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AN EVALUATION OF A SELF-GUIDED VISITOR TOUR AT BEAR RIVER MIGRATORY BIRD REFUGE

by

Steven J. Kohler

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Wildlife Biology

Approved:

UTAH STATE UNIVERSITY
Logan, Utah

1971

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Steven J. Kohler

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ABSTRACT

An Evaluation of a Self-guided Visitor Tour

At Bear River Migratory Bird Refuge

by

Steven J. Kohler, Master of Science

Utah State University, 1971

Major Professor: Dr. Jessop B. Low
Department: Wildlife Resources

In 1967 this study was initiated to evaluate the self-guided visitor tour of Bear River Migratory Bird Refuge. A 20 page visitor information booklet and tour guide was prepared and published for distribution at the refuge, and its effectiveness in telling the refuge story was evaluated. To gain a measure of the self-guided tour in terms of quality, visitor use patterns and satisfactions were critically examined.

To gather data on visitor use of the refuge, the visiting public was directly sampled by three methods: mail questionnaires, on-site interviews and candid tower observations of groups on the tour.

The information and tour guide booklet was not as effective as it should have been in telling the refuge story. Only one-fourth of the visitor groups purchased the guide, and only about half of these groups used it to any degree at the refuge.

Based on expressions of visitor satisfaction, the self-guided tour at Bear River Refuge should be termed a quality recreational activity. The continued quality of the tour depends upon sustained proper management and development of the refuge area to maintain it as a prime nesting and feeding area for migratory birds. (113 pages)

INTRODUCTION

Participation in outdoor recreation activities has been increasing rapidly for several years. Major factors behind this rapid rise have been increased total population, higher personal income, greater leisure time and better travel facilities (Fitch and Shanklin, 1970). Since each of these factors is expected to show higher values for the future than today, the trend toward still greater use of outdoor recreation areas presumably will continue.

Importance of Outdoor Recreation

About 90 percent of all Americans participated in some form of outdoor recreation in the summer of 1960. In total, they participated in one activity or another on 4.4 billion separate occasions. It is anticipated that by 1976 the total will be 6.9 billion and by the year 2000 it will be 12.4 billion--a threefold increase by the turn of the century. The demand for outdoor recreation is surging. Whatever the measuring rod, it is clear that Americans are seeking the outdoors as never before, and this is only a foretaste of what is to come (Outdoor Recreation Resources Review Commission, 1962).

Recreation on National Wildlife Refuges

The bureau of Sport Fisheries and Wildlife on June 30, 1966 administered 304 units of the National Wildlife Refuge System, containing 28,347,305 acres in 45 states (U.S. Department of the Interior, 1967). These lands are open on a seasonal basis to recreation.

Recreational use of national wildlife refuges has increased

rapidly. From 1951 (3½ million visits) to 1956 this use showed an increase of 115 percent, compared with an increase of 48 percent for the National Park System and 75 percent for the national forests for the same period (Clawson, 1959). In 1960, recreationists made 10,754,000 visits to national wildlife refuges--more than double the number in 1954 (Frederic Burk Foundation for Education, 1962). There were over 14 million visits made in 1964, 15.6 million in 1967 and 19.6 million in 1968, a 26 percent increase in one year (U.S. Department of the Interior, 1970). The number of visits has almost doubled in less than 10 years. It appears that the national wildlife refuges will be called upon to handle an even bigger number of recreationists in future years.

Bear River Refuge

While overall recreational visits to national wildlife refuges have experienced this rapid increase, use of Bear River Refuge has remained rather static (Table 1). Annual total of visits for a 21 year period from 1949 to 1969 has fluctuated around 20,000. with a high of 24,317 in 1968 and a low of 16,198 in 1955.

The chief recreational feature of this refuge, aside from hunting and a limited amount of fishing has been a self-guided visitor loop, consisting of 12 miles of dike road, which visitors are permited to drive around. Use of this loop for self-guided nature tours has also remained comparatively static, fluctuating from a high of 14,620 persons in 1951 to a low of 10,362 for 1955 over a 19 year period of 1951 to 1969 (Table 1). The only increase trend evident in the refuge visitor use pattern was a rather abrupt rise in the number of persons in organized educational and school groups participating in visitor tours.

Table 1. Persons making recreational visits to Bear River Refuge for the period of 1940-1969 (source, Bear River Refuge visitor use record)

Year	Total visitor use	Fishing		Hunting		Tours			
		number	percent	number	percent	number	percent		
1940	12,686	824	6.5	4,685	36.9	7,177	56.6		
1941	9,810	944	9.6	1,339	13.6	7,527	76.7		
1942	8,385	725	8.6	4,509	53.8	3,151	37.6		
1943	6,717	1,200	17.9	3,646	54.3	1,871	27.9		
1944	6,786	1,050	15.5	3,902	57.5	1,834	27.0		
1945	8,702	675	7.8	4,562	52.4	3,465	39.8		
1946	12,138	1,800	14.8	4,562	37.6	5,776	47.6		
1947	8,974	500[a]	5.6	3,155	35.2	5,319	59.3		
1948	15,619	600	3.8	4,682	30.0	10,337	66.4		
1949	19,567	1,500[a]	7.7	5,775	29.5	12,292	62.8		
1950	21,033	1,000	4.8	6,605	31.4	13,428	63.8		
						Educational tours		Self-guided nature tours	
						number	percent	number	percent
1951	22,473	1,000	4.4	5,674	25.2	1,179	5.2	14,620	65.1
1952	18,462	850	4.6	4,765	25.8	719	3.9	12,128	65.7
1953	22,308	1,380	6.2	6,417	28.8	1,083	4.9	13,428	60.2
1954	19,645	1,117	5.7	5,748	29.3	566	2.9	12,214	62.2
1955	16,198	1,455	9.0	3,868	23.9	513	3.2	10,362	64.0
1956	16,619	1,767	10.6	3,636	21.9	771	4.6	10,445	62.8
1957	18,307	1,425	7.8	4,866	26.6	816	4.5	11,200	61.2

Table 1. Continued

Year	Total visitor use	Fishing		Hunting		Educational tours		Self-guided nature tours	
		number	percent	number	percent	number	percent	number	percent
1958	20,759	1,398	6.7	5,268	25.4	964	4.6	13,129	63.2
1959	18,721	1,644	8.8	3,661	19.6	412	2.2	13,004	69.5
1960	17,818	1,543	8.7	3,405	19.1	875	4.9	11,995	67.3
1961	18,332	1,500	8.2	2,459	13.4	991	5.4	13,382	73.0
1962	18,973	1,500	7.9	3,700	19.5	873	4.6	12,900	68.0
1963	20,478	704	3.4	4,652	22.7	818	4.0	14,304	69.9
1964	16,601	996	6.0	4,105	24.7	858	5.2	10,642	64.1
1965	20,495	935	4.6	4,810	23.5	1,787	8.7	12,963	63.2
1966	24,138	1,159	4.8	5,039	20.9	1,432	5.9	16,508	68.4
1967	22,018	800	3.6	5,981	27.2	1,200	5.5	14,037	63.8
1968	24,317	683	2.8	4,655	19.1	4,500	18.5	14,479	59.5
1969	20,739	807	3.9	4,039	19.5	4,596	22.2	11,297	54.5

[a]Estimated.

From an average of 933 persons between the years 1951 and 1956, persons in educational tour groups increased to 4,500 in 1968 and 4,596 in 1969. This was an increase of 381 percent over the 1951-1967 average for 1968 and 393 percent for 1969 (Table 1). In almost all cases educational groups were provided with one of the refuge personnel to act as a guide for the duration of the visitor loop.

Study Objectives

A serious problem in realizing the greatest potential in outdoor recreation is one of quality. A substantial proportion of the users of various recreational areas experience only a limited number of the recreational opportunities possible. Perhaps more emphasis should be placed upon the quality of individual experience rather than upon quantity in terms of more and more visitors.

It is difficult to pinpoint possible causes for the relatively static visitor use pressure of Bear River Refuge, when refuges as a whole are experiencing rapid increases. The general purpose of this study was to critically examine the self-guided visitor tour of the refuge in an attempt to learn what type of persons visited Bear River Refuge, where they came from, what they came for, how long they stayed, and to gain a measure of Bear River's self-guided tour in terms of quality.

At the time this study was initiated, the refuge was in the process of preparing a visitor guide in an attempt to upgrade their recreational program. It was decided to include this booklet in the study and to determine its use and acceptance by the visiting public. The booklet also served as a tool for measuring, in that two visitor groups could

be compared: one group who purchased the guide booklet and another group who did not purchase it. This comparison was maintained throughout the study in an attempt to determine the effect of the booklet on the self-guided tour.

Since the greatest share of visitors to the refuge came in single car groups and guided themselves around the visitor loop, the study was restricted to this segment of the visitor population. Specific objectives followed in accomplishing the general purpose of this study were:

(1) To carry out plans of the Bear River Refuge for setting up a visitor tour.

(2) To prepare a visitor information booklet and guide for a tour of the refuge.

(3) To determine the effectiveness of the visitor guide in telling the refuge story.

(4) To evaluate self-guided tour use by studying the characteristics, activities and satisfactions of the visitors.

(5) Evaluate the quality of the self-guided visitor tour at Bear River Refuge and its value as a form of outdoor recreation.

LITERATURE REVIEW

According to Clawson (1963), the whole recreation experience consists of five phases, each having importance in recreational decisions made by visitors. These five phases are: (1) planning or anticipation; (2) travel to the recreation site; (3) experience at the site; (4) travel back; and (5) recollection of the trip and experience. Much of the attention of planners and administrators is devoted to on-site experience (phase 3), but the author stressed that a recreational visit is much more than the experience at the site.

Research scientists should conduct studies of the needs, interests and problems of the recreational visitor (Hutchison, 1962). Clawson (1959) stated that in dealing with the problem of outdoor recreation, one of the first things necessary is to collect better statistics on attendance and gain a better understanding of what they mean. More should be learned about the people who use recreational lands, where they come from, how long they stay and what they come for.

Driving and walking for pleasure lead the list of outdoor activities participated in by Americans, and driving for pleasure is most popular. This is generally true regardless of income, education, age or occupation. Top activities in the total outdoor recreation picture and percent participation are: pleasure driving, 20.7 percent; walking for pleasure, 17.9 percent; playing outdoor games or sports, 12.7 percent; swimming, 6.5 percent; and sightseeing, 5.9 percent (Outdoor Recreation Resources Review Commission, 1962). If pleasure driving and sightseeing are combined, over one-fourth of all recreational activities of Americans are done from an automobile.

Recreation on Federal Refuges

National wildlife refuges have been slow in getting into the recreation picture. As late as 1962, these lands were not considered a recognized part of the recreational resource. The Outdoor Recreation Resources Review Commission (1962) in their report to the President and Congress stated that the Bureau of Sport Fisheries and Wildlife (administrator of the National Wildlife Refuge System) supposedly operates to conserve fish and wildlife, and not to provide a recreation resource. According to their findings, the refuges (1962) are not equipped with either facilities or personnel to handle the large and increasing visitor load. Results indicate that on many areas even the most basic facilities have not been provided for visitors, and that refuge personnel have had to leave their primary duties to manage and control visiting recreationists. Congressional recognition of public recreation on national wildlife refuges has been extremely slow in coming.

Although the Bureau of Sport Fisheries and Wildlife has the sole responsibility for management of fish and wildlife on all refuge areas, its responsibility for outdoor recreation is varied. It ranges from full responsibility on most areas to shared jurisdiction on others, and only secondary involvment in some instances (U.S. Department of the Interior, 1967). Current recreational policy is stated thus:

> The lands and waters of the National Wildlife Refuge System offer significant opportunities for outdoor recreation. However, outdoor recreation on the refuges is a secondary consideration. Bureau of Sport Fisheries and Wildlife allows recreation uses where there is a significant local or national need which can be met while maintaining the primary objectives for the areas and their facilities; where public safety and welfare can be assured; and where there will be no duplication of adequate recreational

> facilities on national, State, or local forests and parks within a reasonable distance.
>
> The Bureau of Sport Fisheries and Wildlife promotes recreation pursuits associated directly with wildlife in its habitat. Priority is given to recreation facilities and services which foster the enjoyment of fish and wildlife. . . . (U.S. Department of the Interior, 1967, p. 77)

In the broadest sense, the wildlife refuges make their greatest contribution to Americans through their recreational opportunities. They provide opportunities for boating, fishing, swimming, hunting, and most important, opportunity to observe and photograph wildlife in its natural habitat (U.S. Department of the Interior, 1960).

The information program of the Bureau of Sport Fisheries and Wildlife strives through a variety of means and media to achieve these objectives:

(1) Give visitors an understanding of and appreciation for the natural and historical aspects of the area.

(2) Explain the Federal management practices being applied to the area.

(3) Enhance the stay of the visitor on Federal lands (U.S. Department of the Interior, 1967).

A search of the literature failed to reveal any specific studies or works done on any particular area in the National Wildlife Refuge System. The foregoing policies of the administrators of the refuges have been presented as a background to show the relatively new position of refuges in the recreation picture.

Specifically, Bear River Refuge, to the knowledge of the author, is unique among the refuge system in its operation of the self-guided tour in conjunction with the visitor guide booklet. Aransas Refuge in

Texas has a visitor loop road, as do Bitter Lake Refuge in New Mexico and Fort Niobrara Refuge in Nebraska, among others. Santa Anna Refuge in Texas operates a self-guided nature trail for visitors to walk around a part of the refuge (Gunther, 1970).

Related Studies

While visitor use studies have not been made on wildlife refuge areas, they have been conducted on other Federal and State recreation areas. Visitor studies were conducted by staff members of the University of South Dakota at Lewis and Clark Lake, a Federal project on the Missouri River (Evans and Van Doren, 1960 and Montgomery, 1961). Visitor interviews were held to measure visitor characteristics and expenditures.

The University of Nebraska conducted a similar study in the southwest part of that state to investigate the demand for recreation at three artificial lakes (Palmer, 1960). Origin of visitors by county was obtained along with socio-economic data on visitors. Another study in Nebraska (Barr, 1969) is a continuing project by the Nebraska Game and Parks Commission to explore use patterns of State recreation areas. Each area will be surveyed every 5 years by means of on-site interviews to determine user characteristics, origin of visitors, and type of use recreation areas receive. Data from the surveys will be used to point out changes in use patterns over a period of time as well as to identify use at a particular point. The study is in its third year.

A Utah study (Richardson and Peery, 1966) on recreational demand by Utah residents showed that Utahns have a higher rate of participation in outdoor recreation than the national average. Hewston (1966)

in a three-year study of recreational use patterns at Flaming Gorge Reservoir in Utah and Wyoming found that sightseeing was the most popular activity during the 3 years of the study.

STUDY AREA

Bear River Migratory Bird Refuge is one of over 300 areas which make up the National Wildlife Refuge System. It is administered by the Bureau of Sport Fisheries and Wildlife of the Fish and Wildlife Service, which is under the supervision of the U.S. Department of the Interior. Total area of the refuge is 64,900 acres. It is located in northern Utah on the delta formed by Bear River as it empties into the Great Salt Lake. The refuge is reached by a paved two-lane road leading 15 miles west from Highway 30 S in Brigham City.

The area consists largely of an extremely level mud flat, which in the developed portion of the refuge, is divided into management units by dikes. The units are flooded to an average depth of 1 foot by a system of canals distributing the water of the Bear River. Roads are maintained on several of the dikes for management purposes, and a 12 mile loop of road around unit 2, one of five main management impoundments, is designated as the visitor tour.

Developments in the headquarters area of the refuge include the refuge office and administration building, two restroom buildings, a newly completed visitor center (1969), a research laboratory, experimental ponds, three residences, a 100 foot observation tower and several utility buildings. There is also a camping and picnic area provided with tables on concrete slabs and barbeque grills. Drinking water is trucked from Brigham City to a storage tank and is available to the public from two drinking fountains and a hydrant.

The primary purpose for the establishment of the refuge was to

provide and preserve suitable resting, feeding and breeding areas for migratory birds. A secondary objective was to minimize losses to avian botulism (Public Law, 1928). During peak use by fall and early spring migrations it is possible that as many as a million waterfowl are on the area (Wilson and Carson, 1959). During the spring and summer, approximately 60 species of birds nest and raise their young on the refuge (Gunther, 1970). It is this opportunity of seeing large numbers of wild birds in their native habitat that is responsible for the bulk of recreational visits to Bear River Refuge.

The entire refuge lies on the floor of the Great Salt Lake Valley at an elevation of slightly more than 4,200 feet. The Wasatch Mountains form the valley wall to the east and rise as high as 10,000 feet. A lower range of mountains, the Promontories, lies to the west. Chief vegetation of the shallow open water areas is sago pondweed (*Potamogeton pectinatus*), the most valuable duck food plant in Utah. Muskgrass (*Chara* sp.) and widgeongrass (*Ruppia maritima*) are also common in these areas. Emergent vegetation in the marsh areas includes alkali bulrush (*Scirpus paludosus*), hardstem bulrush (*S. acutus*) and cattail (*Typha latifolia*). Saltgrass (*Distichlis stricta*), is the dominant plant of the higher ground (Nelson, 1966).

