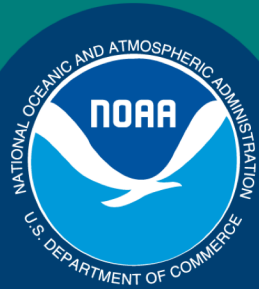


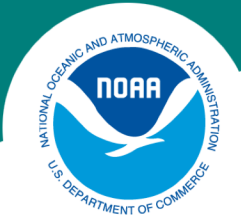
Science, Service, Stewardship



Proposed CPUE Expansion Estimation for Total Discards of Gulf of Mexico Red Grouper

**NOAA
FISHERIES
SERVICE**

Steven G. Smith, Allison C. Shideler, Kevin J. McCarthy
September 2018



Background – Discard Calculation

- General Approach: Catch per unit effort (CPUE) expansion to calculate total catch

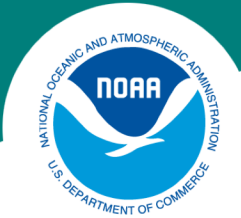
$$\text{total Catch} = \frac{\text{Catch}}{\text{Effort}} \times \text{Total Effort}$$

- CPUE data from Coastal Observer Program
- Total Effort from Commercial Reef Logbooks
- Discards: CPUE computed for various disposition categories (released alive, released dead, etc.)



General Methods

- Data Sources
 - Reef Observer (July 2006 – present; 2007 – 2017 used for analysis)
 - Reef Logbook (1993 – present; 1993 – 2017 used for analysis)
- Analysis of Effort Variables
 - Trip Matching
 - By Gear type – Bottom Longline, Vertical Line (Hook and Line, Bandit)
 - Comparison of Trip-level Effort Variables
 - Paired t-test
- Catch Expansion
- Application to all catch dispositions, including discards (dead and live/unclassified).



Identifying an appropriate effort variable

- Logbook data is collected at the trip level
- Observer data is set-level data with much more detail
 - Longline – Set = one deployment and retrieval of gear
 - Vertical Line – Set = Fishing at a distinct location
- Challenge: to compute a trip-level observer effort variable that corresponds to a logbook effort variable
- Common Issue: Not all sets for a trip may have been fully sampled by an observer.



Effort Variables -- Longline

2018 SE COASTAL FISHERIES TRIP REPORT FORM **Use Black Ink only!** OMB Control No. 0648-0016 Expiration Date: 9/30/2019
Version Date 07/17

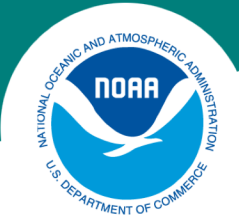
Signature: _____ Phone No.: () - _____ Schedule No. **NMFS Use Only**

Vessel: _____ Trip Start Date: MM DD YY County or Parish: _____ State: _____
Dealer Name: _____
SE Federal Dealer Number: _____
State Trip Ticket No.: _____
Check box if landings sold to multiple dealers: Yes

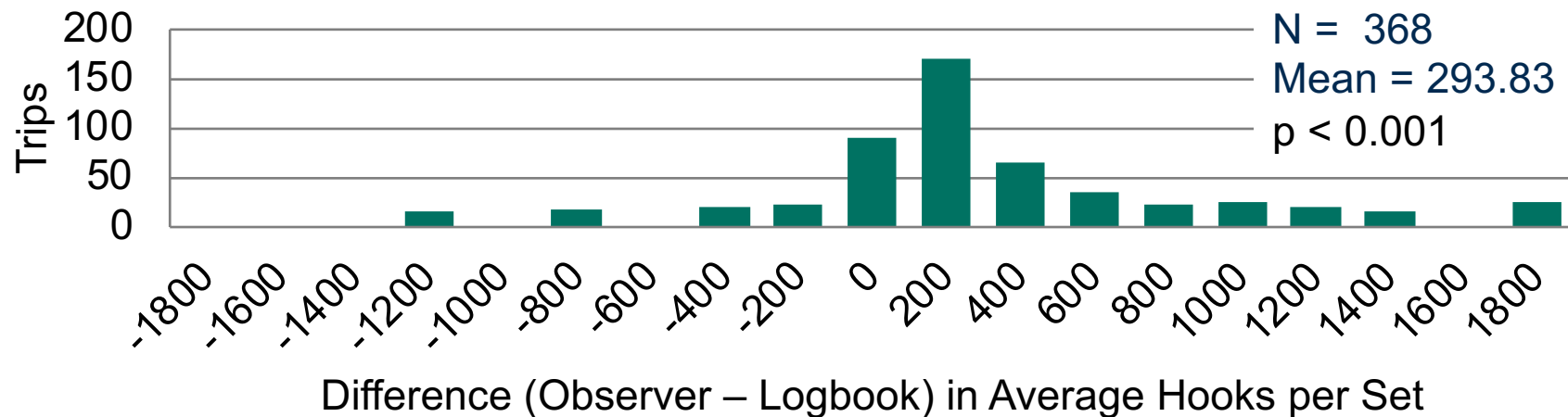
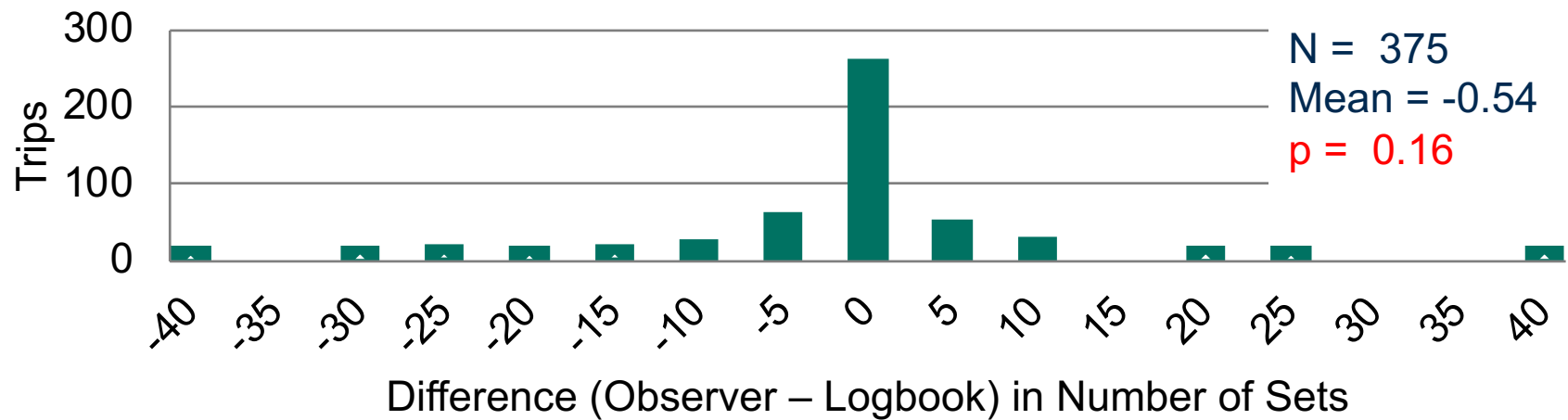
INSTRUCTIONS: See Instructions on Page 2. Check gear box and fill in all the boxes below.

