Discard Estimation Methodology Review

Estimator Performance Simulation Study (Part 1)

Working Paper #2 for TOR 1 & 2

Compare Different Estimators using Observer Data

- Observer trip data was retrieved to produce a dataset based on semi-actual data to capture the expected variation associated with observer discard data.
- Stock and gear specific observer trip data was retrieved to produce a years worth of data with a trip occurring on each day of the year.
- Randomization & calculations were done in excel.

Compare Different Estimators using Observer Data

- The sum of all observer trip data was considered the total landings and discards in the simulation.
- Calculations of the different estimators was done by randomly picking observer trips (day) using a target observer coverage rate.
- Iterations through random draws of observed trips was used to illustrate the variation among the estimators.

Compare Different Estimators using Observer Data

- Estimators compared were 20, 35, and 50 day d/k_all moving window, cumulative d/k_all method, combined ratio estimator, quarter stratified d/k_all estimator.
- Observer coverage rates examined were 10%, 20%, 40%, 60%, and 95%.
- Scenarios examined were GOM Cod, GOM Cod random trip (day) order, GB Haddock (high discards associated with a strong year class in the beginning, middle and end of the year), and a artificial extreme trend in the discards through an ascending and descending sort of the GB Haddock discard rates.
- 5000 random iterations were done on 7 scenarios X 5 different coverage rates (175,000 iterations).

Compare Different Estimators using Observer Data

- For the moving average estimators if an observed trip occurred then the actual discards for that trip was used in the calculation. For the cumulative method the results are the same whether this is or is not explicitly accounted for.
- Estimated ratios within the initial (startup) window is calculated from all trips in the initial window. This information is not available until the day after the end date of the initial window. The cumulative methods starts on day eight in the simulation but this method could be started with the first observed trip.

Separate Ratio Estimator

$$\hat{D}_{1,j} = \sum_{h=1}^{L} K_h r_{s,jh}$$

$$r_{s,jh} = \frac{\sum_{i=1}^{n_h} d_{jih}}{\sum_{i=1}^{n_h} k_{ih}}$$

Combined Ratio Estimator

$$\hat{D}_{2,j} = \sum_{h=1}^{L} K_h r_{c,j}$$

$$r_{c,j} = \frac{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{d_{jih}}{n_h}}{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{k_{ih}}{n_h}}$$

Science, Service, Stewardship

Moving Window Estimators

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Moving Window Estimators

Day	Observer Discard	Trip kept all	ratio		Fishery kept all		Estimated Discards
1	1,000	8,000	0.08974		8,000		1,000
2			0.08974		12,000		1,077
3			0.08974		7,000		628
4	500	10,000	0.08974		10,000		500
5			0.08974		18,000		1,615
6			0.08974		12,000		1,077
7			0.08974		6,000		538
8	800	9,000	0.08974		9,000		800
9	1,200	12,000	0.08974		12,000		1,200
10			0.08974		15,000		1,346
11			0.08974	x	14,000	=	1,256
12					8,000		
13					10,000		
14					21,000		
15	1,400	15,000			15,000		
16					14,000		
17					17,000		
18					7,000		
19					11,000		
20					16,000		

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10			0.08974		15,000		1,346
11			0.08974		14,000		1,256
12			0.08065	x	8,000	=	645
13					10,000		
14					21,000		
15	1,400	15,000			15,000		
16					14,000		
17					17,000		
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9	1,200	12,000	0.08974		12,000		1,200
10			0.08974		15,000		1,346
11			0.08974		14,000		1,256
12			0.08065		8,000		645
13			0.08065	x	10,000	=	806
14					21,000		
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16					14,000		
17					17,000		
18					7,000		
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9	1,200	12,000	0.08974		12,000		1,200
10			0.08974		15,000		1,346
11			0.08974		14,000		1,256
12			0.08065		8,000		645
13			0.08065		10,000		806
14			0.08065	x	21,000	=	1,694
15	1,400	15,000			15,000		
16					14,000		
17					17,000		
18					7,000		
19					11,000		
20					16,000		

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7			0.08974		6,000		538
8	800	9,000	0.08974		9,000		800
9	1,200	12,000	0.08974		12,000		1,200
10			0.08974		15,000		1,346
11			0.08974		14,000		1,256
12			0.08065		8,000		645
13			0.08065		10,000		806
14			0.08065		21,000		1,694
15	1,400	15,000	0.09524	x	15,000	=	1,400
16					14,000		
17					17,000		
18					7,000		
19					11,000		
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11			0.08974		14,000		1,256
12			0.08065		8,000		645
13			0.08065		10,000		806
14			0.08065		21,000		1,694
15	1,400	15,000	0.09524		15,000		1,400
16			0.09444	x	14,000	=	1,322
17					17,000		
18					7,000		
19					11,000		
20					16,000		

Science, Service, Stewardship

Cumulative Estimator

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Cumulative Estimator

Day	Observer Discard	Trip kept all	ratio		Fishery kept all	Cumulative total		Estimated Discards
1	1,000	8,000	0.12500		8,000	8,000		1,000
2			0.12500		12,000	20,000		2,500
3			0.12500		7,000	27,000		3,375
4	500	10,000	0.12500		10,000	37,000		4,625
5			0.08333		18,000	55,000		4,583
6			0.08333		12,000	67,000		5,583
7			0.08333		6,000	73,000		6,083
8	800	9,000	0.08333		9,000	82,000		6,833
9	1,200	12,000	0.08519		12,000	94,000		8,007
10			0.08974		15,000	109,000		9,782
11			0.08974	x	14,000	123,000	=	11,038
12					8,000			
13					10,000			
14					21,000			
15	1,400	15,000			15,000			
16					14,000			
17					17,000			
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10			0.08974		15,000	109,000		9,782
11			0.08974		14,000	123,000		11,038
12			0.08974	x	8,000	131,000	=	11,756
13					10,000			
14					21,000			
15	1,400	15,000			15,000			
16					14,000			
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11			0.08974		14,000	123,000		11,038
12			0.08974		8,000	131,000		11,756
13			0.08974	x	10,000	141,000	=	12,654
14					21,000			
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12			0.08974		8,000	131,000		11,756
13			0.08974		10,000	141,000		12,654
14			0.08974		21,000	162,000		14,538
15	1,400	15,000	0.08974	x	15,000	177,000	=	15,885
16					14,000			
17					17,000			
18					7,000			
19					11,000			
20					16,000			

Cumulative Estimator

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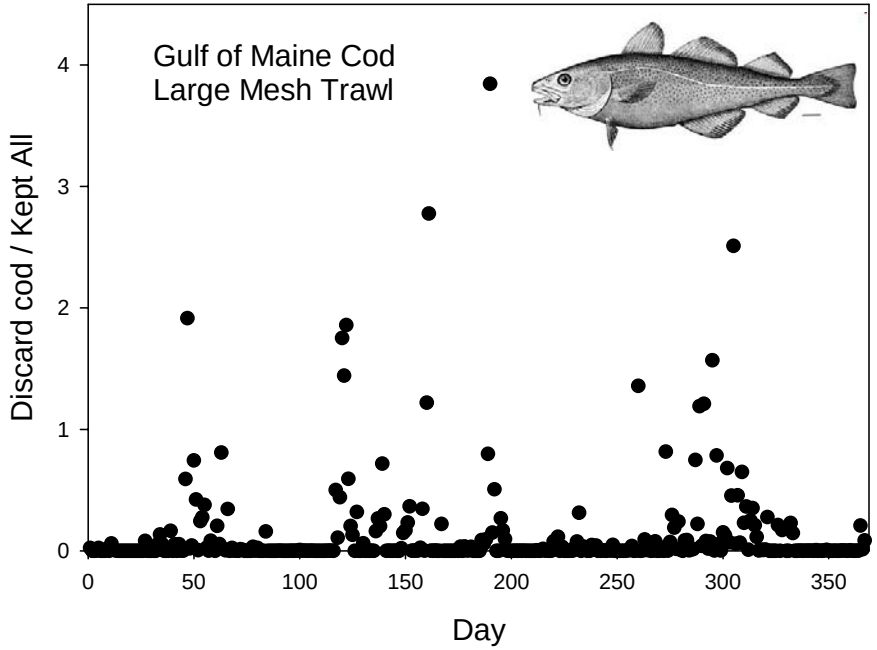
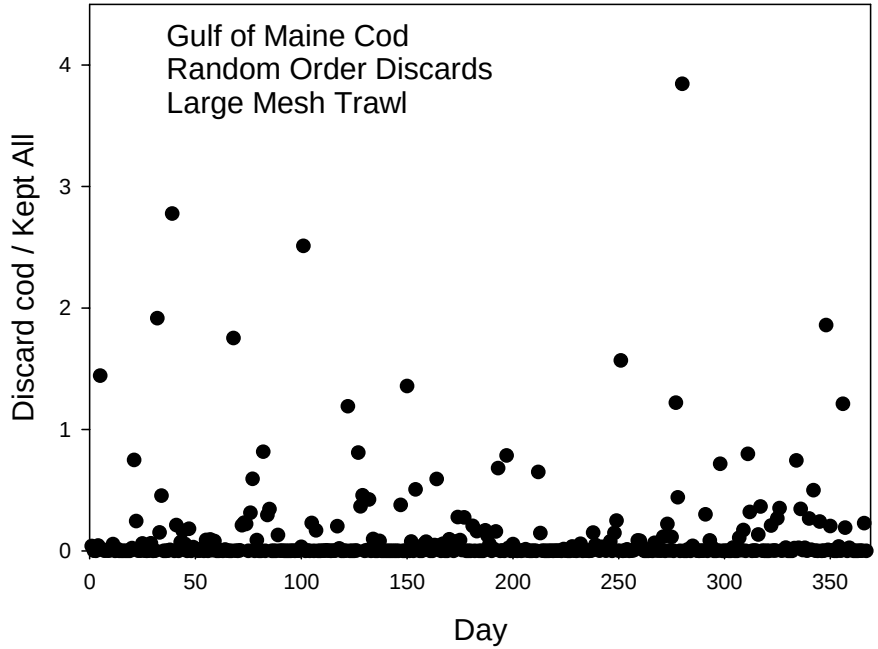
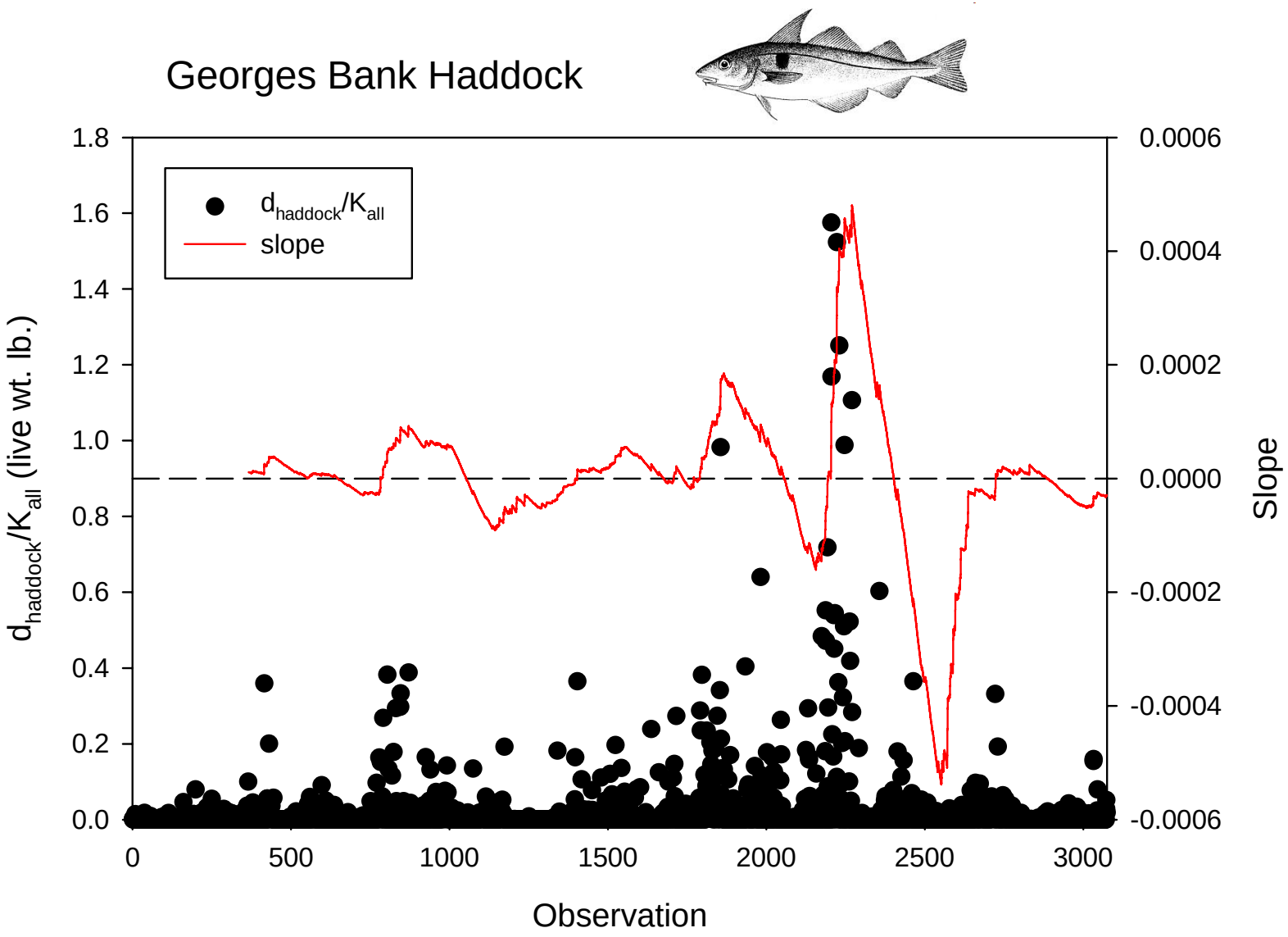
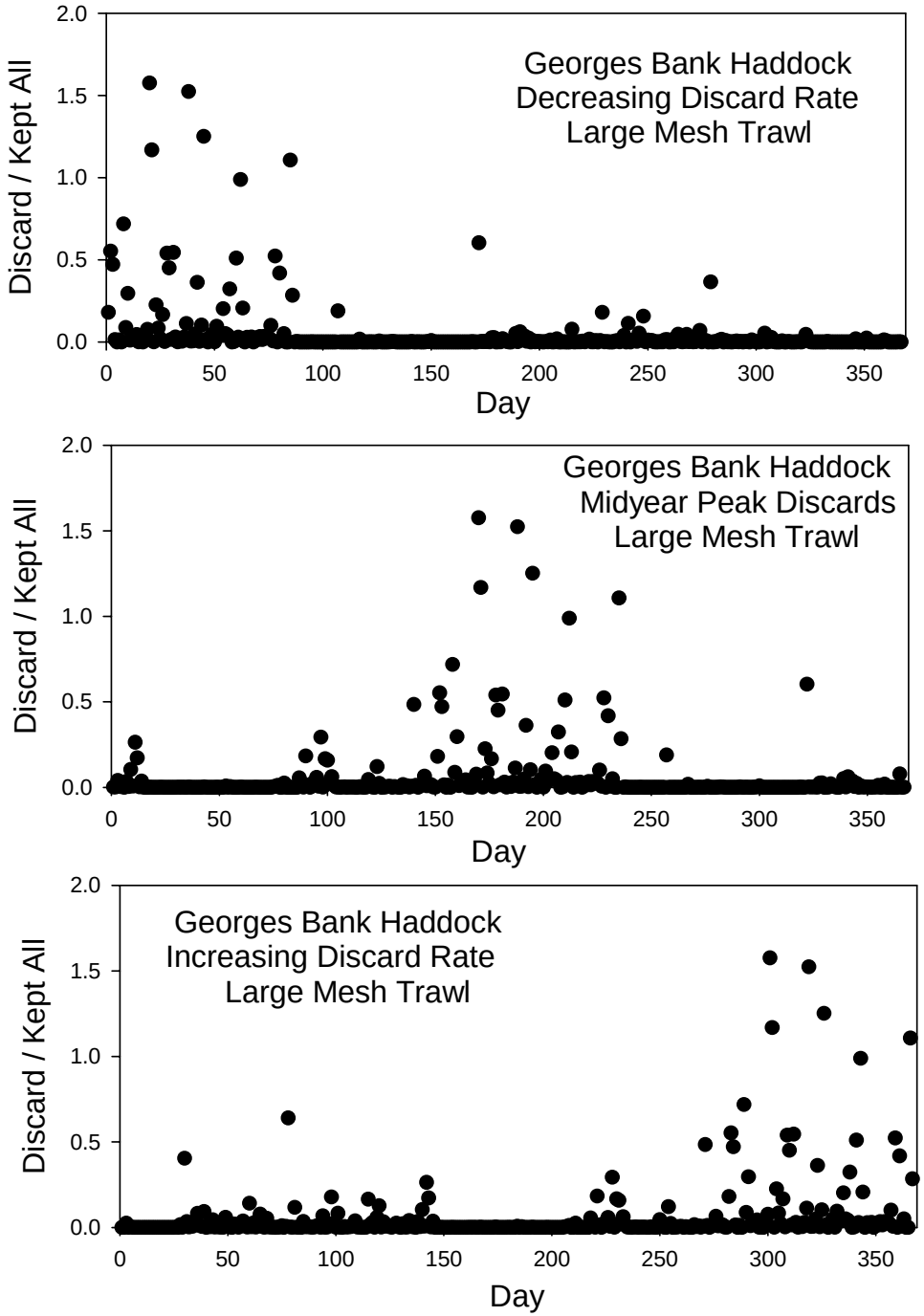
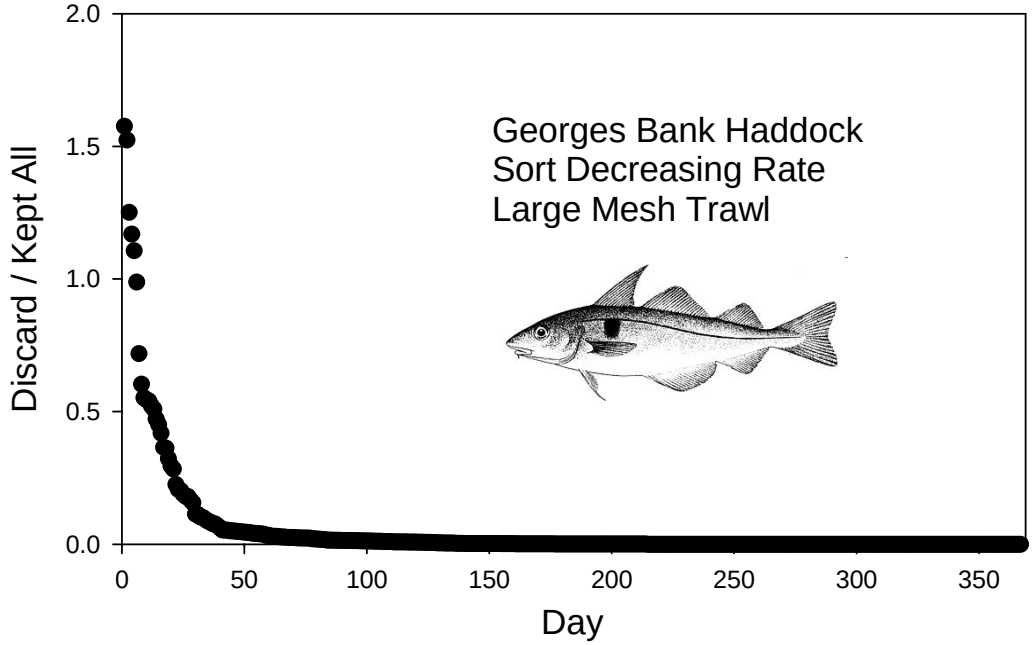
14			0.08974		21,000	162,000		14,538
15	1,400	15,000	0.08974		15,000	177,000		15,885
16			0.09074	x	14,000	191,000	=	17,331
17					17,000			
18					7,000			
19					11,000			
20					16,000			

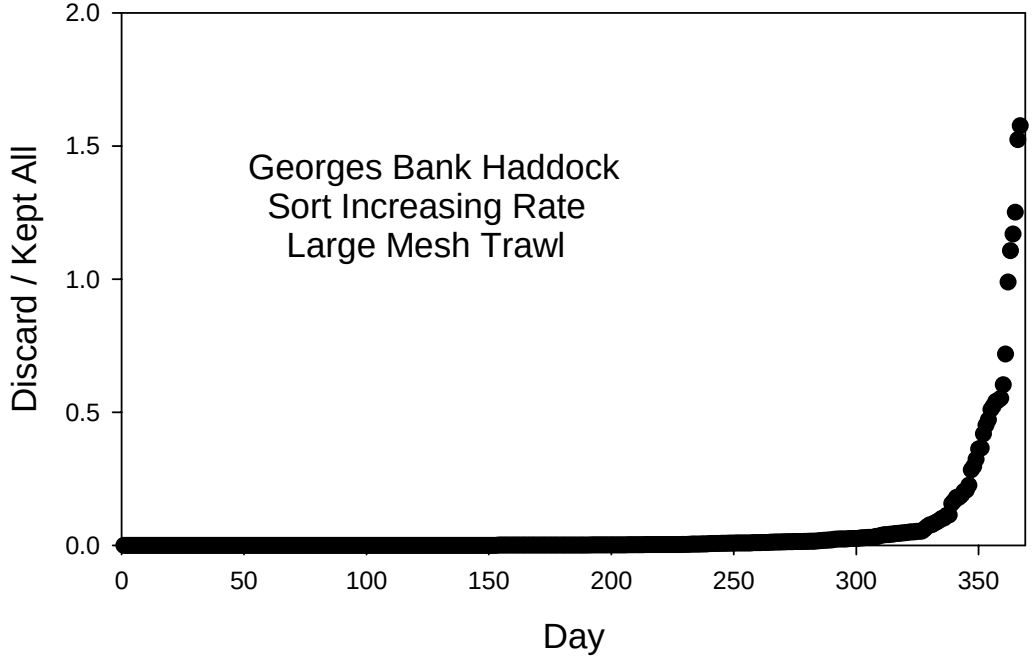

Gulf of Maine Cod
Large Mesh Trawl
Discard cod / Kept All
Day
0
1
2
3
4
0
50
100
150
200
250
300
350


Gulf of Maine Cod
Random Order Discards
Large Mesh Trawl
Discard cod / Kept All
Day
0
1
2
3
4
0
50
100
150
200
250
300
350

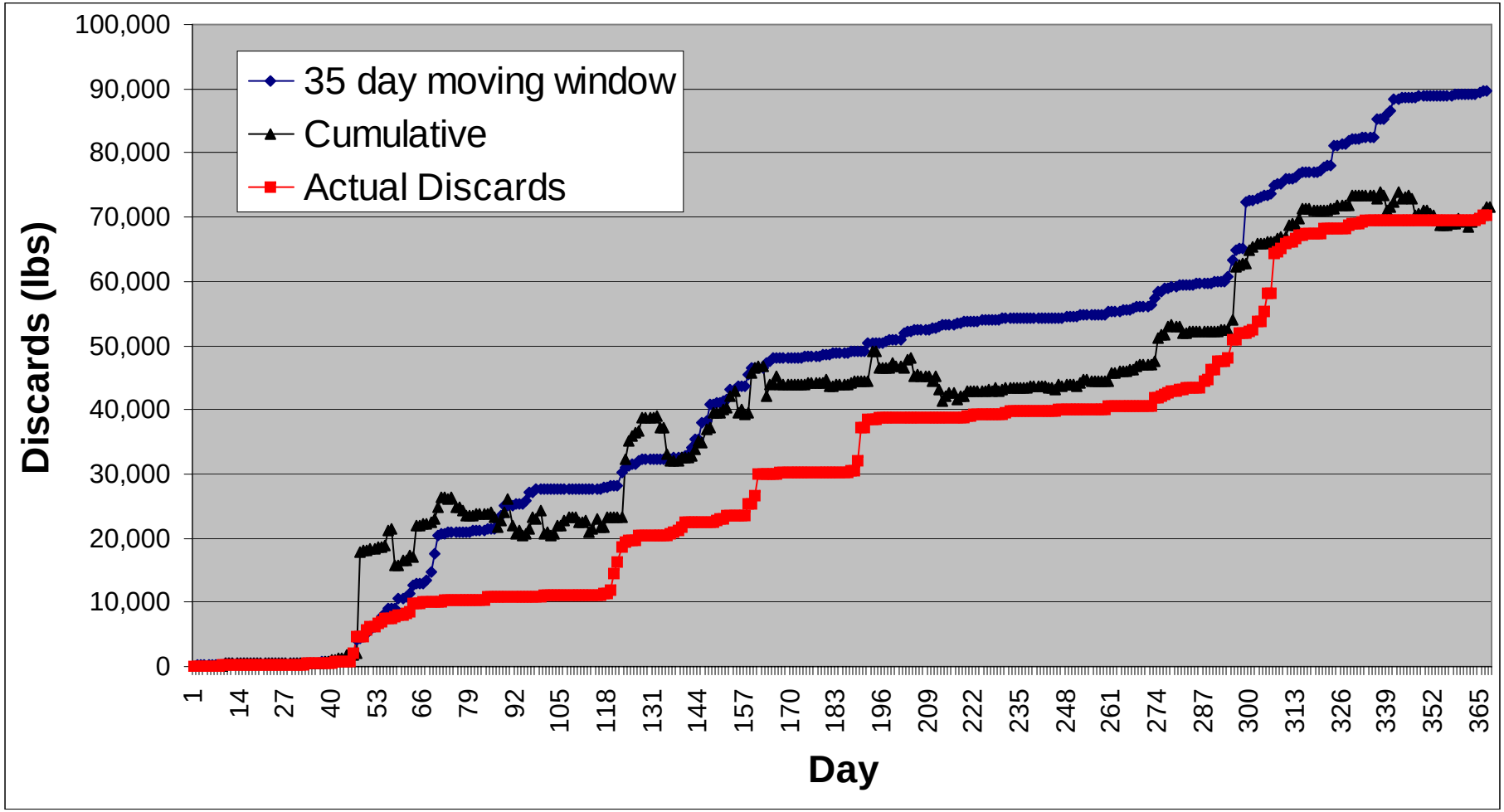

Georges Bank Haddock
$d_{haddock}/K_{all}$
slope
$d_{haddock}/K_{all}$ (live wt. lb.)
Slope
Observation
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0006
0.0004
0.0002
0.0000
-0.0002
-0.0004
-0.0006
0
500
1000
1500
2000
2500
3000


Georges Bank Haddock
Decreasing Discard Rate
Large Mesh Trawl
Discard / Kept All
Day
Georges Bank Haddock
Midyear Peak Discards
Large Mesh Trawl
Discard / Kept All
Day
Georges Bank Haddock
Increasing Discard Rate
Large Mesh Trawl
Discard / Kept All
Day

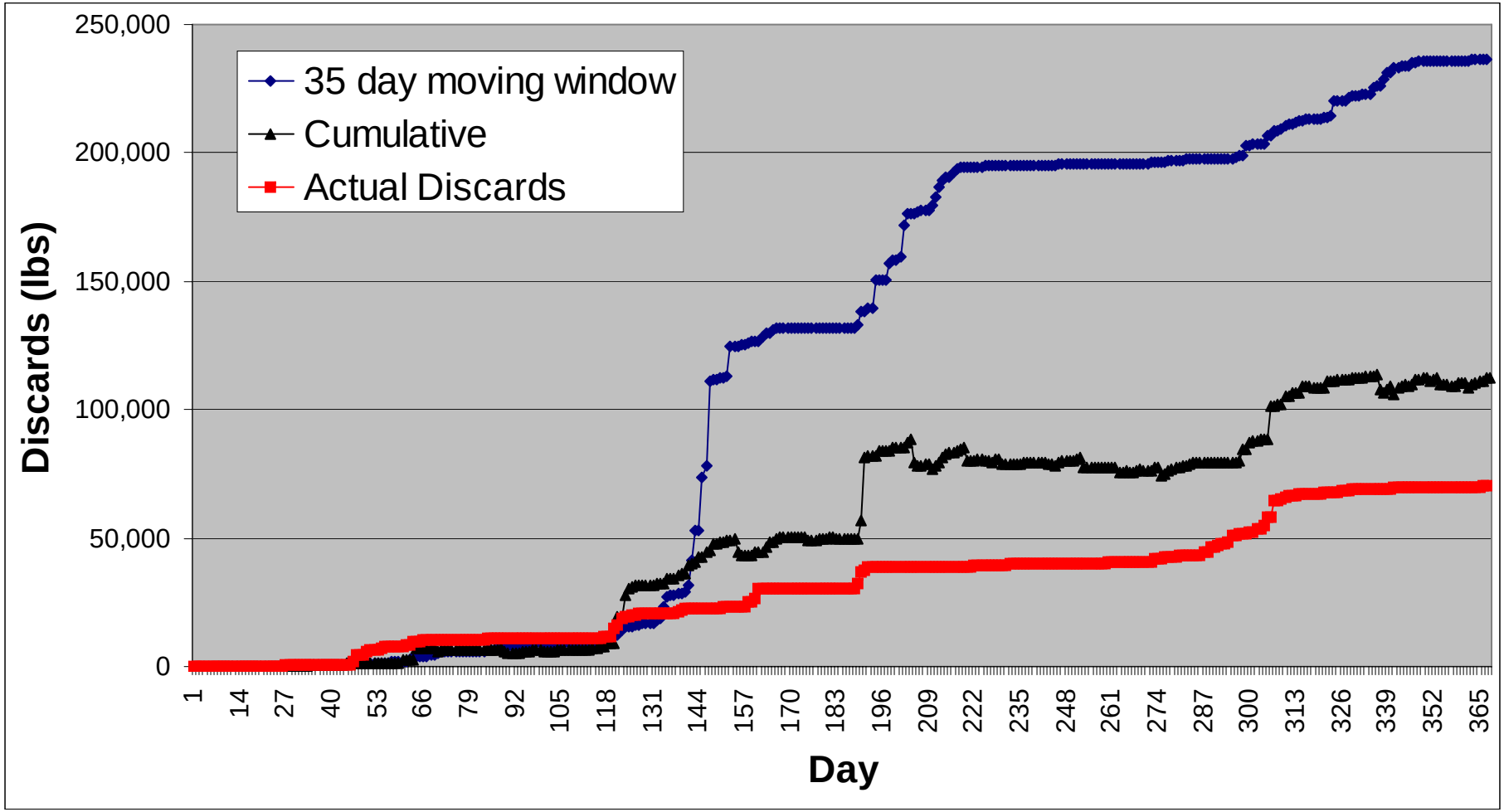

Georges Bank Haddock
Sort Decreasing Rate
Large Mesh Trawl
Discard / Kept All
Day
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
250
300
350


Georges Bank Haddock
Sort Increasing Rate
Large Mesh Trawl
Discard / Kept All
Day
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
250
300
350

