Monitoring Recreational Use in the Eastern Lake Ontario Dune and Wetland Area

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INTRODUCTION

The Eastern Lake Ontario Dune and Wetland Area (ELODWA) is a 17-mile stretch of sand dunes and shoreline comprised of both public and private lands on the eastern coast of Lake Ontario in New York State (Figure 1). Visitors to the ELODWA include boaters who land or anchor their crafts at one of the four management areas, beach users who participate in activities such as swimming and birdwatching, and owners of nearby private properties.

The sand dunes in the ELODWA experience significant erosion, primarily caused by visitor foot traffic across the dunes that kills dune vegetation and enables coastal winds to erode sand. Because of the high impact of visitors on the health and stability of the sand dunes, recreational use data has been collected for public-use areas in the ELODWA from 1988 to 1990, and 1995 to 2002. Differences in the methodology used to collect the data as well as in the types of data collected exist between years. In order to identify important trends in visitor use and activities, and develop effective management strategies to protect this fragile coastal ecosystem, an analysis of existing data is needed. Establishing a data collection protocol for obtaining future recreational use data is necessary for collecting comparable data that can be used for future visitor management.

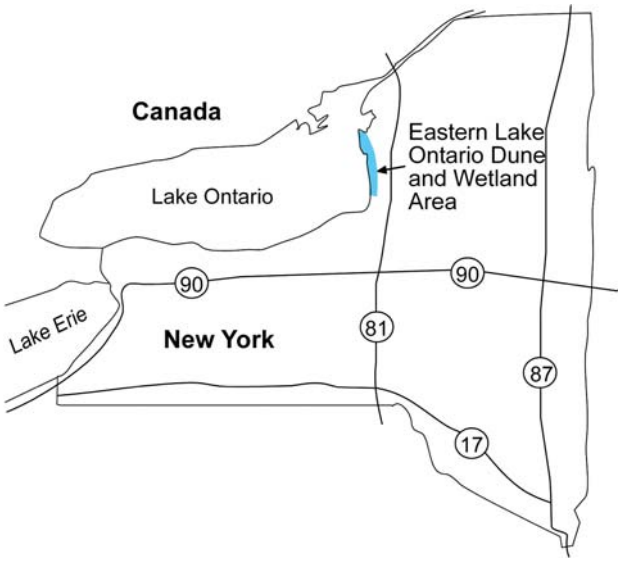

Figure 1. A map of New York State showing the Eastern Lake Ontario Dune and Wetland Area.

This report outlines a data collection protocol for the ELODWA. The focus of the study is on the shoreline/dune areas in the ELODWA and not on wetland or forest habitats. The tremendous impacts caused by visitor use on shoreline and dune sections of ELODWA make this focus necessary. In addition, only summertime and daytime use have been studied because of staffing limitations (i.e., dune stewards are on duty from 11 AM to 5:00 PM five days per week during the summer months).

The objectives of this study are as follows:
1. To identify existing relationships between recreational use and factors such as weather and day of the week (i.e., weekend day or weekday).
2. To estimate total visitor use of the ELODWA and use of each management area within the ELODWA.
3. To identify trends in use patterns for each of the management areas within the ELODWA and the ELODWA as a whole.
4. To identify trends in illegal activities or violations by visitors.
5. To establish a protocol (i.e., data collection sheets, sampling framework, database spread sheet) for collecting future recreational use data for the ELODWA.

METHODS

In May 2003, an assessment of visitor access points was conducted for each public area within the ELODWA (Figure 2). At the same time, existing data for 1988 to 1990 and 1995 to 2002 were entered into a statistical computer program by a graduate student at the State University of New York College of Environmental Science and Forestry. Because of differences in data collection methodologies between 1988 and 2002, data was assessed first for similarities and differences between years. Differences, such as the use of transects in some years and the use of observational counts of varying lengths of time in others, were noted. Inconsistencies were also identified between where data were collected in the ELODWA and the time of day during which data were collected (i.e., morning versus afternoon). Consistent visitor count methodologies were used from 2000 to 2002, enabling the development of a protocol that could be used to predict total visitor use in those years as well as in 2003. Differences in data collection methods used prior to 2000 made it impossible to use these data for trend analysis.

