IWMM Surveys on Cold Springs NWR
Winter 2018-19

by
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INTRODUCTION

The Memorial Marsh Unit on Cold Springs National Wildlife Refuge (Refuge) is managed to provide seasonal wetlands for migratory waterfowl and wading birds. Management actions, consisting primarily of water management and vegetation treatments, are conducted to encourage moist-soil vegetation and discourage undesirable plants. Desirable and/or native moist-soil annual plants include smartweeds (*Polygonum* spp.), barnyard grass (also known as millet) (*Echinocloa crus-gali*), and swamp timothy (*Crypsis schoenoides*), while undesirable or invasive plants include cocklebur (*Xanthium strumarium*) and common reed (*Phragmities australis*).

The Refuge is located within the Columbia River Basin near Hermiston, Oregon, where annual waterfowl populations peak in winter and early spring. Compared with wintering populations, breeding waterfowl populations are relatively small, so Refuge wetlands are managed for wintering and migrating waterfowl. Ponds in Memorial Marsh are typically flooded in fall and drained mid-summer. The resulting growth of moist-soil vegetation provides crucial carbohydrates and structure for invertebrate prey the following winter and spring. Vegetation treatments occur during the summer growing season and typically consist of mechanical mowing of dike edges and emergent plants, and herbicide treatments of invasive species that reduce overall moist-soil quality (e.g. jointgrass).

Refuge management objectives for Memorial Marsh are described in terms of vegetation. Objective 2.1 (draft CCP) states "*Enhance and annually maintain 138 acres of managed, seasonal wetlands for migratory waterfowl, including 40 acres of moist-soil vegetation annually…*". Desirable characteristics of seasonal wetlands are further defined as

>60% cover of desirable and/or native wetland plants, including moist-soil annuals
<20% cover of native emergent species that are >5 feet tall (e.g., cattail, hardstem bulrush)
<40% cover of undesirable/invasive plants.

There are 6 ponds in the marsh unit, and 5 are managed for moist-soil habitats, including Cottonwood (CW), Middle (MI), Upper A (UA), Upper B (UB) and Kosmos (KO) (Figure 1). Upper A and Upper B are hydrologically connected, but defined by a peninsula jutting into the pond from the north. Upper A was separated from Upper B due to majorly contrasting plant communities. Upper A is filled with overflow from Upper B. Moe's Pond is not included in the survey due to its small size, lack of bird use, and lower priority for management. Pond sizes range from 3.8 to 36 acres, with Kosmos being the smallest and Middle the largest (Figure 1).

The Refuge has conducted winter waterbird surveys since winter 2012-13 and started using the Integrated Waterbird Monitoring and Management (IWMM) protocol during winter 2016-17. Waterfowl surveys alone did not provide information on vegetation conditions in the wetlands or vegetation/bird response to management actions. In addition to waterfowl surveys, Vegetation, Unit Condition, and Management Action aspects of the IWMM protocol are used to provide better information on which to base management decisions. The objectives of the survey are to 1) document and track changes in vegetation condition in individual ponds over time; 2) track waterbird use over time; and 3) compare waterbird use and vegetation condition between ponds.

METHODS

Waterbird and Unit Condition

Field methods followed the Waterbird and Unit Condition Survey from IWMM protocol (Loges et al. 2014). Whole area counts conducted from the ground were used to survey waterbirds in each pond. Observers approached each pond and conducted a quick scan to determine relative numbers and species present. Birds that flushed were counted first and their flight direction noted. Observers tried to avoid double counting birds by noting flock movements and directions when birds flushed. Birds that remained on the water were counted next. Observers attempted to count each bird individually, as bird movement and numbers allowed. As flock sizes and species diversity increased throughout the season, observers began counting in increments of 10 to 100 birds, depending on flock size and observer discretion. Waterfowl was the primary guild of management interest, but all waterbirds present were counted during surveys.

Unit condition data were collected immediately following bird counts. Water depth classes were estimated using staff gauge readings and a bathymetric model for all units except Kosmos, which lacked a staff gauge at the time bathymetric data were collected. Water depth on Kosmos was estimated visually.

Vegetation

Vegetation surveys are done during the late summer or seasons preceeding the waterfowl counts since vegetation growth the previous summer provides food resources for waterfowl populations the following winter and spring migration periods. IWMM vegetation protocols produce a rapid assessment of plant community composition and seed production. Plant community composition was estimated by walking through the unit, listing all plants observed and estimating cover of species contributing >5% of the emergent cover. Only current year's growth was considered and canopy cover was estimated as percentage of total emergent vegetation area present in the unit, rather than a percentage of the total survey unit area. Total cover could exceed 100% due to species of different heights and growth forms creating multiple canopy layers.

Size and density of seed heads of important waterfowl food species were estimated by measuring several seed heads of each species and using the average of these measurements to classify seed heads as small, average, or large. Seed head density was estimated based on density of stems for a species and proportion of stems with seed heads. IWMM provides seed head assessment guides for common waterfowl foods in the east, but most species in the guide are not found in our wetlands. Barnyard grass was the only species at Memorial Marsh covered in the guide, seed head density and size was compared between individual ponds. This represents a current limitation in applying the IWMM to western Refuges. *Crypsis schoenoides* and *Panicum capillare* are important waterfowl foods in the west, and we will be working with IWMM to include these species in the guides.

Data Analysis

Bird Use Days (BUD) were calculated and downloaded from the IWMM database. BUD is an estimate of the amount of 24-hour periods individual birds spent in the study area during a user-defined time interval, calculated with the standard trapezoid method (Hilborn et al. 1999, IWMM 2018). BUD may be calculated as either raw or corrected values. The raw BUD calculation assumes that survey dates encompass the entirety of the non-breeding period, preceding birds' arrival and ending after their departure. Thus, raw BUD is only appropriate when the assumption of zero (or nearly zero) counts for both the first and last survey counts is met. When surveys begin when birds have already arrived to the study area or end before they have left, a correction may be applied to account for the departure from this assumption (Bue et al. 1998, Millar and Jordan 2013, IWMM 2018). Counts for both the first and last surveys for this winter were above zero, so data is presented for corrected total BUD and corrected BUD per hectare. Waterfowl were grouped into the dabbling and diving duck guilds for reporting. Bird

migration curves for the 4 most common dabbling and diving duck species were generated within the IWMM reporting portal and were presented as absolute bird numbers.

