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American Coot Nesting and Feeding Habits in Southeastern Washington[1]

Abstract

Nesting and food habits of the American Coot (*Fulica americana*) were studied on the Department of Energy's Hanford Site and Columbia National Wildlife Refuge in Southeastern Washington from 1974 through 1976. Among differences between sites was the presence of low levels of radionuclides on the Hanford Site derived from nuclear fuel reprocessing. Similarities among all nesting habitat were stable water level, moderate to shallow water depth, and emergent aquatic plant communities of cattail and bulrush. Nests found from April through mid-June contained an average of 6.7 eggs per nest. Hatching success was similar at both study sites. Differences found in food habits between study areas were probably related to availability of food items in each pond.

Introduction

The feeding and nesting habits of the American Coot (*Fulica americana*) were studied from 1974 through 1976. Ponds of similar vegetational succession stages and water depth were selected for investigation. These were Gable Mountain Pond, U Pond, and B Pond on the U.S. Department of Energy (DOE) Hanford Site, and Royal Slough, Morgan Lake, and Halfmoon Lake within the Columbia National Wildlife Refuge (NWR) located 15 km north of Othello, Washington. The Hanford site ponds differed from the NWR study ponds, having received small amounts of radionuclides and other contaminants introduced along with process water from nuclear fuel reprocessing facilities.

The objective of this study was to observe possible differences in the nesting biology of coots residing on the contaminated ponds of the Hanford Site and those nesting on the ponds of the Columbia National Wildlife Refuge. Biological features examined were diet, nesting habitat and nest site selection, duration of egg laying and incubation, clutch size, egg and chick weight, and overall nesting success (productivity).

Study Areas

The study areas consisted of shallow ponds, three located on the Hanford site and three

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on the Columbia NWR. The Hanford Site ponds were created to contain liquid waste from nuclear fuel reprocessing facilities (Table 1).

Gable Mountain Pond is the largest of the ponds studied. The water source is primarily coolant water which is discharged continuously. The pond is partly dike-constructed and has not been treated with herbicides to control riparian vegetation. Dense stands of cattails and bulrushes occur around the shoreline and as three island-like patches distributed throughout the pond.

B Pond receives water from a coolant source and a chemical sewer. Shoreline dike construction and herbicide applications in 1971 and 1972 destroyed most riparian and emergent aquatic plants. Some isolated bulrush and cattail patches occur in the pond, but the shoreline is ringed by a narrow zone of barnyard grass. A few willows less than 2 m high occupy one end.

U Pond has received coolant water and other waste water since July, 1944. There was no control of plant growth until July, 1972 when a chemical herbicide was applied which defoliated approximately 80 percent of the cottonwoods and willows. Other species, both terrestrial and aquatic, were less affected. Some of the trees, mostly cottonwoods, showed new growth by the next spring with final recovery of about one-half of the original live canopy cover.

Natural ponds studied on the Columbia NWR were Morgan and Halfmoon Lakes and Royal Slough (Table 1). Morgan and Halfmoon Lakes are connected by a channel. Basalt outcroppings and cliffs form parts of their shorelines. Bulrushes form island-like patches throughout the marshy Royal Slough.

Most of the nesting study data were collected from Gable Mountain Pond and the three ponds on the Columbia NWR. Food study data were collected from all ponds.

Methods and Materials

Visits were made nearly weekly to Gable Mountain Pond, Morgan Lake, Halfmoon Lake, and Royal Slough from late March through July of 1976. Nests were discovered by systematic searching while canoeing and wading. Data recorded included the number of eggs and young present, weight of eggs and young, nest location, cover type, and nest fate. Eggs were counted in each nest during each visit and the date of initiation of laying was estimated by allowing one egg per day (Sooter, 1941; Gullion, 1954). Nests were marked with individually numbered pieces of orange plastic flagging tape tied to nearby vegetation.