Refuge History

As ancient Lake Bonneville receded to form Great Salt Lake, marshes developed at the mouths of rivers and streams, creating waterfowl habitat (Wilson and Carson, 1959). Recent archaelogical findings have shown that waterfowl were an important item in the diet of Indians living near the mouth of the Bear River (Aikens, 1966 and 1967). These

birds must have been present in large numbers to be accessible to the Indians.

Early explorers to the area found extensive marshlands. Captain John C. Fremont gave the following description in his official report of a visit on September 3, 1843:

> The waterfowl made this morning a noise like thunder. A pelican (Pelecanus onocrotatus) was killed as he passed by, and many ducks and geese flew over the camp. Decending the river for about three miles in the afternoon, we found a bar to any further travelling in that direction--the stream being spread out in several branches, and covering the low grounds with water, where the miry nature of the bottom did not permit any further advance. We were evidently on the border of the lake, although the rushes and canes which covered the marshes prevented any view; and we accordingly encamped at the little delta which forms the mouth of Bear River; a long arm of the lake stretching up to the north between us and the opposite mountains. The river was bordered with a fringe of willows and canes, among which were interspersed a few plants; and scattered about on the marsh was a species of Uniola, closely allied to U. spicata of our sea coast. The whole morass was animated with multitudes of waterfowl, which appeared to be very wild--rising for the space of a mile round about at the sound of a gun, with a noise like distant thunder. Several of the people waded out into the marshes, and we had tonight a delicious supper of ducks, geese, and plover. (Fremont, 1845)

A few years later on October 22, 1849, Captain Howard Stansbury, making a reconnaissance of a new route through the Rocky Mountains, arrived at Bear River Bay. He wrote:

> The marshes were covered by immense flocks of wild geese and ducks among which many swans were seen, being distinguishable by their size and the whiteness of their plumage. I had seen large flocks of these birds before, in various parts of our country, and especially upon the Potomac, but never did I behold anything like the immense numbers here congregated together. Thousands of acres, as far as the eye could reach, seemed literally covered with them, presenting a scene of busy, animated cheerfulness, in most gracefull contrast with the dreary, silent solitude by which we were immediately surrounded. (Stansbury, 1852)

Mormon settlers arrived in Salt Lake Valley in 1847. As settlements grew demands for irrigation water from the Bear River and its tributaries intensified and marsh areas in Bear River Bay dwindled. At

the same time, market hunters and avian botulism cut deeply into waterfowl populations. Large portions of the remaining marsh areas were bought or leased by sportsmen's groups, the Utah Fish and Game Commission and the Federal government in an effort to save the rapidly disappearing waterfowl and habitat. The establishment of Bear River Refuge by a special act of Congress on April 23, 1928 was the result of this effort, as well as the establishment of several state waterfowl management areas.

In 1930 contracts were let for construction of the Bear River Refuge dikes, and drag lines began work that same year. By August 31, 1931 the impoundment areas were ready to be flooded. Civilian Conservation Corps workers continued the development of the refuge during the 30's (Gabrielson, 1943). The refuge was much in its present state by 1940 (Gunther, 1970).

Self-guided Tour

In 1937 the dike road around unit 2 of the refuge had been improved enough so that visitors began to use it regularly to tour the refuge (Bear River Migratory Bird Refuge, 1937).

Gabrielson, speaking of Bear River Refuge a short time later states:

> The waters pouring over the spillway are the favorite hunting grounds for herons, forster's terns, snowy egrets, cormorants, and even an ocassional kingfisher. In fact, the show here is so good that many visitors watch the ever-changing panorama of bird life at this vantage point, and depart entirely satisfied with what they have seen. A few take time to go to the dikes where they can see the infinitely greater spectacle of life presented by the marshes themselves. (Gabrielson, 1943, p. 152)

Later in the 1940's the tour had grown in popularity and was seeing considerable use by visitors (Muller, 1948).

From its beginning in 1937 until 1965, the self-guided tour was merely a drive around a section of dike road, with no attempt at interpretive or other recreational facilities. In 1965, two turnouts were provided on the tour route and two low observation platform towers (Figure 1) were constructed at these turnouts for visitor use. In 1966 a 50 foot tower (Figure 2) constructed in 1934 for law enforcement work on the northern end of the refuge was moved to another turnout on the tour for visitor use. Interpretive signs were placed at the 50 foot tower (Figure 3) and two additional turnouts (Figures 4 and 5) in 1966, bringing the total number of turnouts on the tour to five. Original plans of the refuge called for numbered signs designating the different turnouts as station stops (Figures 2 and 6) which were aquired in 1966, but not installed until June of 1969, when data collection on tour use was begun.

Original refuge plans for the tour also included an interpretive sign pointing out various islands and landmarks of the Great Salt Lake, which was to be attached to the observation platform at station 3. It was placed there in late summer of 1969 but removed after a short time because of maintainance problems caused by bird droppings. At this writing, it has not been replaced. A telescope for visitor use was also to be mounted on the rail of the station 5 observation tower to allow visitors to see into a heron and egret colony nearby. The colony moved its location before the telescope was mounted on the tower, and at present this has not been done.

At present the tour consists of five turnouts, each marked with a station number sign (Figure 7). Station 1 has an interpretive sign explaining the swarms of midges encountered by visitors on the tour at

Figure 1. Observation platform at station 5 of the self-guided tour. Note cliff swallow nests attached beneath the platform.

Figure 2. Fifty foot observation tower at station 4 on the self-guided tour.

Figure 3. Interpretive sign at station 4 on the self-guided tour, explaining the different levels of ancient Lake Bonneville.

Figure 4. Interpretive sign at station 1 on the self-guided tour, which tells about the swarming midges on the dike roads.

Figure 5. Interpretive sign at station 2 on the self-guided tour, explaining the Wasatch Fault, a geological feature to the east of the refuge.

Figure 6. Turnout at station 3 on the self-guided tour, showing the placement of the station number identification sign.

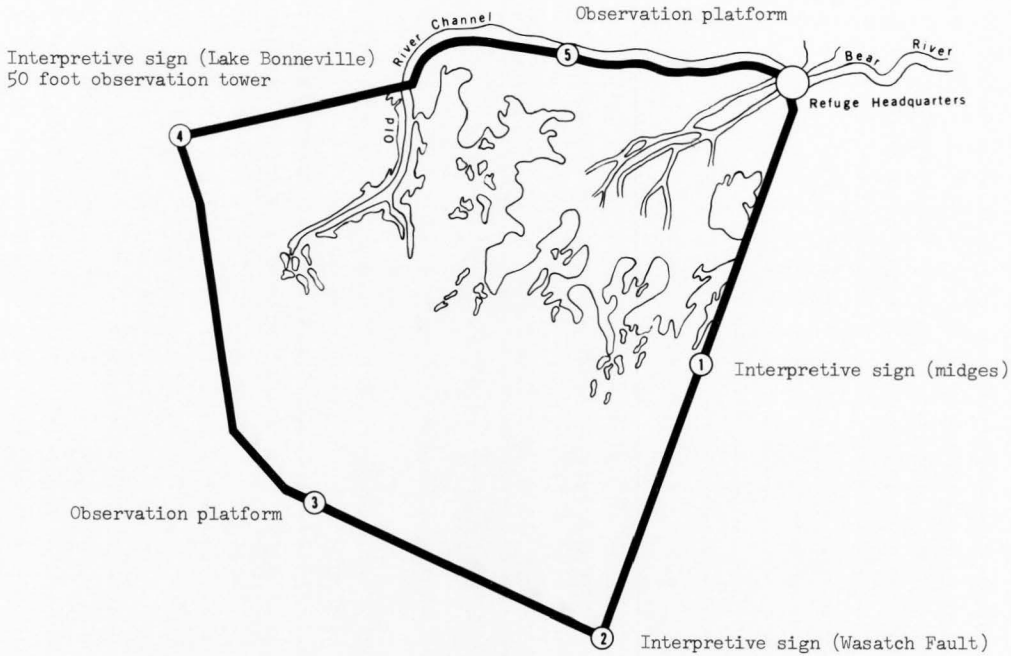

Figure 7. Map of the self-guided tour around unit 2 of the refuge, showing the location of station stops and facilities at each stop.

certain times of the year (Figure 4). Station 2 has an interpretive sign explaining the Wasatch Fault, a geological feature to the east of the refuge which played a part in the forming of the valley (Figure 5). There is a low observation tower at station 3. Of special interest to many visitors at this stop are the clusters of cliff swallow nests built beneath the observation platform (Figure 8). In the spring, visitors can watch as the swallows repair their nests and later care for their young. Station 4 has an interpretive sign telling about ancient Lake Bonneville that once covered the refuge area, and pointing out marks of the different lake levels on the distant Promontory Mountains (Figure 3). It also has the 50 foot observation tower. For the last 3 years a raven has built a nest in the top of the tower and raised young as an added attraction to visitors. Station 5 has a low observation platform (Figure 1), under which, as in station 3, are active cliff swallow nests. An additional interpretive sign explaining the origin and course of the Bear River is placed adjacent to the refuge office building.

In 1966 the refuge began charging fees of visitors taking the self-guided tour. Charges are $.50 for an individual, $1.00 per car or admission by the Federal Golden Eagle Passport (except in 1970 when congress was late in approving the passport and individual agency season passes were accepted).

It was intended that the new visitor center completed in 1969 would handle visitor contact, registration and fee collection, but at present the refuge does not have adequate personnel to have someone on duty at the visitor center. Visitor contact and registrations are handled in the refuge office (Figure 9). The visitor center contains

Figure 8. Cliff swallow nests attached to the observation platform at station 3 on the self-guided tour.

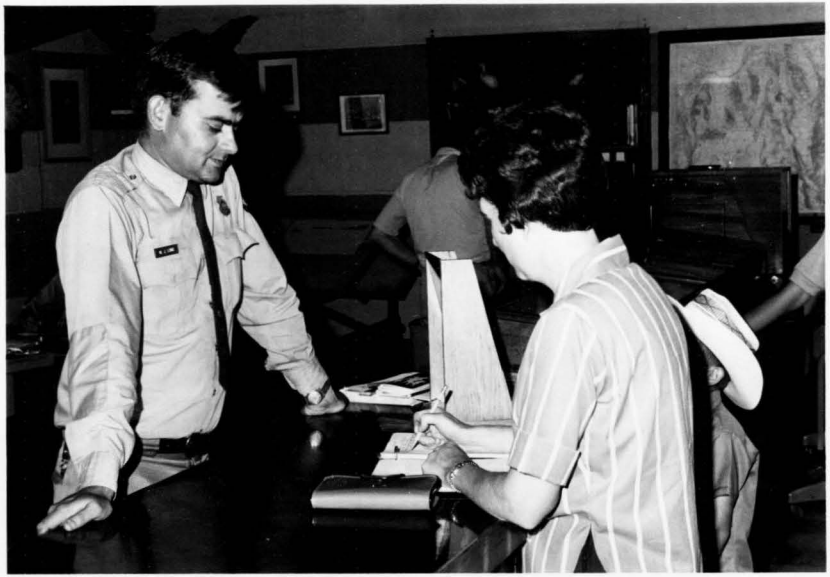

Figure 9. Interior of the refuge office showing the method of visitor contact and registration.

interpretive displays and is open daily. These are seen by most visitors who can enter it by a side door of the refuge office before taking the tour or stop at the completion of the tour.

Information Booklet and Tour Guide

In 1956 the refuge began work on the text and layout of a new information booklet for refuge visitors. The booklet was to include a section to serve as a step-by-step guide with numbered parts to correspond with the stations to be set up around the visitor loop. In March, 1967 when this study began, the author was employed by Bear River Refuge to finish preparing this booklet for publication, along with other duties. During the course of the booklet project, the text was rewritten and the layout changed to include more and larger photographs. Late in 1967 the completed layout and text were submitted to the U. S. Government Printing Office. The printed booklet (Appendix) was ready for distribution in September 1968, and was priced at $.30 by the Government Printing Office. The first copies were placed on sale September 27, 1968 at the refuge headquarters.

It had been the hope of refuge personnel to be able to distribute the booklet free of charge, but its size and use of color for covers made necessary the $.30 charge. Literature in use by the refuge previous to the new booklet included: (1) A 4 page leaflet with brief visitor information about refuge wildlife and operation, with a refuge map, first issued by the Fish and Wildlife Service in 1952 and revised in 1961; (2) A list of the birds of Bear River Refuge; (3) Mammal list; and (4) Seasonal abundance graphs of the more common species. Numbers 1 and 2 are given to all refuge visitors at registration and

3 and 4 are provided if visitors desire additional information. All are free of charge.

SAMPLING METHODS

Data for the study was obtained by directly sampling from the population of refuge visitors by means of: (1) mail questionnaires; (2) on-site interviews; and (3) tower observations. To supplement this direct sample, visitor register sheets kept at the refuge headquarters were used to provide additional information. Plans for conducting the samples were discussed with and approved by the refuge manager. A close cooperation with refuge personnel was maintained throughout the sampling.

Visitor Registers

All visitor groups entering the refuge are requested to sign a visitor register kept in the refuge office (Figure 9). Instructions at the top of the page ask that only one person from each group register for the entire group. Information requested from the registrants has varied from year to year. Minimal information of all years included the date, the name of the person registering for the party, the number of persons in the party and place of residence. Only the years 1967, 1968 and 1969 were used to provide data for the study.

Mail Questionnaires

A post-card questionnaire was designed to mail to a sample of 200 parties of refuge visitors. Questions on the card were constructed to determine: (1) whether or not the party had previously visited the refuge; (2) the approximate number of previous visits; (3) numbered stations on the visitor tour at which the party stopped; (4) if they

had planned adequate time for the visit; (5) satisfaction with the self-guided tour; (6) whether or not the party saw and purchased the visitor guide; (7) use of the visitor guide on the refuge and after returning home; and (8) comments and suggestions about the visitor guide (Appendix).

The questionnaire was so designed that answers could be checked off or filled in with one or two words to take up a minimum of the respondent's time. Space was left for those who desired to comment on the visitor guide booklet and how it could be improved. Several persons answering the questionnaire took advantage of this space. Ideas for design of the questionnaire were obtained from a questionnaire used by the Nebraska Game and Parks Commission in a 1968 fishing survey.

As postage was paid on the questionnaire card, it was only necessary for the recipient to drop the completed card in the mail. The questionnaire card was accompanied by a form letter (Appendix) explaining the study and why the cooperation of refuge visitors was solicited. To obtain the best cooperation, the form letter was printed on a Utah Cooperative Wildlife Research Unit letterhead, identifying the study with Utah State University and the Unit. In addition the name of the visitor was typed at the beginning of the form letter. Also the questionnaire cards were addressed to the Utah Cooperative Wildlife Research Unit, and forwarded to the author as they were received.

Mail questionnaires were sent in 1969 and 1970. In June and July of 1969, refuge personnel compiled a list of 200 names and addresses of persons signing the visitor register for their party. The list included 100 parties who had purchased the visitor guide booklet and

100 parties who had not purchased the booklet. Names were added to the list in linear order, so that the first 100 parties of each category to visit the refuge comprised the list. During the first week the nonbuyer list was completed but the buyer list required approximately 5 weeks to complete. In addition to the names and addresses, refuge personnel also listed the time of day that each party began the self-guided tour and the time the tour was completed.

Of the list of 200 names, 196 were usable and questionnaires were mailed to these visitors in July 1969. Those not replying within a period of approximately 30 days were sent an additional questionnaire and form letter.

Tower Observations

In June of 1970 an additional 73 questionnaire cards and form letters were sent to a group of visitors composed of both buyers and nonbuyers of the visitor guide booklet. Persons receiving these questionnaires were also observed with a spotting scope from the 100 foot observation tower at the refuge headquarters as they drove their cars around the self-guided tour. This made possible a comparison of data from two sources and allowed a means of determining the degree of error by visitor groups in reporting their activities on the mail questionnaire cards. A variable power (15X to 80X) spotting scope and 8 X 50 binoculars were used in the observations. In addition, a portable two-way radio was used to communicate with refuge personnel in the headquarters office.

These observations were designed to determine: (1) which of the numbered stations on the tour were stopped at by each visitor

group; (2) length of time spent on each station stop; (3) time spent traveling between each station; (4) total time spent on the self-guided tour; (5) time spent on the refuge before starting the self-guided tour and time spent after its completion; and (6) behavior of visitor groups on the tour.

A total of 11 observation days (8:00 A.M. to approximately 5:00 P.M.) were spent in the tower between May 13, 1970 and May 24, 1970. Of this total, eight were weekdays, two were Saturdays and one was a Sunday. Data was gathered on a total of 103 visitor groups completing the self-guided tour.

