Population Dynamics Among NC Reservoir Striped Bass

Stephen W. Parker and Jesse R. Fischer

NC STATE UNIVERSITY

NORTH CAROLINA Wildlife RESOURCES COMMISSION

NC Wildlife Resources Commission

- Christian Waters
- Corey Oakley
- Michael Fisk
- Kirk Rundle
- Lawrence Dorsey
- Kelsey Lincoln
- Jessica Baumann
- Kin Hodges
- Chris Wood
- Powell Wheeler

NC STATE UNIVERSITY

NCSU

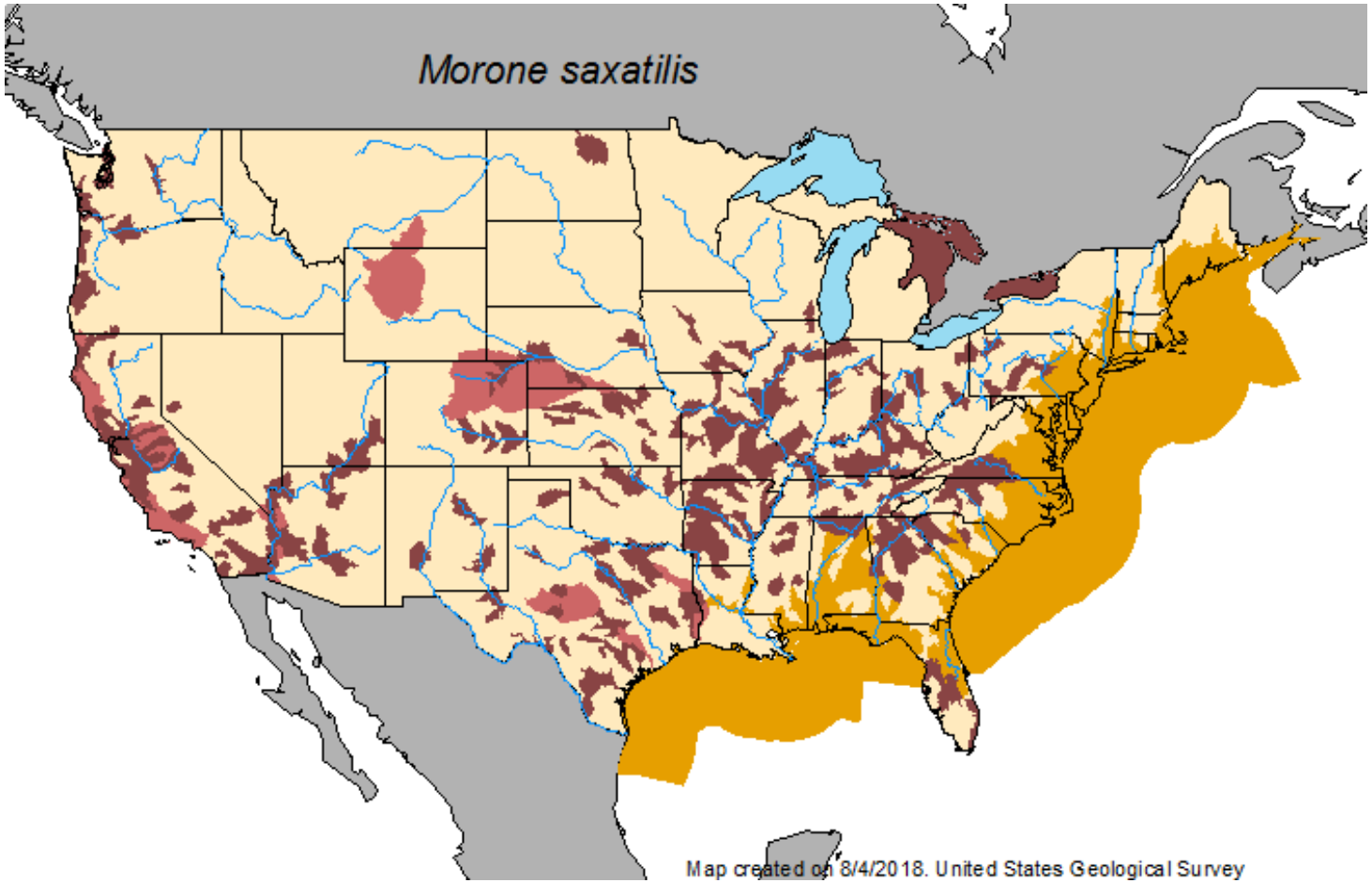
- Tyler Craft
- Eric Torvinen
- Spencer Gardner
- Joseph McIver
- Bobby Cope
- Wilson Xiong
- William Wood

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

SPORT FISH RESTORATION

USGS
science for a changing world

NORTH CAROLINA
Cooperative Fish & Wildlife Research Unit

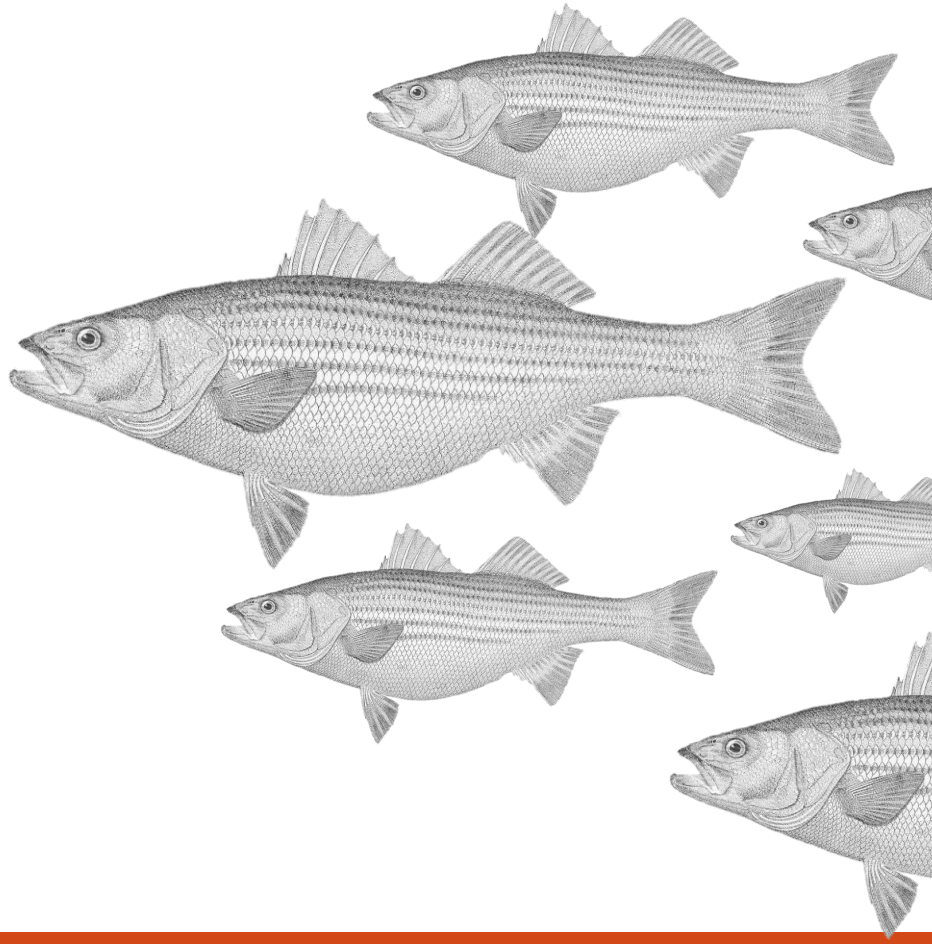


Striped Bass (Morone saxatilis)

- Largest and longest-lived of the genus *Morone*
- Original range:
  - St. Lawrence River to northern Florida
  - Gulf Coast
- Distributed across nearshore waters, bays, and coastal rivers

Introductions and Early Management

- Unsuccessful introduction effort NJ (1930's)
- First isolated, reproductively successful populations
  - Santee-Cooper, SC (1952)
  - Kerr Lake, NC (late 1950's)

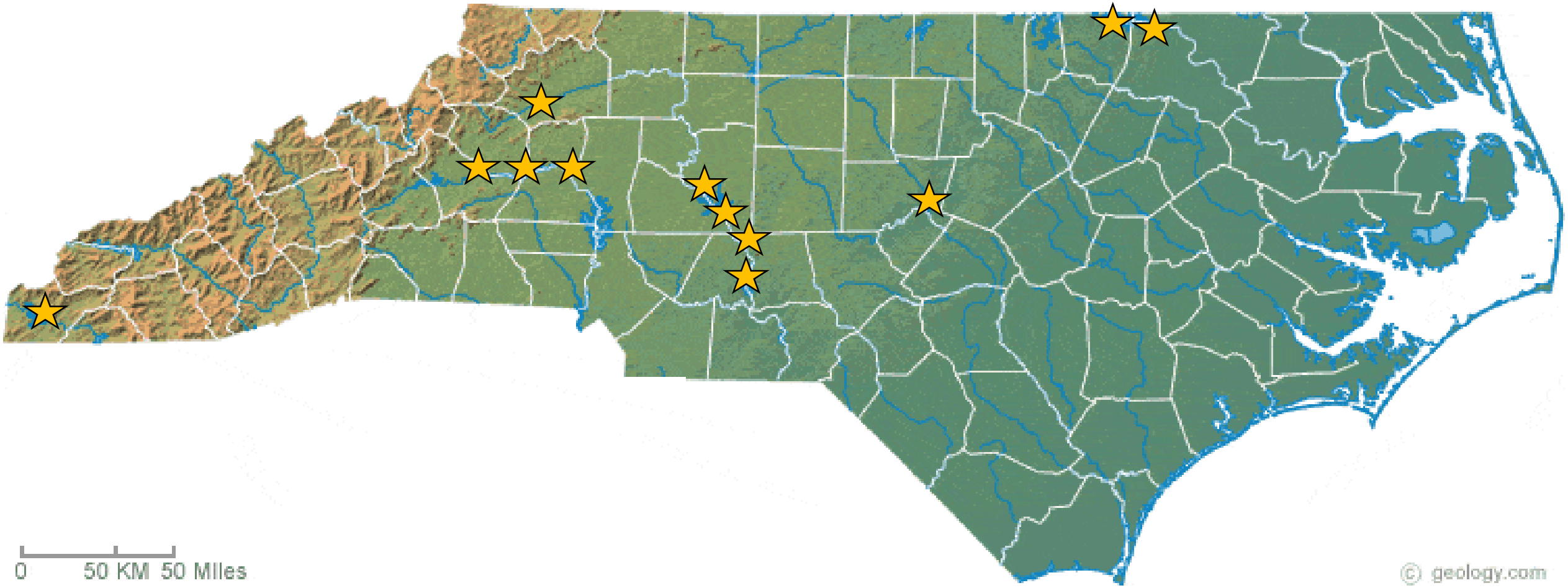


Introductions and Early Management

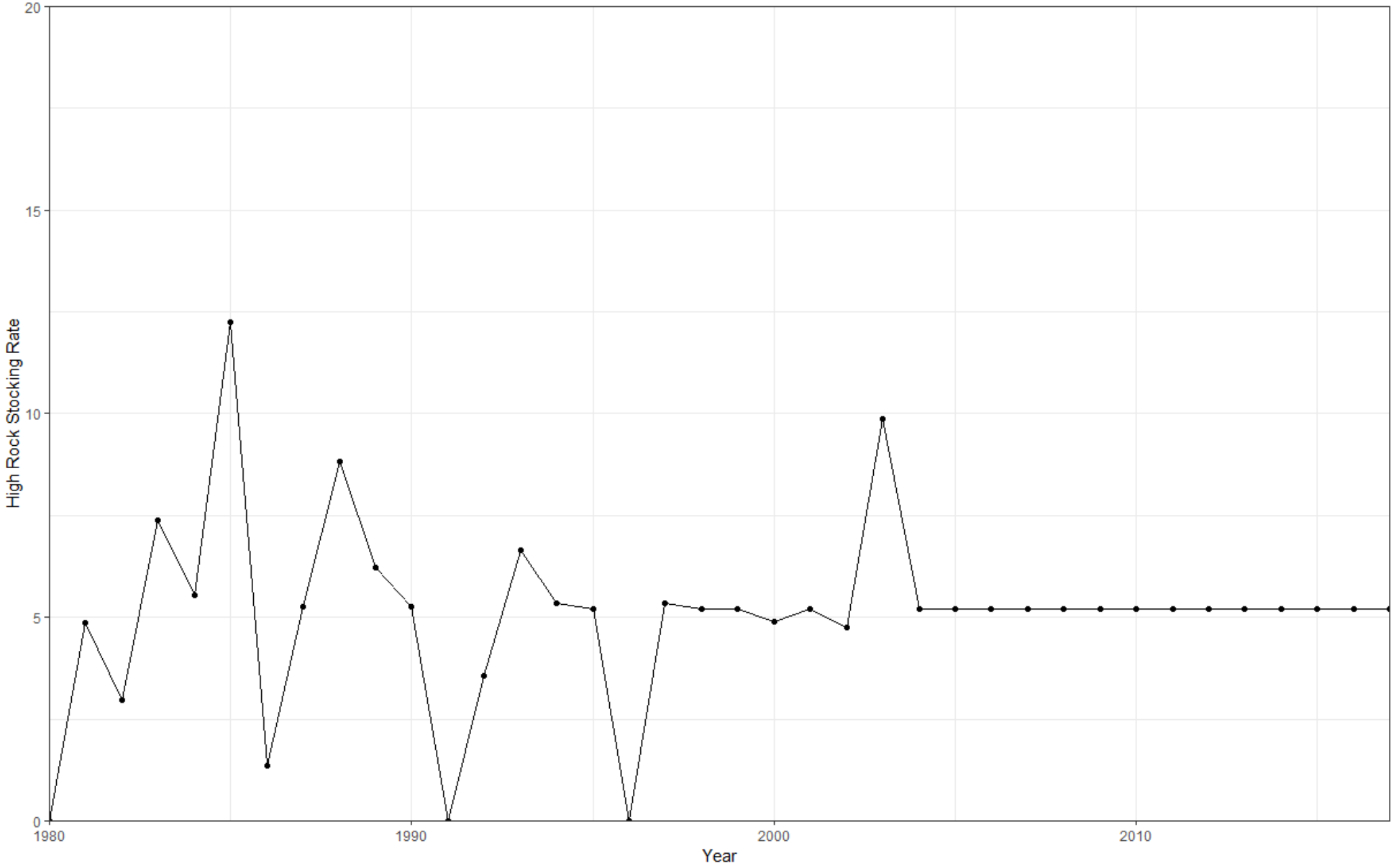
- Hatchery and stocking techniques developed during the peak of reservoir construction
- By 1981, established in at least 279 reservoirs in 34 states
- $24.6 billion USD (USFWS 2011)