Six depth classes were used by IWMM to account for foraging preferences of various waterbird guilds. Ducks were the primary focus of our study so we combined water depth to 3 classes: 0 cm (dry and saturated); <25 cm; and >25 cm. Twenty-five centimeters represents a cut-off between foraging habitat of dabbling ducks, which require shallow water, and diving ducks, which require deeper water (Elphick and Oring 1998, Ma et al. 2010).

The vegetation survey report was downloaded from the IWMM data portal, including total number of plant taxa in each pond (>5% cover), plant diversity index (Shannon's index), and percent cover of all taxa identified as annual and perennial plants, totaled by unit. Seed production index (SPI) was calculated for species included in the IWMM photographic seed head assessment guide, based on seed head size, density, and area covered. However, the seed head assessment guide was developed for eastern wetlands, and barnyard grass was the only plant in our wetlands included in the guide.

Since many western plant species were not included in the IWMM seed assessment guide, we also summarized vegetation data by categories defined in the Refuge CCP; desirable, tall, and undesirable. Value of plant species as waterfowl food was estimated based on literature search and assigned to all desirable plants. Canopy cover was summed within each refuge category for each pond.

RESULTS

Weekly counts were conducted between Oct 31, 2018 and March 27, 2019. Vegetation was surveyed on Sept 11, 2018.

Kosmos and Upper A had the highest plant diversity. Kosmos, Upper A, and Middle Ponds had the highest species richness and number of waterfowl food plants in equal amounts, and also each contained a previously undetected food plant species, *Scirpus americanus*. Upper B had the highest seed production index (Table 1). Upper B contained the second highest level of species richness and number of food species of the 5 ponds (Table 2). Diversity and number of food species was lowest on Cottonwood, and seed production index was zero due to the absence of barnyard grass. Cottonwood also had the lowest cover of food species, while Upper B had the highest. Kosmos Pond had the highest cover of undesirable plants, and also was the only pond with a new undesirable species, *Lepidium latifolium*, detected. *Phragmites* spp. was present in Kosmos, Upper A, and Upper B Ponds and cocklebur was present in all ponds. Cover of tall species increased compared to 2017, but was fairly low in all ponds except Cottonwood. Cover of food species decreased in all ponds except for Upper B compared to 2017, and cover of undesirable species increased in all ponds except for Cottonwood (Figure 2).

Middle and Upper B ponds had both highest overall use and BUD by hectare from dabbling ducks (Figure 3). Cinnamon teal (*Anas cyanoptera*), a species not common in the area until April and not previously detected during surveys, was recorded solely on Cottonwood on March 20. Upper B and Middle consistently maintained shallower water depths throughout the survey period and provide good dabbling duck habitat, but Kosmos had the lowest dabbling duck use despite having the highest percentages of shallow water, and similar food plant cover to Middle Pond. Patterns of dabbling duck use among ponds shifted considerably relative to 2017 (Figure 4), with Kosmos and Middle Ponds changing positions most.

The highest numbers of diving ducks occurred on Cottonwood and Middle Ponds, while Upper B and Cottonwood received the highest diving duck use per hectare (Figure 5). Notably, diving ducks were absent from Kosmos and Upper A ponds, representing a decline compared to 2017/2018. Diving duck use is likely a factor of water depth, as Cottonwood, Upper B and Middle had the deepest water throughout the survey season (Figure 6). Water depth may also explain the lack of diving ducks on Kosmos and Upper A: these ponds not only had the shallowest water of all ponds, but decreased in water depth

compared to 2017/2018. Water depths >25 cm generally provide foraging habitat for diving ducks while excluding dabblers.

DISCUSSION

Waterfowl numbers peak in the Cold Springs area in late winter/early spring, and Memorial Marsh provides important habitat at the time. A range of water depths in all ponds provides habitat for both dabbling and diving ducks.

Unit condition data and vegetation data help provide context and explain patterns of waterfowl use in Memorial Marsh Unit. Kosmos and Upper A are shallow and provide a diversity of food resources, but they are small and support low numbers overall. Although Kosmos had high species richness and the highest plant diversity, it also had the most cover of undesirable plants, which may have degraded the habitat quality of this pond and partially explain the lack of waterfowl use it received. Upper B has lower plant diversity than Kosmos, Middle, and Upper A ponds, but supports a robust stand of barnyard grass. Middle and Upper B ponds have high overall use both from dabbling and diving ducks; these two ponds provided both shallow and deeper water depths throughout the survey season.

Cottonwood had similar percentages of shallow water compared to Middle and Upper B, but contained the highest levels of deep water and had few food plants, and only received substantial use from diving ducks. Despite Cottonwood Pond having the lowest species richness and cover of food plants measured during the vegetation survey, it supports a robust stand of pondweed (*Stuckenia* spp), an important food plant for diving ducks (Wersal et al. 2006). Additionally, refuge staff holds water in Cottonwood Pond as long as possible and it receives heavy use by adults and broods, and may be more appropriately managed for brood habitat (F. Healy, pers. comm.).

Differences in dabbling duck use of ponds between 2017 and 2018 appeared to be driven by vegetation more than water depths. With the exception of Middle Pond, ponds that increased in use between years had also increased in desirable vegetation, while reduced dabbling duck use was associated with a decrease in desirable vegetation and an increase in undesirable vegetation. However, changes in the amount of water <25 cm in individual ponds did not have a clear relationship with changes in the distribution of dabbling ducks. Conversely, water depths provide a possible explanation for the increase in diving duck use on Cottonwood relative to Upper B between years. Proportions of water >25 cm deep on Cottonwood in 2018 slightly increased compared to 2017, while the level of deeper water in Upper B decreased in 2018 (an average of 39% of the unit with water >25 cm deep compared to an average of 47%).

