

County of San Diego
Ocean Illness Survey Results

August 1997 – December 1999



Prepared by the
County of San Diego
Department of Environmental Health

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County of San Diego



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COUNTY OF SAN DIEGO
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August 1997 – December 1999

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OCEAN ILLNESS SURVEY (OIS) RESULTS

August 1997 – December 1999

Background

Recreational beaches are vital to California's economy and quality of life. In 1995, tourists and residents together made more than 565 million visits to California beaches, with beach-related spending contributing over \$27 billion to the state's economy. A 1995 study by the Public Research Institute¹ further estimated that Californians valued their beaches at \$17.5 billion dollars. Like other California coastal communities, San Diego County has recently experienced the impacts of urbanization on its recreational water quality. This has been demonstrated most clearly by the increasing incidence of local beach postings and closures due to bacterial contamination over the past several years. Not unexpectedly, many people have come to associate recreational water contact with resultant increases in risk of illness. Some recent studies have begun to substantiate this relationship. In 1995, an epidemiological study conducted by the Santa Monica Bay Restoration Project showed an increased risk of illness (e.g., gastrointestinal illness, ear infections, respiratory infections, etc.) associated with swimming near flowing stormdrain outlets during dry weather conditions. Other investigations have demonstrated that sewage and contaminated urban runoff harbor potential human pathogens such as bacteria, viruses, and protozoa. While modern sanitary sewers are designed to capture and treat sewage to minimize human exposure to these pathogens, failures of these systems (e.g., pipe breaks, blockages, etc.) occasionally result in the release of untreated sewage to recreational waters. Recent studies have also identified storm drain discharges as an ongoing source of contamination to recreational waters both during dry and wet weather conditions.

Recognizing this potential for increased risk of illness to ocean users, the County of San Diego Department of Environmental Health (DEH) and Surfers Tired of Pollution (S.T.O.P.) jointly initiated the Ocean Illness Survey (OIS) in November 1997. The primary goal of the OIS is to document and provide a framework for the analysis of reports of illnesses contracted by recreational water users along the San Diego County coastline. Although the survey is ongoing, this report presents results for the 29 month period from August 1, 1997 through December 31, 1999. It specifically addresses the following objectives:

1. Characterize the illnesses reported by users of San Diego area beaches,
2. Examine the relationship between reported illnesses and potential sources of contamination, and
3. Identify actions necessary to further characterize the problem.

Study Description

Study Area. The area investigated in this study is the shoreline of San Diego County (Figure 1). From the Orange County border in the north to the US-Mexico border in the south, this includes approximately 73 miles of coastal shoreline, and 27 and 54 miles of shoreline within Mission and San Diego Bays², respectively. The County's coastline is divided into 36 recreational beaches. Several coastal lagoons are also present in the north County, but provide little opportunity for swimming or full body contact. County beaches are used for a variety of activities including surfing, swimming, wading, diving, and kayaking. Access to these areas is variable, but most have significant recreational use. For example, areas such as Sunset Cliffs Park have little or no accessible sandy beach, but are popular for surfing and diving. The County's 1997 population was estimated at 2.7 million residents. Overall beach visitation in San Diego County, presented by individual beaches in Table 1, is estimated at more than 26 million people annually. As a whole, the County is divided into eleven major watershed areas, each of these draining westerly toward the Pacific Ocean. Climate in the coastal County is generally mild with annual temperatures averaging around 65° F. Annual rainfall usually ranges from less than 9" in the southwest to 11" in the north. There are two distinctive climatic periods, a dry period from late April to mid-October and a wet period from mid-October through late April. The wet period generally provides 85-90% of the annual rainfall. Approximately 80% of beach users in the County are local residents³.

¹ *The Economic Value of California's Beaches*. Public Research Institute, May 1997. San Francisco State University.

² Although Mission Bay and San Diego Bay collectively comprise more than 80 miles of shoreline, they account for only 3 miles of recreational beaches.

³ San Diego Regional Coastal Access Study. SANDAG, 1978.

