

Use of an Electronic Fish Counter to Estimate River Herring Run Strength at Walker's Dam Denil Fishway on the Chickahominy River

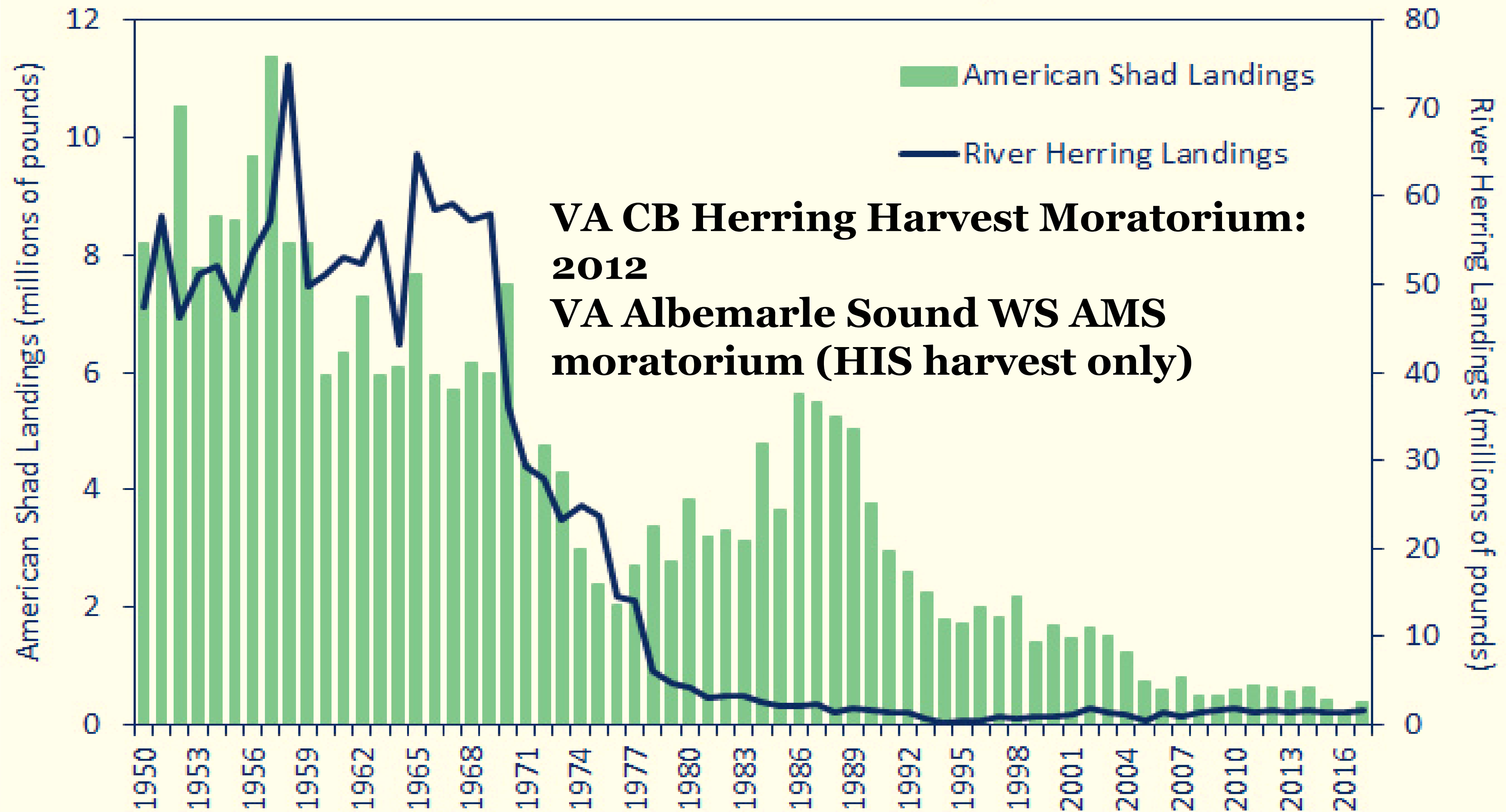
Virginia Chapter AFS Meeting
February 6, 2020
Lexington, VA

Alan Weaver, Fish Passage
Coordinator
and
Tim Owen, Fish Passage
Technician



American Shad & River Herring Commercial Landings

Source: ACCSP Data Warehouse, 2018



Goal

Establish a herring run count (ALE and BLH) in the Chickahominy River at the Walkers Dam double Denil fishway to inform population assessments (ASMFC, NE states)



Objectives

- **Further test the accuracy of Smith-Root 1601 electronic counts**
- **Generate % composition estimates of species passing to apply to run count**
- **Generate annual run count estimates for target species**



PROJECT DEVELOPMENT

- **2017 – construction of tunnel arrays; testing new unit; SR repairs**
- **Deployed in 2017 – SR unit malfunction – back and forth to SR for repairs and testing**
- **2018 – change to shielded data wire (22g)**
- **Field testing at K&Q Hatchery raceway (good results)**
- **2018 – Deployed counting arrays in Walkers fishway exit channels**
- **2018 – Electronic count consistent with fish trapping count**
- **2018 – Species percent composition; run count estimates**
- **2019 – Species percent composition; run count estimates;**
 - **Depth data collected to analyze tide cycle effect on passage**

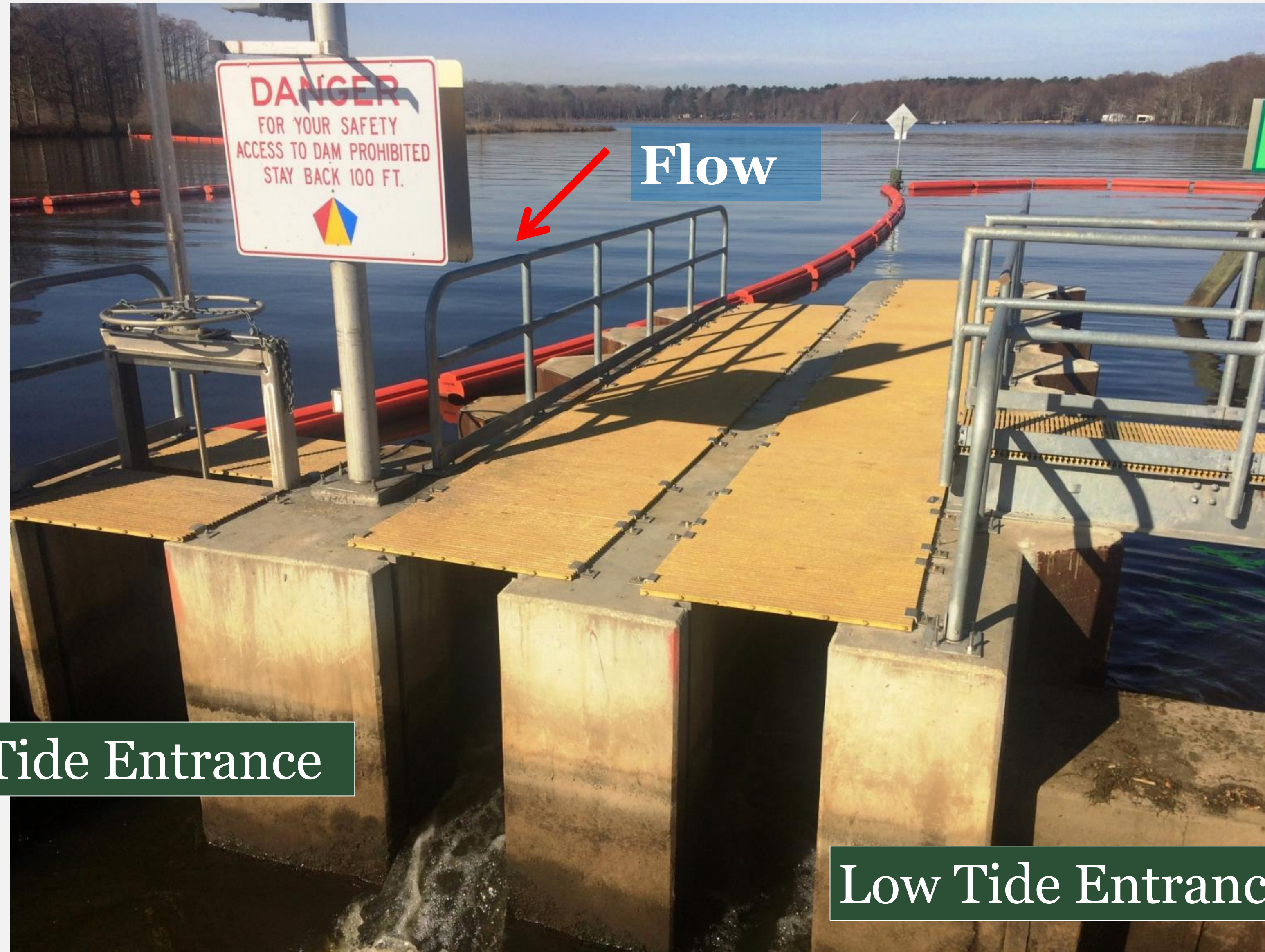


METHODS (2018 and 2019)

- **Trap 1 to 2 times per week**
- **Trapping: Deploy exit channel “box traps” with a ¾” mesh = mesh on tunnel apparatus**
- **Trap sets ranged from as short as a few minutes up to over 1 hour, but mostly ~ 5-10 minutes**
- **Trapped fish were identified and counted to get % species composition**
- **Compared SR count to trapped numbers (total) to determine SR accuracy**
- **SR1601 channel counts captured on DVR (daily; hourly; ½ hourly passage rates)**