Substantial differences in vegetation (plant community composition; cover of desirable, tall, and undesirable plants) were observed compared to 2017. Winter of 2020-21 will be the fifth season of IWMM surveys and a detailed report looking at trends should be prepared. Refuge staff will investigate potential correlations between changes in vegetation, water levels, and bird use numbers, and consider these in management decisions. For instance, vegetation treatments and water manipulations may be scheduled in individual ponds based on any trends observed. This survey may also serve to gauge the effectiveness of any changes in waterfowl management regimes.

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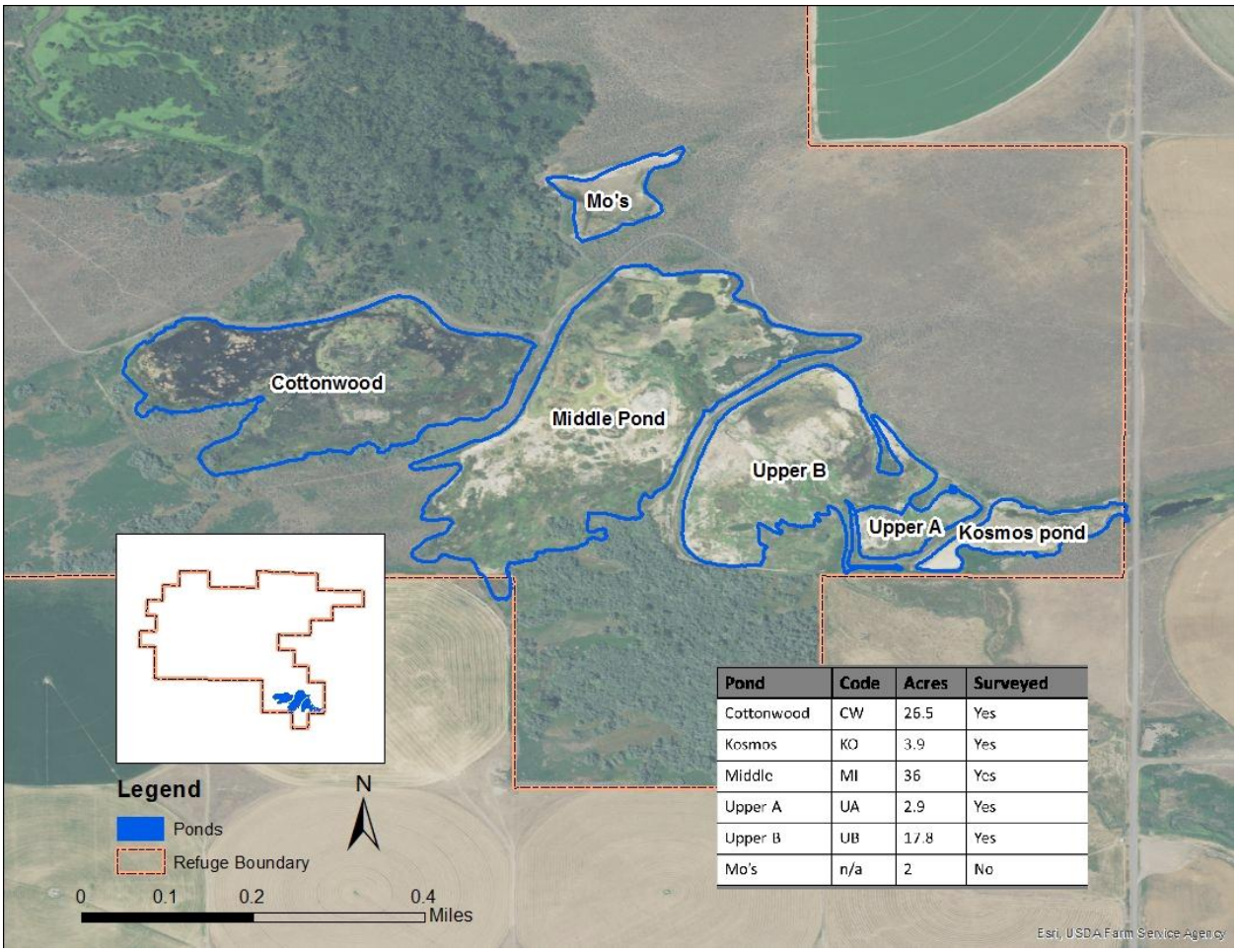


Pond	Code	Acres	Surveyed
Cottonwood	CW	26.5	Yes
Kosmos	KO	3.9	Yes
Middle	MI	36	Yes
Upper A	UA	2.9	Yes
Upper B	UB	17.8	Yes
Mo's	n/a	2	No

Figure 1. Managed ponds in the Memorial Marsh Unit, Cold Springs National Wildlife Refuge.

Tables

Table 1. Vegetation summaries from IWMM reports for ponds in Memorial Marsh Unit, Cold Springs NWR, September 2018.

Pond	**Total Plant Species**	**Diversity Index**	**Annual/Perennial Percent Cover**	**Seed Production Index[1)]**	**Food Species[2)]**
Cottonwood	5	2.96	A:15/P:107		2
Kosmos	10	13.28	A:81/P:72	4	6
Middle	10	8.86	A:58/P:53	3	6
Upper A	10	11.04	A:62/P:68	3	6
Upper B	7	4.34	A:102/P:26	16	5

[1)]Calculated by IWMM, barnyard grass only.

[2)]Desirable plants identified as waterfowl food by refuge staff.

Table 2. Cover of wetland plants in Ponds on Memorial Marsh Unit, Cold Springs NWR, September 2018. Plants were grouped as desirable, tall, or undesirable based on CCP objectives.