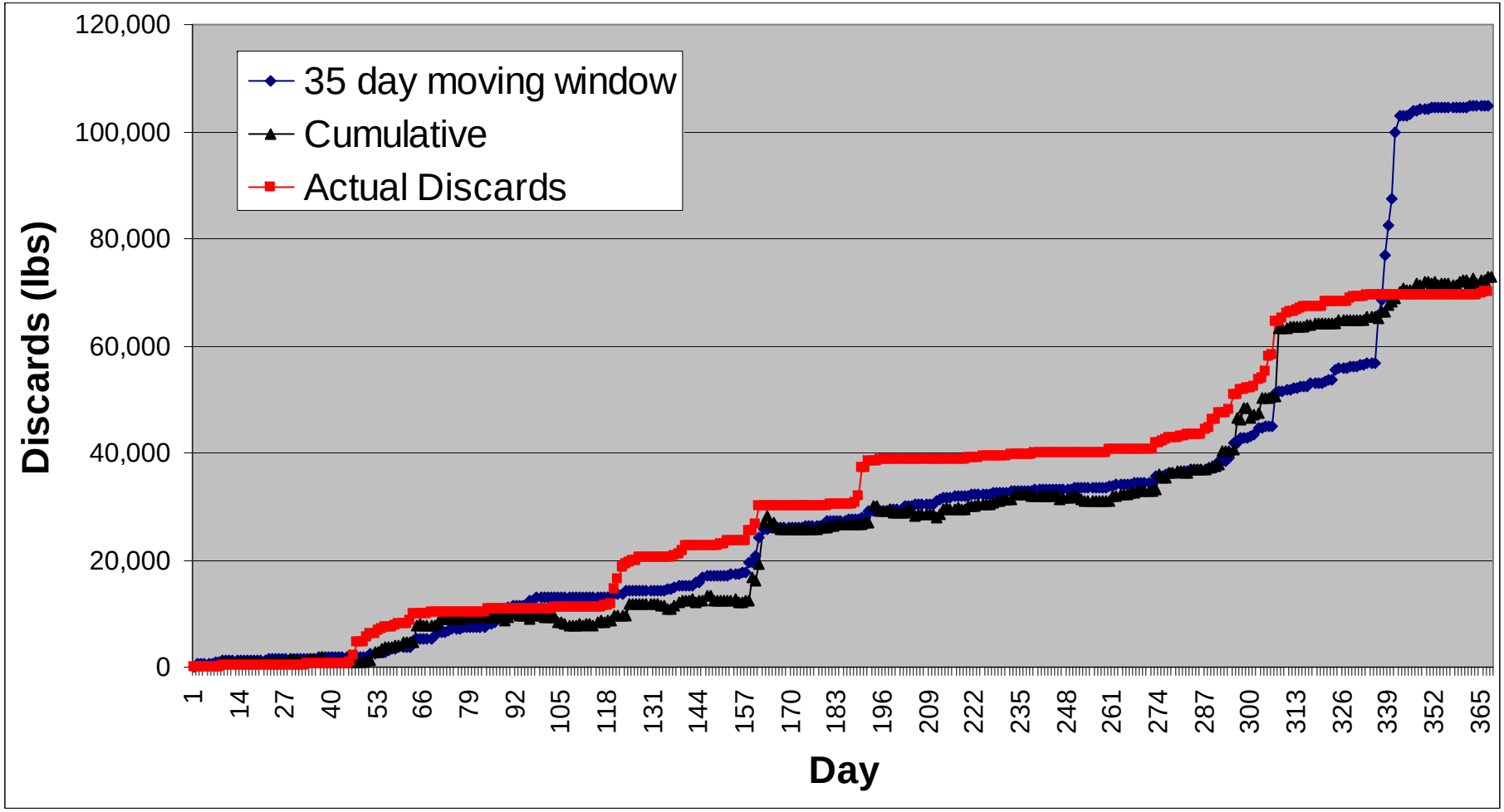
Gulf of Maine Cod 40% Coverage Rate



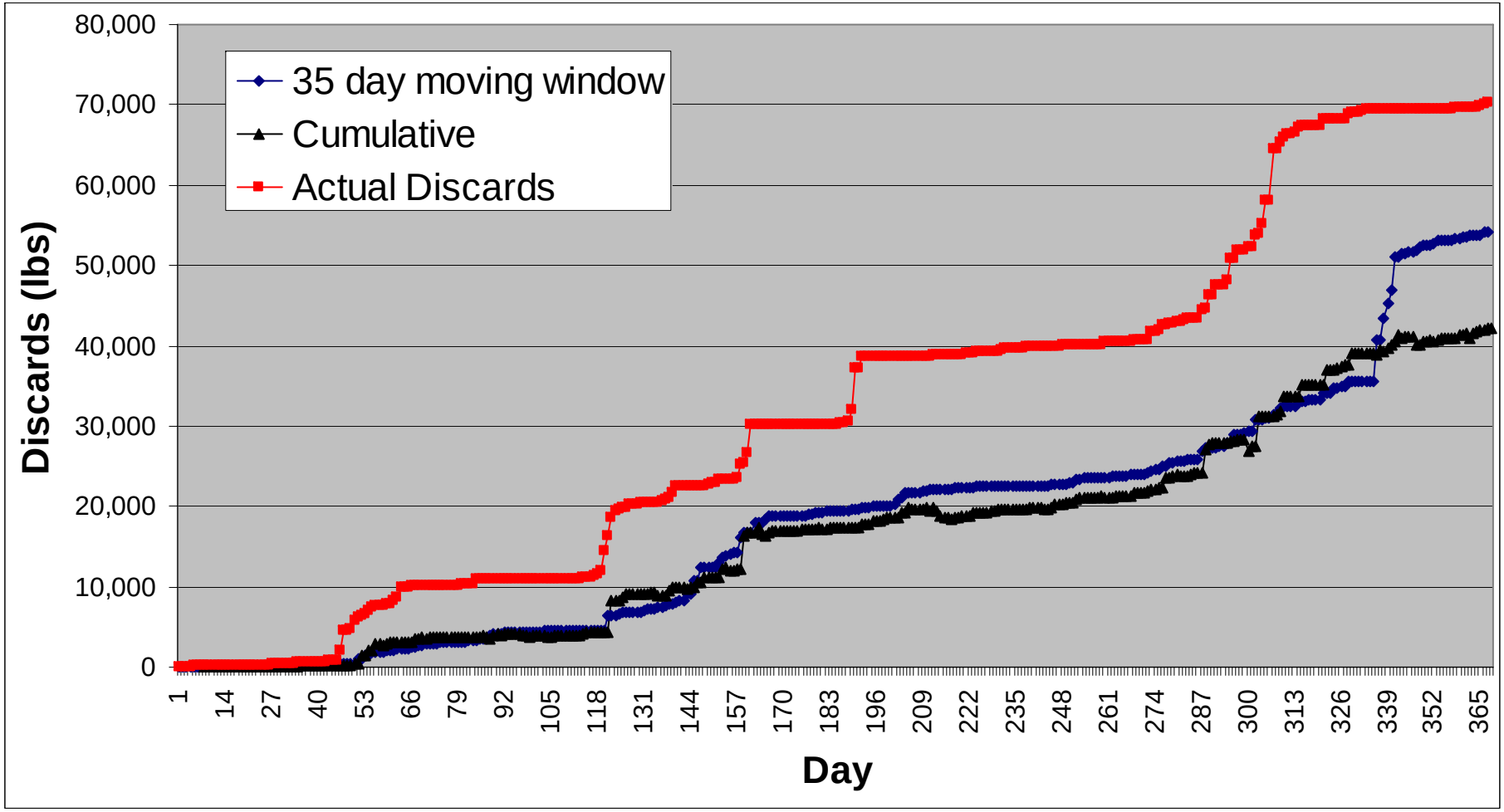
Gulf of Maine Cod 40% Coverage Rate



Gulf of Maine Cod 40% Coverage Rate



Gulf of Maine Cod 40% Coverage Rate



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Results
Discard Estimator Simulation
(Part 1) TOR 1

- Moving average estimators tend to be biased.
- Cumulative estimator had the best overall performance.

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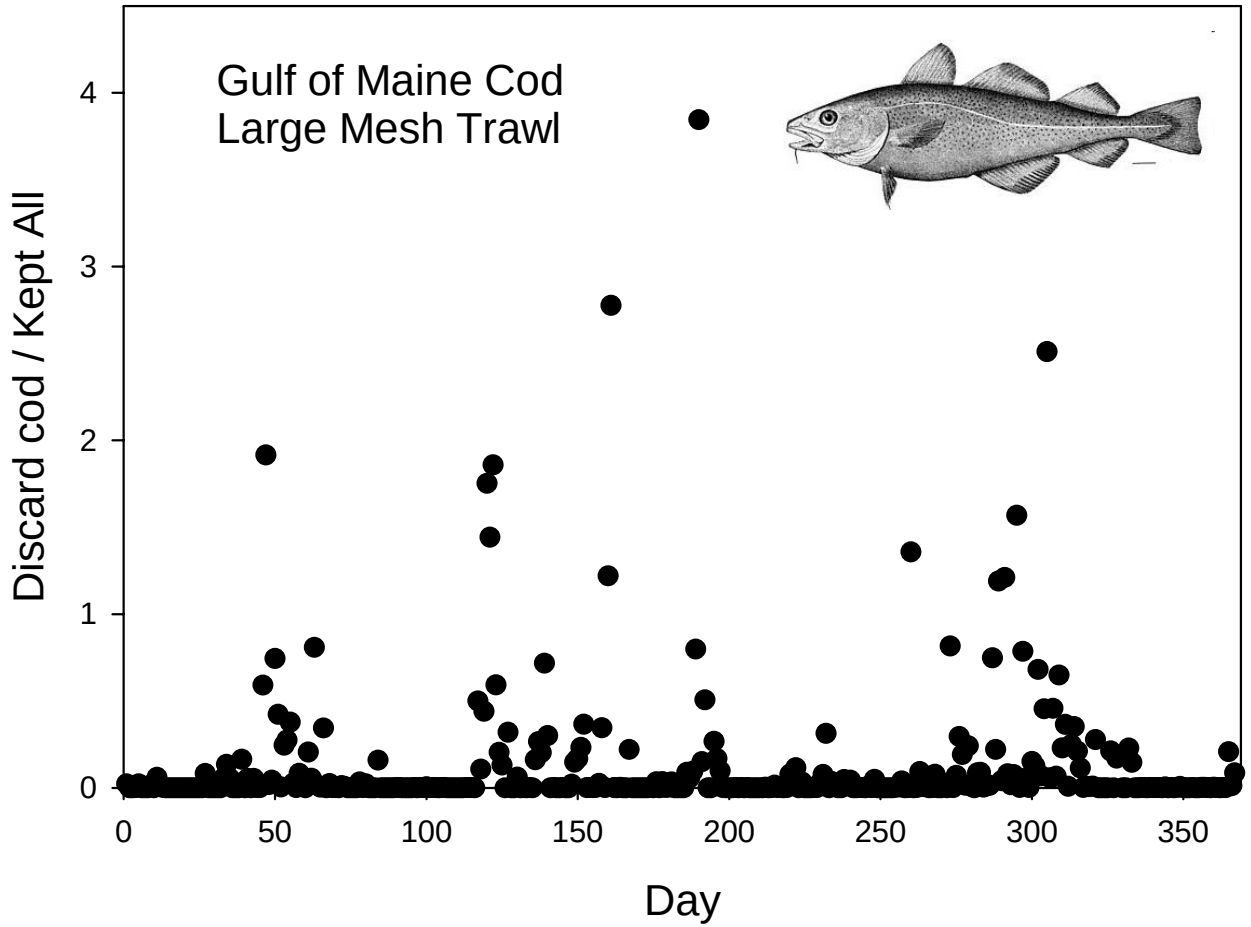
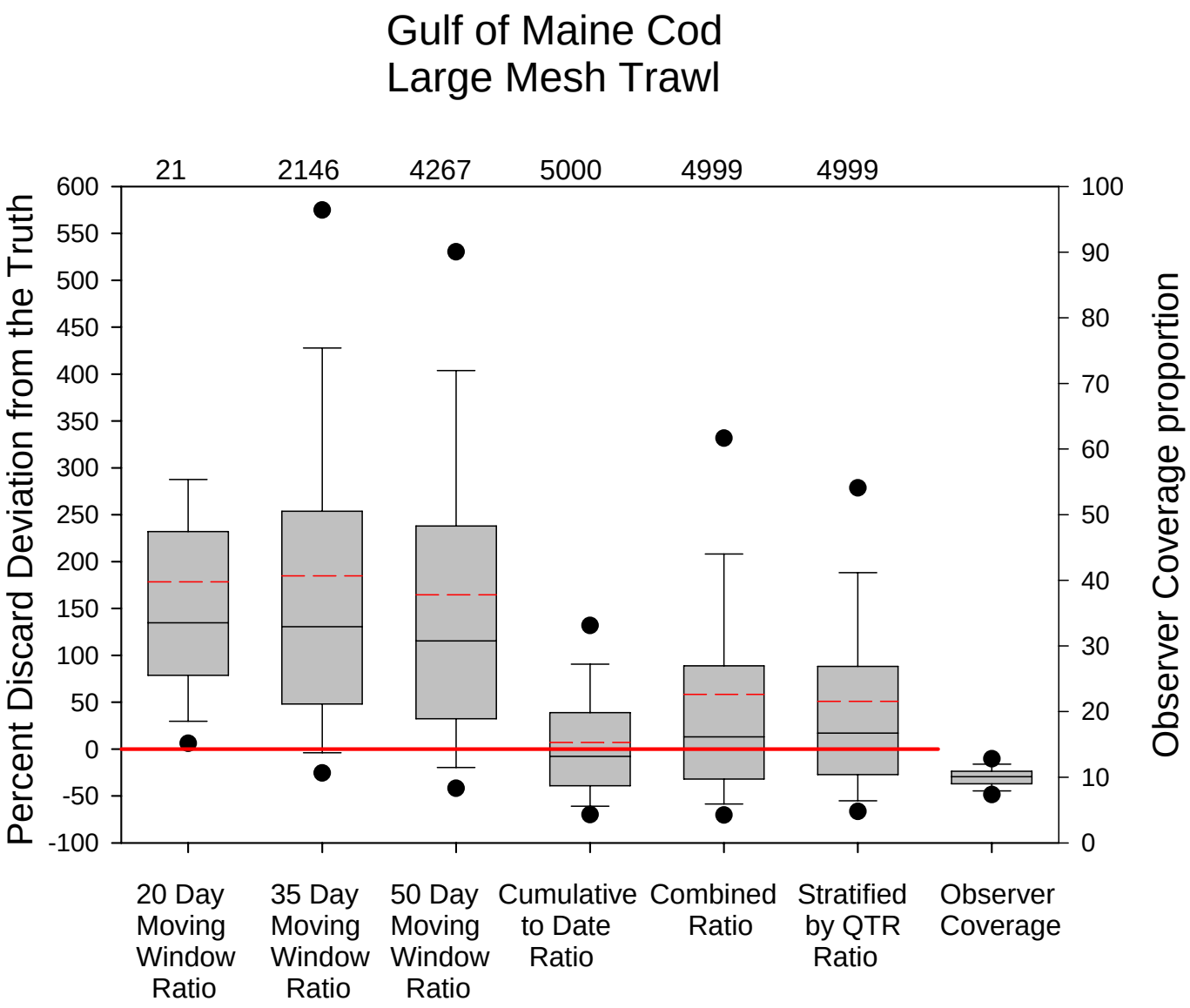
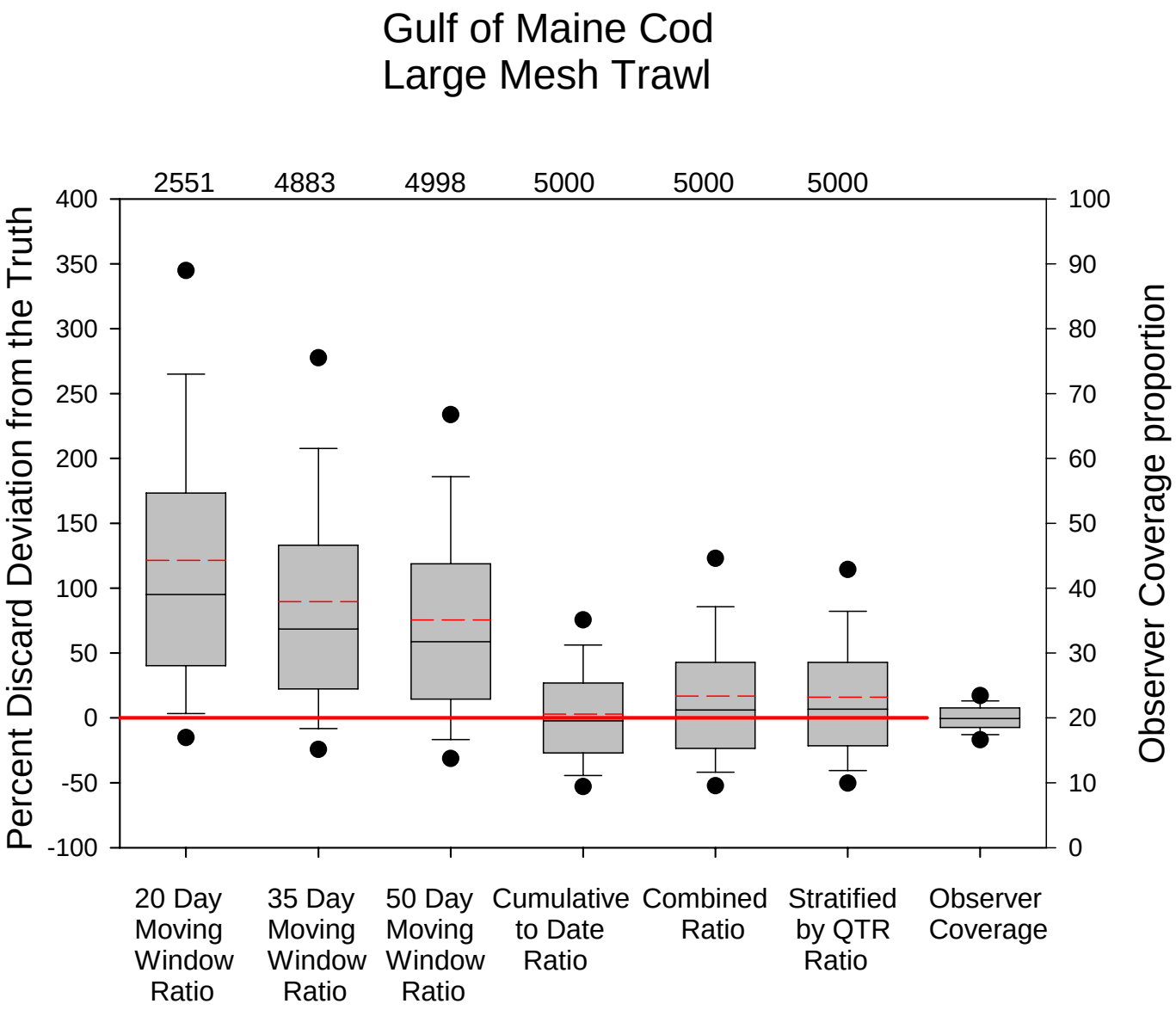
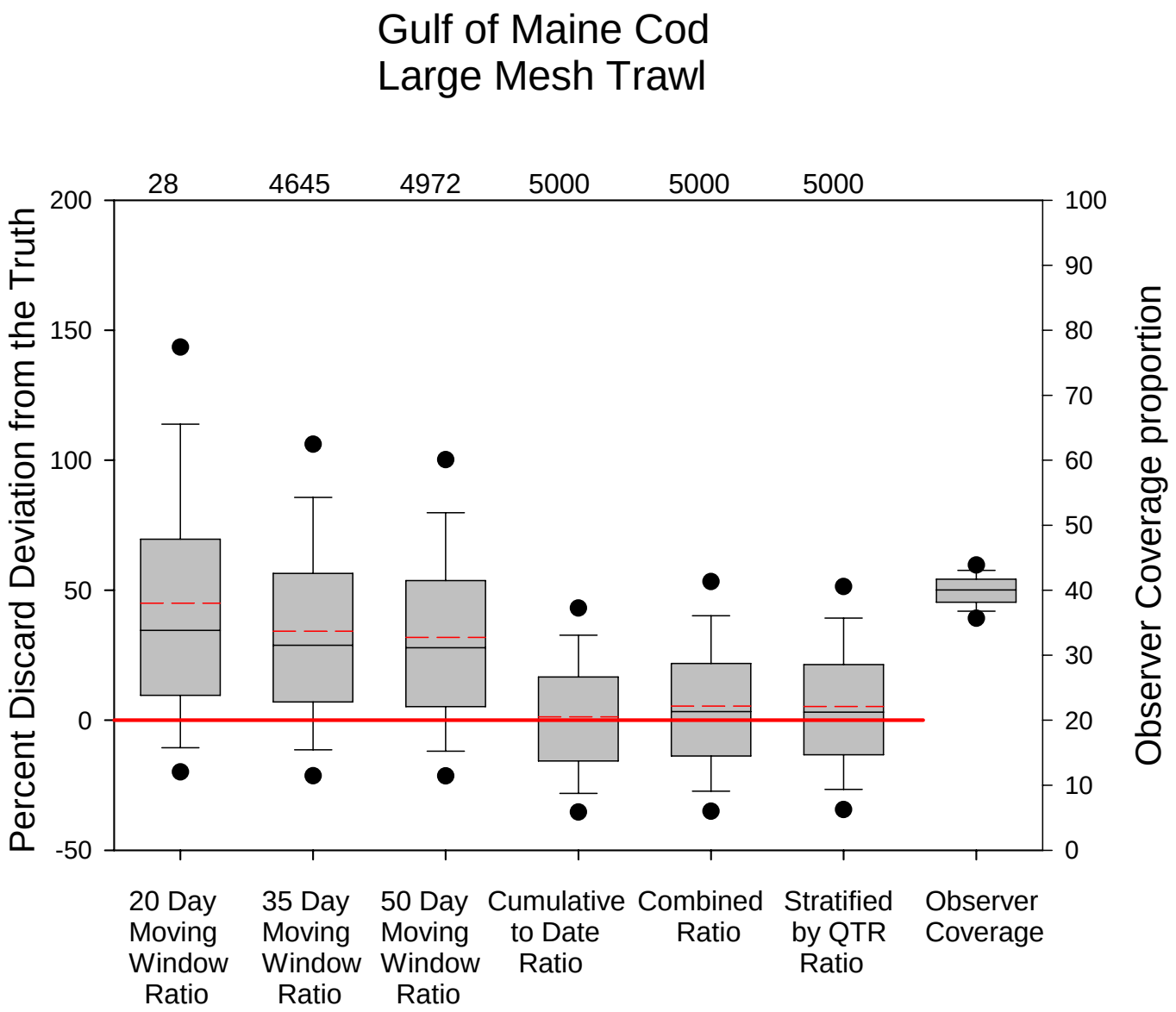
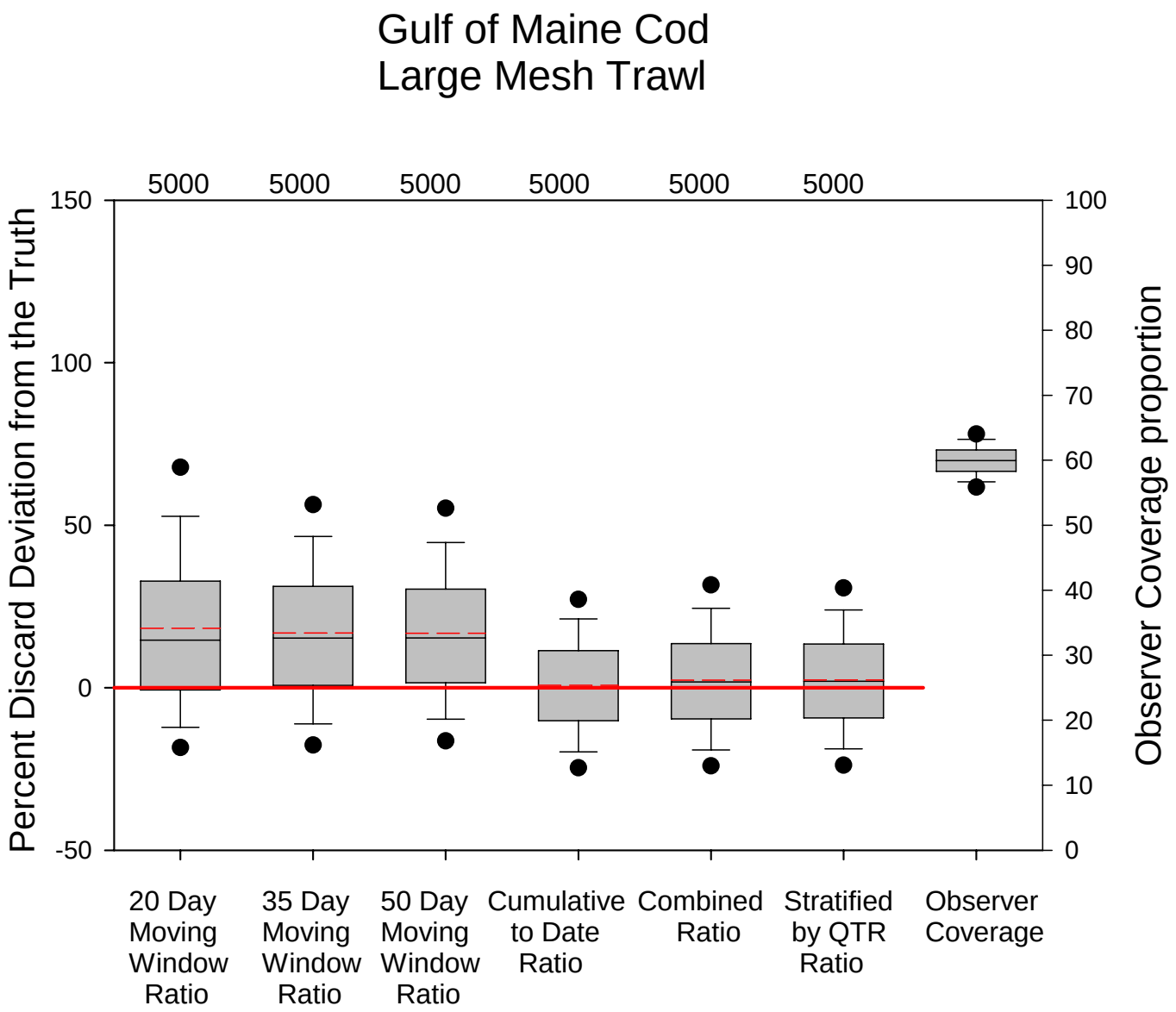
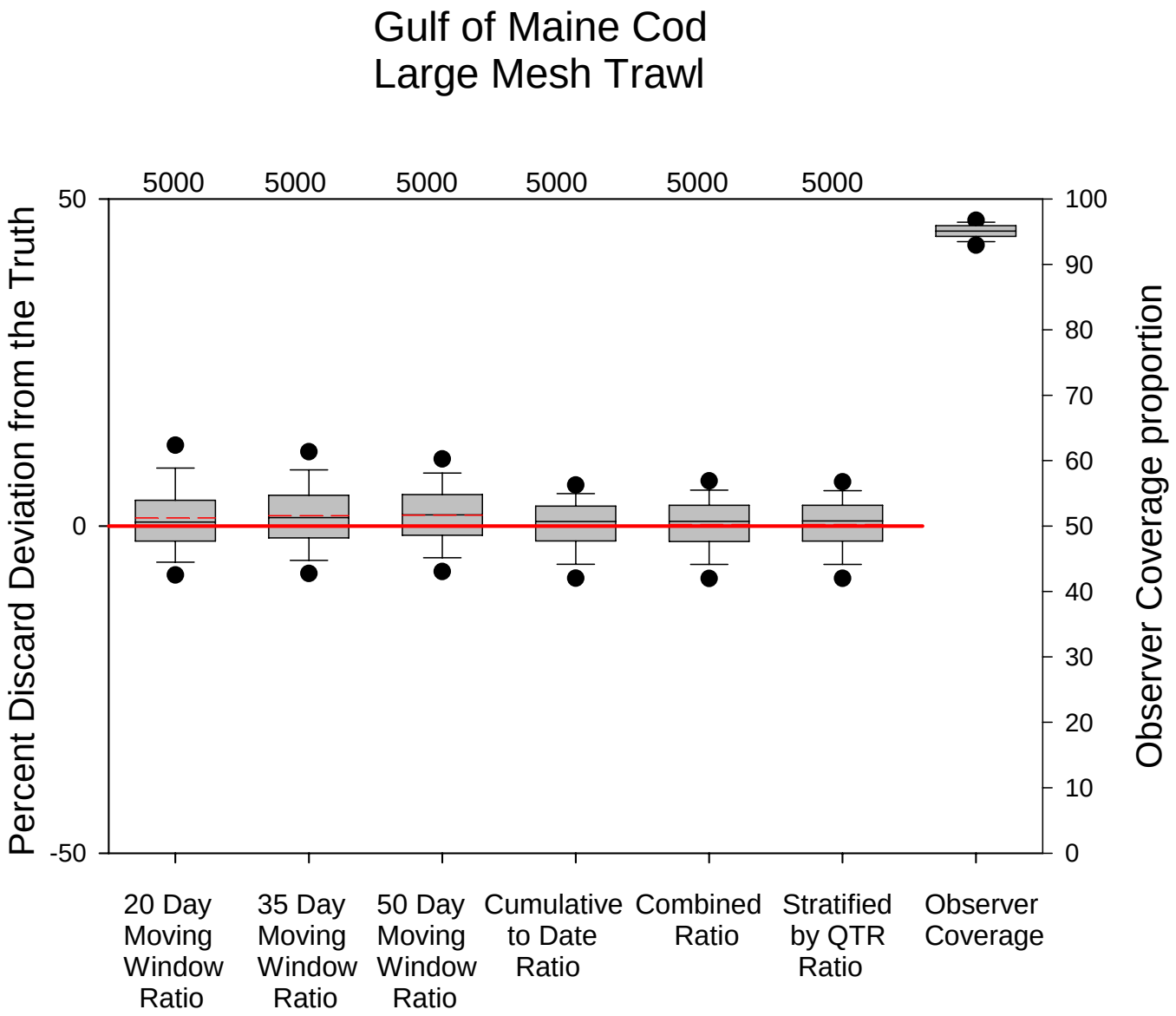

Gulf of Maine Cod
Large Mesh Trawl
Discard cod / Kept All
0
1
2
3
4
0
50
100
150
200
250
300
350
Day


Gulf of Maine Cod
Large Mesh Trawl
21
2146
4267
5000
4999
4999
Percent Discard Deviation from the Truth
600
550
500
450
400
350
300
250
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage


Gulf of Maine Cod
Large Mesh Trawl
2551
4883
4998
5000
5000
5000
Percent Discard Deviation from the Truth
Observer Coverage proportion
400
350
300
250
200
150
100
50
0
-50
-100
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage


Gulf of Maine Cod
Large Mesh Trawl
28
4645
4972
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