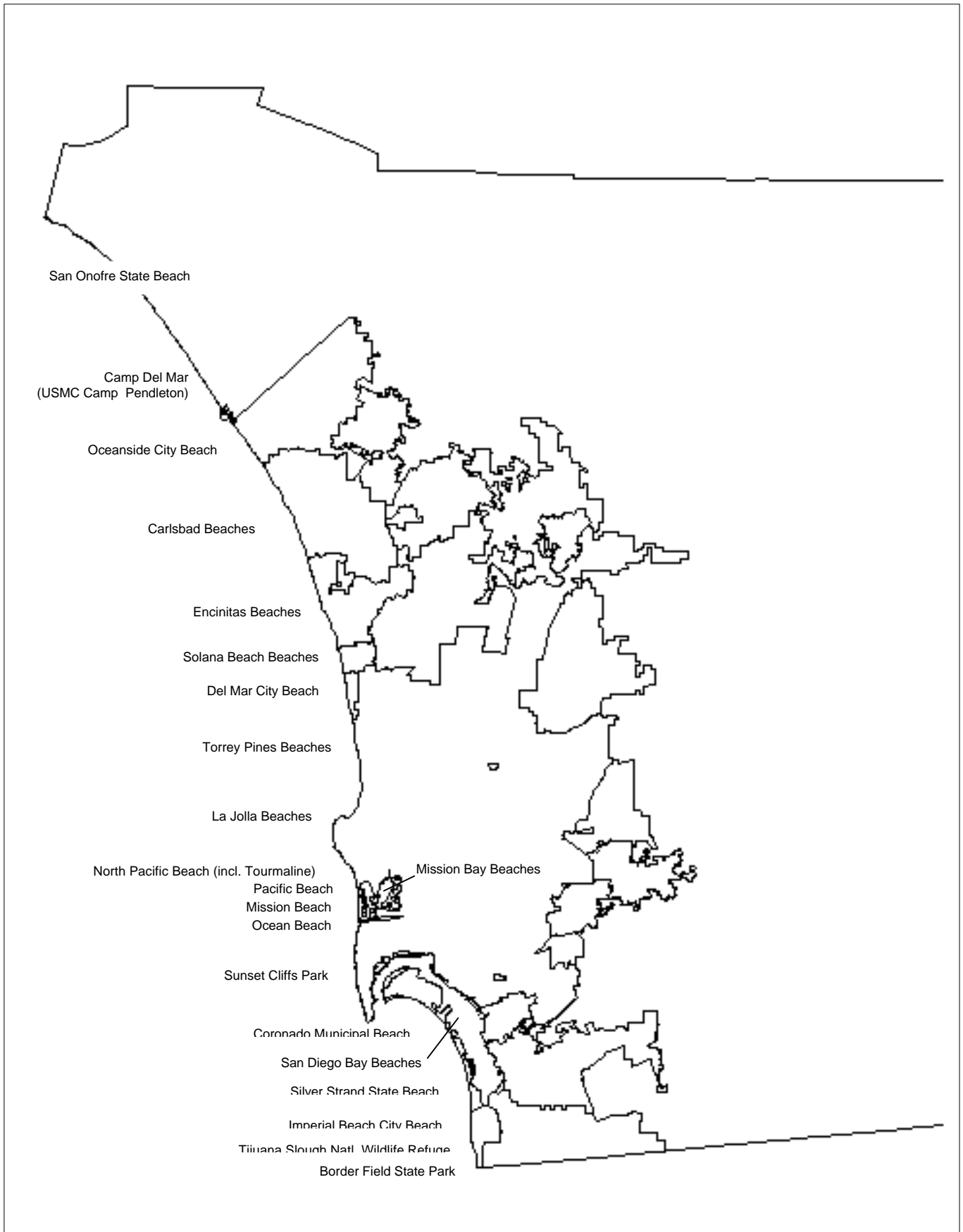


Figure 1: General Locations of San Diego Area Beaches

Table 1: San Diego County Beaches and Estimated Usage (1989/1990) ⁴

JURISDICTION	BEACH NAME	Daily Summer Attendance	Daily Winter Attendance	Annual Attendance
CAMP PENDLETON	1. San Onofre State Beach	4,300	1,200	722,000
	2. Camp Del Mar	---	---	---
OCEANSIDE	3. Oceanside City Beach	16,000	3,500	1,381,000
CARLSBAD	4. Carlsbad City Beach	---	---	---
	5. Carlsbad State Beach	9,500	3,500	1,968,000
	6. South Carlsbad State Beach	2,800	1,300	811,000
ENCINITAS	7. Leucadia State Beach	500	400	149,000
	8. Encinitas City Beaches	2,400	500	299,000
	9. Moonlight State Beach	2,300	900	572,000
	10. San Elijo State Beach	1,500	400	428,000
	11. Cardiff State Beach	7,800	3,400	1,381,000
SOLANA BEACH	12. Tide Beach Park	9,600	2,200	1,195,00
	13. Fletcher Cove Beach Park			
	14. Seascape Beach Park			
DEL MAR	15. Del Mar City Beach	7,000	1,400	1,091,000
SAN DIEGO	16. Torrey Pines State Beach	4,600	1,800	1,024,000
	17. Torrey Pines City Beach	2,900	700	391,000
	18. La Jolla Shores	8,500	1,600	2,080,000
	19. La Jolla Community Beach	3,200	800	443,000
	20. Shell Beach	---	---	---
	21. South Casa Beach	2,400	500	354,000
	22. Wipeout Beach	---	---	---
	23. Whispering Sands Beach	---	---	---
	24. Windansea Beach	1,900	500	214,000
	25. North Pacific Beach (including Tourmaline)	7,700	1,900	527,000
	26. Pacific Beach	11,400	1,600	1,685,000
	27. Mission Beach	9,800	1,300	3,099,000
	28. Mission Bay Beaches	---	---	---
	29. Ocean Beach	18,500	800	1,820,000
30. Sunset Cliffs Park	---	---	---	
PORT DISTRICT	31. San Diego Bay Beaches	---	---	---
CORONADO	32. Coronado Municipal Beach	5,000	800	600,000
	33. Silver Strand State Beach	1,800	100	386,000
IMPERIAL BEACH	34. Imperial Beach City Beach	5,500	1,300	1,000,000
SAN DIEGO	35. Tijuana Slough National Wildlife Refuge Shoreline	---	---	---
	36. Border Field State Park	200	100	30,000

⁴ 1989/ 1990 Beach Use Estimates from City of San Diego and State of California Park and Recreation Departments. Numbers are included only for beaches where estimates were provided.

Study Design. In Fall 1997, the Ocean Illness Survey was designed and distributed to provide ocean users the opportunity to report instances of illness which they suspected were related to recreational water contact. This survey and its methods of distribution and analysis are described below.

Survey Form. The Ocean Illness Survey consists of a return-postage-paid form produced and postmarked by the Department of Environmental Health. It gives respondents the opportunity to provide several types of information.

- Respondent information (name, age, gender, city of residence, and phone number),
- Exposure Information (time and location of water contact),
- Illness information (time till onset, symptoms, and duration),
- Physician Information (whether or not a physician was consulted, physician name and phone number),
- Diagnosis and treatment (if a physician was consulted), and
- Comments.

