



Estimating Gulf of Mexico Commercial Discards using Reef Fish Observer Data

**NOAA
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Background – Discard Calculation

- General Approach: Discards per unit effort (DPUE) expansion to estimate total discards

$$\text{Total Discards} = \frac{\text{Discards}}{\text{Effort}} \times \text{Total Effort}$$

- DPUE data from Reef Fish Observer Program
- Total Effort from Commercial Coastal Logbooks



General Methods

- Data Sources
 - Reef Observer (mid-2006 – present; 2007 – 2017/18 used for analysis)
 - Coastal Logbook (1990 – present; 1993 – 2017/18 used for analysis)
- Analysis of Effort Variables
 - Trip Matching (Observer to Logbook match)
 - By Gear type – Bottom Longline, Vertical Line (Handline, Bandit reels)
 - Comparison of Trip-level Effort Variables
 - Paired t-test
- Application to all catch dispositions, including discards
 - Landings estimation as validation of the method



Identifying an appropriate effort variable

- Logbook data are collected at the trip level
- Observer data are 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

$$\text{Total Discards} = \frac{\text{Discards}}{\text{Effort}} \times \text{Total Effort}$$



Effort Variable Comparison – Vertical Line

| 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 |



Appropriate Effort Variables

Vertical line

Total hours fished per trip (sum of hours fished per day x the number of days fished)

Bottom Longline

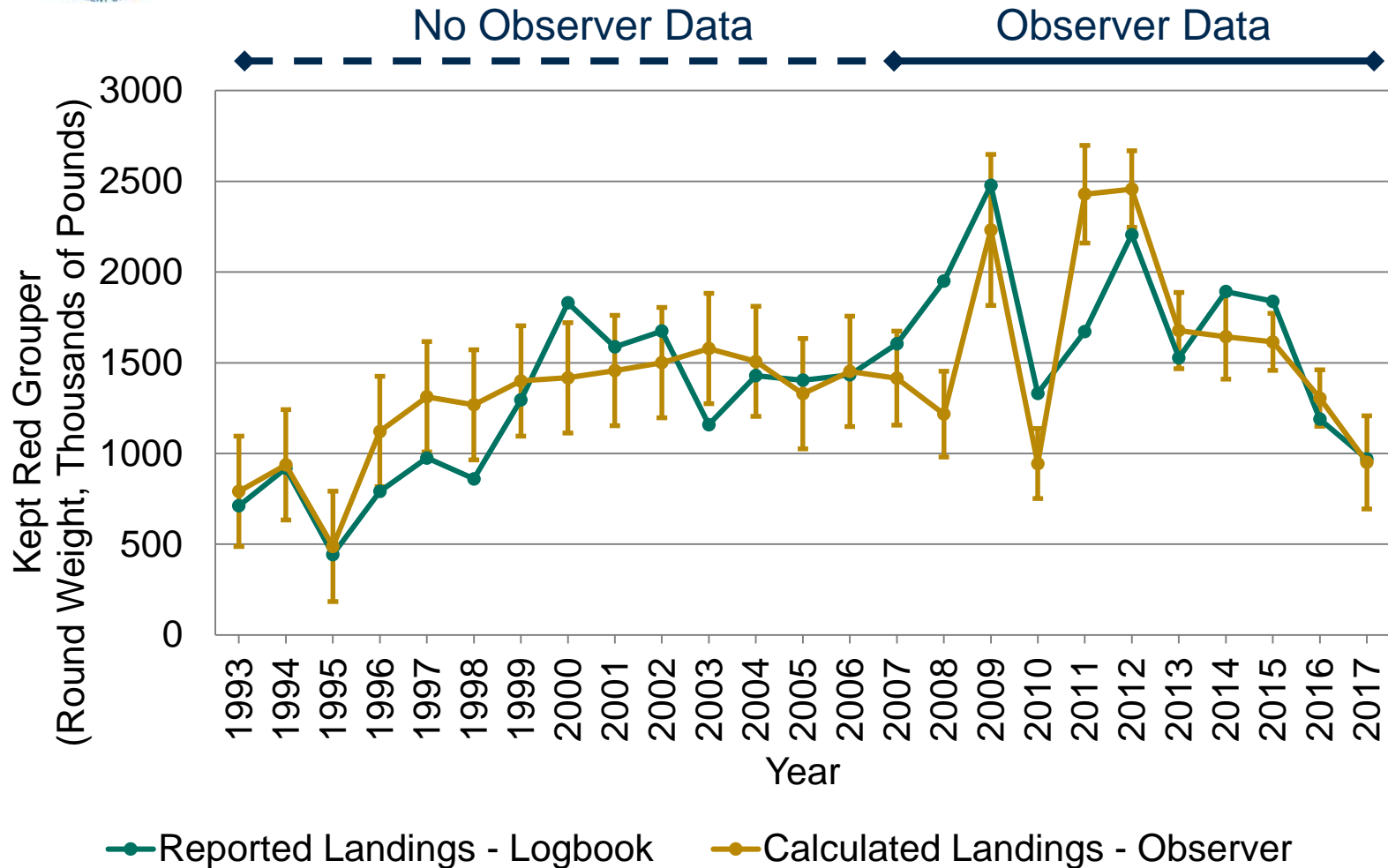
Number of sets per trip

Method validation:

$$\text{Total Landed Fish} = \frac{\text{Landed Fish}}{\text{Effort}} \times \text{Total Effort}$$

