State of California
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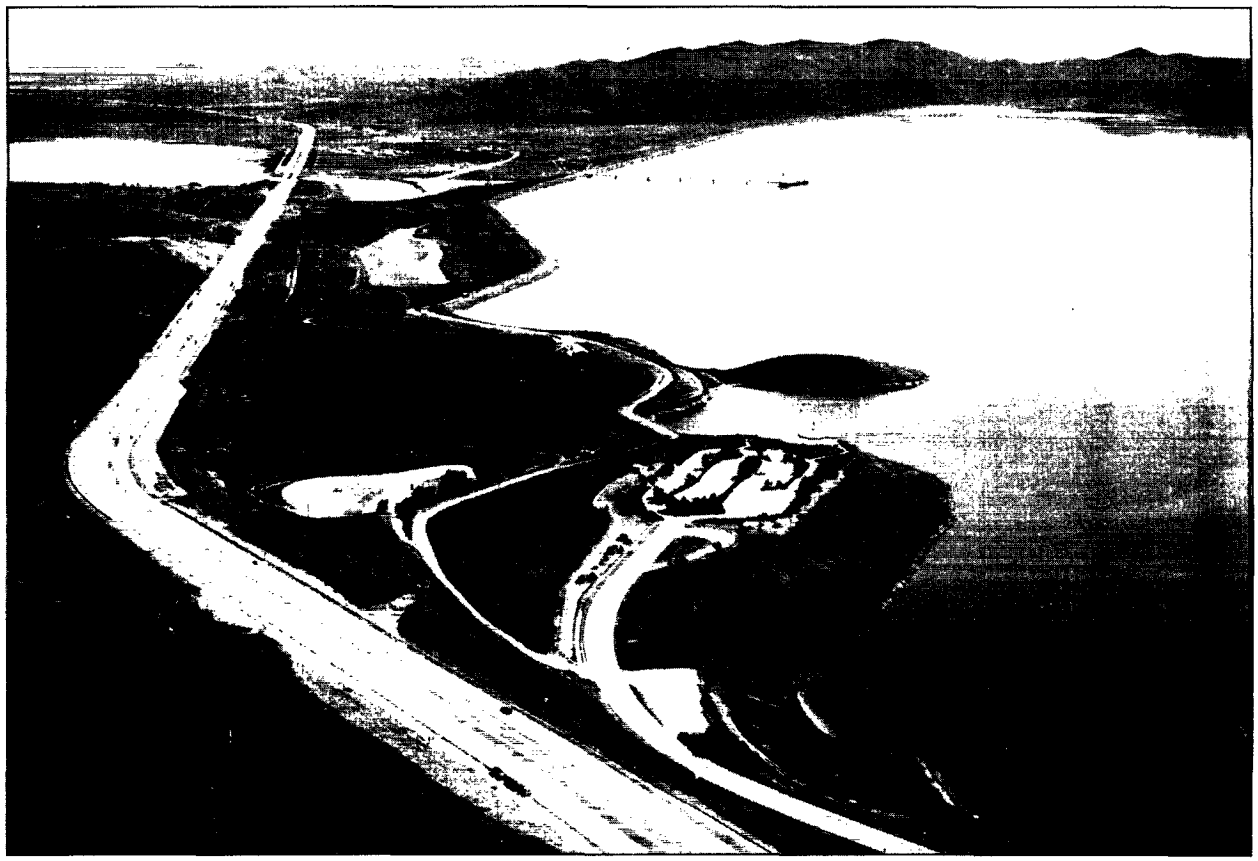
Department of Water Resources
Northern District

RECREATION USE SURVEY OF SAN LUIS RESERVOIR, O'NEILL FOREBAY, AND LOS BANOS DETENTION RESERVOIR, MERCED COUNTY, 1986



October 1987

Gordon K. Van Vleck
Secretary for Resources
The Resources Agency

George Deukmejian
Governor
State of California

David N. Kennedy
Director
Department of Water Resources

ON THE COVER: Looking down at San Luis Reservoir on the right of State Highway 152. On the left is O'Neill Forebay.

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FOREWORD

Planning for recreation development at a major water project such as the proposed Los Banos Grandes Reservoir requires considerable knowledge of local and regional recreational needs and current trends in recreation activities.

Traditionally, a comparable reservoir located in an area with similar population demographics is chosen for study so that data representative of the expected demand at the proposed reservoir may be obtained.

With respect to Los Banos Grandes Reservoir, the obvious choice for a comparable reservoir was San Luis Reservoir and O'Neill Forebay, both located a few miles north of the proposed reservoir site. San Luis Reservoir is similar in size, topography, climate, vegetation, and surrounding population to Los Banos Grandes. Los Banos Detention Reservoir is expected to be the forebay/afterbay for Los Banos Grandes, and its operation, size, and fishery will be greatly modified by the proposed project. O'Neill Forebay is a reasonable, although far from exact, proxy for Los Banos Detention Reservoir. However, no recreation surveys have been conducted at any of these reservoirs since 1967, so available data were greatly out of date.

Therefore, during 1986, the Department of Water Resources conducted surveys of recreation use, activities, visitor characteristics, and angler success at these reservoirs. The data collected are summarized in this report and will be used to identify potential recreation needs at the Los Banos Grandes Reservoir.

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Northern District

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SUMMARY

A recreation-use survey and creel census were conducted at San Luis Reservoir State Recreation Area in 1986 by the California Department of Water Resources. The objective of both the survey and the census was to obtain data on the general recreation use, types of recreation activities, visitor origin and characteristics, and fishing quality of reservoirs comparable to the proposed Los Banos Grandes Reservoir (a key component of the Deukmejian Administration's 1984 legislative proposal for advancing the State Water Project).

The reservoirs surveyed for this purpose were San Luis Reservoir and O'Neill Forebay in Merced County. Los Banos Detention Reservoir, also in Merced County, was included because of potential impact on its use following construction and operation of the proposed reservoir. These reservoirs are multiple-use recreation areas that provide opportunities for shore and boat fishing for coldwater and warmwater fish, camping, picnicking, pleasure boating, swimming and beach use, wildlife and nature study, hiking, bicycling, minibiking, hunting, and other activities.

Recreation users and anglers were contacted on 28 days during 1986, using a traffic stop method for recreationists and a roving census for anglers.

Surveyors conducted 1,550 recreation interviews representing 4,056 people. Shore fishing was the predominant activity at San Luis Reservoir. Picnicking and relaxing had the highest participation at O'Neill Forebay. Shore fishing had the highest annual participation at Los Banos Detention Reservoir, but swimming/wading and relaxing were the most popular summer activities. Other major activities for the three reservoirs (after shore fishing, picnicking, swimming/wading, and relaxing) included camping, boat fishing, sightseeing, pleasure boating, and walking for pleasure.

The most frequent county of origin for San Luis Reservoir and O'Neill Forebay was Santa Clara. Merced County was the county of origin for most visitors to Los Banos Detention Reservoir.

Percentages of visitors who were day users during summer were similar at San Luis Reservoir and O'Neill Forebay (75 and 77 percent) but were slightly lower at Los Banos Detention Reservoir (67 percent). Similarly, length of stay was the same for day users at San Luis Reservoir and O'Neill Forebay during the summer (4.7 hours and 4.3 hours), but was much shorter at Los Banos Detention

Reservoir (2.7 hours). The mean number of people per vehicle in summer was very similar for all three reservoirs (2.6 to 2.9).

Anglers contacted at all three reservoirs numbered 2,517 and had fished a total of 9,275 hours, catching 1,513 fish. The predominant fishery at San Luis Reservoir and O'Neill Forebay was striped bass (Morone saxatilis). However, a variety of other species were also caught at O'Neill Forebay. The most important fishery at Los Banos Detention Reservoir was rainbow trout (Salmo gairdnerii); however, overall, warmwater fish greatly outnumbered trout. The predominant warmwater fish caught was bluegill (Lepomis machrochirus).

Anglers fishing for striped bass were most successful at San Luis Reservoir. A total of 1,018 striped bass were caught in 4,384 hours of fishing.

Striped bass anglers at O'Neill Forebay were less successful. However, fish were generally larger than at San Luis Reservoir. Total striped bass caught numbered 220 in 4,090 hours of fishing. An additional 30 fish of various other species were caught.

Anglers at Los Banos Detention Reservoir had fair success, averaging 0.30 fish per hour. Anglers caught 244 fish, including 89 rainbow trout, 72 bluegill, and a variety of other warmwater fish in 801 hours of fishing.

Using adjusted attendance figures, estimates of total activity days of fishing, and angler catch per hour, total catch was estimated for these reservoirs. About 215,000 anglers fished nearly one million hours and caught nearly 180,000 fish weighing about 250,000 pounds.

