SALTON SEA NATIONAL WILDLIFE REFUGE

CALIPATRIA, CALIFORNIA

ANNUAL NARRATIVE REPORT

CALENDAR YEAR 1993

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, minus 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°-120°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 (IID) 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.

This photo of Morton Bay near the mouth of the Alamo River is typical of the habitat found along the shoreline of the Salton Sea. **SS** #889
WRR 6/22/93

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 its capitol city 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. However, the excessive precipitation which occurred in 1992 and 1993, has reduced the salinity level back to 37 ppt. The salinity will probably rise again as normal precipitation levels return along with annual evaporation of ten feet per year.

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, 41 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.

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A. HIGHLIGHTS

An $86,000 Ducks Unlimited "Marsh Project" was completed in Unit I. The project involved land leveling, splitting the field and installation of concrete lined water delivery system. (Section 1.1)

Excessive rainfall caused extensive flooding in the Hazard Unit for the second year in a row. (Section B)

Endangered Yuma Clapper Rail population on the refuge rose to an all-time high. (Section G.2)

Volunteer efforts were increased this year with a total of 2852 hours being worked by the McCain Valley Conservation Camp, four SCA volunteers and five citizens. (Section E.4)

Cooperative Farming program was reestablished. (Section F.4)

B. CLIMATIC CONDITIONS

Weather in the Imperial Valley is best characterized as very 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 1993 was relatively mild as far as Imperial Valley summers go although a high temperature of 118^{0}F was reached in August. There were a total of 115 days when the temperature reached or exceeded 100^{0}F. As mild as the summer was, high temperatures of 100^{0}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 January when the thermometer dipped to 26^{0}F. This is a normal low temperature in any given year in the Imperial Valley.

In 1993 the Imperial Valley received a whopping 5.84 inches of rainfall. This amount of precipitation exceeded the yearly average of 2.87 inches by 2.97 inches, more than twice the normal amount. Excessive rainfall such as this is not welcome in the Imperial Valley. In addition to causing logistical problems for farmers, there is actual property damage as well as crop loss from the excessive wet periods and flood waters. Excessive precipitation has also caused an overall rise in the Sea's elevation by .55 of a foot which is causing considerable erosion to sea walls and dikes.

During the course of the year the Sea fluctuated from -227.52 feet in January to -225.92 feet in May (a gain of 1.6 feet) to -226.97 feet in December (an overall gain of .55 feet). This increase is considered to be of great significance as it has essentially raised the overall level of the Sea which leaves even less room for runoff in 1994. This trend is expected to reverse itself in the future as weather patterns return to normal and increased water conservation efforts reduce the amount of irrigation runoff entering the Sea.

Despite the current increase in the Sea's elevation, it is still believed that planned reductions in irrigation tailwater/runoff will cause an eventual lowering of the Sea with 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.

Table B.l Salton Sea NWR Weather Summary 1993'

Month	High Temp.	Low Temp.	Precipi-tation	Evapora-tion	Elevation of Sea
January	74°	26°	3.14	2.06	-227.52
February	77°	39°	0.98	3.49	-226.70
March	90°	40°	0.17	6.18	-226.40
April (1)	100°	45°	0.00	9.57	-226.12
May (6)	101°	52°	0.02	11.49	-225.92
June (22)	114°	58°	0.00	13.90	-225.95
July (31)	112°	63°	0.00	13.55	-226.10
August (28)	118°	66°	0.76	13.10	-226.35
September (21)	114°	56°	0.00	10.17	-226.58
October (6)	106°	47°	Trace	7.78	-226.84
November	85°	35°	0.77	3.89	-226.96
December	76°	28°	0.00	3.03	-226.97
Yearly Totals			5.84	98.21	.55 gain

'Weather data (from Imperial Irrigation District at Calipatria, CA)

C. LAND ACQUISITION

2. Easements

The Morton Bay proposal discussed in the 1991 narrative was initiated during the course of the year. Initially, it was believed that the Imperial Irrigation District would donate the parcel to the refuge. However, this did not prove to be feasible so the emphasis was switched to creating an easement whereby IID retains title to the land while the refuge takes over the management. Although all the bugs were not worked out in 1993, the process is well underway and is expected to become finalized early in 1994.

3. Other

The 240-acre CalTrans Tract was submitted to Washington for acquisition this year (see the 1992 narrative for details). By the close of the year final approval still had not been received although the refuge has been managing the area for green browse production since mid-summer. This area will continue to be managed by the refuge under the assumption that it will become a part of the refuge system in the near future.

Surplus military lands again entered the picture as possible acquisition to the refuge. The several thousand acre Salton Sea Naval Test Base on the west side of the Salton Sea was offered to the refuge. This area had been offered in the past but was turned down because of the unknown toxicants which may or may not be present. However, this time the FWS expressed a serious interest in obtaining the area because of the unique sand dune

system present as well as the proposed listed Flat-tailed Horned Lizard. Realty was notified of the available habitat with a request to obtain it as part of the refuge. Initial reaction was favorable and Cathy Osugi from our Portland Office made an initial inspection of the area in December. Hopefully, this issue will become finalized in 1994 and become a welcome addition to the Salton Sea National Wildlife Refuge.

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.
ss #579 WRR 1/22/93

D. PLANNING

2. Management Plans

The initial Integrated Pest Management (IPM) Plan was drafted in 1993. The IPM plan documents the need for pest management relative to meeting objectives and brings together management options for controlling pests. Other plans receiving attention were the Law Enforcement Plan and a Facilities Maintenance Plan.

Another plan identified for revision in 1993 was the Safety Plan for the refuge. Although the initial thought was to simply update the existing plan, further examination of the outdated nature of the existing plan combined with the consideration of the need to include the Coachella Valley Unit in the revision dictates that a more substantial and comprehensive effort will be required.

3. Public Participation

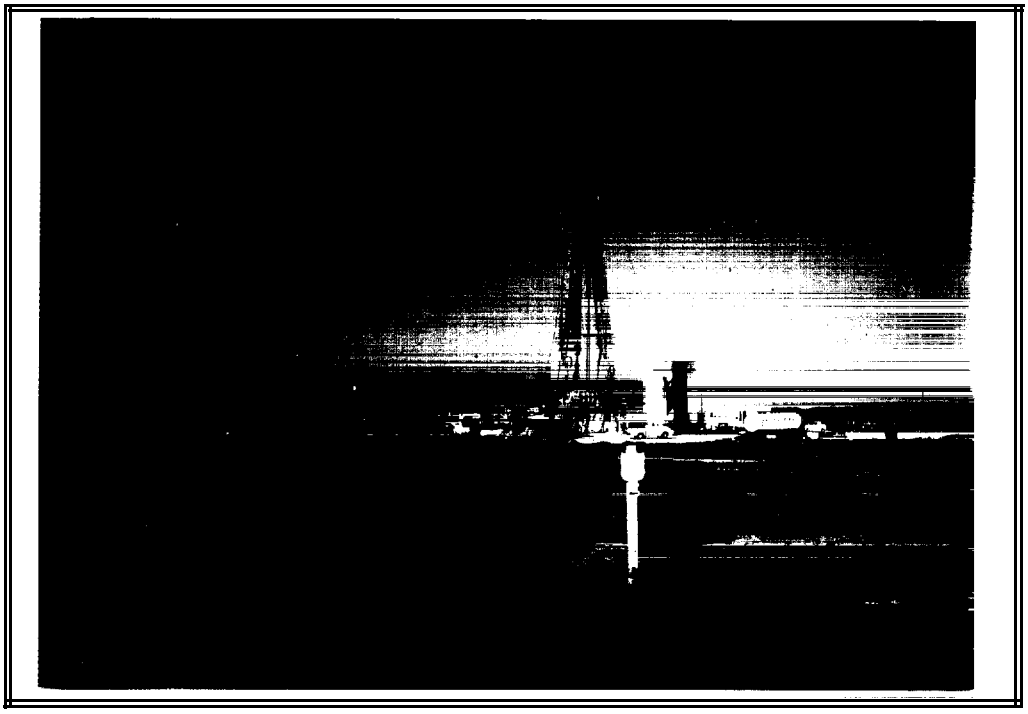
No formal public meetings were conducted this year. However, refuge participation in meetings with the Imperial Waterfowl and Wildlife Habitat Association has proven to be a positive forum for exchanging ideas,

providing answers and gaining input from the hunting sector of the public, many of whom have had a lack of knowledge and significant levels of misinformation in the past.

4. Compliance with Environmental and Cultural Resource Mandates

An Environmental Assessment for chemical use on the refuge was prepared in conjunction with the Integrated Pest Management Plan. This EA was completed in August and submitted to the RO for approval. The completion of this EA brought the refuge into compliance with the current policy of limited or no chemical use. It recognized the need for certain pesticides such as malathion to control alfalfa weevils which could destroy our winter feeding program for upwards to 25,000 white geese if left unchecked.

An emergency Section 7 was also completed this year to allow increased pumping from the Pumice Drain adjacent to Headquarters. Increased runoff and the elevation of the Sea caused the drain to no longer be effective. In order to correct this problem the Imperial Irrigation District proposed to add a battery of two new pumps at the confluence of the Pumice and Vail 4 Drains. These pumps could have had an adverse effect upon Desert Pupfish thus prompting the Section 7. The Carlsbad office did an outstanding job reacting to our request of a Section 7 and had the issue resolved within two weeks. Fortunately, there was no problem with the pupfish identified and the approval to go ahead with the pump installation was granted.



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. SS #6912 WRR 1992

5. Research and Investigations

Several studies were conducted on the refuge this year, including continuations of the previous year, as well as the Phase Iv data collection

portion of the Irrigation Drainage Program for the Salton Sea Area which is funded by the Bureau of Reclamation.

This program focuses on drainwater and its impacts on the Salton Sea and its wildlife. The program is carried out cooperatively by BOR and the USFWS with actual work being conducted by both Refuge personnel and Ecological Services (Contaminants) personnel. During the course of the year, Refuge personnel collected 76 addled eggs from ardeid colonies, 45 Black-necked Stilt eggs and monitored a Black-necked Stilt transect. Deformities were detected in two Great Egret eggs. All data resulting from these field studies was submitted to the Carlsbad Ecological Services Office for cataloguing, lab analysis and data interpretation.

Salton Sea NR90 - "Evaluation of contaminant effects on Burrowing Owl reproduction" (11630-9003)

Burrowing owl (Speotvto cunicularia) populations are generally believed to be declining over much of their North American range and especially along the coastal slope of California. The factors believed responsible are habitat loss due to increased urbanization, ground squirrel control and changes in farming practices. In the Imperial Valley, this species appears to be relatively abundant; however, a number of potential threats exist that may adversely impact the local population, including ditch maintenance activities, ground squirrel control and agricultural pesticide use.

In 1992 an investigation of burrowing owl reproductive success with respect to contaminants was initiated with the construction of artificial burrows. Other aspects of the study included nest site and pair fidelity and population recruitment.

In 1993 ten additional burrows were constructed to provide a total of 30 artificial nest sites established on refuge lands. Twenty-five of the 30 burrows appeared to be attended by adult owls from May through July, and as such were considered active. Eggs were documented from 17 of the 25 active burrows. A total of 45 owls were banded; 43 juveniles and two adult females. Addled eggs from five individual burrows were collected for future contaminants analysis. In addition, feather samples (one tail and four breast) were collected from 27 owls and forwarded to Clark Winchell, U. S. Navy Natural Resources Office, for use in his study of the genetic origins of disjunct populations of burrowing owls.

Life history and dispersal information were also collected this year. One female, banded during the previous year as an adult, was recaptured in a different burrow located approximately 400 m south of her original burrow. A first-year owl, banded as a hatchling in the previous year, bred successfully this season and produced a brood of five. This bird had dispersed approximately 100 m to the northeast of its natal burrow.

Potential predators of the Imperial Valley population include coyotes, raccoons, spotted skunks, gopher snakes and rattlesnakes. Black widow spiders and harvester ants have been observed within burrows.

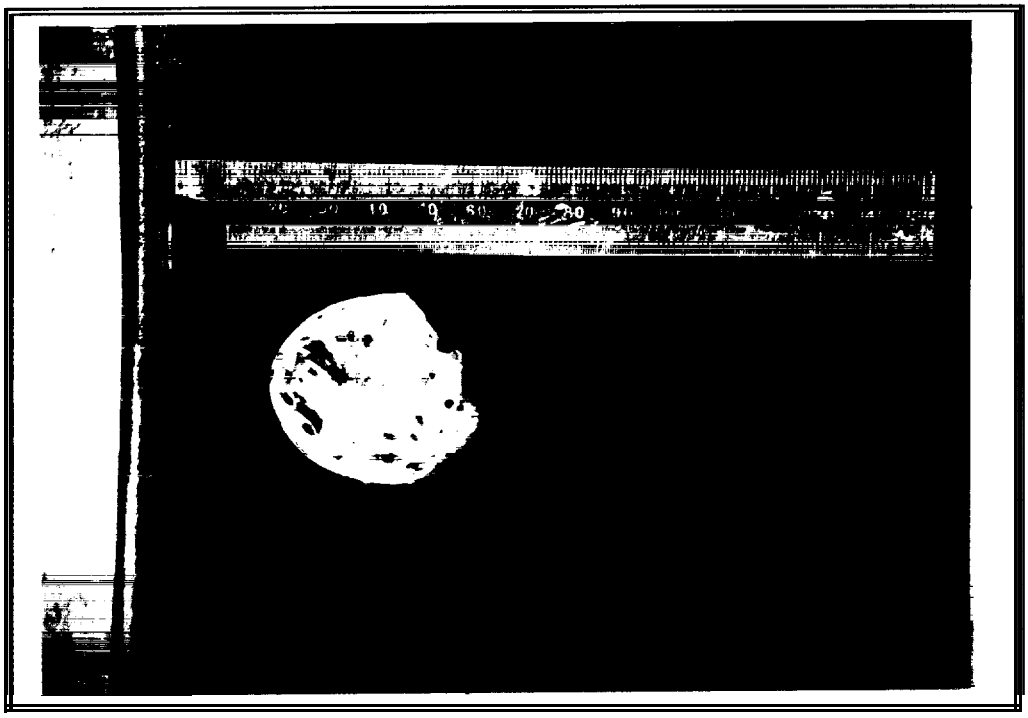
Salton Sea NR91 - "Aspects of the reproductive biology of the Gull-billed Tern (Sterna nilotica vanrossemi)" (11630-9103)

Researcher (and Biological Technician) Kathy Molina reported that the reproductive status of the gull-billed tern for 1993 appeared to be improved over the 1992 season. An estimated 120 pairs were present at four sites; local nesting success was widely variable. A minimum of 170 nesting attempts were documented and 84 chicks were banded. A gull-billed tern banded in 1986 by refuge personnel was recovered on Mullet Island, providing additional information on longevity for the species. Threats to

this small nesting population continue, (e.g. lack of secure nesting habitat, the presence of abundant mammalian predators and the overall health of the Salton Sea ecosystem) despite the cooperative efforts of the Imperial Irrigation District and the Salton Sea NWR to actively maintain nesting habitat at Morton Bay. Thirty-two nests were established by April 30 at the Morton Bay site, but the entire colony was abandoned some 14 days later, just as hatching was commencing in some nests. The cause(s) of colony abandonment are unclear. Morton Bay was re-colonized by black skimmers later in the nesting season.