A time was recorded as approaching cars entered the refuge gate, and groups earmarked for observation were identified on the two-way radio to the refuge worker on duty. At an appropriate time, the name of the person signing the register for the group was relayed from the office by radio, and in addition, if they were return or first-time visitors and if they had purchased the guide booklet. Addresses were obtained at the end of the day from the register.

Color and shape were used as means of keeping track of cars as they made the tour. Times were recorded to the nearest minute, and stops of less than 1 minute were recorded as 1 minute. On weekends when visitor traffic was heavy, it was possible to follow only four or five cars at one time on the tour, and new cars were added as others finished. Weekday traffic was light enough to allow all groups visiting to be observed. Groups observed from the tower in this manner were unaware that they were being watched.

Interviews

Ideas for the content and organization of the questionnaire sheet used in this phase of sampling (Appendix) were obtained from a recreational use study by the Nebraska Game and Parks Commission (Barr, 1969). The sheet was designed so that answers could be recorded by checking categories or by filling in blanks with a word or two. Interview questions were designed to determine: (1) place of residence; (2) characteristics of the groups; (3) previous visits to the refuge; (4) the character of and reason for the visit; (5) activities on the self-guided tour; (6) whether or not the party saw and purchased the tour guide booklet; (7) opinions about the booklet; and (8) satisfaction with the tour and refuge facilities.

A total of 154 interviews were conducted on seven different days between the period of May 29, 1970 and July 1, 1970. Included were three weekdays (one was a holiday, Memorial Day), two Saturdays and two Sundays. Interviews were conducted as the visitor group completed the self-guided tour and returned to the refuge headquarters. A narrow bridge at the completion of the tour was an ideal location to stop cars, since design of the bridge necessitated a slow speed to navigate a turn midway across. In almost all instances, interviews were conducted with the group remaining in the car. Most interviews required from 3 to 5 minutes to complete. At times of peak use it was necessary to allow some cars to pass uninterviewed to prevent a traffic buildup on the bridge.

A standard form of phrasing each question was adopted in an attempt to prevent any bias in the results. Question 3 was phrased, "Did you come specifically to visit the refuge, or are you just passing

through on your way to another place?" To illicit an answer for question 4, "What is your main reason for visiting the refuge?" was asked to get the primary reason, then the other categories were named to get any secondary activities participated in. To avoid prolonged or embarrassing questions the sex and age of visitors in question 6 was estimated. To aid recall of stops made and towers climbed in questions 9 and 10, the map on page 6 of the visitor guide (Appendix) was shown to those visitors who were unsure of their answer. Visitors were shown the front cover of the visitor guide as question 11 was asked and this evoked an immediate response.

Times recorded at the top of the sheet for the beginning and end of the tour and entrance and exit from the refuge were to the nearest minute. License numbers were easily written down while visitors were registering in the office, and were used to keep track of the cars as they made the tour. Notes on the color and make of cars were helpful in finding the correct sheet for cars approaching the bridge, and served to avoid making the car wait while a number of sheets were thumbed through.

Each interview was initiated by identifying the study with Utah State University, and assuring the visitor group that the interview would be short. Only one group refused to participate in the interview.

RESULTS AND DISCUSSION

In the greater part of this section, an effort was made to compare two groups of visitors; those who purchased the information and tour guide booklet and those who did not. This was done to gain some measure of the value of this type of publication in a recreational activity of this kind. To a lesser degree, first-time visitors have been compared to return visitors.

Data from the on-site interviews and the tower observations has been relied upon more heavily than that from the mail questionnaires, because of the greater acuracy of these sampling methods. This is particularly true with the tower observations in regard to visitor behavior on the self-guided tour.

Response of Public to Sampling Methods

In 1969 mail questionnaire cards were sent to a group of 100 nonbuyers of the information and tour guide booklet who had signed the visitor register for their party. Of this number, 59 questionnaires were returned and four did not reach their destination, making for a return of 59 percent. A second mailing after approximately 30 days of 37 questionnaires to persons not responding to the first mailing resulted in 14 additional returns with one questionnaire not reaching its destination. Percentage of return on this second mailing was 37.8 percent. Total questionnaire return for the group of 100 nonbuyers was 73 percent.

A group of 96 buyers of the information and tour guide booklet

were sent questionnaires in 1969. Results were 63 returns with three not reaching their destination, for a return of 65.6 percent for the first mailing. The second mailing after approximately 30 days of 30 additional questionnaires to those not responding resulted in 13 more returns with one not reaching its destination. This was a 43.3 percent return. Total return for the group of 96 buyers was 79.2 percent.

Of the total of 196 mail questionnaires sent to both buyers and nonbuyers in 1969, 149 or 76 percent were returned.

In 1970, a mixed group of 73 buyers and nonbuyers sent mail questionnaires returned 45 and two did not reach their destination for a return of 61.6 percent. No second mailing was made. In all, a total of 269 persons were sent mail questionnaires in 1969 and 1970, and 194 or 72.1 percent were returned.

Of 155 requests for interviews in 1970, 154 were granted. Visitor groups, for the most part, were cooperative and willing to take time to answer questions. It was felt that no group was inconvenienced by the interviews, as those expressing a desire to be on their way were detained, at the maximum, only about 3 or 4 minutes. Some interviews lasted up to 10 minutes or longer, when visitor groups had questions concerning the study or about the area and tour, and traffic was not backed up.

It was felt that the tower observations of visitor groups taking the self-guided tour were completely candid, and that the visitors were unaware of being timed. Because of the height of the tower (100 feet), it was difficult to determine from the ground what was happening in the tower. Visitors who climbed the tower before taking the tour generally assumed that some type of bird census was being taken

with the spotting scope. Occasional inquiries were answered briefly, informing the visitors only that a study of the area was being made.

General Observations

During 1969, the latest year for which complete figures were available, the total use of Bear River Refuge was 20,739 individual visits (Table 1). Of this total, 807 or 4 percent were fishing visits; 4,039 or 20 percent were hunting visits; 4,596 or 22 percent were educational tour visits; and 11,297 or 55 percent were for the purpose of taking self-guided nature tours of the refuge. Hunting and fishing uses of the area naturally are restricted by the length of open season and weather conditions. Use by educational groups for guided tours was primarily during the spring months when the weather warmed and schools were still in session, and to a lesser extent in the fall. Primary months for this type of use were April, May, August and September. On the other hand, the season of use for visitors taking the self-guided tour was almost year-round. There is a period during the winter when refuge water areas are frozen and little in the way of wildlife can be seen, when few visitors come to the refuge. This is from approximately mid-December to mid-February.

During early spring, it is the large concentration of waterfowl and other birds migrating north to nesting grounds that draws visitors. In late spring and summer it is the resident population of nesting birds, and the opportunity to see the young. In the fall it is again the migrating flocks, this time on their way south to winter, that attracts people to the refuge. During the three-year period of 1967-1969 the peak use month for the self-guided tour was June, with 18

percent of the people visiting in this month (Table 2). Other high use months were May with 16 percent of the visits; August, 14 percent; July, 13 percent; and September, 11 percent. Lowest percentage of visits came in January with 0.1 percent of the people, February with 0.3 percent and December with 1 percent.

Days of the week on which the self-guided tour received the most use were Saturdays and Sundays. Use on Saturday was quite evenly distributed, with visitors beginning to arrive early in the day and continuing throughout the day. Sundays received the most use of the two weekend days, but relatively few groups visited on Sunday mornings. Sunday afternoons were peak use periods of the week, and at times in the summer as many as 20 or more cars were on the visitor loop simultaneously. Use of the tour on weekdays was slight compared to weekends and was spread quite evenly over the day. Holidays followed generally a Sunday pattern.

Several cars each week who made the drive out to the refuge did not take the self-guided visitor tour. Often these groups, having not previously visited the area, failed to allow sufficient time to take the tour and had to return to meet some other engagement. Often groups arrived at the refuge too late in the day to allow for sufficient time to tour the refuge. Hours have been from 8:00 A.M. to 4:30 P.M., and since it takes a minimum of 30 minutes to make the tour, those people who arrived after 4:00 P.M. usually did not make the tour. This was the cause for some dissatisfaction with visitor groups. There were also a few groups who objected to the fees charged for the tour and did not take it.

Table 2. Monthly breakdown of refuge visitors in single car groups taking the self-guided tour for the three-year period of 1967-69 (source, Bear River Refuge visitor registers)

Month	1969		1968		1967		Three-year total			
	Cars	People	Cars	People	Cars	People	Cars	Percent	People	Percent
Jan.	6	17	3	5	8	25	17	0.2	47	0.1
Feb.	1	1	10	13	31	77	42	0.5	91	0.3
Mar.	51	168	241	843	128	500	420	4.5	1,511	4.5
Apr.	286	1,165	246	1,000	144	511	676	7.3	2,676	8.0
May	431	1,589	570	2,059	461	1,642	1,462	15.8	5,290	15.7
Jun.	561	2,011	505	2,028	455	1,841	1,521	16.5	5,880	17.6
Jul.	412	1,634	341	1,337	346	1,297	1,099	11.8	4,268	12.7
Aug.	450	1,682	440	1,690	302	1,164	1,192	12.8	4,536	13.5
Sep.	407	1,247	417	1,387	365	1,213	1,189	12.8	3,847	11.4
Oct.	221	695	371	1,247	312	1,094	904	9.7	3,036	9.0
Nov.	228	774	187	594	211	661	626	6.7	2,029	6.0
Dec.	72	220	28	97	33	97	133	1.4	414	1.2
Total	3,126	11,203	3,359	12,300	2,796	10,122	9,281	100.0	33,625	100.0

Origin of Visitors

The place of residence listed on the visitor register in 1969 by persons registering for their group was placed in one of seven zones according to distance from the refuge. Of the total groups taking the self-guided tour in 1969, 31 percent came from within a radius of 25 airline miles from the refuge, 24 percent from 26 to 50 miles, 5 percent from 51 to 150 miles, 5 percent from 151 to 500 miles, 20 percent from 501 to 1,000 miles, 6 percent from 1,001 to 1,500 miles and 9 percent from over 1,500 miles (Table 3). These figures are in line with what would be expected for a trip that is almost always for just 1 day or a part of 1 day.

Table 3. Airline miles to the refuge from the place of residence reported by visitors taking the self-guided tour in 1969 (source, Bear River Refuge visitor register)

Zone	Number of cars	Percent of total
0 to 25 miles	974	31.2
26 to 50 miles	753	24.1
51 to 150 miles	149	4.8
151 to 500 miles	155	5.0
501 to 1,000 miles	620	19.8
1,001 to 1,500 miles	196	6.4
Over 1,500 miles	279	8.9
Total	3,126	100.0

In comparison, the Outdoor Recreation Resources Review Commission (1962) found the following percentages in a 1959-60 study of distance

traveled for vacation trips which are almost always more than 1 day in duration. The figures are: Those who traveled 50 miles or less, 3 percent; 51 to 100 miles, 6 percent; 101 to 250 miles, 23 percent; 251 to 500 miles, 21 percent; 501 to 750 miles, 11 percent; 751 to 1,000 miles, 6 percent; 1,001 to 2,000 miles, 17 percent; over 2,000 miles, 10 percent and 3 percent not ascertained. Again, this is the type of distribution one would expect, since people with more time to spend can generally travel further and generally want to go to an area different from the one they are in most of the time.

The radius of 25 miles from Bear River Refuge included Brigham City (population 11,728) and Ogden (population 70,197), Utah's second largest city. Within a radius of 50 miles are most of metropolitan Salt Lake City (population over 200,000) and Logan (population 18,731). The nearness of these population centers to the refuge accounts for the fact that 55 percent of the visitors taking the self-guided tour came from within a radius of 50 miles. Over 80 percent of Utah's population lives within a radius of 100 miles from the refuge. The largest population of the west coast, chiefly California, with Oregon and Washington was responsible for the rather large percentage (19.8) of visitors from the 501 to 1,000 mile zone.

On weekdays in 1969, 23 percent of visitor groups taking the self-guided tour came from within a radius of 25 miles of the refuge and 16 percent from 26 to 50 miles. The 51 to 150 mile zone accounted for 4 percent (Table 4). Groups coming from within a 25 mile radius on Saturday comprised 28 percent of the total, Sunday they were 46 percent and holidays 31 percent.

Table 4. Airline miles to the refuge from the place of residence reported by refuge visitors taking the self-guided tour in 1969 for the various days of the week

Zone	Weekday		Saturday		Sunday		Holiday	
	Cars	Percent	Cars	Percent	Cars	Percent	Cars	Percent
0 - 25 miles	325	22.6	181	28.4	423	45.8	37	30.8
26 - 50 miles	226	15.7	218	34.2	257	27.5	48	40.0
51 - 150 miles	52	3.6	40	6.3	43	4.7	12	10.0
151 - 500 miles	94	6.6	28	4.4	30	3.2	2	1.6
501 - 1,000 miles	428	29.8	81	12.7	102	10.9	11	9.2
1,001 - 1,500 miles	133	9.4	34	5.4	29	3.1	5	4.2
Over 1,500 miles	177	12.3	55	8.6	45	4.8	5	4.2
Total	1,435	100.0	637	100.0	934	100.0	120	100.0
Percent of year total		45.9		20.4		29.9		3.8

Compared to the percentage of visitor groups from this zone (0 to 25 miles) on weekdays, the weekend and holiday figures show a significant increase. The same holds true for the 26 to 50 mile zone and the 51 to 150 mile zone. Each of these shows a substantial increase in percentage of visitor groups weekends and holidays, which means that local people visited more often on these days. As was expected, the greater distance zones of 151 to 500 miles, 501 to 1,000 miles, 1,001 to 1,500 miles and over 1,500 miles showed lower percentages of groups on weekends and holidays. The 501 to 1,000 mile zone accounted for 30 percent of the groups on weekdays, but only 13 percent on Saturday, 11 percent on Sunday and 9 percent on holidays.

Probable reason for this greater percentage of local groups on weekends and holidays is the availability of the people for recreation

on these days when most are off work. On weekdays relatively few would be off work and available for recreation. A greater part of the groups coming longer distances to the refuge are on vacation trips of several days duration and include a stop at the refuge in their plans. Hence the increase in percentages from these longer distance zones on weekdays.

Visitor groups from the state of Utah accounted for 59 percent of the total groups taking the self-guided tour in 1969 (Table 5). California was listed as home state for 11 percent of the visitor groups, Idaho 2.4 percent, Washington 2.1 percent and Colorado, Texas and Arizona each 1.7 percent. Most states accounted for less than 1 percent of the total, although all states were represented by visitor groups in 1969 with the exception of Mississippi. Canada accounted for 1.1 percent of the groups and other foreign countries were listed as home by 0.6 percent. Countries included Germany, Ireland, Sweden, England, Holland, Japan, Israel, Guatamala, Denmark, France and New Zealand.

Group Characteristics

Of 154 groups of visitors interviewed in 1970 after they had completed the self-guided tour, 85 percent were families, 14 percent were friends who had joined together to visit the refuge, and only 1 percent were individuals alone in the car (Figure 10).

Average size of the 154 groups interviewed was 4.4 persons. Average size of groups taking the self-guided tour in 1969 was 3.6 persons. Average Utah group in 1969 was 4.1 persons, California averaged 2.4 persons and Idaho averaged 3.4 persons per car (Table 5).