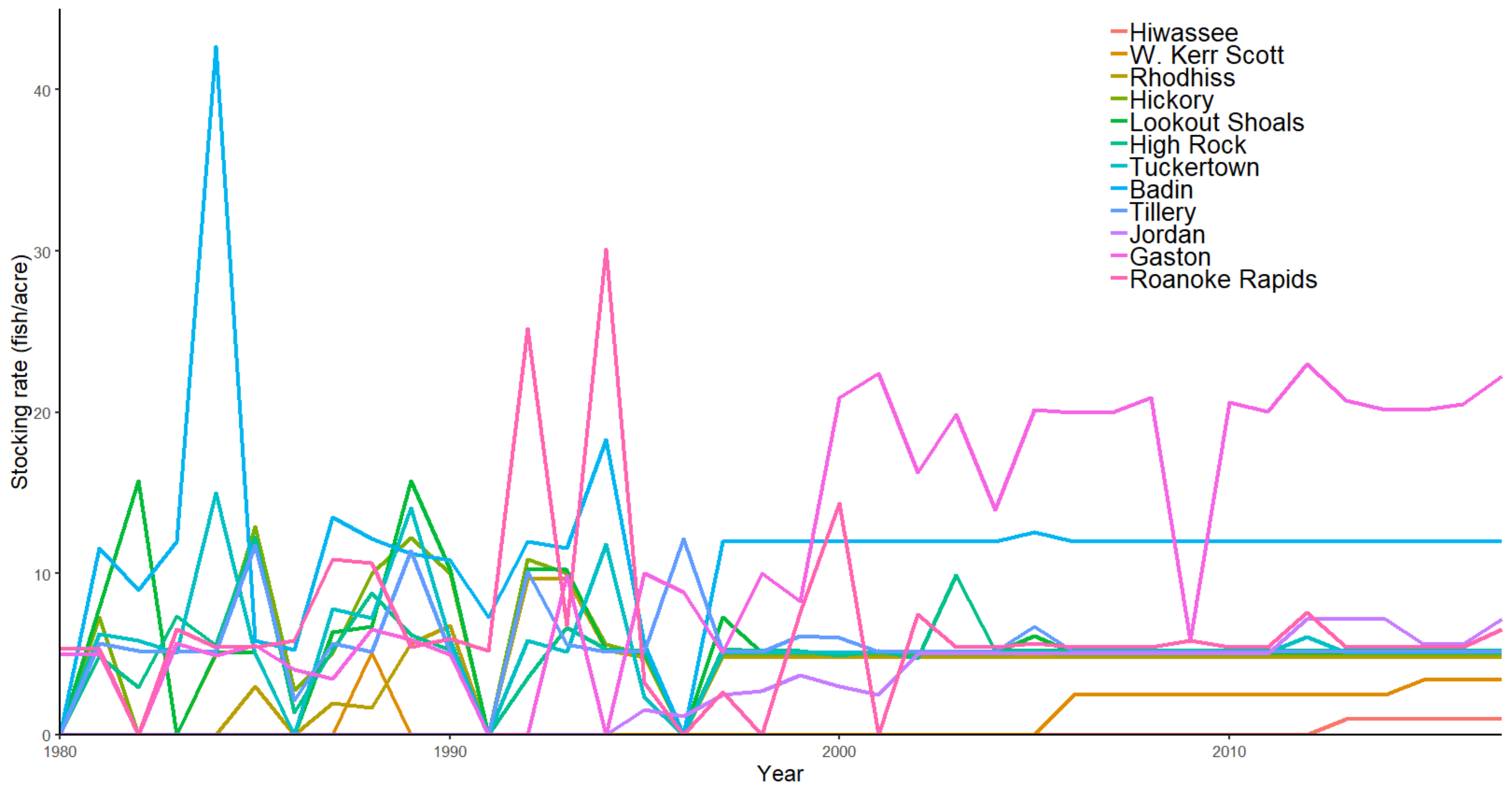
Research Objectives

- Assess reservoir Striped Bass populations and associated fish assemblages
- Compare sampling methods to standardized protocols
- Determine population characteristics and estimate dynamic rate functions (e.g., growth, mortality)


0 50 KM 50 Miles
© geology.com

Reservoir	Surface Area (acres)	Shoreline Length (mi)	Avg Depth (ft)	Max Depth (ft)	Elevation (ft)	Completion Year	Drainage Area (sq mi)	Water Volume (acre-ft)
Badin	5,350	115	90	190	509.8	1917	4,180	129,100
Gaston	**20,300**	350	40	95	200	1963	**8,340**	**450,000**
Hickory	4,100	105	33	85	931	1927	1,310	137,821
High Rock	15,180	**365**	16	**52**	655	1928	3,973	234,866
Hiwassee	6,275	163	**142**	**308**	**1,521**	1940	968	205,590
Jordan	13,940	200	**14**	38	216	**1982**	1,690	215,130
Lookout Shoals	**1,270**	**39**	30	69	835	**1916**	1,449	24,995
Rhodhiss	3,515	90	20	**52**	995	1925	1,090	70,300
Roanoke Rapids	4,600	47	16	99	**132**	1955	8,294	77,100
Tillery	5,263	118	32	72	279	1928	4,834	167,817
Tuckertown	2,560	75	16	55	565	1962	4,210	**6,700**
W. Kerr Scott	1,475	55	28	65	1,030	1962	**367**	41,000

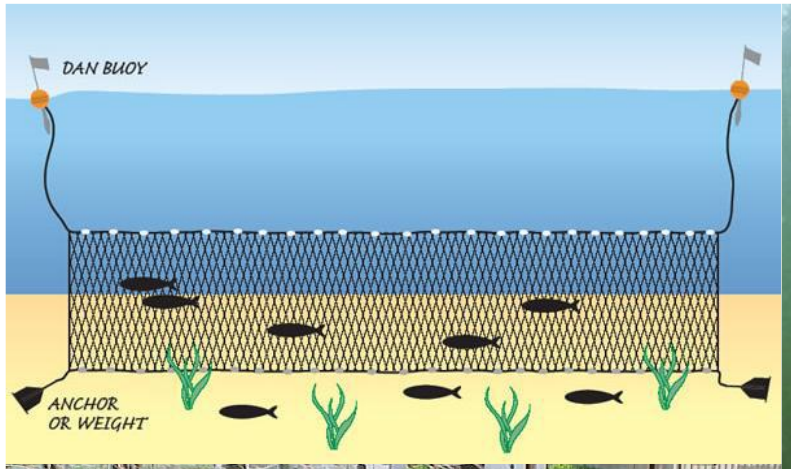

20
15
10
5
0
High Rock Stocking Rate
1980
1990
2000
2010
Year


Hiwassee
W. Kerr Scott
Rhodhiss
Hickory
Lookout Shoals
High Rock
Tuckertown
Badin
Tillery
Jordan
Gaston
Roanoke Rapids
Stocking rate (fish/acre)
0
10
20
30
40
1980
1990
2000
2010
Year

Gill Nets

Fish are caught by being:

- Wedged
- Gilled
- Tangled



Fish Sampling

- Experimental gill nets
  - 200 ft (61 m) long, 8 ft (2.4 m) deep, 4 x 50 ft (15.2 m) panels
  - Randomized bar mesh order: 1.5”, 2.5”, 3”, 2”

Fish Sampling

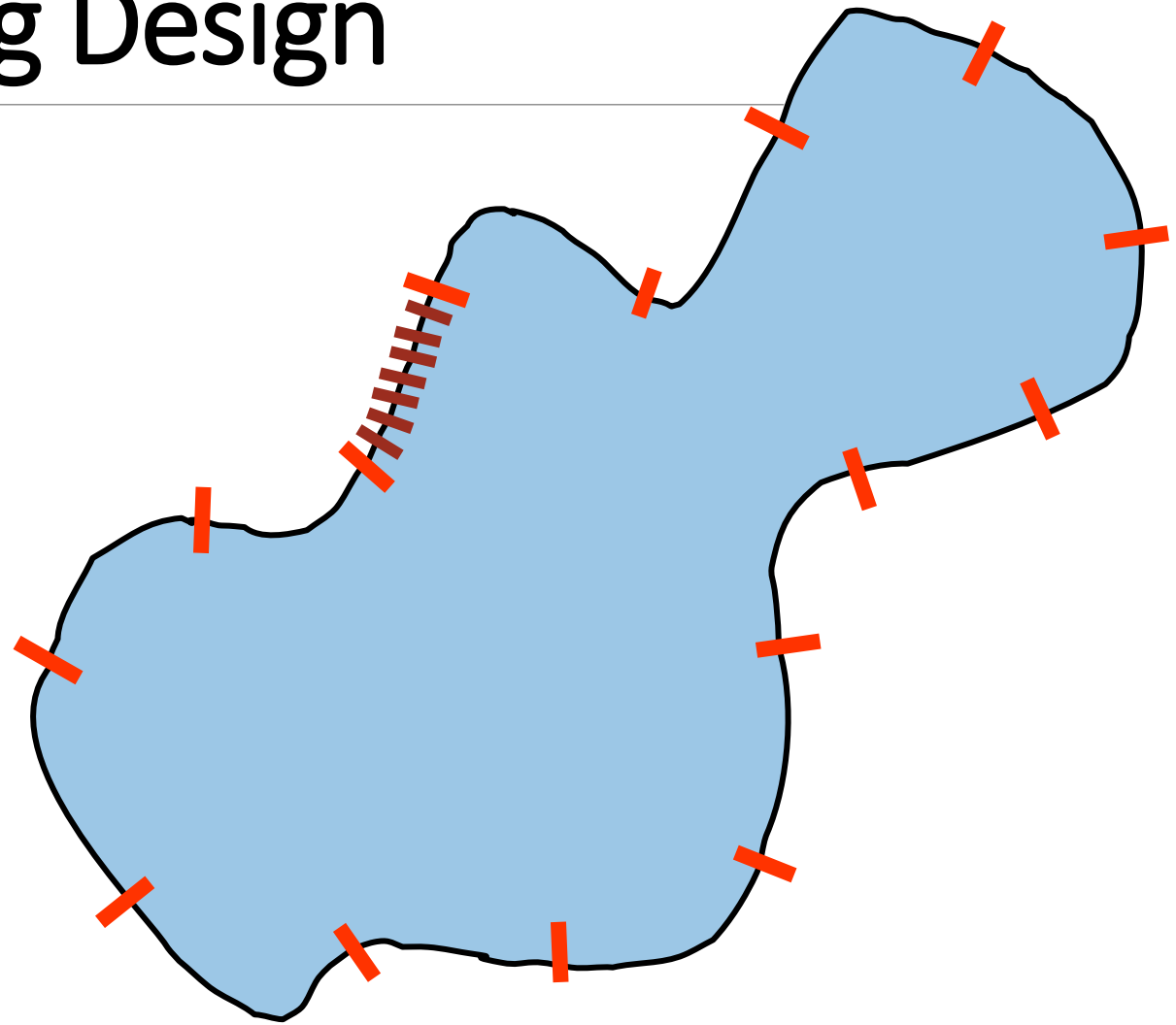
- Lengths and weights recorded for all fish
- Sagittal otoliths taken for Striped Bass

