SALTON SEA
NATIONAL WILDLIFE REFUGE
Calipatria, California

ANNUAL NARRATIVE REPORT
Calendar Year 1992

U.S. Department of the Interior
Fish & Wildlife Service
NATIONAL WILDLFE REFUGE SYSTEM

REVIEW AND APPROVAL

SALTON SEA NATIONAL WILDLIFE REFUGE

CALIPATRIA, CALIFORNIA

ANNUAL NARRATIVE REPORT

CALENDAR YEAR 1992

C Clark Bloom — Refuge Manager — 7/26/93 Date

Refuge Supervisor — 9/24/93 Date

Review

Assistant Regional Director — Date

SALTON SEA NATIONAL WILDLIFE REFUGE

CALIPATRIA, CALIFORNIA

ANNUAL NARRATIVE REPORT

CALENDAR YEAR 1992

U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

Salton Sea National Wildlife Refuge is located 40 miles north of the Mexican border at the southern end of the Salton Sea in California's Imperial Valley. Situated in the Pacific Flyway, Salton Sea is the only refuge located below sea level. Because of its southern latitude, -226 foot elevation, and location in the Colorado Zone of the Sonoran Desert, the Refuge experiences some of the highest temperatures in the nation. Daily temperatures from May to October generally exceed 100°F with temperatures of 116°-119°F recorded yearly.

The Refuge was established "as a refuge and breeding ground for birds and wild animals" in 1930. Originally, it included approximately 35,000 acres. Nearly 60 percent of the original acreage was open saline lake with the balance comprised of shoreline alkali flats, freshwater wetlands, native desert scrub, and upland (farm fields). Due to the inflow of agricultural effluent and a subsequent rise in the level of the Salton Sea, all of the original refuge area has been inundated. In 1947, 24,000 acres were leased from the Imperial Irrigation District and divided between three agencies: California Department of Fish and Game (CDF&G), U.S. Navy, and U.S. Fish and Wildlife Service (USFWS). Most of the current Refuge acreage of 47,827 acres has been flooded by a continued rise in the level of the Sea. At present, 2,500 acres of the Refuge is dry ground, with about 2,200 acres suitable for farming and wetland development.

Salton Sea NWR is flat with the exception of Rock Hill located near the Refuge headquarters. The refuge is bordered by the Salton Sea on the north and intensively farmed agricultural lands on the east, south and west, and is divided into two units, situated eighteen miles apart. Each unit contains managed wetland habitat, agricultural fields, alkali mudflats, and desert brushlands.

The courses of the New and Alamo Rivers run through the Refuge. Both provide freshwater inflow to the Sea. The New River's source is urban effluent and agricultural drainage from Baja California and the Mexican border town of Mexicali. The Alamo River's source is agricultural drainage from the Imperial Valley.

The Salton Sea basin was a prehistoric extension of the Gulf of California and is the largest saline lake in California. It forms a natural sump for the 4,500 square mile Imperial Valley and northern Baja California with its primary sources being rainwater and agricultural drainage. The salinity of the Sea has steadily increased. In 1950, it was 35 parts per thousand (ppt), equaling the Pacific Ocean. By the end of 1992 it had risen to 46 ppt, almost thirty two percent saltier than the Pacific Ocean. With evaporation in the range of ten feet per year, salinity levels will continue to increase.

A variety of piscivourous birds find abundant food, nesting sites, and lack of disturbance at various locations around the Salton Sea's 115 mile shoreline. 92NR01 WRR 6/19/92

Habitat management emphasis is placed on the maintenance and improvement of wintering goose and duck habitat, and the reduction of waterfowl depredations to adjacent croplands. Protection and enhancement of nesting habitat for the endangered Yuma clapper rail, maintenance of habitat for nesting and migratory populations of sensitive species and other marsh and shorebirds, are also major objectives.

Salton Sea NWR provides habitat for over 375 bird species, 40 mammal species, and many reptiles and amphibians. The Refuge winters up to 30,000 snow, Ross' and Canada geese, and 60,000 ducks daily from November through February. Marsh birds and shorebirds account for more than six million use-days each year. Endangered species observed on the Refuge include the southern bald eagle, peregrine falcon, California brown pelican, Yuma clapper rail, and desert pupfish. A significant Yuma clapper rail population nests on the Refuge. Sensitive species using the Refuge include the fulvous whistling-duck, wood stork, long-billed curlew, mountain plover, western snowy plover, and white-faced ibis.

Additionally, the status of burrowing owl populations is an issue of increasing concern.

PAGE

INTRODUCTION

G. WILDLIFE

H. PUBLIC USE

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS PAGE

A. HIGHLIGHTS

Several personnel changes occurred during 1992. (Section E.1)

Farming program reverts to force account. (Section F.4)

Major emphasis to provide secure nesting burrows for burrowing owls. (Section G.6)

Record amount of precipitation occurs with subsequent flooding and property damage. (Sections B and 1.2)

New Case/International 9250 Tractor and 780 Disk/plow are received. (Section 1.4)

150,000 eared grebes die at the Salton Sea for still unknown reasons. (Section G.17)

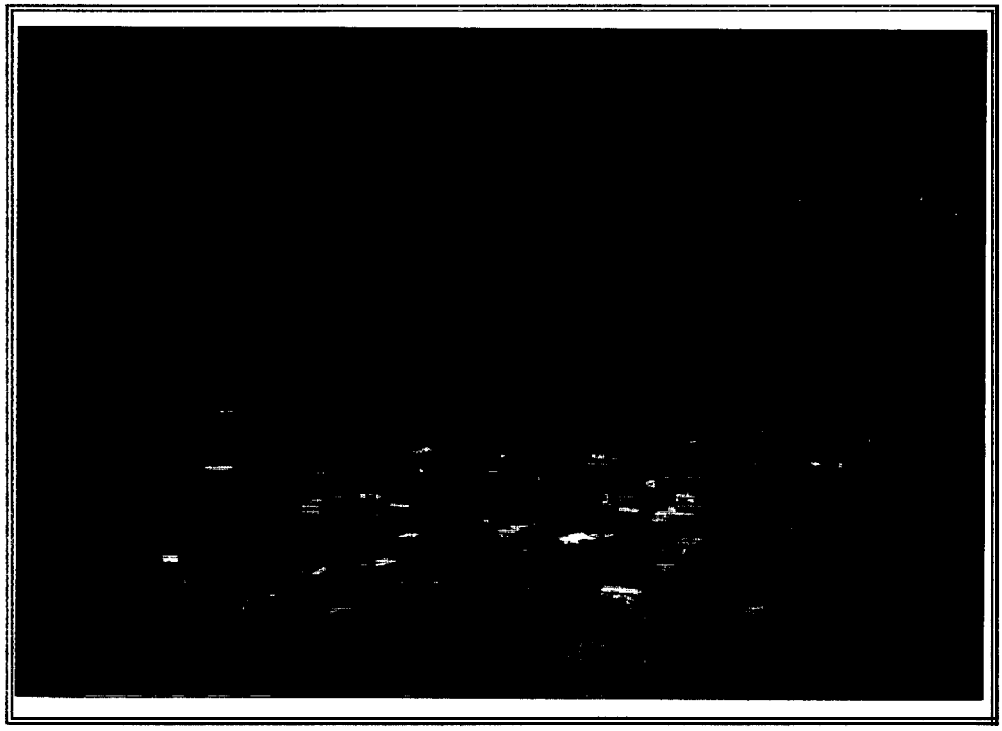
B. CLIMATIC CONDITIONS

Weather in the Imperial Valley is best characterized as extremely hot in the summer with mild and extremely pleasant winters. The growing season lasts all year; with most farmers growing at least two crops per field per year. The summer of 1992 was relatively mild as far as Imperial Valley summers go. A high temperature of only 116°F occurred in both July and August. There were a total of 110 days when the temperature reached or exceeded 100°F.

As mild as the summer was, high temperatures of 100°F and higher can be health threatening when combined with relative humidity reaching 45% or higher. These conditions require proper precautions by the refuge staff in order to survive.

The lowest temperature for the year was recorded in December when the thermometer dipped to 28°F. This is a normal low temperature in any given year in the Imperial Valley.

In 1992 the Imperial Valley received a whopping 6.07 inches of rainfall. This amount of precipitation exceeded the yearly average of 2.87 inches by 3.20 inches, more than twice the normal amount. Excessive rainfall, such as this, is not welcome in the Imperial Valley. In addition to causing a lot of logistical problems for farmers, there is actual property damage as well as crop loss from the excessive wet periods and flood waters.



The waterline left by ancient Lake Cauhilla is a constant reminder to Desert Shores residents that the Salton Sea area has experienced tremendous environmental changes throughout its history.

92NR02 WRR 7/2/92

The average high water elevation of the Salton Sea changed very little from 1991 levels. The average elevation for the sea was -227.08 feet below sea level (based on 12 monthly readings at Fig Tree John, Imperial Irrigation District). During the course of the year the Sea fluctuated from -227.41 feet in January to -226.29 feet in May (a gain of 1.12 feet) to -227.51 feet in December. This represents an overall loss of only .10 feet. This rather small net loss is attributed to the overall cooler summer and subsequent reduction of an evaporation rate of 95.21 inches this year as compared to 109 inches in 1990. However, this loss is expected to accelerate in the future as increased water conservation efforts reduce the amount of irrigation runoff.

The reduction in runoff and eventual lowering of the Sea will cause an increase in salinity and concentration of heavy metals. Unless this process is altered, it will mean the end of a viable fishery resource that has existed for the past 50 plus years.

Salton Sea NWR Weather Summary 1992*

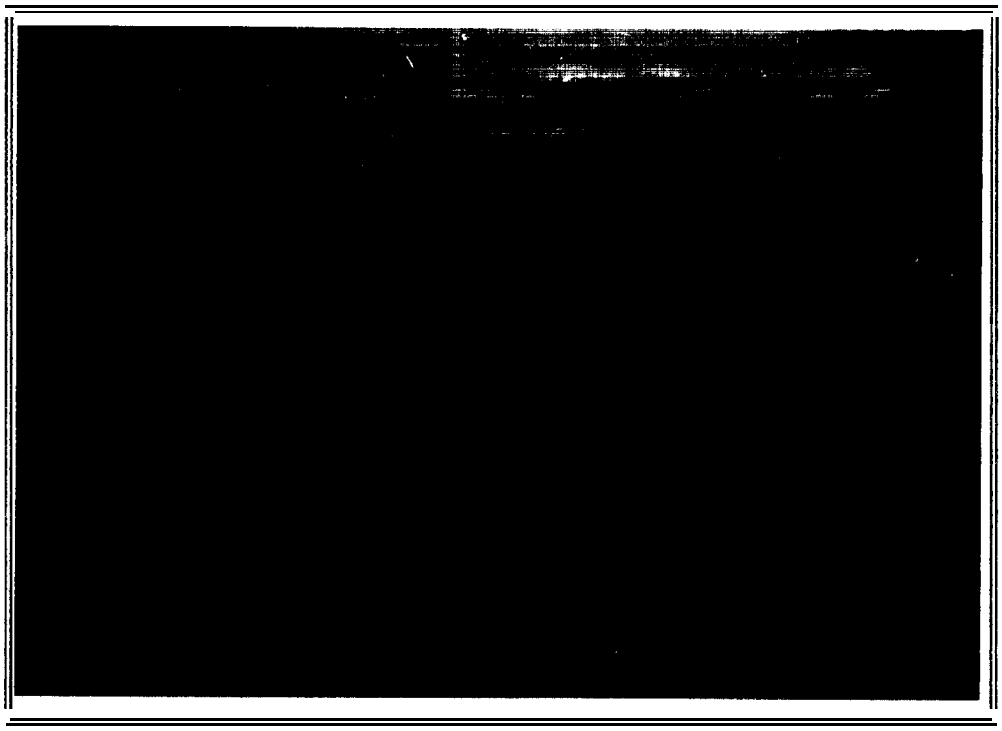
Month	High Temp.	Low Temp.	Precipitation	Evaporation	Elevation of Sea
January	80°	31°	0.49	2.86	-227.41
February	84°	39°	1.11	4.14	-227.05
March	85°	43°	2.39	5.21	-226.71
April	103°	51°	0.21	7.89	-226.37
May	103°	53°	0.12	10.98	-226.35
June	109°	57°	0.00	13.51	-226.73
July	116°	64°	0.00	14.02	-226.93
August	116°	66°	0.26	12.96	-227.23
September	112"	62"	0.00	9.69	-227.40
October	109"	52"	0.15	6.99	-227.59
November	88°	33°	0.00	4.57	-227.72
December	72°	28°	1.34	2.39	-227.51
Yearly Totals			6.07	95.21	.10 net loss

* Weather data obtained from Imperial Irrigation District at Calipatria, CA

C. LAND ACQUISITION.

3. OTHER

The refuge submitted a request to add 240 acres of top quality uplands to Unit 1 on the west side of the refuge. This tract -is being offered to the refuge by the California Department of Transportation (CalTrans) as mitigation for a highway improvement project near Indio, CA. In addition to providing this tract of land, CalTrans has agreed to construct two 40 acre wetland units within this tract as well as a 20 acre native upland tract. The remaining 140 acres will be utilized as farm units after CalTrans has leveled and installed a gravity irrigation system, Washington approval and subsequent management by the refuge is expected to occur in 1993.



Lying adjacent to the west boundary of the refuge, the Salton Sea Naval Test Base contains habitat used by a number of federal candidate species. 92NR03 WRR 5/30/92

D. PLANNING

2. Management Plans

Despite busy schedules, work continued on the development of a revised Habitat Management Plan (HMP). The revised edition is expected to be completed next year, and focuses on management of wetland impoundments for both waterfowl and rails, and the sequential germination of cereal grains in force account managed croplands.

The updated revision of the Fire Management Plan was completed and forwarded to Portland for review/approval. While suppression of wildfires is not a major consideration at Salton Sea, a limited amount of prescribed burning is planned to enhance management of croplands and impoundments, and in salt cedar control efforts.

3. Public Participation

The California Department of Fish & Game (CDF&G) conducted a public meeting on hunter's concerns Friday, January 3, at the check station at the Wister Wildlife Management Unit. Primary Assistant Manager Dan Dinkler represented the Service at the meeting to address any concerns involving issues on refuge programs. Hunting on the refuge is administered by the CDF&G through Wister. CDF&G employees Chris Gonzales, Manager of the Imperial Wildlife Area, and Earl Laupe, Chris' Supervisor based in Long Beach, conducted the meeting. Unfortunately,

it turned out to be a negative lesson in conducting a meeting. Since the meeting was held at the hunter's convenience on a Friday evening before a Saturday morning hunt, many of those in attendance had something to drink and several were clearly intoxicated. Combine that with the general. "lynch mob" mentality of the hostile group and you have a situation where communication is going to be difficult. And it was!

Although most of the hunters wrath was vented at the state employees, some questions involving management of habitat and the hunt program on the refuge did crop up during the course of the proceedings. While an attempt was made to offer explanations, much of the crowd was bent on complaining, not listening. Basically, the hunters had a lack of understanding about how the refuge farming and hunting programs meshed. Many had conjured up a number of anti-hunting rationales as to why blinds on the refuge were not open early in the season. Most of the group understood that the loss of a cooperative farmer hindered the pace at which fields were planted, and that attempts were made to keep geese out of some fields until the crop had a chance to get established. Many hunters operate under the misconception that their license fees pay for refuge operations, and therefore, the hunt program should be given top priority by management.

The outcome of this and followup meetings points to the need to keep the public informed of the identity and purpose of the refuge and how our management operations tie into meeting wildlife objectives. In reality, virtually all the refuge habitat management practices benefit the same resource that the hunters and birders are interested in, regardless of perceptions to the contrary.

4. Compliance with Environmental and Cultural Resource Mandates

The internal Section 7 consultation initiated by the refuge with the Carlsbad Ecological Services office during December of 1991 was completed in June. At issue were possible impacts to endangered species from the implementation of a Drain Maintenance Plan submitted by the Imperial Irrigation District to the refuge. The District's main purposes are the diversion and delivery of Colorado River water for irrigation and domestic purposes, and the operation and maintenance of facilities and approximately 1,460 miles of existing drainage canals. Drain maintenance may include dredging by hydraulic excavator or dragline, grading of drain roads and banks, herbicide applications, mechanical removal of vegetation, water level manipulations, other construction activities, and/or aquatic herbicide application or introduction of triploid grass carp. These activities may potentially impact the endangered desert pupfish, Yuma clapper rail, and California brown pelican.

It was the opinion that the proposed project is not likely to jeopardize the continued existence or modify critical habitat for these species. Reasonable and prudent measures included that impacts be avoided to the fullest extent possible, and the effects associated with the plan shall be monitored. In addition, terms and conditions specified that the opinion only pertains to lands managed by Salton Sea NWR. A partial list of other terms included that no occupied habitat of desert pupfish or Yuma clapper rail shall be disturbed during the breeding season, loss

of rail or pupfish habitat shall be offset prior to disturbance, dewatering shall not occur during the rail nesting season or during their flightless stage, herbicide use was limited to glyphosate, and grass carp introduction was allowed only after consultation and written approval from the refuge manager.

However, it was learned that the District had introduced 120 grass carp for the control of hydrilla into water delivery canal Trifolium Lateral 16 during 1992, without approval from the refuge manager. This canal, and adjacent drain, are adjacent to the Johnson and Flammang Field of Unit 1. The biological opinion requires written refuge manager approval prior to the introduction of grass carp into drains containing or potentially containing pupfish, drains upstream of pupfish, or drains adjacent to or in the refuge or state wildlife areas. Trifolium 16 drain does contain pupfish, as documented in the 1991 California Department of Fish and Game survey.

It was determined that the carp could prove detrimental to our moist soil management and freshwater pond areas in the Reidman Unit, which contain areas specifically managed for the endangered Yuma clapper rail. Screens had been placed so that these fish could not enter the refuge ponds, however, the screens have been moved several times and introduction of the carp into the ponds seem likely. In addition, these ponds ultimately drain into Trifolium 16 drain, which do contain pupfish as previously mentioned. Although the introduction of the grass carp did occur within the Trifolium 16 water delivery canal, no carp were directly introduced into the drain, although hydrilla is present in both the deli-very canal and drain.

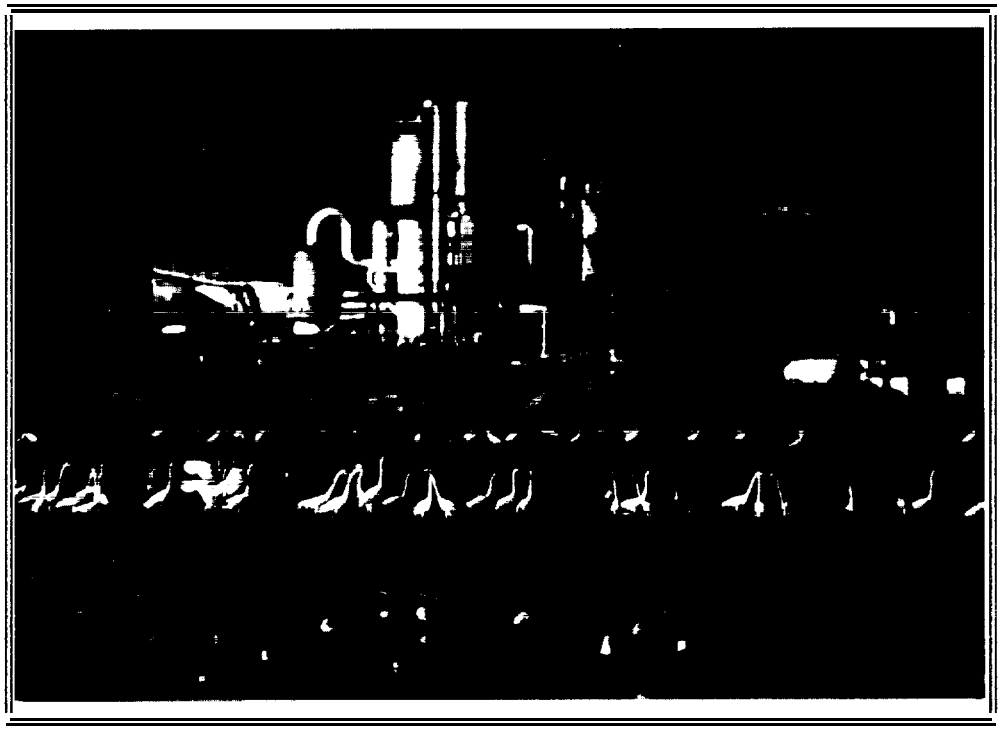
Because of this technicality, Imperial Irrigation District's Fish Biologist Mike Mizumoto and California Department of Food and Agriculture's David Quimayousie were contacted to remedy any misunderstandings. A meeting was held with these individuals, Biologist W. Radke, and Manager Bloom on December 7. These responsible individuals were informed of the biological opinion, and requested to inform the refuge manager of any future grass carp introduction adjacent to or in the refuge. A follow-up letter to these individuals documenting the incident will be sent during 1993, in order to hopefully prevent these incidents from occurring again.

Formal consultation was initiated with the Carlsbad Ecological Services office during December for integrated pest management at Salton Sea and Coachella Valley NWRs. Pesticide use is associated with upland and wetland habitat management, with objectives consisting of the control of invasive non-native weeds along pond margins, in upland habitat, and the management of crops grown for wintering geese (section F.lO).

During September, Laborer Walker was informed by a Red Hill Geothermal worker that toxic spoil from a well site had been deposited on the refuge along the west end of the water delivery ditch at the Hazard hunting blind parking lot. The refuge requested that the spoil be

removed from along the ditch. It was immediately pushed into a pile located on the drill pad. Bruce Carlsen, Environmental Manager for Red Hill, was contacted and samples were taken and analyzed through Red Hill's in-house lab. This analysis showed normal levels of arsenic, copper, lead, and chloride,

After consultation with Contaminant Specialist Steve Goodbred of the Carlsbad Ecological Services office, Biologist M. Radke collected samples from the spoil pile and control area on October 4, which were sent through chain of custody to Quanteq Laboratories in Pleasant Hill. Red Hill Geothermal agreed to pay for costs associated with this analysis, which were approximately $500.00. Results showed normal levels of 17 heavy metals. The spoil pile was subsequently removed from the drill pad.



As Geothermal power production continues to expand in the Imperial Valley, Magma Geothermal began serious negotiation with the Service concerning placement of well pads on lands leased by the refuge.

92NR04 **WRR** 7/18/92

5. Research and Investigations

Salton Sea NR91 - "Evaluation of Contaminant Effects on Burrowing Owl Reproduction." (11630-9003)

Burrowing owl populations have generally been declining throughout California and other western states according to North American Breeding Bird Surveys. These owls, listed as a California species of special concern, are the most common raptor in the Imperial Valley. Burrowing owls were considered for the 1985 federal sensitive species list, and status information was suggestive of localized declines, but data was limited and therefore did not meet the criteria for listing. A number of threats currently exist which may have an effect on the local burrowing owl population, including ditch maintenance activities, ground squirrel control programs, and pesticide use associated with Imperial Valley agricultural production.

A major limiting factor for burrowing owl recruitment in the Imperial Valley may be the number of available nest burrows, and destruction of active nesting burrows through the maintenance of delivery and drainage ditches. Nesting habitat in the valley is generally restricted to man-made irrigation drains, with almost 1500 miles of this habitat existing within the 500,000 acre farm belt of the Imperial Valley, Ditch maintenance activities by the District include drain dredging, pesticide applications, water level manipulations, and mechanical manipulation of ditch banks and slopes. These activities have the potential to negatively impact burrowing owls through the collapse of burrows, destruction of prey habitat, and direct or indirect pesticide exposure with possible acute or chronic effects.

Biologist M. Radke submitted a research/management study proposal to the regional nongame coordinator during March. This proposal was for the evaluation of contaminant effects on burrowing owl reproduction in the Imperial Valley, to include the use and evaluation of artificial nest burrows on burrowing owl recruitment. Towards the end of the fiscal year, $1,800.00 was obligated for this study through the neotropical bird fund. Approximately $1,350.00 of these funds were obligated for contaminant study, to include organochlorine and selenium analysis, of two eggs and one adult owl. The remaining funds were spent on materials for artificial nest boxes.

Research began after receiving approval from the Office of Migratory Bird Management to color-band burrowing owls, as it is unknown whether locally produced birds remain in the Imperial Valley or disperse to other areas. Furthermore, it is unknown whether burrowing owls observed in the Imperial Valley during winter months portray only the local population, or represent populations migrating from a larger area. In addition, information on nest site, pair fidelity, and population recruitment may also be obtained. Therefore, the study proposed the installation of artificial burrows, and the subsequent observation,

trapping or otherwise capturing, and color-banding of owls primarily on the Unit 1 area of the refuge.

In an effort to enhance nesting habitat for burrowing owls while at the same time allowing contaminant research on this species, the YCC crew assisted refuge personnel construct owl boxes. 92NR05 MFR 7/14/92

The construction of artificial nest burrows was initiated during February in secure habitat on Salton Sea NWR's Unit 1. An effort was made to locate artifical burrows in areas that were unlikely to be disturbed by drain cleaning, farming, flooding, or other activities. A total of five burrows were constructed out of plastic water distribution boxes, plywood, and 6" plastic corrugated tile drain at a cost of approximately $25 each. Alton Hoyt of Holtville supplied approximately 30 feet of tile drain free-of-charge. To provide future nest sites, another nine artificial burrows of the same design were installed with

YCC help during July and August. Two of these burrows were installed at the headquarters area. During November, six additional burrows were installed adjacent to the fields recently acquired by CalTrans (257 and 258). All these boxes were installed at a price of approximately $30 each, including the cost of tile drain.

The design of the artificial burrow includes a 26" long x 20" wide x 12.5" high plastic water distribution box with lid, the bottom of which is nailed to a 24" x 32" piece of plywood which makes up the floor of the burrow. A 6" diameter hole is cut in the bottom (plywood) side of

the narrow end of the water box, in which a 6' piece of 6" corrugated plastic tile drain is inserted about 1". Silicone is applied to any cracks between the drain tile and water box. The other hole in the water box is sealed with the cut-out plastic piece and silicone. The tile drain must have a 90° angle at about 2' from the water box. A small amount of soil should be placed throughout both the water box's plywood floor and the tile drain tunnel. Mounds of soil are constructed by front-end loader, and the mounds are either excavated and the burrows installed and then reburied by hand, or the mounds are dumped over the already completed burrows. In either case, there should be a small slope down through the tunnel to the nesting chamber, with approximately 18" of soil covering the nesting chamber. Perch posts with burrowing owl information signs are employed near, and visible from, the tunnel entrance.

Each artificial burrow installed in February was occupied by owls an average of 22 days after construction, with a range of seven to 42 days. This time period is probably actually much shorter since owls were not looked for at each location every day. Most of the boxes installed during the summer were also readily occupied by roosting owls within a short time.

After plugging the entrance tunnel with a wooden 2" x 4" with padding on one end, the juvenile owls were captured by excavating them from the five artificial burrows which were installed during February. A limited time was unsuccessfully spent in an effort to capture adult owls using Havahart traps. Banding occurred during the late evenings throughout the month of June, with all five of the burrows installed during February producing young. The juvenile owls were estimated to be approximately three to five weeks old, with some of the younger owls in a clutch being at least one week younger than their siblings.

A total of 25 owls were found in the five artificial burrows, with a total of 24 owls banded with a USFWS band, of which 23 were also color-banded. Of the 25 owls, one was an adult female which was found in the nesting chamber with the juveniles. One juvenile owl was banded only with a USFWS band because of the owl's small size, and one juvenile was not banded with either a USFWS band or color-bands because of its small size. Table D.5a shows the band number and color combination for each of the 24 owls banded.

The number of juveniles in each artificial nest ranged from four to six, with five being the average number of juveniles per burrow. Wing chord, weight, and culmen length were recorded at the time of banding for each of the one adult and 24 juvenile owls. After completion of the banding and measuring process, all owls were released together back into the nesting chamber or tunnel, the lid was closed, and soil was replaced over the artificial burrow.

Table D.5a Band Number and Color Combination for Burrowing Owls Banded During 1992.

LOCATION	DATE	USFWS BAND #	COLOR BAND COMBINATION*	AGE-SEX
Site E	6/1/92	120416101	S/B	adult female
		120416102	S/W	local unknown
		120416103	S/G	local unknown
		120416104	S/R	local unknown
Site D	6/1/92	120416105	S/Y	local unknown
		120416106	B/S	local unknown
		120416107	W/S	local unknown
		120416108	G/S	local unknown
Site B	6/4/92	120416109	R/S	local unknown
		120416110	Y/S	local unknown
		120416111	SB/-	local unknown
		120416112	SW/-	local unknown
		120416113	none	local unknown
		120416114	SG/-	local unknown
Site A	6/5/92	120416115	SR/-	local unknown
		120416116	SY/-	local unknown
		120416117	BS/-	local unknown
		120416118	WS/-	local unknown
		none	none	local unknown
Site C	6/15/92	120416119	GS/-	local unknown
		120416120	RS/-	local unknown
		120416121	YS/-	local unknown
		120416122	-/SB	local unknown
		120416123	-/SW	local unknown
		120416124	-/SG	local unknown

* left leg / right leg, first color is color on top
S = USFWS band G = green
B = blue R = red
W = white Y = yellow
- = no band

Table D.5b Selenium Levels Within Burrowing Owl Tissue Samples Collected During 1992.

Sample	Selenium (ppm dry weight)
Egg	1.35
Egg	3.10
Egg	.55
Liver	.80

Samples collected that were analyzed for selenium through the end of the year included three eggs, and liver tissue from one adult owl. Selenium levels were all within normal ranges (Table D.5b), and we are awaiting results of organochlorine analysis.

Salton Sea NR91 - "Boron Contamination in Waterfowl of the Salton Sea." (11630-9101)

The large amount of agricultural effluent entering the Salton Sea poses a threat of contamination to the area's wildlife. Since the Salton Sea area is an important wintering area for waterfowl, there are concerns that boron may be significantly impacting these birds. To help answer this question, a study was designed to: 1) determine the extent of boron bioaccumulation in important waterfowl species utilizing the Salton Sea, 2) determine if waterfowl are accumulating boron in concentrations sufficient to adversely affect reproductive success, 3) determine seasonal variability of boron concentrations in waterfowl, waterfowl food, and the area's sediments, and 4) compare the obtained data to U.S. Department of the Interior's Drainwater Studies data.

The study is a unique cooperative effort between Ecological Services Contaminant Specialists, refuge personnel, and the Imperial Valley Fish and Game Commission. Refuge biologists collected various waterfowl and food items during 1991 and 1992. Analyses of samples is being funded by the Fish and Game Commission, and interpretation of the results will be conducted by Ecological Services. While collection has been completed, sample analyses and results are pending completion.

Salton Sea NR92 - "Impacts of Selenium and DDE on the Endangered California Brown Pelican and other Piscivorous Birds at the Salton Sea NWR." (11630-9104)

Colonial nesting piscivorous birds are monitored yearly at the Salton Sea, and the number of active nests has declined significantly since 1987. Data from the Salton Sea Irrigation Drainwater Reconnaissance and Detailed Investigations showed high levels of selenium and DDE in piscivorous birds. A major concern is selenium bioaccumulation in the increasing California brown pelican population utilizing the Salton Sea as a post-breeding feeding area. For this reason, a study was initiated in 1991 by Wildlife Biologist W. Radke and Contaminant Specialists Goodbred and Audet to determine the extent of selenium and DDE contamination to both nesting and non-nesting piscivorous birds utilizing the Sea. Samples were largely collected by refuge personnel, processed by refuge and ecological services staff, and analyzed at

Service approved laboratory facilities. The following four tables depict selenium and DDE levels which were found in various biota samples during 1991. All values are in ppm (dry weight).