INTRODUCTION

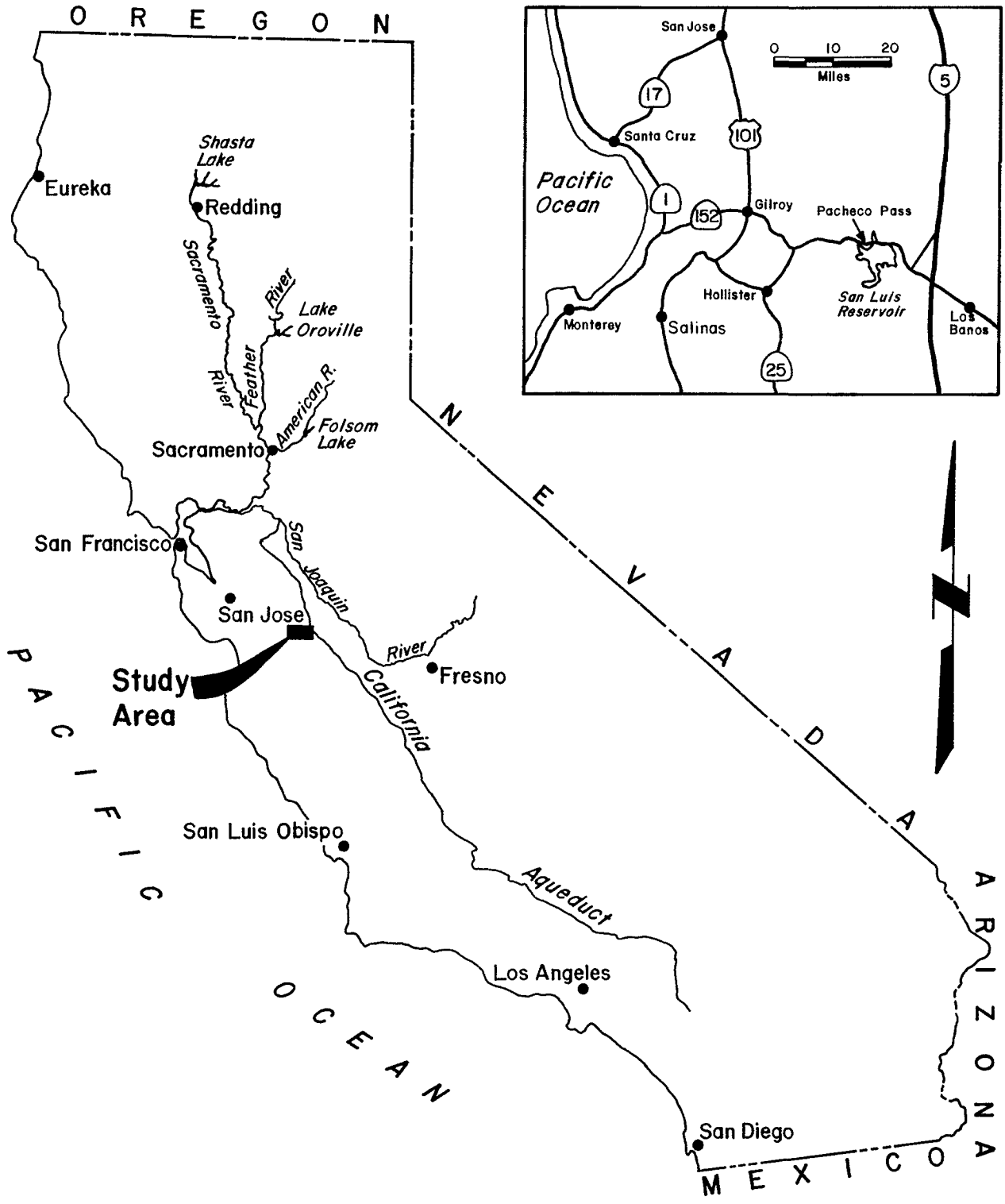
Section 11900 of the Davis-Dolwig Act of 1961 requires that State water storage facilities be constructed to meet recreational needs. Section 345 of the California Water Code also requires the Department of Water Resources (DWR) to plan for needed recreational development.

In 1984, the State Legislature approved Assembly Bill 3792 (Isenberg), which authorized further study of the proposed Los Banos Grandes Reservoir. The proposed reservoir, in western Merced County, is a key component of the Administration's 1984 legislative proposal for advancing the State Water Project (SWP).

Los Banos Grandes would be an offstream storage project. The main dam would be located on Los Banos Creek, 6 miles west of the California Aqueduct. Excess water from the Delta pumped south through the aqueduct during wet months (primarily November through March) would be pumped from the aqueduct into the existing Los Banos Detention Reservoir and from there into Los Banos Grandes. Stored water would be released during water-short periods for use by agencies contracting for water from the SWP. The operation would be similar to nearby San Luis Reservoir, a joint-use facility of the SWP and the federal Central Valley Project.

This report provides data needed to plan recreation development at the proposed reservoir. These data were collected in 1986 through recreation-use and angler-success surveys at San Luis Reservoir, O'Neill Forebay, and Los Banos Detention Reservoir. The surveys provide data on the recreation use, recreation activities, visitor origin and characteristics, and fishing quality needed to identify current and potential recreation needs. San Luis Reservoir and O'Neill Forebay were chosen for the study area because of similarities to the proposed Los Banos Grandes site in physiographic features, location, and access by potential users. Los Banos Detention Reservoir was included because of potential impacts from construction and operation of Los Banos Grandes Reservoir.

Figure I



Location of San Luis Reservoir State Recreation Area

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STUDY AREA

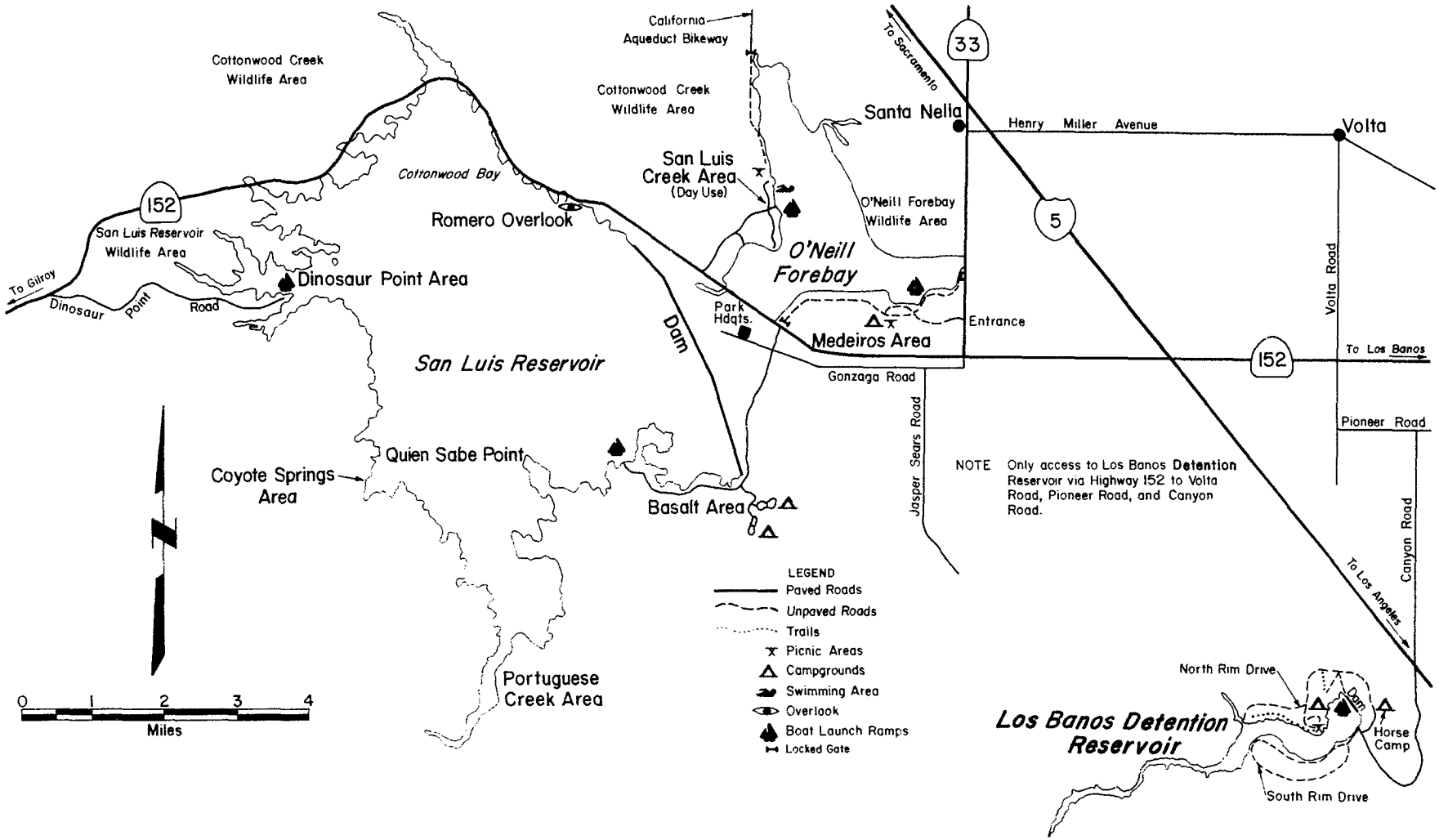
The study area was San Luis Reservoir State Recreation Area, which includes San Luis Reservoir, O'Neill Forebay, and Los Banos Detention Reservoir.

San Luis Reservoir is located in the foothills on the western side of the San Joaquin Valley in Merced County. It is 12 miles west of the City of Los Banos on San Luis Creek and just west of O'Neill Forebay (Figures 1 and 2). State Highway 152 bisects the reservoirs and extends from the City of Los Banos, over Pacheco Pass, to the Gilroy-Hollister area on U.S. Highway 101.

Los Banos Detention Reservoir is 7 miles southwest of the City of Los Banos in Merced County. Interstate Highway 5 is about one mile east. Access, however, is from State Highway 152 via Volta, Pioneer, and Canyon Roads.

San Luis Reservoir is a key conservation feature of the SWP. It provides offstream storage for excess winter and spring flows diverted from the Sacramento-San Joaquin Delta. In periods of excess runoff, water is pumped into San Luis Reservoir through O'Neill Forebay. Stored water is later released for use by agencies contracting for water from the SWP. Hydroelectric power generation is an incidental project benefit. At initial construction, it was anticipated that San Luis Reservoir would have a large annual drawdown when water demand reached its maximum. The Forebay was perceived to be more attractive to recreationists because it would have less annual fluctuation than the main reservoir. Most of the initial recreation construction occurred here for this reason. The initial recreation development provided for picnicking and boating facilities on the western side of the Forebay at San Luis Creek Area. At San Luis Reservoir, camping and boating facilities at the Basalt Area on the south and an overlook on the north shore were also developed. Initial construction was completed in 1967.

Los Banos Detention Reservoir provides flood protection for the California Aqueduct, the Delta-Mendota Canal, the City of Los Banos, and other downstream developments. Initial recreation facility development was presumed to be temporary and was limited to a small area on the north shore and near the dam. A larger area had been identified west of the site for future permanent development. Construction was completed in 1966, with permanent facilities planned for development in the 1980s. However, no additional facilities were developed until 1985, when a two-lane boat ramp and a related parking area were built by the Department of Boating and Waterways.