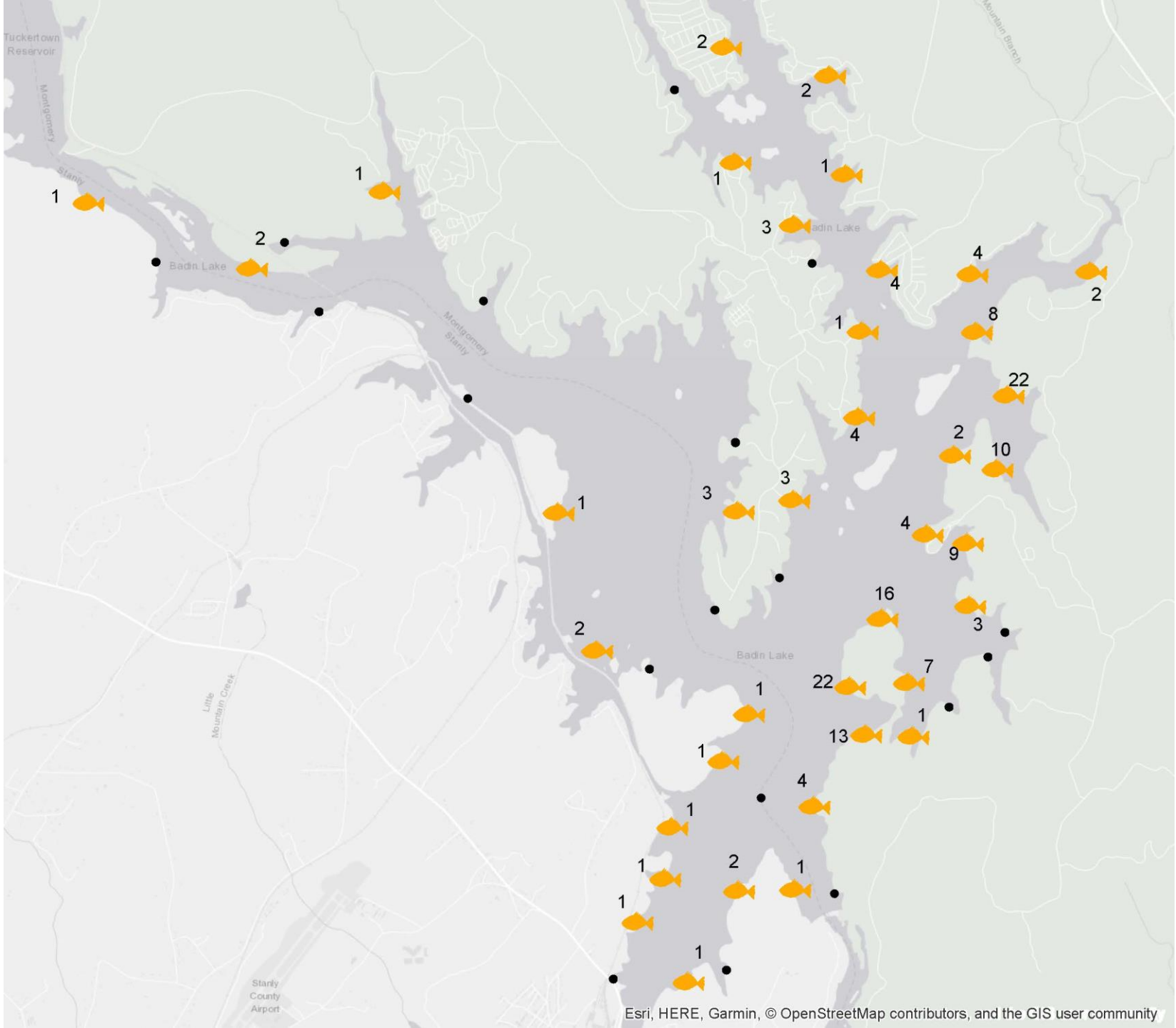
Age and Growth

- Otoliths aged by a single reader
- Distances between annuli measured

Sampling Design

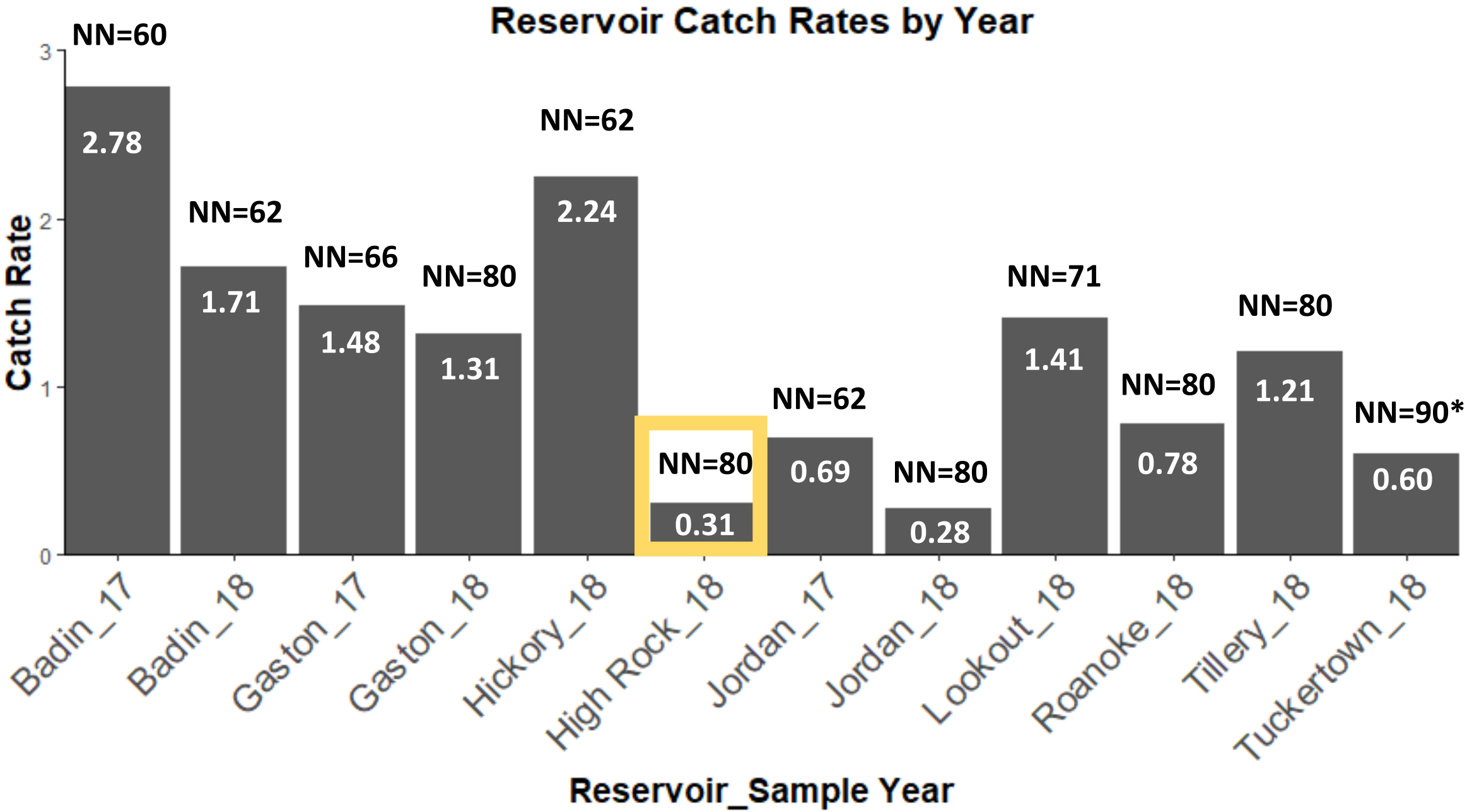
- Systematic Random Sampling
  - 80 shoreline segments
  - Randomly selected reaches
  - 60 – 80 net nights

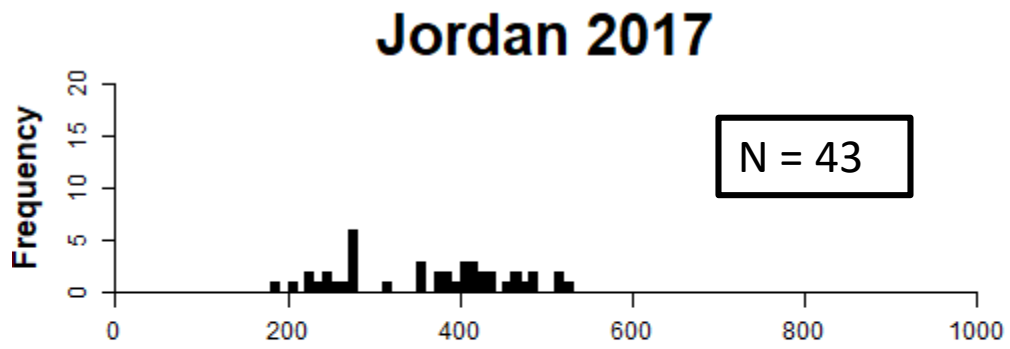


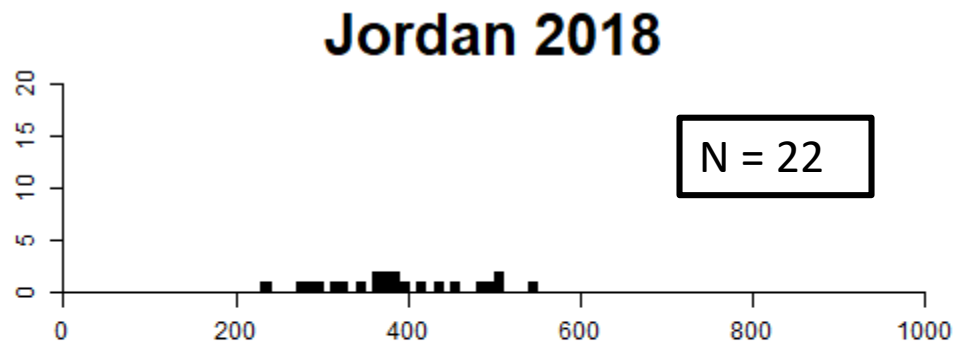

Tuckertown Reservoir
Montgomery
Stanly
Badin Lake
Montgomery
Stanly
Badin Lake
Little Mountain Creek
Stanly County Airport
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

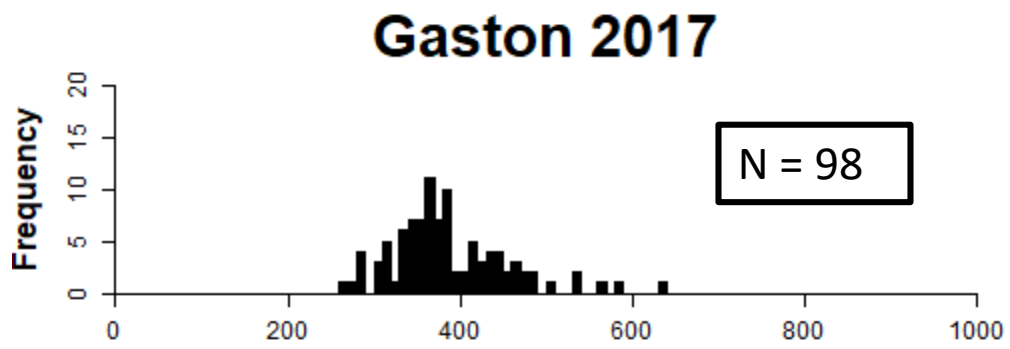
Project Summary

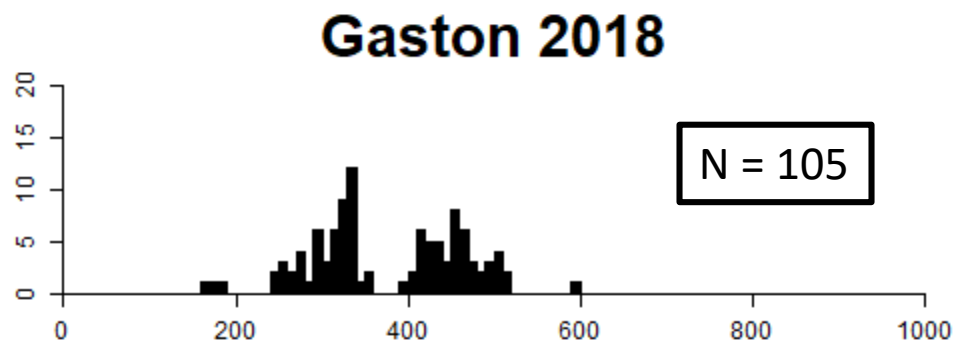
- 873 total net nights of effort
- 22,988 fish measured
- 1017 Striped Bass caught
  - 2017: 308
  - 2018: 709
- 9 of 12 possible reservoirs sampled
  - 3 repeat sampling events (2017-2018)

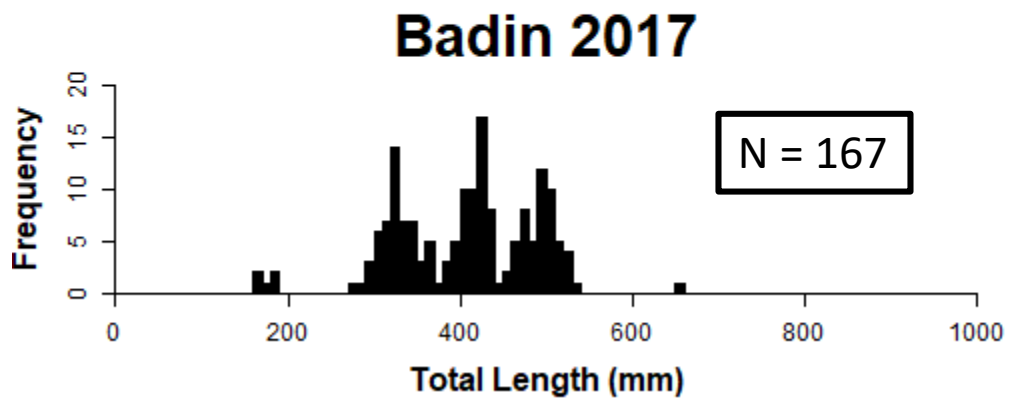

Reservoir Catch Rates by Year
Catch Rate
3
2
1
0
NN=60
2.78
NN=62
1.71
NN=66
1.48
NN=80
1.31
NN=62
2.24
NN=80
0.31
NN=62
0.69
NN=80
0.28
NN=71
1.41
NN=80
0.78
NN=80
1.21
NN=90*
0.60
Badin_17
Badin_18
Gaston_17
Gaston_18
Hickory_18
High Rock_18
Jordan_17
Jordan_18
Lookout_18
Roanoke_18
Tillery_18
Tuckertown_18
Reservoir_Sample Year