Salton Sea NR91 - "Impacts of selenium and DDE on the endangered California Brown Pelican and other piscivorous birds at the Salton Sea NWR" (11630-9102)

The black skimmer (Rynchops niger) was selected as the focal species for the 1993 phase of the continuing investigation on the reproductive success of piscivorous bird species nesting at the Salton Sea. This study was funded and conducted in conjunction with the Carlsbad Ecological Services Office. Initially, one egg was sampled from each of 48 nests that were monitored on a weekly basis for hatching success. The resulting analyses of contaminants in black skimmer eggs, when complete, may then be correlated with the hatching success of the remaining clutch. Of the total number of nests monitored, 46% were considered successful and 15% unsuccessful. Hatching success could not be determined for 39% of the nests. A total of 231 black skimmer young were incidentally banded under Technician Molina's banding permit.



A soft shell caused this black skimmer egg to collapse rendering it non-viable. SS #8826 KM 7/94

A significant number of eggs laid at the Morton Bay colony appeared soft-shelled. When turned, the undersides were noted to be concave, rendering these eggs non-viable. The incidence of gross physical abnormalities in

chicks was rare for all colonies. A single chick hatched at Obsidian Butte had clubbed feet and was retained for analysis. Several nearly-fledged juveniles at the Johnson Street colony were observed with an abnormal folding of the wing and eroded or absent primary tips. The carpal joints of these birds also appeared bruised and edematous. This condition may have resulted from trauma that occurred as chicks fled from intruders and collided with the many natural obstacles (shrubbery, flotsam) present at this colony site. Several of these young were also retained for analysis.

The post-breeding dispersal of black skimmers nesting at the Salton Sea is not well known. It is presumed that this population moves south in fall and winters along the coast of west Mexico. Interestingly, a first-year bird banded at the Salton Sea was repeatedly observed within a flock of black skimmers wintering at Seal Beach in coastal southern California. This is the first such documentation of dispersal from the interior to the coast for this population.

Because black skimmers nest in proximity to gull-billed terns, the threats to these two unique interior-nesting populations are identical.

Telemetry of Northern Pintail

Refuge personnel once again cooperated with the Northern Prairie Wildlife Research Center, Dixon, California in the reconnaissance of radio-transmitter equipped pintail. Surveys of areas with high concentrations of ducks were accomplished by Operations Specialist K. DesRoberts with equipment supplied by the USFWS San Joaquin Valley Pintail Project. Two radio transmitters were recovered, both on harvested females. No other transmissions were received.

The status of wintering Sandhill Cranes in the Imperial Valley

In 1993 a maximum of 327 Sandhill Cranes were observed on November 20. Regular roost sites were located on private hunt properties referred to as D & K and Ostercamp duck ponds. These roost sites are located in vicinity of Keystone and Harris Roads on the north and south and Highway 111 and McConnell Road on the east and west. Sandhill Cranes have been consistently observed in this area since at least 1985. Roost site censuses were accomplished by K. DesRoberts, K. Molina and volunteer K. Garrett from early November 1993 through early February 1994. A count of 327 cranes in November 1993 is comparable to a maximum count of 299 for a similar time period in 1992 suggesting a stable wintering population for known roosting locations in the Imperial Valley. A visit in early December yielded not a single crane, suggesting that the birds are using alternate and as yet unknown roost sites.

Important foraging areas within the valley are not clearly delineated; several hundred cranes were noted foraging in the area west of Forrester Road and bordered on the north and south by Blais and Imler Roads. Alfalfa was under cultivation here while other nearby fields lay fallow, but flooded.

Institute for Bird Populations Burrowing Owl Census

Intensive burrowing owl surveys were conducted throughout the Imperial Valley in cooperation with the Institute of Bird Populations' efforts to census the entire state of California in 1993. Censusing took place from June 9 through July 15 by Wildlife Biologist M. Radke and on June 28 and 29 by K. DesRoberts. Results were: 423 adults observed in an estimated 378 pairs, and 108 juveniles observed.

The status of ardeid nesting colonies at the north end of the Salton Sea

Researcher Norm Hogg of Santa Monica College provided a summary of the reproductive status and banding effort that took place at several heron and egret rookeries located at the north end of the Sea. Mr. Hogg has been active in studying these colonies for the last 10 years. Estimates of the minimum number of breeding pairs of various species are listed below. The number of young banded during the period 25 June - 19 July are also included. Banding activities were terminated prematurely due to the unfortunate theft of both boat and banding gear. Nesting colonies were located at the terminus of Johnson Street and 76th Avenue, Riverside County.

SPECIES	NO. OF PAIRS	NO. YOUNG BANDED
Great Blue Heron	9	4
Great Egret	127	40
Snowy Egret	455	231
Black-crowned Night Heron	121	78
Cattle Egret	35	55

Species composition, relative abundance and timing of migratory and seasonally resident bird species utilizing the Salton Sea NWR HQ in fall and winter, 1993-94

Biological Technician Molina initiated a mist-netting study in the fall of1993 to determine species composition, relative abundance and timing of migratory and seasonally resident passerines moving through the Colorado Desert region. The effects of diminished wintering and breeding habitats throughout North and South America on migratory bird populations are of increasing concern to ornithologists and ecologists. A methodology of standardized effort and net placement can provide a useful index of avian diversity and relative abundance on refuge lands. It can also provide information on the timing of migration and geographical origin (by subspecies) of neotropical migrants. This index may then aid in the identification of important habitats and in the development of guidelines for vegetation enhancement to provide quality habitats for neotropical migrants and residents.

The fall season is arbitrarily defined as the period of August through October, although mist-netting had not commenced until mid-September. The winter period is also arbitrarily defined as November through February. These season breaks are appropriate for the general pattern of movement for most migrants encountered here. A total effort of 241 net-hours yielded the capture of 194 individuals, representing 17 species of passerines during the fall and winter period. Ten of these species can be considered neotropical migrants, i.e., those species (or populations of species) that winter south of the U. S. border, and are listed below.

Long Distance	Short Distance
Yellow Warbler	Audubon's Warbler
Chestnut-sided Warbler	Orange-crowned Warbler
Gambel's White-crowned Sparrow	Song Sparrow spp.
Ruby-crowned Kinglet	Lincoln's Sparrow
	Savannah Sparrow
	House Wren

The classification of long or short range migrant is a general one; for many subspecies, winter ranges are not well delineated. Based on available information, the above species are grouped according to the best overall description.

The most abundant migratory species in fall and winter are Audubon's warblers and Gambel's white-crowned sparrows, forming the majority of the winter resident population at refuge headquarters. The chestnut-sided warbler is noteworthy as it is one of relatively few records for the Salton Sea region. A complete species list is found in Section G.16.

Nets were attended by Biological Technician Kathy Molina, General Biologist J. Tinsman (Hopper Mountain NWR), Volunteer K. Garrett and SCA Volunteer K. Coffey.

E. ADMINISTRATION

1. Personnel

Numerous personnel changes took place at Salton Sea during 1993. Kathy Molina was hired in April to help with toxicant monitoring projects. Kathy was especially helpful in collecting and cataloguing addled eggs from piscivorous bird nesting colonies. Robert Berryman was hired in June to help out with routine housecleaning chores which always seem to drop to the lowest rung on the current list of priorities.

In September, Wildlife Biologist Bill Radke accepted the Project Leader's job at Bitter Lake National Wildlife Refuge in eastern New Mexico. Although this was a well-earned promotion as well as a golden opportunity for Bill, he was sorely missed very shortly after his departure in September. In addition, when he left he took his wife Marcia who also served as our Private Lands/Technical Advisor, Environmental Assessment Specialist, Ornithologist, Plant Taxonomist and general all around good person. The loss of both these folks at the same time came as a real blow to remaining staff. Although I am not ready to forgive Nita Fuller for doing this to us, everyone here wishes Marcia and Bill the very best for their new assignments in Region 2.

Shortly after the Radkes departed our administrative person Kathy Arnett announced that she had finally sold her home and would soon be leaving. Kathy's husband had retired from the State of California over a year before and had planned to move to the San Luis Obispo area as soon as they could break ties in Imperial County. Kathy departed Imperial County with our best wishes for a full and happy retirement, she was an invaluable person who was missed immediately.

Staffing Levels at Salton Sea NWR

	Permanent		Temporary		Total
	Full time	Part time	Full time	Part time	FTE
1993	8	0	2	2	11.0
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	15.0

Salton Sea Staff (left to right): Back Row 10, 6, 8, 7
ss #617 (1/11/93) Middle Row 1, 2, 3
Front Row 5, 4, 9

1. **Clark Bloom - Refuge Manager GS-485-12 PFT**
2. **Daniel Dinkler - Primary Assistant Refuge Manager GS-485-11 PFT**
3. **William Radke - Wildlife Biologist GS-486-11 PFT**
   Transferred 9/2/93
4. **Kathleen Arnett - Administrative Support Assistant GS-303-6 PFT**
   Resigned 10/1/93
5. Sandi **Harris - Administrative Support Assistant GS-303-5 PFT**
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**
   Resigned 9/2/93
10. **Mark Marquez - Maintenance Mechanic Helper WG-4749-5 TFT**

Not Pictured

Kathy Molina - Biological Technician GS-485-4 TPT EOD 4/3/93

Kevin DesRoberts - Refuge Operations Specialist GS-485-7 PFT EOD 2/7/93

Robert Berryman - Laborer WG-2 TPT EOD 6/28/93

Kelly Chapin - SCA Volunteer 10/2/92 - 1/31/93

Kenneth Sturm - SCA Volunteer 2/1/93 - 5/1/93

Amy Goodwin - SCA Volunteer 6/15/93 - 8/31/93

Kim Coffey - SCA Volunteer 10/1/93 - 12/31/93

2. Youth Programs

The Salton Sea Complex again hosted an eight-week non-resident Youth Conservation Corps (YCC) Camp, located at the Coachella Valley NWR. Crew leader Amy Goodwin (SCA volunteer) and the Refuge Operations Specialist DesRoberts were primarily responsible for the camp. Amy was acquired through the SCA program when extensive advertisement failed to fill the Social Service Assistant position. Six enrollees were hired, but three failed to show up and one quit after the first day of work.

The 1993 YCC Crew:(right to left) A. Goodwin, D. Inderwiesche, B. Ureste, A. Ramos, A. Delagarza and L. Harris. SS #2023 KJD 7/93

The enrollees stationed at Salton Sea NWR assisted the crew at Coachella on numerous projects and completed important projects at Salton Sea. These included cleaning and organizing refuge storage facilities, noxious weed removal, boundary posting, maintenance of hunting blinds and access trails, yard work/cleanup, water reservoir and cistern maintenance and assisting maintenance workers on irrigation projects. Maintenance worker Mark Marquez assisted in supervising enrollees and was vital to the success of the program.

Environmental awareness activities were conducted about once a week and included visits to museums, parks and zoos. Most visits included a narrative or tour given by the crew leader or museum/park personnel. Due to transportation problems, enrollees at Salton Sea were not able to participate with the Coachella crew in all field trips, and were taken on environmental awareness trips by refuge staff instead. These included a tour of Sweetwater Marsh, a kayak trip to observe colonial bird nesting ecology on Salton Sea, a visit to Salton Sea Naval Base for education on the blowsand ecosystem and capturing and banding of caspian terns and black skimmers.

YCC enrollees Lance Harris and Angel Ramos helping Biological Technician Kathy Molina band caspian terns on Mullet Island, Salton Sea. SS #8845 KJD 07/23/93

Accounting Data:

Appraised value of program:	$14,147.25
Paid enrollee hours:	1,532.30
Total cost of program:	$12,098.13

Cost to benefit ratio = $\frac{14,147.25}{12,098.13} = 1.17$

3. Other Human Resource Programs

Crews from the California Department of Forestry's McCain Valley Conservation Camp contributed their effort on thirty occasions in 1993. Under a Challenge Grant agreement, fire crews from the conservation camp performed labor-intensive projects before the start of the fire season. Fire crews averaging fifteen members in size performed ditch maintenance, landscaping, and painted the headquarters building for a total of about 1800 hours of work. One problem with the McCain Valley crews, however, is the time they lose due to travel, resulting in a four hour work day, at best.

4. Volunteer Program

The volunteer program was more active in 1993 than in recent years with four Resource Assistants from the Student Conservation Association (SCA) combining with a total of five other volunteers. SCA Resource Assistants contributed a total of 976 hours during the course of their twelve-week tours of duty and the five other volunteers contributed 196 hours, combining for a grand total of 1172 hours of volunteer effort.

The four SCA volunteers who lent their able assistance to refuge operations in 1993 were Kelly Chapin, Kenneth Sturm, Amy Goodwin and Kim Coffey. Kelly's SCA term ran from November, 1992 through January, 1993 giving her 120 hours of volunteer time in 1993. Ken Sturm's twelve week term ran between February and April, totaling 480 hours. Amy Goodwin took on the atypical task of "field facilitator" for the summer Youth Conservation Corps program and spent the majority of her time with the crew at Coachella Valley NWR (efforts to hire a Social Services Assistant from the Coachella Valley area were unsuccessful). Kim Coffey split her tenure between fall 1993 and winter 1994, with 256 hours contributed in calendar year 1993.