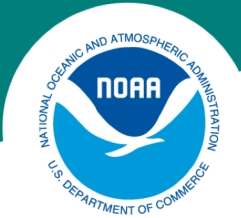
<input type="checkbox"/> Longline(L) <input type="checkbox"/> Bottom <input type="checkbox"/> PLL <input type="checkbox"/> Other	<input type="checkbox"/> Gill Net (GN) <input type="checkbox"/> Drift <input type="checkbox"/> Strike <input type="checkbox"/> Anchor <input type="checkbox"/> Other	<input type="checkbox"/> Hook & Line <input type="checkbox"/> Hand <input type="checkbox"/> Bandit <input type="checkbox"/> Trolling <input type="checkbox"/> Buoy	<input type="checkbox"/> Divers (S) <input type="checkbox"/> Spear Power (P)	<input type="checkbox"/> Other Gear (O)
# Sets	# Sets	# Lines	# of Divers	Type
# Hooks per Line	Length (yards)	# Hooks per Line	Total Hrs Fished	Total Hrs Fished
Set Soak Time (hrs)	Depth (yards)	Total Hrs Fished	SE VTR #: R18100001	
Total Soak Time (hrs)	Set Soak Time (hrs)	Date Received: _____ NMFS use only		
Length (miles)	Length (miles)	Mesh: _____		

Logbook Trip Effort Variable	Corresponding Observer Effort Variable(s)
Number of Sets	Sampled Sets + Unsampled Sets
Average Hooks per Set	Sum of Sampled Set Hooks / Sampled Sets
Average Soak Time (hrs) per Set	For sampled sets: Estimated from various hook in / hook out times
Total Hooks Fished	
Hook Hours	