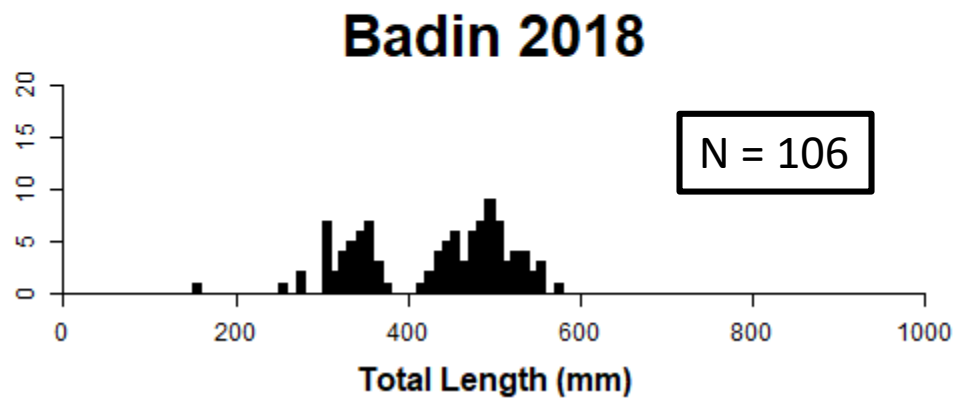

Jordan 2017
Frequency
N = 43
0
5
10
15
20
0
200
400
600
800
1000

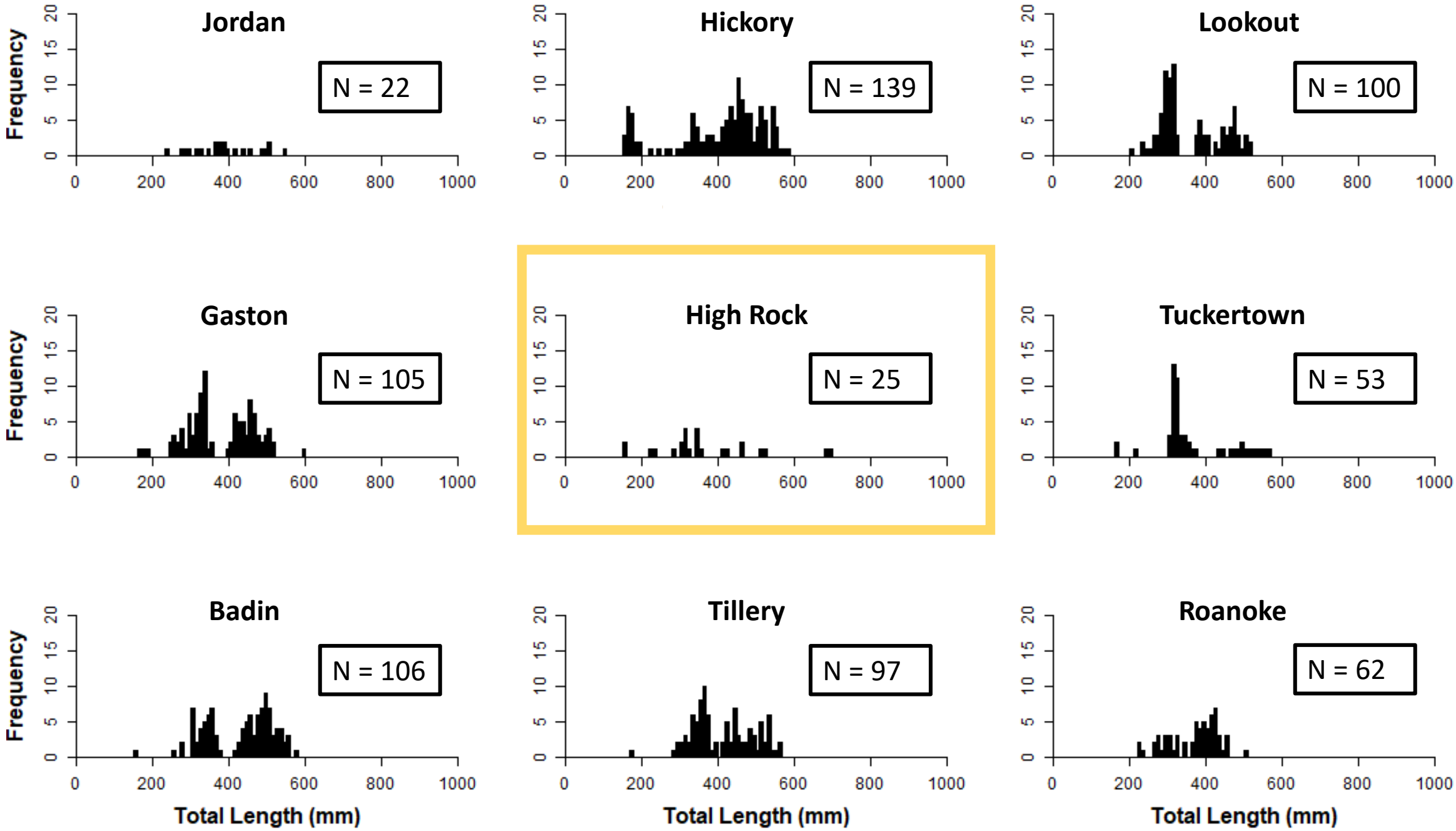

Jordan 2018
N = 22
0
5
10
15
20
0
200
400
600
800
1000


Gaston 2017
Frequency
N = 98
0
5
10
15
20
0
200
400
600
800
1000


Gaston 2018
N = 105
0
5
10
15
20
0
200
400
600
800
1000

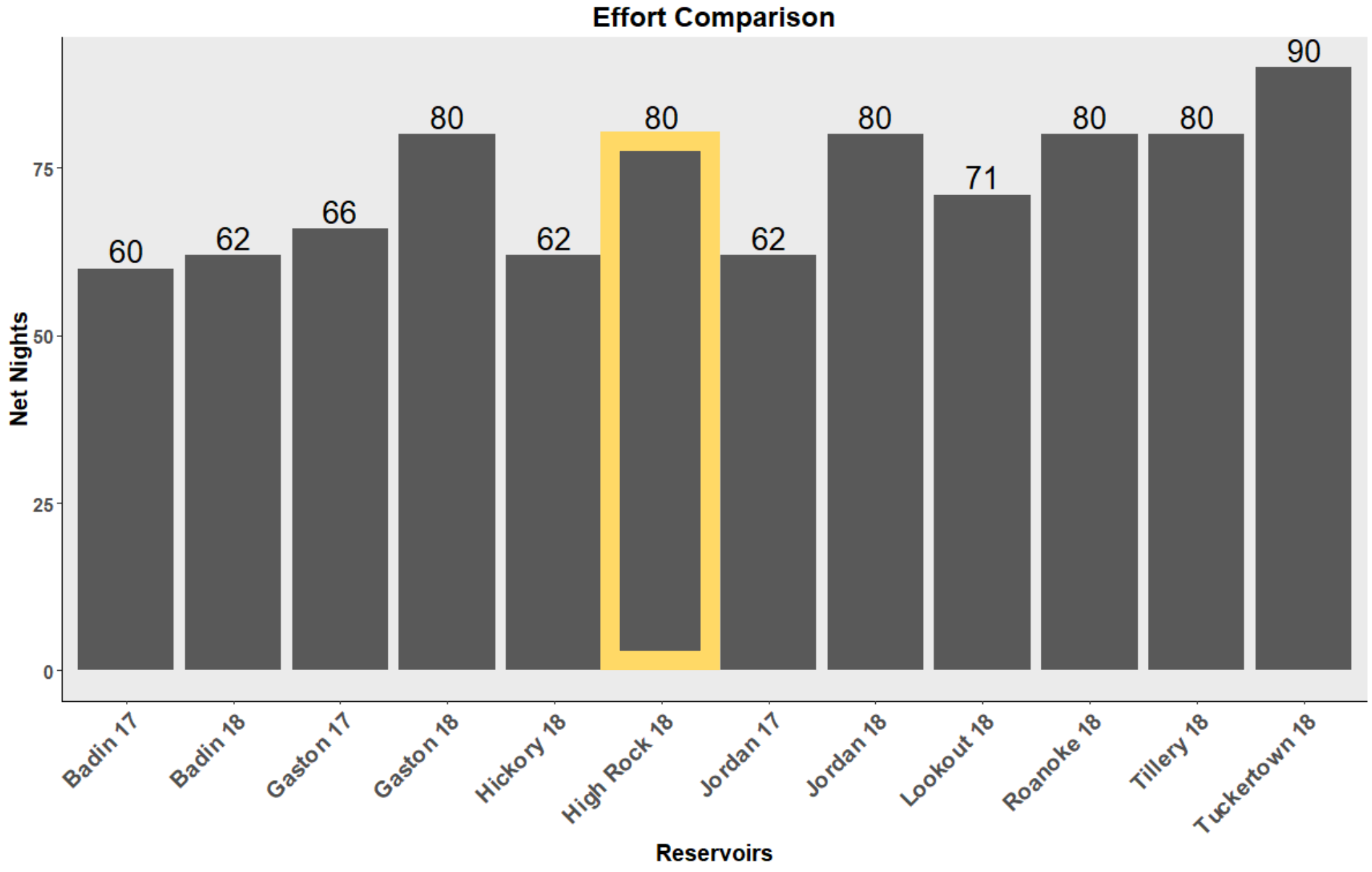

Badin 2017
Frequency
N = 167
0
5
10
15
20
0
200
400
600
800
1000
Total Length (mm)

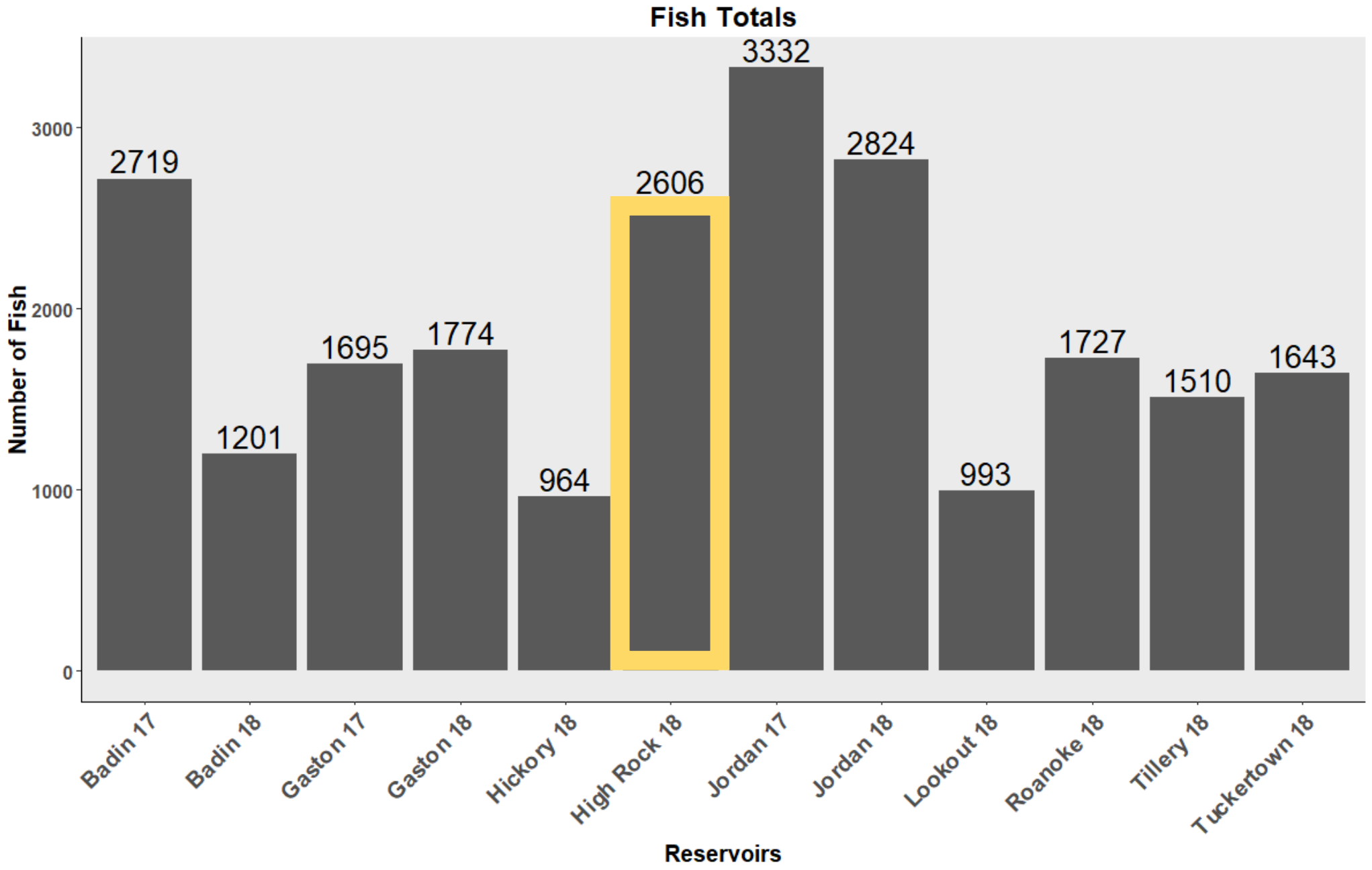

Badin 2018
N = 106
0
5
10
15
20
0
200
400
600
800
1000
Total Length (mm)

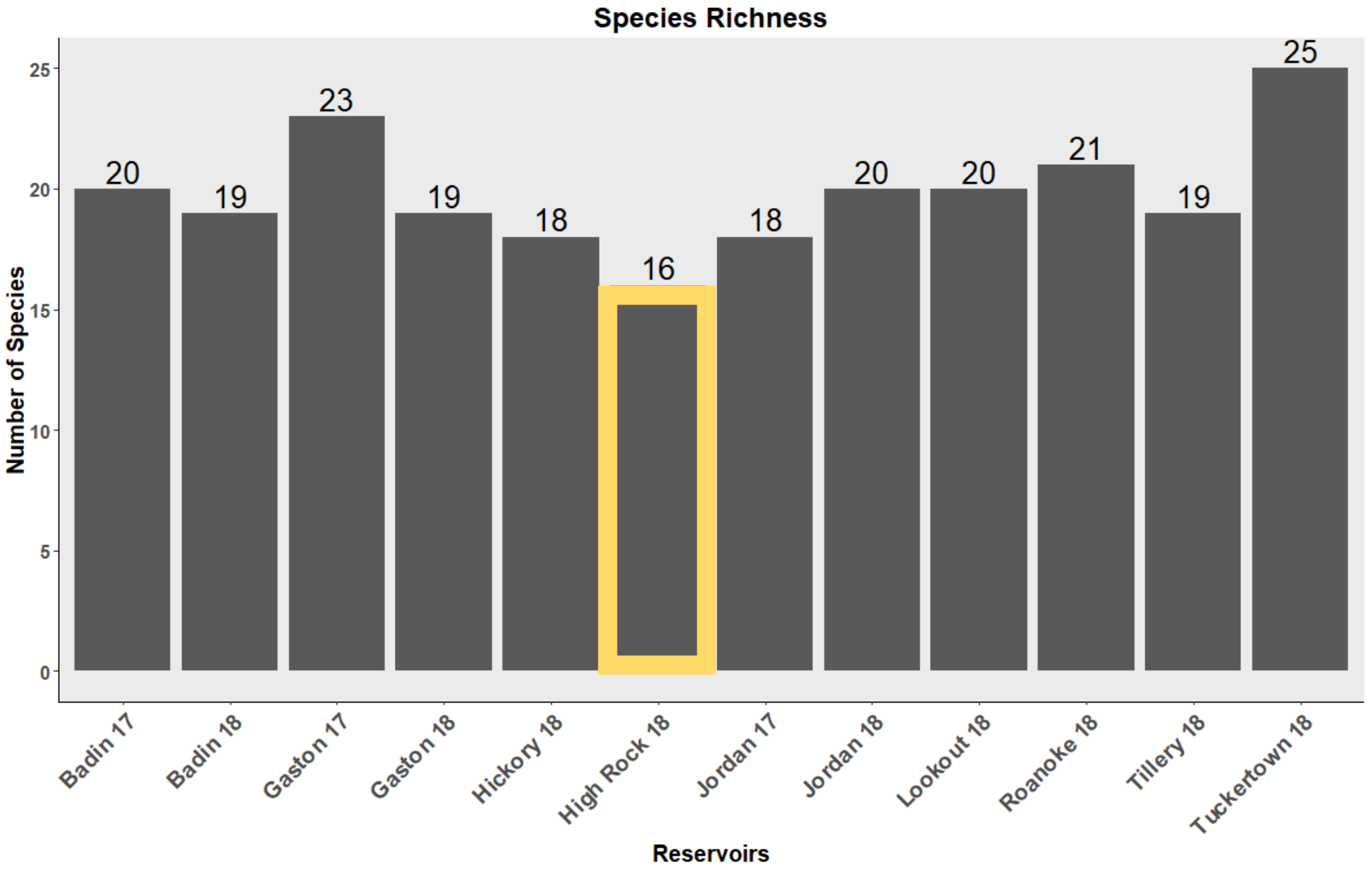

Jordan
N = 22
Hickory
N = 139
Lookout
N = 100
Gaston
N = 105
High Rock
N = 25
Tuckertown
N = 53
Badin
N = 106
Tillery
N = 97
Roanoke
N = 62
Frequency
Total Length (mm)
0
5
10
15
20
0
200
400
600
800
1000