Location of San Luis Reservoir State Recreation Area, Merced County

Figure 2

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Summer temperatures in the area rise into--and sometimes over--the 90° F. range; evenings are generally cool. Rain falls mostly between November and April, for a total of 8 to 9 inches. Winter temperatures rarely go below freezing, and tule fog occurs frequently. Winds of 20-35 miles per hour often blow through Pacheco Pass and over San Luis Reservoir and O'Neill Forebay.

In general appearance, the San Luis Reservoir area consists of rounded hills with annual grasses that are green only briefly in the spring. Scattered stands of oak and cottonwood also exist. O'Neill Forebay is similar, except for its eastern and southern sides, which extend into the valley flatlands. Los Banos Detention Reservoir lies in a narrow, steep-sided canyon with walls 200 to 300 feet above normal pool level. The plateaus above offer scenic views of the reservoir site.

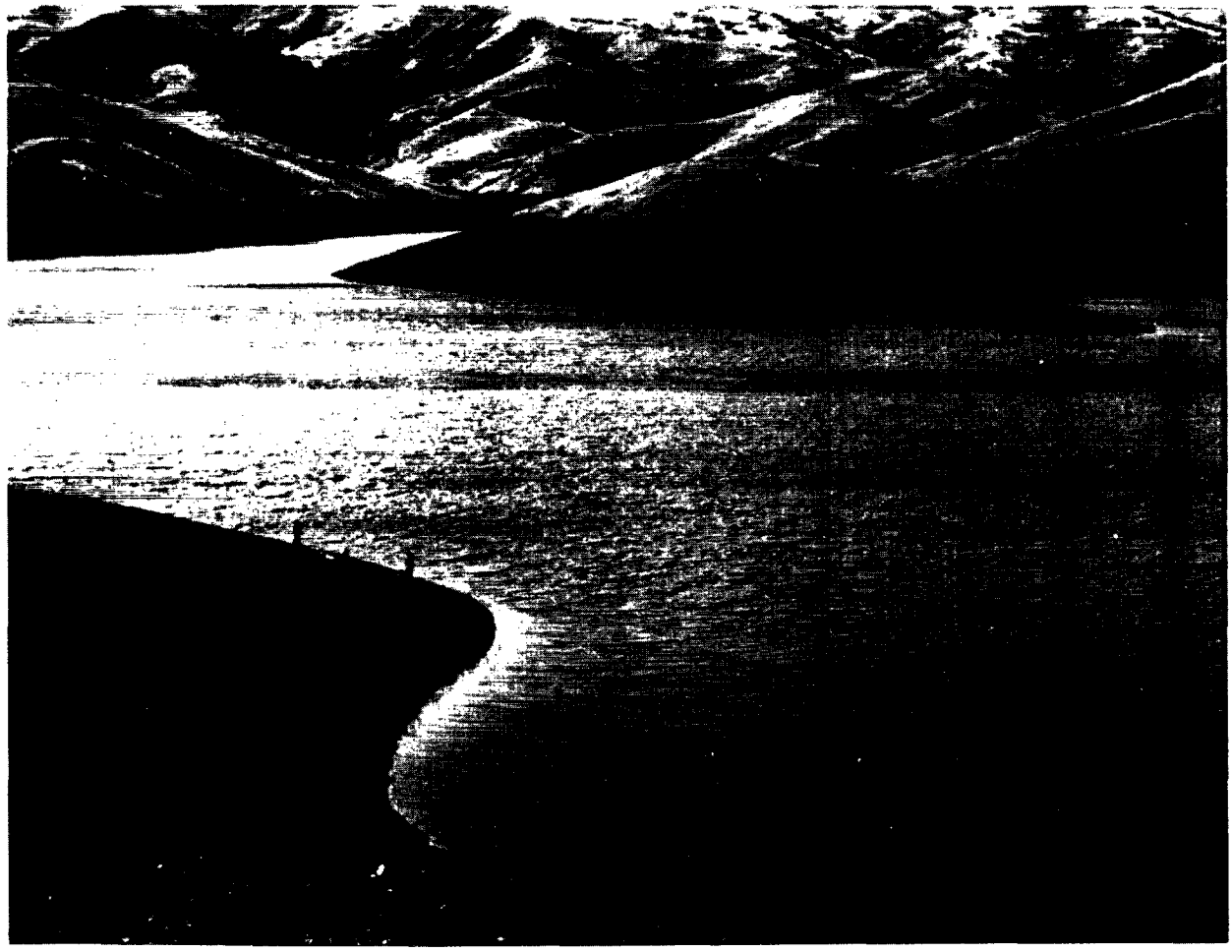
Table 1. Reservoir Sizes (Maximum Recreation Storage)

	San Luis	O'Neill	Los Banos
Storage (AF)	2,027,835	53,730	20,600
Surface acres	12,732	2,670	500
Shoreline miles	65	12	10

San Luis Reservoir and O'Neill Forebay offer a wide variety of recreation opportunities. Fishing, boating, camping, picnicking, swimming and beach use, wildlife and nature study, bicycle trails, minibike trails, and hunting activities are all available. Los Banos Reservoir offers almost all the same activities.

The predominant fishery in San Luis Reservoir and O'Neill Forebay is striped bass. Los Banos offers rainbow trout in the fall, winter, and spring. Largemouth bass, catfish, crappie, and a variety of other warmwater fish are caught throughout the year.

San Luis Reservoir has two major access sites--Basalt Area and Dinosaur Point. The Basalt Area includes 79 developed campsites and a boat ramp. Dinosaur Point has picnic sites and a large multi-lane boat ramp.



San Luis Reservoir provides up to 65 miles of shoreline for angling and other recreation activities (G. Grimm).

O'Neill Forebay also has two major access sites--San Luis Creek Area and Medeiros Area. San Luis Creek has 482 developed picnic sites, with an adjacent beach, swimming area, and three-lane boat ramp. Campsites and additional day-use facilities are being constructed. Medeiros Area has a boat ramp and primitive campsites that can accommodate up to 400 pickup campers or trailers. Other improvements are being planned for this reservoir.

Los Banos Reservoir has 20 primitive campsites, picnic sites, and a boat ramp.

Boating and water skiing are allowed on both larger reservoirs. Sudden strong winds are a danger to boats at the larger reservoirs and closures often occur. Some strong winds are favorable to sailboarders who are allowed to use O'Neill Forebay on a limited basis when ordinary boats are not allowed.

At the Detention Reservoir, the speed limit is 5 miles per hour and only motors of 10 horsepower or less are allowed.

San Luis Reservoir has two wildlife areas--San Luis Reservoir Wildlife Area and Cottonwood Creek Wildlife Area. O'Neill Forebay Wildlife Area is contiguous to the forebay. Deer, feral pig, waterfowl, and upland game hunting is allowed in season at these sites. Waterfowl can also be hunted at Los Banos Detention Reservoir.

The California Aqueduct Bikeway, San Joaquin Valley Section, is paved and extends 70 miles from O'Neill Forebay in the south to Bethany Reservoir in the north. It is open during daylight hours to bicycles, hikers, and anglers. Also, just south of O'Neill Forebay and across State Highway 152 on Jasper Sears Road is a 157-acre minibike trail area.

Recreation facilities are generally managed by the California Department of Parks and Recreation (DPR). However, DWR operates the Romero Overlook visitor and interpretive center on the northern shore of San Luis Reservoir. Fees are charged at the major access sites.

The area is rich in history. The 49,000-acre Rancho San Luis Gonzaga was granted to Don Jose Maria Mijia and Don Juan Perez Pacheco in 1843. Don Juan's homestead was located on the site of an Indian village that had existed long before the arrival of the mission fathers. Indian artifacts and significant fossils were found nearby. The mission fathers bathed in the naturally formed "baths" (los banos) upstream from where Los Banos Detention Reservoir is now located.

The local economy is based primarily on irrigated agriculture, agricultural services, and industrial activities related to food processing and farming equipment and supplies.

Los Banos Detention Reservoir (DWR).

SURVEY METHODS

A traffic stop method for collecting recreation use data was adapted from methods described in the U.S. Army Corps of Engineers' Recreation Use Estimating Workshop manual. A roving creel census method was used to determine angling success.

Four strata were created to represent seasonal use. An optimum allocation method described by Abramson and Tolladay (1959) was adapted to select the number of days to be sampled within each stratum. Twenty-eight days were sampled in 1986; 3 days were sampled in the spring, 15 in the summer, 4 in the fall, and 6 in the winter (Table 2). Days sampled for each stratum were consecutive, except for the summer and winter strata. Weeks during which sampling was done were selected at random.

Survey schedules were constrained by the number of days in each stratum, the number of days to be surveyed, the deletion of holiday periods, the hours of available daylight, general safety factors, and availability of resources.

Table 2. San Luis Reservoir State Recreation Area
1986 Survey Schedule

Season	Dates Sampled	Week Days Sampled	Weekend Days Sampled
Spring	April 12-14	1	2
Summer	June 26-30	3	2
	July 24-28	3	2
	September 26-30	3	2
Fall	November 21-24	2	2
Winter	March 7-8	1	1
	December 12-15	2	2
	Totals	15	13

Each of the five controlled access sites was sampled each survey day. Each site was surveyed for an equal length of time (usually two hours each day). These periods were assigned to survey sites randomly for the first survey week. Thereafter, periods were assigned to sites by a combination of random selection and assignment by daylight periods not previously sampled so that all periods were surveyed at each site. Surveys usually began at 7:00 a.m. The last survey periods usually ended shortly before sunset.

During survey periods, vehicles were stopped as they exited the site. Vehicles were then categorized into Recreation Vehicles (RVs), Returning Recreation Vehicles, Non-Recreation Vehicles, and Passed Vehicles.

