



Yukon Flats National Wildlife Refuge Report – 2018

# Production of Lesser Scaup and other waterbirds at four locations within Yukon Flats National Wildlife Refuge, 2014-2017

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## ABSTRACT

A waterbird production survey was implemented in 2014 and conducted through 2017 at four locations across the Yukon Flats National Wildlife Refuge. Timing of the survey was for peak emergence of Lesser Scaup broods. Teams of two observers counted waterbirds and recorded age class. Wetlands were counted twice, once by each observer. Compared to 2014-2016, production in 2017 was above average for Lesser Scaup, average for Canvasback, American Wigeon, and Green-winged Teal, and below average for White-winged Scoter and Horned Grebe. Compared to previous years (2014-2016), there was less consistency in production among locations in 2017, implying local-scale factors (predation, habitat) may have been more important to production than large-scale factors (rainfall, phenology). Differences between observers in counts of the same wetlands were evident, but the magnitude of this noise was less than an annual signal for late-nesting species over the long term (2014-2017).



## **INTRODUCTION**

Situated north of the White Mountains and south of the Brooks Range in eastern interior Alaska is a vast complex of wetlands through which the Yukon River flows. Stretching approximately 300km from west to east, the wetlands of this region provide breeding habitat in summer for waterbirds that come from wintering locations throughout the four North American flyways and beyond. Highly productive wetlands (Heglund and Jones 2003, Lewis et al. 2016) necessary for providing invertebrate food to newly hatched broods are the attraction, and each spring flocks of paired birds arrive to nest and rear their young. In recognition of the unique contribution of the wetlands along this flat section of the Yukon River to production of North American waterfowl, this region was designated a National Wildlife Refuge (NWR) in 1980 (ANILCA) and given the name Yukon Flats National Wildlife Refuge (YFNWR). For wildlife managers, documenting the contribution of the region's wetlands to annual production of waterbirds has long been a priority.

The first surveys of waterbird broods on YFNWR were counts from canoe by James King and Calvin Lensink, beginning in 1965 and continuing until 1971, then occurring inconsistently from 1973 to 1981 (Shively and Lake 2009). During the early to mid-1980s, Bruce Conant and Jack Hodges (and others) expanded these surveys to include other regions of Alaska (Hodges and Conant 1987). Concurrently, on the YFNWR, staff also surveyed 11 plots for broods (Vivion 1988, Heglund 1992). This Refuge survey was disbanded in the late 1980s while the office of Migratory Bird Management experimented with the use of airplanes and helicopters to survey waterbirds (Conant et al. 1988). These aerial efforts were discontinued after 1990 for various reasons. YFNWR staff again surveyed broods during 1998 using helicopter methods (Person and Bertram 1999). Lewis (2016) replicated the waterbird surveys of Heglund (1992) during 2010 to 2012, but on a subset of the original plots. Roach and Griffith (2015) surveyed broods on 123 wetlands during 2010 and 2011. In 2014, in response to recommendations from a biological program review (Martin and Bertram 2010), YFNWR staff once again began an annual index survey of waterbird production.

Unlike prior efforts, this most recent survey was timed for peak hatch of Lesser Scaup, a species whose density in Alaska is highest on the Yukon Flats NWR (Mallek and Groves 2011, Guldager et al. 2016), and whose population numbers throughout North America have declined (Zimpfer et al. 2013). In addition, in 2013, Lesser Scaup were designated a priority species by the Alaska USFWS (Region 7); thus, efforts to monitor this species are of heightened regional interest. Finally, in 2015, a team of USFWS biologists developed a conservation framework for Lesser Scaup that identified population threats, information needs, and management recommendations. Among those recommendations was an annual survey of production.

## **Objectives**

- 1) Monitor annual trend in an index of brood production.
- 2) Monitor annual trend in brood age class.
- 3) Relate brood productivity over the long-term to landscape characteristics, consistent with strategic habitat conservation (SHC).
- 4) Relate duckling age class over the long-term to phenology.

## **METHODS**

## **Study Area**

Duck broods were surveyed at five locations (Figures 1-4). A wetland complex by Track Lake (66.88900, -145.20400), Echoing Lake (66.27500, -149.34400), Plot F (66.61400, -146.80700), and Canvasback Lake (66.38500, -146.37900). The fifth location (Plot C) was surveyed in 2014, but has been discontinued from future consideration because of the marginal length of the landing lake for floatplane take off.

## **Sampling units and sample frame**

The sampling frame included federal (non-private) lands with wetlands large enough to operate a float plane on (Cessna 185, Found Bush Hawk), and the sampling unit included surrounding satellite wetlands and the landing wetland. Note: the design of this study was primarily driven by limited funding (<\$10K annually). Consequently, inference should be limited to the wetlands sampled and primary objectives were focused on temporal rather than spatial trends. With more available funding, wetlands could be sampled more efficiently from a helicopter using a probabilistic design (non-zero probability of selection), sample sizes could be increased, and inference could be made at a broader scale (see protocol developed by Walker and Lake 2012). Due also to fiscal reality, a goal of the survey design was to develop a simple protocol that could be implemented by permanent Refuge staff and volunteers with a wide range of experience and motivation in counting duck broods. Sample size recommendations were described in a brood survey protocol (Lake 2014).

## **Survey timing**

Crew deployment (3-4 crews of 2) began approximately 21 July. Deployment date was based on: 1) numbers of ducklings on wetlands increasing just before that date on YFNWR (Lewis et al. 2014), and 2) hatch dates of Lesser Scaup nests on YFNWR from 2001-2008 (Lake 2014). Surveying was concurrent rather than by one or two crews that moved to different locations over a two to four week period, as was done in the past. Concurrent surveying was to minimize or eliminate spatial and temporal confounding.

## **Data collection**

The general approach was that broods ( $\geq 1$  duckling accompanied by a female, or chick accompanied by an adult in the case of Horned Grebes) of Lesser Scaup and other waterbirds were counted and age class recorded by two observers conducting replicate surveys (Pagano and Arnold 2009, Walker et al. 2013, Lewis et al. 2014). Wetland covariates were recorded, such as wind speed, survey duration, and percent emergent vegetation. Replicate surveys were conducted closely in time in an attempt to satisfy the assumption of closure. Observers were provided laminated maps of each landing area (Figures 1-4). Each wetland was marked with a unique number, which was referenced while conducting a survey.

For wetlands small enough to survey at a single point (i.e., the entire wetland was visible), observers generally surveyed back to back (an exception was at Wetland by Track Lake where small wetlands were surveyed on different days because of logistical efficiencies). That is, an observer recorded observations, and upon finishing, the other observer rotated in and conducted their survey (observers sometimes used a spotting scope at such small wetlands; otherwise, binoculars were used). The second observer was instructed to turn their back or otherwise not watch the actions of the first observer. This was necessary for independence. It

was also important that the first observer did not disturb the wetland. Therefore, it was necessary to survey from a point that permitted observation while minimizing disturbance. For large wetlands where multiple survey points were necessary, replicate visits were conducted on subsequent days. That is, the first observer conducted a survey on day 1 and the second observer conducted their survey on day 2. For such large wetlands, observers moved between survey points using a small pak boat. At a survey point, observers were instructed to spend as long as necessary to identify and record all visible broods, surveying a minimum of 10 minutes. Broods seen while transiting with a boat were recorded when it was clear the brood would not be visible at a survey point. Observers sampled all wetlands on a first round of surveying, and then conducted a second round of surveying as time permitted.

Each brood was recorded as a separate line on the data sheet. Each brood observation included an adult female count and duckling/gosling/chick count by age class. Broody hens were also counted. Broody hens were hens without a visible brood, making a distraction display. All species of duck or goose broods were recorded, in addition to loon and grebe chicks. If observers were unsure of species, they recorded notes, consulted a field guide, or took a photo. Broods comprised of multiple species and/or age classes were occasionally observed. Observers were instructed to break those out by species/age class using separate lines on the data sheet. Photos of large broods (up to ~60 ducklings) aided those counts.

### **Data analysis**

Counts of ducklings, goslings, and chicks were summed by species, location (wetland landing area), year, and observer. Counts were summed only for the first round of surveying, as not all wetlands were surveyed during the second round. Only locations with >1 year of surveying were included (i.e., Plot C in 2014 was not included in this report). Median brood size was estimated for broods attended by  $\geq 1$  female; broods without a female were omitted because brood counts may have been incomplete. Counts were summarized for the following species: Lesser Scaup, Canvasback, White-winged Scoter, Horned Grebe, American Wigeon, and Green-winged Teal; for the remaining species, data were sparse.

## **RESULTS**

### **Survey dates and wetlands sampled**

In 2017, surveying was from 19 July to 25 July (Echoing Lake), 17 July to 24 July (Canvasback Lake), 18 July to 25 July (Wetland by Track Lake), and 19 July to 24 July (Plot F).

Total wetlands sampled were 32 in 2014, 35 in 2015, 44 in 2016, and 45 (Table 1). Specific ID's of wetlands sampled were in Table 1.

### **Lesser Scaup**

Production was greater in 2017 than 2016 at Canvasback Lake, Plot F, and Wetland by Track Lake. At Echoing Lake, production was similar to 2016. Among years 2014-2017, production was highest in 2015, and 2017 was average to above average. Observer differences were present, and seemed greater in 2017 than 2014-2016. Age classes trended toward younger ducklings.

### **White-winged Scoter**

In 2017, production was lower than 2016 at Wetland by Track Lake and Canvasback Lake. The opposite pattern was observed at Plot F with greater production in 2017. Zero White-winged

scoter ducklings have been observed at Echoing Lake in the two years of survey. The year of best production was 2015, and compared to 2014-2016, 2017 could be characterized as below average. Observer differences were present, but were minimal relative to annual differences except at Wetland by Track Lake in 2017. Age classes were heavily skewed toward younger ducklings.

### **Canvasback**

In 2017, production was greater at Canvasback Lake than 2016, but similar at Wetland by Track Lake. Few broods have been observed at Plot F or Echoing Lake across years. 2015 was the year of greatest production, and compared to 2014-2016, 2017 was average. Observer differences in 2017 were greatest among years, with the exception of Wetland by Track Lake. Observer differences for Canvasback were greater than for the other diving ducks, Lesser Scaup and White-winged Scoter. Age classes were 2a and below.

### **American Wigeon**

Production of ducklings was average in 2017 compared to 2014-2016 except at Echoing Lake where production was reduced compared to 2016. Observer differences were evident; there was a wide range between observers with some locations exhibiting little difference and others with extreme differences. Some observer differences were on par with annual differences. Median brood sizes did not exhibit any clear trend. Age classes trended toward the moderate age classes (1b-2b), with few 1a ducklings.

### **Green-winged Teal**

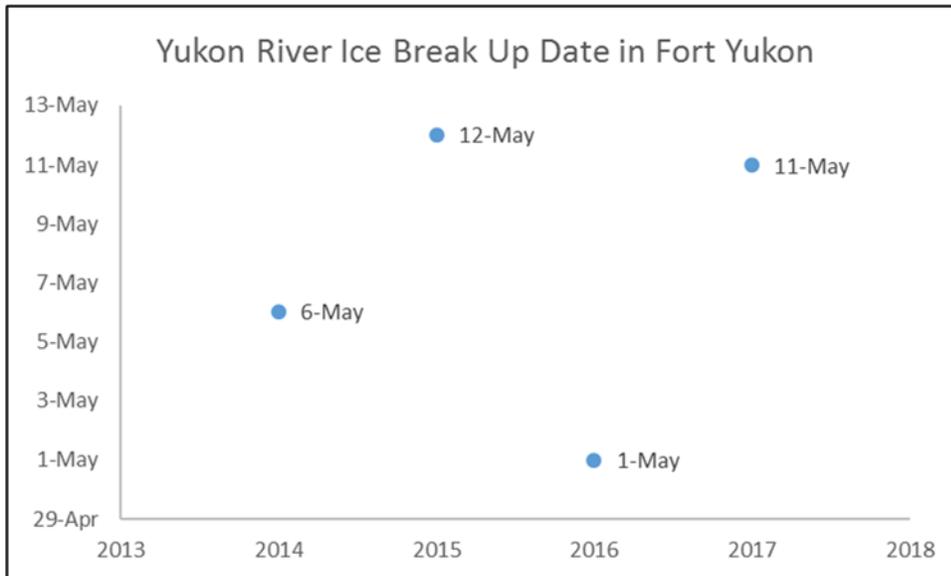
At plot F, a lack of data prevented much inference. At Wetland by Track Lake, production seemed greater in 2017 than 2016, while the opposite was observed at Canvasback Lake. No broods were observed at Echoing Lake in either 2016 or 2017. Observer differences were evident, and in some cases of similar magnitude to annual differences. Age classes trended toward older ducklings.

