random, Within 1nm     Repeat

**Operation Auto-Generated Impact Codes**

(O1) Good Performance

**Gear Impact Codes**

(G1) No Damage/Malfunction

**Acquisition Auto-Generated Impact Codes**

(A1) No Data Acq. Errors

Watch Chief comments...

Door Spread Chart

**Bridge Comments**

No Bridge Comments

**Chief Scientist Comments**

No Chief Scientist Comments

**Tow Validation for Tow 229 (Operation ID: 242, Strata-Tow: 01100-3)**

Door Spread Std Dev	Door Spread Mean	Δ Winch Tension	EK60 - 18 kHz Mean	% Tow in Strata	Distance Planned
0.22	33.73	0	78.82	100	0.182 nm
Wing Spread Std Dev	Wing Spread Mean	Δ Block Tension	Ship vs Trawl Depth	Rep. in Last Day	Area Swept (DS)
0.61	13.79	-0.05	76.38	7	0.06016 km <sup>2</sup>
Headrope Std Dev	Headrope Mean	Δ Winch Wire Out	Tow Duration	Non-Rep. in Last Day	Area Swept (WS)
0.08	3.86	-2.87	00:20:00	2	0.02458 km <sup>2</sup>
Scope Ratio	Ship Speed Mean	Δ Block Wire Out	Distance Towed	Bridle Angle	Volume Swept
226	2.91	-1.58	0.9633 nm	11.79	8.475E-05 km <sup>3</sup>
Scope Ratio	Ship Speed Mean	Δ Block Wire Out	Distance Towed	Volume Swept	Bridle Angle
365	2.87	-1.72	0.9576 nm	84.872 cubic km	14.3