A Recreation Vehicle is any vehicle whose occupants have been participating in recreation activities at the survey site and are leaving the area for the last time on this visit. For those who are camping at the site, this means they have ended their multi-day stay. For those who live in the area or are staying in the area overnight (but not at their homes or the site), this means they have ended their visit at the site for the day.

A Returning Recreation Vehicle is any vehicle whose occupants have been participating in recreation activities at the site but will be returning to the area sometime during their visit (for example, someone going to the store to buy bait and returning to fish).

A Non-Recreation Vehicle is any vehicle whose occupants are not participating in recreation at the site (for example, law enforcement vehicles, construction vehicles).

Passed Vehicles are vehicles which could not be reasonably categorized (for example, a vehicle that refused to stop and could not be readily identified as to its status). In order to keep the number of passed vehicles to a minimum, a reasonable effort was made to place each vehicle into one of the other categories.

Only visitors (RVs) leaving the site for the last time on that visit were fully interviewed. Some vehicles could not be surveyed due to traffic buildup. These vehicles were stopped long enough to determine category, the number of axles, and persons in the vehicle.

Roving creel censuses were conducted simultaneously with the recreation interview periods. Length of time fishing that day and zip code were recorded. Fish were counted, measured (fork length to nearest 0.5 cm [0.2 in]), and identified by species.

TOTAL RECREATION USE AND CATCH

Data collected during the 1986 DWR survey indicated that actual recreation attendance may be about one-half that reported by the California Department of Parks and Recreation. Total attendance is based primarily on the number of vehicles entering the recreation area and the average number of people per vehicle. Survey results showed substantially fewer people per vehicle on the average than the number used to estimate attendance. Furthermore, a significant number of vehicles passing through the recreation areas were either nonrecreation vehicles or returning recreation vehicles that were counted twice. Traffic meter error and number of axles per vehicle used in converting meter counts to vehicle counts also added error to the estimated attendance.

DPR estimates of attendance were therefore adjusted using data obtained from the survey (Table 3).

Table 3. San Luis Reservoir State Recreation Area Adjusted Attendance Estimates, 1986

San Luis Reservoir	O'Neill Forebay	Los Banos Detention Reservoir
180,000	220,000	50,000

Weighted percentages of people participating in each activity were applied to the adjusted estimate to determine use measured in activity days (Table 4). An activity day is one person's participation in one recreation activity at any time during a calendar day without regard to how long or how many times he or she participated in that activity. An individual can generate more than one activity day for each calendar day by participating in more than one activity during the same calendar day.

Table 4. Activity Day Estimates, 1986
(in thousands)

San Luis Reservoir		O'Neill Forebay		Los Banos Detention Reservoir	
Shore fishing	80	Picnicking	75	Shore fishing	14
Camping	45	Relaxing	72	Relaxing	12
Picnicking	35	Swimming/wading	60	Sightseeing	11
Sightseeing	33	Shore fishing	52	Swimming/wading	11
Relaxing	32	Beach use	48	Camping	10
Boat fishing	30	Sightseeing	38	Boat fishing	7
Walking	24	Pleasure boating	32	Walking	7
Pleasure boating	13	Boat fishing	30	Beach use	5
Swimming/wading	10	Walking	30	Picnicking	5
Children playing	7	Camping	29	Pleasure boating	4
Other	16	Other	26	Other	6
Totals	325		492		92

Each reservoir had different combinations of recreation activities. At San Luis Reservoir, fishing was the leading activity, with camping a distant second. At O'Neill Forebay, picnicking and relaxing were the leading activities, followed rather closely by swimming/wading and shore fishing. At Los Banos Detention Reservoir, shore fishing was the most frequent activity, followed by relaxing, sightseeing, and swimming/wading.

Estimates of fish caught were based on catch-per-hour rates for each species and the mean length of a completed angler-day applied to the adjusted attendance estimates. Estimates of total weight of the fish caught were based on their measured lengths and mean weight for each species derived from the literature (Carlander, 1969; Calhoun, 1966; Borgeson and McCammon, 1967; Robinson, 1966; and Tharrat, 1966).

The survey and creel census indicated that about 215,000 anglers spent nearly one million hours fishing at the three reservoirs and caught nearly 180,000 fish weighing about 250,000 pounds (Table 5).

Table 5. Total Estimated Catch Per Reservoir, 1986

Reservoir		Total Anglers	Total Angler-Hrs	Estimated Catch				Total Weight (lbs)
				SB	RT	BG	Other* Species	
San Luis	B	30,000	192,000	50,000	-	-	300	60,000
	S	80,000	316,000	75,000	-	-	-	90,000
O'Neill	B	30,000	166,000	18,000	-	-	200	50,000
	S	52,000	244,000	10,000	-	500	2,000	31,000
Los Banos	B	7,000	29,000	-	1,500	2,500	5,000	7,500
	S	14,000	48,000	-	4,500	5,000	3,500	9,500
Totals		213,000	995,000	153,000	6,000	8,000	11,000	248,000

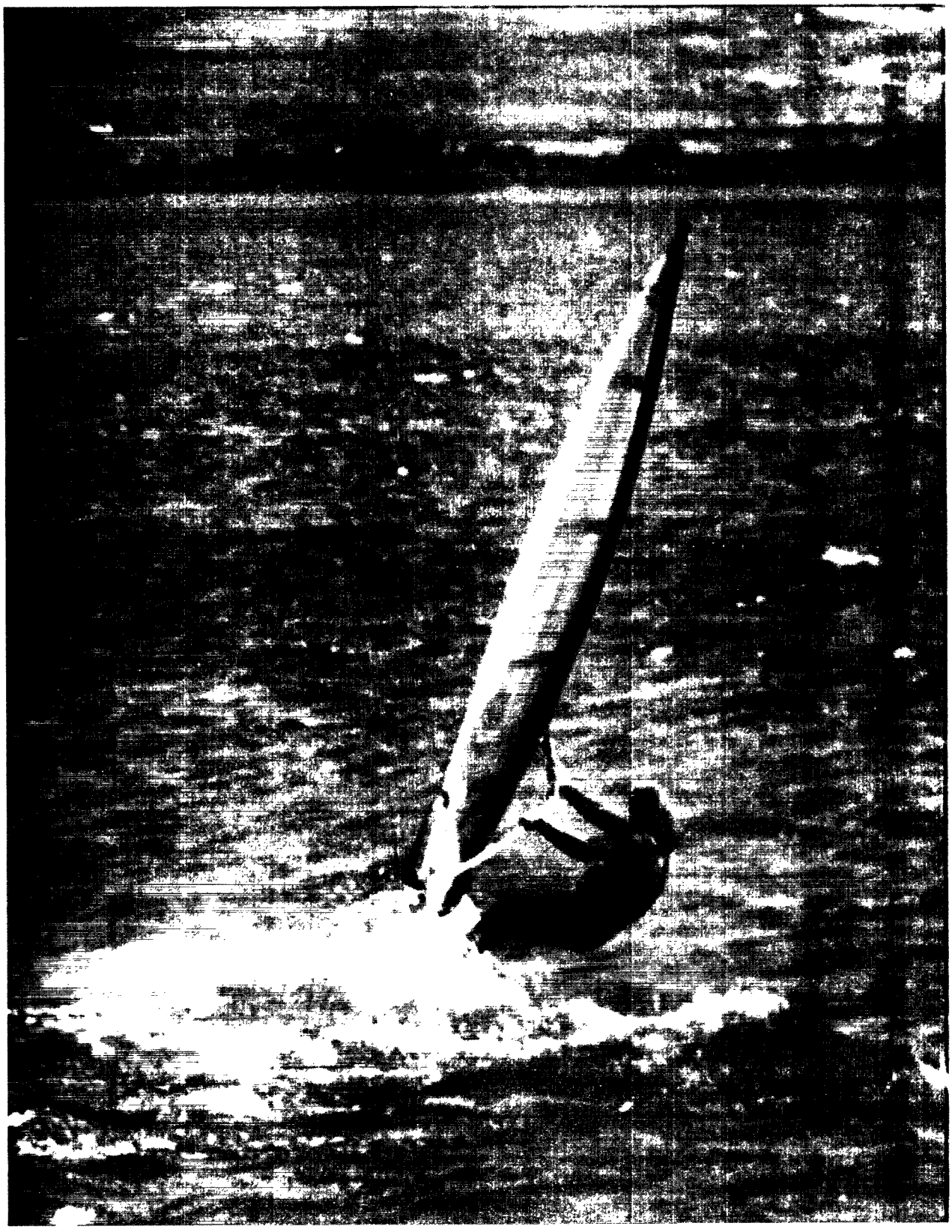
KEY: B = boat, S = shore
SB = striped bass, RT = rainbow trout, BG = bluegill

*Includes white catfish, channel catfish, largemouth bass, white crappie, green sunfish, black crappie, redear sunfish, Sacramento perch, brown bullhead, pumpkinseed, and splittail.

At San Luis Reservoir, the fishery focused almost exclusively on striped bass. About 110,000 anglers fished 508,000 hours and caught an estimated 125,000 striped bass and 300 other fish.

More species were caught at O'Neill Forebay, although the fishery there was also primarily for striped bass. An estimated 82,000 anglers fished 410,000 hours and caught 28,000 striped bass and about 2,700 other fish.

Rainbow trout was the most important fishery at Los Banos Detention Reservoir. Many more species were caught there than at the other reservoirs; however, striped bass were not observed. About 21,000 anglers fished 77,000 hours and caught about 6,000 rainbow trout, 7,500 bluegill, and 8,500 other fish.



Sailboarding is an increasingly popular activity at O'Neill Forebay (G. Grimm).

RECREATION ACTIVITIES

Recreation activities and the number of people participating in each activity vary with season and location. The peak season of use for all three reservoirs is summer. Discussion is centered around the overall annual use and peak season use. Participation rates are given in terms of the percent of people interviewed who said they participated in a given activity. Percentages total more than 100 percent because visitors frequently participate in more than one activity per visit. Table 6 compares activity participation rates at each reservoir for the entire year. Seasonal and other more specific information is given in tables or appendices following.