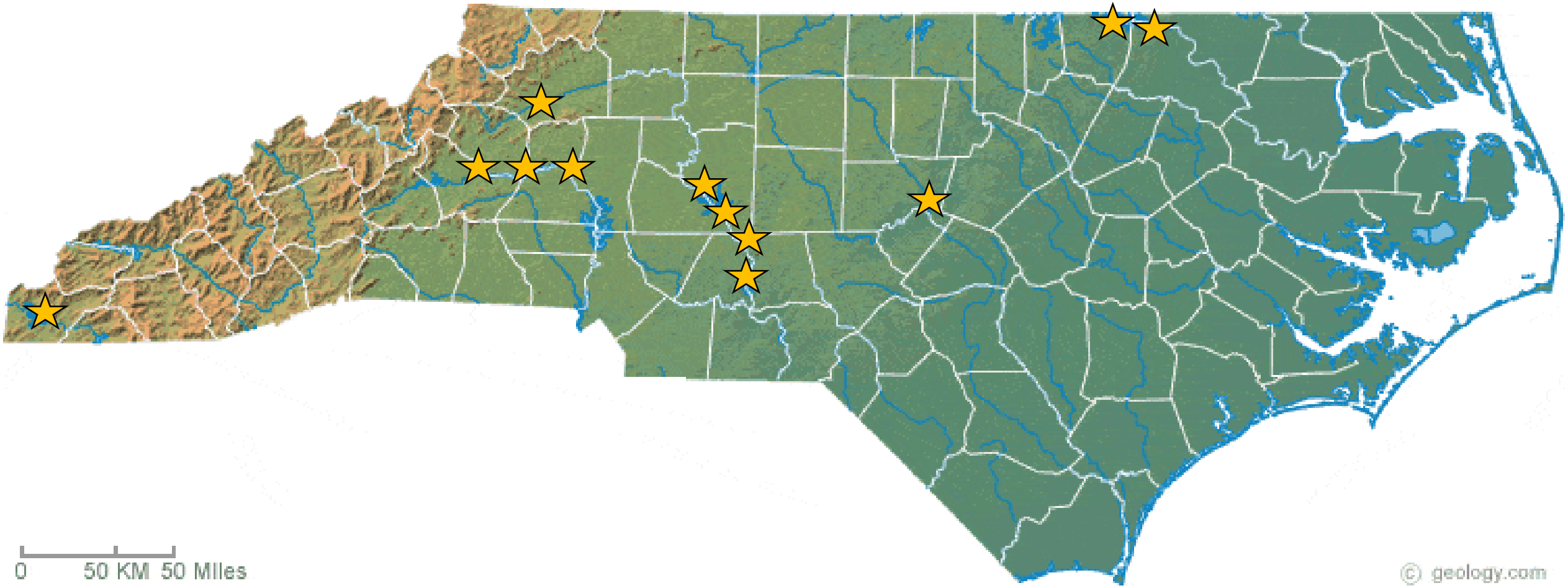
Non-native Species

- Importance of Biodiversity
- Introduced Species
  - Striped Bass
  - Largemouth Bass
- Invasive Species outcompete native species and commonly lack predators
  - Common Carp
  - Flathead Catfish

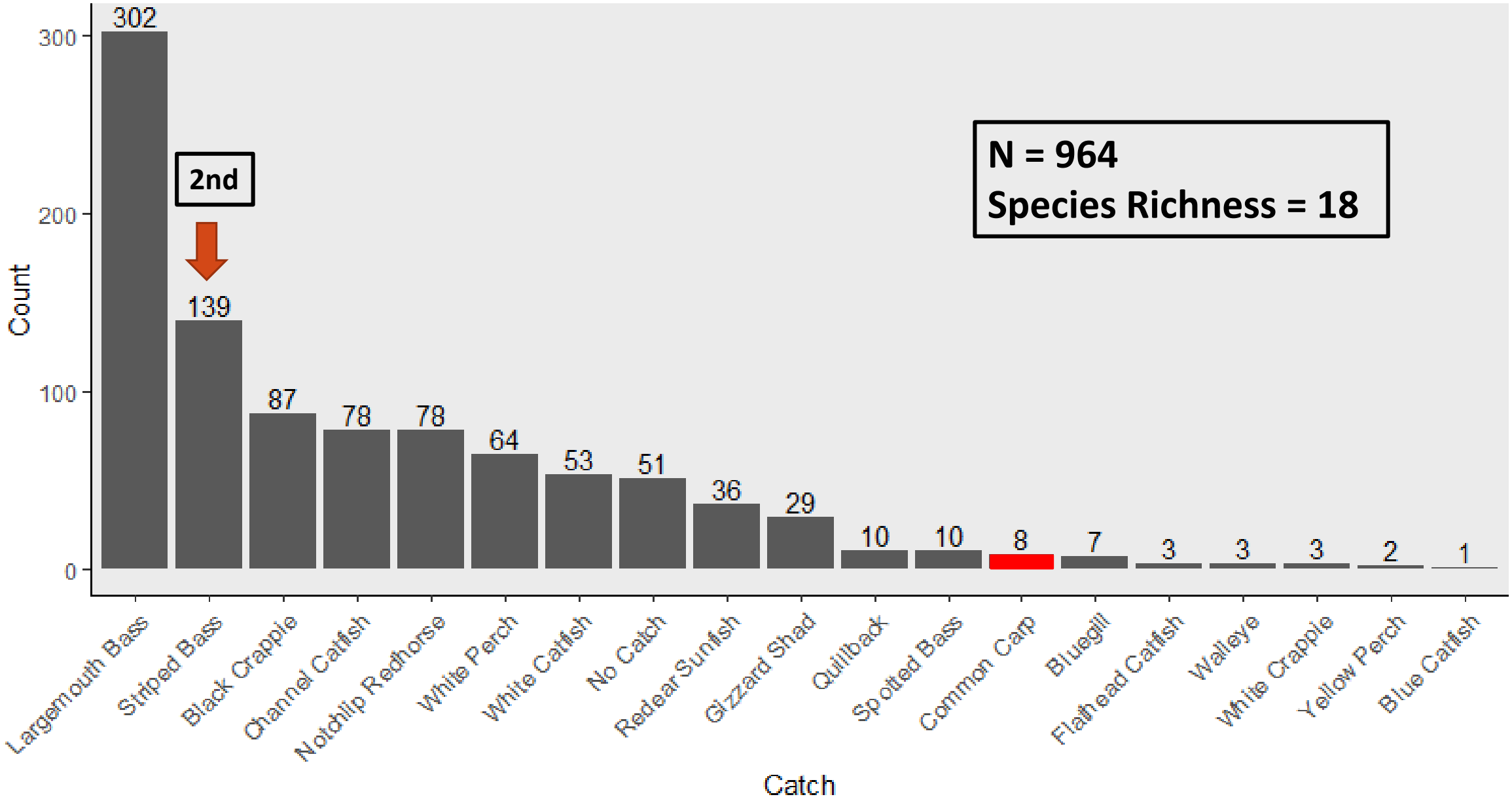

Effort Comparison
Net Nights
0
25
50
75
60
62
66
80
62
80
62
80
71
80
80
90
Badin 17
Badin 18
Gaston 17
Gaston 18
Hickory 18
High Rock 18
Jordan 17
Jordan 18
Lookout 18
Roanoke 18
Tillery 18
Tuckertown 18
Reservoirs


Fish Totals
Number of Fish
0
1000
2000
3000
2719
1201
1695
1774
964
2606
3332
2824
993
1727
1510
1643
Badin 17
Badin 18
Gaston 17
Gaston 18
Hickory 18
High Rock 18
Jordan 17
Jordan 18
Lookout 18
Roanoke 18
Tillery 18
Tuckertown 18
Reservoirs

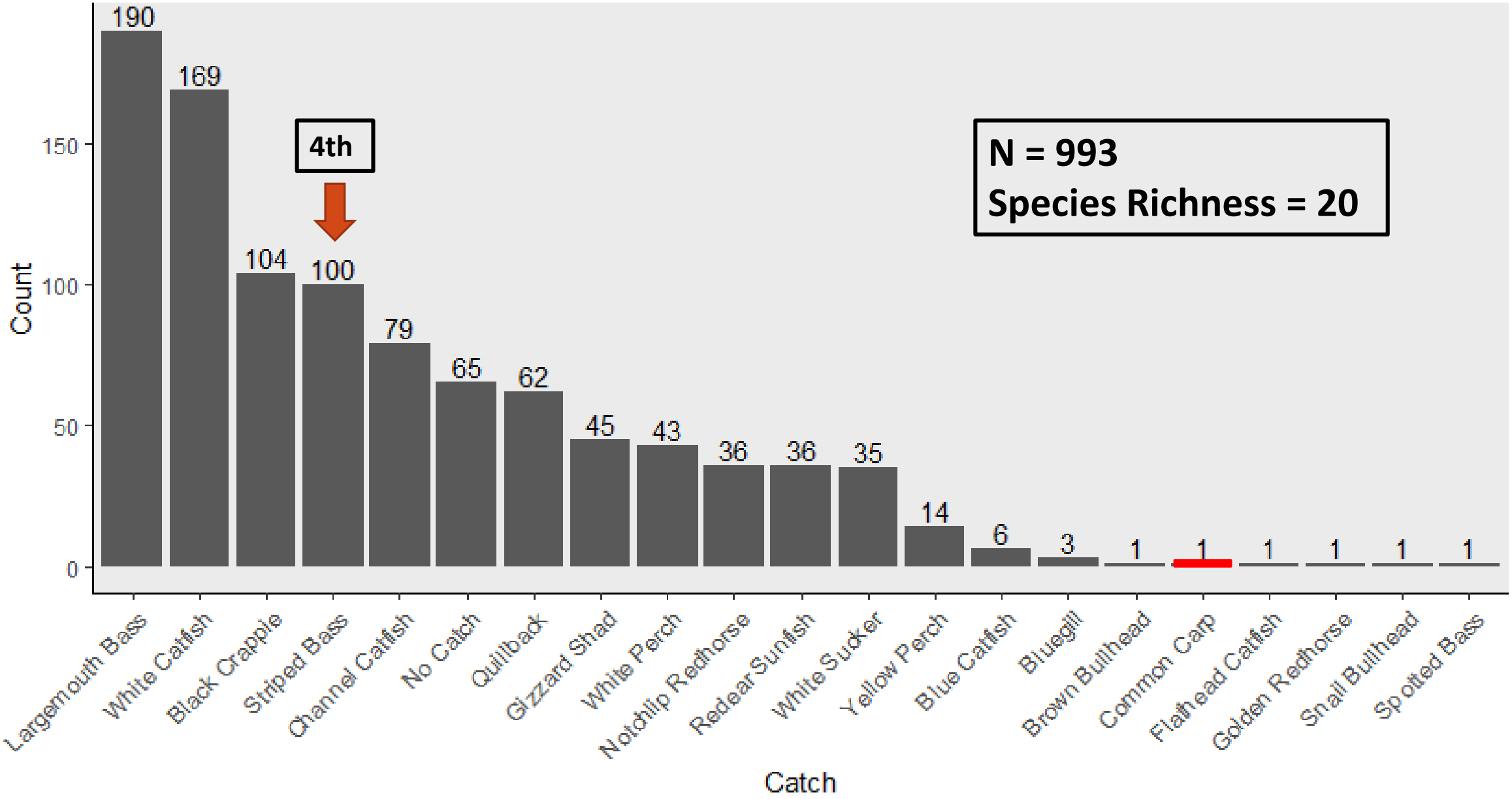

Species Richness
Number of Species
0
5
10
15
20
25
20
19
23
19
18
16
18
20
20
21
19
25
Badin 17
Badin 18
Gaston 17
Gaston 18
Hickory 18
High Rock 18
Jordan 17
Jordan 18
Lookout 18
Roanoke 18
Tillery 18
Tuckertown 18
Reservoirs