Effort Variable Comparison





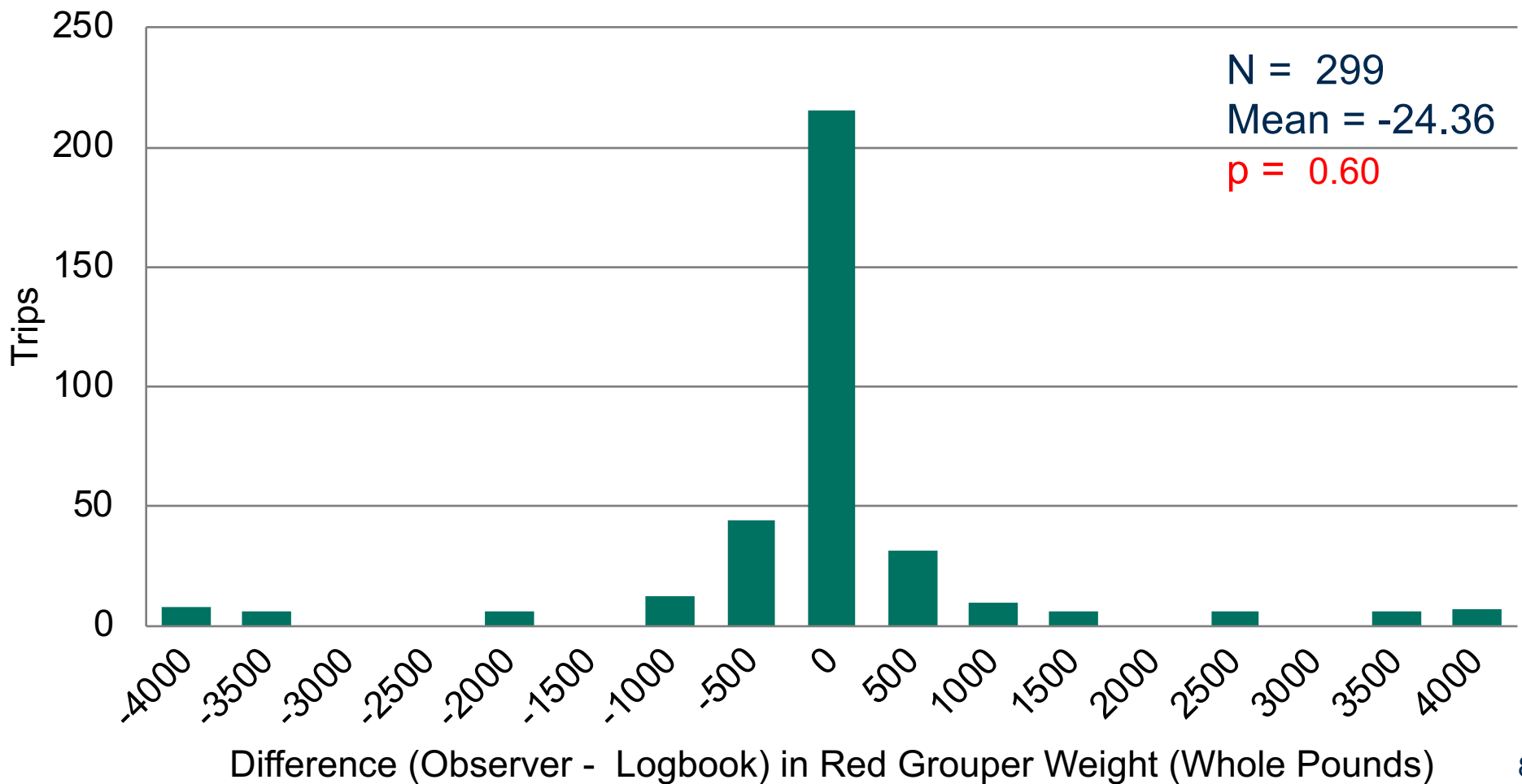
Soak Time Calculations from Observer Data

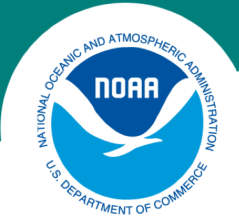


Effort Variable	Number of Trips	Mean Difference	SE	p
Average Soak Hours per Set 1	355	2.327	0.084	< 0.0001
Average Soak Hours per Set 2	301	1.232	0.078	< 0.0001