Table 6. Overall Recreation Activities by Reservoir and Percent of Participation

San Luis Reservoir	%	O'Neill Forebay	%	Los Banos Detention	%
Shore fishing	46	Picnicking	36	Shore fishing	30
Camping	23	Relaxing	34	Relaxing	23
Picnicking	20	Swimming/wading	29	Sightseeing	23
Boat fishing	18	Shore fishing	24	Camping	20
Sightseeing	17	Beach use	23	Swimming/wading	19
Relaxing	16	Sightseeing	18	Boat fishing	15
Walking	12	Pleasure boating	16	Walking	15
Pleasure boating	7	Walking	14	Picnicking	12
Swimming/wading	5	Camping	13	Beach use	9
Children playing	3	Boat fishing	10	Pleasure boating	8
Other	5	Other	11	Other	12
Total	172		228		186

San Luis Reservoir

Surveyors conducted 655 interviews at San Luis Reservoir during 1986, representing 1,687 people. Overall, shore fishing was the distinct predominant activity, with 46 percent of those surveyed participating. Shore fishing was followed by camping (23 percent), picnicking (20 percent), boat fishing (18 percent), sightseeing (17 percent), just relaxing (16 percent), and walking for pleasure (12 percent). Other activities included pleasure boating, swimming/wading, children playing, water skiing, hiking, and miscellaneous other activities (Table 6 and Appendix A).

During the summer, 375 interviews were conducted, representing 1,029 people. Participation rates for this period (Table 7) were similar to the annual percentages.

Table 7. Seasonal Recreation Activity at San Luis Reservoir, 1986

Activity	Percent	Activity	Percent
Spring		Summer	
Shore fishing	53	Shore fishing	48
Camping	20	Camping	25
Sightseeing	19	Picnicking	23
Boat fishing	15	Relaxing	19
Picnicking	12	Sightseeing	14
Walking	7	Boat fishing	14
Pleasure boating	5	Walking	13
Other	16	Other	31
Total	147	Total	187
Fall		Winter	
Boat fishing	44	Sightseeing	39
Shore fishing	41	Camping	31
Picnicking	24	Shore fishing	24
Relaxing	15	Walking for pleasure	22
Camping	10	Boat fishing	21
Sightseeing	10	Relaxing	18
Pleasure boating	8	Pleasure boating	5
Other	11	Other	8
Total	163	Total	168

During the spring and summer months, shore fishing was the most frequent activity. During the fall, it dropped to second rank behind boat fishing. Participation in boat fishing during the spring, summer, and winter was about one-third as high as in the fall.

Camping was the second most frequent activity in spring, summer, and winter, but decreased significantly in the fall.

Picnicking was the third most popular activity in the summer and fall, but had relatively low participation in the spring and winter.

Picnickers at Dinosaur Point also enjoy the view (G. Grimm).

O'Neill Forebay

Visitor interviews totaled 756 during 1986. The interviews represented 2,031 people. An additional bus and two vans with 66 people were also observed but not included in survey results. Activity participation rates were generally higher than at San Luis Reservoir because a developed picnic area contiguous to a developed swimming and beach area and boat ramp made it more convenient for visitors to participate in more than one or two activities during any one visit. Overall, picnicking received the highest participation rate at 36 percent followed by relaxing (34 percent), swimming and wading (29 percent), shore fishing (24 percent), beach use (23 percent), sightseeing (18 percent), pleasure boating (16 percent), walking for pleasure (14 percent), camping (13 percent), and boat fishing (10 percent). Numerous other activities were reported (Table 6 and Appendix A).

During the summer use period, 502 people were interviewed, representing 1,443 visitors. Summer activities at O'Neill Forebay were also similar to the annual uses, but with generally higher participation rates (Table 8). This is because visitors participated in more activities during summer than in other seasons. More people participated in picnicking during the summer than any other activity, although two other activities (relaxing and swimming/wading) were nearly as popular. During the spring, fall, and winter, participation in picnicking was considerably lower. Relaxing and swimming/wading followed a similar pattern, as did beach use.

Table 8. Seasonal Recreation Activity at O'Neill Forebay, 1986

Activity	Percent	Activity	Percent
Spring		Summer	
Shore fishing	42	Picnicking	45
Sightseeing	28	Relaxing	44
Picnicking	16	Swimming/wading	40
Camping	12	Beach Use	32
Pleasure boating	11	Shore fishing	20
Walking	9	Pleasure boating	20
Relaxing	7	Walking	17
Beach use	5	Camping	14
Other	7	Sightseeing	14
		Water skiing	8
		Boat fishing	5
		Other	7
Total	137	Total	266
Fall		Winter	
Sightseeing	44	Boat fishing	47
Boat fishing	29	Shore fishing	26
Shore fishing	22	Sightseeing	19
Picnicking	15	Camping	13
Walking	10	Relaxing	12
Camping	8	Picnicking	8
Relaxing	6	Walking	6
Other	6	Other	8
Total	140	Total	139

Shore fishing had its lowest rank and participation rate during the summer. Both rank and participation rate increased through the fall and winter until spring, when shore angling had the highest participation rate of any activity.

Boat fishing was the most frequent activity in winter, second to sightseeing in the fall, but was only a minor activity in spring and summer.

O'Neill Forebay had the highest overall participation rate in pleasure boating of all three reservoirs. During the summer, the rate was 20 percent. Of 283 visitors who participated in pleasure boating during this period, 58 percent were motor boating, 35 percent sailboarding, 4 percent sailing, and 3 percent jet skiing.

Strong winds at San Luis Reservoir do not deter these shore anglers (G. Grimm).

Los Banos Detention Reservoir

Interviews for the year numbered 139 and represented 338 people. Picnic tables and beach-like areas are located close together and are more protected from wind than at the other reservoirs. Visitors are consequently provided with convenient opportunities to participate in more than one activity per visit. This is similar to O'Neill Forebay; however, the Detention Reservoir is not as well developed. Participation rates were higher at Los Banos for more activities than at San Luis Reservoir, but lower than at O'Neill Forebay. Overall, shore fishing had the highest participation rate at 30 percent, followed by relaxing (23 percent), sightseeing (23 percent), camping (20 percent), swimming/wading (19 percent), boat fishing (15 percent), walking for pleasure (15 percent), picnicking (12 percent), beach use (9 percent), and pleasure boating (8 percent) (Table 6 and Appendix A).

For the summer season, 64 interviews were conducted representing 167 people. Unlike San Luis Reservoir and O'Neill Forebay, summer activities at Los Banos Detention Reservoir were very different from annual rates (Table 9).

Table 9. Seasonal Recreation Activity at Los Banos Detention Reservoir, 1986

Activity	Percent	Activity	Percent
Spring		Summer	
Shore fishing	34	Swimming/wading	37
Sightseeing	32	Relaxing	37
Walking	13	Camping	28
Camping	9	Shore fishing	23
Swimming/wading	9	Sightseeing	19
Beach use	9	Beach use	16
Relaxing	9	Walking	16
Other	21	Picnicking	15
		Pleasure boating	15
		Boat fishing	11
		Other	14
Total	136	Total	231
Fall		Winter	
Shore fishing	40	Shore fishing	32
Boat fishing	24	Sightseeing	32
Camping	21	Boat fishing	22
Picnicking	20	Walking	9
Sightseeing	20	Camping	4
Relaxing	19	Other	4
Walking	17		
Other	13		
Total	174	Total	103

During the summer, swimming/wading and relaxing were the most frequent activities. Both had much lower participation during the other seasons.

Camping had its highest participation rate during the summer and was the third most frequent activity. It had a slightly lower rate during the fall and was a relatively minor activity in the spring and winter.

Shore fishing had its highest participation rate during fall. It was the most frequent activity during this period and during the spring and winter. It was also an important activity in summer. Boat fishing was a relatively minor activity during the summer and spring, but it was the second and third most frequent activity in the fall and winter, respectively.

Sightseeing was an important activity at Los Banos Detention Reservoir all year, with participation rates ranging from 32 percent in spring and winter to about 20 percent in summer and fall. Walking for pleasure also was a popular activity at Los Banos, with highest participation in summer and fall.

Los Banos Detention Reservoir is a good place for beginning sailboarders (G. Grimm).

San Luis Creek Area provides easy access for boats (J. Tittel).

VISITOR CHARACTERISTICS

San Luis Reservoir

Visitor Origin

Residents of Merced and contiguous counties (Fresno, Madera, Mariposa, San Benito, Santa Clara, and Stanislaus) accounted for 64 percent of the visitors surveyed (Table 10 and Appendix B). The major county of origin was Santa Clara (34 percent) followed by Monterey County (11 percent, not a contiguous county) and Merced County (10 percent).

Length of Stay

Overall, 77 percent of those interviewed were day users only. They averaged about 4.4 hours per visit. Those camping at the site amounted to 21 percent, with an average stay of 2.5 days. Visitors who stayed overnight in the area represented 2 percent of those interviewed and stayed an average 2.4 days. Lengths-of-stay for the summer period were similar to, but slightly longer than, those of the overall annual period (Tables 11 and 12).

Accommodations

Of those camping at the site during the overall period, 27 percent used motor homes or vans, followed by tent use (26 percent), pickup campers (21 percent), travel trailers (16 percent), tent trailers (6 percent), and sleeping out (4 percent). During the summer, more visitors used tents (35 percent), followed by motorhomes or vans (21 percent), pickup campers (17 percent), travel trailers (14 percent), tent trailers (7 percent), and sleeping out (6 percent).

Special Equipment

Visitors surveyed brought 158 boats, 8 bicycles, 3 extra cars, 1 motorcycle, and 1 all-terrain vehicle. Of 655 vehicles surveyed, 21 percent brought trailered boats, and another 3 percent brought other types of boats (for example, cartop, sailboards, sailboats, and rafts). During the summer months, only 15 percent of the vehicles surveyed brought trailered boats, while the percentage of vehicles that brought other boats stayed the same.

People Per Vehicle

Overall, vehicles contained about 2.6 people on the average. Summer was similar with an average 2.7 people per vehicle (Table 13).