SELENIUM VALUES IN EGGS PROM 1991
PISCIVOROUS BIRD STUDY AT THE
SALTON SEA

SPECIES	LOCATION	SAMPLE SIZE	AVERAGE	RANGE	MODE	MEDIAN
Black Skimmer	Sea Wide	1.2	4.65	2.2-8.2	5.0	5.1
	South end	4	6.51	5.5-8.2	5.6	6.35
	Barth Rd.	4	3.69	2.2-5.4	3.0	4.1
	Johnson	4	4.19	3.7-5.0	3.8	4.1
Cattle Egret	North End	3	3.60	2.7-5.4	3.2	3.2
Great Blue Heron	North End	4	3.86	2.8-5.0	3.3	4.05
Great Egret	Sea Wide	9	4.77	3.5-7.1	5.2	5.0
	North	4	4.02	3.5-5.2	3.6	3.8
	South	5	5.47	4.9-7.1	5.2	5.2
Gull-Billed Tern	Sea Wide	6	4.10	3.4-5.3	4.2	4.2
	Barth Rd.	3	4.27	3.5-5.3	4.2	4.2
	South	3	3.95	3.4-4.3	4.2	4.2
Black-Crowned Night Heron	North End	3	5.27	4.6-6.5	4.9	4.9
Snowy Egret	North End	3	3.9	3.9-4.0	3.9	3.9

SELENIUM VALUES IN LIVERS FROM 1991
PISCIVOROUS BIRD STUDY AT THE
SALTON SEA

SPECIES	LOCATION	SAMPLE SIZE	AVERAGE	RANGE	MODE	MEDIAN
White Pelican	Sea Wide	6	14.79	11-22	15	15
	South	3	1.7 .04	15-22	15	15
	North	3	12.83	11-16	12	12
Bairdiella	Sea Wide	10	11.10	8.2-24	10	10
	south	5	9.97	8.2-12	1.0	10
	North	5	12.41	9.3-24	11	11
Sailfin Molly	Sea Wide	8	4.98	2.7-12	5	5.25
	south	5	6.03	4.3-12	5.5	5.5
	North	3	3.63	2.7-6.1	2.9	2.9
Mosquitofish	Sea Wide	8	4.56	2.2-11	4.6	4.6
	South	5	6.18	4.3-11	5.4	5.55
	North	3	3.05	2.2-4.6	2.8	2.8

DDE VALUES IN EGGS FROM 1991
PISCIVOROUS BIRD STUDY
AT THE SALTON SEA

SPECIES	LOCATION	SAMPLE SIZE	AVERAGE	RANGE
Black Skimmer	Barth Rd.	4	5.8	1.8-16.4
	Johnson	4	4.8	2.9-5.5
	Morton Bay	4	7.8	4.2-11.0
Cattle Egret		3	3.1	1.6-4.8
Great Blue Heron	North	1	4.3	4.3
	South	3	7.5	2.6-10.0
Great Egret	North	4	7.19	0.86-19.0
	South	5	20.30	3.30-30.0
Gull-Billed Tern	Barth Rd.	3	1.	1
	south	3	2.0	1.4-2.8
Black-Crowned Night Heron		3	2.5	1.7-3.6
Snowy Egret		3	20.3	5.0-31.0

DDE VALUES IN FISH FROM
1991 STUDY AT THE
SALTON SEA

SPECIES	LOCATION	SAMPLE SIZE	AVERAGE	RANGE
Bairdiella	South	5	0.16	0.067-0.39
	North	5	0.05	0.03-0.076
Mosquitofish	South	5	0.212	0.094-0.34
	North	3	0.518	0.11-0.955
Sailfin Molly	South	5	0.25	nd-0.51
	North	3	0.22	0.13-0.38

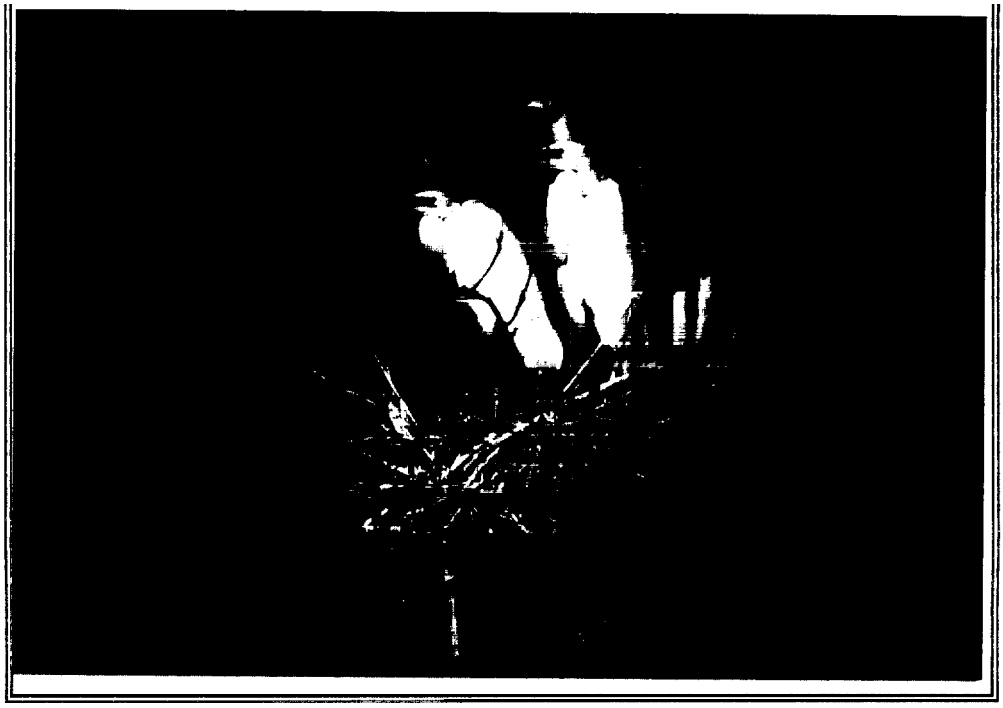
Salton Sea NR92 - "Nesting Success and Productivity of Great Egrets at the Salton Sea." (11630-9201)

Environmental contaminants such as selenium, boron, and DDE have been documented in the foodchains at the Salton Sea in Riverside and Imperial Counties, California. In addition, eggs sampled during 1991 from piscivorous birds at various sites at the Sea indicated that there were indeed eggshell thinning problems and elevated levels of selenium in great egrets, Casmerodius albus, and other species. Based on this information, the Service funded a project in 1992 to determine if contaminant levels are impacting great egret productivity at the Sea. Information gathered during this project will ultimately help determine whether contaminants are having an effect on egret productivity through either direct mortality, reduced growth, impaired survivability of young (deformity), or reduced nesting success.

Piscivorous bird nesting colonies at the Sea are generally near the mouths of freshwater drains where dead trees remain inundated by saltwater. Birds build stick nests in these trees but will also use the overwater wooden platforms of vacant waterfowl hunting blinds when they are available. Rarely, great blue herons at the Sea have built nests upon large rocks or even on the ground. During 1992, great egrets began establishing nesting territories on these areas as early as March 19. By July 2, most nests had either failed or fledged young.

From March through July Service personnel monitored a total of 89 different great egret nests to determine annual productivity. Information was gathered from four separate nesting colonies, representing both the north and south ends of the Sea. Twenty-three nests were monitored at the West Whitewater River Colony, forty-one nests at the Johnson Drain Colony, eight nests at the Mallard Road Colony, and seventeen nests at the Lack/Lindsey Road Colony. Each of these sites was chosen based upon the availability of nesting egrets, accessibility to researchers, and an otherwise lack of human

disturbance. The West Whitewater Kiver Colony, established as a control site, was monitored only twice to determine nest success and productivity. This allowed a comparison between other colonies which received considerably more disturbance relating to the monitoring program.



Great egrets were studied in detail to document hatchability, productivity, and rate of chick growth during the 1992 nesting season.
92NR06 WRR 6/19/92

Aerial surveys of each colony were conducted May 8 and July 2 to estimate the total number of piscivorous birds nesting at the Sea. Individual nests in colonies were monitored by one or two persons in either chest waders or in a kayak. Monitoring was accomplished beginning one hour before sunrise and lasting no later than two hours after sunrise to minimize disturbance due to heat stress. Active nests were marked with aluminum covered cardboard tags wired in place below each nest where they were easy for an observer to locate, yet created no visual disturbance to nesting birds. The time spent at each nest varied from about five to fifteen minutes. Adult egrets typically remained at the nest until closely approached, and immediately returned to the nest after disturbance ceased. Nests were monitored from the time that eggs were laid through the time nests either succeeded or failed in fledging young. After a full clutch of eggs was laid at a given nest, the egg first laid (determined by floating in distilled water) was collected and later processed for contaminant analyses. All other eggs were allowed to hatch normally. Upon hatching, nestlings were monitored at three to

seven day intervals until they were about three weeks old. During each visit, all nestlings were weighed with a pesola spring scale and linear measurements of their bill were taken with a caliper. Once nestlings had grown large enough to retain leg bands, they were fitted with standard aluminum Service bands, with 77 birds ultimately being banded.

While many of the results will not be known until contaminant analyses is complete, basic productivity data and nest success information were determined and are included in this report. During the research period, a total of 89 individual nests were monitored. These nests contained a total of 281 eggs (range 1-5) for an average of 3.16 eggs/nest. Of the 89 nests, 42 were successful in fledging at least one young egret, for a nest success value of 47%. A total of 94 young fledged from the 89 nests monitored, for an average of 1.06 young/nest, Aerial surveys estimated a total of 221 great egrets nesting during 1992. Using this estimate, 234 young were produced at Salton Sea colonies this year. Although no mortality of eggs or young relating to our monitoring program was documented, indirect impacts to productivity are difficult to measure. It is noteworthy that individual eggs were collected from nearly all nests except those at the control site, which certainly could alter the number of young fledged. Egrets hatch asynchronously, and the younger siblings often do not survive because of the competition for food at the nest. There were nests containing four nestlings which did fledge all four birds, however, there were also nests containing four nestlings in which none or only one bird survived to flight age.

Nesting success varied considerably between the four colonies, with a low of 35% at the West Whitewater River Colony (the control site) to a high of 71% at the Lack/Lindsey Road Colony. There was a significant difference in nesting success between northern and southern colonies, with north end colonies averaging 39% success and south end colonies averaging 68% success. The reasons for this difference are uncertain, but may be associated with contaminant issues, food availability, or human induced mortality resulting from predation at fish farm facilities. The exact reason for which a nest failed to fledge young was often difficult to assess. Most nests failed because high winds or associated waves destroyed the nest and accompanying eggs or nestlings. Presumably, at least some of these adult egrets renested. Predation on great egrets probably occurred to an unknown degree, but was never documented. Raccoons were occasionally observed in or near the Johnson Drain Colony, and a night heron was once observed carrying off a nestling snowy egret in this same colony. Entire broods of dead nestlings were documented at some nests at the West Whitewater River Colony and at the Johnson Drain Colony, and in a few instances, dead adults were found on their nests in these same colonies. In three cases, egrets which had already fledged were later found dead in the colony for unknown reasons. In addition, younger siblings apparently became undernourished and died in nests at each colony monitored.

Adult great egrets can be observed feeding in freshwater drains, backwaters, ponds, agricultural fields, and along the Salton Sea shoreline. Since nestling great egrets rarely regurgitated food when

handled, no accurate assessment or quantitative measurement of food items was undertaken. However, incidental observations of food items found at nests indicated that crickets, crayfish, tilapia, mollies, pupfish, and young bairdiella were all eaten by great egrets. South end birds appeared to feed more heavily on invertebrates than did north end birds. The following table depicts nesting success at the four colonies monitored during 1992.

Table D.5c Nesting Success and Productivity of Great Egrets at Salton Sea, During 1992.

Northern Colonies	# Nests	# Eggs	# Successful Nests		Young Fledged
West Whitewater	23	72	8	(35%)	19
Johnson Drain	41	124	17	(41%)	34
TOTAL:	64	196	25	(39%)	53

Southern Colonies	# Nests	# Eggs	# Successful Nests		# Young Fledged
Mallard Road	8	28	5	(63%)	13
Lack/Lindsey	17	57	12	(71%)	28
TOTAL:	25	85	17	(68%)	41
GRAND TOTALS:	**89**	**281**	**42**	**(47%)**	**94**

Salton Sea NR91 - "Aspects of the Reproductive Biology of the Gull-billed Tern (Sterna nilotica)." (11630-9103)

The gull-billed tern race vanrossemi breeds at the Salton Sea and locally south through west Mexico to Ecuador, and has been little studied. Ornithological researcher Kathy C. Molina of the Natural History Museum of Los Angeles County began a study last year to monitor the Salton Sea tern colony throughout the entire breeding season, from the arrival of the adults at the colony until the young are fledged. The study, which began in 1991, is anticipated to be a minimum of three years, with specific objectives being to: 1) form a demographic profile of the population, including population size, hatching success, fledging success, age of first breeding, and longevity, 2) document courtship behavior and vocalizations, 3) document food habits and foraging techniques, 4) record chick growth and development, 5) record philopatry for natal colony, 6) compare egg shell thickness before the advent of intensive agriculture to those of the present, utilizing discarded shell fragments, and 7) determine nest site microhabitat selection and inter-nest spatial relationships. The Service will gain benefits regarding management of terns and other sensitive species at the Salton Sea colony, and refuge personnel provided logistical support for the study.

Gull-billed terns were known to nest at four locations around the Salton Sea during 1992. These locations include Morton Bay, Barth Road, Mullet Island, and Johnson Street. Gull-billed terns were first observed at Morton Bay on March 20, with courtship and nesting activities well

underway on the Main Islet as of April 18. By April 24, the colony was noted to be completely deserted, and appeared to have been depredated by a raccoon. The site was devoid of activity until May 15, and by May 22 a few nests appeared to be established on Shade Islet. Hatching and chick rearing continued until July 7, at which time two young were fully fledged and a third was flying short distances. American avocets, black-necked stilts, and black skimmers also utilized this area for nesting.

Table D.5d Nesting Success of Gull-Billed Tern Colonies at the Salton Sea, During 1992.

	Morton	Barth Rd.	Johnson
Total Nesting Attempts	25	5	
Total Eggs Produced	33	112	
Total Eggs Hatched	4	19	
Total Eggs Depredated/ Abandoned	22	--	
Total Eggs Unaccounted For	7	--	
Total Chicks Banded	3	10	
Total Young Fledged	3	2?	20
Total Eggs Collected	3	0	
Hatch Rate	12%	17%	
Fledging Rate	75%	7.1%	

On May 2, 43 gull-billed tern nests were found on the Desert Ranch at the northern extention of Barth Road, however, the colony had been overrun by roosting brown pelicans by May 7. Based on projected wing chord growth, two terns may have fledged from this colony by June 11. On June 29, 48 adult gull-billed terns were observed near the Johnson Street colony, which also included breeding black skimmers. A total of 20 young fledged from this colony by July 18. On June 25, Mullet Island was surveyed, and resulted in four gull-billed tern nests with complete clutches. Several other species nested on Mullet Island this year, including great blue heron, black skimmer, caspian tern, and lesser nighthawk. A total of 27 caspian tern nests were located, the first documentation of this species in many years. Unfortunately, follow-up visits were not possible and fledging success for these species was not documented.

During 1992, total number of gull-billed terns nesting on the Salton Sea was therefore probably less than 100, with a total of 25 young fledged (Table D.5d). Major factors contributing to low nesting success are believed to be mammalian predation at Morton Bay, trampling of nests by roosting brown pelicans at Barth Road, and perhaps localized and rather violent spring thunderstorms this season.

E. ADMINISTRATION

1. Personnel

Salton Sea Staff - (left to right) Back Row 10, 6, 8, 7
92NR07 Middle Row 1, 2, 3
Front Row 5, 4, 9

1. Clark Bloom - Refuge Manager GS-485-12 PFT EOD 6/14/92
2. Daniel Dinkler - Primary Assistant Refuge Manager GS-485-11 PFT
3. William Radke - Wildlife Biologist GS-486-11 PFT
4. Kathleen Arnett - Administrative Support Assistant GS-303-6 PFT
5. Sandi Harris - Office Automation Clerk GS-326-4 PFT EOD 6/28/92
6. Lee Laizure - Heavy Equipment Mechanic WG-5803-10 PFT
7. Richard Marquez - Engineering Equipment Operator WG-5716-10 PFT
8. Marcos Orozco - Engineering Equipment Operator WG-5716-9 PFT
9. Marcia Radke - Wildlife Biologist GS-486-7 TPT
10. Mark Marquez - Maintenance Mechanic Helper WG-4749-5 TFT

Not Pictured

Kenneth Voget - Refuge Manager GS-485-12 PFT - Transferred to Desert NWR 5/31/92

Christian Schoneman - R.O.S. GS-485-7 PFT - Transferred to Desert NWR 5/31/92

Gaylord "Skeeter" Schultz - Wildlife Biologist GS-486-7 TFT - Resigned 4/4/92

Jeffrey Walker - Laborer WG-3502-3 TFT - Terminated - 10/31/92

Lonnie Perry - Social Services Assistant GS-0186-4 EOD 6/9/92 Terminated 8/14/92

During 1992 several changes took place at Salton Sea. Refuge Manager Ken Voget moved to Desert NWR in May and took R.O.S. Chris Schoneman with him. In addition, Temporary Biologist Skeeter Schultz resigned in April to accept a job with the U.S. Forest Service. In October, temporary laborer Jeff Walker was terminated due to funding reductions.

Staffing Levels at Salton Sea NWR

	Permanent		Temporary		Total
	Full time	Part time	Full time	Part time	FTE
1992	9	0	4	1	13.5
1991	9	0	4	1	13.5
1990	10	0	1	0	11.0
1989	11	0	4	0	15.00
1988	10	0	6	0	16 OO

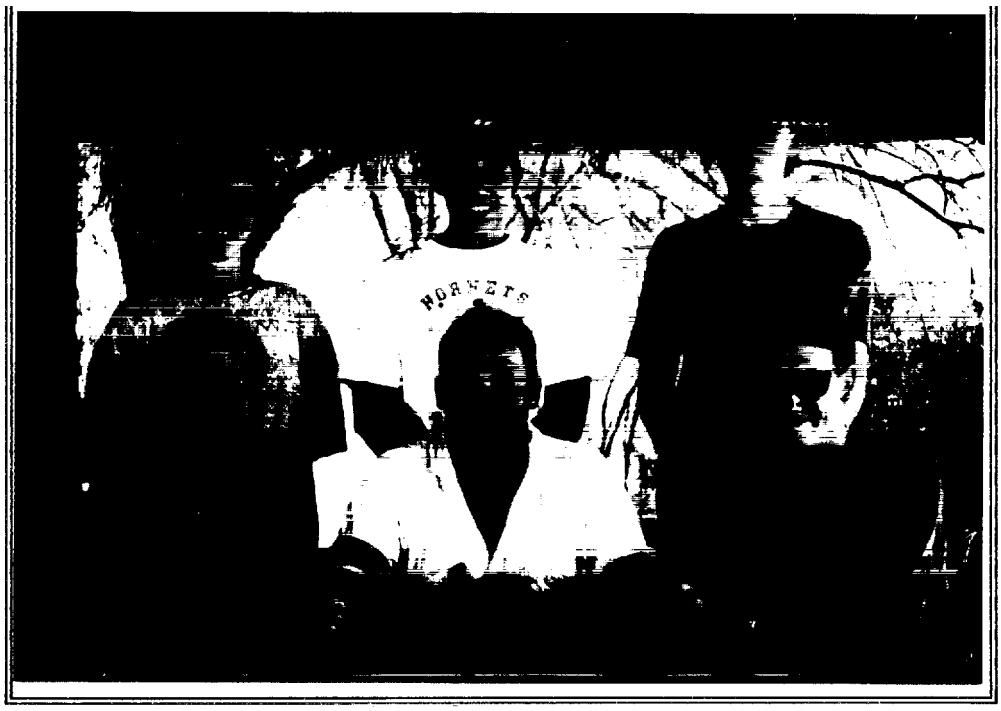
In mid-June (What bad timing for a move from northeast California to the Sea), Clark Bloom left Modoc NWR to become the Project Leader at the Salton Sea NWR complex. Despite the heat, earthquakes, and toxicant problems, Bloom has settled in and is enjoying his new assignment.

Social Services Assistant Lonnie Perry was hired to run the YCC Program for 1992. Lonnie came to us from the U.S.M.C. as a 25 year veteran. Surprisingly enough, Sgt. Lonnie got along with his crew quite well and several projects were accomplished during the summer.

2. Youth Programs

The Salton Sea Complex again hosted an eight week non-resident Youth Conservation Corps (YCC) Camp. Social Services Assistant Lonnie Perry

served as "Crew Leader" for the program. Mr. Perry utilized the communication skills he developed as a Marine Corps Recruiter to coax the YCC Crew into performing a variety of labor intensive jobs in the general categories of habitat and facilities maintenance. Additionally, Laborer Jeffrey Walker assisted by working with the YCC crew on numerous occasions.



The 1992 YCC Crew:(left to right, top row) K. Barfell, M. Medina, D. Griffith, (bottom row) M. Barfell, L. Perry, M. Higgins.

92NR08 DRD 7/92

New YCC enrollees for the 1992 camp were Dale Griffith, Martin Medina, and Kristal Barfell. Additionally, two enrollees returned from the 1991 camp; Michael Higgins and Melissa Barfell. Ms. Barfell served as Youth Leader.

A GSA van was rented for the summer and transportation was provided for enrollees from Calipatria to the refuge and back each day.

Specific tasks performed by YCC included controlling weeds (especially sesbania) in the Reidman Ponds, cleaning vehicles, assisting with burrowing owl box installation, cleaning up hunting blinds and the access to blind 10, and assisting with concrete work for the new metal shade building. As required, fully twenty percent of YCC time was dedicated towards environmental education. This included field trips to Anza Borrego Desert State Park, Unocal Geothermal, the coastal refuges (Tijuana Slough and Sweetwater Marsh), the Wister Wildlife Area, the Parker Dam area (including Bill Williams NWR), and the Desert Museum in

Palm Springs. Additionally, the YCC crew participated in CPR training along with refuge staff at the Naval Air Facility in El Centro.

While the 1992 YCC program did accomplish a variety of unskilled, labor-intensive tasks, the usual concerns about the viability of the program arose. The challenges of keeping the entire crew busy while avoiding the stifling summer heat vexed the program again. The fact is that Salton Sea is a tough place to work outside in the summer. The key to success of the program is a good, experienced Crew Leader and an adequate variety of inside and outside chores to keep the crew from "burning out", both literally and figuratively. Credit goes to the entire 1992 crew, as no one dropped out of the program.

On an additional note, a potential way to avoid heat stress and "burn out" among YCC program participants would be to adjust the normal tour of duty for the program to mornings only, except for field trip days and special projects. Most of the hours lost due to shorter days could be regained by continuing the program for nine or ten weeks, instead of the traditional eight,

4. Volunteers

Volunteer support came from two sources in 1992. Off-season fire crews from the McCain Valley Conservation Camp contributed 1682 hours and Resource Assistants from the Student Conservation Association (SCA) provided an additional 640 hours, combined for a grand total of 2322 hours of volunteer effort.

Crews from McCain Valley, usually consisting of fourteen honor camp inmates, performed a variety of labor-intensive projects. An estimated total of 1232 hours were contributed by the regular conservation camp crews on projects including landscaping, concrete work, ditch and road clearing, and salt cedar control. A "special" masonry crew constructed a new cinder block oil house adjacent to the new Convault fuel docks. Four hundred fifty hours of volunteer labor went into this well done project.

SCA volunteer Jeff Durbin's term as a Resource Assistant carried over from 1991 into 1992. Jeff proved to be more than capable providing valuable assistance to the public use program, including handling most environmental education groups and staffing the visitor contact station on weekends. Jeff also helped out with the biological program (particularly with the grebe die-off) and with clerical duties after the transfer of the Office Automation Clerk. Jeff's volunteer career ended when he was hired as a temporary GS-0303-1 Clerk on February 11, with a total of 240 volunteer hours contributed in 1992.

SCA volunteer Kelly Chapin with a group of students visiting the Refuge.
92NR09 DRD 12/17/92

SCA volunteer Kelly Chapin started as a Resource Assistant on October 14, contributing a total of 400 hours in 1992. A main emphasis item for Kelly was the development of the environmental education program and activities for visiting school groups. However, as Mother Nature picked this season to break the six year drought in the west, most of the preparation work done by Kelly could not be implemented. Almost the entire outdoor classroom season was "rained out" due to extremely muddy conditions at headquarters and along the Rock Hill Trail.

5. Funding

The overall funding levels for the Salton Sea Complex for FY92 was sufficient to get us through the year. All FTE's were filled at least for a portion of the year. Despite this, several much needed maintenance projects as well as vehicle replacements went unfunded this year. Hopefully, this shortfall will be remedied in the near future as our backlog of much needed maintenance continues to grow.

The following table depicts funding levels for the Salton Sea Complex for the past five years.

ACTIVITY	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992
1.260 O&M	424,200	445,600	562,500	570,000	573,500
7201 (Coachella)[1]	7,000	22,000	21,600	13,600	7.400
Fire Funds (91xx)	300	700	1,000	7,200	7,000
Special one-time funds, MMS, RPRP, & PCS moves'	139,900	140,000	50,000	**92,600**	135.000
TOTAL STATION FUNDS	571,400	608,300	635,100	683,400	722,900

(1) 7201 funds are derived from at trust administered by the Nature Conservency. The actual amount shown in the above figure represents an annual O&M figure for the Coachella NWR as decided upon by the management committee. In addition, any unexpended dollars from the previous year are added back into this subactivity.

(2) Special one time funds for FY92 include 135K for MMS packages to replace a farm tractor and disk/plow.

6. Safety

Safety was once again a highly emphasized program in 1992. Monthly safety meetings were conducted with all staff members being responsible for specific topics which were discussed in detail. In addition to the monthly safety meetings, "tailgate" sessions were conducted on at least a weekly basis or more often as required to meet the needs of current work projects.

As in 1991, the "safety" element of the crew's performance standards was listed as a critical element with "no accidents" as the standard for meeting the fully successful level. This increased level of safety awareness has not proven to be completely successful in reducing the number of accidents at Salton Sea. There were three accidents involving four injuries reported during the course of the year.

A maintenance mechanic received a squirt of hydraulic fluid to one of his eyes when a valve malfunctioned while changing a hose. A trip to the doctor was all that was necessary to correct the injury.

About two weeks later, an equipment operator was cleaning the radiator on a truck when the wind blew dirt particles into his eye. This incident required a doctor visit to correct the injury.

An employee from Kern NWR, while on detail to the Salton Sea to pick up grebes, was involved in an air boat accident. While maneuvering an air boat to pick up dead grebes, a sand bar was encountered which threw the Operator and a passenger from the boat into the Sea. The Operator received a severely lacerated hand which required several stitches to repair. The passenger received a bruised knee. He was examined by the doctor and released.

These accidents occurred despite the increased awareness of safety while on the job. Perhaps it was a "bad" year for accidents. Or, perhaps it points out the need for every member of the staff to try even harder to have a safe work area with no accidents either on or off the job.

7. Technical Assistance

The International Tracking System data base forms were completed and forwarded to the regional office. These forms were completed for several duck clubs, and for other on-refuge projects, including the CalTrans mitigation (Section F.4), Morton Bay (Section C.3), and Bruchard Bay (Section F.2).

Several notices of preparation, draft environmental impact reports, or other documents from the County of Imperial and/or various cities were reviewed. Written comments were provided to the appropriate agencies. These included the Imperial County General Plan Revision, Imperial County Enterprise Zone, County of Imperial Open Space/Conservation Plan, City of Imperial Annexation, City of Holtville Annexation, American Girl Joint Mining Venture, Mesquite Regional Landfill, Tract 919, Tract 924, Mt. Signal Vistas, Niland Sanitary District, Donte, Neumann, PM2119, and McClure.

Several of these projects will impact thousands of acres of prime farmland within the Imperial Valley, converting acreage from agricultural to commercial, industrial, and residential uses. Therefore, they have potential impacts to habitat and several wildlife species. Concerns with the Imperial Enterprise Zone and City of Imperial Annexation include the proximity of the areas to an important winter sandhill crane roost located at D & K and Ostercamp Farms Duck Clubs. The American Girl Mining Venture and Mesquite Regional Landfill occurs within tortoise habitat. The Ecological Services Office was notified regarding these and other proposals with the potential to impact listed species. The refuge replied to the Niland Sanitary District after several requests from Farmers Home Administration, who were not receiving replies from Ecological Services.

Imperial County is undergoing rapid growth and development, with wildlife values usually placed at the bottom of the priority list. Refuge personnel have responded to these issues with written comments and meeting attendance in the hopes that wildlife values will be addressed and habitat protected, especially for those projects which could impact listed species. A letter was sent to the County Planning Department requesting that Ecological Services be added to their mailing

list. It now appears that Ecological Services is receiving these environmental documents.

Other documents which were provided with written comments during 1992 included the Bureau of Land Management (BLM) Dos Palmas Environmental Assessment for the control of saltcedar, the BLM Coachella Valley Preserve Habitat Management Plan, the Imperial Irrigation District Notice of Preparation of Environmental Impact Report on Water Conservation, the Coachella Valley Water District's Environmental Assessment, and U.S. Geological Survey's Selenium Processes.

On May 8 and 15, Biologist W. Radke attended meetings held in Denver to develop monitoring strategies for the Salton Sea Area Irrigation Drainage Program coordinated and funded by the Bureau of Reclamation. Target species requiring biological monitoring at the Sea include the great blue heron, snowy and great egrets, black-necked stilt, pileworm, water boatman, crayfish, bairdiella, mollie, desert pupfish, and bulrush. The interagency team met to discuss monitoring these species to determine the level of inpacts on their populations.

During the May 8 meeting, the team modified the original goal to implement a monitoring program to document any changes in biological impacts as related to agricultural drainage. During the development of the work plan it became apparent that two philosophies were being presented. One philosophy was to implement a comprehensive biomonitoring program to document impacts. The other philosophy was to implement a base level monitoring program to find effects as they occur. Impacts were defined to mean significant deformities, reduced hatchability, or lack of recruitment for a species. Impacts would be substantiated by elevated levels of toxic constituents from agricultural drainage sources; however, elevated levels of constituents alone would not be considered an impact.

The team's goal was finalized to make a recommendation to the Irrigation Drainage Program Manager by December 1993 to either a) stop phase IV activities, b) continue with a monitoring, plan to document adverse impacts, or c) begin remediation to resolve identified adverse impacts.

The team decided to include both philosophies in the form of two distinct monitoring programs for the Salton Sea Monitoring Strategy. Both programs were forwarded to the Program Manager with the recommendation to determine which program will be implemented.

Program A is designed to monitor any changes in biological impacts. This comprehensive program would find adverse impacts while documenting trends in accumulation of toxic constituents in the food chain. Biological data, including levels of toxic constituents within target species, sediment data, and water quality data, would be collected. If an adverse impact is noted, the Irrigation Drainage Program will have the information to make recommendations to begin planning remedial activites, and data from this program would be used for immediate plan formulation.

Program B is designed to find adverse impacts. This program would also provide information for recommendations to begin planning remedial activities if adverse impacts are documented. Additional data would likely be needed in order to complete plan formulation. Biological data would be collected for black-necked stilt, heron, and egrets, and population data would be collected for pupfish.

Both proposals will be expanded into a work plan to be presented in the management strategy. This plan will include specific site locations, number of samples, type of analysis and data interpretation, resources available, estimated costs, and timeframe. The team will meet as needed to analyze data, respond to events, or reassess the effectiveness of the monitoring program.

On November 12, refuge staff hosted a tour and discussion concerning habitat management for the Yuma Clapper rail, a species which is federally listed as endangered. The seven participants included BLM Wildlife Biologists from the Yuma District, Yuma Resource Area, and Havasu Resource Area, and Biologists from Region 4 of the Arizona Game and Fish Department. The tour and discussion were well received by all persons involved, and refuge personnel will continue to provide any technical assistance required by these other agencies. Outreach into Region 2 is also a possibility.

On November 20 and 21, Biologist W. Radke particiated in a conference held at the Los Angeles Biltmore titled "California Water Policy: Resolving Critical Controversies." This conference was sponsored by the Los Angeles Department of Water and Power, and had participants from all over the state representing varied interests. Radke was asked to attend and represent the Service as a member of a panel concerning the future of the Salton Sea. Others on the panel included: Supervisor Bill Cole representing Imperial County, Tom Levy representing Coachella Valley MWD, and Charles Shreves representing Imperial Irrigation District. The major topics discussed during this two hour panel session included: 1) whether the Salton Sea should be saved, 2) the amount of water that is at stake, 3) the impacts of rising salinity on fish and wildlife, and 4) how change to the Sea will impact farmers and resort owners. Fish and wildlife values and how they relate to water use in California were perhaps not the most popular topics at the conference. However, Service participation in the conference stimulated a good exchange of ideas and gave the impression that we are interested in resolving conflicting issues and are not just sitting on the sidelines as a regulatory agency.

8. Other Items

Refuge staff participated in the following training sessions throughout the year:

Primary Assistant Refuge Manager Dan Dinkler attended the International Conference on Hunter Compliance in Reno, Nevada, January 21-22.

Several staff members attended The Wildlife Society Western Section Conference in San Diego February 6-8, including Project Leader Voget, Wildlife Biologists Bill and Marcia Radke, Primary Assistant Dinkler and Refuge Operations Specialist Chris Schoneman. Bill Radke also presented a paper to the session.

Administrative Support Assistant Kathy Arnett attended the session on R-base budget tracking in Portland on March 18-19.

Refuge Officers Marcos Orozco and Bill Radke (February session) and Ken Voget and Dan Dinkler (March session) attended 40 hours of mandatory Law Enforcement Refresher Training at Marana, Arizona. All four officers were certified in Pressure Point Control Tactics (PPCT).

Refuge staff members Jeff Walker, Mark Marquez, Chris Schoneman, Marcos Orozco, Bill Radke, and Dan Dinkler attended a course for four wheel ATC operation conducted by BLM Office-r Stan Kerlin at the Glamis dunes on April 2.

Project Leader Voget, Primary Assistant Dinkler and Wildlife Biologist Bill Radke attended the Regional Conference "From Vision To Action" in Portland, Oregon, April 13-17.

Refuge staff members along with YCC crew attended CPR training at El Centro Naval Air Station, June 26, 1993.

Primary Assistant Dinkler attended the Environmental Education Methods workshop at San Francisco Bay NWR July 13-15.

Refuge Officers Radke, Orozco, and Bloom attended the firearms course for conversion from revolvers to semi-automatic firearms in Fresno, California, August 24-28. Semi-annual requalification was also conducted at that time.

Office Automation Clerk Sandi Harris attended WordPerfect training in Palm Springs on August 20.

Refuge Officer Dinkler completed semi-annual firearms qualification locally with BLM Officer Zimmer on August 31.

Refuge Manager Clark Bloom, Primary Assistant Dinkler, and Wildlife Biologist Bill Radke attended a 16 hour session on Equal Employment Opportunity/ Affirmative Action at the FWE office in Carlsbad September 16-18.

Refuge Manager Clark Bloom and Primary Assistant Dinkler (the latter at employee's expense) attended the Neotropical Migratory Bird Workshop in Estes Park, Colorado, September 22-24.

Wildlife Biologist Marcia Radke attended Workshop for Continuing Educaton Units for Qualified Applicator's License in Palm Springs.

In an additional item, all Refuge Officers at Salton Sea were obliged to participate in random drug tests. Three employees were tested during the course of the year.

F. HABITAT MANAGEMENT

1. General

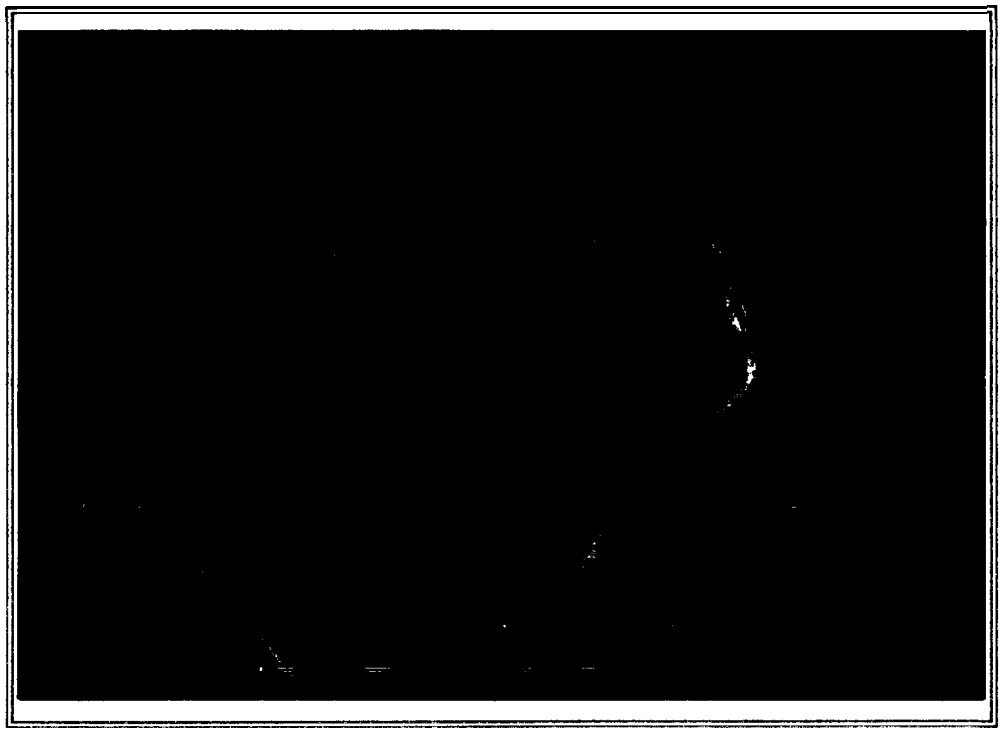
The New River, one of three rivers emptying into the Salton Sea, creates deltas which provide important loafing and foraging habitat for a variety of wildlife. 92NR10 WRR 7/2/92

In support of the goals of the National Wildlife Refuge System, Salton Sea National Wildlife Refuge was established by executive order in 1930 "as a refuge and breeding ground for birds and wild animals." Primary objectives on the refuge include endangered species production and maintenance, sensitive species production and maintenance, wintering waterfowl maintenance, and other migratory bird maintenance. Refuge habitats are intensively managed, with ponds and agricultural fields engineered, developed, and manipulated to achieve wildlife objectives.