As mentioned, SCA Goodwin's efforts were primarily aimed at supporting the needs of the Coachella Valley-based YCC program; she deserves a lot of credit for hanging in there for the entire duration of the program, especially considering the extremely hot working conditions in the field, putting up with the YCC enrollees and successfully dealing with being geographically isolated from the rest of staff most of the time. Only 120 hours of Amy's 480 total were spent at Salton Sea.

Resource Assistants Chapin, Sturm and Coffey assisted refuge operations by handling most of the environmental education activities, staffing the visitor contact station on weekends, and assisting with the biological program and clerical duties. Coffey also developed a position description for her "Refuge Operations Assistant" position and worked up a "volunteer checklist" of items and actions needed for new recruits, which is also helpful for newly hired staff as well.

Other "regular" volunteers (and hours contributed) consisted of Kimball Garrett (120), Marnie Crook (48), Mike Sifling (13), Wanda Spot (12) and Jim Miller (11). Mr. Garrett is a noted ornithologist and contributed his time in support of the biological program, as did Ms. Crook. Volunteers Sifling, Miller and Spot provided assistance on a variety of projects, including signing efforts, trail maintenance, electronic mail and bird banding.

As the volunteer program grew, an effort was made to cluster volunteer support on one weekend a month, thereby gaining a multiplier effect for the refuge staff member supervising/facilitating the volunteer efforts.

Primary Assistant Dinkler provided the majority of volunteer program oversight...yet another of those collateral duties on refuges that we all love. This program has the assistance of a capable SCA volunteer trained and experienced to the point that they can in turn oversee the activities of other volunteers.

5. Funding

The overall funding levels for the Salton Sea Complex for FY93 were sufficient to get us through the year although things were a bit "tight" at times. All FTE's were filled at least for a portion of the year. However, several badly needed maintenance projects as well as vehicle/equipment replacements went unfunded for the year. Our MMS backlog is getting larger instead of smaller.

Table E.l Funding Levels for the Salton Sea Complex in the past five years

ACTIVITY	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993
1260 O&M	445,600	562,500	570,000	573,500	540,000
7201 (Coachella)[1]	22,000	21,600	13,600	7,400	7,000
Fire Funds (91xx)	700	1,000	2,200	2,000	1,000
MMS[2]	140,000	50,000	92,600	135,000	94,000
TOTAL STATION FUNDS	1608,300	1635,100	1678,400	717,900	642,000

[1] 7201 funds are derived from a trust administered by the Nature Conservancy. 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] MMS funds for FY93 included a new cultipacker, a new grain drill, a new pickup and funding for rehabilitation of the irrigation system.

6. Health, Safety and Wellness

The station safety program is headed up by a designated Safety Officer and three person safety committee who serve on a rotational basis. Primary Assistant Dinkler was officially tabbed with the collateral duty Safety Officer title in mid 1993, while the Safety Committee was made up of Marcos Orozco (Chairman), Sandi Harris, and Mark Marquez. The single year tenure of the safety committee was extended beyond mid-1993 to maintain continuity in completing ongoing projects that had not been finalized. Monthly safety meetings were conducted by all staff members on a rotational basis.

Some accidents and Workman's Compensation Claims were experienced in 1993. Three accidents occurred: Laborer Robert Berryman was backing up in an S-10 pickup when he opened the door and impacted a stationary object, inflicting substantial damage to the door and front quarter panel; Mechanic Lee Laizure suffered irritation and an infection in one eye as a result of a cement mixer spitting its mixture out into his face, around his glasses into one eye; and Equipment Operator Marcos Orozco suffered a torn knee ligament when bending his knees to work on the new interpretive trail at

Unit 1. Orozco's knee injury eventually required corrective surgery (in 1994).

Workman's Compensation disability claims relating to physical conditions resulting from their occupations were filed by Mechanic Laizure for hearing loss (from working around loud noises) and Equipment Operator Richard Marquez for lower back problems (from operating equipment). The cases are still pending review by the Department of Labor.

The station safety program received considerable attention in 1993. Regional Safety Specialist Gary Wilson made a station visit on June 8 and provided the staff with a good introduction to the new Service Hazard Communication (HAZCOM) Program. Gary also conducted an informal safety inspection and provided us with a list of items that we needed to work on to attain compliance with safety standards. Although the station was generally in pretty good shape, the following safety program-related deficiencies were identified:

-designate station Safety Officer
-update station Safety Plan
-document monthly safety meeting attendance and content
-correct miscellaneous electrical situations
-guard machinery properly (pulleys, belts, etc.)
-rewire power tools with automatic shutoff circuit
-stop all work on vehicle brakes (asbestos memo to staff generated)
-upgrade smoke detectors in residences
-upgrade housekeeping "across the board"
-conduct self-inspections regularly (safety committee)
-anti-slip strips were placed on observation platform steps and storage room stairway
-implement HAZCOM program for station

Considerable time, effort and funding went into correcting the deficiencies. An additional measure of motivation was generated when we were put on notice that the national safety inspection team would be conducting an on-site review in December. However, the formal inspection was later canceled indefinitely.

The new HAZCOM program was implemented with emphasis on labeling all containers, upgrading waste oil product storage and disposal, and cataloging material safety data sheets for potentially hazardous chemicals in the work place. Laidlaw Environmental Services helped the cause and provided free disposal of old oil drums and other "hazardous" items.

Much media attention and controversy were created in 1993 when the Environmental Protection Agency proclaimed that the water supplied by Imperial Irrigation District irrigation ditches was unfit for human consumption. Of course, the refuge water is supplied by just such a ditch which was only recently converted from dirt to concrete (in late 1992). After a lot of battling, it was finally determined in essence that IID delivers irrigation water, not drinking water, although many rural residents use that irrigation water for their domestic supply. On a health and safety-related note, all three of the water quality tests conducted on drinking water produced by the refuge water treatment systems were negative for bacteria. However, it is believed that the refuge water system does provide something of an "elixir" as far as a mineral supplement is concerned.

Refuge Officers Orozco, Radke, Bloom and Dinkler attended CPR Training at Imperial Valley College on January 26; hearing tests were conducted for staff members exposed to loud noises on 11/16 at Valley Hearing Consultants in Palm Desert; effort went into developing a draft Emergency Plan by the

Sandi alone to deal with the end of FY budgeting and all other clerical and front office administrative tasks.

Primary Assistant Dan Dinkler attended monthly meetings of the Federal Executive Board at the El Centro Naval Air Facility and the Imperial Waterfowl and Wetland Habitat Association (IWWHA). Dinkler also attended the national Integrated Pest Management (IPM) meeting at Sacramento NWR the first week in December and presented a brief slide show on IPM relative to the refuge farming program.

Project Leader Clark Bloom was active in the newly formed "Salton Sea Authority", a joint power agreement between Imperial and Riverside Counties as well as the Coachella Valley Water District and Imperial Irrigation District. This action came about as a result of the old "Salton Sea Task Force" becoming inactive in 1992. Since Bloom could not become a member of the Authority he was asked to serve on the Technical Advisory group which meets monthly. Bloom was active in the Imperial County Fish & Game Commission which meets monthly to discuss problems and make recommendations and/or resolution which many times include funding. Bloom also attended all Coachella Valley Preserve work group meetings.

Eduardo Carillo, Professor at the National University in Heredia, Costa Rica, visited the refuge as part of an international training/exchange. program with the FWS and State Department. Professor Carillo, accompanied by General Biologist Jeanne Tinsman from Hopper Mountain NWR, spent the last week in October with us and received a good overview of refuge operations and even some hands on activities in the field.

An effort was made to have one of the bilingual hispanic members of the Salton Sea staff accompany Professor Carillo throughout the week. He took a particular interest in our hunting program and also presented two programs to Brawley School System gifted and talented fifth and sixth grade classes concerning conservation efforts in his native Costa Rica.

F. HABITAT MANAGEMENT

1. General

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 spp.), swamp timothy (Heleochloa schoenoides), wigeongrass (Ruppia maritima), and other associated species. Sesbania (Sesbania exaltata) and salt cedar (Tamarix pentandra) remain serious weed problems

safety committee representatives; the regional Safety Office sent down videos on Blood Born Pathogens and Hazard Communication which provided good information on the subjects for all the staff, including volunteers; and finally, the need for drafting initial versions of both HAZCOM and Blood Born Pathogen Plans for the station has been identified and initiated.

7. Technical Assistance

The refuge has been contacted periodically by various interested parties concerning issues relating to the flock of 2-3,000 great basin Canada geese that winter in the San Fernando Valley area, located just north of Los Angeles. This history of technical assistance came to a head when a group involved with saving the Pierce Community College Farm requested a statement from the refuge pertaining to goose habitat needs that could be entered into court as "expert testimony", contending that the geese require the foraging habitat provided by the farm pasture.

After sending a draft letter to the RO for review and approval, we were directed by Refuges and Wildlife to redirect this and all further such requests to Ecological Services, due to their increased budgetary capability to handle such requests. Hopefully, the needs and interests of the wildlife resource and positive public relations/outreach aspects of such requests will be given adequate attention by our counterparts in Ecological Services.

8. Other

The following meetings, training sessions and activities occurred in 1993:

Refuge Officers Marcos Orozco, Bill Radke, and Clark Bloom (February session) and Dan Dinkler (April session) attended 40 hours of mandatory Law Enforcement Refresher Training at Marana, Arizona. All four officers were recertified in Pressure Point Control Tactics (PPCT). Requalification' sessions were also conducted with BLM firearms instructors on May 17 and again with SRA Farrington August 31.

The refuge staff attended Defensive Driver Training on May 18th. The one day session was conducted with the gracious cooperation of IID Safety Officer Ed Lindsey.

Refuge Officers Orozco and Dinkler had the dubious pleasure of assisting the California Department of Fish and Game with of cleanup effort involving "funny ducks" infected with the virulent pathogen Duck Virus Enteritis (DVE) in the Venice Beach area west of Los Angeles. Two visits to the area were made by the pair to participate in cleanup work groups with CDF&G personnel June 9-11 and June 14-17. Both were rewarded with Special Act Awards in the amount of $100.00.

Equipment Operator Marquez made a road trip with the truck tractor in May. Irrigation pipe from Havasu NWR was hauled up to Modoc NWR, and the earthmover that Modoc had borrowed was brought back from Alturas. Richard also provided his dozer operator skills at the request of the Southern California Complex in annual dune restoration work at Tijuana Slough.

Three Regional Office support personnel visited the refuge for their first time this year. Fire Management Officer Andy Anderson visited the refuge on June 7, followed by Safety Specialist Gary Wilson on June 8. Toni Cherry came down from Refuge Operations Branch in Portland to lend her considerable administrative expertise in providing much needed administrative training to our Clerk Sandi Harris the week of July 12th. Cherry's visit focused on budgeting procedures in preparation for the departure of Administrative Support Assistant Kathy Arnett, which left

Sandi alone to deal with the end of FY budgeting and all other clerical and front office administrative tasks.

Primary Assistant Dan Dinkler attended monthly meetings of the Federal Executive Board at the El Centro Naval Air Facility and the Imperial Waterfowl and Wetland Habitat Association (IWWHA). Dinkler also attended the national Integrated Pest Management (IPM) meeting at Sacramento NWR the first week in December and presented a brief slide show on IPM relative to the refuge farming program.

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in moist soil units. All seasonal ponds on the refuge are used as nesting areas by black-necked stilts, American avocets and killdeer.

For the second year in a row, intensive flooding occurred at the Hazard Unit. A series of rainstorms moved through the Imperial Valley in January with very heavy rains occurring on January 16 and 17. The resulting runoff was sufficient to cause the Alamo River to breach it's banks and cause serious flooding of the Hazard Unit. This flooding continued for several days causing a complete disruption of normal-pond management. The Alamo River finally subsided enough by the end of February to permit repair of the breached river bank by the Imperial Irrigation District. The final repairs were completed by the end of March and should provide us with sufficient protection from future floods. (See Section I.2 for details)

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. SS #1091 WRR 1/22/93

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 A1, A2 and B1.

Bulrush germination in the remaining seven ponds was spotty with the best growth being limited to the intake ends of the ponds. This indicates that continued leaching of these ponds will be required to ensure maximum food production in the future. Ponds B4 and B5 had little to no wetland plant germination, but still provided large numbers of invertebrates. Flooding of the ponds was accomplished throughout the winter beginning in late September. Actual flood-ups were staggered, thus providing maximum benefits to waterfowl by ensuring ample food throughout the winter months.

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 bulrush/cattail habitat for Yuma clapper rails. Nesting was documented although actual numbers are unknown.

Ponds 1 and 2 were reflooded in early fall and provided food and resting habitat for numerous snow geese, Ross' geese, pintail and many other waterfowl species.

The flood event in early January completely inundated most of the ponds in the Hazard Unit causing extensive damage to the dikes. This damage, and the subsequent repairs caused a severe disruption of the normal moist soil management program for this unit. As a result, there were only limited amounts of bulrush and swamp timothy produced in Ponds 3, 4 and 5. Ponds 6, 7, 8, 9, 10 and 11, which were essentially unaffected by the flood, produced significant amounts of food. Ponds 1, 1A, 2, 2A and 3A have highly alkaline soils and do not produce much vegetation. However, when these ponds were flooded they produced tremendous midge and corifid populations which were utilized by various waterfowl and shorebirds. The shallow water also provided loafing areas for curlews, avocets, godwits and numerous 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 and fulvous whistling ducks 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 salt cedar 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 salt cedar. Weeds were controlled in these ponds through the use of herbicides or by discing, and large salt cedars were removed from all pond edges by bulldozer. Ponds 10 and 11/12 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 lo-acre Union ponds remained shallowly flooded throughout the year, and were managed as permanent ponds to provide emergent vegetation and an invertebrate prey base 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 Pond 2, one of the nicest permanent ponds on the refuge, was pulled down during the summer months to enhance cattail production along the pond's edge. This pond responded well and its shoreline is now excellent habitat for Yuma Clapper rails and numerous other species of water/marsh birds.

Shorebirds feed in mudflats created by drawing down refuge impoundments. SS #1251 WRR 1/92

Headquarters Ponds 3 and 4 were drawn down in the spring and then reflooded in the fall. Vegetative response was poor but invertebrates did well and proved to be an abundant food source especially for shorebirds.