In response to a review of surveys in early 1999, some changes to the form were made April 1999. The most significant change was the addition of check boxes to report symptoms. Prior to this respondents were asked to provide a written description of symptoms. A copy of the form including these April 1999 changes is included as Appendix A.

Survey Distribution. Beginning in November 1997, survey forms were distributed by Surfers Tired of Pollution (S.T.O.P.) to the public at various locations along the San Diego coast. These were made available through 18 coastal businesses including Harrys' Surf Shop in Pacific Beach, the California Surf Museum in Oceanside, the Surf Hut in Imperial Beach, Leucadia Surf Boards, and Mitch's Surf Shop in Solana Beach and La Jolla. Surveys were also stocked at beach area medical offices such as the Mission Beach Clinic, distributed by local surfers and volunteers from San Diego State University and Mesa College, and through the Surfrider Foundation internet website. In some cases, forms were provided to interested parties by DEH field staff. The form was also made available on the County's internet website. Completed forms could either be mailed or faxed to the DEH, or respondents could telephone in responses directly; in the latter case, forms were completed by DEH staff.

Analysis of Results. Once received, survey responses were logged into a Microsoft Access database. Database fields were established for each of the questions on the form, as well as several additional fields for staff use in analyzing the responses. Surveys in which the respondent did not indicate that an illness had occurred or that were outside the study area were not included in the analysis. In some cases, illnesses were reported but without a specific location or time of contact. These surveys were included in analysis only to the degree allowed by the specificity of information provided. In this case, surveys were included in the overall analysis of symptoms, but excluded from the analysis of exposure information (date and beach location) or the relationship of this information to reported illnesses.

Based on initial review of responses, the following categories of symptoms were established in the database:

- Respiratory / Sinus,
- Sore Throat / Swollen Glands
- Eye / Ear,
- Gastrointestinal,
- Skin
- Headache / Fever
- Other, and
- Undetermined

Fields were also created to capture comments. These were not included in the survey analysis, although in some cases they were helpful in clarifying other information provided on the forms.

Biases and Limitations. Although the OIS provides information about the nature of illnesses potentially contracted in San Diego County's coastal waters, it is not a controlled epidemiological study. It is therefore important to acknowledge several biases and limitations which may affect overall results.

Survey Distribution. Because of the limited number of distribution points, surveys were generally more easily available near beaches within the City of San Diego than in the north County (Oceanside, Carlsbad, Encinitas, Solana Beach, and Del Mar) and south County (Coronado and Imperial Beach). Distribution of surveys also relied more heavily on surf shops than on businesses frequented by a cross-section of other recreational users (e.g., dive shops, sporting goods stores, etc.). Results are therefore likely to be more representative of central County beaches, and of surfers rather than other users such as swimmers and divers.

Self-Reporting. Surveys were completed by recreational users rather than trained medical personnel. Although some respondents indicated that they consulted a physician, illnesses were generally self-diagnosed and symptoms always self-reported. Because of the large number of surveys received, no attempt was made by County staff to verify the authenticity or accuracy of individual surveys for the purposes of this report. The accuracy of information reported is likely to be highly variable since the length of time between exposure and the filing of reports ranged from days to months. The data analysis assumed that all survey information is reported accurately.

Respondent Usage Patterns. Although the survey form provided respondents an opportunity to provide basic demographic information (age, sex, and city of residence), it did not request specific information about individual usage patterns (e.g., type and frequency of water contact, etc.). Because of the general bias in survey distribution toward surfers, results are therefore likely to be less representative of occasional or infrequent recreational water users.

Respondent Perception of Water Quality. Frequent ocean users often have a heightened awareness of water pollution issues, and may have formed opinions about the safety of recreational contact. As such, a tendency may exist in some cases to assume that illnesses are related to water exposure regardless of whether such a relationship exists.

Limitation of Survey Results in Assessing Water Quality. Because survey forms are generally completed only when suspected illnesses have occurred, the number of times that beaches are frequented without adverse results cannot be estimated. Higher numbers of reported illnesses at specific beaches may therefore be attributable to factors other than differences in water quality (e.g., higher beach usage or differences in survey distribution). Results should therefore not be used to characterize the general water quality of beaches or to make comparisons between these locations.

Decrease in Survey Response Over Study Period. Following the initial release of the OIS in November 1997, responses decreased significantly during 1998 and 1999. For the 219 total surveys that could be assigned an exposure date, 77 corresponded to August through December 1997, 109 to 1998, and 33 to 1999. The effect of this trend on overall survey results is unknown.

Discussion of Results

For the period of August 1, 1997 to December 31, 1999, 281 total surveys were completed and returned to the County DEH. Of these 281, 39 were initially excluded from analysis; seventeen because they were either outside of the study area or did not correspond to the survey period; one because it was completed for a dog; and twenty-one because they did not indicate that any illness had occurred. Results discussed in this section are based on these remaining 242 surveys. Since 10 people completed multiple surveys, only 232 of 242 are used in the calculation of respondent demographic information. However, since each of these surveys corresponds to a unique report of illness, all 242 surveys are used in the remaining calculations.

Respondent Characteristics. Table 2 and Figures 1 and 2 show the gender and age distribution of survey respondents. Ages of those for whom illnesses were reported ranged from under one to 75 years. Two-thirds of all respondents were between the ages of 21 and 50, with the greatest number between 21 and 30. Ten percent did not specify an age. Male respondents (159) outnumbered females (48) by more than three to one. Twenty-five people did not specify their gender.

Illnesses and Symptoms Reported. Two-hundred and forty-two (242) surveys reporting a specific incidence of illness were completed; thirty-two of these did not specify symptoms. The remaining 210 surveys reported a total of 377 symptoms (1.79 symptoms per survey). Reported symptoms are shown in Table 3 by general category. Respiratory / Sinus accounted for the highest percentage of total (26.3%), followed by Sore Throat / Swollen Glands (19.1%), Eye / Ear Infections (19.6%), and Gastrointestinal (13.3%). Other symptoms accounted for 21.7% collectively.