Table 5. Home state of refuge visitors taking the self-guided tour in 1969 (source, Bear River Refuge visitor register)

State	Number of cars	Number of people	Average per car	Percent of total cars	Percent of total people
Utah	1,834	7,557	4.1	58.7	67.5
California	330	798	2.4	10.6	7.1
Idaho	75	257	3.4	2.4	2.3
Washington	67	208	3.1	2.1	1.9
Colorado	53	152	2.9	1.7	1.4
Texas	53	169	3.2	1.7	1.5
Arizona	52	148	2.8	1.7	1.3
Ohio	41	109	2.7	1.3	1.0
Illinois	39	124	3.2	1.2	1.0
Oregon	36	116	3.2	1.1	1.0
Michigan	33	99	3.0	1.1	0.9
Pennsylvania	33	92	2.8	1.1	0.8
New York	32	96	3.0	1.0	0.9
Minnesota	29	91	3.1	0.9	0.8
Florida	28	67	2.4	0.9	0.6
New Mexico	28	81	2.9	0.9	0.7
Wisconsin	27	64	2.4	0.9	0.6
Massachusetts	26	67	2.6	0.8	0.6
Kansas	25	69	2.8	0.8	0.6
New Jersey	23	61	2.7	0.7	0.5
Iowa	21	59	2.8	0.7	0.5
Missouri	18	55	3.1	0.6	0.5
Montana	18	49	2.7	0.6	0.4
Nebraska	13	39	3.0	0.4	0.3
Oklahoma	13	39	3.0	0.4	0.3
Wyoming	13	41	3.2	0.4	0.4
Maryland	11	29	2.6	0.4	0.3
North Carolina	10	28	2.8	0.3	0.2
Connecticut	7	14	2.0	0.2	0.1
Deleware	7	21	3.0	0.2	0.2
Indiana	7	19	2.7	0.2	0.2
Virginia	7	21	3.0	0.2	0.2
Louisiana	6	12	2.0	0.2	0.1
Alabama	5	21	4.2	0.2	0.2
Alaska	5	9	1.8	0.2	0.1
Rhode Island	5	15	3.0	0.2	0.1
Georgia	4	14	3.5	0.1	0.1
New Hampshire	4	9	2.6	0.1	0.1
North Dakota	4	11	2.8	0.1	0.1
Tennessee	4	18	4.5	0.1	0.2
Vermont	4	13	3.3	0.1	0.1
West Virginia	4	12	3.0	0.1	0.1
Kentucky	3	5	1.7	0.1	0.0
Nevada	3	9	3.0	0.1	0.1

Table 5. Continued

State	Number of cars	Number of people	Average per car	Percent of total cars	Percent of total people
Hawaii	2	9	4.5	0.1	0.1
Maine	2	7	3.5	0.1	0.1
South Carolina	2	6	3.0	0.1	0.1
South Dakota	2	6	3.0	0.1	0.1
Dist. of Columbia	2	6	3.0	0.1	0.1
Arkansas	1	5	5.0	0.0	0.0
Mississippi	-	-	---	---	---
Canada	35	98	2.8	1.1	0.9
Other foreign	20	79	4.0	0.6	0.7
Total	3,126	11,203	3.6	100.0	100.0

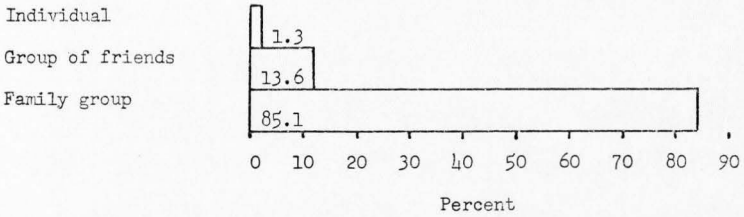

Figure 10. Group characteristics of refuge visitors interviewed at completion of the self-guided tour (154 groups).

Of the 676 people in the 154 groups interviewed in 1970, 54 percent were males and 46 percent were females. Of the 676 people, 30 percent were under 12 years of age. This was the largest age group, and the next largest was those people 25 to 44 years old (Figure 11). The 18 to 24-year-olds were the smallest of the age groupings with 5.3

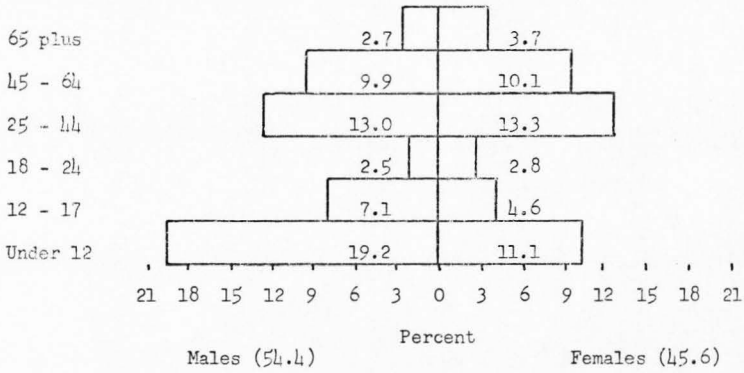

Figure 11. Age groupings of 154 visitor groups (676 people) interviewed at completion of the self-guided tour.

percent. There were more females than males in all of the age groupings except two, those under 12 years of age and the 12 to 17-year-olds.

Character of Visit

The predominant type of visit to Bear River Refuge of the 154 groups interviewed was 1 or a part of 1 day with the refuge as a specific destination. Of 39 buyers of the guide booklet interviewed, 64 percent made this type of visit. Of 115 nonbuyers of the booklet, 84 percent made this type of visit (Table 6). Visitor groups who were just passing through the area but decided to stop at the refuge for 1 day or part of a day made up 13 percent of the total 154 groups. Percentage of buyers making this type of visit was 21 percent, but only 10 percent for nonbuyers. The percentage of groups visiting for

Table 6. Character of visit of groups interviewed at completion of the self-guided tour

Character of visit	Buyers[a]		Nonbuyers[a]		Total	
	Number	%	Number	%	Number	%
Just passing through-1 day	8	20.5	12	10.4	20	13.0
Just passing through-2 days or more	2	5.1	4	3.5	6	3.9
Refuge as destination-1 day	25	64.1	96	83.5	121	78.6
Refuge as destination-2 days or more	4	10.3	3	2.6	7	4.5
Total	39	100.0	115	100.0	154	100.0

[a]Those who did or did not purchase the visitor guide booklet.

more than 1 day was quite low, especially for the nonbuyer group where only 6 percent were in this category. In contrast, 15 percent of the buyer groups spent more than 1 day at the refuge. More nonbuyer groups (86 percent) had planned the refuge as a destination before making the visit than did buyer groups (74 percent).

Sightseeing and pleasure driving as the main reason for visiting was reported by 46 percent of the 154 groups interviewed, and was the most popular main activity. Second in popularity was bird watching, with 39 percent of the groups reporting this as their main activity. Primary activities other than those enumerated on the interview sheet were reported by 10 percent of those interviewed. These activities included such things as working on Boy Scout conservation and nature merit badges, studying the refuge system, nature study, looking for hunting possibilities and watching wildlife. Photography was reported as a main reason for visiting by 4 percent of those interviewed, and fishing was reported by 0.6 percent (Figure 12).

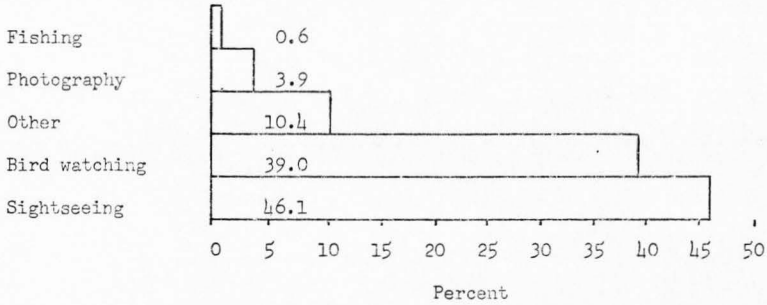

Figure 12. Primary reason for refuge visit reported by 154 groups interviewed at completion of the self-guided tour.

A total of 76 activities other than the main reason for visiting were reported by the 154 groups interviewed. Bird watching was the most popular of these secondary activities, and was reported by 17 percent of the visitor groups. Picnicing as a secondary activity was reported by 15 percent of the groups and activities other than those on the interview sheet by 6 percent (Figure 13). These other secondary activities included work on Boy Scout merit badges, education, nature study, exploring hunting possibilities, curiosity and recording bird calls. Secondary activities were reported by the 154 groups interviewed at the rate of 0.5 activities per group.

Length and Frequency of Visit

Those visitor groups coming to the refuge for the first time had a greater tendency to purchase the visitor guide booklet than those who had previously visited. Of the groups answering the mail

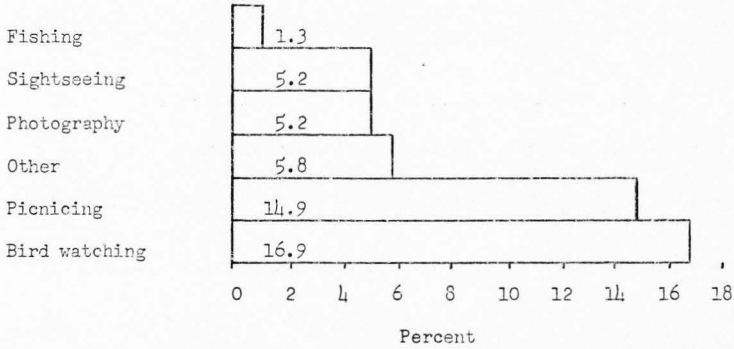

Figure 13. Secondary activities participated in by 154 groups of refuge visitors interviewed at completion of the self-guided tour.

questionnaire, 62 percent of those who bought the booklet were first-time visitors while only 29 percent of those who did not buy the booklet were first-time visitors (Table 7). Of the groups interviewed, 41 percent of the buyers and 36 percent of the nonbuyers were first-time visitors (Table 8).

Of the total 194 respondents to the mail questionnaire, 45 percent had been first-time visitors to the refuge, and 21 percent had visited one or two times previous. Of the total, 6 percent had previously visited over 15 times. Of the interviewed groups, 37 percent were first-time visitors, 29 percent had visited one or two times previous and 7 percent over 15 times. Groups answering the mail questionnaire reported an overall average of 4.7 previous visits per group, and interviewed groups reported 6.4 previous visits per group (first-time

Table 7. Number of previous refuge visits made by persons answering mail questionnaires

Previous visits	Buyers[a]		Nonbuyers[a]		Total	
	Number	Percent	Number	Percent	Number	Percent
None	58	61.7	29	29.0	87	44.8
1 or 2	18	19.1	23	23.0	41	21.1
3 to 5	5	5.3	25	25.0	30	15.5
6 to 10	7	7.4	11	11.0	18	9.3
11 to 15	3	3.3	3	3.0	6	3.1
Over 15	3	3.2	9	9.0	12	6.2
Total	94	100.0	100	100.0	194	100.0

[a]Those who did or did not purchase the visitor guide booklet.

Table 8. Number of previous visits made by persons interviewed at completion of the self-guided tour

Previous visits	Buyers[a]		Nonbuyers[a]		Total	
	Number	Percent	Number	Percent	Number	Percent
None	16	41.0	41	35.7	57	37.0
1 or 2	14	35.9	31	27.0	45	29.2
3 to 5	4	10.3	14	12.2	18	11.7
6 to 10	2	5.1	12	10.4	14	9.1
11 to 15	1	2.6	8	7.0	9	5.8
Over 15	2	5.1	9	7.7	11	7.2
Total	39	100.0	115	100.0	154	100.0

[a]Those who did or did not purchase the visitor guide booklet.

visitors included). From the 55 percent of mail questionnaire respondents who had previously visited the refuge, the average number of

visits was 8.5 per group. The 63 percent of groups interviewed who reported previous visits made an average of 10.2 visits per group.

Buyer groups answering mail questionnaires reported 2.7 previous visits per group, and interviewed buyer groups reported 2.8 previous visits per group (first-time visitors included). Excluding first-time visitors, buyer groups reporting previous visits on the mail questionnaire averaged 7 visits per group, and interviewed groups 4.8 previous visits per group. Nonbuyer groups on the mail questionnaire reporting previous visits made 9.4 per group, and interviewed nonbuyer groups 11.8 per group. Of the 154 groups interviewed in 1970, 14 groups had been to the refuge more than once in that same year.

Average time spent at the refuge by 153 groups interviewed in 1970 was 103 minutes. Average time actually spent on the tour itself by the groups interviewed was 79 minutes. Time lapse from when groups entered the refuge gate until they began the tour was an average of 15 minutes, and an average of 9 minutes was spent by groups between completion of the tour and leaving the refuge property (Table 9). Times spent at the refuge ranged from a low of 40 minutes to a high of 6 hours 35 minutes. Time spent on the actual self-guided tour varied from 33 minutes to 6 hours 25 minutes.

Buyers of the tour guide booklet spent more time on the tour, with an average of 84 minutes spent, compared to an average of 78 minutes for nonbuyers. Buyers also spent more total time on the refuge averaging 107 minutes compared to 102 minutes for nonbuyers. Buyers averaged more time spent before starting the tour (17 minutes) than nonbuyers (14 minutes), but were more anxious to leave the refuge after tour completion. They averaged only 6 minutes time between tour

Table 9. Comparison of times spent at the refuge and on the self-guided tour by segments of 153 visitor groups interviewed at completion of the tour (in minutes)

Type of group	Number of groups	Ave. time before tour	Ave. time after tour	Ave. time on tour	Ave. time on refuge
Buyers[a]	38	17.4	6.0	83.7	107.1
Nonbuyers[a]	115	13.9	10.3	77.5	101.6
First-time visitor	57	18.5	9.4	76.7	104.6
Return visitor	96	12.6	9.2	80.4	102.1
Traveled more than 50 miles	39	18.8	7.6	92.9	119.4
Traveled less than 50 miles	114	13.4	9.8	74.3	97.4
Average of all groups	153	14.8	9.3	79.0	103.0

[a]Those who did or did not purchase the visitor guide booklet.

completion and leaving the refuge, while nonbuyers averaged 10 minutes.

When times of first-time visitors to the refgue were compared to times of return visitors, the first-timers spent less time on the tour, but more total time on the refuge than did return visitors. First-timers spent an average of 77 minutes on the tour compared to 80 minutes for return visitors, and 105 minutes total time on the refuge compared to 102 minutes for return visitors.

Greatest differences of time spent on the refuge and taking the tour were seen when groups who had traveled less than 50 miles to the refuge were compared to groups traveling more than 50 miles. Groups traveling the shorter distance spent an average of only 74 minutes on the tour compared to an average of 93 minutes spent by groups coming a greater distance. Average total time spent on the refuge was 97 minutes for those groups traveling less than 50 miles and 119 minutes for those traveling more than 50 miles.

Of 154 groups interviewed at completion of the tour only one visitor group spent the night on the area. Most of the time spent before and after the tour was used to see exhibits in the visitor center, climb the 100 foot observation tower at headquarters, look around the grounds or picnic.

Tour Behavior

Of the buyers of the tour guide booklet answering the mail questionnaire, 61 percent reported stopping at all five of the stations on the tour. Of the nonbuyers, only 49 percent reported making all five of the station stops. Percentage of buyers making no stops at stations on the tour was 16 percent, while the percentage of nonbuyers making no

stops was 19 percent. The percentage of groups reporting one, two or three stops out of the five was higher for the nonbuyers, but lower for groups making four of the five stops. Of the total number of groups responding to the mail questionnaire, 18 percent reported making no stops at the five stations on the self-guided tour, and 55 percent reported that they had stopped at all five of the stations (Table 10). Average number of stops reported by all groups answering the questionnaire was 3.4 stops per group. Buyers reported an average of 3.6 stops per group while nonbuyers reported 3.2 per group.

Table 10. Number of station stops made on the self-guided tour reported by 194 refuge visitors answering mail questionnaires

Station stops made	Buyers[a]		Nonbuyers[a]		Total	
	Number	Percent	Number	Percent	Number	Percent
0	15	15.6	19	19.0	34	17.5
1	6	6.5	9	9.0	15	7.7
2	5	5.4	11	11.0	16	8.2
3	6	6.5	7	7.0	13	6.7
4	5	5.4	5	5.0	10	5.3
5	57	60.6	49	49.0	106	54.6
Total	94	100.0	100	100.0	194	100.0

[a]Those who did or did not purchase the visitor guide booklet.

Of the tour guide buyers interviewed after finishing the tour, 46 percent reported stopping at all five stations. Of the nonbuyers, only 32 percent reported making all five station stops. The percentage

of interviewed buyers stopping at none of the stations on the tour was only 8 percent, while 17 percent of the nonbuyers made no stops. Again, as in the mail questionnaire responses, the percentages of nonbuyers reporting one or two station stops were higher than the buyer percentages in these categories. But the percentage of groups making three or four of the five stops was higher for the buyers. Of the total groups interviewed, 15 percent reported making no station stops on the tour and 36 percent reported stopping at all five of the stations (Table 11). Average number of station stops reported by all groups interviewed was 2.9 per group. Buyers reported an average of 3.6 stops per group while nonbuyers reported only 2.7 stops per group.

Table 11. Number of station stops made on the self-guided tour reported by persons interviewed at completion of the tour

Station stops made	Buyers[a]		Nonbuyers[a]		Total	
	Number	Percent	Number	Percent	Number	Percent
0	3	7.7	20	17.4	23	14.9
1	3	7.7	15	13.0	18	11.7
2	3	7.7	18	15.7	21	13.6
3	7	17.9	14	12.2	21	13.6
4	5	12.8	11	9.6	16	10.4
5	18	46.2	37	32.1	55	35.8
Total	39	100.0	115	100.0	154	100.0

[a]Those who did or did not purchase the visitor guide booklet.

Of the visitor groups responding to the mail questionnaire, 70 percent reported stopping at station 1 on the self-guided tour, 71 percent stopped at station 2, 68 percent at station 3, 69 percent at station 4 and 61 percent at station 5. The percentage of buyers stopping was higher than that for nonbuyers at all of the stations. Percentage of buyers stopping at stations 1 through 4 varied from 71 percent at 4 to 76 percent at 2. Buyers stopped at station 5 67 percent of the time. Nonbuyer percentages at stations 1 through 4 ranged from 62 percent at 3 to 68 percent at 1. Station 5 was stopped at by only 55 percent of the nonbuyers (Table 12).