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

Refuge tree rows managed for native species and biodiversity fall into this category. Species planted include mesquite (honey and screwbean), palo verde, sweet acacia and quailbush. Tree rows are located at both Unit 1 and at the Union Tract near Headquarters. At Unit 1 fields 256 (N. Johnson), 257 (C Tract), and 310A (Reidman) have tree rows. At the Union Tract fields 419, 420 and 421 have tree rows.

The 421, 256 and 310A tree rows are well-established, while the 257, 419, and 420 rows have spotty or poor growth. Additionally, all of the tree rows are planted in a narrow, linear orientation. Wildlife and habitat objectives could be better met if all of the tree rows received additional plantings to add density and width, perhaps even converting additional portions of the adjacent field at each tree row to native woody species.

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 thirteen individual fields comprising 1067 acres were farmed in 1993. Acreage figures include four fields totaling 255 acres at the Union Tract (near refuge headquarters) and nine fields totaling 812 acres at Unit 1, including three fields at the 240 acre CalTrans tract managed through a "Right To Enter" agreement with the California Department of Transportation (CalTrans).

Significant activities in the refuge cropland management program during 1993 included the postponement and possible cancellation of CalTrans mitigation projects at Unit 1, several changes in the cooperative farming program, a major laser leveling project at the Union Tract Vail 4-419 and 420 fields, and another major project to divide and level the huge, sandy Flammang field Trifolium 16-310. Additionally, maintenance was performed on gates, ditches and the Vail 4-419 field tile line.

Several CalTrans-funded mitigation projects targeted for Unit 1 did not materialize as anticipated. The projects, including the conversion of 100 acres of croplands (80 acres to wetlands and 20 acres to native upland), the lining of the earthen portion of the 258 delivery to the A/B ponds, and the transfer of the 240 acre CalTrans tract of cropland to the refuge, were postponed indefinitely due to CalTrans' decision to realign the route of the Highway 86 project, thereby not impacting the habitat that they would have had to mitigate for following the original route. The way things stand currently, it looks as if the entire mitigation package may be a moot point for lack of necessity due to the realignment of the Highway 86 route. However, the refuge did receive a one year extension of the Permit to Enter for the 240 acre CalTrans tract; a vital element of the cooperative farming program at Unit 1.

Croplands at the refuge are managed by both force account and cooperative methods, and are summarized in Table F.l. The cooperative farming program was overhauled and reorganized in 1993, with all of Walt Slovak's operations moving to the Union Tract and John Benson signing on as a new cooperator at Unit 1.

A new aspect of the updated cooperative farming agreements was the provision that the refuge would purchase the irrigation water for cooperators, an adjustment intended to entice cooperators into sticking with the program in the face of ever-tightening restrictions on pesticide use, combined with the harmful effects of goose foraging pressure. Challenges to both cooperative and force account farming operations include insect infestations (silverleaf whitefly, Egyptian alfalfa weevil, blue and pea aphids, armyworms and cutworms) and weed infestations (including malva or cheeseweed, lambsquarter, pigweed and mustards, among others).

Table F.l Ma_nagement of Refuse Croplands in 1993

LOCATION	FIELD	GATE	ACRES	CROP: (SPRING/SUMMER/FALL)
Unit I	S. Johnson	T13 255	80	fallow/burn/barley
	N. Johnson	T13 256	100+	rye/Sudan/barley
	C Tract	T13 257	140+	wheat/fallow/barley & oats
	CalTrans S.	T13 257A		
	North	north	80**	wheat/Sudan/alfalfa
	South	south	80**	wheat/Sudan/alfalfa
	CalTrans N.	T13 258A	80**	wheat/fallow/alfalfa
	Reidman	T16 310A	80	wheat/fallow/wheat
	N1/2Flamang	T16 310	100+	fallow/sudan/fallow
	S1/2Flamang	T16 310	82+	wheat/Sudan/barley
	Flammang 20	T16 304	20+	alfalfa/fallow
Union Tract	419	v4 419	60*	wheat/fallow/rye
	420	V4 420	60*	wheat/fallow/wheat
	421	V4 421	55	spring wheat left standing
	461	V4 461	80*	alfalfa/Sudan/alfalfa

+ Cooperati ely farmed b John Bens n
* Cooperatively farmed by Walt Slovak
** Cooperators changed from Slovak to Benson after wheat harvested

With the implementation of the new cooperative agreements, cooperative. farmer Walt Slovak again shifted his farming activities from growing sudan and wheat at Unit 1 back to growing alfalfa, sudan and wheat at Union Tract fields Vail 4-420 and 461. Mr. Slovak also assisted with irrigation duties at all Union Tract fields, especially when those activities occurred outside the refuge staffs' normal tour of duty.

John Benson was recruited as a new cooperator in 1993, particularly for his status as a certified organic alfalfa grower. Mr. Benson planted fields to sudan in the spring and went to either alfalfa, oats or barley in late summer, prior to the arrival of the geese.

Several problems were encountered with Benson's alfalfa plantings located in the three CalTrans fields, due to a variety of events. The initial planting was done a bit on the early side in August in an effort to get the alfalfa well established before the geese arrived. Although the planting started out to be a successful one, a beet armyworm outbreak devastated the plantings.

After planting the alfalfa for the second time, weeds became well established in the stands. Mr. Benson requested the use of Buctryl to combat the weeds, but his request was declined due to the arrival of geese. Sheep were used as an integrated pest management tool to knock back the weeds in an effort to save the stand, which was again replanted. This scenario is a not uncommon example of how difficult and complicated it can be to farm alfalfa cooperatively on the refuge... and make any money!

It should be noted that, although Mr. Benson is a certified organic alfalfa producer and that growing organic alfalfa for quality goose browse is a goal of his cooperative operations on the refuge, the process does start with the use of herbicides to help control weeds, thereby improving the vigor and density of the stand. Such herbicide applications can include both pre-emergent and post-emergent treatments, providing that goose presence is not an issue.

Force account farming efforts included growing wheat in Vail 4-421 and Reidman Trifolium 16-310A fields, and barley in the South Johnson Trifolium 13-255 field, as well as assisting with cooperatively farmed fields Vail 4-419 (rye), Vail 4-420 (wheat), and 461 (sudan followed by alfalfa).

The spring-germinated wheat crop in the 421 field behind headquarters turned out quite well. This field is traditionally very difficult to cultivate during the fall because the snow geese prefer to use it (as well as the back ponds) as "home base", particularly when they first arrive. Portions of the field were mowed, then irrigated. With the drains plugged, the geese found the situation to their liking; waste grain fell to the ground and germinated, providing a second green crop after the standing grain had been consumed. This type of spring planting regime, producing a standing crop of carbohydrate-rich grain for the geese when they arrive in the fall, should be considered favorably for future applications.

Weed problems again plagued the rye grass planting in V4-419. This field, which also contains the Union 3 and 4 goose blinds, looked great following germination, and was in good shape for the beginning of waterfowl season. However, the chronic infestation of wild beets combined with wild oats really took off in the cool season, creating the need to mow the field, twice to make the field more attractive to geese and preclude the weeds from going to seed.

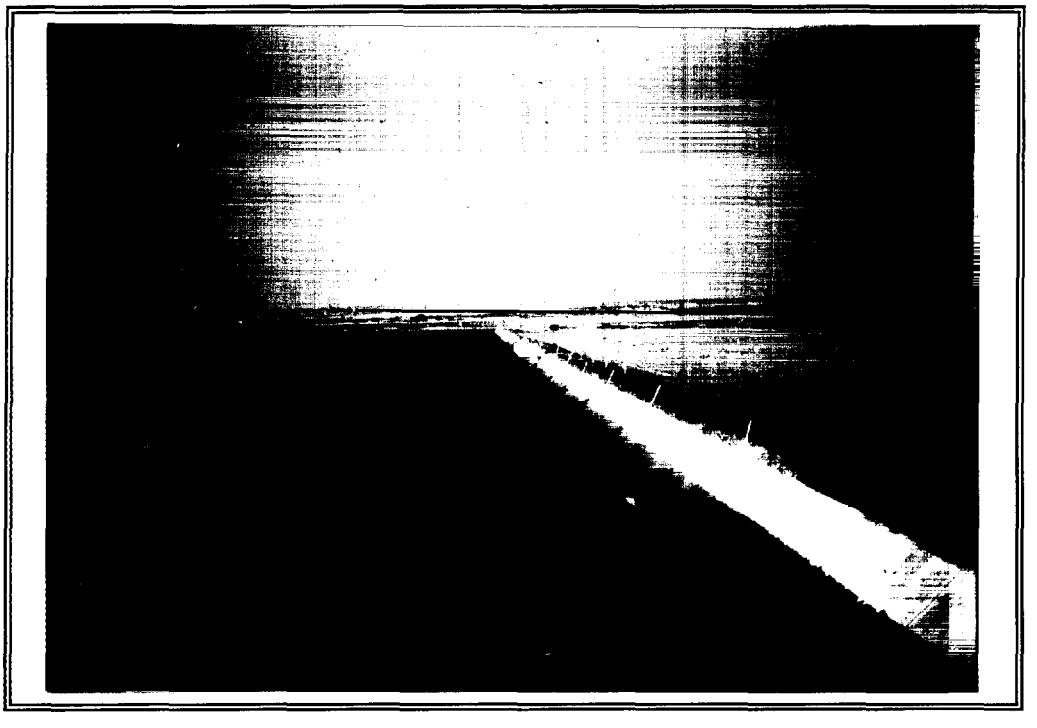
The weed problem might be addressed in future years by pre-irrigating the field in mid-September, discing the weeds in mid-October, and then planting and germinating the crop in late October or early November. While this regime might seem to conflict with the interests of hunters relative to the waterfowl opener, a conflict does not really exist since the blinds in question are for geese and almost no geese are here in October. Also, a later planting will produce a shorter, more accessible stand in late November when geese will use the 419 field.

Significant difficulties were also encountered in trying to get the new stand of alfalfa established in the Vail 4 461 field, where the "preferred" Union goose blinds 1 and 2 are located. After the field was pre-irrigated to manage weeds, there was a three week delay before the field dried out enough to be worked. Inefficient tile drains in need of cleaning were suspected to be the cause of the drainage/wetness problem and associated delays. With the planting three weeks behind schedule the late planting (germinated October 28) was then "between a rock and a hard place". Letting hunters into the field would surely trample parts of the young stand, but not having any hunting pressure in the field three days a week would encourage more use by geese.

Milo **and millet were planted** next to the C Tract T13-257 tree row and in the five-acre pond immediately behind the equipment yard. Both plantings did well, but the preferred germination date is before mid-April. Gangs of red-winged blackbirds cleaned up most of the seed produced in the small pond, perhaps striking a blow for biodiversity. No waterfowl were ever observed using the pond after it was flooded.

The refuge combined with Ducks Unlimited, the Imperial County Fish and Game Commission, California Waterfowl Association and several local companies in a cooperative venture to divide and laser level the huge Flammang field T16-310. The $90,000 project involved correcting the slope of the extremely sandy field and dividing it into two parts, with a new concrete delivery canal constructed to supply the north portion with irrigation water separately. Cooperators included Ryerson Concrete, Elms Equipment Rental, Val Rock, Tesco Engineering, Kuhn Land Leveling, Laidlaw Environmental and Duggins Construction. Formerly, the irrigation runs on the field were up to a full half mile long, which caused significant headaches for irrigators and used a tremendous amount of water. In fact, the Flammang field sudan crop alone used just over 20% of the total water used on the entire refuge in FY-93! See Table F.2 for a summary of Co-op and other water uses.

Union Tract fields Vail 4-419 and 420 were laser leveled by Masters Construction Company at Imperial Irrigation District cost. IID borrowed significant amounts of dirt from the eastern margins of both fields in December of 1992 for use as fill material in the project to concrete line the Vail 4 delivery canal to headquarters. IID then corrected the unevenness in the fields by contracting out the laser leveling project.



New concrete-lined delivery ditch in Flammang Field. SS #1269 ECB 11/24/93

Table F.2 Fiscal Year 1993 Water Use Summary

USE TYPE		COST	ACRE FEET
Totals for Co-op Farming Fields by Gate:			
N. Johnson	T13-256	$ 7,751.12	668.2
C Tract	T13-257	2,326.96	200.6
S. CalTrans	T13-257-A	4,848.80	440.8
N. CalTrans	T13-258-A	1,702.88	146.8
S.Flammang20	T16-304	1,591.52	137.2
Flammang	T16-310	16,453.44	1,418.4
Union 419	V4-419	816.64	70.4
Union 461	V4-461	2,617.00	225.6
Summary of Water Use Amounts and Costs:			
Total Slovak Purchased for FY93		$ 3,865.12	333.2
Total Co-op Farming paid by USFWS		37,573.92	3,239.1
Total Non-Co-op (impoundments and force account farming)		41,941.76	3,615.7
Total USFWS Purchased for FY93		79,515.68	6,854.8
Grand Total for Refuge for FY93		$83,380.80	7,188.0

Several cropland management related facilities received repairs in 1993. Portions of the tile drain on field 461 was cleaned in response to significant problems experienced with the cooperator's sudan crop. Several bad sections of concrete delivery canals and worn out gates at Unit 1 received attention through MMS-funded force account efforts. While these efforts were a good start, the need for these kinds of facilities 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 or replace delivery canals, gates, tile lines and ditches in the future.

7. Grazing

Weed control is a major and ongoing concern of the refuge cropland management program. Occasionally, grazing has been used as an integrated, non-chemical pest management tool to control cool season weeds when geese are present and other options are not viable.

Such a scenario developed in late 1993 in the recently planted alfalfa cooperatively farmed by John Benson on the 240-acre CalTrans Tract. After beet army worms devastated the first planting, the second alfalfa planting was seriously challenged by a well established infestation of malva, lambsquarter and pigweed. With geese using the refuge, Mr. Benson's request to spray Buctryl post-emergent herbicide was declined, leaving grazing as the only viable option short of losing the stand altogether and replanting in spring.

About 400 sheep were introduced by Mr. Benson into the CalTrans fields in late October for about two weeks, the equivalent of about 40 animal unit months. The sheep did a good job of eating weeds (and alfalfa) back to ground level, giving the alfalfa stand a chance to survive through its first winter.

