SALTON SEA NATIONAL WILDLIFE REFUGE
Calipatria, California

ANNUAL NARRATIVE REPORT

CALENDAR YEAR 1987

DATE IN	DATE OUT	STATION NAME	SIGNATURE	COMMENTS
	1/24/89	Salton Sea NWR	Thomas R. Alexander	
2/26/89	3/10/89	Hawaiian Islands	Jerry Leinecke	Good Job. Gary + Tom
4/27/89	5/16/89	Nisqually NWR Complex	Bill Hesselbart	Nice job.
5/23/89	6/12/89	RIDGEFIELD N.W.R.	BRUCE WISEMAN	
6/16/89	6/23/89	Conboy Lake NWR	Harold Cole	
7/10/89	7/10/89	Ankeny	Scott M. Stenquist	
7/21/89	7/27/89	Baskett Slough	R. Lettenmaier	
8/17/89	8/22/89	Toppenish	G. Fenn	
8/25/89	9/1/89	Columbia	Dave Goeke	Well done, learned a bunch
9/5/89	9/8/89	TURNBULL NWR	D. Boone	Gary - aggressive thinking to get results
9/11	9/18/89	Kootenai	Larry Napier	
9-25	9-26	Deer Flat	Todd A. Fenn	
9/27		SE Idaho Refuge Complex	/S/ CHARLES S. PECK	
10/11	10/12/89	Camas	Jack Richardson	What a difference 2 yrs makes! Hi guys!
10/16	11-13	Ruby Lake		
11/16	11-17	Stillwater	W. HENRY	HEY! WHAT AN IMPROVEMENT
12/4	12/15/89	Malheur	FW Cameron	
12/20/89		Sheldon-Hart Mt	M. Smith	
1/5		Modoc		
1/23/90	2/1/90	Klamath Basin	L. D. Johnson	
FEB 6 1990	FEB 15 1990	SACRAMENTO N.W.R.	Gary Kramer	
2/22/90	2/28/90	S.F. Bay	Richard Coleman	
3/23/90	3/30/90	Kern	Thomas R. Alexander	Hi All
4.9.90		Desert Complex	David J. Brown	

DATE IN	DATE OUT	STATION NAME	SIGNATURE	COMMENTS

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SALTON SEA NATIONAL WILDLIFE REFUGE

CALIPATRIA, CALIFORNIA

ANNUAL NARRATIVE REPORT

CALENDAR YEAR 1987

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

REVIEW AND APPROVAL

SALTON SEA NATIONAL WILDLIFE REFUGE

CALIPATRIA, CALIFORNIA

ANNUAL NARRATIVE REPORT

CALENDAR YEAR 1987

Refuge Manager — Date 12/30/88

Refuge Supervisor Review — Date 1/13/89

Regional Office Approval — Date 1/13/89

INTRODUCTION

Salton Sea National Wildlife Refuge is located 50 miles north of the Mexican border at the southern end of the Salton Sea in Californias' Imperial Valley. It is the southern-most refuge in the Pacific Flyway and the only refuge located below sea level. Because of it's southern latitude, -226 elevation and location in the upper Colorado Zone of the Sonoran Desert, the Refuge experiences some of the highest temperatures in the nation. Daily temperatures from May to October generally exceed 100°F with temperatures of 116-119°F recorded yearly.

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

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

Two rivers, the New and Alamo, border the Refuge. Both provide freshwater inflow to the Sea. The New River's source is water outflow and drainage from Baja California and Mexican border town of Mexicali. The Alamo River's source is agricultural drainage from the Imperial Valley.

The Salton Sea basin was a prehistoric extension of the Gulf of California and is the largest saline lake in California. It forms a natural sump for the 4,500 square mile Imperial Valley and northern Baja California with its only inflow source being either rainwater or agricultural drainage. The salinity of the Sea has steadily increased. In 1950, it was 35 ppt equaling the Pacific Ocean. In 1987, it was 40 ppt, fully ten percent saltier than the ocean.

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 birds and shorebirds, also are major objectives.

Salton Sea NWR provides habitat for over 372 bird species, 40 mammal species and many reptiles and amphibians. The Refuge winters up to 30,000 snow and Canada geese and 60,000 ducks daily from November through February. Marsh and shorebirds account for more than six million use days each year. Endangered species that use the Refuge include the southern bald eagle, peregrine falcon, California brown pelican and Yuma clapper rail. A significant Yuma clapper rail population nests on the Refuge. Candidate (sensitive) species using the Refuge include the fulvous whistling duck, wood stork, long-billed curlew, mountain plover, and white-faced ibis.

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I. INFORMATION PACKET - - - (inside back cover)

A. HIGHLIGHTS

Ducks Unlimited funded two waterfowl habitat improvement projects on the Refuge. (Section I.1 and 1.2).

The Westmorland Duck Club funded the 2B Levee Rehabilitation Project at an estimated value of $60,000. (Section I.2).

The headquarter visitor facilities improvement project was completed. (Section H.l).

Habitat improvements benefited waterfowl hunters with an average take per hunter of 1.81 birds, highest on record. (Section H.8).

The total number of recorded bird species utilizing the Refuge increased by one to 372. (Section B.7).

The Refuge finally has a computer. (Section 1.6).

B. CLIMATIC CONDITIONS

The Imperial Valley received 2.58 inches of rainfall during the year which was 0.36 below the long term mean average of 2.94 inches. October was the wettest month of the year with 1.12 inches, slightly less than half the annual precipitation. Only 0.5 inches of rain brings farming activities and other habitat management work to a halt because the Valley's non-porous clay soils make the areas' dirt roads impassable.

The desert climate of the Imperial Valley generates extremely hot summer temperatures. From May 31 through October 8, 1987 (150 days), only 16 days had temperatures below 100°F. The highest temperature for the year was 115°F recorded on August 31 and lowest temperature recorded was 28°F on December 27, 1987.

	1914 - 1986		1986	1987			
	Avg. Temp°F	Avg. Rainfall	Rainfall	Temperature Min	Max	Rainfall (inches)	Humidity (%)
Jan	55	0.39	0.14	31	a3	0.05	52.87
Feb	59	0.34	0.64	39	82	0.22	60.78
Mar	64	0.24	0.11	41	a5	0.00	52.80
Apr	70	0.11	0.00	50	101	0.00	42.70
May	77	0.01	0.00	56	104	0.00	42.30
Jun	85	0.00	0.00	65	114	0.00	43.00
Jul	92	0.09	0.06	64	112	0.00	39.00
Aug	91	0.38	0.00	66	115	0.14	49.90
Sep	85	0.40	0.01	62	110	0.01	44.93
Oct	74	0.25	2.59	56	106	1.12	58.50
Nov	63	0.20	0.28	41	a4	0.72	62.20
Dec	55	0.53	0.10	28	77	0.32	66.10
Total		2.94	3.83			2.58	

The level of the Salton Sea has stabilized during the past five years between 226 and 227 feet below sea level. In 1987 the level of the Salton Sea has fluctuated from a high of -226.20 on May 1 to a low of -227.25 on October 1, a variation of 1.05 feet. The evaporation total for the Sea in 1987 was 9.67 feet (116.10 inches). The evaporation rate and the volume of irrigation runoff determine the level of the Salton Sea.

D. PLANNING

4. Compliance with Environmental and Cultural Resource Mandates

The Sea Levee Rehabilitation Project for 2B was given the "go ahead" by the Corp of Engineers. The project is covered under a national permit because it was rebuilding of an old levee.

5. Research and Investigations

Refuge Personnel

a. Salton Sea Basin Irrigation Drainage Study

In a joint effort the USFWS, Bureau of Reclamation (BR) and U.S. Geological Survey (USGS) began working to identify if irrigation drain waters have caused or have potential to cause harmful effects on human health, fish and wildlife or other water users. The 1986 field screening identified problems and determined that more detailed investiqations were needed. The following tables provide data collected in 1986.

Comparison of Selenium Values for Three Sites in California
(Reported in micrograms per gram (dry weight))

	Kesterson 1/		Volta 1/		Salton Sea (1986)	
	min.	max.	min.	max.	min.	max.
Mosquito fish	115	283	1.2	1.4	5.4	16
Sailfin Mollies	--	--	--	--	3.7	11
Coot Liver	21	63	4.4	5.6	14	21
Black-necked Stilt Liver	12	74	--	--	19	20
Duck Liver	19	42	3.9	4.4	8.3	27

1/Ohlendorf, unpublished data (1985). Kesterson receives only drainwater while Volta receives class 1 agricultural water.

Comparing 1986 Salton Sea trace element data to published values from National Contaminant Biomonitoring Program (Lowe, et al. 1985) for fish and waterbirds values from Kesterson NWR, and Westfarmer's ponds by Kern Pixley NWR in the San Joaquin Valley, California.

	FISH		WATERBIRDS		
Element	Salton Sea	NCBP	Salton Sea	Kesterson	Westfarmers
As	ND-2.6	0.88	ND-l.0	--	<0.2
Cd	ND	--	ND-3.4	0.12-.96	3.7-38
Cr	ND-O.77	--	ND-3.4	--	<0.4
Cu	ND-10	3.6	7.5-150	--	18-78
Hg	ND	0.72	0.14-49	0.35-10	1.3-4.6
Ni	ND-3.4	--	ND-2.4	--	0.31-4.3
Se	3.5-17	2.8	7.0-27	25-37	26-120
Zn	8.7-250	160	17-220	55-170	120-180

ND = Not Detected

Selected biota totalling 29 samples were collected and catalogued from five stations within the vicinity of the Salton Sea. Sixteen birds, 30 eggs of five species, and 13 fish, crayfish and clam samples were collected on the Salton Sea NWR from March 29 to June 19, 1987.

All samples were prepared and shipped in April 1988 to the two contract labs; Weyerhaeuser Analytical and Testing Service (organics) and University of Missouri Environmental Trace Substance Research Center (metals) for analysis.

Other Personnel

a. Reproductive Dynamics of Burrowing Owls (Athene Cunicularia) in Southern California

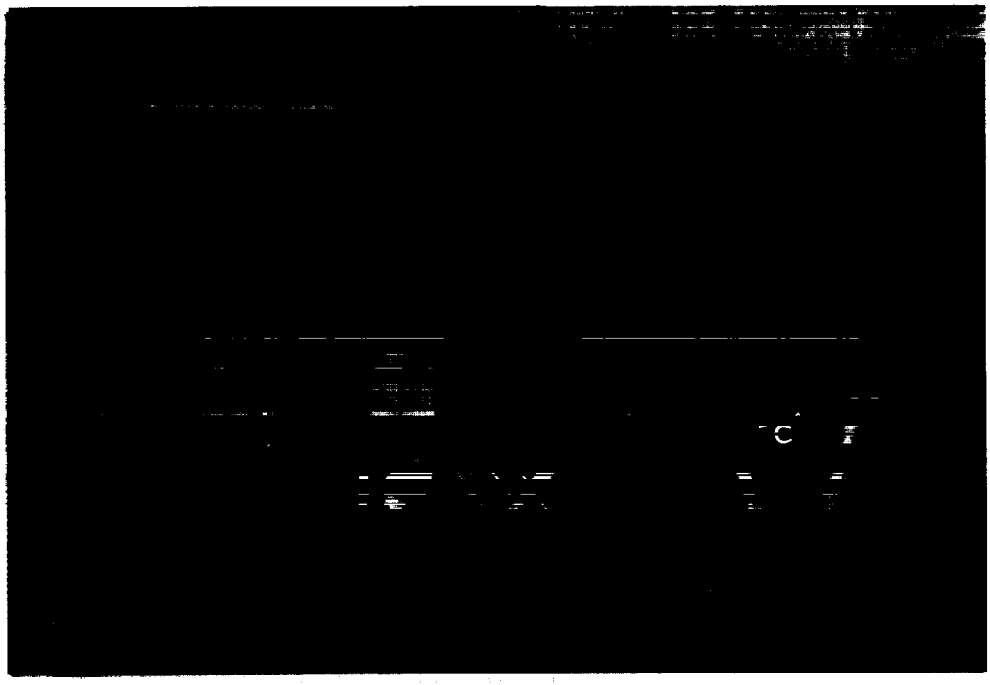
Cameron Barrows

The investigator is attempting to determine: 1) factors for differential reproductive success, 2) degree of site and mate fidelity, 3) degree of juvenile survival and fidelity to natal area, 4) age and sex structure of wintering populations.

Research began in the spring of 1987.

E. ADMINISTRATION

1. Personnel



Back Row: 8 7 9 2 6 4
Front Row: 1 5 11 3 10

1. Gary Kramer - Refuge Manager, GS-485-12 PFT
2. Thomas Alexander - Assistant Refuge Manager, GS-485-09 PET
3. Marc M. Weitzel - Asst. Refuge Manager (Tijuana Slough), GS-485-09 PFT
4. William Henry - Wildlife Biologist, GS-486-09 PFT
5. Kathleen Arnett - Refuge Clerk, GS-303-05 PET
6. Lee Laizure - Heavy Equipment Mechanic, WG-5803-10 PET
7. Richard Marquez - Crane Operator, WG-5725-09 PFT
8. Marcos Orozco - Maintenance Worker, WG-4749-08 PFT
9. Steve Clay - Assistant Wildlife Biologist, GS-486-05 TFT
10. Betty J. Grizzle - Biological Tech. (Tijuana Slough), GS-404-05 TFT
11. Shelly Laizure - Clerk-Typist, GS-322-03 TPT

Refuge Manager, Gary Kramer was promoted to GS-12 on May 24 for accretion of duties associated with the addition of Coachella Valley Refuge to the complex and the staffing of Tijuana Slough Refuge.

Shelly Iaizure, temporary clerk-typist was increased from 20 to 32 hours per week beginning June 21. Her appointment was extended for another year in October.

Steve Clay's, appointment as a temporary wildlife biologist was extended for a year in September. Steve's primary responsibility is assisting with the contaminant monitoring projects at Salton Sea and Tijuana Slough refuges.

2. Youth Programs

The Refuge hosted an eight week, non-resident Youth Conservation Corps (YCC) program which began on June 24 and continued through August 14, 1987. Steve Clay acted as the station program coordinator and Shirley Collins was the crew leader of the six member crew. The crew members were from Niland, Calipatria, or Brawley. Transportation and supplies were provided by the Refuge. Safety was emphasized daily by work leaders and crew leaders. Specialized safety programs included a two hour session on Heat Stress Training. One minor injury occurred requiring stitches on an enrollee's scalp. Due to extreme heat (110°F) and high humidity (45+%) the crew worked from 7:00 am to 3:30 pm.

The eager YCC crew and crewleaders ready to begin another day. SAL WH

Salton Sea NWR projects included: Cleaning out concrete irrigation ditches; construction of a fence at headquarters; brush clearing and landscaping of headquarters area; painting and posting signs; planting of native shrubs for wildlife habitat improvement; cleaning out hunting blinds; installation of drip irrigation; repairing of refuge boundary fences; and pouring of concrete walkways. Organized environmental education activities included: A self-guided tour of Anza Borrego State Park to observe a desert flora ecosystem; a day at San Diego Zoo; a tour of a local fish hatchery; a tour of The Living Desert in Palm Desert; and a talk on the endangered Coachella Valley fringe-toed lizard. In addition, four slide/film presentations were given by the refuge personnel emphasizing the role and management of the National Wildlife Refuge system.

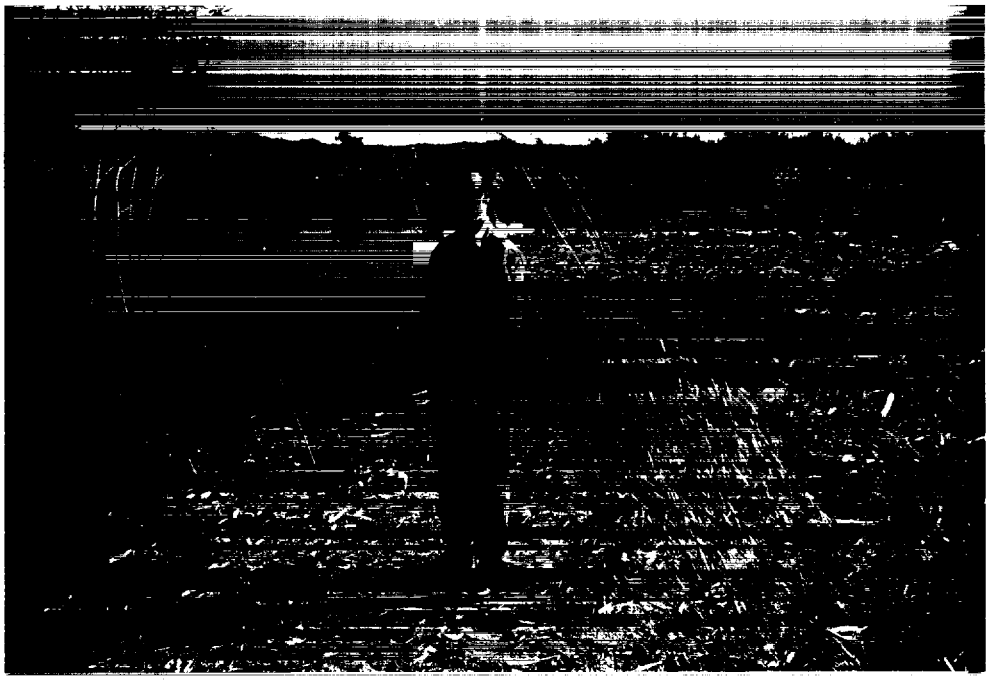
YCC crew planting a field border with mesquite and pa1o verde trees. SAL WH

Recommendations for 1988 YCC program include: Continue to hire a youth leader from past YCC crews and continue to hire a crew leader while keeping the crew size to a minimum of six.

3. Other Manpower Programs

In 1987, two programs were implemented to recruit additional manpower.

One student sponsored by the Student Conservation Association (SCA) was hired as a resource assistant. Jim Barse, from Maryland, worked November 16 through May 30; the time frame encompassed two programs, early winter program and late winter program. Jim assisted the staff in a variety of jobs ranging from building a carport to installing steps on a Refuge trailer house. He also completed waterfowl and shorebird surveys, clapper rail breeding surveys, summarized wildlife inventory data, planted native shrubs and trees and assisted in guided tours of the Refuge to elementary school classes. The work performed by Jim was very beneficial to the Refuge. The SCA program will continue to be implemented.



SCA volunteer, **Jim** Barse helping transplant willow spears along the **HQ** pond. SAL WH

5. Funding

A five year funding comparison for Salton Sea NWR and its satellites, Tijuana Slough and Coachella Valley NWR's is listed below.

ACTIVITY	FY 1983	ACTIVITY	FY 1984	FY 1985	FY 1986	ACTIVITY	FY 1987
1210	212,000						
1220	500	1260	364,900	317,100	328,000	1261	263,200
1240	4,000					1262	122,700
1400	35,000						
		1270	1,500	1,500	1,500		--
		1520	23,250	19,440	20,700		12,800
		8610	3,550	900	2,700		2,700
		7201"	--	--	7,000		10,000
		1240	--	--	--		301
TOTAL	273,344		393,200	338,940	359,900		411,700
Jobs Bill	400,000						
Other		2841[b]	30,000				
		1971[c]		139,973	145,027		
		1902[d]			15,000		7,000
		1975[e]					24,500
		1971[f]					68,600
		RPRP[g]					122,000

"Contributed funds - Coachella Valley NWR.

[b]Construction and Anadramous Fish funding used for dredting and dune reconstruction at Tijuana Slough NWR.

"Mitigation funds received from the Bureau of Reclamation. Funds were used at Salton Sea NWR for habitat improvements.

[d]Habitat Resources Funding for contaminant studies (Salton Sea Irrigation Drainage Study).

"U.S. Navy funds for Sikes Act Management Plan preparation in San Diego area.

[f]U.S. Navy funds for dredging operations at Tijuana Slough NWR.

[g]One time RPRP (1261) funds - $36,000 for Tijuana Slough contaminant studies and ARMY (1262) funds - $86,000 for Tijuana Slough dredging.

6. Safety

The Refuge safety program is directed toward increased safety awareness among all staff members and maintaining a safe environment for the staff and visitors alike.

To involve the whole staff in the safety program, responsibility for the monthly safety meeting rotates through the staff; some topics addressed were heat stress, hearing protection, defensive driving, heavy equipment, shop tools, welding, ATC and aircraft safety.

Only one accident occurred during the 1987 YCC camp. An enrollee hit his head on the door frame of the van while entering the vehicle. The laceration required several stitches.

But overall, this year was not good for safety. At one point in June all three of the maintenance crew were on light duty because of back injuries.

Marcos Orozco, maintenance worker, had three accidents. In February he hammered a nail through plywood into his ankle while building concrete forms and later pulled the ligaments in his wrist while pulling nails from the forms. His back injury occurred on June 12 from a combination of rowing a boat and then manhandling it up a ten foot dike.

Lee Laizure, heavy equipment mechanic, missed three days of work in June after he reinjured his back while loosening bolts to replace the bearing on a disk. Lee has been on restricted duty since 1985 when his lower back problem was classified as an occupational disease. His back was first injured in 1965. Lee's second accident was a spider bite, probably a black widow.

Richard Marquez, crane operator, also had two accidents, both of them back injuries. In June his lower back started hurting after performing daily maintenance on the crane and operating it a short time. In November he strained his back while lifting pipe and lost his footing in mud.

Because of hazards of working around the polluted New and Alamo Rivers all refuge staff required to work in the field received immunizations for typhoid, tetanus and polio by the County Health Department at refuge expense.