Double-Denil Fishway High and Low Tide Channels

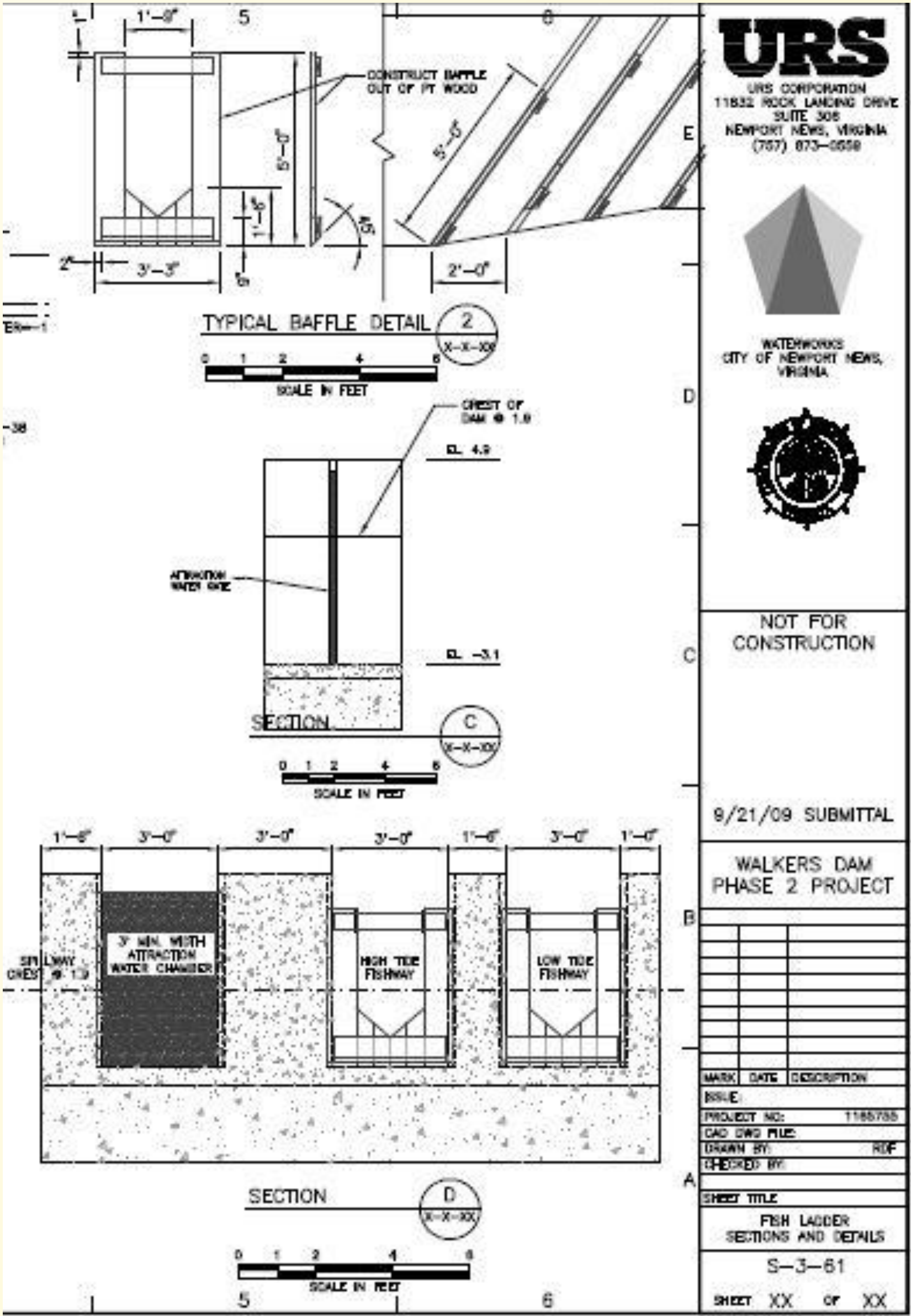


High Tide Entrance

Low Tide Entrance



Walkers Denil Fishway Exit Channel

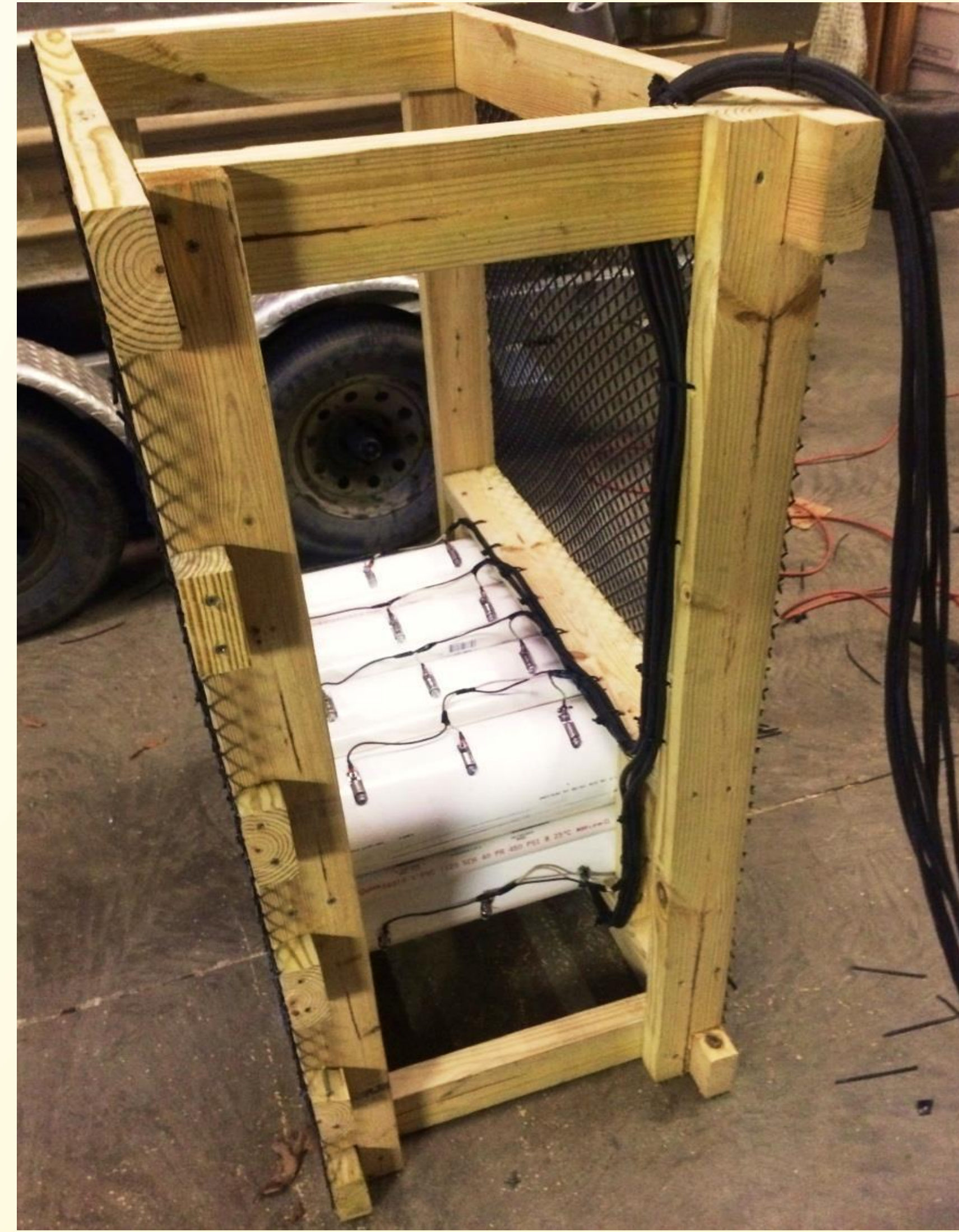








Counter tunnel array



Specifications Summary

- **Type of detection: Potentiometric bridge**
- **Water conductivity range: 20 to 5000 microSiemens/cc**
- **Count sensitivity: 1% tunnel unbalance, minimum**
- **Count rate: 10 per second/channel**
- **Potential for 576,000 counts/hour**
- **Count Capacity/channel: 999,999 six digit LCD**
- **Counting mode: 16 discrete channels**
- **Smallest fish detected: length equal to tunnel diameter**
- **Power requirement: 120 VAC 60 Hz**
- **Battery life with 12V 12Ah batteries: 4 days minimum**