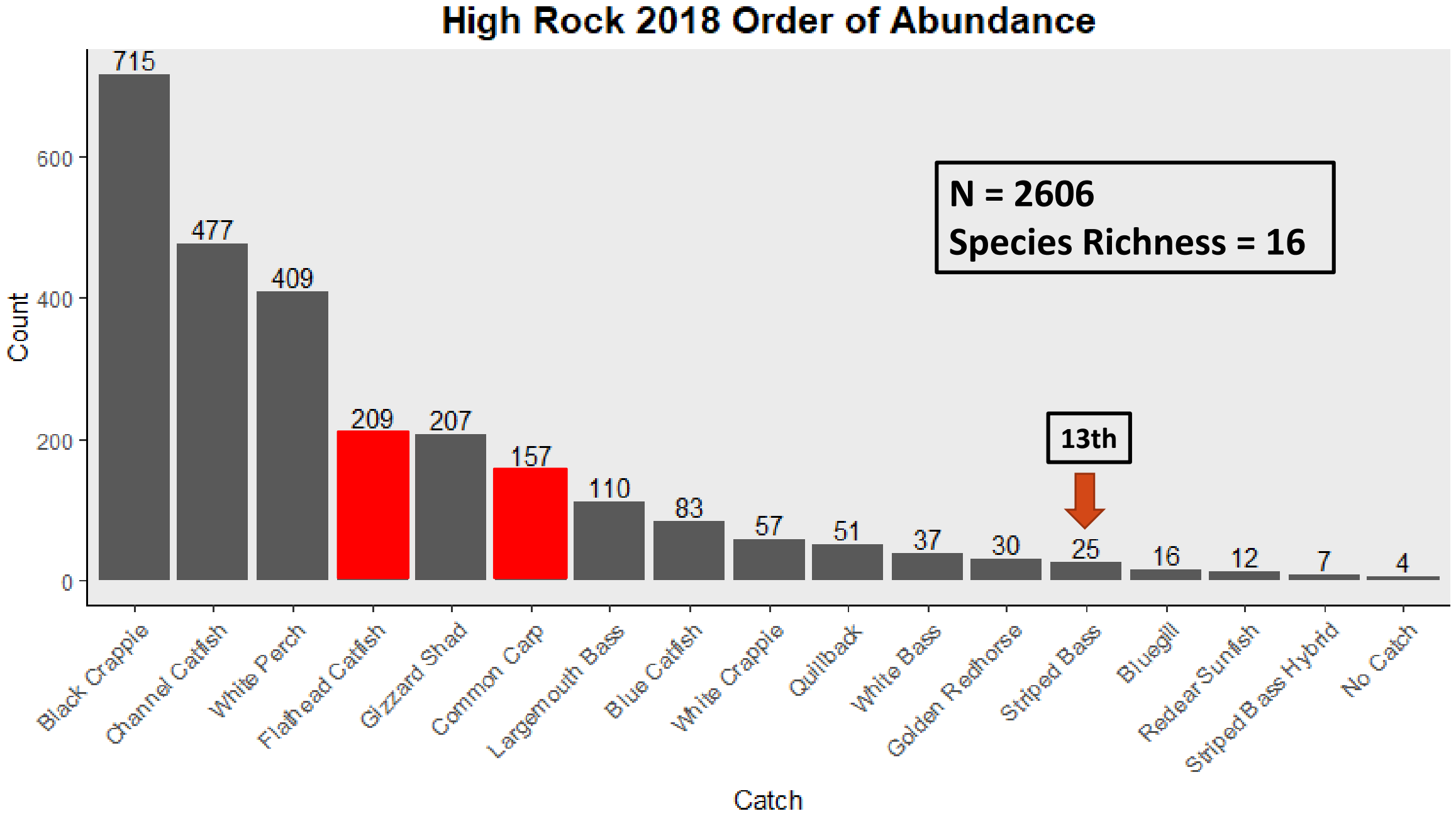

0 50 KM 50 Miles
© geology.com

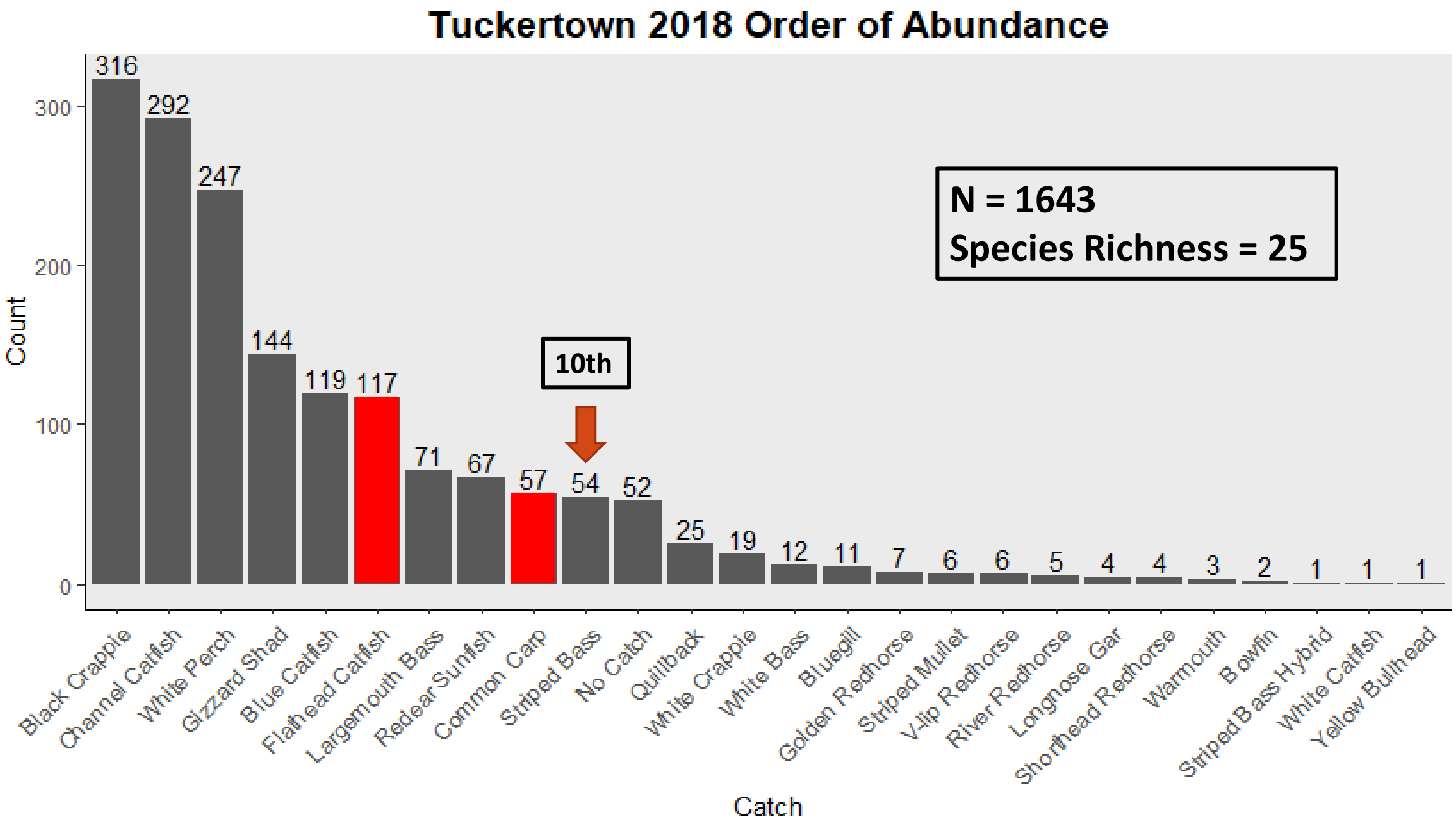
Hickory 2018 Order of Abundance



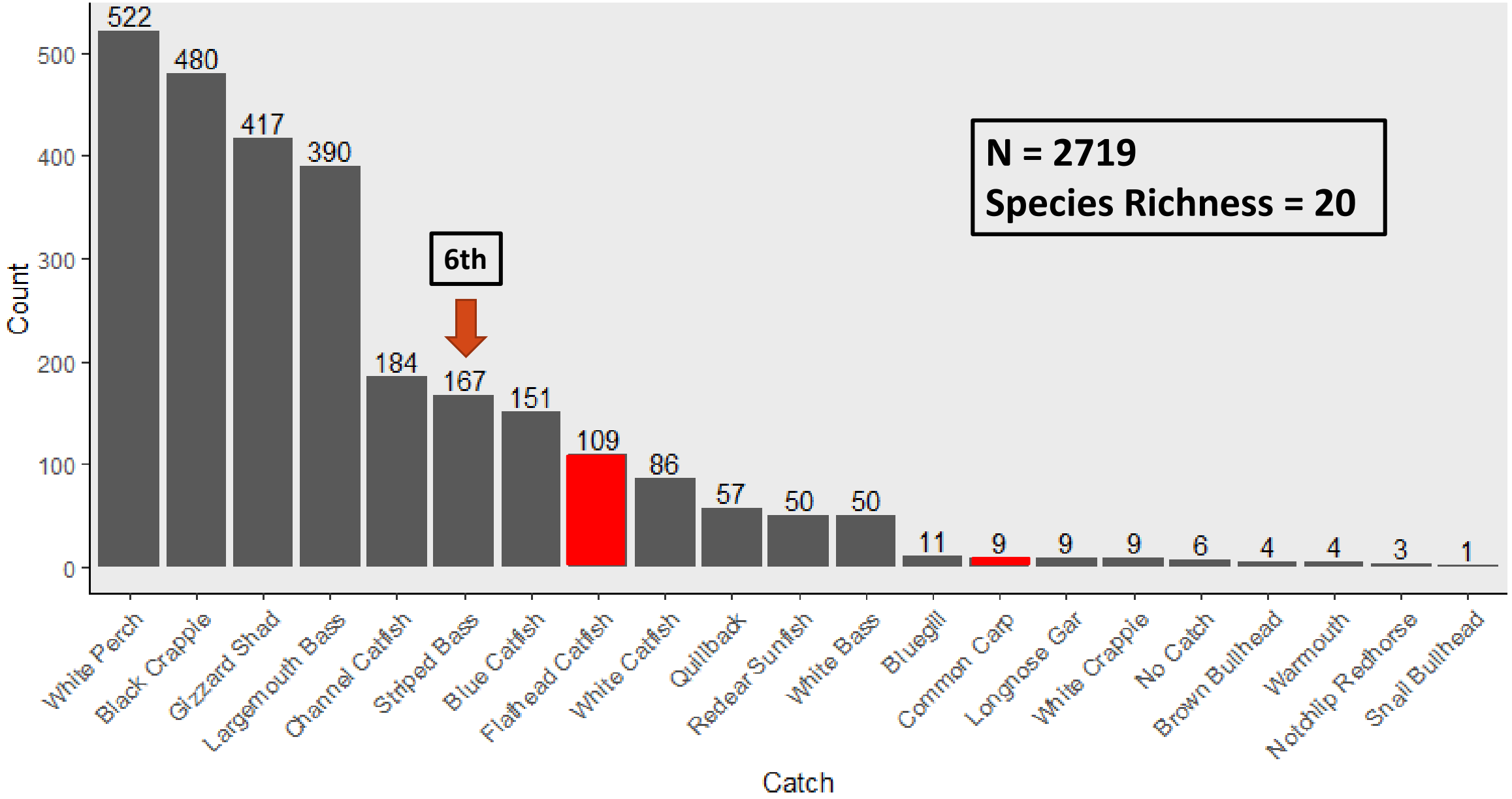
Lookout 2018 Order of Abundance

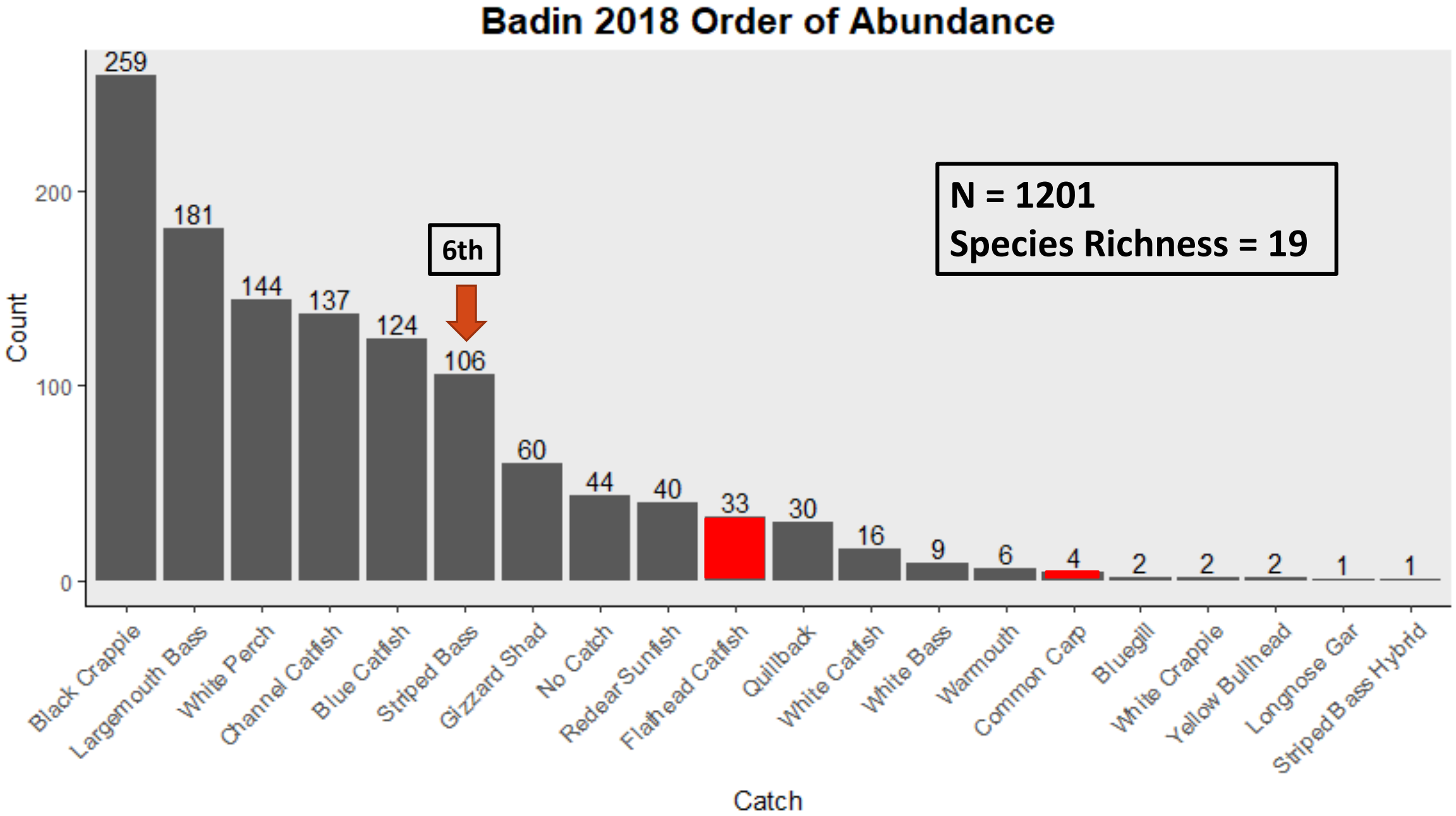



High Rock 2018 Order of Abundance
N = 2606
Species Richness = 16
13th
Count
Catch
0
200
400
600
715
477
409
209
207
157
110
83
57
51
37
30
25
16
12
7
4
Black Crappie
Channel Catfish
White Perch
Flathead Catfish
Gizzard Shad
Common Carp
Largemouth Bass
Blue Catfish
White Crappie
Quillback
White Bass
Golden Redhorse
Striped Bass
Bluegill
Redear Sunfish
Striped Bass Hybrid
No Catch

