

**Report on the Lost Recreational Use Resulting from the
August 24, 1998 Tesoro Oil Spill off Barbers Point**

May 12, 1999

1. Introduction

This report evaluates the recreational losses resulting from the Tesoro oil spill off Barbers Point, Oahu on August 24, 1998 when up to 117 barrels of oil were released following an accidental hose failure. Several weeks after the spill, about September 5th, tarballs and dead oiled birds began coming ashore on the eastern shore of the island of Kauai. As a result of the oiling and clean up activities, two beaches, Fugi Beach and Nukoli'i Beach, were officially closed on September 13th. In addition, several other recreational sites along the coast of Kauai were affected by the presence of oil and oil cleanup crews.

Economists generally agree that the correct measure of the net economic value of a recreation trip is the average consumer's surplus per trip. Consumer surplus is the measure of an individual's value for a good, in this case recreation, above and beyond any payments that are necessary to obtain that good. The change (net) in consumer surplus as a result of a policy change or environmental impacts, is the consumer's measure of economic loss. This concept of net consumer surplus is applied in economics to measure losses under a wide range of circumstances, for example, impacts on consumers from changes in food prices, losses from outages in water or power supply, as well as disruptions of outdoor recreation due to oil spills or other pollution. In the case of beach recreation, net consumer surplus per trip is the monetary measure of a consumer's loss of use and enjoyment of the beaches because of changes in the quality of the beaches or their closure. In the case of oiled beaches, losses can occur if a beach is closed down and an individual is forced to incur extra costs

in terms of time and money to travel to an alternative beach, or if an individual must recreate at a less valued location due to a spill. A less valued site could either be the now oiled beach or an alternative non-oiled beach with less desirable characteristics (e.g., more crowded, different amenities, riptides, etc.).

This analysis outlines the two main components needed to estimate the loss of consumer's surplus resulting from the Tesoro oil spill: (1) an estimate of the number of recreation trips affected either through lost trips or trips of reduced quality; and (2) an estimate of the unit value (consumer's surplus) per trip for each of these affected recreational activities. The estimate of the aggregate lost recreational use value caused by the Tesoro oil spill is computed as the product of the number of trips affected times the unit value per trip, summed over the recreational activities considered.

To estimate the number of trips affected by the oil spill, counts of beach visitors were developed through on-site surveys of recreators at the closed beaches after reopening. Information on the types and locations of recreational activities of tourists were developed through surveys of local businesses and individual recreators.

To estimate the consumer surplus loss resulting from the oil spill the Benefits Transfer approach is used in this analysis. With the Benefits Transfer approach, one transfers an existing estimate of consumer surplus developed in another situation for a similar resource to the current problem of concern. The Benefits Transfer approach is well accepted as a method to estimate losses in the context of *Natural Resource Damage Assessments*. Key considerations in a benefits transfer exercise are that the resource and the users in the other studies be comparable to those affected by the Kauai oil spill, that the other study deal with the same type of change (shutting sites down for a small period of time), and that it be of acceptable quality from a methodological perspective.

2. Description of Beaches and Beach Closures

The various recreational activities that take place in the spill area include general beach recreation, surfing, kayaking, fishing, Opihi gathering and Limu (seaweed) harvesting. This area offers a high-quality recreational experience to residents from many parts of the island as well as a large number of tourists. Fortunately, the oil spill did not affect all of the recreational sites along the east coast of Kauai.

The two beaches that were officially closed by the oil spill were Fugi Beach and Nukoli'i Beach (See Figure 1). Both beaches were officially closed on Sunday, September 13, 1998 and experienced heavy oiling several days prior to the official closings. Exclusionary tape and warning signs were posted to prevent the public from using these beaches during the closure periods. Fugi Beach reopened on the morning of Wednesday, September 16th and based on observations by individuals at this beach, attendance at this beach did not return to normal levels until the beginning of the next week after the opening. Nukoli'i beach was partially reopened on Thursday, September 17th and did not fully reopen until the afternoon of Sunday, September 20th. The primary users of this beach are the guests of the Kauai Outrigger Beach Hotel and the guests of the Aston Kauai Beach Villas. They would have been aware of the beach's reopening so it is likely that the attendance levels at Nukoli'i beach returned to normal fairly quickly.