			Pond				
Scientific Name	**Common Name**	**Food Value[1]**	**CW**	**KO**	**MI**	**UA**	**UB**
Desirable							
Bolboschoenus maritimus	cosmopolitan bulrush	Med	6	10	6	6	6
Chenopodium album	lambsquarters	Med		6	6	6	6
Crypsis schoenoides	swamp pricklegrass	High		15	30	20	
Echinochloa crus-galli	barnyard grass	High		15	6	6	75
Eleocharis palustris	common spikerush	High	6				6
Panicum capillare	witchgrass	High		10	10	10	15
Schoenoplectus pungens	common threesquare	Med					
Scirpus americanus	chairmaker's bulrush	High		6	6	20	
TOTAL			**12**	**62**	**64**	**68**	**108**
Tall							
Schoenoplectus acutus	hardstem bulrush		15	20	10	6	
Typha latifolia	broadleaf cattail		80		25	30	10
TOTAL			**95**	**20**	**35**	**36**	**10**
Undesirable							
Lepidium latifolium	perennial pepperweed			6			
Paspalum distichum	jointgrass				6		
Phragmites australis	common reed			30		6	10
Xanthium spp.	cocklebur		15	35	6	20	6
TOTAL			**15**	**71**	**12**	**26**	**16**

[1)]Determined by Refuge staff through literature search and professional opinion.

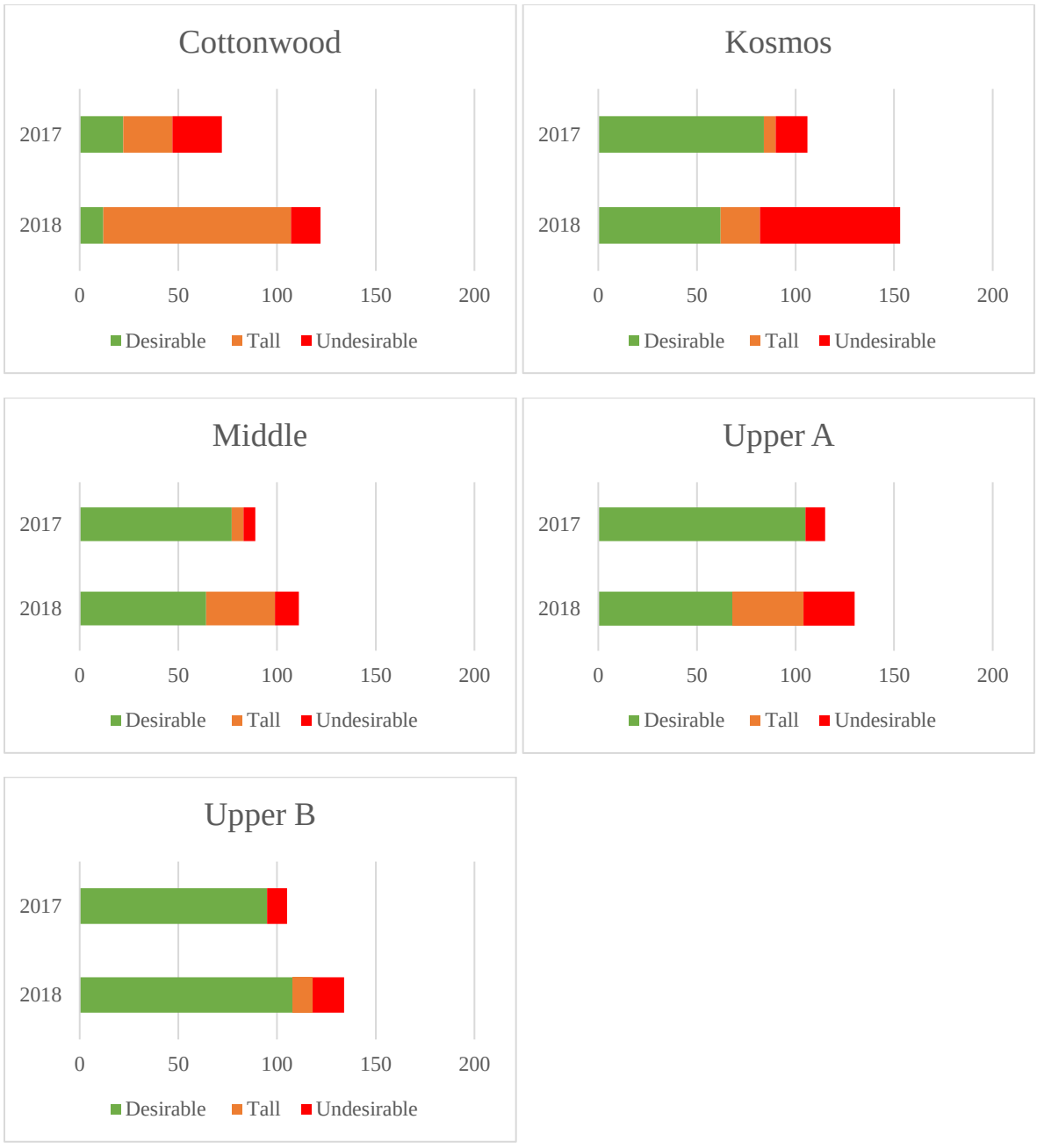
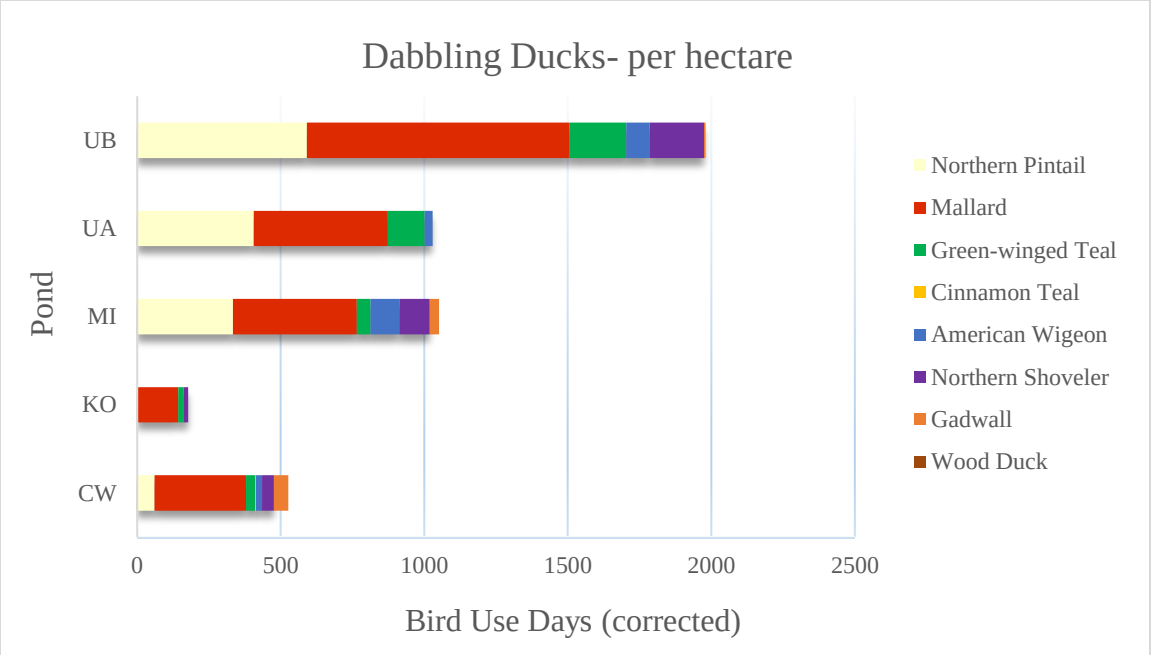