On September 22 and 23 equipment certification/training was given at the Refuge by Dale Green from Klamath Basin NWR.

The staff spent several days viewing films and filling out workbooks prior to Dale's arrival so that the certification could be completed in only two days.

Certification accomplished:

Marcos Orozco - farm tractor

Richard Marquez - dragline
farm tractor

Steve Clay - dozer
backhoe
farm tractor

Lee Laizure - dragline
dozer
backhoe
grader
farm tractor

This completed all heavy equipment certification required by refuge staff.

In a heavily agricultural area like the Imperial Valley the potential for pesticide problem always exists and on the evening of March 17 all personnel living on the Refuge had to be evacuated after an irrigator had incorrectly applied Vapam, a herbicide, to an asparagus field adjacent to the Refuge.

The chemical should have been applied over ten to twelve hours through the sprinkler system but due to a mistake by the irrigator was applied in only one hour. The result was a cloud of Vapam mist which causes burning to eyes, nose and throat. The chemical was diluted using the sprinkler system and the area -was declared safe around midnight by the County Health Department.

7. Technical Assistance

Technical assistance was offered to private duck clubs in Coachella and imperial Valleys again this year. This assistance has occurred for four years and is provided as a joint effort by the USEWS, CDF&G and Waterfowl Habitat Owner's Alliance (WHOA).

The technical assistance program was accelerated in mid December when Refuge Biologist, Bill Henry, was given regional direction to actively contact all private duck clubs in the Imperial and Coachella Valleys. All participating duck clubs were inspected and evaluated, with management practices recommended for each club to improve moist soil forage plants, reduce pest plants, and lower water and soil salinity levels.

F. HABITAT MANAGEMENT

1 .General

Salton Sea NWR is geographically located in the upper Colorado Desert Region of the Sonoran Desert_ where annual rainfall rarely exceeds three inches. Native habitat consist of creosote bush - white bursage and pa1o verde - mesquite communities with isolated riparian ***zones*** dominated by cottonwoods and willows.

These basic habitat types are considered climax communities and are very stable unless disturbed.

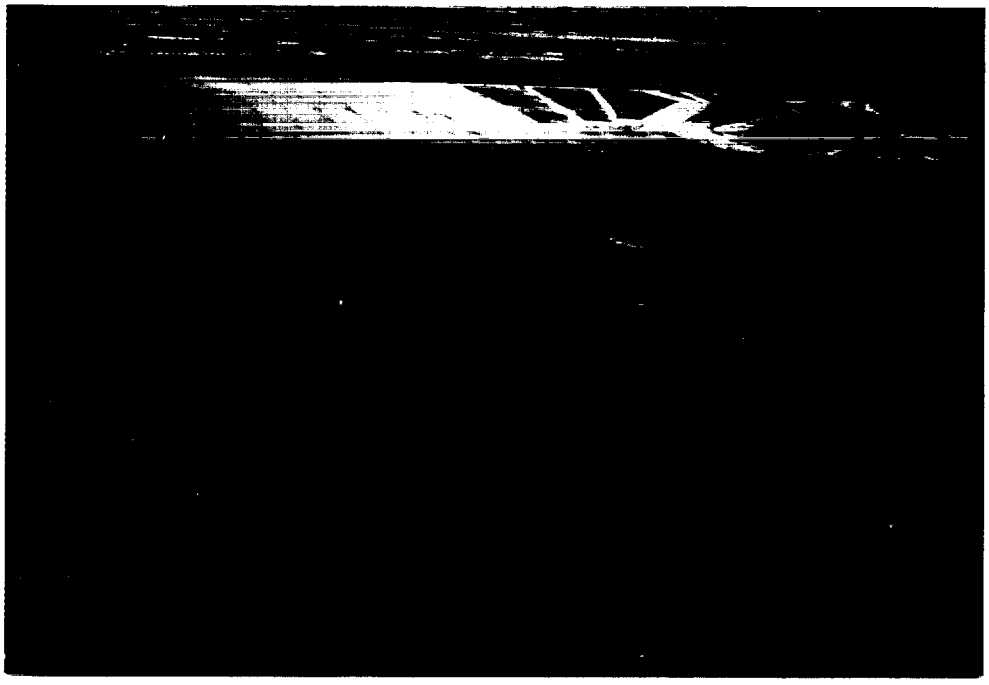
As early as 1850, there were plans to alter the Salton Sink by bringing irrigation water from the Colorado River for irrigation. Since that time, over 475,000 acres have been converted from desert brushlands to agricultural lands.

2. Wetlands

wetland management is directed toward production of natural foods to provide wintering habitat for waterfowl and nesting habitat for Yuma clapper rails.

Tract 1A (160 acres) in Unit I was drawn down and left dry throughout the year to facilitate land-leveling and levee rebuilding that was scheduled for the late summer and fall. Due to lack of funds and equipment this work has not been completed. The unit remained dry during the fall and winter.

Tract 2B was managed to provide varying aged stands of cattail and bulrush. These areas are used by clapper rails for nesting and provide roosting and foraging areas for waterfowl and shorebirds. Water was maintained and circulated in 2B to keep shallow pools and flooded vegetation available for nesting clapper rails through the spring and early summer. Tract 2B was reflooded beginning in early October and maintained at shallow levels through March.



Tract 2B - fall floodup. SAL WH

All water used to flood 1A and 2B prior to 1985 was agricultural drainage (primarily subsurface - "tile" drain water). Late in 1985, these waters became suspect of carrying toxic trace elements (selenium) and soluble pesticides and their use was discontinued. A new water delivery system is being developed and beginning in January 1986, all water used to flood 2B was class one agricultural water.

The Reidman ponds 1 and 2 were drained in early March and disced and planted to watergrass. Ponds 1 and 2 were seeded to watergrass but due to hypersaline conditions, only pond 1 produced a good stand of sprangletop (Leptochloa). Irrigations in May and June were used on pond 4 due to high salinity levels. This resulted in a good stand of alkali bulrush.

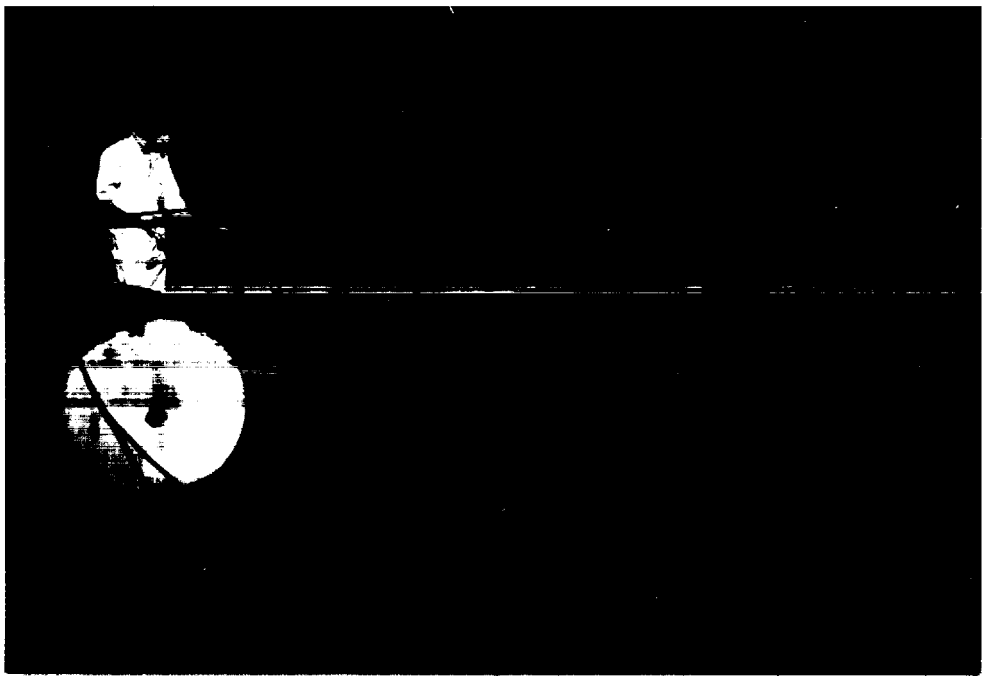
Fall floodup began October 6 and all ponds were at desired depths (4-6 inches) by October 10. Waterfowl use peaked during the months of December and January with over 2,000 wigeon and 9,000 white geese utilizing the new 80 acre ponds.. Shorebird use fluctuated greatly with peaks of over 1000 long-billed dowitchers recorded in November and February.

On October 9, 1986 a thunderstorm knocked out power and dumped 2.59 inches of rain in a matter of hours causing the Alamo River to overflow its banks. Water flowed into the Hazard tract creating a 140 acre lake on the north end of the unit. Ponds 1, 2 and 3 were flooded with over three feet of water and all levees were nearly covered. Ponds 4 and 5 were back filled causing flooding of several blind sites. Pond 9 also received back spill from the river, causing a partial flooding.

Due to fall flood damage and to enhance wetland acreage the Refuge applied for and received special funding through the Ducks Unlimited MARSH programs to rehabilitate the Hazard Tract. The project began in early Octoberand included development of three new ponds, repairing and enlarging levees, rough land leveling installation of PTO lift pump, and dike and island construction involving 25,000 yards of dirt. This work provided independent flooding and drainage of 130 new acres allowing active management for moist soil plants.

Newly developed Hazard ponds 1A, 2A and 3A remained barren of any vegetation due to the high water table and hypersaline soils ranging from 8,000 ppm to 19,000 ppm. All ponds were kept flooded to promote widgeon grass (Ruppia) development. Hazard ponds 1 and 2 were kept shallowly flooded and wigeon grass quickly became established. Hazard pond 3 was drained in late March but due to hypersalinity failed to produce any plant growth. Hazard ponds 4, 5, 6 and 7 were managed for swamp timothy (Heleochloa) and water grass (Echinochloa) with spring draw downs beginning in early March. Two irrigations in May produced good to excellent stands. Mowing of the scattered clumps of sesbania and saltcedar was completed in all ponds by late July.

An active saltcedar spraying program was initiated in early June to control saltcedar growth along the pond edges and by late June all dry ponds were sprayed with a 2% solution of 2,4-D Weed Rhap with 97% effectiveness.



Rental spray trailer used to control saltcedar along impoundments. SAL WH

Waterfowl use rose markedly with over 5,000 birds primarily pintails using the Hazard through October and November.

Hazard ponds 8 and 9 remained at the mercy of the high water flows of the Alamo River. Draining was attempted in early March but high water levels in the Alamo River during April caused back filling of both ponds. Due to the high water level of the Sea and high river flows, drainage of ponds 8 and 9 will remain a problem until a lift pump is installed. This pump was installed by D.U. in June and will be used in next springs draw down. Dozer work was completed around the pond edges to remove old growth saltcedars.

Hazard pond 10 was drained in mid March, disced and planted to watergrass. Three irrigations in June produced a fair stand of watergrass. Mowing in early September was needed to control sesbania.

The headquarters ponds were drained in late March to promote moist soil plant growth but due to hypersaline conditions only saltcedars germinated.

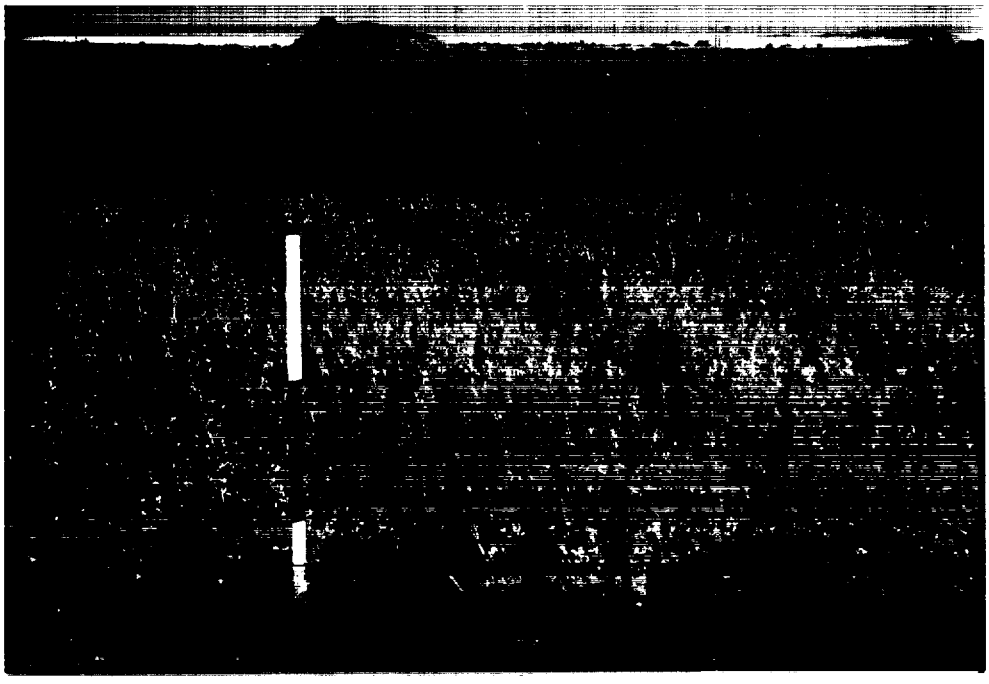
The headquarter ponds levees were reworked to remove the dense thickets of saltcedars. Discing in July removed all seedlings and flooding in October prevented additional regrowth. The Soil Conservation Service (SCS) surveyed the south pond and it was disced, leveled and a new drain box installed to facilitate complete and rapid drainage. The rock hill pond also had a new

drain pipe and box installed to allow drainage, provide water circulation and control flood-up.

4. Croplands

The Refuge had 795 acres of goose pasture with 205 acres in alfalfa and 590 acres in combination of sudan grass (summer) and winter wheat/rye/oats (fall-winter). All farming is under a cooperative agreement that is renewed every four years. The cooperator harvest the alfalfa from April 1 to September 30 leaving the remaining (winter) cuttings for goose browse. The annual summer crop was sudan grass which the cooperator harvests. To provide the governments share, the cooperator plants wheat, barley or rye grass in the fall (after October 1) and the entire crop is grown as green browse for wildlife. No harvesting or cutting of annual crops occurs from October 1 to March 30.

In late March the cooperator seeded sudan grass on 460 acres in Unit I. The first sudan and alfalfa cuttings were made in June with final cuttings in September. Irrigation of field crops was required every ten to twelve days due to the high temperatures and evaporation rates. Alfalfa and sudan fields were hayed every 20-30 days. The total yield was 1604 tons of sudan hay and 882 tons of alfalfa hay.



Alfalfa field (Vail 461) before geese arrive.
SAL WH

The Union Tract (field Vail 419) was disced and seeded to wheat in mid Cctober. The north 30 acres were leveled and bordered for leach ponds. Leaching continued for seven months.

The north 30 acres of the Reidman Tract were leveled and bordered for leach ponds by September and after flooding in October was leaching salts at 45 ppt @ 30 gal./min. (43,200 gal/day).

The Refuge fields provided a continuous source of goose browse throughout. the winter months. The Unit II fields planted to wheat received limited use in 1987 compared to 1986, even though the fields were ready and waiting for the fall migrants. In contrast to the low use of green wheat;heavy use of alfalfa occurred in Unit II with 185 acres 80 percent utilized by mid December. Goose use days for Unit II rose 300% with the corresponding acreage of alfalfa available.

Goose use of alfalfa fields increased 300% over green wetland wheat fields. SAL WH

The four acre headquarters field was seeded and irrigated to wheat on 15 March by Refuge staff and left standing for upland birds and wildlife.

6. Other Habitats

Field borders along the western edge of Union fields Vail 419 and 461 were disced, seeded to wheat, corrugated, bordered and planted by Refuge staff to five desert tree species: (2) pa1o verde, screwbean and honey mesquite, desert-thorn, and sweet acacia.

On May 16, eleven Brawley Boys and Girls Club members planted 100 native pa1o verde and mesquite trees along the edge of the Union Vail 420 field. This will increase species diversity by providing native desert shrub and tree habitat along field borders.

9. Fire Management

On May 29, a fire along the Alamo River and Hazard N-37 burned eight acres. Due to inaccessibility the fire was allowed to burn itself out under watch by fire units from Niland and Calipatria.

11. Water Rights

The Refuge currently uses about 2800 acre feet (AF) of water per year for management of wetland units with 30 percent obtained as "free water". The "free water" is a mixture of irrigation water (operational spill) and surface drain waters. Included in the 2800 AF of water is the usage for 4 newly developed 20 acre impoundments on the Reidman Tract which came on line in the spring of 1986. These areas were previously unflooded farmland.

In.1985 the quality of the "free" subsurface drain water used to flood some ponds was suspect of carrying toxic trace elements and soluble pesticides. As a result of these concerns the use of subsurface drain water was discontinued. Water quality monitoring has been initiated to determine if these drain waters are of an acceptable quality for irrigation and flooding of our wetlands. Until that data is analyzed, subsurface drain waters will not be used.

With the renovation of 300 acres in Tract lA-2B and 100 acres in the Hazard the need for deliver&i water will increase by an additional 2000 AF. This equates to $20,000.00 at the current price of $10.00 acre/foot for class one water purchased from Imperial Irrigation District (IID).

As the Central Arizona Project and a proposed water transfer from IID to the Southern California Metropolitan Water District comes on line it will cause stricter water conservation measures in the Imperial Valley. This will mean less surface drain water and irrigation spillage for use on the Refuge. The time has come to obtain additional funds to purchase water. If funding is not provided to purchase good quality water, some moist soil impoundments heavily used by waterfowl and nesting habitat for the endangered Yuma clapper rail will not be flooded.

G. WILDLIFE

1. Wildlife Diversity

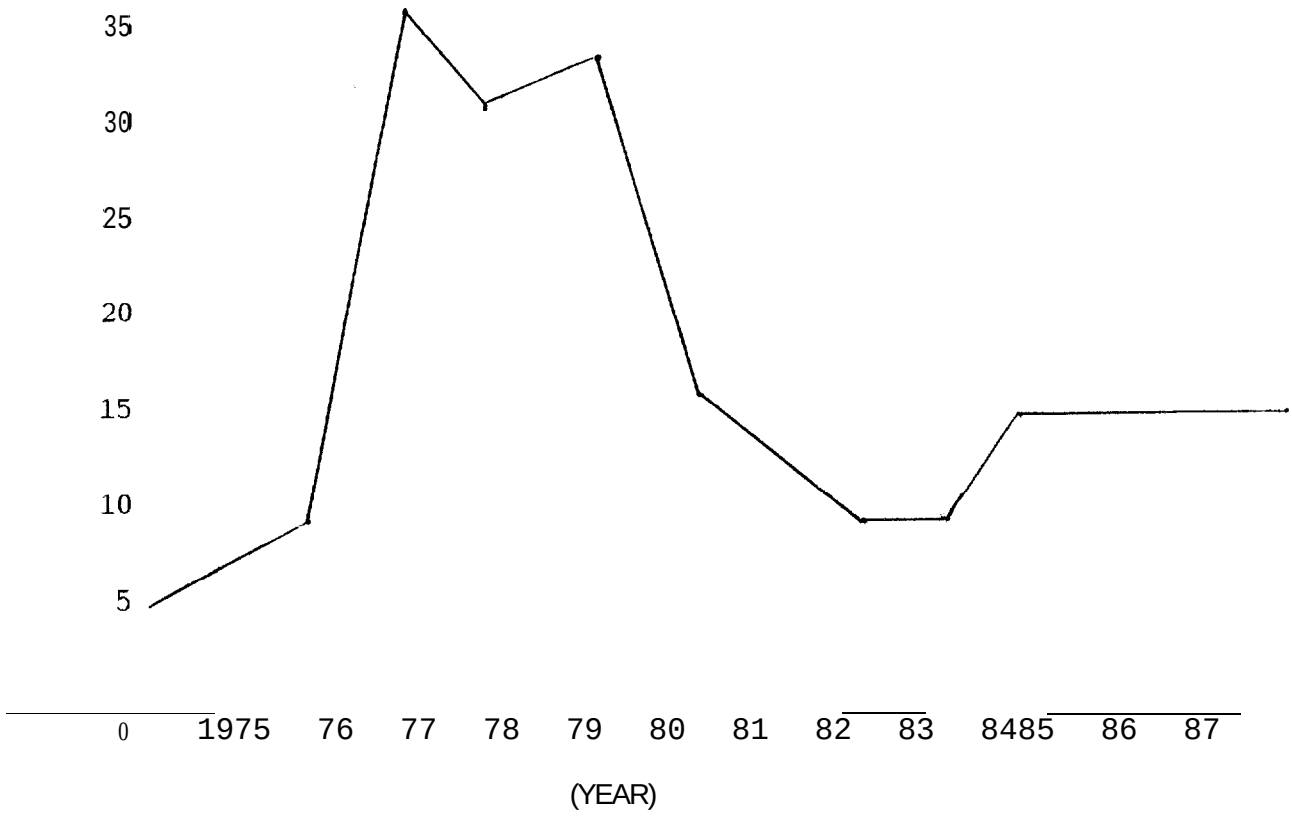
A total of 372 species of birds, the most reported for any refuge in the United States, have been observed along with 40 species of mammals, 20 species of amphibians and reptiles and 13 species of fish.

2. Endangered and/or Threatened Species

Yuma clapper rail populations remained at levels comparable to 1985 with an estimated 14 pairs scattered throughout the Refuge with the majority (70%) using tract 2B and Bruchard area of Unit I. Other nesting activity was documented in Hazard pond 10 and along both the Alamo and New Rivers.