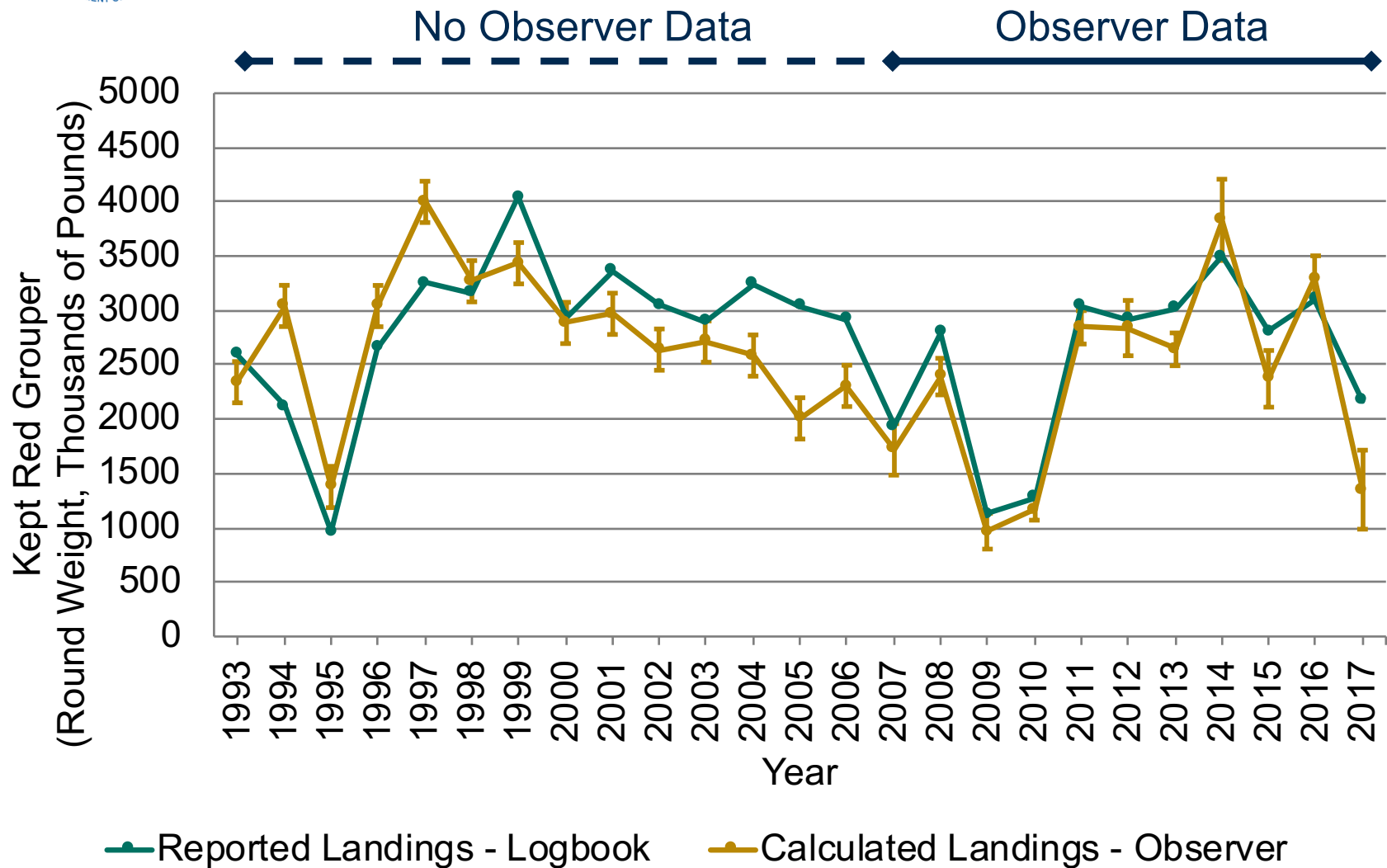


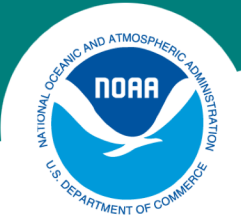
CPUE Catch Expansion – Longline Matched Trip Comparison



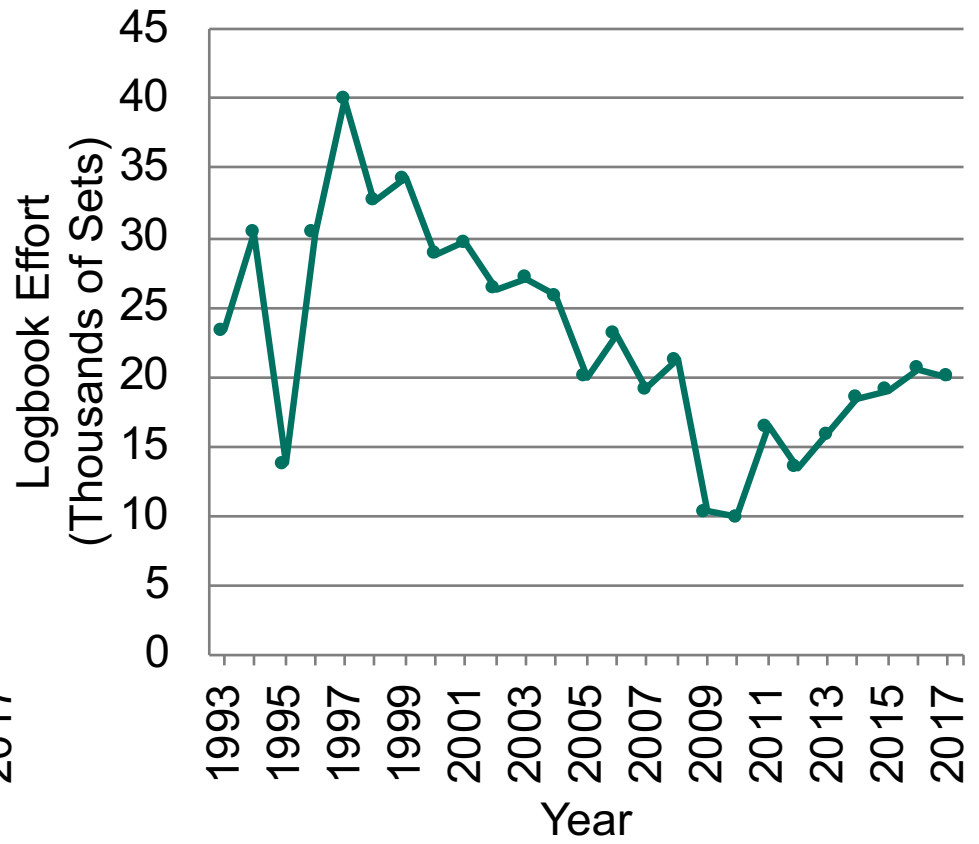
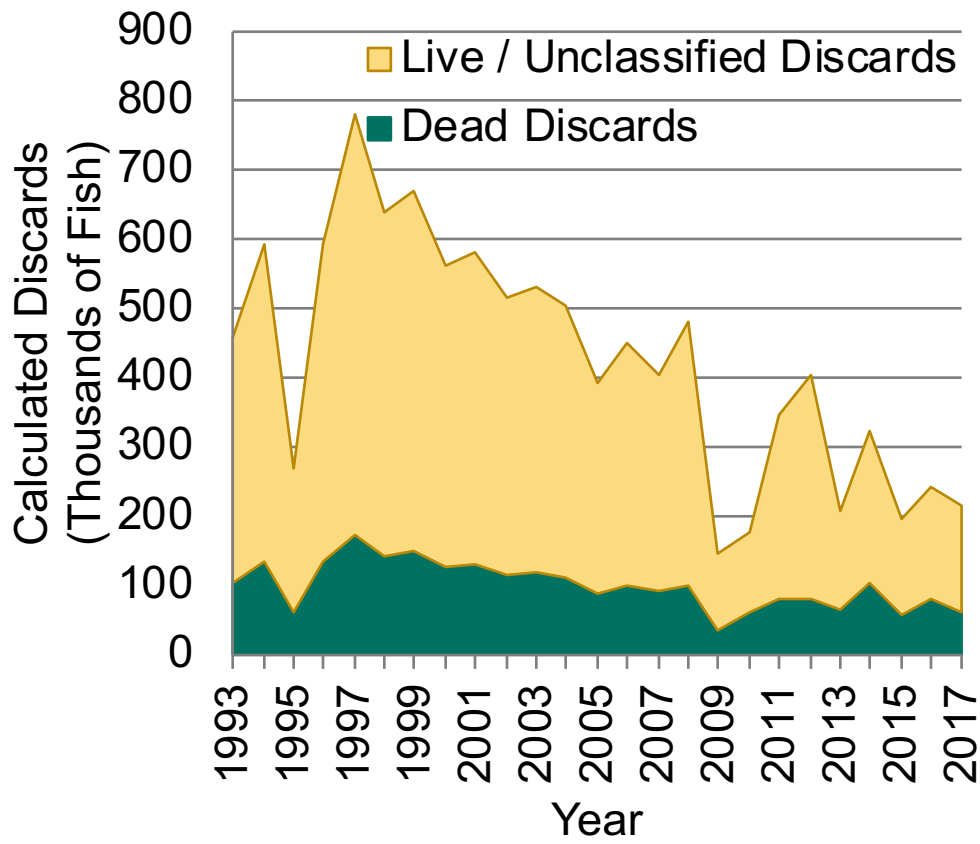