Table 12. Frequency of stops at stations reported by 194 refuge visitors answering mail questionnaires

Station	Number of visitors stopping			Percent of visitors stopping		
	Buyers[a]	Nonbuyers[a]	Total	Buyers[a]	Nonbuyers[a]	Total
1	68	68	136	72.3	68.0	70.1
2	71	66	137	75.5	66.0	70.6
3	70	62	132	74.5	62.0	68.0
4	67	66	133	71.3	66.0	68.6
5	63	55	118	67.0	55.0	60.8

[a]Those who did or did not purchase the visitor guide booklet.

Visitor groups interviewed after finishing the self-guided tour reported stopping at the various stations in the following percentages: 64 percent at station 1, 57 percent at station 2, 64 percent at station 3, 62 percent at station 4 and 44 percent at station 5. As in the mail questionnaires, the percentage of buyers stopping was also higher than

the percentage of nonbuyers stopping for all stations. Buyers stopped most at station 3 and least at station 5. Nonbuyers stopped most at station 1 and also least at station 5, which was stopped at by only 38 percent, compared to 62 percent of the buyers (Table 13).

Table 13. Frequency of stops at stations reported by 154 groups interviewed at completion of the self-guided tour

Station	Number of visitors stopping			Percent of visitors stopping		
	Buyers[a]	Nonbuyers[a]	Total	Buyers[a]	Nonbuyers[a]	Total
1	29	69	98	74.4	60.0	63.6
2	27	61	88	69.2	53.0	57.1
3	32	66	98	82.1	57.4	63.6
4	28	68	96	71.8	59.1	62.3
5	24	44	68	61.5	38.3	44.2

[a]Those who did or did not purchase the visitor guide booklet.

A reliability test on the mail questionnaire responses indicated that this type of sampling was not too reliable in gathering accurate data. The test was performed by sending mail questionnaire cards to visitor groups who were observed from the tower at refuge headquarters as they took the self-guided tour. Answers regarding tour stops made on the questionnaires returned were then checked against the observations recorded from the tower. Results are listed in Table 14. The average number of disagreements per questionnaire was 2.2. Disagreements ranged from zero to five, the maximum number possible. The tendency of most persons filling in questionnaires was to report more stops at stations than were observed as being made.

Table 14. Agreement of station stops on the self-guided tour reported by groups answering mail questionnaires with tower observations

Station stops reported on mail questionnaires	Station stops observed from tower	Points of disagreement
1 2 3 4	1	3
1 2 3 4 5	3	4
1 2 3 4 5	1 4 5	2
1 2 3 4 5	3 5	3
1 2 4	1 2	1
1 2 3 4 5	1 2	3
1 2 4	1 2 3 4	1
1 2 3 4 5	1 4	3
1 2 3 4 5	2 3 4 5	1
1 2 3 4 5	1 2 3 4	1
2 4	1 2 3 4	2
1 2 3 4 5	1 2	3
1 2 3 4 5	1 3	3
1 2 3 4 5	3	4
1 2 3 4	1 3	2
1 2 3 4	1 2 3	1
1 2 3 4 5	1 2 3 4 5	0
2	1 2 3 4	3
3 5	1 3 4 5	2
	1 3	2
1 2 3 4	1 2 5	3
2 3 4	2	2
1 2 3 4 5	1 2 3 4 5	0
	3 5	2
1 2 3 4 5	3 5	3
1 2 3 4 5	1 3 4 5	1
1 2 3 4 5	3 4	3
1 2 3 4 5	1 3 4	2
1 2 3 4 5	1 2 3 4 5	0
	1	1
	4	1
1 2 3 4 5	1 2 3 4	1
1 3 4 5	1 2	4
	3 4 5	3
5	1 2 3 4 5	4
1 2 3 4 5	2 3	3
	1 3 4 5	4
1 2 3 4 5	1 2	3
5	1 2 3 4	5
1 2 3 4 5	1 2 3 4 5	0
1 2 3 4 5	3 4 5	2

Table 14. Continued

Station stops reported on mail questionnaires	Station stops observed from tower	Points of disagreement
1 2 3 4 5	1 3 4	2
	2 4	2
1 2 3 4 5	1 3	3
	1 2	2
Total - 45 observations		100
Average per reply		2.2

Tower observations of buyers of the visitor guide booklet showed that 80 percent stopped at station 1, 70 percent at station 2, 3 and 4, and 50 percent at station 5 (Table 15). Average time spent per group at the station stops was the least for station 1 (1.7 minutes) and greatest for station 3 (5.5 minutes).

Table 15. Tower observations of time in minutes spent at station stops on the self-guided tour by 20 buyers of the visitor guide

Stop	Total time at stop	Percent of total time	Average time per car	Number of cars stopping	Percent of cars stopping
1	34	10.3	1.7	16	80.0
2	72	21.9	3.6	14	70.0
3	109	33.1	5.5	14	70.0
4	74	22.5	3.7	14	70.0
5	40	12.2	2.0	10	50.0
Total	329	100.0	16.5		

Compared to buyers, nonbuyers observed from the tower stopped less at the stations and spent less time when they did stop. Only 58 percent stopped at station 1 and 36 percent at station 5. Least average time spent at the stops was o.7 minutes for station 5 and the greatest average was 3.9 minutes for station 3 (Table 16). The most time was spent by both buyers and nonbuyers at station 3, and the greatest percentage of nonbuyers stopped at this station. The greatest percentage of buyers stopped at station 1.

Table 16. Tower observations of time in minutes spent at station stops on the self-guided tour by 83 nonbuyers of the visitor guide

Stop	Total time at stop	Percent of total time	Average time per car	Number of cars stopping	Percent of cars stopping
1	70	8.9	0.8	48	57.8
2	76	9.6	0.9	37	44.6
3	321	40.6	3.9	55	66.3
4	264	33.4	3.2	45	54.2
5	59	7.5	0.7	30	36.1
Total	790	100.0	9.5		

Tower observations of visitor groups were also divided on a basis of first-time opposed to return visitor groups. On this basis, first-time visitor groups stopped more at the stations and spent more time. They stopped most at station 1 (71 percent of the time) and least at station 5 (45 percent of the time). They spent the most time at station 3, averaging 4.4 minutes there and the least time at station 5, averaging 1.1 minutes there (Table 17).

Table 17. Tower observations of time in minutes spent at station stops on the self-guided tour by 38 first-time refuge visitors

Stop	Total time at stop	Percent of total time	Average time per car	Number of cars stopping	Percent of cars stopping
1	51	11.4	1.3	27	71.1
2	74	16.6	1.9	24	63.2
3	168	37.7	4.4	26	68.4
4	111	24.9	2.9	25	65.8
5	42	9.4	1.1	17	44.7
Total	446	100.0	11.6		

Return visitors stopped most often at station 3 (66 percent of the time) and least often at station 5 (35 percent of the time). They averaged 0.8 minutes at station 1, 4 minutes at station 3 and 0.9 minutes at station 5 (Table 18). Highest average time for both categories of visitors was spent at station 3, and also the greatest percentage of visitors stopped at this station.

Table 18. Tower observations of time in minutes spent at station stops on the self-guided tour by 65 return visitors to the refuge

Stop	Total time at stop	Percent of total time	Average time per car	Number of cars stopping	Percent of cars stopping
1	53	7.9	0.8	37	56.9
2	74	11.0	1.1	27	41.5
3	258	38.3	4.0	43	66.2
4	231	34.3	3.6	34	52.3
5	57	8.5	0.9	23	35.4
Total	673	100.0	10.4		

Of the total 103 visitor groups observed from the tower, 62 percent stopped at station 1, 50 percent at station 2, 62 percent at station 3, 57 percent at station 4 and 39 percent at station 5. This indicates that station 3 was most popular, followed by stations 1, 4, 2 and 5 in that order. The most time was spent at station 3, which had an average of 4.1 minutes spent per visitor group. The least amount of time was spent at stations 1 and 5, which each showed an average of 1 minute spent per visitor group (Table 19).

Table 19. Tower observations of time in minutes spent at station stops on the self-guided tour by all 103 refuge visitors

Stop	Total time at stop	Percent of total time	Average time per car	Number of cars stopping	Percent of cars stopping
1	104	9.3	1.0	64	62.1
2	148	13.2	1.4	51	49.5
3	426	38.1	4.1	64	62.1
4	342	30.6	3.3	59	57.3
5	99	8.8	1.0	40	38.8
Total	1,119	100.0	10.8		

A number of stops at the various stations observed were of a duration of only a few seconds, but as previously mentioned, these were considered stops of a full minute in the tabulations. Keeping this in mind, the true average time spent at the different stops would be somewhat lower for all of the stops. Brief stops were particularly noticed at stations 1 and 5 of the tour.

Observations from the tower were also used to determine the rate

of speed of visitor groups during different segments of the tour. Groups taking the tour were observed to follow a general pattern of slow rate of travel during the first portion of the tour, and then gradual increase of speed during the remainder of the tour. This may be an indication that possibly the tour is too long, and some interest of the visitor groups is lost by seeing largely a repetition of what was seen in the first portion during the remainder of the tour.

Since the distances between station stops on the tour are unequal, it was necessary to adjust the distances to a common unit of measurement in order to compare rates of travel. Unit of measurement selected was the amount of time (minutes) that it would take at a particular speed to travel 1 mile. Average time per group to drive from refuge headquarters to station 1, a distance of 1.4 miles was 16.6 minutes, or 11.9 minutes per mile. Average speed between station 1 and station 2 (2.1 miles) was 7.7 minutes per mile; between station 2 and station 3 (2.1 miles) it was 6.2 minutes per mile; between station 3 and station 4 (2.4 miles), 5.6 minutes per mile; between station 4 and station 5 (2.6 miles), 5.4 minutes per mile and between station 5 and refuge headquarters, a distance of 1.4 miles, speed was 5.6 minutes per mile (Table 20).

Converting minutes per mile to miles per hour, the visitor groups observed showed the following average speeds: Headquarters to station 1, 5.1 m.p.h.; station 1 to station 2, 7.8 m.p.h.; station 2 to station 3, 9.6 m.p.h.; station 3 to station 4, 10.8 m.p.h.; station 4 to station 5, 11.1 m.p.h. and station 5 to headquarters, 10.7 m.p.h.

Of the 154 groups of visitors interviewed after finishing the tour, 31 percent climbed none of the four observation towers available

Table 20. Tower observations of time spent traveling between station stops by visitor groups taking the self-guided tour

Portion of tour	Distance in miles	Number observed	Total time[a]	Average per car	Minutes per mile
Headquarters to station 1	1.4	73	1,212	16.6	11.9
Station 1 to station 2	2.1	57	810	14.2	7.7
Station 2 to station 3	2.1	53	693	13.1	6.2
Station 3 to station 4	2.4	60	802	13.4	5.6
Station 4 to station 5	2.6	48	673	14.0	5.4
Station 5 to headquarters	1.4	57	447	7.8	5.6
Total	12.0	348	4,637	79.1	

[a]In minutes.

to the public. Of the total, 29 percent climbed only one of the four towers and only 10 percent climbed all four towers. Buyers of the visitor guide who climbed all four towers were 13 percent of the total, compared to 9 percent of the nonbuyer groups who climbed all of the towers. Percentage of buyers climbing one or three towers was also greater than that of nonbuyers, but more nonbuyers (22 percent) climbed two of the towers than did buyers (15 percent). Only 15 percent of the buyer groups did not climb any of the towers, while 36 percent of nonbuyers failed to climb any (Table 21).

The tower receiving the most use by both buyer and nonbuyer groups was the one at station 3. It was climbed by 67 percent of the buyer groups and 42 percent of nonbuyer groups. The tower receiving the least use by buyer groups was the headquarters tower, while nonbuyers used the one at station 5 the least. A greater percentage of buyers climbed all of the towers than did nonbuyers, with the exception of the

Table 21. Number of towers climbed per group on the self-guided tour by 154 groups interviewed at completion of the tour

Towers climbed	Buyers[a]		Nonbuyers[a]		Total	
	Number	Percent	Number	Percent	Number	Percent
0	6	15.4	41	35.7	47	30.5
1	16	41.0	29	25.2	45	29.3
2	6	15.4	25	21.7	31	20.1
3	6	15.4	10	8.7	16	10.4
4	5	12.8	10	8.7	15	9.7
Total	39	100.0	115	100.0	154	100.0

[a]Those who did or did not purchase the visitor guide booklet.

headquarters tower, which was climbed more by nonbuyers. Of the total 154 groups interviewed, 48 percent climbed the tower at station 3 and 18 percent the tower at station 5 (Table 22).

Table 22. Frequency of tower climbing at stations on the self-guided tour reported by 154 groups interviewed at completion of the tour

Tower location	Number of visitors climbing			Percent of visitors climbing		
	Buyers[a]	Nonbuyers[a]	Total	Buyers[a]	Nonbuyers[a]	Total
Headquarters	10	44	54	25.6	38.3	35.1
Station 3	26	48	74	66.7	41.7	48.1
Station 4	19	40	59	48.7	34.8	38.3
Station 5	11	17	28	28.2	14.8	18.2
Total	66	149	215			

[a]Those who did or did not purchase the visitor guide booklet.

Average number of towers climbed by buyer groups taking the self-guided tour was 1.7 per group. Nonbuyers averaged 1.3 towers climbed per group while the average of the total visitor groups interviewed was 1.4 towers climbed per group.

The average time spent on the actual self-guided tour by a total of 450 visitor groups sampled by the three methods, mail questionnaires, interviews and tower observations was 89 minutes per group (Table 23).

Table 23. Time in minutes spent on the self-guided tour by 450 groups of refuge visitors sampled by three different methods

Type of sample	Number of groups	Total time on tour	Average time per group
Mail questionnaire - buyers[a]	92	10,419	113.3
Mail questionnaire - nonbuyers[a]	102	8,434	82.7
Tower observations - buyers[a]	20	1,876	83.5
Tower observations - nonbuyers[a]	82	6,845	83.5
Interviews - buyers[a]	39	3,344	85.7
Interviews - nonbuyers[a]	115	9,015	78.4
Total - buyers[a]	151	15,639	103.6
Total - nonbuyers[a]	299	24,294	81.3
Grand total	450	39,933	88.7

[a]Those who did or did not purchase the visitor guide booklet.

Average tour time of 151 tour guide buyers sampled by the three methods was 104 minutes per group and 299 nonbuyers averaged 81 minutes per group. Of the total sample then, buyers of the tour guide averaged

23 minutes longer on the self-guided tour than did nonbuyers. Mail questionnaire results showed the greatest difference between these two categories of visitors, with buyers spending an average of 31 minutes longer on the tour. Tower observation tabulations showed buyers spending an average of 22 minutes longer than nonbuyers, and interviews showed a difference of 7 minutes in the average time spent, also in favor of the buyers.

Information and Tour Guide Booklet

From September 27, 1968 when the tour guide was first placed on sale until July 17, 1970, a total of 1,678 copies were sold to visitors at the refuge. Additional copies were distributed or sold by local motels, the Brigham City Chamber of Commerce and the Utah Travel Council in their promotion of the area as a tourist attraction. A total of 798 copies of the booklet were sold to visitors at the refuge during the year of 1969. Since approximately 3,126 groups of visitors took the self-guided tour in 1969, only about 25.5 percent of the groups purchased an information and tour guide booklet. Since the above figure does not take into account those booklets purchased by educational groups touring the refuge with guides, a more realistic figure perhaps would be that slightly under 25 percent of the groups taking the self-guided tour purchased the information and tour guide booklet. Of the sampling methods used in this study, only the interviews conducted at the conclusion of the self-guided tour could be considered a random sample. Of 154 groups interviewed, 39 or 25.3 percent had purchased the visitor guide.

During the period of data gathering for this study, copies of the

tour guide were put in a rack which was placed on the counter at the refuge headquarters. The rack was positioned near the visitor register (Figure 14) so that visitors could see the booklet as they registered. Generally the refuge worker on duty at the counter called no specific attention to the booklet unless questions were directed to him about it. This was particularly true during the periods when visitor groups were interviewed, and when the list of names was gathered for the mail questionnaire. During these periods refuge personnel, at the request of the author, did not call attention to the booklet, but rather let the visitor groups see and purchase it on their own.

Of the 100 nonbuyers of the booklet answering mail questionnaires in 1969, 68 percent replied that they had not seen a copy of the booklet, even though it was directly in front of them when they signed the visitor register. The remaining percentage replied that they had seen the booklet but had not purchased it. Of the 115 nonbuyers interviewed, 77 or 67 percent reported that they had not seen a copy of the tour guide.

Respondents to the mail questionnaire who purchased the visitor guide booklet reported the following use of the booklet as a step-by-step guide as they drove around the tour. Of the total, 52 percent reported using the booklet as a step-by-step guide most of the time, 30 percent reported using it step-by-step some of the time and 14 percent reported using it in this manner none of the time (Table 24). Of the interviewed buyer groups, 38.5 percent reported using the booklet as a step-by-step guide.