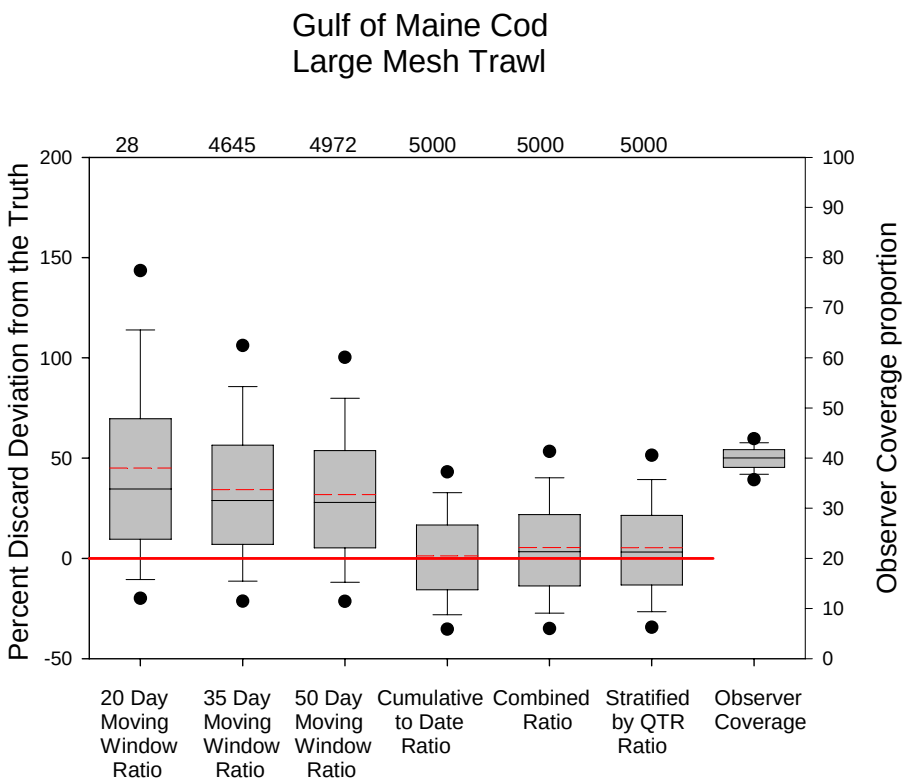

Gulf of Maine Cod
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

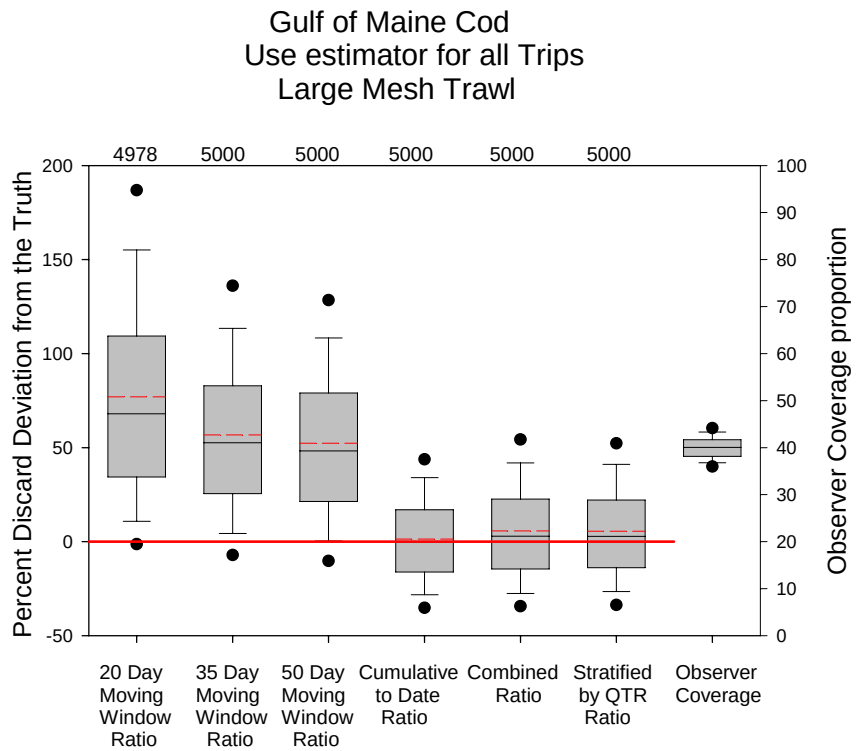

Gulf of Maine Cod
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
50
0
-50
100
90
80
70
60
50
40
30
20
10
0
Percent Discard Deviation from the Truth
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

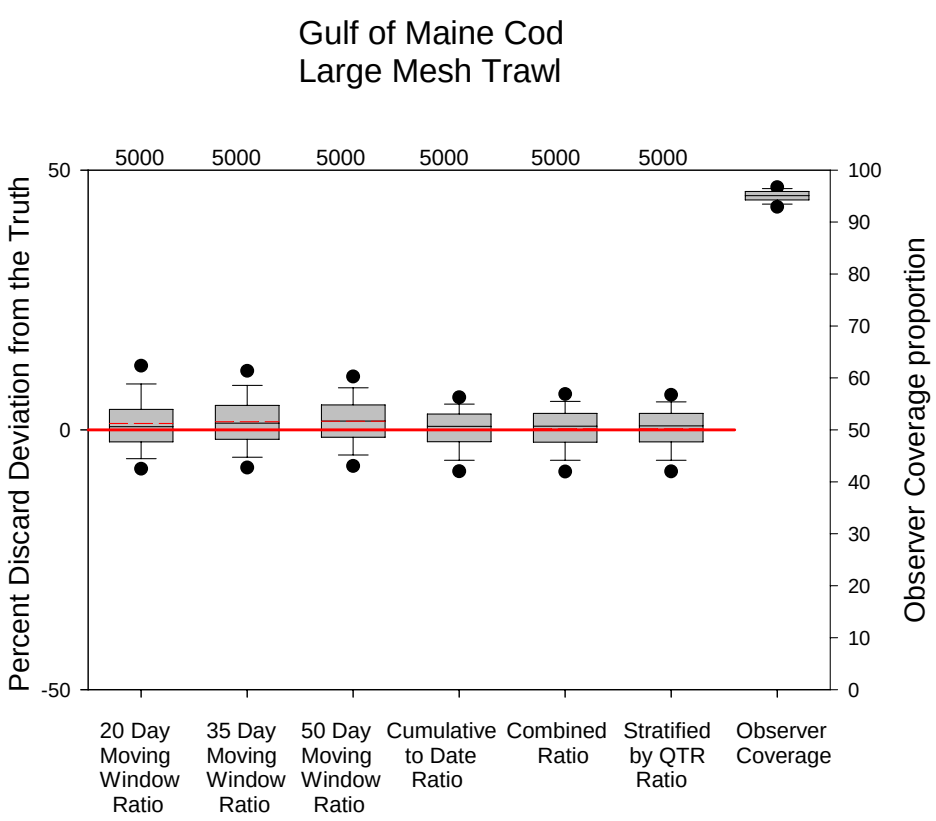
Science, Service, Stewardship

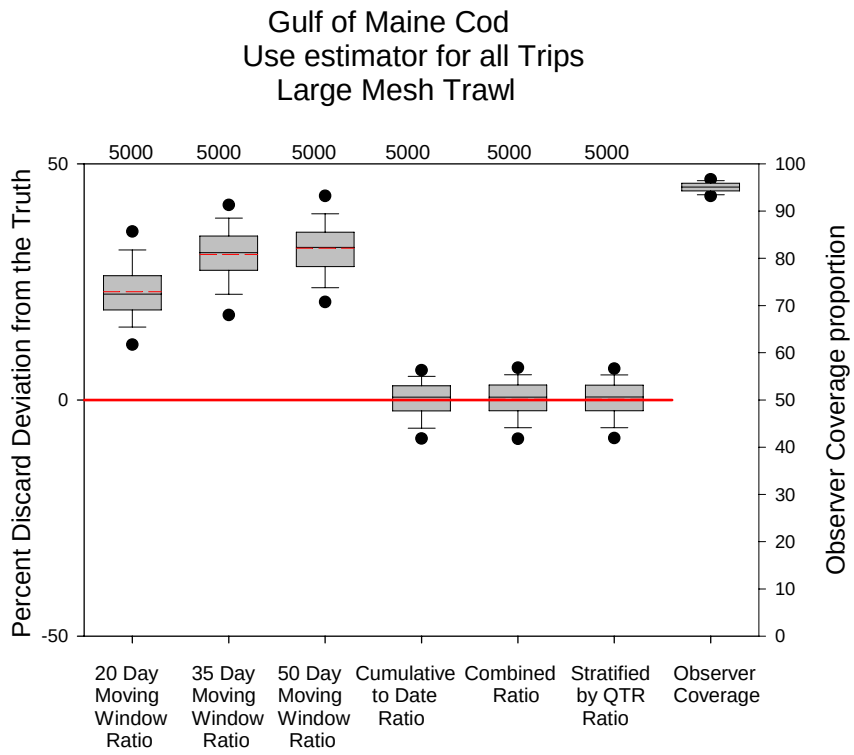
Test the influence of using the actual discards on observed trips by using the predicted discards from the estimator on all trips?

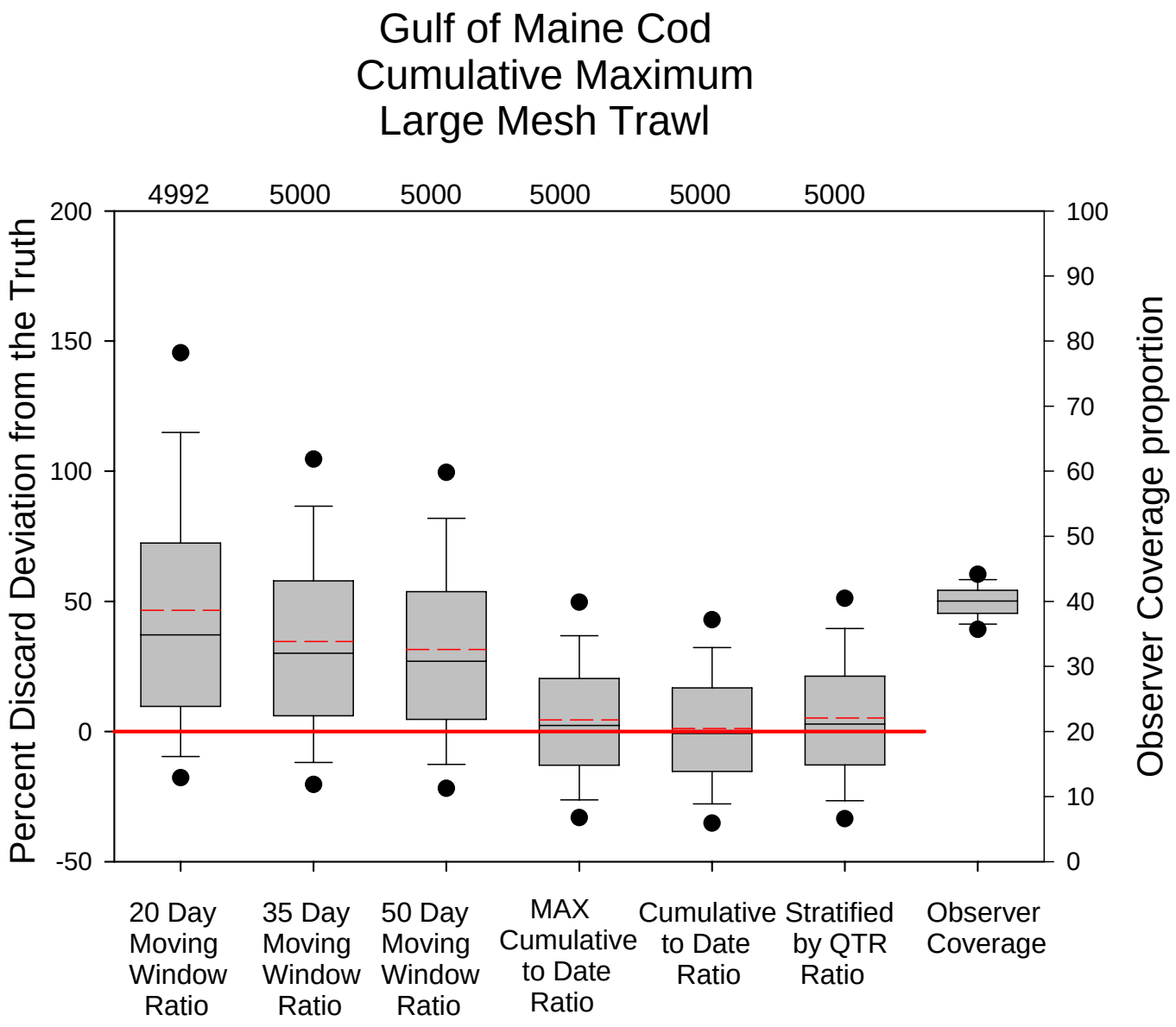
NOAA FISHERIES SERVICE

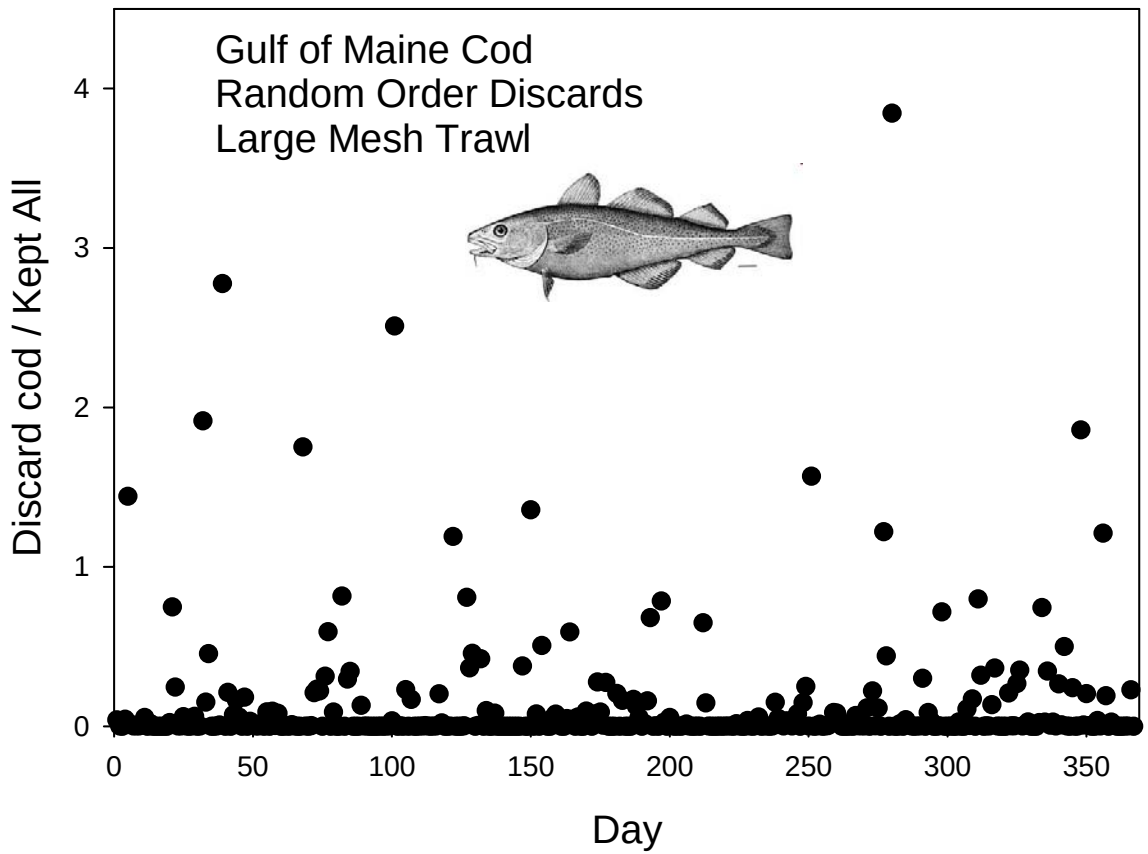

Gulf of Maine Cod
Large Mesh Trawl
28
4645
4972
5000
5000
5000
Percent Discard Deviation from the Truth
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

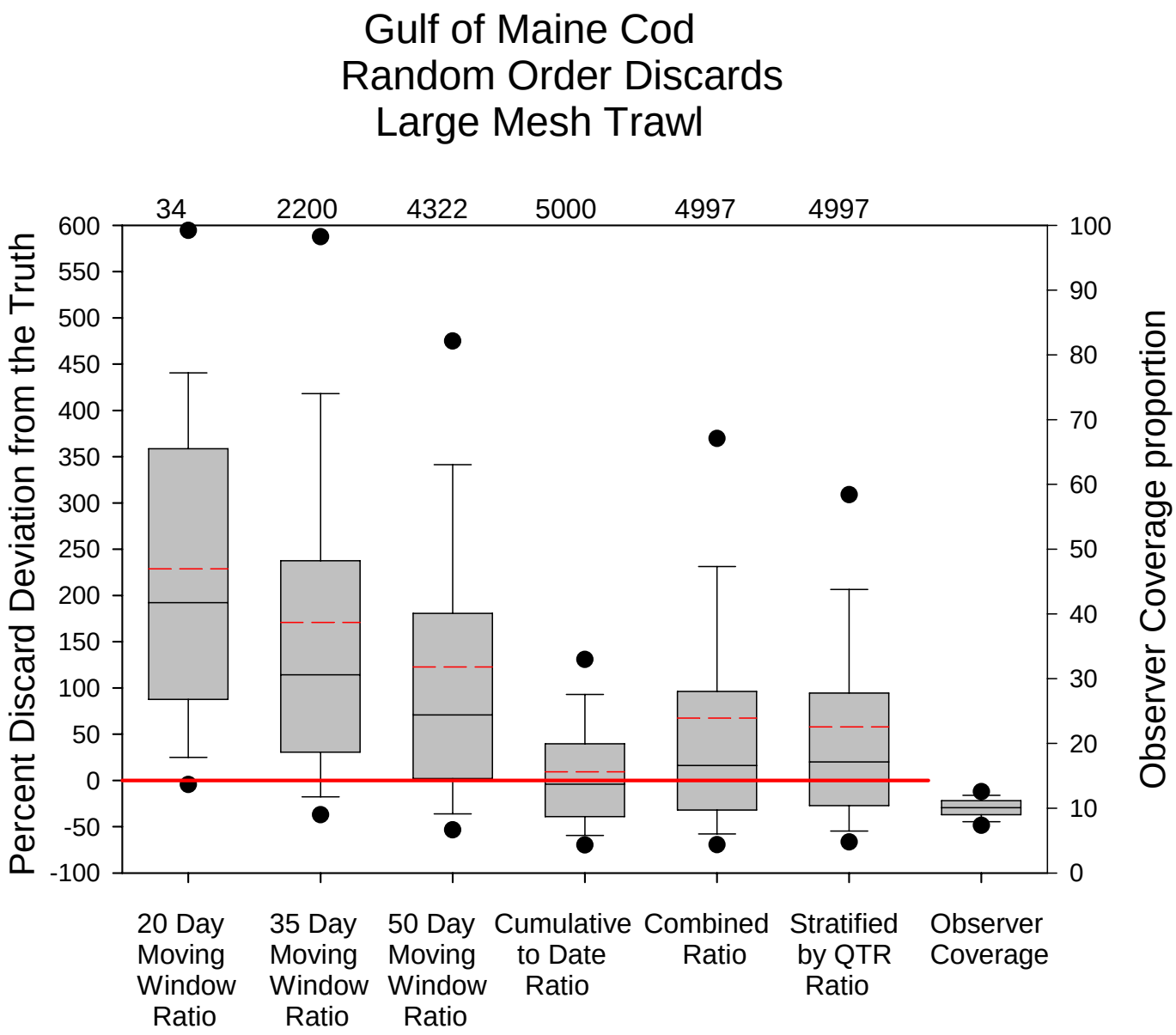

Gulf of Maine Cod
Use estimator for all Trips
Large Mesh Trawl
4978
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

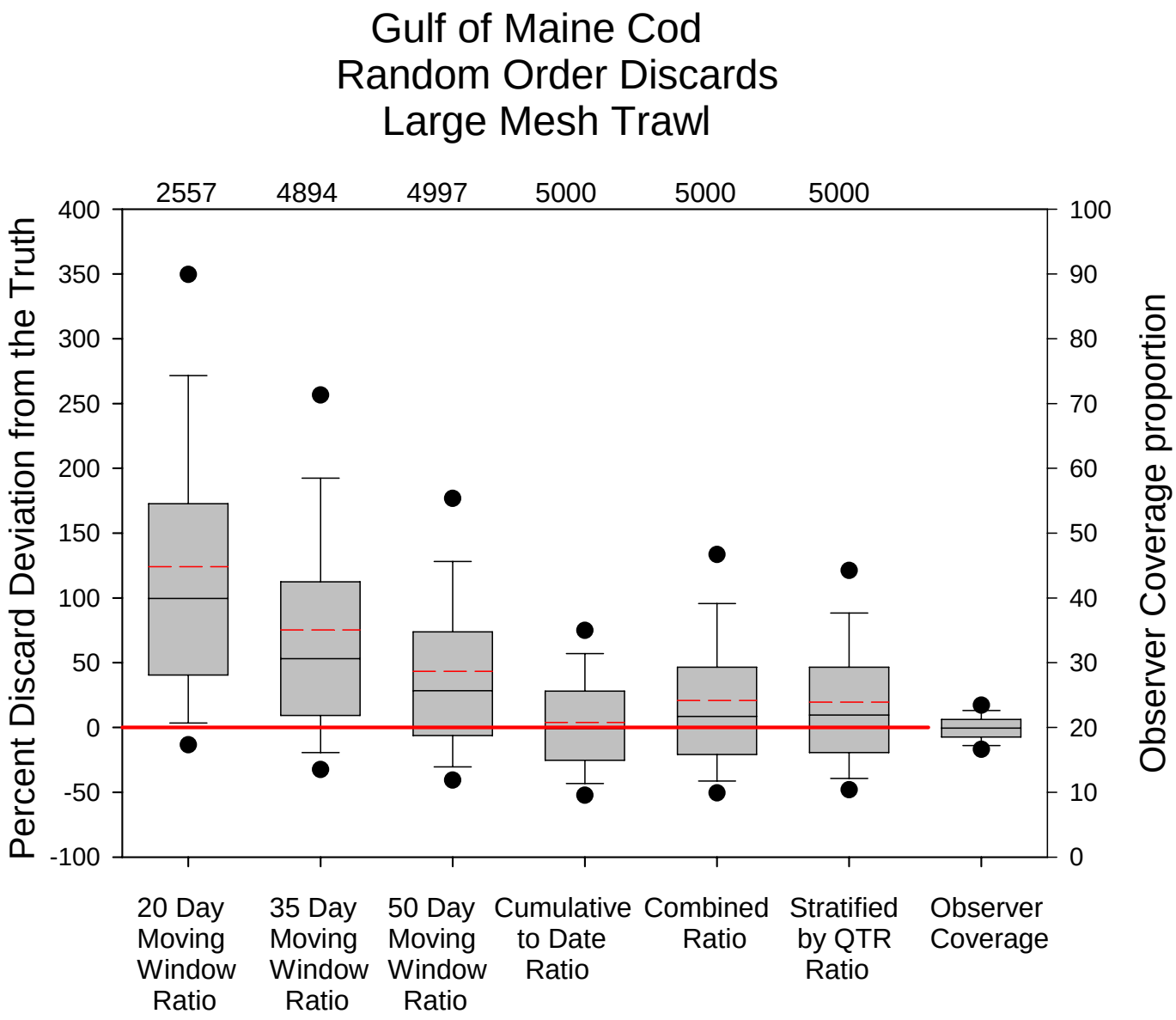

Gulf of Maine Cod
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
Observer Coverage proportion
50
0
-50
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

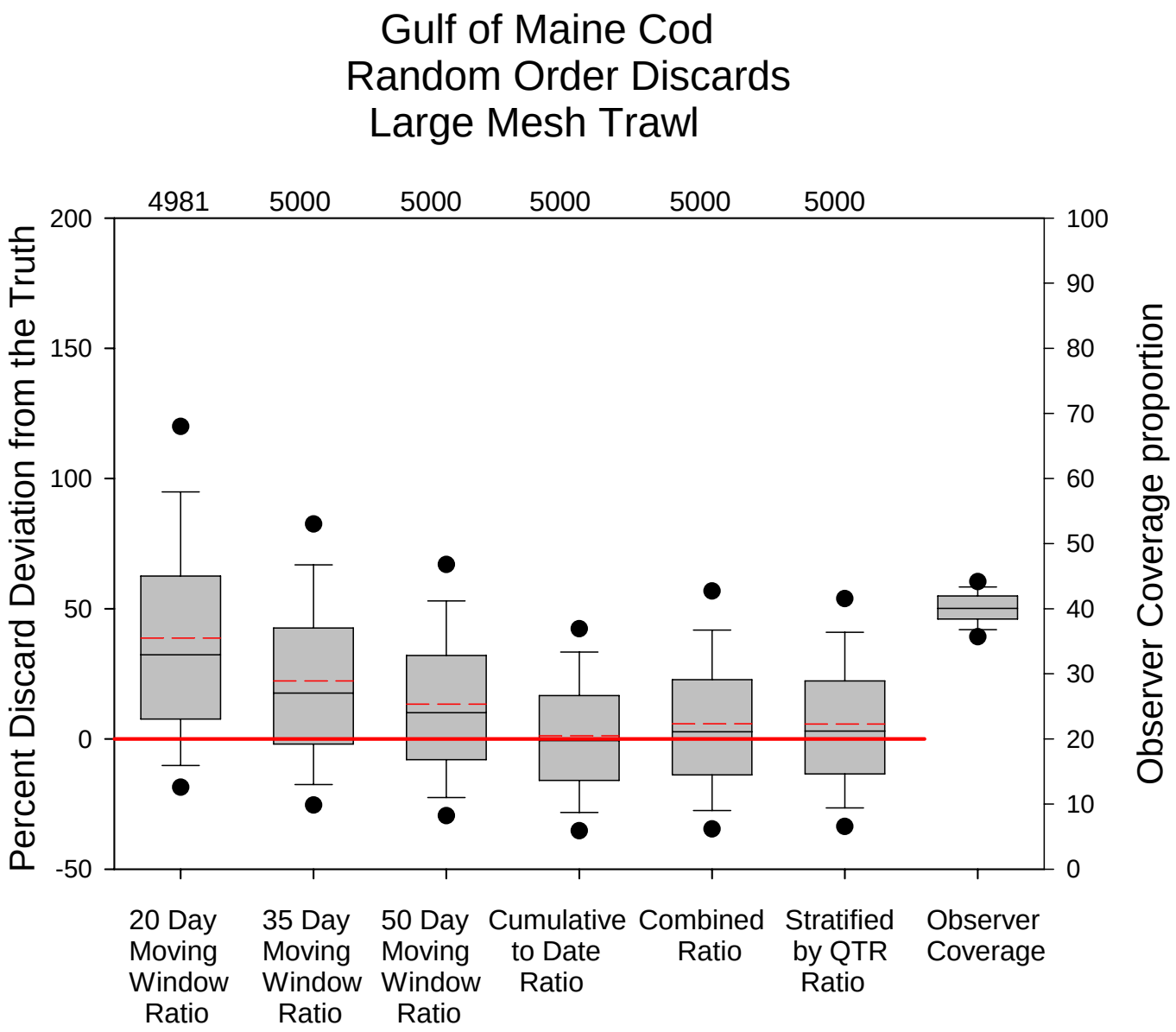

Gulf of Maine Cod
Use estimator for all Trips
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
Observer Coverage proportion
50
0
-50
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

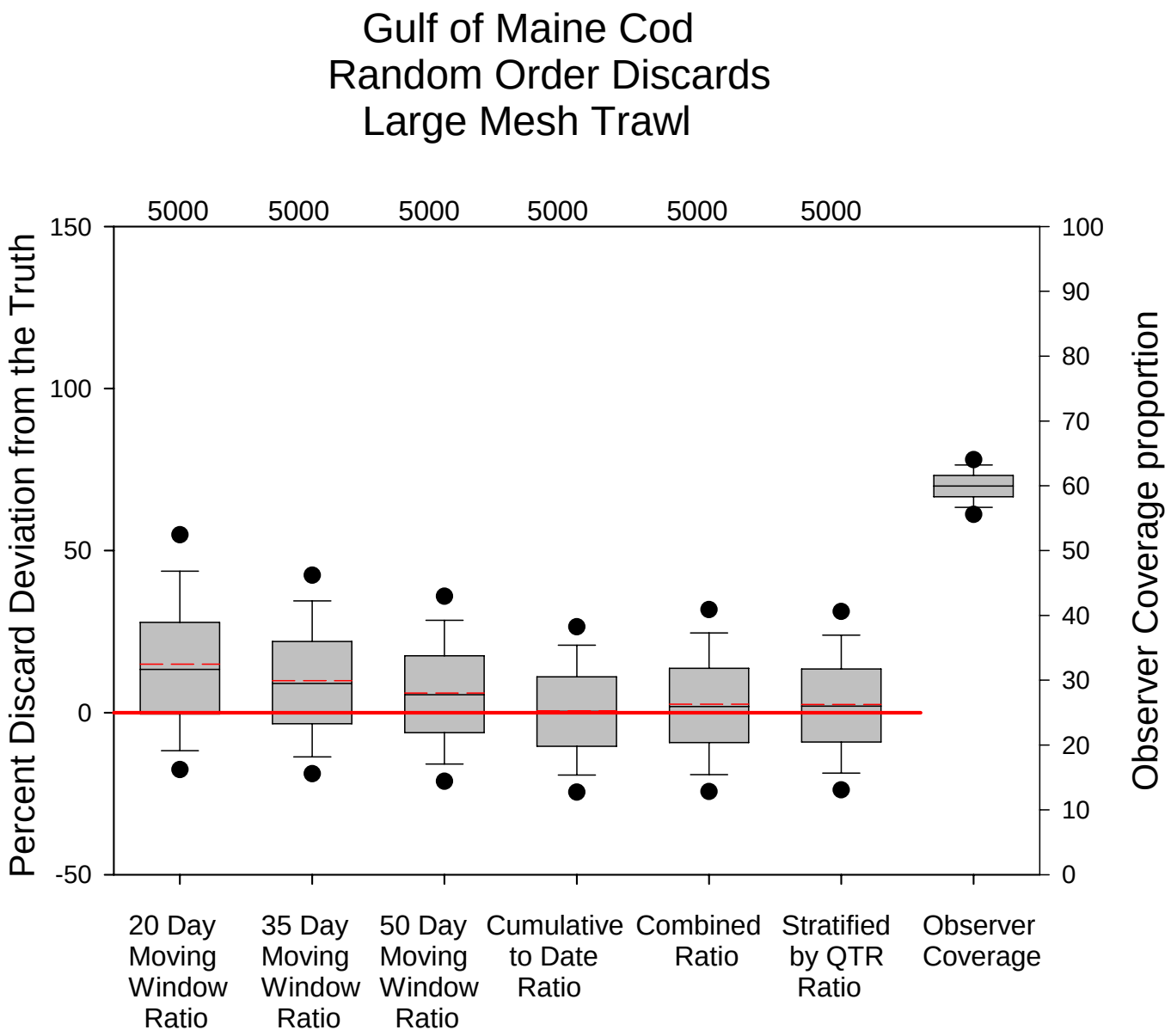

Gulf of Maine Cod
Cumulative Maximum
Large Mesh Trawl
4992
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
MAX Cumulative to Date Ratio
Cumulative to Date Ratio
Stratified by QTR Ratio
Observer Coverage