2. Wetlands

Wetland habitat is managed to provide critical habitat for year-round populations of endangered Yuma clapper rails, and also to produce

natural foods for migratory and resident waterfowl, shorebirds, and other wildlife. These objectives are sometimes mutually exclusive, All water used to flood refuge wetlands is class-l irrigation water, which is essentially free of the soluble pesticides and toxic trace elements found in agricultural drain water. Moist soil management is geared toward production of alkali bulrush (Scirpus robustus), watergrass (Echinochloa crusgalli), sprangle-top grass (Leptochloa sp.), swamp timothy (Heleochloa schoenoides), wigeongrass (Ruppia maritima), and other associated species. Sesbania (Sesbania exaltata) and saltcedar (Tamarix pentantra) remain serious weed problems in moist soil units. All seasonal ponds on the refuge are used as nesting areas by black-necked stilts and American avocets.



This 25 acre impoundment at Bruchard Bay was completed during 1992 and will be managed to provide dense emergent vegetation for clapper rails and black rails. 92NRll WRR 1/22/93

Intensive flooding occurred at the Hazard Unit on March 27, and again on April 27, when heavy rains caused the Alamo River to breach its banks. This flooding caused extensive damage to the unit by eroding and cutting dikes and roads, silting in water control structures, drowning wetland vegetation which was in the critical stage of spring germination, and generally degrading soils with poor quality water. Following the flood event, ponds were pumped dry May 20, but generally preclude moist soil management because the unit had to remain dry to allow access by equipment to rebuild dikes and repair ponds. The sediments in some ponds will take years to leach out and become productive again, and are still subject to repeat floods. Negotiations are underway with the

Imperial Irrigation District to help prevent annual flooding from damaging wetland units on the refuge.

Wetland management at Unit 1 accommodates nesting rails, black-necked stilts, killdeer, snowy plovers, common yellowthroats, song sparrows, and other species. The unit is heavily used by a variety of shorebirds during both spring and autumn migrations, and provides food and sanctuary for many thousands of waterfowl during the winter months. Management of the wetland units therefore emphasizes biodiversity. At Unit 1, Tracts A and B were drawn down the end of March during peak shorebird migrations to allow existing alkali bulrush seed and tubers within each pond to begin sprouting, while at the same time providing easy food for sandpipers. Cooler than normal temperatures during this period slowed growth, but ultimately the response of bulrush in these ponds was good to excellent as soils continue to be leached of salts. Germination and growth of bulrush was excellent in ponds Al, A2, and B1. On May 6, alkali bulrush was aerially seeded on ponds A3, B2, and B3, but germination seemed limited to the intake ends of these ponds, an indica-tion that further leaching of the ponds is still necessary. Pond B4 and B5 still show no signs of wetland plant germination, probably due to high soil salinity, but B5 responded well to wigeongrass production. Flooding of the ponds was accomplished throughout the winter beginning September 28, with staggered floodups benefitting waterfowl by providing ample food throughout the winter rather than making it available to them all at once.

The four 20 acre Reidman ponds were drawn down during mid-March to allow existing bulrush seed and tubers to begin sprouting. Pond 1 provided good swamp timothy and patches of alkali bulrush. Pond 2 received abundant irrigating which hampered production of swamp timothy, but provided ample bulrush and cattail. Ponds 3 and 4 were managed as permanent ponds and the thick cattail and bulrush provided habitat for several Yuma clapper rails, which probably nested in both ponds, but were documented nesting in Pond 4. Sesbania also grew well in each of the Reidman ponds, and was mowed in ponds 1 and 2, and chopped or sprayed in ponds 3 and 4. Clapper rails nested in cattails and bulrush amid huge sesbania plants, and disturbance to rails by weed control efforts would seem to outweigh the benefit of sesbania removal. The Reidman ponds were flooded beginning September 23, and provided food and resting habitat for snow geese, Ross' geese, pintail, and numerous other waterfowl species during the winter.

During 1992, extensive work was conducted at Bruchard Bay to facilitate water management in the unit. This area provided important habitat for both Yuma clapper rails and California black rails before being significantly altered and ultimately drained by the Imperial Irrigation District during 1989/1990. While the improved water management should allow creation of cattail wetlands, the unit is currently an open pond used by various waterfowl, shorebirds, egrets, pelicans, and cormorants.

At Unit 2, Hazard pond 1A has long experienced poor drainage, and water levels are influenced by the level of the Alamo River and associated

seepage into the unit. As a result, this pond has highly alkaline soils and does not produce vegetation. During 1992, this pond was kept shallowly flooded all year to produce and maintain tremendous midge and corixid populations which were fed upon by various waterfowl and shorebirds. The shallow water also provided a roost area for pelicans, curlews, avocets, godwits, and numerous other species. Hazard pond 3A was drawn down beginning March 10, and remained dry until October 1 to allow maintenance activities. Saltcedar was treated in pond 3A during September, and the pond was flooded in October to provide habitat for invertebrates which were heavily utilized by ruddy ducks, northern shovelers, and other waterfowl upon migrating into the area.

Hazard ponds 1, 2, 2A, and 9 were drawn down beginning in mid-March to accomodate shorebirds migrating through the region. Pond 9 was not effected by the flood events, and was pumped out beginning April 20. All the ponds were dry by May 5, and all but pond 9 were planted with alkali bulrush and watergrass during July and August. Pond 9 soils are still poor following many years of dewatering through evaporation. Irrigation during August produced a fair crop of watergrass, but temperatures were to warm for good bulrush germination. The water level in these four ponds was set at about ten inches throughout the fall and winter to provide habitat for migrating waterfowl. An irrigation mishap during late December caused pond 9 to nearly overflow its banks, causing dike erosion and flooding the adjacent waterfowl hunting blinds.

Hazard ponds 3, 4, 5, and 8 were initially drawn down beginning in mid-March to accomodate shorebirds and ready the ponds for germination of alkali bulrush and swamp timothy which is already present and established in pond sediments. The flood events slowed germination of bulrush, and drowned swamp timothy which had already began germinating in the ponds. Irrigation of the ponds in May produced excellent habitat conditions in ponds 3 and 5, but pond 4 remained mostly bare. Alkali bulrush was aerially seeded in ponds 3 and 8 on May 6, but only pond 3 responded. Following maturity of timothy and bulrush, all ponds were dried out beginning in mid-July. Saltcedar in each of the ponds was treated with herbicide during September, and ponds were shallowly flooded beginning early October through the end of the year to make vegetation available to waterfowl and to provide an invertebrate preybase for various other species.

Hazard ponds 6 and 7 were managed as permanent wetlands throughout the year and remained shallowly flooded to provide nesting habitat for Yuma clapper rails and other species. Cinnamon teal, fulvous whistling-ducks, and even one black-bellied whistling-duck were observed using pond 7 during the summer. The permanent water enhanced the area for leopard frogs, crayfish, and various small fish and invertebrate species, which were all utilized heavily by egrets, herons, bitterns, white-faced ibis, and rails. Pond 7 was drawn down during August to oxidize sediments, recycle nutrients, and allow control of sesbania and saltcedar. Pond 7 contained a multiple year's accumulation of decadent vegetation which was burned during November and then reflooded to provide late winter waterfowl habitat.

Hazard ponds 10, and 11/12 have less than adequate water control capability, and only pond 10 is currently capable of producing wetland vegetation. Floodwaters from the Alamo River backed up into pond 10, preventing adequate moist soil management. However, excellent cover by dwarf spikerush and scattered stands of alkali bulrush were flooded up beginning September 23, and provided food for waterfowl, coots, and shorebirds throughout the fall and winter. Pond 11/12 was irrigated for the first time on July 2, which resulted in poor germination of scattered stands of alkali bulrush and swamp timothy, but excellent growth of saltcedar. Weeds were controlled in these ponds through the use of herbicides or by disking, and large saltcedars were removed from all pond edges by bulldozer. Ponds 10, 11, and 12 were full by October 5, and were held shallowly flooded through the end of the year. Overall, tremendous numbers of pintails, shovelers, green-winged teal, snow geese, Canada geese, dowitchers, egrets, sandpipers, avocets, and stilts utilized the Hazard ponds for feeding and loafing.

The two 10 acre Union ponds remained shallowly flooded throughout the year, and were managed as permanent ponds to provide emergent vegetation and an invertebrate preybase for year-round clapper rail habitat. Mixed stands of alkali bulrush, sprangletop, and cattail were heavily utilized by common yellowthroats, egrets, shorebirds, and waterfowl, including snow geese. In addition, Yuma clapper rails, Virginia rails, soras, and least bitterns were increasingly observed in these ponds throughout the year.

Headquarters pond 1, surrounded by mesquite tree rows on three sides, was managed to germinate sunflowers, watergrass, and other herbaceous vegetation, which provided abundant food for Gambel's quail, mourning dove, and numerous passerine species throughout the year. Headquarters ponds 2, 3, and 4 were drawn down temporarily in April to accommodate germination of wigeongrass. Pond 2 was then reflooded and water levels were kept lower to enhance cattail production along the pond's edge in the hope of creating additional habitat for rails, yellow-headed blackbirds, and other species. Pond 3 was kept dry throughout the spring and summer to kill carp in the unit and also with the goal of allowing necessary dike repairs and maintenance, which were ultimately never accomplished. Pond 4 was aerially seeded with alkali bulrush on May 6, but although much of the seed germinated, the elevated alkalinity of the sediments did not allow most of the bulrush to survive. During this period of bulrush germination, the pond was flooded to mudflat and provided feeding and nesting areas for stilts and avocets.

Headquarters Pond 5 is a small hypersaline pond which currently receives no active management. The Headquarters ponds provided feeding and/or loafing habitat for large numbers of shorebirds, teal, pintail, shoveler, snow geese, Ross' geese, and Canada geese. Additionally, the ponds were used by white pelicans, gulls, black skimmers, terns, common gallinules, American coots, and other species throughout the year.

3. Forests

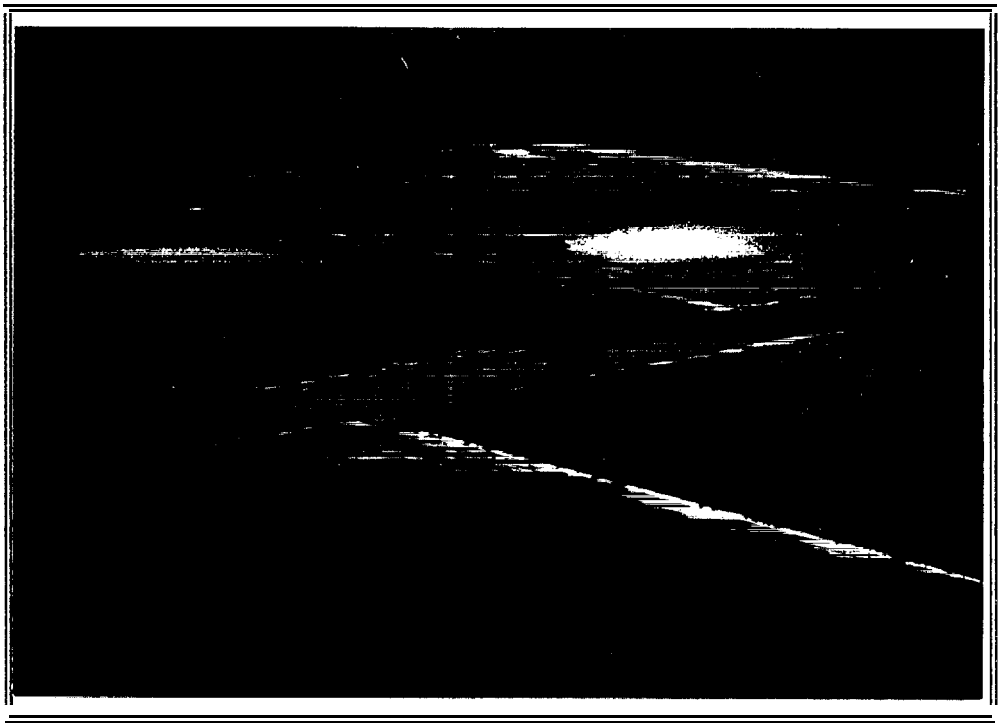
A total of 29 quailbush (Atriplex sp.) were planted along the headquarter's tree row. Because of cottontail depredation on the quailbush, wire cages were constructed and will remain around the new plantings until they become established.

4. Croplands

Croplands at Salton Sea play an important role in meeting nutritional needs for wintering geese and also provide habitat and foraging opportunities for migratory birds and other wildlife. A total of fourteen individual fields comprising 1067 acres were farmed in 1992. Acreage figures include four fields totaling 255 acres at the Union Tract (near refuge headquarters) and ten fields totaling 812 acres at, and adjacent to, Unit 1. In addition to the 827 acres of cropland previously farmed on the refuge, a 240 acre tract was farmed through an agreement with the California Department of Transportation (Caltrans).

The 240 acre Caltrans tract, situated immediately east of Unit 1, was purchased by Caltrans for transfer to the refuge system as partial mitigation for the Highway 86 realignment (see the Fee Title Section C. 1 for more details). While the tract was not transferred to the refuge system in 1992, the Service did obtain a "Right to Enter" agreement from Caltrans so that the refuge could begin management of the fields. All three 80 acre fields, which had been in asparagus for several years, were disked more than once to eliminate sprouting from persistent asparagus roots. The fields, Trifolium 13 Gates 2578 north and south, and 2588, contain good sandy loam soils that are almost weed-free. All three fields have tile drains which are in need of cleaning to remove clogging from asparagus roots.

The refuge farming program benefits from adequate availability of irrigation water (delivered by the Imperial Irrigation District), productive soils, and the nearly frost-free, year-round growing season afforded by the hot-summer/mild-winter climate of the Imperial Valley. Despite these favorable conditions, timing is often critical in germinating crops. While the heat of summer is to be avoided when planting a new crop, traditional wisdom requires that crops be started as soon in possible in September so that they are less suspectable to damage from geese arriving in November. In contrast, spring plantings are normally germinated after the geese depart to avoid depredation problems.



Managed croplands and wetlands at Unit 2 provided ample food for wintering snow geese Ross' geese, and Canada geese during 1992.
92NR12 WRR l/22/93

Crops that were grown on the refuge included wheat, rye, and alfalfa. Additionally, the cooperative farmer grew sudan as a hot-season cash crop. Different plantings of wheat were managed in a variety of ways, being germinated in fall, winter, and spring, and grown as cool season green browse, matured in spring for harvesting, and left standing to provide carbohydrate-rich forage for geese arriving in the fall. In contrast, the only planting of rye was germinated in winter to provide green browse.

Alfalfa, traditionally planted in either spring or fall, had become the major crop on the refuge in recent years. A high percentage of cooperatively grown acreage had been alfalfa since the late 1980's due its high nutritional value for geese and the economic advantages of this perennial crop. Alfalfa acreage has declined due to loss of vigor and value of the stands, placing the economic viability of farming alfalfa on the refuge below the economic threshold of cooperators. Viable alfalfa plantings became almost non-existent by the end of 1992. While refuge farming operations in 1992 were successful, changes continued to affect the program.

Out of necessity, the farming program at Salton Sea is accomplished through both force-account and cooperative means. While the refuge has benefitted from the efforts of two cooperative farmers in the past, only one cooperator was able to hang on through 1992. Challenges for

cooperative farmers on the refuge include the scourge of the whitefly, impacts from other insect pests in the face of increasing restrictions against pesticide use, and making a profit from a crop that has been impacted by several thousand geese throughout the winter. In addition to the whitefly, other insect pests normally include both pea and blue aphids, Egyptian alfalfa weevil (in early spring), and cutworms (in summer). The severe infestation of the silverleaf whitefly (formerly known as biotype B of the sweetpotato whitefly) continues to plague farming throughout the Imperial Valley. The whitefly has reduced both yields and quality of hay. Not only is the vigor of stands lowered, honeydew exuded by whiteflies causes mildew on the hay which lowers its quality and may cause health problems for cattle which consume it, depressing its value.

Cooperative farmer Walt Slovak experienced a difficult year on the refuge. He shifted his cooperative farming efforts from alfalfa fields at the Union Tract to growing sudan and wheat in two fields at Unit 1. The two Union Tract alfalfa fields involved (Vail 421 and 461) were basically abandoned over the summer and watered in the fall, resulting in inferior stands of alfalfa for goose forage in those fields. Two of the Caltrans leased fields (T13 257A, north and south) were planted by cooperator Slovak to crops of summer sudan and fall wheat, the latter monitored with considerable consternation for potential damage by geese. In addition to supplying (Service certified) tractor operator labor on the sudan fields he was farming, Walt also supplied tractor operator labor on the new 258A field (including drilling the wheat) and supplied overnight and we&end irrigation labor for watering other refuge fields outside of the refuge staff's "tour of duty" hours.

An effort was made throughout the fall '92/winter '93 season to stagger the germination of wheat and rye plantings so as to bring forage on line in sequence and to avoid the development of decadent stands, especially in wheat, which geese might avoid. Although the results of this effort were mixed, the principle is viable and can benefit from adjustments in future years. It was found that while wheat grew well when germinated in the fall, rye germinated in winter came up and grew slower than was desirable. Wheat germinated in winter came up and grew at acceptable rates. In applying this knowledge to future operations, it may be preferable to limit the germination of mid-winter plantings to wheat. It was also found that geese would eventually enter stands of fully-grown wheat, which they did in both the Reidman and Flammang fields, even if that was not their preference. Geese did not use the established stand of wheat in the 420 field (located between headquarters and Union goose blinds 3 and 4) to the extent expected, demonstrating that although you can plan farming operations, you can't count on the geese!

Irrigating fields proved to be an adventure when it came time to germinate new fall plantings. Particular difficulty was encountered in irrigating the C Tract and Flammang Tracts, both of which have sandy soils with a tendency to be uneven. In preparing these fields for future plantings, particular attention will need to be paid to taking

the borders out and land planing across the fields in more than one direction to provide an even slope to facilitate irrigation. Putting borders in before land planing, then land planing parallel to and between the borders may not level such fields adequately.

The margins of six refuge fields are planted to tree rows, creating a variety of habitat in refuge uplands that promote biodiversity. Additionally, milo and millet were planted next to the 257 (C Tract) tree row.

The following table summarizes management of refuge croplands in 1992:

LOCATION	FIELD	GATE	ACRES	CROP:(SPRING/SUMMER/FALL)
Unit I	S. Johnson	T13 255	80+	fallow all year
	N. Johnson	T13 256	100+	fallow/fallow/rye
	C Tract	T13 257	140	fallow/fallow/wheat++
	Caltrans S.	T13 257A	-	
	North	north	80*	sudan/sudan/wheat
	South	south	80*	sudan/sudan/wheat
	Caltrans N.	T13 258A	80*	fallow/fallow/wheat
	Reidman	T16 310A	80+	fallow/fallow/wheat
	N1/2Flamang	T16 310	100	fallow all year
	S1/2Flamang	T16 310	82	fallow/fallow/wheat**
	Flammang 20	T16 304	20	alfalfa all year***
Union Tract	419	V4 419	60	fallow/fallow/wheat
	420	V4 420	60	spring wheat left standing
	421	V4 421	55	alfalfa all year***
	461	V4 461	80	alfalfa all year***

+ pre-irrigated to germinate weeds prior to disking
++western-most 18 lands replanted to provide additional late-season forage
* Caltrans property farmed under agreement - formerly in asparagus
**new wheat planted in alternate rows between rows of standing wheat
***abandoned by cooperator - not watered over summer

Near Refuge Headquarters, fields 419, 420 and 421 all have tree rows. At Unit 1, fields 256 (N. Johnson), 257 (C Tract), and 310A (Reidman) have tree rows. Desirable species include mesquite (honey and screwbean), paloverde, sweet acacia and quailbush. While the 421, 256 and 310 tree rows are well-established, additional plantings could benefit all the tree rows. Winter or spring "cool season" plantings are preferable and promote survival. Additionally, while these plantings tend to literally be in rows, benefits could be derived from adding to the linear orientation of the plantings with thicker, wider stands of new plantings. The odd-shaped northwest corner of 256 field (N. Johnson, next to Vendel Road) will be taken out of production and put into a planting of native upland species.

A continuing and underestimated aspect of cropland management is the maintenance of the gates, ditches, and tile drains that support the success of the farming operation. While some minor gate and ditch maintenance projects have been performed in recent years, and both gate and ditch maintenance projects are in the MMS system, the need for these kinds of maintenance projects will increase at an accelerating rate as the existing facilities continue to deteriorate. There will be an increasing need to find funding to repair gates and tile lines and replace ditches in the not too distant future.

In the event of a significant earthquake in this area of seismic activity, the damage to these types of facilities will likely be substantial.

6. Other Habitats

The native tree and shrub plantings installed at the manager's residence during 1991 continue to thrive. Weed control, maintenance of the drip irrigation system, irrigation, and pruning of the area was completed during 1992.

7. Grazing

Weed control is a routine concern in refuge cropland management, particularly in the spring. The loss of cooperative farmer Chip Corfman in 1991 further complicated the management of weeds in Unit 1 fields. In an effort to control a growing weed problem in fields 255 (S. Johnson), 256 (N. Johnson), 257 (C Tract), and 304 (S. Flammang), local cattle operator Phil Kellum was contacted about introducing steers from his operation.

About 200 head of steers were introduced into the above mentioned fields for a total of six weeks (300 AUMs) in January and February. Despite concerns over the foraging preference of the cattle, they did do a good job of controlling the standing crop of weeds, which included mustard, malva, and goosefoot. When considering cattle and weed management, a significant issue is the potential for introduction of exotic weed species brought into the field by the livestock. That issue was minimized by using local cattle that were not as likely to introduce new weed species in refuge fields. Cattle should be fenced out of burrowing owl artificial burrow sites in future years.

In a related weed control matter, the refuge was contacted by the Imperial County Agricultural Commission about controlling weeds in field 304. The refuge was instructed to control the weeds or else be billed for the county having it done. It seems that the neighboring farmer, John Benson, was concerned about the likelihood of the overgrown field supporting populations of damaging insects, such as the whitefly, The problem was solved through the introduction of cattle in February.

9. Fire Management

The station fire management program saw the completion of a Environmental Assessment (EA) for prescribed burning, development on a Burn Plan for the Hazard 7 impoundment, successful accomplishment of the Hazard 7 burn, and completion of a fire report for the burn. The normal absence of wildfire at this station combined with an active yet modest prescribed fire program translates into a small amount of funding for fire operations at Salton Sea. Fire funding for FY-92 totaled $2,200 and funding for FY-93 totaled $2,000. With the decline in the amount of alfalfa farmed on the refuge and the resulting increase in wheat, rye, or barley acreage, it can be expected that additional burning will be needed to remove stubble from fields prior to disking in future years.

The station fire management program was facilitated with the completion of an EA for the use of fire on the refuge. The EA, entitled the Use of Prescribed Fire to Enhance Habitat, was drafted in October and signed off in November, clearing the way for the development of individual burn plans (see below). The objectives identified in the EA closely followed the objectives in the Habitat Management Plan for the refuge and focused on using fire for improving upland and wetland habitats and in controlling salt cedar. Particular attention was paid to maintaining compatibility with Yuma clapper rail management needs.

A Burn Plan was completed for burning the Hazard 7 impoundment and signed off in November. The Hazard 7 burn was successfully conducted on November 16. The unit was dewatered and dried, prior to the burn, which went pretty much as planned. The only casualty was the pumper unit, which choose the opportunity to blow a head gasket, becoming useless just five minutes into the burn. Fortunately the dike roads around the unit held the burn in check.

In other fire management activities, staff changes required that a revised edition of the Fire Dispatch Plan page from the Fire Management Plan be sent to the Regional Fire Management Coordinator, representing the current refuge staff. The annual process of updating equivalency scores for the step test (converted from 1.5 mile run results) was also completed.

10. Pest Control

The key insect pest for alfalfa in the Imperial Valley is the larva of the Egyptian alfalfa weevil (Hypera brunneipennis), which can cause serious losses in the first spring cutting of alfalfa. Weevils cause two kinds of damage to alfalfa: defoliation, which reduces yield and photosynthetic capacity of the plant, and damage to regrowth buds, which stunts growth and sometimes kills stems. Severe weevil damage early in the spring may retard plant growth enough to reduce yields not only in the first cutting, but also in the second cutting after the weevils have left the field.

Biological control of the alfalfa weevil (H. postica) includes the introduction of a parasitic wasp (Bathvplectes curculionis). Unfortunately, this parasite does not control the Egyptian alfalfa weevil, which is the species found locally.

The pea aphid (Acvrthosiphon pisum) and blue aphid (A. kondoi) become pests for alfalfa in the early spring. Both aphids develop peak populations in the spring as temperatures begin to warm, but populations are drastically reduced during the first hot spells. Pea aphid populations may remain high until early summer and often reappear in significant numbers in late summer and fall. The blue aphid is generally not seen in the fall. Both species overwinter at the base of the alfalfa crowns. As is the case with most aphids, there are many generations each year.

The blue aphid stunts alfalfa growth; infested plants have smaller leaves and shorter internodes than normal. Leaf curling, yellowing, and leaf drop may also occur. Large amounts of honeydew are associated with blue aphid infestations. Pea aphids may produce the same symptoms, but only when present in greater numbers.

The convergent lady beetle (Hippodamia convergens) is an important aphid predator in the spring, but not usually at other times of the year. Other predators feed on aphids, but their significance in the Imperial Valley is not known. These include green lacewings (Chrysopa carnea), bigeyed bugs (Geocoris spp.), damsel bugs (Nabis spp.), parasitic wasps (Anhidius smithi and A. ervi), and various syrphid flies.

Summer insect pests include alfalfa caterpillars (Colias eurytheme) and beet armyworms (Spodoptera exigua). Alfalfa caterpillars consume leaves, eating large portions of foliage or entire leaves. The most important way to control these pests is to preserve and encourage natural enemies such as insect pathogens and two parasitic wasps, Ananteles medicaginis and Trichogramma semifumatum. Naturaily occurring insect pathogens of importance are Baccillus thuringiensis, and a virus.

The beet armyworm is a pest primarily from June through September, with populations frequently controlled by natural enemies. Armyworms skeletonize foliage, leaving the veins of leaves largely intact. This damage is readily distinquished from feeding by the alfalfa caterpillar, which eats the entire leaf.

All of these insect pests reduce yields by consuming or damaging alfalfa leaves, stems, and buds. In addition, they may cause losses in more subtle ways by altering conditions to provide a favorable environment for other kinds of pests. For instance, weeds thrive where the alfalfa canopy has been reduced by insect feeding. Similarly, insect damaged plants are believed to be more susceptible to plant pathogens, and insect pests may occasionally spread pathogenic microorganisms. This results in a cycle of insect pests - weeds - low or no use by wintering geese.

Even when biological controls or cultural practices and the use of insect resistant alfalfa cultivars are used, insect populations may rise to levels which are economically damaging and require the use of an insecticide treatment. Insect pests do not cause economic damage in every field in every year, especially if proper conditions for natural enemies are maintained.

Different pesticides are periodically needed on the refuge for control of these various insects. Heavy infestations of blue and pea aphid and Egyptian alfalfa weevil occasionally require control. This management maintains the vigor and productivity of alfalfa to meet wildlife objectives for geese, and retains the commercial value for our cooperative farmer. Insecticides which control these pests include Cygon (dimethoate) and Cythion (malathion), both of which have been receiving stricter accomodation by the Regional and Washington Office in recent years. Javelin (Bacillus thuringiensis) may also be used in alfalfa fields for biological control of alfalfa caterpillars. Because of more restrictions on the use of pesticides, in recent years this refuge is growing fewer acres of alfalfa and more acres of cereal grains, which have fewer insect pests. However, our wintering geese typically continue to use adjacent landowner's alfalfa fields (Elmore's), which do receive pesticide use and are subsequently much more lush and palatable to the geese.

Herbicides requested for use (but not always used) on the refuge for alfalfa include Balan, an incorporated preemergence herbicide in new plantings used to control grasses and broadleaf weeds. Eptam also controls germinating grasses and annual weeds in established alfalfa. Buctril is used for postemergence control of broadleaf weeds in seedling alfalfa, and Treflan is used for preemergence control of grasses in established alfalfa.
Plant pests which are present on the refuge include saltcedar (Tamarix pendontra), Colorado River hemp or sesbania (Sesbania exaltata), and common reed (Phragmites communis). These weeds outcompete native plant species and provide poor wildlife habitat. Herbicides used to control saltcedar or phragmites on the refuge include Garlon, Rodeo, and Roundup. Weed control using these herbicides are usually applied by refuge staff and not a cooperator. During 1992, a total of one gallon of Rodeo, one quart of Roundup, and six gallons of Garlon were applied.

Pesticide use proposals were submitted during March for 1992. These proposals included Balan EC, Cygon 400, Eptam 7E, Garlon 4, Javelin WG, Malathion 8E, Rodeo, and Roundup. All were approved except for Cygon and Malathion, which were approved for ground application only. These pesticides are normally applied by a refuge farming cooperator, with 15 quarts of Eptam applied during 1992.

During November, nine pesticide-use proposals were submitted to the Regional Office for 1993. Pesticides proposed for use on the refuge include Balan DF, Cygon 400, Cythion, Eptam 7E, Garlon 3A, Garlon 4, Javelin WG, Rodeo, and Roundup. Cygon and Cythion both require Washington Office review and approval, and we were informed that they

would most likely he denied due to more stringent regulations. An additional two pesticide-use proposals for Treflan and Buctril were submitted to the Regional Office during December to allow organic alfalfa farming by potential cooperator John Benson. During December of 1992, all except two pesticide-use proposals for 1993 were approved or approved with modifications. The proposal for Cygon was withdrawn by the refuge because of excessive hassles in receiving approval, and approval for Cythion is unknown.

On December 16, Manager Bloom and Biologist W. Radke met with Mr. Benson, a local organic alfalfa farmer. Mr. Benson has expressed interest in cooperatively farming organic alfalfa on the refuge, but details and a cooperative agreement have yet to be implemented. We are anticipating a cooperative agreement with Mr. Benson in 1993.

Mr. Benson informed the refuge that in order for the alfalfa to become established, he will require the use of Buctril and Treflan, hence the two additional pesticide-use proposals. He anticipates the use of these herbicides only during the seeding and establishment phase of alfalfa cultivation, with their use only required once every four years. These pesticides would not be required once the alfalfa was established. Weed and insect control of established alfalfa would be accomplished by utilizing organic farming techniques.

This method of alfalfa cultivation, if successful, could result in lower overall pesticide use, with increased palatability to wintering geese on the refuge. Hopefully, the refuge would not require the use of Cygon or Cythion, both of which require Washingon office approval. Mr. Benson's organic alfalfa fields, when observed during the meeting, were very attractive, and fields of similar quality on the refuge would provide excellent goose browse.

Because of the refuge pesticide-use proposals for Cygon and Cythion which require Washington office approval, Scott Stenquist of ARW-DBS requested that the refuge initiate formal consultation with Ecological Services. A letter dated December 19 from the refuge to Ecological Services requested formal Section 7 consultation, with completion of an Environmental Assessment and Biological Opinion expected during 1993.

The CalTrans mitigation site near Mecca (under easement to the Service) was added to the pesticide proposals for Garlon, Rodeo, and Roundup. Intensive saltcedar control is required on this parcel in order for construction and habitat development to occur (Section C.2).

11. Water Rights

The refuge does not hold any water rights. All water used on the refuge for management of croplands or impoundments is purchased from the Imperial Irrigation District as needed. Water required for management of permanent ponds averages about ten acre-feet per year, seasonal ponds average about four acre-feet per year, and upland agricultural operations average about three acre-feet per year.

The refuge purchased 5,235 acre-feet of water in calendar year 1992, for a total cost of $60,726.00. The irrigation district increased the price of an acre-foot of water from $11.50 to $11.60.

Additional water used on the refuge comes from two sources. A decreasing amount of free water is available as water received from upstream sources who ordered more water than they could use. Free water has been estimated to account for an additional ten to thirty percent over what the refuge purchases, but has decreased in volume in recent years. This trend is expected to continue with ongoing water conservation initiated by the Imperial Irrigation District, such as the Trifolium Interceptor Project. Free water received at Unit 1 is estimated to average approximately seven to eight acre-feet per week. This water is used for moist soil management and ponds, with no free water received for irrigation of croplands.

Additional water is purchased by our cooperative farmer, Walt Slovak, for use on fields he is managing. This amount of water is used almost exclusively for the cultivation of commercial crops, rather than for use on crops directly utilized by wildlife. Walt purchased 365 acre-feet of water for Gate 2578, for a total cost of $4,234.00 during 1992.

Therefore, total water used by the refuge during 1992 equals approximately 6,900 acre-feet, including free and cooperator water.

15. Private Lands

The refuge provided on-site evaluations and written management plans to six private duck clubs, including Artesian Acres, Casa de Los Gonzos, Coldwater Ranch, Rancho de Los Patos, Shady Acres, and Westmorland. These management plans included general comments for cultivation of wetland plant species, water manipulation, and other habitat management techniques, with specific recommendations for each club relating to location of ponds, water control, soil salinity, etc.