Fugi beach, often referred to as "Baby Beach", is a favorite location for many families on Kauai because an offshore reef creates a shallow pool where children can safely swim. In addition, many Fugi beach goers believe that Fugi beach is less crowded than other beaches in the area. A majority of those interviewed said that during the period of time that Fugi was closed or oiled they went to Lydgate City Beach Park or Annahola Beach Park, which are approximately 3.5 miles and

6 miles driving distance from Fugi Beach respectively. Some indicated that they took their children to the near by stream or the beach just north of Fugi.

Lydgate City Beach Park is relatively close to Fugi Beach and does have swimming areas for children but was viewed as more crowded by most beach goers interviewed at Fugi Beach. Interviews indicated that Annahola Beach Park is considered as less convenient than Fugi Beach. In addition, most people interviewed at Fugi Beach said that the swimming areas at the two substitute sites were not as well suited for very young children.

Nukoli'i Beach, which is located behind the Outrigger Kauai Beach Hotel and the Aston Kauai Beach Villas, is used primarily by guest at these two hotels. Beach combing and sun bathing are the main activities used by the hotels' guests. According to the manager of the Outrigger, most of their guests use the protective swimming coves at Lydgate and visit Hanalei Bay and possibly Kalapaki Beach when they want to spend the day swimming at the beach. The hotel guests probably did not have substitute sites available to them for most of the visits affected by the beach closure. Morning or evening strolls along the beach as well as short visits to the beach between other activities would have been lost because there was no access to the beach near the hotel.

Although never officially closed to the public, substantial oiling and clean up activities occurred at Kealia Beach and in the Ahukini area. Oiling was also heavy near Kipu Kai. Fishermen and Opihi harvesters would have been precluded from some areas near Ahukini.

3. Methods Used to Quantify Losses

For the two closed beaches, Fugi and Nukoli'i, the number of trips affected by the spill is defined as the difference between the number of recreational trips that would have occurred at these sites in the period following the spill if there had been no oil spill minus the number of recreational

trips that actually did occur following the spill. To estimate the number of people who would normally use Fugi Beach sample counts were taken over several days following the week after the beach reopened.¹ For Nukoli'i beach we relied on information provided by the manager of the Kauai Outrigger Beach Hotel to estimate the number of trips to the beach affected by the spill. See Table A-1 in the appendix for the days, times and number of people counted during each sample count. Generally, more people recreate on weekends than on weekdays. To ensure that the samples represent these differences, sample counts were taken during different times on both weekend days and weekday days at Fugi Beach. With these sample counts, which only cover certain parts of the day, and an estimate of the number of people who come to the beach during other times of the day one can estimate the total number of people who would use the beach during a typical weekend day or weekday day. To determine the total number of weekend or weekday trips affected by the spill one would multiply the estimated number of weekday or weekend beach users by the number of these days that the spill affected the beach.

Fugi Beach

Estimates of a normal weekend day usage were based on counts taken during the following times over a 24 hour period: 11:30 a.m. - 1:00 p.m. on 9/19/98, 3:35 p.m.-4:05 p.m. on 9/19/98 and 6:35 a.m. - 7:05 a.m. on 9/20/98. During these times, 36 individuals were counted using Fugi Beach. Interviews with beach goers indicated that they thought that the recent oil spill and resulting beach closure was still keeping some people away from the beach. Most people interviewed believed that normal beach usage would be two and possibly as much as three times higher. Under these

¹ NOAA and Entrix personnel made the counts cooperatively.

conditions we would have observed between 72 and 108 individuals using the beach. In order to account for the times not counted, we make the conservative assumption that on average one person would enter and leave the beach during each hour not counted. This would add 10 additional individuals to the estimates of beach users on a normal weekend.² Therefore, there would have been between 82 and 118 lost trips to Fugi Beach on the weekend days following the closing because beach usage had not returned to normal, assuming that normal weekend use was between two and three times the level observed soon after the beaches reopened.