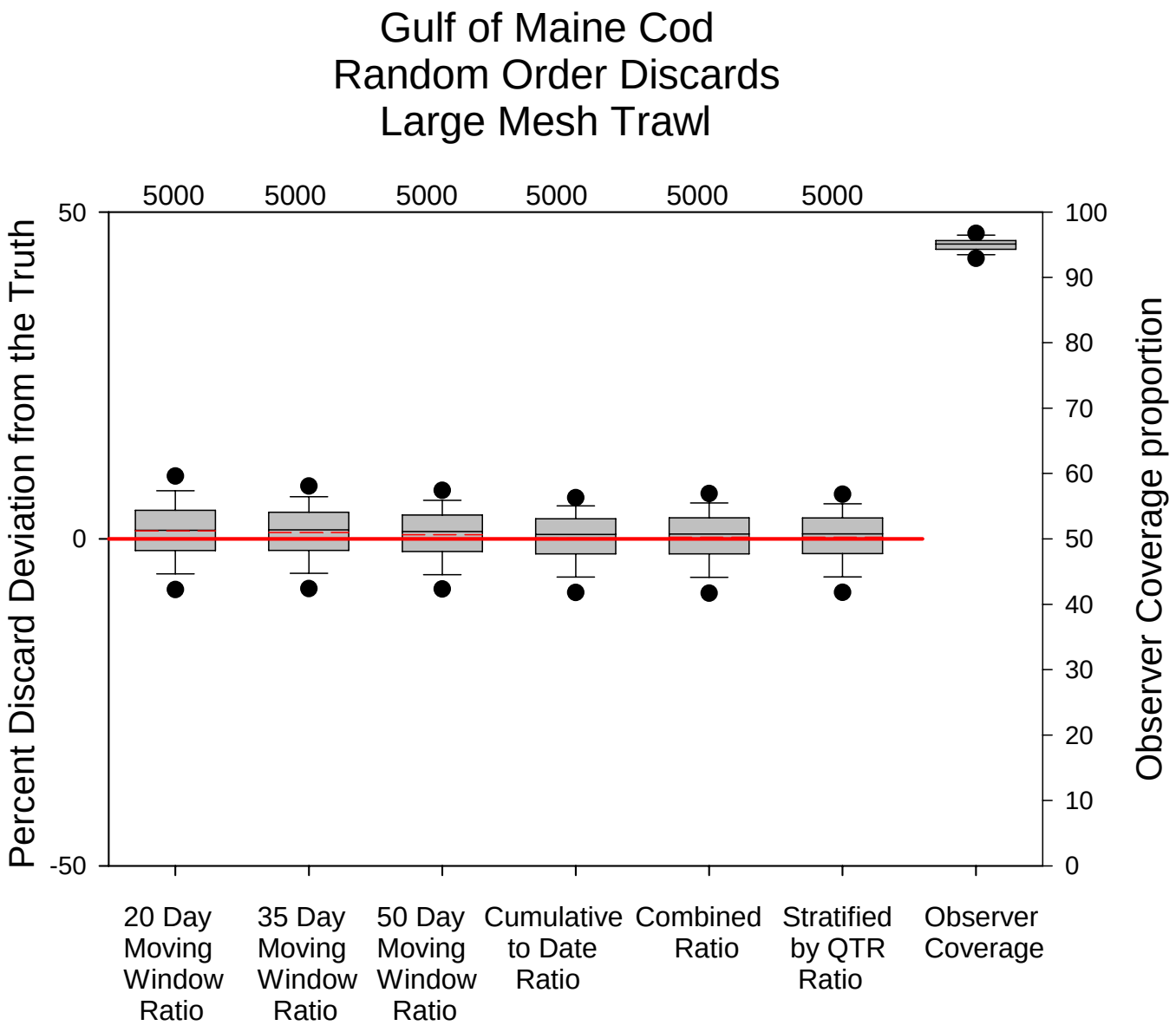

Gulf of Maine Cod
Random Order Discards
Large Mesh Trawl
Discard cod / Kept All
0
1
2
3
4
0
50
100
150
200
250
300
350
Day

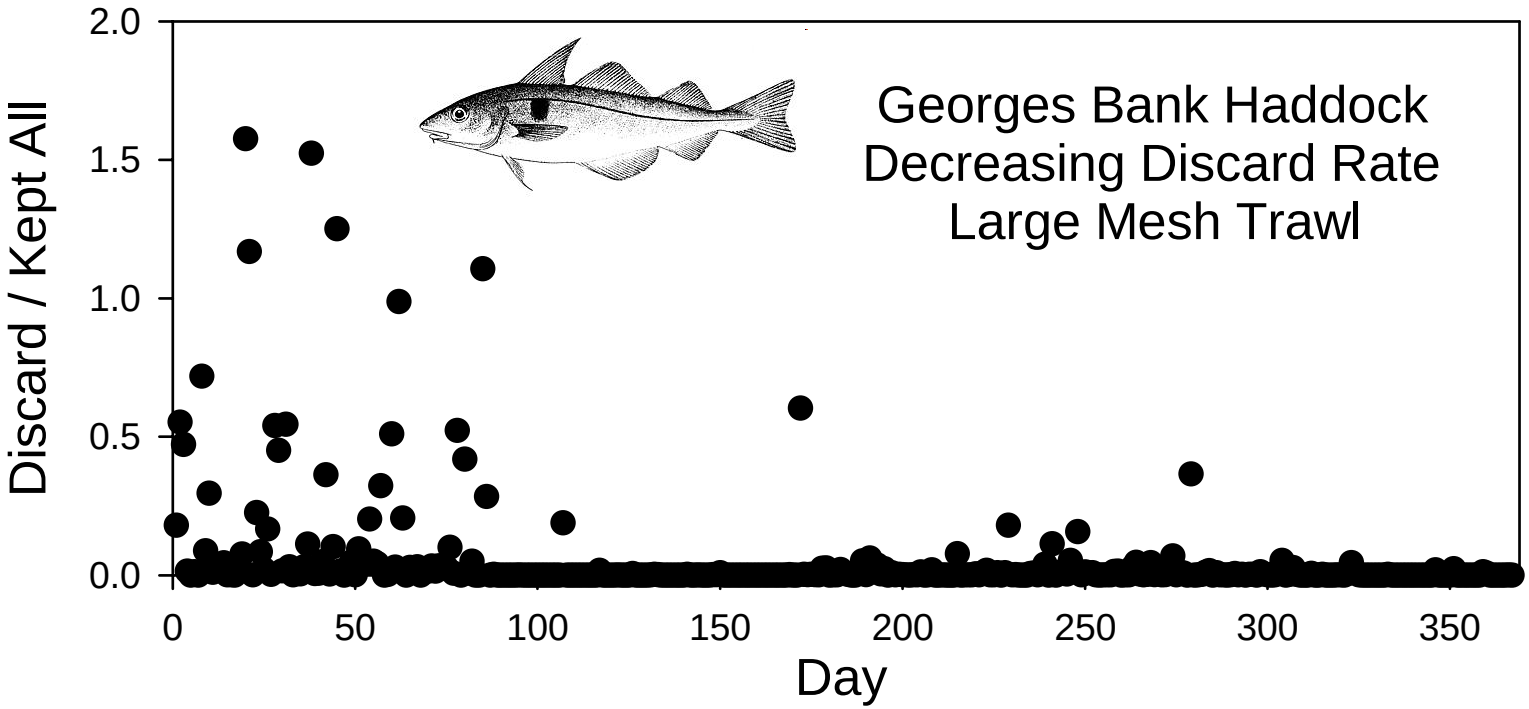

Gulf of Maine Cod
Random Order Discards
Large Mesh Trawl
34
2200
4322
5000
4997
4997
Percent Discard Deviation from the Truth
600
550
500
450
400
350
300
250
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

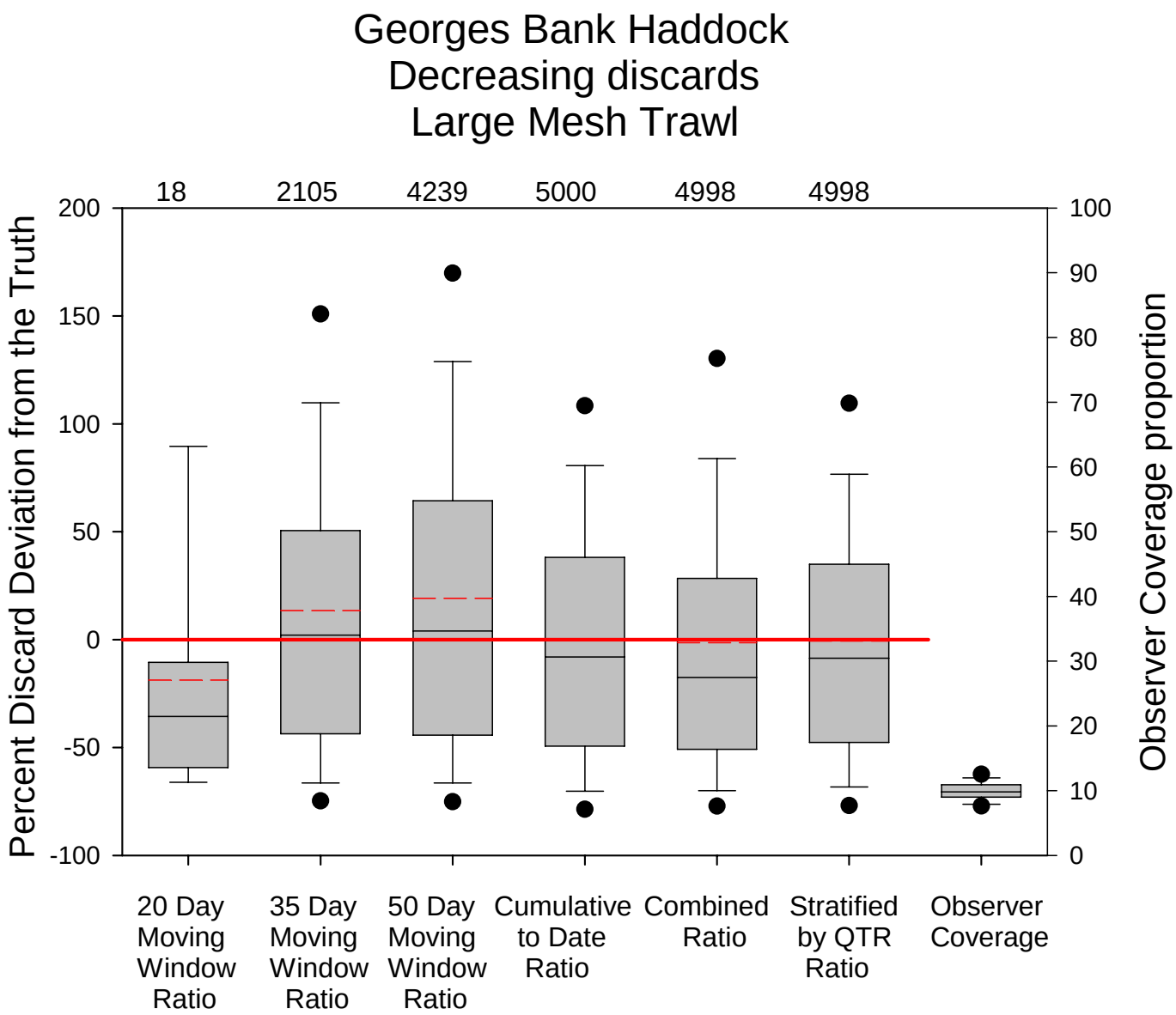

Gulf of Maine Cod
Random Order Discards
Large Mesh Trawl
2557
4894
4997
5000
5000
5000
Percent Discard Deviation from the Truth
400
350
300
250
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

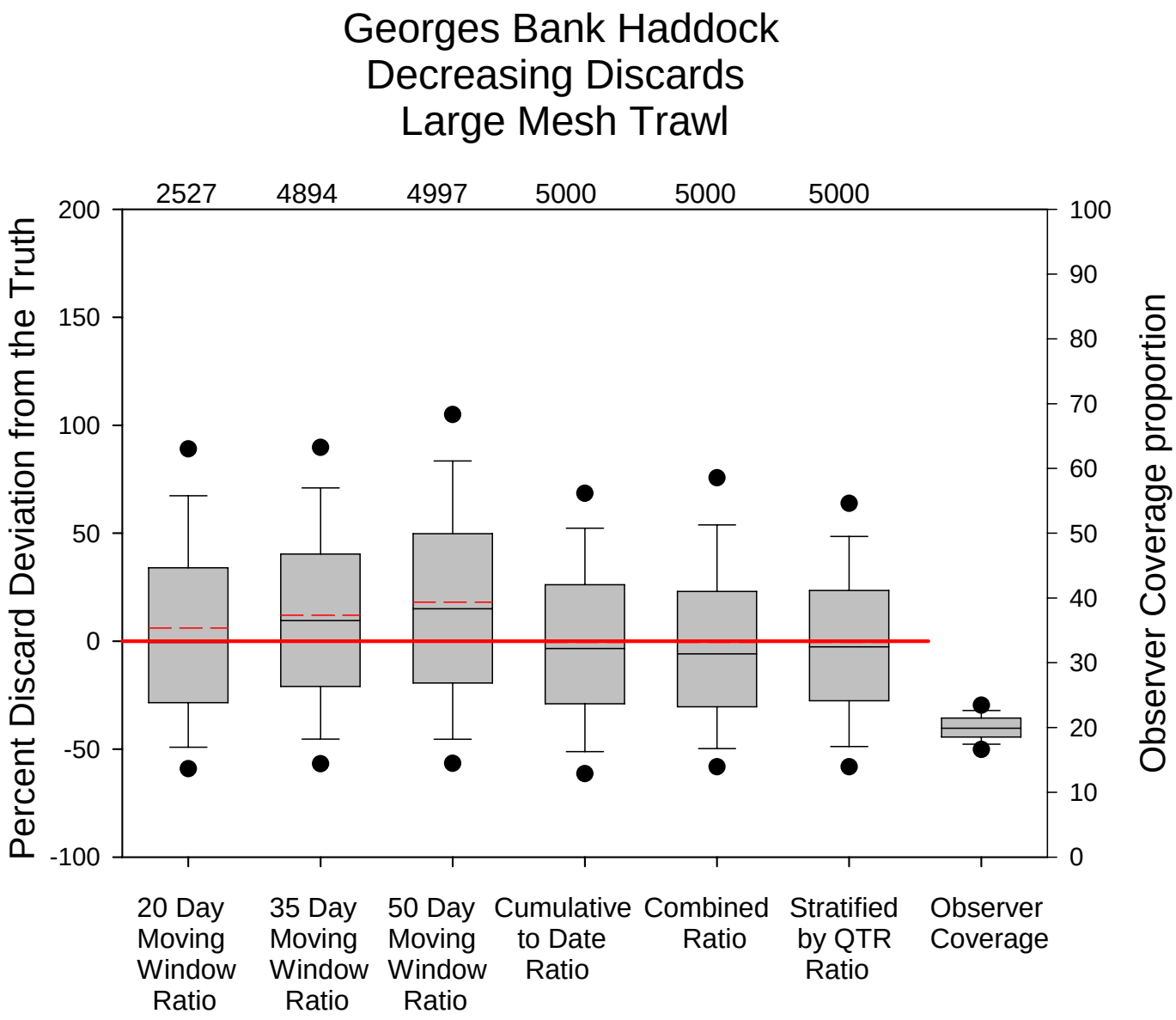

Gulf of Maine Cod
Random Order Discards
Large Mesh Trawl
4981
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

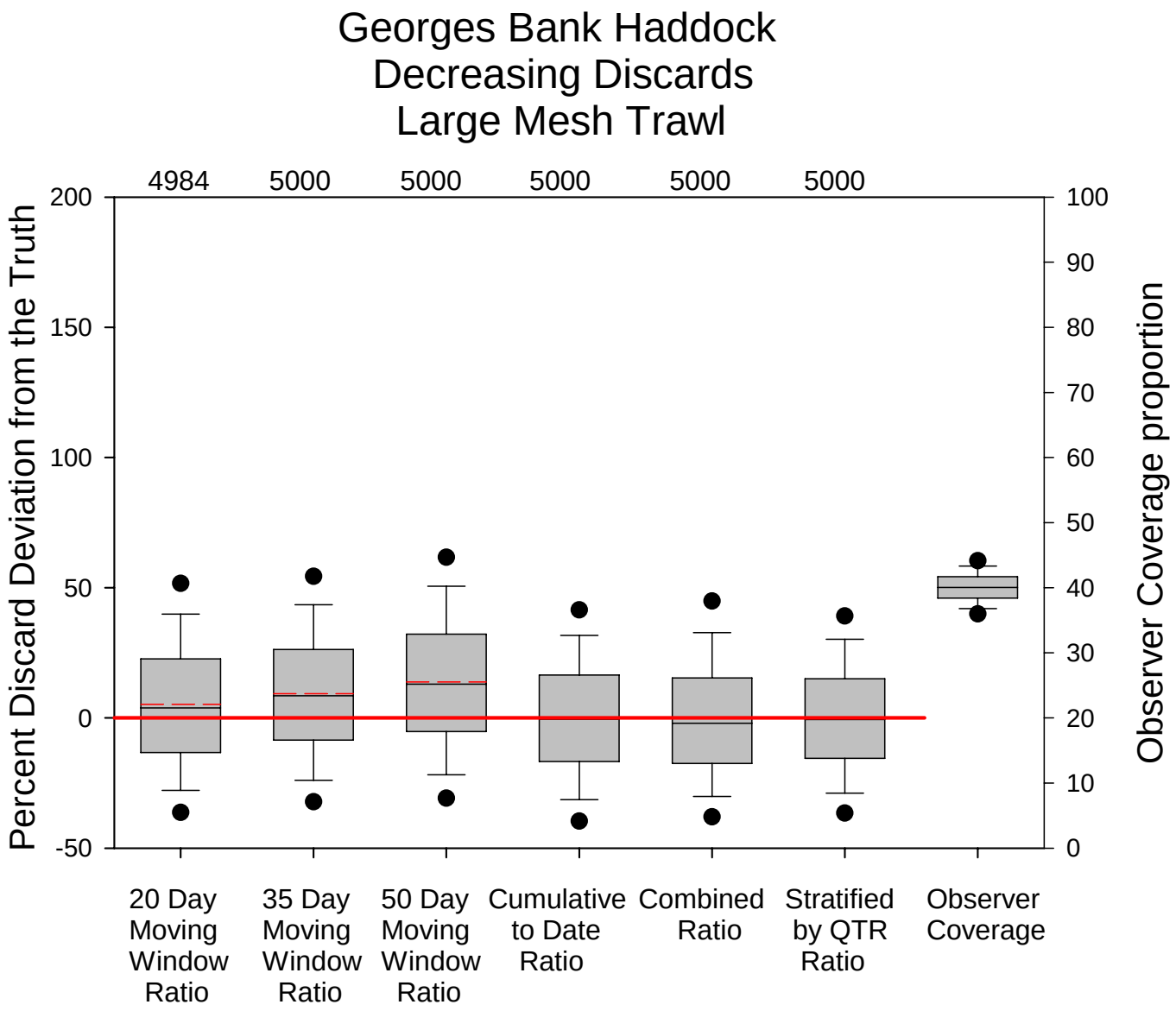

Gulf of Maine Cod
Random Order Discards
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
150
100
50
0
-50
100
90
80
70
60
50
40
30
20
10
0
Percent Discard Deviation from the Truth
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

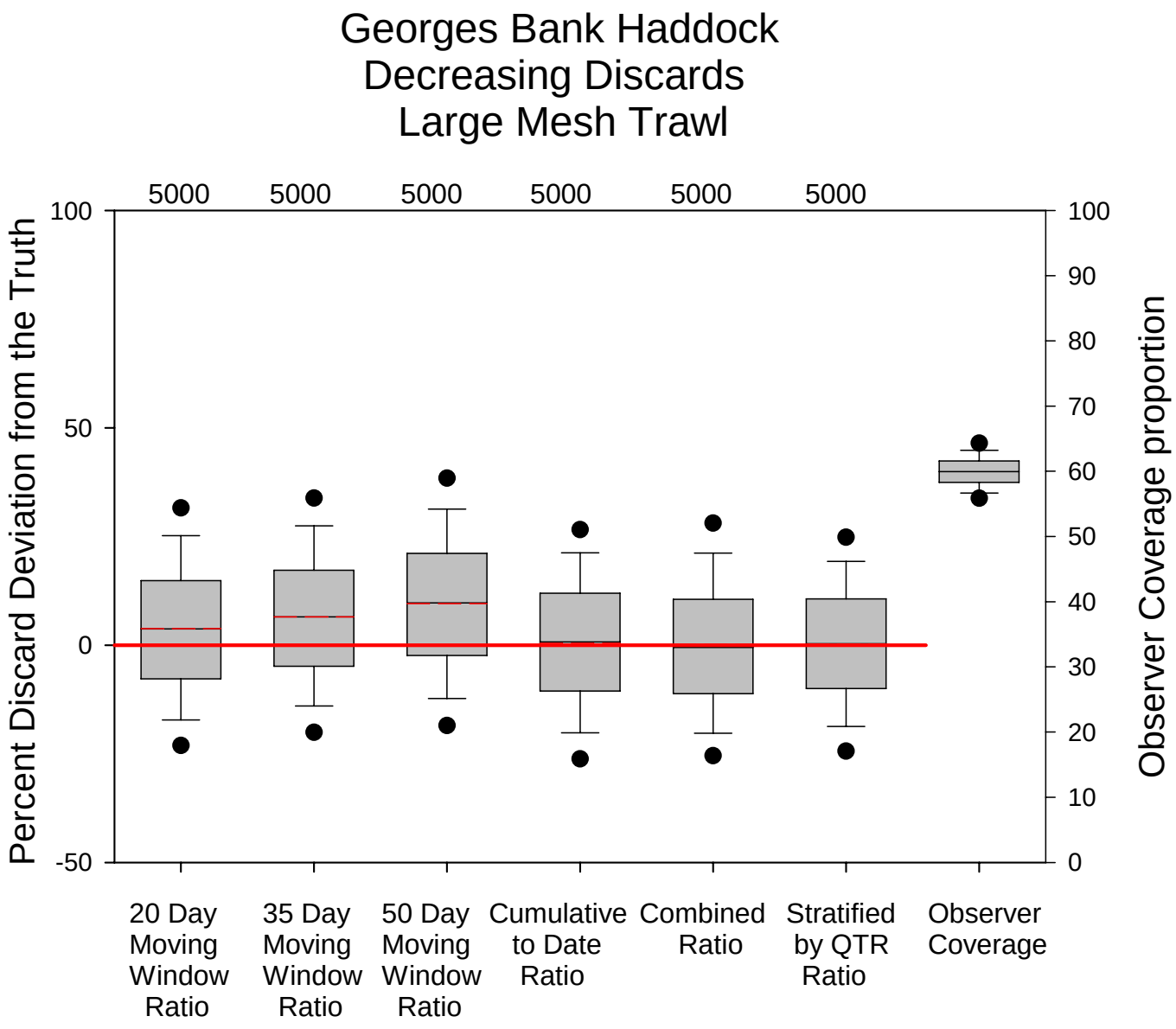

Gulf of Maine Cod
Random Order Discards
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
50
0
-50
100
90
80
70
60
50
40
30
20
10
0
Percent Discard Deviation from the Truth
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

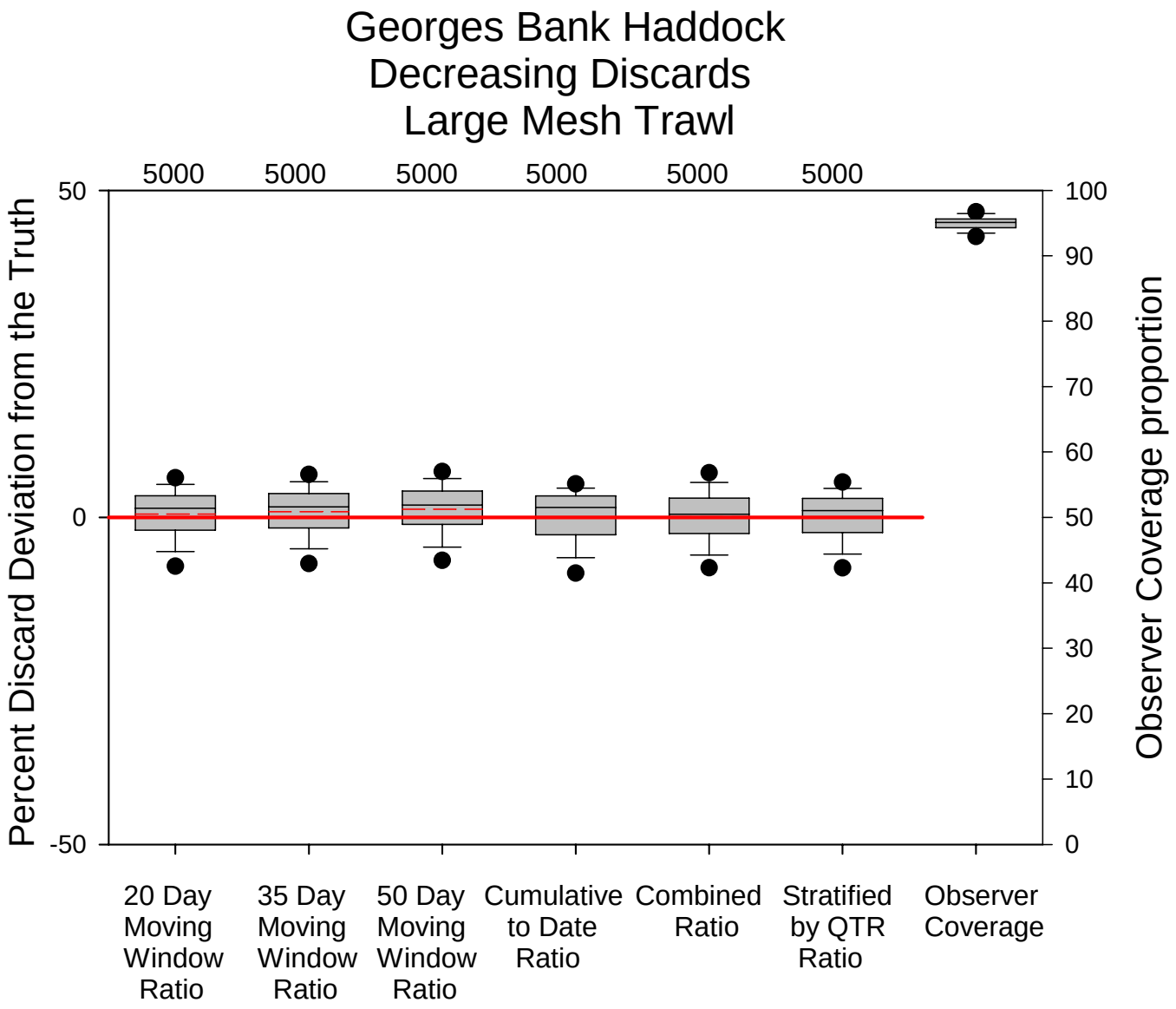

Georges Bank Haddock
Decreasing Discard Rate
Large Mesh Trawl
Discard / Kept All
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
250
300
350
Day

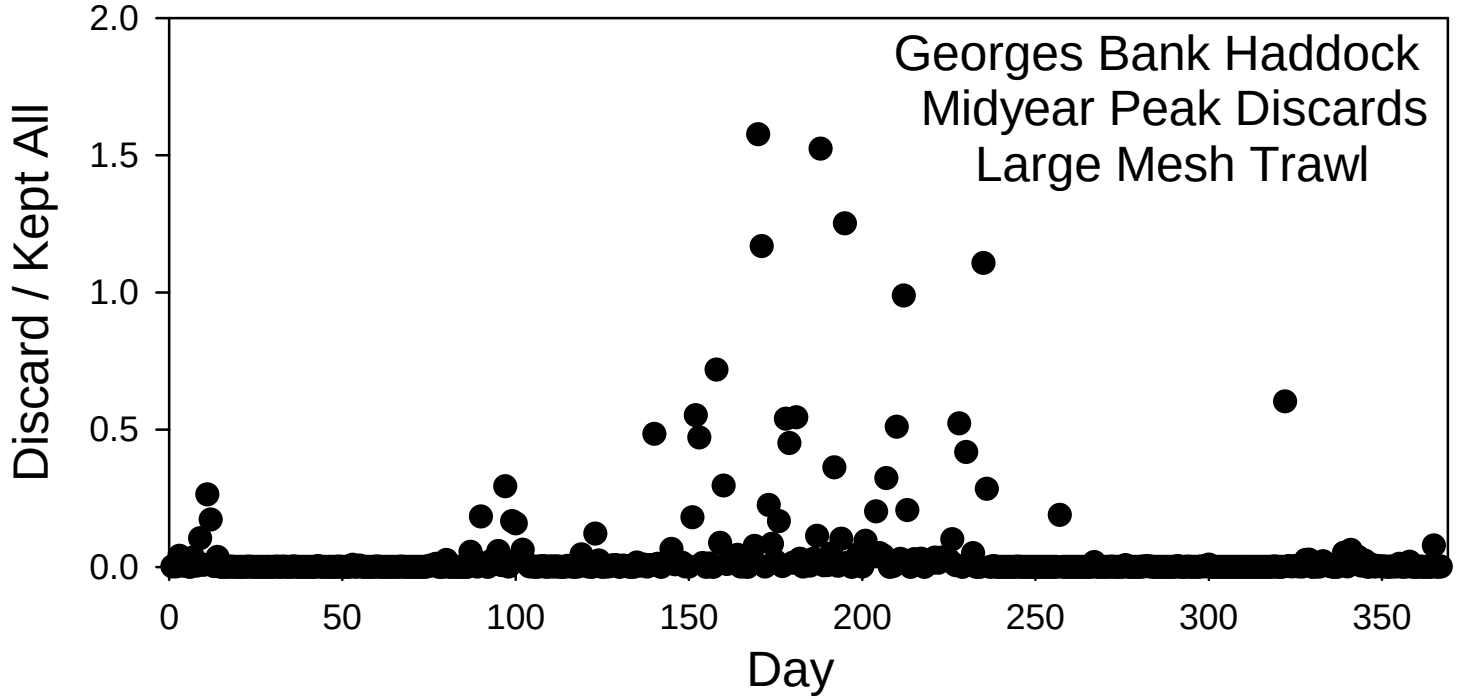

Georges Bank Haddock
Decreasing discards
Large Mesh Trawl
18
2105
4239
5000
4998
4998
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