Shady Acres Duck Club also received a partial payment from the Service in the amount of $2,600 for habitat enhancement on their 20 acre club, consisting of dike refurbishment and seeding. Steven Shepherd of Casa de Los Gonzos, who in prior years received $3,500.00 from the Service, was directed to the Agricultural Stabilization and Conservation Service, and received $3,500.00 from ASCS in cost-sharing for habitat enhancement as outlined in the management plan completed by the refuge. Jim Copp and Ray Harwell received information and on-site evaluations of their properties.

Several cooperative habitat enhancement projects were submitted to the Imperial Irrigation District (District) during 1990, all of which met with positive replies from their general manager. To date, the refuge has received $6,000.00 for habitat enhancement through a Challenge grant for the enhancement of Morton Bay, located east of the Alamo River delta. The District's donation to the project during 1992 included surveying the drain in order to insure proper gravity flow of water into

the bay, completion of blueprints and perimeter dike repairs, extensive reconstruction of the delivery ditch including saltcedar removal on the refuge, and investigations into lease agreements with the District's legal department. Some question remains as to the yearly per acre cost to the refuge for the lease of this property after work is complete. The Section 7 consultation for the District's Drain Maintenance Plan was completed in June (Section D.4).

As a result of these possible cooperative projects with the District, funds were solicited through the North American Wetlands Conservation Council and resubmitted during the April council meeting. The proposal submitted by the refuge for Morton Bay was denied based on the Technical Assessment Score, partially as a result of the loss of ten points for not being within a Joint Venture.

G. WILDLIFE

1. Wildlife Diversitv

Colorado Desert lands on the refuge, although characterized by extremely low precipitation and very high temperatures, support a surprising diversity of wildlife species. Habitat diversity on refuge lands provides the needs of various resident wildlife, while many of the birds are seasonal residents or migrants. At least 380 bird species have been observed at Salton Sea NWR, and at least 93 species have nested on the refuge. In addition, 41 species of mammals, 18 species of reptiles, four species of amphibians, and 15 fish species have been identified on the area.

2. Endangered and/or Threatened Species

State and federally listed endangered species which occurred on the refuge during 1992 include the desert pupfish, California brown pelican, bald eagle, peregrine falcon, California least tern, and the Yuma clapper rail. Although Aleutian Canada geese have been documented at the Salton Sea in the past, none were observed during 1992,

California brown pelicans (Pelecanus occidentalis) are normally occasional summer visitors to the Salton Sea, usually reaching peaks of perhaps 50 post-breeding birds from the Sea of Cortez. However, an unprecedented peak of 5,000 birds was estimated during July, 1990. They are most commonly observed on the Salton Sea at the river deltas or mouths of freshwater drains. The arrival date for brown pelicans during 1992 occurred on March 3, when an individual was observed at the Whitewater River delta. Six were seen on April 24 at the New River Delta, and on May 8 an estimated 400 brown pelicans had already peaked at the Sea.

The refuge received several notifications during 1992 from people who reported observations of dead or dying pelicans. A pelican was retrieved near Niland, which died within minutes. Another was picked up near the Elmore Geothermal plant, and released in Hazard Lake. A

distressed pelican was reported near Red Hill, and one dead pelican was collected from McKendry Road. All pelicans were severely emaciated, and covered with lice. Apparently, the weather system "El Nino" has resulted in a scarcity of available food, with pelicans arriving at the Salton Sea in poor condition. Any dead pelicans which were not severely decomposed were frozen for eventual contaminant analysis.

Bald eagles (Haliaeetus leucocephalus) are occasional fall and winter residents at the Salton Sea, where they feed on waterfowl and fish. During 1992, an immature bald eagle was sighted at the New River delta on January 6, and another immature was observed over headquarters on March 6. No eagles were observed during the annual January waterfowl survey.

Peregrine falcons (Falco peregrinus) are occasional residents at the Salton Sea, and one or two are normally observed during every month of the year. Population peaks of peregrines appear to coincide with major shorebird migrations, however, little is known about the peregrine falcons using the Salton Sea. During 1992, peregrine falcons were observed east of Morton Bay on January 14, with three observed on January 21, and one observed from Pound Road on January 26. A peregrine with a green band on the left leg was observed from Davis Road on January 22. Peregrines were observed twice on February 17: at the intersection of Davis and McDonald, and at Red Hill. During March, peregrines were observed on the 21st at Rock Hill, at the Hazard Unit on the 24th, and at Davis and Schrimpf Roads on the 25th. A peregrine was observed at Bruchard Bay chasing shorebirds on April 21. A peregrine was observed during the fall shorebird survey on August 21 at the mouth of the New River. On September 29 and October 30, a peregrine was sighted at Morton Bay. One peregrine was observed at refuge headquarters on December 3, and another off the Rock Hill Trail on December 25. During August, a dead peregrine was found under a powerline along Lack Road. This bird was collected and frozen pending analysis to determine the cause of death.

Yuma **clapper rails** (Rallus longirostris yumanensis) are permanent residents in freshwater marshes associated with the Salton Sea. About 700 birds are estimated in the United States, with another 200 in Mexico. Saltwater inundation of wetlands, direct habitat destruction associated with wetland draining and agriculture, water conservation methods, and contaminants have all led to the demise of this species. Following recovery team instructions, refuge populations are surveyed each spring to document the minimum number of birds utilizing available refuge wetlands. Although pair counts occur each year, no production surveys have ever been attempted. Yuma clapper rails were trapped and banded during the months of December and January in the Union Ponds. Refuge Operations Specialist Schoneman constructed the drift traps, checked traps, and measured and banded trapped birds. A total of one female AHY clapper rail was captured and banded on January 11 in the Union pond.

Biologist M. Radke conducted the 1992 Yuma clapper rail surveys between April 25 and May 15, encompassing five survey mornings. Areas surveyed included all suitable habitat on and adjacent to Salton Sea National Wildlife Refuge and "Barnacle Beach," an area south of Bombay Beach and 10 miles north of the Wister Fish Hatchery. The Salt Creek area was not included in our surveys this year since The Nature Conservancy has agreed to monitor this area and provide results to the recovery team. Surveys were conducted using the audio tape and protocol provided by the Yuma clapper rail recovery team.

On April 25 the Union ponds at headquarters were monitored with a total of at least three pair of rails responding with a duet clatter. An additional pair responded from the cattail area within the Barnacle Bar pond, the first time rails have been documented using this area. Pond 2 at headquarters contained a single rail responding to the call. Pond 2 was again monitored on May 2, with again only one single bird responding. The cattail area just south of the far west end of Lack Road was also monitored on May 2, but no birds responded. Production of clapper rails was documented in the Union Ponds when Refuge Biologist W. Radke observed three juvenile clapper rails at the south end of these ponds on June 22. The number of adult rails in the headquarters area therefore included four pair and one single bird, for a total of nine individuals.

Unit 1 was surveyed on April 25, which resulted in two single clatters in the Reidman ponds, one single clatter at the end of Trifolium 16, and a total of one pair and one single in Bruchard Bay, north of the area previously disturbed by the Imperial Irrigation District in 1990. The habitat improvements at Bruchard Bay are now complete, and this area will be managed as Yuma clapper rail habitat in the future as freshwater marsh becomes established. The Reidman ponds were surveyed again on May 9, and again only two single birds responded. However, a duet clatter was heard at Reidman ponds on June 1 while conducting other duties, resulting in two pair and three singles for a total of seven individuals in the Unit 1 area. A single rail was observed in the bulrush area of pond A 1 on June 21.

The Hazard Unit was surveyed on April 25, and resulted in three duet clatters in pond 6, and one single clatter in pond 5. A single bird was heard just east of pond 3A in the phragmites/cattail area within the drainage ditch, however, on May 2 no birds responded in this area. Pond 7 contained a total of one single individual on May 2.5, but one pair responded with a duet clatter on May 2, and two pair responded while conducting other duties at a later date. Another pair was heard north of pond 3A in the Alamo River delta area. Hazard was again surveyed on May 2, with one duet clatter responding from pond 10. Walt's Club, a private duck club located north of Hazard on McDonald Road, contained excellent cattail habitat on the north end of the ponds early in the year, however, the ponds had been dried and no rails responded to the taped calls. A cattail marsh just southeast of Hazard 7 and adjacent to the Alamo River was monitored on May 14, with four single birds in separate locations responding with clatters. The tape was played for a

longer period of time than usual, but none of the single clatters were ever responded to by a duet. The Alamo River delta area from the Garst Road bridge towards the east was monitored on May 15 with two pair responding. Surveys of the Hazard Unit therefore resulted in nine pair and six single birds, for a total of 24 individuals. A dead Yuma clapper rail was collected on May 30 near the twin pumps which drain the Hazard Unit, and may have died as a result of hitting a powerline. Production of clapper rails was documented in Hazard pond 7 when Refuge Biologist W. Radke observed three juvenile clapper rails at the west side of this pond on June 22.

Barnacle Beach was monitored on May 26 by Refuge Operations Specialist Schoneman and resulted in one duet response and a single bird kekking. Suitable habitat existed for more than the three individuals which responded, but the entire area was not surveyed because high water levels created difficulties in traveling over the terrain.

Overall rail numbers were extremely high during 1992, with 15 pairs and 40 individuals documented on or adjacent to the refuge. The number of rail pairs was almost 300% above the eight year average from 1984 through 1991. Rail habitat management activities on the refuge appear to be achieving their goal of increasing both quality and quantity of rail habitat. Habitat continues to degrade along the Alamo and New River deltas as a result of cattail being outcompeted by phragmites and tamarisk. Areas on the refuge which are specifically managed for Yuma clapper rail habitat include Reidman ponds 3 & 4, the two Union ponds, Hazard ponds 6 & 7, and Headquarters pond 2. Now that adequate water control has been achieved at Bruchard Bay, this area will also be managed as rail habitat.

The following table depicts Yuma clapper rail numbers at Salton Sea NWR since 1984, and does not include rails monitored at Barnacle Beach.

Table G.2a Minimum Numbers of Yuma Clapper Rails Responding to Taped Calls On or Immediately Adjacent to Salton Sea NWR.

YEAR	NUMBER OF PAIRS	TOTAL # OF INDIVIDUALS
1984	3	10
1985	5	21
1986	8	25
1987	6	20
1988	4	18
1989	1	5
1990	6	16
1991	5	13
1992	15	40

During November, the refuge hosted a workshop to discuss clapper rail habitat management on the refuge. This workshop was attended by BLM and Arizona Game and Fish Department representatives, and was well received by all (see Section E.7). Salton Sea NWR and associated freshwater wetlands managed by California Fish and Game provide habitat for

approximately 350 Yuma Clapper rails, about one-third of the estimated total population of this animal. Management on the refuge provides year around habitat for rails through the creation and maintenance of adjacent shallow permanent ponds in which emergent vegetation is promoted. About 130 acres of permanent freshwater wetlands currently exist on the refuge with an additional 120 acres planned for the near future. Water is manipulated in these ponds to create thick stands of cattail and alkali bulrush which provide nesting cover, and to create habitat for crayfish and other invertebrates upon which rails feed. Annual surveys indicate a tremendous increase in rail use of refuge habitats since permanent wetland management became emphasized in 1990. In addition, species such as the fulvous whistling-duck, cinnamon teal, and least bittern have also increased on the refuge.

As a result, conflicts with other refuge management objectives are minimal. Ponds up to 25 acres in size are constructed in adjacent pairs to allow necessary periodic habitat maintenance in one "half" while providing unaltered rail use of the other "half." Such maintenance eliminates "take" of an endangered species we are actively managing. This innovative approach has so far proven successful and appears to be promising in enhancing or creating clapper rail habitat throughout the bird's range in both California and Arizona, where intensive management is possible along with a clean source of water.

California least terns (Sterna antillarum) are occasional spring and summer migrants to the Sea which nest along the California coast. One was observed near English Road on July 1, and individuals were seen at the Whitewater and New River mouths on July 4.

Desert pupfish (Cyprinodon macularius) are the only fish native to Salton Sea. Historically, this fish was widespread in portions of Arizona, southeastern California, and northern Mexico, but was listed as endangered by the California Fish and Game Commission in 1980 and by the U.S. Fish and Wildlife Service in 1986. Reasons for its current endangered status, according to Federal Register 49(96):20740, include the introduction of exotic fish species, modifications to water conveyance facilities used for irrigation and drainage of agricultural lands, the application of agricultural pesticides, and the dewatering of natural spring habitats by groundwater pumping.

A 1991 survey documented desert pupfish in 72% of the drains surveyed around the Sea. Along the northern portion, 24 out of 27 (89%) drains surveyed contained pupfish, while 17 out of 30 (57%) drains along the southern shore contained pupfish. Both Salt Creek and San Felipe Creek also contained pupfish, as did 64% of all shoreline pools. At least three areas on the refuge, McKendry Pond, Barnacle Bar Pond, and Unit 1 Trifolium 16 Drain contain pupfish. McKendry Pond, a small brackish "barnacle bar" pond which receives freshwater inflow from Vail 5 Lateral near headquarters, will be surveyed annually for pupfish by refuge personnel in order to obtain trend data and to determine possible results of various management regimes (see also section G.ll).

During 1992, McKendry pond was surveyed August 5 - 6 and 13 - 14. Minnow traps of 1/4" wire mesh measuring approximately nine by 16 inches with 1.5 inch funnel entrance holes were used to capture fish. The traps were baited with canned cat food placed inside perforated ziplock bags. The cheapest fish-flavored cat food appeared to have the most success in trapping results. Traps were placed during the morning and remained in place for approximately 24 hours.

Surveys conducted by other researchers found that optimal trapping success was usually achieved in or near algal growth or other aquatic vegetation, with water depths of less than 12", and with low turbidity and water movement. A total of four traps were arbitrarily placed in a square pattern near the shoreline of McKendry Pond on August 5, and checked approximately 24 hours later. Four traps were again placed in the pond in a diamond pattern in deeper water on August 13, and checked approximately 24 hours later. Traps were placed further from shore and entrance holes in the traps were made smaller to limit entry by tilapia and crayfish. Trapping was again attempted on August 14, with two traps placed along the southern end of the pond along the algae-covered large boulders where pupfish had been visually observed in the past. "Whiskas" brand cat food was used, which was minimally foraged on by fish and crayfish. Again, the trap openings were made as small as possible to impair the capture of tilapia and crayfish. An effort was made to select what hoped to be more suitable pupfish habitat during this third trapping attempt. Trapping success for the three efforts is summarized in Table G.2b.

In addition to desert pupfish, two other species of fish, one species of crustacean, and one species of amphibian were captured. These included tilapia (Tilapia spp.), molly (Poecilia spp.), crayfish (Procambarus clarkii), and one bullfrog tadpole (Rana catesbeiana). In order to simplify identification problems, the two species of African cichlids common to the Sea, the Mozambique mouthbrooder (T. mossambica) and Zills cichlid (T. zilli), were lumped under "Tilapia spp.". For the same reason, sailfin and shortfin mollies, P. latipinna and P. mexicana, respectively, were lumped as "Poecilia spp.". In addition to the species captured, mosquitofish (Gambusia affinis) were visually observed in the pond. They were not captured in traps, perhaps because of their small size and their habit of foraging near the water surface.

The most commonly captured species included tilapia (n = 90) and crayfish (n = 37), with only six mollies, one bullfrog tadpole, and one desert pupfish captured. This resulted in 10 tilapia, 3.7 crayfish, .6 mollies, .1 bullfrog, and .1 pupfish captures per trap-night. The ratio of predator and/or competitor species to desert pupfish was 134:1.

Only the first day's trapping resulted in one pupfish capture from trap 2, located on the southeast section of the pond. The pupfish was captured in 18" of water with a barnacle substrate. The trap was located approximately five feet from shore which was moderately vegetated with saltcedar/bermudagrass and scattered cattails. The ziplock bag with catfood had not been ripped or pulled out of the trap

by tilapia. Because almost half of the traps had food that did not last for 24 hours, it may he advisable to use individual small perforated cans of catfood for each trap.

Table G.2b Results of pupfish survey of McKendry Pond, August 1992.

Date	Trap	Species	# of Individuals	Trap Depth	Substrate	Distance to Shore	Other
8/6	1	P. clarkii	6	18"	barnacle	7'	Food gone
		Tilapia spp.	4				
	2	P. clarkii	14	18"	barnacle	5'	Food OK
		C. macularius	1				
	3	Tilapia spp.	56	24"	silt	10'	Food gone
		Poecilia spp.	1				bag out
	4	Tilapia spp.	5	24"	silt	8'	Food gone
		P. clarkii	2				
8/14							
	1	Tilapia spp.	7	24"	barnacle	20'	Food gone
		Poecilia spp.	1				bag out
	2	Tilapia spp.	7	18"	silt	10'	Food gone
		P. clarkii	3				bag out
		Poecilia spp.	1				
		R. catesbeiana	1				
	3	P. clarkii	8	1.8"	silt	7'	Food OK
		Tilapia spp.	4				
		Poecilia spp.	1				
	4	Poecilia spp.	1	24"	barnacle	30'	Food OK
8/15	1	Tilapia spp.	7	6"	silt	1'	Food OK
		P. clarkii	4				
		Poecilia spp.	1				

Management recommendations:

1) This survey for pupfish should be continued on a year to year basis to determine population trends, and to try and determine the effects of various management techniques, such as drain dredging, on pupfish populations. The survey should be a standardized effort, utilizing the same methods discussed previously. Traps and stakes should be hidden from the public's view since the area around Obsidian Butte is heavily fished at times. Temperature and salinity measurements should be included in subsequent surveys. Black (1980) states that pupfish were

more abundant in shoreline pools during the fall survey period, therefore, this survey should probably be repeated during September or October. Also, Barlow (1961) states that pupfish in water temperatures of 38°C are metabolically forced to forage continuously, and therefore may be more vulnerable to trapping. It may be appropriate to test water temperatures until they reach this level before surveys are undertaken.

2) A more in-depth study should be initiated with the Imperial Irrigation District or Bureau of Reclamation on a cooperative basis to study drain maintenance activities and their effect on pupfish populations in selected drains year after year. The District would be responsible for supplying information such as maintenance activities on the drain, and USFWS personnel would be responsible for yearly trapping efforts.

3. Waterfowl

A primary benefit of Salton Sea NWR is to provide a sanctuary area necessary to protect wintering waterfowl in the Imperial Valley. During the year, at least 26 waterfowl species utilized the refuge, with common species including snow geese, Ross' geese, northern pintail, northern shoveler, and green-winged teal.

During 1992, observations of noteworthy waterfowl included fulvous whistling-ducks observed nesting at Finney Lake on May 2, at the Hazard Unit on August 4 and 28, on August 8 over McKendry Bay, and with 63 sighted at the corner of Grumble/Lack Roads on August 21. A black-bellied whistling-duck was observed at the Hazard Unit on July 6 (only the seventh reported occurrence for this species). A Barrow's goldeneye was reported during the Christmas Bird Count on December 22, a bufflehead was seen at the New River on November 1, and an oldsquaw was observed on December 22, with two seen from the Rock Hill Trail on December 25. A surf scoter was observed at the naval test base on April 6, and a white-winged scoter was observed on December 22. Red-breasted mergansers were sighted at Salton Sea State Park on March 3, at headquarters on May 4 and June 4, at Johnson Drain on June 15, at the Hazard Unit on November 9, and near Young Drain on December 3.

Waterfowl numbers both on and off the refuge were surveyed using the same methods as in past years. Survey areas included both the Imperial and Coachella Valley wetlands most important to waterfowl. Refuge personnel conducted Salton Sea aerial surveys during January, February, November, and December. Total waterfowl numbers between November and February were estimated at 512,465 birds during 1992-93, compared to 257,889 birds during the same period last year. There were a total of 15,373,950 waterfowl use-days between November and February during the 1992-93 season, as compared to 7,736,670 use-days during 1991-92, representing a 99 percent increase.

In addition to monthly surveys at the Salton Sea, a mid-winter waterfowl survey covering the south coast of California was conducted January 9th, using a Partenavia aircraft contracted with Aspen Helicopters of Oxnard,

California. The refuge contracted with Sun Western Flyers, Inc. of Yuma, Arizona for other Salton Sea flights, with aircraft costs averaging about $400 per survey. The following table depicts estimated waterfowl peaks at Salton Sea NWR, the Imperial Valley, and the Coachella Valley during 1992-93.

Table G.3. Waterfowl Peak Populations During 1992-93.

PEAK WINTER POPULATIONS
FOR WATERFOWL, 1992-93

SPECIES	SSNWR	IV	CV
SNOW/ROSS'S GOOSE	13.070 (D)	20.285 (D)	0
CANADA GOOSE	680 (D)	3.025 (J)	0
GREEN-WINGED TEAL	5.105 (D)	12.955 1.810	(F)
MALLARD	235 (D)	760 (D)	170 (D)
NORTHERN PINTAIL	7,400 (N)	27.830 (D) 5 7 5	(N)
CINNAMON/BLUE-WINGED TEAL	420 (F)	1,710 (F)	285 (F)
NORTHERN SHOVELER	10.800 (D)	41,830 (F)	4,220 (N)
GADWALL	550 (D)	1.495 (D)	215 (N)
AMERICAN WIGEON	1.750 (D)	3,255 (F)	750 (D)
CANVASBACK	640 (D)	1.430 (F)	75 (D)
REDHEAD	720 (F)	1,730 (F)	250 (D)
RING-NECKED DUCK	495/F)	2,690(F)	400 (J)
GREATER/LESSER SCAUP	2,210 (D)	4,370 (D)	890 (F)
BUFFLEHEAD	25 (D)	175 (J)	50 (D)
RUDDY DUCK	4,800 (F)	22.195 (J)	11.050 (F)

(N) = Indicates peak winter population occurred in November; D = December; J = January; F = February

SSNWR = Salton Sea National Wildlife Refuge
IV = Imperial Valley
CV = Coachella Valley

a. Ducks

The common duck species at Salton Sea include the northern shoveler, northern pintail, and green-winged teal. The duck population peaked at 137,950 birds during December, compared to a peak of 60,840 birds estimated for 1991-92.

Nesting on the refuge by mallards, cinnamon teal, northern pintail, and redhead was documented during the year, but production on the area by these species is minimal. Fulvous whistling-ducks, a sensitive species, did not nest on the refuge during 1992, although nesting was again documented at nearby Finney Lake.

b. Geese

Salton Sea NWR provides two significant sanctuary areas within the Imperial Valley. Nearly every goose wintering in the valley utilizes refuge habitat at some point. The overall refuge goose population peaked at 13,750 birds during December, which is above the average peak goose population observed during the last five years. Most white geese departed the refuge during late February, with some lingering into early May. The first two snow geese arrived on the refuge October 13 at Headquarters. The fall arrival date for white-fronted geese was also on October 13 at Unit 1.

Total Imperial Valley goose populations increased to a surveyed high of 22,140 birds during the 1992-93 winter, compared with 20,100 counted during the 1991-92 winter. Canada goose numbers in the Imperial Valley increased, with a high of 3,025 compared to 2,300 counted last winter. White goose populations in the Imperial Valley also increased to a high of 20,285, compared to 18,000 counted during 1991-92.

This year an attempt was made to estimate the proportions and numbers of lesser snow geese and Ross' geese wintering in California, and refuge personnel participated in the survey at Salton Sea. At the Sea, an estimated 17,000 white geese were present on December 3, 1992, the survey date. Of these, 10,931 (64.3%) were snow geese and 6,069 (35.7%) were Ross' geese. This compares to a statewide total of 598,110 white geese in California during the survey period, of which 376,814 (63%) were snow geese and 221,286 (37%) were Ross' geese.

A few neck-collared geese were observed on the refuge in 1992, though a lack of staff prevented a concerted effort in reading collars. When the geese are banded at the breeding grounds, the collars are color-coded to their region of origin. Therefore, most collared snow geese seen at Salton Sea were banded in the western Canadian Arctic (black collars) and all the Ross' geese were banded in the central Canadian Arctic (blue collars).

Brant are normally rare visitors to the Salton Sea, with four observed at Salton Sea State Park on March 4, five seen at Bruchard Bay on May 30, ten observed at Unit 1 on April 7, six seen at Unit 1 on April 15,

and five more seen at Hazard on April 20. On May 20, two brant were present at Unit 1, and 16 were counted at Avenue 76 on May 26. A total of 129 brant were observed on the Salton Sea during an aerial survey on July 2, and on August 21, four brant were observed at the New River delta and the Whitewater River delta, indicating these birds summered at the Salton Sea.

Observations of color-banded brant indicate that Salton Sea birds are coming from the Yukon Delta.

4. Marsh and Water Birds

A great number and diversity of marsh and water bird species were present on Salton Sea during the year. Nesting species included pied-billed grebe, great blue heron, great egret, snowy egret, cattle egret, green-backed heron, black rail, clapper rail, common moorhen, American coot, and least bittern.

Noteworthy species included a Pacific loon observed at Unit 1 on March 3, with others found at Obsidian Butte on October 26 and at Morton Bay on November 2. On June 24, two magnificent frigatebirds were reported at Red Hill, while one immature frigatebird was documented at Mullet Island on June 25. An additional three frigatebirds were sighted at Fig Lagoon on August 12. American bitterns were observed at Unit 1 on March 14, at the Union Ponds on October 2, on October 5 at the Hazard Unit, and at Hazard on November 6; least bitterns were sighted at the Reidman Ponds on June 9, at Jo'hnson Drain and Barnacle Bar on June 23, and three were observed at McKendry Bay on August 6. A flamingo was observed at the Hazard Unit on July 5, with three observed on the Alamo River delta on July 2, with up to seven observed during the winter months near Red Hill and the Alamo and Whitewater River deltas. The first wood stork was sighted May 24 at Finney Lake. On June 23 storks were observed at Red Hill, and on July 6 seven storks were seen at Morton Bay, with 23 observed at the Hazard Unit on July 23. A little blue heron was observed at Wister Wildlife Area on June 6, and a tricolored heron was seen at Obsidian Butte on July 11. Yuma clapper rails were observed during the annual surveys conducted in April and May, with juvenile rails observed on June 22 at the Union and Reidman Ponds (section G.2).

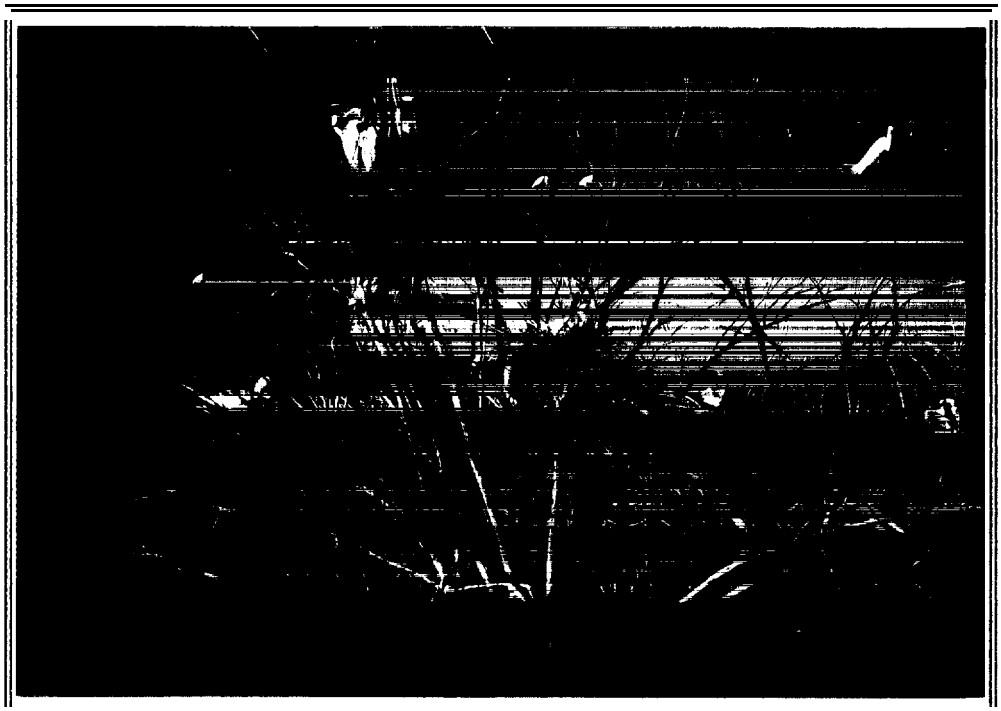
A few sandhill cranes from the Lower Colorado River population winter in -the Imperial Valley each year. On November 23, a total of 229 sandhill cranes were tallied by Biologist M. Radke in shallowly flooded freshwater ponds of a private duck hunting club used each year by the birds as a winter roost site. Of this total, 30 of the cranes appeared to be the "lesser" subspecies, based on their smaller overall size, shorter necks and legs, smaller heads and beaks, shorter tail feathers, and different behavioral characteristics noted while in close proximity to the "greater" subspecies. The total count was assumed to be low since not all the cranes present could be observed as they roosted behind dikes covered with saltcedar. Approximately 10,000 white-faced ibis were also tallied as they flew into the roost for the night.

Many nesting piscivorous birds, including black-crowned night herons, continue to decline at the Sea. Contaminant issues and fish culturalists are a concern. 92NR13 WRR 6/15/93

The roost was again surveyed on November 30, with cranes counted as they landed in the same pond area. On this date, 299 sandhill cranes were tallied. No determination was made as to the number of "lessers." About 100 of the cranes first landed in a dry pond just south of the fish farm before finally flying over to the main roost site. Biologist W. Radke estimated 295 sandhill cranes at this area on December 9, with 45 of these being "lessers." For the first time, surveys were coordinated with counts conducted along the Colorado River by Cibola National Wildlife Refuge personnel in order to obtain more accurate total population estimates each year.

Colonial nesting bird surveys were accomplished by refuge personnel between March 19 and July 2 along the entire Salton Sea shoreline and at Finney Lake. Surveys were conducted aerially during March, May, and July, and from the ground throughout the nesting period. This expanded survey began in 1991, justified by the dynamic nature of colonies, and because a more thorough documentation of colonial nesting birds on the entire Sea is required to better understand the Salton Sea ecosystem, including the refuge. During 1992, record numbers of piscivorous birds nested on the Imperial Wildlife Area at Finney Lake, and traditional cattle egret colonies in the Imperial Valley at Brunt's Corner and at Dogwood Road were not used by birds this year. Interactions between

colonies along the Salton Sea shoreline and the colony at Finney Lake have not 'been documented.



Inundated trees near the Johnson Street drain provided nesting sites for the largest and most diverse colony of piscivorous birds at the Salton Sea during 1992. 92NR14 WRR 6/19/92

On March 19, a seawide aerial survey found at least 25 great blue herons incubating eggs or on territories, and a total of 28 great egrets were on territories at the west Whitewater colony and at the Lack/Lindsey colony. In addition, eight great egrets were on territories at Finney Lake. By March 21, black skimmers were present at Johnson Drain and Morton Bay, and great blue herons were incubating at most traditional nest sites. A total of over 110 great egrets, cattle egrets, snowy egrets, and black-crowned night herons were incubating at the west Whitewater colony and the Johnson colony. By March 27, about 10 great egrets were incubating at the Mallard Road colony off the Wister shoreline, and about 25 were incubating at the Lack/Lindsey colony. In addition, black skimmers appeared to be incubating at the Johnson colony.

During a seawide aerial survey conducted May 8, there were at least 100 active great blue heron nests, 220 great egret nests, 200 snowy egret nests, and 55 cattle egret nests at the Sea, and an estimated 30,000 nesting egrets present at Finney Lake. The vast majority of the birds at Finney Lake were great egrets, though snowy egrets were also present. Also nesting at Finney were an estimated 1,300 black-crowned

night herons, 140 great egrets, 12 great blue herons, and 370 white-faced ibis. On June 25, refuge personnel visited Mullet Island and documented four nesting great blue herons, five gull-billed terns, 10 black skimmers, and 27 caspian terns (the first documentation of this species nesting since 1950). By the July 2 aerial survey, many nests seawide had either failed or fledged birds though there were an estimated 42 great blue herons, 140 great egrets, 129 snowy egrets, 40 cattle egrets, 35 caspian terns, 35 black skimmers, and five gull-'billed terns still on active nests at the Sea.

Overall numbers of nesting piscivorous birds declined from last year, and continue a long-term trend of decline. Once again there were large numbers of double-crested cormorants on the Sea throughout the period, yet none of these birds attempted to nest, and there has been no local cormorant production since 1988. Gull-billed terns had a poor reproductive year at the Sea. Although colonies were initiated at Morton Bay, Barth Road, Mullet Island, and Johnson Drain, only the Johnson Drain was successful in fledging an estimated 20 young. Black skimmers fared little better in 1992, with colonies established at Morton Bay, Mullet Island, and Johnson Drain. One bird fledged at Morton Bay, and an estimated 30 birds fledged from Johnson Drain. Mullet Island nests were not revisited and may have fledged young. Morton Bay was plagued with raccoon depredation throughout the nesting period, causing eventual abandonment of the colony, which likely renested on nearby Mullet Island. The Barth Road colony received heavy disturbance from loafing brown pelicans, which were present on the Sea as early as March 19, and peaked at over 700 birds.

Contaminant research continues at the Salton Sea to ascertain the effects on piscivorous birds and other species. Research conducted during 1991 determined that piscivorous birds at the Sea are suffering from elevated levels of both DDE and selenium. As a result, this year refuge research emphasis was placed on determining great egret production at various colonies at the Sea, and this information will be available in a separate report. While monitoring colonies, eggs from white-faced ibis, great egrets, black-crowned night herons, and great blue herons were collected by refuge personnel for contaminant analysis. Pipped eggs and young from ten night heron nests were also collected as part of a nationwide contaminant biomonitoring program coordinated by Patuxent Wildlife Research Center. Results of these studies will not become available until 1993. The following tables depict nesting activity of the survey areas.