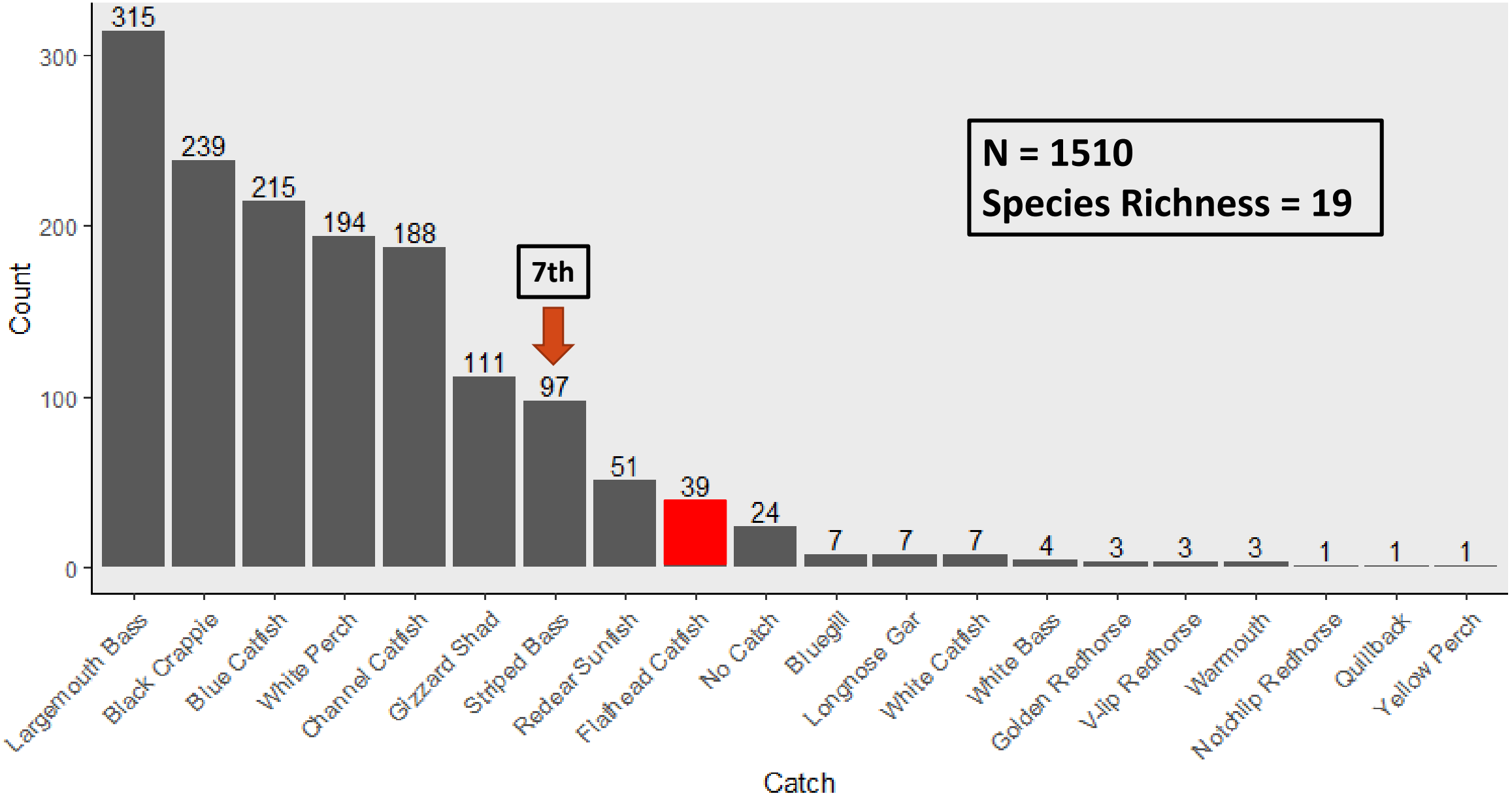

Tuckertown 2018 Order of Abundance
N = 1643
Species Richness = 25
10th
Count
Catch
0
100
200
300
316
292
247
144
119
117
71
67
57
54
52
25
19
12
11
7
6
6
5
4
4
3
2
1
1
1
Black Crappie
Channel Catfish
White Perch
Gizzard Shad
Blue Catfish
Flathead Catfish
Largemouth Bass
Redear Sunfish
Common Carp
Striped Bass
No Catch
Quillback
White Crappie
White Bass
Bluegill
Golden Redhorse
Striped Mullet
V-lip Redhorse
River Redhorse
Longnose Gar
Shorthead Redhorse
Warmouth
Bowfin
Striped Bass Hybrid
White Catfish
Yellow Bullhead

Badin 2017 Order of Abundance

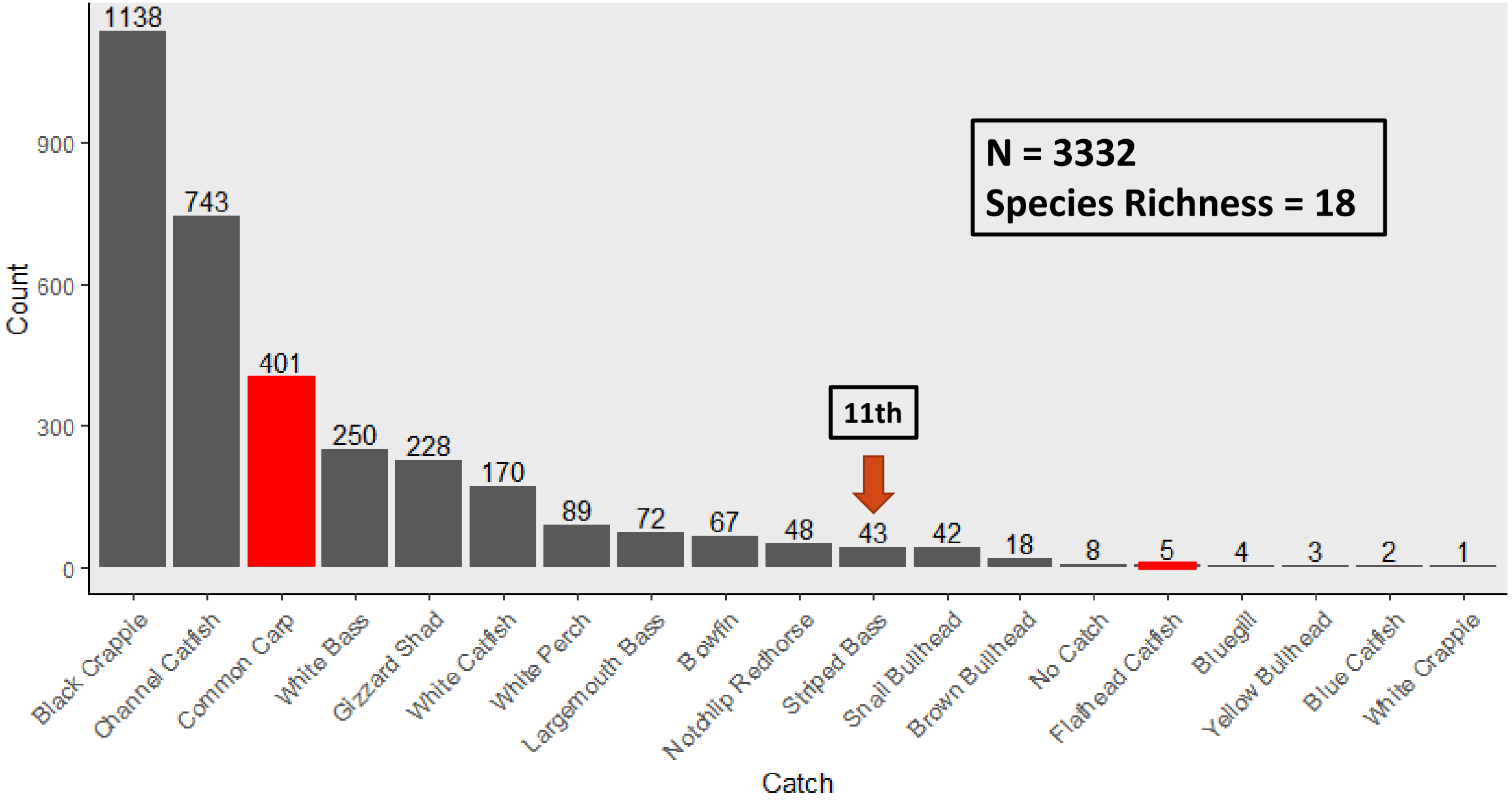


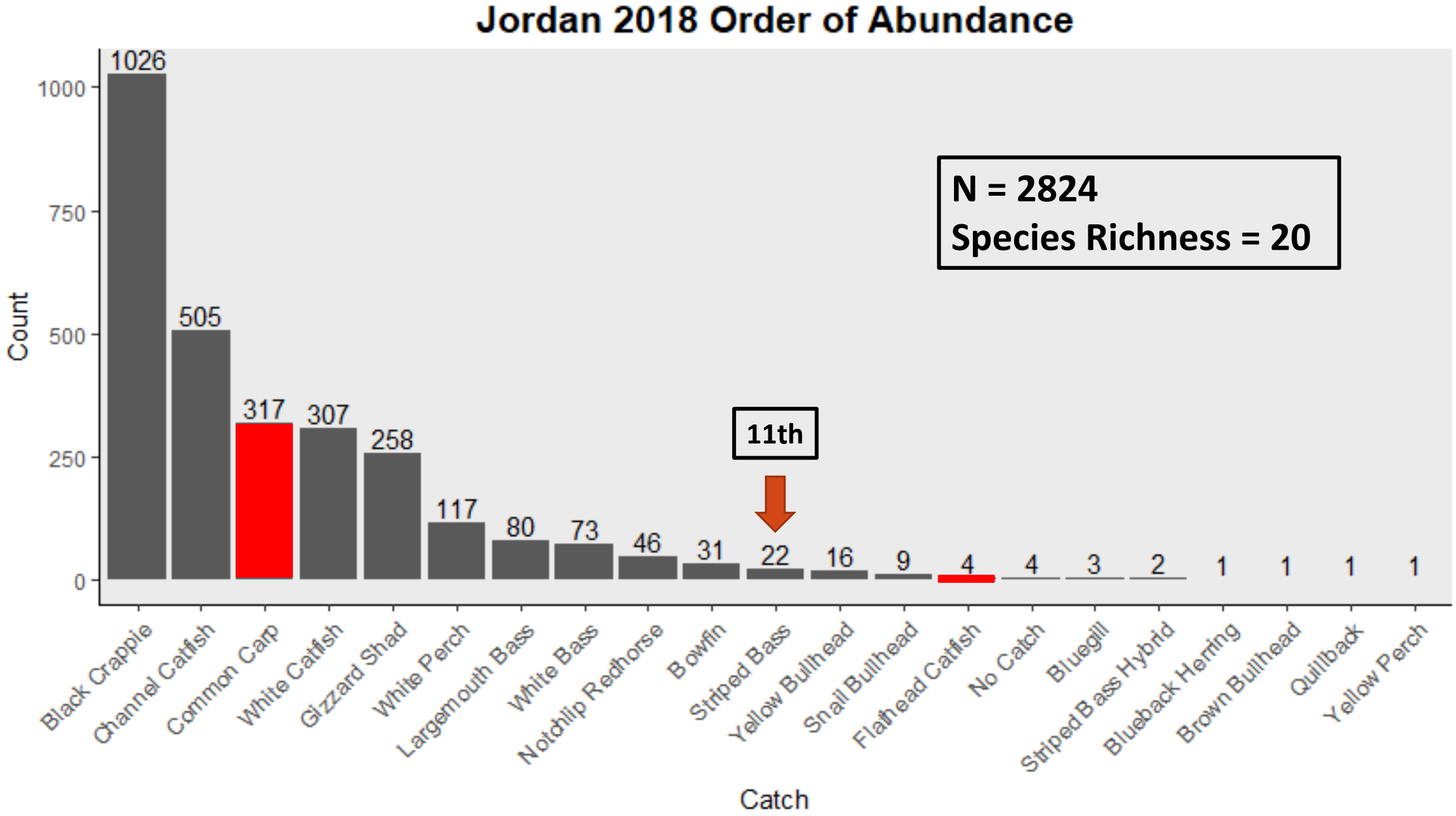

Badin 2018 Order of Abundance
N = 1201
Species Richness = 19
6th
Count
Catch
0
100
200
259
181
144
137
124
106
60
44
40
33
30
16
9
6
4
2
2
2
1
1
Black Crappie
Largemouth Bass
White Perch
Channel Catfish
Blue Catfish
Striped Bass
Gizzard Shad
No Catch
Redear Sunfish
Flathead Catfish
Quillback
White Catfish
White Bass
Warmouth
Common Carp
Bluegill
White Crappie
Yellow Bullhead
Longnose Gar
Striped Bass Hybrid