For dietary information, coots were collected (by shooting) monthly in 1975 and 1976. The proventriculus and gizzard contents were saved for food habit analysis. Few food items were present in the proventriculi, but most gizzard samples did contain food fragments. The gizzard contents were separated into food and grit by washing with distilled water. Two slides from each gizzard sample were prepared with Hoyer's solution (Hansen and Flinders, 1969) and dried for approximately 72 hr at 60°C. Plant fragments were identified by microscopic examination of epidermic cells. Reference material prepared from plant specimens collected in the study area aided in identification. Twenty microscope fields were examined on each slide and all recognizable fragments recorded. Frequency of occurrence was measured by dividing the number of microscope fields in which a given species occurred by the total number of views x 100 (Curtis and

TABLE 1. Historical and biological information concerning study areas.

Location and pond name	size (ha)	Age year	Date Initiation	Average depth	Dominant emergent aquatic plants	Dominant submergent aquatic plants	Adjacent shoreline vegetation
Hanford Site							
Gable Mountain Pond	29	17	1957	1.6	Cattail (**Tyhpa latifolia**) Bulrush (**Scirpus acuta**)	Pondweeds (**Potamogeton Spp.**)	Big sagebrush (**Artemisia tridentata**) with understory of cheatgrass (**Bromus tectorum**) and Sandberg bluegrass (**Poa sandbergii**) (Cline et al., 1977).
B Pond	19	29	1945	3	Bulrush (**Scirpus acuta**)	Pondweeds (**Potamogeton Spp.**)	Russian thistle (**Salsola kali**) and cheatgrass and barnyard grass (**Echinochloa crus-galli**)
U Pond	6	30	1944	1.5	Bulrush (**Scirpus acuta**) and sedges (**Carex** spp.)	Pondweeds (**Potamogeton Spp.**) and duckweed (**Lemna minor**)	Cottonwoods (**Populus** sp.) and willows (**Salix amygdaloides**) Russian knapweed (**Centurea repens**) and cudweed (**Graphalium margaritacea**)
Columbia NWR							
Morgan Lake	13	—	—	3	Cattail and Bulrush	Pondweeds	Big sagebrush-cheatgrass-Sandberg bluegrass
Halfmoon Lake	6	—	—	1	Cattail and Bulrush	Pondweeds	Big sagebrush-cheatgrass-Sandberg bluegrass
Royal Slough	24	—	—	1	Bulrush	Pondweeds	Big sagebrush-cheatgrass-Sandberg bluegrass

McIntosh, 1950). This value of frequency for a given species was divided by the total of the frequency values for all species and expressed as relative percent frequency.

Results and Discussion

Nesting Habits and Clutch Sizes

All ponds had stable water levels and moderate to shallow (1 to 3 m) depths. Shorelines supported cattail-bulrush communities. These features appear to be important for coot nesting; in particular, cattails and bulrushes serve as nesting and rearing cover.

Nests were floating platforms of cattails and/or bulrushes woven around standing vegetation (Fig. 1). Fifty (76 percent) of the study nests were situated in bulrush (*Scirpus*) stands and 16 (24 percent) in cattail (*Typha*) habitat. A summary of coot nest locations is shown in Table 2.

TABLE 2. Vegetation occurrence and use at coot nesting sites.

Study Area	Vegetation	approximate % occurrence	number of nests	% occurrence
Gable Mountain Pond	**Typha** (cattail)	60	9	64
	Scirpus (bulrush)	40	5	36
Royal Slough	**Scirpus** (bulrush)	100	24	100
Morgan and Halfmoon Lake	**Typha** (cattail)	40	7	25
	Scirpus (bulrush)	60	21	75

Nests containing eggs were observed from mid-April to mid-June, 1976. Guillion (1954) reported that the American Coot lays one egg a day with clutches containing from four to ten eggs. Our data appear to support his findings. Coots we observed finished egg laying in mid-May. Nests with eggs observed in mid-June were thought to be renestings after loss of initial clutch.

We examined 66 coot nests during the course of this study and found 41 used for egg laying. Eleven nests were examined on Gable Mountain Pond, 13 on Halfmoon and Morgan Lakes, and 17 on Royal Slough. The mean clutch size was 6.71 $\pm$ S.E. 0.49. We compared clutch sizes among areas using an ANOVA test and found no significant differences $\alpha = 0.05$. Clutch size data collected in our study are compared to data from other North American areas in Table 3. Clutch sizes of the American coot in southeastern Washington appear to be smaller than those reported in other studies. The reasons for this are presently unclear. Our sample size of 41 clutches may not be ade-

TABLE 3. Clutch sizes of the American Coot.