Table 2: Gender and Age of Respondents (n=232)

Gender	Number	Percent Of Total	Ave. Age (yrs)
Male	159	68.5	31.6
Female	48	20.7	29.3
Unspecified	25	10.8	11.2
	232	100	

Table 3: Symptoms Reported (n=377)

Type of Symptom	Number	% of Total
Respiratory / Sinus	99	26.3
Sore Throat	72	19.1
Eye / Ear	74	19.6
Gastrointestinal (GI)	50	13.3
Skin	17	4.5
Headache / Fever	46	12.2
Other	19	5.0
	377	100

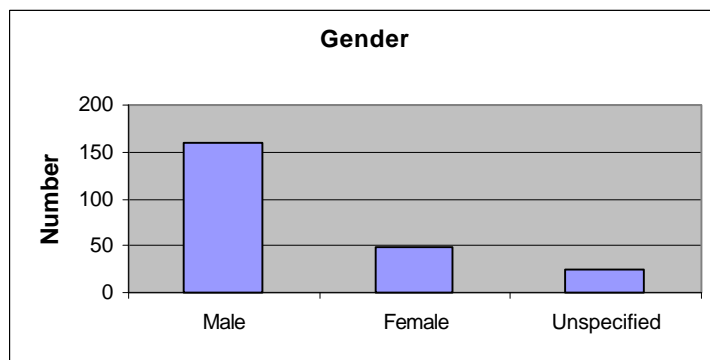


Figure 2: Respondent Gender

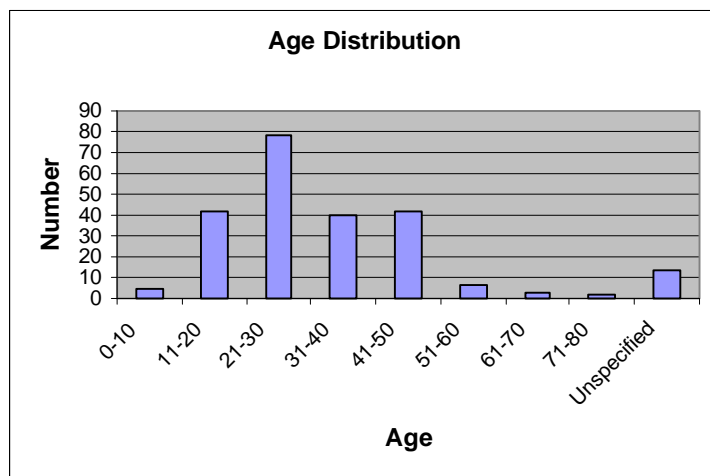


Figure 3: Age of Survey Respondents

Total numbers of illnesses reported are shown in Table 4 by beach location. Illnesses were reported at 27 of 36 beaches; 10 or more reports were received at nine beaches. Nineteen reports did not provide a specific location. The highest numbers of reports were at Tourmaline Surf Park (32), Ocean Beach (25), and Cardiff State Beach (21). It should be cautioned that these results cannot be used to make general statements about the water quality of specific beaches since many variables (e.g., survey distribution, beach usage, etc.) affect the numbers of illnesses reported for each. Appendix B summarizes the numbers of days of documented water contamination at each beach. More detailed information on beach postings, closures, and general advisories is available in annual Beach Closure Reports published by the DEH.

Table 4: Numbers of Illness Reported by Specific Location (n=242)

Beach Name		Illnesses Reported	
		Number Reported	% of total
1	San Onofre State Beach	5	2.1
2	Camp Del Mar	1	0.4
3	Oceanside City Beach	12	5.0
4	Carlsbad City Beach	1	0.4
5	Carlsbad State Beach	5	2.1
6	South Carlsbad State Beach	4	1.7
7	Leucadia State Beach	5	2.1
8	Encinitas City Beaches	0	0.0
9	Moonlight State Beach	3	1.2
10	San Elijo State Beach	2	0.8
11	Cardiff State Beach	21	8.7
12	Tide Beach Park	0	0.0
13	Fletcher Cove Beach Park	1	0.4
14	Seascape Beach Park	0	0.0
15	Del Mar City Beach	11	4.5
16	Torrey Pines State Beach	3	1.2
17	Torrey Pines City Beach	2	0.8
18	La Jolla Shores	14	5.8
19	La Jolla Community Beach	8	3.3
20	Shell Beach	0	0.0
21	South Casa Beach	0	0.0
22	Wipeout Beach	0	0.0
23	Whispering Sands Beach	0	0.0
24	Windansea Beach	12	5.0
25	North Pacific Beach (including Tourmaline)	32	13.2
26	Pacific Beach	12	5.0
27	Mission Beach	7	2.9
28	Mission Bay Beaches	6	2.5
29	Ocean Beach	25	10.3
30	Sunset Cliffs Park	5	2.1
31	San Diego Bay Beaches	3	1.2
32	Coronado Municipal Beach	6	2.5
33	Silver Strand State Beach	0	0.0
34	Imperial Beach City Beach	16	6.6
35	Tijuana Slough National Wildlife Refuge Shoreline	1	0.4
36	Border Field State Park	0	0.0
37	Beach Not Specified	19	7.9
Total		242	100

Association of Illnesses with Potential Causes. Contaminants are generally introduced to recreational beaches via a combination of natural and manmade pathways including surface flow, coastal rivers, and storm drain and lagoon outlets. Recent studies have documented the presence of pathogenic organisms in urban runoff and have demonstrated an increased risk of illness for people swimming near flowing storm drain outlets during dry weather. However, data on the general occurrence of ocean-related illnesses and their relationship to documented incidents of water quality contamination are limited. A primary focus of this study is to further examine this relationship. The following types of contamination sources and events are specifically addressed:

- Rainfall (General Advisory)
- Sewage Spills (Beach Closure)
- Routine Maintenance Activities Such as Lagoon Mouth Openings (Beach Posting)
- Monitoring Results Exceed State Standards⁵ (Beach Posting)
- Other sources

It should be cautioned that cause and effect relationships between specific reports of illness and contamination events cannot be definitively established within the limitations of this study. However, by examining general trends in the data collected, some conclusions can be tentatively drawn and may establish directions for future investigation.

