Backwater Analysis

B. Kesner

Known Survival

Known survival analysis uses PIT scanning data to track the number of PIT tagged fish alive in the backwater on any given date. For a fish to be included in the total, it must have been scanned on or after the date (x-axis), and that scan must have occurred at least 120 days after it's release or tagging date. This avoids including fish that were scanned within a few days of tagging, but died before contributing significantly to the population.

Figure 1 provides known survival numbers over time for the initial stocking into Yuma Cove backwater on 2013-02-11. The initial stocking was 100 females and 100 males, but only 104 (80 females and 24 males) survived to 120 days post-stocking based on PIT scanning data. The stair step pattern of this graph indicates a dramatic decline in survival over summer months in many years for both sexes. Based on PIT scanning after the most recent spawning season, the known survivors from the initial stocking include 13 females and 4 males. This represents a mean annual survival of 83.4% over 10 years.

Figure 2 provides known survival numbers over time for all PIT tagged fish stocked or captured and tagged into Yuma Cove backwater by sex. New fish are added to the figure once they have been scanned 120 days post-release (stocked or captured). Increases in the known population are therefore due to survival of tagged, naturally recruited fish or fish from supplemental stockings.

Figure 3 provides a clearer picture of the overall known PIT tagged population size over time by combining all sexes.

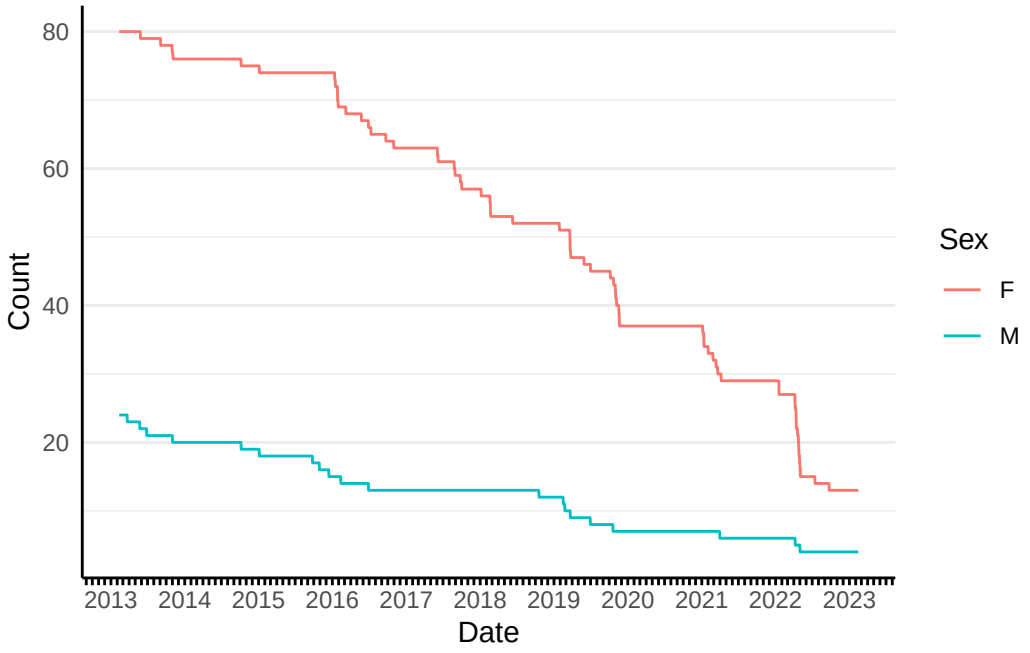

Figure 1: Initial stocking survivors over time.