Table 1 shows the number of estimated weekend beach days lost prior to the closure because of oiling, during the closure and after the closure. We assume that beach usage returned to normal on Monday, September 22, 1998.

² The visitor turnover rate at Fugi appeared relatively low. People interviewed indicated that most people who came to Fugi beach on weekends stayed a considerable amount of time.

Table 1: Estimated Weekend Lost Visits at Fugi Beach

	Total Number of Individuals Counted at the Beach	Estimated Number of Individuals Using Beach at Non-Sample Times	Estimated Weekend Visits Lost Per Day Before Closure (Sept. 12, 1998)	Estimated Weekend Day Visits Lost Per Day During Closure (Sept. 13, 1998)	Estimated Weekend Visits Lost Per Day After Closure (Sept. 19-20, 1998)	Estimated Total Visits Lost Resulting from the Spill
Assuming Normal Weekend Usage Observed	36	10	46	46	0	92
Assuming Normal Weekend Usage 2 Times Higher than Observed	36	10	82	82	36	236
Assuming Normal Weekend Usage 3 Times Higher than Observed	36	10	118	118	72	380

Estimates of weekday lost use are based on three samples taken on September 22, 1998 and September 23, 1998.³ Two counts, one on September 22, and one on September 23 were taken at the same time of day. If these two counts are averaged and this figure is combined with the third count, one gets a figure of 38 people counted over this one weekday day.⁴ To account for those hours not counted, we make the conservative assumption that on average one person would enter and leave the beach during each 2 hours not counted. This would add 6 additional individuals to the estimates of beach users for a total of 44 beach visitors on a normal weekday day. For the period of time between the beach closure and the time that beach usage returns to normal we assume that half these visits are lost. Table 2 presents the estimates of lost weekday days.

Table 2: Estimated Weekday Lost Visits at Fugi Beach

Estimated Weekday Visits Lost Per Day During Closure (Sept. 14-15, 1998)	Estimated Weekday Visits Lost Per Day After Closure (Sept. 16-18, 1998)	Estimated Total Weekday Visits Lost Resulting from the Spill
44	22	154

We estimate that the number of trips to Fugi Beach affected by the oil spill range from 390 to 550. We believe a reasonable point estimate is approximately 460 visits. This number computed by adding the estimated 154 lost weekday visits to an estimated 308 lost weekend visits, which is the midpoint of our estimated range of lost weekend visits.

³ Counts were taken at other times this same week but poor weather conditions would make estimates of normal beach usage based on these counts unreliable.

⁴ There were 26 people counted on the afternoon of the 22nd and 6 people counted on the 23rd. A large variability in beach visitation makes estimates of the number of beach visits uncertain.

Nukoli'i Beach

Table A-2 in the Appendix shows the number of guests staying at the Outrigger Hotel and the Aston Villas respectively. Estimates of number of beach visits affected by the spill were based on information provided by the managers of the Outrigger Hotel and the Aston Villas. We averaged the number of visitors staying at each hotel during the spill period and then, based on the Outrigger Hotel's visitor survey, assumed that each person would take 1.5 trips to the beach every 3 days. Before determining the average we subtracted out 50 guests from the Outrigger totals starting Monday, September 14, 1998⁵. This is the number of people that we assumed were staying at the hotel for response and assessment purposes. Under these assumptions, we estimate that there were approximately 1,100 trips affected by the spill on the Saturday before the beach was closed and during full closure of the beach. We also estimate that 870 trips were affected by the spill during partial closure of the beach. In addition, based on our observations at Nukoli'i, it is estimated that approximately 50 fishing visits were affected by the spill.