9. Fire Management

Fire management on Salton Sea NWR involves primarily wetland vegetation manipulation and soil preparation through the use of prescribed fire. Due to climatic conditions and vegetation types, the incidence of wildfire is very low.

The station Fire Management Plan was revised and updated to better address habitat management requirements and comply with regional office standards. Four prescribed burns were completed during the year.

Union Tract 419: 80 acres of wheat stubble burned on March 31 to facilitate soil preparation.

Unit 1 (257A & 258): 240 acres of wheat stubble burned on June 10 to facilitate soil preparation.

Hazard Tract #7: 15 acres of cattail and alkali bulrush burned on September 9 to remove decadent vegetation and release bulrush seed crop. Unit was flooded after a successful burn, which resulted in vigorous vegetation growth. Waterfowl response to the increase in forage was excellent, and by December over 1000 white geese and 1000 ducks were observed foraging in the unit.

South Johnson: 80 acres of various weed species burned on September 17 to remove decadent vegetation and prepare seedbed for fall planting.

All burns were completed safely and under the guidelines of approved prescribed burn plans. The pumper unit (500 gal, trailer mounted) continues to be a problem. The only refuge vehicle capable of towing the pumper is a 3/4 ton 4x4 pickup. The trailer has no brakes and when full, makes transportation unsafe. Hopefully this problem will be resolved in 1994 with the acquisition of a slip-on pumper unit.

10. Pest Control

To comply with the Service's policy to eliminate unnecessary use of pesticides and meet refuge objectives, IPM was incorporated in refuge pest control efforts. The Biological Opinion, Environmental Assessment for IPM and the station IPM plan was completed this year. In addition to using pesticides when necessary, several IPM techniques are used to control exotic plant and animal pests. These include biological, cultural, mechanical and physical controls, and are used to minimize use of pesticides while providing effective pest control.

Plant pests which are present on the refuge include salt cedar (Tamarix pentandra), Colorado River hemp or sesbania (Sesbania exaltata) and common reed (Phragmites communis). These weeds out-compete native plant species and provide poor wildlife habitat. Herbicides used to control salt cedar or phragmites on the refuge include Garlon, Rodeo and Roundup. These herbicides are usually applied by refuge staff and not cooperators. During 1993, a total of 222 gallons of Roundup and 50.75 gallons of Garlon were applied.

In addition to IPM techniques, herbicides requested for use (but not always used) on the refuge for alfalfa include Balan, an incorporated preemergence herbicide in new plantings 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. Sheep grazing was used to control broadleaf weeds in 240 acres of seedling alfalfa during the fall. The alfalfa responded well, out-competing the weeds, and provided forage for thousands of white geese.

Sheep removing broadleaf weeds in field 257, Unit I. SS #1291 KJD 11/15/93

Different pesticides are periodically needed on the refuge for insect control. **Even when biological controls, cultural practices and the use of insect-resistant alfalfa cultivars are used, insect populations (e.g., blue and pea aphids and Egyptian alfalfa weevil) may rise to economically damaging levels. Insect pests do not cause economic damage in every field** every year, **especially if conditions for natural enemies are maintained. This type of management maintains the vigor and productivity of alfalfa to meet wildlife objectives for geese, and retains the commercial value for the cooperative farmer. Insecticides which control these pests include Cygon (dimethoate) and Cythion (malathion), both of which have been receiving stricter accommodation by the Regional and Washington Offices in recent years. Javelin (Bacillus thuringiensis) may also be used in alfalfa fields for biological control of alfalfa caterpillars.**

During November 1992, 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 be denied due to more stringent regulations.**

Two additional pesticide-use proposals for Treflan and Buctril were submitted to the Regional Office during December and one proposal for Amdro was submitted in August. Most proposals are for herbicides necessary for weed control when establishing seedling alfalfa. In subsequent years, weeds will be controlled with organic methods only. The use of IPM techniques will reduce pesticide use on the refuge and provide high quality forage for wintering waterfowl.

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 required. This year, a total of 7,188.0 acre-feet of water was purchased at a cost of $11.60 per acre foot for a grand total of $83,380.80. The majority of this water was **utilized, in** the refuge farming program.

Additional water used on the refuge comes from two sources. A decreasing amount of free water is available 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 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.

14. Farmers Home Administration Conservation Easements

The refuge has one conservation easement that consists of 200 acres of poor riparian-habitat along the Whitewater storm drain in Riverside County. This easement has approximately 10 acres in mature cottonwoods that are being invaded by salt cedar. The remaining acreage is covered by a mixture of salt cedars, arrowweed and iodine bush. There was no management of any kind conducted on this land in 1993.

15. Private Lands

There were limited actions concerning private lands in 1993. Refuge staff provided technical assistance for two duck clubs, one in the Coachella Valley and the other in Imperial Valley. The assistance included plant identification and moist soil management techniques with emphasis on providing food for wintering populations of waterfowl.

The cooperative habitat enhancement project with the Imperial Irrigation District for the development of Morton Bay continued during the course of the year. Actions included rebuilding the dike around the periphery of the Bay, installation of two water outlets and one water delivery structure. The work was completed by the end of April which provided two new nesting islands for gull-billed terns and black skimmers.

G. WILDLIFE

1. Wildlife Diversity

The Salton Sea NWR is geographically located within the southwestern edge of the Colorado zone of the Sonoran Desert biome. This location, coupled with its minus 226-foot elevation results in extremely low precipitation and extremely high daytime temperatures. Despite the fact that the Salton Sea can be a rather unpleasant area to live at times, it supports a surprising diversity of wildlife species. Habitat diversity on refuge lands provides for the needs of resident wildlife species as well as numerous seasonal residents and 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.

Biologist W. Radke holding a very nice specimen of a western diamondback rattlesnake. This species of wildlife is not common on the refuge but there are enough around to keep you on your toes. SS #766
ECB 1/22/93

2. Endangered and/or Threatened Species

State and federally listed endangered species which are known to have occurred on the refuge during 1993 include the desert pupfish (Cyprinodon macularius), California brown pelican (Pelicanus occidentalis), peregrine falcon (Falco peregrinus), California least tern (Sterna antillarum), and Yuma clapper rail (Rallus longirostris yumanensis). The Aleutian canada goose (Branta canadensis leucopareia) and the southern bald eagle (Haliaeetus leucocephalus), while known to occur on the refuge at times, were not seen in 1993.

The U.S. population of **Yuma** clapper rails numbers slightly over 1000 individuals within freshwater marshes of California and Arizona, with additional birds occurring in marshes in Mexico. Habitat destruction caused by saltwater inundation of freshwater marshes, draining of wetlands for agriculture and water conservation practices, combined with effects of contaminants, have led to the demise of this species.

Following Recovery Team instructions, rails are surveyed each spring with a tape recording of rail calls which elicits responses from the birds. Because not all birds respond to the tape, the minimum number of birds using the available habitat is determined. During 1993, surveys were conducted from April 10 through May 15 by Wildlife Biologists Marcia and William Radke, SCA Resource Assistant Ken Sturm, Refuge Operations Specialist Kevin DesRoberts and Refuge Manager Clark Bloom; Areas surveyed

included all suitable habitat within and adjacent to the refuge, areas of the New and Alamo Rivers and "Barnacle Beach", an area south of Bombay Beach and 10 miles north of the Wister Fish Hatchery.

Table G.l Minimum Numbers of Yuma Clapper Rails Respondins to Taped Calls On or Adjacent to Salton Sea NWR

YEAR	# PAIRS	# 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
1993	27	96

At Unit l/New River area, responses were elicited from nine pairs and eight singles, for a total of 26 individual birds. Twenty-three individuals were located in the Headquarters area -- three pairs and 17 single birds. In the Hazard Tract/Alamo River area, 14 pairs and 16 individuals responded to the tapes for a total of 44 individuals. An additional pair and a single bird responded at the corner of Lack and Grumble Roads, adjacent to the Sea. Sixteen individuals (six pairs and four singles) were tallied at Barnacle Beach. At least two rails were known to have died during May. Both were apparent road kills.

Overall rail numbers were up in 1993, with a minimum of 96 individuals occurring on or adjacent to the refuge (see table G.2.1). This total was over 400% above the nine year average of 18.7 from 1984 through 1992. Possible explanations of these numbers include the displacement of rails from the flooded Gila and lower Colorado Rivers and ongoing management of rail habitat by the refuge and Wister Wildlife Area which may have resulted in good production and recruitment of rails.

California least terns nest along the California coast and are occasional spring and summer migrants to the Salton Sea. In 1993 two least terns were observed at Obsidian Butte on June 22.

California brown pelicans are occasional summer visitors to the Salton Sea. Typically around 50 post-breeding birds from the Sea of Cortez visit each year and are observed at freshwater drains and river deltas. However, in 1993 numbers built to over 600 individuals in late June.

The first sighting of a brown pelican in 1993 occurred off Garst Road on April 1. On June 22 an aerial survey of the Sea detected 299 pelicans, mostly at the Whitewater River delta. On June 24, 80 brown pelicans were seen in the sea off Garst Road. Fall observations included sightings on October 30 at Finney Lake and on November 23 at Red Hill.

Peregrine falcons are occasional residents of the Sea, with sightings almost every month of the year. While population peaks of peregrines occur during major shorebird migrations, little is known about the falcons using Salton Sea.

Table G.2 Peak Waterfowl Populations During Winter 1993-94

SPECIES	SSNWR	IV	CV
Snow/Ross' Goose	17000 (N)	28490 (J)	0
Canada Goose	30 (J)	113 (F)	37 (F)
Green-winged Teal	8330 (F)	29985 (F)	1810 (F)
Mallard	10 (J)	33 (F)	49 (F)
Northern Pintail	6860 (F)	20943 (F)	3765 (F)
Cinnamon Teal	25 (M)	137 (M)	165 (M)
Northern Shoveler	43150 (F)	68459 (F)	4660 (J)
Gadwall	500 (J)	1110 (N)	380 (N)
American Wigeon	1500 (J)	1565 (J)	289 (F)
Canvasback	0	25 (F)	15 (F)
Redhead	20 (J)	602 (J)	38 (M)
Ring-necked Duck	20 (F)	22 (F)	12 (F)
Greater/Lesser Scaup	63 (F)	149 (F)	201 (F)
Bufflehead	10 (JF)	10 (JF)	0
Ruddy Duck	2775 (F)	4392 (F)	570 (N)
Goldeneye	0	31 (F)	0
Total Geese	17005 (N)	28533 (J)	37 (F)
Total Ducks	61801 (F)	124862 (F)	11232 (F)
Total Waterfowl	77871 (F)	143100 (F)	11269 (F)

Month of estimated peak winter population: (N) = November, (J) = January, (F) = February, (M) = March
SSNWR = Salton Sea National Wildlife Refuge
IV = Imperial Valley
CV = Coachella Valley

a. Ducks

The most common species at Salton Sea are the northern shoveler, northern pintail and green-winged teal. The winter population of ducks peaked in February at 136,141 birds in the survey area compared to a peak of 137,950 for 1992-93. A total of 61,801 ducks used the refuge. The Imperial Valley hosted 124,862 birds, while Coachella Valley was used by 11,232 birds.

Each year a few mallards, cinnamon teal, pintails and redheads use the refuge for nesting. However, production by these species is minimal.

b. Geese

Salton Sea NWR provides two significant sanctuary areas for geese within the Imperial Valley. With an abundance of available feed raised by the

Sixteen documented sightings of peregrines occurred during 1993. The first falcons were observed on January 16 and 19 at the intersections of Kalin and Eddins Roads and Gentry and Walker Roads, respectively. Peregrines were observed at Unit 1 on April 23 and May 28, Davis Road on April 27, Morton Hay on May 9, New River Delta on June 2, two miles south of Niland on July 24, Schrimpf Road on July 30 and October 15, Garst Road on April 29 and August 8, and Red Hill on October 8, November 23 and December 21.

Desert pupfish are the only fish native to the 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 endangered status 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 study documented desert pupfish in 72% of the drains surveyed around the Sea. Along the southern portion of the Sea, where the refuge lies, 57% of drains contained pupfish. In 1993, another survey was done by Imperial Irrigation District personnel in conjunction with California Department of Fish and Game biologists. Twenty-nine drains, two pools and San Felipe Wash were surveyed. Of the 29 drains, 17 (59%) contained pupfish. Pupfish were also found in one pool and in San Felipe Wash.

3. Waterfowl

Much of Salton Sea NWR is devoted to providing habitat and forage for wintering waterfowl. At least 25 species of waterfowl used the Sea, adjacent freshwater ponds or agricultural fields during 1993. Common species included snow geese, Ross' geese, northern pintail, northern shoveler, green-winged teal and ruddy duck. Species of special interest around the sea include an oldsquaw near headquarters from February through March, a black-bellied whistling duck at Whitewater River Delta on July 12 and a surf scoter at Whitewater delta and by Rock Hill on August 3 and November 26 respectively.

Each year refuge personnel survey waterfowl populations, on and off-refuge, at the Sea and in both the Imperial and Coachella Valleys. Surveys for 1993-94 were conducted by air in October, November, January, February and March. Survey routes and methods were the same as those used in past years. The refuge contracted with Sun Western Flyers, Inc., Yuma, Arizona, for flights in October, November, February, and March of the 93-94 survey period.

Due to Sun Western's problems with meeting OAS specifications for low level flight, no December survey was flown and Redlands Aviation Corp. was used for the January flight. Peak waterfowl totals for the entire survey area were achieved in February when 154,416 birds were using the Sea and vicinity. There were a total of 12,724,875 waterfowl use-days from November through February, as compared with 15,373,950 use-days during the 1992-93 season. Estimated peak waterfowl numbers are shown below.

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Bufflehead	10 (JF)	10 (JF)	0
Ruddv Duck	2775 (F)	4392 (F)	570 (N)
Gold&eve	0	31 (F)	0
Total Geese	17005 (N)	28533 (J)	37 (F)
Total Ducks	61801 (F)	124862 (F)	11232 (F)
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a. Ducks

The most common species at Salton Sea are the northern shoveler, northern pintail and green-winged teal. The winter population of ducks peaked in February at 136,141 birds in the survey area compared to a peak of 137,950 for 1992-93. A total of 61,801 ducks used the refuge. The Imperial Valley hosted 124,862 birds, while Coachella Valley was used by 11,232 birds.