Wetland management for the production and maintenance of rail habitat continued with improved water level manipulation and the planning of a new water delivery system for Unit I. No longer will agricultural drain water be used, all water will be class one agricultural water or surface runoff.

The following graph shows nesting population of Yuma clapper rails (pairs) at Salton Sea NWR for the last 13 years.



Sightings of other endangered/threatened species included 200 brown pelicans and three individual peregrine falcons. All were observed during the fall and winter months.

3. Waterfowl

Goose populations wintering along the southern edge of the Salton Sea dropped from a high of 27,300 (1986) to 23,750 birds in 1987. Canada goose numbers were only 50 percent of normal and white goose populations were similar to those in 1985. Even with an excellent white goose hatch, a mild winter held birds to the north and were significant factors in explaining the slight decline.

Monthly aerial flights were conducted in cooperation with CDF&G, to count waterfowl on Salton Sea NWR, Imperial Wildlife Area (Wister and Finney-Ramer Units), local duck clubs and private farmlands adjacent to the Salton Sea shoreline. This count area is described as the south end of the **Salton' Sea** and Imperial Valley.

The Refuge goose population peaked at 9,500 during the months of November, January and February. Goose use on the Union Tract rose nearly three-fold with an average of 6,000 birds during the four winter months. However, this average does not represent the exchange and movements between the Refuge and adjacent areas. The Refuge remains the only significant sanctuary within the Imperial Valley. Nearly every white goose using the Imperial Valley utilized the Refuge ponds and farm fields sometime during the fall, winter or spring months.

The first snow geese arrived on October 20. The major influx occurred in November with 10,000 birds counted during a three day period beginning on November 17, when large flocks were observed arriving hourly.

Age ratio counts were conducted from early November to mid-December with 37 percent juveniles in the white goose flock. A major turn around from 1986. Ross' geese comprised 15 percent of the white goose population including the second sighting of a blue phase Ross' goose.

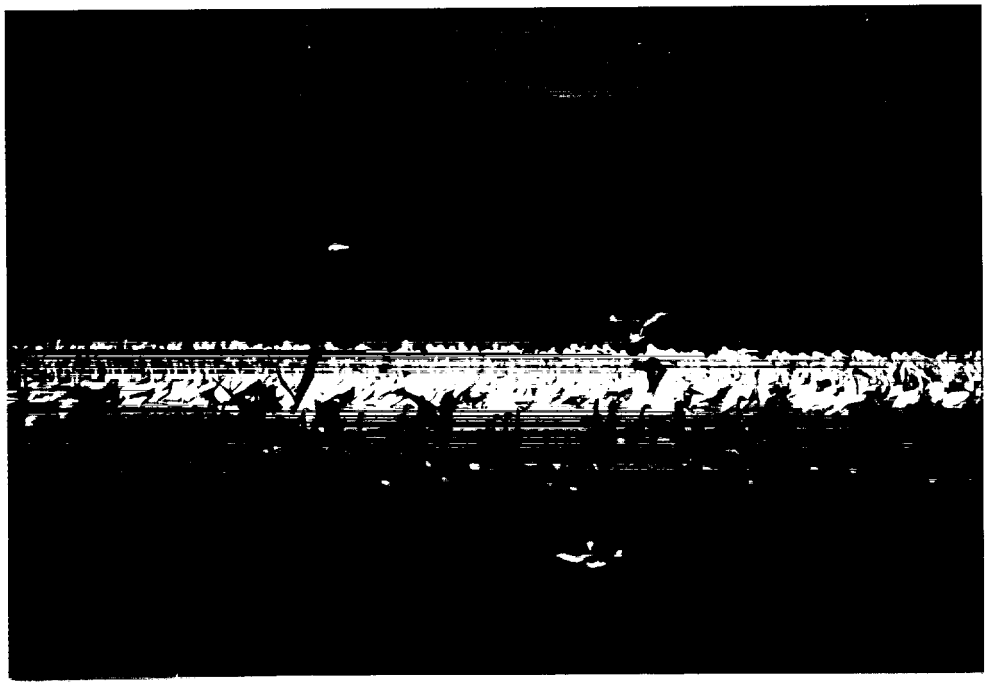
Total duck use days increased to over 2,650,000 a three-fold increase from the 1984-85 season with primarily pintail, shovelers, ruddy ducks and wigeon showing sharp increases. In February 1986, 42,000 ruddy ducks were counted in the Salton Sea area. This population represents 49 percent of the entire Pacific Flyway population of ruddy ducks.

Estimated Waterfowl Peaks, Salton Sea NWR and Vicinity 1987-88

Species	South End Salton Sea			Date
	Salton Sea NWR	Other Areas	Total	
Canada Goose	470	2.805	3,275	10 Feb
Snow/Ross Goose	8,000	12,800	20,800	07 Dec
Mallard	70	40	110	19 Nov
Pintail	725	23,635	24,360	22 Oct
Shoveler	17,605	5,335	22,940	19 Nov
Green-winged Teal	2,210	6,545	8,755	19 Nov
Cinnamon Teal	255	1,195	1,450	10 Feb
Wigeon	845	4,320	5,165	10 Feh
Ruddy Duck	11,050	10,995	22,075	07 Dec
Scaup	205	1,125	1,330	30 Dec
Canvasback	75	825	900	10 Feb
Redhead	0	285	285	07 Dec

4. Marsh and Waterbirds

Colonial nesting species continued to expand with more than 250 great blue heron, 1,600 cattle egrets and 100 great and snowy egret nests scattered among the three major colonies along the sea. Peak populations were established for white pelicans (33,000) double crested cormorants (2,400) and eared grebes (65,000).



Some of the common waterbirds utilizing the Salton Sea shoreline. SAL GK

5. Shorebirds, Gulls, Terns and Allied Species

Peak shorebird use continued during the fall and spring months (September - November and February - April). The mud flats and shallow ponds surrounding the Sea received heavy use by large concentrations of long-billed dowitchers, dunlin, western and least sandpipers and Wilson's and red-necked phalarope.

'Long-billed curlews, marbled godwits and whimbrels continue to be abundant during the fall and spring with mountain plovers commonly seen in large wintering flocks in open grass or plowed fields.

Black-necked stilts, avocets and killdeer nested on the Refuge again in large numbers. Searches finally documented the nesting of 42 gull-billed terns and 10 snowy plovers with peak populations of 160 terns and 42 plovers observed.

More than 220 wood storks and 700 black skimmers were observed throughout the summer months. About 100 skimmers nested just north of the Alamo River along

the Sea. This breeding population of skimmers is at the northern limit of their range.

The Imperial Valley continued to provide foraging areas to several thousand wintering white-faced ibis. The Refuge ibis population fluctuated greatly with a peak of 400+ observed in November.

Large concentrations of ring-billed gulls (30,000) continue to gather during the winter months along the Sea edge and in the flood irrigated fields. Mixed in these masses are numerous allies including: yellow-footed, laughing, mew and California gulls, Forster's, black and caspian terns.

6. Raptors

American kestrels and barn owls are abundant winter visitors and many remain to nest, primarily in the numerous hay stacks on the Refuge and in surrounding farm fields. *Burrowing owls* were a common sight along all major drainage ditches, primarily in Unit I.

Peregrines and prairie falcons were seen occasionally in the fall and winter. Red-tailed, ferruginous and marsh hawks were commonly observed throughout the fall and winter.

7. Other Migratory Birds

The Audubon Christmas Bird Count was conducted on December 22, 1987, 154 species totalling 81,729 individuals were recorded. Highlights included: a palm warbler, two laughing gulls, a dusky capped flycatcher and a McCowan's longspur.

UNUSUAL BIRD SIGHTINGS

Date: 1987	Species	Number
10/07	Greater White-fronted Goose	33
11/02	Mountain Plovers	300
04/14	Dusky-capped Flycatcher*	1
06/25	Gull-billed Terns	160
06/10	Black Terns	450
07/06	Wood Storks	220
l0/27	Yellow-footed Gulls	42
06/10-07/20	Laughing Gulls	110
07/20-08/30	Black Skimmers	550
08/09-08/20	Red-necked Phalaropes	500
10/12	Brown Pelicans	200
12/10	Mountain Bluebirds	70

*This bird put the total Refuge species count at 372.

10. Other Resident Wildlife

Desert cottontails, raccoons and striped skunks are very abundant on the Refuge, especially around the headquarters area. Soft-shell turtles, rattlesnakes, desert spiny and whiptail lizards also add variety to the fauna of the Refuge.

11. Fisheries Resources

During the mid-1950's, various species of marine fish from the Gulf of California were transplanted into the Salton Sea by CDF&G. Orangemouth corvina, sargo, gulf croaker, and tilapia have flourished and provide excellent sport fishing. CDF&G and other researchers consider the Salton Sea to be the most productive fishery in the western United States.

During recent years, the annual inflow of irrigation drainage to the Salton Sea generally has been balanced by natural evaporation. As a result, the five million tons of salt added to the Sea each year have slowly increased salinity to about 40,000 milligrams per liter. If salinity continues to increase, the marine fishery will eventually be destroyed. This will affect the food resources of some endangered species and numerous other fish-eating birds. Various mitigating measures have been proposed and studied, but no project has been funded to solve the salinity problem.

14. Scientific Collections

In 1986, the California Department of Fish and Game collected 80 samples of four bird species and 35 fish samples from the Refuge were analyzed for selenium as part of the Selenium Verification Sampling Program.

Date	Collections	Results Selenium Concentration (wet weight, ppm)	
		Liver	Muscle
May 1986	10 Black-necked Stilts	3.9	
	10 Double-crested Cormorant	10.3	
	10 American Wigeon	1.3	1.0
	12 Lesser Scaup	3.1	1.2
	19 bird samples from Red Hill area		
	10 Black-necked Stilts	6.4	
	9 Double-crested Cormorants	9.1	
	35 fish samples from Salton Sea near Red Hill		
	11 Corvina	2.4	3.1
	9 Croaker	4.6	3.9
	15 Tilapia	6.8	3.6

These preliminary results issued in May 1986 were followed by a formal health warning by the Department of Health Services limiting the amount of fish consumed to only eight ounces per month. Women who are pregnant, nursinq mothers, and children age 15 and under should not eat fish from the Salt& Sea.

Five crippled Ross' and one snow geese were rounded up on January 16 and donated to Mr. Rene Van Swinderen (SPP PRT-691100) of Phoenix, Arizona for his captive breeding program.

16. Marking and Banding

Following the close of waterfowl season on January 17, duck trapping began with 791 ducks being banded at two trap locations on the Hazard tract. The Refuge banding provides hands-on experience and is used in conjunction with the environmental eduction program for elementary school groups and the SCA volunteer. In addition, 118 black-necked stilts, 100 black skimners and 68 gull-billed terns were banded in conjunction with the agricultural drainwater study.

Biologist, Steve Clay banding juvenile black-necked. stilt as part of contaminant monitoring study. SAL WH

Table 3. 1987 Duck Banding Summary at Salton Sea NWR

	Banded	Returns
Northern Pintail	345	(18) 2-Los Banos, CA (l/87), 1-Coachella Valley, CA (12/87), 3-Sacramento Valley, CA (10/86), 9-Imperial Valley, CA (11/86, 2/87), l-Rio Colorado (11/86), l-San Felipe (l/87), 1-Juarez, Mexico (l/88)
		Recaptures
		(2) Mills Lake, Dist. of Mackenzie, Canada
		Returns
Green-winged Teal	58	(2) Imperial Valley, CA (10 & 12/86)
Mallard	9	(2) Imperial Valley, cA (11/87, l/88) (1) Gunnison, UT (10/87)
Cinnamon Teal	105	(3) l-Jalisco (12/87), 1-Sinaloa, Mexico (l/88), l-Rio Hardy, B.C. Mexico (l/88)
Redhead	32	(1) Prescott Valley, AZ (10/87)
Canvasback	37	(2) l-Rio Vista, CA (?/87), 1-Temecula, CA
Lesser Scaup	203	(3) l-Lafayette, CO (12/87), 1-Sinaloa, Mexico (3/88), 1-Denair, CA (l/88)
Ruddy Duck	2	
Total	791	

H. PUBLIC USE

1. General

This year public use was estimated between 25,000 and 30,000 with the bulk of the visitation occurring November through March. The Salton Sea has always been a popular area for bird watching and as the facilities continue to improve public use increases.

The interior exhibit was installed in March under contract #14-16-0001-860023 (NR) for $31,315, by Howard Schureman and Associates.

The exhibit included 35 birds, mounted and displayed in a floor to ceiling case depicting three habitat types found on the Refuge - Seasonally Flooded Freshwater Marshes, Cropland and Coverstrips.

In May the entrance road and parking lot were paved under contract #14-16-0001-87037 (TA) for $54,563. The project included paving of the visitor parking area, entrance road, service road to maintenance area, and behind the office and residence. This was the last step of a four year project to improve visitor facilities at the headquarters unit.

Since the office/visitor center was completed in 1984 the staff has poured concrete curbing and sidewalks, built fences and landscaped to improve the appearance of the headquarters area. In 1986 refuge entrance and information signs and interpretive panels were installed by Wilderness Graphics, the observation tower was built and the landscaping was completed.

Beautiful job!

Landscaping around headquarters office. SAL WH

In October, the Advanced Public Use Development and Design Work visited the Refuge to see an example of what can be done for public use facilities working within a typical refuge budget. The workshop held in San Diego was put on by the Regional Office Outdoor Recreation Planners shop and hosted by the Refuge. One of the goals of the workshop, besides training, was to design public use facilities for Tijuana Slough NWR.

8. Hunting

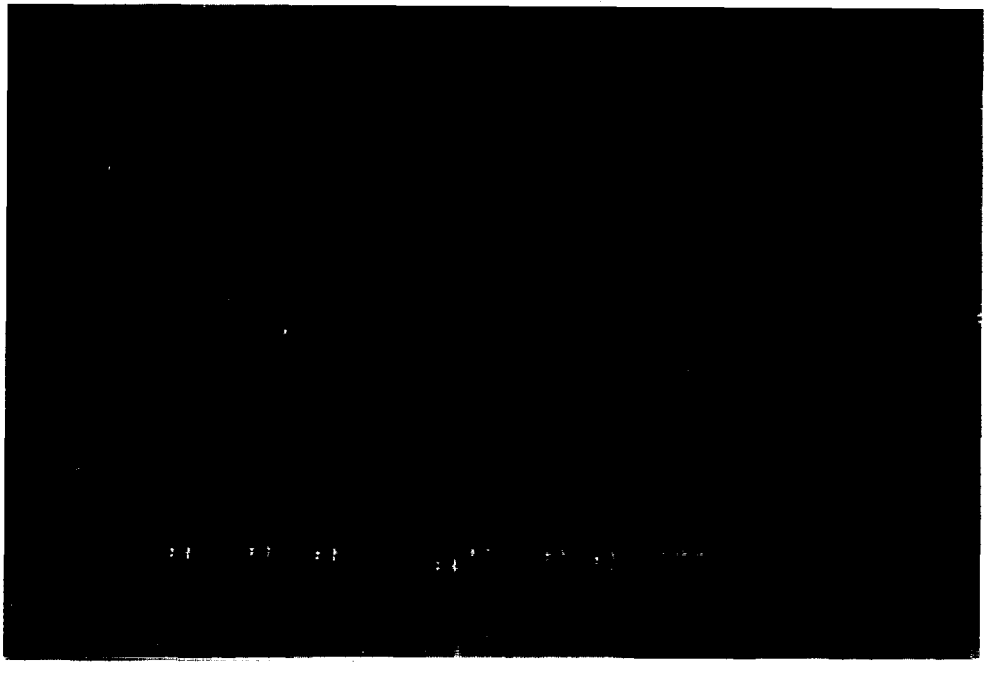
Hunting on the Refuge is limited to waterfowl hunting by permit only. Permits are issued by CDF&G as part of the Imperial Wildlife Area hunt.

The Refuge has ten waterfowl blinds located in moist soil units on the Hazard tract and four goose pits in green browse fields on the Union tract.

A 25 shell limit was initiated in 1986 on the Refuge and the Imperial Wildlife Area. The regulation limits a hunter (in the field) to 25 shells in possession; there is no limit on the number of times a hunter may return to his. vehicle to replenish his shell supply. The regulation is welcomed by most hunters as a method of improving hunting quality by reducing sky scraping and crippling. Steel shot was required for Imperial County this year.

The duck season was split again with seasons running October 17 through November 29 and December 7 through January 19. The daily bag limit remained at five with not more than one hen mallard and one hen pintail in the bag and a possession limit of ten with not more than two mallard hens and two pintail hens. The goose season opened October 17 and ran through January 17, with a one week delay for Canada geese, October 24 through January 17. Limits were six per day/six in possession with no more than three white geese and three dark geese of which only one may be a Canada goose or two in possession.

This year all the Hazard blinds were opened late because of work on the Hazard Rehabilitation Project sponsored by Ducks Unlimited. Blinds H-7 through 10 were opened on November 18 and blind H-l through 6 were opened on December 9. Very few negative comments were received on the delayed opening. On the contrary, most hunters praised the Refuge for the habitat improvements accomplished over past three years.



Typical hunting scenario - to shoot or not? SAL WH

The newly completed leach ponds on the Union Tract also drew favorable comments

With all the improvements in waterfowl habitat on the Refuge it is not surprising waterfowl use and hunter success are both up. This year the Refuge had the highest hunter success recorded, 1.81 birds per hunter.

Hunting was best on the Hazard tract with 224 hunters taking 638 ducks and 15 geese for an average of 2.9 birds per hunter.

Waterfowl Harvest

	Ducks	Geese	Hunt Average	Hunters
1987-88	684	236	1.81	508
1986-87	694	133	1.17	706
1985-86	270	237	1.10	460
1984-85	187	364	0.83	664
1983-84	152	193	1.07	305
1982-83	488	184	1.05	639
1981-82	82	245	0.73	444
1980-81	1084	203	1.45	886

9. Fishing

Much of the Refuge is inundated by the Sea. The majority of this areas is open to public fishing. With an estimated 26,000 angler use days/year, these areas contribute significantly to the overall use of the Refuge. In a recent survey conducted by CDF&G, the Salton Sea had one of the highest catch-per-angler hour values of any inland fisheries within the State and possibly the nation. Fishermen caught an average of 1.46 fish per hour for over 76,000 pounds of fish taken legally each year. Tilapia made up 41 percent of this catch followed by bairdiella (gulf croaker) - 28 percent, sargo - 28 percent and corvina - 3 percent.

In April 1986, the closed area of the Sea adjacent to Rock Hill was opened to fishing for the first time. This area (approximately 1000 acres) has been closed since it was inundated in the early 1970's and acts as the only sanctuary for migratory birds on the Sea. The area was opened to summer fishing, April 1 to September 30, on a trial basis after the Refuge biologist determined that fishing activity would not have a significant impact on nesting colonial birds. During the first two summers no adverse effects were observed and compliance with the winter closure has been much better.

On April 26, 1986, California Department of Health Services recommended that adults limit their consumption of Salton Sea fish to no more than eight ounces per month because of the elevated levels of selenium found in fish samples taken by the State. Since the warning was issued fishing activity on the Sea has been cut in half. Comparing 1987 to 1985 the number of boats launched at Red Hill Marina were down over 50 percent.

The "60 Minutes" story on the New River which aired on December 28, 1986 may further reduce angler interest in the Salton Sea. The New River, which "60 Minutes" called the most polluted river in the world, starts in Mexico and empties into the Sea near Unit I of the Refuge.

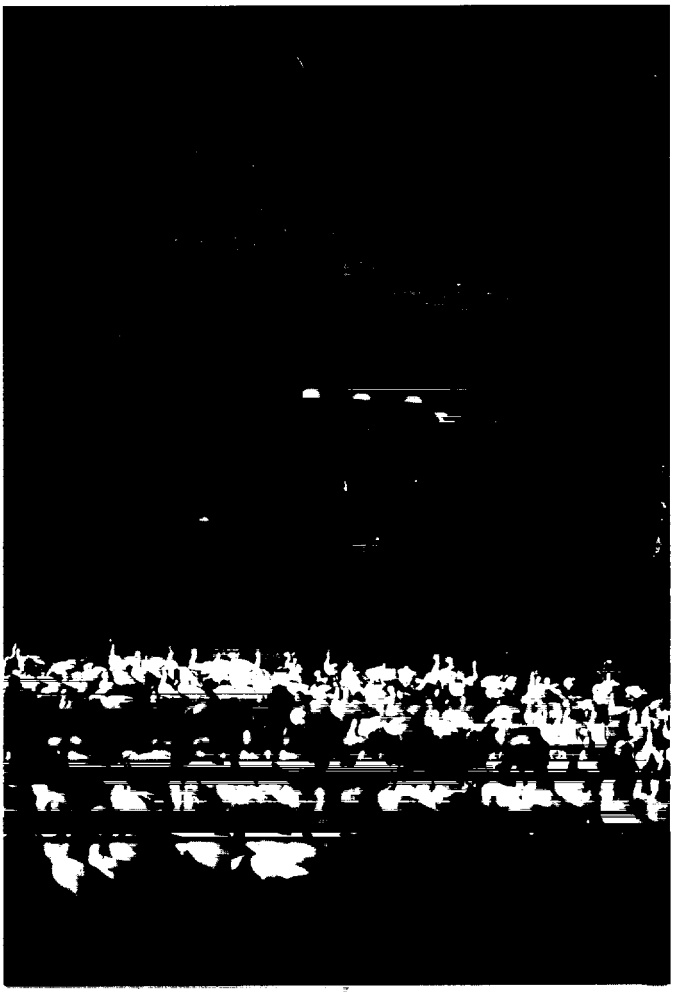
RED HILL BOAT LAUNCH RECORD

	1984	1985	1986	1987
Jan	*	599	1152	277**
Feb	*	1699	1116	261**
Mar	*	1976	2126	525
Apr	2726	5237	3180	1052
May	4266	4553	1781	1085
Jun	1858	1614	1004	1363
Jul	1572	1394	1227	1703
Aug	1682	1794	765	559
Sep	1036	466	407	356
Oct	775	395	123	422
Nov	967	465	372	332
Dec	514	615	283	198
Total		20,807	13,536	8,133
		May-Dec 11,296	May-Dee 5,962	

*No records kept before April 1984
**Boat ramp silted in - boat launching difficult

11. Wildlife Observation

Wildlife observation at Salton Sea NWR translates into bird watching. The Refuge supports 372 species of birds, more than any other refuge in the United States. This year serious birders from Canada, England, Switzerland, Belgium, Norway, Australia and throughout the U.S. visited the Refuge to see a variety of birds found only in extreme southeastern California. Some of the rare or unusual birds that attracts these people include: Abert's towhee, brown and blue-footed booby, crissal thrasher, gull-billed tern, yellow footed gull, mountain plover, fulvous whistling duck, black-bellied whistling duck and wood stork.