### **Horned Grebe**

Across three locations, production was reduced in 2017 compared to 2014-2016. No broods were observed at Echoing Lake in either 2016 or 2017. Brood sizes tended to be low, probably because this species does not forage as a group like waterfowl. Age classes were moderate to young.

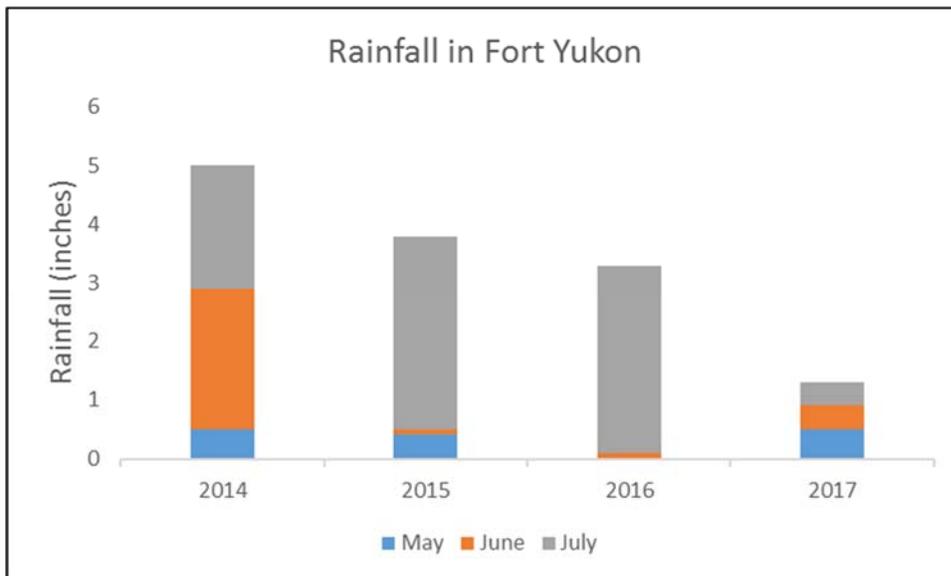
### **Phenology of Break Up**

Trailcameras placed at landing lakes indicated ice off between 19 and 21 May, 2017. The Yukon River ice in Fort Yukon broke up on 11 May <http://w2.weather.gov/aprfc/breakupDB?site=472>.



### Rainfall

In 2017, rainfall was the lowest amount, May to July, among 2014 to 2017. Rainfall was measured in Fort Yukon. <https://wcc.sc.egov.usda.gov/nwcc/site?sitenum=961>



### DISCUSSION

This simple waterbird production survey evolved from a more rigorous protocol that was developed, but not implemented because of funding shortfalls (Walker and Lake 2012). The current version costs less than \$10K annually and provides managers with a coarse-level index of annual waterbird production. Information is probably adequate for day-to-day management of the YFNWR, and for presentation to the public, such as at regional advisory council meetings. If finer-scale resolution or more reliable inference is required, for instance to inform controversial

decision making, then the more expensive protocol of Walker and Lake (2012) or similar (Carrlson et al. 2018) should be implemented.

Production in 2017 was above average for Lesser Scaup, average for Canvasback, American Wigeon, and Green-winged Teal, and below average for White-winged Scoter and Horned Grebe. This generalization was not necessarily consistent among locations. For instance, White-winged Scoter production was lower than 2016 at Wetland by Track Lake and Canvasback Lake, but greater at Plot F. Compared to previous years (2014-2016), there was less consistency among locations, implying local-scale factors may have been more important to production. We speculate that numbers of mesopredators were increasing and possibly more of a factor in 2017 than previous years. Some locations may harbor greater numbers, vary in species assemblage, or contain habitat less favorable to avoiding predators. In previous years, rainfall (large-scale factor) was tied to brood production (2014, 2016). Rainfall in 2017 was the lowest among 2014-2017 and probably not a factor.

As brood counts were replicated at the same wetland by different observers, this provided an opportunity to explore observer differences. Two things seemed evident. First, some of the most extreme variation was when an experienced observer was paired with an inexperienced observer. Second, species differences in sightability were probably reflected as some observer differences through an interaction with experience. On a continuum of sightability from easiest to hardest, White-winged Scoter was probably the easiest to detect, then Lesser Scaup, Horned Grebe, Canvasback, with American Wigeon and Green-winged Teal being the hardest. Some of the variability between observers in production of American Wigeon and Green-winged Teal was probably because of more difficult sightability. This contributed to more noise in the data. Conversely, the clearer signal for Lesser Scaup and White winged Scoter was probably from less noise in the data owing to easier and more consistent detection. These species usually stay on the wetland instead of seeking cover in emergent vegetation when approached. For the latter species, it is noteworthy that while observer differences were evident, the magnitude was less than annual differences over the long term (2014-2017).

Perhaps one day information such as this could be used in the adaptive management process to inform waterfowl harvest regulations. In the past, a criticism of brood surveys in Alaska was the information came too late to be used in setting the fall's waterfowl hunting regulations. However, a new approach to setting harvest regulations that makes use of lagged information has been implemented (Johnson et al. 2016).

### **Shortcomings and future improvements**

When interpreting or sharing these results, it cannot be stressed enough that abundance was confounded with sightability or detection. In other words, a count might not have been high (or low) simply because there were actually many (or few) waterbird broods. Instead, an alternate explanation could have been that a brood(s) was easier (or harder) to detect. Replicate surveys of the same wetland by different observers provided an idea of the magnitude of observer differences described above, but did not explicitly correct for these differences. Disentangling abundance from observer differences can be accomplished, but is more expensive, requiring a greater sample size of wetlands surveyed (150 at a minimum). With the current sample size (32 to 45 wetlands), observer difference could probably be decoupled from the probability that a

wetland was occupied by a particular species (i.e., occupancy models). In the future, if there were a management need to estimate wetland occupancy of a species, this survey could be a first step to address that need.

The data bear out the value of experienced surveyors, and such individuals should be enlisted in data collection whenever possible.

Deployment of groups in a single four-place aircraft flight was made possible by pre-staging gear in bear proof, steel drums. This was an efficient use of aircraft and time, and should be continued.

Echoing Lake study location had few broods, and zero Horned Grebe, White-winged Scoter, or Green-winged teal were observed in two years. The wetlands in this location contain no amphipods, and are likely of low productivity. In 2018, instead of a crew at Echoing Lake, a crew should be deployed to Shack Lake.

### **ACKNOWLEDGEMENTS**

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Table 1. Surveyed wetland ID's by year and location.

	Plot F	Canvasback Lake	Wetland by Track Lake	Plot C	Echoing Lake
<b>2014</b>	not surveyed	3,4,6,11,13,14,16,30,31,32,33,34,35,36	1,2,6,9,10,11,12,13,15,16	9, 10, 11, 16, 18, 19, 22, 23	not surveyed
<b>2015</b>	1,2,3,4,6,7,8,9,10,11,12	3,4,6,11,13,14,16,30,31,32,33,34,35,36	1,2,6,9,10,11,12,13,15,16	not surveyed	not surveyed
<b>2016</b>	1,2,3,4,6,7,8,9,10,11,12	3,4,6,11,13,14,16,30,31,32,33,34,35,36	2,6,9,10,11,12,13,15,16	not surveyed	1, 9, 10, 12, 13, 14, 16, 17, 18, 19
<b>2017</b>	1,2,3,4,6,7,8,9,10,11,12	3,4,6,11,13,14,16,30,31,32,33,34,35,36	1,2,6,9,10,11,12,13,15,16	not surveyed	1, 9, 10, 12, 13, 14, 16, 17, 18, 19



Figure 1. Echoing Lake survey area.

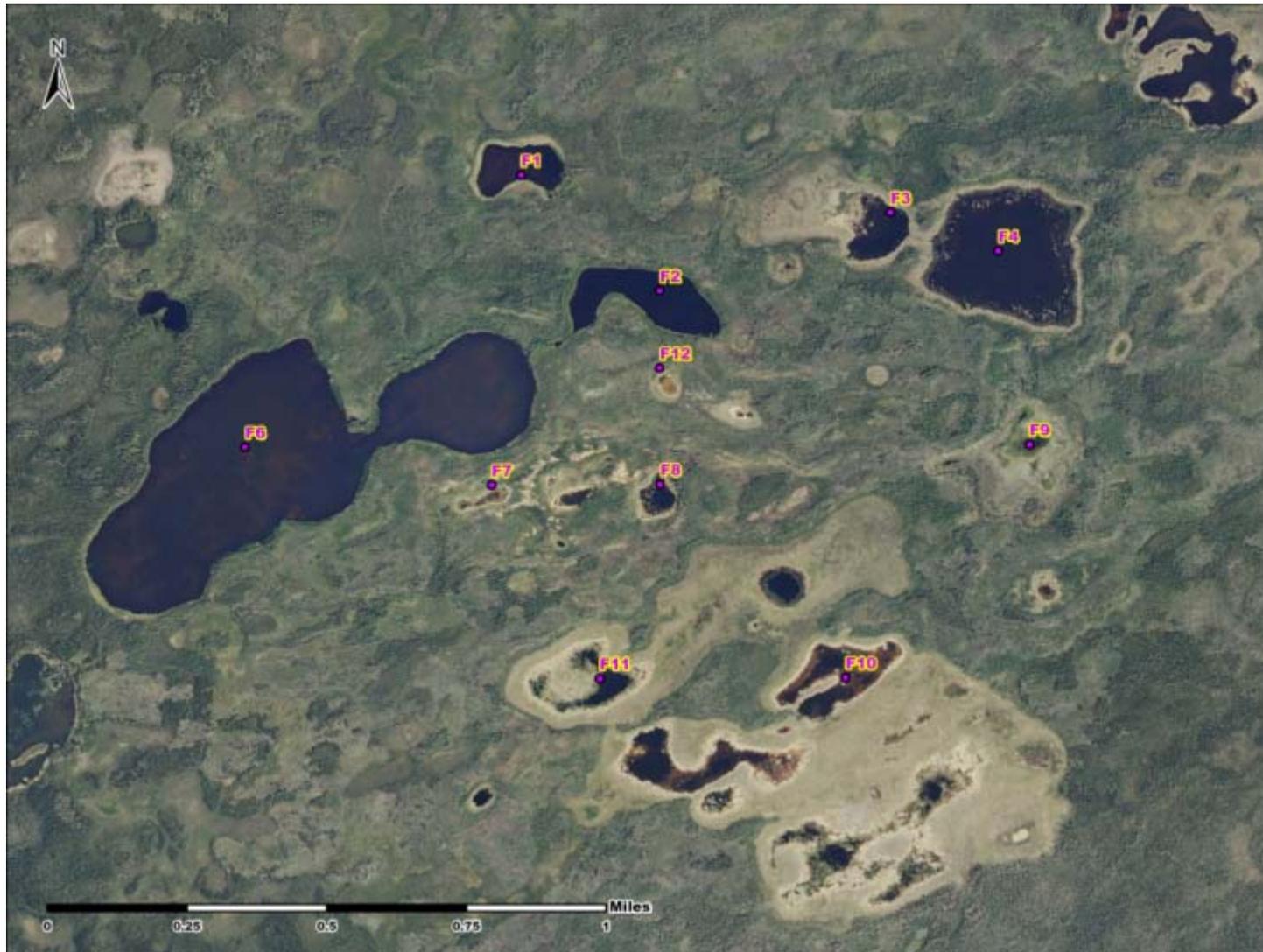


Figure 2. Plot F survey area.



Figure 3. Canvasback Lake survey area.