Each year a few mallards, cinnamon teal, pintails and redheads use the refuge for nesting. However, production by these species is minimal.

b. Geese

Salton Sea NWR provides two significant sanctuary areas for geese within the Imperial Valley. With an abundance of available feed raised by the farming program, nearly every goose wintering in the Valley utilizes refuge habitat at some point. The refuge goose population peaked at 17,005 during November, which is a 24% increase over the 1992-93 season. Most white geese left the refuge by late February.

Imperial Valley's peak goose population increased to 28,533 birds during January from 22,140 the previous year. White geese made up the bulk of the population with 28,490 individuals counted. A peak of 113 Canada geese were seen in Imperial Valley in February, down from 3,025 in 1992-93. Only

a few neck-collared geese were observed on the refuge, as observations were limited to those made in conjunction with other activities.

4. Marsh and Water Birds

Tremendous numbers of marsh and water birds reside at the Salton Sea. Nesting species include pied-billed grebes, great blue herons, great egrets, snowy egrets, cattle egrets, green-backed herons, black rails, clapper rails, common moorhens and American coots. Noteworthy species observed during 1993 include a tricolored heron at Hazard unit on August 2 and at least three flamingos seen at various locations on the Sea throughout the year. Wood storks were seen several times during the summer: two on June 17 at Morton Bay, three at Obsidian Butte on June 22, one at Morton Bay on June 24, one at Schrimpf Road on July 30, one at the intersection of Noffsinger and Davis Roads on July 31, two at Red Hill on August 2, 15 at Morton Bay on August 18, six at Garst Road on August 20-21 and four east of Garst Road on August 21.

Each year a portion of the Lower Colorado River population of sandhill cranes winters in the Imperial Valley at Ostercamp and D & K Duck Clubs south of Brawley. During 1993 the local population peaked at 327 individuals on November 20. Most were of the Greater subspecies.

Refuge personnel accomplished colonial nesting bird surveys along the entire Salton Sea shoreline and at Finney Lake between March 1 and August 3. An aerial survey was conducted on June 22, and estimates from the ground or by boat were conducted throughout the nesting period. Beginning in 1991, this survey of the entire Sea and adjacent areas has been 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 entire Salton Sea ecosystem and how it may be impacted by environmental contaminants or changes in the food chain. Large numbers of piscivorous birds continue to nest on the Imperial Wildlife Area at Finney Lake, and may begin utilizing nearby Ramer Lake as that impoundment begins filling with water. Traditional cattle egret colonies in the Imperial Valley at Brunt's Corner and at Dogwood Road were not used by nesting birds in 1993.

Great blue herons are always the earliest nesters at the Sea, and several were incubating at various locations by March 1. By April 1, most cattle egrets were incubating eggs at Finney Lake. By mid-April, great egrets were incubating at most colonies, as were many snowy egrets and black-crowned night herons. By May, white-faced ibis were nesting at Finney Lake. Double-crested cormorants were present at the Sea in great numbers, but none attempted to nest in 1993. Interestingly, most nesting by piscivorous birds was not synchronized this year, and surveys conducted in mid-July revealed fledged young in some nests and freshly laid clutches of eggs in other nests. The Poe Road colony was particularly noteworthy in that the earliest great egret eggs did not hatch until July 7.

Nearly weekly visits were made to Mullet Island, Obsidian Butte, Morton Bay, and Johnson Drain to document nesting success by black skimmers, gull-billed terns, Caspian terns and associated species. These intensified surveys were funded as part of a Salton Sea Piscivorous Bird Contaminant Study coordinated with Ecological Services personnel in Carlsbad, CA since 1991. To date, this study has documented significant bioaccumulation of DDE in at least seven bird species at the Sea, with the highest mean being found in great egrets and snowy egrets. A linear correlation of egg DDE concentration and egg shell thickness in great egrets showed the highest DDE levels reduced egg shell thickness by 17%. DDE has been detected in

all fish samples collected at the Salton Sea, and since DDE is well documented to biomagnify in the food chain, it is clear that Salton Sea piscivorous birds are picking up all or most of their DDE burden while feeding on fish at the area.

Selenium was found in all piscivorous bird eggs collected in 1991, but samples analyzed so far have means below the value shown to be a significant reproductive risk. The highest mean selenium value was found in black skimmers, indicating that they may be the species having the highest risk. However, livers sampled from double-crested cormorants in 1991 also had mean selenium values very close to values known to be a significant reproductive risk, which may help explain their complete lack of reproduction at the Sea since 1988. We are awaiting laboratory results from productivity studies conducted in 1992 to determine if significant reproductive problems are occurring in great egrets at the Sea. The Bureau of Reclamation has also agreed to fund a study to help document teratogenic effects in great egrets at the Salton Sea.

While hatching success was not determined this year, productivity surveys of great egrets conducted at three colonies at the Sea determined that each successful nest fledged a mean of 2.48 young during 1993. Clutch size ranged from one to six eggs, with four eggs being normal. While individual species experienced population increases during the year, the following tables show that overall numbers of colonial nesting birds continue to decline at the Salton Sea.

Table G.3.a Active Nests at Traditional Survey 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	19
1991	11	0	0	36	0	47
1992	15	0	0	36	0	51
1993	12	0	0	11	0	23

Table G.3.b Active Nests at Salton Sea and Finney Lake - 1993

LOCATION	GTBH	CAEG	SNEG	GREG	DCCO	BCNH	GBTE	BLSK	CATE	WFIB	TOTAL
Avenue 81	4	0	0	0	0	0	0	0	0	0	4
W. Whitewater	5	35	455	91	0	119	0	0	0	0	705
Johnson Drain	4	0	0	36	0	2	60	82	0	0	184
State Park	8	0	0	0	0	0	0	0	0	0	8
Bombay Beach	1	0	0	0	0	0	0	0	0	0	1
Wister Shoreline	18	0	0	7	0	0	0	0	0	0	25
Mullet Island	2	0	0	0	0	0	20	40	48	0	110
Morton Bay	0	0	0	0	0	0	23	37	1	0	61
Alamo Delta	8	0	0	0	0	0	0	0	0	0	8
Hazard Lakes*	0	0	0	0	0	0	0	0	0	0	0
Red Hill/HQ*	0	0	0	0	0	0	0	0	0	0	0
Obsidian Butte*	3	0	0	0	0	0	35	52	0	0	90
Lindsey/Lack*	0	0	0	11	0	0	0	0	0	0	11
Vail Ranch*	0	0	0	0	0	0	0	0	0	0	0
New River Delta*	7	0	0	0	0	0	0	0	0	0	7
Bruchard Bay*	0	0	0	0	0	0	0	0	0	0	0
Trifolium Drain*	2	0	0	0	0	0	0	0	0	0	2
W. Poe Road	0	0	1	25	0	0	0	0	0	0	26
Garst Road	0	0	0	0	0	0	0	0	0	0	0
Desert Ranch	0	0	0	8	0	0	0	0	0	0	8
San Felipe CK	1	0	0	0	0	0	0	0	0	0	1
Salton Sea Total	63	35	456	178	0	121	138	211	49	0	1251
Finney Lake Total	3	19K	1500	110	0	800	0	0	0	320	21733
Grand Total	**66**	19K+	**1956**	**288**	0	921	138	211	49	320	229848

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.**

5. **Shorebirds, Gulls, Terns, and Allied Species**

During 1993 at least 50 species within this category occurred at the Salton Sea. At least 45 of those occurred on the refuge. Nesting birds included American avocet, black-necked stilt, killdeer, black skimmer and gull-billed tern. Unusual sightings for the year included a Laysan albatross at the north end of the sea on May 2, an arctic tern at Salton City on June 2, five magnificent frigatebirds between June 20 and June 27, and an immature blue-footed booby on July 25. A Bulwer's petrel was seen at the Whitewater

River delta at the north end of the sea on July 10. The same day an unidentified shearwater was spotted near Salton City, a least storm petrel was seen at the north end, and a pomarine jaeger was seen near Poe Road The second record of a Cook's petrel was attained at the north end of the Sea on July 10-12 and July 25-August 6. Presumably the same bird was seen at the south end on July 17. On September 26, two long-tailed jaegers, two parasitic jaegers and a juvenile Sabine's gull were seen near Salton City. The same day two juvenile Sabine's gulls were observed at the mouth of the New River. The first sighting of the year of gull-billed terns was at Hazard Pond 5 on March 17. Later, 120 pairs successfully nested at the Sea. Black skimmers were first seen at Morton Bay on March 20. From 250 to 300 pairs nested at the Sea.

Seventeen species of gulls occur at the refuge, with ring-billed gulls being the most numerous. Other common species are California gull, herring gull, and Bonaparte's gull. Yellow-footed gulls are fairly common in summer. This Mexican species is heavily pursued by birdwatchers as the Salton Sea is the only place within the United States where it occurs.

Salton Sea NWR is of regional significance to shorebirds, providing important breeding habitat for several species, and foraging areas to one of the largest inland concentrations of migrating shorebirds in the Pacific Flyway. In addition to the shoreline and mudflat habitat of the Sea itself, the refuge provides shorebird habitat by varying water depth in freshwater ponds and drawing down ponds during peak shorebird migrations.

During 1993 refuge personnel participated in three shorebird surveys coordinated by the Point Reyes Bird Observatory. The Spring survey took place on April 23. A total of 77,124 birds were observed representing 40 species. A total of 60,000 individuals and 48 species were counted during the fall survey held on August 20. A winter shorebird survey was held for the first time in 1993. Thirty-four species and 3215 total birds were observed. Peak numbers on the refuge included 57,002 western sandpipers, 1990 least sandpipers, 5751 black-necked stilts, 7090 American avocets and 9947 long-billed and short-billed dowitchers.

Mountain plovers are uncommon winter visitors in the Imperial Valley and are also of interest to bird watchers. Observations are typically made from September through March in fallow fields and short grass fields throughout the Valley. Plovers are also found in burnt sudan or bermuda grass or in burnt asparagus fields wherein the invertebrate activity has been stimulated thereby providing food for the birds. While the wintering population is unknown, the maximum number of mountain plovers reported in 1993 was over 600 birds found at one site near the Forrester/Imler Roads junction.

6. Raptors

Twenty-eight species of raptors have been documented at Salton Sea NWR. Of these red-tailed hawk, northern harrier, American kestrel, burrowing owl and barn owl are the most common. Breeding species include American kestrel, burrowing owl and barn owl.

Raptors of note include merlins, seen on January 18 (at Davis Road), April 2 and October 18-29. A Cooper's hawk was observed on the refuge between March 1 and May 31. A peregrine falcon was seen at the intersection of Kalin and Eddins Roads on January 16 and at the Gentry/Walker junction on January 19. A prairie falcon was seen at headquarters on January 18 and at the Naval Test Base on April 8. Several sightings of ospreys were made: one east of headquarters on March 8, two by Morton Bay on April 2, a pair at the end of Lack Road by a geothermal plant on November 10 and one at Red Hill on November 28. Two white-tailed kites were observed on several

occasions at Unit 1 and may have nested west of the Reidman field. A single white-tailed kite was observed at Finney Lake on April 1.

Several species of raptors were observed during the Christmas Bird Count on December 28. These included turkey vulture, osprey, white-tailed kite, northern harrier, sharp-shinned hawk, Cooper's hawk, red-tailed hawk, ferruginous hawk, American kestrel, merlin and prairie falcon.

Breeding burrowing owls were censused as part of a study coordinated by the Institute for Bird Populations. Surveys took place from June 9 through July 15 in areas of the Imperial Valley. In the survey area 423 adults and 108 juveniles were observed. A total of 378 pairs were estimated. An October survey estimated a maximum of 28 owls present in Unit 1, seemingly associated with artificial nest boxes.

7. Other Migratory Birds

Numerous noteworthy species occurred on the refuge and in the vicinity of the Salton Sea during 1993. These included a northern parula warbler at the Whitewater River delta on January 2, a Lapland longspur at the south end of the Sea on February 20, a possible canyon wren at Rock Hill on February 4 and a Scott's Oriole along Garst Road on February 22 and at refuge headquarters on March 28. An eastern kingbird was spotted at the junction of Lindsey and Lack Roads on July 10 and a Bendire's thrasher was seen at Salton City on September 26.

The annual Christmas Bird Count took place on December 28. A total of 152 species were observed (Table G.4). "Good" birds included two brown pelicans at the New River delta, seven blue-winged teal at Red Hill and another at Ramer Lake, two greater scaup by Rock Hill and New River, three white-tailed kites, 146 stilt sandpipers, two laughing gulls at the intersection of Schrimpf and Garst Roads, and three glaucous-winged gulls at Red Hill, Rock Hill and the west end of Schrimpf Road.

Also noted were 13 Inca doves, apparently colonizing southwest of Calipatria, one short-eared owl on English Road north of Calipatria, a vermilion flycatcher in Calipatria and another in Niland, a northern rough-winged swallow, a rock wren along the Alamo River, 13 western bluebirds along Ramer Lake and a yellow warbler at the mouth of New River. The corner of Beach and Highway 111 produced a Cape May warbler, a palm warbler and two American redstarts. An adult female summer tanager was found at Ramer Lake, a green-tailed towhee was seen at New River, a lone swamp sparrow was heard in appropriate habitat and two lark buntings were seen in Niland.

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.