The geese were accommodating for our winter bird watchers. SAL WH

Audubon and Natural History Museum groups and University classes from all over **southwest annually visit the Refuge during January and February.**

17. Law **Enforcement**

The number of violation notices issued dropped substantially this year mainly because no tickets were issued for boat trespass in the closed area of the Sea adjacent to Rock Hill. Since the areas was opened to **summer fishing (April 1 - September** 30) **in** 1986 **compliance with the winter closure has been excellent.**

Previosly, as many as 30 violation notices were issued annually to anglers thinking the best fishing had to be in the closed area.

	Number
Trespass (vehicle)	2
Hunting without Duck Stamp	2
Take excess daily bag limit	1

I. EQUIPMENT AND FACILITIES

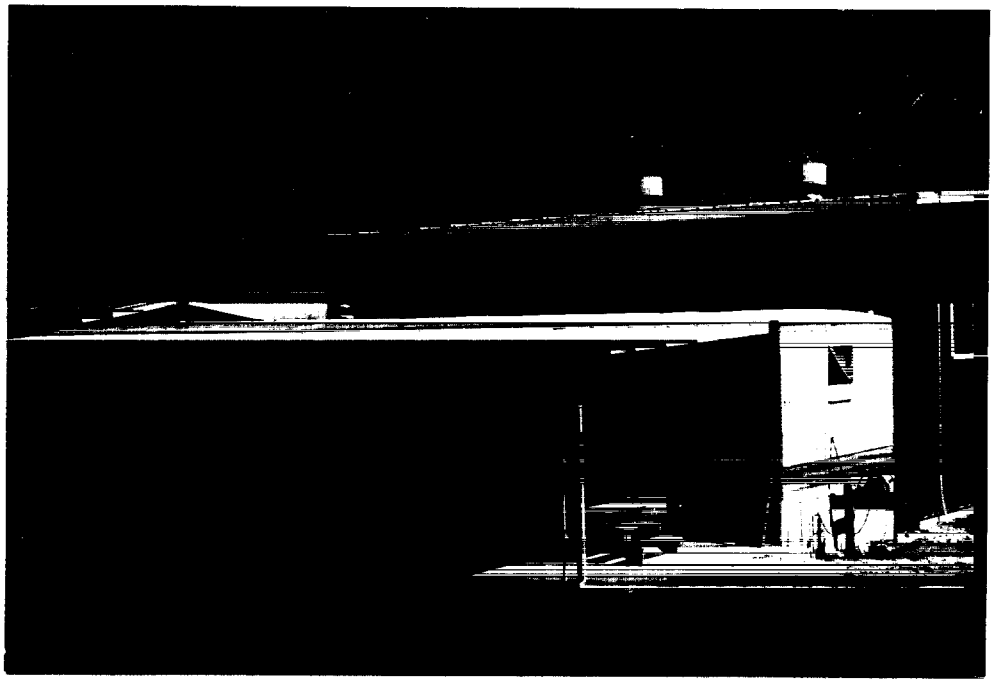
1. New Construction

The Hazard Lift pump project, one of two projects funded by Ducks Unlimited (DU), was completed in June. The other DU project, Hazard Rehab is discussed under Rehabilitation.

Ducks Unlimited lift pump being installed on the Hazard Tract. SAL WH

Anderson Pump, Company of Chowchilla, California completed the project for $9,500.00. Work involved modifying a vertical PTO powered lift pump which had been purchased by the Refuge in the late 70's, constructing a concrete pump structure and tractor pad in Hazard Unit pond H-9 and installing the pump. The lift pump permits better water manipulations in H-7, 8 and 9 and prevent the Alamo River water from backing into the ponds. The refuge completed all preliminary dirt work associated with the project.

A 12' x 50' canopy was installed on the front of the SCA trailer over a cement pad poured with the help of YCC. The canopy, installed by Randy's Mobile Home for $1,800.00, shades the west side of the trailer, reducing air conditioning expenses and provides covered parking for residents of the trailer.

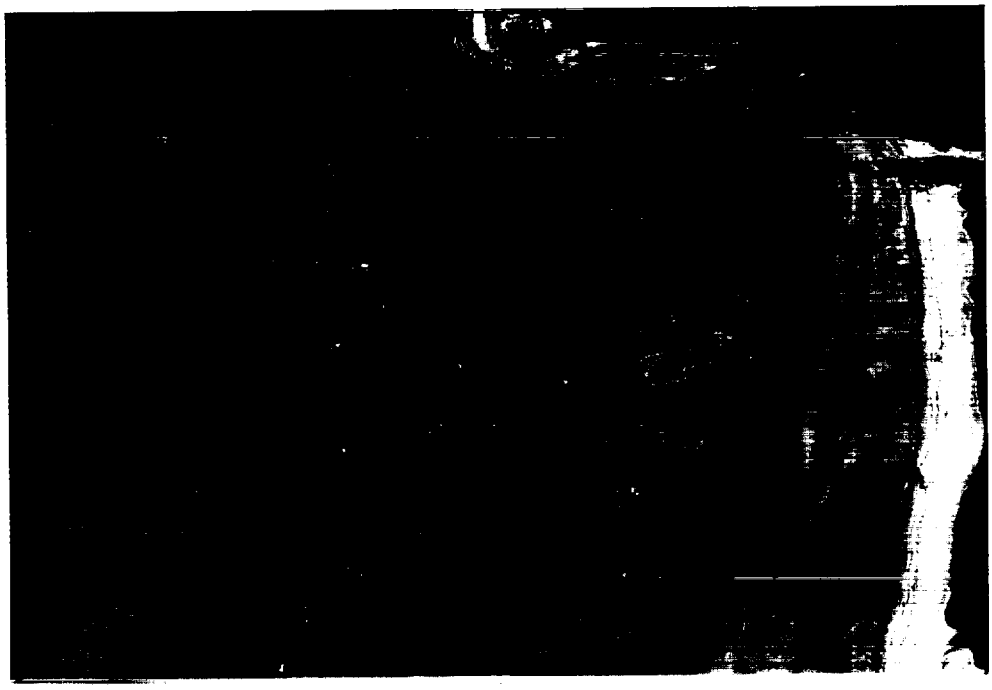


New canopy and cement pad for the SCA trailer.
SAL WH

2. Rehabilitation

Two major rehabilitation projects funded by outside sources were completed on the Refuge this year. Ducks Unlimited paid Master Construction Company $57,000.00 for the Hazard Rehabilitation Project (D.U. Project # CA-922). The project included reconstruction of levees and installation of water control structures for ponds H-1A, 2A and 3A and construction of independent water delivery ditches to ponds 1, 2, 3 and 8. Also levees damaged in the October 1986 flood were repaired.

The Westmorland Duck Club funded the 2B Levee Rehabilitation Project on Unit 1. Hobbs Construction Company, owned by a club member, rebuild the levee at an estimated value of $60,000. The completion of the levee is the first step to reclaiming the 160 acre unit for moist-soil management. Construction of water delivery ditches and dividing the unit into four manageable impoundments should be completed by fall of 1988.



Levee rehabilitation along Tract 2B funded by the Westmorland Duck Club. SAL WH

Unit lA adjacent to 2B is also under'going major rehabilitation and will be completed for 1988 fall flood up. Units 1A and 2B will share the same water delivery system and IA will have the same design as 2B with four independently manageable impoundments.

In March, Bolsa Drainage, Inc. installed 1282 feet of three inch and 2746 feet of four inch plastic subsurface drain line in the Flammang tract for $3,437.38 to replace a deteriorated line. In the Imperial Valiey all farmland has subsurface drain tile to insure drainage and prevent salt build-up.

Leach ponds were developed on the north third of Union 3-4. The ponds which cover about 30 acres will improve soil conditions by leaching salts and will also furnish additional marsh habitat.

The drinking water system for the office/visitor center was replaced with a new system which will produce 25 gallons per day. The old system only made about 5 gallons per day which did not keep up with the demand.

Maintenance of the concrete lined water delivery ditch is a continual expense. In 1987 a total of $3,588.20 was spent on repairs; replacing the gate and slide, and patching cracks.

Other projects completed by the refuge staff include completion of the dirt work in the Headquarters pond and installation of a drop box, releveling N-37 and seeding with water grass and developing several tree rows on the Union and Headquarter tracts.

3. Major Maintenance

The under carriage on the D-7 Caterpillar was overhauled'by G&W Tractor Repair for $2,458.78. The overhaul included turning the pins and repairing the track adjusters and checking the rest of the under carriage for other problems. The work should prolong the life of the under carriage and reduce maintenance costs.

The cooling system on the D-7 Caterpillar was also overhauled. The dozer had always run a little hot but during the last few years it was over heating more often and causing delays on projects. The core of the radiator was replaced with a larger one by North End Radiator for $1,500.00 and a new fan to reverse the air flow through the radiator was purchased from Empire Machinery for $900.00. The dozer will operate better in the desert with the modifications.

The overhaul on the John Deere 2940 was completed by the refuge mechanic on March 13, just in time to power the Crisifulli pump on the Hazard unit. Last year the 2940 over-heated after a water line broke while the tractor was powering the pump. To prevent the problem from recurring an automatic shut-down system was installed.

The transmission on the Jeep Cherokee was overhauled by AAMCQ Transmission for $1,352.06.

4. Equipment Utilization and Replacement

Two military surplus loaders were picked up from Port Hueneme. The Refuge planned to keep one to replace the Hugh H-50 which blew the transmission early in the year and give the second loader to another refuge. Unfortunately only one of the Hough H-90 loaders was repairable and parts from the second were required to reduce costs.

Two Huber road graders which had been picked up from Yuma Marine Corps Air Station were transferred to Kern NWR in January.

A trailer mounted, 500 gallon pumper for firefighting was purchased with fire money in 1987. The $6,291 unit is needed to support crews during prescribed burning and wild fire suppression.

The newly acquired 500 gallon trailer pumper being field tested. SAL WH

6. Computer Systems

The week of September 8, Doug Robertson, computer specialist from Regional Office came to the Refuge to set up the new computer and train the staff. His trip was cut short after he discovered the hard disk had malfunctioned and he could not bring the system up. The main unit was shipped back to Portland so Doug could trouble shoot the unit, reprogram the hard disk and try again later. On October 13, he returned and this time everything went as planned. Doug stayed through the 15th programming the system and training the refuge staff.

J. OTHER ITEMS

2. Items of Interest

March 23-26, a Programmatic Inspection of the complex was conducted by Larry DeBates, assistant regional director, Bob Fields, refuge district supervisor - California, Dick Bauer, migratory bird coordinator, and Fred Caslick, program analyst officer. The team arrived in San Diego on Monday to begin the inspection at Tijuana Slough NWR. They spent approximately one and half days at Tijuana Slough NWR, two days at Salton Sea NWR and one day at Coachella Valley NWR and departed from Palm Springs airport Friday afternoon.

The area inspected by each was:
DeBates – policy compliance/overall refuge management
Fields - personnel/policy compliance/overall refuge management
Bauer - resource objectives
Caslick - contracting/purchasing/property/control and accountability of funds

In November 1987, a cooperative effort between the USFWS and Mexico's Direccion de Flora y Fauna Silvestres (DFFS) began under cooperative agreement # 14-16-009-87-9851. The study was conducted under the auspices of the u.s. Mexico Joint Agreement on Wildlife Conservation. It was designed to obtain black brant harvest data from Baja California. The study was similar to a 1984-85 joint study, and like the previous investigation, efforts were concentrated at San Quintin Bay. Biologists from the USEWS (Gary Kramer (project coordinator), Bill Eldridge, Bill Henry and DFFS (Fernando Geovanini, Javier Lopez, Mario Lopez) were involved in the various aspects of the study. Gary Kramer will provide a report to the Pacific Flyway Technical Committee in March 1988.

Training continued as an important part of the overall Refuge program. This year, refuge biologist Bill Henry completed the four week basic Refuge Managers Training Academy at Blair, Nebraska. Bill also attended the American Association for the Advancement of Science Symposium on Border Water Resources - Hydrology, Ecology and Management, at San Diego State University; the Agricultural Drainwater Monitoring Workshop in Sacramento; the Wildlife Toxicology Workshop at Huxley College in Bellingham, Washington; and the Waterfowl Disease Workshop at Sacramento NWR.

Assistant manager, Tom Alexander and Henry attended the Marsh Management Workshop at Sacramento NWR.

The three refuge officers, manager Gary Kramer, maintenance worker, Marcos Orozco and Alexander, attended In-Service Law Enforcement Refresher at Sacramento. Mid-year requalification was completed with BLM Rangers at the El Centro police range.

Kramer and Alexander both attended the CDF&G USFWS annual coordination meeting in Sacramento and the Regional Budget Meeting held in Reno, Nevada. Training on Systematic Development of Informed Consent was held in conjunction with the budget meeting.

Gary attended Introduction to Federal Historic Preservation Law in Seattle, Washington and the California Maritime Academy for Waterfowl Workshop in Vallejo, California.

4. Credits

Sections A, H, and I were written by Tom Alexander; sections F and G by Bill Henry; section B by Ramon Vega; and all other sections were written by their combined efforts. Editing was done by Gary Kramer. Credits, typing, and assembly of report was done by Shelly Hunter.

TIJUANA SLOUGH NATIONAL WILDLIFE REFUGE

IMPERIAL BEACH, CALIFORNIA

ANNUALNARRATIVE REPORT

CALENDAR YEAR 1987

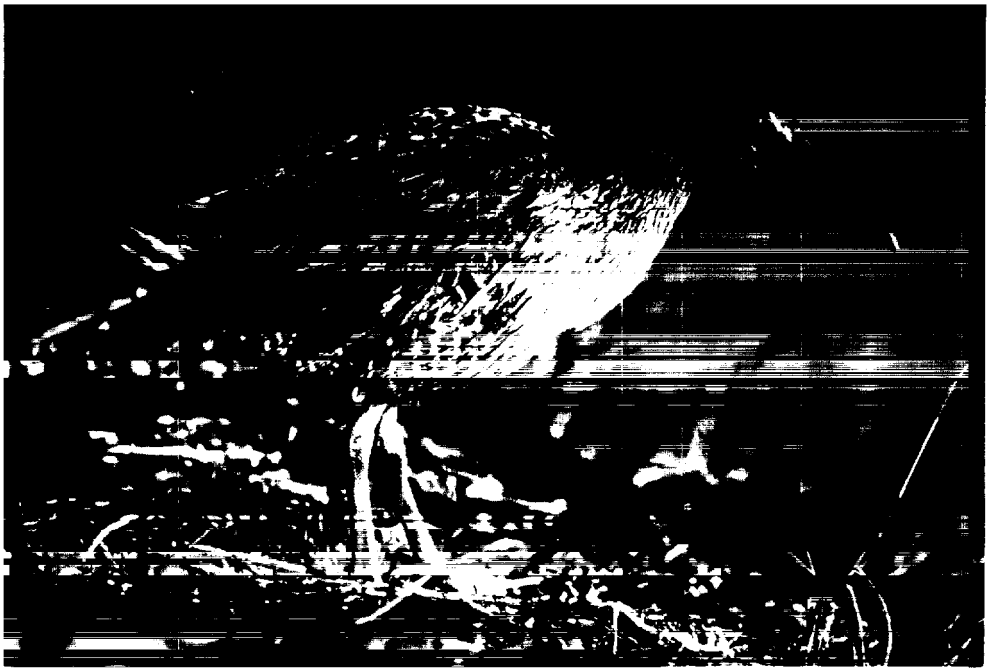
U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

Sited in southern San Diego County, approximately one mile north of the United States/Mexico border, Tijuana Slough NWR encompasses 1,056 acres of saltmarsh, riparian, dune, and upland habitats. Established in 1980, the Refuge includes the southern-most estuarine system (Tijuana Estuary) on the Pacific Coast of the U.S., and represents one of the few remaining, relatively undisturbed tidally influenced wetlands in southern California.

The Refuge forms the northern half of the Tijuana National Estuarine Research Reserve. The Reserve, established in 1982 under Section 315 of the Coastal Pond Management Act, totals 2,531 acres. Overall Reserve management is a cooperative effort,primarily between the Fish and Wildlife Service and the California Department of Parks and Recreation.

Because the Refuge lies in proximity to the seventh largest metropolitan center in the U.S. (San Diego), and the most rapidly expanding urban site in Mexico (Tijuana), public use pressures remain fairly intense throughout the year. Tijuana Slough supports numerous federal and state listed endangered species, including the California least tern, light-footed clapper rail, and the salt marsh birds beak. Priority management efforts are directed at minimizing public use impacts to these resources, enhancing the Estuary's tidal prism, and restoring degraded saltmarsh and dune habitat.



California light-footed clapper rail. TJ PJ

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H. PUBLIC USE

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS

K. FEEDBACK NTR

A. HIGHLIGHTS

First on-site manager arrived in late January, and Refuge office officially **opened** in February. (Section E.l and 1.1).

Major tidal prism and dune restoration activities completed. (Section F.2-6).

Visitor center planning efforts continue. (Section D.6).

Refuge staff assigned with development of natural resource plans for local naval installations. (Section E.7).

"Advanced Public Use Design and Development Workshop" hosted. (Section D.6).

B. CLIMATIC CONDITIONS

1987 Smmary - San Diego/Imperial Beach, California

Month	Precipitation (Inches)	Temperature (°F)		
		Max	X	Min
January	1.68	78	55	36
February	1.53	82	65	44
March	1.04	85	59	46
April	0.78	87	63	51
May	0.03	77	65	55
June	Trace	79	66	60
July	0.03	78	67	59
August	0.01	82	70	61
September	0.70	85	69	60
October	1.74	104	71	59
November	1.33	81	62	45
December	2.73	74	54	34

Climatic conditions exemplify a coastal sub-tropical Mediterranean) climate. Annual precipitation averages ten inches, with December to March typically receiving the most rainfall. Mean temperatures reach annual lows of 48°F in winter and increase to 78°F in July/August. Dominant winds are from the southeast during the winter and from the northwest in summer.

No significant storms occurred during the year. Temperature ranges for 1987 were normal; however, an extreme high of 104 was recorded in October. Precipitation for the period totaled 11.6 inches.

C. LAND ACQUISITION

1. Fee Title

Late in the year, a decision was made to submit an acquisition request relative to the purchase of three vacant parcels of land that border the

Tijuana Slough NWR (Refuge) along south Seacoast Drive. These lots are the only remaining privately owned vacant parcels located immediately adjacent to the Refuge, and this acquisition would preclude additional residential/commercial development along our border. Given the current intense level of public use pressure on Refuge resources, restricting additional development along our border is a significant action.

In December, relevant real estate information was secured from the State Coastal Conservancy, and early next year a formal acquisition request will be forwarded to the Regional Office.

D. PLANNING

2. Management Plan

A major wetlands restoration plan, the "Tijuana Enhancement - Hydrologic Analysis" (by Philip Williams and Associates, San Francisco), was distributed in February. This document provides detailed recommendations relative to enhancing subtidal zones, intertidal mudflats, saltmarsh habitats, and the riparian corridor. Complete implementation of this plan will cost an estimated $18+ million. Any future Refuge dredging efforts will incorporate recommendations outlined in-this report-

3. Public Participation

Tijuana Slough NWR is a component of the Tijuana River National Estuarine Research Reserve (Reserve). The Reserve, established in 1982, includes land owned by the Fish and Wildlife Service (Service), the California Department of Parks and Recreation (CDPR), the U.S. Navy, and the County and City of San Diego. Under a 1984 memorandum of understanding, the Navy transferred management of their property (551 acres) within the Reserve to the Service.

To promote cooperative management efforts throughout the Reserve, an eight member group, the Reserve Management Authority (Management Authority) meets monthly to discuss complex resource issues affecting the area. The Management Authority is directed by the CDPR, and includes representatives from the Service, the State Coastal Conservancy, the National Oceanic and Atmospheric Administration (NOAA), California Coastal Commission, County of San Diego, and the Cities of Imperial Beach and San Diego. Project Leader Kramer is the Service representative. Assistant Refuge Manager (ARM) Weitzel attends the monthly meetings, and assumes the Service representative's role when the Complex Manager is absent. Subcommitmittees have been designated to address specialized resource issues such as public use, research, and contaminants.

4. Compliance with Environmental Mandates

Dredging efforts were completed under an existing Section l-/404 permit and Endangered Species Act Section 7 internal consultation.