Number of Clutches	Clutch size	Mean	Location	Reference
11	3-10	6.45	Gable Mountain Pond	Present study
13	1-11	6.08	Morgan and Halfmoon Lakes	Present study
17	1-12	7.35	Royal Slough	Present study
41	1-12	6.71	All ponds	Present study
169	5-13	9.9	Manitoba	Kiel (1955)
104	1-11	6.08	Iowa	Sooter (1941)
347	4-18	7.92	Iowa	Sooter (1941)
281	4-17	9.03	Iowa	Fredrickson (1967)
8	7-10	9.0	California	Gullion (1954)
5	4-8	6.4	California	Gullion (1954)

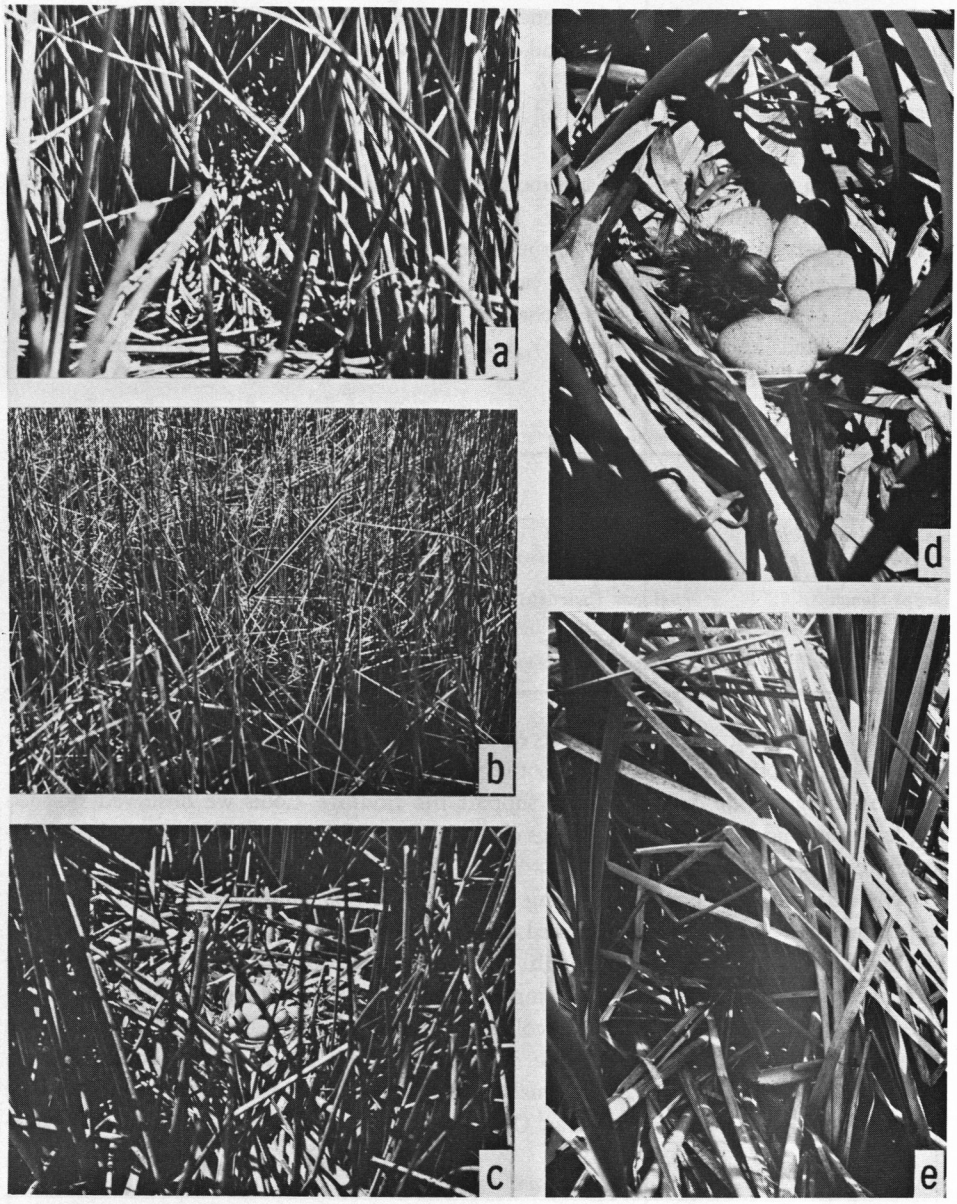

Figure 1. Typical nest structures of the American Coot. a. Approach ramp to nest in bulrush habitat; b. Nest concealed in typical bulrush habitat; c. Clutch in bulrush nest; d. Newly hatched chick in cattail nest; and e. Nest hidden by a dense canopy of cattails.

quate for comparison purposes. Differences may simply reflect population variation in different geographical areas. Clutch sizes reported in this study may not represent the actual (maximum) clutch size because eggs which were destroyed or lost between surveys could not be used in computing clutch size. The mean clutch sizes reported in this study, therefore, represent the minimum clutch size as influenced by natural egg losses

during laying. Table 4 presents the frequency distribution of clutch sizes. These data reveal that clutches from 6 to 10 eggs are most common.

TABLE 4. Distribution of clutch size in the American Coot study areas-1976.

Clutch Size	Gable Mountain Pond	Morgan and Halfmoon Lakes	Royal Slough	Total
1	0	2	3	5
2		1		1
3	1			1
4		1		2
5	1			1
6	5	2	2	9
7	1	1	1	3
8	2	1	5	8
9		2	1	3
10	1		3	4
11		2		2
12			2	2

Egg and Chick Weight

Eggs from a pond in each study area were weighed in May, 1976. Results are shown in Table 5. These data are similar to those reported by Gullion (1954) in California. There are no significant differences in egg weights among coots on Gable Mountain Pond and Morgan Lake and the California birds. We did not statistically compare egg weights among study areas, since expected variations can be accounted for as a function of weight loss through incubation time. Ranges in egg weights do show that there are no gross differences in egg weights among study areas.