Figure 2. Vegetation cover of desirable, tall, and undesirable plants on Memorial Marsh Unit in September 2017 and September 2018.



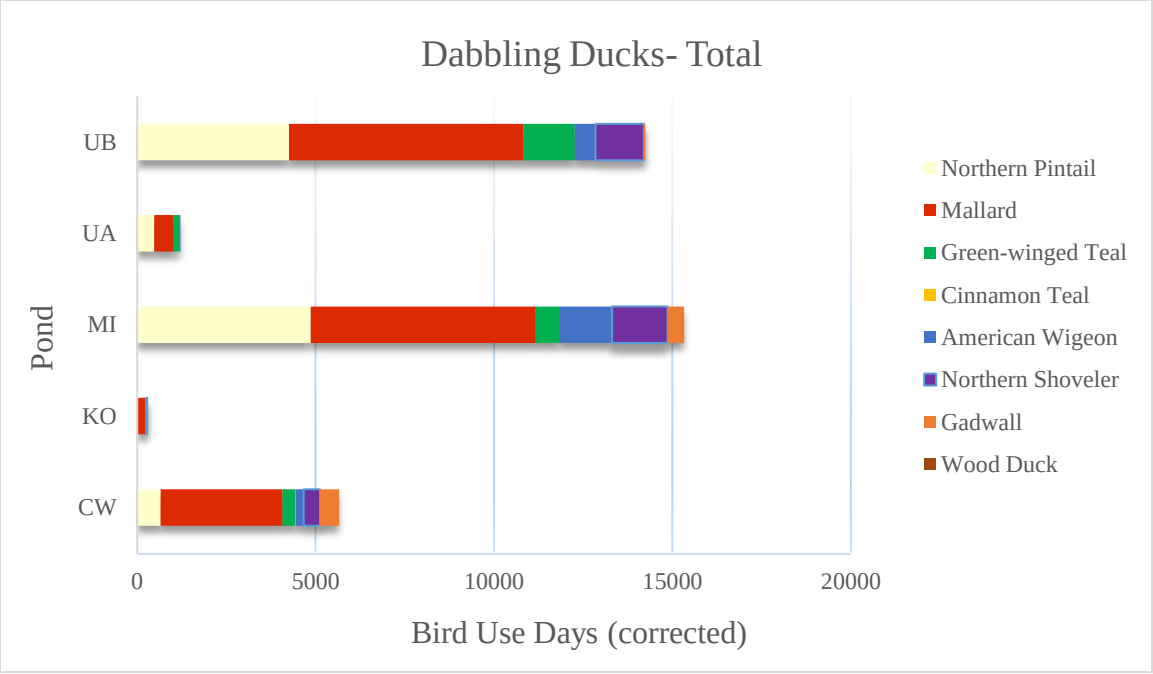


Figure 3. Bird Use Days (BUD) for dabbling ducks on Memorial Marsh Unit, Cold Springs NWR, winter 2018-19. The upper chart shows total BUD while the lower chart shows BUD per hectare, by pond. UB = Upper B; UA = Upper A; MI = Middle, KO = Kosmos; CW = Cottonwood.