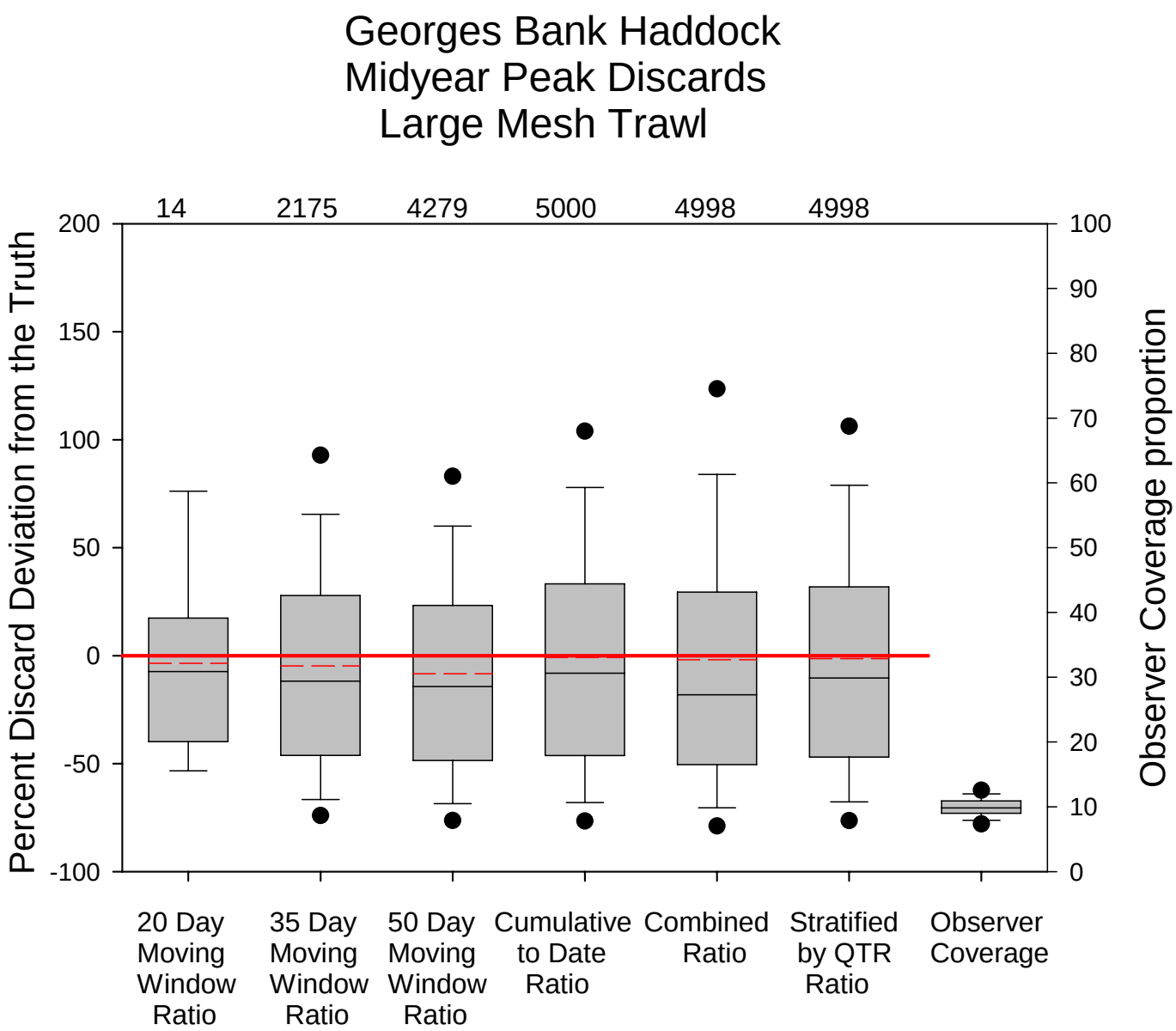

Georges Bank Haddock
Decreasing Discards
Large Mesh Trawl
2527
4894
4997
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

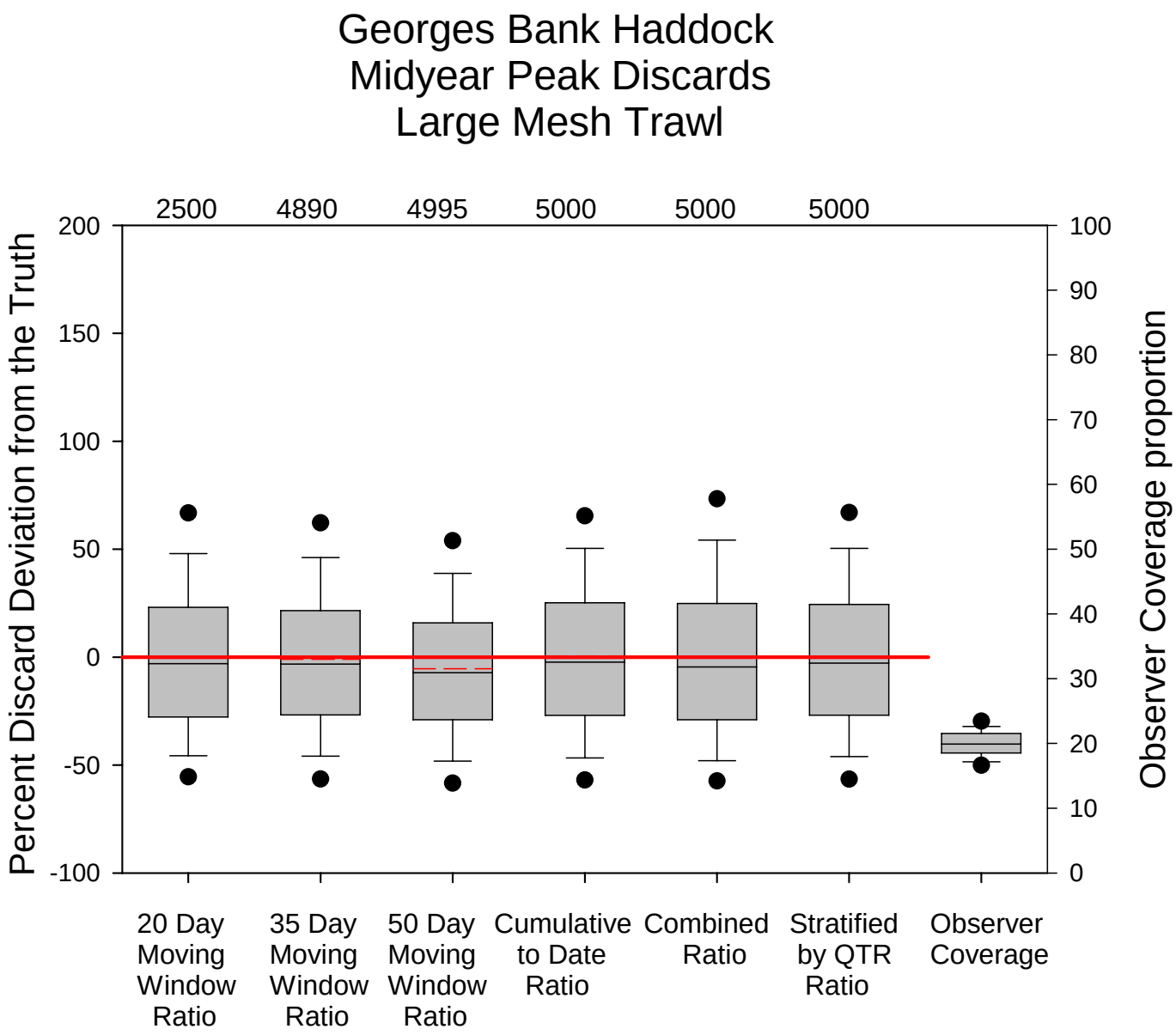

Georges Bank Haddock
Decreasing Discards
Large Mesh Trawl
4984
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

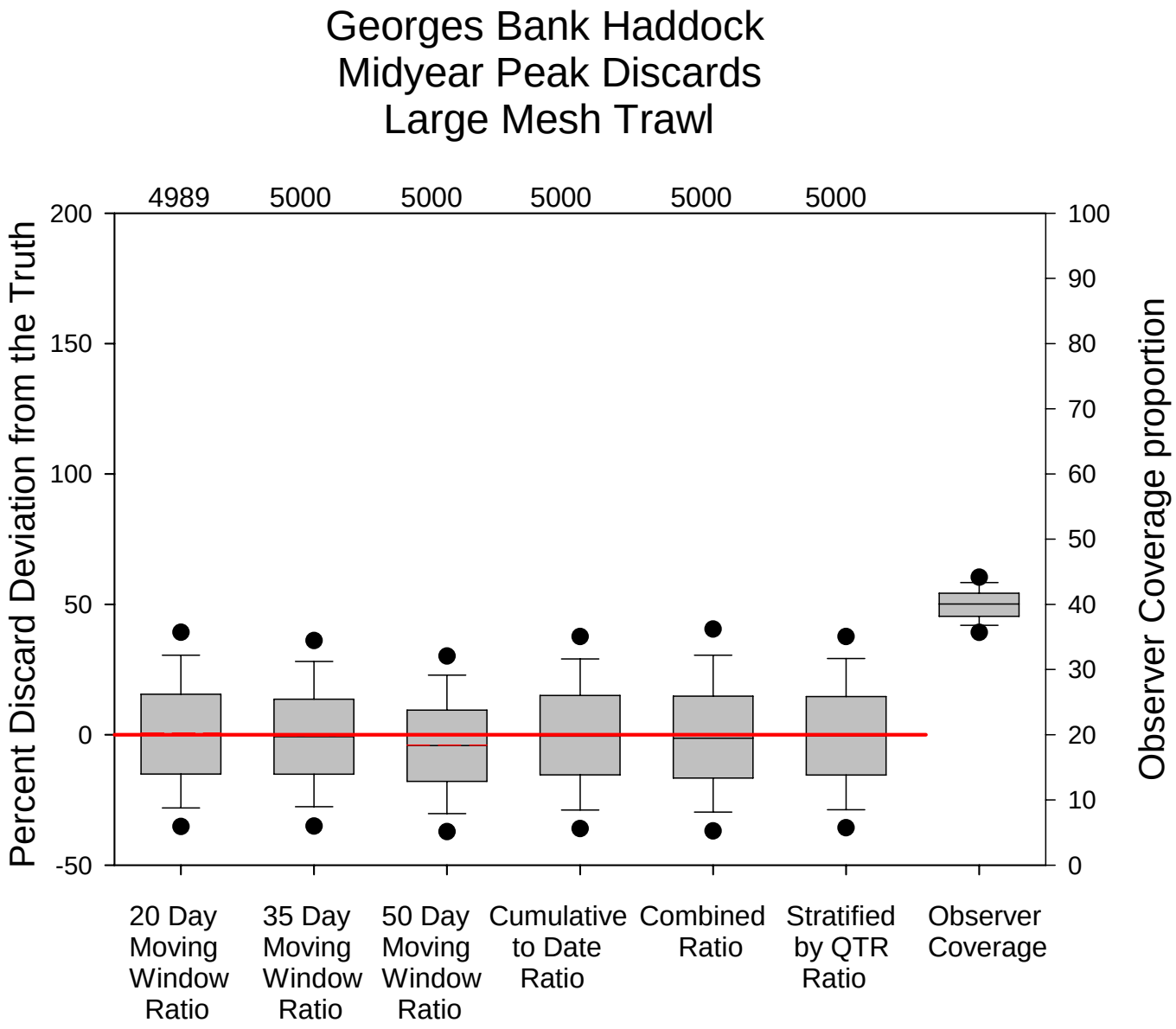

Georges Bank Haddock
Decreasing Discards
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
100
50
0
-50
Percent Discard Deviation from the Truth
100
90
80
70
60
50
40
30
20
10
0
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

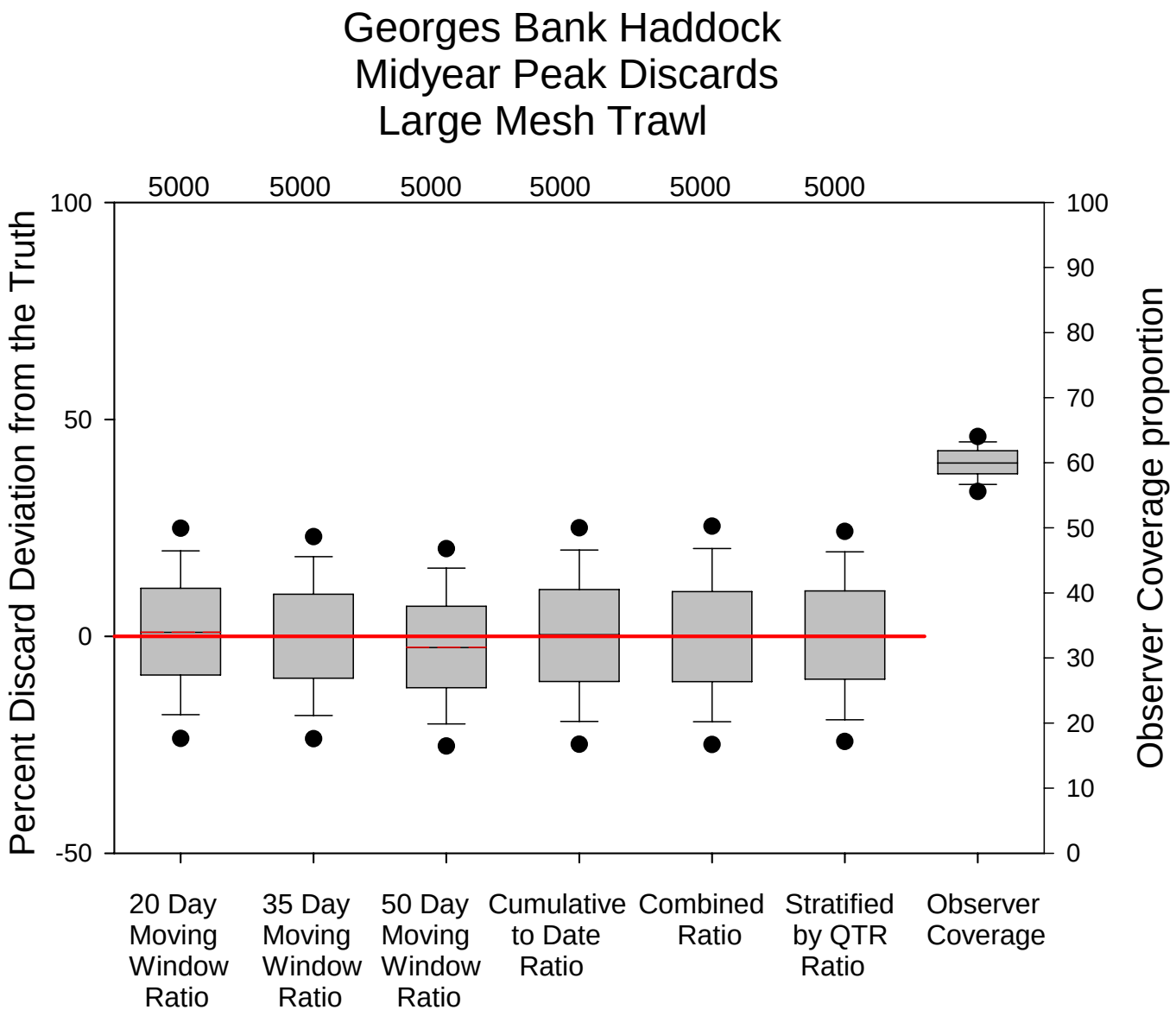

Georges Bank Haddock
Decreasing Discards
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

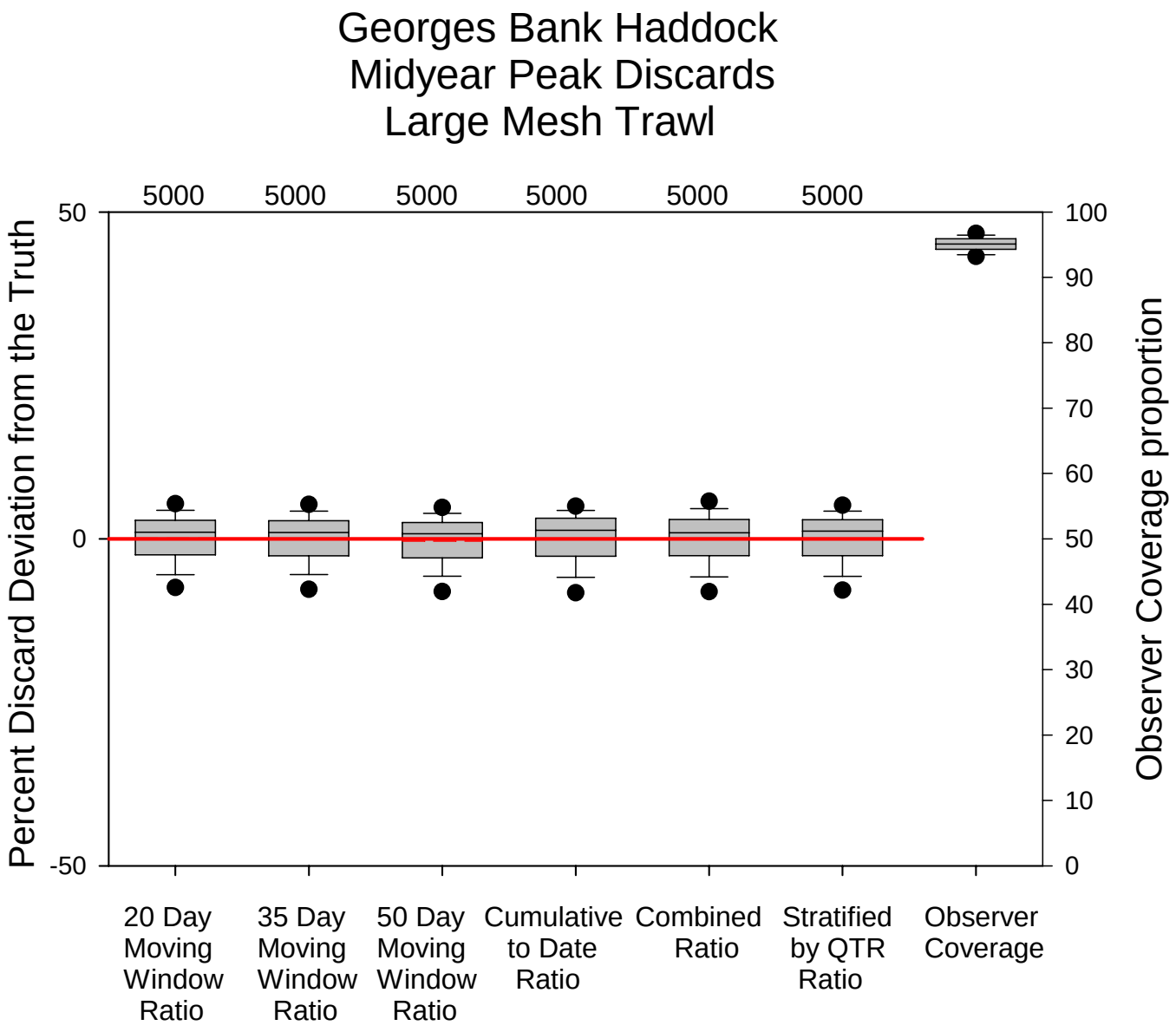

Georges Bank Haddock
Midyear Peak Discards
Large Mesh Trawl
Discard / Kept All
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
250
300
350
Day

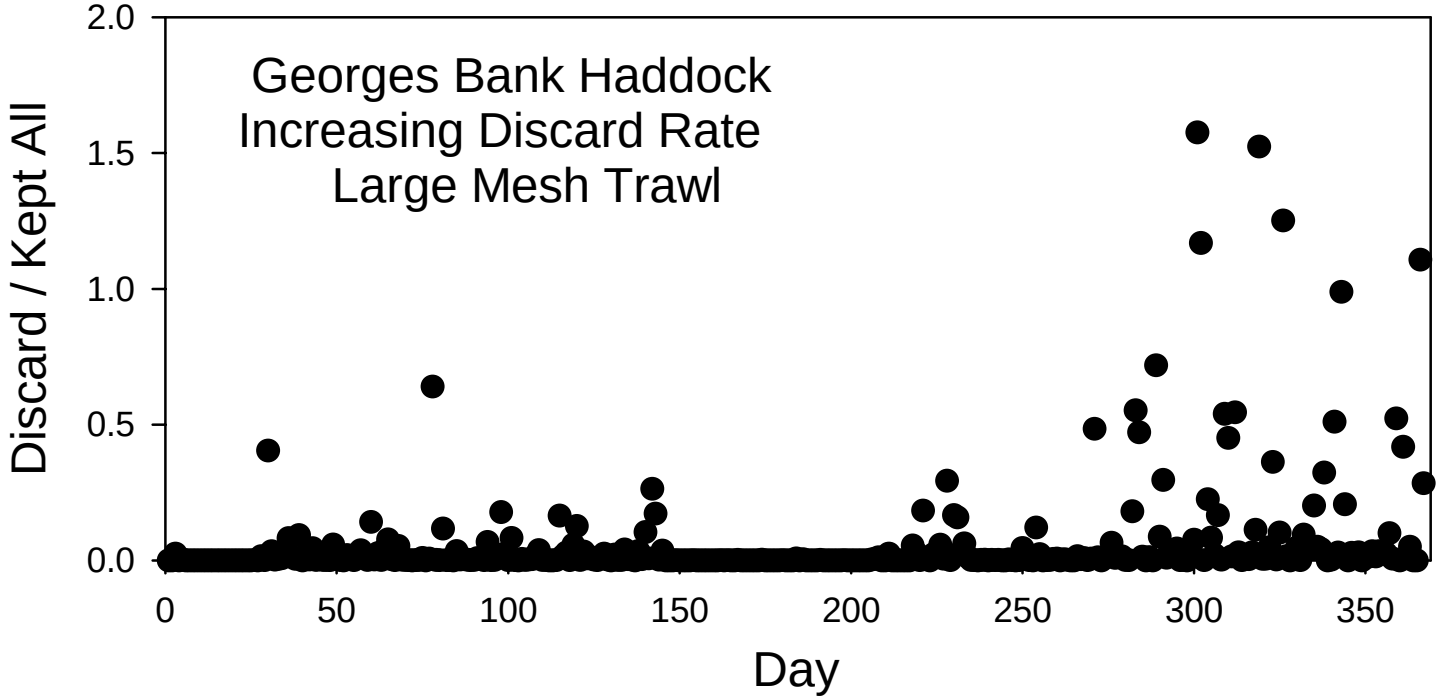

Georges Bank Haddock
Midyear Peak Discards
Large Mesh Trawl
14
2175
4279
5000
4998
4998
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

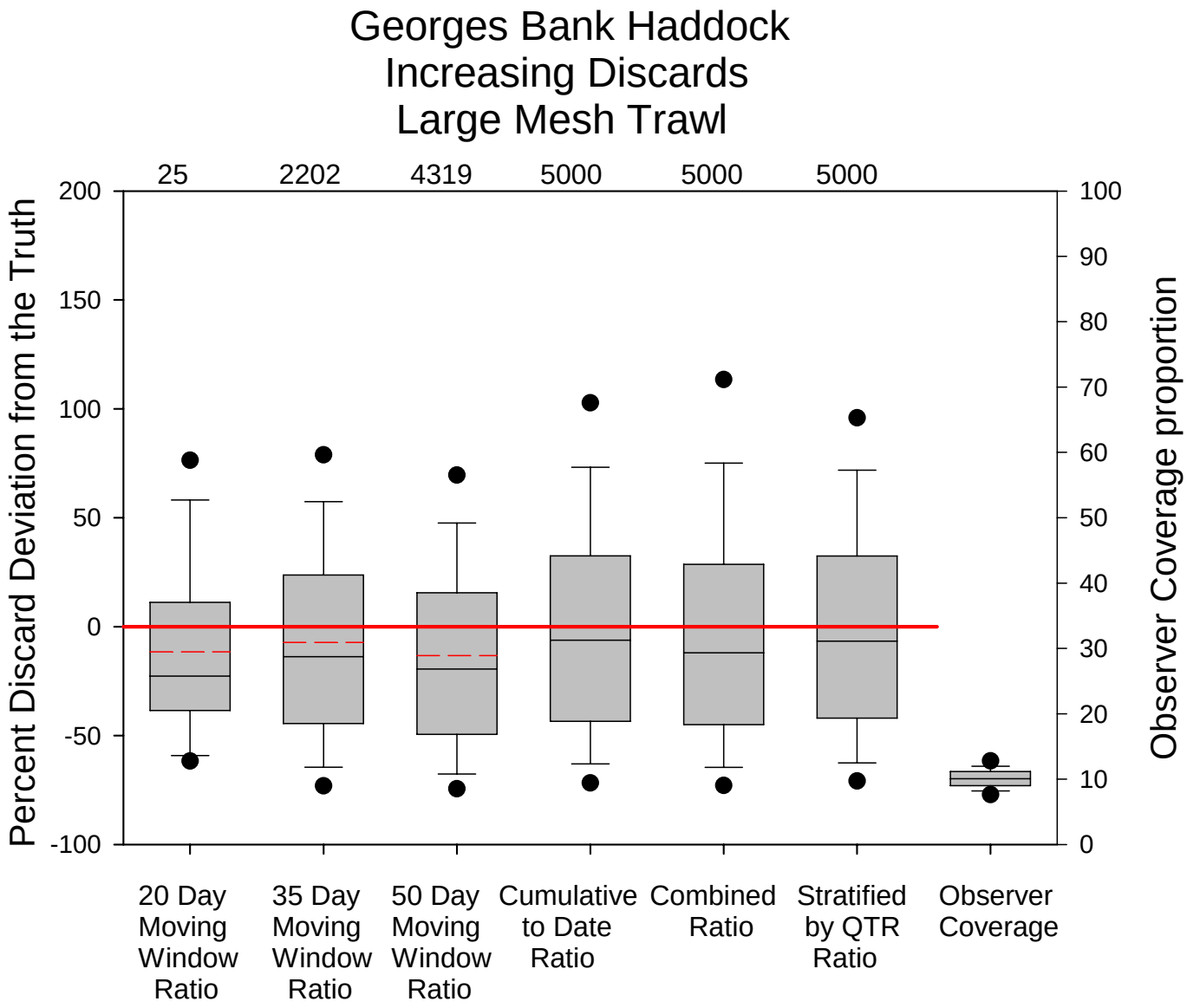

Georges Bank Haddock
Midyear Peak Discards
Large Mesh Trawl
2500
4890
4995
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

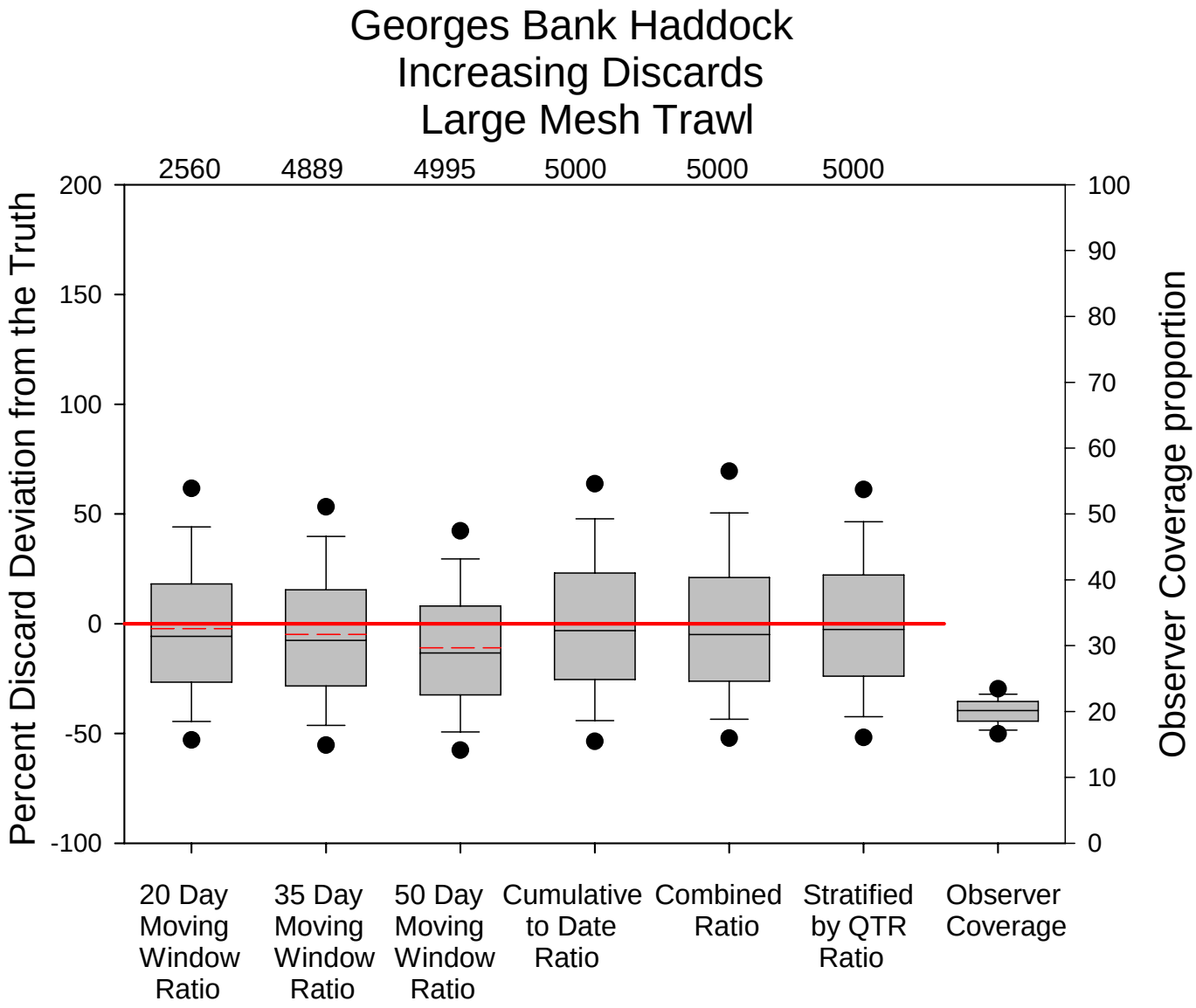

Georges Bank Haddock
Midyear Peak Discards
Large Mesh Trawl
4989
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