**3/4" mesh exit trap
(low tide side)**

Blueback Herring trapped



Alewife

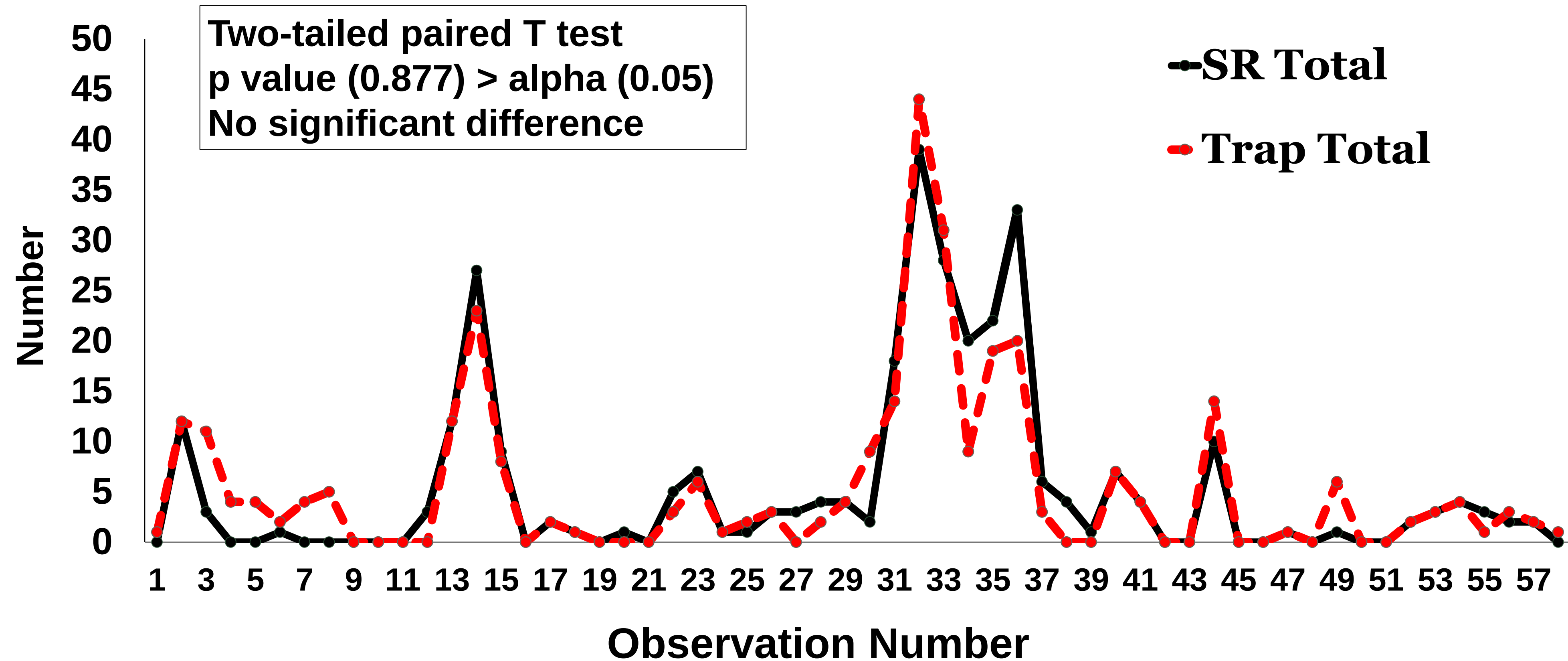
**Blueback
Herring**



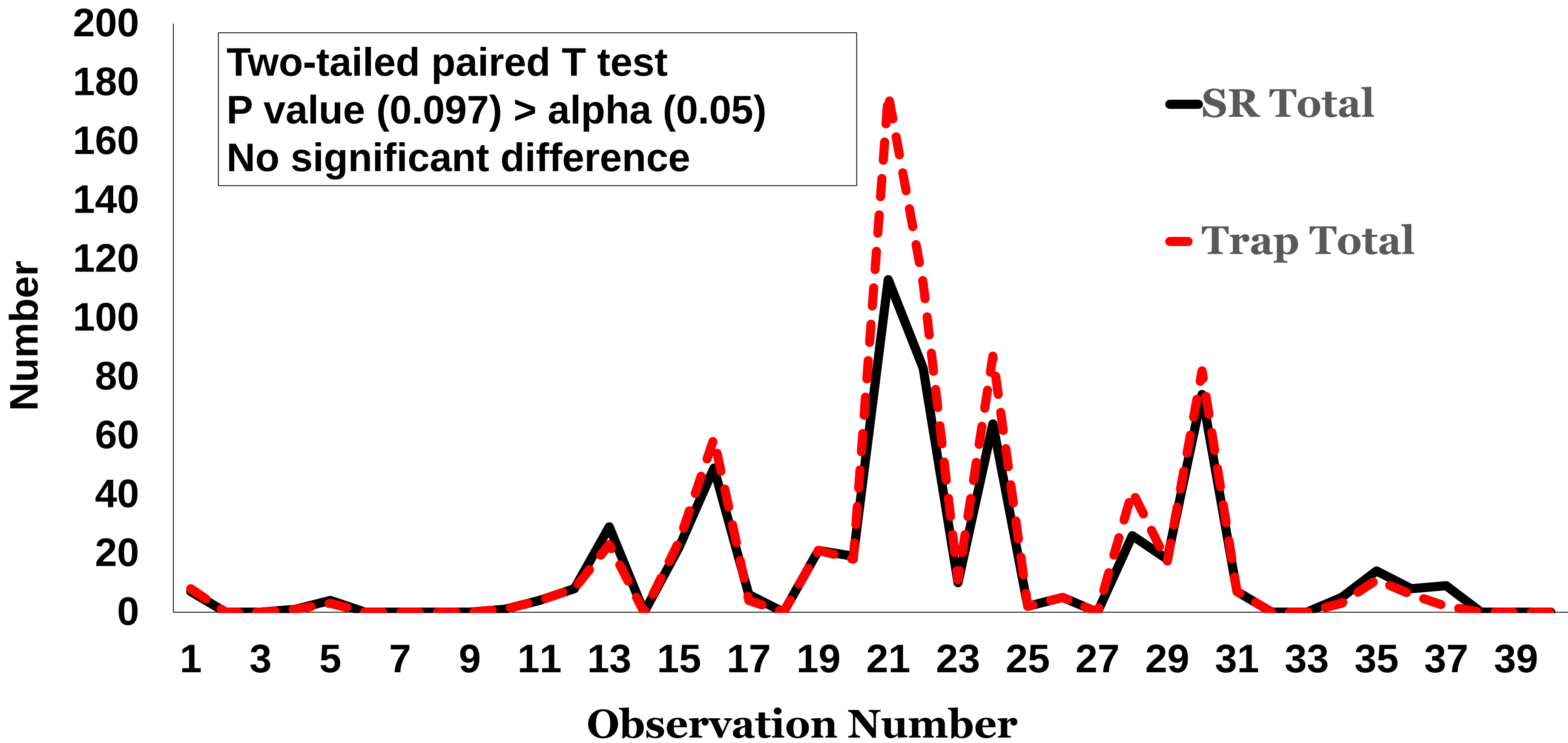
GIZ



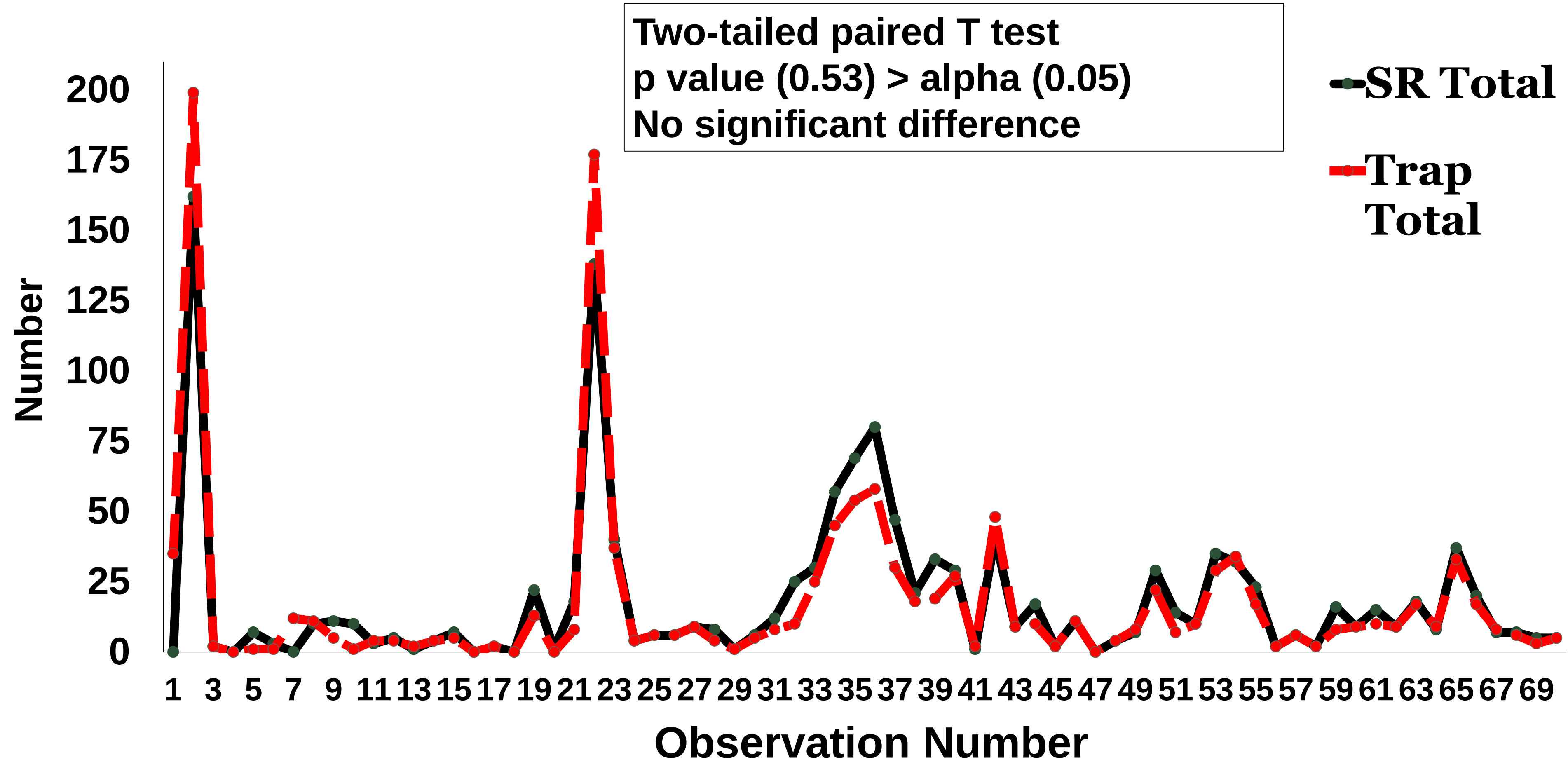
2018 High Tide SR Fish Detections vs. Fish Trapped



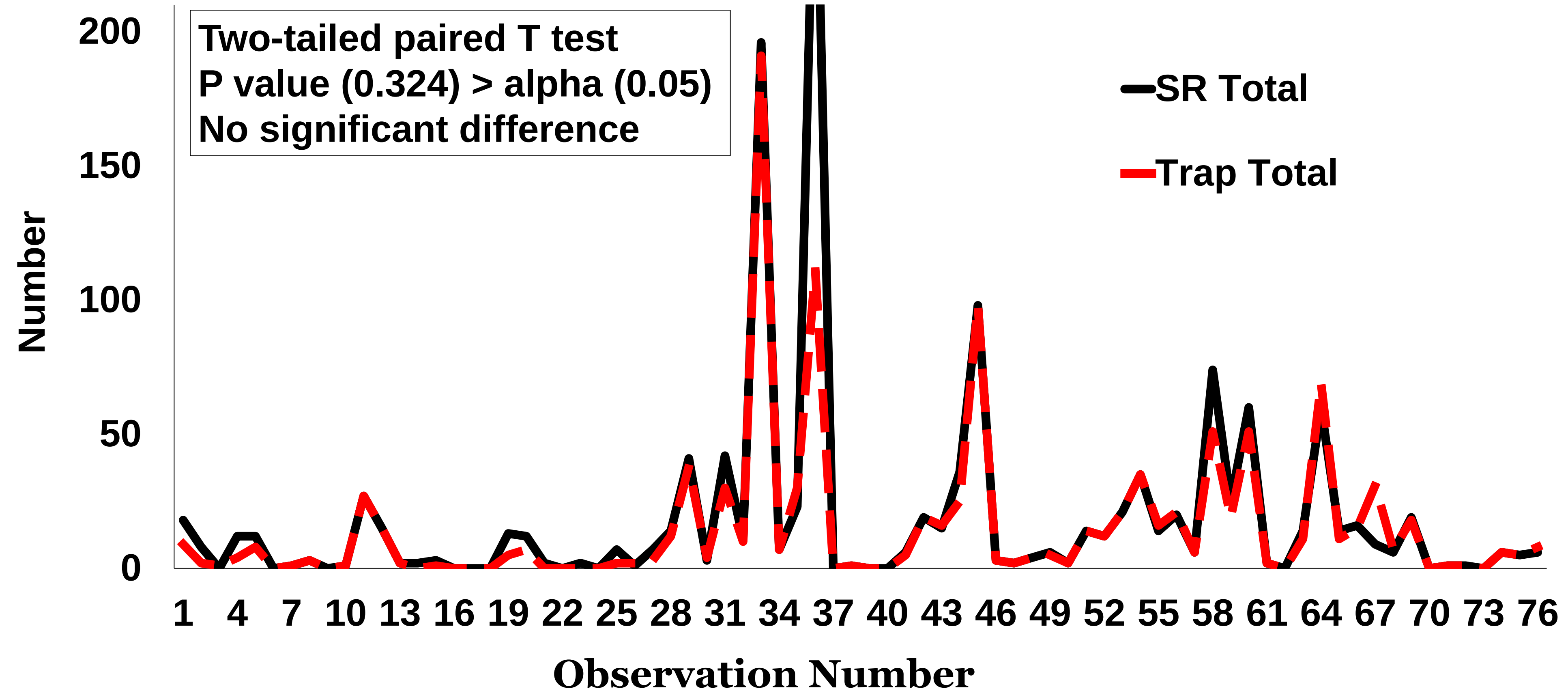
2019 High Tide SR Fish Detections vs. Fish Trapped