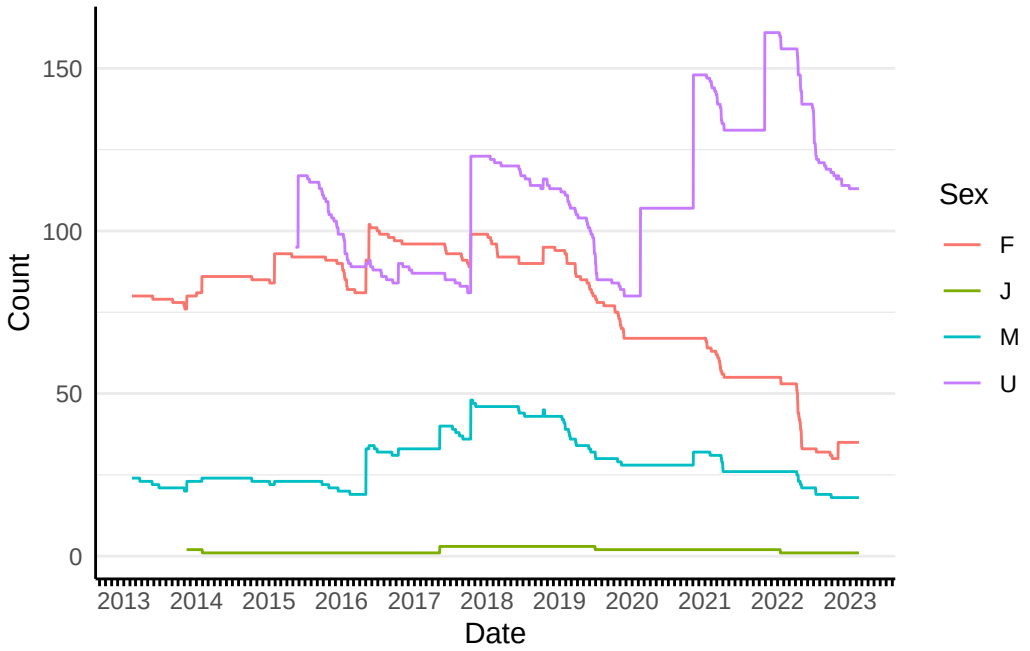

Figure 2: Known PIT tagged population over time by sex.

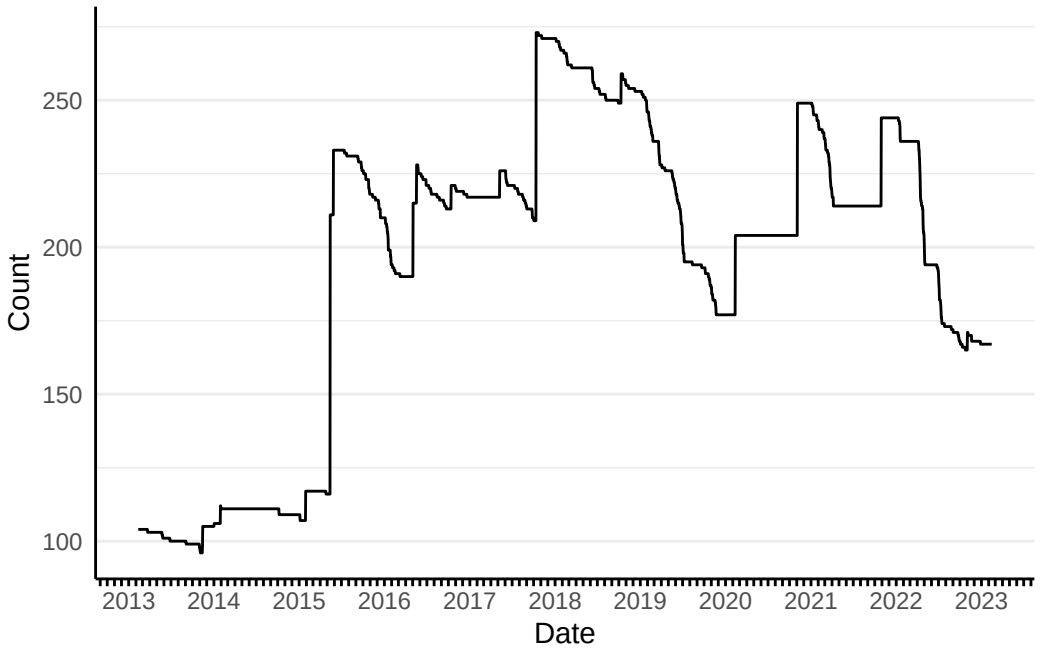

Figure 3: Known PIT tagged population over time total.

Table 1 breaks down the current, PIT tagged, known population of 168 fish in Yuma Cove backwater by event in which each fish was initially tagged and the sex it was assigned. Mean TL is the mean total length recorded of all known survivors at tagging.

Table 1: Known PIT tagged population.

Event	Year	Month	TL (mm)	M	F	U	J
Stocking	2013	February	408	4	0	0	0
Stocking	2013	February	440	0	13	0	0
Stocking	2014	January	360	0	2	0	0
Stocking	2015	January	435	0	1	0	0
Stocking	2020	February	363	0	0	12	0
Capture	2015	May	428	0	0	38	0
Capture	2016	May	480	0	0	1	0
Capture	2016	May	430	4	0	0	0
Capture	2016	May	452	0	9	0	0
Capture	2016	October	475	0	0	1	0
Capture	2016	October	443	1	0	0	0
Capture	2017	May	472	5	0	0	0
Capture	2017	May	272	0	0	0	1
Capture	2017	October	361	0	0	18	0

Capture	2017	October	415	2	0	0	0
Capture	2017	October	518	0	3	0	0
Capture	2018	October	525	0	2	0	0
Capture	2020	November	478	0	0	24	0
Capture	2020	November	488	2	0	0	0
Capture	2021	October	489	0	0	19	0
Capture	2022	November	143	0	0	1	0
Capture	2022	November	545	0	5	0	0

Backwater Captures and Recaptures

Capture and tagging events in Yuma Cove backwater have resulted in the capture and tagging of 2371 fish. Most fish captured are small and do not survive long enough to contribute to the overall spawning population. To separate the small fish unlikely to contribute to the adult population from the larger potential spawners, all captured fish are broken down into three size classes based on the TL at capture; 1 <350, 2 >=350 and <500, 3 >=500 mm TL.