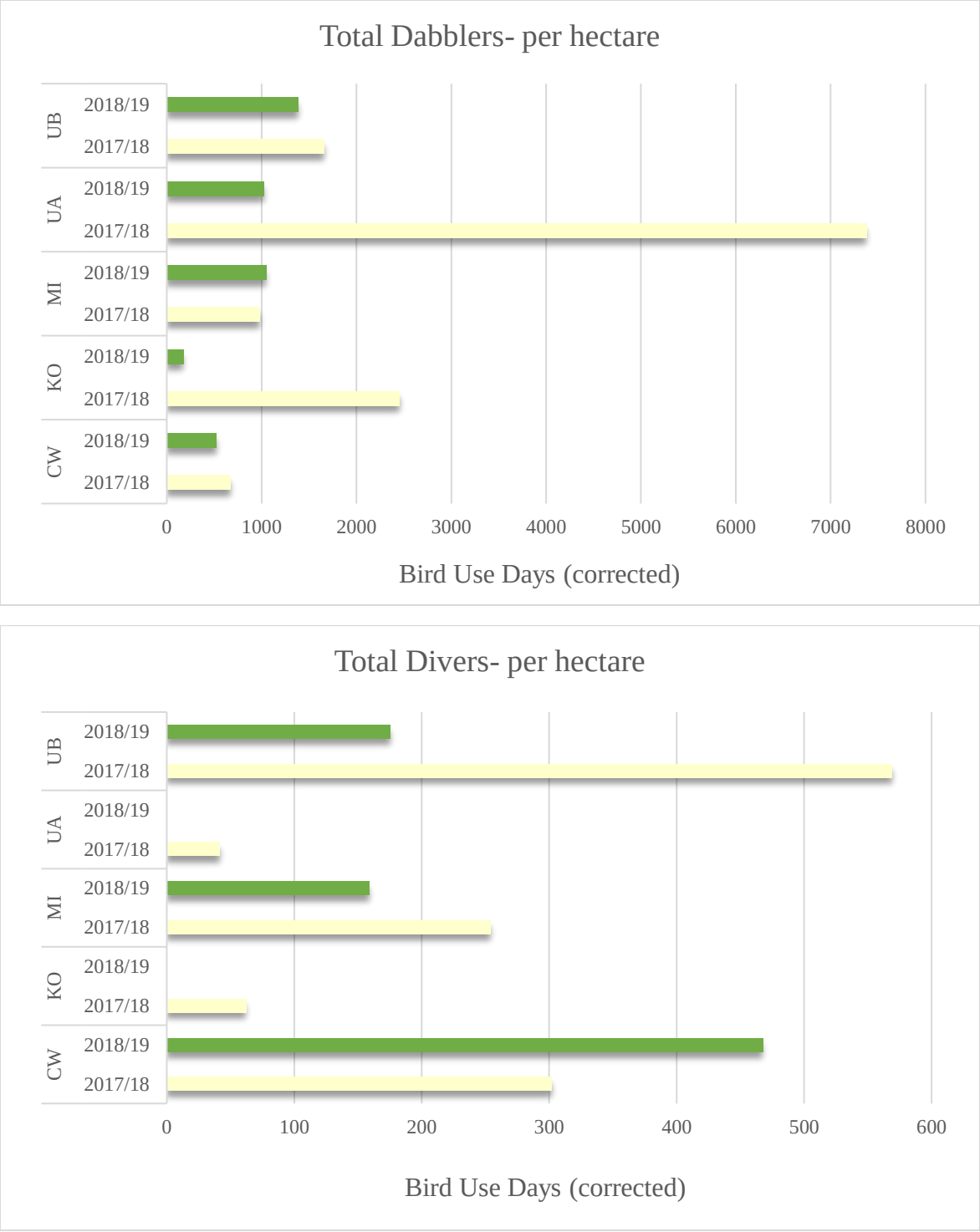
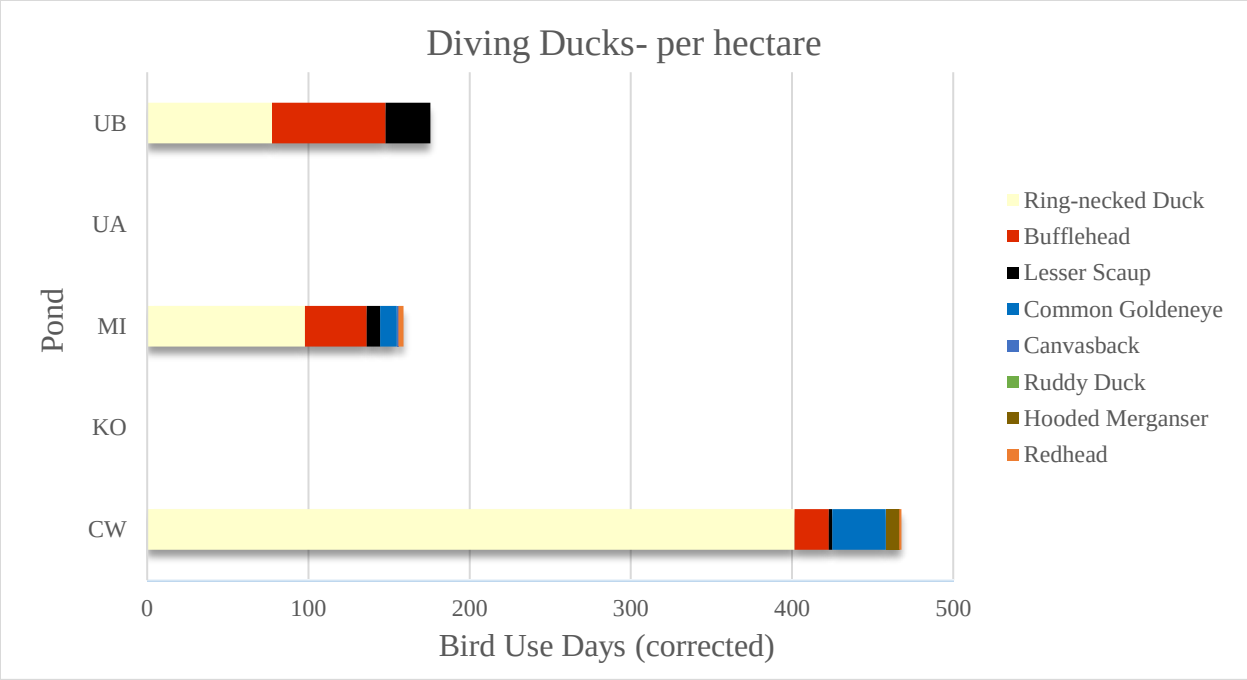


Figure 4. Comparisons of bird use days (BUD) per hectare between winters 2017-2018 and 2018-2019 on Memorial Marsh Unit, Cold Springs NWR. Dabbling ducks are represented in the upper chart, and diving ducks are shown in the lower chart. UB = Upper B; UA = Upper A; MI = Middle, KO = Kosmos; CW = Cottonwood.