We also had to determine if areas other than the closed beaches were affected by the spill. Although never officially closed to the public, substantial oiling and clean up activities occurred at Kealia Beach and the Ahukini area. The Kipu Kai area was also heavily. Beach goers, surfers, kayakers, fishermen, and boaters from Nawiliwili State Boat Harbor in the south to Anahola City Beach Park in the north were interviewed from September 17, 1998 to September 24, 1998. Based on these interviews it appears that some people who wanted to recreate in areas other than at

⁵ The assumption that 50 people staying at the hotel were associated with response activities is an informal estimate. A request had been made to Mary Jo Kealy that Tesoro provide us with the exact number of people staying at the Outrigger associated with the spill.

officially closed beaches came into contact with oil. In addition to interviewing recreators, managers and employees at several surf and kayak shops were interviewed in the Wailua and Kapa area. They indicated that their businesses were not affected by the spill. Managers of hotels not directly located next to a closed beach said that some of their guests were curious about the spill but there were no known guest complaints and there were no known cancellations as a result of the spill. Based on this information we believe that trying to quantify any recreational losses outside of the two closed beaches would not be cost effective.

4. Value of Recreational Losses

Fugi Beach

As explained above, Fugi Beach provides a unique recreational experience, especially to families with children. Therefore, the spill resulted in loss in consumer surplus because residents recreated at locations that were not their first choice and, therefore, were presumably less attractive to them. Even if the alternative sites were equally attractive, there would be a cost of time and money incurred when traveling to the less convenient location, which also results in a loss of consumer's surplus.

Table 3 presents some of the existing literature on consumer's surplus for general beach recreation. The first seven rows show the studies relied upon by the Department of Interior in developing its regulations for Type A Damage. Based on these studies, the Department of Interior recommends that a generic day of beach recreation in the United States be valued at about \$14.05 per trip in January 1999 dollars. This figure is a national average. Obviously, for different people,

different beaches are better than others; some beaches will generate a consumer's surplus above average and others will generate a consumer's surplus below average.

The beaches affected by the Tesoro oil spill are probably better than an average beach in the mainland United States, and the consumer's surplus for these beaches is higher than the generic consumer's surplus for beach recreation in the United States. The entire consumer's surplus resulting from a beach recreation trip was not lost however, because there were close by alternative beaches for residents to use. As mentioned previously, these alternative beaches were less desirable than Fugi beach and located further away from some of the recreators. Therefore, due to the less desirable recreation experience and additional travel costs, we estimate that the loss of consumer's surplus per affected trip to be near 1/3 of the consumer's surplus used by the DOI as a national average. This would make the estimated loss of consumer's surplus per trip approximately equal to \$5.

General Beach Recreation: Value of a Beach Day (January 1999 \$)			
Authors	Date of Study	State	Value
Curtis & Shows	1982	FL	\$3.84
Curtis & Shows	1984	FL	\$7.32
Dornbush et al.	1986	CA	\$10.39
Tyrrell	1982	RI	\$15.57
Bell and Leeworthy	1986	FL	\$16.96
Meta Systems, Inc.	1985	MA	\$17.38
Leeworthy and Wiley	1991	NJ	\$26.90
Kouru	1993	MA	\$20.54
Hanemann	1997	CA	\$13.83-\$50.28

Nukoli'i Beach

Nukoli'i Beach, which is located behind the Outrigger Kauai Beach Hotel and the Aston Kauai Beach Villas, is used primarily by guest at these two hotels. As stated earlier, the reefs in front of this beach and the strong tides in the area do not make this a safe place to swim. Beach combing and sun bathing are the main activities used by the hotels' guests. The hotel guests probably did not have substitute sites available to them for most of the visits affected by the beach closure. Morning or evening strolls along the beach as well as short visits to the beach between other activities would have been lost because there was no access to the beach near the hotel. The value of a generic day of beach recreation used by the DOI includes several types of general beach activity: swimming, wading, picnicking, walking, beach combing and other beach related activities. The value of each specific activity would be either higher or lower than the average value of all these activities. We estimate that the specific value of short walks and beach combing to be roughly 1/3 the value of the national value for a generic beach day, which includes several different beach related activities. The loss of consumer's surplus for tourists at Nukoli'i Beach would equal \$5 per trip. We estimate that *the lost value per trip during the partial closing of Nukoli'i Beach is equal to \$2.50.* Although hotel guests could use part of the beach at this time, the closed area was nearest the hotel and included the some of the widest beachfront on Nukoli'i. Therefore, during the partial closing the tourists' beach experience was still diminished.