Table 2 breaks down the size class of tagged fish during capture events in Yuma Cove backwater.

Table 2: Capture summary by size class.

Year	Month	1	2	3
2013	November	48	33	56
2014	January	3	4	6
2014	May	0	15	59
2015	May	0	152	14
2016	May	0	83	17
2016	October	113	23	4
2017	May	3	14	2
2017	October	40	56	35
2018	October	484	24	14
2019	November	10	45	34
2020	November	230	66	46
2021	October	245	30	35
2022	November	284	17	27

Fish that are in size class 2 or 3 are assumed to makeup the adult population in the backwater. The proportion of these fish that are recaptures (captured with a tag) are an indication of the proportion of the total population that is tagged within the backwater. This proportion can be calculated from all capture events summarized in Table 3.

Table 3: Recapture status for size class 2+.

Year	Month	N	Y	Proportion
2013	November	10	79	0.888
2014	January	1	9	0.900
2014	May	0	74	1.000
2015	May	124	42	0.253
2016	May	56	44	0.440
2016	October	13	14	0.519
2017	May	7	9	0.562
2017	October	55	36	0.396
2018	October	15	23	0.605
2019	November	42	37	0.468
2020	November	56	56	0.500
2021	October	25	40	0.615
2022	November	19	25	0.568

Spawning Adult Population Size

The total population available to spawn is estimated from the recapture proportion for each year there is a fall or early winter (after September) capture event, taking the known population (Figure 4) for each year as of December 1st, and dividing by autumn recapture proportion. The recapture numbers and total captures that are used to calculate recapture proportion are adjusted for fish that avoid detection or that are harvested during the capture event by removing any fish captured but never scanned after the capture event. Population estimates were made for all years with a fall sample with more than 10 total captures after adjustment. The 95% confidence intervals are derived from the binomial distribution based on the fall capture values (trials = total captures, successes = recaptures).

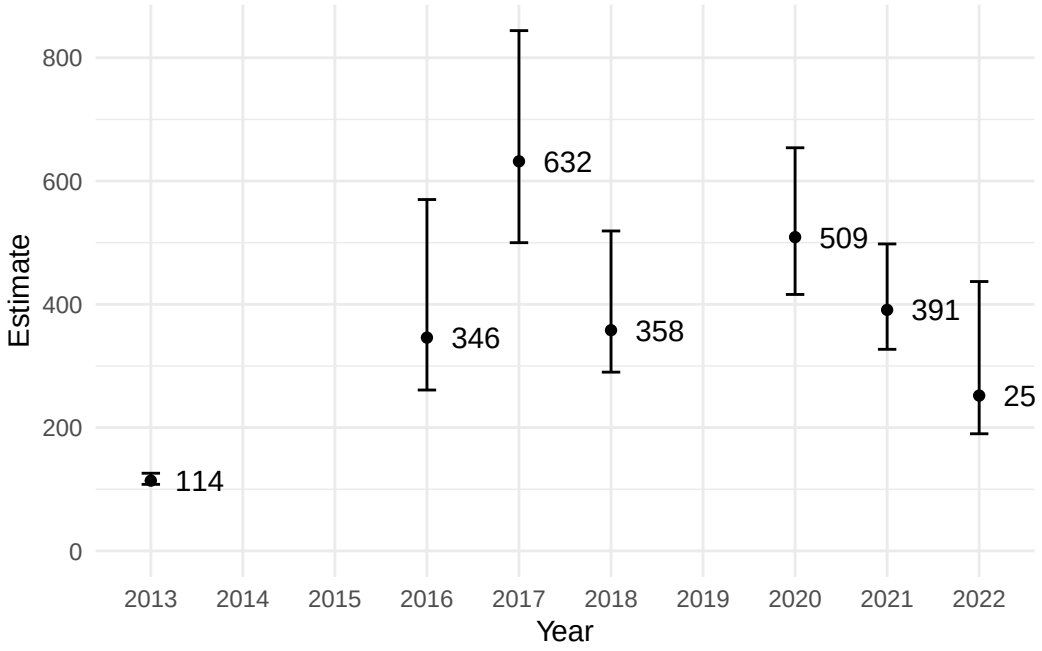

Figure 4: Adult population estimates based on recapture proportion and PIT scanning.