Table G.4a Active Nests at Salton Sea and Finney Lake - 1992

LOCATION	GTBH	CAEG	SNEG	GREG	DCCO	BCNH	GBTE	BLSK	CATE	WFIB	TOTAL
Avenue 81	6	0	0	0	0	0	0	0	0	0	6
W. Whitewater	10	0	5	30	0	0	0	0	0	0	45
Johnson Drain	14	55	193	127	0	117	30	40	0	0	576
State Park	5	0	0	0	0	0	0	0	0	0	5
Bombay Beach	2	0	0	0	0	0	0	0	0	0	2
Wister Shoreline	30	0	0	16	0	0	0	0	0	0	46
Mullet Island	4	0	0	0	0	0	5	32	35	0	76
Morton Bay	0	0	0	0	0	0	25	15	0	0	40
Alamo Delta	9	0	0	0	0	0	0	0	0	0	9
Hazard Lakes*	0	0	0	0	0	0	0	0	0	0	0
Red Hill/HQ*	4	0	0	0	0	0	0	0	0	0	4
Obsidian Butte*	1	0	0	0	0	0	0	0	0	0	1
Lindsey/Lack*	1	0	0	36	0	0	0	0	0	0	37
Vail Ranch*	1	0	0	0	0	0	0	0	0	0	1
New River Delta*	5	0	0	0	0	0	0	0	0	0	5
Bruchard Bay*	0	0	0	0	0	0	0	0	0	0	0
Trifolium Drain*	3	0	0	0	0	0	0	0	0	0	3
W. Poe Road	0	0	0	0	0	0	0	0	0	0	0
Barth Road	0	0	0	0	0	0	29	0	0	0	29
Desert Ranch	6	0	0	12	0	0	0	0	0	0	18
San Felipe CK	3	0	0	0	0	0	0	0	0	0	3
Salton Sea Total	104	55	198	221	0	117	89	87	35	0	906
Finney Lake Total	12	30K	P	140	0	1300	0	0	0	370	31822
Grand Total	116	30K+	198+	361	0	1417	89	87	35	370	32728

GTBH: Great Blue Heron
CAEG: Cattle Egret
SNEG: Snowy Egret
GREG: Great Egret
DCCO: Double-crested Cormorant
BCNH: Black-crowned Night Heron
GBTE: Gull-billed Tern
BLSK: Black Skimmer
CATE: Caspian Tern
WFIB: White-faced Ibis

* Traditional nesting areas surveyed since 1985.

Table G.4b Active Nests at Traditional Survey Areas Areas

YEAR	GREAT BLUE HERON	CATTLE EGRET	SNOWY EGRET	GREAT EGRET	DOUBLE-CRESTED CORMORANT	TOTAL
1987	246	1373	9	85	63	1776
1988	208	850	3	8	57	1126
1989	0	98	80	53	0	231
1990	15	0	0	4	0	I - 19
1991	11	0	0	36	0	47
1992	15	0	0	36	0	51

5. Shorebirds. Gulls, Terns. and Allied Species

Common spring and fall migrants include the white-faced ibis, greater yellowlegs, willet, whimbrel, long-billed curlew, marbled godwit, Western and least sandpipers, dunlin, long-billed dowitcher, Wilson's phalarope, California and ring-billed gulls, and Caspian, Forster's, and black terns. Breeding species include the killdeer, black-necked stilt, American avocet, and snowy plover.

Tens of thousand of Western sandpipers utilize the Salton Sea shoreline and refuge wetlands during spring and fall migrations.

Noteworthy species during 1992 included approximately 200 mountain plovers observed about 15 miles southwest of Westmorland on January 2, near Sinclair Road on January 3, and south of Westmorland on February 3. Snowy plovers were observed at Wister Wildlife Area on February 22, at the New River Delta on March 10, and nesting at Unit 1 on May 9. A snowy plover nest with three eggs was observed at Unit 1 on June 26, and had hatched by July 2. A semi-palmated plover was observed at the Hazard Unit on July 14, and during the shorebird survey on August 21. Stilt sandpipers were observed on the Hazard Unit during the fall shorebird survey on August 21. On September 28, two Baird's sandpipers were observed at the mouth of Salt Creek, a solitary sandpiper was observed near headquarters, two pectoral sandpipers were sighted on MacDonald Road, and a black turnstone was seen at Morton Bay. A pectoral sandpiper was also seen during the Christmas Bird Count on December 22. On April 23, four red knots were observed at the Unit 1 shoreline, with 27 observed the next day between Poe Road and Unit 1, and one knot observed on September 28 at Red Hill. Ruddy turnstones were sighted on August 21.

Ring-billed gulls are the most common gull species in the Imperial Valley, with numbers estimated at 400,000. Although abundant, gulls do not nest at the Salton Sea. Yellow-footed gulls were seen during January and February at headquarters and Red Hill, with good numbers appearing at headquarters by May 23. Peak numbers of over 200 birds appeared during June and July, with birds still observed near headquarters on September 24, and late birds sighted throughout October, November, and December. A glaucous-winged gull was sighted at the Brawley dump on January 26. A Western gull was observed at the mouth of the Avenue 81 drain on March 23. A little gull, only the fifth reported occurrence for this species, was observed on July 4 at the Whitewater River mouth. On August 21, four Bonaparte's gulls were sighted. An unsubstantiated report of two elegant terns were reported at the Whitewater River on July 26, which may be only the second reported occurrence for this species at the Salton Sea. An unsubstantiated report of a common tern was reported on the Rock Hill trail on June 21. An ancient murrelet was observed at Salton City on March 12 by Art Davenport (only the second reported occurrence for this species).

Clearly, the Salton Sea supports one of the largest inland concentrations of migrating shorebirds in the Pacific Flyway. Refuge personnel assisted with both the spring and fall Salton Sea shorebird census coordinated by the Point Reyes Bird Observatory. The spring and fall shorebird surveys were conducted on April 24 and August 21, respectively. Refuge personnel who participated in the surveys included Bloom, Dinkler, Durbin, M. Radke, W. Radke, Schoneman, and Voget. A total of 34,600 individuals and 42 species were observed during the spring survey, with 33,158 individuals and 39 species observed during the fall survey. Commonly observed species during both the spring and fall included black-necked stilt, American avocet, Western and least sandpipers, and dowitcher. Overall numbers and number of species were down when compared to 1991 data.

In order to provide shade for newly hatched gull-billed terns and black skimmers, several concrete and fiberglass pipes were placed on one of the smaller islands within Morton Bay on April 22 by Biologists W. Radke and M. Radke. It was noted at this time that the bay was devoid of both species, and that a disturbance had occurred to the colony. It was difficult to assess the pipe's effectiveness because of the overall low nesting success by gull-billed terns and black skimmers at Morton Bay this year. However, if the pipes do prove effective in future years in increasing nesting success, additional pipes may also be placed on the larger islands of Morton Bay.

Mountain plovers are uncommon winter visitors in the Imperial Valley, and are of special interest to the public visiting Salton Sea NWR. These birds typically arrive during October and have been reported in the Imperial Valley as late as March 13. The Service is currently reviewing the status of mountain plovers, whose total population is estimated at 5,000, in preparation of a listing package. There are concerns that plovers may be picking up contaminants on their wintering areas, including the Imperial Valley. In 1990, the Imperial Valley (on the U.S. side) contained 560,790 acres of agriculture, including 4,725 acres in asparagus and 11,954 acres in bermudagrass (for seed). Both of these perennial crops provide important feeding areas for mountain plovers near the Salton Sea. Asparagus is matured during the summer and is chopped at ground level and burned off during fall and winter to allow harvest of the resprouting shoots. Burning of the earliest fields begins in October, while late fields are burned in December. The bare, blackened earth apparently provides localized invertebrate activity and food for mountain plovers. Bermudagrass is burned or mowed primarily during late January through March to promote spring growth and seems to provide much the same conditions for plovers. However, mountain plovers also will use any bare agricultural field (or short-grass field) in the valley, and their population size is difficult to determine. Bermudagrass has declined as a crop in the area, however asparagus is the same or increasing. Refuge agricultural lands are managed to provide green browse for wintering geese, and do little to provide good plover habitat. Mountain plovers are generally seen on refuge lands in late winter after geese have partially denuded alfalfa fields.

6. Raptors

A total of 28 raptor species have been documented at Salton Sea NWR, with common species including the Northern harrier, red-tailed hawk, American kestrel, burrowing owl, and common barn owl. Breeding species include the American kestrel, burrowing owl, and common barn owl. Barn owls commonly use the many haystacks located throughout the Imperial Valley as nesting locations. Juvenile burrowing owls were observed emerging from ditchbank burrows by May 27.

Other regularly observed species may include the osprey and Cooper's hawk. Ospreys are most commonly observed around the Salton Sea shoreline, or occasionally perched on utility poles near refuge headquarters. Ospreys were sighted north of Unit 1 on March 5, near the

Whitewater River delta on March 14, on August 3 and 15 near headquarters, and on August 6 at Morton Bay. Cooper's hawk are most commonly seen at headquarters, utilizing the thick mesquite tree rows with their abundance of passerine species. Cooper's hawk were observed at headquarters on March 19, October 9 and 10, and November 16.

Noteworthy raptor observations during 1992 included a pair of black shouldered kites along the Rock Hill Trail during January, and at Unit 1 and Wister Wildlife Area during February. They were sighted throughout March, on April 15, and on June 4 at Unit 1, and were reported to have nested on the area in a salt cedar tree. A sharp-shinned hawk was observed at headquarters on March 17. On March 10, a Swainson's hawk was observed at headquarters. An immature zone-tailed hawk was observed from Kalin Road on January 4, and at Schrimpf and Davis Roads on March 19. Merlins were observed on January 18 near Obsidian Butte, during February at Wister and at the corner of Gentry and Young, at Davis and McDonald Roads on March 24, and on October 25 at Davis Road. A prairie falcon was observed near Schrimpf and English Roads on February 17, and on October 24 at Davis Road.

As part of a study which was begun in 1990, a research proposal for burrowing owls was submitted to the regional nongame coordinator during March. A total of 20 artificial nesting structures for burrowing owls were installed during the year, with 24 owls banded. Tissue samples of three eggs and one liver have undergone analysis for selenium (Section D.5).

Breeding burrowing owls were also censused as part of a study coordinated by the Institute for Bird Populations. The refuge received 11 packets from the Institute, with each packet containing materials necessary to census one three-square mile section for burrowing owls. Because of time constraints, one package was forwarded to California Dept. of Fish and Game at Wister Wildlife Area, and six packets were forwarded to the Imperial Irrigation District for completion by their "ditch riders." The remaining four packets were kept because of their proximity to the refuge.

A total of three sections were surveyed by Biologist M. Radke from May 25 through July 7, with approximately 23 hours spent during the censusing effort. A total of 147 pairs of burrowing owls were observed in the three areas, for an average of 16.3 pairs of owls per square mile.

In an attempt to gain information as to the influx of American kestrels which inhabit the Imperial Valley during the winter, a banding program was initiated by Biologist Schulz during February. Cylindrical bal-chatri traps baited with mice were used to capture birds. A total of 22 kestrels were captured, of which 13 were females. Of the nine males, two were recaptures from the previous summer.

7. Other Migratory Birds

The 93rd annual Christmas Bird Count was conducted on December 22 by 11 individuals in five parties. A total of 56,792 individual birds were observed representing 141 species. In addition, a Barrow's goldeneye was reported, but not documented. This year's noteworthy species included an oldsquaw, white-winged scoter, pectoral sandpiper, chestnut-sided warbler, rose-breasted grosbeak, and lark bunting. The following table lists the species and numbers observed on the count area, centered 2.2 miles east-southeast of the Salton Sea NWR headquarters.

Noteworthy observations of passerines on or near the refuge during the year included hundreds of Western bluebirds at the Reidman Tract on January 26, a cactus wren at the Hazard Unit on March 29, the first reported sighting of a brown-crested flycatcher at headquarters on May 5, unsubstantiated reports of two Lucy's warblers and a female summer tanager at headquarters on July 12, a Gila woodpecker along McKendry Road on August 8, an Inca dove at the Hazard Unit on August 10, mountain bluebirds at the Reidman Tract on September 24, a male vermilion flycatcher at Unit-l on October 31, a groove-billed ani observed along Bowles Road between November 27 and 29, and a chestnut-sided warbler, rose-breasted grosbeak, and lark bunting during the Christmas Bird Count on December 22.

Table G.7 Species Observed During December 1992 Christmas Bird Count

Pied-billed grebe	22	Common snipe	12
Eared grebe	3,291	Bonaparte's gull	a
Western grebe	2	Ring-billed gull	8,220
Clark's grebe	3	California gull	49
American white pelican	44	Herring gull	228
Double-crested cormorant	410	Yellow-footed gull	21
American bittern	2	Glaucous-winged gull	1
Least bittern	1	Caspian tern	2
Great blue heron	53	Forster's tern	42
Great egret	151	Rock dove	305
Snowy egret	88	Mourning dove	387
Cattle egret	3,761	Common ground-dove	a5
Green-backed heron	6	Greater roadrunner	14
Black-crowned night heron	556	Common barn-owl	2
White-faced ibis	485	Burrowing owl	43
Snow goose	330	Anna's hummingbird	7
Ross' goose	52	Belted kingfisher	11
Canada goose	312	Ladder-backed woodpecker	4
Green-winged teal	3,875	Northern flicker	4
Mallard	31	Black phoebe	102
Northern pintail	665	Say's phoebe	69
Cinnamon teal	34	Vermilion flycatcher	4
Northern shoveler	5,205	Horned lark	171
Gadwall	102	Tree swallow	11
American wigeon	328	Common raven	2
Canvasback	18	Verdin	104

Redhead	20
Greater scaup	1
Lesser scaup	879
Oldsquaw	1
White-winged scoter	1
Common goldeneye	7
Bufflehead	176
Ruddy duck	10,575
Turkey vulture	6
Black-shouldered kite	3
Northern harrier	41
Sharp-shinned hawk	3
Cooper's hawk	6
Red-tailed hawk	33
ferruginous hawk	1
Rough-legged hawk	1
American kestrel	108
Merlin	1
Peregine falcon	2
Ring-necked pheasant	1
Gambel's quail	81
Clapper rail	1
Virginia rail	1
Sora	9
Common moorhen	30
American coot	2,204
Black-bellied plover	86
Snowy plover	23
Semipalmated plover	2
Killdeer	232
Mountain plover	267
Black-necked stilt	227
American avocet	1,978
Greater yellowlegs	13
Lesser yellowlegs	1
Willet	182
Spotted sandpiper	2
Long-billed curlew	135
Marbled godwit	239
Western sandpiper	939
Least sandpiper	1,390
Pectoral sandpiper	1
Dunlin	87
Stilt sandpiper	4
Long-billed dowitcher	801

Cactus wren	21
Bewick's wren	1
House wren	4
Marsh wren	32
Ruby-crowned kinglet	60
Blue-gray gnatcatcher	20
Black-tailed gnatcatcher	11
Hermit thrush	1
American robin	1
Northern mockingbird	45
Crissal thrasher	2
Water pipit	101
Cedar waxwing	15
Phainopepla	27
Loggerhead shrike	49
European starling	916
Orange-crowned warbler	63
Chestnut-sided warbler	1
Yellow-rumped warbler	962
American redstart	3
Common yellowthroat	34
Rose-breasted grosbeak	1
Abert's towhee	95
Chipping sparrow	6
Brewer's sparrow	10
Vesper sparrow	30
Lark sparrow	15
Sage sparrow	12
Lark bunting	1
Savannah sparrow	85
Song sparrow	92
Lincoln's sparrow	1
White-crowned sparrow	473
Dark-eyed junco	2
Red-winged blackbird	1,452
Western meadowlark	68
Brewer's blackbird	300
Great-tailed grackle	96
Brown-headed cowbird	25
House finch	152
Pine siskin	14
Lesser goldfinch	6
American golf inch	10
House sparrow	335

Noteworthy observations of passerines in the Imperial Valley included a solitary vireo at the Red Hill Marina on January 25, vermilion flycatchers at the Brawley Cemetery on January 26 and near Holtville on February 22, a Townsend's solitaire near Ramer Lake on February 22, a Lewis' woodpecker at the intersection of Brandt and Eddins Roads on

March 14, an unsubstantiated report of an Eastern kingbird near Mecca on June 18, and bronzed cowbirds at the Oasis Station on July 4.

10. Other Resident Wildlife

At least 41 mammal species are present at Salton Sea NWR. Common species include the desert cottontail, raccoon, striped skunk, spotted skunk, valley pocket gopher, deer mouse, pocket mouse, muskrat, and house mouse. Most of the rodent species exist in terrestrial habitats, where they provide important foods for raptors and other predators. During winter months, rodents become an important food for herons and egrets. Muskrats are present in freshwater tributaries where their feeding and burrowing activities help maintain marsh habitats for various other species.

Amphibians and reptiles actually observed on the refuge during 1992 include the bullfrog, red-spotted toad, Woodhouse toad, leopard frog, spiny softshell turtle, side-blotched lizard, desert spiny lizard, western whiptail lizard, gopher snake, common kingsnake, checkered garter snake, western diamondback rattlesnake, coachwhip, and ground snake. Lowland leopard frogs were observed in large numbers in Hazard Ponds 6, 7, and 10, and seem to respond well to shallow permanent wetland habitat created for clapper rails. Leopard frogs are not present elsewhere on the refuge due to competition from exotic bullfrogs.

Since 1991, the Imperial Valley, including refuge lands, has been besieged by billions of whiteflies (Bemisia tabaci). The minute insects suck plant juices, transmit viruses lethal to plants, create "honeydew" which promotes fungus growth, and are not susceptible to pesticides. Considerable damage was done to agricultural crops countywide, including refuge lands, and researchers are working to evaluate the use of biological control as a means to combat the whitefly population.

For the second year in a row, painted lady butterflies (Vanessa cardui) reached a peak of billions during April and May throughout southern California, including refuge lands. These adult butterflies are relatively long-lived, and during favorable years population buildups occur which culminate in extensive northerly migrations, with population peaks occurring on the average of once each twenty years.

11. Fisheries Resources

Because it is within a closed basin having low rainfall and high evaporation, the Salton Sea has become increasingly saline. Presently the Sea has a salinity ranging up to 44 parts per thousand, which is about 25 percent saltier than the Pacific Ocean. A major ecological influence comes from solar radiation, which creates extremes between surface and bottom temperatures, and in turn effects the dissolved oxygen content of the water. During the eventual mixing which follows oxygen depletion at the Sea bottom, the dissolved oxygen concentration at the water's surface can temporarily be lowered below the minimum level necessary to maintain many forms of life in the Sea. In addition, high concentrations of sulfide and ammonia present at the bottom during the summer are mixed into surface waters. The result is annual fish

kills providing sudden meals for thousands of gulls, herons, raccoons, and other wildlife. Oxygen becomes increasingly less soluble in higher salinities, which influences both present and future life in the Sea.

Although the desert pupfish is the only fish native to the Salton Sea (see Section G.2), there are currently at least 15 introduced fish species which inhabit the Sea and its associated drains. The chief gamefish of the Sea is the orangemouth corvina, Cvnoscion xanthulus, which has supported a substantial sport fishery in the past. This species occupies the top of the aquatic food chain, and feeds upon tilapia, longjaw mudsuckers, gulf croakers, sargo, and threadfin shad, which are all important forage species. The forage fish, in turn, feed upon fish eggs, copepods, barnacle larvae, amphipods, and especially pileworms. Pileworms are the staple food item for all but very young fish, and the most important limiting factor for some fish species in the Sea may be the scarcity of pileworms during summer and early fall. The Salton Sea is currently too salty to allow successful spawning by many of the present fish species, and recruitment probably comes from fish entering the Sea from freshwater inlets. Freshwater drains contain large numbers of tilapia, carp, mosquitofish, sailfin mollies, longjaw mudsuckers, and red shiners, which are important forage for larger fish, predatory birds, and numerous other wildlife. While corvina, sargo, and gulf croaker eggs and fry can currently tolerate the salinity levels in the Sea, there is some indication that production of these species is declining, Tilapia were never captured in the Sea during 1991 refuge research efforts, but were present in several freshwater drains. Threadfin shad, which may no longer reproduce in the Sea, were captured in gill nets set near the Whitewater River delta during June, 1991. The reproductive potential of the Salton Sea fishery is extraordinary, however, numbers are traditionally held in check through the fish mortalities which occur each year during summer or early fall as a result of food depletion, lack of oxygen, or a combination of factors.

Historically, the desert pupfish was widespread in portions of Arizona, southeastern California, and northern Mexico, but was listed as endangered by the U.S. Fish and Wildlife Service in 1986. A 1991 survey by California Department of Fish and Game documented desert pupfish in 72% of the overall drains surveyed around the Sea. Both Salt Creek and San Felipe Creek also contained pupfish, as did 64% of all shoreline pools. At least three areas on the refuge, McKendry Pond, Barnacle Bar Pond, and Unit-l B-Pond Drain contain pupfish. McKendry Pond, a small brackish "barnacle bar" pond which receives freshwater inflow from Vail 5 Lateral near headquarters, was surveyed for pupfish during 1992 for the first time by refuge personnel in order to obtain trend data and to determine possible results of various management regimes (see section G.ll).

14. Scientific Collections

Throughout the year, wildlife specimens suitable for study skins or other scientific purposes are picked up and held for universities or researchers. During 1992, 19 species and 31 individuals were salvaged and stored in refuge freezers

Table G.14 Specimens Collected and Frozen During 1992

Species	Number	Species	Number
Pacific Loon	1	American Coot	1
Eared Grebe	7	Western Sandpiper	3
Brown Pelican	3	Dowitcher	1
Snowy Egret	1	Yellow-footed Gull	1
Cinnamon Teal	2	Ring-billed Gull	1
Red-breasted Merganser	1	Barn Owl	1
American Kestrel	2	Burrowing owl	1
Sora	1	Rough-winged Swallow	1
Yuma Clapper Rail	1	Loggerhead Shrike	1
Western Meadowlark	1		

The Yuma clapper rail, tissue samples from two brown pelicans and one burrowing owl, and two burrowing owl eggs were sent to the Carlsbad Ecological Services office for analysis as part of approved studies (section D.5).

16. Marking and Banding

The majority of banding returns this year were from eared grebes, which were picked up during the die-off (see section G.17). These birds were banded at Mono Lake, California by Joe Jehl of Hubbs-Seaworld Research Institute. A total of only three species and 13 individuals were received, with two northern pintail and one lesser scaup returned (Table G.16a).

Table G.16a Band Returns Received During 1992

Species	Banding Date	Return Location
Eared grebe	07-28-88	Salton Sea, CA
Eared grebe	08-01-88	SW Calipatria, CA
Eared grebe	08-17-88	Salton Sea, CA
Eared grebe	08-11-89	Salton Sea, CA
Eared grebe	08-31-89	Salton Sea, CA
Eared grebe	10-10-89	Salton Sea, CA
Eared grebe	08-27-90	Salton Sea, CA
Eared grebe	08-22-91	S. Mecca, CA
Eared grebe	08-24-91	Salton Sea State Park, CA
Eared grebe	10-02-91	SW Calipatria, CA
Northern Pintail	02-20-87	Princeton, CA
Northern Pintail	02-17-90	Salton Sea, CA
Lesser Scaup	02-21-87	Hagerman, ID

A total of six species and 181 individuals were banded this year in support of approved refuge research or management studies. No duck banding was attempted. The following table depicts the number and species banded during 1992.

Table G.16b Species and Number Banded During 1992

Species	Number Banded
Black-crowned night heron	39
Snowy egret	17
Great egret	77
American kestrel	23
Yuma clapper rail	1
Burrowing owl	24
Total	181

During winter banding efforts for Yuma clapper rails in the Union Ponds, a total of one clapper rail. was banded (Section G.2). Black-crowned night herons, snowy egrets, and great egrets were banded as part of the study discussed in Section G.4. The American kestrels were banded as part of a study to determine whether the influx of individuals observed during the winter months portray only local birds or those from other areas (Section G.6), although one kestrel was banded and released after rehabilitation by refuge personnel.

A total of 24 burrowing owls were banded from five artificial burrows (Section D.S.), of which 23 were also color-banded. Of the 24 banded owls, one was an adult female which was found in the nesting chamber, with the remaining banded owls being locally hatched juveniles.

17. Disease Prevention and Control

The harsh environment present at hypersaline lakes creates a severe challenge to wildlife, and worldwide there are only about a dozen bird species that have managed to successfully exploit these environments.

One of the most conspicuous birds utilizing the Salton Sea is the eared grebe, which winters here in numbers peaking at over 1.5 million birds. At the Salton Sea, food is not a limiting factor, and eared grebes consume vast quantities of abundant aquatic invertebrates such as waterboatmen, pileworms, and amphipods. Grebes generally begin arriving at the Sea in great numbers during December. Some winter here, while others continue south to the Sea of Cortez in Mexico. The number of grebes at the Salton Sea normally peaks during February when birds begin arriving from Mexico and congregate before departing during March and April for breeding grounds. Very few eared grebes spend the summer on the Salton Sea, instead breeding in various colonies throughout the western United States and into British Columbia. Post-breeding grebes congregate at Abert Lake in Oregon, the Great Salt Lake in Utah, and at Mono Lake in California before again departing for wintering grounds during late fall and early winter.

The mass mortality of aquatic birds anywhere is an uncommon event. While in some cases these events are associated with well defined circumstances such as pollution problems, ha'bitat alterations, or natural phenomena such as storms, so far the situation which occurred at the Salton Sea during the winter of 1991-1992 is not understood. The Salton Sea die-off is the largest documented mortality event of eared

grebes, however, other die-off events have been recorded for this species on both coasts of the Baja California Peninsula, California's Owens Lake and Salton Sea, and elsewhere. The mass mortality at the Sea during 1991-1992 is noteworthy because of the large number of individuals that died, because the event was well documented and well researched, and because a cause of death was never determined.

Eared grebes began exhibiting aberrant behaviors, with some hauling up on shore and dying, during the largest die-off of this species ever documented. 92NR16 WRR 3/11/92

On December 16, 1991, Equipment Operator Orozco reported that he had seen several sick and dead eared grebes east of the Alamo River Delta near Morton Bay. It is not unusual for large numbers of grebes to succumb to avian cholera each winter at the Salton Sea, and biologists picked up samples of dead and sick birds and sent them to the Madison National Wildlife Health Research Center (NWHRC) for analysis.

Necropsic evaluations performed at the NWHRC were inconclusive, but all bacteriological and virologic test results were negative, though brain cholinesterase levels were slightly reduced in one bird. The birds did not die from avian cholera, and the cause of death was not resolved. Meanwhile, refuge biologists observed no additional sick or dead grebes in the area, and the mortality occurrence seemed to have passed.

National Wildlife Health Research center Wildlife Disease Specialists Lynn Hayes and Linda Glaser, and CDFG Wildlife Veterinarian Thierry Work conducted numerous necropsies on eared grebes during the mortality event. 92NR17 WRR 2/27/92

On January 19, 1992 over 180 eared grebe carcasses were discovered along the barnacle beach west of Salton Sea NWR headquarters. While most of the birds were partially decomposed, many live grebes were acting ill and hiding beneath rocks to escape predation from herring gulls. These gulls were not waiting for the grebes to die, but were actively attacking despondent grebes, killing them, and eating them. Eight of the sick grebes were euthanized and shipped to NWHRC for analysis, where necropsic evaluations again showed nothing abnormal, and bacterial and virologic tests were inconclusive. Continued surveys of the refuge shoreline during this period located only three additional dead grebes, and again the event seemed to have passed.

Another die-off was noted along the refuge shoreline between February 19-26, 1992 when tremendous numbers of dead grebes washed ashore. The refuge began receiving calls from private citizens who were noticing dead birds at the northwest end of the Sea near Salton City, and birdwatchers began reporting observations of grebes which exhibited abherant behavior along various shoreline areas. Ornithologist Robert McKernan of the San Bernardino County Museum became aware of the die-off and conducted carcass surveys in several areas at the north end of the Sea. Extrapolating from these survey results, McKernan estimated the number of dead grebes at about 135,000.

On February 24, Biologist W. Radke flew an aerial survey of the Salton Sea shoreline, and estimated that about one million eared grebes were utilizing the Sea. Many of these live grebes were concentrated at the

mouths of virtually every freshwater source flowing into the Sea, including the New River, Salt Creek, San Felipe Creek, the Whitewater River, and most agricultural drains. It appeared from the air that dead grebes were widespread at the Sea, and were scattered fairly evenly along the entire shoreline in numbers proportionate to concentrations of live grebes offshore. Dead grebes were not concentrated at any particular location, and there were no indications that the deaths resulted from a point source. From the air it was obvious that many grebes were dead at Sea and had not yet reached the shoreline, though some of those washed ashore were being dashed apart by wave action and rocky shores, or were buried by sand and barnacles. Predation on sick and dead grebes was also widespread, with large numbers of coyotes and tremendous numbers of gulls observed feeding on the birds.

Interestingly, very few dead gulls or other avian species were observed during the February reconaissance flight, indicating an apparent lack of secondary poisoning or infection. Refuge personnel collected dead, sick, and seemingly healthy grebes from various locations at the Sea and held them in anticipation of additional necropsy work and contaminant analysis.

Laborer Walker and Kern NWR A_ssistant Manager Flores cruising the Salton Sea shoreline during bird pick-up efforts. 92NR18 WRR 3/11/92

Periodically during the die-off event, grebes at the Salton Sea characteristically exhibited several behavioral abnormalities which seemed to be associated with the die-off. The most obvious included congregating at freshwater tributaries to the Sea and repeatedly gulping fresh water. Researchers believe that grebes rarely drink water as they meet their water requirements with the foods they consume. Grebes at

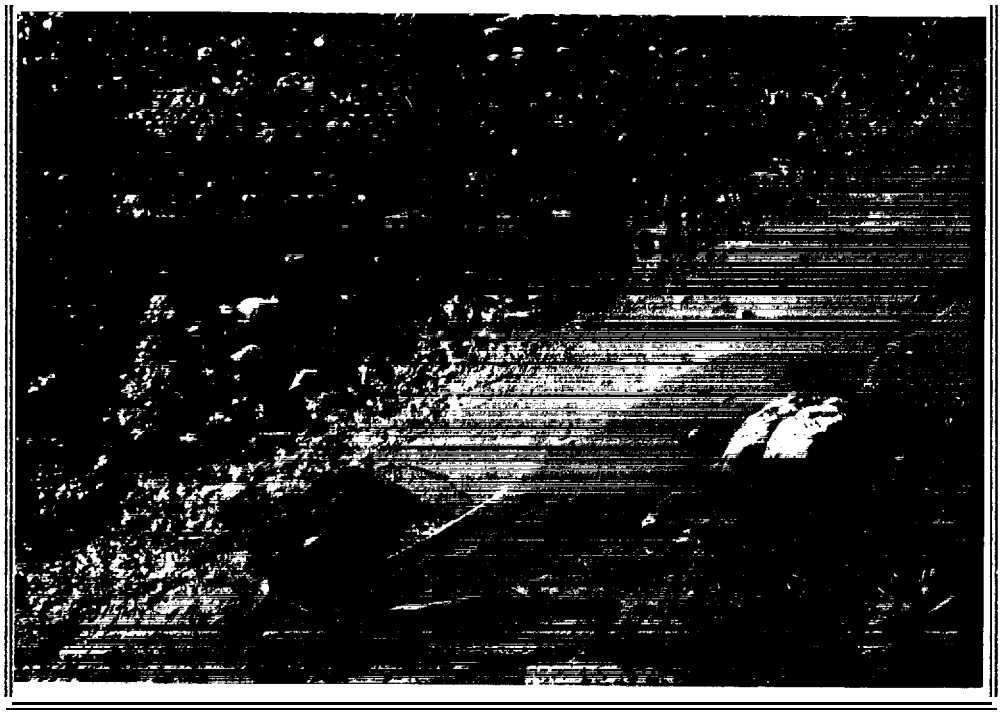
the Sea also preened excessively, and moved out of the water onto land, often allowing close approach or even capture by hand. While preening and feather maintenance are crucial to all waterbirds, the continual and fervent preening exhibited by grebes at the Sea was abnormal in that it was achieved to the apparent total disregard to all other normal activities, including feeding.

On February 24, refuge personnel contacted the NWHRC and reported the extent and magnitude of the die-off, and on February 27, Service biologists, Environmental Contaminant Specialist Dan Audet from Laguna Niguel (now Carlsbad), Wildlife Disease Specialists Linda Glaser and Lynn Hayes from the the NWHRC, and California Department of Fish and Game Wildlife Veterinarian Thierry Work from Sacramento assembled to begin an emergency on-scene investigation at the Sea. Based on field necropsies which were later supported by laboratory tests, avian cholera and botulism were ruled out as the cause of death for the vast majority of grebes. However, virtually all dead ruddy ducks, gulls, and coots examined proved to have died from avian cholera. Numerous tissue samples were collected and preserved for ultimate laboratory analysis, and recommendations to monitor the situation and begin gearing up for a major clean-up effort were suggested.

While Disease Specialists were conducting necropsies and preparing tissues, Contaminant Specialists were preparing tissues and composite samples of dead, dying, and healthy grebes as a rapid turnaround analytical catalog for examination at the Patuxent Analytical Control Facility in Maryland. Preliminary contaminant sampling was conducted to determine if any elevated contaminant levels were present in the dead grebes. This sampling effort was conducted as a screen to determine if contaminants were directly or indirectly implicated in the grebe die-off. Contaminants found in this preliminary screen at levels of concern included selenium, mercury, DDE, and chromium. Based on the results of these samples, a more extensive sampling effort was justified, and additional grebes were collected from the Sea and from Camp Pendleton Marine Corps Base located in northern San Diego County which served as a reference location. Dead ruddy ducks were also collected from the Salton Sea and tissue samples were analyzed.

Water samples were collected from various freshwater drains, creeks, and rivers flowing into the Sea for Microtox testing. This is a fairly new testing method which has proven very useful in determining relative toxicity in other southern California areas. However, all water samples had an increased light output, and no EC50s could be determined. High nutrient loads in water often can cause such results.

Solid phase sediment testing was also conducted utilizing the Microtox unit. Clean sediment EC50 values are considered to be 26,000 ppm, and EC50 results from contaminated areas range as low as 1,200 ppm. Sediments from Salton City and Young Avenue Drain were the most toxic encountered at the Sea. Sediment EC50 values indicated increased toxicity in drains and rivers following a storm event occurring March 1, 1992. Sediment samples were sent to Patuxent Analytical Control Facility for chemical analysis.



Dead grebes littered the Salton Sea shoreline during the spring. Although an estimated 150,000 birds died, the cause of death was never determined. 92NR19 WRR 3/11/92

Eared grebes wintering at the Sea feed predominantly on aquatic invertebrates, and samples of these invertebrates were collected during the die-off. Additional samples of invertebrates had been collected in previous months as part of another study. All of these samples were sent to Patuxent and analyzed for metals, organophosphate pesticides, and organochlorine pesticides.