Table 5 summarizes total reported illnesses coinciding with each event type. Of 242 total illnesses reported, 52 (21.5%) corresponded to documented contamination events. One-half were during general rainfall advisories, followed by sewage spills (23.1%), beach postings (21.2%), and lagoon openings (5.8%). Table 6 shows total illnesses reported by location and event type for each beach in the County.

Table 5: Total Illnesses Reported by Event Type⁶

Contamination Event	Total Illnesses	% of Total
General Rainfall Advisory	26	50.0
Sewage Spills	12	23.1
Beach Posting	11	21.2
Routine Maintenance	3	5.8
	52	100

Rainfall (General Advisory). Most runoff in the County occurs during the wet period from mid-October through late April. When rainfall exceeds 0.2 inches, the DEH issues a general advisory to avoid ocean water contact 300 feet on either side of storm drain outlets during and up to 72 hours after the event. Unlike other event types, general rainfall advisories are applicable Countywide. Illnesses reported during these periods can therefore be examined collectively, or as individual contamination events. Between August 1997 and December 1999 (881 total days), County beaches were subject to general rainfall advisories a total of 100 days⁷. Twenty-six illnesses were reported during these days (0.260 illnesses / day). This compares to 216 illnesses in 781 days (0.277 / day) which were not under general advisory (Table 7). This slight decrease (~ 6%) suggests that incidences of illness are not increased during general advisories. The question of whether an increase in illnesses might be observed during the days immediately after general advisories are lifted was also examined. Fifteen additional illnesses were reported within two days after the lifting of the 26 general advisories that occurred during the study period. Dividing the fifteen illnesses by these 52 total days resulted in a rate of 0.173 illnesses per day, again suggesting that an increase in illnesses is not present and that the current 72 hour advisory policy is adequately protective.

⁵ Beach postings generally occur when sample results in routine monitoring exceed state standards for recreational water contact. However, beaches exceeding standards over longer periods may be changed to a chronic posting status.

⁶ In some cases, specific beaches were subject to more than one type of listing, e.g., a sewage spill during a general advisory, etc. No adjustment was made for these overlaps since each type of event is discussed separately.

⁷ Four areas (San Diego Bay beaches, Imperial Beach City Beach, Tijuana Slough National Wildlife Refuge, and Border Field State Park) were subject to an additional six days each. Since this represents a minority of the County's total beach area, 100 days is used as County-wide total for this report.

Table 6: Comparison of Illnesses Reported by Location and Event Type

Beach Name		Illnesses Reported		Number of Illnesses Coinciding with Contamination Events				
		#	(% of total)	General Advisory	Sewage Spill	Posting	Lagoon Opening	All Events
1	San Onofre State Beach	5	(2.1)	---	---	---	---	---
2	Camp Del Mar	1	(0.4)	---	---	---	---	---
3	Oceanside City Beach	12	(5.0)	1	---	4	1	6
4	Carlsbad City Beach	1	(0.4)	---	---	---	---	---
5	Carlsbad State Beach	5	(2.1)	---	---	1	---	1
6	South Carlsbad State Beach	4	(1.7)	1	---	---	---	1
7	Leucadia State Beach	5	(2.1)	---	---	---	---	---
8	Encinitas City Beaches	0	(0.0)	---	---	---	---	---
9	Moonlight State Beach	3	(1.2)	---	---	---	---	---
10	San Elijo State Beach	2	(0.8)	1	---	---	1	2
11	Cardiff State Beach	21	(8.7)	3	3	---	1	7
12	Tide Beach Park	0	(0.0)	---	---	---	---	---
13	Fletcher Cove Beach Park	1	(0.4)	1	---	---	---	1
14	Seascape Beach Park	0	(0.0)	---	---	---	---	---
15	Del Mar City Beach	11	(4.5)	---	---	---	---	---
16	Torrey Pines State Beach	3	(1.2)	---	---	---	---	---
17	Torrey Pines City Beach	2	(0.8)	---	---	---	---	---
18	La Jolla Shores	14	(5.8)	2	---	---	---	2
19	La Jolla Community Beach	8	(3.3)	---	---	---	---	---
20	Shell Beach	0	(0.0)	---	---	---	---	---
21	South Casa Beach	0	(0.0)	---	---	---	---	---
22	Wipeout Beach	0	(0.0)	---	---	---	---	---
23	Whispering Sands Beach	0	(0.0)	---	---	---	---	---
24	Windansea Beach	12	(5.0)	---	1	---	---	1
25	Tourmaline Surf Park	32	(13.2)	1	---	4	---	5
26	Pacific Beach	12	(5.0)	2	---	---	---	2
27	Mission Beach	7	(2.9)	---	---	---	---	---
28	Mission Bay Beaches	6	(2.5)	---	---	1	---	1
29	Ocean Beach	25	(10.3)	5	---	2	---	7
30	Sunset Cliffs Park	5	(2.1)	---	1	---	---	1
31	San Diego Bay Beaches	3	(1.2)	---	---	---	---	---
32	Coronado Municipal Beach	6	(2.5)	---	---	---	---	---
33	Silver Strand State Beach	0	(0.0)	---	---	---	---	---
34	Imperial Beach City Beach	16	(6.6)	2	6	---	---	8
35	Tijuana Slough National Wildlife Refuge Shoreline	1	(0.4)	---	---	---	---	---
36	Border Field State Park	0	(0.0)	---	---	---	---	---
37	Beach Not Specified	19	(7.9)	7	---	---	---	7
Total		242	100	26	11	12	3	52