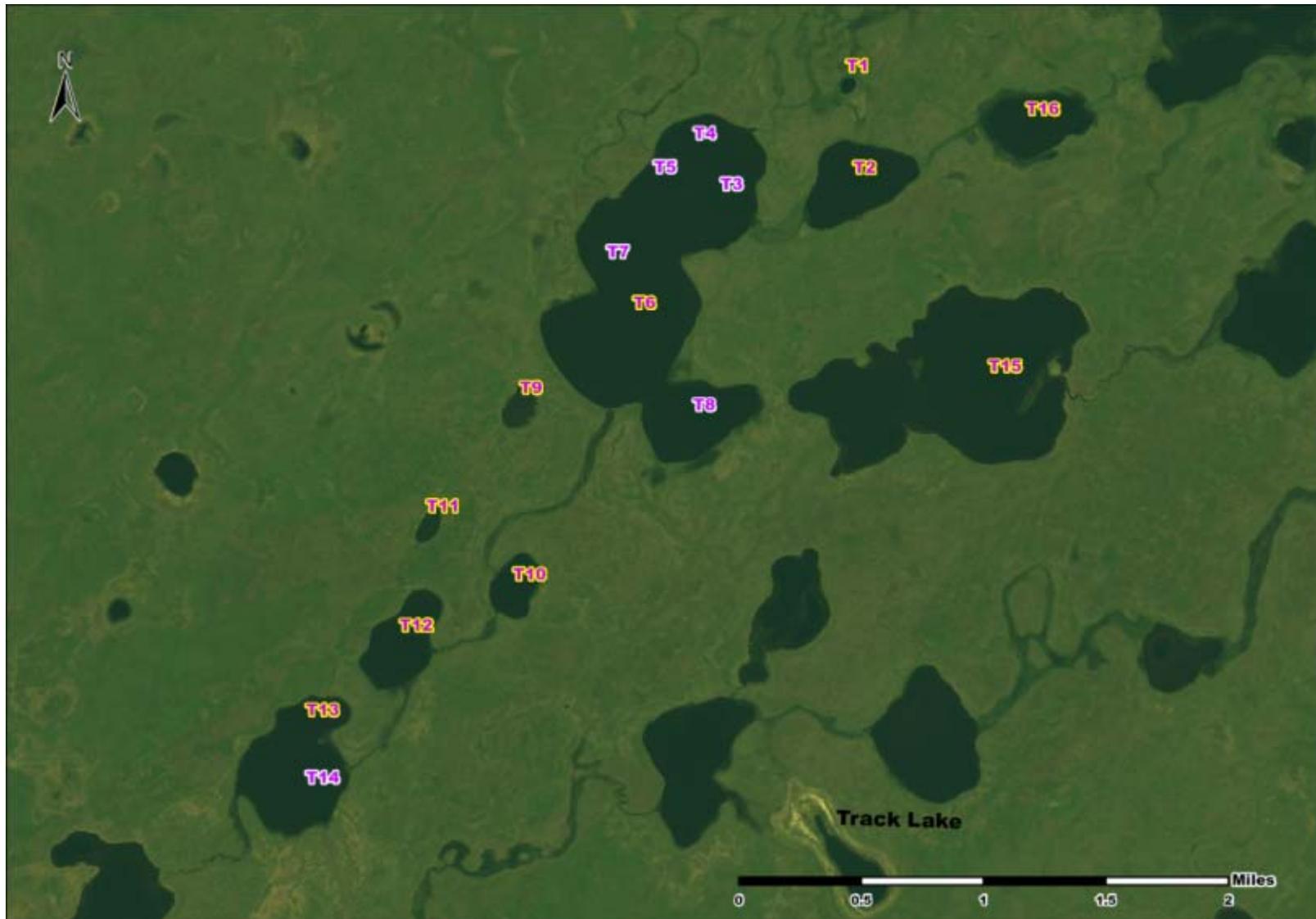
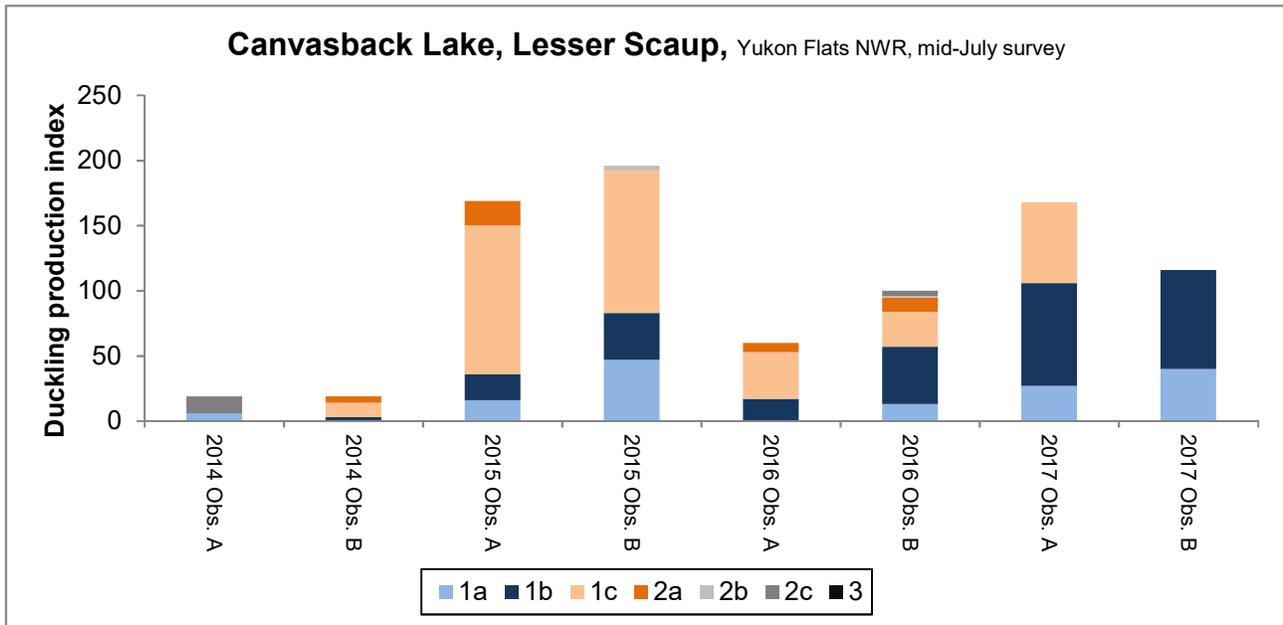
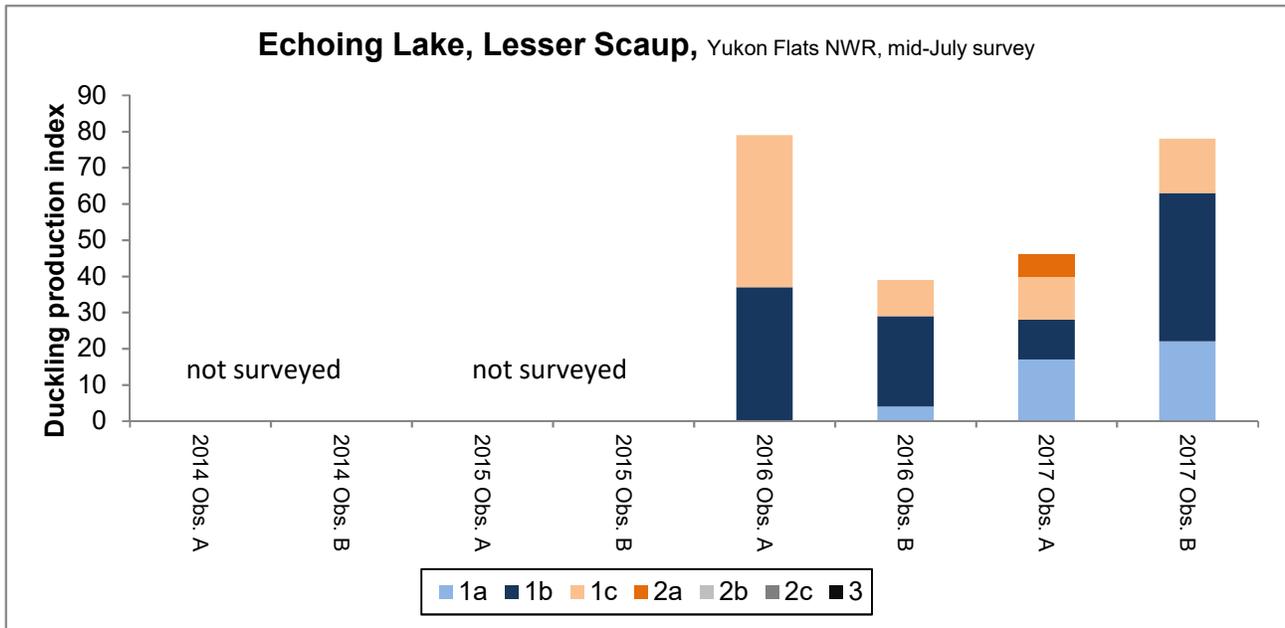


Figure 4. Wetland by track lake survey area. Red/yellow numbers refer to current (higher water) wetland ID's. Pink/white numbers refer to lower water wetland ID's.



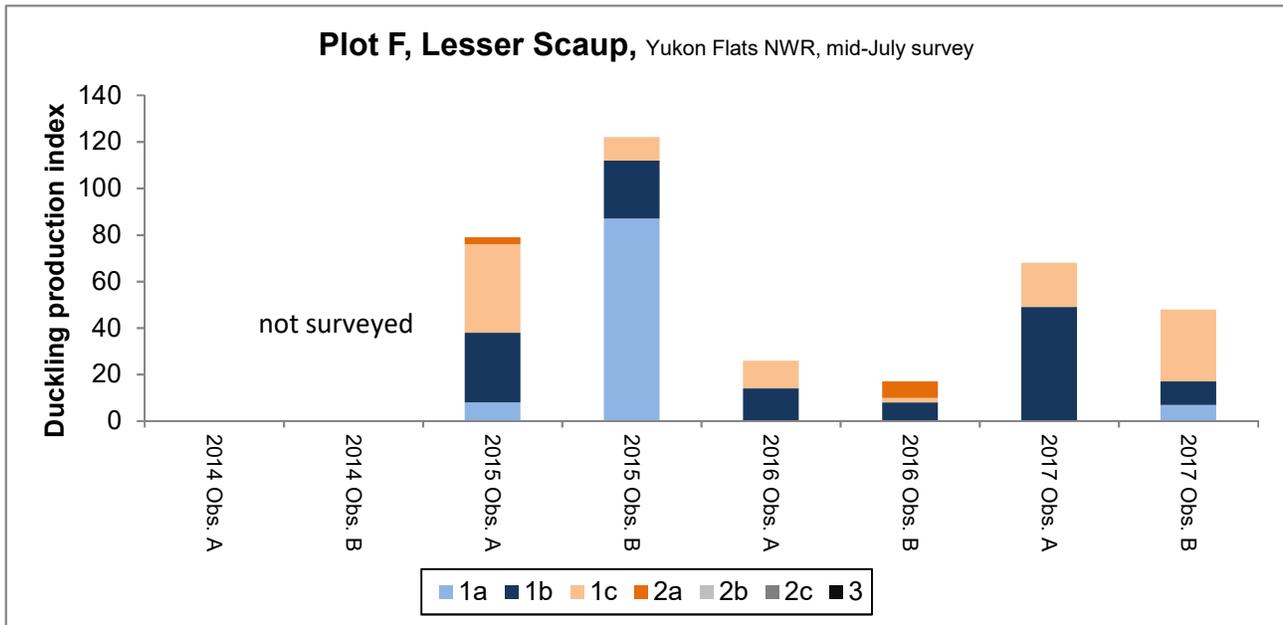
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	6	0	0	0	0	13	0	19	14	6.0 (3)
2014 Obs. B	0	3	11	5	0	0	0	19	14	5.0 (4)
2015 Obs. A	16	20	114	19	0	0	0	169	14	8.0 (18)
2015 Obs. B	47	36	109	0	4	0	0	196	14	8.0 (19)
2016 Obs. A	0	17	36	7	0	0	0	60	14	6.5 (10)
2016 Obs. B	13	44	27	11	1	4	0	100	14	7.0 (13)
2017 Obs. A	27	79	62	0	0	0	0	168	14	6.5 (14)
2017 Obs. B	40	76	0	0	0	0	0	116	14	6.5 (14)

Duckling production index for Lesser Scaup on Yukon Flats National Wildlife Refuge, Canvasback Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