Table G.4 Results of Salton Sea (south) 1993 Christmas Bird Count

Species	Total	Species	Total
Pied-billed Grebe	26	Glaucous-winged Gull	3
Eared Grebe	3113	Caspian Tern	14
western Grebe	3	Forster's Tern	96
Clark's Grebe		Rock Dove	365
Am. White Pelican	70	Mourning Dove	275
Brown Pelican	2	Inca Dove	13
Double-crested Cormorant	896	Common Ground-Dove	120
American Bittern	11	Greater Roadrunner	51
Least Bittern	3	Barn Owl	2
Great Blue Heron	57	Great Horned Owl	1
Great Egret	292	Burrowing Owl	34
Snowy Egret	555	Short-eared Owl	1
Cattle Egret	2190	White-throated Swift	335
Green Heron	7	Anna's Hummingbird	7
Black-crowned Night-Heron	164	Costa's Hummingbird	1
White-faced Ibis	989	Belted Kingfisher	12
Snow Goose	5013	Red-naped Sapsucker	1
Ross' Goose	225	Ladder-backed Woodpecker	4
Canada Goose	340	Northern Flicker	44
Green-winged Teal	3505	Black Phoebe	166
Mallard	108	Say's Phoebe	201
Northern Pintail	1109	Vermilion Flycatcher	2
Blue-winged Teal	a	Horned Lark	2861
Cinnamon Teal	45	Tree Swallow	242
Northern Shoveler	7681	N. Rough-winged Swallow	1
Gadwall	189	Common Raven	6
American Wigeon	624	Verdin	184
Canvasback	5	Cactus Wren	10
Redhead	38	Rock Wren	1
Ring-necked Duck	5	Bewick's Wren	6
Greater Scaup	2	House Wren	12
Lesser Scaup	50	Marsh Wren	136
Common Goldeneye	25	Ruby-crowned Kinglet	101
Bufflehead	200	Blue-gray Gnatcatcher	27
Ruddy Duck	1152	Black-tailed Gnatcatcher	28
Turkey Vulture	15	Western Bluebird	13
osprey	2	Mountain Bluebird	98
White-tailed Kite	6	Hermit Thrush	1
Northern Harrier	51	American Robin	6
Sharp-shinned Hawk	9	Northern Mockingbird	40
Cooper's Hawk	6	Crissal Thrasher	2
Accipiter sp.	1	American Pipit	936
Red-tailed Hawk	60	Phainopepla	22
Ferruginous Hawk	4	Loggerhead Shrike	154
American Kestrel	236	European Starling	490
Merlin	3	Orange-crowned Warbler	136
Prairie Falcon	4	Yellow Warbler	1
Ring-necked Pheasant	2	Cape May warbler	1
Gambel's Quail	199	Yellow-rumped (Myrtle) Warbler	11
Virginia Rail	4	(Audubon's) Warbler	1187
Sora	23	Palm Warbler	1
Common Moorhen	32	American Redstart	3
American Coot	7021	Common Yellowthroat	122
Black-bellied Plover	509	Summer Tanager	1
Snowy Plover	17	Green-tailed Towhee	1
Killdeer	176	Rufous-sided Towhee	1
Mountain Plover	207	Abert's Towhee	142
Black-necked Stilt	478	Chipping Sparrow	10
American Avocet	1321	Brewer's Sparrow	115
Greater Yellowlegs	31	Vesper Sparrow	28
Lesser yellowlegs	5	Lark Sparrow	78
Willet	a2	Black-throated Sparrow	12
Spotted Sandpiper	5	Sage Sparrow	a5
Long-billed Curlew	1092	Lark Bunting	2
Marbled Godwit	256	Savannah Sparrow	449
western Sandpiper	744	Song Sparrow	155
Least Sandpiper	567	Lincoln's Sparrow	50
Dunlin	57	Swamp Sparrow	3
Stilt Sandpiper	146	White-crowned Sparrow	2407
Long-billed Dowitcher	885	Red-winged Blackbird	2092
Common Snipe	7	Western Meadowlark	153
Laughing Gull	2	Yellow-headed Blackbird	5
Bonaparte's Gull	3	Brewer's Blackbird	377
Ring-billed Gull	7300	Great-tailed Grackle	237
California Gull	60	Brown-headed Cowbird	20
Herring Gull	447	House Finch	332
Yellow-footed Gull	a	House Sparrow	470

Total Species = 152
Total Individuals = 66,622

Amphibians and reptiles occurring on the refuge 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.

Tens of thousand of Western sandpipers utilize the Salton Sea shoreline and refuge wetlands during spring and fall migrations. SS #1184
WRR 4/18/91

11. Fisheries Resources

Because it is within a closed basin having low rainfall and high evaporation, the Salton Sea is becoming increasingly saline. (Presently the Sea has a salinity ranging up to 37 parts per thousand.) 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, Cynoscion 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 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. Numbers of fish species 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.

Two significant fish kills occurred on the refuge during November and December. Both incidents occurred in the Pumice Drain (agricultural drain) located just south of headquarters. An estimated 3000 - 5000 fish (mostly carp and tilapia) were killed in November and 800 - 1000 in December. The Carlsbad field office was contacted, but offered no assistance in determining the cause, so water and fish samples were sent to the state Fish and Wildlife Water Pollution Control Laboratory (Pesticide Investigations Unit) for analysis. The samples were analyzed for presence of lethal pesticides and arsenic. Methomyl, endosulfan, dacthal and arsenic were detected in the November samples, but none were of lethal concentrations. Dacthal, chlorpyrifos and arsenic were detected in the December samples, but none were of lethal concentrations. The cause of the fish kills remains unknown.

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 1 B-Pond Drain contain pupfish. The Barnacle Bar Pond and Pumice Drain were surveyed by refuge staff in 1993 and no pupfish were found.

16. Marking and Banding

Eighteen bird species were banded in support of approved refuge research or management studies during 1993 and are listed below.

Forty-four hatchling burrowing owls were color-banded this year. (See Section D.5)

Mist-netting efforts were initiated in the fall of this year to provide information on the composition and relative abundance of migratory passerines using refuge lands. (See Section D.5)

Refuge personnel also provided substantial assistance in 1993 to banding studies of black skimmers, caspian and gull-billed terns initiated by K. Molina in previous years. (See Section D.5)

Table G.5.a Avian Species and Totals Banded Under Refuse Permit

Burrowing Owl	44
Say's Phoebe	1
Verdin	6
Bewick's Wren	2
Ruby-crowned Kinglet	5
Loggerhead Shrike	2
Orange-crowned Warbler	5
Yellow Warbler	2
Chestnut-sided Warbler	1
Audubon's Warbler	32
Common Yellowthroat	8
Abert's Towhee	5
Savannah Sparrow	2
Song Sparrow	2
Lincoln's Sparrow	6
White-crowned Sparrow	58
House Finch	1
TOTAL	182

Waterfowl band recoveries occurred from Mexico and California during i993. Noteworthy band recoveries included a fulvous whistling-duck and a gull-billed tern. Significant band returns included two Audubon's warblers, an abert's towhee and a black skimmer.

Table G.5.b Band Recoveries and Returns for 1993

Species	Year Banded	Recovery Location
Northern Pintail	1990	Niland, CA
Canvasback	1987	Lake Barrett, CA
Fulvous Whistling--Duck	1988	Colorado R., Mexico
Gull-billed Tern	1987	Salton Sea
Northern Pintail	1987	Salton Sea NWR
Northern Pintail	1990	Salton Sea NWR
Lesser Snow Goose	1974	Wister WMA, CA
Black Skimmer	1993	Seal Beach, CA
Audubon's Warbler	1991	Salton Sea NWR
Audubon's Warbler	1992	Salton Sea NWR
Abert's Towhee	1990	Salton Sea NWR

17. Disease Prevention and Control

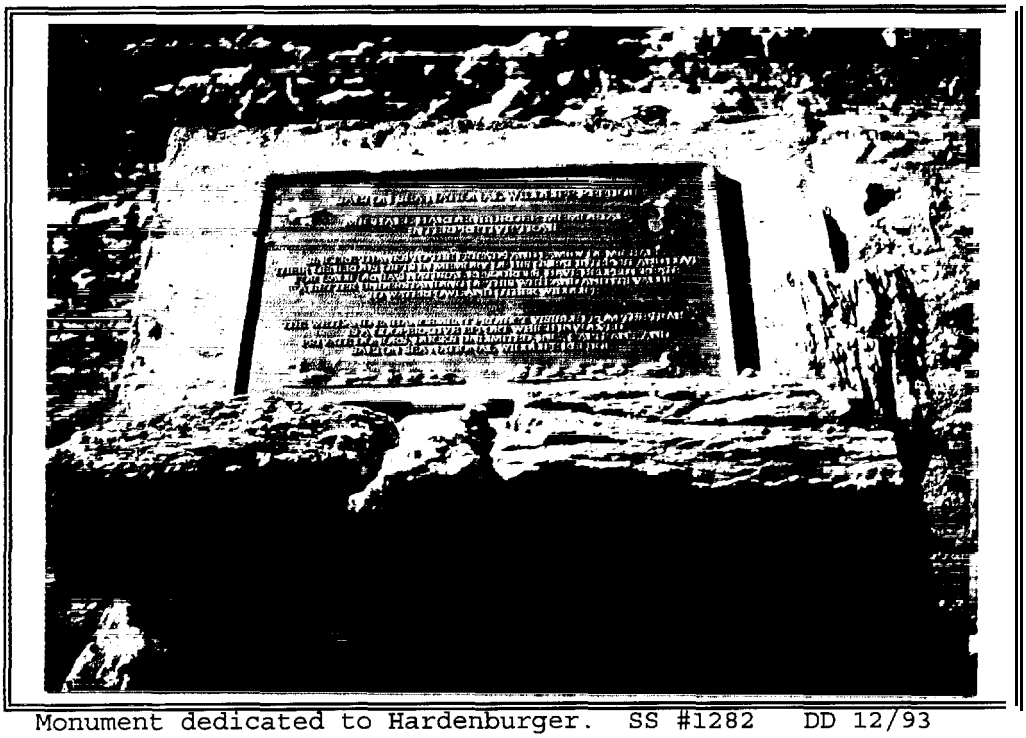
A suspected avian cholera outbreak occurred at the Salton Sea during the spring of 1993. Dead birds were first observed beginning March 1, 1993, and the last dead bird was observed on April 9, 1993. Peak period of die-off occurred between March 5 - 10. The problem appeared to be widespread at the Sea, but fairly low numbers of birds were affected. Large numbers or concentrations of sick or dead birds were never observed anywhere. Service personnel concentrated clean-up efforts on areas of the refuge that contained waterfowl and shorebird concentrations, and collected about 50 birds during the event. Five dead birds, representing five representative species affected, were collected and frozen for analyses at the NWHRC in Madison. During this period, an estimated total of 500 birds died at the Sea. Most of these were ruddy ducks, coots and ring-billed gulls.

H. PUBLIC USE

1. General

An estimated 30,000 visitors migrated to the refuge in 1993, roughly the same number as in 1992. Most refuge visits fall under the "wildlife oriented" category with many of those being "birders" ranging from casual to world class in capability. The Salton Sea has become a well known destination for birders in search of new birds for their state, United States, or life lists. Many public contacts start with questions such as "Are the wood storks here yet?" or "Where can I find a yellow-footed gull?". A working list of noteworthy wildlife observations is posted in the picnic area, along with appropriate flyers, to help foster communication with and between birders visiting the refuge.

Visitor facilities at refuge headquarters include a paved parking area for 25 vehicles (including one for our physically challenged visitors), entrance and orientation signs, paired rest rooms, shaded picnic area with adjacent observation deck, the Rock Hill Interpretive Trail and a visitor center featuring a wildlife habitat diorama with 31 mounted specimens.



Monument dedicated to Hardenburger. SS #1282 DD 12/93

Visitor facilities at Unit 1 include a second observation deck and a new interpretive trail around the Reidman Pond 4. The parents of the late Michael Hardenburger set up a memorial fund through Ducks Unlimited for the purchase of interpretive signs and a memorial plague for the new trail. Fiberglass embedded interpretive signs featuring graphics and text on waterfowl, migration, wetlands and wading birds were purchased from Wilderness Graphics by the fund and installed by refuge staff late in 1993, along with a bronze memorial plague mounted in a handsome stone base.

The new loop trail around the Reidman impoundment affords visitors the opportunity to venture through managed wetland and cropland habitats at Unit 1 while minimizing disturbance issues. The potential also exists for locating observation blinds providing premium wildlife photography and "watchable wildlife" opportunities off the trail loop. A mandatory permit system combined with "photo blind - permit required beyond this point" signing has been identified as one way to manage access to the blind(s) from the trail and avoid visitor versus visitor conflicts.

Some public accessibility issues remain to be resolved before the arrival of the September 30, 1995 deadline. Both two-story elevated observation decks need to be retrofitted with 1:12 sloped access ramps (and both projects are identified in the MMS system). Other program accessibility issues involve basic program information for the visually impaired and for the learning impaired. Ideas for correcting these deficiencies include an audio tape program for the blind and reprinting the "Wildlife Checklist For Young People" with larger bold type (and a new name) for the learning and visually impaired of all ages.

The "Wildlife" checklist was revised and reprinted this year. This list is ***very*** popular with birders and the general public alike.

The Cape May Bird Observatory initiated the "Salton Sea National Wildlife Refuge Birding Survey" in October. The one year survey focuses on the economic effects of birders on the area and should provide the refuge and local businesses and government good data on what an economic boon it is to have viable wildlife habitat in the community.

2. Outdoor Classrooms - Students

A total of 210 students representing seven class groups were recorded in this category for 1993. Several groups' visits were canceled due to rain and muddy conditions along the Rock Hill Trail, where outdoor classroom activities are normally concentrated.

3. Outdoor Classrooms - Teachers

A total of seven educators (all elementary school teachers) brought their charges out to the refuge for on-site educational activities. No Educator Workshops were conducted, although those types of activities have been identified as being the vehicle by which we can make the transition from staff-led programs to educator-led programs, thereby gaining the benefit of the multiplier effect.

4. Interpretive Foot Trails

Facilities in this category were expanded with the development of the 0.75-mile Michael Hardenburger Memorial Trail at Unit 1 late in 1993. The refuge now sports interpretive walking trails at both Unit 1 and the headquarters area, adding substantially to the outdoor recreation opportunities afforded to wildlife oriented visitors.

Implementation of the new trail at Unit 1 was delayed for months due to indecision over on-again off-again mitigation work to have been done by the California Department of Transportation (CalTrans). CalTrans was to have performed significant habitat modification work along the course of the original trail route. However, after CalTrans' need to do the mitigation project fell through, the loop trail route around Reidman Pond 4 was adopted.

6. Interpretive Exhibits/Demonstrations

The Duck Stamp exhibit was set up at the annual dinner of the Niland chapter of Ducks Unlimited on December 11. About 80 folks attended the dinner and saw the portable display, which makes a good presentation tool.

7. Other Interpretive Programs

The Sea and Sage (Orange County) chapter of the Audubon Society visited the refuge and received a specially adapted conducted tour of selected habitat management locations on June 6. The dozen or so visitors were treated to a brief but good glimpse of a Yuma clapper rail near the Hazard 6 impoundment; a life bird for some of the Auduboners!