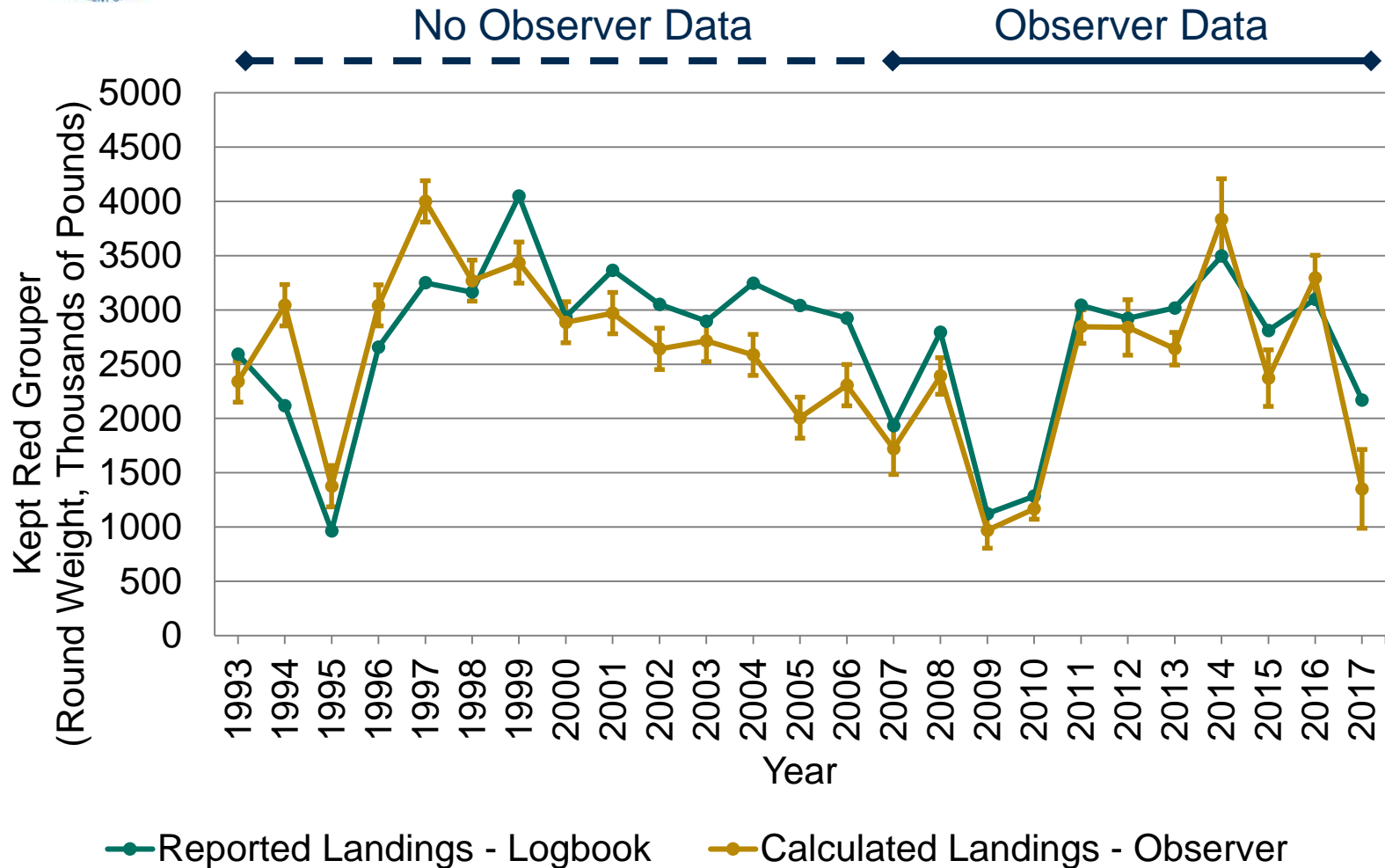


CPUE Catch Expansion - Vertical Line





CPUE Catch Expansion - Longline





Summary: Discard Calculation

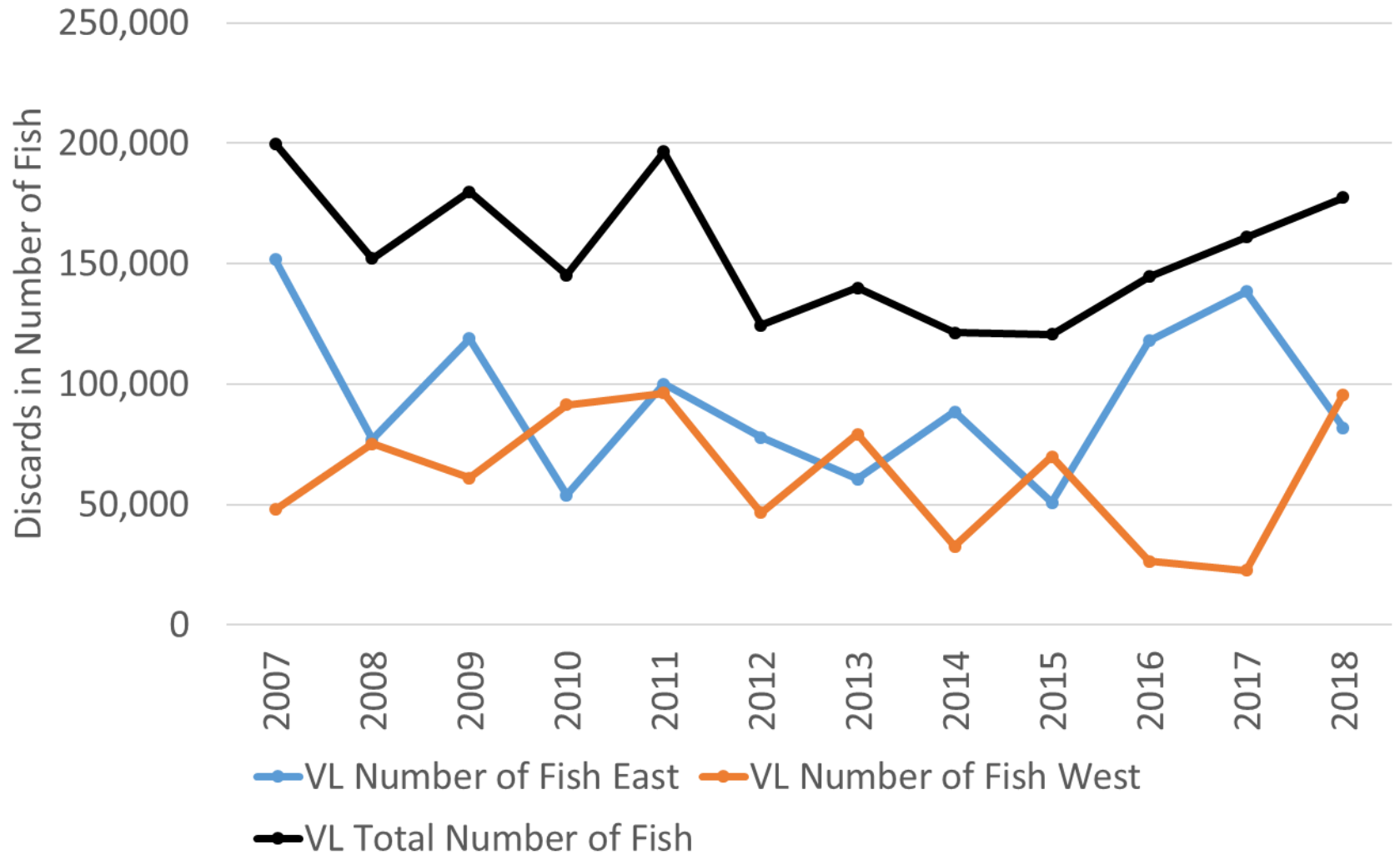
$$\text{Total Discards} = \frac{\text{Discards}}{\text{Effort}} \times \text{Total Effort}$$