A California Coastal Consistency Determination, covering current and

projected Refuge operations, was drafted in May; the Coastal Commission ratified the plan in July.

The following documents were prepared to accommodate Service and NEPA requirements relative to leasing 7.71 acres to the State of California for construction of the visitor center: environmental assessment, Right-of-Way review form, FONSI, certificate of Right-of-Way compatibility, coastal consistency determination, and an internal Section 7 evaluation.

5. Research and Investigations

Since the 1970's, research interest in the Tijuana Estuary has increased exponentially, with emphasis centered around saltmarsh and dune communities. Research efforts have addressed the challenges posed by environmental changes and ecosystem responses. Studies have progressed from resource inventories and measurements of wetland processes to long-term comparisons of the effects of disturbances. Of priority concern is the determination of cause-effect relationships. The types of projects have shifted as the estuary experienced new and different environmental assaults.

All research proposals are evaluated by Refuge staff and submitted to the Regional Office for approval. In 1987, only one research application, relative to working with California least tern nestlings, was rejected by Refuge staff. Research efforts during the year included:

Refuge Personnel

a. Tijuana Slough Contaminant Reconnaissance Study

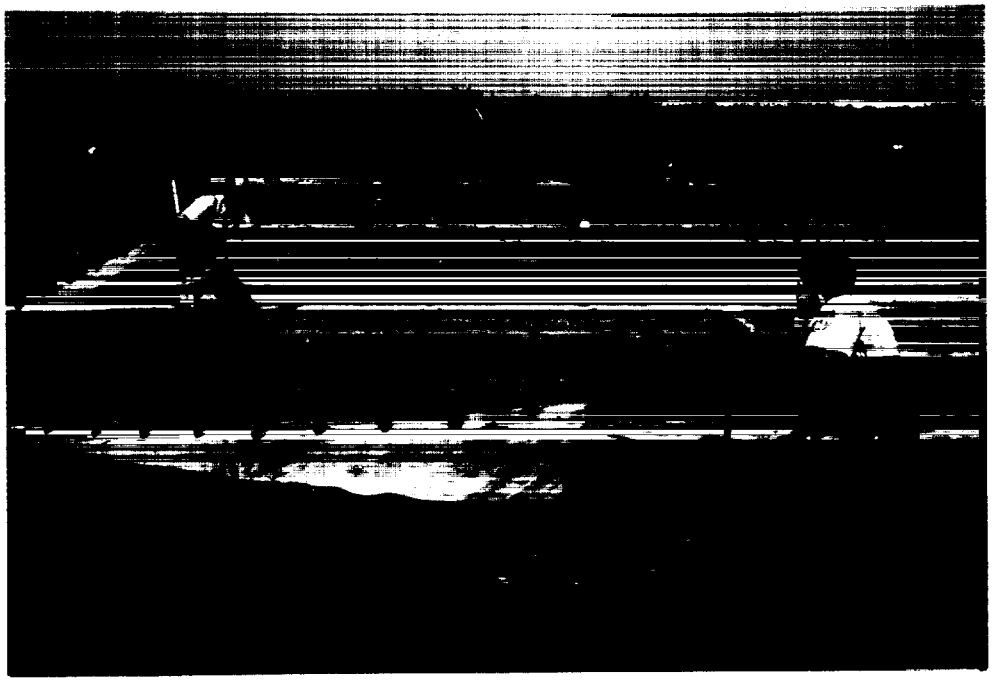
This project was initiated to determine concentrations of various contaminants in fish, birds/mamnaIs, plants, invertebrates, and sediments.

The primary concern is the potential uptake of contaminants such as organochlorine pesticides, trace metals, and aliphatics, in the diets of resident and migratory birds, and other waterbirds in general.

During the period, selected biota totalling 26 samples were collected and catalogued from three stations within the Tijuana Estuary. Nine composite birds, representing three species: (7) wigeon, (6) coots, (17) black-necked stilts (adults, chicks and eggs) were collected. In addition, 17 composite fish and invertebrate samples composed of killifish, gobies, mullet, mussels and mud crabs were collected from 1 April to 4 June.

Samples will be shipped next year, for analysis, to the following contract labs: Weyerhaueser Analytical and Testing Service (for organics), and University of Missouri Environmental Trace Substance Research Center (for metals).

Contaminant sampling has been accomplished primarily by the refuge complex biological staff; however, Tijuana Slough employees will become increasingly involved in future efforts. Sampling will continue through EY 88.



Biologists from Salton Sea NWR collecting fish and invertebrate samples for contaminant study. TJ PJ

Other Personnel

a. The integration of simulation modeling and saltmarsh monitorins for improved management at Tijuana Estuary

Joy Zedler, San Diego State University, Ted Foin, UC Davis.

Activities include developing a simulations model to predict interannual variation in vegetation, based on factors controlling plant growth. This project, involving the systematic sampling of saltmarsh flora, was initiated nine years ago.

b. Fish and Benthic invertebrate dynamics: responses to wastewater influxes

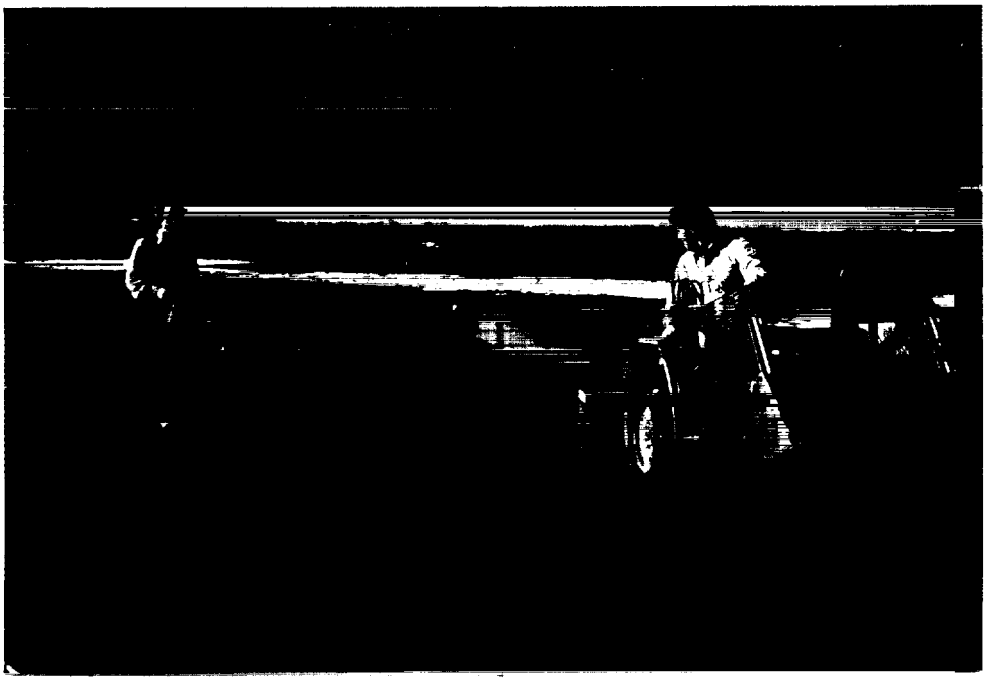
Chris Nordby and Joy Zedler, Pacific Estuarine Research Laboratory.

Efforts include quarterly monitoring of fish and benthic invertebrate species composition to examine relationships between fauna and proximity to wastewater sources. Testing includes water salinity and oxygen, and assessing fish for heavy metal concentration.

c. Restoration of abandoned vehicle/pedestrian paths

Refuge funded. Implementors: Pacific Estuarine Research Laboratory.

An assessment of revegetation options, including transplanting, seeding, and combined seeding/planting of disturbed upper marsh habitat. Efforts will continue through CY 88.



Preparing upper marsh substrate for revegetation - Path Restoration Project. TJ WH

d. Sediment movement within the entrance channel to the Tijuana River

Chris Webb, M.S. candidate, Geography Department/San Diego State University.

Primary objectives include: assessing changes in channel/river geometry, and monitoring scouring and/or fill within the River's entrance.

This project, expected to conclude in early CY 88, will provide vital data relative to those features which act to keep the River mouth open, including sediment sources and transport processes.

e. Restoring/stabilizing dunes through revegetation

Brian Fink, M.S. candidate and Joy Zedler, San Diego State University.

This project evaluated numerous dune species and the various factors impacting their growth, and the overall role of specific dune flora in stabilizing the Tijuana Estuary barrier dune. Research efforts were

completed in February of this year. An M.S. Thesis is on file at the Refuge office.

Results will assist us in designing future dune revegetation projects.

f. Dune vegetation at Tijuana Estuary: Interactions between an exotic annual (Cakile sp.) and a native perennial (Abronia sp.)

Lisa Wood, M.S. candidate, and Joy Zedler, San Diego State University.

This project concluded in mid 1987. An M.S. Thesis is on file at the Refuge office.

It was evident that Cakile was quick to colonize disturbed substrate, such as dunes recently created by dredge spoil. Cakile is a weak beach strand stabilizer, and is known to outcompete species that possess good sand holding properties, such as Abronia. Hence, artificially constructed dunes tend to become dominated by Cakile, and are thus more susceptible to physical disturbances, such as storm surge.

6. Other

Planning for a proposed visitor center continued throughout the period. The center, to be constructed adjacent to Caspian Way, will include administrative offices for both the Refuge and CDPR. Construction of this one million dollar plus venture will be accomplished using state and federal matching funds; operation and maintenance of the facility will be a State Park's responsibility.

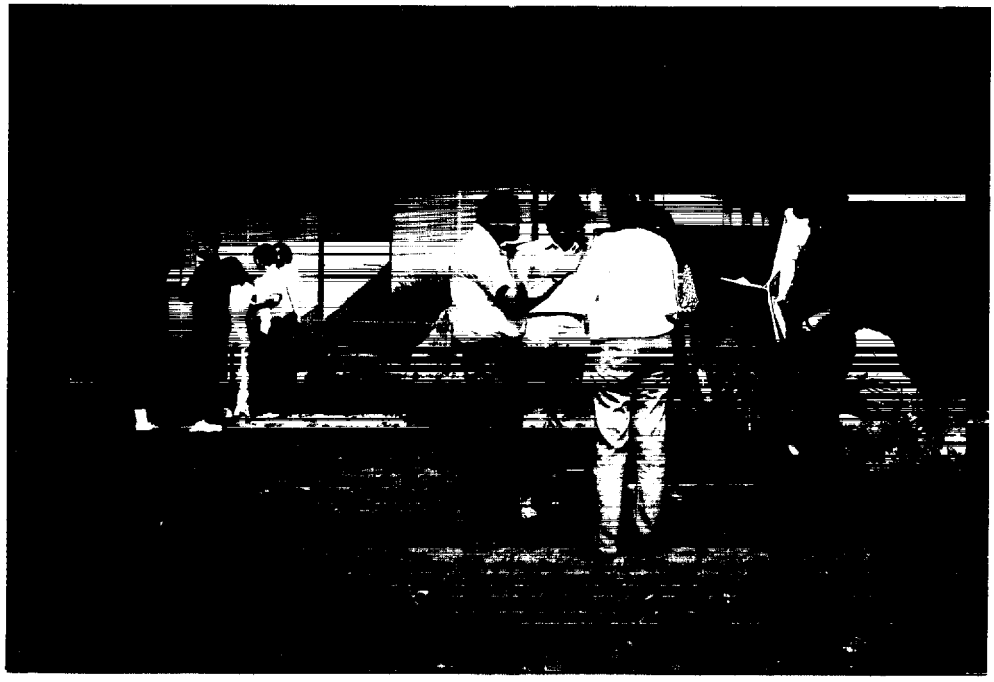
The visitor's center comnittcc, initiated in 1986, and composed of members from the Southwest Wetlands Interpretive Association (SWIA), the private sector, CDPR and the Service, met infrequently throughout the year. The committee addressed such concerns as facility layout, interpretive themes, and the selection of architects and exhibit designers. Other functions relevant to visitor center matters, including SWIA quarterly/monthly meetings and Imperial Reach City Council sessions, were attended, when possible, by ARM Weitzel.

Most environmental documents relative to the visitor center were completed during the period (see Section D.4). An easement for Right-of-Way was executed in October. This agreement allows the state to construct the center and related facilities within designated Refuge property. A visitor center operation and maintenance accord between CDPR and the Service will be drafted at a later date. It is anticipated that the official "ground breaking" ceremony for the center will occur in late September 1988.

In October, the Complex sponsored a week long "Advanced Public Use Design and Development Workshop". Held in Imperial Beach, this effort, provided participants with hands-on experience in public use and interpretive planning. Sited close to major urban centers, and lacking visitor facilities, Tijuana Slough was an ideal candidate for a workshop of this type.

Attendance included Project Leaders, assistant managers, and outdoor recreation planners from throughout Region 1; interpretive specialists from the Service's Regional Offices in Portland, Boston and Atlanta; and local CDPR administrators and educators.

Participants divided into groups and addressed various interpretive/visitor use requirements. Group recommendations included those relative to Seacoast Drive, the visitor center parking scheme, aspects of the proposed trail system, and welcome/interpretive signage in general. Seacoast Drive was identified as an area in urgent need of a visitor program; proposals included an observation platform and interpretive panels. Next year, workshop recommendations will be incorporated into a Seacoast Drive interpretive prospectus.



Participants of the Advanced Public Use Design and Development Workshop discussing interpretive needs, Seacoast Drive. TJ TA

E. ADMINISTRATION

1. Personnel

Marc M. Weitzel - Assistant Refuge Manager, GS-485-09 PET: EOD 1/87
Betty J. Grizzle - Biological Technician, GS-486-05 TFT: EOD 3/87

Transferring from the Caribbean Islands NWR, Marc M. Weitzel assumed responsibility as the Refuge's first on-site manager on 21 January. Betty J. Grizzle, a Doctoral candidate from the University of California (Los Angeles) Environmental Science and Engineering Program, was hired as a seasonal

biological technician in March. Betty's primary task was to develop natural resource plans for eleven Navy installations in the San Diego area (see Section E.7). Consistent with Betty's responsibilities, her position will be reclassified to Wildlife Biologist early next year. This seasonal position will continue at least through CY 88.

Tijuana Slough is a satellite station of the Salton Sea NWR Complex, which is located in Imperial County, California, approximately 130 miles east of the Refuge. Many office/field duties are accomplished by on-site staff; however the Refuge does secure administrative and maintenance support from Salton Sea.

2. Youth Programs

The Refuge did not have an on-site Youth Conservation Corps program during 1987; however, a local crew is expected on board next year.

3. Other Manpower Programs

In an effort to work off multiple fines, a ward of the Chula Vista, California court expended time attempting to collect litter from the Refuge. This individual recorded a total of 12 hours of Refuge work. Although he had approximately 150 hours worth of fines to work off, he proved to be extremely unreliable, and, after the 12 hours, we elected to terminate our contract with him.

4. Volunteer Program

While not official Service volunteers, various groups did donate their time towards litter pick-up. Included were: a) the Mar Vista High School cross country team (October and November); and b) local chapters of cub scouts. In October thirty scouts celebrated "Coast Week" by removing Refuge trash. Phil Roulland, a San Diego County park ranger, expended many hours photographing birds. Copies of these photos were provided to the refuge.

5. Funding

The Refuge does not receive direct funding; refer to the Salton Sea narrative for Complex funding levels.

In February, a station imprest fund ($500.00) was established. ARM Weitzel was designated cashier.

6. Safety

All safety oriented literature received from the Regional Office and Complex headquarters was reviewed. Safety discussions were conducted as needed. Time permitting, formal safety meetings at Salton Sea were attended. No accidents (to personnel or equipment) occurred during the period.

7. Technical Assistance

Project Leader Kramer and ARM Weitzel attended monthly Management Authority meetings and actively participated in decisions affecting the Reserve. ARM Weitzel is an agency advisor to the Pacific Estuarine Research Laboratory, and is on the San Diego County Wetlands League.

In March, ARM Weitzel assisted the State Coastal Conservancy in preparing a "Notice of Proposed Negative Declaration" relative to the proposed visitor center, and he helped the Service's Caribbean Field Office develop a Sikes Act natural resource management plan for Roosevelt Roads Naval Station, Puerto Rico. In April, input was provided into a city project designed to replace Melaluca trees, planted along Imperial Beach Blvd. and Seacoast Drive, with species better adapted to the area. In August, ARM Weitzel attended a "Tijuana River Basin Project" meeting, at San Diego State University and affiliated with the Man and Biosphere program, to discuss potential research projects for the Tijuana Estuary (Estuary). In September, the draft "Land Acquisition Plan for the Tijuana River National Estuarine Research Reserve" was reviewed, and assistance was provided to Philip Williams and Associates, Consulting Hydrologists, in collecting tidal range data used to evaluate the iqact of dredging efforts on the Estuary's tidal prism. During the same month, a California least tern predator control multi-agency meeting was attended at Laguna Niguel, California. In October, the Navy requested, and received, natural resource background material to incorporate into environmental assessment documents for a proposed helicopter pad construction project at the Naval Outlying Landing Field, Imperial Beach. Also in October, Refuge staff participated in the California least tern and light-footed clapper rail recovery team meeting held at Laguna Niguel, CA.

Throughout the 1987 California least tern nesting season (April - September), Refuge staff coordinated Tijuana Slough monitoring efforts with California Department of Fish and Game (CDFG) contract biologists (see Section G.2d). Assistance was also provided to a CDPR ecologist overseeing California light-footed clapper rail winter high tide surveys and spring call counts. With Refuge operations now established, local Service staff will assume the lead role in managing Tijuana Slough's endangered species.

By way of a contract between the Naval Facilities Engineering Command, San Bruno, CA and the Service, Refuge staff was given the responsibility of formulating Sikes Act funded "fish, wildlife and habitat management" plans for 11 naval installations in the San Diego area. Drafting these documents was Bio Tech Grizzle's primary duty during the year, and through December, individual plans relative to the following naval bases were completed to first draft:

Naval Radio Receiving Facility, Imperial Beach
Naval Amphibious Base, Coronado
Fleet Combat Training Center, Pacific San Diego
Naval Oceans Systems Center, San Diego
Naval Submarine Base, San Diego
Naval Supply Center, Point Loma Annex, San Diego

Naval Outlying Landing Field, Imperial Beach
Naval Station, Magnetic Silencing Facility, San Diego

These plans are designed to provide the subject bases with practical, working documents that acknowledges each installation's primary military mission and enables the commanders to address natural resource management responsibilities.

Plans were reviewed by ARM Weitzel, Project Leader Kramer, Regional staff and Navy personnel from their San Bruno, CA office. All eleven reports will be finalized by the end of FY 88.

In November, Pat McCoy, President of SWIA requested, and received a list of Refuge projects that might be addressed by obtaining grants from the San Diego Fish and Wildlife Commission. The Ccmmission limits their grants to $3,000, and projects must meet specific criteria. Removal of large concrete debris was listed as a priority Refuge project that would accommodate the Commission's guidelines.

8. Other

In March, Regional staff (ARW L. DeBates, District Supervisor B. Fields, Migratory Bird Coordinator D. Bauer, and Program Analyst F. Caslick) completed a "programmatic review" of Refuge operations. At the time of the inspection, the Refuge office had only been operative approximately 1.5 months. Included was a meeting with Nancy Kaufman, Supervisor/Laguna Niguel Field Office, to discuss aspects of the proposed Sweetwater Marsh NWR.

The following Special Use Permits were issued during the year:

September: Mar Vista High School to execute three cross country races within a specified area of the Refuge. In exchange, their cross country team agreed to collect Refuge litter over a two day period.

October: A year long permit to employ a temporary blind and canoe to photograph avifauna.

December: A four month permit to photograph endangered California light-footed clapper rails during specified winter high tides.

In November, a letter of endorsement was forwarded to the State Coastal Conservancy, Oakland, relative to a proposal to disburse $292,000 to the San Diego State University Foundation for the monitoring/permitting phase of an upcoming Estuary restoration project. This project is associated with the "Tijuana Enhancement - Hydrologic Analysis" (see Section D.2).

A revenue sharing check for $21,623.00 was presented to the San Diego County Board of Supervisors on 01 July.