TABLE 5. Comparison of weights of American Coot eggs from two study areas.

	Number nests	Weight, g average	range
Gable Mountain Pond (30 eggs) May 12, 1976	4	31.62 ± 0.51	27.2 – 37.0
Morgan Lake May 22, 1976	1	30.8 ± 0.43	29.0 – 32.0
	1	31.0 ± 0.27	30.0 – 32.0
	1	30.0 ± 0.27	28.0 – 31.0
Morgan Lake May 29, 1976	1	29.6 ± 0.41	28.0 – 31.0
(Same eggs as above)	1	29.6 ± 0.24	28.0 – 31.0
	1	28.0 ± 0.24	26.0 – 29.5

Pipping eggs had a mean weight of 25.65 g ± S.E. 0.58 (N = 13). Gullion (1954) provides similar data. As eggs approached the hatching date, they lost weight, which is a common phenomenon in birds. Six chicks weighed immediately after hatching had a mean weight of 19.97 g ± S.E. 0.44 (range 18.5 -21.3 g). Gullion (1954) reported the weight of a newly hatched chick as 22.4 g.

Hatching

The first hatching we observed occurred on Gable Mountain Pond on 12-13 May. The

peak period for hatching on all ponds was approximately 8 June, although a small number of eggs hatched after 20 June. In the 41 nests examined for hatching success (Table 6), only four infertile eggs and no dead embryos were found. Three infertile eggs were found in a clutch of six eggs and one was found in a clutch of eight eggs, both from Royal Slough. Successful nests usually hatched all eggs; unsuccessful nests usually resulted from loss of an entire clutch.

TABLE 6. Percentage of successful American Coot nests.

Nests Number	% Success	Location	Reference
66	92	Washington	Present study
14	100	G. M. Pond	Present study
17	89	Royal Slough	Present study
13	92	Morgan and Halfmoon Lakes	Present study
104	91	Iowa	Sooter (1941)
347	77	Iowa	Sooter (1941)
380	97	Manitoba	Kiel (1955)
161	86	Iowa	Fredrickson (1967)

Food Habits

The gizzard contents of 95 adult and 48 juvenile coots were analyzed. Eighty-nine coots were collected from Gable Mountain Pond, 25 from B Pond, 14 from U Pond and 15 from the NWR. Vegetable material made up 79 percent of the food eaten by the juveniles and 89 percent of the food eaten by the adults (Table 7). The most common plants eaten were pondweeds, water milfoil (*Myriophyllum* sp.), and filamentous algae.