Residents of Kauai have access to the beach and primarily use the south end of the beach for fishing or family outings that include fishing and picnicking. Interviews with several fishermen indicated that there were substitute sights available to them. The estimates of the loss associated with a fishing site closure range widely. Those studies that consider very small site closings, which leave

many possible substitute sights, estimate relatively small losses in the range of \$1.97 to \$7.77 (Freeman, 1995)⁶. Therefore, we believe that a reasonable estimate of the fishing loss resulting from the closing of Nukoli'i would be in the range of \$2.00 per trip.

5. Conclusions

Based on estimates of the number of recreation trips affected by the spill and estimates of the value of these trips, we believe that the value of recreational losses resulting from the spill is approximately \$10,000. Table 4 presents a summary of the estimated recreation losses at Fugi and Nukoli'i beach.

⁶ These studies included fishing from boats and include sites larger than under consideration at Nukoli'i Beach, which would tend to raise the value of a lost trip.

Table 4: Recreational Losses

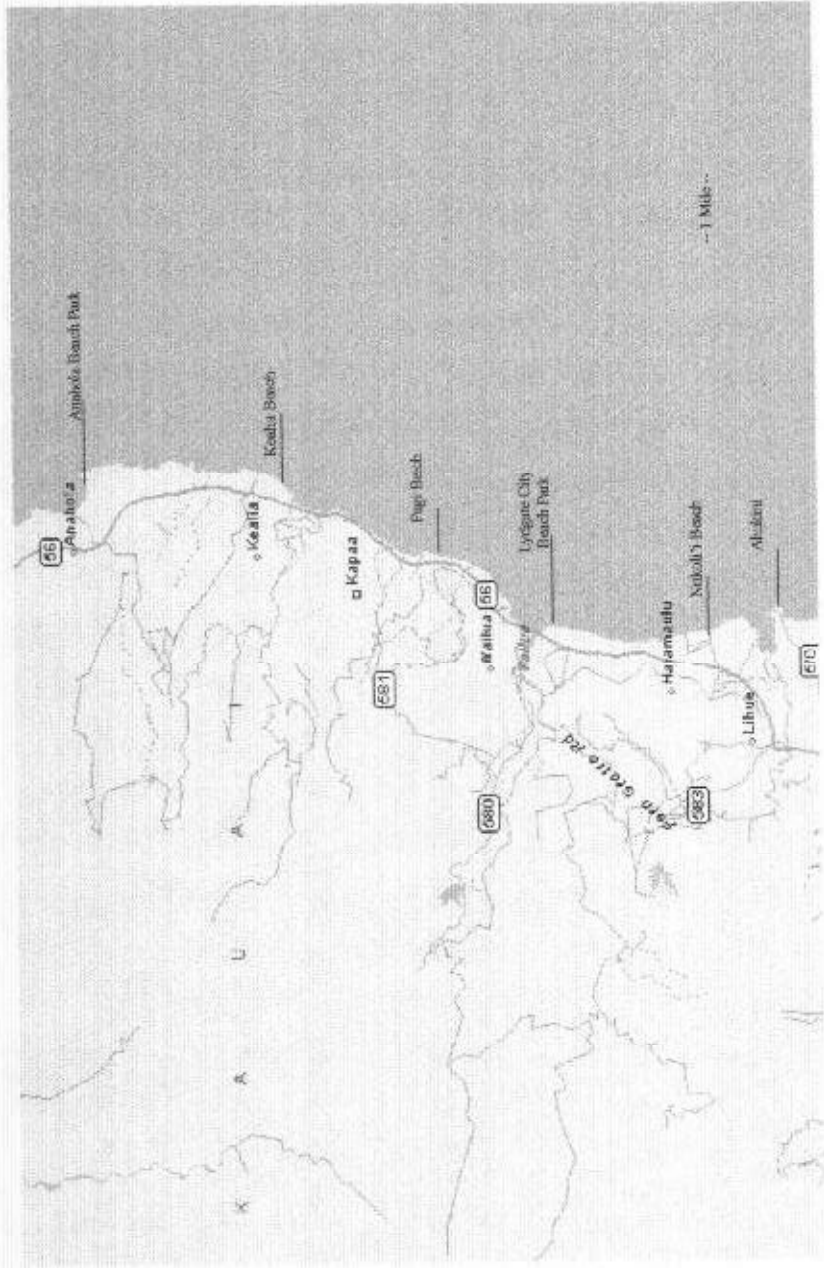
	Estimated Number of Trips Affected	Estimated Loss Per Trip	Estimated Total Recreational Losses
Fugi Beach	460 (390-550)*	\$5.00	\$2,300 (\$1,950-\$2,750)
Nukoli'i Beach Pre-Closure and Full Closure Hotel Guests	1,100	\$5.00	\$5,500
Nukoli'i Beach Partial Closure Hotel Guests	870	\$2.50	\$2,175
Nukoli'i Beach Full Closure Kauai Residents (Fishermen)	50	\$2.00	\$100
Total For Both Beaches			\$10,075 (\$9,725-\$10,525)