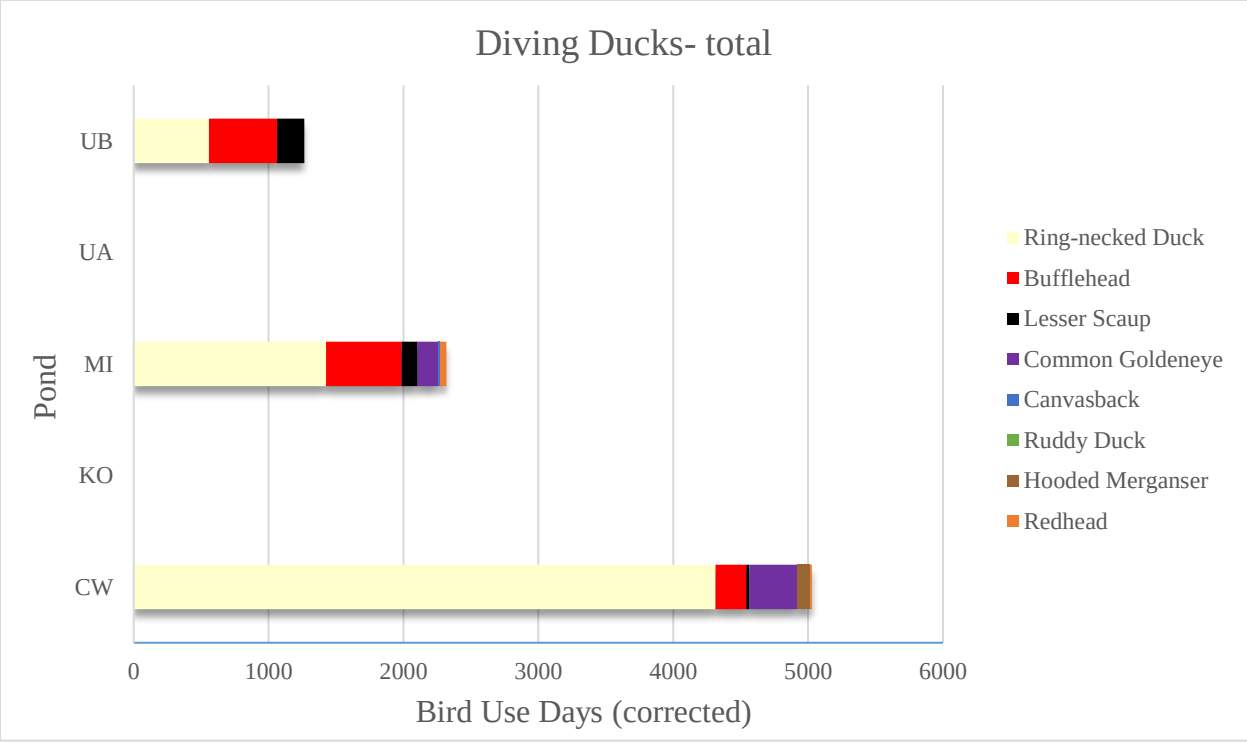


Figure 5. Bird Use Days (BUD) by diving ducks on Memorial Marsh Unit, Cold Springs NWR, winter 2018-19. The upper chart show total BUD while the low chart shows BUD per hectare, by pond. UB = Upper B; UA = Upper A; MI = Middle, KO = Kosmos; CW = Cottonwood.