Table 10. Major Counties of Origin (Percent)

San Luis Reservoir		O'Neill Forebay		Los Banos Detention Reservoir	
Santa Clara	34	Santa Clara	25	Merced	51
Monterey	11	Merced	18	Santa Clara	17
Merced	10	Stanislaus	10	Monterey	16
Fresno	8	Monterey	9	Stanislaus	4
San Benito	7	San Benito	7	Fresno	2
Santa Cruz	5	Santa Cruz	5		
Alameda	4	Fresno	5		
Stanislaus	4				
Total	83		79		90

Table 11. Comparison of Percentages of Types of Users at the Three Reservoirs During Summer Months

	San Luis Reservoir	O'Neill Forebay	Los Banos Detention Reservoir
Day users	75	77	67
Overnight at site	22	15	27
Overnight in area	3	8	6

Table 12. Comparison of Lengths of Stay at the Three Reservoirs During Summer Months

	San Luis Reservoir	O'Neill Forebay	Los Banos Detention Reservoir
Day use hours	4.7	4.3	2.7
Days staying at site	2.7	2.4	2.4
Days staying in area	2.5	2.9	3.8

Table 13. Comparison of Average Number of People Per Vehicle

	San Luis Reservoir	O'Neill Forebay	Los Banos Detention Reservoir
Overall	2.6	2.7	2.4
Summer	2.7	2.9	2.6

O'Neill Forebay

Visitor Origin

Residents of Merced and contiguous counties accounted for 66 percent of visitors interviewed. Residents of Monterey and Santa Cruz accounted for another 14 percent total. The county with the highest rate of origination was Santa Clara (25 percent) followed by Merced County (18 percent) and Stanislaus County (10 percent) (Table 10 and Appendix B).

Length of Stay

Lengths of stay at O'Neill Forebay were similar to those at San Luis Reservoir. Day users represented about 80 percent of those interviewed. They stayed an average 4.2 hours. Visitors camping at the site amounted to 14 percent and stayed an average 2.4 days. Those who stayed overnight in the area amounted to 6 percent and stayed an average 3.0 days. Lengths of stay for summer visitors were also similar to, but slightly longer than annual means.

Accommodations

Accommodations used at O'Neill Forebay were somewhat different than at San Luis Reservoir. There was much greater use of motorhomes or vans. For the overall period, those visitors camping at the site used motorhomes or vans 48 percent of the time, followed by pickup campers (19 percent), tents (15 percent), sleeping out (13 percent), travel trailers (4 percent), and tent trailers (4 percent). For the summer period, campers at the site used motorhomes or vans 44 percent of the time, followed by sleeping out (19 percent), tents (17 percent), pickup campers (15 percent), tent trailers (5 percent), and travel trailers (4 percent).

Special Equipment

For the year, visitors surveyed brought 260 boats and 7 bicycles. Of 756 vehicles surveyed, 17 percent brought trailered boats, 12 percent brought sailboards (some more than one board), and 2 percent brought other types of boats (including cartop boats, jet skis, sailboats, and rafts). For the summer period, 13 percent of the vehicles brought trailered boats. The percentage of vehicles bringing sailboards during the summer (14 percent) was slightly higher than the overall period. Vehicles bringing other types of boats stayed the same.

People Per Vehicle

Overall, there was an average 2.7 people per vehicle. The summer months averaged 2.9 (Table 13).

Los Banos Detention Reservoir

Visitor Origin

Residents of Merced and contiguous counties accounted for 75 percent of visitors. The major county of origin was Merced (51 percent), followed by Santa Clara County (17 percent) and Monterey County (16 percent, not a contiguous county) (Table 10 and Appendix B).

Length of Stay

Overall, day users amounted to about 77 percent of those surveyed and stayed an average 3.0 hours. Those staying at the site overnight amounted to 19 percent staying an average 2.5 days, and those staying in the area (4 percent) stayed an average 3.6 days. For the summer period, a higher percentage of visitors camped at Los Banos than at the other reservoirs. A lower percentage were day users only. Day users here also averaged shorter stays, and those staying in the area stayed for more days on the average (Tables 11 and 12).

Accommodations

Campers at Los Banos Detention Reservoir were more evenly distributed among a variety of overnight accommodations than at the other reservoirs. Those using pickup campers totaled 26 percent, followed by tents (22 percent), motorhomes or vans (15 percent), tent trailers (15 percent), travel trailers (11 percent), and sleeping out (11 percent). The summer period was very similar. The use of pickup campers amounted to 29 percent, followed by tents (24 percent), tent trailers (18 percent), motorhomes or vans (12 percent), sleeping out (12 percent), and travel trailers (6 percent).

Special Equipment

Visitors surveyed brought 35 boats and 4 bicycles. Of 139 vehicles, 9 percent brought cartop boats. Another 9 percent brought trailered boats. Vehicles with sailboards amounted to 5 percent, and vehicles with other types of boats amounted to 3 percent. All vehicles with sailboards were observed during the summer (11 percent of vehicles surveyed for the summer). Vehicles bringing trailered boats amounted to 8 percent for the summer, and vehicles with cartop boats 5 percent. Vehicles with other types of boats also totaled to 5 percent.

People Per Vehicle

There was an average of 2.4 people per vehicle for the year. Summer months averaged 2.6 (Table 13).

CREEL CENSUS RESULTS

San Luis Reservoir

A total of 1,268 anglers were contacted on 28 days at San Luis Reservoir. They had fished 4,384 hours and caught 1,018 striped bass (Morone saxatilis), ranging in length from 18 cm (7.1 in) FL to 73.5 cm (28.9 in) FL, and one Sacramento perch (Archoplites interruptus) (Appendix D). Anglers fishing for striped bass were most successful at this reservoir (0.23 bass per hour).

Shore anglers numbered 1,103 and fished 3,371 hours. Census takers observed 739 striped bass caught, for a catch per hour rate of 0.22. Mean fork length was 31 cm (12.2 in) and mean weight was estimated at 1.1 pounds using length-weight data in Robinson, 1960. Total estimated weight of striped bass taken by shore anglers was 775 pounds.

Boat anglers numbered 165 and fished 1,013 hours, catching 279 striped bass and one Sacramento perch. Catch per hour was 0.28. Mean length and estimated weight of bass were 37 cm (14.6 in) and 1.6 pounds, respectively. Total estimated weight for striped bass caught by boat anglers was 455 pounds.

Interviews showed that 84 percent of anglers were trying to catch striped bass. In addition, 18 percent said they were fishing for anything that would bite (totals amount to more than 100 percent because some anglers gave more than one response).

Shore anglers who had completed their fishing effort for the day fished an average of 3.9 hours, while boat anglers fished an average of 6.3 hours. For all completed efforts, anglers fished an average of 5.9 hours.

O'Neill Forebay

Anglers at O'Neill Forebay were also contacted 28 days and numbered 992. They had fished 4,090 hours and caught 220 striped bass, ranging in length from 17 cm (6.7 in) FL to 103 cm (40.6 in) FL, and several other species of warmwater fish (Appendix D). Striped bass anglers had fair to good success at this reservoir. Although bass were caught less often than at San Luis Reservoir, they were generally larger.

O'Neill Forebay yielded only one striped bass for each of these anglers. They had been on the Forebay for 5 hours on a cold December day, but at 79 cm (31.1 in) FL and 92.5 cm (36.4 in) FL (an estimated 36+ pounds totaled), they didn't complain (J. Tittel).

Census takers contacted 832 shore anglers who had fished 3,260 hours and caught 137 striped bass (0.04 bass per hour). Mean length was 34.5 cm (13.6 in) and mean estimated weight was 2.0 pounds. An additional 29 fish of other species weighing an estimated 60 pounds were caught. Total estimated weight of striped bass caught by shore anglers was 280 pounds.

Boat anglers numbered 160 and had fished 830 hours. Striped bass observed were 83, for a catch-per-hour rate of 0.10. Mean fork length was

47 cm (18.5 in) with an estimated mean weight of 3.9 pounds. One white catfish was also caught. Striped bass caught by boat anglers weighed an estimated 320 pounds.

Anglers fishing for striped bass amounted to 67 percent of those interviewed. Those fishing for anything amounted to 31 percent; 21 percent said they were fishing for catfish.

Shore anglers who had finished fishing had fished an average of 4.7 hours. Boat anglers who had completed their day averaged 5.6 hours. For all completed efforts, anglers averaged 5.5 hours.

Los Banos Detention Reservoir

Anglers contacted at Los Banos Detention Reservoir totaled 257 with 801 hours of fishing and included 11 species of fish, including 89 rainbow trout (Salmo gairdnerii), ranging from 19 cm (7.5 in) FL to 38.5 cm (15.2 in) FL, 72 bluegill (Lepomis machrochirus), and 83 other fish (Appendix D). Anglers here had fair success, averaging 0.30 fish per hour (including all fish for shore and boat anglers).

Shore anglers numbered 188 with 532 hours of fishing. Rainbow trout observed caught numbered 63, for a catch-per-hour rate of 0.12. Mean length was 29 cm (11.4 in) and mean weight was estimated at 0.7 pound (Calhoun, 1966). Bluegill numbered 42, averaging 18.5 cm (7.3 in) FL. Twenty-nine other warmwater fish were also caught.

Boat anglers numbered 69 people fishing for 269 hours. They had 26 observed rainbow trout for a catch-per-hour rate of 0.10. Mean length was 30 cm (11.8 in), and mean estimated weight was 0.7 pound. Boat anglers caught 30 bluegill, averaging 16 cm (6.3 in) FL. Fifty-four other warmwater fish were also caught.

Total estimated weight of rainbow trout caught was 60 pounds. An estimated 20 pounds of bluegill were caught. Total estimated weight for all fish caught was 180 pounds.

Of anglers interviewed here, 51 percent said they fished for rainbow trout, 31 percent fished for anything, 18 percent fished for catfish, 7 percent fished for bluegill, 3 percent fished for largemouth bass, and 1 percent fished for crappie.