- DPUE from the Observer Program Data
 - Discards – 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: Total Hours Fished per Trip
- Estimated landings closely follow logbook reported landings

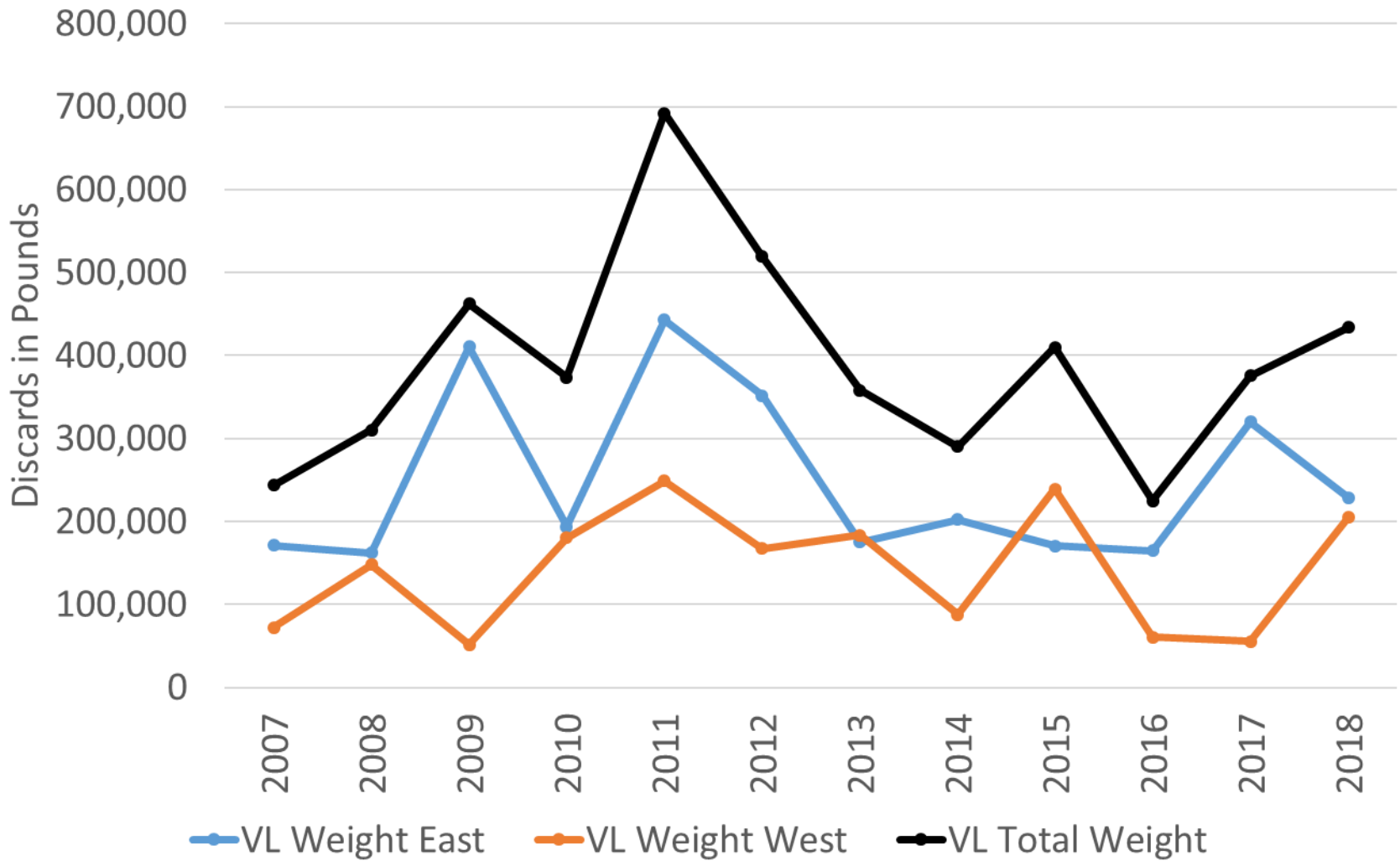


Estimated Red Snapper and Red Grouper Discards

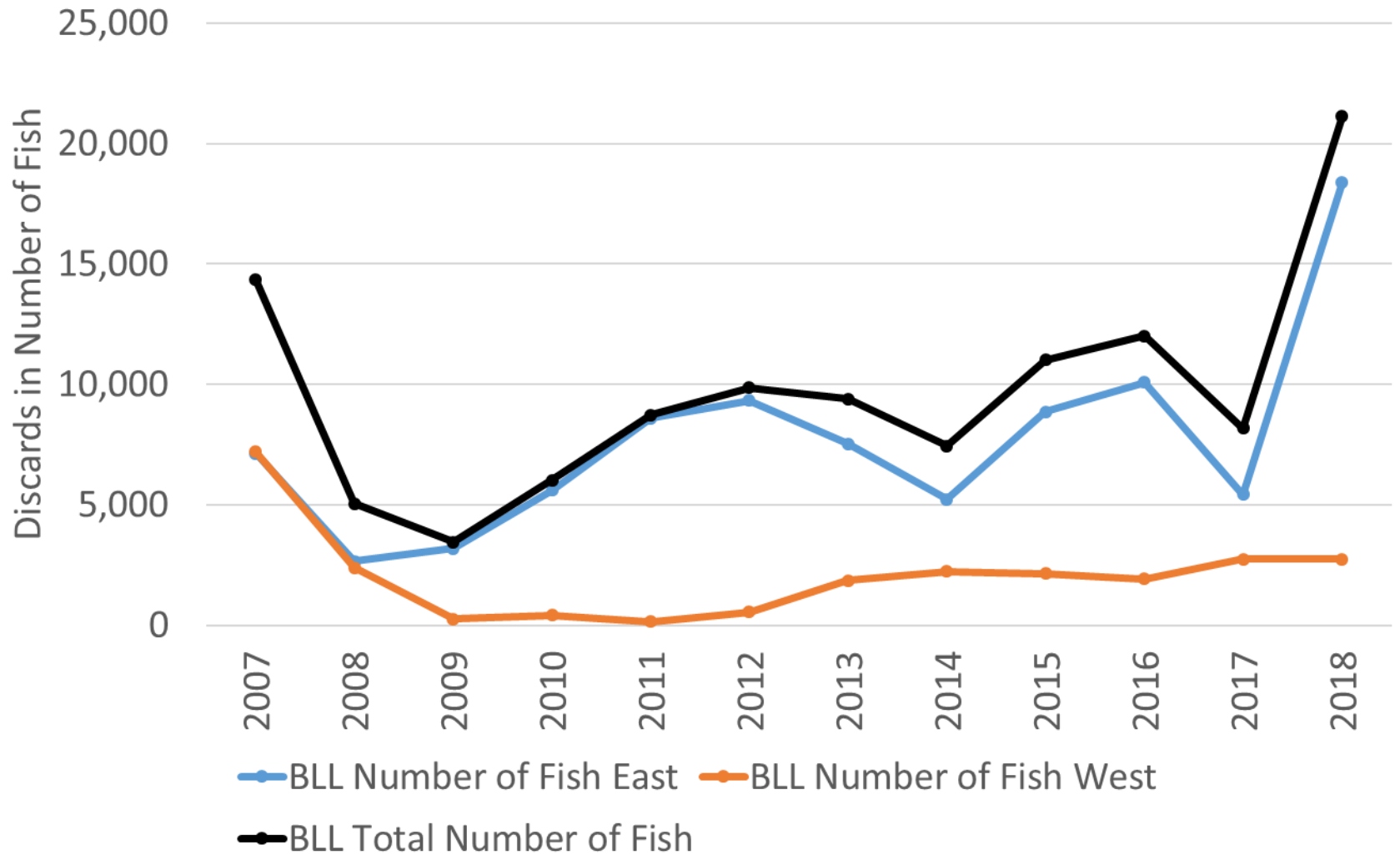
Red Snapper Estimated Commercial Discards - VL