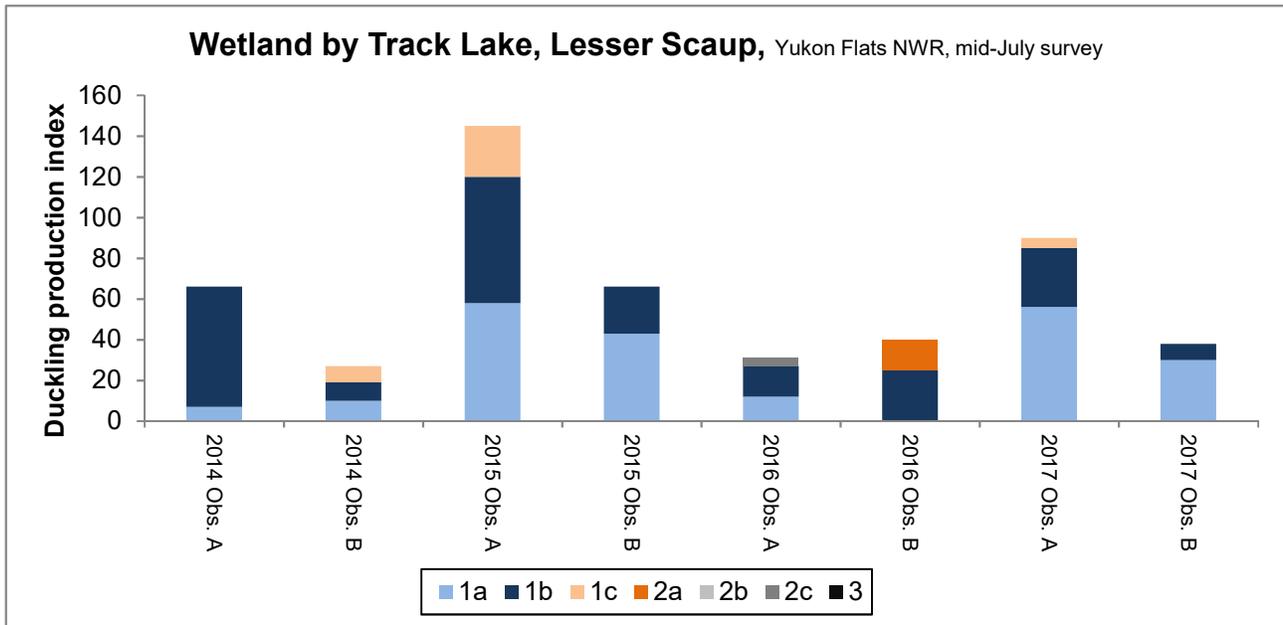
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	not surveyed									
2014 Obs. B	not surveyed									
2015 Obs. A	not surveyed									
2015 Obs. B	not surveyed									
2016 Obs. A		37	42	0	0	0	0	79	10	13.5 (6)
2016 Obs. B	4	25	10	0	0	0	0	39	10	5.0 (7)
2017 Obs. A	17	11	12	6	0	0	0	46	10	7.0 (7)
2017 Obs. B	22	41	15	0	0	0	0	78	10	6.5 (12)

Duckling production index for Lesser Scaup on Yukon Flats National Wildlife Refuge, Echoing Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



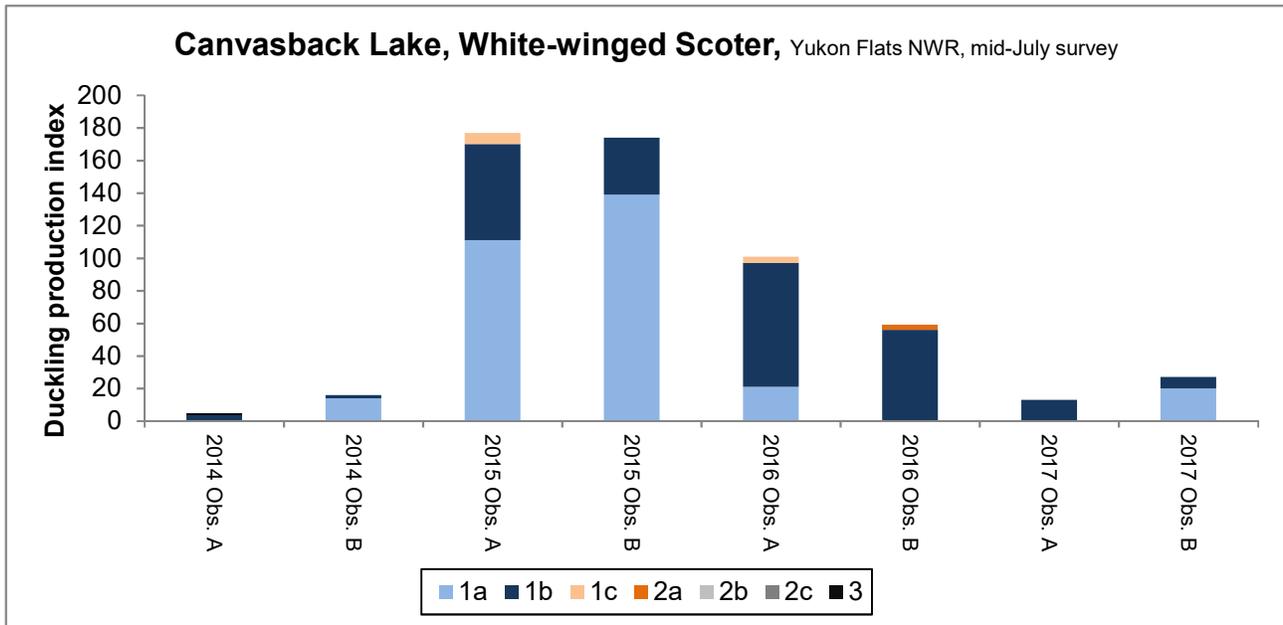
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	not surveyed									
2014 Obs. B	not surveyed									
2015 Obs. A	8	30	38	3	0	0	0	79	11	4.0 (13)
2015 Obs. B	87	25	10	0	0	0	0	122	9	7.0 (15)
2016 Obs. A	0	14	12	0	0	0	0	26	11	4.0 (6)
2016 Obs. B	0	8	2	7	0	0	0	17	11	3.5 (4)
2017 Obs. A	0	49	19	0	0	0	0	68	11	6.0 (8)
2017 Obs. B	7	10	31	0	0	0	0	48	11	5.0 (5)

Duckling production index for Lesser Scaup on Yukon Flats National Wildlife Refuge, Plot F. Counts by age class are presented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



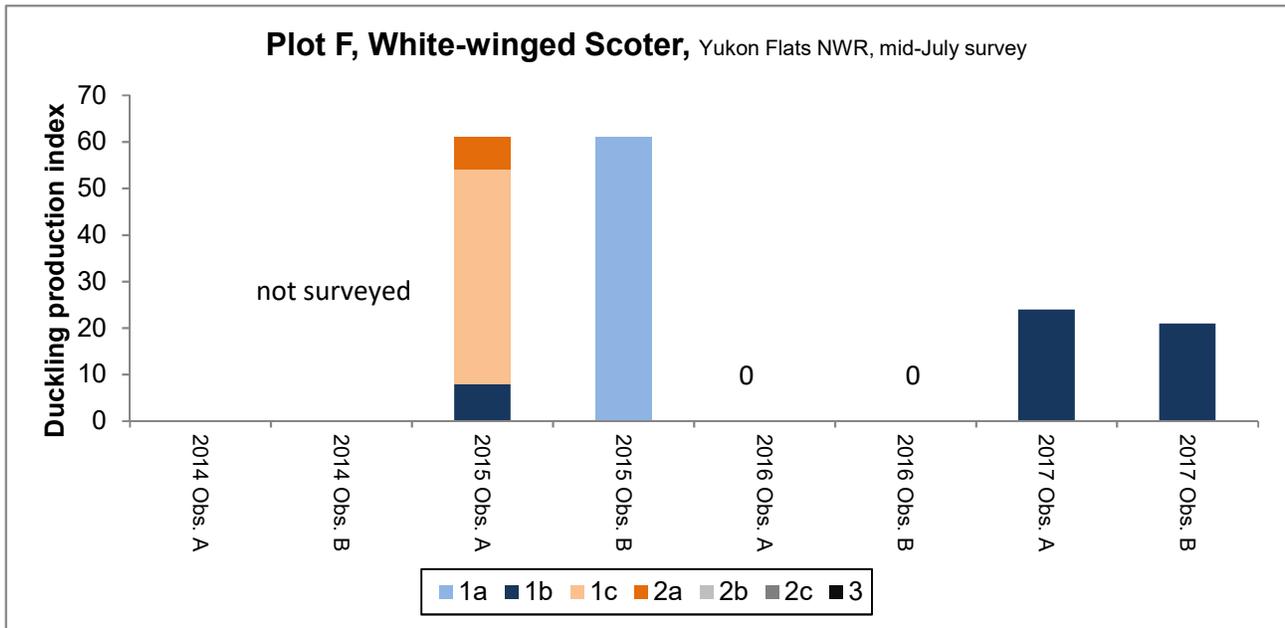
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	7	59	0	0	0	0	0	66	10	8.0 (6)
2014 Obs. B	10	9	8	0	0	0	0	27	10	5.0 (4)
2015 Obs. A	58	62	25	0	0	0	0	145	10	7.0 (17)
2015 Obs. B	43	23	0	0	0	0	0	66	10	6.0 (10)
2016 Obs. A	12	15	0	0	0	4	0	31	9	4.0 (5)
2016 Obs. B	0	25	0	15	0	0	0	40	9	6.0 (7)
2017 Obs. A	56	29	5	0	0	0	0	90	10	8.0 (9)
2017 Obs. B	30	8	0	0	0	0	0	38	10	9.0 (5)

Duckling production index for Lesser Scaup on Yukon Flats National Wildlife Refuge, Wetland by Track Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



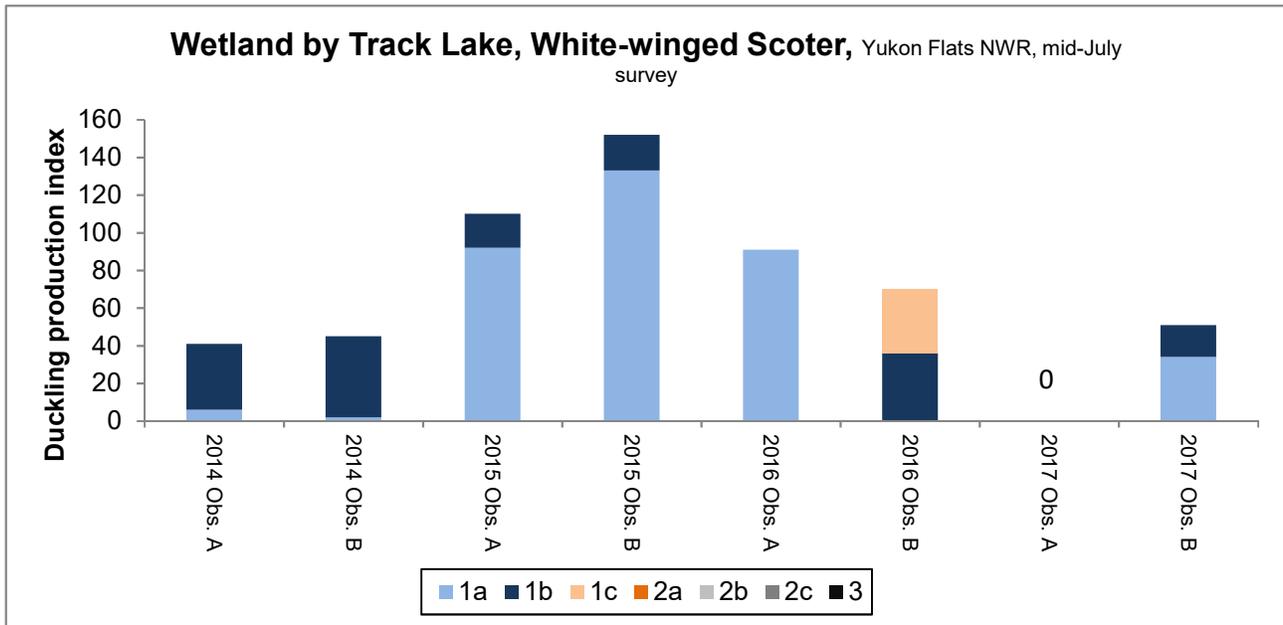
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	0	4	0	0	0	0	1	5	14	2.5 (2)
2014 Obs. B	14	2	0	0	0	0	0	16	14	3.0 (4)
2015 Obs. A	111	59	7	0	0	0	0	177	14	10.0 (11)
2015 Obs. B	139	35	0	0	0	0	0	174	14	11.0 (11)
2016 Obs. A	21	76	4	0	0	0	0	101	14	6.0 (9)
2016 Obs. B	0	56	0	3	0	0	0	59	14	3.0 (3)
2017 Obs. A	0	13	0	0	0	0	0	13	14	6.5 (2)
2017 Obs. B	20	7	0	0	0	0	0	27	14	7.0 (3)