2018 Low Tide SR Fish Detections vs. Fish Trapped



2019 Low Tide SR Fish Detections vs. Fish Trapped



2018 Bias Summary – Combined Fishways

Exact Counts; Plus Counts; Negative Counts

Season Totals		3/30	4/2	4/5	4/12	4/17	4/19	4/27	5/1	5/9	5/14	5/17
# of Observations	73	4	6	9	7	6	6	12	8	3	8	4
Exact %	32%	2	1	5	1	4	0	2	2	2	3	1
Negative %	12%	2	0	1	1	0	0	2	0	1	1	1
Median Difference	4											
Positive%	56%	0	5	3	5	2	6	8	6	0	4	2
Median Difference	5											

Sheppard and Bednarski NAJFM 2015



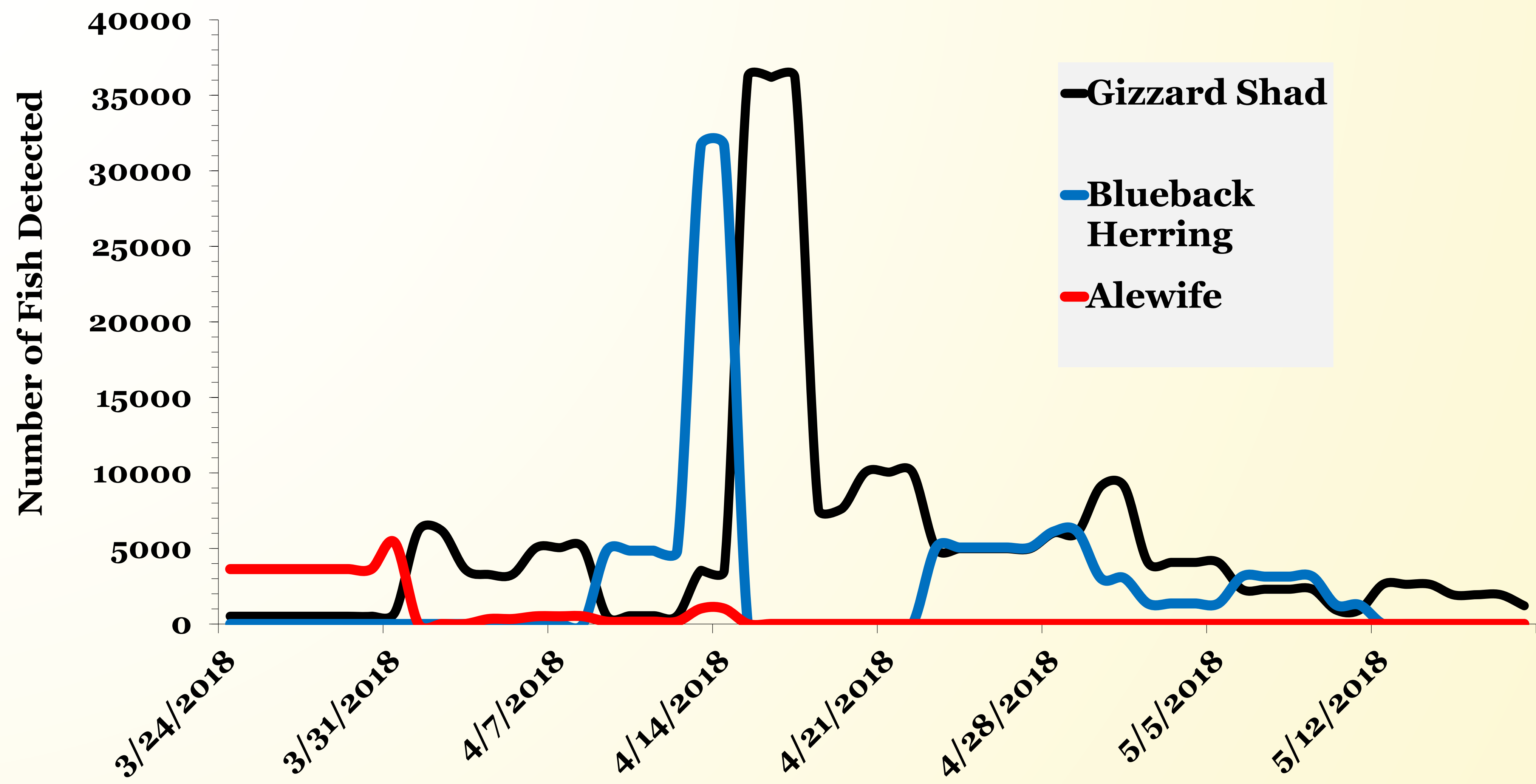
2019 Bias Summary – Combined Fishways

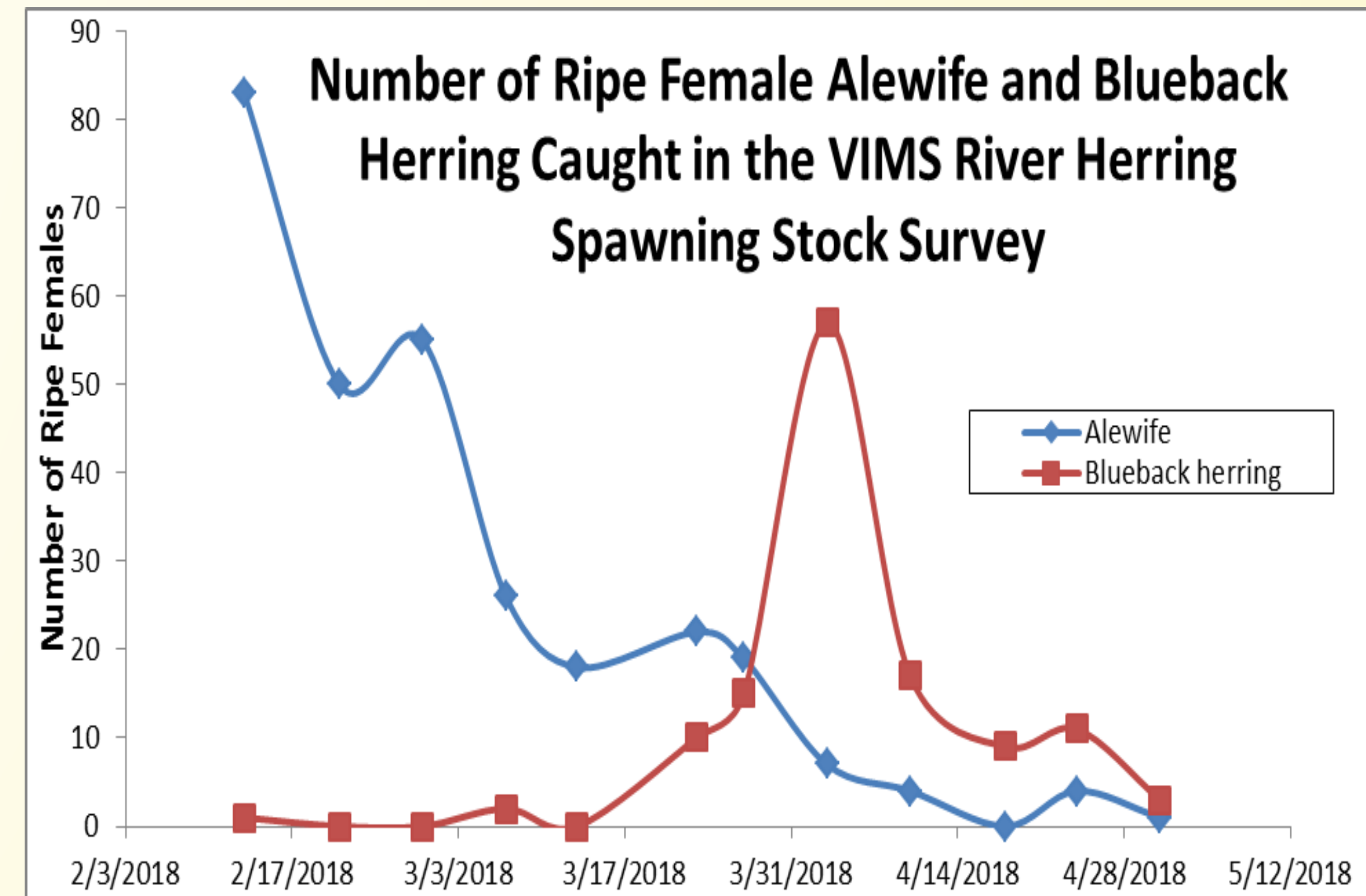
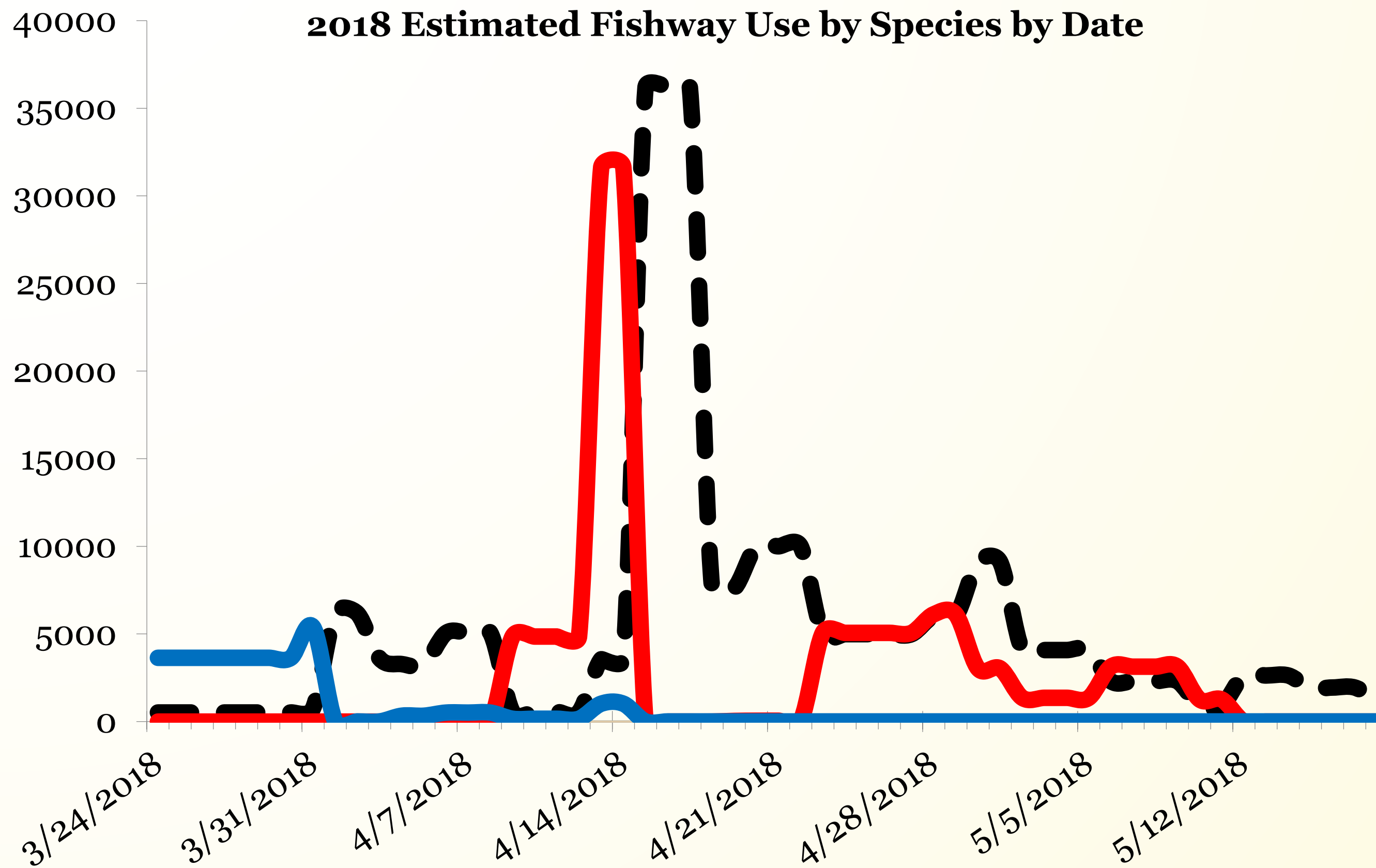
Exact Counts; Plus Counts; Negative Counts