Table 7: Comparison of Illness Rates by Water Quality Condition

Water Quality Condition	Illnesses Reported	Total Days	Illnesses / Day
General Advisory	26	100	0.260
No Known Water Quality Impairment	216	781	0.277
1-2 Days After General Advisory	15	52	0.173

Sewage Spills (Beach Closure). During the study period, sewage spills impacted 25 of the County's 36 beaches for a total of 968 beach closure days. Beaches near the U.S.-Mexico border (Imperial Beach City Beach, Tijuana Slough National Wildlife Refuge, and Border Field State Park) were the most highly impacted due to flows from the Tijuana River. The DEH advises against water contact during periods in which beaches are impacted by sewage spills. However, closure signs do not prevent users from entering the water, especially when these areas are not actively patrolled by lifeguards. In some cases, signs may also be removed by vandals, leaving beaches unposted until the signs can be replaced. A total of twelve illnesses were reported at five of the 25 beaches impacted by sewage spills, six of these at Imperial Beach City Beach and three at Cardiff State Beach (Table 8). The low overall number of illnesses reported indicates that current closure practices are generally effective, but serves to emphasize that exposure to pathogens during periods of contamination from sewage spills remains a possibility.

Table 8: Days Closed Due to Sewage Spills and Illnesses Reported at San Diego Beaches

Beach Name	Days Closed	Illnesses Reported
San Onofre State Beach	9	---
Camp Del Mar	14	---
Oceanside City Beach	14	---
Carlsbad City Beach	2	1
Carlsbad State Beach	3	---
South Carlsbad State Beach	14	---
Moonlight State Beach	3	---
Cardiff State Beach	28	3
Seascape Beach Park	4	---
Del Mar City Beach	7	---
Torrey Pines State Beach	22	---
La Jolla Community Beach	6	---
Shell Beach	2	---
Windansea Beach	15	1
Tourmaline Surf Park	34	---
Mission Bay Beaches	57	---
Ocean Beach	57	---
Sunset Cliffs Park	2	1
San Diego Bay Beaches	69	---
Coronado Municipal Beach	2	---
Silver Strand State Beach	14	---
Imperial Beach City Beach	183	6
Tijuana Slough National Wildlife Refuge Shoreline	203	---
Border Field State Park	204	---

Routine Maintenance Activities (Beach Posting). Seven of the County’s 36 beaches were posted a total of 80 days for routine maintenance activities such as lagoon mouth excavation and storm drain cleaning. The DEH received three reports of illness corresponding to these events, all for lagoon mouth openings (Table 9). Based on these limited numbers there does not appear to be a significant incidence of illnesses reported during these events. This suggests that current posting policies are generally effective. As with sewage spills, these results emphasize the possibility of exposure to pathogens during periods of beach posting and the need for recreational users to adhere to postings and closures.

Table 9: Total Illnesses Reported During Days Affected by Maintenance Activities

Beach Name	Maintenance Activity	Days Posted	Illnesses Reported
Oceanside City Beach	Loma Alta Lagoon Opening	28	1
San Elijo / Cardiff State Beach	San Elijo Lagoon Opening	28	2
Fletcher Cove	Storm Drain Cleaning	1	0
Del Mar City Beach	San Dieguito Lagoon Opening	6	0
Torrey Pines State Beach	Los Penasquitos Lagoon Opening	5	0
La Jolla Shores Beach	Storm Drain Cleaning	12	0

Monitoring Results Exceed State Standards (Beach Posting). Pursuant to the implementation of Assembly Bill 411 on July 26, 1999, bacteriological monitoring at San Diego beaches underwent significant changes. The most notable of these were an increase to weekly sampling between April and October and the addition of a third bacterial indicator test, enterococcus. These changes caused the numbers of beach postings to increase significantly in 1999. In most cases, beaches remain posted only a few days until sampling confirms bacteria levels are within State standards. However, in other cases, beaches that fail to meet standards over longer periods, or which have known sources of contamination, can revert to a chronic posting status. Three beach (Table 10) areas were chronically posted during the study period, Oceanside City Beach (423 days), Children’s

Table 10: Total Illnesses Reported During Days with Monitoring Results in Exceedance of State Standards

Beach Name	Days Posted (Routine)	Days Posted (Chronic)	Illnesses Reported
Oceanside City Beach	---	423	4
Moonlight State Beach	9	---	---
Del Mar City Beach	3	---	---
Torrey Pines State Beach	14	---	---
La Jolla Shores Beach	17	---	---
La Jolla Community Beach	2	---	---
Children’s Pool (South Casa)	---	848	---
Whispering Sands Beach	27	---	---
Windansea Beach	3	---	4
Tourmaline Surf Park	116	---	---
Pacific Beach	3	---	---
Mission Bay Beaches	275	---	1
Ocean Beach	44	---	2
San Diego Bay Beaches	11	---	---
Imperial Beach City Beach	11	---	---
Tijuana Slough National Wildlife Refuge Shoreline	6	555	---
Border Field State Park	1	555	---

Pool at South Casa Beach (848 days), and Tijuana Slough National Wildlife Refuge / Border Field State Park (555 days). Of these chronically posted beaches, illnesses were reported only at Oceanside City Beach. The remaining seven illnesses were during routine postings. In all cases it is difficult to establish a relationship between postings and reported illnesses since monitoring results alone cannot identify specific sources of contamination. Since sufficient data are not currently available to assess this relationship, it should be further examined in the future.