Duckling production index for White-winged Scoter on Yukon Flats National Wildlife Refuge, Canvasback Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



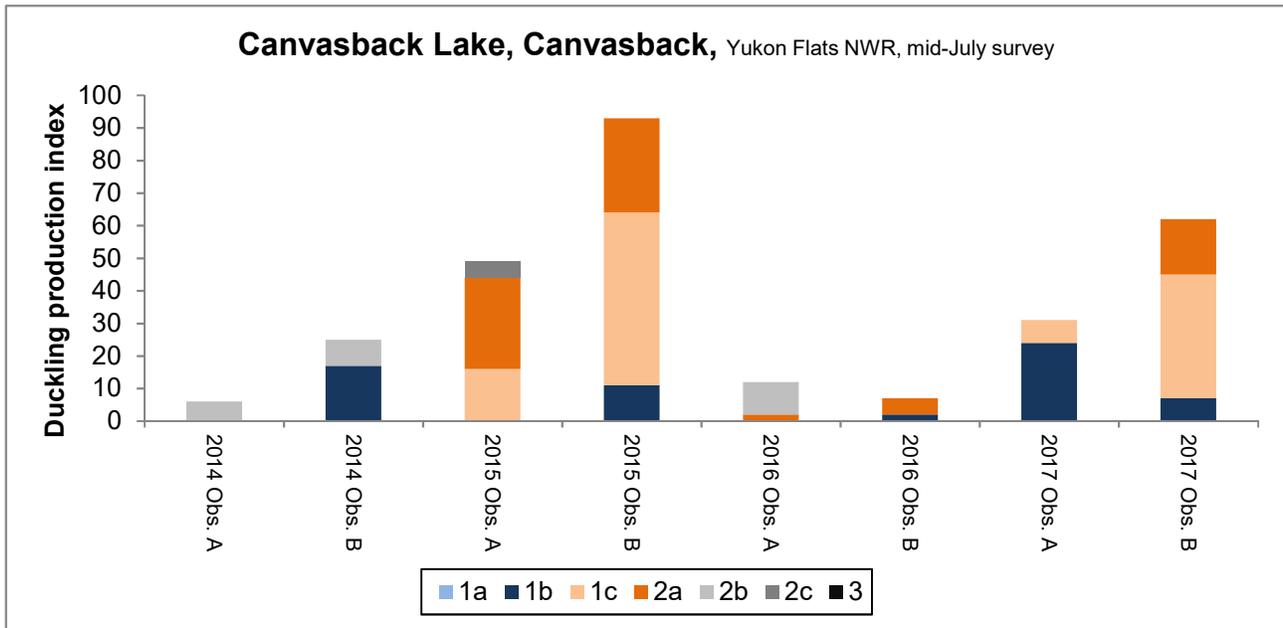
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	not surveyed									
2014 Obs. B	not surveyed									
2015 Obs. A	0	8	46	7	0	0	0	61	11	8.0 (3)
2015 Obs. B	61	0	0	0	0	0	0	61	9	30.5 (2)
2016 Obs. A	0	0	0	0	0	0	0	0	11	
2016 Obs. B	0	0	0	0	0	0	0	0	11	
2017 Obs. A	0	24	0	0	0	0	0	24	11	24.0 (1)
2017 Obs. B	0	21	0	0	0	0	0	21	11	21.0 (1)

Duckling production index for White-winged Scoter on Yukon Flats National Wildlife Refuge, Plot F. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



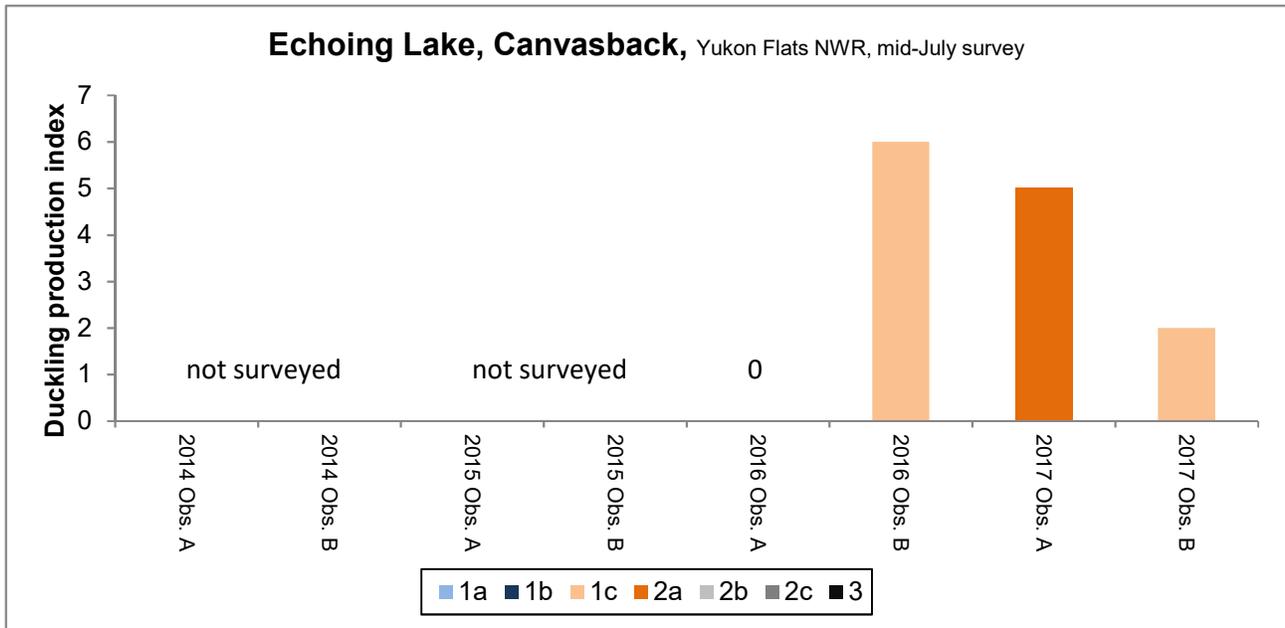
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	6	35	0	0	0	0	0	41	10	19.5 (2)
2014 Obs. B	2	43	0	0	0	0	0	45	10	4.0 (3)
2015 Obs. A	92	18	0	0	0	0	0	110	10	8.5 (10)
2015 Obs. B	133	19	0	0	0	0	0	152	10	8.0 (13)
2016 Obs. A	91	0	0	0	0	0	0	91	9	17.0 (5)
2016 Obs. B	0	36	34	0	0	0	0	70	9	10.0 (5)
2017 Obs. A	0	0	0	0	0	0	0	0	10	
2017 Obs. B	34	17	0	0	0	0	0	51	10	12.5 (4)

Duckling production index for White-winged Scoter on Yukon Flats National Wildlife Refuge, Wetland by Track Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



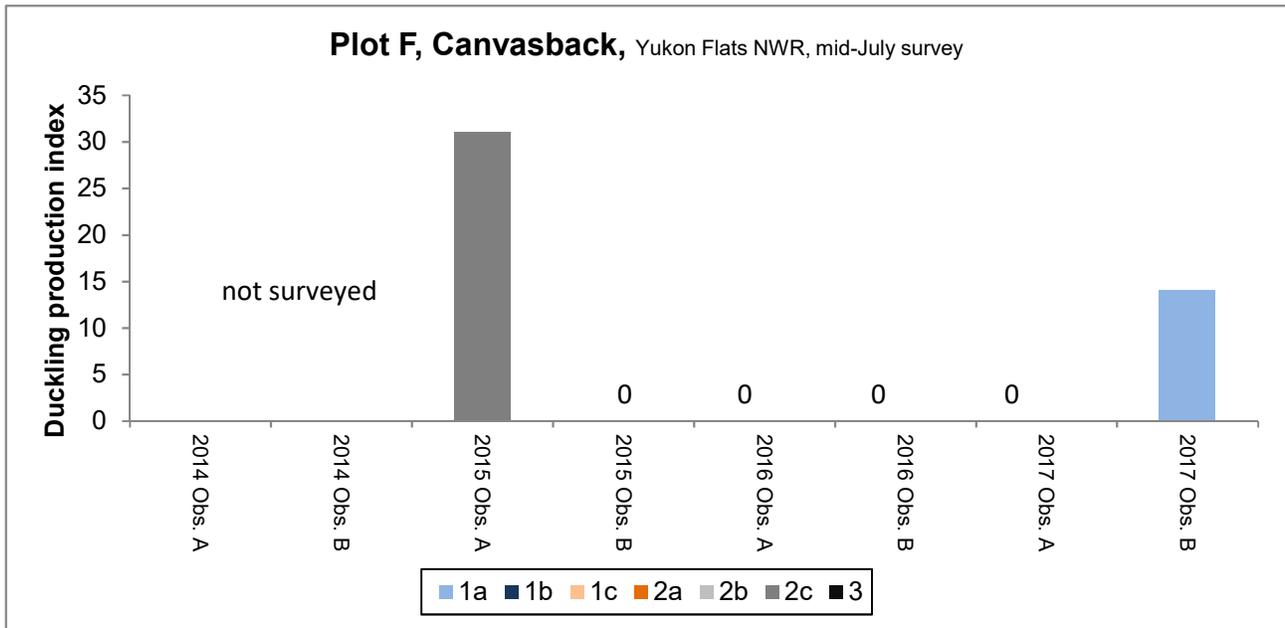
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	0	0	0	0	6	0	0	6	14	6.0 (1)
2014 Obs. B	0	17	0	0	8	0	0	25	14	6.0 (4)
2015 Obs. A	0	0	16	28	0	5	0	49	14	5.5 (6)
2015 Obs. B	0	11	53	29	0	0	0	93	14	8.5 (12)
2016 Obs. A	0	0	0	2	10	0	0	12	14	3.0 (4)
2016 Obs. B	0	2	0	5	0	0	0	7	14	2.0 (3)
2017 Obs. A	0	24	7	0	0	0	0	31	14	4.5 (6)
2017 Obs. B	0	7	38	17	0	0	0	62	14	5.5 (8)

Duckling production index for Canvasback on Yukon Flats National Wildlife Refuge, Canvasback Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