Of the buyers of the visitor guide booklet responding to the mail questionnaire, 85 percent reported use of the guide after returning

Figure 14. Interior of the refuge office showing the placement of the information and tour guide booklet.

Table 24. Use of the visitor guide booklet as a step-by-step tour guide reported by buyers responding to mail questionnaires

Use of guide during tour	Number	Percent
Most of the time	49	52.1
Some of the time	28	29.8
None of the time	13	13.8
No answer	4	4.3
Total	94	100.0

home from their visit. The 94 buyers responding reported 108 uses of the booklet. Of the 94 buyers, 76 percent reported use of the booklet as a reference, 40 percent as a souvenir and 19 percent other uses (Table 25). Included in this category were such uses as showing to friends, giving away to friends and relatives, making it a part of a nature library, using to encourage others to visit the refuge and to prepare talks for slide shows.

Table 25. Guide booklet buyers responding to mail questionnaires who used the booklet after returning home and type of use

Response	Number	Percent	Type of use	Number	Percent
Yes	80	85.1	Reference	61	76.3
No	9	9.6	Souvenir	32	40.0
No answer	5	5.3	Other	15	18.8
Total	94	100.0		108	

Of the buyers responding to the mail questionnaire, 91.5 percent said that they felt they had benefited more from their trip to the refuge by purchasing the visitor guide booklet. A total of 28 suggestions for improving the booklet were offered. Included were such suggestions as the use of more color, more detail about bird identification, include current census data, include more bird descriptions, use of bird paintings instead of just photographs, include more information on nesting habits, more migration information and include pictures of all the refuge birds.

Of the buyers interviewed, 89.7 percent felt they had a better refuge visit because of the booklet, and 10.3 percent said they had not. Suggestions for improving the booklet were much the same as those listed above for the mail questionnaire respondents.

Visitor Satisfaction

Of the visitor groups responding to the mail questionnaire, 64 percent expressed that they would have liked more time to spend on the tour. This indicates that a good share of visitors, not knowing the extent of the recreational opportunities of the refuge failed to plan sufficient time for their visit, or came too late in the day and were rushed by the closing time. Of groups who bought the visitor guide booklet, 70 percent would have liked more time, while 58 percent of nonbuyer groups expressed the desire for more time (Table 26).

A total of 86 percent of the visitor groups responding to the mail questionnaire expressed that they were in favor of the self-guided tour at Bear River Refuge, while 8.2 percent did not favor the tour. Both buyer and nonbuyer groups were very close in percentages expressing

Table 26. Number of refuge visitors responding to mail questionnaires who would have liked more time to spend on the self-guided tour

Response	Buyers[a]		Nonbuyers[a]		Total	
	Number	Percent	Number	Percent	Number	Percent
Yes	66	70.2	58	58.0	124	63.9
No	17	18.1	32	32.0	49	25.3
No answer	11	11.7	10	10.0	21	10.8
Total	94	100.0	100	100.0	194	100.0

[a]Those who did or did not purchase the visitor guide booklet.

satisfaction with the tour. Buyers were satisfied 85 percent of the time and nonbuyers were satisfied 86 percent of the time (Table 27).

Table 27. Number of refuge visitors responding to mail questionnaires who favored the self-guided tour

Response	Buyers[a]		Nonbuyers[a]		Total	
	Number	Percent	Number	Percent	Number	Percent
Yes	80	85.1	86	86.0	166	85.6
No	8	8.5	8	8.0	16	8.2
No answer	6	6.4	6	6.0	12	6.2
Total	94	100.0	100	100.0	194	100.0

[a]Those who did or did not purchase the visitor guide booklet.

A total of 93 percent of visitor groups interviewed expressed satisfaction with the Bear River Refuge tour, leaving 7 percent who were not satisfied. Buyer groups expressed satisfaction 95 percent of the time, and nonbuyer groups 92 percent (Table 28).

Table 28. Satisfaction with the self-guided tour of visitors interviewed at completion of the tour

Response	Buyers[a]		Nonbuyers[a]		Total	
	Number	Percent	Number	Percent	Number	Percent
Yes	37	94.9	106	92.2	143	92.9
No	2	5.1	9	7.8	11	7.1
Total	39	100.0	115	100.0	154	100.0

[a]Those who did or did not purchase the visitor guide booklet.

Buyer dissatisfactions with the tour were that there had been no development of the area in 20 years and that not enough birds were seen. Nonbuyer dissatisfactions included: not enough birds were seen, tour road should be paved, more information needed at the station stops and the closing time was too early.

A total of 83 dissatisfactions with the refuge area and refuge facilities were expressed by the 154 visitor groups interviewed at completion of the self-guided tour. Three groups were dissatisfied with the restrooms, four with signs, five with roads, five with picnic facilities, 27 with the fee charge system and 39 expressed dissatisfaction with facilities other than those on the interview sheet

(Figure 15). Of the 27 groups expressing dissatisfaction with the fee charging system, 22 groups said they preferred the Federal Golden Eagle Passport, which was not approved by congress in 1970. These groups felt that the Golden Eagle was better than paying fees at each different Federal area.

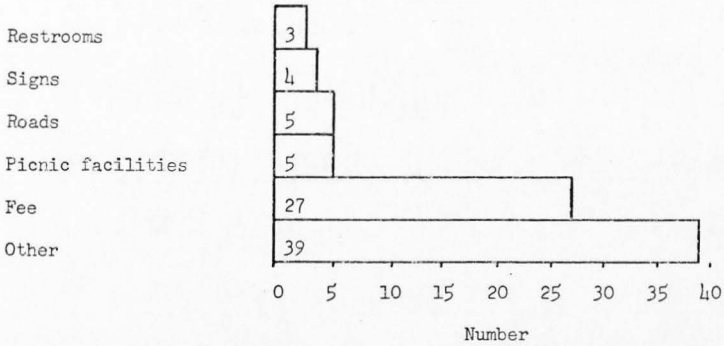

Figure 15. Number of visitor groups mentioning various types of dissatisfaction with refuge facilities when interviewed at completion of the self-guided tour (154 groups)

Dissatisfactions other than those on the interview sheet included: too many mosquitos and other insects, lack of sufficient shade trees, not enough visitor contact in the refuge office, lack of concession facilities (pop and other vending machines), poor drinking water, closing time too early and lack of more informative displays in the visitor center.

CONCLUSIONS AND RECOMMENDATIONS

From examination of the data, the following conclusions and recommendations have been made:

(1) Visitor groups tend to fall into two categories, with exceptions: The first is the group who has not been to the refuge before, who purchased the visitor guide booklet, has traveled a considerable distance to reach the refuge, spends more time on the tour, makes more stops at the stations, climbs more towers and spends more overall time on the refuge. The second category includes groups who are return visitors, who do not purchase the visitor guide, have traveled only a short distance to the refuge, spend less time on the tour, make less stops and climb less towers. It cannot be concluded, however, that the first category is getting a better recreational experience. Return visitors have less need for the guide booklet, since they are familiar with the area, and having experienced the station stops and towers, are less prone to make these a part of every tour. The fact that these people keep returning is evidence enough that they are getting the recreational experience for which they came.

(2) The tour is probably too long, or if not too long, there is not enough in the final portion of the tour to sustain visitor interest. This is pointed out in the data by the increase in the rate of travel of visitor groups during the latter portions of the tour, and by the low percentage of visitors stopping at station 5, the last stop on the tour. There is no interpretive sign at station 5 to attract visitor interest. Station 3 received the most stops of any station, even

though it had no interpretive sign, but being early in the tour, and the first station with an observation tower, is probable reason for its popularity.

To sustain visitor interest, station 5 should have an interpretive sign. A logical subject for the sign is the cliff swallow, since nests of this bird are on the station tower year-round and active in spring and summer. The sign should be similar in design to the others on the tour and be anchored in the ground at the edge of the turnout near the tower.

Consideration should be given to replacing the sign on the station 3 tower. If it is not feasible to have the sign on the tower because of bird droppings, it should be anchored in the ground. Consideration should also be given to other subjects in place of the Great Salt Lake islands and mountains for interpretation on this sign, as two of the signs are already concerned with the geology of the area.

Another addition to the tour that would do much to stimulate visitor interest would be the installation of speaker boxes on posts at the station stops. These could contain a repeating recorded narrative about highlights at the station area and could be activated by visitors pushing a button on the box.

(3) The visitor information booklet and tour guide is not as effective as it could be in telling the refuge story. It was included as a part of the recreation experience of only 25 percent of the groups taking the tour, and of this 25 percent only about half used the booklet to any degree in their tour.

Several groups expressed the view that they felt they didn't have enough time to read the booklet while at the refuge, but would rather

wait until they returned home and use all the time at the refuge to see what was available. However, most groups expressed satisfaction with the booklet and commended it as a quality publication. A cause for concern is the fact that of those sampled who did not purchase the booklet, almost 70 percent said they had not seen it and did not know it was available, even though it was in the rack directly in front of them as they registered. Refuge personnel should adopt a policy of calling the booklet to the attention of every visitor group, and briefly explaining its purpose and contents.

A means of assuring all visitor groups the opportunity of seeing and using the visitor guide booklet would be to give each group a copy of the booklet to use on the tour with the instruction that if, after the tour, they desired to purchase it they could do so by paying for it at the refuge headquarters at the end of the tour. If they desired not to purchase the booklet they could just return it to headquarters so that another group could use it. There would undoubtedly be some loss of booklets without payment, but this would probably be minimal, and the value gained by giving all visitor groups the opportunity to see the booklet would perhaps outweigh any losses.

(4) Since the visitor information booklet and tour guide is not being used to any extent as a step-by-step guide during actual tours as anticipated, it should be modified to better serve this purpose. It is felt that the booklet in its present form is too long to be utilized as a step-by-step guide by most visitors. One solution would be to divide the booklet into two separate and more distinct sections; an information section in essentially the same format and content as the present booklet, and a much-shortened tour guide.

Another solution would be to use the booklet in its present form with a brief and colorful tour guide section inserted inside the front cover. An insertion of this type could be made up for each of the major seasons when there is heavy visitor use; spring, summer and fall.

A supplement to either of these alternatives could be the use of a system of short-range repeating radio broadcasts originating from each of the station stops. Visitors could be instructed at headquarters to tune their car radios to a certain frequency to receive the broadcast. As the car progressed around the tour, it would leave the broadcasting range of one station and enter the next, and receive five different interpretive messages during the course of the tour.

(5) The self-guided tour at Bear River Refuge is sustaining itself as a recreation resource, hinged upon proper management of the area. It cannot be stressed enough that the quality of the Bear River Refuge tour depends on the continued management and development of the refuge area to keep it in a condition where it will support and attract large numbers of waterfowl and other birds. Deterioration of the refuge area as prime nesting and feeding grounds for these birds would seriously affect the quality of the self-guided tour. Liberties of visitors taking the tour should be restricted to assure continued enjoyment of the tour. Allowing free run of the area, even on a small scale could have a noticable effect on the quality of a tour of this type.

(6) A high percentage of visitors taking the self-guided tour expressed satisfaction with it and with the refuge facilities. If it is possible to judge area quality solely on user satisfaction, then the self-guided tour at Bear River Refuge should be termed a quality recreational activity.

SUMMARY

In 1967 a study was initiated to evaluate the self-guided tour of Bear River Migratory Bird Refuge, a national wildlife refuge. Specific objectives of the study were: (1) To carry out plans of the Bear River Refuge for the setting up of a visitor tour; (2) To prepare a visitor information booklet and guide for a tour of the refuge; (3) To determine the effectiveness of the visitor guide in telling the refuge story; (4) To evaluate self-guided tour use by studying the characteristics, activities and satisfactions of the visitors; and (5) Evaluate the quality of the self-guided visitor tour at Bear River Refuge and its value as a form of outdoor recreation.

The overall objective of the study was to critically examine the self-guided tour of the refuge in an attempt to learn what type of persons visit Bear River Refuge, where they come from, what they come for and how long they stay, and to gain a measure of Bear River's self-guided visitor tour in terms of quality.

To gather data on visitor use of the refuge, three methods of directly sampling the visitor public were employed. They were: mail questionnaires, on-site interviews and candid observations of tour group behavior from a refuge tower with the aid of a spotting scope. In analyzing the findings, more emphasis was placed on the latter two sampling methods.

A review of the literature indicated that visitor use studies had been done on other Federal and state recreation areas, but none on a national wildlife refuge, or none concerned with a self-guided

automobile tour.

Throughout the study an effort was made to compare visitor groups who purchased the tour guide booklet with those who did not. Comparison was also made between first-time visitors and return visitors.

Peak use months of the area were May, June, July, August and September, with June receiving the greatest use. The self-guided tour received the greatest use on weekends and holidays, with the most use coming on Sunday afternoons.

Over half of the refuge visitors taking the self-guided tour came from within a radius of 50 miles of the refuge. A good number of visitors came from the west coast, chiefly California. More local people visited on weekends and holidays, while more people came from greater distances on weekdays.

Of the total visitor groups taking the self-guided tour, 85 percent were families. Average size of groups was just under 4 persons. More males than females visited and almost one-third of the visitors were under 12 years of age, and slightly more than one-fourth were 25 to 44 years of age.

Predominant type of visit was 1 day or less, with the refuge as a definite destination. Sightseeing and pleasure driving were the main reasons for visiting for the most groups, and birdwatching was second in popularity. Birdwatching and picnicing were the most popular secondary activities.

About 60 percent of the visitors were first-time and 40 percent return visitors. More of the first-time visitors bought the tour guide booklet. Of the return visitors, buyer groups averaged between 5 and 7 previous visits while nonbuyer groups averaged between 10 and

12 previous visits.

Average time spent on the self-guided tour by all of the groups sampled was 88.7 minutes. Buyer groups averaged over 20 minutes longer on the tour than did nonbuyer groups. Average time spent by groups on the refuge before beginning the tour was about 15 minutes, and average time spent on the refuge after the tour was about 9 minutes. Average total time spent on the refuge by visitor groups was 103 minutes. Generally, buyer groups spent more time in all categories than did nonbuyer groups, first-time visitors spent more time than did return visitors and those traveling greater distances to the refuge spent more time than did those traveling lesser distances.

About one-half of the visitor groups stopped at all five of the stations on the tour. Buyer groups stopped more often than did nonbuyer groups. An average of about three station stops per group were made by all groups sampled. The most popular station was number 3, while station 5 was stopped at the least. An average of 4.4 minutes was spent at station 3 by all groups sampled while an average of only 1.1 minutes was spent at station 5. The average spent at all of the stops combined was 11.6 minutes per group. Buyers of the booklet spent more time at the stops than did nonbuyers, and first-time visitors spent more time than return visitors.

Visitor groups traveled slower during the early parts of the tour, but gradually picked up speed as the tour progressed. Buyers traveled more slowly than did nonbuyers.

Tower climbing was popular with visitor groups, with 70 percent climbing at least one of the four towers available. All four towers were climbed by 10 percent of the visitors. Again, buyers climbed more

towers than did nonbuyers, and the tower at station 3 was climbed most often. The tower at station 5 was climbed the least.

About one-fourth of the visitor groups taking the tour purchased the visitor guide booklet. Almost 70 percent of those groups not buying the booklet reported that they had not seen the booklet and were not aware that it was available. Less than half of those groups purchasing the booklet used it as a step-by-step guide while taking the tour, though most groups expressed satisfaction with the booklet. Most of the buyers reported using the booklet after returning home from the refuge visit.

A total of 86 percent of one sample and 93 percent of another sample expressed satisfaction with the visitor tour. The most common dissatisfaction with the refuge area and facilities was annoyance caused by mosquitos and other insects. Generally the refuge facilities received few complaints.

Conclusions reached were: (1) Visitor groups tend to fall into two categories; first-time visitors who buy the booklet, come from greater distances and spend more time, and return visitors who do not purchase the booklet, travel shorter distances and spend less time; (2) The tour is probably too long, or if not too long, there is not enough in the final portion to sustain visitor interest; (3) The visitor information booklet and tour guide is not as effective as it could be in telling the refuge story; (4) The tour guide should be modified to be more useful as a step-by-step guide; (5) The self-guided tour is sustaining itself as a recreation resource, hinged upon proper management of the area; and (6) Based on visitor satisfaction, the self-guided tour should be termed a quality recreational activity.

Recommendations include: (1) The installation of interpretive signs at stations 3 and 5; (2) Installation of speaker boxes at the stations with a repeating recorded message; (3) Calling the attention of all visitor groups to the booklet; (4) Separating the present booklet into two distinct sections, an information part and a tour guide part; (5) Using the booklet in its present form with a brief seasonal tour guide inserted; and (6) Installation of a short-range radio broadcast system at each station which could be received on visitors' car radios as they neared each station.