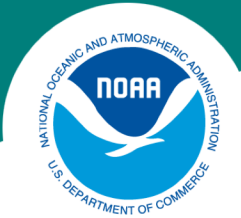
CPUE Catch Expansion - Longline



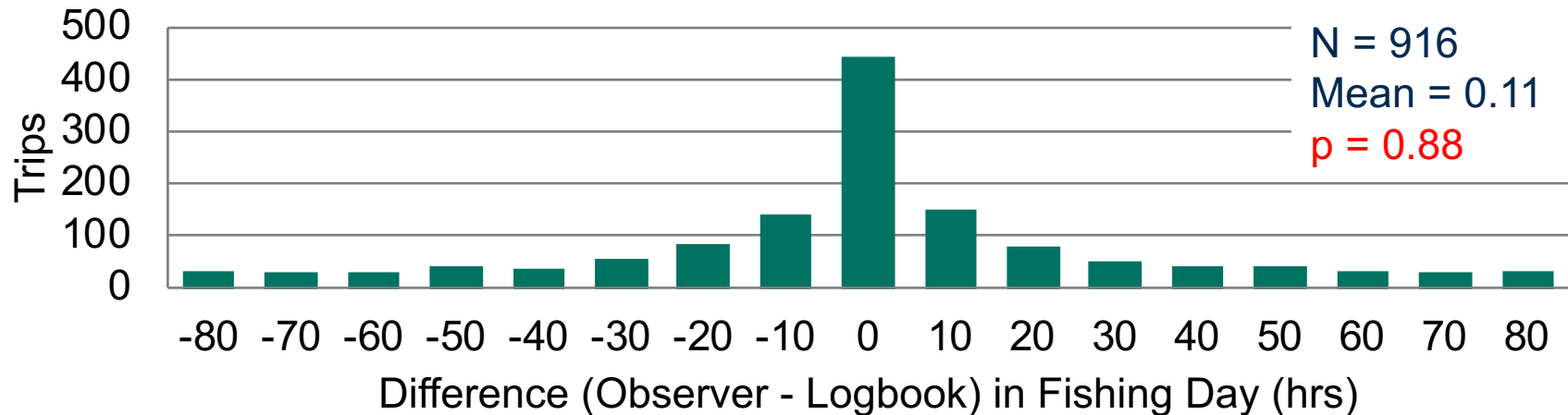
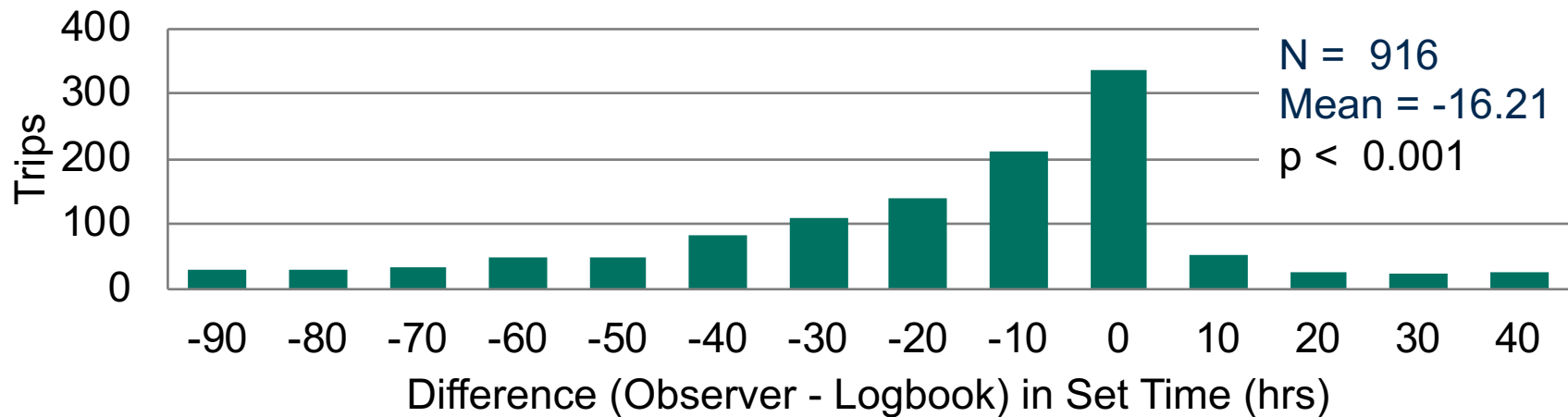