A special interpretive program was also conducted for visitors touring the region as part of a Northwestern Irrigation Operators group. Two walking tours featuring water management on the refuge were conducted for a total of about 200 visitors on December 7. The group was made up of mostly farmers from the western states and Canada.

An offsite program was presented to a combined group of three eighth grade classes at the Westmorland School. The program centered on the refuge and wildlife habitat needs, but it is doubtful that the kids actually had much interest in the subject matter, unfortunately.

8. Hunting

Hunting on the refuge is limited to the taking of ducks, geese, coots and moorhens by permit and is restricted to the designated Union and Hazard hunting areas. The waterfowl hunt is conducted under cooperative agreement with the California Department of Fish & Game (CDF&G) through the nearby Wister Unit of the Imperial Wildlife Management Area. Hunters pay an administrative fee of $11.00 per day to hunt on the area and are assigned to a specific hunting site on a permit basis.

Facilities for the hunting program were both repaired and expanded for the 1993-94 season. Several of the fiberglass pit blinds in the Hazard Unit popped up and moved as a result of flooding in the unit due to the rain-swollen flow of the Alamo River. This required many staff hours to reposition the blinds. Additionally, two new hunting sites were established at the Hazard Unit.

The two new Hazard Unit shooting points, numbered 2A and 10A, were established in "no man's land" and on the south side of impoundment 10, respectively. The no man's land site number 2A was developed in conjunction with the replumbing of the Vail 2 drain and the placement of a new water control structure, creating a new pond with relatively fresh water from the drain. Additionally, the shooting point for Hazard Blind 6 was moved from the location of the fiberglass pits on the west side of Impoundment 6 to a site on the dike on the north side of Impoundment 6. Impoundment 6 has been managed for clapper rail habitat in recent years and has prohibitively dense vegetation which stifles hunters' efforts at retrieving any downed birds.

Hunter success increased to an average of 1.92 waterfowl taken for each hunter, as summarized in Table H.2 below. Hunter numbers and success for the last five years are summarized in the following table:

Table H.l Five-Year Hunter Success Summary

SEASON	NUMBER OF-HUNTERS	TOTAL WATERFOWL TAKEN	BIRDS/HUNTER
1989-90	1222	1135	0.929
1990-91	564	710	1.259
1991-92	635	874	1.376
1992-93	972	1011	1.040
1993-94	821	1581	1.925

The 1993-94 season figures for total waterfowl taken (1581) and average birds taken per hunter (1.925) are significantly higher than figures for any recent year.

Table H.2 Hunter Harvest Data for 1993-1994 Waterfowl Season'

	DUCKS	GEESE	TOTAL BIRDS	HUNTERS	BIRDS/HUNTER
Hazard	1149	158	1307	610	2.14
Union	0	274	274	283	0.97
Overall	1149	432	1581	821	1.92

*Does not include refill hunters that are normally relocating and therefore do not represent new hunters.

The most successful Hazard hunting blinds were #3 (184 total birds including 56 geese), #5 (177 total with 38 geese), #8 (154 total with eight geese), and #10A (124 total with two geese). The most successful Union blinds were #4 (85 geese), #3 (79 geese), and #2 (54 geese).

Both prehunt and posthunt coordination meetings were conducted with refuge staff, Wister management personnel and the local state game warden (William "Rudy" Arruda) with respect to patrolling the Wister Unit.

An effort was made to attend each of the monthly meetings of the Imperial Waterfowl and Wildlife Habitat Association (IWWHA). The meetings provided a good forum for meeting with and talking to IWWHA members, all of whom are waterfowl hunters. The meetings, and often the time before and after the actual sessions, afford the opportunity to do some "outreach" with hunters and discuss management with CDF&G representatives from Long Beach. Along those lines, John Anderson replaced Earl Laupe as the CDF&G administrator who oversees Imperial Wildlife Management Area operations from the Long Beach Office.

9. Fishing

Saltwater fishing is permitted on most portions the refuge inundated by the Salton Sea. While no effort is made at regulating public use on the large tract of some 35,000 submerged acres located offshore, public use (i.e., fishing and boating) is regulated on the two nearshore tracts which are part of Units 1 and 2 (the latter near headquarters and the Hazard tract).

The nearshore portions of the refuge located in the vicinity of the New River and westward to the boundary of the Millionaire Duck Club are closed to all entry throughout the year, while the nearshore portion of the refuge north and west of headquarters is open to fishing and boating from April 1 through September 30. No bank fishing is permitted anywhere on the refuge.

Sport fish in the Salton Sea are all introduced salt water species and include corvina, tilapia, gulf croaker and sargo. Although the corvina fishery at the Sea has historically been very popular, declining productivity combined with health warnings against consuming **more than four**

ounces of Sea-caught fish in any two week period (due to selenium levels) have resulted in a sharp decline in fishing pressure. Salton Sea State Park reports that their visitation has declined 90% in the last five years.

With the decline in the Salton Sea fishery, the refuge-sponsored National Fishing Week activity was conducted June 12 at Weist Lake, managed by Imperial County. A fishing clinic put on by local angling expert and lure manufacturer Al Kalin was conducted on "Free Fishing Day" and attracted about 40 youths. With the cooperative effort of CDF&G Wildlife Officer Steve Messick the event turned into an interagency success, although no one landed any "keepers". Special thanks to Al Kalin and his wife for their time and effort and for providing set-ups for the youths to fish with.

11. Wildlife Observation

Watchable Wildlife signing was implemented along major access corridors to the refuge this summer. The county road department placed the standard binocular symbol signs, acquired at refuge expense, at two points along Forrester and Gentry Roads. One sign, located in Westmorland, was vandalized with spray paint, while the other was apparently collected as a souvenir soon after its placement. The spray paint was successfully removed with Softscrub. Caltrans placed a total of four signs on Highways 86 and 111, rounding out the Watchable Wildlife signing package.

14. Picnicking

The visitor area at headquarters provides a popular shaded picnic area for eating, resting and cooling off. An estimated one in four visitors utilizes the picnic area in the course of their activities.

17. Law Enforcement

Law enforcement efforts focus on hunting activities associated with the dove and waterfowl hunting seasons. Since the only hunting permitted on the refuge is for waterfowl, most of the patrol work during dove season is conducted off the refuge and includes visits to Coachella Valley Refuge and its environs. Patrol efforts during waterfowl season are pointed towards improving compliance with federal, state and refuge regulations on the refuge and federal and state regulations off the refuge.

A total of 23 cases were made by refuge law enforcement officers, as in the previous year. The following table summarizes violations cited in 1993:

Table H.3 Summary of Law Enforcement Cases

VIOLATION	FEDERAL NOTICES	STATE COURT CASES
Take Overlimit	2	3
Hunting in Closed Area	1	
Unplugged Gun	1	2
Loaded Gun in Vehicle		2
Take Out of Season		2
State Hunting License Infractions	-	4
Vehicle Trespass	2	
Possession of Lead Shot	1	
Exceeding 25 Shell Limit	1	
No Federal Duck Stamp	1	
Disturbing With Aircraft	1	
TOTALS	10	13

I. EQUIPMENT AND FACILITIES

1. New Construction

Items in this category include a major farm field project and a project to upgrade and redesign the Alamo River south levee. In the first project, the 180-acre Trifolium 16-310 Flammang field was divided into two subunits in an effort to save water and improve the efficiency of irrigation. This large field has extremely sandy soil with irrigation runs that were as long as one-half mile in length. The refuge entered into a cooperative agreement with Ducks Unlimited and several local vendors to laser level the field and construct a new concrete delivery canal, cutting the field into two subunits with much shorter irrigation runs. A new drain box servicing the southern part of the newly divided field was purchased and installed by the refuge in the northeast corner of the south portion of the new field. See Section H.4 for more details.

In a second major project, the elevation of the south levee of the Alamo River was increased and the drainage redesigned. In response to recurring habitat and facilities damage resulting from flooding of part of the Hazard Tract by waters topping the south levee of the Alamo River, the refuge contacted IID personnel Myron Corfman, Superintendent of Drainage Maintenance, and Eldon Moore, Assistant Manager of the Water Department, requesting that they upgrade the IID levee to preclude flooding of the refuge. After a formal written request was submitted to Jesse Silva, Manager of the Water Department, IID did indeed undertake the substantial task of raising the elevation of the south levee, but not until several Hazard ponds had been flooded and dikes had sustained severe erosion for the second consecutive year.

An important part of the project was redesigning the drainage for Vail drain 2A, flowing northward just west of Hazard Ponds 7, 8 and 9. In addition to raising the elevation of the levee, the part of the levee along the aforementioned drain was moved south to meet up with the north side of the Hazard Pond 9, with Drain 2A replumbed to flow into the Hazard Unit "no man's land", requiring the placement of a new water control structure. The upshot of relocating the terminus of Drain 2A and adding a new structure flowing into a previously unmanaged part of the Hazard Unit (no man's land - located north of Ponds 1A, 2A, and 3A) is that we now have a semi-fresh water source flowing into a previously alkaline area. This improves both the amount and quality of our wetland habitat and our flexibility in managing it. The project also included the addition of another low profile control structure within no man's land, enabling the pond created above the structure to support a new hunting blind; number 2A.

Another potential project in this category was identified. IID has a water conservation program whereby they will pay for the installation of pump back systems that meet their criteria for water savings. The implementation of such a system on the refuge was discussed with Tim O'Halloran, who heads up this program with IID. The Unit 1A and B ponds and other locations on the refuge were identified as having potential for pump-back systems.

2. Rehabilitation

Repairing the Hazard ponds and dikes damaged by the flood waters of the Alamo River became a major force account MMS project in 1993. After the flood waters subsided and the ponds were dried up, silt in Ponds IA, 2A, 3A, 1, 2 and 3 was removed to reestablish the slope of the ponds.

The elevation of the eroded dikes surrounding these ponds **was** also restored. Several fiberglass pit hunting blinds also had to be relocated after they popped up and moved in the flood. Some dikes adjacent to the new terminus of Drain 2A were relocated to better coordinate with the Alamo River south levee project completed by IID. The newly realigned dikes tie into the new drain crossing connecting Hazard Pond 3A to Pond 9.

Masters Construction Company was contracted by IID to laser level the Vail 419 and 420 fields. IID had used the eastern portion of both fields to borrow fill for the conversion of **a** the Vail 4 irrigation supply ditch from dirt to concrete in late 1992. The leveling project was conducted between spring and fall plantings to minimize conflicts with the farming program objectives for goose habitat.

Contracted heavy equipment leveling the 420 Field. ss #1191 DD 04/93

The Service's conversion to electronic mail turned out to be a major headache requiring the total replacement of the supply "pairs" for the headquarters telephone system. Unfortunately, the existing five pair system was already "maxed out", meaning that we had to restring a whole new set of lines to support the system. After much consideration, exploratory digging, refiguring and some cursing, the new supply system with extra pairs was pulled into our junction box and we eventually got our electronic mail capability on line.

In yet another "fun" project in 1993, the septic system received considerable attention, usually on an emergency basis. After repeated problems with backups in the system and calls to Roto Rooter to come pump out the tank, some exploratory digging discovered that we needed a new pipe and distribution box. A new pipe and manhole were fitted over the junction box to provide access for troubleshooting should problems with the septic system blossom in the future.

3. Major Maintenance

A significant amount of time, effort and funding went into the maintenance of concrete irrigation deliveries in 1993. An MMS project provided funding for the force account project which involved many staff days, primarily on ditches at Unit 1, with virtually every ditch receiving some patch work. The crew utilized the backhoe, a rented cement mixer and lots of hand work to complete the project. Although the project repaired many cracks and replaced cracked panels, the aging concrete canals will eventually need to be replaced; a major MMS project that will take tens of thousands of dollars for each mile of new ditch. In other ditch maintenance work, the earthen portion of the Trifolium 13-258 delivery to the A/B Ponds at Unit 1 was cleaned with the backhoe. California Department of Forestry crews.from McCain Valley cleaned numerous other ditches by hand.

Equipment Operator Richard Marquez was detailed to the Southern California Coastal Complex to perform dozer operation on November 8-12. The purpose of the project was the annual need to reestablish the integrity of the dune system at the Tijuana Slough NWR to protect the coastal salt marsh and other endangered species habitat from erosion caused by high winter tides.

4. Equipment Utilization and Replacement

Equipment replacement in 1993 was highlighted by the acquisition of an all-wheel drive John Deere Model 8570 agricultural tractor and a full size Chevy half-ton 4X4 pickup. The new John Deere substantially adds to the refuge force account farming capability, providing a second tractor capable of pulling a disk or the land plane. When used in tandem with the Case tractor we can now prep a field twice as fast. It also provides the flexibility to disk or land plane at both Unit 1 and the Union fields at the same time.

The new Chevy 4X4 pickup is a welcome addition to the vehicle fleet that adds a dimension to our capability that our little S-10 units simply don't offer. While the new unit adds to the refuge fleet, we are still behind on our replacement schedule and are short by two vehicles that have already been excessed.

5. Communications Systems

The aforementioned new full-sized Chevy pickup received a new Kenwood Model TK 730 radio. The unit, installed by Comm-Pact Radio in Palm Desert at a cost of $844.00, features a robust 45 watts, a 99-channel programmable capability, and an alpha numeric display. The increased power of the new unit provides better range than Motorola Spectra units we have.

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.

As previously discussed under Section 1.2, the old five pair telephone system was replaced with a new fifteen pair system, enabling the refuge to bring the electronic CC:Mail system on line.

6. Computer Systems

A 286 personal computer was picked up on excess in 1993. Additionally, a new Hewlett Packard LaserJet 4 printer was purchased. These acquisitions increased our computer capability by 50% and helped alleviate the frequent "log jams" that were hampering the staffs' capability to get their computer chores accomplished.

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 1993. 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, C2, C3, El, E5, F1, F11, F14, F15, G1.
Dinkler: E3, E6, E7, EB, F4, F7, H1-4, H6-9, H11, H14, H17.
DesRoberts: E7, F1, F2, Gl-4, G10, G11, G17, H17, J4
Hunnicutt: G2-7, G10, G17.
Molina: D5, G16
Tinsman: Edited document
Harris/Sturm: Organization, assembly, and editing.

Photographs are credited by initials.