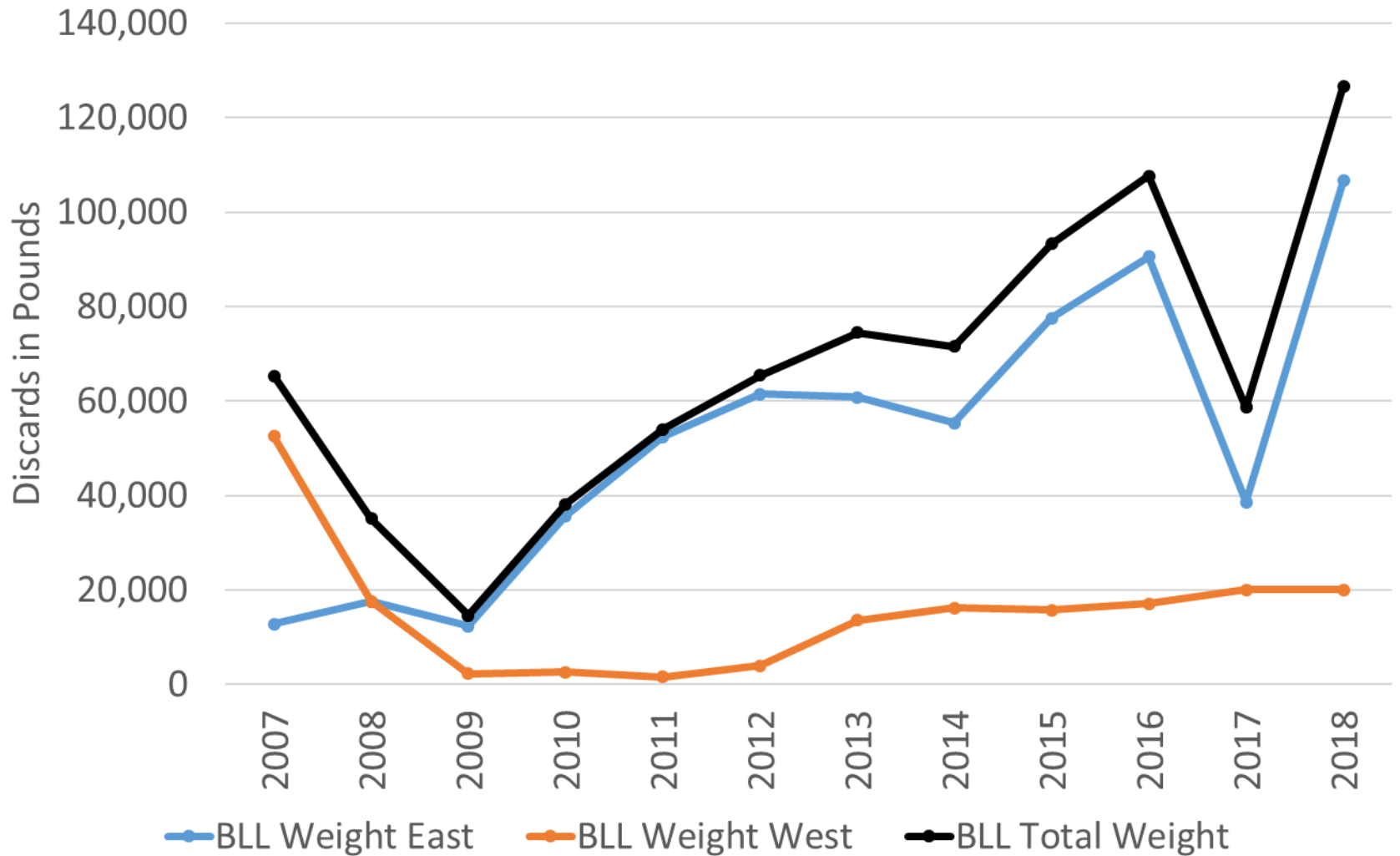
Red Snapper Estimated Commercial Discards - VL



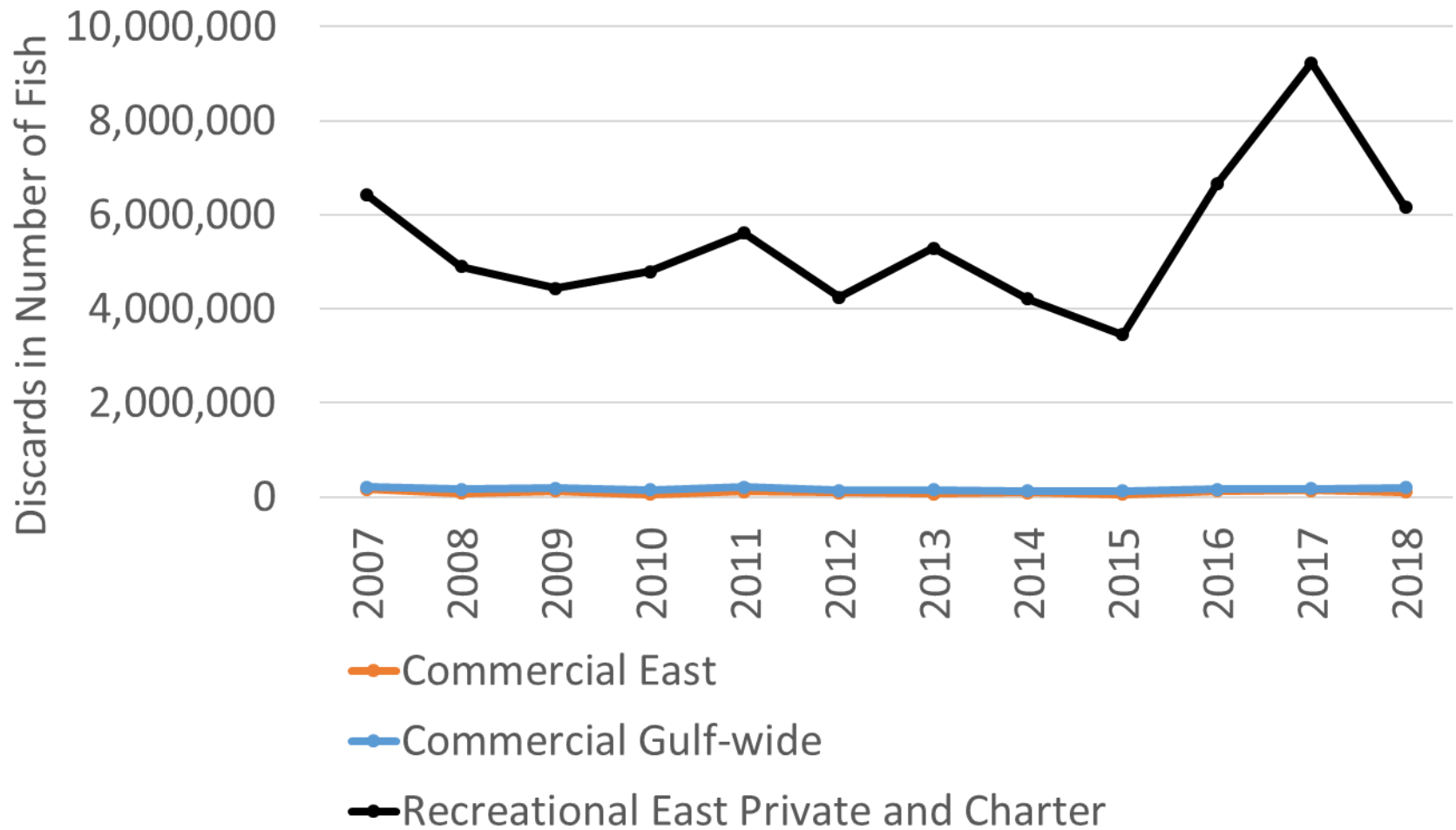
Red Snapper Estimated Commercial Discards - BLL