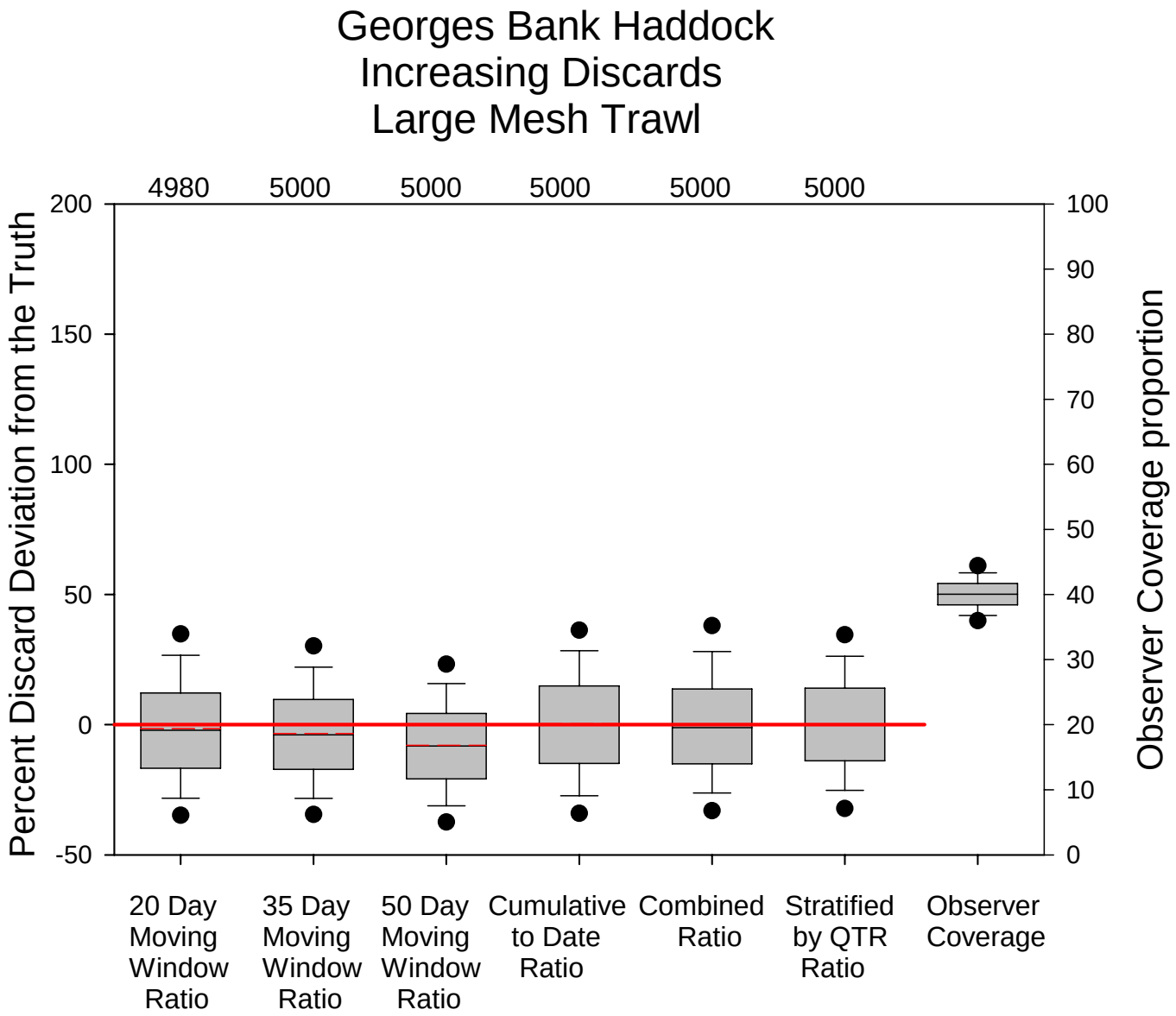

Georges Bank Haddock
Midyear Peak Discards
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

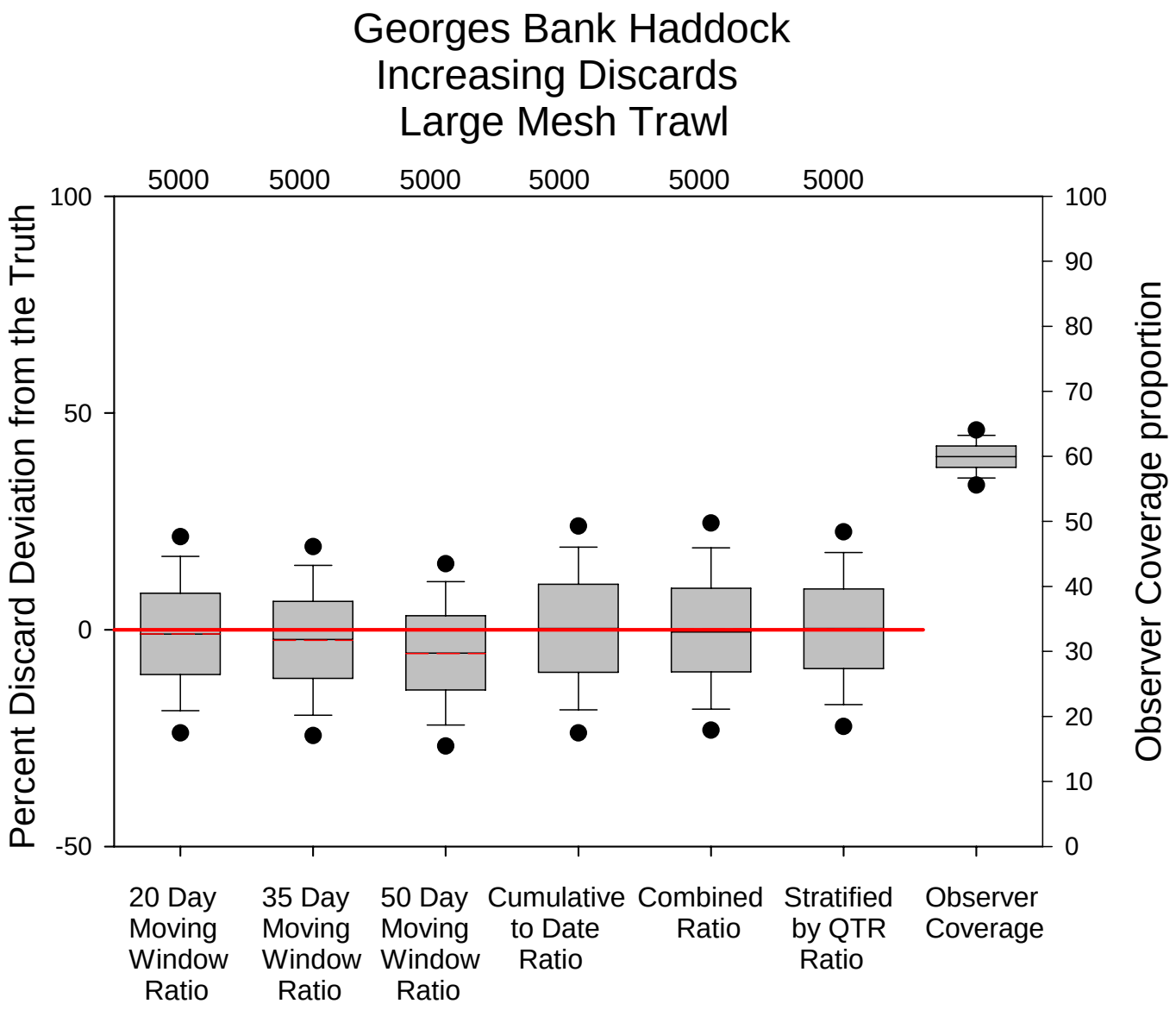

Georges Bank Haddock
Midyear Peak Discards
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
50
0
-50
100
90
80
70
60
50
40
30
20
10
0
Percent Discard Deviation from the Truth
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

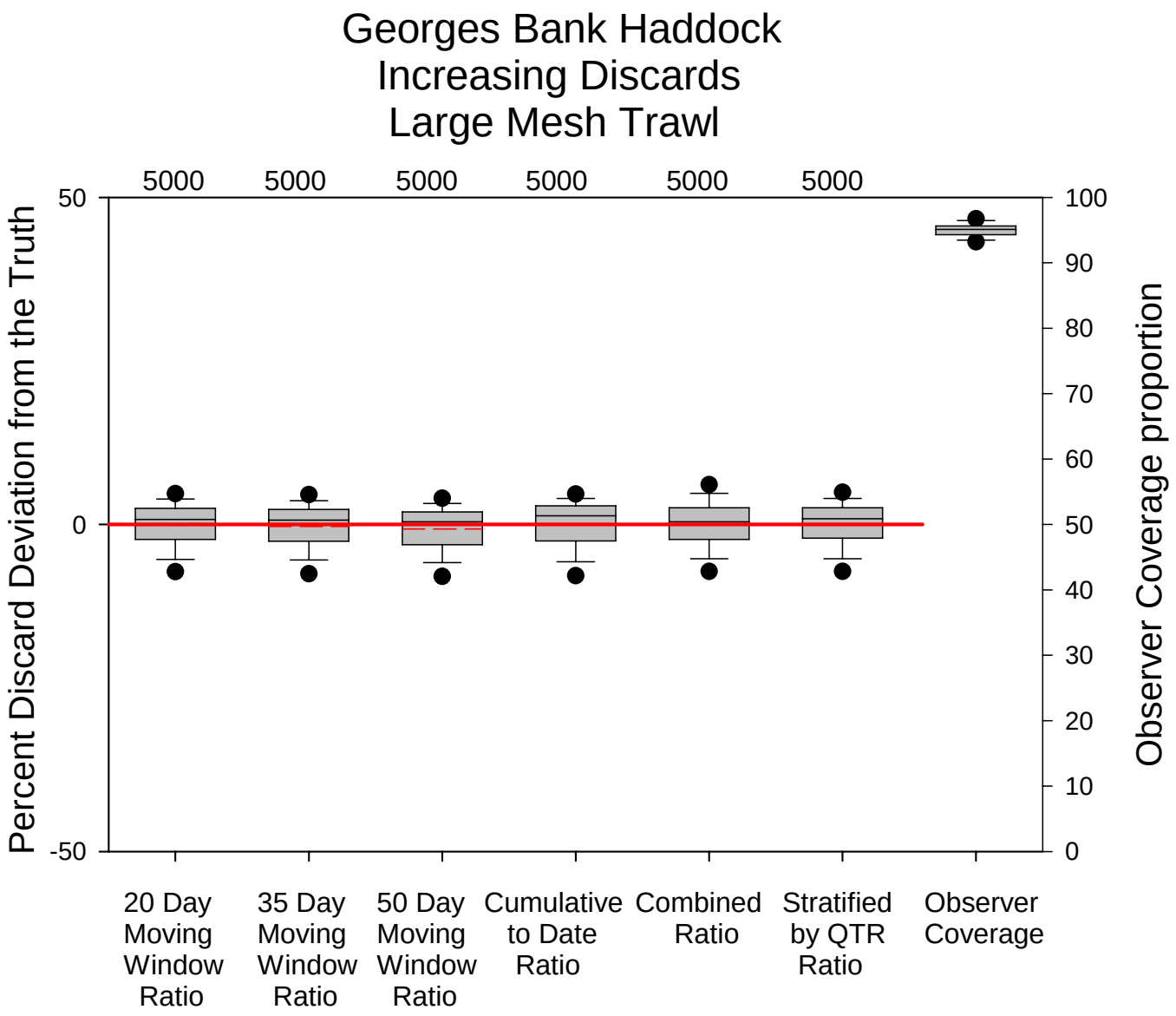

Georges Bank Haddock
Increasing Discard Rate
Large Mesh Trawl
Discard / Kept All
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
250
300
350
Day

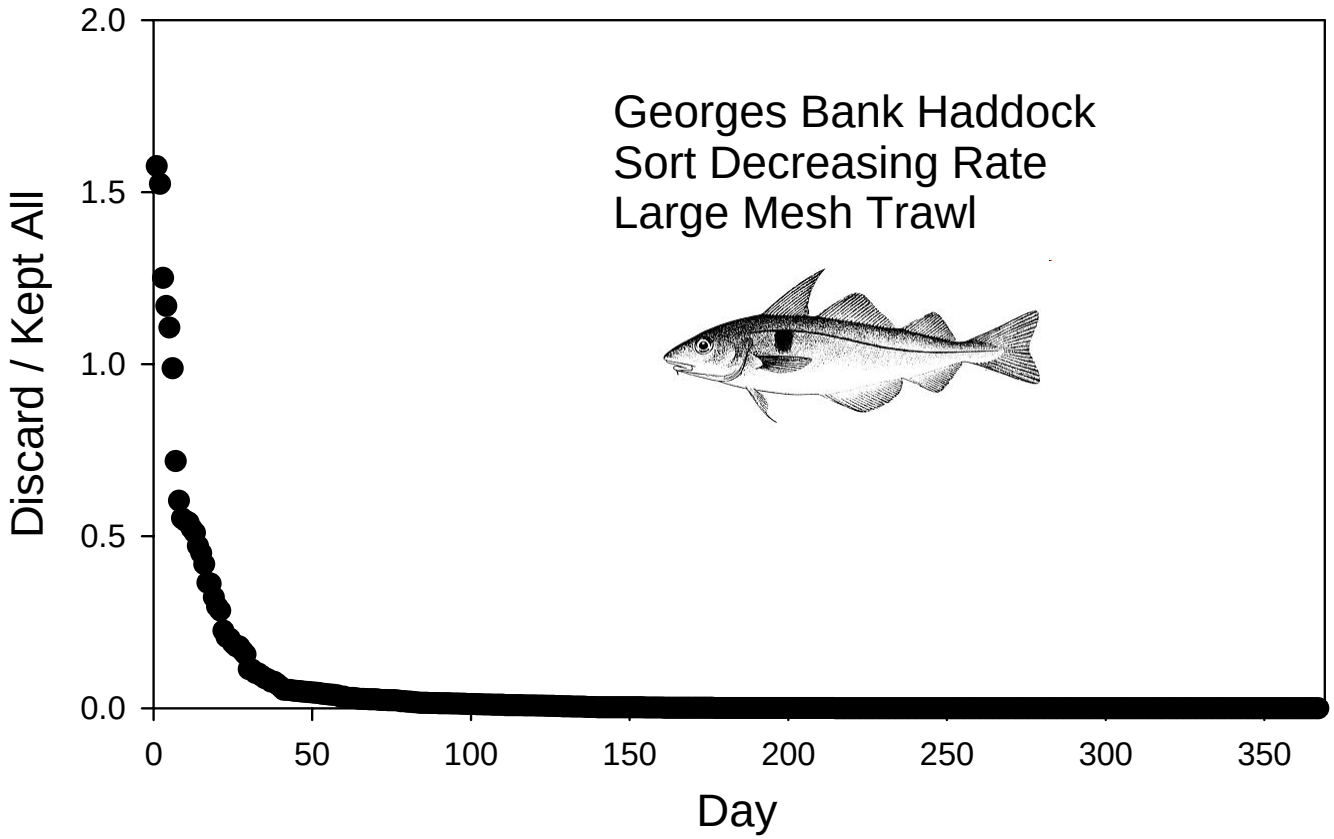

Georges Bank Haddock
Increasing Discards
Large Mesh Trawl
25
2202
4319
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

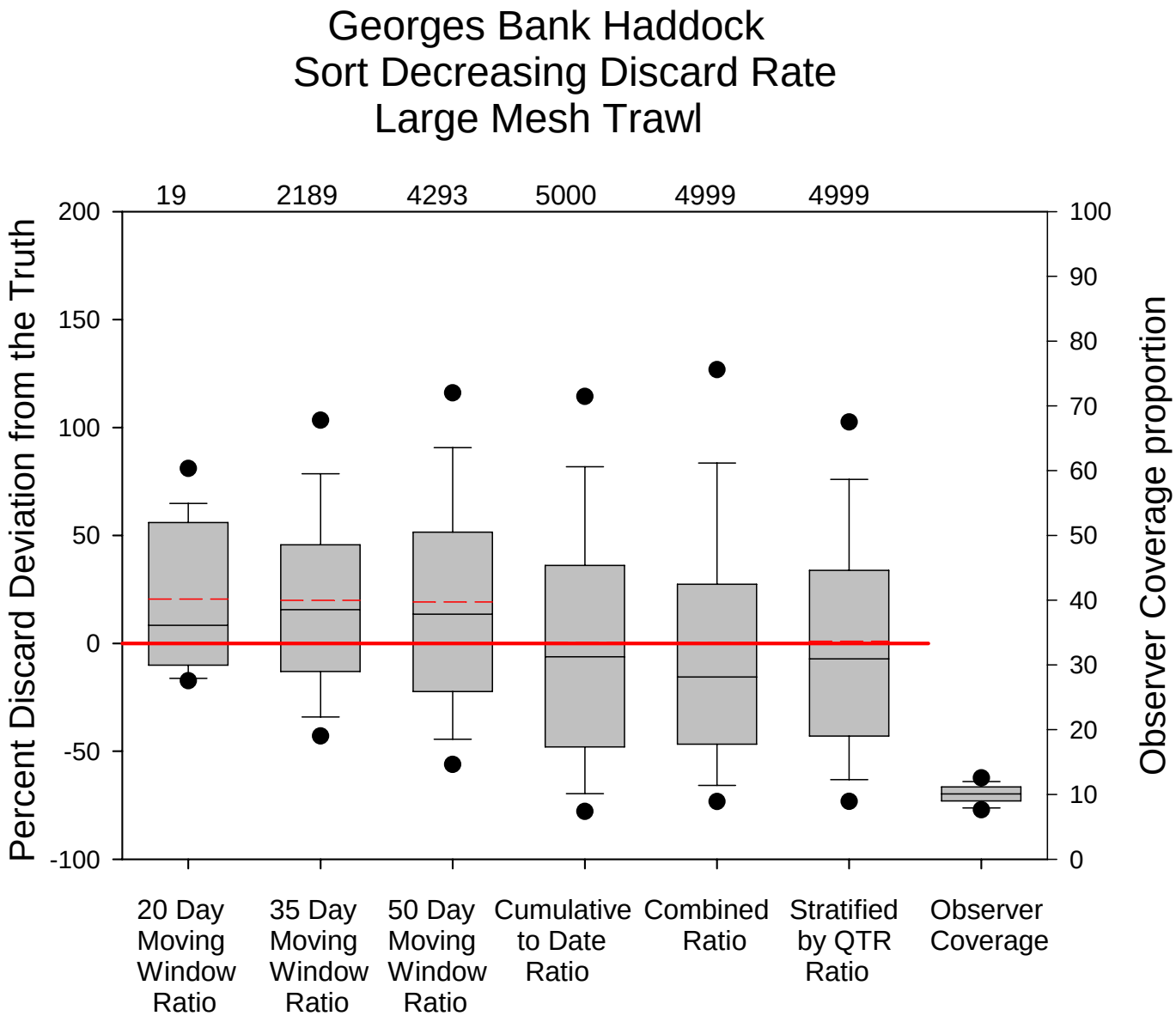

Georges Bank Haddock
Increasing Discards
Large Mesh Trawl
2560
4889
4995
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

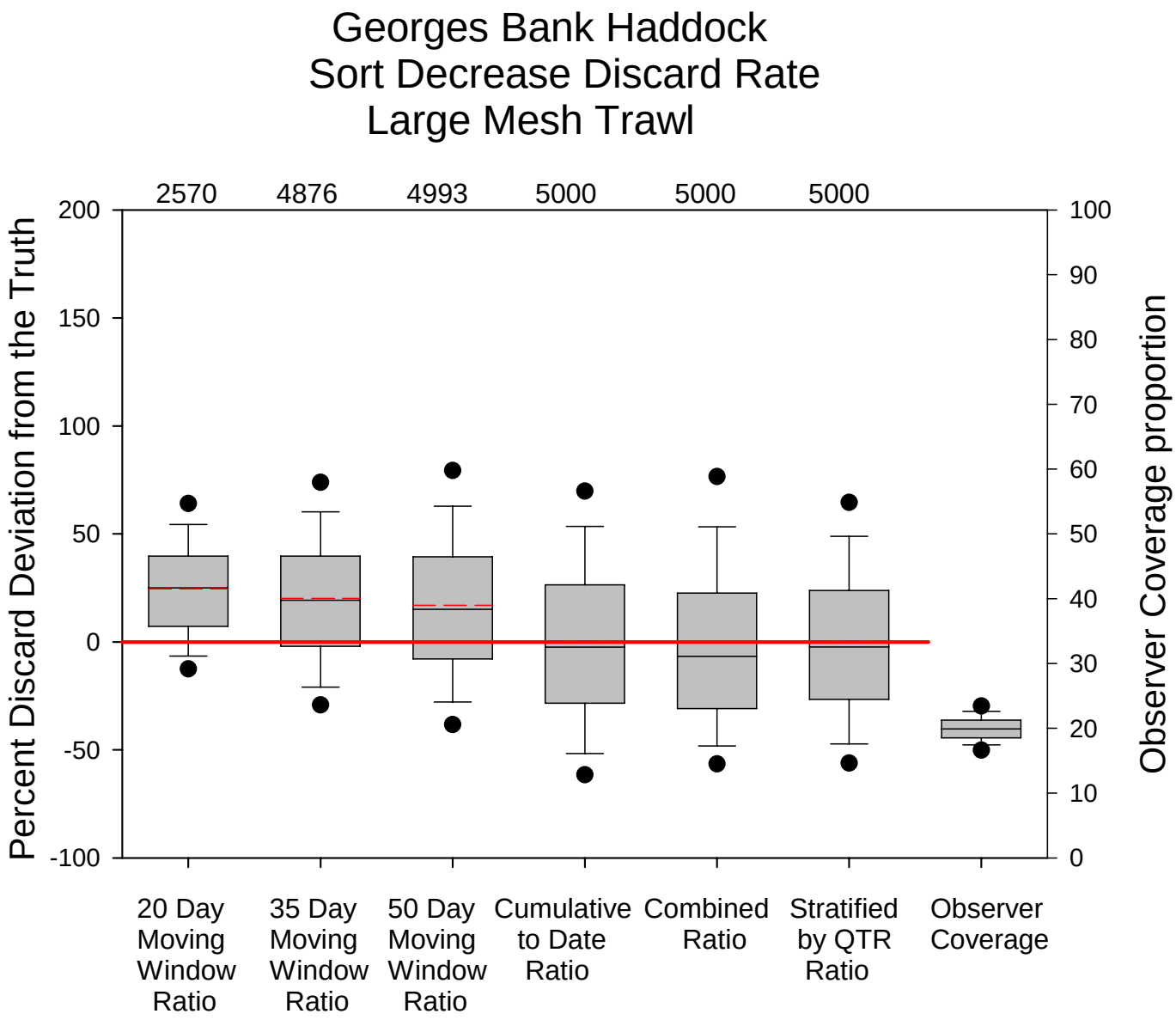

Georges Bank Haddock
Increasing Discards
Large Mesh Trawl
4980
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

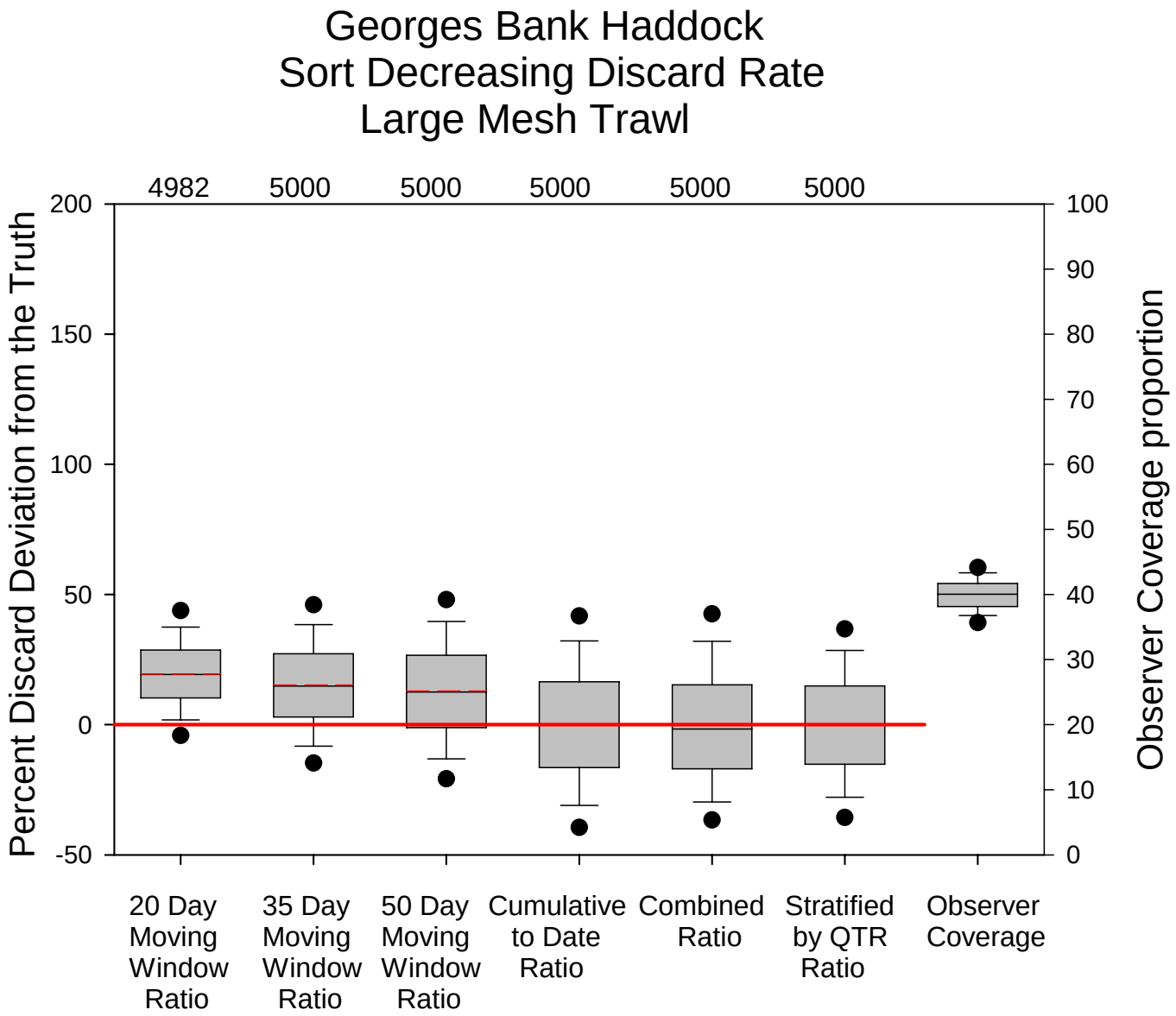

Georges Bank Haddock
Increasing Discards
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
100
50
0
-50
Percent Discard Deviation from the Truth
100
90
80
70
60
50
40
30
20
10
0
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

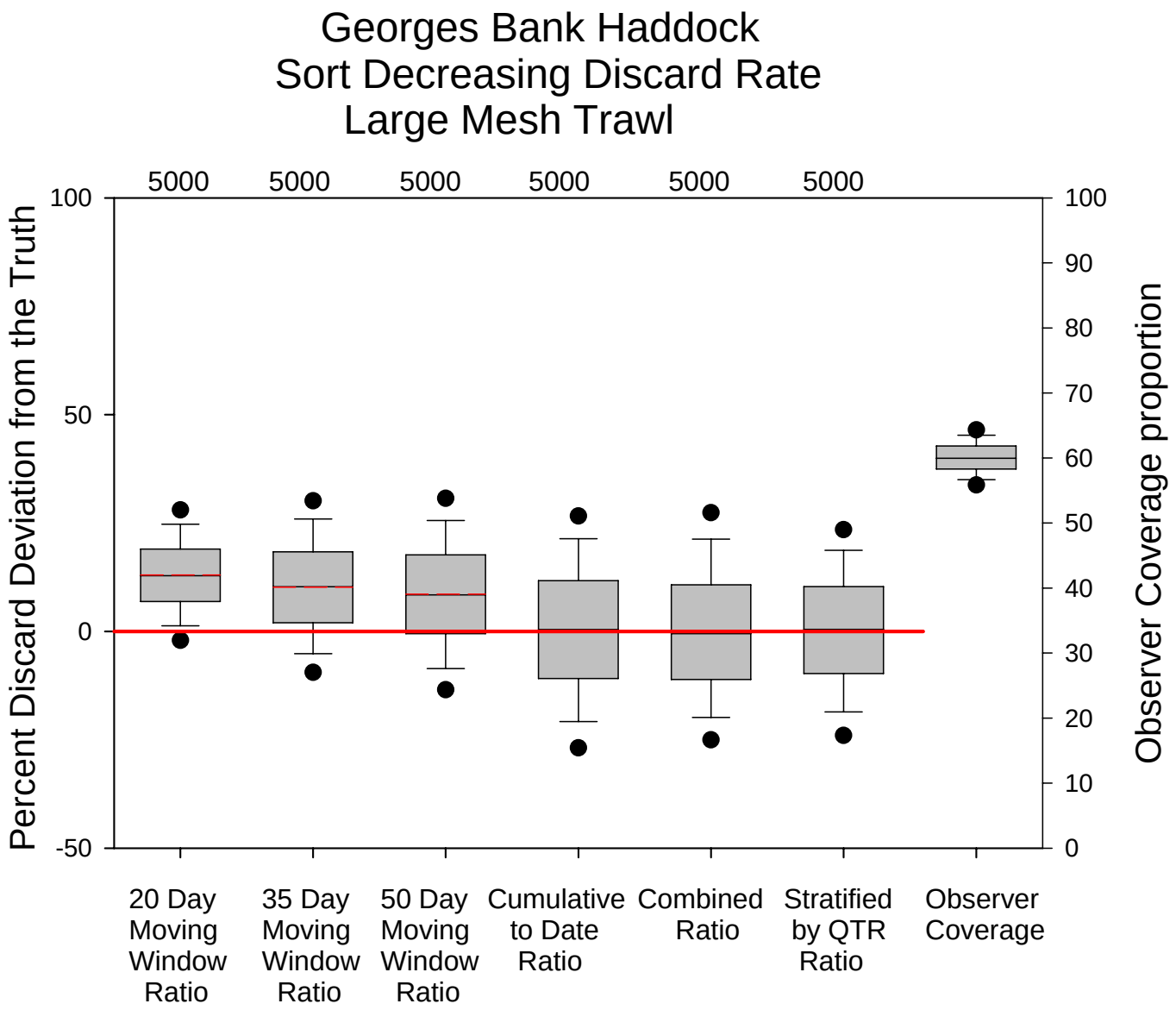

Georges Bank Haddock
Increasing Discards
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
50
0
-50
100
90
80
70
60
50
40
30
20
10
0
Percent Discard Deviation from the Truth
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

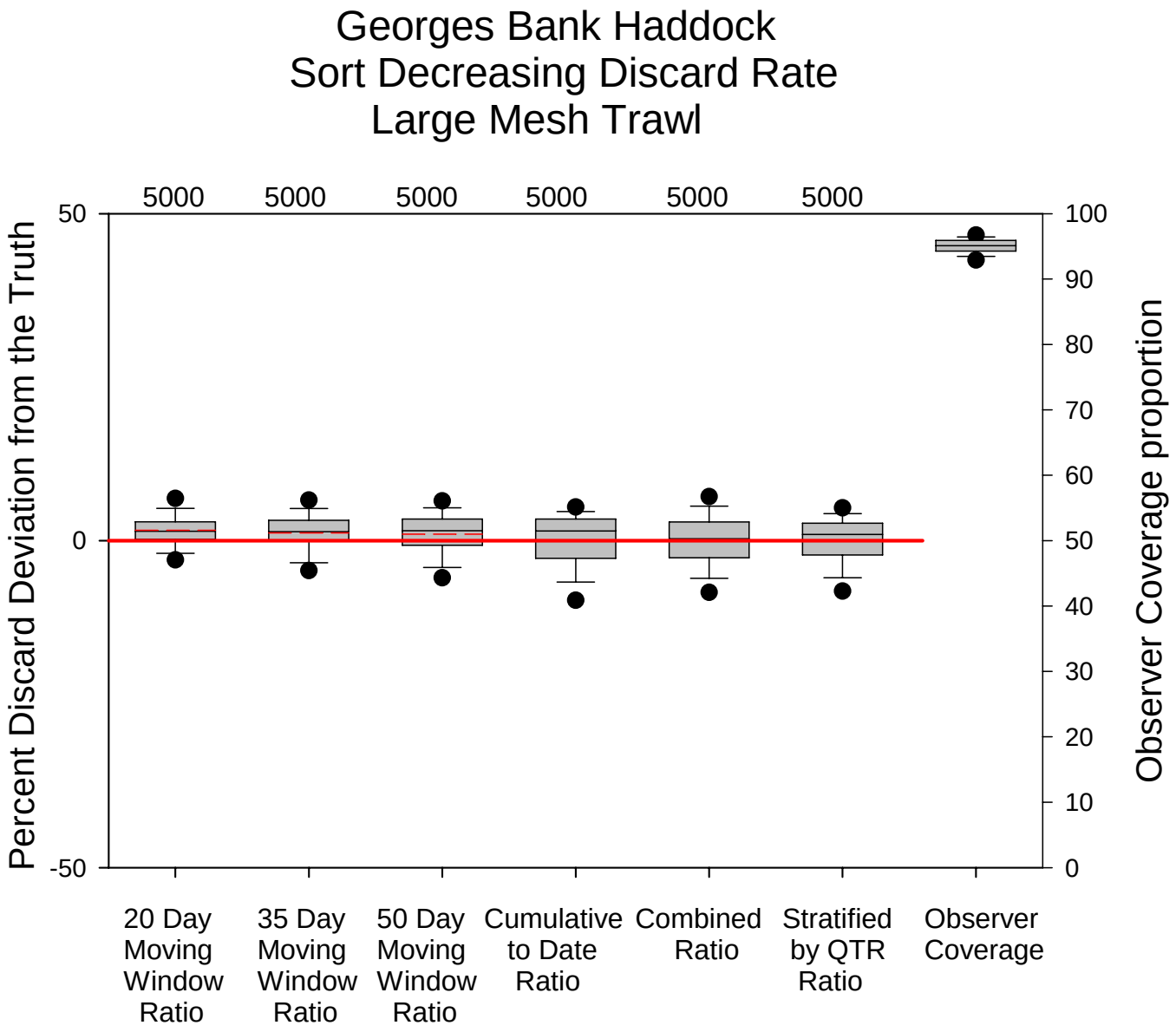

Georges Bank Haddock
Sort Decreasing Rate
Large Mesh Trawl
Discard / Kept All
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
250
300
350
Day