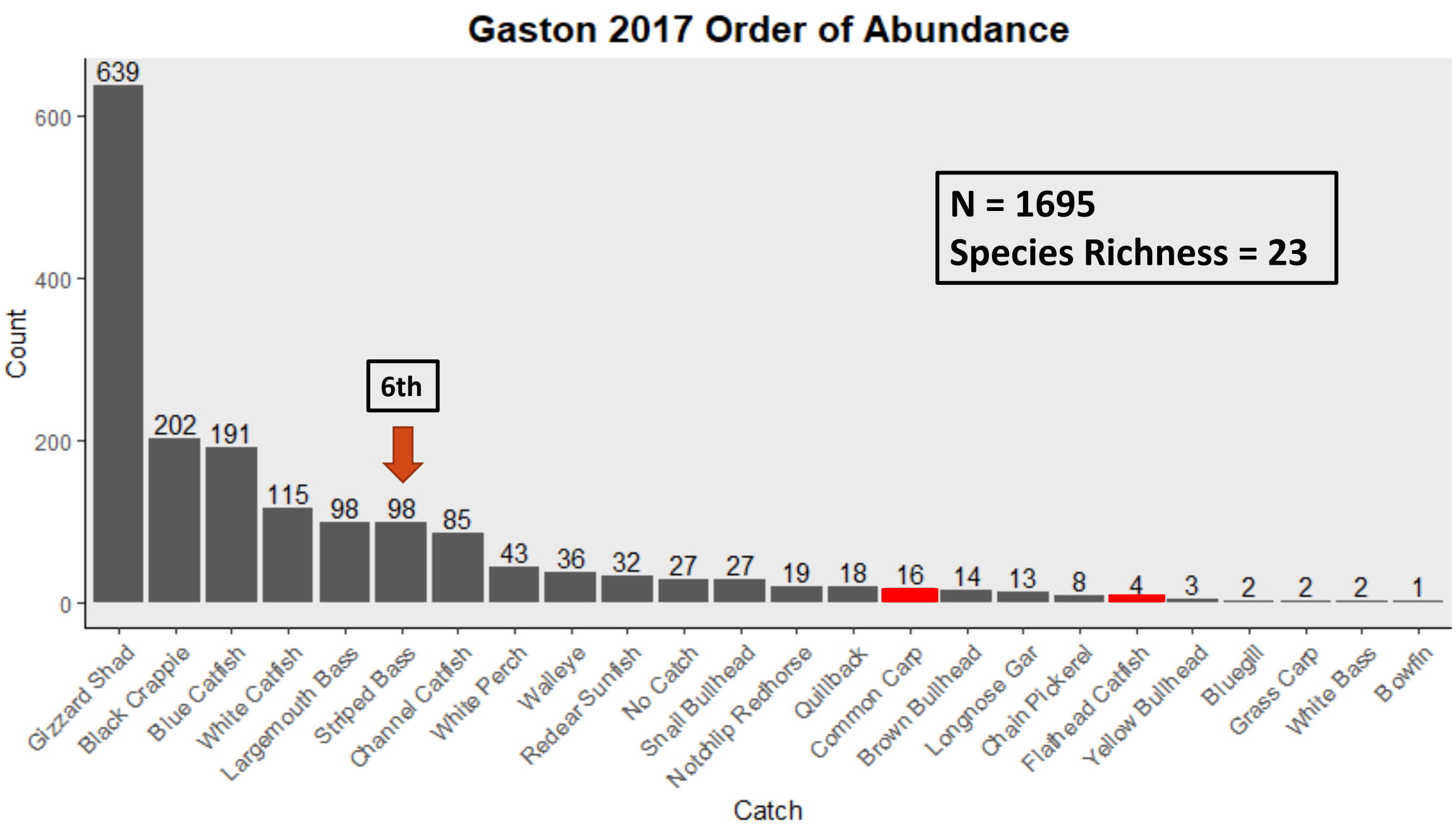
Tillery 2018 Order of Abundance

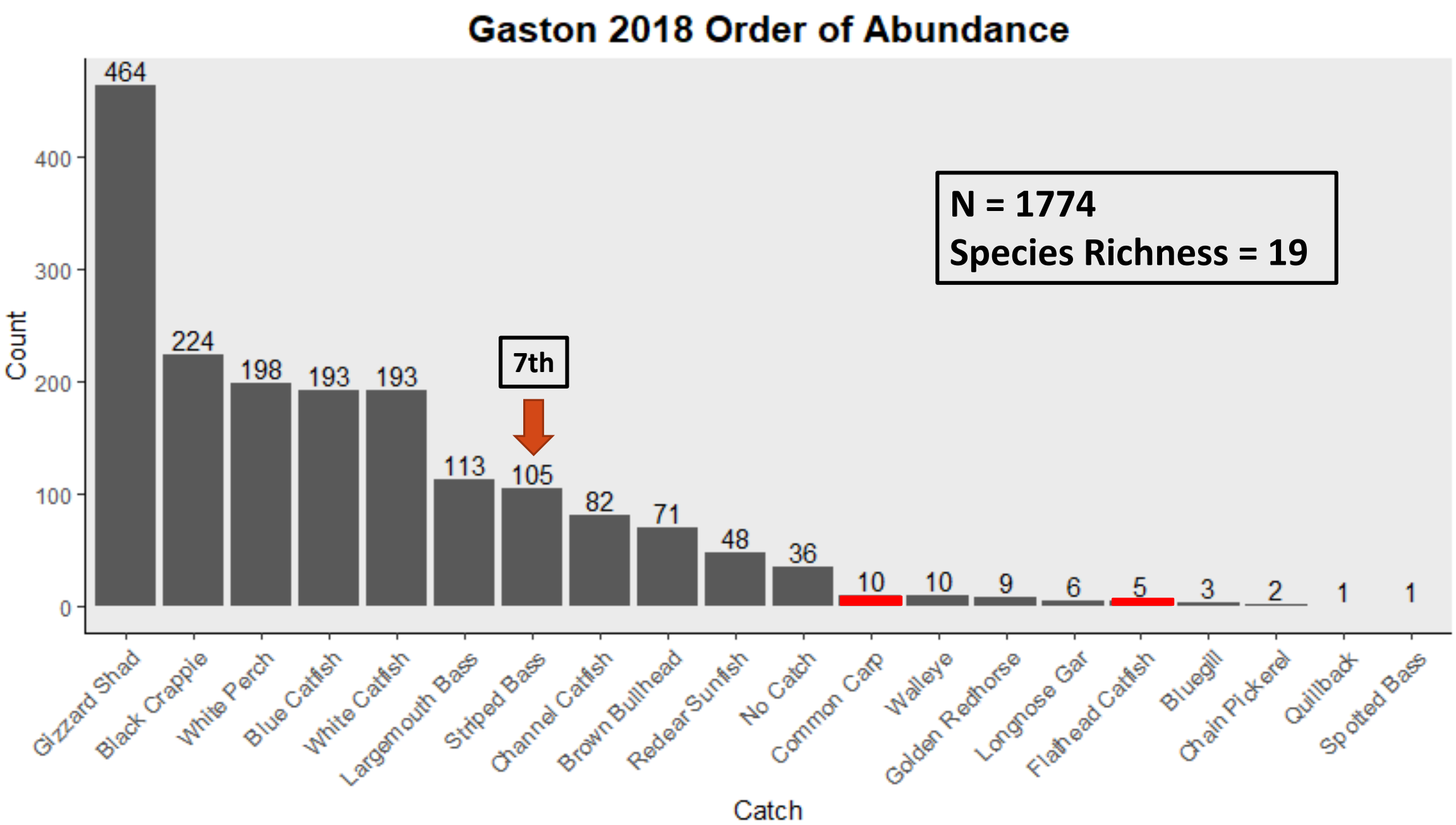


Jordan 2017 Order of Abundance

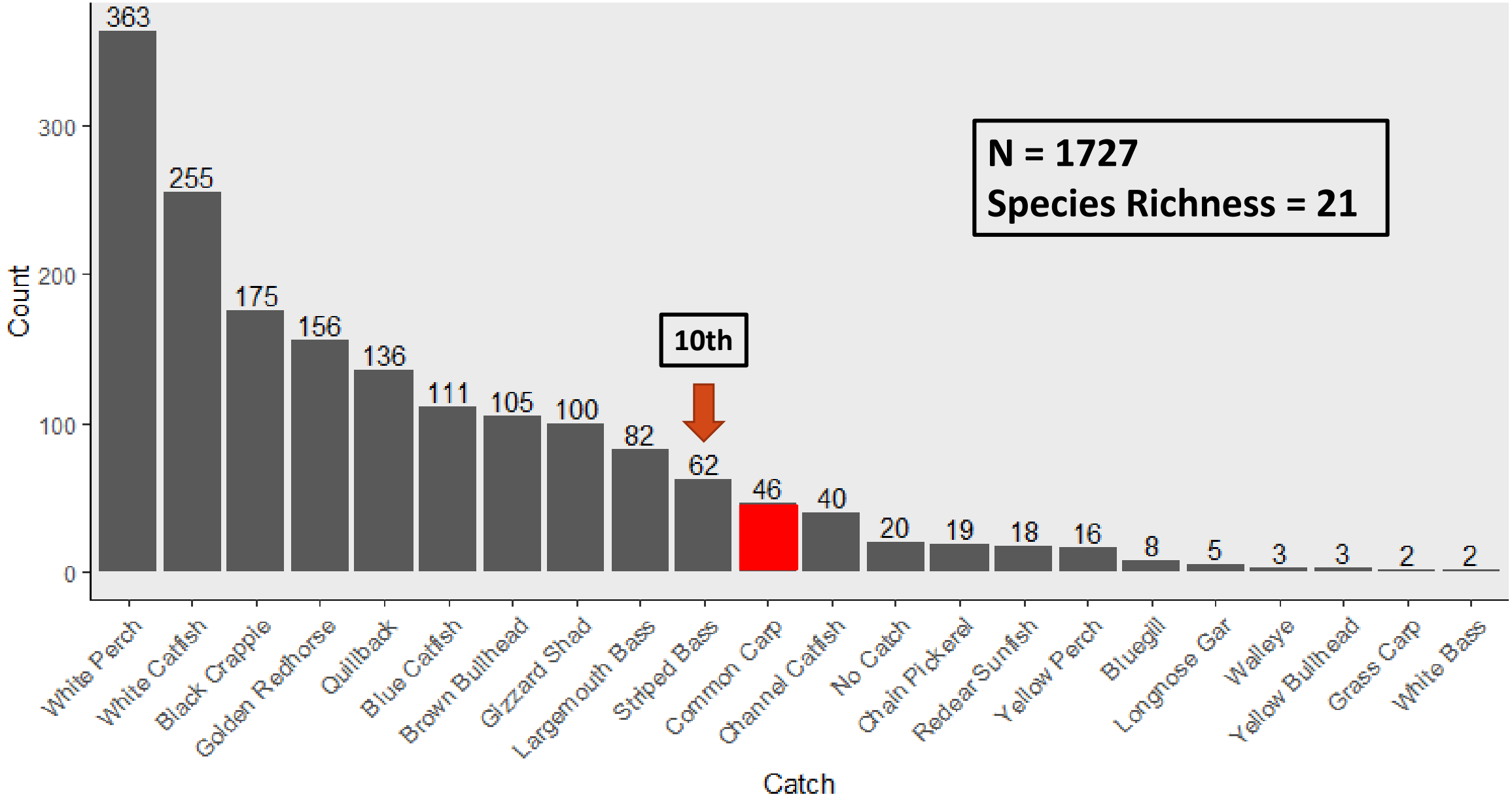



Jordan 2018 Order of Abundance
N = 2824
Species Richness = 20
11th
Count
Catch
1000
750
500
250
0
1026
505
317
307
258
117
80
73
46
31
22
16
9
4
4
3
2
1
1
1
1
Black Crappie
Channel Catfish
Common Carp
White Catfish
Gizzard Shad
White Perch
Largemouth Bass
White Bass
Notchlip Redhorse
Bowfin
Striped Bass
Yellow Bullhead
Snail Bullhead
Flathead Catfish
No Catch
Bluegill
Striped Bass Hybrid
Blueback Herring
Brown Bullhead
Quillback
Yellow Perch


Gaston 2017 Order of Abundance
N = 1695
Species Richness = 23
6th
Count
Catch
0
200
400
600
639
202
191
115
98
98
85
43
36
32
27
27
19
18
16
14
13
8
4
3
2
2
2
1
Gizzard Shad
Black Crappie
Blue Catfish
White Catfish
Largemouth Bass
Striped Bass
Channel Catfish
White Perch
Walleye
Redear Sunfish
No Catch
Snail Bullhead
Notchlip Redhorse
Quillback
Common Carp
Brown Bullhead
Longnose Gar
Chain Pickerel
Flathead Catfish
Yellow Bullhead
Bluegill
Grass Carp
White Bass
Bowfin


Gaston 2018 Order of Abundance
N = 1774
Species Richness = 19
7th
Count
Catch
0
100
200
300
400
464
224
198
193
193
113
105
82
71
48
36
10
10
9
6
5
3
2
1
1
Gizzard Shad
Black Crappie
White Perch
Blue Catfish
White Catfish
Largemouth Bass
Striped Bass
Channel Catfish
Brown Bullhead
Redear Sunfish
No Catch
Common Carp
Walleye
Golden Redhorse
Longnose Gar
Flathead Catfish
Bluegill
Chain Pickerel
Quillback
Spotted Bass

Roanoke 2018 Order of Abundance



Summary

- Similar assemblage structure and predominant species across reservoirs
- Variation in Striped Bass size structure among reservoirs
- Little interannual variation observed
- High species richness for gill net sampling

High Rock Summary

- Maximum Effort
- 4th most fish caught
- Lowest Species Richness
- Few Striped Bass
  - Second lowest catch rate

Future Direction

- Additional assessment of important reservoir characteristics
  - Prey assemblage and population characterization
- Incorporate historical Striped Bass information from reservoirs
  - >3000 otoliths from 2004 – present obtained from NCWRC staff

Future Direction

- Reservoirs to be sampled in 2019
  - Third Year: Jordan, Gaston, Badin
  - Second Year: Hickory, Lookout, Tuckertown
  - First Year: Rhodhiss, W. Kerr Scott, Hiwassee
- Reservoirs not sampled again:
  - **High Rock**, Tillery, Roanoke Rapids