Other Causes. In addition to the sources discussed above, reported illnesses may be attributable to other possible causes. Although it is not possible to quantify the impacts of these sources, some bear additional consideration. Beach usage is considerably higher during summer months (Table 1). It follows that as use increases, numbers of reported illnesses may also undergo a corresponding increase. The seasonality of beach use affects both the numbers of people who may be exposed and of those potentially acting as sources. Additionally, some illnesses reported may have been contracted from sources other than recreational water contact. For example, many of the symptoms reported were consistent with those of colds and flu. To examine the influence that seasonal illness such as influenza might have on survey results, peaks⁸ (CDC, 2000) were compared to the temporal distribution of reports received. Figure 4 shows this distribution by month for all reports, as well as for those reports most likely to be associated with influenza⁹. No association between flu season peaks and numbers of reports received is observable. However, 1998 results suggest a summer peak (June through September). This could be attributable to a number of factors, most notably an increase in the number of bathers.

Finally, other in-water sources should be considered. Waterfowl, marine mammals (e.g., seals at Children’s Pool), decaying vegetation, and soil resuspension can all result in elevated levels of indicator bacteria in water samples. While the relationship of these sources to reported illness remains unclear, it should continue to be considered.

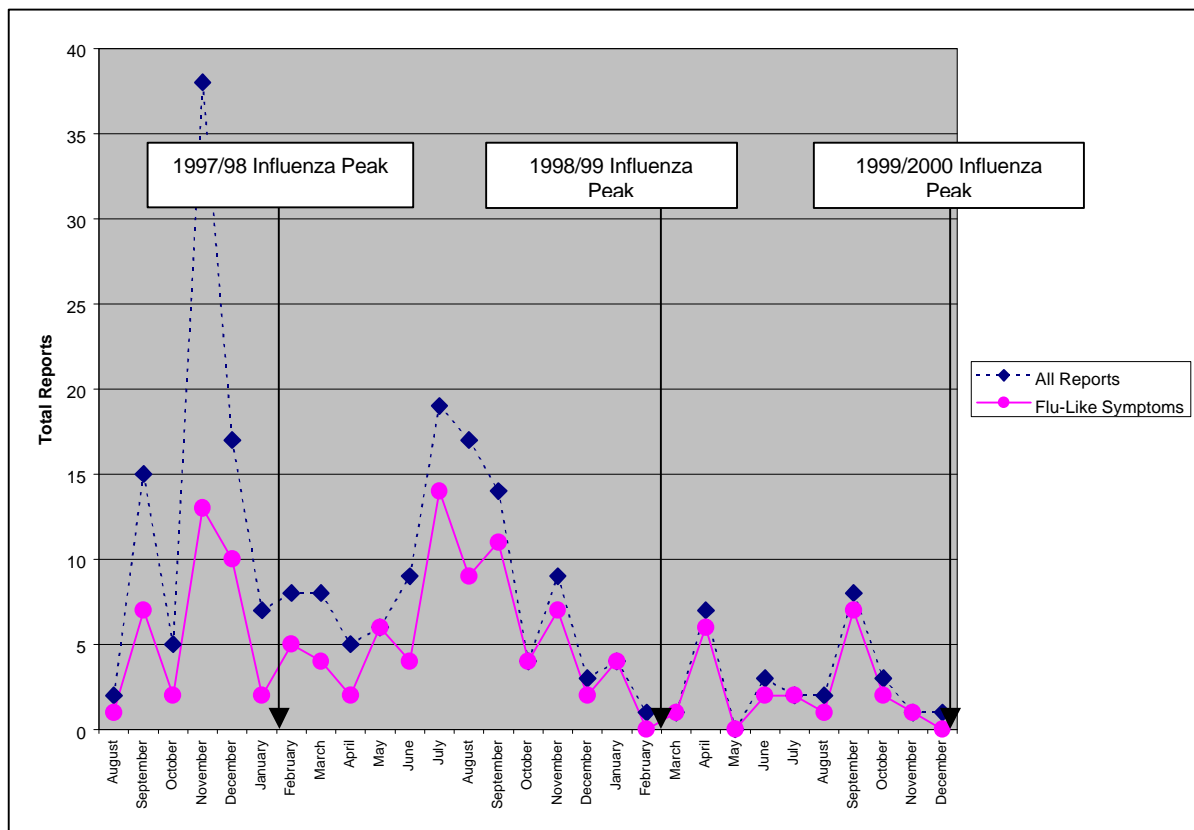


Figure 4: Number of Illnesses Reported by Month (August 1997 – December 1999)

⁸ Update: Influenza Activity – United States, 1999-2000 Season; Centers for Disease Control, January 28, 2000 / 49(03); 53-7

⁹ Influenza-like reports include only surveys reporting combinations of the following symptoms: Respiratory / Sinus, Sore Throat / Swollen Glands, Gastrointestinal, and Headache / Fever.

Conclusions and Recommendations

Conclusions. The number of surveys received over the 29 month study period demonstrated a high level of concern over the safety of water contact activities at San Diego area beaches. Although specific causes and rates of illness cannot be determined within the limitations of the Ocean Illness Survey, the survey response emphasizes the need to continue focusing management efforts on better understanding actual health impacts rather than focusing only on indirect measures (e.g., levels of indicator bacteria, etc.).