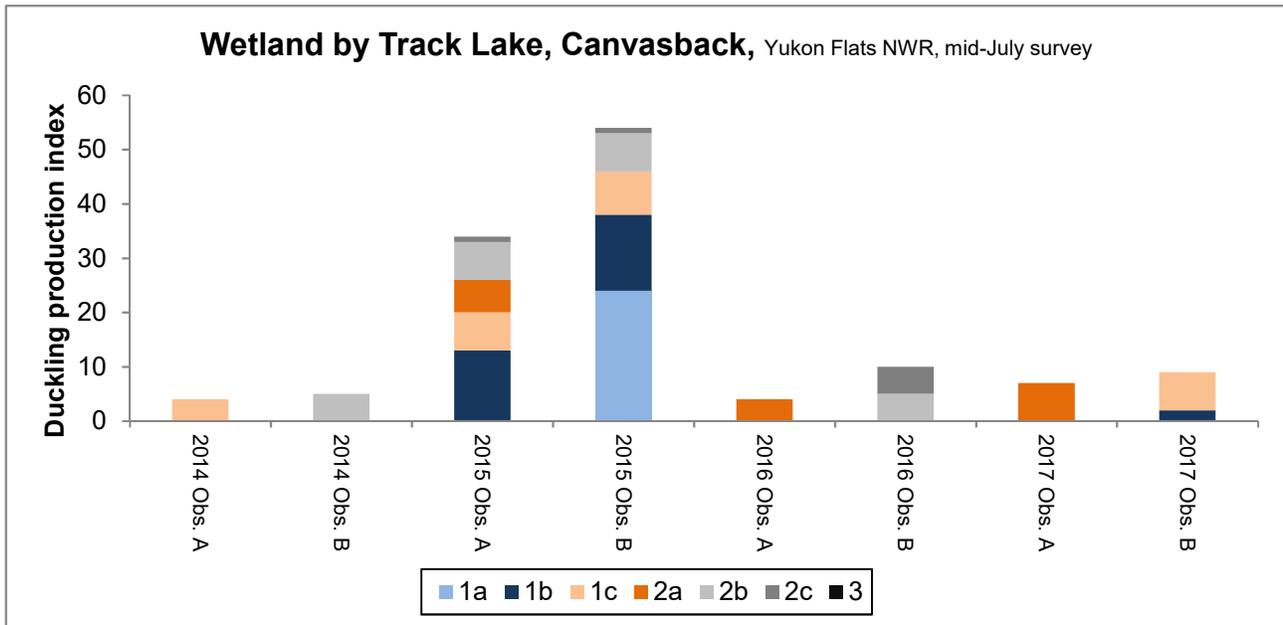
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	not surveyed									
2014 Obs. B	not surveyed									
2015 Obs. A	not surveyed									
2015 Obs. B	not surveyed									
2016 Obs. A	0	0	0	0	0	0	0	0	10	
2016 Obs. B	0	0	6	0	0	0	0	6	10	6.0 (1)
2017 Obs. A	0	0	0	5	0	0	0	5	10	5.0 (1)
2017 Obs. B	0	0	2	0	0	0	0	2	10	2.0 (1)

Duckling production index for Canvasback on Yukon Flats National Wildlife Refuge, Echoing Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



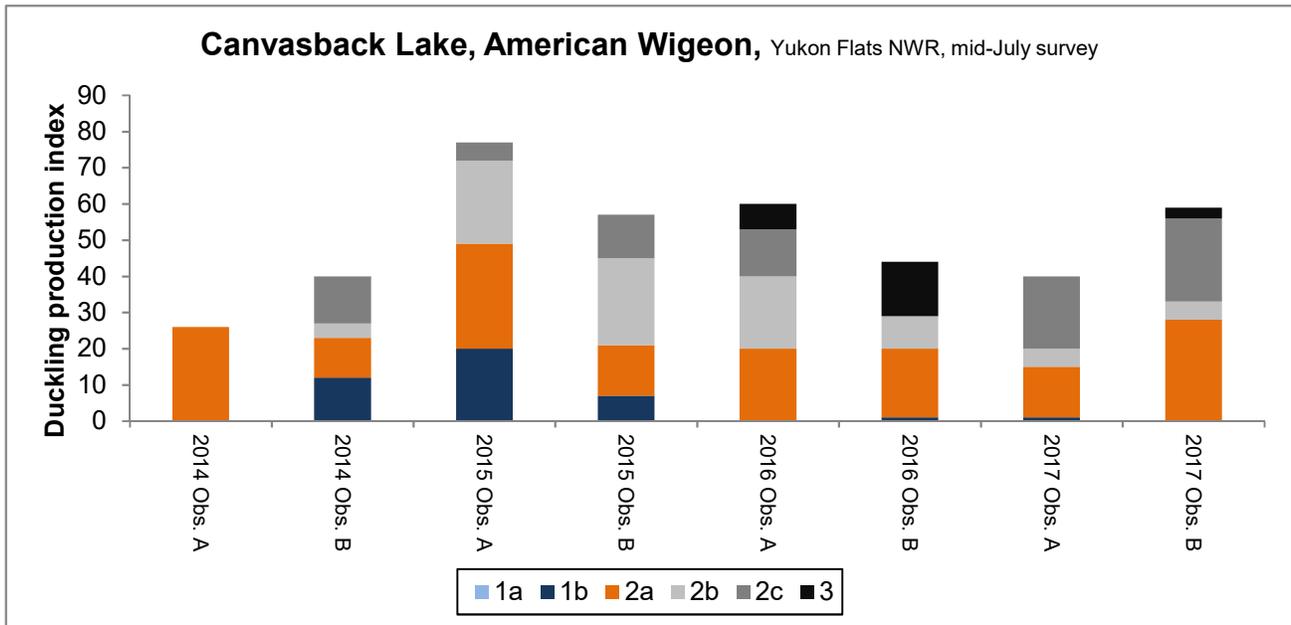
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	not surveyed									
2014 Obs. B	not surveyed									
2015 Obs. A	0	0	0	0	0	31	0	31	11	7.0 (5)
2015 Obs. B	0	0	0	0	0	0	0	0	9	
2016 Obs. A	0	0	0	0	0	0	0	0	11	
2016 Obs. B	0	0	0	0	0	0	0	0	11	
2017 Obs. A	0	0	0	0	0	0	0	0	11	
2017 Obs. B	0	14	0	0	0	0	0	14	11	14.0 (1)

Duckling production index for Canvasback on Yukon Flats National Wildlife Refuge, Plot F. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



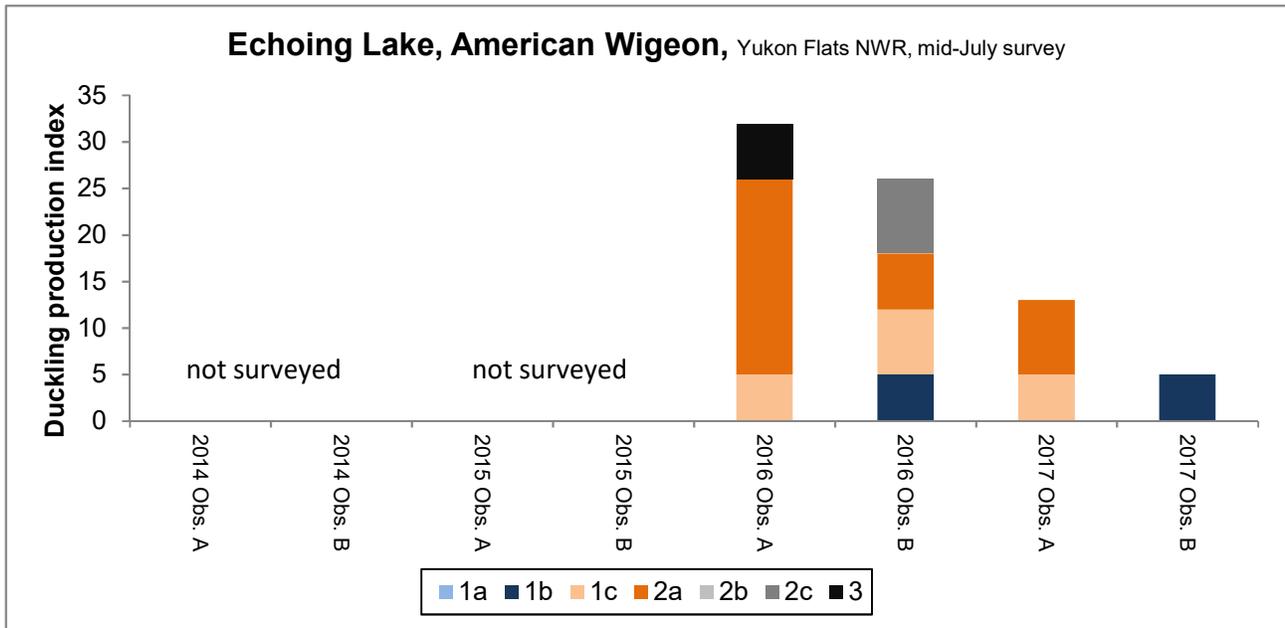
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	0	0	4	0	0	0	0	4	10	---
2014 Obs. B	0	0	0	0	5	0	0	5	10	5.0 (1)
2015 Obs. A	0	13	7	6	7	1	0	34	10	2.5 (10)
2015 Obs. B	24	14	8	0	7	1	0	54	10	3.0 (13)
2016 Obs. A	0	0	0	4	0	0	0	4	9	4.0 (1)
2016 Obs. B	0	0	0	0	5	5	0	10	9	5.0 (2)
2017 Obs. A	0	0	0	7	0	0	0	7	10	7.0 (1)
2017 Obs. B	0	2	7	0	0	0	0	9	10	4.5 (2)

Duckling production index for Canvasback on Yukon Flats National Wildlife Refuge, Wetland by Track Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



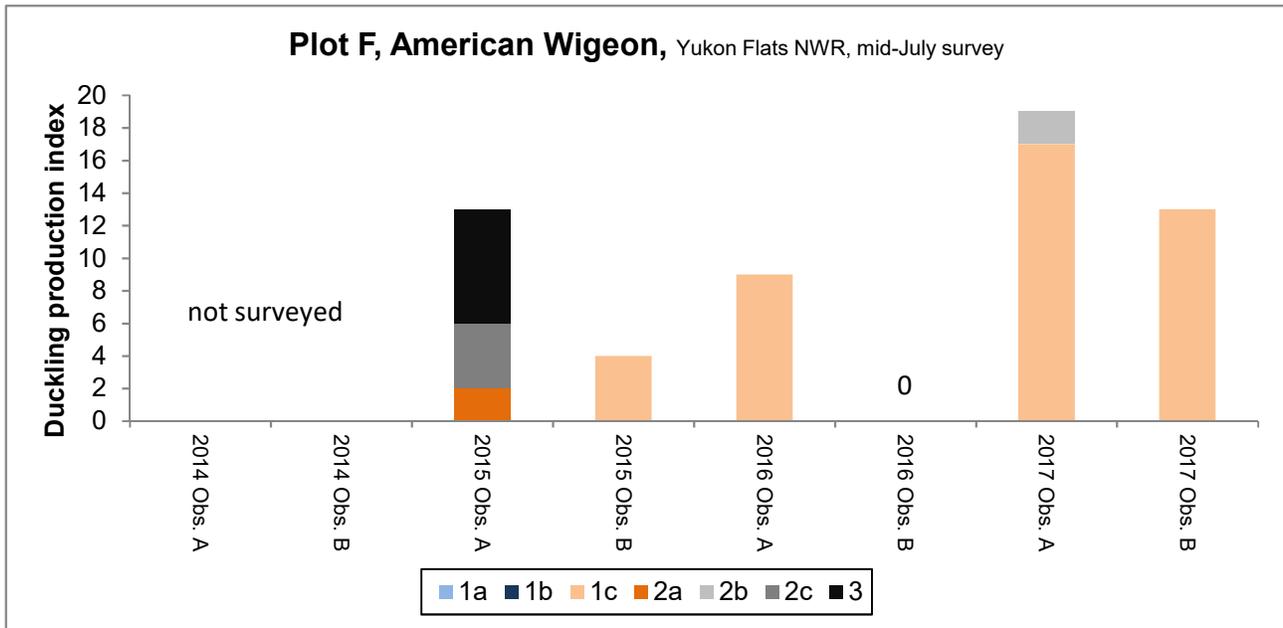
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	0	0	0	26	0	0	0	26	14	6.5 (4)
2014 Obs. B	0	12	8	11	4	13	0	48	14	3.0 (14)
2015 Obs. A	0	20	34	29	23	5	0	111	14	6.0 (17)
2015 Obs. B	0	7	18	14	24	12	0	75	14	5.0 (15)
2016 Obs. A	0	0	4	20	20	13	7	64	14	4.0 (15)
2016 Obs. B	0	1	3	19	9	0	15	47	14	3.5 (10)
2017 Obs. A	0	1	13	14	5	20	0	53	14	4.0 (9)
2017 Obs. B	0	0	34	28	5	23	3	93	14	4.0 (20)

Duckling production index for American Wigeon on Yukon Flats National Wildlife Refuge, Canvasback Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