TABLE 7. Food of the American Coot in Southeastern Washington.

	Plants	% Frequency ± S.E. Juvenile Diet N = 48	% Frequency ± S.E. Adult Diet N = 95	Total
Plants	Thallophyta			
	Algae			
	Filamentous algae	18.2 ± 0.3	22.5 ± 0.2	21.2 ± 0.2
	Chara sp (muskgrass)	1.6 ± 0.1	4.5 ± 0.2	3.7 ± 0.1
	Spermatophyta			
	Najadaceae			
	Potamogeton sp (pondweed)	22.5 ± 0.3	21.2 ± 0.2	21.2 ± 0.2
	Potamogeton pectinatus (Sago pondweed)	19.5 ± 0.5	16.7 ± 0.3	17.2 ± 0.3
	Cyperaceae			
	Scirpus sp (bulrush)	0.2 ± 0.1	0.4 ± 0.1	0.3 ± 0.1
	Lemnaceae			
	Lemna sp (duckweed)	0.5 ± 0.4	0.5 ± 0.2	0.5 ± 0.2
	Typhaceae			
	Typha latifolia (cattail)	0.6 ± 0.3	0.5 ± 0.2	0.5 ± 0.2
	Ranunculaceae			
	Ranunculus aquatilis (white water crowfoot)	0.2 ± 0.2	2.9 ± 0.2	2.1 ± 0.5
	Haloragidaceae			
	Myriophyllum sp (watermilfoil)	14.0 ± 0.4	17.0 ± 0.2	17.2 ± 0.2
	Undetermined vegetation	2.2 ± 0.1	2.7 ± 0.2	2.5 ± 0.2
Animals				
	Invertebrates	20.5 ± 0.5	11.1 ± 1.6	13.6 ± 0.2

Animal materials (Odonata, Diptera, Coleoptera, Hemiptera) made up 21 percent of the food eaten by juveniles. Juvenile coots from 1 to 120 days of age were pooled in our dietary analysis and hence our values very probably underestimate the true importance of invertebrates to birds from 1 to 30 days old. Sooter (1941, p. 91) states that "animal food material was evidently of more importance with the youngest coots, for older juveniles and adults had eaten only a small percent of this type of food."

No vertebrate remains were found in any of the coot stomachs we examined, although we did observe adult coots feeding on goldfish at Gable Mountain Pond. However, in view of our analyses of the stomach contents of 143 coot and the known feeding habits of the species, it appears unlikely that coots consume many fish.

Our study reflects changes in food habits of the coot on the Hanford Site since the 1950s. Hanson and Browning (1957) did not find pondweeds in their dietary analysis of coots inhabiting ponds on the Hanford Site. In the late 1950s, the ponds (Fitzner and Price, 1973; Fitzner and Rickard, 1975) were relatively new and pondweeds had not yet become established. Gable Mountain Pond was not even created until 1957. At that time, smartweed (*Polygonum* spp.), bulrush, and wild millet (*Echinochloa* sp.) were present and served as food for the coot. Table 7 lists the food consumed in 1976 by coots in the study areas. The ponds on the Hanford Site have abundant algae because there is no outflow, but the ponds of the Columbia Wildlife Refuge have little algae because there is some water flow. Since coots are fairly opportunistic in their selection of foods (Sooter, 1941), we assume that they would eat food in proportion to its availability. Our food habit analyses confirm the findings of Sooter (1941), Jones (1940), Hanson and Browning (1957), and Eley and Harris (1976), which reported that coots feed primarily on plant materials. Sooter (1941) and Jones (1940) noted that animal foods were more important to juvenile coots than adults.

Our studies of the American coot show that the differences in feeding and nesting habits among sites result from differences in availability of food and cover as they do in other studies in the United States and not from the presence of waste in the manmade ponds.

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