F. HABITAT MANAGEMENT

1. General

The following habitat types are found within the Refuge:

a) Upland Zones. Best classified as coastal sage scrub and modified grasslands, indicator species includes California sagebrush (Artemisia californica), flat-top buckwheat (Erioqonum fasciculatum) and lemonade-berry (Rhus integrifolia). Within the Refuge, this zone is primarily impacted by trampling from illegal alien foot traffic from Mexico.

b) Riparian and Brackish Marsh. Represented by flora such as willows (Salix sp.), saltcedar (Tamarix sp.) and cattail (Typha sp.). Within the Refuge's riparian corridor, nesting pairs of the federally listed least Bell's vireo (Vireo bellii pusillus) have been recorded.

c) Salt pannes. These areas are found adjacent to mud and high saltmarsh habitat. Salt pannes are inundated during the winter; however, due to evaporation, these areas are dry and covered with a salt crust in Summer. Winter bird use of this habitat during the aquatic phase is substantial.

d) Upland/Wetland Transitions. A zone, indicated by both saltmarsh and coastal sage scrub flora, including flat-top buckwheat, coastal cholla (Opuntia prolifera saltgrass (Distichlis spicata), and alkali health (Frankenia qrandifolia). This zone has been historically exposed to substantial pedestrian traffic; however, through increased law enforcement and environmental awareness efforts, visitor use impacts to this habitat type have been reduced.

e) Intertidal flats. These include the sand and mudflat areas exposed during low tide. This habitat type is used extensively by the shorebird community for foraging and loafing; bird densities are highest in the winter.

f) Dunes/Beach. A dynamic habitat, subject to numerous disturbances, such as human trampling of vegetation, and assorted public use impacts to beach/dune nesting avifauna, including the California least tern and the western snowy plover. Sand verbana (Abronia maritimia) and dune ragweed (Ambrosia chamissonia) are typical native dune plants.

g) Salt Marsh. The Refuge administers 85 percent of the 1,255 acres of critical saltmarsh habitat within the Reserve. Typically the zone is subclassed as either low, middle or high marsh. An elevational range of approximately five feet separates the low marsh from the high marsh wetland zone. The low marsh (that area around mean sea level) is dominated by cordgrass (Spartina foliosa) a species which requires daily tidal inundation. Cordqrass provides dense cover and nesting material for the light-footed clapper rail. The intermediate zone, from mean high water to approximately mean higher high tide, is dominated by perennial pickleweed (Salicornia virqinica). The middle marsh is biologically rich and supports the nesting efforts of the Belding's Savannah sparrow (Passerculus sandwichensis beldingi) a species listed by the state of California as endangered. The

high marsh zone, from mean higher high tide to extreme high tide, is indicated by flora such as shoregrass (Monanthochloe littoralis), perennial glasswort (Salicornia subterminalis), and alkali health. The endangered saltmarsh bird's beak (Cordylanthus maritimus spp. maritimus) can be found in the high marsh.

The Tijuana River bisects the Refuge and flows easterly through sand dunes to the Pacific Ocean. The River transports untreated wastewater, up to 12 million gallons daily, from Tijuana, Mexico, to the ocean. Efforts are in progress to alleviate this situation. Assessments relative to the long-term effects of this effluent load on Refuge resources are lacking; short-term impacts have not been noted.

2. Wetlands

Priority habitat management efforts are directed at enhancing the Estuary's tidal prism (flushing capacity). Adequate tidal flushing is considered the key to the health of the entire system. Reduction in tidal prism can threaten the status of all resources associated with the Estuary. Over the years, the Service has been actively involved in maintaining and increasing the tidal prism.

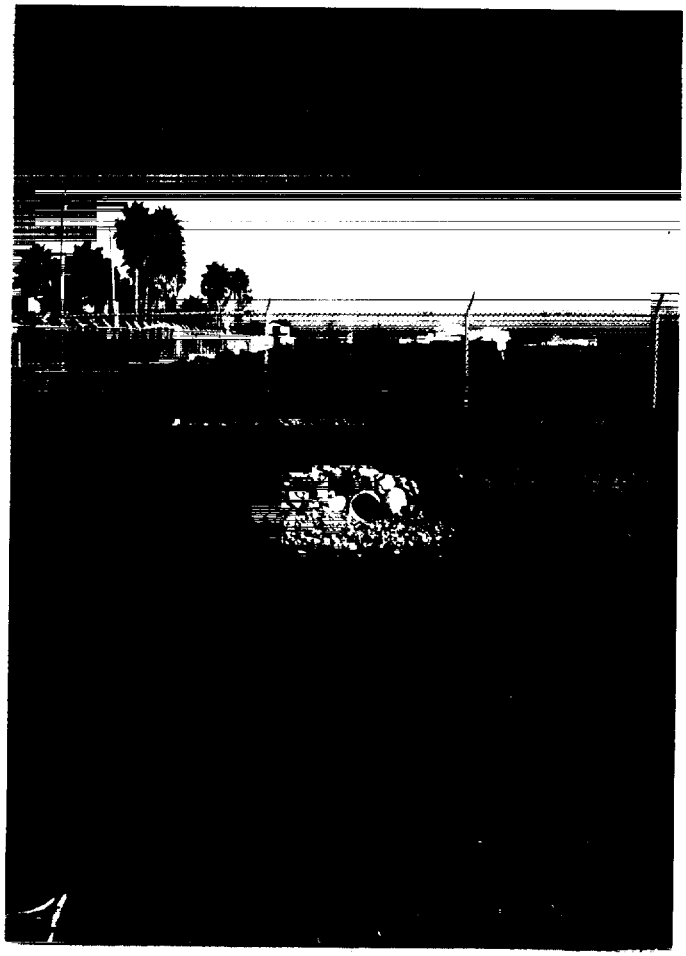
During the winter of 1982 and 1983, violent storms impacted the coast of southern California. Resulting storm surge accreted large volumes of sand, over-wash from the barrier dune system, into the Refuge's primary flushing channel, the Oneonta Slough. This sand deposition depressed tidal flows, and the resulting reduction in ebb tide scouring caused periodic closure of the Tijuana River mouth. This situation created various management problems relative to endangered species and their habitats. In addition, three dams on the Mexican side of the Tijuana River substantially reduced the River's flow. This reduced flow and tidal flushing eventually caused extreme changes in the saltmarsh community, including severe impacts to the saltmarsh bird's beak and light-footed clapper rail. The longest closure of the River's mouth, with a complete absence of tidal flushing, occurred from April - December 1984. This eight month closure had a devastating effect on the Estuary; tidal channels became hypersaline, shallow creeks evaporated, and the substrate turned to brick. Soil salinity was recorded at greater than 100 ppt in September 1984, and this caused a substantial die-back of salt marsh vegetation.

From 1982-84, staff from Salton Sea NWR made several attempts to open the River's mouth, however, after each effort, the ocean established a sand bar across the mouth and, within hours, tidal flushing was again restricted or blocked. From September 1984 to January 1985, to increase tidal prism and open the mouth, Refuge staff dredged over 6400 cubic yards of sand/sediment from Oneonta Slough. Tidal flushing was again reestablished. From January to April 1985, dredge spoil was used to refurbish the barrier dune system. 0n 1 February 1986, the River's mouth again because blocked with sand due to extremely high winds and nearshore waves, accompanied by high tides. On 4 February, dozer work again restored tidal flushing. The mouth of the Tijuana

River has since remained open, with continued tidal flushing throughout the year. Low marsh vegetation is once again exhibiting vigor.

To further enhance the Estuary's tidal prism, contract dredging was initiated in March of this year. The contractor Northbilt, Inc. (Lake Tahoe, CA) dredged ±4000 ft. of Oneonta Slough and repaired a 700 ft. breached section of the barrier dune. Dredging was accomplished via dragline. Spoil, (about 50,000 cubic yards) was stockpiled along the western side of the Slough. Because of least tern nesting season (April - September), the operation was curtailed on 08 April. Under a new contract, efforts were reinitiated on 19 October. The new contractor, Gyro Engineering accomplished the following: a) approximately 200 ft of the west bank of the Slough was widened by up to 25 ft, and sloped at ±3:l; b) a backdune system was constructed; c) to facilitate drainage of any overwash, a gradient was created from the landward base of the backdunes to the Slough; d) the seaward aspect of the barrier dune was refurbished; e) light colored sand was deposited around the perimeter of one of the historical least tern nesting sites, thus increasing potential nesting habitat for the species; and f) grading down substrate north of the Seacoast Drive entry gate to expose the area to tidal action. After initial contractual requirements were completed, a substantial amount of surplus hours existed. To utilize these hours, the contractor redeployed his equipment to the 5th and Iris area to complete the following: a) dozer removal of exotic fennel; b) regrading the maintenance road; c) assisting Refuge staff in excavating a runoff catchment basin; and d) bridging a section of Scirpus marsh with fill generated from the Refuge quarry site. The "bridge" was constructed so that a portion of the old maintenance road could be rerouted away from a more sensitive upper marsh zone. That segment of the old maintenance road which had traversed the upper marsh was then ripped with a dozer to promote revegetation. Gyro Engineering completed their Refuge work on 29 December.

Enhancing the Tijuana Estuary's tidal prism: 1987 dredging efforts. TJ GK



Catchment basins were built to contain potentially contaminated runoff from the Navy Outlying Landing Field's tarmac. This runoff naturally evaporates, and thus, this discharge is precluded from entering the wetland zone.

In April, a wetland mitigation project (Shelter Islands Yachtways Boatyard) was completed. Actions included creating ± 8,000 sq. ft. of intertidal habitat, widening an existing levee by 20 ft., transferring all spoil to a county landfill, and relocating vegetation that would have been impacted by dredging efforts to an adjacent area within the Refuge. This project had been initiated a year earlier; however, adverse weather had delayed its completion.

6. Other Habitats

In early December, in preparation for a revegetation project, a work detail from Salton Sea NWR used a grader to scarify numerous trails and roads within the coastal sage scrub/grassland zone. These specific trails/roads were considered obsolete relative to Refuge operations. Later that month Bio Tech

Grizzle began seeding these areas with appropriate species. The seeds were raked in, and efforts were coordinated with rainfall to the extent practicable. Results will not be evident until CY 88.

As previously outlined, maintaining a strong barrier dune is a key factor in precluding sediment deposition resulting from wave overwash into tidal channels. In addition, the presence of these dunes tends to direct visitors to the intertidal beach areas, and thus, **reduce public use in the more sensitive habitat landward of the dune system.**

In late November - early December, in conjunction with dredging efforts, contractors (Gyro Engineering) used the spoil generated from their activities to restore eroded segments of the barrier dune, and construct a backdune system. The seaward face of the barrier dune, however, was refurbished using intertidal beach sand that had accreted during the fall and winter months. The backdunes were constructed as a second line defense against major storm surge. All efforts were accomplished with one front-end loader and one crawler dozer.

Recently constructed barrier and backdunes, south of Seacoast Drive. TJ WH

In an attempt to stabilize these new dunes, a revegetation project will be initiated in CY 88. Both nursery stock and seeds will be employed; plant growth will be expedited via drip line irrigation. Also next year, erosion control blankets, donated by North American Green (Evansville, Indiana), will be experimentally used at various points to promote dune stabilization. Relative to the drip irrigation line, the annual backflow valve certification was accomplished in May by Rain Rite Irrigation Repair Service.

10. Pest Control

At least 11 species of mosquitos occur within the Estuary. Because of their potential as pests and disease vectors, and due to the proximity of the Refuge to urbanization, a formal mosquito control plan has been drafted. Under the provisions of this document, the Vector Control Division, County of San Diego, assumes all control measures; however, they must coordinate their actions with the Refuge office. The control plan outlines procedures for source reduction, larviciding, adulticiding, and sets minimum levels of mosquito breeding before treatment is initiated.

G. WILDLIFE

1. Wildlife Diversity

Within the Refuge, the intertidal salt marsh and estuarine tidal channels of the Estuary provide wildlife habitat for a variety of birds, fishes and invertebrate species. As previously stated, the federally endangered light-footed clapper rail is found within the lower salt marsh while the state endangered Belding's Savannah sparrow occurs in the pickleweed-dominated middle and upper marsh areas. The California least tern is frequently observed foraging within the Estuary's tidal channels. Upland habitat provides foraging opportunities for many birds, reptiles and small mammals. Raptors such as the northern harrier are frequently observed in these areas. Small mammals such as deer mice, rabbits and ground squirrels provide a food base for these and other birds of prey.

The coastal sand dunes and intertidal beach habitat offers important foraging, roosting, and nesting areas for numerous shorebirds. As mentioned, both the endangered California least tern and the western snowy plover nest on the sandy beaches and dunes of the Refuge. Migrating and resident shorebirds make use of the intertidal beach areas.

2. Endangered and/or Threatened Species

Species	status*
California Brown Pelican	FE, SE
American Peregrine Falcon	FE, SE
Light-footed Clapper Rail	FE, SE
California Least Tern	FE, SE
Least Bell's Vireo	FE, SE
Belding's Savannah Sparrow	Federa1 Candidate, SE
Salt Marsh Bird's Beak	FE, SE

*FE = Federal Endangered, SE = State Endangered

a) California Brown Pelican

This endangered bird typically occurs along the California coastline where it forages and roosts. At the Refuge, their numbers increase in the summer months to 150 individuals. They are generally observed roosting at the Tijuana River mouth. No nesting activity occurs on the Refuge; however, breeding is documented from the nearby Coronado Islands, Mexico.

b) American Peregrine Falcon

Although this falcon historically nested along the San Diego coastline, recent nesting activity within the County has not been documented. A hacking program for these birds is currently underway on the Point Loma peninsula, approximately 12 miles north of the Refuge. Individuals of this species are infrequently observed within the Estuary, particularly near mudflats, shores or ponds where water birds congregate.

c) Light-footed Clapper Rail

This secretive bird is endangered throughout its range due to the critical decrease in salt marsh habitat in Southern California. The rail population which occurs within the Estuary has been the subject of study since 1975 and its occurrence in the area is monitored regularly. Census activities for these birds were conducted in March 1987. Results of this count, and previous surveys for the Refuge are listed below. It appears that the birds are rebounding from the previous years when closure of the River mouth (1984) resulted in severe habitat loss and degradation in the Estuary.

Census of Light-footed Clapper Rail at Tijuana Marsh

Year	1982	1983	I.984	1985	1986	1987
Number of Pairs	25	41	38	0	0	23
Individuals	--	--	--	4	16-18	30

Day old California light-footed clapper rail chick. TJ PR

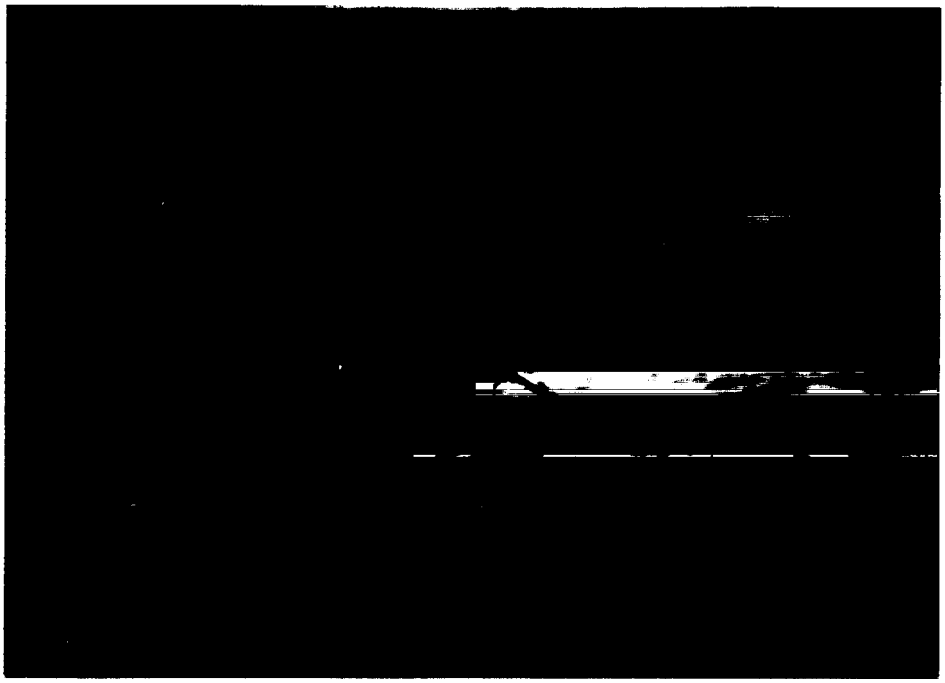
d) California beast Tern

The California least tern is a migratory species, with breeding activity in southern California occurring between April and September. This endangered bird has suffered a significant decline in numbers due to loss of nesting habitat and feeding areas, general disturbance of nesting birds and depredation. Least terns have been documented as nesting in the Tijuana River area since 1962. Their numbers have remained somewhat sporadic from year to year as indicated below:

California Least Tern Nesting Data at Tijuana Slough NWR

Year	1982	1983	1984	1985	1986	1987
Number of Nests	21-30	60-65	50-66	41	36-41	46+
Fledglings	17+	50+	12-20	18-20	25-40	13-19

Generally these birds nest on the sandy beach to the south of the Tijuana River mouth, and in an area north of the mouth and landward of the barrier dunes; however recent use of the beaches imediately north of the mouth has been documented. In 1987, both the northern and southern dune/beach areas were utilized for nesting. Nesting efforts were monitored by Bio Tech Grizzle and contract personnel from California Department of Fish and Game (CDFG). Least terns were first observed in the area on 5 May; nesting activity began in mid-May. Nineteen (19) nests were recorded during the 1987 season at the northern site, while 27 nests were located in the colony south of the River mouth. However, many of the nesting pairs were unsuccessful during the season and renesting was suspected at both sites. Although both nesting sites are clearly posted and the northern site "fenced" with a strand of wire between signs, human disturbance to the nesting colonies remained a significant problem. Illegal alien traffic, particularly at the site south of the river mouth, essentially destroyed that nesting colony. There were unconfirmed reports of illegals "egging" at this southern site. Equestrian traffic is an additional problem for the south colony; the site will be fenced for the 1988 season. The northern colony receives pressure from beach users, some illegal fishing activity, loose dogs, illegal alien traffic, and infrequent off-road vehicular traffic. Other than to post a 24-hour armed guard at these sites, there is no possible way to contain this public use problem. Increased educational efforts along with an on-site presence offer some long-term solutions for this resource protection issue.



California least tern, TJ PR

e) Least Bell's Vireo

This vireo was once commonly found throughout southern California and parts of Mexico, nesting in riparian woodland habitat found along rivers and streams. This population has declined substantially since 1920 as a result of brood parasitism by brown-headed cowbirds, and destruction of up to 95% of its critical habitat due to farming practices and development pressures. The current population of these birds within the Refuqe is found south of the Naval Outlying Landing Field along the Tijuana River.

f) Belding's Savannah Sparrow

This bird is a year-round resident of coastal salt marshes of southern California, including the Estuary. It is considered endangered by the State of California and is a federal candidate for listing. A recent survey (1986) by biologists from the Laguna Niguel Field Office recorded 225 pairs within the Estuary. Of these pairs, 160 were found along the Oneonta Slough. This large number of pairs is attributed to an increase in suitable elevations for nesting as a result of reduction in tidal flow within the Estuary due to closing of the River mouth in 1984.

g) Salt Marsh Bird's Beak

This endangered plant occurs in patches throughout the northern portion of the Refuge. Encountered in the high marsh zone, this species is subject to trampling by Refuge pedestrian traffic. The bird's beak is an annual, and the establishment of yearly population numbers is contingent upon seed dispersal. The plant is hemiparasitic on the roots of species such as pickleweed and alkali health. Flowering typically occurs April through June. To update distribution patterns, extensive surveys will be conducted in Spring of next year.

3. Waterfowl

0nly one aerial waterfowl survey was conducted (mid-winter) in southern coastal California. The results of this 12 January effort are listed below:

Aerial Waterfowl Survey, Tijuana Slough NWR, January 1987

Species	Numbers
American Coots	130
American Wigeon	400
Northern Shoveler	150
Northern Pintail	225
Dabbling Ducks (Total)	775
Canvasback	35
Bufflehead	5
Ruddy Duck	10
Diving Ducks (Total)	50

Ground surveys were conducted throughout the year by Bio Tech Grizzle. American coot, lesser scaup, American wigeon, and northern pintail were the most common waterfowl wintering within the Tijuana River Valley. The month of December and January generally afford the highest counts of these and other species. Other waterfowl sighted include ruddy duck, red-breasted merganser, black brant (1 only), cinnamon and green-winged teal and bufflehead. Known nesters within the Estuary include mallard, ruddy duck, northern pintail, American coot and cinnamon teal.

4. Marsh and Water Birds

The mudflats and saltmarsh zones of the Estuary provides water birds with important foraging and loafing areas. Herons (including the little blue heron), egrets, cormorants, ibis, grebes, sora and others all make extensive use of the Refuge's estuarine environment. There are no known nesting colonies of herons or egrets within the Refuge; however, rookeries of wood storks, egrets, and herons are located within the Tijuana River Valley.

5. Shorebirds, Gulls, Terns and Allied Species

Shorebird numbers generally increase during the fall and winter months. Marbled godwits and willets comprise a large fraction of these birds. Other species include: dowitchers, dunlin, long-billed curlew, plovers, American avocet, and black-necked stilt. These birds are generally observed foraging or loafing on tidal mudflats within the Estuary or along the shoreline. Caspian, elegant and forster's terns are common throughout the summer months. A newcomer to the area, a gull-billed tern, was sighted within the Refuge in July; individuals nested in south San Diego Bay during the 1987 breeding season, a new nesting record. Black skimmers, which also nest in south San Diego Bay, were often observed in the summer foraging in tidal channels. Numerous gulls are found within the Refuge, the most common being western, California, Heermann's and ring-billed gulls.

6. Raptors

Northern harrier, American kestrel, red-tailed hawk, black-shouldered kite and an occasional short-eared owl were sighted foraging within the Refuge in 1987. At least one osprey was observed near the sloughs in July; however, this species more commonly occurs in the area during spring and fall migration. American peregrine falcons also frequent the Refuge during fall and spring months.

7. Other Migratory Birds

Noteworthy migratory birds observed in 1987 on the Refuge include: American white pelican (February-March), and Eurasian wigeon (March-April). Of the 359 birds recorded for the entire Tijuana River Valley, 303 are considered migrants or visitors (non-breeders). Avifauna represent the primary group of sensitive wildlife recorded in this area, many of which are migratory and federal candidate species such as the reddish egret, long-billed curlew, and the Savannah sparrow.