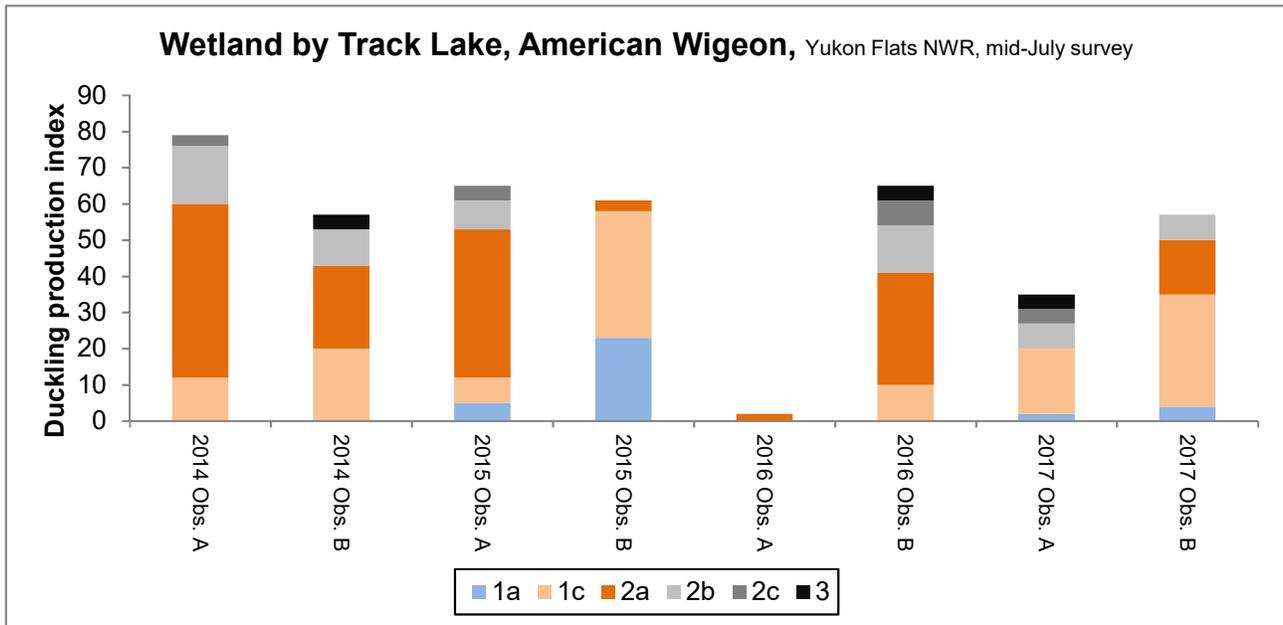
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	not surveyed									
2014 Obs. B	not surveyed									
2015 Obs. A	not surveyed									
2015 Obs. B	not surveyed									
2016 Obs. A	0	0	5	21	0	0	6	32	10	6.0 (5)
2016 Obs. B	0	5	7	6	0	8	0	26	10	3.0 (7)
2017 Obs. A	0	0	5	8	0	6	0	19	10	5.5 (4)
2017 Obs. B	0	5	0	0	0	0	0	5	10	5.0 (1)

Duckling production index for American Wigeon on Yukon Flats National Wildlife Refuge, Echoing Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



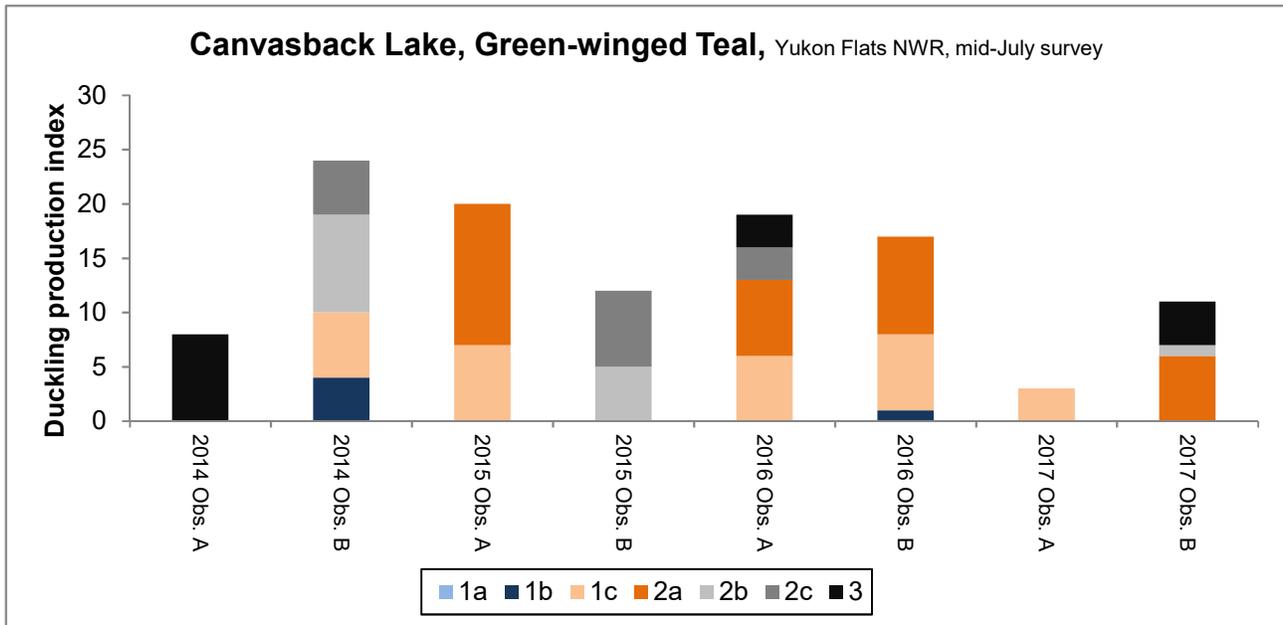
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)	
2014 Obs. A	not surveyed								0		
2014 Obs. B	not surveyed								0		
2015 Obs. A	0	0	0	2	0	4	7	13	11	4.0 (3)	
2015 Obs. B	0	0	4	0	0	0	0	4	9	4.0 (1)	
2016 Obs. A	0	0	9	0	0	0	0	9	11	4.5 (2)	
2016 Obs. B	0	0	0	0	0	0	0	0	11		
2017 Obs. A	0	0	17	0	2	0	0	19	11	4.0 (4)	
2017 Obs. B	0	0	13	0	0	0	0	13	11	6.5 (2)	

Duckling production index for American Wigeon on Yukon Flats National Wildlife Refuge, Plot F. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



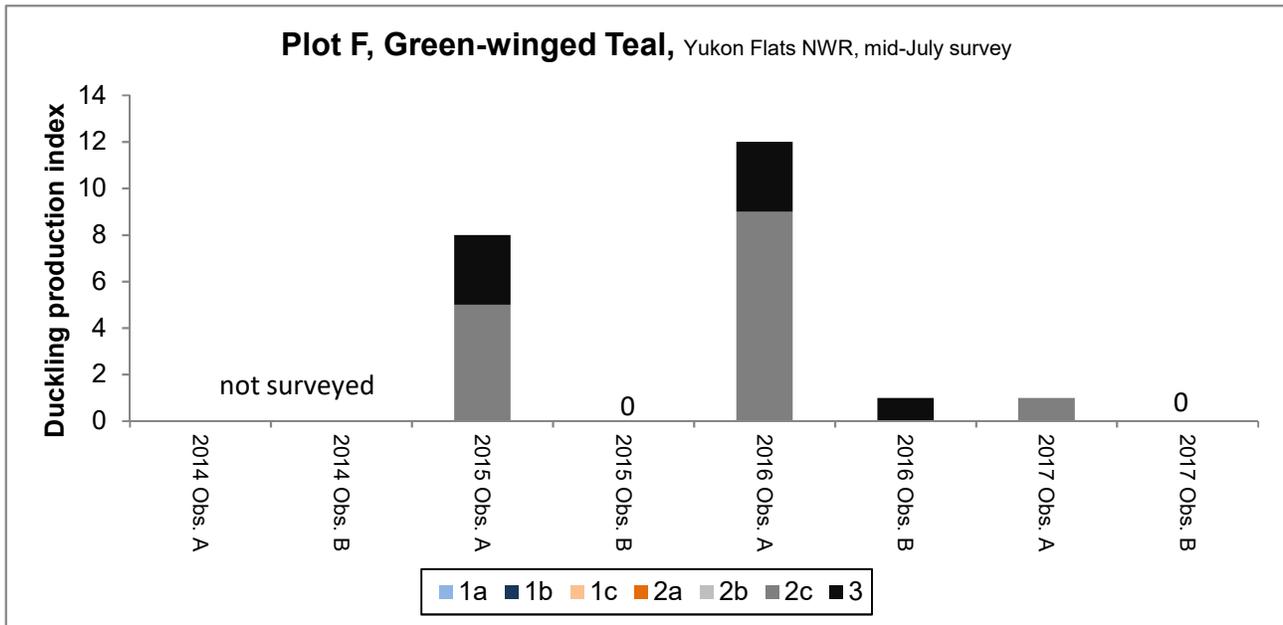
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	0	3	12	48	16	3	0	82	10	6.0 (12)
2014 Obs. B	0	12	20	23	10	0	4	69	10	5.0 (13)
2015 Obs. A	5	0	7	41	8	4	0	65	10	5.0 (13)
2015 Obs. B	23	22	35	3	0	0	0	83	10	3.0 (14)
2016 Obs. A	0	10	0	2	0	0	0	12	9	2.0 (3)
2016 Obs. B	0	0	10	31	13	7	4	65	9	4.0 (13)
2017 Obs. A	2	9	18	0	7	4	4	44	10	4.0 (9)
2017 Obs. B	4	25	31	15	7	0	0	82	10	5.5 (16)

Duckling production index for American Wigeon Yukon Flats National Wildlife Refuge, Wetland by Track Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



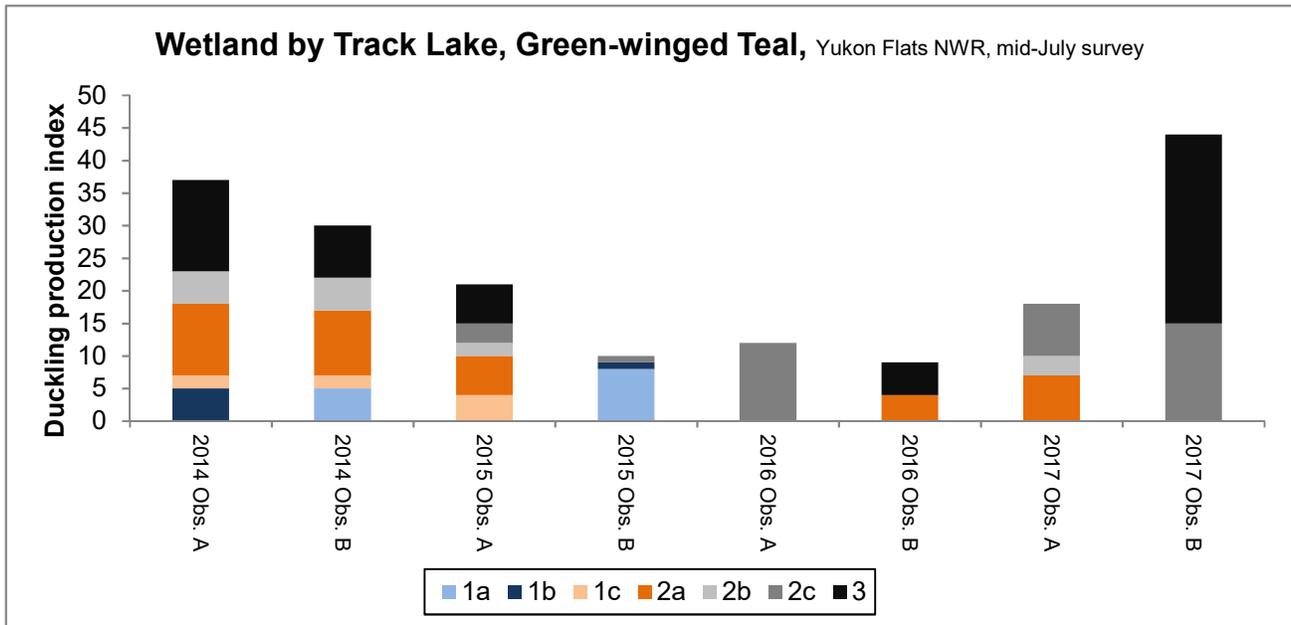
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	0	0	0	0	0	0	8	8	14	4.0 (2)
2014 Obs. B	0	4	6	0	9	5	0	24	14	3.0 (5)
2015 Obs. A	0	0	7	13	0	0	0	20	14	7.0 (3)
2015 Obs. B	0	0	0	0	5	7	0	12	14	6.0 (2)
2016 Obs. A	0	0	6	7	0	3	3	19	14	3.0 (5)
2016 Obs. B	0	1	7	9	0	0	0	17	14	4.5 (4)
2017 Obs. A	0	0	3	0	0	0	0	3	14	3.0 (1)
2017 Obs. B	0	0	0	6	1	0	4	11	14	4.0 (3)