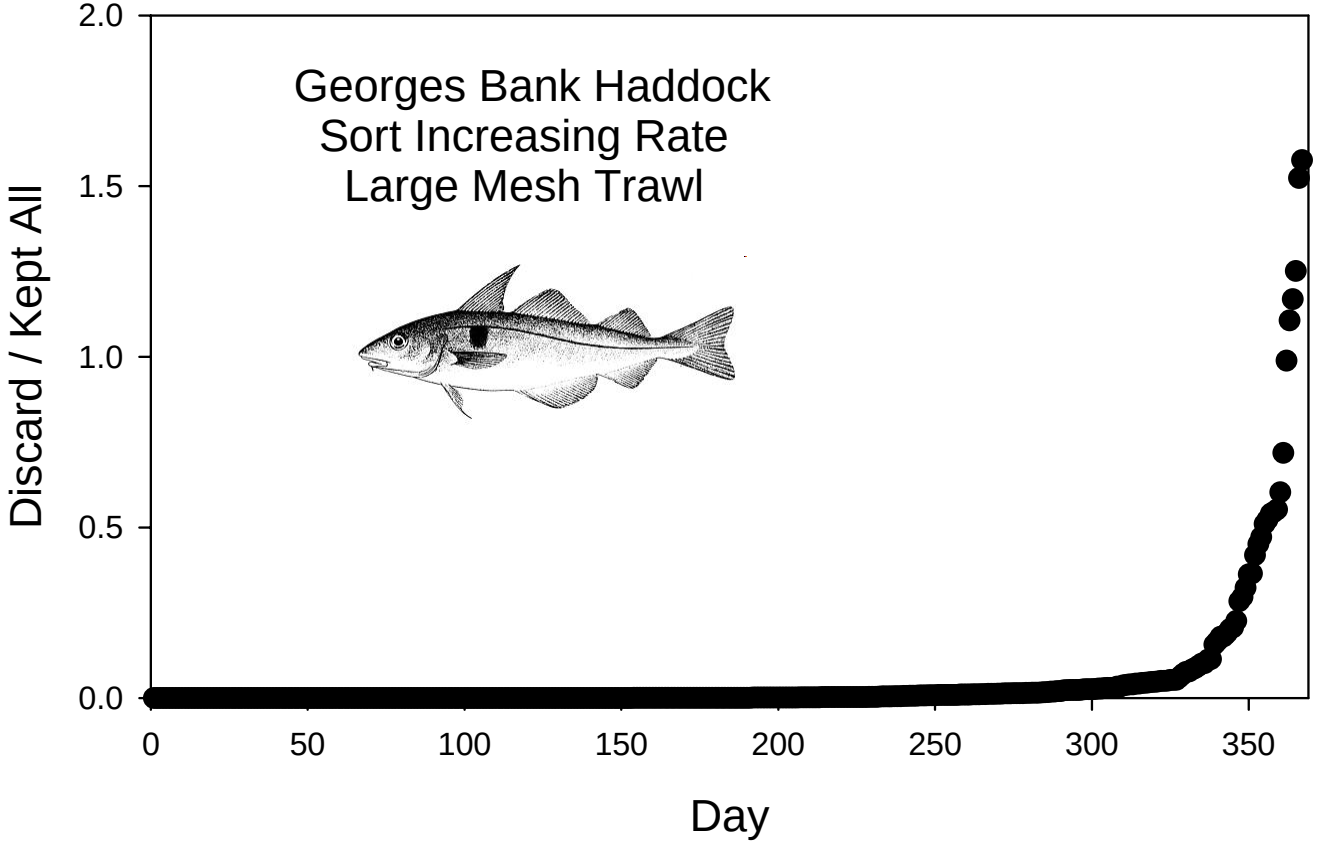

Georges Bank Haddock
Sort Decreasing Discard Rate
Large Mesh Trawl
19
2189
4293
5000
4999
4999
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

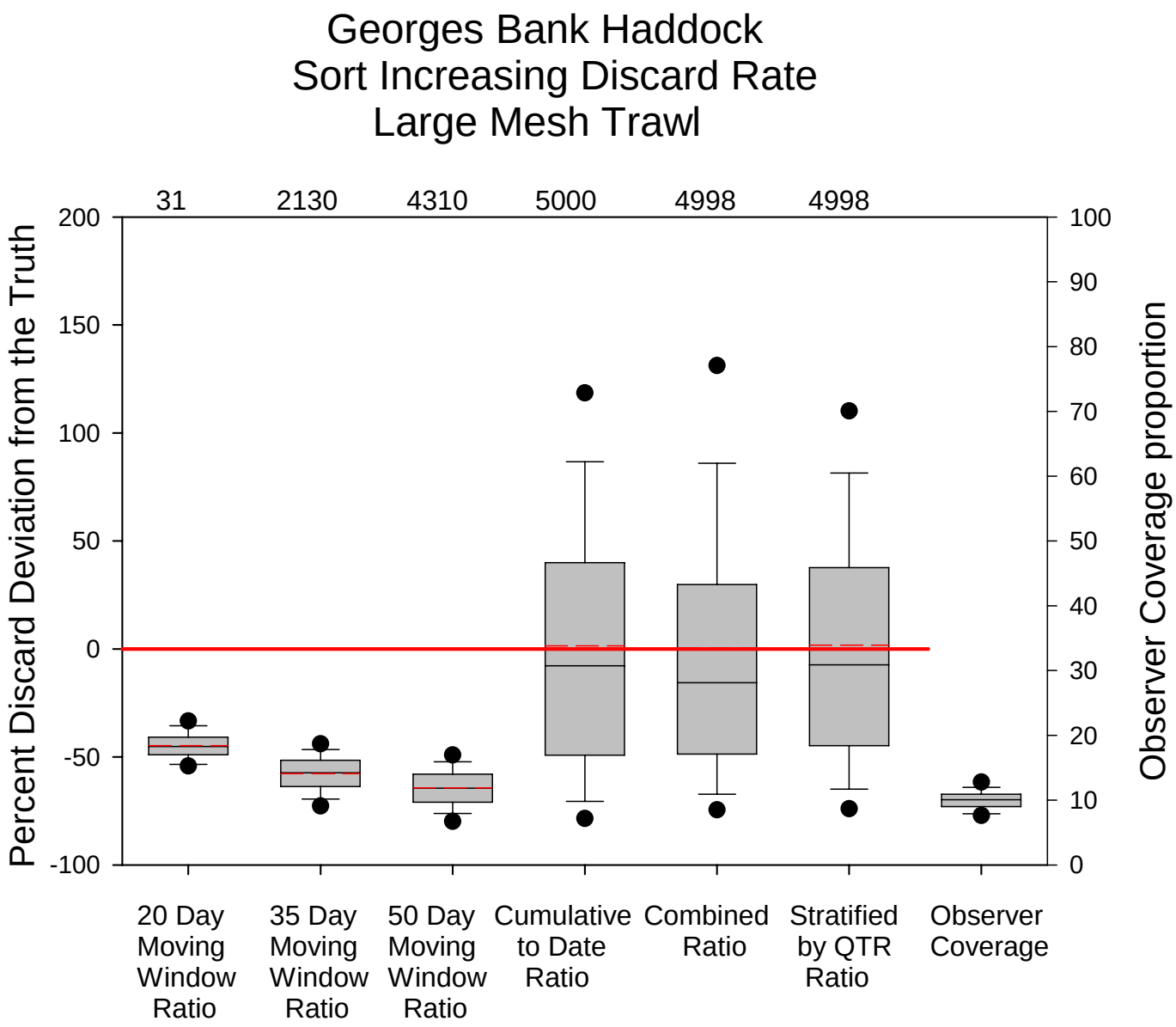

Georges Bank Haddock
Sort Decrease Discard Rate
Large Mesh Trawl
2570
4876
4993
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

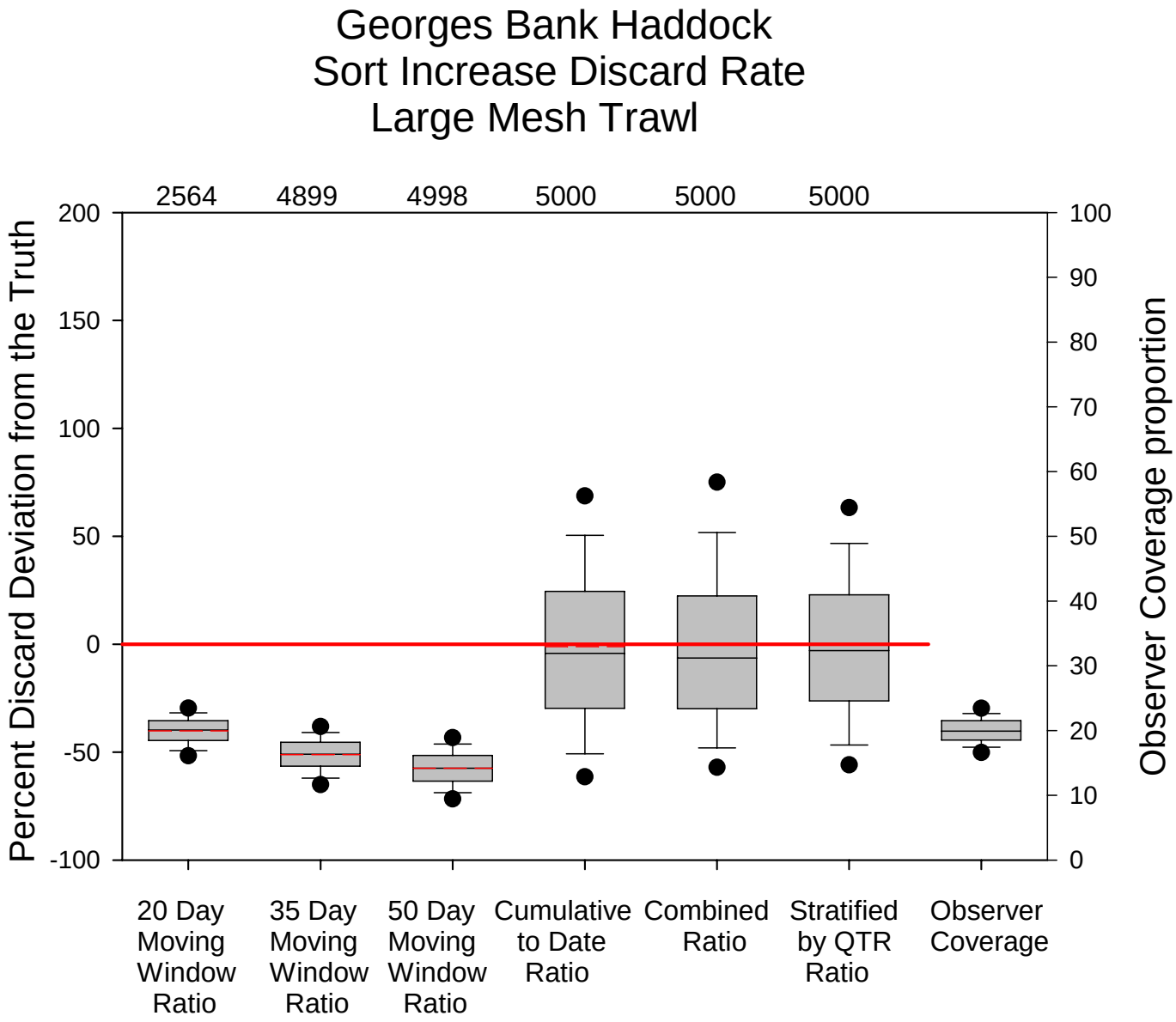

Georges Bank Haddock
Sort Decreasing Discard Rate
Large Mesh Trawl
4982
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

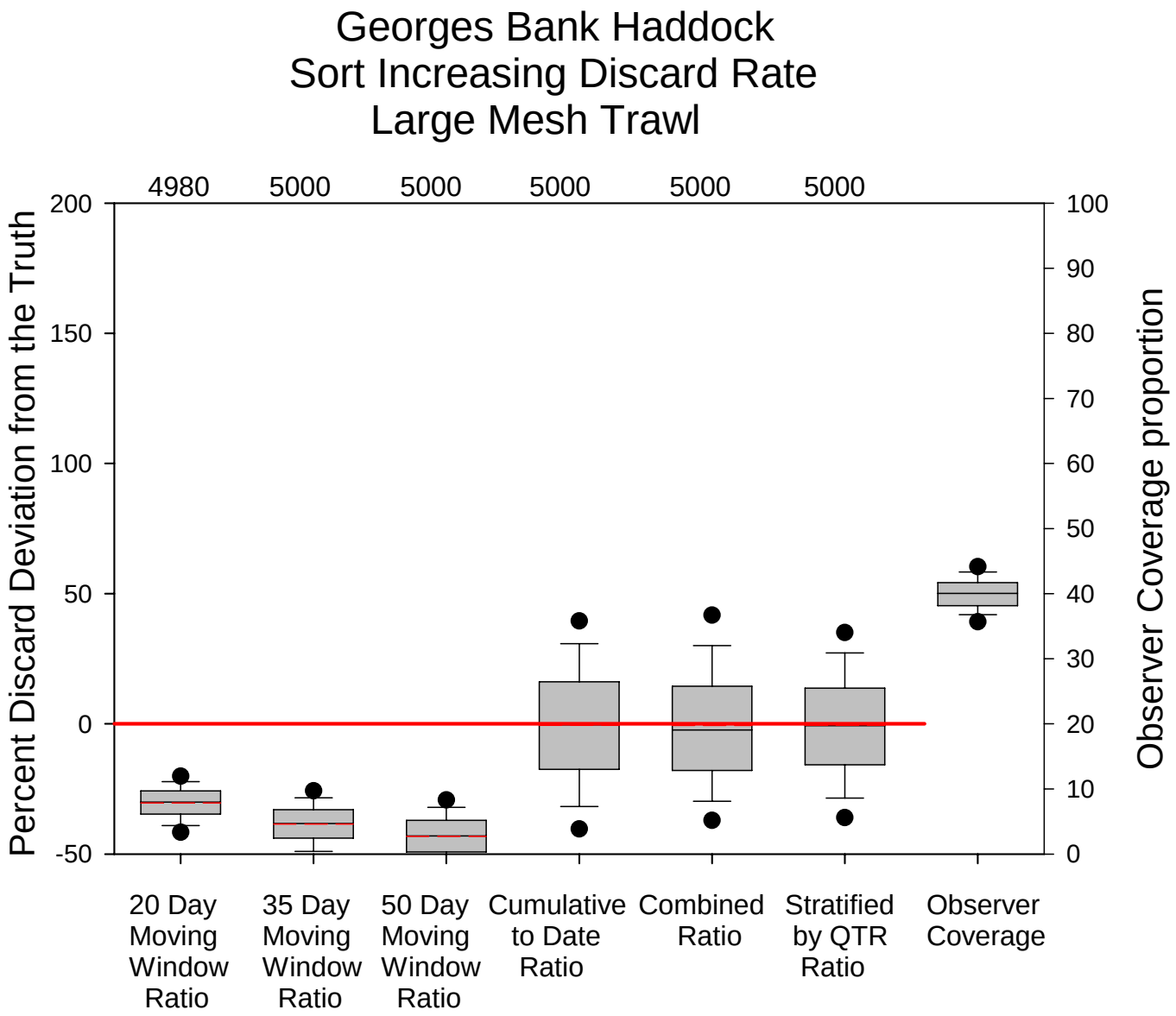

Georges Bank Haddock
Sort Decreasing Discard Rate
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

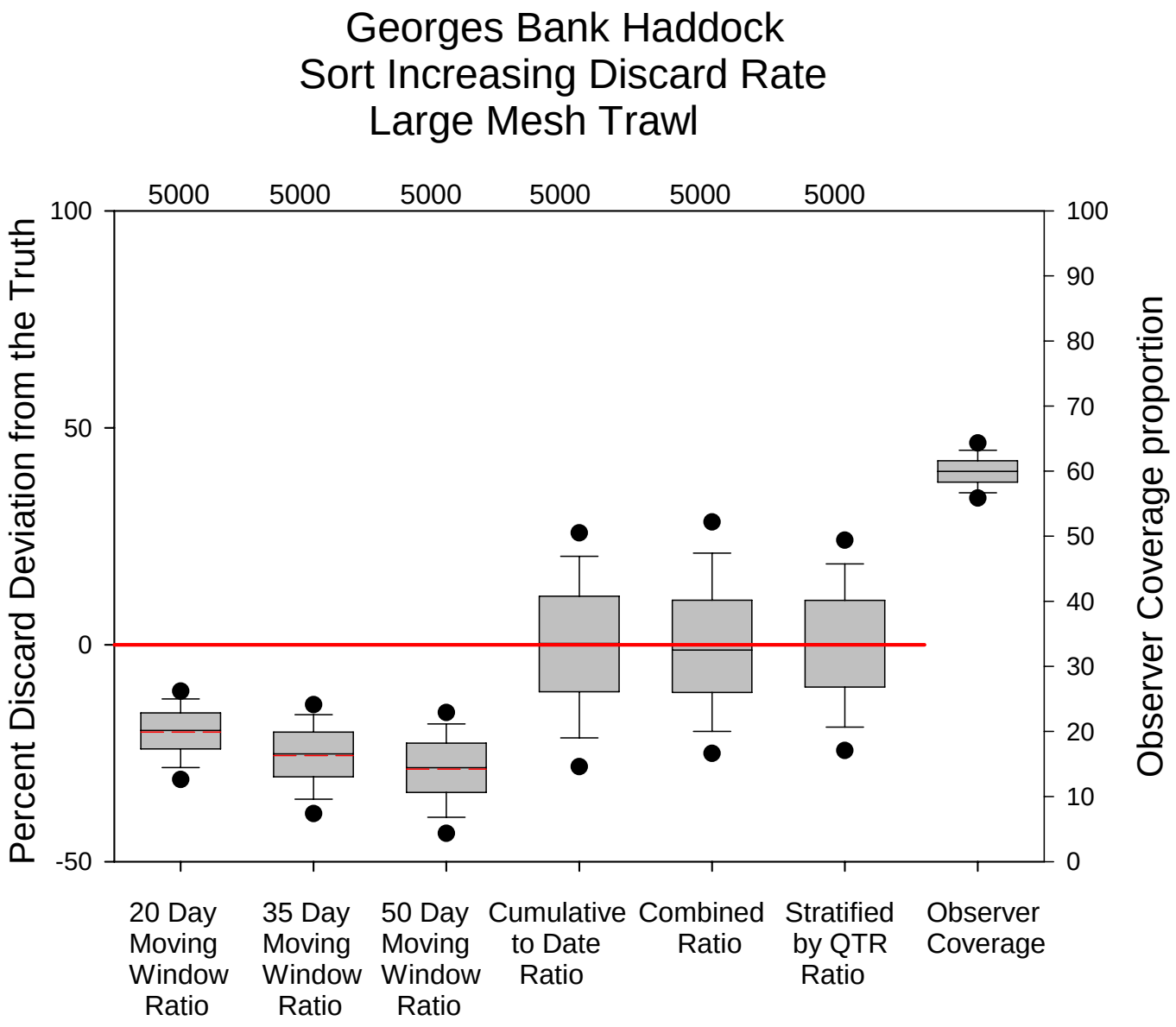

Georges Bank Haddock
Sort Decreasing Discard Rate
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

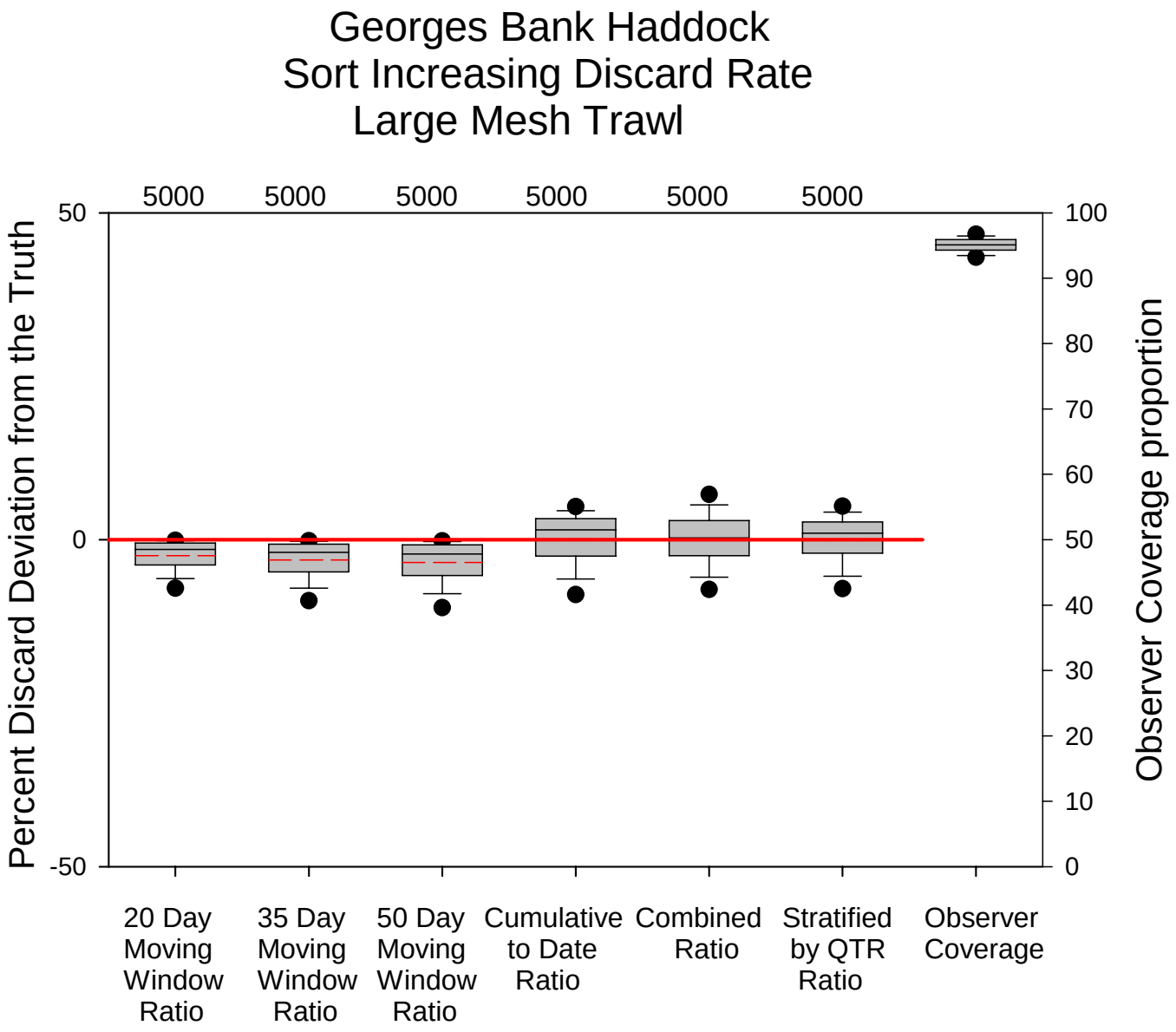

Georges Bank Haddock
Sort Increasing Rate
Large Mesh Trawl
Discard / Kept All
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
250
300
350
Day

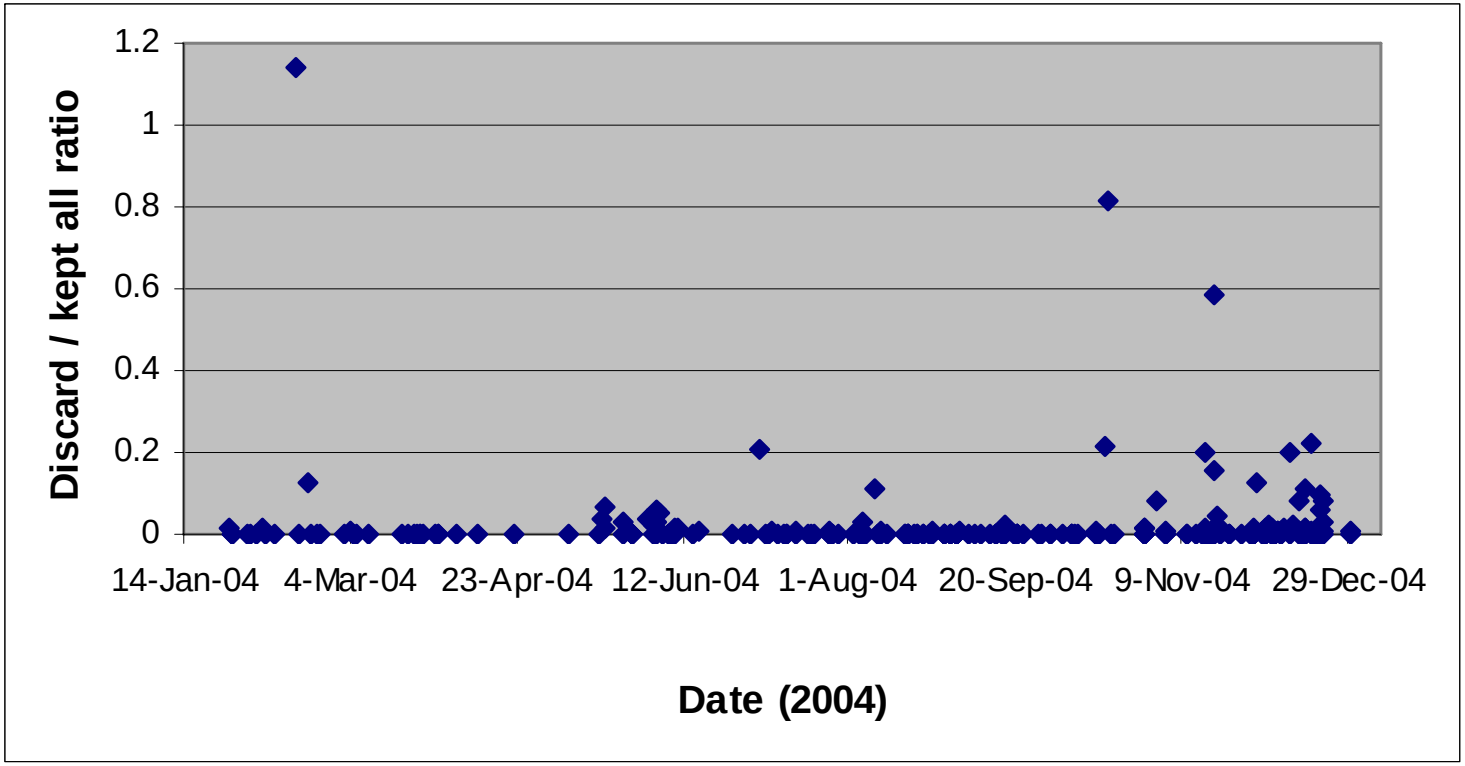

Georges Bank Haddock
Sort Increasing Discard Rate
Large Mesh Trawl
31
2130
4310
5000
4998
4998
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage


Georges Bank Haddock
Sort Increase Discard Rate
Large Mesh Trawl
2564
4899
4998
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

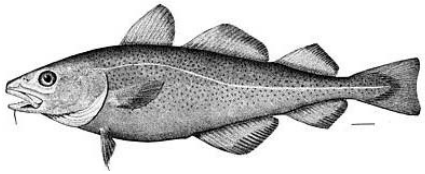

Georges Bank Haddock
Sort Increasing Discard Rate
Large Mesh Trawl
4980
5000
5000
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

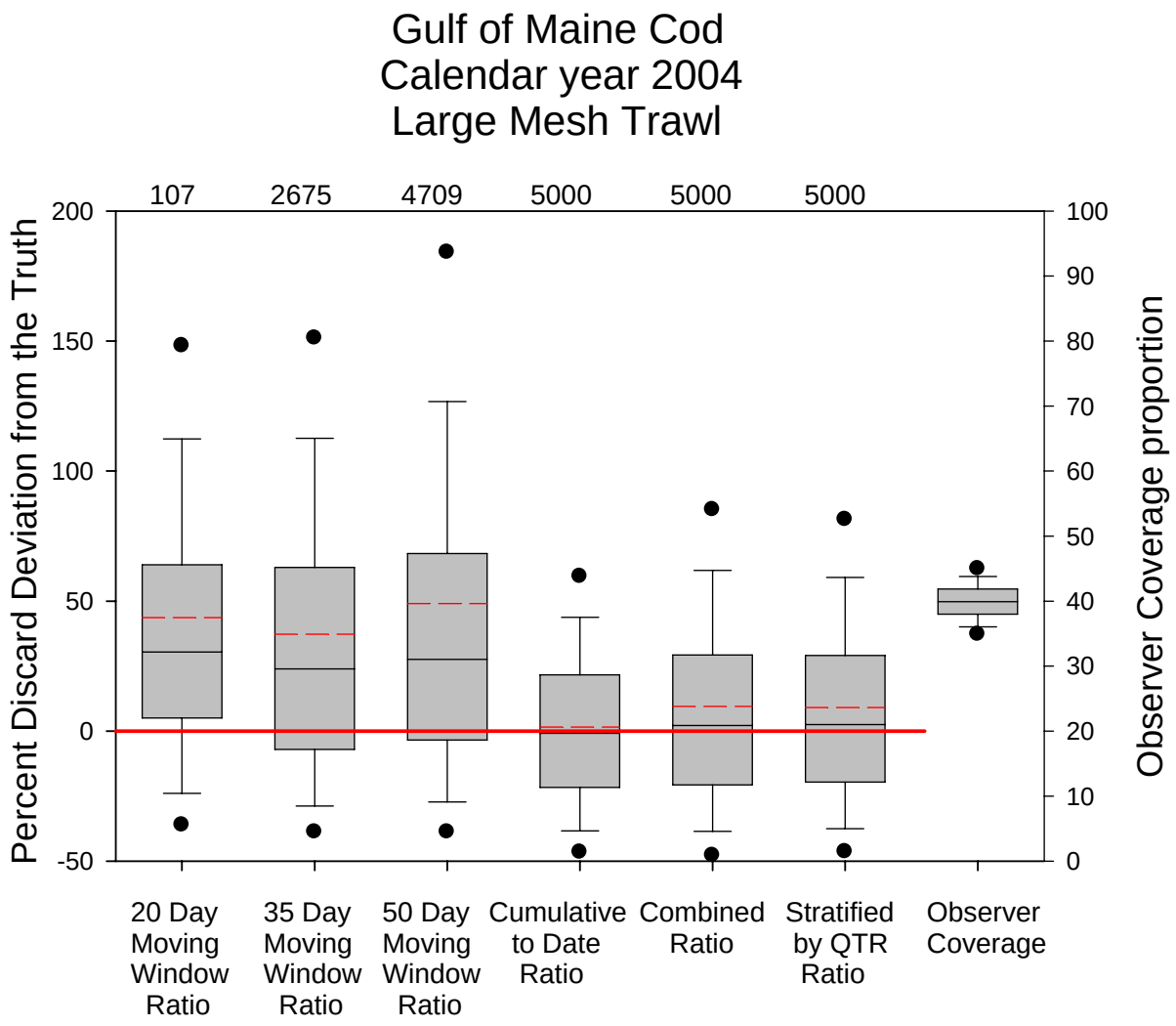

Georges Bank Haddock
Sort Increasing Discard Rate
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
100
50
0
-50
Percent Discard Deviation from the Truth
100
90
80
70
60
50
40
30
20
10
0
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