Boat anglers fished an average of 4.1 hours. Insufficient data were collected to establish mean length of completed efforts for shore anglers.

This shore angler had good success near the Basalt Area (J. Tittel).

LIMITATIONS AND DISCUSSION

Availability of resources limited survey days to 28--less than 8 percent of all days in 1986. Only about 1 percent of total estimated visitors were interviewed. Anglers fishing at night may not have been included in daytime surveys. This may have caused some underestimation of shore angler use. In addition, visitors who used areas without controlled access (for example, wildlife areas and shoreline along the highway) were not interviewed. Many special events (for example, dog trials sponsored by hunting clubs and regattas sponsored by sailing clubs) occurred on days or at sites that were not surveyed. Reported use by the Department of Parks and Recreation showed that the actual peak month of use at each site was not surveyed.

Types of use, particularly at O'Neill Forebay, may change rapidly as facility development in progress is completed.

Sailboarding is a rapidly growing recreation activity at O'Neill Forebay. At least one world-class regatta was held during the summer. Surveys were not conducted during this event. The number of sailboards actually brought by surveyed vehicles may be 20 percent more than reported. Early survey techniques did not take into account that visitors sometimes bring more than one "boat" per vehicle. Later techniques showed an average 1.6 sailboards per vehicle bringing boards.

Recreation surveys conducted in 1967 at O'Neill Forebay and Los Banos Detention Reservoir provide limited data on recreation use and allow some comparison to determine possible changes in use patterns.

At O'Neill Forebay, 498 people were interviewed in the summer of 1967. This is about one-third of the number surveyed in the summer of 1986. Percentages of those fishing rose from less than 1 percent in 1967 to 25 percent in 1986. The picnicking rate increased from 28 percent (there were only 50 developed picnic sites in 1967) to 45 percent. Swimming stayed about the same (38 and 40 percent). Water skiing decreased from 16 percent to 8 percent, but pleasure boating rose from 4 percent to 20 percent. The increase in pleasure boating and a decrease in percentage of trailered boats (from 95 percent down to 39 percent) brought by visitors reflects significant increased activity in sailboarding. The average length of stay for summer day users was much higher in 1986, rising from 1.9 hours in 1967 to 4.3 hours. Average number of people

per vehicle dropped from 3.7 to 2.9. Summer visitors in 1967 came predominantly from Merced County (49 percent). In 1986, 24 percent came from Santa Clara County and only 21 percent came from Merced County. Visitors who came from Merced County or contiguous counties amounted to 79 percent in 1967 and 66 percent in 1986. Visitors from nearby Monterey County increased from 3 to 8 percent, and out-of-state or out-of-country visitors rose from 0 to 4 percent.

In the summer of 1967, 81 people were interviewed at Los Banos Detention Reservoir compared to 167 in 1986. Visitors who fished amounted to 45 percent of those interviewed in 1967 and only 34 percent in 1986. The rate for those picnicking dropped from 58 percent to 15 percent. Swimming stayed the same at 37 percent. Only two boats were observed in 1967, both of which were cartop. In 1986, 17 percent of boats brought were cartop variety. More sailboards were observed than any other type of boat. The average number of people per vehicle dropped from 3.2 to 2.6. Average length of stay was not determined in 1967. Visitors from Merced County and contiguous counties amounted to 94 percent of those interviewed in 1967 and dropped to 83 percent in summer 1986. Visitors from Merced County amounted to 75 percent in 1967 and only 61 percent in 1986. Santa Clara County visitors rose from 13 to 16 percent. Visitors from nearby Monterey County rose from 0 to 13 percent.

Creel censuses conducted in 1973, 1974, and 1976 at San Luis Reservoir and O'Neill Forebay also provide data on angler success and allow some comparison of catch differences (Table 14). Estimated catch in 1973 was 325,000 striped bass and 13,000 other fish. In 1974, catch was estimated at 295,000 striped bass and 44,000 other fish (Bartholomew, 1975). In 1976, the estimated catch increased to 310,000 striped bass and 142,000 other fish (Naylor, 1976 and 1977). Estimated catch in 1986 was 153,000 striped bass and about 3,000 other fish. The earlier censuses did not adjust DPR attendance data and assumed all visitors fished; therefore, they probably over-estimated angler use and catch. Estimated hours fished were much higher in 1974 and 1976, but catch-per-hour rates were higher in 1986 than in 1974. Census results from 1974 and 1976 showed a significantly higher proportion of other species caught compared to 1973 and 1986 estimates.

The actual number of hours sampled in the 1986 census amounted to only about one percent of total estimated angler hours.

Table 14. Comparison of Angler Use and Catch, San Luis Reservoir and O'Neill Forebay Combined 1973, 1974, 1976, and 1986

Year	Estimated Anglers	Estimated Hours	Striped Bass	Other Species
1973	-	-	325,000	13,000
1974	394,000	2,437,000	295,000	44,000
1976	288,000	1,986,000	310,000	142,000
1986	192,000	918,000	153,000	3,000

Fish recorded as "caught" in the 1986 census were fish that were verified by sight and removed from the reservoir. Actual catch may have been somewhat higher. At San Luis Reservoir, shore anglers reported catching (not verified by sight) or catching and releasing (returned to the reservoir) 190 additional striped bass. Boat anglers reported another 95. At O'Neill Forebay, shore anglers reported catching or releasing 78 striped bass and 5 catfish, while boat anglers reported having caught or released another 13 striped bass. Shore anglers at Los Banos Detention Reservoir reported catching or releasing 25 bluegill, 7 rainbow trout, 2 unidentified "perch", and 1 largemouth bass (Micropterus salmoides). Boat anglers here reported 22 channel catfish (Ictaluras punctatus), 15 white crappie (Pomoxis annularis), 12 largemouth bass, and 8 bluegill caught or caught and released.

Based on reported catch, and reported catch and release, about 10,000 striped bass and 500 other fish may have been caught at San Luis Reservoir and O'Neill Forebay and nearly 40,000 striped bass and 200 other fish may have been caught and released back to the reservoirs. Anglers considered most of these fish too small to keep. At Los Banos Detention Reservoir, an additional 3,000 bluegill, 1,500 crappie, 200 rainbow trout, 200 catfish, and 100 largemouth bass may have been caught. Up to 1,800 catfish, 1,100 bluegill, and 1,100 largemouth bass may have been caught and released.

Although creel censuses were conducted only during daylight hours and did not include periods when fish are believed to be most catchable (that is, early morning and late evening), catch rates remain an index of fishing quality because any real abundance of fish would be reflected in midday catch as well

as during more favorable periods. However, actual angling success may have been better than reported.

Additionally, it may be argued that quality of angling may be better measured by the success of those anglers who use relatively efficient angling methods (that is, measuring success by species actually caught in relation to terminal gear used and species sought). The method is complex but should be considered for future censuses.

APPENDIX A

REPORTED RECREATION ACTIVITIES, 1986

San Luis Reservoir

Number of interviews	655
Number of persons represented	1,687

Activity		Number of People Participating
Shore fishing		776
Camping		383
Picnicking		333
Boat fishing		310
Sightseeing		280
Just relaxing		269
Walking for pleasure		195
Pleasure boating:		
Motorboating	92	
Sailing	9	
Raft use	9	
Sailboarding	8	
Total		118
Swimming/wading		84
Children playing		59
Water skiing		32
Hiking		22
Beach use		20
Bicycling/motorcycle riding		17
Bird watching		12
Visiting friends		6
Checking lake conditions		6
Reading		5
Junior Ranger program		4
Stargazing		3
Watching sailboarders		3
Undefined		3
Off-road vehicle use		2
Having a beer		2
Checking facilities		2
Photography		2
Running		2
Sunbathing		2
Horseback riding		1
Duck hunting		1
Nature study		1
Playing with dog		1

O'Neill Forebay

Number of interviews	756
Number of persons represented	2,031

Activity		Number of People Participating
Picnicking		727
Just relaxing		682
Swimming/wading		586
Shore fishing		480
Beach use		472
Sightseeing		368
Pleasure boating:		
Motorboating	167	
Sailboarding	127	
Sailing	11	
Jet skiing	9	
Rafting	2	
Undefined	2	
Total		318
Walking for pleasure		288
Camping		262
Boat fishing		198
Water skiing		108
Children playing		67
Bicycling/motorcycle riding		8
Sunbathing		8
Undefined		7
Visiting friends		6
Football		6
Watching sailboarders		5
Volleyball		4
Looking for friends		3
Church worship		3
Playing cards		3
Bird watching		2
Duck hunting		2
Partying		2
Pleasure reading		2
Waiting for wind to die down		2
Jogging		1
Painting		1
Photography		1
Reading paper		1

Los Banos Detention Reservoir

Number of interviews	139
Number of persons represented	338

Activity		Number of People Participating
Shore fishing		100
Just relaxing		78
Sightseeing		78
Swimming/wading		65
Camping		63
Walking for pleasure		50
Boat fishing		49
Picnicking		39
Beach use		31
Pleasure boating:		
Sailboarding	12	
Motorboating	6	
Sailing	6	
Canoeing	3	
Total		27
Children playing		11
Hiking		5
Jogging/running		4
Bicycling/motorcycling		4
Checking fishing		2
Duck hunting		2
Girl watching		2
Hunting		2
Looking for friends		2
Stargazing		2
Flying radio-controlled airplane		1
Helping set up camp		1
Walking dog		1