Season Totals		3/18	3/20	3/27	3/29	3/31	4/3	4/5	4/8	4/10	4/12	4/16	4/19	4/22	4/25	4/29	5/3	5/6	5/20
# of Observations	116	7	5	4	2	8	8	5	4	12	4	12	8	7	6	3	12	7	2
Exact %	51%	1	4	4	2	6	4	3	0	3	4	4	7	2	3	3	1	7	1
Negative %	12%	2	0	0	0	0	0	0	1	3	0	5	0	4	0	0	3	0	1
Median Difference	2																		
Positive%	33%	4	1	0	0	2	4	2	3	6	0	3	1	1	3	0	8	0	0
Median Difference	3																		

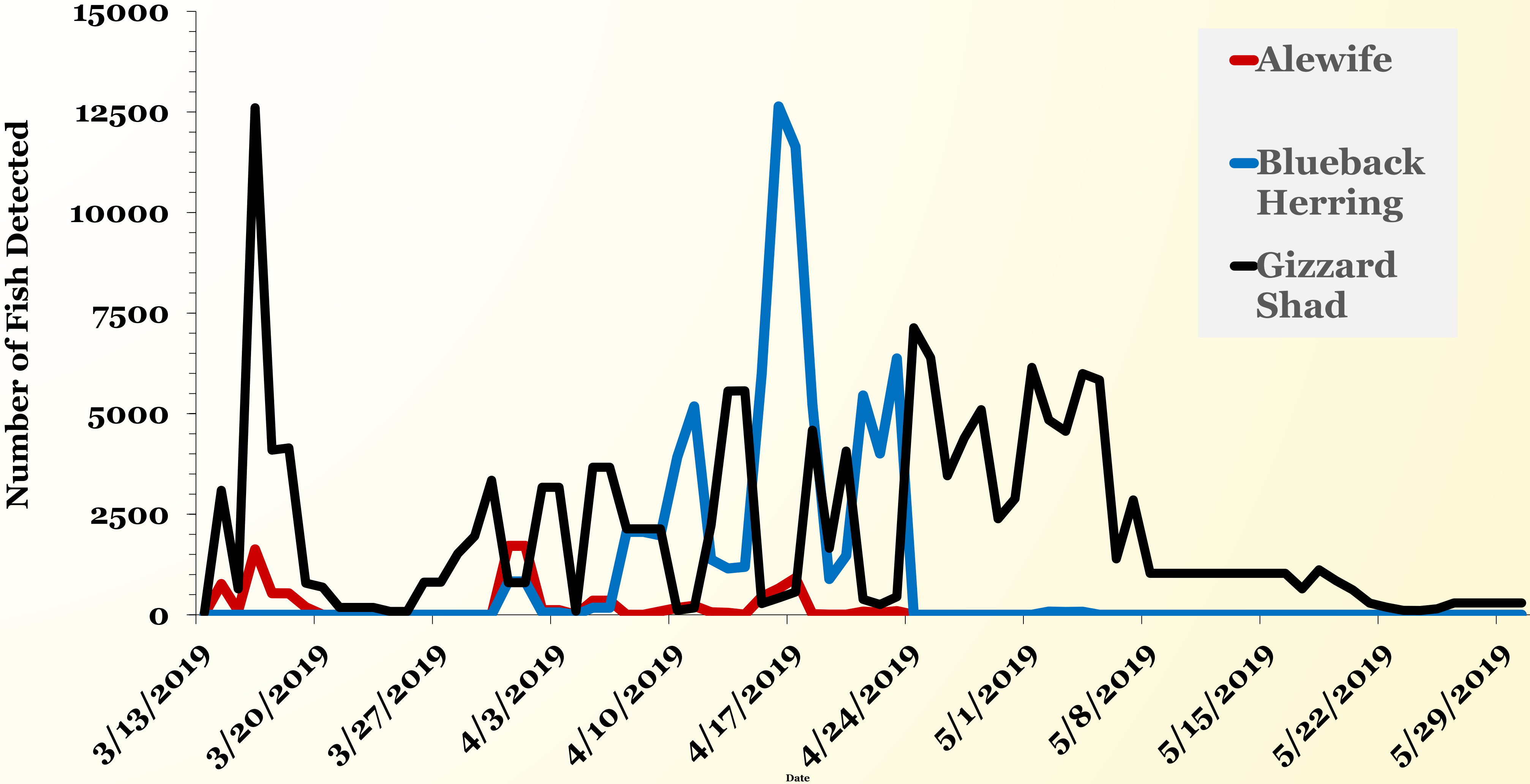


2018 Estimated Walkers Fishway Use by Species by Date

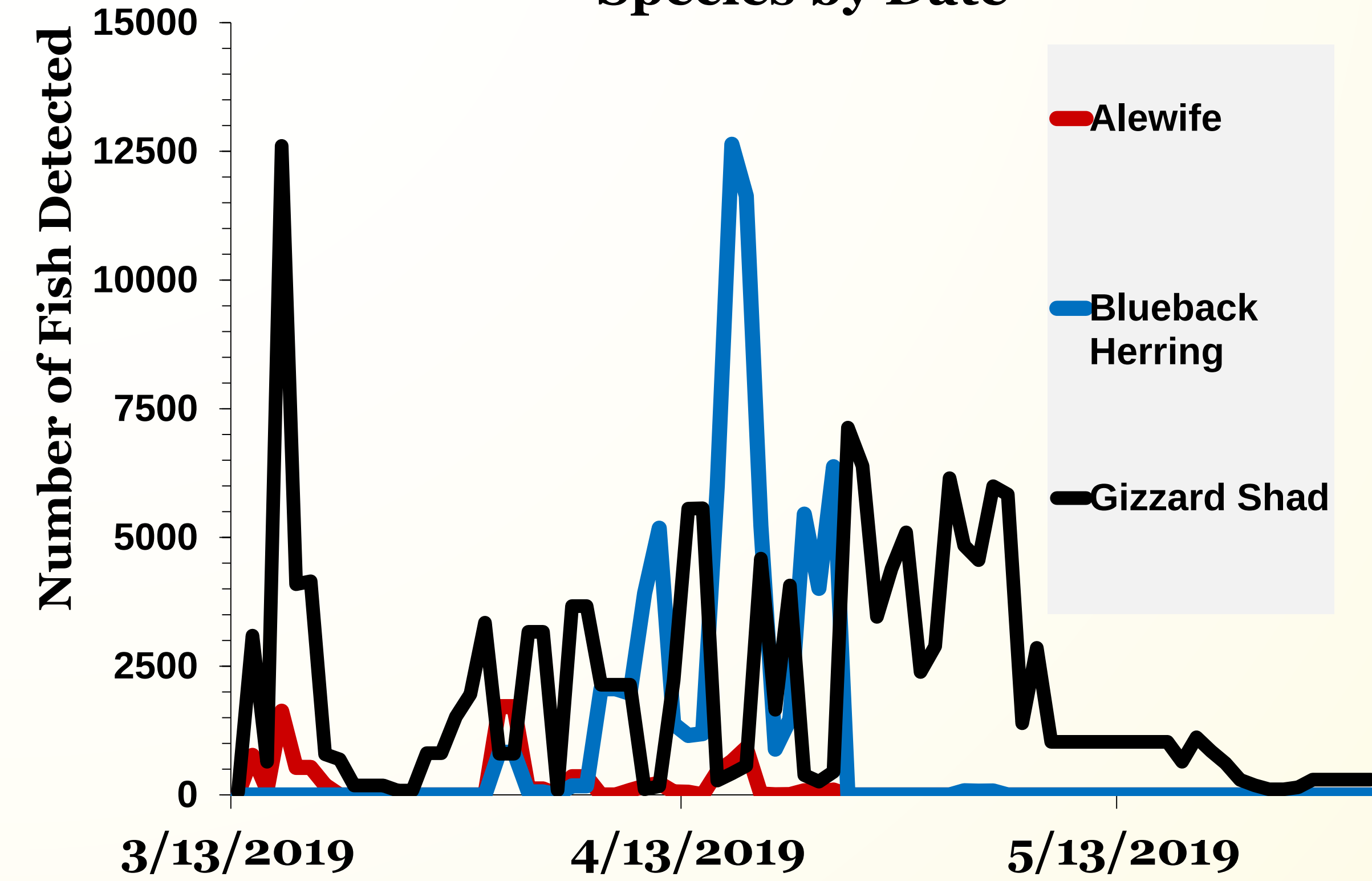




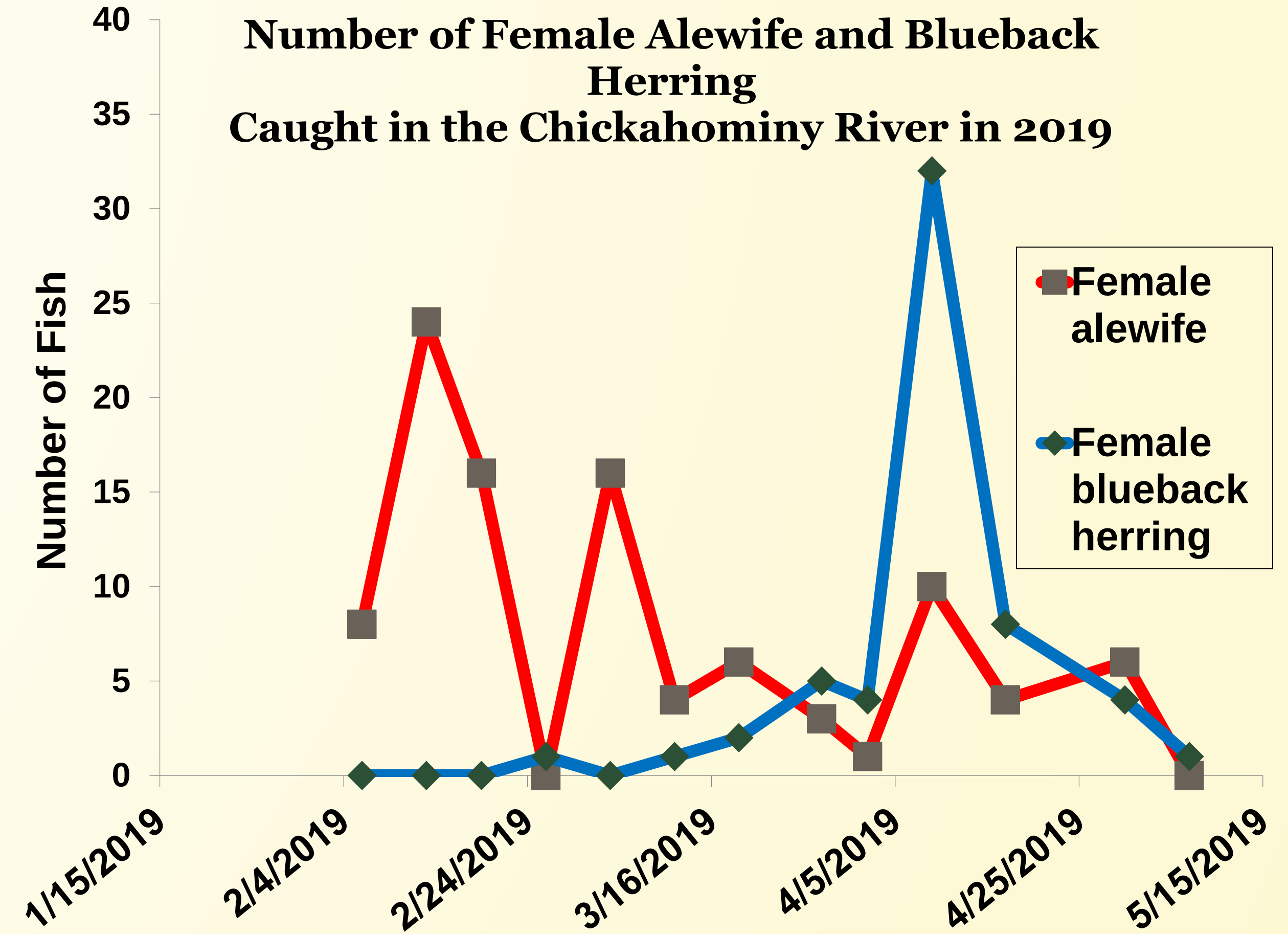
2019 Estimated Walkers Fishway Use by Species by Date



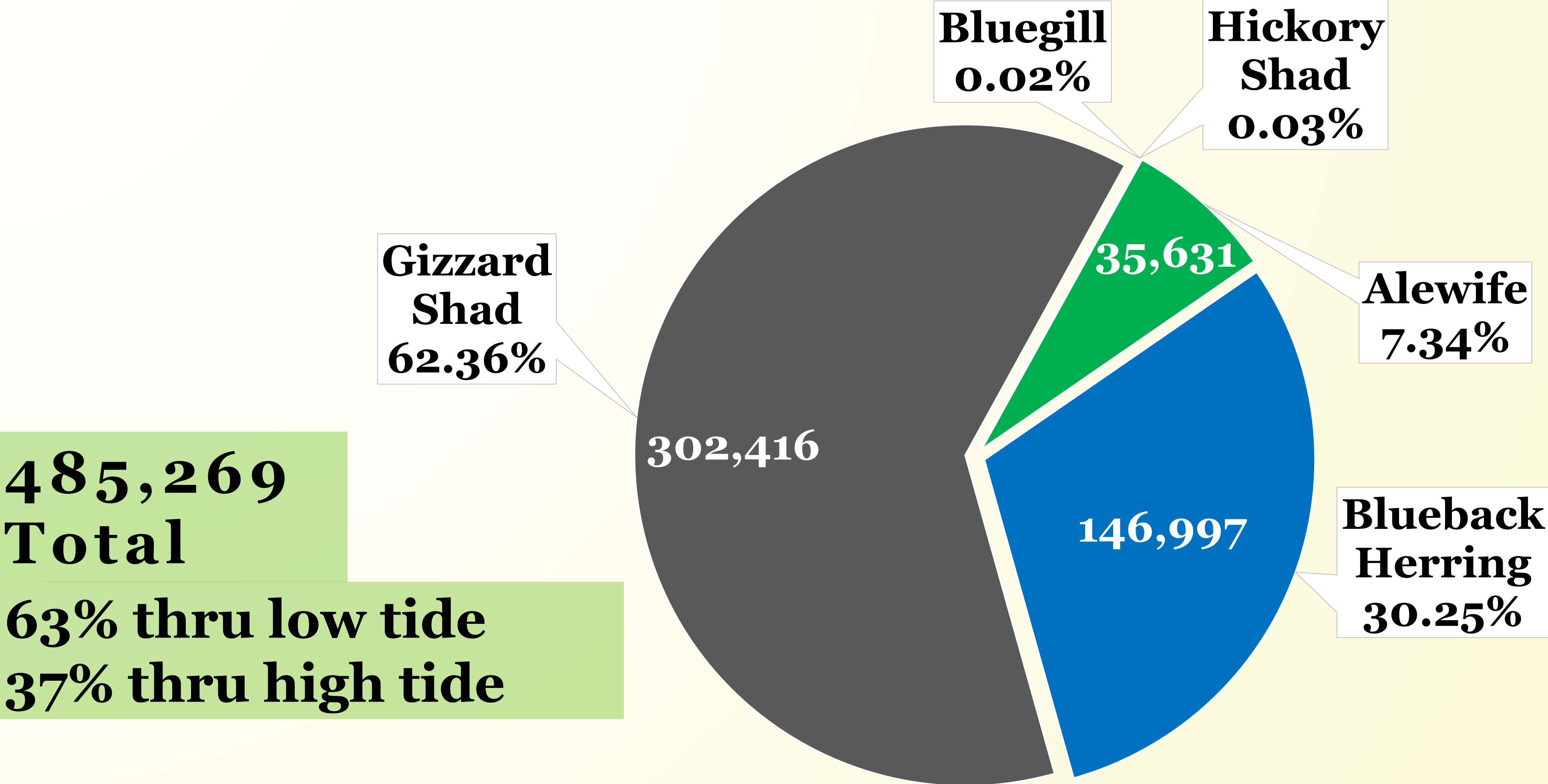
2019 Estimated Walkers Fishway Use by Species by Date