Because avian cholera was confirmed in some birds associated with the die-off, and because of the additional risk of initiating a possible botulism cycle from decaying carcasses at a major bird wintering area, refuge personnel began to organize a large scale carcass clean-up effort. By the end of February, Salton Sea NWR staff were inundated with difficulties associated with the die-off, in addition to regular refuge operations. Regional Office Assistant Associate Manager Mike Nunn helped organize staff and equipment from other refuges to assist in the clean-up. As a result, Service personnel, volunteers, and airboats from Stillwater NWR, San Francisco Bay NWR, Sacramento NWR, Kern NWR, Modoc NWR, Sheldon NWR, Tijuana Slough NWR, and the Carlsbad Field Office spent considerable time assisting in the effort.

The major pick-up was conducted between March 3 and April 21, 1992 and was emphasized along areas containing concentrations of waterfowl, shorebirds, or endangered species habitat to minimize the effects on these species from avian cholera or botulism. Later, clean-up efforts were conducted near communities, marinas, resorts, or other points of human concentration at the Sea. The carcasses picked up were

incinerated, however, many remains were never recovered, and sunk to the bottom of the Sea or were consumed by predators. This clean-up cost well in excess of $20,000, yet preempted additional outbreaks of cholera and botulism, which had a great potential for occurring without the effort and would have killed many more thousands of birds.

At the time of the die-off, there were about 105 miles of Salton Sea shoreline plus an additional estimated 25 miles of shoreline associated with freshwater ponds adjacent to the Sea. All of these shores contained dead birds, and while it was physically impossible to pick up the entire 130 miles of combined shoreline area, 40 miles of the total were cleaned up by Service personnel and volunteers. A total of 46,040 dead birds representing 47 different species were picked up during the effort (average 1,151 birds/mile). Based on these figures associated with the clean-up, along with shoreline surveys and aerial surveys, an estimated total of 150,000 eared grebes died at the Salton Sea. This number represents about 8% of the North American population of eared grebes, which is estimated to total 2 million birds. An additional estimated 5,500 birds, representing primarily ruddy ducks, gulls, and shorebirds, died at the Sea from avian cholera. See table G.17.

Ultimately, the NWHLC conducted a total of 70 bird necropsies, including 52 on eared grebes. Of the eighteen non-grebes necropsied, fourteen of these showed signs compatible with avian cholera, and the remaining four were too autolyzed to be conclusive. Necropsies showed that grebe's lungs were filled with blood or fluid in many cases. Some had enlarged or congested livers. Most grebes had skin lesions, probably from excessive preening, while subcutaneous bleeding likely resulted from gull attacks. Dehydration was evident in many birds, and most had stomachs which contained a dry, compact, feather bolus which may be typical for this species.

Endrin was ruled out as the cause of death based on results of brain, liver, and muscle tissue samples which all had non-detectable levels of this organochlorine pesticide. Acute organophosphate pesticide poisoning was ruled out based on ChE levels in brain samples. Pasturella was isolated in some birds, but enhanced culturing showed that avian cholera did not play a significant role in the vast majority of grebe deaths. Virus isolation was attempted on numerous tissues, usually trachea and lung, with largely negative results. However, an as yet unidentified, but probably insignificant, virus was isolated from two grebes. Botulism testing was performed on the grebes, but was positive in only one. Mycoplasma cultures were performed on lungs and tracheas of grebes, but little significance was attached to the unidentifiable mycoplasma isolated from a lung in one grebe. Brain cholinesterase activity was determined and considered to be within the normal range. Brain sodium levels were determined for dead grebes but were similar to levels measured for the control grebes. Parasitology was performed on grebe intestinal tracts, but the findings were either negative or considered insignificant. Microscopic examination of skin showed that mites were present within the feather shafts of grebes. Some sections of skin showed inflammation and bacteria within the feathers, which was thought to be associated with the excessive preening seen at the Sea. Grebe salt glands were evaluated microscopically and showed no evidence of inflammation or necrosis. Microscopic liver

changes were noted in some grebes, but the significance of this is not known because some of the control grebes collected at Camp Pendleton had some of these same changes in their livers. Erythrophagocytis in the liver and spleen may suggest abnormal breakdown of red blood cells, which was not seen in the Camp Pendleton grebes. Schistosomes were present in the adrenal glands of some grebes, but also were present in the control grebes. Toxins produced by algae and/or plankton may have been consumed by eared grebes directly or indirectly through the food chain, and future investigations concerning this possible cause are being considered. Pasteurella multocida was isolated from the livers of all non-grebe bird species submitted to Madison, indicating that they died from avian cholera.

Over 100 samples relating to the mortality event were processed and sent to the Patuxent Wildlife Research Center in Laurel, Maryland for examination. Contaminant analyses of eared grebes indicated elevated levels of selenium, mercury, DDE, and chromium in eared grebe livers when compared to previous samples from the Salton Sea. In fact, the data showed that selenium levels had increased over 200% in three years. These values are as much as four times greater than the mean value for eared grebe selenium liver concentrations found at the Sea during the 1989 DO1 Detailed Drainwater Investigation, and exceeded all waterfowl selenium concentrations found during the 1986-87 DO1 Reconnaissance Drainwater Investigation. All liver samples from dead, sick, and healthy grebes had selenium levels above threshold levels known to cause adverse impacts (30 ppm dry weight). Dry weight values for grebes at the Sea ranged from 34 ppm to 47 ppm. Selenium concentrations found in livers of grebes collected from the Sea were all above background levels (10 ppm dry weight) and the threshold determined in past studies to cause adverse effects (30 ppm dry weight). Despite the fact that these levels are higher than normal, they are much lower than levels in livers of coots and grebes which died of selenium toxicosis at Kesterson NWR. This was substantiated by diagnostic work and lab results which also ruled out selenium toxicosis as a cause of death. Samples of food items (pileworms, corixids, and amphipods) consumed by eared grebes were analyzed for contaminant residues. Results showed that selenium has increased in pileworms over 200% from samples collected three years ago. Though not implicated as a direct cause of the die-off, selenium was at levels suggesting at least indirect involvement.

Mercury concentrations found in livers from dead and healthy birds exceeded all values known for waterfowl species previously collected from the Sea. The source of the mercury accumulation is not believed to originate from the Salton Sea area, and played an unknown role in the mortality event. However, mercury may be implicated in the die-off, and more extensive chemical analysis is needed to determine the significance of mercury in liver samples.

Grebe liver samples were also analyzed for DDE, though liver samples are typically not a good indicator of DDE contamination. It was determined that DDE concentrations were highest in samples from grebes found dead, and were not detected in healthy birds collected at the Sea. DDE was also detected in grebe brain tissue and in sediment samples from the Sea.

Chromium concentrations in liver and breast muscle samples were determined to be highest in birds found dead at the Sea, and levels found in both dead and healthy grebe liver samples exceeded the threshold for chromium contamination in birds. Liver chromium concentrations in dead grebes were higher than any previous data collected for Salton Sea birds. Chromium has not typically been found in other biological samples collected at the Sea, suggesting that the Salton Sea is not the source of chromium found in grebes.

Although various contaminant levels were determined to be elevated in eared grebes at the Sea, there is no evidence that contaminants were a direct cause of death. There is a possibility that contaminants may have played an indirect role in the die-off by interacting with other factors which may have led to mass mortality. For example, elevated levels of selenium and mercury may have contributed to the die-off indirectly by compromising the bird's immune systems. In addition, the elevated DDE concentrations and selenium levels suggest that adverse reproductive effects might be seen on the nesting areas of eared grebes staging at the Salton Sea.

During the mortality event, numerous people were contacted for assistance and many other experts were identified with an interest in determining the cause and impacts of the eared grebe die-off. In an effort to bring these people together for a comprehensive review and discussion on the die-off, a meeting was held July 21 and 22 in San Diego, California. The goals of the meeting were to 1) develop a concensus on potential causes of the die-off, 2) decide what additional investigations are needed utilizing archived samples, and 3) determine what biomonitoring is needed in future years to assure protection of eared grebes and possibly other sensitive migratory birds. Information presented at the meeting revealed that tissue concentrations of boron, selenium, and DDE were elevated in grebes picked up at the Sea, however, none of these contaminanats exceeded thresholds for independent lethality. Whatever killed the grebes was not infectious, was not a known virus, and was not a bacteria. Avian cholera, botulism Type Cl, salmonella, selenium toxicosis, and salt toxicosis were all ruled out as causes of the die-off, though avian cholera was isolated from several species of birds picked up during the latter phase of the event. The cause of death for 150,000 eared grebes remains undetermined.

Meeting participants generally agreed that several aspects of the mortality event deserved further investigation. Considerations included exploring the effects of interactive contaminants possibly combined with immunosuppression, and investigating specific sensitivity of eared grebes to selected contaminants. There is a need to know more about specific eared grebe behaviors such as plucking and ingesting feathers, or food habits and associated contaminant or toxin exposures. More work is required to determine the potential effects of toxins produced by various phytoplanktons at the Sea, and additional research should be conducted concerning local and flyway-wide movements of grebes and associated contaminant exposures.

Table G.17. Species and Number of Carcasses Collected at the Salton Sea, January 9 through April 7, 1992.

2	Pacific Loon
42,587	Eared Grebe
27	Western Grebe
4	American White Pelican
1	Brown Pelican
15	Double-crested Cormorant
3	Great Blue Heron
3	Great Egret
5	Snowy Egret
2	Cattle Egret
7	Black-crowned Night Heron
2	White-faced ibis
16	Snow Goose
11	Ross' Goose
5	unidentified white geese
8	Canada Goose
48	Green-winged Teal
13	Mallard
52	Northern Pintail
7	Cinnamon Teal
195	Northern Shoveler
24	Gadwall
35	American Wigeon
3	Canvasback
8	Redhead
2	Ring-necked Duck
35	Scaup (Greater & Lesser)
1621	Ruddy Duck
4	Common Moorhen
140	American Coot
1	Black-bellied Plover
3	Snowy Plover
41	Black-necked Stilt
14	American Avocet
1	Lesser Yellowlegs
7	Willet
1	Long-billed Curlew
1	Marbled Godwit
79	Western Sandpiper
1	Least Sandpiper
1	Long-billed Dowitcher
1	Bonaparte's Gull
77	Ring-billed Gull
20	Herring Gull
752	unidentified gulls
2	Forster's Tern
1	Tree Swallow
1	unidentified sparrow
1	House Sparrow
150	unidentified birds
46,040	**TOTAL**

An environmental reporter from Brawley observed dead birds at the Sea, and broke the story on February 25, which began an onslought of discussion with the media, Although a tremendous amount of time was spent dealing with numerous television and newspaper reporters, the results were generally positive in relaying accurate and current information on the situation. The press was highly supportive of Service efforts in dealing with the issue, and communication was very positive. There was some misinformation printed, and a good share of sensationalism, but through it all, the Service was generally portrayed as a highly credible agency conducting a well organized investigation.

Intensive coverage of the event occurred in various newspapers including The Brawley News, the Palm Springs Desert Sun, The Riverside Press Enterprise, The San Diego Tribune, and the front page of the Los Angeles Times. Many of these articles were picked up across the country by the Associated Press, which created additional media attention. Several magazines, including Defenders, Sports Illustrated, and National Geographic featured articles about the die-off. Television picked up the story and ran local, regional, and national segments on CBS, NBC, and ABC. Over one-year later, the die-off continues to receive much attention from local, national, and international media.

Salton Sea did not experience another mass mortality of grebes during the winter of 1992-93, however, several nagging questions are conspicuous and the Service is continuing to support efforts into determining the cause of the die-off. Currently, the Service is proposing a comprehensive contaminant study of eared grebes. The proposed study area would include breeding grounds in Oregon, Idaho, California, and Montana; major staging areas at Mono Lake and the Great Salt Lake; and wintering grounds at the Salton Sea and the Gulf of California, Mexico. This would be a cooperative study involving Regions 1, 6, and 8.

The Service, along with other researchers and biologists, is developing work plans for continued investigations of the die-off and long-term monitoring of eared grebes. Investigations will include accurate population censusing, documentation of population movements, and cooperative studies with other agencies and institutions to more thoroughly record changes in grebe populations. Based on the unique qualities of the eared grebe, more specific information of grebe biology is needed from not only the Salton Sea, but from all other staging areas. Specifically, research concerning food habits, seasonal variations in food availability, and additional food chain studies are necessary.

H. PUBLIC, USE

1. General

An estimated 30,000 visitors journeyed to the refuge in 1992, down from an estimated 40,000 visits the previous year. It is suspected that the decline in the economy and the lack of sensational bird sightings, such as the "booby invasion" of 1990, contributed to the decline in visitation. Most refuge visitors come to view wildlife, and are especially interested in the variety and abundance of birds for which

the area is known. In fact, the refuge has the second largest bird list of any National Wildlife Refuge. Birding publications and word of mouth have made the Salton Sea a destination for birding enthusiasts on an international level.

Visitor facilities at refuge headquarters include a twenty-five space parking area (plus overflow), entrance and orientation signs, rest rooms, a contact station featuring a popular habitat diorama with thirty-five mounted specimens, shaded picnic area with three tables and an adjacent observation platform, self-service brochure box, and the self-guided interpretive Rock Hill Trail. Additional facilities at Unit 1 include a small parking area, observation platform, entrance and orientation signs and self-service brochure box.

From the standpoints of safety, physically challenged accessibility, and all weather access, some refuge facilities could stand to be upgraded. The observation platform at headquarters suffers from a staircase with a very steep, 1:1 slope. Neither the Unit 1 nor headquarters platforms offer accessibility to physically challenged persons, having only stairways. The Rock Hill Trail, which is the only trail on the refuge, becomes largely impassable for several days following a rain, interrupting not only access for the general public but also shutting down the Environmental Education Program. The clay soils along the trail provide a solid surface when dry, but turn into a thick "gumbo" when wet. Upgrading these facilities should be included in future funding exercises for the MMS or RONS systems.

A continuing challenge to managing public use at Salton Sea is allowing a level of public access which balances the demand for access with wildlife objectives needs. With the limited amount of manageable habitat there are conflicts involved in maintaining spatial separation between hunters and non-hunters. In particular, the location of the four Union Blinds less than one-third of a mile from headquarters and the Rock Hill Trail, the focal points of public use at the station, creates a situation which is less than ideal. Current plans are to add an additional foot trail at Unit 1, where no hunting is permitted, to provide additional wildlife viewing opportunities further away from hunting pressure.

2. Outdoor Classrooms - Students

A total of 11 class groups totaling about 315 students took part in outdoor classroom sessions on the refuge in 1992, representing a drop from 450 students the previous year. Almost ail school groups visit the refuge in the cool season when waterfowl viewing opportunities are best. Scheduling visits by class groups on hunt days (Wednesdays) is avoided in order to reduce conflicts among interest groups.

Traditionally, all class groups visiting the refuge, regardless of grade level, have received what essentially has been an interpretive tour of the Rock Hill Trail conducted by a refuge staff member as a collateral duty. While this type of activity seems to be popular with the class groups, it probably falls short in terms of hands on activities which reinforce the students curriculum at individual grade levels and in terms of the best utilization of limited refuge staff.

Most school groups visiting the refuge in 1992 were hosted by a SCA volunteer, although several groups were "rained out" by muddy conditions. The concept of using activity stations with learning aids was developed, with success, but considerably more time and effort will be required before the transition to teacher workshops and teacher-led activities can be accomplished. A significant item identified at the Environmental Education Workshop at San Francisco Bay NWR was the "six-tenths" rule, whereby it should be realized that developing and conducting teacher workshops to implement the transition to teacher-led activities takes at least six-tenths of one FTE. While SCA volunteers provide valuable assistance, their twelve week tenure just does not come close to enough time to meet the six-tenths rule and carry the program.

4. Interpretive Foot Trails

The Rock Hill Trail provides visitors with a self-guided interpretive opportunity with a good chance of seeing a variety of wildlife. The trail leads from headquarters out to Rock Hill, where it dead ends. The one mile (each way) trail has several interpretive panels that inform visitors about habitat, migration and other natural history subjects. About half of the visits to headquarters include a walk down at least part of the trail, which is also main access route used for outdoor classroom sessions.

Two visitors pause to view wildlife along the Rock Hill Trail near the Barnacle Bar, a popular viewing site. 92NR20 3/93 DRD

While mud is not normally a significant problem here in the desert (our average annual rainfall is about 2.5 inches), use of the Rock Hill Trail is susceptible to muddy conditions when it does rain. Unfortunately, unusually heavy rainfall created almost impassable conditions along the

Rock Hill Trail in both spring and fall of 1992. If funding were to become available, the public would benefit from paving a path along the course of the Rock Hill Trail at least to the Barnacle Bar.

Initial developments in creating a new self-guided interpretive trail at Unit 1 took place in 7.992. The refuge was contacted by Ducks Unlimited representative Del Case on the behalf of the parents of Michael Hardenburger with an interest in their funding interpretive signs for a trail. In addition to funding a series of interpretive panels to be ordered from Wilderness Graphics, a memorial brass plaque honoring their late son has been purchased by the Hardenburgers and is already on hand at the refuge.

Since the closure of the trail at Unit 1, which led from the end of Vendel Road to the sea and back, there has been a continuing need to provide additional wildlife viewing opportunities at Unit 1. A complicating factor in the development of the wildlife trail is the "on again - off again" habitat modification project to be funded as mitigation by the California Department of Transportation (Caltrans). The problem is that the proposed route of the trail, consisting of a semi-loop to be routed along the north side of the Reidman 4 Pond and around part of what is now the Reidman field, is also proposed for major habitat modification work. Hopefully, the status of the Caltrans project will get resolved soon and the interpretive panels, memorial plaque (mounted on a low profile masonry monument), and trail locator signs can be installed to establish the trail.

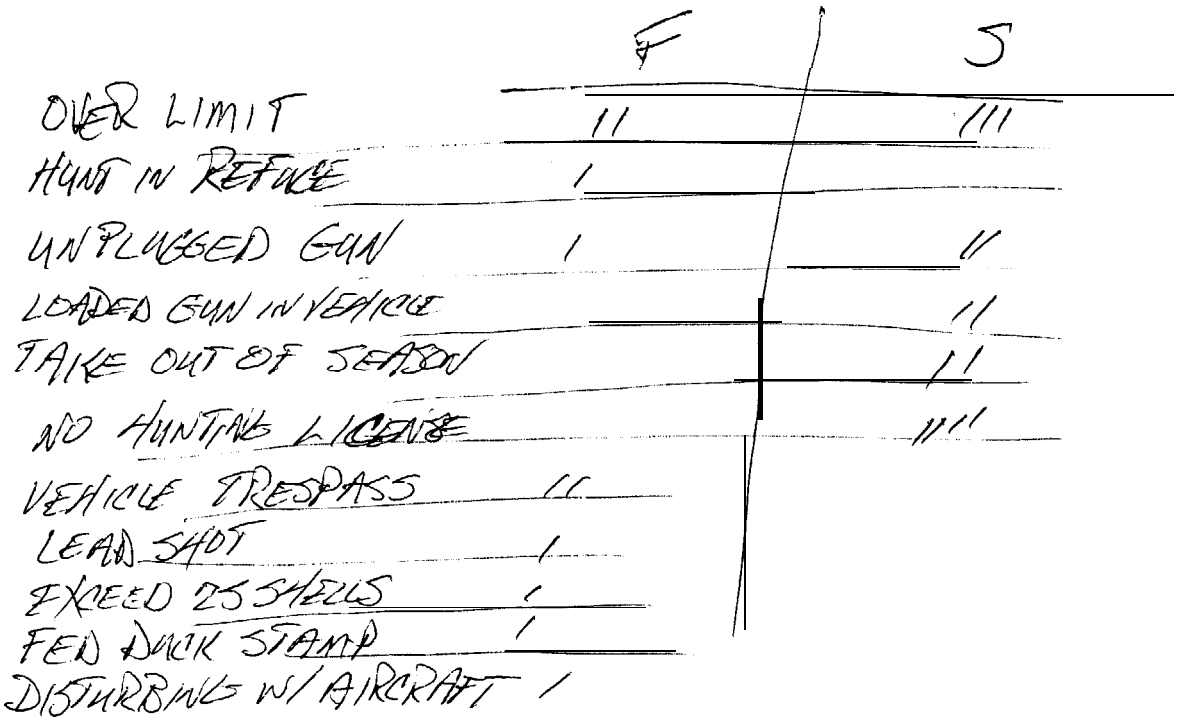
7. Other Interpretive Programs

Refuge staff members participated in the Imperial County Association of Governments tour conducted on February 29. Participants started the day at Salton City on the west side of the sea, then boated across to Salton Sea State Park where they received a presentation from park staff, next boarded buses and drove to Red Hill via Bombay Beach and the Hot Springs, then came to the refuge for lunch and a presentation before winding up with a tour at the Unocal Geothermal Unit. Although there were supposed to be three buses, only two were needed. Wildlife Biologist Bill Radke provided "in route" commentary to the group on one bus while Wildlife Biologist Marcia Radke and Primary Assistant Dan Dinkler teamed up with the group on the second bus. The tour provided a good opportunity to exchange general information and answer specific questions for area government and business representatives.

8. Hunting

The refuge waterfowl hunting program is conducted under cooperative agreement with the California Department of Fish and Game (CDF&G). Hunts are administered through the neighboring state-operated Wister Unit of the Imperial Wildlife Management Area on Wednesdays, Saturdays and Sundays on a reservation/permit basis. Hunting parties of not more than four individuals (including minors and non-shooters) are assigned to specific pit blinds or shooting points and must hunt from only those points.

W0188?8	9/1/93	Barnes, Timothy E.	Radke	Over Limit	350.00
555167	9/1/93	Pittman, Jeffery A.	Bloom	Take Migratory Bird in Refuge	100.00
555168	9/1/93	Kerr, Roger Louis	Bloom	Unplugged Gun	250.00
B19262	9/1/93	Rice, David Lee	Orozco	Unplugged Gun (State Proc)	
B19264	9/1/93	Jones, Donald Eugene	Orozco	Over Limit (State Proc)	
19263	9/1/93	Saracco, John Adams	Orozco	Unplugged Gun (State Proc)	
19263	9/1/93	Saracco, John Adams	Orozco	Loaded Gun in Vehicle (State Proc)	
19265	9/2/93	Truong, Huy Tien	Orozco	Take out of Season (State Proc)	
19266	9/2/93	Hamusek, Theodore Tony	Orozco	Loaded Gun in Vehicle (State Proc)	
19267	9/4/93	Corral, Rick NMI	Orozco	No License (State Proc)	
19267	9/4/93	Corral, Rick NMI	Orozco	Hunting w/Another Persons Lic. (State Proc	
W32825	9/15/93	Crawford, Ralph M.	Dinkler	Vehicle in Closed Area	75.00
W32826	Y/15/93	Joy, Herbert	Dinkler	Vehicle in Closed Area	75.00
B19272	10/23/93	Garner, Woody Timothy	Orozco	Take out of Season (State Proc)	
W32827	11/02/93	Knebel, Jack W.	Dinkler	Possess Lead Shot	104.00
W32828	12/04/93	Hackney, Dale Z.	Dinkler	Possess m/25 shells	74.00
	9/1/93	McGee, Michael Dewayne	Bloom	No License (State Violation)	
	11/6/93	Kulakowski, Michael	Bloom	Overlimit (State Proc)	
	11/6/93	Matzenger, David	Bloom	Overlimit (State Proc)	
	12/7/93	Brant, David M.	Bloom	No License (State Proc)	
W32829	12/8/93	Pratt, John R.	Dinkler	Over Limit	250.00
555169	12/18/93	Garcia, Joseph M.	Bloom	No Federal Duck Stamp	100.00
W32830	12/29/93	Corn, Wiley E.	Dinkler	Disturbing Wildlife w/Aircraft	250.00



In summary, both hunter visits and total birds taken increased substantially in 1992 over the previous year. The total number of hunters increased from 635 to 972 (53%) and the combined total of ducks and geese harvested rose from 874 to 1011 (16%). The average number of birds taken per hunter declined from 1.376 to 1.040 (24%). Part of the reason for the decline in birds per hunter is the one pintail limit and waterfowlers preference not to shoot shovelers and teal, two of the most common duck species available.

The following table summarizes hunter use and success for the last four seasons:

HUNTER/HARVEST DATA+

DUCKS	GEESE	TOTAL BIRDS	HUNTERS	BIRDS/HUNTER
1989-90 Season				
Hazard				
953	34	987	943	1.047
Union				
6	142	148	279	0.530
Overall				
959	176	1135	1222	0.929
1990-91 Season				
Hazard				
453	74	527	305	1.728
Union				
2	181	183	259	0.707
Overall				
455	255	710	564	1.259
1991-92 Season				
Hazard				
653	87	740	492	1.504
Union				
0	134	134	143	0.937
Overall				
653	221	874	635	1.376
1992-93 Season				
Hazard				
731	71	802	655	1.224
Union				
8	201	209	317	0.659
Overall				
739	272	1011	972	1.040

*Hunter Data Does Not Include Refill Hunters as most are relocating, not new hunters.

The rumor and complaint mills were again operating at full speed in 1992, continuing the momentum of hunter hostility built up the previous year. The bulk of hunter complaints are aimed at CDF&G's management of habitat at Wister and with the hunt program there. A special interest group called the Imperial Waterfowl and Wildlife Habitat Association (IWWHA) has formed in an effort to steer management at Wister in a direction that they feel would benefit waterfowl hunters. Additionally, a public meeting with hunters was conducted by CDF&G at Wister to discuss hunter complaints (see Section D.3 for details).
A few complaints came up concerning the refuge hunt program, mostly based on misinformation, lack of knowledge, or the good old rumor mill. Complaints involved the Hazard 7 blind not opening soon enough, the Hazard 6 blind not opening at all, and the Union 3 blind being in a state of disrepair. In summary, the Hazard blind was dewatered, dried, burned, reflooded, then opened (later than usual); the Hazard 6 pond was managed as rail habitat and supported too dense a stand of vegetation to retrieve birds from, so the blind was not opened; and the fiberglass Union 3 blinds popped up out of the ground when the new wheat crop was germinated and was relocated in the ground as soon as soil moisture permitted.

Although a picture and letter of complaint entitled "Wister Still The Pits" appeared in the Western Outdoor News (WON) concerning the blind, the refuge was not contacted by either the hunter or WON concerning the condition of the blind site. The only other option was to keep the blind site closed until the pit blinds could be replanted, but that seemed an unnecessarily extreme solution.

Both prehunt and posthunt coordination meetings were conducted with CDF&G personnel from both the Imperial Wildlife Management Area and the state's Law Enforcement Division to facilitate the operation of the public hunt managed through Wister.

9. Fishing

Portions on the refuge flooded by the waters of Salton Sea provide sport fishing opportunities, primarily for corvina. The number of visitors in this category is thought to be in the range of 10,000 anglers, and declining. The decline of the fishery due to increasing salinity (and possibly contaminants), combined with health warnings against eating more than eight ounces of fish a month, have lead to a substantial decrease in fishing activity; a trend which is expected to continue.

On the positive side, the public is becoming more aware of the ecological decline of the sea and the related impacts to the fishery, and wildlife in general. On the other hand, the message seems lost on some folks; in a brief conversation with one fisherman, his response to the health warning against eating fish was "Oh, I give them away." Anyway, we do try to get the word out even if we don't manage the fishery or monitor it on a regular basis.

11. Wildlife Observation

Most refuge visitors are recorded in this category, with birding being the primary activity of choice. While the majority of visits occur

during the waterfowl wintering season, birders venture to the area throughout the year in search of new species to add to their life lists. The opportunity to see a yellow-footed gull, residents including Abert's towhee, burrowing owl, and greater roadrunner, the occasional pelagic stray, or flocks of geese serves as a mecca for "listers" and casual birders alike. The Salton Sea area has developed a world-wide reputation as a birding "hot spot," with specific references in a variety of birding publications. The large variety and seasonal concentrations of birds, combined with a sprinkling of rare migrant and vagrant species, make the Salton Sea a popular destination for birders.

14. Picnicking

The visitor area at headquarters provides a shaded picnic area with three tables that is a favored spot for eating, resting, and finding some welcome shade. A good percentage of wildlife-oriented visitors take advantage of the picnic area in the course of their activities. Additionally, several hundred non-wildlife oriented individuals and groups use the facilities while passing through the area.

17. Law Enforcement

Law enforcement activities at Salton Sea are highly seasonal and center on the dove and waterfowl hunting seasons. Regulations enforced include general refuge regulations and refuge specific waterfowl hunting regulations on the refuge, and the Migratory Bird Treaty Act on and off the refuge. Additionally, Refuge Officers working dove and duck hunters made several cases off the refuge that were turned over to CDF&G Warden Carol Sassie for prosecution locally in state court. Refuge Officers stationed at Salton Sea also perform occasional patrol work at the Coachella Valley NWR satellite (please see that separate narrative report for details). However, Refuge Officers no longer perform patrol work at the former coastal satellite refuges as those units have been reorganized as part of the new Southern California Coastal Complex, representing a significant decrease in total patrol time, especially in comparison to 1991 when a special effort was made to maintain a law enforcement presence at the coastal satellites.

Federal cases are heard by the U.S. Magistrate in San Diego, requiring five hours of driving just to appear in court, whether or not the defendant shows up for the trial. Additionally, the Magistrate consistently finds first time offenders guilty, but suspends the fine, sending a message to the violator that may be less than effective. In contrast, turning cases over to the state means less paperwork, very little travel time (if any), and larger fines which are turned over to the County Game and Fish Commission for use on local projects benefitting wildlife.

The total number of cases made in 1992 was 23, up from 17 cases made the previous year. Two significant changes in the violation case load occurred in 1992; there was a drop in cases involving waterfowl hunters on the refuge, and there was a large shift away from Federal prosecution of cases and towards state prosecution of cases, both with good reason.

The following Table H.17 summarizes the number and kind of cases made by refuge offices on and around the Salton Sea Refuge in calendar 1992:

Table H.17

VIOLATION	FEDERAL VIOLATION NOTICES	STATE COURT CASES
Unfeathered Wing		4
Federal Duck Stamp		3
State Duck Stamp		3
Hunting License		1
Unplugged Gun		1
Non-Steel Shot		1
Loaded Weapon In Vehicle		4
Taking Non-game migratory bird	1	1
Shooting from Road		1
Special Refuge Hunt Regulations	1	
Exceeding 25 Shell Limi-t	2	
TOTALS	4	19

The continuing decline in cases involving waterfowl hunters on the refuge represents the benefits derived from substantially increasing patrols on the refuge hunting areas (Hazard and Union) beginning in 1990, resulting in an increase in hunter knowledge, understanding and compliance with regulations. The shift towards state prosecution of cases is due to several reasons centering the negative aspects of federal prosecution and weighed against the positive benefits of going through state court locally.

On September 4, 1992, Refuge Manager Clark Bloom received a phone call from Desert Shores resident Nellie McConnell who stated that she knew of several brown pelicans that had died as a result of striking a power line along Capri Lane in Desert Shores, at the northwest edge of the Salton Sea in Riverside County, California. Refuge personnel ultimately had various conversations with Ms. McConnell and her husband Clyde, and the couple stated that they have lived in the area for ten years and bird mortalities have always been a problem. Furthermore, the McConnells estimated that an average of three birds per week are killed by flying into the powerline. Although they have reported the problem to the Imperial Irrigation District, who own the powerline, the District

has responded that nothing could be done to correct the situation. Mr. McConnell stated that the District has repaired the powerline many times over the years after birds had flown into them and disconnected power to the residences. He mentioned that the power has been out for up to six hours and that he has seen brown pelicans crippled and killed after striking the wires.

Brown pelicans are listed as federally endangered, and occur at the Salton Sea throughout the year. They are generally represented at the Sea by post-breeding birds arriving from nesting areas in the Gulf of California. Brown pelicans at the Salton Sea are most common between April and September, with peaks of up to 5,000 birds being present during July.

Imperial Irrigation District power distribution lines at Desert Shores created strike hazards for numerous endangered brown pelicans during 1992. 92NR21 MFR 9/14/92

Manager Bloom investigated the complaint on September 5, and found the remains of ten brown pelicans along a half mile stretch of powerline

along Capri Road. This stretch of distribution line runs the length of an artificial peninsula having the Salton Sea on the east side and a large boat slip or bay on the west side. Bloom noted that several healthy brown pelicans were loafing along the shoreline on the west side of the peninsula. Bloom reported the incident to District Power Department Manager Henry Legaspi in Imperial. Legaspi assured Bloom that he would look into the situation and get back to the Service regarding a possible solution. On September 10, Bloom again checked the powerline and found the fresh carcasses of three brown pelicans, one California gull, and one great blue heron. There were considerable numbers of birds, including pelicans, flying and feeding in the area, and several just missed colliding with the powerline as they crossed the peninsula. The incident was again reported to Legaspi.

On September 21, Special Agent Diane Petrula and Wildlife Biologist W. Radke met with Legaspi at the District's main office to discuss problems relative to the powerline killing several birds, including endangered species. Petrula explained the problem in detail, including explanations of the Migratory Bird Treaty Act and Endangered Species Act along with the respective corporate penalties pertaining to violations of these Acts. Legaspi was receptive to arriving at a solution, and made the commitment that the District will de-energize and remove the two innermost wires to help eliminate electrocutions to birds perching on the powerpoles. Furthermore, the District will obtain orange powerline markers and install them between pole spans to make wires more visible to flying birds. If these measures do not stop 100 percent of the bird mortality, the District will install the distribution line underground.

Petrula explained that the Service would not prosecute as long as the District made a good faith effort to eliminate the hazard. Radke stated that refuge personnel would monitor the area for injured or killed wildlife, and offered technical assistance to the District concerning powerline markers.

From September 4, 1992 through January 13, 1993 the powerline was checked by either Refuge Manager Bloom, Wildlife Biologist M. Radke, or SCA volunteer Kelly Chapin on a weekly basis to check for bird carcasses and determine the District's progress toward removing the hazards associated with their line. During this period, a total of 11 pelicans, 2 gulls, and 1 heron were picked up by refuge personnel. Extremely warm temperatures at the Salton Sea provide for rapid decomposition, and scavenging by coyotes probably removed other carcasses. One pelican collected September 25 was frozen as evidence, but the remaining birds were disposed of due to severe decomposition and storage inadequacies. By September 25, the District had removed the two innermost wires of the powerline. During an aerial survey conducted December 14, biologists noted that the District was in the process of installing orange powerline markers along Capri Lane. On December 15, W. Radke received a phone call from District Power Department Operations Superintendent Preston Polk who reported that the District had placed powerline markers at Desert Shores beginning December 11 and completed the project on December 14. A letter was received during December from a Desert Shores resident who thanked the Service for stepping in and facilitating the necessary action to protect pelicans from striking the powerline.