10. Other Resident Wildlife

The Refuge provides habitat for other groups of wildlife such as small mammals, invertebrates (both marine and terrestrial), as well as reptiles and amphibians. Examples of these groups include: mammals - bobcat, striped skunk, raccoon, long-tailed weasel, desert cottontail, black-tailed jackrabbit, deer mouse and coyote; herptiles - western fence lizard, gopher snake, San Diego horned lizard, Pacific tree frog, and western toad. Over 100 marine invertebrates have been recorded from the Estuary's tidal creeks, channels and mudflats. The Refuge and surrounding areas host over 2000 species of insects, several of which are federal candidates for listing as endangered or threatened.

11. Fisheries Resources

The Estuary's channels support an important fishery resource within the Refuge. The distribution and abundance of the fishes is dynamic, responding to the variable tidal and flood regimes of the area. Up to 29 species of fish have been recorded for the Estuary, dominated by arrow goby fish, topsmelt, and California killifish. Monitoring of fishes and benthic invertebrates of the Estuary is regularly conducted by the Pacific Estuarine Research Laboratory, with funding provided by NOAA.

14. Scientific Collections

During September and October, a live mammal trapping program was conducted on the Refuge with a primary objective of acquiring information regarding the status and distribution of the pacific pocket mouse (Perognathus longimembrus pacificas), a federal candidate species and described as high priority species of special concern in California. The necessary scientific collector's permits were obtained through CDFG for both ARM Weitzel and Bio Tech Grizzle. These permits will be renewed annually. No target specimens were recorded in the three areas surveyed, which included upper salt marsh, modified grassland, and disturbed coastal sage scrub habitats. Both the deer mouse and house muse were found in all of these areas. The pacific pocket muse has been recorded for the Tijuana River Valley and additional surveys are scheduled for 1988.

16. Marking and Banding

California least tern chicks were again banded in 1987 in cooperation with CDFG contract biologist Elizabeth Copper. A total of 6 chicks were marked with Service bands during July and August at both the northern and southern tern colonies.

17. Disease Prevention and Control

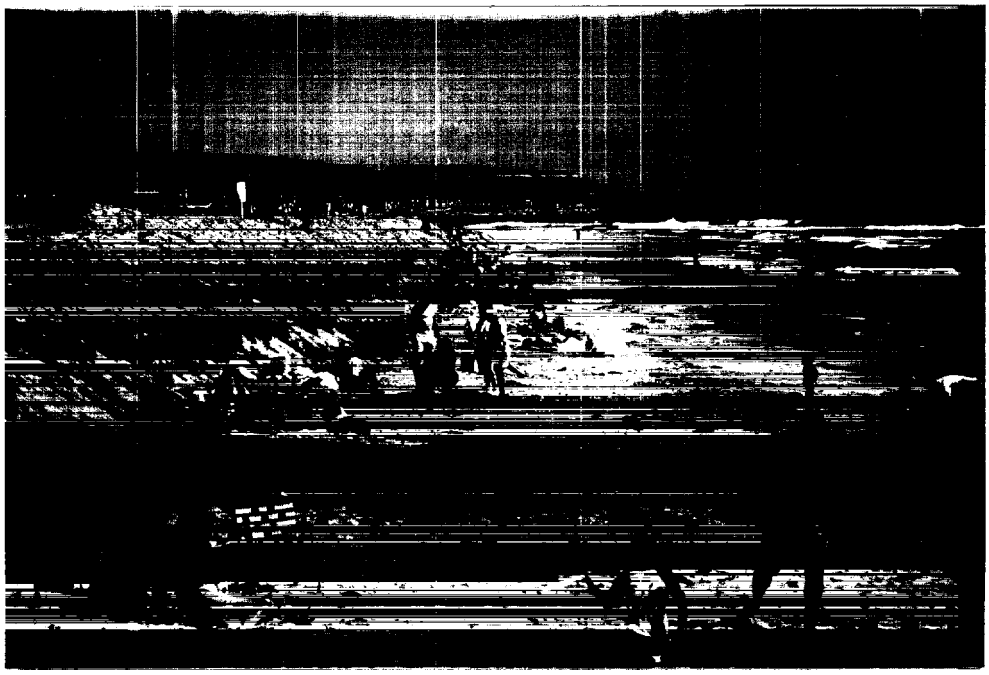
As outlined in F.l, renegade wastewater from Mexico flows into the Estuary, primarily **via** the Tijuana River. The longest influxes occur as sewage spills which have the potential of discharging industrial/toxic compounds into the Estuary. As yet, there has been no documented disease outbreaks within the

Refuge, but the potential is high due to the discharges from Mexico and other sources, such as contaminants from the adjacent Navy Outlying Landing Field.

H. PUBLIC USE

1. General

Tijuana Slough receives at least 25,000 visits annually. Due to the Refuge's urban setting and mild climate, public use levels are fairly constant throughout the year.



A Saturday afternoon at the beach - Tijuana Slough NWR. Tijuana, Mexico lies in the background. TJ MW

Refuge staff actively promote environmental awareness in the community by emphasizing visitor contact; disseminating interpretive literature; generating newspaper articles; and, time permitting, providing formal tours and presentations to school groups, organizations/clubs, political officials, and other interested parties. Tours conducted, for example, during the month of October include:

-- an on-site overview of Refuge programs, presented by ARM Weitzel to 26 members of the Association of Environmental Professionals, San Diego Chapter.

-- a refuge and international border orientation tour, by ARM Weitzel, to Jeff Updyke, Acting Supervisor/Laguna Niguel Field Office.

-- a general Refuge tour, by ARM Weitzel, to Costantine Dillon, Assistant to Speaker of the California Assembly Willie Brown.

San Diego and Imperial Beach newspapers produced several articles during the period covering Refuge related subjects, including: the Refuge's water quality (wastewater) problem, Navy Outlying Landing Field helicopter activity, illegal alien movement through the area, the Advanced Public Use Design and Development Workshop, ARM Weitzel's background, habitat development activities (e.g. tidal prism enhancement and dune restoration projects), and the status of least terns and other endangered species.

The future visitor center will result in an upsurge of public use activities; however, potential impacts to Refuge resources that might be caused by this increased use of the area will be partially mitigated by a well planned trail system, active visitor education programs, and intensified law enforcement efforts.

2. Outdoor Classrooms - Students

The CDPR environmental education specialist conducts classes within the Refuge throughout the year. Local elementary/high school groups participate in these programs. In addition, Boy/Cub Scout clubs, docents from the Chula Vista Nature Interpretive Center, and undergraduate/graduate students from San Diego State University, were among the numerous groups that incorporated Refuge visits into their classroom activities during 1987. Refuge staff assisted with many of these efforts.

4. Interpretive Foot Trails

Throughout the period, Refuge staff and CDPR managers discussed the location of the future interpretive trail system; the layout should be finalized during CY 88. The presence of endangered/threatened plants and ground nesting birds will partially dictate where such trails are established. A well maintained trail system will facilitate control of public use activities and direct visitor use away from sensitive resources.

7. Other Interpretive Programs

A major biological report, "The Ecology of Tijuana Estuary: An Estuarine Profile", was distributed during the period. This document produced by the National Coastal Ecosystems Team, and authored by Dr. Joy Zedler of San Diego State University, presents a detailed discussion of all resources encompassed within the Estuary. The Refuge office received about 150 copies, and because this publication is considered a valuable interpretive tool, that initial supply was quickly exhausted. The possibility of locally reproducing this report is being pursued.

The need for bilingual (Spanish/English) signage and interpretive leaflets is recognized. Efforts next year will include translating educational posters, questionnaires and other material to Spanish. Most translations will be accomplished by Refuge staff.

9. Fishing

Fishing, including clamming and shrimping, is restricted to the intertidal beach zone and mouth of the Tijuana River. Due to active law enforcement patrols and the public's perception of a deteriorated water quality situation (from untreated wastewater), illegal fishing efforts are infrequent. Ghost shrimping within closed areas is the most commonly observed violation.

11. Wildlife Observation

With over 300 species frequenting the Refuge, birding opportunities are considered excellent. In 1987, groups participating in organized bird watching trips included: San Diego Field Ornithologists, local chapters of the Audubon Society and the Sierra Club, Imperial Beach Quilters, Scripps Aguarium, and numerous elementary/high school/college classes.

The Southwest Wetlands Interpretive Association and CDPR offer guided tours on the first and second Saturday of each month. These popular tours, initiated in 1984, average 30 participants per session.

15. Off-Road Vehicling

Non-Service traffic is prohibited; however, access by U.S. Border Patrol and County of San Diego Mosquito Abatement vehicles is authorized under special circumstances. All vehicles must stay on established maintenance roads.

In December, four Border Patrol ATV's were observed operating within the historical least tern nesting area south of the River mouth. The agents were detained on-site and questioned; no citations were issued. Fortunately, least terns are not present on the Refuge this time of the year. A memo outlining the incident was submitted to the Management Authority and Border Patrol Sector Headquarters, San Ysidro.

In August, members of the public reported that San Diego County Sheriff's Department Search and Rescue Units were operating ATV's on dune/intertidal beach habitat between Seacoast Drive and the mouth of the Tijuana River. After speaking with high ranking personnel of that Department, ARM Weitzel received assurances that this situation will not be repeated.

16. Other Non-Wildlife Oriented Recreation

Surfing and swimming in the beach zone are avidly practiced throughout the year. Bike riding, jogging and hiking are common recreational pursuits in the upland areas; these activities are restricted to established roads.

A + one acre site, located immediately adjacent to 5th Street housing, is used by City of Imperial Reach Little League teams. Under an annual Special Use Permit, League teams have utilized this area for many year; however, no permanent structures are allowed on the site.

Kayaking, at high tide, is allowed under a special use permit. TJ PR

17. Law Enforcement

The presence of on-site staff has alleviated the intensity of illegal actions such as off road vehicle use of beach/dune habitat, dumping/littering, and trespass; however, because of the Refuge's urban position, these activities will probably always occur to some degree. Law enforcement efforts at this stage in the development of the Refuge emphasize sensitizing visitors to the value of the area's resources and informing them of public use regulations. Citations, however, are issued when necessary.

Impacts to marsh vegetation and least tern nesting efforts result from illegal alien foot traffic from Mexico. The U.S. Border Patrol apprehends 1500 or more illegals on the Refuge every month; hundreds more pass through the area, escaping arrest. Illegal traffic can be expected to increase as more Mexicans are forced to seek work in the U.S. due to the continued devaluation of the Mexican peso.

Some of these aliens are in the business of transporting illicit drugs, with most of this narcotic traffic accomplished at night. According to Border Patrol, the Refuge is becoming a well established drug route. Enforcement efforts within the Refuge, relative to these alien/drug activities, are left to the Border Patrol.

Illegal irmigrants from Mexico in the custody of the U.S. Border Patrol. TJ MW

In October, ARM Weitzel briefed Izell Gunner, the new CDPR Silver Strand/Border Field State Parks Field Supervisory Ranger on Refuge LE concerns. It was decided that formal orientation sessions, designed to brief new Park Rangers to Service law enforcement policy, are needed. These briefings will commence in early 1988.

In **November,** a new entry sign at the end of Seacoast Drive was struck by a Porshe. The sign's two 6" x 6" supporting posts were destroyed, and the vehicle was severely damaged. The driver fled, but was apprehended by a sheriff's deputy. The sheriffs office refused to pursue the matter; however, ARM Weitzel convinced the owner of the vehicle that, to avoid federal prosecution, he would have to remedy the situation, including installation and replacement of damaged materials. Within one week, the sign had been replaced by said individual.

In December, two adults transporting air guns (and probably target practicing) on Refuge property were cited by ARM Weitzel. Also during the month, a group of juveniles playing "war games" started a brush fire ±0.5 miles west of the Sunset entry gate. The San Diego Fire Department manned the Sunset perimeter area in the event the fire was to progress east and endanger housing. Navy helicopters assessed the extent of the fire, which contained itself within a ±1.5 acre area. The impact to Refuge resources was considered insignificant. No suspects were apprehended.

I. EQUIPMENT AND FACILITIES

1. General

The Refuge office officially opened in February of this year. At that time ARM Weitzel began organizing the filing system, and initiating procurement of tools, office supplies, reference materials, and other items.

Because an office/maintenance facility does not yet exist on Refuge property, the City of Imperial Beach provides the Service with a 17 ft. x 12 ft. office located within their Public Works building. This office, approximately one mile from the Refuge, will serve as headquarters until the visitor center is ready. Refuge owned equipment is stored within the City's locked maintenance yard.

This current office arrangement promotes communication with City officials, and thus enhances our position as part of the community.

2. Rehabilitation

In February, a ±200 ft. highly dilapidated drift fence was removed from the northern perimeter of the barrier dune; and in April, with assistance from Salton Sea, a 350 ft. fence was installed at this same location in an effort to reduce public use impacts to sensitive dune habitat.

In September, the Sunset Avenue entry gate was replaced. The gate had been hit and severely damaged by a speeding (and stolen) vehicle. The occupants dispersed at the time of the accident; their identity remains unknown. Also this same month, a work detail from Salton Sea refurbished the primary maintenance road (see Section F.2).

4. Equipment Utilization and Replacement

Procurement of standard office and field supplies continued throughout the period. Noteworthy additions included:

a) Bushnell 15x60 sporting scope and Discover 9x30 binoculars, secured from Salton Sea; b) conductivity meter; c) IBM Wheelwriter 3 typewriter; d) security cabinet; e) S&W model 66 revolver; f) Bushnell Spacemaster II 70mm spotting scope; g) Bushnell 10x40 binoculars.

Orders were placed for a desk top xerox machine and photographic equipment, including a Canon T-90 camera. These items should arrive early next year.

Refuge vehicles are leased through GSA Fleet Management. A GSA Dodge 4x4 pickup was employed until April, at which time that vehicle was exchanged for a more fuel efficient Ford Ranger. For Bio Tech Grizzle's use, a 1986 Ford Ranger was obtained from GSA in March.

We have an ongoing request to GSA for a compact 4x2 pickup; however, those vehicles are apparently very difficult to secure.

5. Communication Systems

Telephone service was connected on 6 February. Because the Refuge lacks on-site secretarial assistance, a Panasonic answering machine was purchased in March.

8. Other

In September, the heavy equipment operator (and a tractor with backhoe and bucket) from Salton Sea assisted Refuge staff in placing eight new Reserve entry signs at various locations on the Refuge, and other sites in the Estuary.

J. OTHER ITEMS

3. Items of Interest

Formal training courses/workshops completed by ARM Weitzel during the period:

-- Waterfowl Disease Workshop; Sacramento NWR, CA; 3-4 February.

-- Law Enforcement Training; FLETC, Glynco, GA; 9 June -13 August.

-- Advanced Public Use Design and Development Workshop; Imperial Beach, CA; 5-9 October.

In June, Bio Tech Grizzle attended a one day symposium entitled "Binational Cooperation in the Development and Management of Shared Resources - Border Water Resources: Hydrology, Ecology, and Management; and the Role of Biological Reserves in Research and Conservation". (whew!)

Bio Tech Grizzle received a Special Achievement Award for her efforts in producing the Navy natural resource plans, and in functioning as the principle Refuge contact while ARM Weitzel was attending FLETC.

ARM Weitzel is a member of the following professional organizations:

-- Society for Ecological Restoration and Management

-- National Military Fish and Wildlife Association

Bio Tech Grizzle is affiliated with:

-- The Nature Conservancy

-- National Wildlife Federation

-- World Wildlife Fund

-- Environmental Defense Fund

Mountain Lion Preservation Foundation

4. Credits

Section D.5a was written by Marc Weitzel, with sampling data supplied by Bill Henry; section G was written by Betty Grizzle and Marc Weitzel; all other sections were written by Marc Weitzel. Editing was done by Gary Kramer and Marc Weitzel. Typing and assembly of report was done by Shelly Hunter.

COACHELLA VALLEY NATIONAL WILDLIFE REFUGE

THOUSAND PALMS, CALIFORNIA

ANNUAL NARRATIVE REPORT

CALENDAR YEAR 1987

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

INTRODUCTION

Coachella Valley NWR is presently a 2,589 acre refuge in Southern California located about 10 miles east of Palm Springs in the heart of the rapidly developing Coachella Valley. The Refuge was established in 1985 as part of Coachella Valley Preserve with the primary purpose of protecting the threatened Coachella Valley fringe-toed lizard (*Uma inornata*)(CVFTL) and the desert ecosystem that supports this species. The Preserve is a 13,000 acre area jointly managed by the Bureau of Land Management (BLM), the Nature Conservancy (TNC), California Department of Fish and Game (CDF&G) and the U.S. Fish and Wildlife Service (USFWS). Because of the expanding human population of the area, which has doubled to over 180,000 people during the last ten years, the Preserve is essential to protect an array of desert ecosystems threatened by the development associated with this population growth. The three most dynamic ecosystems are the palm oasis woodlands sustained by water available through fractures in the bedrock along the San Andreas Fault, perennial desert pools, a result of the San Andreas Fault which forces ground water through fractures to the surface, and the blow-sand habitat necessary for the survival of the CVFTL. In addition to the CVFTL, the Preserve supports three amphibians, 23 reptiles (including the flat-tailed horned lizard, a candidate species for federal listing), 180 birds and 25 mammals. Two plant species found on the Refuge are listed as endangered by the State of California and are being considered for federal listing.

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J. OTHER ITEMS

A. HIGHLIGHTS

CVFTL adult population was down 54 percent but juveniles are up 128 percent. (Section G.2).

ORV traffic was greatly reduced. (Section H.17).

Acquisition of additional 250 acres took place. (Section C.l).

B. CLIMATIC CONDITIONS

Weather conditions in the Coachella Valley are typical of the southern interior desert. The area averages less than five inches of annual precipitation with January through March being the wettest months. The area experiences extremely hot summer temperatures.

1987

Month	Precipitation (inches)	Temperature (°F) Max	Min
January	0.30	80	32
February	0.00	84	41
March	0.12	88	45
April	0.00	108	54
May	0.02	105	57
June	0.00	113	65
July	0.00	114	66
August	0.00	112	67
September	0.20	108	67
October	1.27	107	59
November	1.96	83	42
December	0.73	81	30

C. LAND ACQUISITION

1. Fee Title

During FY 87 a total of 250.85 acres were purchased at a cost of $911,850, bringing the total acreage of the Refuge to 2588.73 for a total cost of $9,273,908.

Acquisition should be completed in 1988 or early 1989 with the purchase of a 10 acre tract at an estimated value of 35,500.

D. PLANNING

2. Management Plan

All management activities on the Refuge are guided by the Coachella Valley Preserve System Management Plan which was signed in October 1986 by the four land owning agencies - USFWS, BLM, CDF&G, and TNC. The Plan list ten goals and then details the actions required to meet them. The goals are as follows:

1) Maintain and enhance the natural condition of all lands within the Coachella Valley Preserve System.

2) Restrict vehicle access within the Coachella Preserve System to the minimum number of routes needed to service authorized rights-of-ways and private land.

3) Remove all exotic species of plants and animals where and when feasible to the benefit of native species.

4) Restrict the use of firearms from all lands within Coachella Preserve system.

5) Remove abandoned buildings, cars, and debris.

6) Establish hiking and equestrian trail systems through the major habitats of the Coachella Preserve System. Locate equestrian trails outside sensitive habitats such as palm oases and sand dunes.

7) Provide the public with information on the resources, origin and cooperative nature of the Coachella Valley Preserve System.

8) Monitor the sensitive biological components contained within the Coachella Valley Preserve System.

9) Make the Coachella Valley Preserve System available for use by researchers.

10) Provide refugia for endangered species of native plants and animals which occur in similar habitats (e.g. desert pupfish).

Management meetings with a representative from each agency are held monthly to coordinate activities on the Preserve. The chairmanship of the Management Committee rotates among all four agencies. In 1987, the BLM representative acted as chairman.

4. Compliance with Environmental and Cultural Resource Mandates

In 1986 the Habitat Conservation Plan (HCP) was signed by the USEWS, BLM, CDF&G, TNC, the County of Riverside and the cities of Desert Hot Springs, Palm Springs, Cathedral City, Rancho Mirage, Palm Desert, Indian Wells, La Quinta, Indio and Coachella. The signing of the HCP cleared the way for

issuing an Endangered Species Act Section 10(a) permit. This allowed the incidental taking of CVFTL and the development of CVFTL habitat outside the Preserve boundaries. As a stipulation of the 10(a) permit developers are required to pay a $600 per acre fee which goes into an endowment fund for the Preserve.

5. Research and Investigations

Other Personnel

a. Fraction of net primary production attributable to mycorrhizal fungi in a warm desert ecosystem.

Dr. T.V. St. John, National Science Foundation grant BSR 86-96089.

The study will attempt to estimate: the fraction of net primary production attributable to vesicular-arbuscular mycorrhizal symbionts in a warm desert ecosystem and the production of carbon allocation to the symbionts, based on NPP and fungal respiration.

Field research is underway and will continue through October 1988.

b. Seed selection in wintering desert sparrows and finches

Dick Repasky, M.S. candidate, University of British Columbia, Vancouver, B.C. Canada.

The project will attempt to determine: the efficiency with which the different species use different food types and the competition between wintering desert sparrows and finches.

Field research began in November 1986 and will continue through 1988.

E. ADMINISTRATION

1. Personnel

The Refuge is an unstaffed satellite, with all administrative and maintenance functions handled by personnel from Salton Sea NWR.

4. Volunteer Program

A group of four volunteers have participated in the tour and guide program at the Nature Conservancy's Palm Canyon Visitors Center throughout the year. They introduce the visiting public to the Preserve and provide guided tours. A group from the College of Pomona assisted Cameron Barrows, manager of the Preserve, in eradication of saltcedars on the Preserve and marina High School volunteers provided fence work on the area. A Boy Scout group of 20 individuals assisted Cameron Barrows in removal of saltceders. Also Bill Neal took a group of volunteers from the Sierra Club three times during the year to eradicate saltcedars on the Preserve. All volunteer activities occur throughout the Preserve including refuge lands.