Duckling production index for Green-winged teal on Yukon Flats National Wildlife Refuge, Canvasback Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



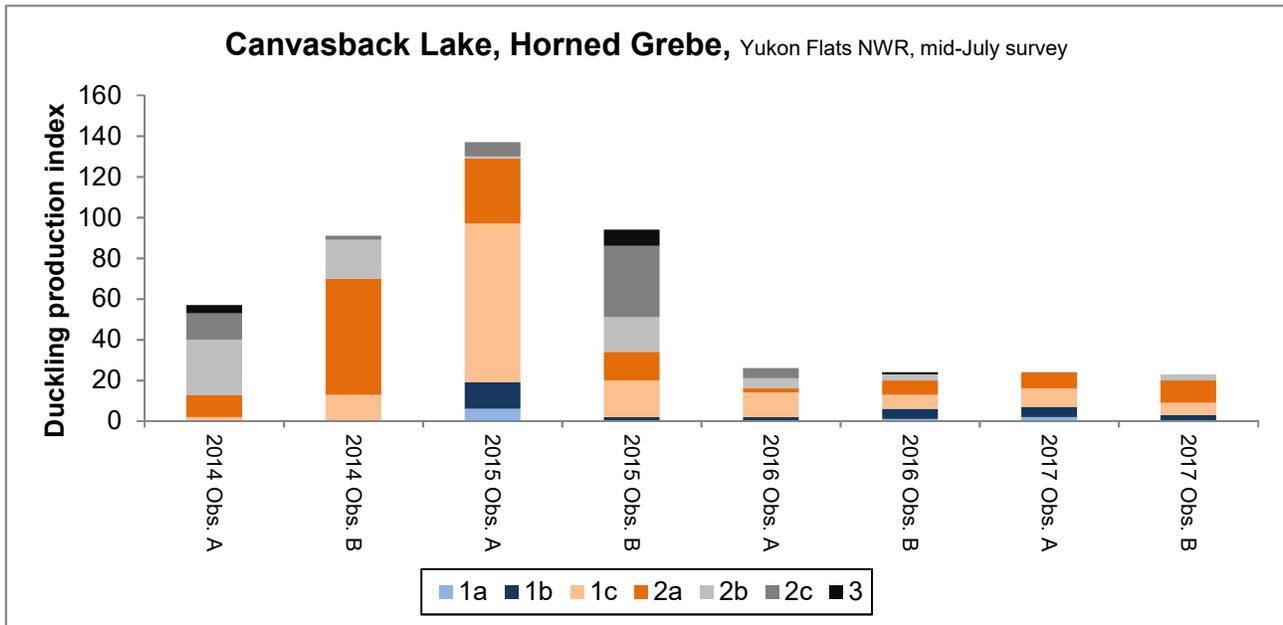
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	not surveyed									
2014 Obs. B	not surveyed									
2015 Obs. A	0	0	0	0	0	5	3	8	11	2.0 (3)
2015 Obs. B	0	0	0	0	0	0	0	0	9	
2016 Obs. A	0	0	0	0	0	9	3	12	11	3.0 (3)
2016 Obs. B	0	0	0	0	0	0	1	1	11	1.0 (1)
2017 Obs. A	0	0	0	0	0	1	0	1	11	1.0 (1)
2017 Obs. B	0	0	0	0	0	0	0	0	11	

Duckling production index for Green-winged Teal on Yukon Flats National Wildlife Refuge, Plot F. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



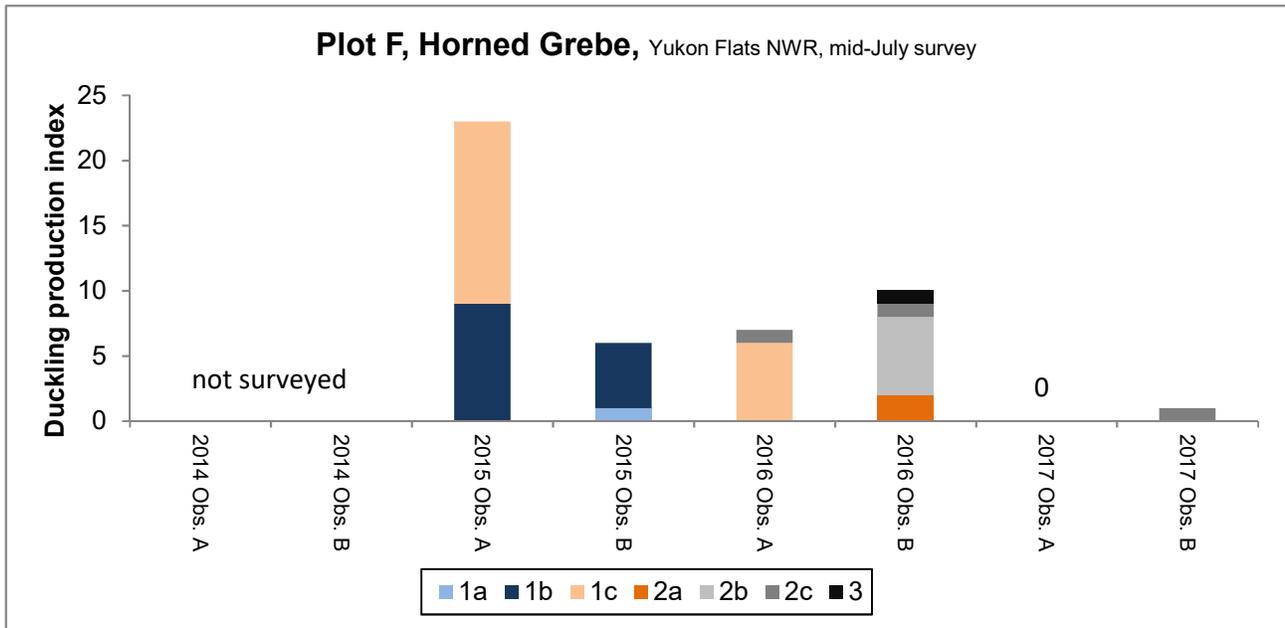
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	0	5	2	11	5	0	14	37	10	5.0 (4)
2014 Obs. B	5	0	2	10	5	0	8	30	10	4.0 (7)
2015 Obs. A	0	0	4	6	2	3	6	21	10	3.5 (6)
2015 Obs. B	8	1	0	0	0	1	0	10	10	4.5 (2)
2016 Obs. A	0	0	0	0	0	12	0	12	9	12.0 (1)
2016 Obs. B	0	0	0	4	0	0	5	9	9	3.0 (3)
2017 Obs. A	0	0	0	7	3	8	0	18	10	3.0 (3)
2017 Obs. B	0	0	0	0	0	15	29	44	10	4.0 (9)

Duckling production index for Green-winged Teal on Yukon Flats National Wildlife Refuge, Wetland by Track Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



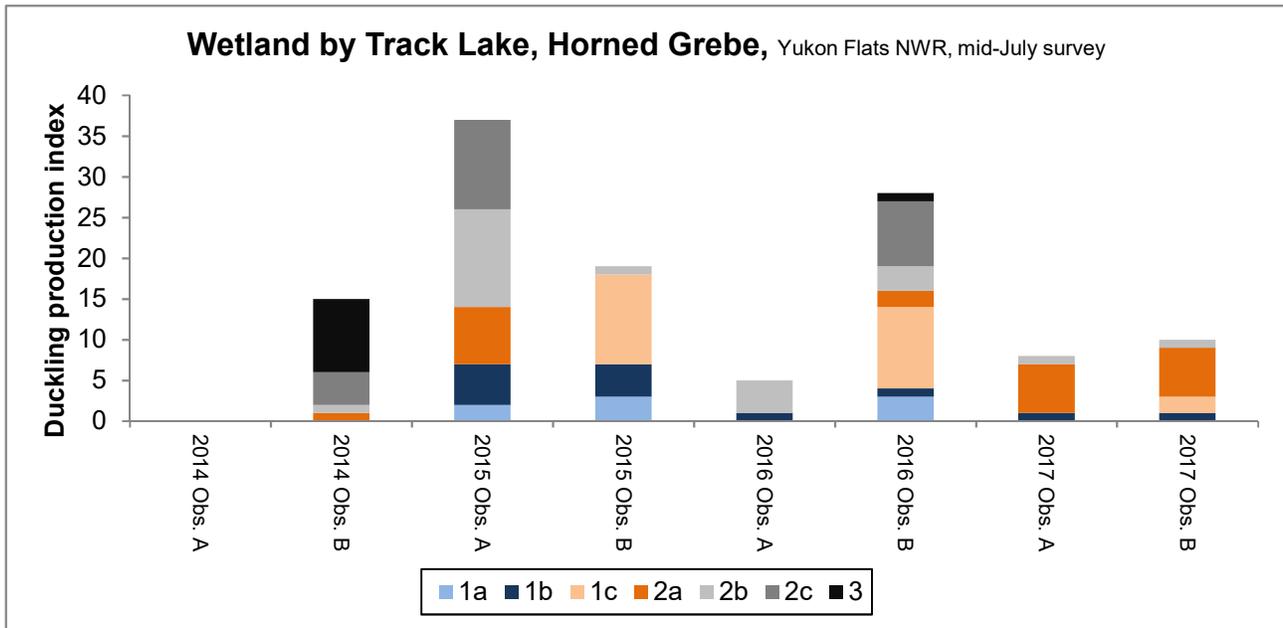
	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	0	0	2	11	27	13	4	57	14	6.0 (1)
2014 Obs. B	0	0	13	57	19	2	0	91	14	2.0 (25)
2015 Obs. A	6	13	78	32	1	7	0	137	14	5.5 (6)
2015 Obs. B	0	2	18	14	17	35	8	94	14	1.0 (37)
2016 Obs. A	0	2	12	2	5	5	0	26	14	3.0 (4)
2016 Obs. B	1	5	7	7	3	0	1	24	14	1.0 (20)
2017 Obs. A	2	5	9	8	0	0	0	24	14	1.0 (16)
2017 Obs. B	0	3	6	11	3	0	0	23	14	1.0 (16)

Duckling production index for Horned Grebe on Yukon Flats National Wildlife Refuge, Canvasback Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	not surveyed									
2014 Obs. B	not surveyed									
2015 Obs. A	0	9	14	0	0	0	0	23	11	1.5 (12)
2015 Obs. B	1	5	0	0	0	0	0	6	9	1.0 (5)
2016 Obs. A	0	0	6	0	0	1	0	7	11	1.0 (6)
2016 Obs. B	0	0	0	2	6	1	1	10	11	1.0 (9)
2017 Obs. A	0	0	0	0	0	0	0	0	11	
2017 Obs. B	0	0	0	0	0	1	0	1	11	1.0 (1)

Duckling production index for Horned Grebe on Yukon Flats National Wildlife Refuge, Plot F. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.



	1a	1b	1c	2a	2b	2c	3	total	n wetlands	median brood size (n)
2014 Obs. A	0	0	0	0	0	0	0	0	10	
2014 Obs. B	0	0	0	1	1	4	9	15	10	1.0 (9)
2015 Obs. A	2	5	0	7	12	11	0	37	10	2.0 (10)
2015 Obs. B	3	4	11	0	1	0	0	19	10	1.0 (7)
2016 Obs. A	0	1	0	0	4	0	0	5	9	
2016 Obs. B	3	1	10	2	3	8	1	28	9	1.0 (15)
2017 Obs. A	0	1	0	6	1	0	0	8	10	1.5 (4)
2017 Obs. B	2	1	2	6	1	0	0	12	10	1.5 (6)

Duckling production index Horned Grebe on Yukon Flats National Wildlife Refuge, Wetland by Track Lake. Counts by age class are represented, along with the corresponding total and number of wetlands sampled. Wetlands are sampled twice and counts are reported for each observer. Median brood size for broods attended by a hen is presented, with sample size in parentheses.