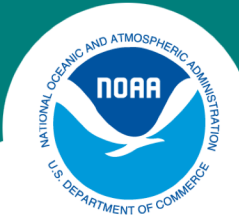
Discard Estimation -- Longline





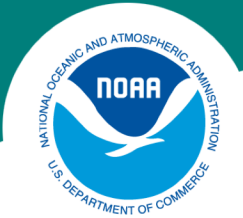
Effort Variable Comparison





Effort Variable Comparison

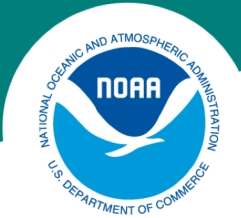
Effort Variable	<i>n</i>	Mean Difference	SE Difference	<i>p</i>-value
Set Time (hrs)	916	-16.21	0.74	<0.0001
Fishing Day (hrs)	916	0.11	0.73	0.8831
Average Lines per Set	916	-0.310	0.039	<0.0001
Maximum Lines	916	0.356	0.046	<0.0001
Average Hooks per Line 1 (gear configurations)	916	-0.95	0.17	<0.0001
Average Hooks per Line 2 (sampled lines/sets)	916	-0.36	0.16	0.0226



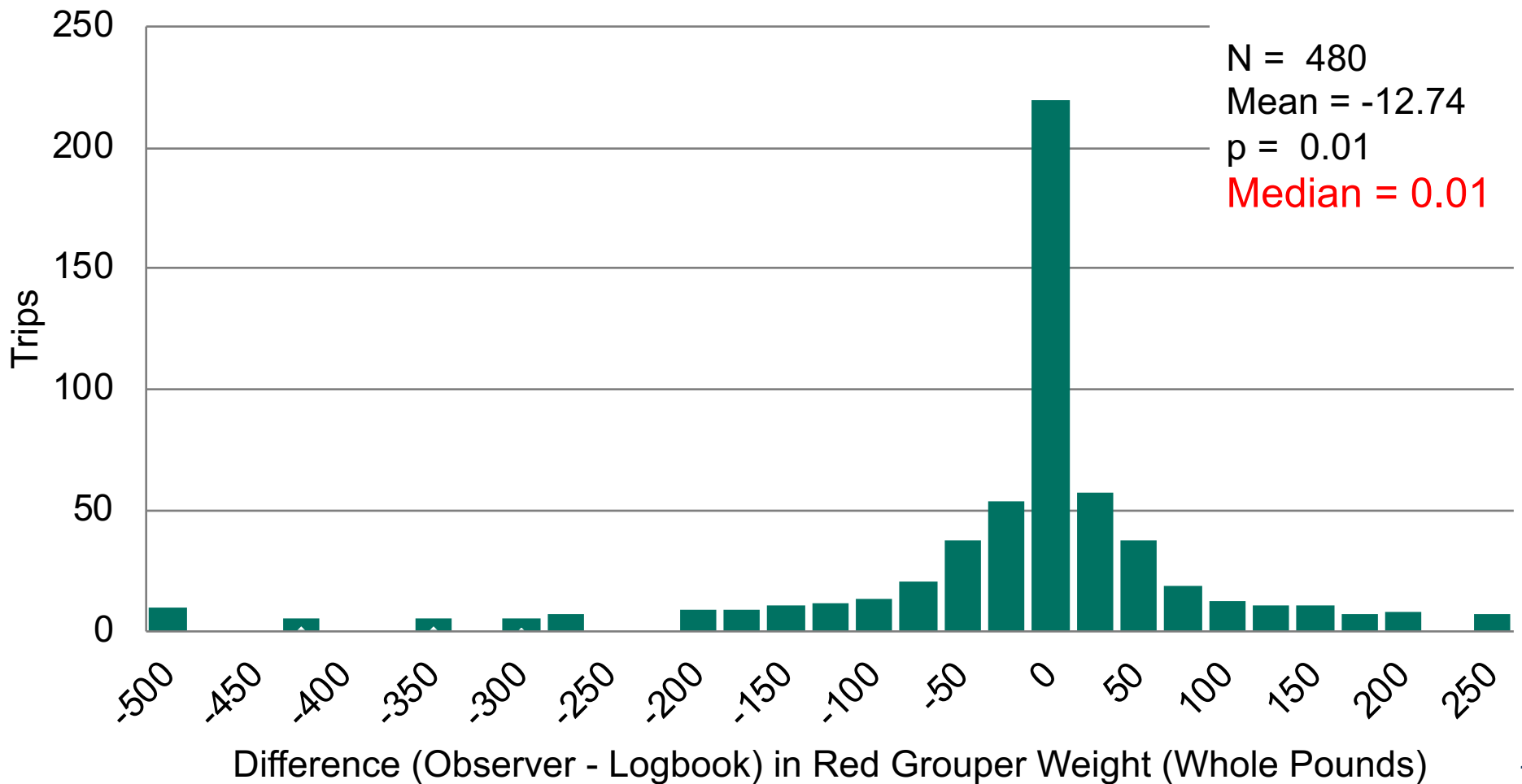
Catch Expansion

Subsampling:

- ↳ Sets within a trip
 - ↳ Reels within a set
 - ↳ Drops within a reel

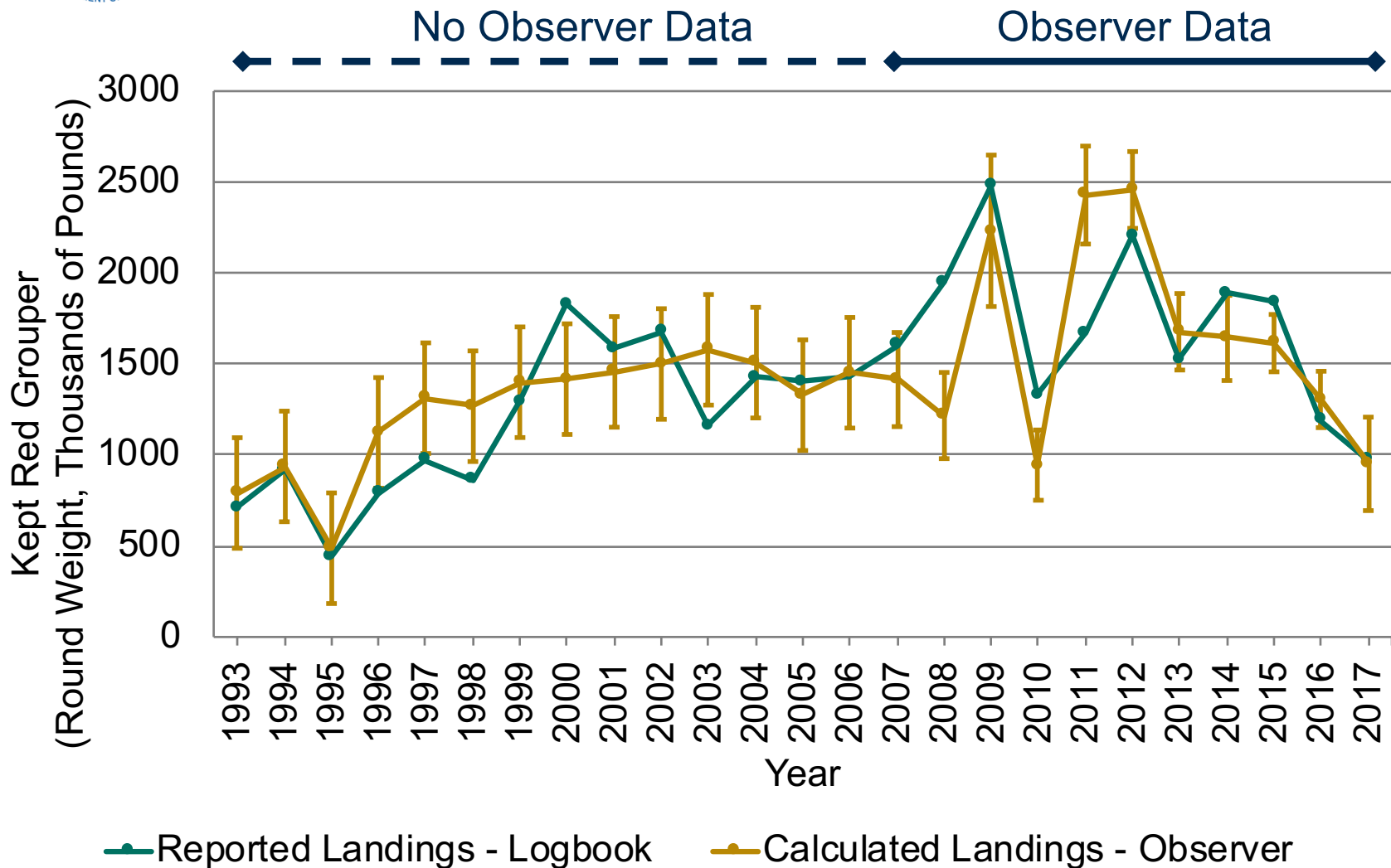


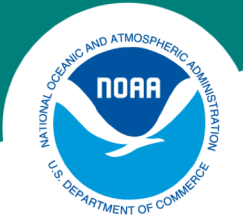
CPUE Catch Expansion – Vertical Line Matched Trip Comparison