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APPENDIX

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
UTAH COOPERATIVE WILDLIFE RESEARCH UNIT
UTAH STATE UNIVERSITY
LOGAN, UTAH 84321

Utah State University
Logan, Utah 84321

June 9, 1969

Dear

Since the spring of 1967 we have been conducting research on the public use program of the Bear River Migratory Bird Refuge. More specifically, our project deals with the self-guided visitor tour which has been a part of the refuge program for some time.

As the project nears completion, we realize it is most important to seek the viewpoint of the visiting public. It is for this reason we have mailed you and other recent visitors to the refuge the enclosed questionnaire. We sincerely hope you can take a few minutes from your schedule to complete and return this self-addressed questionnaire. This is practically the only way we can find out if the recreation programs of the refuge are meeting the needs of the public.

We thank you for your cooperation.

Sincerely,

Steven J. Kohler

Steven J. Kohler
Utah Cooperative Wildlife Research Unit
Utah State University

Bear River Refuge Visitors Use Questionnaire

1. Have you visited the Bear River Refuge before? ( )yes ( )no. About how many times? _____

2. At which of the numbered stations on the visitor tour did you stop? ( )1 ( )2 ( )3 ( )4 ( )5. Would you have liked more time to spend on the tour? ( )yes ( )no. Do you favor a self-guided tour of this type? ( )yes ( )no.

3. Did you see a copy of the 20 page color Visitor Information Booklet and Tour Guide which sells for $ .30? ( )yes ( )no. Did you buy the booklet? ( ) ( ).

IF YOU BOUGHT THE BOOKLET:

4. Did you use the booklet as a step-by-step guide during your actual tour of the refuge? ( )most of the time ( )some of the time ( )none of the time.

5. Have you or any member of your family used the booklet since returning home from your refuge visit? ( )yes ( )no. What type of use was it? ( )reference ( )souvenir ( )other _____.

6. Do you feel that you benefited more from your trip to the refuge by buying the guide booklet? ( )yes ( )no. How could the booklet be improved?_____.

Thank you,

Utah Cooperative Wildlife Research Unit
Utah State Univeristy
Logan, Utah 84321

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Utah Cooperative Wildlife Research Unit

Utah State University

Logan, Utah 84321

BEAR RIVER REFUGE VISITOR USE QUESTIONNAIRE

Date _____ Day of Week _____
License Number _____ Vehicle Description _____
Time In _____ Time Out _____
Start Tour _____ End Tour _____

1. Have you visited the refuge before?
   Yes ___ No ___ Approximate number of times ___
   This year? Yes ___ No ___

2. Place of residence _____

3. Character of visit:
   Just passing through ___ Day outing ___ More than one day ___

4. Reason for visit: Primary (X) Secondary (/)
   Sightseeing and pleasure driving ___ Bird watching ___
   Photography ___ Picnicing ___
   Other _____ Fishing ___

5. Group characteristics: Family outing or group of friends?
   Individual ___ Family ___
   Friends ___ Number in Vehicle ___

6. Sex and age of visitors:

	Male	Female		Male	Female
Under 12	___	___	25-44	___	___
12-17	___	___	45-64	___	___
18-24	___	___	65 and over	___	___

7. Were you satisfied with the visitor tour?
   Yes ___ No ___ Too long ___ Too short ___

8. What facilities do you think could be improved?
   Roads ___ Signs ___ Picnic facilities ___ Fee ___
   Restrooms ___ Other _____

9. At which of the numbered stations on the tour did you stop?
   (1) ___ (2) ___ (3) ___ (4) ___ (5) ___

10. Did you climb any of the towers?
    Headquarters ___ (3) ___ (4) ___ (5) ___

11. Did you see a copy of the 20 page Visitor Information Booklet and Tour Guide which sells for $.30? Yes ___ No ___

12. Did you buy the booklet? Yes ___ No ___

13. Do you feel that you benefited more from your trip to the refuge by buying the booklet? Yes ___ No ___

14. How could the booklet be improved?

BEAR RIVER MIGRATORY BIRD REFUGE

VISITOR INFORMATION AND TOUR GUIDE BOOKLET

pages 92 through 103

Bear River

MIGRATORY BIRD REFUGE

VISITOR INFORMATION
AND TOUR GUIDE

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MIGRATORY BIRD REFUGE

A Visitor Information Booklet and Tour Guide

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Front Cover:
Canada goose and young.

Inside Front Cover:
White-faced ibis.

The National Wildlife Refuge System

When the first colonists reached America, they found a land of abundant soil, forests, and wildlife. The settlers that followed them and continued to push westward were not concerned about the future of wildlife and the other resources of the land; to them it seemed there was enough to satisfy all demands. But as expansion continued, great areas of wildlife habitat gave way to the ax and plow, and wildlife numbers dwindled under the pressure of uncontrolled hunting. By the late 1800's a few species had disappeared, and it seemed that many would meet the same fate. During this period, conservation-minded leaders realized the need for setting aside the best remaining wildlife areas for the use of future generations.

The first National Wildlife Refuge was created in 1903 when President Theodore Roosevelt set aside Pelican Island on the east coast of Florida to protect a nesting colony of brown pelicans and herons. He later established additional refuges on public lands, and Congress and later presidents continued to add more areas. In 1929 the Migratory Bird Conservation Act provided the authority for purchase of wetlands, and many waterfowl refuges were added to the system.

Today there are more than 300 refuges totalling 28,750,000 acres which in combination make up the National Wildlife Refuge System. These refuges protect many types of wildlife and preserve varied habitats and breeding sites, but are particularly important to migratory birds, with three-fourths of the refuges being established for these birds. Also part of the National Refuge System are numerous small pothole marshes in the prairie states. These areas produce large numbers of ducks, and emphasis has been placed on their acquisition to prevent drainage and conversion to farmland. Approximately 2,000,000 acres of these small wetland areas have been scheduled for purchase, lease, or easement.

Often refuges have been created from areas that were misused in the past through drainage, lumbering, burning, or overgrazing, and have been restored to good habitat by building dikes or replanting. The Bear River Refuge is one of these refuges that consists largely of reclaimed lands. Administration of the National Wildlife Refuge System is by the Bureau of Sport Fisheries and Wildlife in the Fish and Wildlife Service, which falls under the supervision of the Department of the Interior.

THE UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND WILDLIFE • FISH AND WILDLIFE SERVICE

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Bear River Migratory Bird Refuge

Welcome to Bear River Refuge. Located on the delta of Bear River where it empties into the Great Salt Lake in northern Utah, the refuge constitutes an area of approximately 65,000 acres, most of which is excellent waterfowl habitat. The refuge is divided into five units of open water and marsh areas surrounded by earthen dikes. A dam across Bear River near the refuge headquarters helps regulate the variable water flow entering the refuge, and a system of canals carries water to the marsh areas. When originally built, the outer dikes were intended to prevent the highly saline waters of the Great Salt Lake from intruding into the fresh water developments but due to decreased rainfall and increased demand for water by agriculture, industry, and communities, the level of the lake has fallen and the shore is presently about 12 miles beyond the dikes.

HISTORY OF THE REFUGE AREA

When the first white men entered Great Salt Lake Valley, they found it inhabited by wildlife and Indians. Recent archaeological findings have shown that waterfowl were an important item in the diet of these Indians, and this source of food may have been one reason for their gathering in the otherwise dry and desolate valley.

Early explorers found an extensive marsh area on the delta where the Bear River empties into Great Salt Lake, and such men as Jim Bridger and Captain John C. Fremont reported seeing great numbers of waterfowl. One such explorer, Captain Howard Stansbury, gave the following description of what he saw at Bear

Artist Bob Hines has pictured his concept of how it may have looked when Jim Bridger came down the Bear River and entered the bay.

River Bay in October 1849. "The marshes were covered by immense flocks of wild geese and ducks among which many swans were seen, being distinguishable by their size and the whiteness of their plumage. I had seen large flocks of these birds before, in various parts of our country, and especially upon the Potomac, but never did I behold anything like the immense numbers here congregated together. Thousands of acres, as far as the eye could reach, seemed literally covered with them, presenting a scene of busy, animated cheerfulness, in most graceful contrast with the dreary, silent solitude by which we were immediately surrounded."

The first settlers arrived in the valley of the Great Salt Lake in 1847. Because of the aridness of the land irrigation was necessary to grow crops, and water from the Bear River was used extensively for this purpose. As settlements grew the demands for water from the Bear River and its tributaries became intense, and by the early 1900's little remained of the once extensive marshes at the mouth of the river.

Loss of habitat combined with unrestricted hunting cut deeply into the great waterfowl flocks. From 1877 to 1900, market hunters killed more than 200,000 ducks annually and shipped them to eastern markets.

Avian botulism was another factor in further reducing the waterfowl populations. It was first noticed around 1900, and in 1910 about half a million ducks died near the mouth of the Bear River during late summer. In an effort to save the rapidly dwindling waterfowl and habitat, large portions of the remaining marsh areas were bought or leased by sportsmen's groups and the Utah Fish and Game Commission.

Through their efforts and those of Federal officials, the Bear River Migratory Bird Refuge was established by a special act of Congress on April 23, 1928. Its primary purpose was to preserve suitable resting, feeding, and breeding areas for migratory birds. A secondary objective was to minimize losses to botulism.

REFUGE ACTIVITIES

Headquarters of the refuge are about 15 miles west of Brigham City, and consist of an administration building, a research laboratory, residences, and several utility buildings. Rest rooms, drinking water, camping, and picnic areas are provided for visitor comfort. There is also a 100 foot tower which offers a fine view of the refuge and surrounding area.

The numerous aspects of the refuge offer interest to all visitors, and whether you have come as a tourist, naturalist, photographer, sportsman, or student, you will find something here to enjoy. Fishing is allowed in the water near headquarters and is popular during the summer months. Catches include carp, black bullhead, and channel catfish. A portion of the refuge is open to public hunting during the fall and winter and offers excellent shooting. Please check at headquarters for information about hunting and fishing.

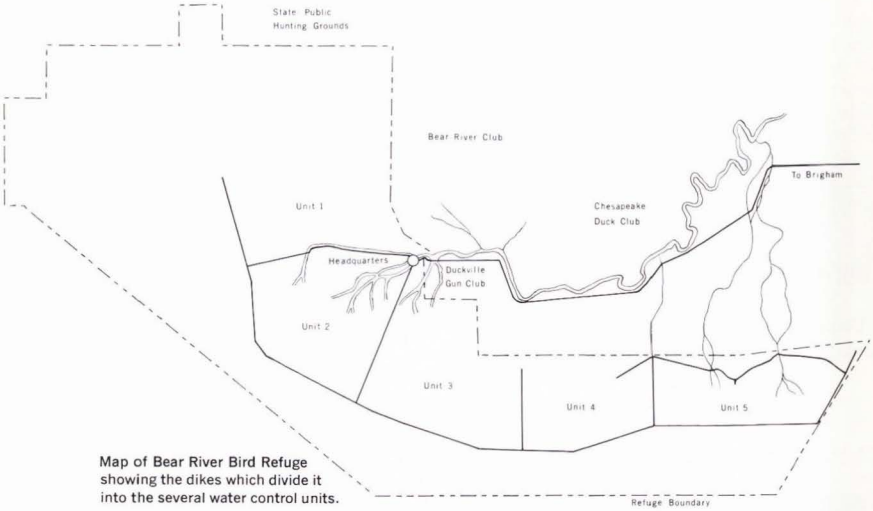
Tour of the Refuge

Visitors are invited to drive their cars around the 12 miles of dike road surrounding Unit Two. For those with limited time, the drive can be made in about 45 minutes.

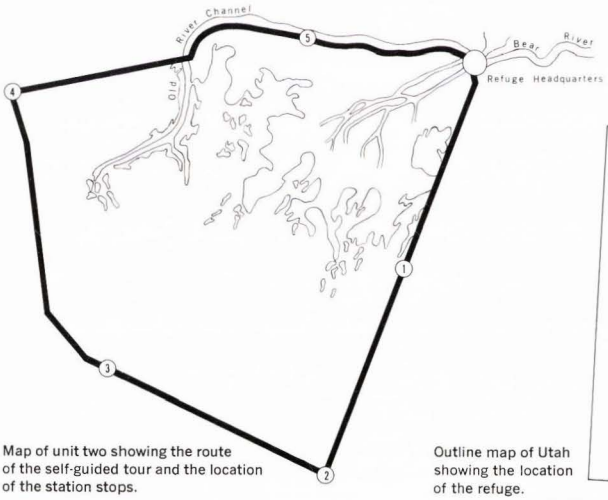
This booklet will serve as your guide for the tour, which is outlined on the refuge map. As you drive around the dike you will see numbered signs which correspond to sections in this booklet. These stops are designed to point out certain features of the area and suggest points of special interest. Take as much time as you like and enjoy yourself, but please remember to stay on the dike road and prevent any unnecessary disturbance to the wildlife. The care and respect you show will insure the same amount of pleasure for those who follow.

We hope this booklet will enhance your visit and make the memory of your trip to the refuge a pleasant one.

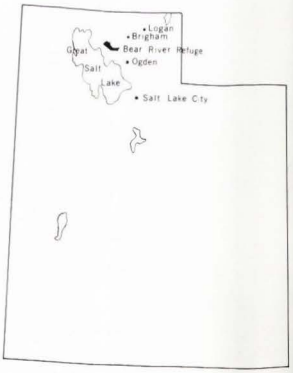
The loss of ducks to botulism in the early 1900's was a motivating factor in the establishment of the Bear River Refuge. Pictured below is the result of a botulism outbreak in Willard Bay, near the refuge.



Map of Bear River Bird Refuge showing the dikes which divide it into the several water control units.



Map of unit two showing the route of the self-guided tour and the location of the station stops.



Outline map of Utah showing the location of the refuge.

Mallards *(right)* are a common dabbling duck on the refuge throughout most of the year.

The gadwall is the most common dabbling duck on the refuge in the spring and is the most abundant nester.

Refuge Ducks

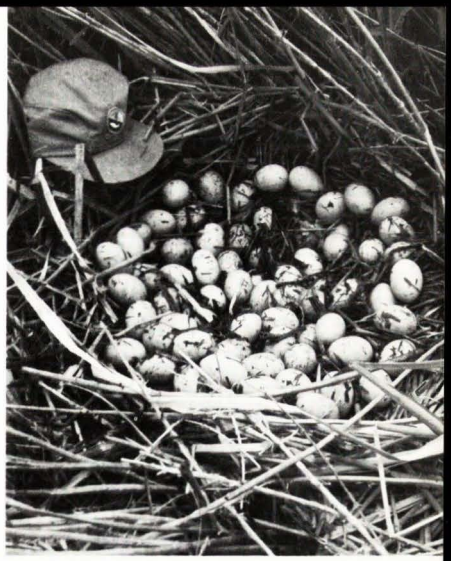
The refuge has two different types of ducks, and several examples of these may be seen shortly after beginning the tour. The first, called dabblers or surface-feeding ducks, are most characteristic of shallow water ponds and marshes. They obtain food by dabbling and tipping up with their heads under water, and when alarmed spring directly into the air instead of pattering along the surface of the water before taking off.

Eight species of these dabblers are common on the refuge and are frequently seen during spring, summer, and fall. They are the gadwall, mallard, pintail, American widgeon or baldpate, shoveler, green-winged teal, cinnamon teal, and blue-winged teal.

In the spring the gadwall, a slender gray duck with a white belly, is most common and is the refuge's most abundant nester. The drakes leave the females shortly after the eggs have been laid, gather into flocks, and undergo a complete molt. The flight feathers are shed rapidly and the birds are flightless for 2 or 3 weeks during this molting period. In the fall, when the refuge sometimes hosts a million ducks, the pintail and green-winged teal are most abundant.

The second type of ducks is the diver, primarily birds of more open bodies of water, although they breed in marshes. They all dive beneath the water surface for food, and when taking flight, do not spring directly upward, but must patter along the surface while getting underway.

The redhead, canvasback, goldeneye, bufflehead, and lesser scaup are common on the refuge, but only the redhead nests here. The females often lay eggs in common unattended nests called "dump" nests. These nests are not incubated and may contain several dozen eggs, none of which hatch.



The bright blue bill and white cheek patch of the male ruddy duck *(upper left)* make him easy to identify. *(bottom)* The ring-necked duck, one of the divers, is seen on the refuge in the spring and fall. Redheads, also diving ducks, often lay eggs in common unattended "dump" nests, which do not produce young. This one (*upper right*) had 81 eggs.

Included with the diving duck group but rather different from them is the ruddy duck, the male of which is a small rusty-red bird with white cheeks and a blue bill. Ruddy ducks often cock their tails vertically like a wren, and thus are easily recognized. Although one of the smallest of ducks, the female ruddy lays the largest egg of any. Ruddies dive for most of their food.

First Stop—Station One

The large body of water west of the station sign is Unit Two, which contains 4,300 acres of open water, and 1,400 acres of marsh. The water level in each of the refuge units is regulated by controlling inflow at the dam near headquarters and outflow at several points on the south dike. During the summer months, the greatest depth for this unit is about 30 inches, with an average depth of about 12 inches.