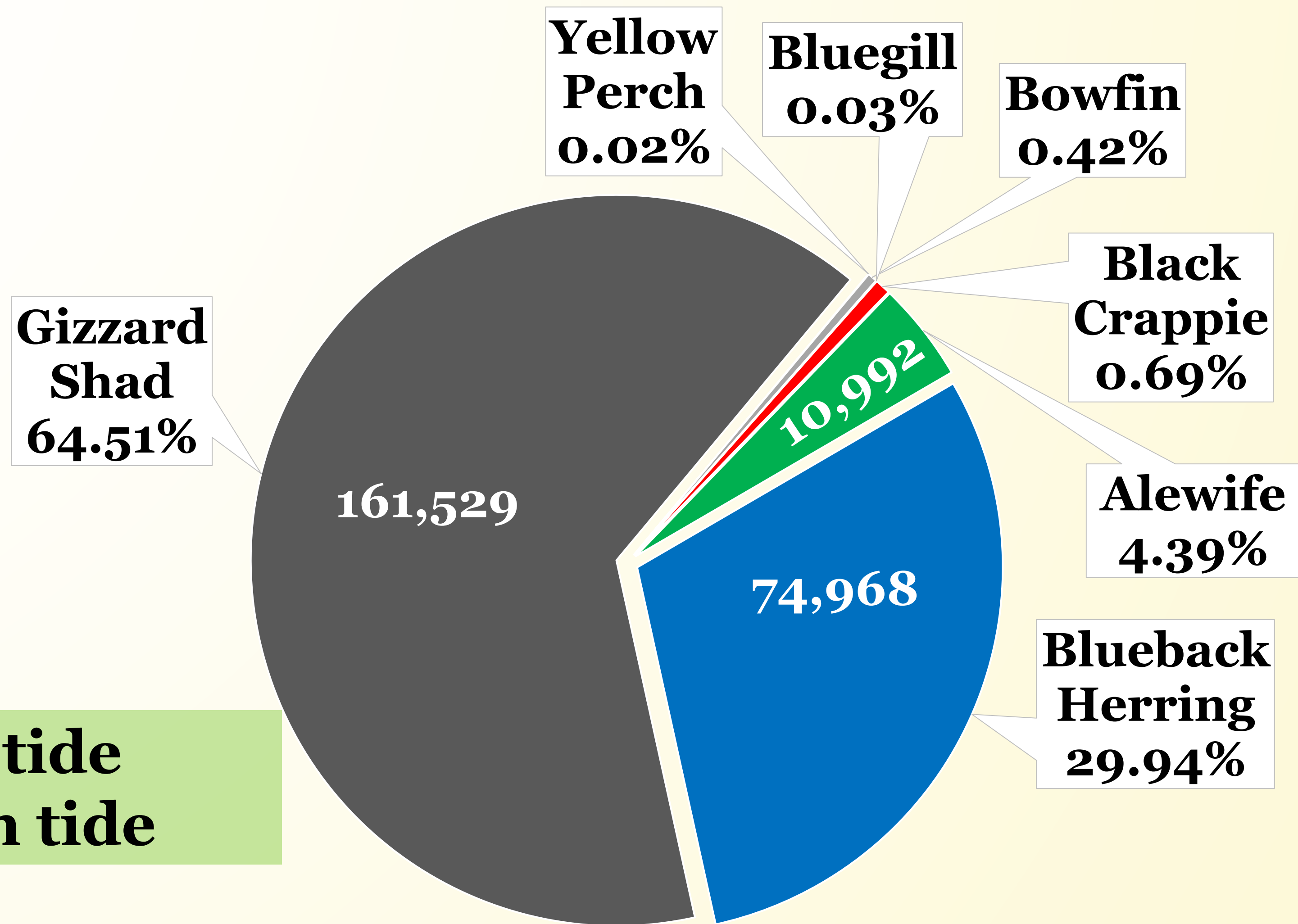
Number of Female Alewife and Blueback Herring Caught in the Chickahominy River in 2019



2018 Walker's Fishway Combined Species Composition



2019 Walker's Fishway Combined Species Composition

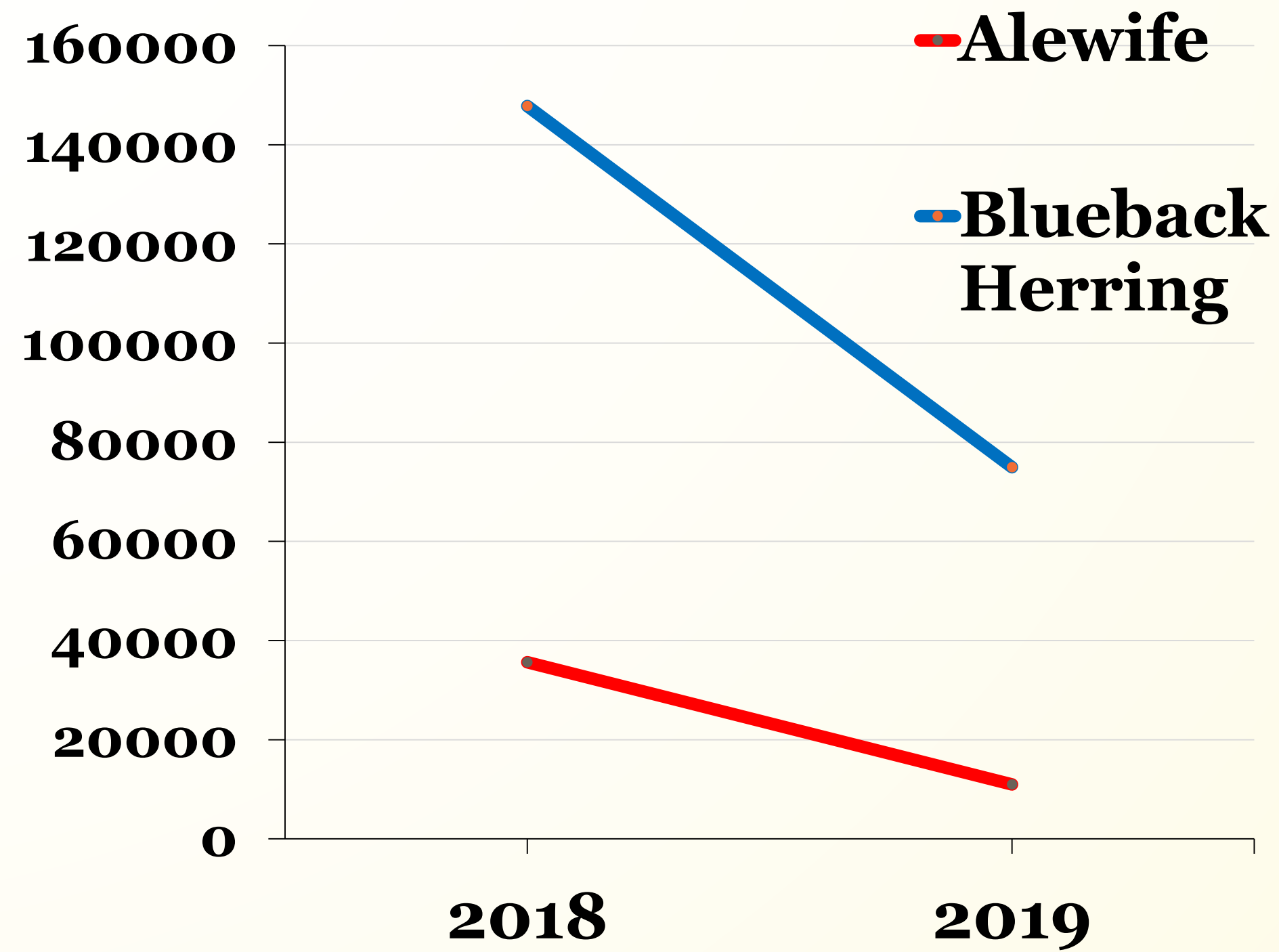


**250,394
Total**

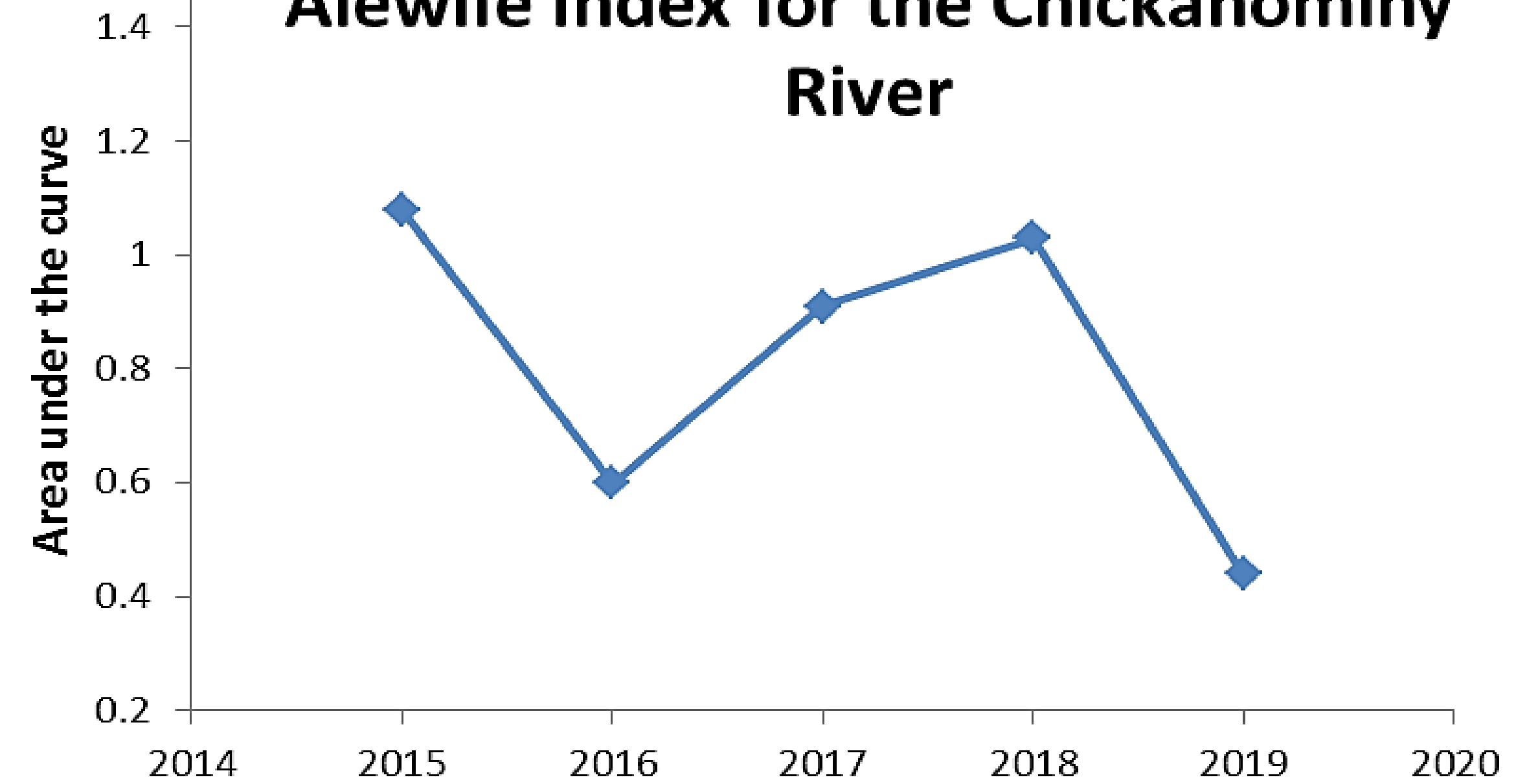
**72% thru low tide
28% thru high tide**