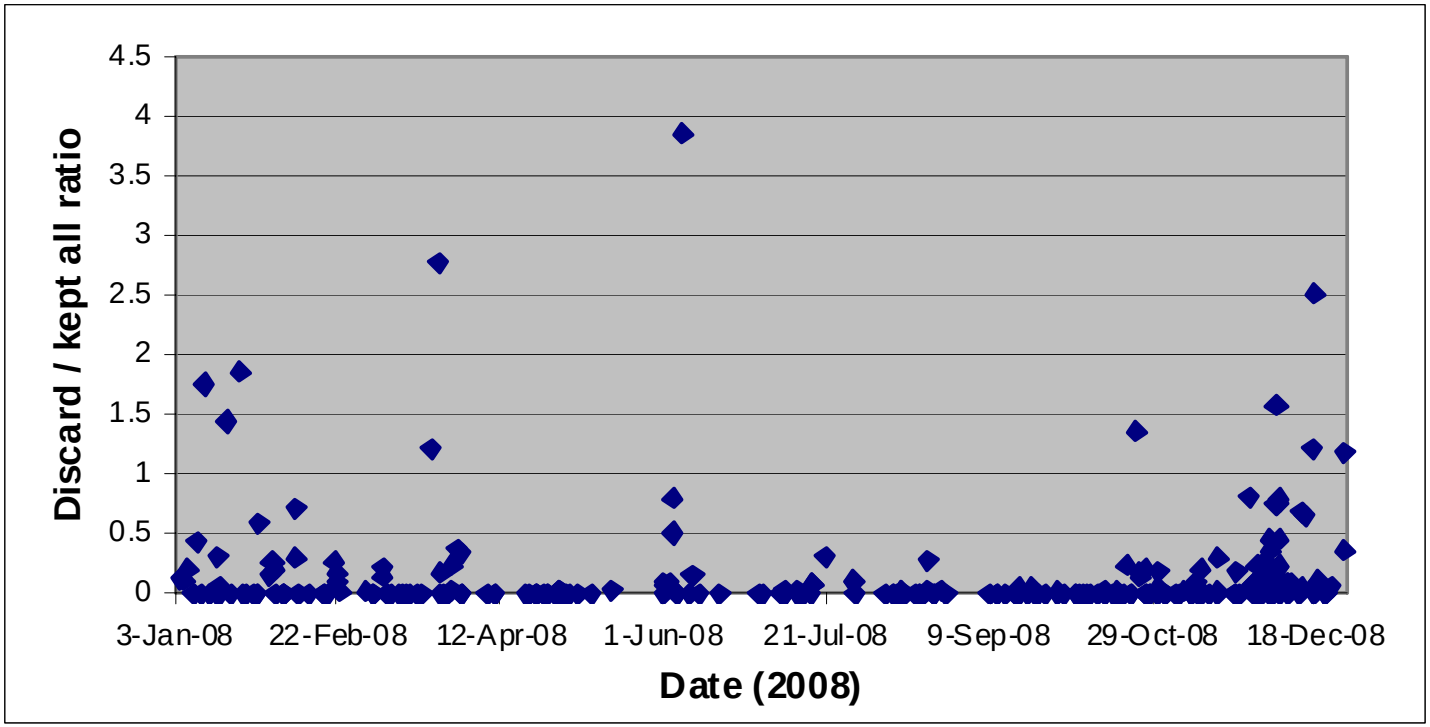

Georges Bank Haddock
Sort Increasing Discard Rate
Large Mesh Trawl
5000
5000
5000
5000
5000
5000
50
0
-50
100
90
80
70
60
50
40
30
20
10
0
Percent Discard Deviation from the Truth
Observer Coverage proportion
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage



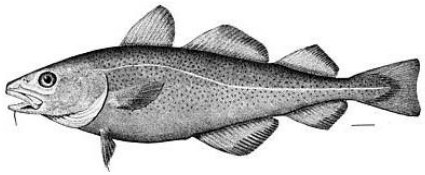
Gulf of Maine Cod
Calendar year 2004

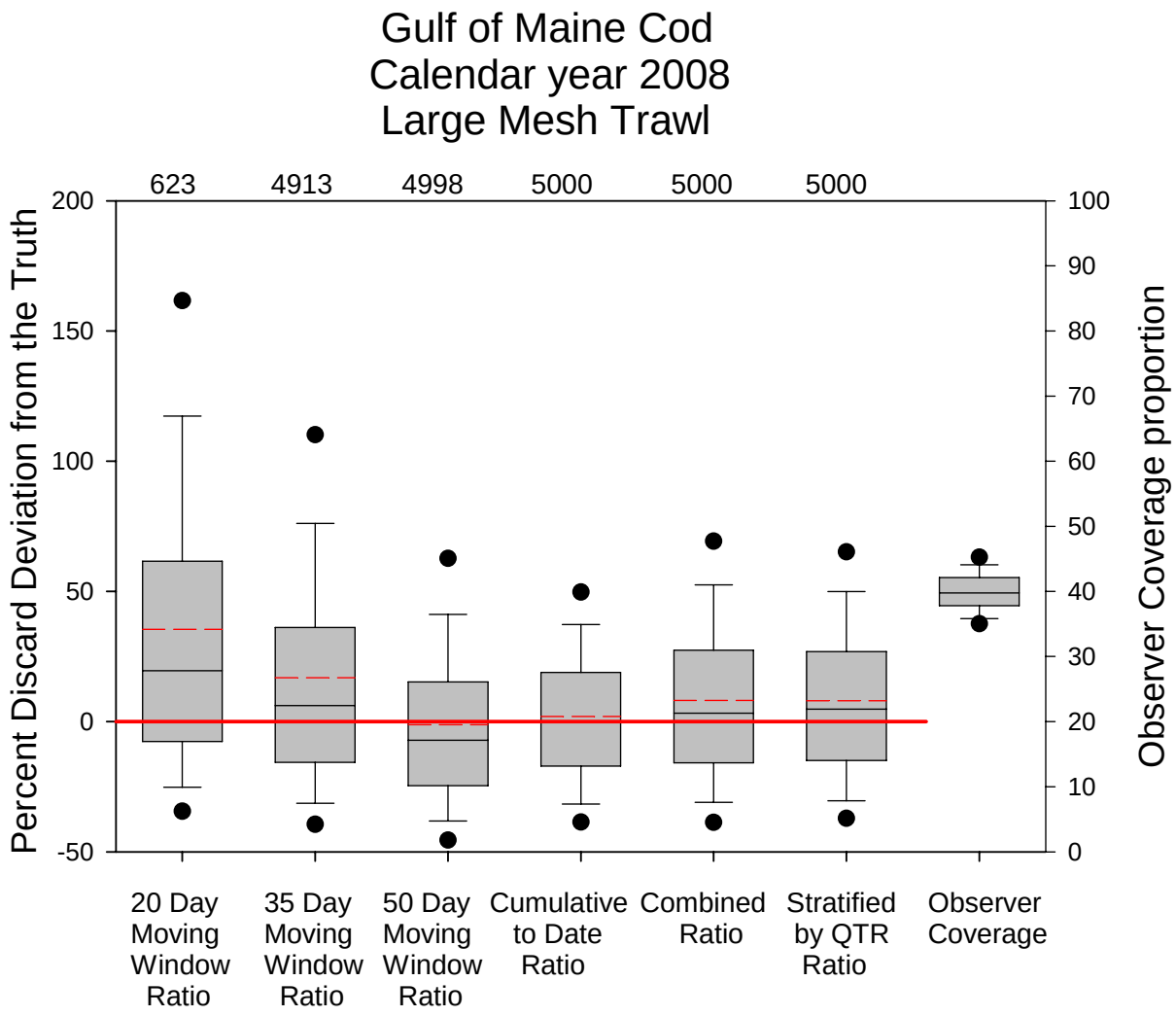



Gulf of Maine Cod
Calendar year 2004
Large Mesh Trawl
107
2675
4709
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage



Gulf of Maine Cod
Calendar year 2008



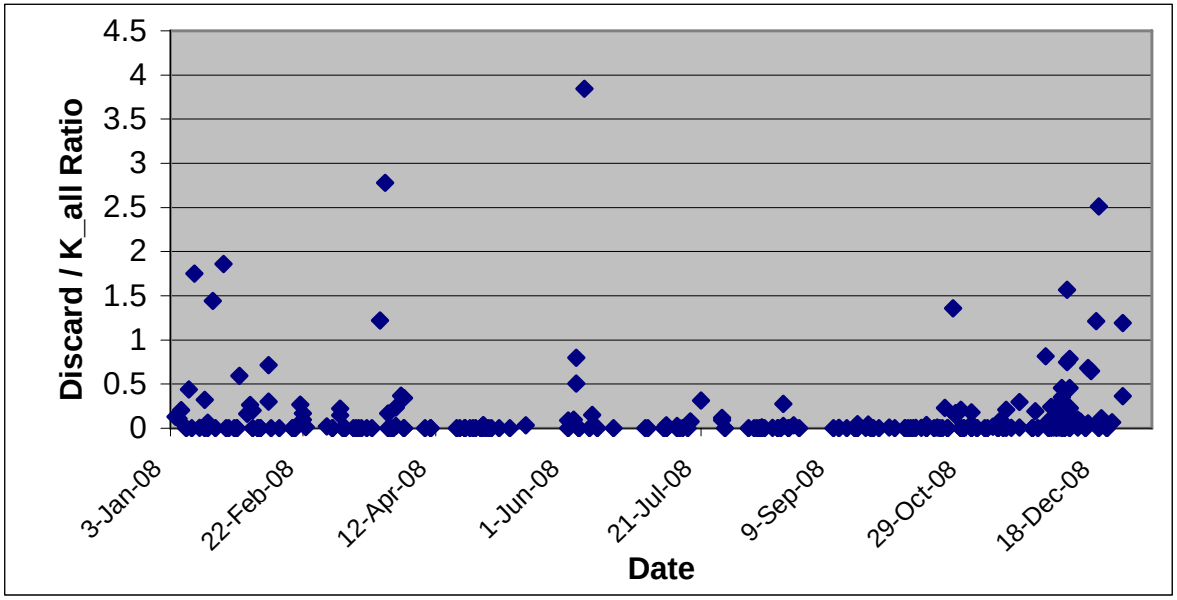

Gulf of Maine Cod
Calendar year 2008
Large Mesh Trawl
623
4913
4998
5000
5000
5000
Percent Discard Deviation from the Truth
200
150
100
50
0
-50
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

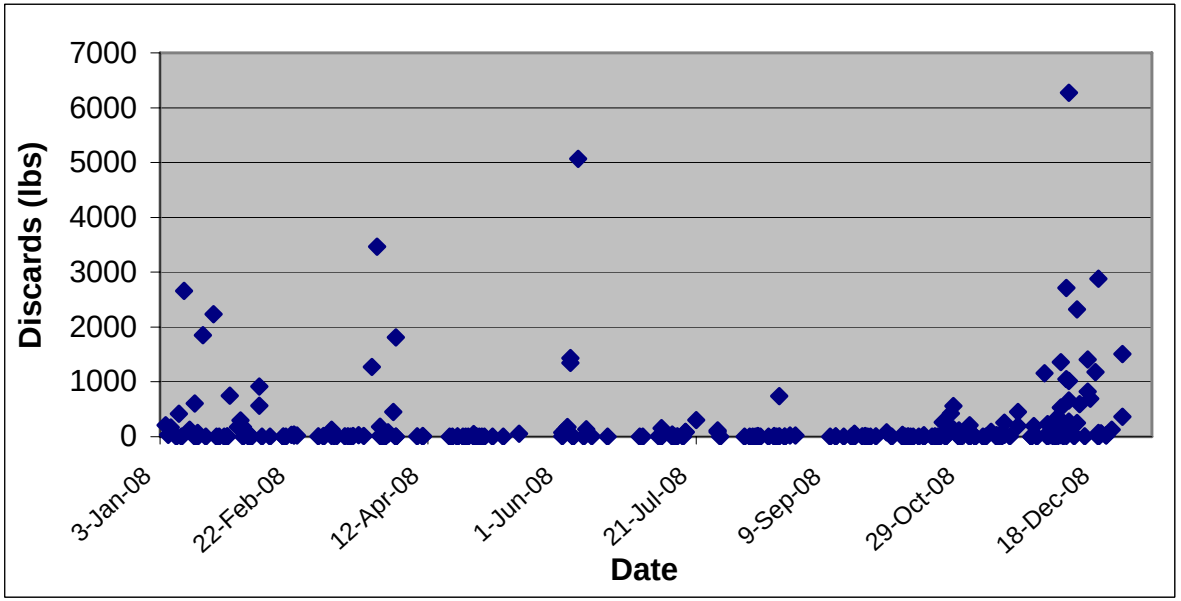
Discard Estimator Simulation Conclusions (Part 1) TOR 1

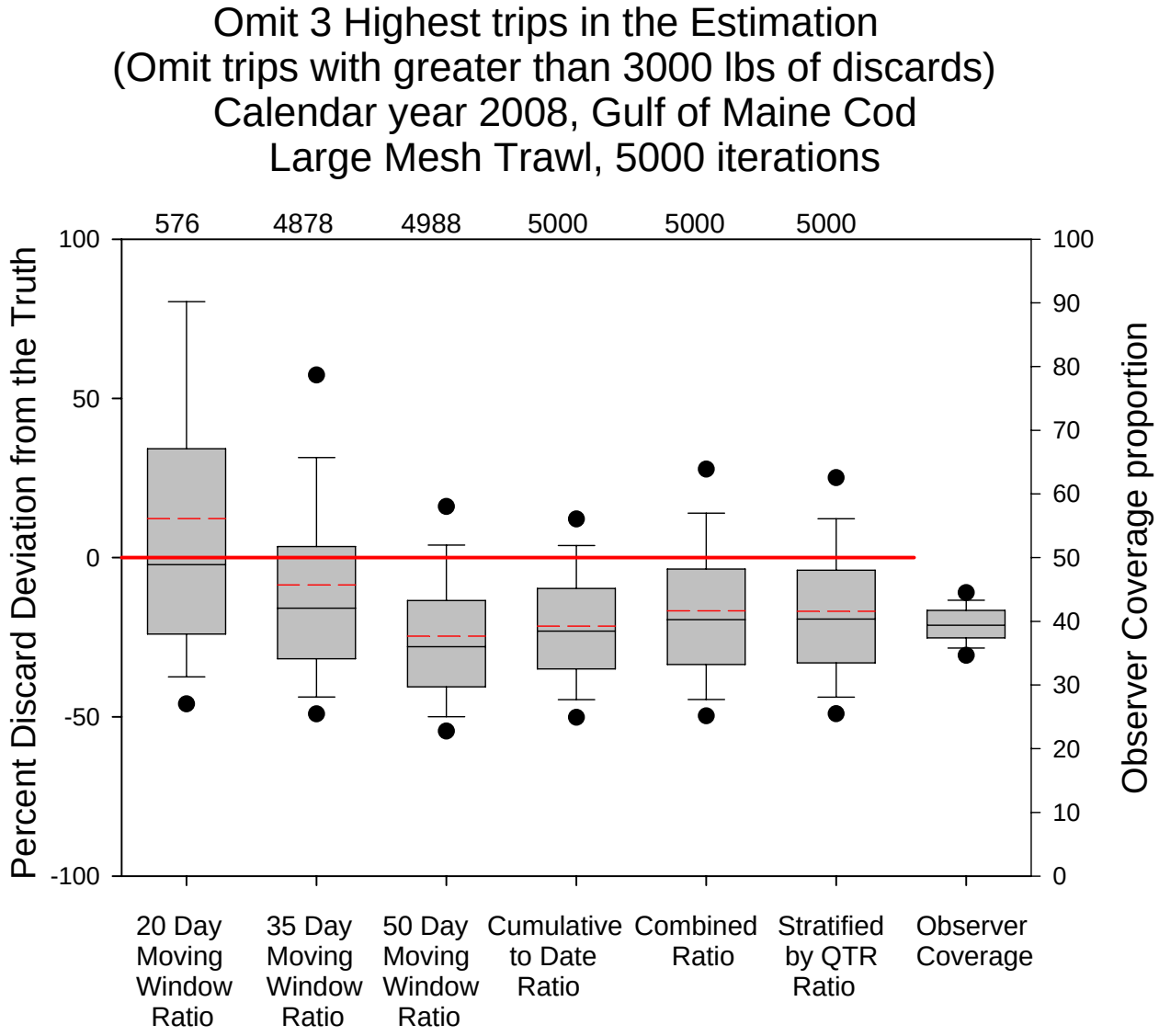
- This simulation exercise suggests the moving average estimators tends to be bias high unless discard rates are increasing at the end of the year in which case the estimator tends to be biased low.
- There was considerable variation in the estimates for all of the estimators from random draws of observed trips with coverage rates as high as 40% (+/- 30%).

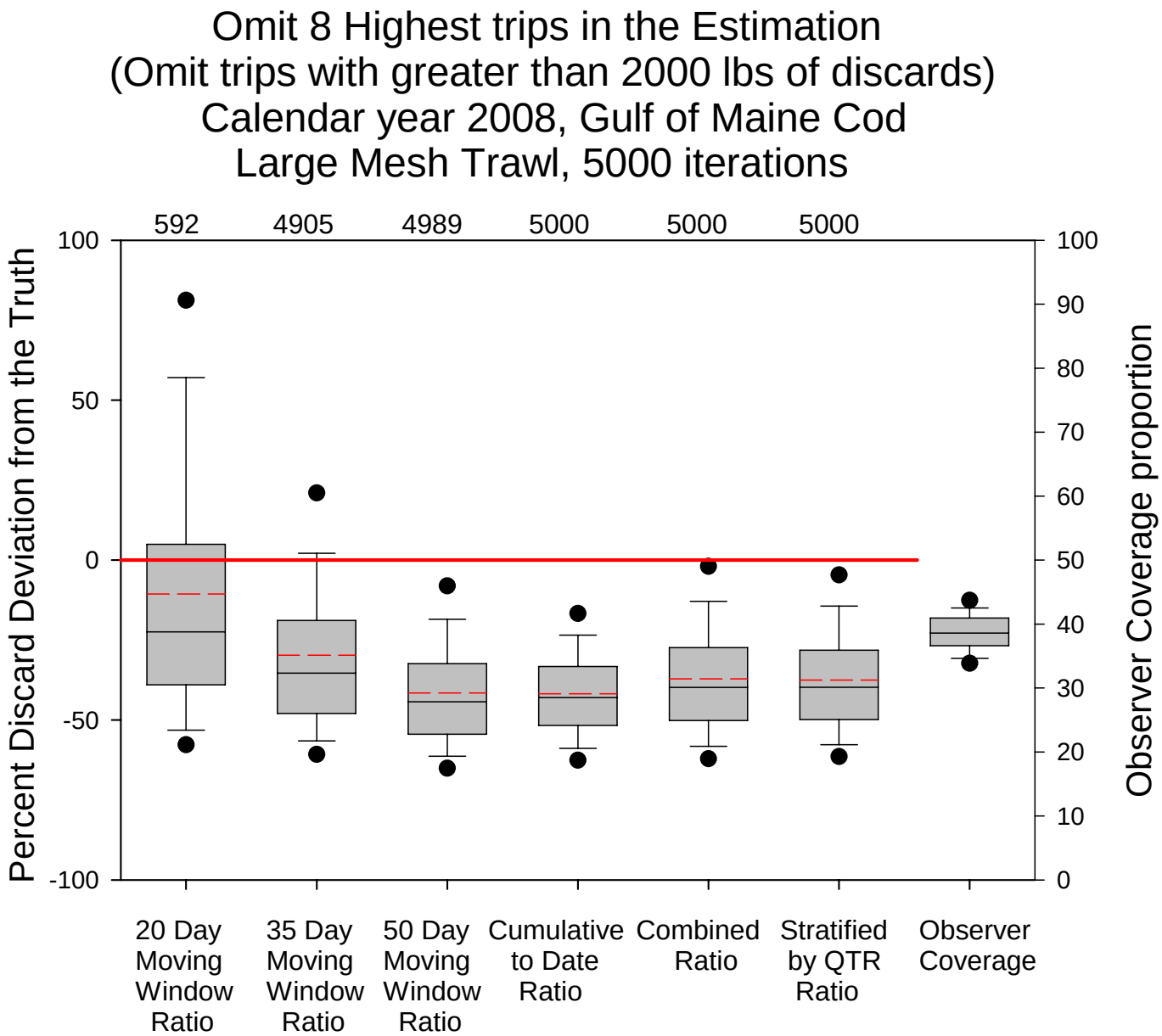
Outlier trimming
Scenario
TOR 2

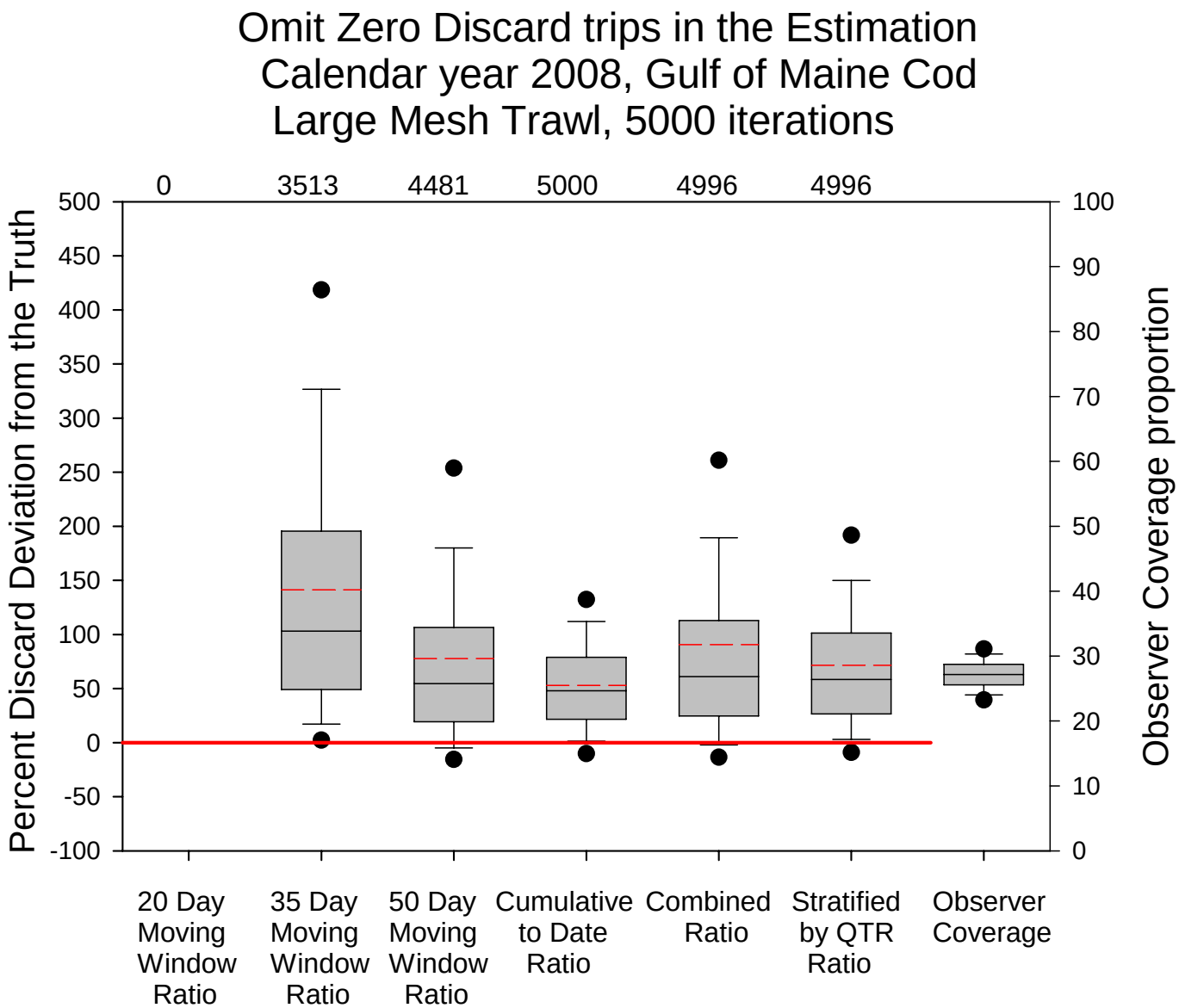
2008
Gulf of Maine Cod
Large Mesh Trawl

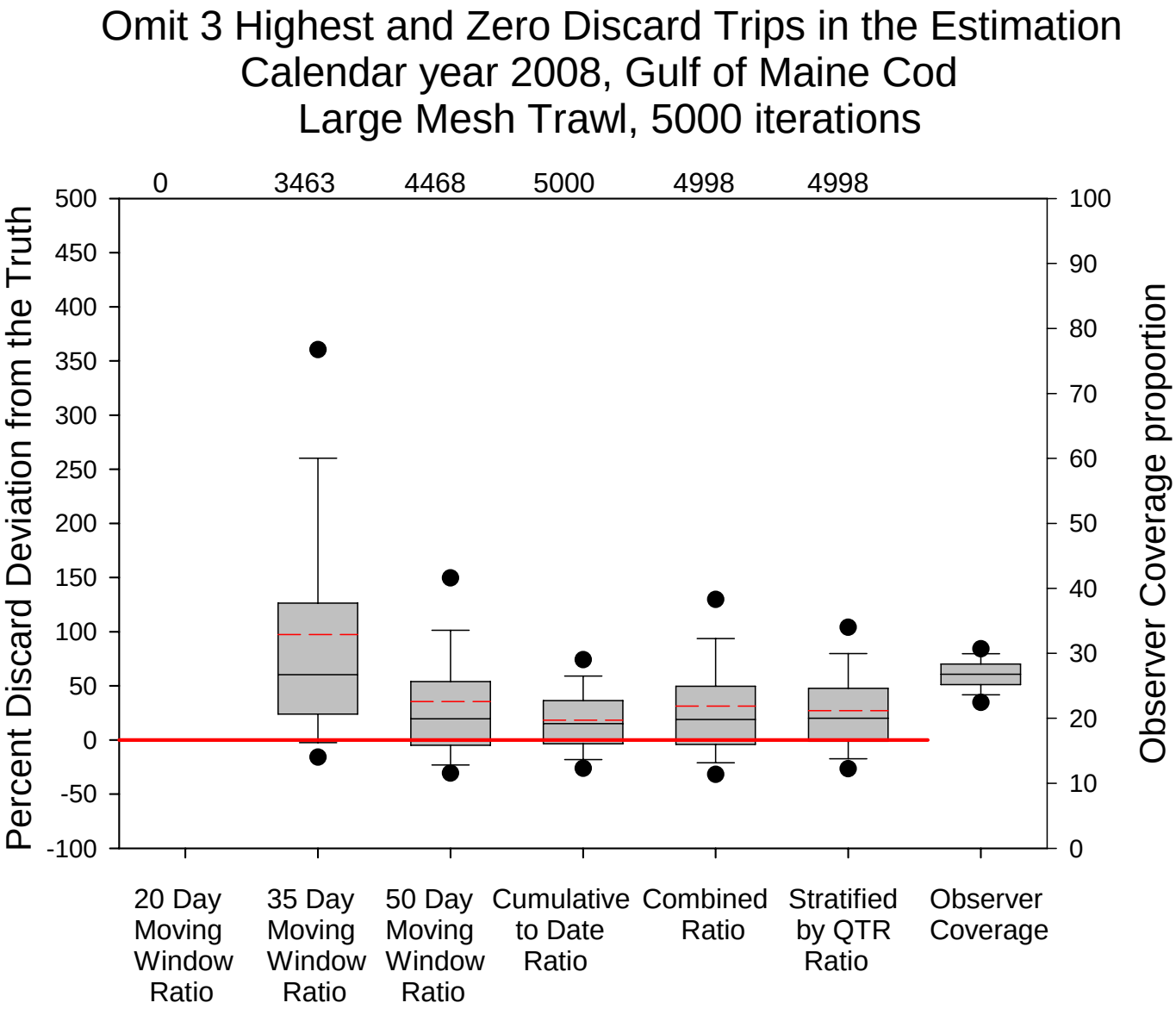





Omit 3 Highest trips in the Estimation
(Omit trips with greater than 3000 lbs of discards)
Calendar year 2008, Gulf of Maine Cod
Large Mesh Trawl, 5000 iterations
576
4878
4988
5000
5000
5000
Percent Discard Deviation from the Truth
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage


Omit 8 Highest trips in the Estimation
(Omit trips with greater than 2000 lbs of discards)
Calendar year 2008, Gulf of Maine Cod
Large Mesh Trawl, 5000 iterations
592
4905
4989
5000
5000
5000
Percent Discard Deviation from the Truth
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage


Omit Zero Discard trips in the Estimation
Calendar year 2008, Gulf of Maine Cod
Large Mesh Trawl, 5000 iterations
0
3513
4481
5000
4996
4996
Percent Discard Deviation from the Truth
500
450
400
350
300
250
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage


Omit 3 Highest and Zero Discard Trips in the Estimation
Calendar year 2008, Gulf of Maine Cod
Large Mesh Trawl, 5000 iterations
0
3463
4468
5000
4998
4998
Percent Discard Deviation from the Truth
500
450
400
350
300
250
200
150
100
50
0
-50
-100
Observer Coverage proportion
100
90
80
70
60
50
40
30
20
10
0
20 Day Moving Window Ratio
35 Day Moving Window Ratio
50 Day Moving Window Ratio
Cumulative to Date Ratio
Combined Ratio
Stratified by QTR Ratio
Observer Coverage

Discard Outlier Trimming Conclusions TOR 2

- Outlier trimming produced highly biased estimates for all of the estimators.
- The sensitivity of the results to data omission suggests that data trimming should not be done when monitoring discards.

Science, Service, Stewardship

The End of Part 1

NOAA FISHERIES SERVICE