Red Snapper Estimated Commercial Discards - BLL



Red Snapper Discards: Commercial East, Commercial Gulf-wide, Recreational East Compared





Commercial Fishery (Vertical Line and Bottom Longline) and Recreational Fishery Red Snapper Estimated Discards Compared
(total discards in number of fish)

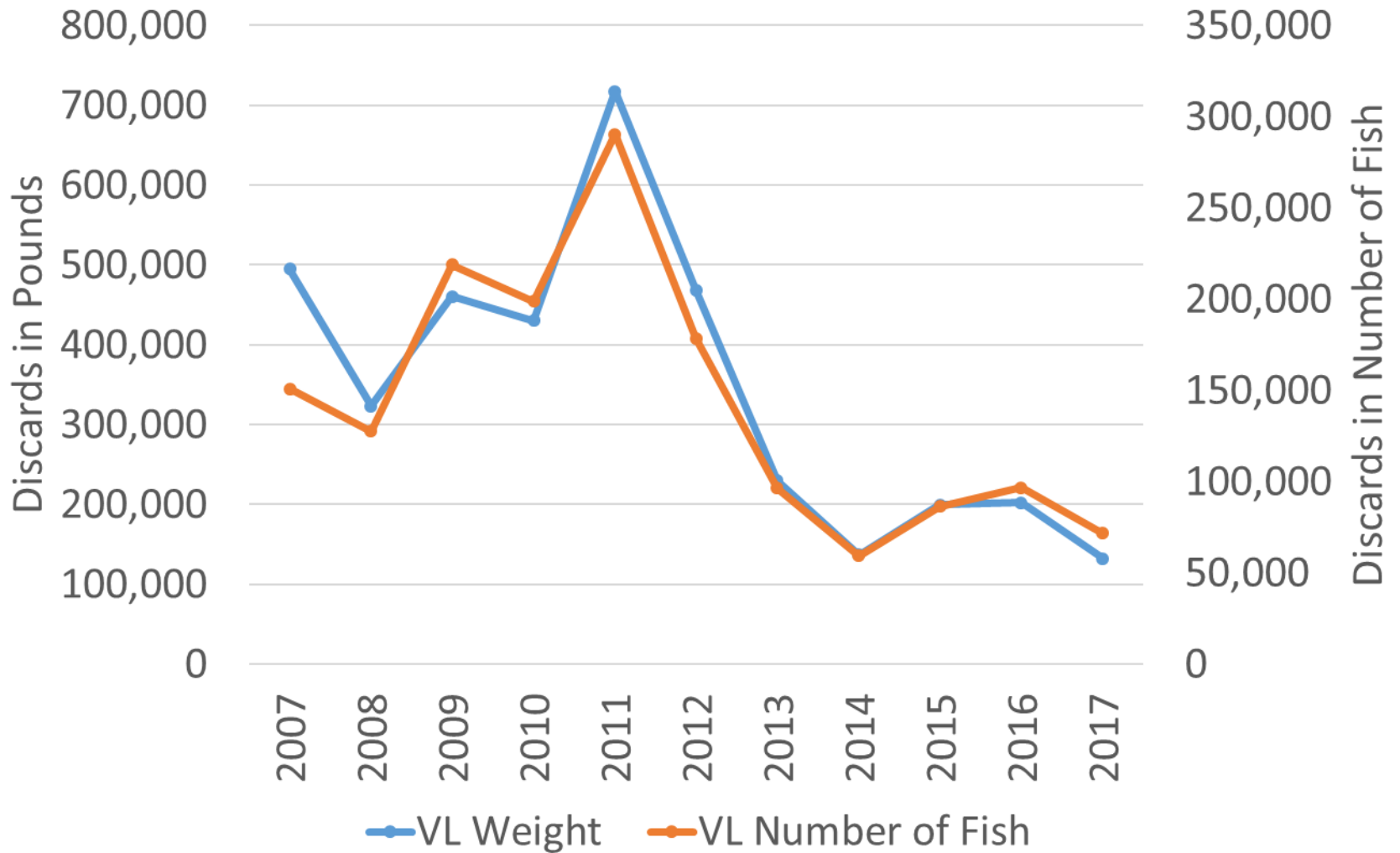
| Year | Commercial East | Recreational East Discards (B2) | Commercial Discards % of Total |
|------|-----------------|---------------------------------|--------------------------------|
| 2007 | 158,909 | 6,426,573 | 2.4 |
| 2008 | 79,550 | 4,899,209 | 1.6 |
| 2009 | 122,181 | 4,432,976 | 2.7 |
| 2010 | 59,459 | 4,786,077 | 1.2 |
| 2011 | 108,745 | 5,607,985 | 1.9 |
| 2012 | 87,136 | 4,245,404 | 2.0 |
| 2013 | 68,137 | 5,294,055 | 1.3 |
| 2014 | 93,817 | 4,205,008 | 2.2 |
| 2015 | 59,666 | 3,455,311 | 1.7 |
| 2016 | 128,153 | 6,649,843 | 1.9 |
| 2017 | 143,821 | 9,227,951 | 1.5 |
| 2018 | 100,306 | 6,153,547 | 1.6 |