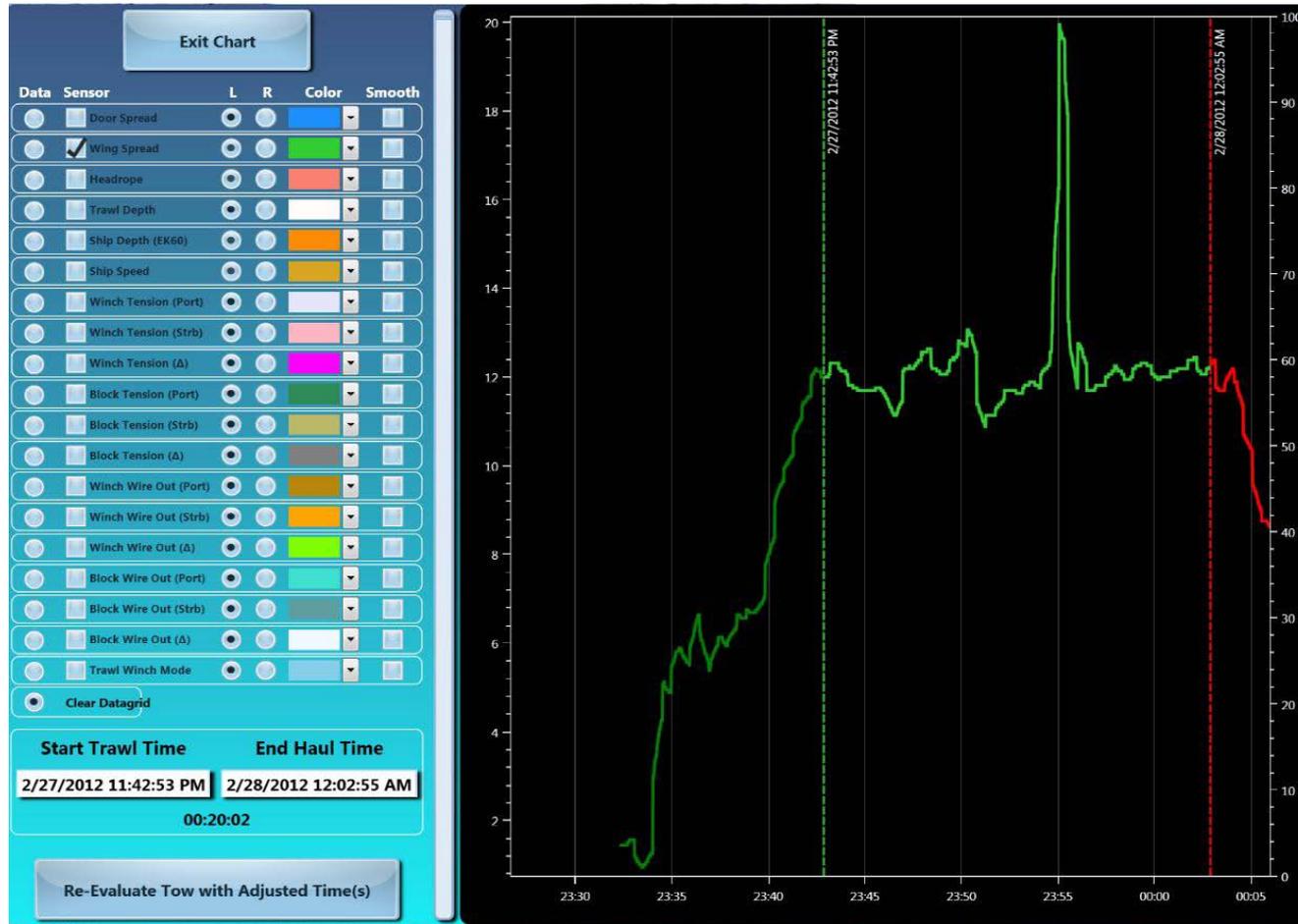
**Invalid Data Streams**

- Door Sensors
- Wing Sensors
- Headrope Sensors
- Trawl Depth
- EK60 Depth
- Ship Speed
- Block Tension
- Winch Wire Out
- Block Wire Out
- Tow Duration
- GPS
- % Tow in Strata

**Sensor Use**

Door (Master)	Door (Slave)	Trawl Sounder
A4335	MIR3830	TS2287
12 - 1 2:30	12 - 1 2:30	4 - 0 5:50
Wing (Master)	Wing (Slave)	
A7070	MR6248	
3 - 0 3:34	3 - 0 3:34	
Headrope	Depth	
N/A	HC12656	
N/A	3 - 0 3:34	

# Multispecies Bottom Trawl Survey: Tow Standardization Efforts





# Multispecies Bottom Trawl Survey: Products

## Biomass, Abundance and Distribution

- Stock assessments (>45 species)
- Ecosystems management
- Essential fish habitat
- Area closures
- Rotational management

## Demographics – size, age, sex

- Stock assessments
- Rotational management
- Effects of removals

## Feeding Habits

- Predator- prey relationships
- Ecosystems management

## Cooperative Endeavors

- Thousands of partners
- Life history
- Genetics
- Stock differentiation
- Animal health

# Multispecies Bottom Trawl Survey: Strengths

Time-series length

Survey design

Standardization – gear, tow, catch processing

- Tow evaluation process / data quality control – real-time

# Multispecies Bottom Trawl Survey: Challenges

Expense, competition for limited NOAA sea day capacity

Reduced inshore sampling

Sampling intensity

Sweep efficiency/selectivity

Bottom contact

Strata boundaries

Survey drift

Stakeholder confidence

# Multispecies Bottom Trawl Survey: Proposed Solutions

Expense/competition – use alternate smaller NOAA or contract vessels  
(would require additional calibration or way of mitigating uncalibrated vessel effects)

Reduced inshore sampling – NEAMAP activity

Sampling intensity – reallocate stations

Sweep efficiency/selectivity – video technology investments, HabCam

Bottom contact – trawl eye, bottom-contact sensor development

Strata boundaries – ship time with multi-beam

Survey drift – extensive metadata, documentation

Stakeholder confidence – cooperative research, outreach