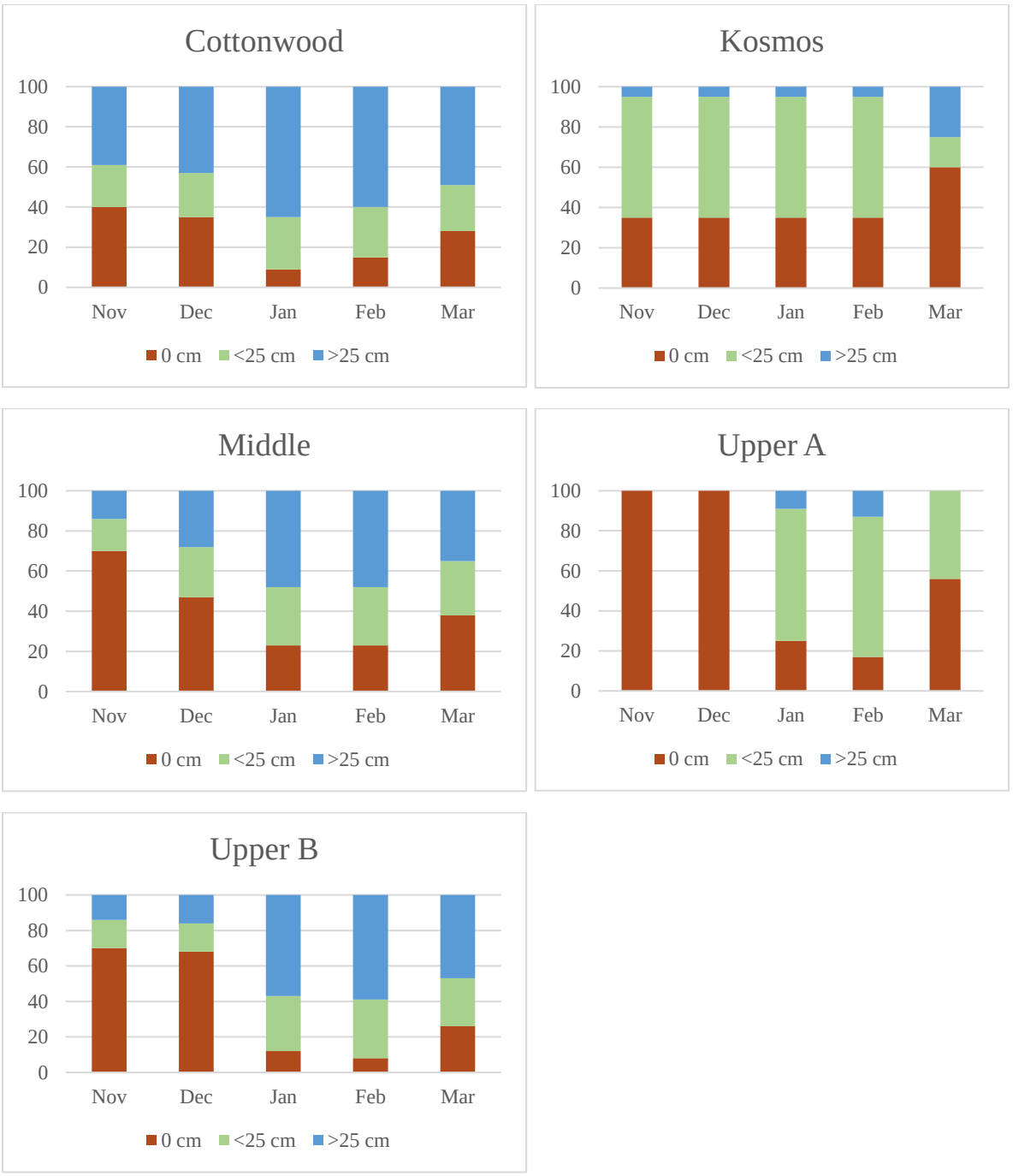


Figure 6. Water depth on the first survey day of the month, Memorial Marsh Unit, Cold Springs NWR, winter 2018-19. Depth classes are based on IWMM and represent water depths used primarily by diving ducks (>25 cm) and dabbling ducks (<25 cm).

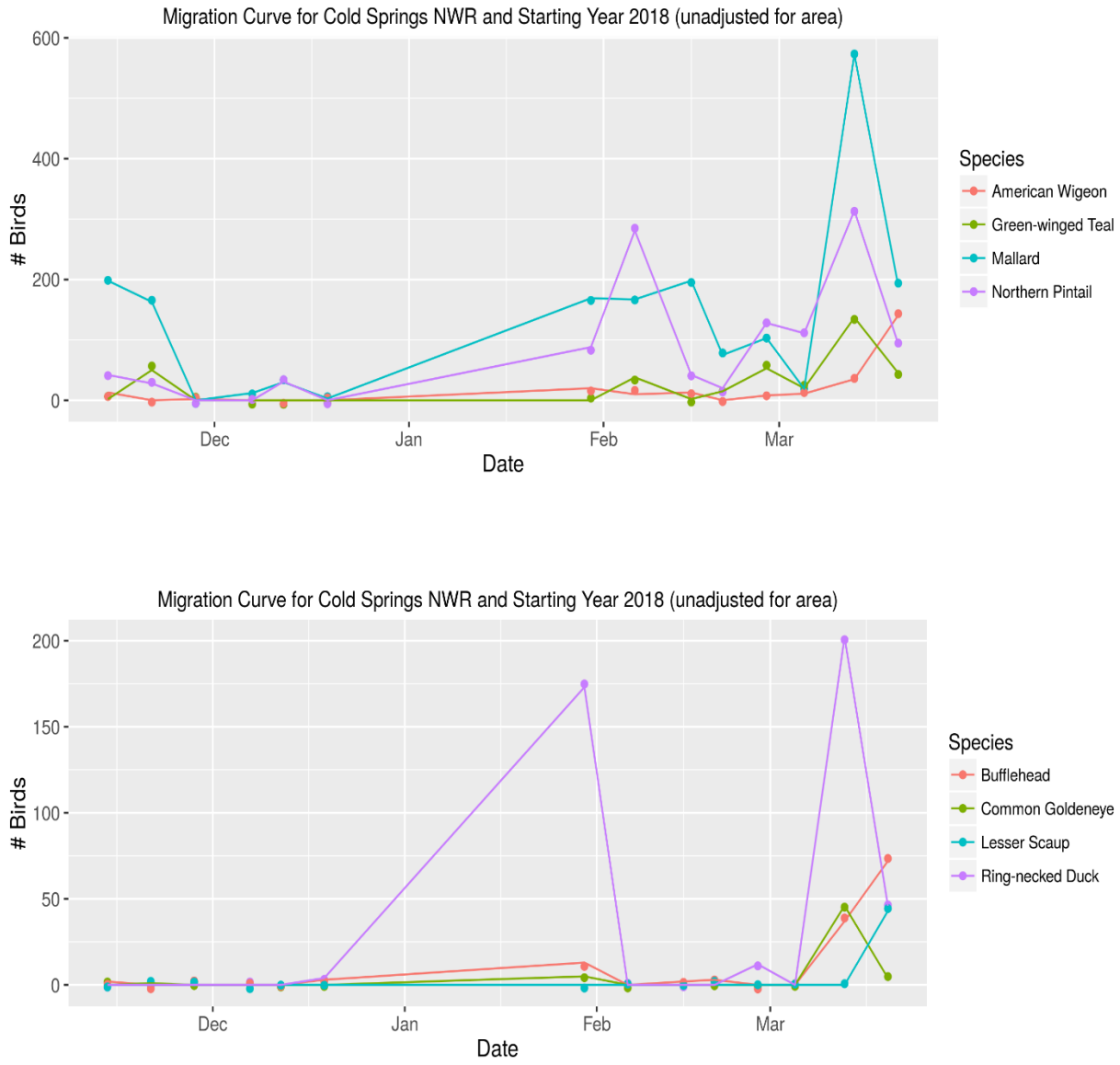


Figure 7. Migration curves for 4 common dabbling duck and 4 common diving duck species on Memorial Marsh Unit, Cold Springs NWR, winter 2018-2019.