* This range represents the difference between a normal weekend beach use equal to twice the observed level and a normal weekend use equal to three times the observed level.

REFERENCES

- Bell, F. W. and V. R. Leeworthy (1986). *An Economic Analysis of the Importance of Saltwater Beaches in Florida*. Florida State University, Department of Economics, Tallahassee, FL, Florida Sea Grant College, Report Number 82, Sea Grant Project No. R/C-P-12.
- Curtis, T. D. and E. W. Shows (1982). *Economic and Social Benefits of Artificial Beach Nourishment Civil Works at Delray Beach*. Prepared for Florida Department of Natural Resources, Division of Beaches and Shores. Sea Grant, Department of Economics, University of South Florida.
- Curtis, T. D. and E. W. Shows (1984). *A Comparative Study of Social Economic Benefits of Dornbush, D. and et al. (1991). OCS Impacts on California Coastal Recreation, Volume 3: Detailed Methodology*. Prepared for the U.S. Department of the Interior, Minerals Management Service. Los Angeles, CA.
- Dornbush, D. et al. (1991). *OCS Impacts on California Coastal Recreation, Volume 3: Detailed Methodology*. Prepared for the U.S. Department of the Interior, Minerals Management Service. Los Angeles, CA.
- Freeman, A.M. (1995). "The Benefits of Water Quality Improvements for Marine Recreation: A Review of the Empirical Evidence." *Marine Resource Economics* 10: 385-405.
- Hanemann, W. M. (1997). *Final Conclusions of Professor Michael Hanemann Regarding Lost Recreational Damages Resulting From the American Trader Oil Spill*. August 15.
- Kaoru, Y. (1993). "Discrete-Choice Contingent Valuation of Beach Recreation Benefits for Tourists and Local Residents." Marine Policy Center, Woods Hole Oceanographic Institution Contribution No. 8500, September 23.
- Leeworthy, V. R. and P.C. Wiley (1991). *Recreational Use Value for Island Beach State Park*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Ocean Resource Conservation and Assessment, Strategic Environmental Assessments Division. Rockville, MD.
- Meta Systems, Inc. (1985). *A Methodological Approach to an Economic Analysis of the Beneficial Outcomes of Water Quality Improvements from Sewage Treatment Plant Upgrading and Combined Sewer Overflow Controls*. Prepared for the U.S. Environmental Protection Agency, Office of Policy Analysis, Washington, D.C.
- Tyrrell, T. J. (1982). "Estimating the Demand for Public Recreation Areas: A Combined Travel Cost - Hypothetical Valuation Approach." Working Paper No. 11. University of Rhode Island, Department of Resource Economics, Kingston, RI.