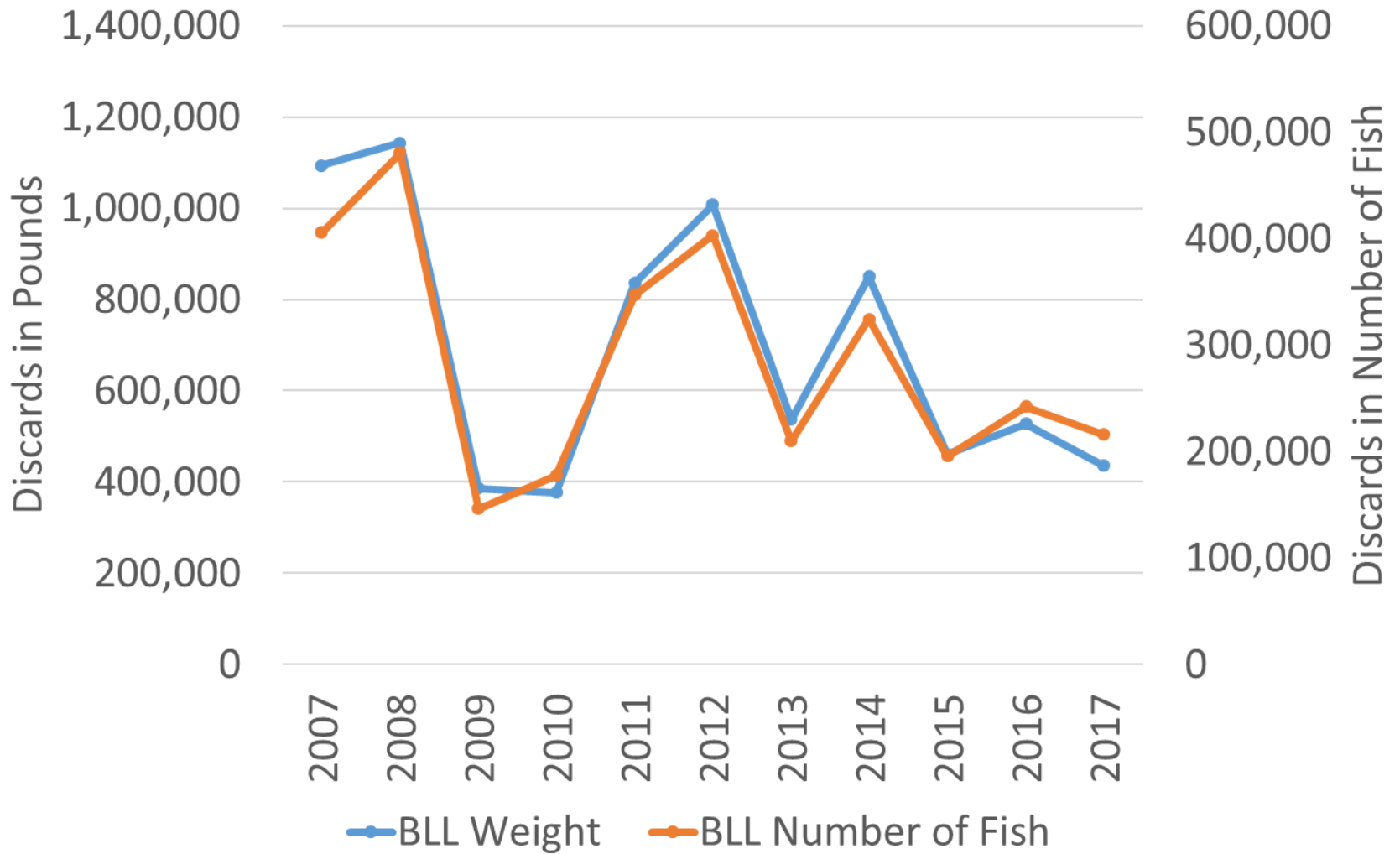
Commercial Fishery (Vertical Line and Bottom Longline) and Recreational Fishery Red Snapper Estimated Discards Compared
(total discards in number of fish)

| Year | Commercial East | Commercial Gulf-wide | Recreational East Discards (B2) | Commercial Discards % of Total (East only) | Commercial Discards % of Total (Gulf-wide) |
|------|-----------------|----------------------|---------------------------------|--|--|
| 2007 | 158,909 | 214,101 | 6,426,573 | 2.4 | 3.2 |
| 2008 | 79,550 | 157,113 | 4,899,209 | 1.6 | 3.1 |
| 2009 | 122,181 | 183,349 | 4,432,976 | 2.7 | 4.0 |
| 2010 | 59,459 | 151,374 | 4,786,077 | 1.2 | 3.1 |
| 2011 | 108,745 | 205,154 | 5,607,985 | 1.9 | 3.5 |
| 2012 | 87,136 | 134,354 | 4,245,404 | 2.0 | 3.1 |
| 2013 | 68,137 | 149,309 | 5,294,055 | 1.3 | 2.7 |
| 2014 | 93,817 | 128,671 | 4,205,008 | 2.2 | 3.0 |
| 2015 | 59,666 | 131,657 | 3,455,311 | 1.7 | 3.7 |
| 2016 | 128,153 | 156,524 | 6,649,843 | 1.9 | 2.3 |
| 2017 | 143,821 | 169,155 | 9,227,951 | 1.5 | 1.8 |
| 2018 | 100,306 | 198,642 | 6,153,547 | 1.6 | 3.1 |