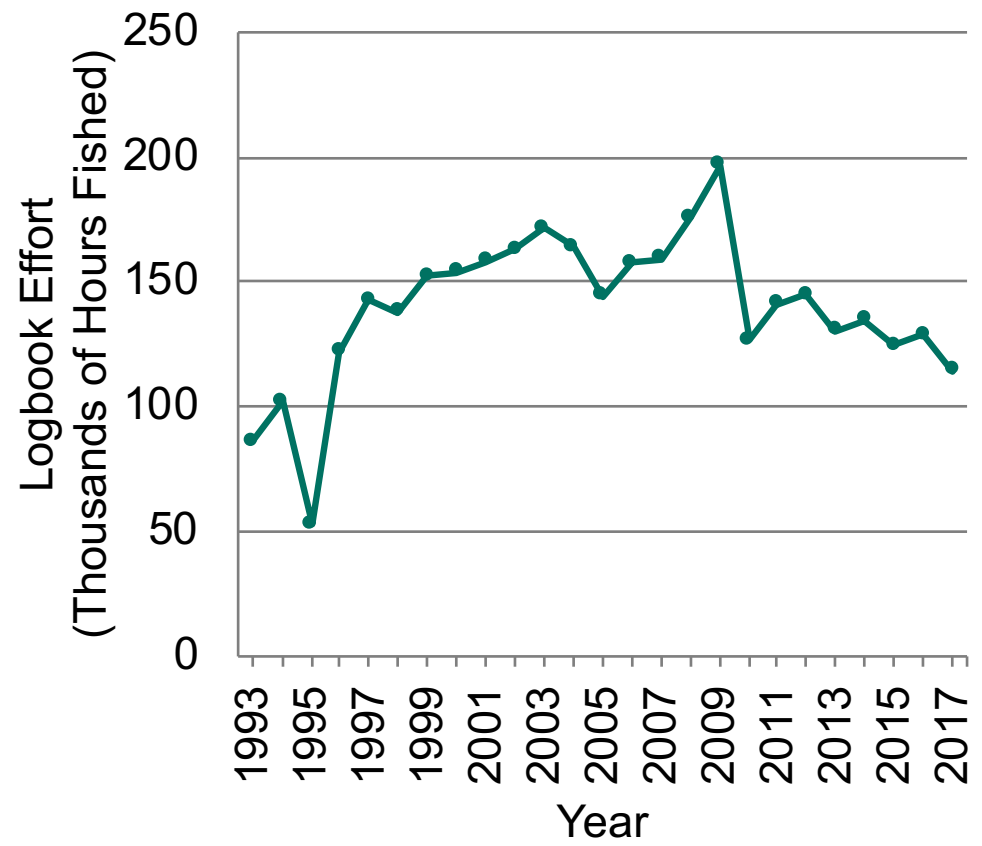
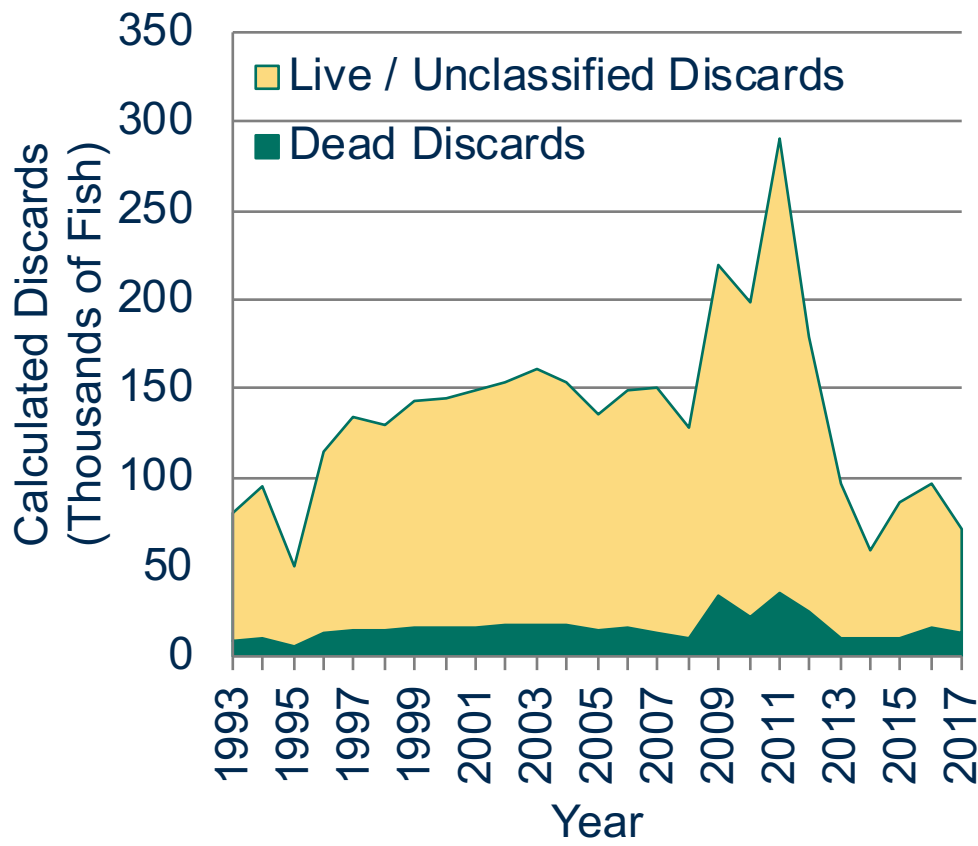


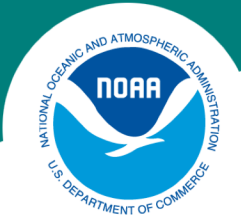
CPUE Catch Expansion - Vertical Line





Discard Estimation - Vertical Line





Conclusion: Discard Calculation

$$\text{total Catch} = \frac{\text{Catch}}{\text{Effort}} \times \text{Total Effort}$$

- CPUE from the Observer Program Data
 - Catch – Expanded from sub-trip level to trip-level
 - Effort – Determined matching effort variables between logbook and observer data sets
 - Bottom Longline: Number of Sets
 - Vertical Line: Fishing Day
- Estimated landings closely follow logbook reported landings