Figure 2
Eastern Kauai, Hawaii



Appendix A: Beach Counts and Hotel Guest Information

Table A-1: Beach Counts

Person(s) Counting	Beach	Day	Day of Week	Time In	Time Out	Type	Adults Present	Children Present	Total Present	Adults Entered	Children Entered	Total Entered	Total
CC	Fugi	9/17/98	4	AM		Swim	2	0	2	0	0	0	2
CC	Fugi	9/18/98	5	4:00 PM	4:05 PM		0	0	0	0	0	0	0

CC&MJK	Fugi	9/19/98	6	1:30 AM	1:00 PM	Swim	1	0	1	11	18	29	30

CC&MJK	Fugi	9/19/98	6	3:35 PM	4:05 PM	Swim	2	1	3	0	0	0	3

CC	Fugi	9/20/98	7	6:35 AM	7:05 AM	Swim	1	0	1	2	0	2	3
CC&MJK	Fugi	9/21/98	1	1:00 PM	1:15 PM	Swim	2	6	8	0	0	0	8

CC	Fugi	9/22/98	2	12:25 PM	12:55 PM	Swim	13	7	20	5	0	6	26

CC	Fugi	9/22/98	2	3:15 PM	3:45 PM	Swim	12	2	14	4	3	7	21

MJK	Fugi	9/23/98	3	1:00 PM	1:15 PM	Swim	4	2	6				6

MJK	Fugi	9/23/98	3	1:00 PM	1:15 PM	Fish	2	0	2				2

CC	Nukoli'i	9/17/98	4	AM			0	0	0	0	0	0	0
CC	Nukoli'i	9/18/98	5	5:43 AM			0	0	0	0	0	0	0
CC	Nukoli'i	9/18/98	5	2:30 PM	2:45 PM	Swim	5	0	5	0	0	0	5
MJK	Nukoli'i	9/19/98	6	6:00 AM	7:00 AM	Fish	5	1	6				6
CC	Nukoli'i	9/19/98	6	7:13 AM	7:25 AM	Fish	2	1	3	0	0	0	3
CC&MJK	Nukoli'i	9/19/98	6	2:42 PM	3:12 PM	Fish	2	0	2	0	0	0	2
CC&MJK	Nukoli'i	9/19/98	6	2:42 PM	3:12 PM	Swim	5	0	5	0	0	0	5
CC&MJK	Nukoli'i	9/20/98	7	1:05 PM	1:35 PM	Swim	7	0	7	3	0	3	10
MJK	Nukoli'i	9/22/98	2	6:00 AM	7:15 AM	Fish	4	0	4				4
MJK	Nukoli'i	9/22/98	2	6:00 AM	7:15 AM	Swim	10	0	10				10
MJK	Nukoli'i	9/23/98	3	6:30 AM	7:30 AM	Fish	0	0	0				0
MJK	Nukoli'i	9/23/98	3	6:30 AM	7:30 AM	Swim	6	0	6				6
MJK	Nukoli'i	9/24/98	4	7:15 AM	8:45 AM	Fish	0	0	0				0
MJK	Nukoli'i	9/24/98	4	7:15 AM	8:45 AM	Swim	8	0	8				8

**** Counts used to estimate Fugi Beach visits (other days affected by poor weather or too soon after opening)

Type indicates type of activity observed: Swim = General Beach Activity; Fish = fishing

CC - Curtis Carlson

MJK - Mary Jo Kealy

Table A-2: Hotel Guest Not Related to Spill

Date	9/10/98	9/11/98	9/12/98	9/13/98	9/14/98	9/15/98	9/16/98	9/17/98	9/18/98	9/19/98	9/20/98
Outrigger	456	417	486	468	486	508	519	452	-	-	-
Aston	268	284	289	250	249	276	280	334	338	338	287