Large black columns of midges like the one below are formed by mating swarms in the spring and fall.

Midges are an important food for many birds on the refuge.

SWARMING MIDGES

Large black columns of swarming midges are often seen along the dike road, and are commonly mistaken for mosquitos. The non-biting adults emerge throughout the summer, but are most common during May, June, and September. The large columns formed are mating swarms composed almost entirely of males, and mating takes place when females enter the swarm. Midge eggs are deposited in gelatin-enclosed masses on the plentiful floating debris and aquatic plants produced in the shallow water. One of the most important food items for many water birds is midge larvae, called "blood worms" because of their reddish color. Adult midges also serve as food for many birds on the refuge.

CANADA GOOSE

The Canada goose is the only goose nesting on the refuge, and may be seen on dikes and in the water next to the road. These geese begin breeding when 2 or 3 years old and may mate for life. The nest, with four to six eggs, is placed in the cover of salt grass or roadside weeds, or on a muskrat mound. The female incubates with her long neck outstretched to avoid detection. Incubation period is about 30 days, and during this time the gander remains near the nest and will attack with loud hissing and powerful wing blows any enemy which threatens his mate. From the time the goslings hatch in May until the next breeding season, the family stays together. These family groups are often seen swimming about in search of food, the gander leading and the female bringing up the rear. The refuge produces about 2,500 Canada geese each year.

With a wingspan of between 5 and 6½ feet and a weight of 7 to 14 pounds, the Canada goose is surpassed in size among waterfowl only by the swan. Because of its size, wariness, and excellent table qualities, the "honker" in probably the most sought after game bird in America. Considered by many as the grandest of all waterfowl, the Canada goose is found here at all times of the year.

Western grebes (*above*) are often seen in the summer with their young riding on their backs. (*below*) This brood of Canada geese is an exceptionally large one, which has been picked up from other parents. Average brood size is five or six young.

The American avocet is a common shore bird on the refuge and builds a flat nest near the water's edge.

WESTERN GREBE

A common sight on the canals and open water areas of the refuge during the spring and summer months is the western grebe. These grebes dive under the water for their food of small fish and insects, and propelled by large, lobed feet can swim long distances before coming to the surface. Visitors in the spring may witness the strange "water ballet" courtship ritual performed by the male and female. As they swim sideby side, they suddenly stand with wings tight to the body, neck arched, beak down, and run along the surface of the water for several feet.

Later in the summer, young grebes may be seen riding on their parents' backs, sometimes almost concealed among the feathers. Western grebes have difficulty arising from the water and usually dive when alarmed or approached too closely.

Station Two

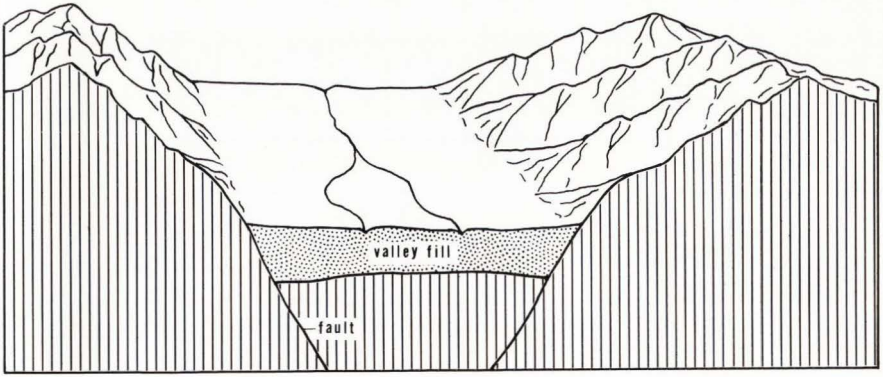
The western half of Utah and most of Nevada make up the Great Basin, a unique area characterized by series of isolated oblong mountain ranges which create many smaller basins. This situation has come about as a result of numerous faults or fractures in the earth's crust, which permitted some sections to move upward and others to settle. Mountains formed in this way rise abruptly from adjacent basins and are called fault block mountains or "horsts." Bear River Refuge and the surrounding valley make up a basin formed by the Wasatch Fault, which like others in the area, is still active. Geologists feel that if the valley floors were not constantly settling into the earth, this basin would eventually fill with stream sediments and Great Salt Lake would drain into the ocean.

The long legs of the black-necked stilt are useful for feeding in shallow water.

SHORE BIRDS

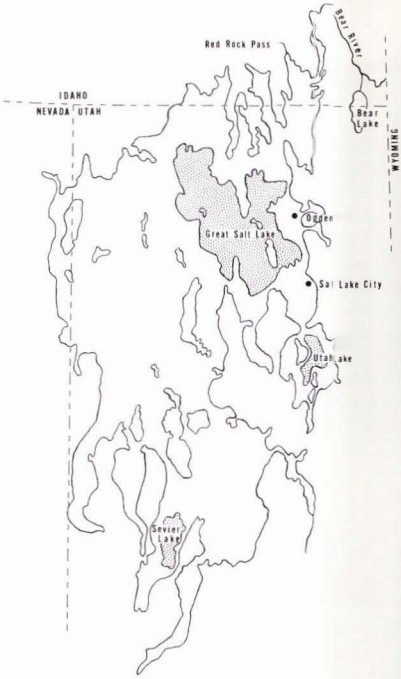
Shallow water areas beyond the outer dike and along the dike roads attract shore birds who hunt insects while wading. The American avocet and the black-necked stilt are the most striking in appearance. The avocet, a large black and white bird with a brown head, has a distinctive habit of sweeping its long up-

Diagram illustrating the formation of fault block mountains. The fault or fracture in the earth's crust allows the valley floor to settle while the surrounding mountains rise.



turned bill from side to side in the water while feeding. By doing so the insects and other aquatic organisms which make up its diet are encountered and swallowed.

The black-necked stilt is also a black and white bird, and has long reddish legs. Both stilts and avocets build flat nests of a few sticks or grass on dry ground, and the young are able to run after their parents just a few hours after hatching. Other common shore birds include the killdeer, dowitcher, godwit, phalarope, willet, yellowlegs, and sandpipers.



Station Three

GREAT SALT LAKE

In 1928, the refuge outer dikes separated the salty waters of Great Salt Lake from the fresh waters of the refuge, but in recent years irrigation and other demands on upstream water have caused the lake shore to recede about 12 miles to the south. At its maximum depth in 1873, the Great Salt Lake had an area of about 2,200 square miles, while today it covers only 1,700 square miles. The lack of an outlet is responsible for the high salt concentration, which varies with fluctuations in the lake level, and may reach 25 percent or more. In

(*Upper right*) Map showing the area covered by Lake Bonneville at its greatest depth. The ancient lake drained through Red Rock Pass in Cache Valley. (*below*) A whistling swan family group. The young do not acquire pure white plumage until the second year.

this high salt concentration no fish can survive, and the only life the lake supports is tiny brine shrimp, brine flies, flagellate protozoans, and blue-green algae.

The surrounding flats have highly alkaline soil which must be leached by fresh water before it can support vegetation. One of the common small plants on these flats is salt-tolerant glasswort, a good fall food for waterfowl.

To the south and west of the refuge are some of the larger islands; Antelope, Fremont, and Carrington, and the Promontory Mountains, which form a peninsula into the lake. Hidden behind the Promontory Mountains is Gunnison Island, the traditional nesting site of the white pelicans seen on the refuge. Some of the smaller islands serve as nesting areas for herons, cormorants, terns, and gulls.

(*Above*) Whistling swans visit the refuge in large numbers on their fall and spring migrations. (*below*) A carp taken from the Bear River is proudly displayed.

CLIFF SWALLOWS

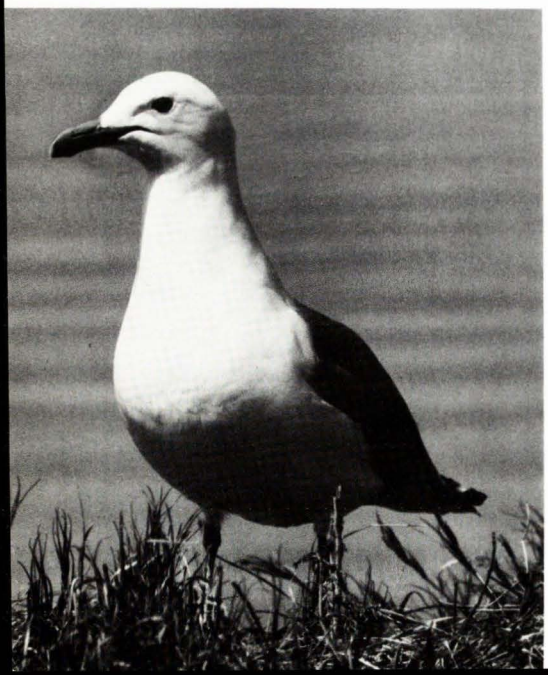
At this station, visitors in the spring enjoy watching the cliff swallows build nests on the tower. The gourd-like nests are shaped from mud carried to the tower and are lined with feathers and grass.

Station Four

LAKE BONNEVILLE

The Great Salt Lake today is a remnant of ancient Lake Bonneville, which existed about 25,000 years ago and covered a large part of Utah and Nevada. At its greatest size Lake Bonneville had a depth of nearly 1,000 feet and covered 20,000 square miles. Early lake levels are visible as "bench" marks along the mountains, especially on the Promontory foothills to the west. The highest mark is the Bonneville level, the next and most conspicuous is the Provo level, and the third and lowest is the Stansbury level.

Large numbers of California gulls, Utah's State bird, nest on the refuge, and though mostly a beneficial bird, the gulls often do harm by eating duck eggs and young.



The yellow-headed blackbird (*above*), redwing, and Brewer's blackbird are all common summer residents.

WHISTLING SWAN

During the fall and early spring the refuge has one of the largest concentrations of whistling swan anywhere. They usually arrive about mid-October and as many as 20,000 may be seen, most of which congregate in the unit just north of this one. The swan that pass through the refuge during migration nest in the arctic, and the young stay the first year with their parents, which usually mate for life. Although they may reach a weight of 20 pounds, whistling swan are slightly smaller than the more famous but less abundant trumpeter swan.

The pintail is the most abundant duck on the refuge in the fall, and it and the green-winged teal are the ones most often taken by hunters.

Station Five

The refuge is home to several large wading birds. Many of them nest in the heron colony or rookery about one-third mile southeast of this stop. Most common are the graceful white snowy egret and the stately great blue heron, which are often seen catching the small fish which make up their diet. The young of these birds are helpless when hatched and remain in or near the nest until they can fly.

This station concludes the tour of the refuge, and we sincerely hope it has been an enjoyable one. Refuge headquarters are straight ahead, and you must return to Brigham City on the same road by which you entered the refuge.

The colorful ring-necked pheasant is a common game bird on the refuge and is frequently seen on the dikes and edges of the marshes.

Other Points of Interest

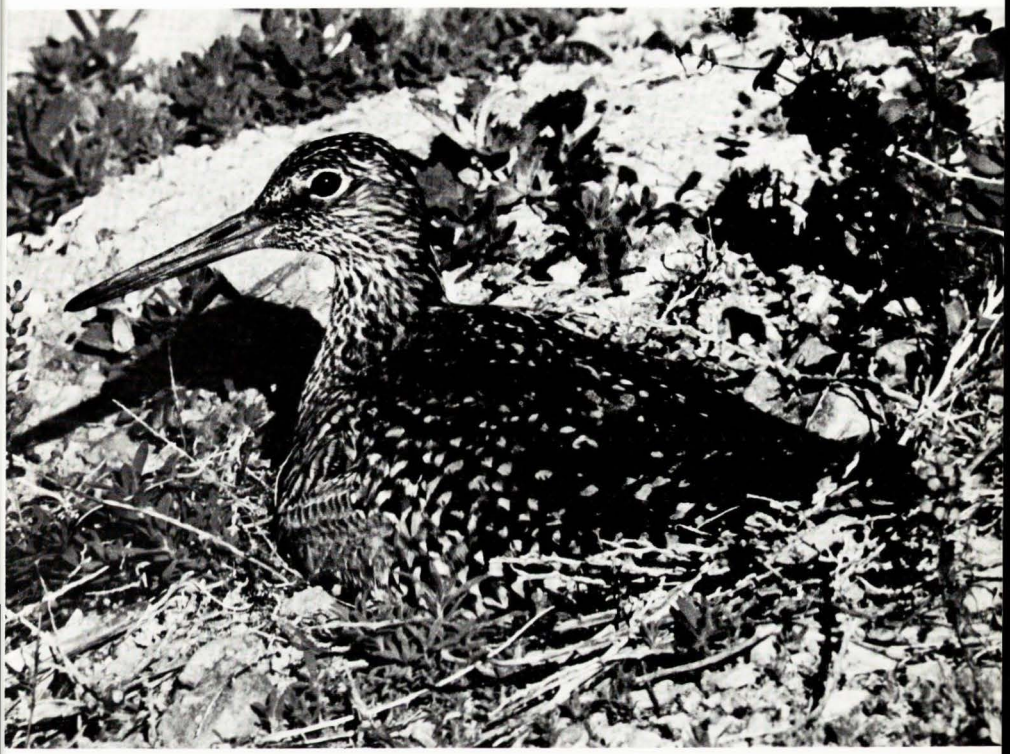
There are approximately 160 different plant species growing on the refuge. Sago pondweed is the most prominent duck food. Large quantities of sago, muskgrass, and widgeon grass are produced in the open water areas. The emergent vegetation of the marsh areas includes alkali bulrush, hardstem bulrush, and cattail, while the dominant plant of the higher ground is saltgrass.

The most abundant fish in refuge waters is the carp, which was introduced in America in 1870 and Utah in 1881. When carp are small they serve as food for such fish-eating birds as pelicans, cormorants, herons, grebes, and gulls. In the warm, shallow waters of the refuge, they often reach excessive numbers. Large carp are detrimental to waterfowl habitat, and when they reach these large numbers they destroy aquatic plants which serve as duck food. Periodic control of carp is carried out on the refuge to prevent undue damage to waterfowl food.

In Bear River, 20 pound carp are common, and occasionally one will weigh as much as 35 pounds.

The refuge is home to many mammals, some of which are occasionally seen by visitors. Most common of these is the muskrat, which builds the mounds dotting the marsh areas. A few beaver live in some of the canals, and other mammals that might be seen are jackrabbits, skunks, and badgers.

Badgers (*below*) are sometimes seen on the refuge. Other common mammals include the muskrat, skunk, jackrabbit, and weasel.



The willet, a medium sized shore bird, can be recognized by its striking wing pattern when in flight, and by its distinct call.

Bear River Research Station

The building just south of the administration building houses the Bear River Research Station, which was originally established to study methods of controlling botulism in the Great Basin. It is a branch of the Denver Research Center, employs a permanent staff, and has facilities for research on various waterfowl diseases, parasites, waterfowl ecology, and habitat development.

At present treatment and control of diseases like avian botulism, aspergillosis, and cholera as they affect waterfowl, are being studied at the laboratory. This type of research attacks one of the least understood phases of wildlife management, and requires a vast amount of time and intimate knowledge of the organisms involved. Little information exists on the effect of disease on wild birds and animals, and a great amount of work remains to be done.

The research station collaborates with the U.S. Public Health Service, Utah State University, and other institutions and individuals who are involved in providing a continuing wildlife resource for future recreation.

A snowy egret, one of the large wading birds of the refuge.

Inside Back Cover: Sunset on the Bear River Refuge.

Back Cover: Killdeer shading her young from the hot sun.

ILLUSTRATION CREDITS

Bob Hines, Bureau of Sport Fisheries and Wildlife, p. 4; William F. Martins, p. 10 (lower left); Steven J. Kohler, Bureau of Sport Fisheries and Wildlife, front cover, inside front cover, p. 3, 6, 7, 8, 9 (upper left and bottom), 10 (upper right), 11, 12, 13, 14 (upper right), 15 (lower right), 16, 17, 18, 19, 20, inside back cover, back cover; Utah State Dept. of Fish and Game, p. 5; Bureau of Sport Fisheries and Wildlife, p. 9 (upper right), 14 (bottom), 15 (top).

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As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

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Master of Science

Thesis: An Evaluation of a Self-guided Visitor Tour at Bear River Migratory Bird Refuge

Major Field: Wildlife Biology

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Professional Experience: Have been employed as a forest entomologist since December 1970 by the Montana State Forester's Office; Information and Education Section, Utah Division of Fish and Game, June-December, 1970; staff photographer for Nebraskaland Magazine, Nebraska Game and Parks Commission, 1968-70; wildlife technician at Bear River Bird Refuge, Brigham City, Utah, 1967; and forestry aid with the U.S. Forest Service, Ogden, Utah, 1966.