Volunteer Chapin checked the area January 13, 1993 and noted that 29 twelve-inch orange powerline markers were in place between pole spans along Capri Lane. There were no brown pelicans utilizing the area. Refuge personnel and volunteers will continue to monitor the area periodically to assess the effectiveness of the powerline markers in preventing bird mortality.

I. EQUIPMENT AND FACILITIES

1. New Construction

The single item in this category is the large metal frame building acquired from the Salton Sea Navy Base, which was abandoned years ago and is now administered through the China Lake Naval Weapons Station facility. Although the materials are not new, this large 54x84 foot structure provides a new source of valuable shaded storage space for refuge equipment. Lesicka Construction Incorporated performed the disassembly and reassembly of the building, paid for by $9,280 in funds from the Salton Sea Segregated Account administered by the Fish and Wildlife Foundation. Refuge staff hauled the building parts from the old Navy Base to the refuge and poured the concrete footings for the building, with an assist from the YCC crew on the concrete work.

Lesicka Construction reassembling the metal frame building acquired from Salton Sea Navy Base. A large amount of valuable shade was made available with the relocation of this structure. 92NR22 DRD 7/92

A new water delivery system was installed along the eastern side of the Hazard 11/12 pond. A section of culvert was installed to connect the new, 1991 vintage, N-35 outlet structure to a new earthen irrigation

ditch, allowing the impoundment to be irrigated down slope. The previous system irrigated the pond by backing water uphill to flood the pond, being both inefficient and contrary to the means necessary for proper moist soil management. The life of the earthen delivery system will hopefully be short-term; plans are for Magma geothermal to convert the ditch to a concrete delivery system as part of their geothermal lease agreement with the state of California.

2. Rehabilitation

The major project in this category was the rehabilitation of the fuel dock and oil house located in the yard behind headquarters. The old gas and fuel storage tanks were above ground, but the delivery lines to the pumps were underground. The old metal oil shed was a bit undersized for station needs.

Two new 1,000 gallon convault storage tanks were acquired and a new cinder block building was constructed with $19,600 in Maintenance Management System funding.

While the fuel storage and delivery systems were completely replaced, the old oil shed was simply scooted over on its concrete pad to make room for the new building. The oil house project included prep work and pouring the new slab, many days of masonry work, and several additional days to put on the roof, doors, and vents. Most of the labor for the masonry and roof work was provided by McCain Valley Conservation Camp Crews (See Section E.4). The fuel dock required the preparation and placement of a new slab for the convaults. Equipment Operator Marcos Orozco and Laborer Jeffrey Walker provided most of the expertise and labor for completing the project.

3. Major Maintenance

Unusually heavy rains in April, and again in May, caused the Alamo River to flood portions of the Hazard Unit, causing significant damage to dikes and impoundments in Hazard ponds 1A, 2A, 3A, 1, 2 and 3. Numerous staff days were required to reshape eroded dikes, reslope impoundments, and reset fiberglass hunting blinds. Additionally, impoundments 1, 2 and 2A were planted in an effort to establish some vegetation in the damaged ponds. In addition to the direct physical damage to the impoundments and dikes, the flooding/dewatering/drying sequence destroys the moist soil management scheme in the affected ponds, essentially eliminating the production of vegetation in those units for the year.

In addition to performing a good deal of dirt work on the dikes and in the impoundments, several fiberglass hunting blinds also required attention. The pit blinds floated up like corks in the high water and had to be relocated to their former positions along the levees.

In a related effort, IID repaired the portions of the Alamo River Levee and the adjoining drain dike along the Hazard Unit which were inundated by the high water. Some sections were repaired twice by IID, in April and May.

Additional force account projects were also completed at the Hazard Unit. The Hazard 10 water control structure and both concrete and earthen irrigation ditches received attention. The concrete water control structure in the northwest corner of Hazard Unit 10 was replaced and cracks and leaking gates were patched in the 273 concrete ditch along ponds 4, 5, and 6. A large amount of mud was also removed from ditch using one of the two ditch cleaning buckets made by Rarnirez Welding for the Case backhoe/loader. The backhoe was also utilized to clean other dirt delivery ditches, removing unwanted vegetation.

Over water boundary signing continued at Unit 1 west of the New River along the western margin of section 23 (523). The north/south oriented portion of boundary located between the northwest corner of S23 and Bruchard Bay received five posts and signs, with difficulty. Several factors, including triangulating the precise location of the "inside" corner at Bruchard Bay and the challenge of trying to pound in posts in eight feet of water, made the job interesting. A surveying crew from IID had previously assisted in the accurate placement of the corner post west of the New River. Two staff members on land lined up the posting crew in the boat along known section lines to establish the "inside" corner at Bruchard Bay. The crew then worked north, being lined up visually from land. Fortunately, the weather cooperated by providing a calm day with little chop and almost no water movement (wind tide) to complicate the considerable task of keeping the boat in place while driving in steel posts; an experience which confirms the adage "for every action there is an equal and opposite reaction." The east/west portion of boundary moving west of Bruchard Bay, and the connecting north/south portion south to The Millionaire Duck Club, remains to be posted at Unit 1.

In addition to lubrication and other routine maintenance, the following maintenance repairs/parts replacements totaling $22,225 were made to refuge vehicles and equipment:

8430 John Deere Tractor (borrowed from Kern); overhaul engine - $6,932
2940 JD Tractor; clutch, starter, ignition switch, wiring harness, PTO seal, guide, gasket, and shaft - $2,379
4630 John Deere Tractor; radiator, alternator and belts - $294
Caterpillar Motor Grader; air brakes, battery, heater fan motor, fan blade and major service job - $1,034
9250; major service job - $500
Forklift (silent hoist); drum seal, axle, and seals - $834
Case 590 Backhoe; major service - $353
Caterpillar D-7G Crawler Tractor; rear engine seal - $700
1975 GMC Truck Tractor; transmission and chassis reinforcement - $1,735
1974 GMC Dump Truck; brake drums and shoes - $795
1985 Jeep Cherokee; front disk brakes, clutch master cylinder, tires, and tuneup - $579
1971 IHC Stake Truck; service and tune up - $302
1978 IHC Service Truck; service job, axle, clutch and clutch bearing, conversion from flatbed to service truck - $2989
1979 Dodge 4x4; brake job and electrical short - $653

1989 Chevy Blazer; tires and windshield - $464
1989 Chevy S-10 (I-155348); 4-wheel drive switch, windshield, water pump and battery - $709
1989 Chevy S-10 (I-155349); tires, brakes, chassis crossmember and battery - $973

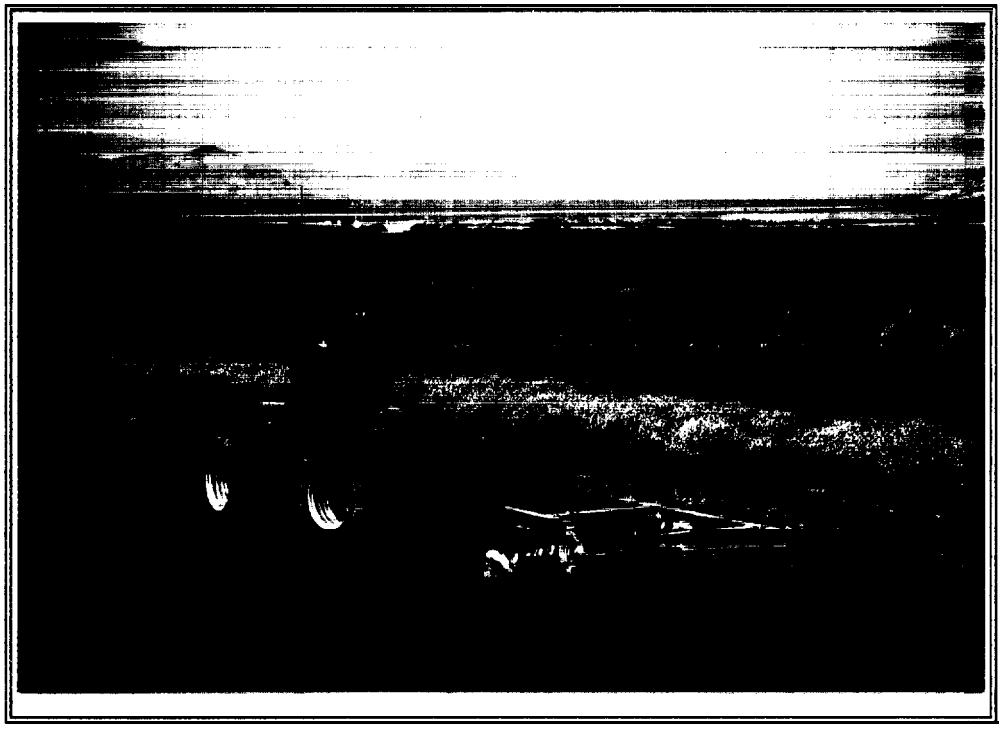
Several miscellaneous maintenance projects were performed in 1992, including repainting and waxing the floors in crew room, gear room, shower and restrooms, refinishing the wooden picnic area tables and trash barrels, painting entrance sign posts, replacing FWS emblems, and a clean up of the boat house. An attempt was also made to improve the drainage at the end of Vendel Road, which turns into a mud bog after a rain, by installing sand-filled drain fields. However, additional work is needed to place drain pipes in the drain fields with an outlet to the adjacent ditch.

Substantial effort amounting to numerous staff days were dedicated to converting the 1978 flatbed truck into a service truck. The converted unit features a 400 gallon fuel tank (diesel), and can deliver compressed air, grease and motor oil to equipment in the field. This unit provides a needed measure of efficiency and flexibility to field operations and equipment utilization capabilities.

4. Equipment Utiliza-tion and Replacement

Equipment replacement in 1992 was highlighted by the acquisition of an all-wheel drive Case Model 9250 agricultural tractor ($90,000 MMS-funded) and a 14 foot Case disk harrow ($16,000 MMS-funded). The 9250 "Big Red" Case instantly became the flagship of our equipment fleet and has become invaluable to the farming program. Prior to the acquisition of the new tractor, there was a significant void at the upper end of our farm tractor's horsepower availability. We did not have a tractor big enough to pull a disk efficiently or effectively without using the very slow, fuel-guzzling D-7 crawler tractor.

Before the new Case was acquired, our need for a big tractor became particularly poignant when one of our two cooperative farmers dropped out of the program in 1991. Arrangements were made to borrow the John Deere Model 8430 from the Kern Refuge Complex to get us through the fall '91/winter '92 farming season. While Kern's tractor performed admirably, it also developed a serious leak from the oil pan, requiring a $6,932 engine overhaul to repair the damage. It was later determined that the oil pan had already been off the tractor, suggesting that the gasket was not seated correctly. The tractor was returned to the San Joaquin Valley in spring. Also borrowed from Kern in 1992 was their cultipacker, which is still in use here and will be returned in 1993 (at which time our new, MMS-funded cultipacker should be on hand).



Big Red, the new Case farm tractor, pulling the new Case disk harrow, make quick work of disking the 421 field next to headquarters; this combination provides a tremendous improvement to the refuge farming program. 92NR23 DRD 2/93

In an effort to augment the acquisition of equipment for Salton Sea and other stations in the region, Engineering Equipment Mechanic Lee Laizure occasionally screens surplus equipment at various military installation in southern California. Four pieces of surplus military equipment were acquired in 1992, including a 1971 IHC stake truck, a 1980 Pettibone fork lift, a 8x20 foot Sanders tilt trailer, and a 1972, 34 foot, gooseneck low boy trailer.

The sale of miscellaneous pieces of scrap metal helped tidy up the scrap pile and generated $60.00 in revenues for the U.S. Treasury. Another sale involving derelict implements is planned for 1993. Such sales involving scrap and obsolete pieces of equipment should continue being done to reduce the volume of "junk" that has piled up through the years.

5. Communications Systems

The Motorola Spectra radios acquired in 1990 were programmed to include other agency channels in 1992. New channels added included two California Department of Fish & Game frequencies (car-to-car and Black Mountain repeater), California Law Enforcement Mutual Aid Radio System (CLEMARS), and four BLM frequencies (car-to-car, Toro Peak repeater, Chuckwalla repeater, and Black Mountain repeater). Of particular value is the Toro Peak repeater frequency, which can be accessed from Salton Sea and Coachella Valley Refuges and anywhere in between. It provides access to the 24-hour federal dispatch center in San Bernardino,

California. The Salton Sea Segregated Account with the Fish and Wildlife Foundation was tapped for $771.58 to fund the radio work.

Future plans to upgrade the complex's radio system include the addition of a FWS frequency repeater at Cactus Peak, located east of the Coachella Valley south of Interstate 10 near Scirocco Summit.

6. Computer Systems

Although the refuge compliment of desk top computers with printers is two, there is a continuing need for a third work station. Our overall staff demand for computer time frequently exceeds availability.

J. OTHER ITEMS

1. Cooperative Programs

Several cooperative habitat enhancement projects were initiated with the Imperial Irrigation District during 1990, with consultations and meetings occurring during 1992. Properties for habitat enhancement are owned in title by the District, but fall within the identified Salton Sea Reserve boundary. The Service would obtain these properties through the refuge's long-term lease agreements with the District. Benefits derived from these proposals include habitat development for Yuma clapper rail, gull-billed tern, black skimmer, and waterfowl. Work completed by the District to date on Morton Bay include surveying, perimeter dike repair, and legal consultation regarding our lease agreement (Section C.3).

4. Credits

Bloom: Introduction, A, B, Cl, C3, El, E5, E6, K.
Dinkler: D2, D3, E2, E4, E8, F4, F7, F9, HL-17, 11-6.
W. Radke: D5, E7, F1, F2, G1-4, G10, G11, G17, H17, J4
M. Radke: D4, D5, E7, F3, F6, F10, F11, F15, G2, G4-7, G11, G14, G16, J1, and K.
Harris: Organization, assembly, and editing.

Photographs are credited by initials.

K. FEEDBACK

Imperial County, like the rest of southern California, is undergoing rapid population growth and subsequent development. This refuge is on the mailing lists for the Imperial County Planning Department, the Imperial Irrigation District, and other governmental agencies. Subsequently, we receive numerous notices of preparation, environmental assessments, and environmental impact reports from these various agencies, and are requested to comment on them. Several notices of preparation, draft environmental impact reports, or other documents from the County of Imperial and/or various cities were reviewed, and written comments were provided to the appropriate agencies (See-Section E.7).

Normally, the Ecological Services office at Carlsbad, CA provide review and comments on these documents. However, because of increased workloads and/or insufficient Ecological Services staff, the refuge has been increasingly involved in the review/comment process in order to ensure that the FWS views are made known to the authors of these documents.

Among the documents commented on within the past year were several major ones including Imperial Irrigation District's Test Water Conservation Program Environmental Assessment, The Imperial County General Plan Revision draft EIR and the Coachella Valley Water District's Environmental Assessment.

Several of these projects will impact thousands of acres of native habitat and/or prime farmland within the Imperial Valley, converting acreage to commercial, industrial, and residential uses. Therefore, they have potential impacts to habitat and several wildlife species.

Specific concerns include the Imperial Enterprise Zone and City of Imperial Annexation including the proximity of the areas to an important winter sandhill crane roost located at D & K and Ostercamp Farms Duck Clubs. The American Girl Mining Venture and Mesquite Regional Landfill occurs within critical habitat for the Desert Tortoise.

The Imperial Irrigation District's water conservation projects would impact the quantity and quality of water entering the Salton Sea, which ultimately impacts avian and fisheries resources, and several listed species. It also appears that several water projects have received negative declarations or categorical exemptions, even though cumulative effects of the water projects would impact the Salton Sea and listed species.

As can be seen, the refuge has spent considerable time and energy ensuring that these important documents were commented upon. While the refuge staff is willing to help Ecological Services, there is a rapidly approaching point where we will be unable to continue in the capacity that we have in the past year.

Perhaps it is time for ARW and ES to sit down and analyze this situation. An increase in the Ecological Services staff and/or refuge staff appears to be in order. Some sort of resolution needs to be adopted so that wildlife comes out a winner.

K. FEEDBACK

Imperial County, like the rest of southern California, is undergoing rapid population growth and subsequent development. This refuge is on the mailing lists for the Imperial County Planning Department, the Imperial Irrigation District, and other governmental agencies. Subsequently, we receive numerous notices of preparation, environmental assessments, and environmental impact reports from these various agencies, and are requested to comment on them. Several notices of preparation, draft environmental impact reports, or other documents from the County of Imperial and/or various cities were reviewed, and written comments were provided to the appropriate agencies (See Section E.7).

Normally, the Ecological Services office at Carlsbad, CA provide review and comments on these documents, However, because of increased workloads and/or insufficient Ecological Services staff, the refuge has been increasingly involved in the review/comment process in order to ensure that the FWS views are made known to the authors of these documents.

Among the documents commented on within the past year were several major ones including Imperial Irrigation District's Test Water Conservation Program Environmental Assessment, The Imperial County General Plan Revision draft EIR and the Coachella Valley Water District's Environmental Assessment.

Several of these projects will impact thousands of acres of native habitat and/or prime farmland within the Imperial Valley, converting acreage to commercial, industrial, and residential uses, Therefore, they have potential impacts to habitat and several wildlife species.

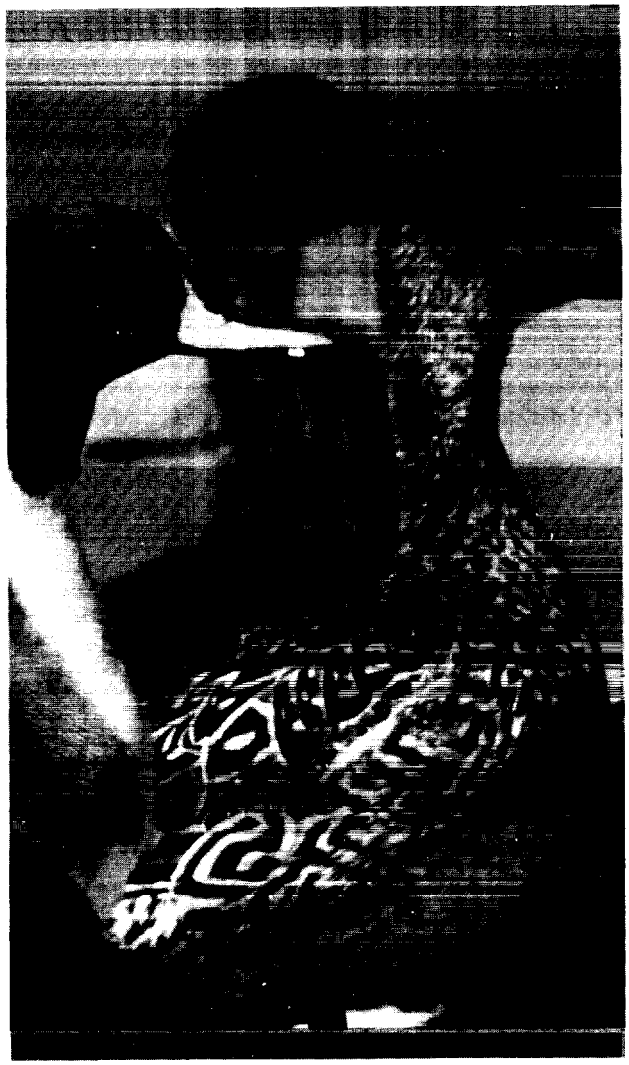
Specific concerns include the Imperial Enterprise Zone and City of Imperial Annexation including the proximity of the areas to an important winter sandhill crane roost located at D & K and Ostercamp Farms Duck Clubs. The American Girl Mining Venture and Mesquite Regional Landfill occurs within critical habitat for the Desert Tortoise.

The Imperial Irrigation District's water conservation projects would impact the quantity and quality of water entering the Salton Sea, which ultimately impacts avian and fisheries resources, and several listed species. It also appears that several water projects have received negative declarations or categorical exemptions, even though cumulative effects of the water projects would impact the Salton Sea and listed species.

As can be seen, the refuge has spent considerable time and energy ensuring that these important documents were commented upon. While the refuge staff is willing to help Ecological Services, there is a rapidly approaching point where we will be unable to continue in the capacity that we have in the past year.

Perhaps it is time for ARW and ES to sit down and analyze this situation. An increase in the Ecological Services staff and/or refuge staff appears to be in order. Some sort of resolution needs to be adopted so that wildlife comes out a winner.

Wildlife



of Salton Sea National Wildlife Refuge

California

U.S. Fish and Wildlife Service

Department of the Interior

RF11630 June 1967

Enjoying the Refuge's Wildlife

The study of wild animals in their natural habitat has become increasingly popular. Viewing of wildlife can be greatly enhanced by a pair of binoculars or spotting scope and a good wildlife/birding guide.

Wildlife species in this brochure have been grouped into four categories: Birds, Mammals, Reptiles and Amphibians, and Fish.

Birds

Bird populations vary greatly in numbers and species according to seasons. Heavy migrations of waterfowl, marsh and shorebirds occur during spring and fall. Throughout the mild winter and spring a wide variety of smaller birds and birds of prey are present. They are attracted to the freshwater marshes and riparian habitat along the New and Alamo Rivers. The best opportunity to observe the greatest diversity of bird life is from November to May.

The following list of birds contains 371 species that have been recorded on Salton Sea NWR and the adjacent Imperial Valley. The nominclature and taxonomic order used in this list follows that appearing in the **6th** edition of the American Ornithologists' Union Check-List *of North American Birds* published in 1983. Salton Sea NWR holds the distinction of having the most diverse array of bird species found on any of the over 400 National Wildlife Refuges.

When looking at a bird, pay close attention to characteristics such as color, size, shape, and wing and head markings. Always observe first and then refer to your identification book because the bird may not remain where it can be readily observed for a long period of time. This is especially true of perching birds.

Legend

Sp — Spring, April through May
s — Summer, June through August
F — Fall, September through October
w — Winter, November through March

Spring — Some species migrate much earlier than others, appearing in the area of Salton Sea during March, but are none-the-less spring migrants rather than winter visitors. Their status at this time of the year is indicated under Spring rather than Winter.

Summer — Status indicated under this heading indicates the relative abundance of summering birds. Observers must remember late spring migrants can be found into early June, and that early fall migrants can occur as early as late June, but these are not summering birds. Their status as migrants is indicated under Spring and Fall rather than Summer.

Fall — Since some species, particularly shorebirds, migrate quite early in the fall, appearing in the area of the Salton Sea in July or earlier. Their status as fall migrants in July and August is indicated under Fall rather than Summer.

Winter — As indicated above, some early spring migrants may be present during March or earlier, as with the swallows. Likewise, some late fall migrants linger in November. However, these occurrences are omitted from the winter column so as to clearly indicate the status of each species as a winter visitor.

Notes — Information over and above the relative abundance shown for each season to clarify the status of some species in the area.

Abundance Codes

c — Common to Abundant, easily found in suitable habitat.
u — Uncommon to Fairly Common, found where looked for in suitable habitat, but can be missed.
r — Rare to Very Uncommon, more often **missed** than seen, even when looked for in suitable **habitat.**
o — Occasional, normally less than five individuals per season during any given year, but to be looked for.
a — Accidental, less than ten records for the entire area, and not to be expected.

Threatened/Endangered Species

Habitat Codes

o - **Open** Water - Restricted to the open water of the Salton Sea and larger lakes in the Imperial Valley.

b - Beach and **Mudflat** - Basically the shore line of the Salton **Sea,** but expanded to include flooded fields and other such areas of shallow water and mud.

m -Marshes - Cattail marshes and other such areas found at various locations around the Salton Sea, along the rivers and canals, and at shallow lakes.

f - Farmland - Agricultural land found extensively throughout the Imperial Valley south of the Salton Sea, including planted and unplanted fields alike.

s - Shrubland - Mesquite thickets and other brushy areas. Some shrubland contains scattered trees.

r - Riparian Vegetation Limited to areas of salt cedar and willows along waterways, and at some points along the shore of the Salton Sea.

a - **Aerial** - Use Limited to those strong flying species most often seen in the air.

h -Houses **and** Towns - Immediate area of ranch houses and the residential areas of such towns as Niland and Calipatria. It is in these areas that most of the larger trees can be found and where ornamental planting supports a variety of landbirds.

Abbreviation Listed Under Notes

b - Species regularly breeds in the area.

b+ - Species has bred in the area, and may continue to breed sporadically in the area, but is not expected to become a regular nesting species.

I - Species occurs only locally within the area.

e - An erratic species, occurring in numbers some years, and being very scarce or even absent in others.

x - Species formerly occurred in the area, but is now extripated, occurring only as an accidental straggler if at all.

xb - An extripated breeder formerly nesting in the area, but with no recent breeding records.

p - A post-breeding visitor to the area from the south, being most numerous in the area between July and September.

l-9 - Actual number of recorded occurrences for those species listed as accidentals in the area.

Common Name	Habitat	S	W	Notes
LOONS				
Red-throated Loon			a	
Pacific Loon	0	a	a	
Common Loon	0	a	a	
GREBES				
Pied-billed Grebe	m	u	u	
Horned Grebe	o	a	o	
Eared Grebe	o	u	c	
Western Grebe	o	u	u	
Clark's Grebe	o	u	u	
ALBATROSS				
Laysan Albatross		a		
FULMARS, PETRELS AND SHEARWATERS				
Cooks Petrel		a		
Buller's Shearwater		a		
Sooty Shearwater		a		
STORM-PETRELS				
Leach's Storm-Petrel		a		
Black Storm-Petrel				
Least Storm-Petrel				
BOOBIES AND GANNETS				
Blue-footed Booby	o			
Brown Booby				
PELICANS AND CORMORANTS				
American White Pelican	oa	u	u	
Brown Pelican	o	r	o	
Double-crested Cormorant	o	c	c	
Olivaceous Cormorant		a	a	
FRIGATEBIRDS				
Magnificent Frigatebird	a	o	a	
BITTERNS, HERONS AND EGRETS				
American Bittern	m	o	u	
Least Bittern	m	u	o	
Great Blue Heron	bm	c	c	
Great Egret	bm	c	c	
Snowy Egret	bm	c	c	
Little Blue Heron	m	o	a	
Tricolored Heron	bm	o	a	
Reddish Egret		a		
Cattle Egret	fm	c	c	
Green-backed Heron	m	u	u	
Black-crowned Night-Heron	m	c	c	
IBIS AND SPOONBILLS				
White Ibis		a		
White-faced Ibis	mf	u	c	
Roseate Spoonbill	bm	o	a	
STORK				
Wood Stork	bm	c	a	
WATERFOWL				
Fulvous Whistling-Duck	m	r	a	
Black-bellied Whistling-Duck		a		
Tundra Swan	om		o	
Greater White-fronted Goose	fm	a	r	

Common Name	Habitat	Sp	S	F	W	Notes
Snow Goose	fm		o		c	
Ross' Goose	fm				c	
Brant	om		o		a	
Canada Goose	fm		o		c	
Wood Duck	om		a		o	
Green-winged Teal	om		r		c	
Baikal Teal					a	
American Black Duck					a	
Mallard	om		o		u	
Northern Pintail	om		r		c	
Blue-winged Teal	om		o		o	
Cinnamon Teal	om		u		r	
Northern Shoveler	om		r		c	
Gadwall	om		r		u	
Eurasian Wigeon	om				o	
American Wigeon	om		o		c	
Canvasback	o		o		c	
Redhead	o		u		u	
Ring-necked Duck	o		a		r	
Tufted Duck					a	
Greater Scaup	o		a		r	
Lesser Scaup	o		o		c	
Oldsquaw	o		a		o	
Black Scoter			a		a	
Surf Scoter	o		o		o	
White-winged Scoter	o		o		o	
Common Goldeneye	o		o		u	
Barrow's Goldeneye					a	
Bufflehead	o		o		u	
Hooded Merganser	o				o	
Common Merganser	o		a		r	
Red-breasted Merganser	o		r		r	
Ruddy Duck	om		c		c	
VULTURES						
Turkey Vulture	af		r		r	
OSPREY, KITES, EAGLES AND HAWKS						
Osprey	ao		r		r	
Black-shouldered Kite			o		o	
Bald Eagle	ao				o	
Northern Harrier	afm		o		c	
Sharp-shinned Hawk	ars				u	
Cooper's Hawk	ars				u	
Harris' Hawk						
Red-shouldered Hawk					o	
Broad-winged Hawk					a	
Swainson's Hawk	af					
Zone-tailed Hawk						
Red-tailed Hawk	af		r		u	
Ferruginous Hawk	af				r	
Rough-legged Hawk	af				o	
Golden Eagle					a	
FALCONS						
American Kestrel	afh		u		c	
Merlin	af				r	
Peregrine Falcon	am		o		o	
Prairie Falcon	af		o		r	
GALLINACEOUS BIRDS						
Ring-necked Pheasant	f		r		r	
Gambel's Quail	s		u		u	

Common Name	Habitat	Sp	S	F	W	Notes
RAILS						
Black Rail	m		o		o	
Clapper Rail	m		r		r	
Virginia Rail	m		r		u	
Sora	m				c	
Common Moorhen	m		u		u	
American Coot	om		c		c	
CRANES						
Sandhill Crane	f				u	
PLOVERS						
Black-bellied Plover	bf		u		c	
Lesser Golden-Plover	bf				a	
Snowy Plover	b		u		r	
Wilson's Plover			a			
Semipalmated Plover	b		o		r	
Killdeer	fb		c		c	
Mountain Plover	f				u	
OYSTERCATCHERS						
American Oystercatcher						
STILTS AND AVOCETS						
Black-necked Stilt	mf		c		c	
American Avocet	m		c		c	
SHOREBIRDS						
Greater Yellowlegs	mf		o		c	
Lesser Yellowlegs	mf				r	
Spotted Redshank						
Solitary Sandpiper	mf				a	
Willet	mf		u		c	
Wandering Tattler	m					
Spotted Sandpiper	m				u	
Whimbrel	mf		o			
Long-billed Curlew	mf		u		c	
Hudsonian Godwit						
Marbled Godwit	b		u		u	
Ruddy Turnstone	b				a	
Black Turnstone	b					
Surfbird	b		a			
Red Knot	b		a		o	
Sanderling	b				o	
Semipalmated Sandpiper	b					
Western Sandpiper	b		o		c	
Little Stint						
Least Sandpiper	b		o		c	
White-rumped Sandpiper						
Baird's Sandpiper	b					
Pectoral Sandpiper	b				a	
Dunlin	b		o		u	
Curlew Sandpiper						
Stilt Sandpiper	b				r	
Ruff					a	
Short-billed Dowitcher	b		o			
Long-billed Dowitcher	b		o		c	
SNIPE						
Common Snipe	m				r	
PHALAROPES						
Wilson's Phalarope	bo		o		a	
Red-necked Phalarope	bo		o		a	
Red Phalarope	o		a			

Common Name	Habitat	Sp	S	F	W	Notes
JAEGERS						
Pomarine Jaeger			a			
Parasitic Jaeger	o		a			
Long-tailed Jaeger						
GULLS AND TERNS						
Laughing Gull	ob		c		o	
Franklin's Gull	ob		o			
Little Gull					a	
Bonaparte's Gull	ob		r		o	
Heermann's Gull	ob		o		a	
Mew Gull	ob		a		o	
Ring-billed Gull	obf		u		c	
California Gull	obf		c		u	
Herring Gull	obf		o		c	
Thayer's Gull	ob		a		r	
Lesser Black-backed Gull					a	
Yellow-footed Gull	ob		c		r	
Western Gull	ob				o	
Glaucous-winged Gull	ob		o		r	
Glaucous Gull	ob		a		o	
Black-legged Kittiwake			a			
Sabine's Gull	o					
Gull-billed Tern	bf		u		a	
Caspian Tern	ob		c		u	
Elegant Tern			a			
Common Tern	ob		r			
Arctic Tern						
Forster's Tern	ob		c		u	
Least Tern	ob		o			
Black Tern	bf		c		a	
SKIMMERS						
Black Skimmer	b		u		a	
SEABIRDS						
Ancient Murrelet			a			
DOVES						
Rock Dove	h		c		c	
Band-tailed Pigeon						
Spotted Dove						
White-winged Dove	sh		u		a	
Mourning Dove	fsh		c		c	
Inca Dove	h		r		r	
Common Ground-Dove	sh		u		u	
CUCKOOS						
Yellow-billed Cuckoo			a			
Greater Roadrunner	sf		c		c	
Groove-billed Ani						
OWLS						
Common Barn-Owl	sh		r		r	
Flammulated Owl						
Western Screech-Owl	sh		r		r	
Great Horned Owl	sh				o	
Burrowing Owl	f		c		c	
Long-eared Owl	r				o	
Short-eared Owl	f				r	
Northern Saw-whet Owl					a	

Common Name	Habitat	Sp	S	F	W	Notes
GOATSUCKERS						
Lesser Nighthawk	fs		u		a	
Common Poorwill	s					
Whip-poor-will						
SWIFTS						
Black Swift						
Vaux's Swift	a					
White-throated Swift	a				r	
HUMMINGBIRDS						
Black-chinned Hummingbird	h		r			
Anna's Hummingbird	h		r		u	
Costa's Hummingbird	hs		r		u	
Calliope Hummingbird	hs					
Rufous Hummingbird	hs					
Allen's Hummingbird	h					
KINGFISHERS						
Belted Kingfisher	rm				u	
WOODPECKERS						
Lewis' Woodpecker	h				o	
Red-headed Woodpecker			a			
Acorn Woodpecker						
Gila Woodpecker	h		r		r	
Yellow-bellied Sapsucker					a	
Red-naped Sapsucker	h				r	
Red-breasted Sapsucker	h				o	
Ladder-backed Woodpecker	sh		u		u	
Nuttall's Woodpecker						
Northern Flicker	hs				c	
FLYCATCHERS						
Olive-sided Flycatcher	hs					
Greater Pewee						
Western Wood-Pewee	hs					
Willow Flycatcher	hs					
Least Flycatcher	hs				a	
Hammond's Flycatcher	hs					
Dusky Flycatcher	hs					
Gray Flycatcher	hs				a	
Western Flycatcher	hs					
Black Phoebe	hm		u		c	
Eastern Phoebe					a	
Say's Phoebe	f		r		c	
Vermilion Flycatcher	h		o		r	
Ash-throated Flycatcher	sh		r			
Tropical Kingbird						
Cassin's Kingbird	h				a	
Western Kingbird	fh		c		a	
Eastern Kingbird						
Scissor-tailed Flycatcher						
LARKS						
Horned Lark	f		u		c	
SWALLOWS						
Purple Martin	a					
Tree Swallow	a		o		c	
Violet-green Swallow	a				a	
Northern Rough-winged Swallow	a		c		u	
Bank Swallow	a		o		a	
Cliff Swallow	a		c			
Barn Swallow	a	c	r	c	o	b