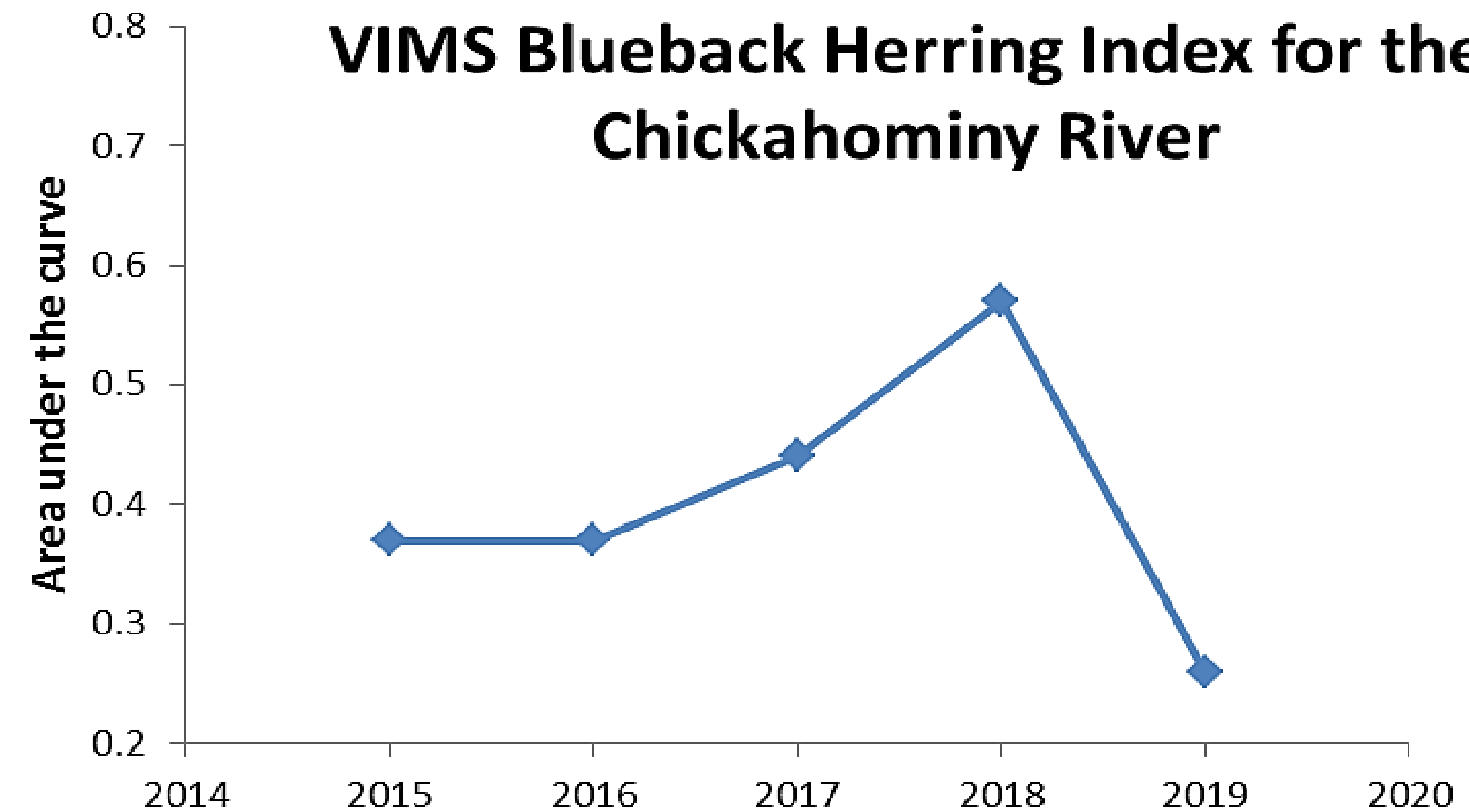
Walker's Fishway Count Estimate



Alewife Index for the Chickahominy River



VIMS Blueback Herring Index for the Chickahominy River

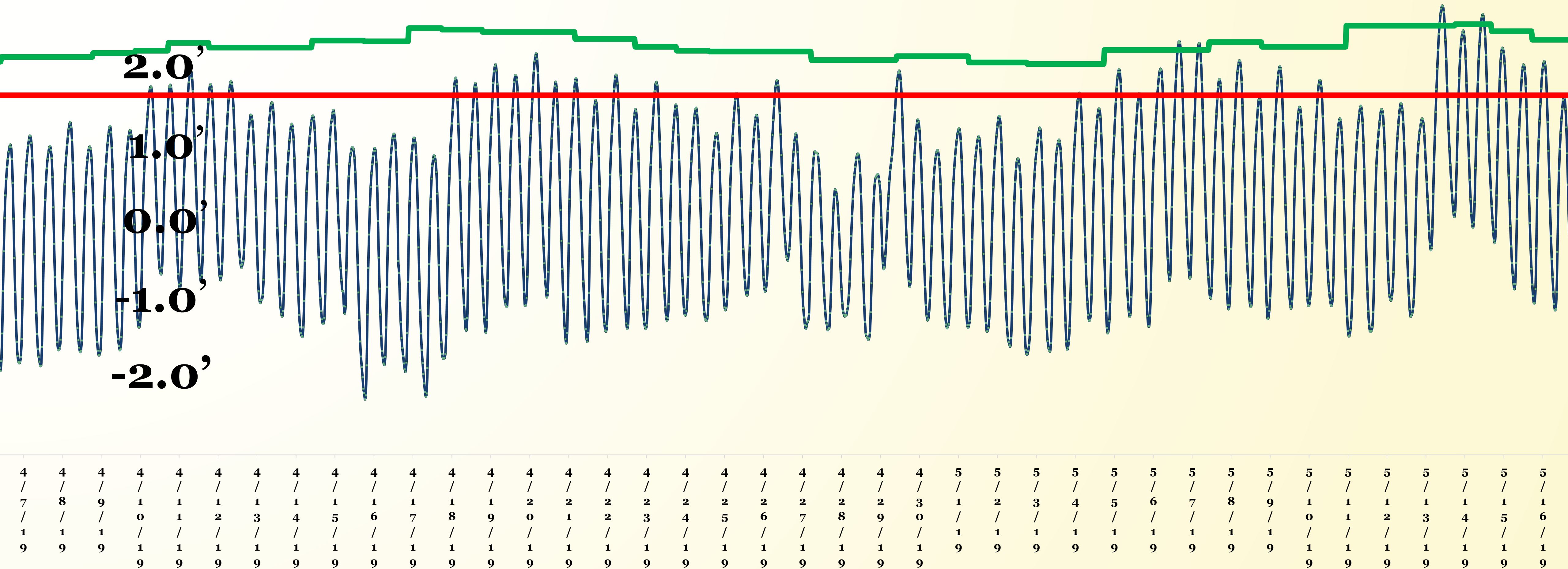


Tide Depth (ft.) Sea Level

Dam Level

Lake Level

Tide Chart - Converted Depths to Sea Level (feet)



Date





April 16, 2019 @ 1324





April 29, 2019 @ 0930



CONCLUSIONS

- **The SR1601 Electronic counter is a useful tool for counting fish passing through the fishway**
- **Reasonable accuracy of the SR counter was demonstrated**
- **Species % composition was used to estimate passage by individual species**
- **SR 1601 generally under counted during the few periods of high passage rates observed**
- **Overall, when looking at combined channels or individually, the SR over-counted between 1% and 10% (2018). Probably because GIZ passage tends to result in positive count bias.**
- **Early results support the possibility of being able to infer population trends in terms of run strength**



FUTURE/IMPROVEMENTS

- **Continue annual counting**
- **Maintain trapping frequency to improve % composition analysis**
- **Tighten SR % Accuracy (+/-) with more data**
- **Absent video in at least one channel there is still a need to count fish in both channels (e.g., more BLH used High than Low in 2018)**
- **Electrical outlet installed; maintain batteries with tenders = reduce interruptions in time stamp = understanding the timing of passage and the effects of tide, flow, temperature, etc.**
- **Continue temp/depth data below the dam (tide cycle) and add temp/depth data above dam at dam (goes along with time stamp data)**
- **Continue comparison trends in run size/strength to VIMS' netting CPUE**



Acknowledgements (2017-2019)

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Lydia Smallwood – 2018 intern

Adam Simon – 2017 intern

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Marcia Davis

Ben Freudenberg

DGIF Biologists

Mike Bednarski

Catherine Lim

Ernie Aschenbach

Aaron Bunch

Fritz Hoogakker

Brady Donovan

Robbie Willis

City of Newport News

CT DEEP





Low-Tide Fishway Channel (2018)

Paired T-Test: same group of subjects that are being measured twice
(1. Smithroot - Experiment) (2. Trap - Control)

Two-Tail Test: not concerned about which direction the numbers may differ (+/-) , only if they do differ significantly

Null Hypothesis: No statistical difference in SR and Trap numbers
Alpha: 0.05

Conclusion: p value (0.53) > alpha (0.05) - therefore, **we do not reject the null hypothesis.**

Two-tail test (inequality). If $t \text{ Stat} < -t \text{ Critical two-tail}$ or $t \text{ Stat} > t \text{ Critical two-tail}$, we reject the null hypothesis. This is not the case, $-1.99 < 0.63 < 1.99$. The observed difference between the sample means (2.78 - 2.65)



High-Tide Fishway Channel (2018)

Paired T-Test: same group of subjects that are being measured twice
(1. Smithroot - Experiment) (2. Trap - Control)

Two-Tail Test: not concerned about which direction the numbers may differ (+/-) , only if they do differ significantly

Null Hypothesis: No statistical difference in SR and Trap numbers
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SR-1601 Testing in King & Queen Hatchery Raceway



Chickahominy just below high tide at Walkers Dam



Chickahominy at high tide over Walkers Dam