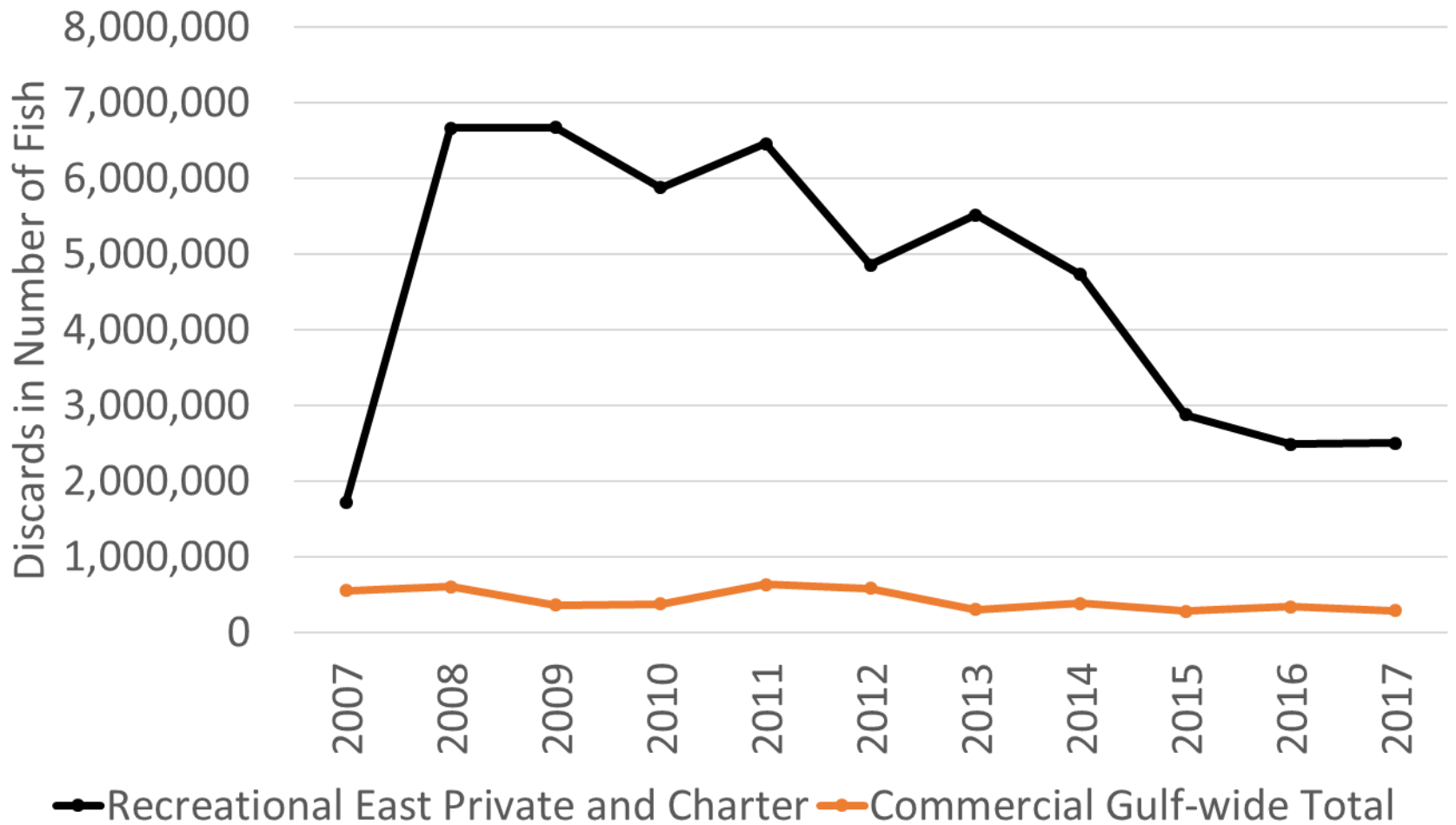
Red Grouper Estimated Commercial Discards - VL



Red Grouper Estimated Commercial Discards - BLL



Red Grouper Discards: Commercial Gulf-wide and Recreational East Discards Compared





Commercial Fishery (Vertical Line and Bottom Longline) and Recreational Fishery Red Grouper Estimated Discards Compared
(total discards in number of fish)

| Year | Commercial Gulf-wide | Recreational East Discards (B2) | Commercial Discards % of Total |
|------|----------------------|---------------------------------|--------------------------------|
| 2007 | 556,583 | 1,711,604 | 24.5 |
| 2008 | 608,191 | 6,662,610 | 8.4 |
| 2009 | 365,463 | 6,674,316 | 5.2 |
| 2010 | 376,254 | 5,877,946 | 6.0 |
| 2011 | 637,402 | 6,455,272 | 9.0 |
| 2012 | 581,639 | 4,856,994 | 10.7 |
| 2013 | 306,266 | 5,515,843 | 5.3 |
| 2014 | 384,108 | 4,728,813 | 7.5 |
| 2015 | 282,295 | 2,877,717 | 8.9 |
| 2016 | 339,171 | 2,486,211 | 12.0 |
| 2017 | 287,704 | 2,504,895 | 10.3 |



Summary: Red Snapper Discards

- Red Snapper Estimates for Eastern and Western Gulf
 - *Vertical line discards:*
 - Account for >90% of total discards (121,000 – 200,000 fish)
 - In most (2/3) years more discards in the eastern Gulf of Mexico
 - *Bottom longline discards:*
 - Account for <10% of discards (3,400 – 21,000 fish)
 - In most years more discards in the eastern Gulf of Mexico
- Estimated recreational Red Snapper discards account for 96 – 98% of all discarded Red Snapper per year
 - Recreational percentage higher if western Gulf included



Summary: Red Grouper Discards

- Red Grouper Estimated for Entire Gulf of Mexico
 - *Vertical line discards:*
 - Account for approximately 30% of commercial Red Grouper discards except during 2009-2011 (55 – 60%)
 - *Bottom longline discards:*
 - Account for approximately 70% of commercial discards except during 2009-2011
- Recreational discards:
 - >90% of all discarded Red Grouper, except during 4 nonconsecutive years (largest commercial percentage of discards was in 2007 - approximately 25% of discards)
 - Recreational percentage higher if western Gulf included



Questions?