Common Name	Habitat	S	W	Notes
JAYS, MAGPIES AND CROWS				
Scrub Jay	hs		o	
American Crow	f		r	
Common Raven	af	r	r	
CHICKADEES AND TITMICE				
Mountain Chickadee				
VERDIN				
Verdin	s	c	c	
NUTHATCHES				
Red-breasted Nuthatch	h		o	
White-breasted Nuthatch				
CREEPERS				
Brown Creeper	h		o	
WRENS				
Cactus Wren	s	c	c	
Rock Wren	s		r	
Bewick's Wren	s		r	
House Wren	sr	r	u	
Winter Wren			a	
Marsh Wren	m	c	c	
KINGLETS, BLUEBIRDS AND THRUSHES				
Golden-crowned Kinglet	rh		o	
Ruby-crowned Kinglet	rsh		c	
Blue-gray Gnatcatcher	rs		u	
Black-tailed Gnatcatcher	s	u	u	
Western Bluebird	sh		o	
Mountain Bluebird	f		u	
Townsend's Solitaire	s		o	
Swainson's Thrush	rsh			
Hermit Thrush	rsh		u	
American Robin	h		u	
Varied Thrush			a	
MOCKINGBIRDS AND THRASHERS				
Northern Mockingbird	sh	c	c	
Sage Thrasher	s		o	
Brown Thrasher			a	
Bendire's Thrasher			a	
Curve-billed Thrasher			a	
Crissal Thrasher	s	r	r	
Le Conte's Thrasher				
WAGTAILS AND PIPITS				
Water Pipit	f		c	
Sprague's Pipit				
WAXWINGS				
Cedar Waxwing	h		u	
PHAINOPEPLA				
Phainopepla	s		u	
SHRIKES				
Northern Shrike			a	
Loggerhead Shrike	sf	u	u	
STARLINGS AND MYNAS				
European Starling	hf	c	c	

Common Name	Habitat	S	W	Notes
VIREOS				
Bell's Vireo			a	
Solitary Vireo	sh		o	
Warbling Vireo	sh		a	
Red-eyed Vireo				
WARBLERS				
Tennessee Warbler				
Orange-crowned Warbler	r		c	
Nashville Warbler	rs		a	
Virginia's Warbler	s			
Lucy's Warbler				
Northern Parula			a	
Yellow Warbler	rh		r	
Chestnut-sided Warbler			a	
Magnolia Warbler				
Cape May Warbler			a	
Black-throated Blue Warbler				
Yellow-rumped Warbler	rsh		c	
Black-throated Gray Warbler	sh		o	
Townsend's Warbler	sh		o	
Hermit Warbler	sh			
Prairie Warbler				
Palm Warbler			a	
Bay-breasted Warbler				
Cerulean Warbler				
Black-and-white Warbler	hr		o	
American Redstart	rh		r	
Ovenbird				
Northern Waterthrush	r	o		
MacGillivray's Warbler	rs			
Common Yellowthroat	mr	u	u	
Wilson's Warbler	rs		o	
Yellow-breasted Chat	r	o		
TANAGERS				
Summer Tanager	h		a	
Western Tanager	hs		o	
GROSBEAKS AND BUNTINGS				
Pyrrhuloxia		a	a	
Rose-breasted Grosbeak				
Black-headed Grosbeak	hs			
Blue Grosbeak	rs	u	a	
Lazuli Bunting	rs			
Indigo Bunting				
Dickcissel				
TOWHEES AND SPARROWS				
Green-tailed Towhee	s		r	
Rufous-sided Towhee	s		r	
Abert's Towhee	s	c	c	
American Tree Sparrow			a	
Chipping Sparrow	h		r	
Brewer's Sparrow	fs		u	
Black-chinned Sparrow				
Vesper Sparrow	f		u	
Lark Sparrow	fs		r	
Black-throated Sparrow	s			
Sage Sparrow	fs		u	
Lark Bunting	fs		o	
Savannah Sparrow	f	o	c	
Grasshopper Sparrow		a	a	
Fox Sparrow	rs		o	

Common Name	Habitat	Sp	S	F	W	Notes
Song Sparrow	rm		r		u	
Lincoln's Sparrow	rf				c	
Swamp Sparrow	m				o	
White-throated Sparrow	rsf				o	
Golden-crowned Sparrow	rsf				o	
White-crowned Sparrow	rsf				c	
Harris' Sparrow	sf				o	
Dark-eyed Junco	sf				u	
McCown's Longspur	f				o	
Lapland Longspur	f				o	
Chestnut-collared Longspur	f				o	
Bobolink			a			
BLACKBIRDS, MEADOWLARKS AND ORIOLES						
Red-winged Blackbird	fm		c		c	
Tricolored Blackbird					a	
Western Meadowlark	f		u		c	
Yellow-headed Blackbird	mf		c		u	
Brewer's Blackbird	fh		o		c	
Great-tailed Grackle	mf		u		u	
Bronzed Cowbird	h		r			
Brown-headed Cowbird	fhs		u		c	
Orchard Oriole					a	
Hooded Oriole	h		u		o	
Northern Oriole	hrs		r		a	
Scott's Oriole					a	
FINCHES						
Purple Finch	rh				o	
Cassin's Finch	rh				o	
House Finch	hs		c		c	
Red Crossbill	hs				o	
Pine Siskin	rsh				r	
Lesser Goldfinch	s		r		u	
Lawrence's Goldfinch	s				r	
American Goldfinch	s				r	
WEAVER FINCHES						
House Sparrow	h		c		c	

Mammals

All mammals listed are considered resident species with the exception of the bats which migrate on a seasonal basis like many of the birds. Families follow that of *A Field Guide to the Mammals* by Burt and Grossenheider.

Shrews
Desert Shrew

Cats
Bobcat

Dogs
Coyote
Desert Kit Fox
Gray Fox

Leafnose Bats
California Leafnose Bat

Plainnose Bats
California Myotis
Western Pipistrel
Big Brown Bat
Spotted Bat
Hoary Bat
Western Yellow Bat
Pallid Bat
Long-tongued Bat

Freetail Bats
Mexican Freetail Bat
Pocketed Freetail Bat
Big Freetail Bat

Rabbits/Hares
Desert Cottontail
Blacktail Jackrabbit

Raccoons
Raccoon

Squirrels/Chipmunks
Roundtail Ground Squirrel
Antelope Ground Squirrel

Weasels, Skunks, Badgers
Striped Skunk
Spotted Skunk
Badger

Pocket Gophers
Valley Pocket Gopher

White Footed Mice
Cactus Mouse
Deer Mouse

Pocket/Kangaroo Mice and Kangaroo Rats
Desert Pocket Mouse
Little Pocket Mouse
Desert Kangaroo Rat
Spiny Pocket Mouse
Merriam Kangaroo Rat
Longtail Pocket Mouse

Woodrats
Desert Woodrat
Whitethroated Woodrat

Voles and Muskrats
Muskrat

Old World Rats and Mice
House Mouse
Black Rat
Norway Rat

Amphibians and Reptiles

Reptiles are found in brushy areas on the refuge and surrounding desert habitats while amphibians are found in or near freshwater. Names used follow that found in *A Field Guide to Western Reptiles and Amphibians* by Stebbins.

Amphibians
Bullfrog
Leopard Frog
Red-spotted Toad
Spiny Softshell Turtle

Lizards
Side-blotched Lizard
Leopard Lizard
Long-tailed Brush Lizard
Desert Horned Lizard
Flat-tailed Horned Lizard
Desert Spiny Lizard
Western Whiptail Lizard

Snakes
Gopher Snake
Common Kingsnake
Checkered Garter Snake
Western Rattlesnake
Western Blind Snake
Red Racer
Western Patch-nosed Snake
Desert Glossy Snake
Western Ground Snake

Fish

Very few fish can tolerate the high salinity of the Salton Sea. In 1950 attempts were made to introduce several marine fish. These attempts resulted in the largest inland fishery in California. The introduced saltwater species are underlined. Freshwater species are found in rivers, canals and some marsh areas.

Orangemouth Corvina
Sargo
Gulf Croaker
Threadfin Shad
Sailfin Molly
Desert Pupfish
Longjaw Mudsucker
Mosquitofish
Red Shiner
California Killifish
• Tilapia
Largemouth Bass
White Catfish
Channel Catfish

• *found in both fresh and saltwater*

For additional information contact:

Refuge Manager
Salton Sea NWR
PO Box 120
Calipatria, CA 92233
Telephone (619) 348-5278

Notes

Date _____ No. Species _____
Time Afield _____
Observers _____
Weather _____
Remarks _____

Salton Sea

National Wildlife Refuge

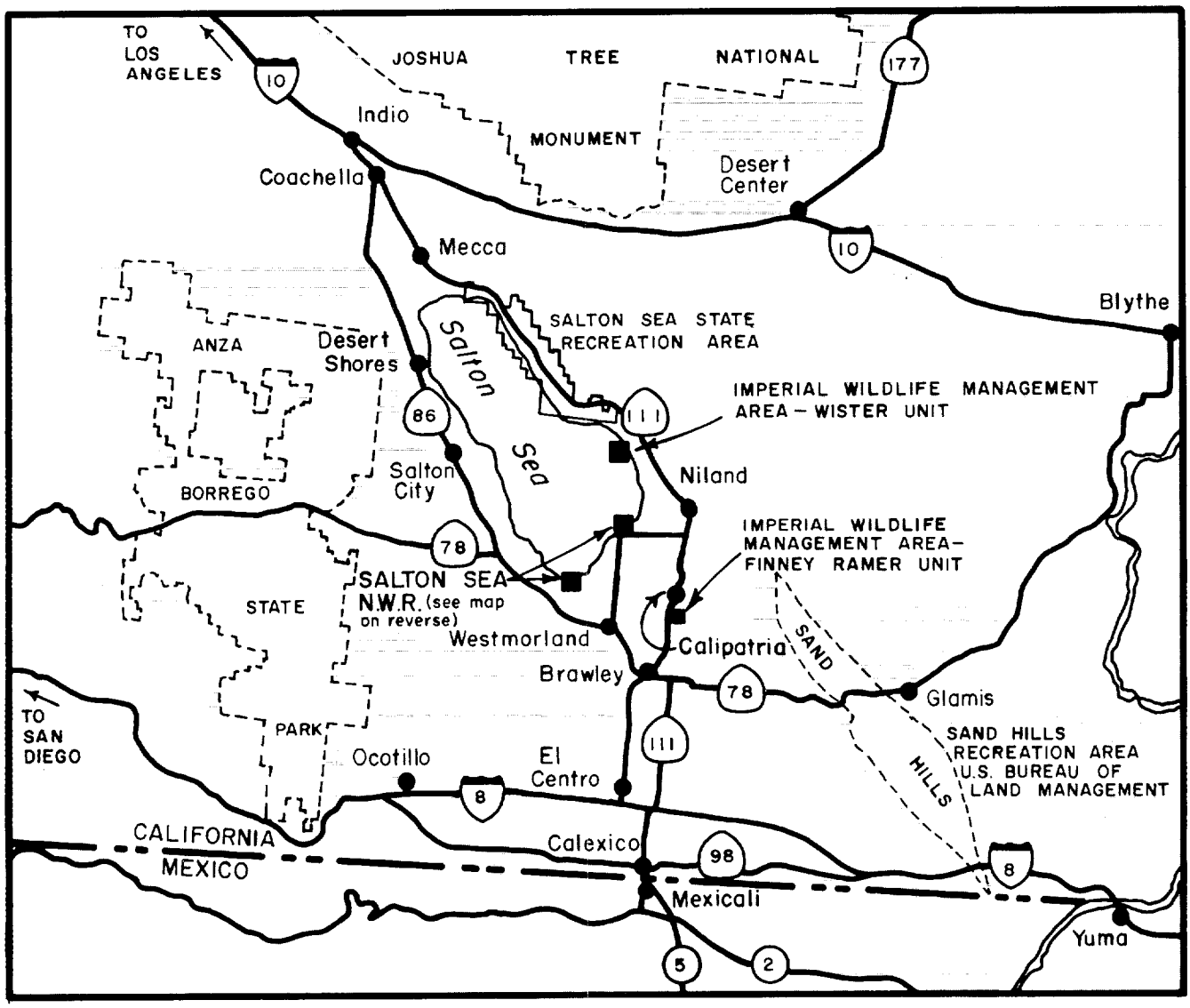
California

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Salton Sea National Wildlife Refuge
P.O. Box 120
Calipatria, CA 92233

OFFICIAL BUSINESS
Penalty for Private Use, $300

U.S.MAIL

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF THE INTERIOR
INT-423



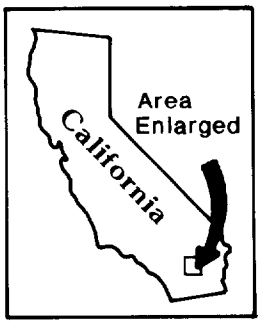
0 10 20 30

SCALE IN MILES

Services Available Nearby

Motels are available in Brawley (20 miles), Niland (10 miles), Imperial (28 miles), and El Centro (33 miles). Restaurants, gasoline, and other supplies are available in Brawley, Calipatria, El Central, Imperial, Niland, and Westmorland.

Camping is permitted at the Wister and Finney Ramer units of the Imperial Wildlife Area and Salton Sea State Recreation Area.



RF11630

September 1992

Wildlife and a Changing Sea

Snow Geese

The Salton Sea National Wildlife Refuge has shrunk—The Salton Sea National Wildlife Refuge was established in 1930 by a Presidential Proclamation. It is located along the course of the Pacific Flyway in the Imperial Valley of California. Originally the refuge consisted of approximately 35,000 acres. Now, because of flooding by the Salton Sea, only about 2,200 manageable acres remain. Dikes are expected to keep the sea from further expansion on the refuge.

From Gulf to ancient sea to desert-At one time the Gulf of California extended into what is now known as the Imperial and Coachella valleys. A natural dam was then formed through silt deposits from the Colorado River. This deposit blocked off the Gulf and resulted in the formation of an ancient sea. Through time, the sea evaporated and formed a dry alkaline basin. In the early 1900s only dry desert shrubs were present where the refuge and lake shore is today.

Sea **re-created in 1905 from break in irrigation canal**—In 190 1, Colorado River waters were diverted from Yuma, Arizona, into Mexico and back into the Salton Sea basin for agricultural development. In 1905, failure of a diversion structure caused the Colorado to flow unchecked into the Imperial Valley between 1905-1907, thus creating the present Salton Sea. Agricultural drainage and run-off from the surrounding mountains now supply the Salton Sea. There is no outlet from the sea, and water is removed only by evaporation.

Over 200 **feet below sea level**—The Salton Sea covers over 380 square miles. Its width varies from 9 to 15 miles, it is 35 miles long with about 115 miles of shoreline. The depth of the Salton Sea varies with the gentle valley slope to a maximum of about 40 feet. The surface elevation is currently about 227 feet below sea level.

Canada Goose

Waterfowl have adapted to changing habits and foods in Imperial and Mexicali Valleys-Before the Salton Sea was formed waterfowl were only found along the marshes and delta of the Colorado River (primarily in Mexico). During the 1920s, as more water was diverted from the Colorado River for agriculture, marshes were inadvertently created. These marshes, at the edges of the then smaller Salton Sea, resulted from agricultural water runoff. Waterfowl were attracted to the marshes from their former winter home in the drying Colorado River Delta. As farming intensified in the 1940s and Salton Sea expanded, marshland once again shrunk and waterfowl turned to farmers' crops for food. Today, crops are grown on the refuge to feed wintering waterfowl and to keep the birds from eating farmers' crops.

Increasing sea salt stresses fish transplants- As the salinity of the Salton Sea began to rise as the result of evaporation, many of the native freshwater fish species began to die out. In the 1950s the salinity of the Salton Sea was nearly that of the Pacific Ocean-(35,000 parts per million). Attempts were made to introduce several marine fish. These attempts resulted in the establishment of the Orange-mouth Corvina, Sargo, and Gulf croaker (Bairdiella), all transplanted from the Gulf of California. Later tilapia, an African species, were introduced into canals surrounding the Salton Sea. They are now well established in the sea. Unfortunately, the fishery is threatened by increasing salinity. The current salinity level is in excess of 40,000 parts per million, more than 10 percent saltier than the Pacific Ocean.

Long-billed Dowitchers

Other animals introduced into the Salton Sea, accidently or intentionally, include barnacles, pile worms, and copepods. These animals play a very important part in providing food for the fishery. The relationship between the fish and their food is so close that if one were to disappear the entire system would be significantly affected.

Numerous wildlife now conserved on the refuge-- Thousands of waterfowl and other birds spend the winter at the refuge. Canada geese, snow geese, American avocets, black-necked stilts, pintails, green-winged teal, eared grebes, and a wide variety of other species are commonly seen during the winter.

The primary purpose of the refuge is to provide habitat for migrating and wintering waterfowl and endangered species. The refuge is also important in providing feeding, resting, and nesting habitat for a large number of shorebirds and in supporting a diversity of wildlife species throughout the year.

White Pelicans

Endangered species at the refuge- The Yuma clapper rail breeds in marshes along the Colorado River from the Nevada/California border south to the Colorado Delta region of Mexico. It is also found in marsh habitat around the southeastern portion of the Salton Sea. The preferred habitat is mature cattail-bulrush stands in shallow fresh water. Yuma clapper rails occur in suitable habitat throughout the year and breed successfully on the refuge.

Other endangered or threatened species occasionally observed on the refuge include the bald eagle, California brown pelican, and peregrine falcon.

Yuma Clapper Rail

Enjoying the Salton Sea National Wildlife Refuge

REFUGE HOURS—Refuge open sunrise to sunset. Office hours 7:00 a.m. to 4:30 p.m., Monday through Friday.

WILDLIFE OBSERVATION AND PHOTOGRAPHY—These activities are encouraged from designated trails. Self-guided interpretive exhibits are available near the office. A wildlife list is available.

DESIGNATED TRAILS—Walking and hiking are enjoyed on designated trails. Most refuge roads and trails are closed to vehicles.

WATERFOWL HUNTING—Waterfowl hunting is permitted on areas shown on map under California State and Federal regulations. Write the refuge manager for hunting regulations leaflet.

FISHING—Boat fishing only is permitted, except where posted as closed. From April 1 to September 30, areas on the Salton Sea between the buoys and shoreline are open to boat fishing. These areas are closed to all entry at other times of the year. No bank fishing.

PETS—Pets must be on a leash at all times. Hunting dogs on the public hunting areas must be under effective control.

LITTERING—Please help us save your tax money for clean-up. Don't litter.

CAMPING—No camping is allowed on the refuge.

FOR MORE INFORMATION, CONTACT:

Refuge Manager
Salton Sea National Wildlife Refuge
P. O. Box 120
Calipatria, California 92233
Phone (619) 348-5278

Information on other nearby recreation land can be obtained from:

Salton Sea State Recreation Area
P. O. Box 3166
North Shore, California 92254
Phone (619) 393-3052

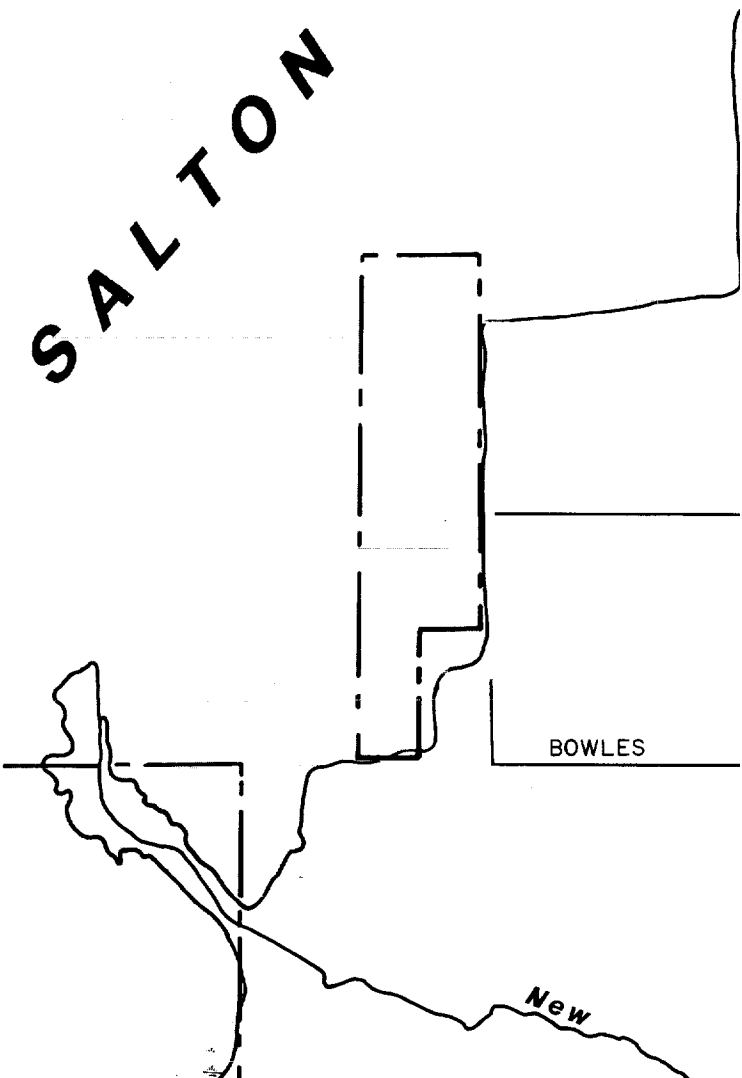
Bureau of Land Management
333 South Waterman Avenue
El Centro, California 92243
Phone (619) 352-5842

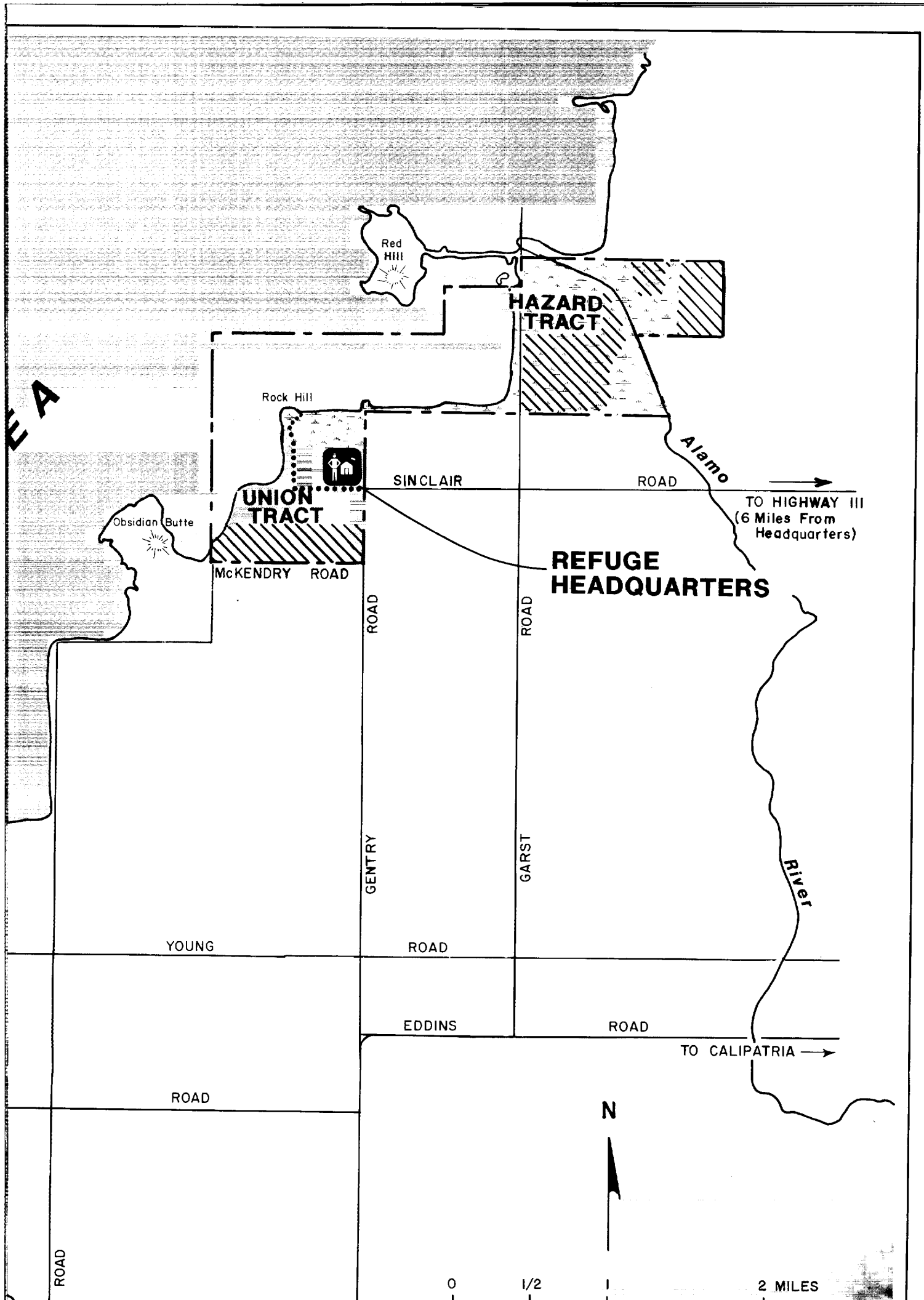
California Department of Fish and Game
8700 Davis Road
Niland, California 92257
Phone (619) 359-0577

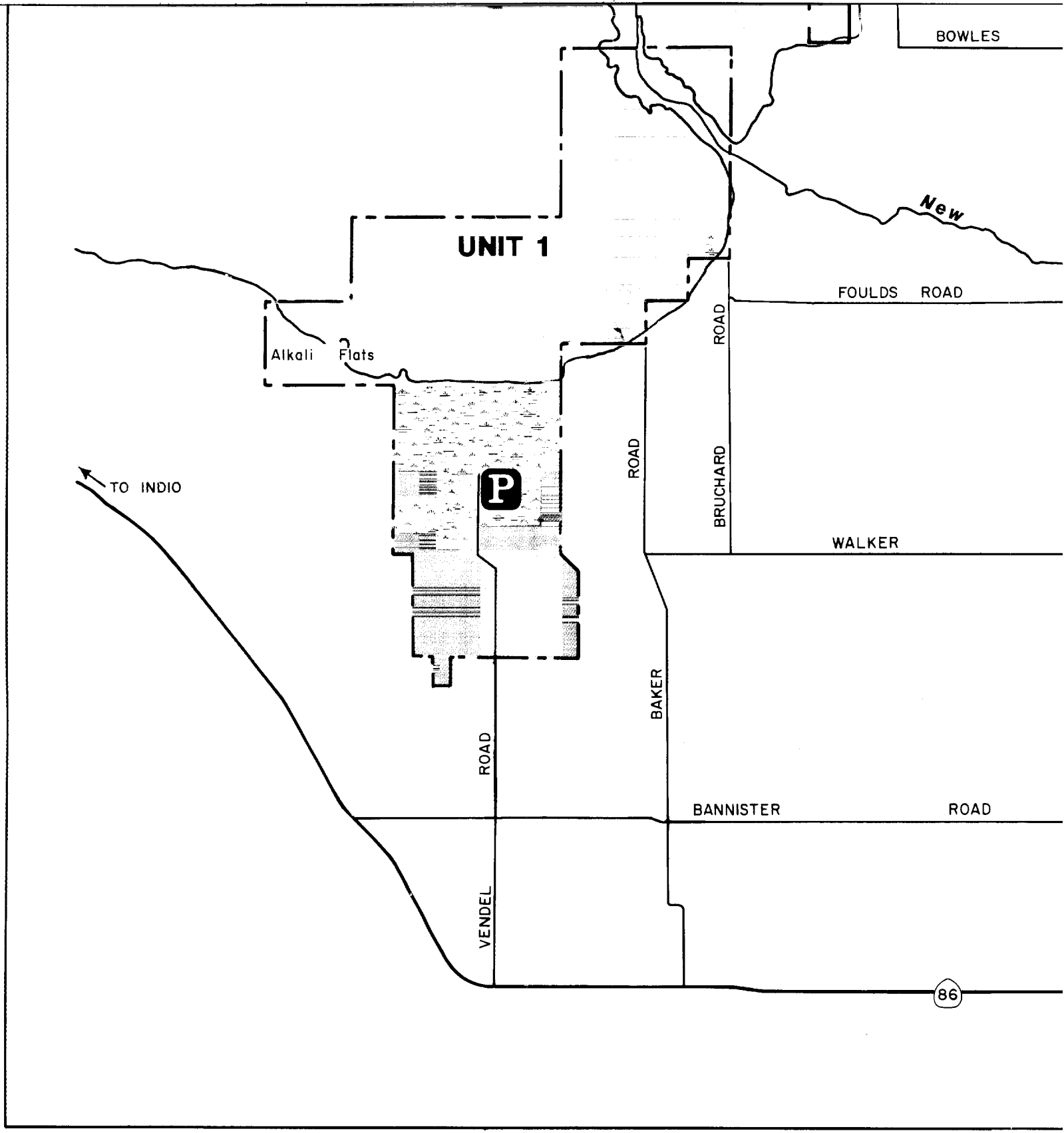
LEGEND

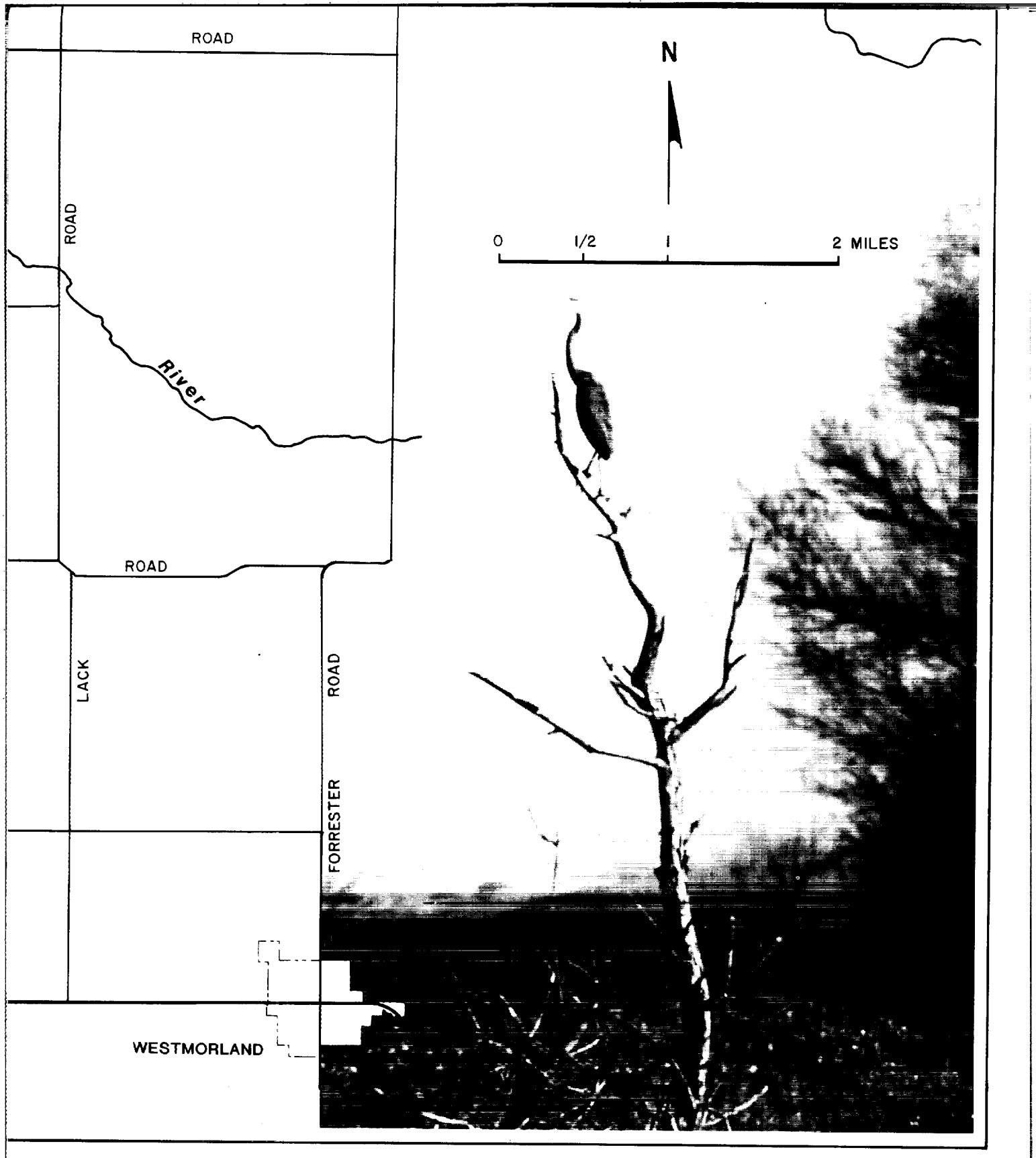
- Refuge Boundary
- Designated trails open year-round
- Marsh
- Agricultural Fields
- Public Hunting Area, open by permit October–January

All other areas, except designated trails are closed to entry. Write for hunting leaflet.




Red Hill
HAZARD TRACT
Rock Hill
Alamo
SINCLAIR ROAD
TO HIGHWAY 111
(6 Miles From Headquarters)
UNION TRACT
Obsidian Butte
McKENDRY ROAD
REFUGE HEADQUARTERS
ROAD
ROAD
GENTRY
GARST
River
YOUNG ROAD
EDDINS ROAD
TO CALIPATRIA
ROAD
ROAD
N
0
1/2
2 MILES


BOWLES
UNIT 1
New
FOULDS ROAD
ROAD
Alkali Flats
BRUCHARD
ROAD
TO INDIO
P
WALKER
BAKER
ROAD
BANNISTER ROAD
VENDEL
86


ROAD
N
ROAD
0
1/2
1
2 MILES
River
ROAD
LACK
ROAD
FORRESTER
WESTMORLAND