Overall numbers of reported illnesses compared during episodes of known water quality contamination (general rainfall advisory, sewage spills, beach postings, and maintenance activities) and at times without impairment did not indicate that illnesses occur more frequently during such events. This does not, however, mean that *risks of illness* are not greater during these periods. In fact, such risks have been well demonstrated in other studies. Rather, it suggests that risk management efforts (general advisories, postings, and closures) are effective in limiting the potential exposure of recreational water users during such episodes.

Recommendations. Based on the results of this study, the following are recommended.

(1) Continue use of the existing Ocean Illness Survey with modifications. While results support the continued use of the Ocean Illness Survey as a tool for the general assessment of illnesses potentially associated with recreational water contact, they also suggest that a number of improvements are needed. These include the following:

- The survey form should include more detailed information on respondent usage patterns.
- Survey distribution should focus on a broader cross section of recreational users to better understand overall patterns of risk.
- Survey distribution should be more carefully tracked to better understand its effect on results.

(2) Consider the use of other methods of investigation to more thoroughly assess incidences of illness and their association with recreational water contact. The most fundamental limitation on the use of the Ocean Illness Survey is the need for ocean users to seek out, complete, and return the questionnaires on their own initiative. Although attempts were made to distribute the survey as widely as possible, this passive strategy introduces significant biases, severely limiting the ability of investigators to accurately characterize types and rates of illness, to assess cause and effect relationships, and to characterize levels of error. These limitations suggest the need to consider additional assessment tools such as an epidemiological study or other statistically based survey.

OCEAN ILLNESS SURVEY

Surfers Tired of Pollution (S.T.O.P) and the San Diego County Department of Environmental Health (DEH) are working together to better serve our community. By completing this questionnaire you help us to better understand potential illnesses associated with surfing or swimming in San Diego's coastal waters. Your comments are extremely helpful.

Name: _____ Age: _____
City: _____
Phone: _____

In the past six months, have you become ill from swimming or surfing in ocean or bay waters? Y N

Location: (Please be specific)

Date: _____ Time: _____

Symptoms: (check all that apply)

- | | | | |
|-------------------|--------------------------|---------------|--------------------------|
| Upper respiratory | <input type="checkbox"/> | Sore Throat | <input type="checkbox"/> |
| Ear Infection | <input type="checkbox"/> | Eye Infection | <input type="checkbox"/> |
| Headache | <input type="checkbox"/> | Skin Rash | <input type="checkbox"/> |
| Upset Stomach | <input type="checkbox"/> | Diarrhea | <input type="checkbox"/> |
| Fever | <input type="checkbox"/> | Vomiting | <input type="checkbox"/> |
| Other | | | |

How long after you were in the ocean did you start experiencing these symptoms and how long did they last?

Did you see a doctor? Y N

Dr. Name & Phone number (if available)
()

Diagnosis & Treatment

Comments:

You may leave this survey where you found it, or mail your comments to the address on the back of this form. Please include your name and phone number if you would like us to contact you. Responses may also be faxed to (619) 338-2848.

APPENDIX B: Numbers of Days with Documented Water Quality Contamination¹⁰ (August 1997 through December 1999)

Beach Name	Rainfall Advisory	Sewage Spill	Maintenance / Clearing	Routine Sampling	Chronic Posting	Total Days Impacted	Total Days Not Impacted
San Onofre State Beach	100	9	0	0	0	109	772
Camp Del Mar	100	14	0	0	0	114	767
Oceanside City Beach	100	14	28	0	423	454	427
Carlsbad City Beach	100	2	0	0	0	102	779
Carlsbad State Beach	100	3	0	0	0	103	778
South Carlsbad State Beach	100	14	0	0	0	111	770
Leucadia State Beach	100	0	0	0	0	100	781
Encinitas Beach Parks	100	0	0	0	0	100	781
Moonlight State Beach	100	3	0	9	0	109	772
San Elijo State Beach	100	0	0	0	0	100	781
Cardiff State Beach	100	28	28	0	0	140	741
Tide Beach Park	100	0	0	0	0	100	781
Fletcher Cove Beach Park	100	0	1	0	0	101	780
Seascape Beach Park	100	4	0	0	0	104	777
Del Mar City Beach	100	7	6	3	0	113	768
Torrey Pines State Beach	100	22	5	14	0	128	753
Torrey Pines City Beach	100	0	0	0	0	100	781
La Jolla Shores	100	3	12	17	0	129	752
La Jolla Community Beach	100	6	0	2	0	108	773
Shell Beach	100	2	0	0	0	102	779
South Casa Beach (incl. Children's Pool)	100	0	0	0	848	848	33
Wipeout Beach	100	0	0	0	0	100	781
Whispering Sands Beach	100	0	0	27	0	125	756
Windansea Beach	100	15	0	3	0	115	766
Tourmaline Surf Park (incl. P.B. Point)	100	34	0	116	0	235	646
Pacific Beach	100	0	0	3	0	103	778
Mission Beach	100	0	0	0	0	100	781
Mission Bay beaches	100	57	0	275	0	409	472
Ocean Beach	100	57	0	44	0	187	694
Sunset Cliffs Park	100	2	0	0	0	102	779
San Diego Bay beaches	106	69	0	11	0	170	711
Coronado Municipal Beach	100	2	0	0	0	102	779
Silver Strand State Beach	100	14	0	0	0	109	772
Imperial Beach City Beach	106	183	0	11	0	258	623
Tijuana Slough National Wildlife Refuge Shoreline	106	203	0	6	555	363	518
Border Field State Park	106	204	0	1	555	359	522

¹⁰ In some instances, total days impacted are less than the sum of the contamination events because events overlapped, e.g., sewage spills during rainfall advisories, etc.