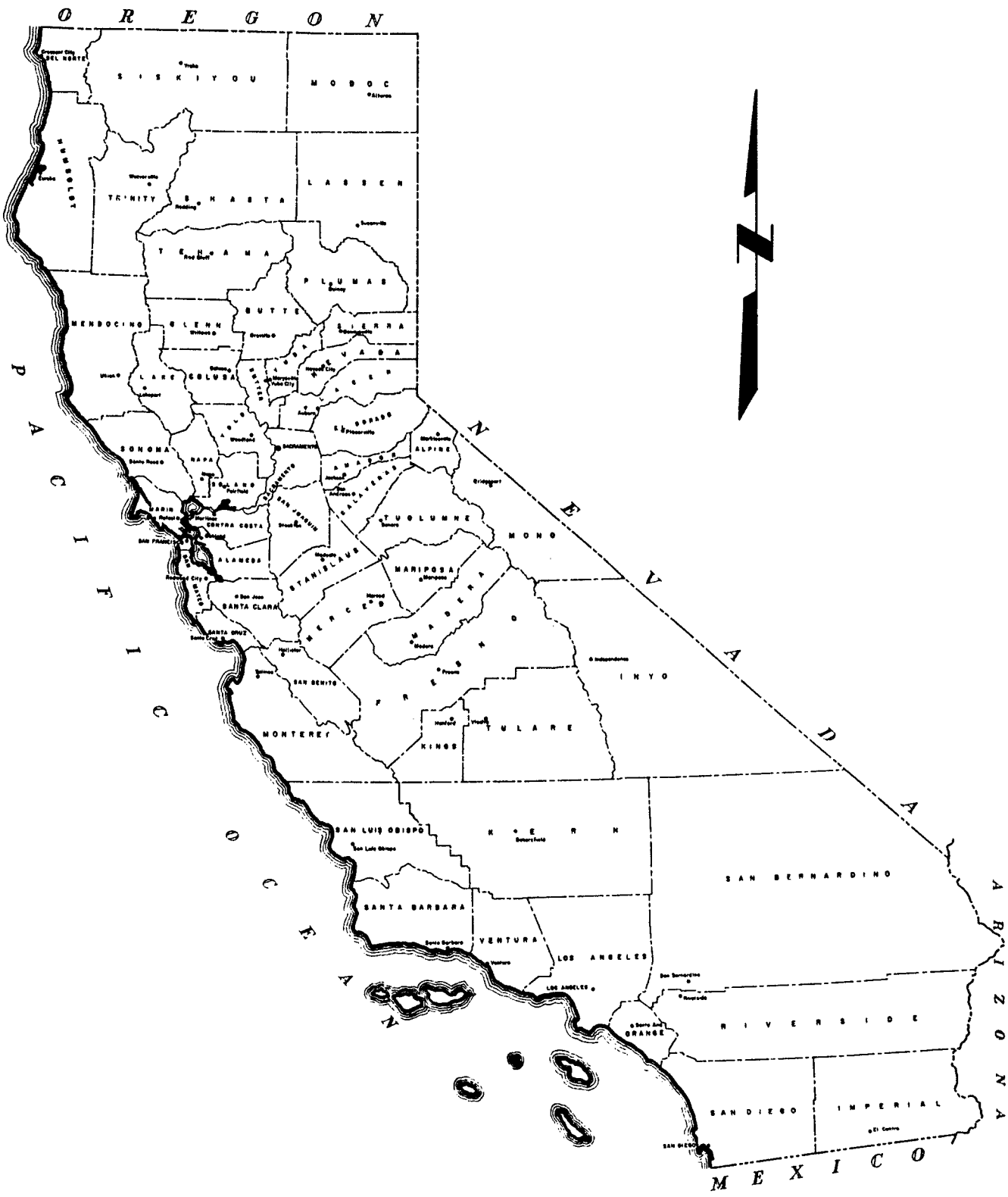
APPENDIX B

NUMBER OF VISITORS FROM EACH COUNTY, 1986

County	San Luis Reservoir	O'Neill Forebay	Los Banos Detention Reservoir
Alameda	70	27	4
Alpine	0	0	0
Amador	0	2	0
Butte	2	0	0
Calaveras	2	2	0
Colusa	0	0	0
Contra Costa	20	9	2
Del Norte	0	0	0
El Dorado	2	9	0
Fresno	128	100	8
Glenn	0	0	0
Humboldt	0	0	0
Imperial	4	0	0
Inyo	0	0	0
Kern	8	5	4
Kings	12	11	0
Lake	0	0	0
Lassen	0	0	0
Los Angeles	51	61	4
Madera	24	23	0
Marin	2	0	0
Mariposa	4	0	2
Mendocino	2	2	0
Merced	161	370	173
Modoc	0	0	0
Mono	0	0	0
Monterey	183	189	55
Napa	0	0	0
Nevada	0	6	0
Orange	13	13	0
Placer	4	4	0
Plumas	0	2	0
Riverside	2	2	0
Sacramento	4	14	2
San Benito	117	145	4

APPENDIX B (continued)

County	San Luis Reservoir	O'Neill Forebay	Los Banos Detention Reservoir
San Bernardino	3	0	0
San Diego	10	7	0
San Francisco	16	23	2
San Joaquin	24	27	0
San Luis Obispo	14	3	0
San Mateo	29	53	2
Santa Barbara	3	9	1
Santa Clara	576	503	57
Santa Cruz	81	102	2
Shasta	0	0	0
Sierra	0	0	0
Siskiyou	0	0	0
Solano	0	11	0
Sonoma	0	10	0
Stanislaus	65	193	13
Sutter	0	0	0
Tehama	0	0	0
Trinity	2	0	0
Tulare	9	7	2
Tuolumne	4	3	0
Ventura	2	0	0
Yolo	0	5	0
Yuba	0	0	0
Out of State	27	56	1
Out of Country	7	23	0
Total	1,687	2,031	338



Counties of California

APPENDIX C

CREEL CENSUS BY RESERVOIR - MAJOR SPECIES ONLY

San Luis Reservoir

	Shore	Boat
Anglers contacted	1,103	165
Angler hours	3,371	1,013
Striped bass	739	279
Average size (inches)	12.2	14.6
Catch per hour	0.22	0.28

O'Neill Forebay

	Shore	Boat
Anglers contacted	832	160
Angler hours	3,260	830
Striped bass	137	83
Average size (inches)	13.6	18.5
Catch per hour	0.04	0.10

Los Banos Detention Reservoir

	Shore	Boat
Anglers contacted	188	69
Angler hours	532	269
Rainbow trout	63	26
Average size (inches)	11.4	11.8
Catch per hour	0.12	0.10

APPENDIX D

SPECIES OF FISH CAUGHT BY QUANTITY

Striped bass (Morone saxatilis)	1,238
Rainbow trout (Salmo gairdnerii)	89
Bluegill (Lepomis machrochirus)	76
White catfish (Ictalurus catus)	31
Channel catfish (Ictalurus punctatus)	24
Green sunfish (Lepomis cyanellus)	12
Largemouth bass (Micropterus salmoides)	12
White crappie (Pomoxis annularis)	12
Black crappie (Pomoxis nigromaculatus)	9
Brown bullhead (Ictalurus nebulosus)	3
Red-ear sunfish (Lepomis microlophus)	2
Unidentified catfish	2
Pumpkinseed (Lepomis gibbosus)	1
Sacramento perch (Archoplites interruptus)	1
Splittail (Pogonichthys macrolepidontus)	1
Total	1,513

SPECIES OF FISH CAUGHT BY RESERVOIR

San Luis Reservoir

Striped bass	1,018
Sacramento perch	1
Total	1,019

O'Neill Forebay

Striped bass	220
White catfish	15
Channel catfish	7
Bluegill	4
Unidentified catfish	2
Largemouth bass	1
Splittail	1
Total	250

Los Banos Detention Reservoir

Rainbow trout	89
Bluegill	72
Channel catfish	17
White catfish	16
Green sunfish	12
White crappie	12
Largemouth bass	11
Black crappie	9
Brown bullhead	3
Red-ear sunfish	2
Pumpkinseed	1
Total	244

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CONVERSION FACTORS

Quantity	To Convert from Metric Unit	To Customary Unit	Multiply Metric Unit By	To Convert to Metric Unit Multiply Customary Unit By
Length	millimetres (mm)	inches (in)	0.03937	25.4
	centimetres (cm) for snow depth	inches (in)	0.3937	2.54
	metres (m)	feet (ft)	3.2808	0.3048
	kilometres (km)	miles (mi)	0.62139	1.6093
Area	square millimetres (mm^2)	square inches (in^2)	0.00155	645.16
	square metres (m^2)	square feet (ft^2)	10.764	0.092903
	hectares (ha)	acres (ac)	2.4710	0.40469
	square kilometres (km^2)	square miles (mi^2)	0.3861	2.590
Volume	litres (L)	gallons (gal)	0.26417	3.7854
	megalitres	million gallons (10^6 gal)	0.26417	3.7854
	cubic metres (m^3)	cubic feet (ft^3)	35.315	0.028317
	cubic metres (m^3)	cubic yards (yd^3)	1.308	0.76455
	cubic dekametres (dam^3)	acre-feet (ac-ft)	0.8107	1.2335
Flow	cubic metres per second (m^3/s)	cubic feet per second (ft^3/s)	35.315	0.028317
	litres per minute (L/min)	gallons per minute (gal/min)	0.26417	3.7854
	litres per day (L/day)	gallons per day (gal/day)	0.26417	3.7854
	megalitres per day (ML/day)	million gallons per day (mgd)	0.26417	3.7854
	cubic dekametres per day (dam^3/day)	acre-feet per day (ac-ft/day)	0.8107	1.2335
Mass	kilograms (kg)	pounds (lb)	2.2046	0.45359
	megagrams (Mg)	tons (short, 2,000 lb)	1.1023	0.90718
Velocity	metres per second (m/s)	feet per second (ft/s)	3.2808	0.3048
Power	kilowatts (kW)	horsepower (hp)	1.3405	0.746
Pressure	kilopascals (kPa)	pounds per square inch (psi)	0.14505	6.8948
	kilopascals (kPa)	feet head of water	0.33456	2.989
Specific Capacity	litres per minute per metre drawdown	gallons per minute per foot drawdown	0.08052	12.419
Concentration	milligrams per litre (mg/L)	parts per million (ppm)	1.0	1.0
Electrical Conductivity	microsiemens per centimetre (uS/cm)	micromhos per centimetre	1.0	1.0
Temperature	degrees Celsius (°C)	degrees Fahrenheit (°F)	(1.8 × °C)+32	(°F−32)/1.8