5. Funding

Salton Sea NWR receives funds for management of Coachella Valley NWR from a management endowment fund managed by TNC! for the Preserve. The account is set up to handle money generated from developer's mitigation fees ($600 per acre) collected for development activities on fringe-toed lizard habitat outside the Preserve in accordance with section 10(a) of the Endangered Species Act.

Once the full endowment fund is established at approximately 2.5 million, the annual budget of the Preserve will be limited to interest yields from the endowment. By the end of 1987 the mitigation fees remained below a million dollars with most of the collected fees going for acquisition.

The Refuge received $10,000 in FY 87 for law enforcement activities, biological monitoring of the lizard, removal of saltcedar and buildings on newly acquired lands and to off-set administrative costs.

F. HABITAT MANAGEMENT

1. General

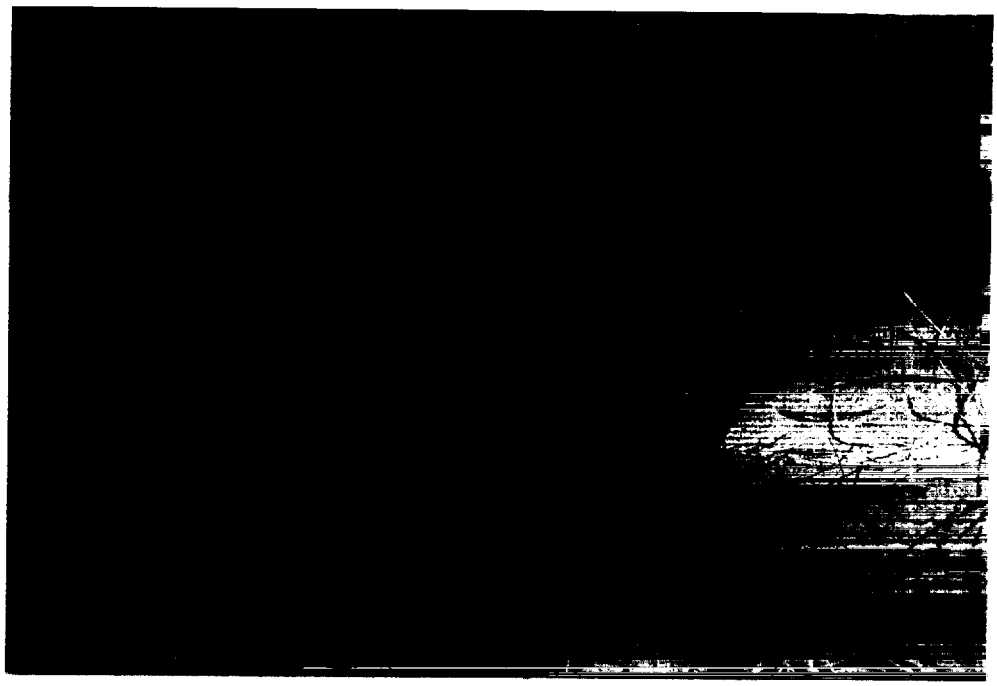
The Refuge contains large areas of blow-sand fields which are created by a combination of surface water and wind transport processes. The sand fields are dependent upon periodic flooding which funnels sand down the watershed to create sand fields and dunes. This action coupled with strong winds create and maintain the blow sand habitat critical to the CVFTL.

The Refuge presently administers 13 percent of the proposed 13,030 acres of designated critical habitat for the federally threatened CVFTL and is responsible for the protection of some 81 annual herbs, eight perennial herbs, 29 shrubs and vines, 23 rushes and sedges, three trees and two succulent plants. Species of special concern which may occur include Wiggin's croton (Croton wigginsii), flat-seeded spurge (Euphorbia platysperma), and Coachella milk-vetch (Astragalus lentinginosus var. coachellae).

G. WILDLIFE

1. Wildlife Diversity

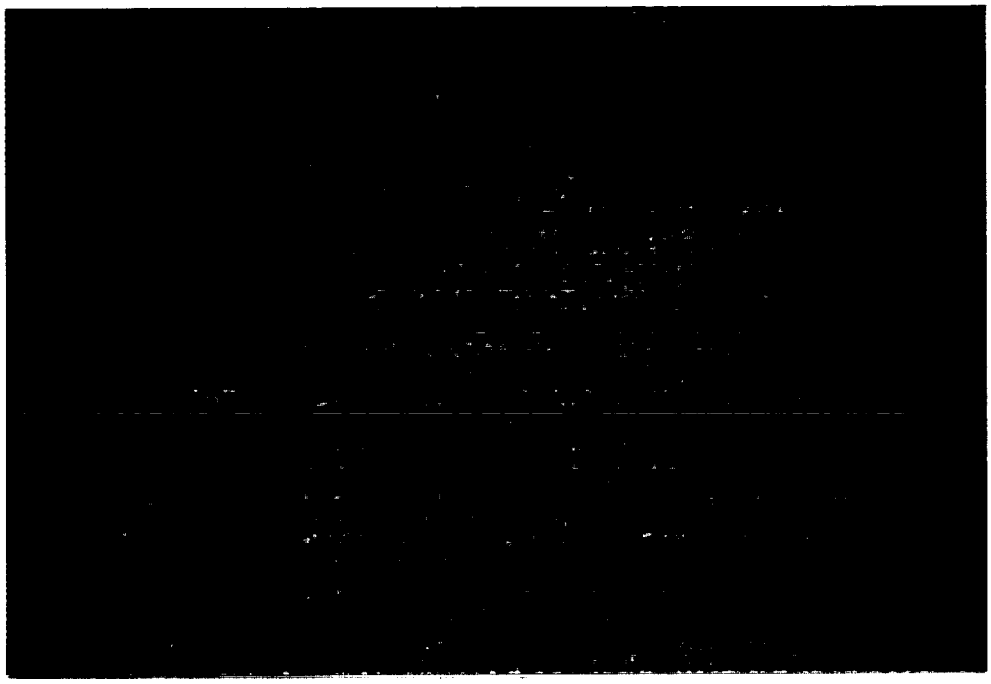
Vertebrate species observed in the general vicinity of the Refuge include: three amphibians, 23 reptiles, and 25 mammals, many of which occur as permanent residents; and 180 birds which are primarily migrants and utilize valley floor habitats on a seasonal basis.



A mature female desert tortoise. CV

Two species of special management concern include the flat-tailed horned lizard (Phrynosoma mcallii) (FTHL) and the CVFTL.

The FTHL, a candidate species for federal listing, is also present in sandy habitats where soils are sufficiently hard to support colonies of harvester ants, their principal prey. The species is generally considered difficult to find and, although the geographic range is relatively extensive, FTHL's are comparatively rare throughout.



An adult flat-tailed horned lizard. CV

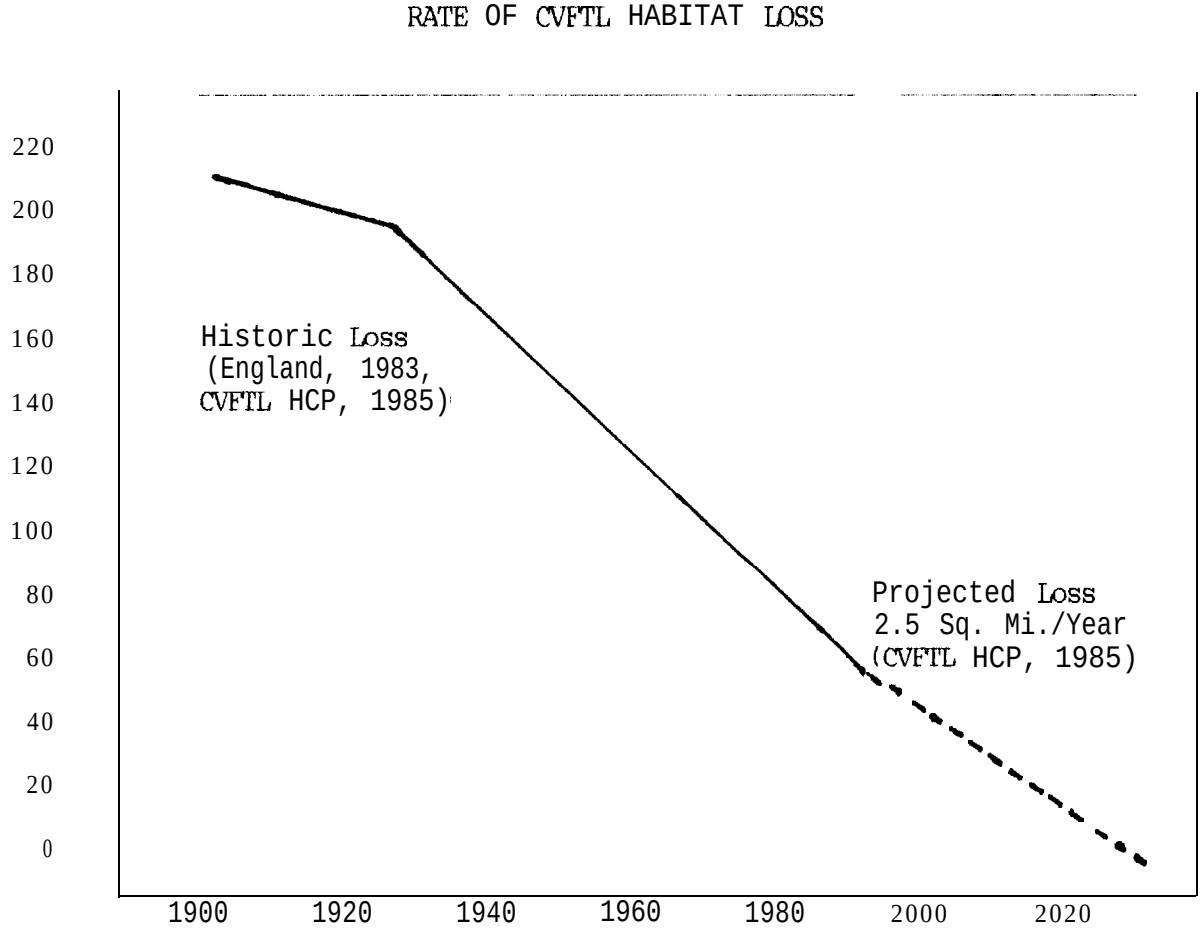
2. Endangered and/or Threatened Species

The CVFTL is a highly specialized species endemic to blow-sand areas of Coachella Valley and was federally listed as threatened on September 25, 1980 (Federal Register 45:188). In a parallel action, the State of California Fish and Game Commission designated the CVFTL as "endangered".

In order to determine existing populations of CVFTL on the Refuge, a monitoring program was initiated in May 1986. Three permanent 1000 meter transects, covering the full diversity of CVFTL habitat, were established and censused during the period of May 14 to July 8. Each of the three transects is surveyed once daily, for six days in a row. Running a transect consists of two people walking abreast and agitating any vegetation occurring within five meters of the transect midline. All sightings of CVFTL are recorded, along with any other sightings of reptiles or mammals.

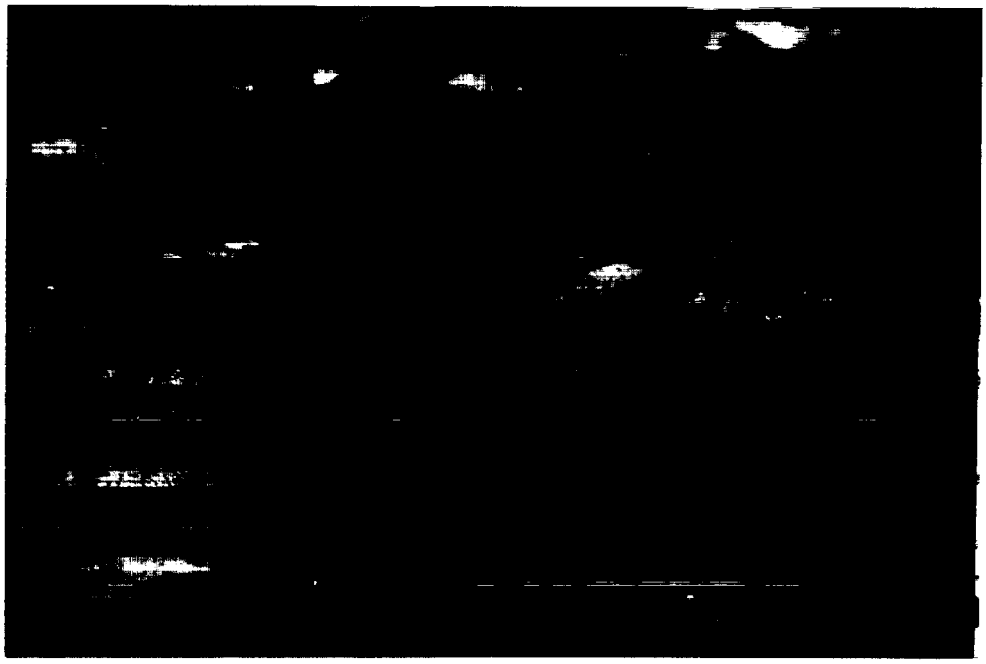
Historically, some 200 square miles of the Valley and an additional 70 square miles in peripheral areas were covered with loose, windblown sand and served as CVFTL habitat. The range of this species has been reduced by 50 percent, principally due to the loss of habitat associated with agricultural development and urbanization. It is projected that, without some type of restrictions to protect habitat, all the remaining CVFTL range could be lost within 50 years (Figure 1).

FIGURE 1: PATE OF CVFTL HABITAT LOSS



The continued perpetuation of this highly specialized species is dependent upon the continuing renewal of windblown (aeolian) sand. Wind shielding by development stabilizes and eventually prevents renewal of its habitat and results in elimination of the lizard population. Other threats to habitat include off-road vehicles, flood control projects, and invasive exotic plants.

The CVFTL is a medium-sized lizard that displays several striking adaptions for living in the severe environment of blowsand ecosystems. These include the species' ability to "swim" through sand, run across the surface at high speed, and dive into the sand to escape predators and heat. Physical characteristics that make this possible are the small, rounded scales on the lizard's skin, the enlarged scales or "fringes" on the toes for which the lizard is named, a wedge-shaped nose, double eye membranes, and a skin flap over the ear to keep sand out.



A juvenile CVFTL blending with it's surroundings. CV

Taxonomically, the species is related to two other species of Uma, the Colorado fringe toed lizard (U. notata) and the Mojave fringe toed lizard (U. scoparia). Because of their geographic isolation from each other, the three species are functionally separate, even if they occasionally interbreed in captivity. By virtue of its isolation in the Coachella Valley, U. inornata has evolved morphological and behavioral differences from the other two species.

Fringe toed lizards use burrows of other animals and can construct burrows in loose sand, with only minimal adhesive structure, which they apparently use for thermoregulation and for incubating their eggs. The lizard is active when its body temperature is between 26" and 45°C, with a mean of 38°C (100°F). It attains these temperatures by basking on the sand. When the external temperatures are too hot, the lizards spend most of the day below the surface and are active only in the early morning and late afternoon. The species hibernates from November to February or March when'external temperatures are often below its activity range.

Adult CVFTL "sun bathing" on a cool day (< 100°F). CV

Individual fringe-toed lizards live for about five years. They attain sexual maturity at two years and breed each year thereafter. Multiple clutches of eggs may be laid in one season. Hatchlings appear from late June to early September. It is reported that the amount of winter rainfall can influence reproduction in Uma. In years of low rainfall, winter annual plants may fail to germinate, and do not support the normal insect population on which the CVFTL feeds. In response to a food supply, the reproductive system of the lizards is depressed and fewer young are produced.

Similar to several other lizards, CVFTL are omnivorous, but they seem to have a preference for insects over other food items. Predators on CVFTL include snakes, birds, and other lizards (e.g. leopard lizards).

While the taxonomy, sand adaptations, behavior and reproductive physiology are relatively well known, the population biology and ecology of the species has been little studied. Information such as the population density throughout the Valley, population size and reproduction from year to year, movement of individuals, barriers to movement, and contiguity of subpopulations throughout the Valley are conjectured, but not documented. CVFTL may be more abundant on natural blowsand sites where plant density and diversity are greater.

H. PUBLIC USE

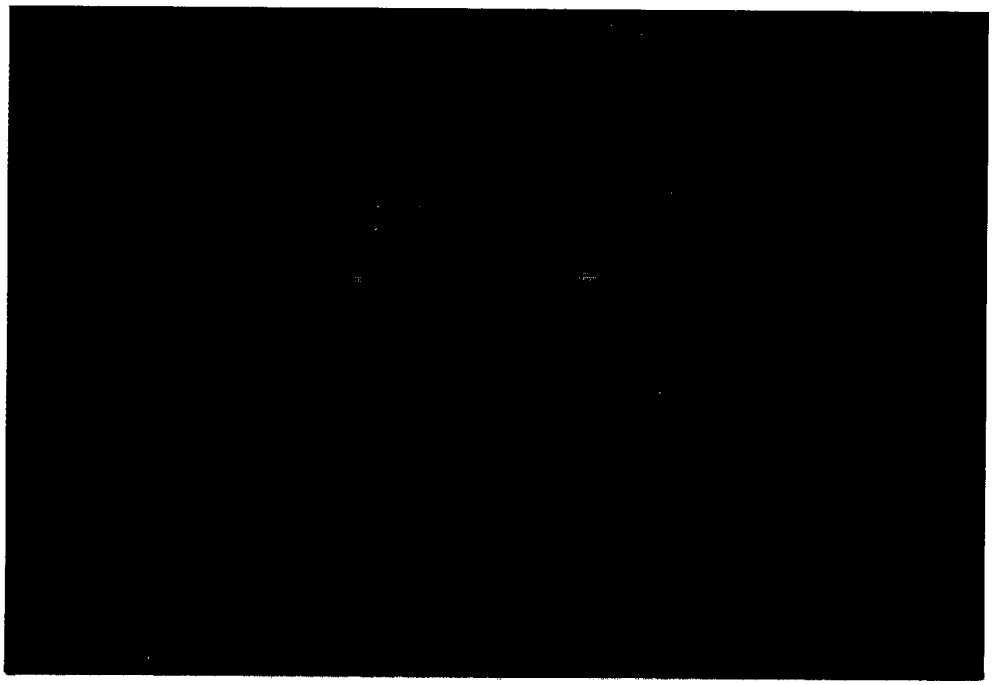
1. General

The Preserve receives approximately 10,000 visitors annually. Most of the visitation occurs from November through April with the majority of the people visiting the Palm House, which is owned by TNC and acts as the Preserve headquarters. Popular activities on the Preserve are hiking, birding, and photography particularly along the trails located on the north end of the Preserve. Horseback riding, a traditional activity in the area, is growing in popularity and will have to be restricted to trails in non-critical habitat. An equestrian trail system is still in the planning stages. The Refuge, located on the south half of the Preserve, has no hiking trails and relatively low public use. Most of the prime lizard habitat within the 13,000 acre Preserve, is on the Refuge.

17. Law Enforcement

Trespass by off-road vehicles (ORV) is still the problem of greatest concern on the Preserve. ORV's directly impact the fringe toes lizard by destroying habitat, and inadvertently harassing the lizards. A few cases of actual mortality caused by ORV's running over lizards, eggs and burrows have been documented.

The first major law enforcement effort to control ORV use took place in 1986 on Easter weekend when two Refuge Officers from Salton Sea NWR worked with two BLM Rangers. Prior to that effort, TNC with help from BLM and volunteers had installed a three strand barb wire fence along 38th Avenue and Washington Street. The fence was cut and repaired several times over the weekend and a few ORV's made it on and off the Preserve without being apprehended, but for the first time the public was aware the area was closed to ORV use.



Combined patrols by BLM and **USEWS** helped reduce illegal trespass by local ORV's. CV

Since then a BLM Ranger has been assigned half-time to the Preserve and at **least one Ranger and one Refuge Officer has worked every holiday weekend. Also** the fence building continued until most access points were closed. At first fence repair was a constant job for the part-time **TNC** maintenance worker but persistence paid off and vandals finally stopped cutting the fence. By the end of the year only an occasional **ORV ventured on to the** Preserve.

In 1987 BLM issued over 50 federal and state tickets, about half the number issued in 1986. Only two trespass violation notices were issued by USFWS. **Most** of the tickets were issued by BLM Rangers because of their broader authority under CFR 43 to enforce laws on all public lands and their state authority granted by CDF&G. **BLM** also has the lead responsibility for law enforcement on the Preserve and Rangers patrol the area regularly.

I. EQUIPMENT AND FACILITIES

2. Rehabilitation

In June, the D-7 dozer and backhoe were transported to the Preserve to demolish two old houses and rip out adjacent saltcedar windrows. Most of the debris had to be hauled off or buried on site, only a small amount could be burned because of county permits. The YCC crew from Salton Sea NWR helped on the project during the second week, picking up smaller pieces of debris.

J. OTHER ITEMS

1. Cooperative Programs

The Refuge is managed cooperatively with BLM, TNC and CDF&G as part of the Preserve within the guidelines of the Management Plan but it still remains part of the National Wildlife Refuge System and must be managed independently to meet its own objectives. Few problems arise from this because the other agencies are in the same situation.

4. Credits

Section B was written by Ramon Vega; sections F, G, and part of D by Bill Henry. The reminder of the narrative was written by Tom Alexander. Editing was done by Gary Kramer. Credits, typing, and assembly of report was done by Shelly Hunter.