In May 2003, the decision was made to use an indirect count method. This method uses "spot counts" (i.e., counts of visitors made from a single location during a 5-minute time interval) to calculate total visitor counts. Regression analysis is used to identify the relationship between the

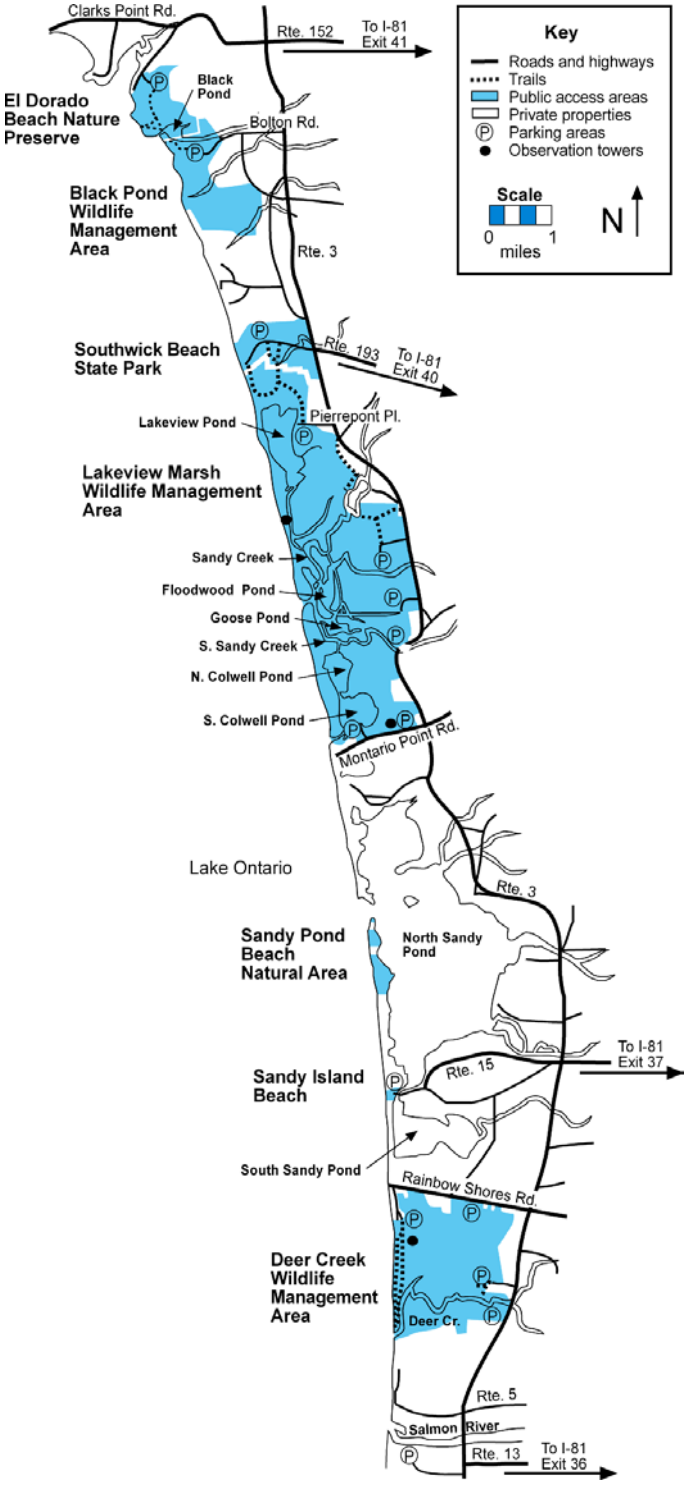

Figure 2. A map of the ELODWA and its public access areas.

spot and total counts. The regression analysis produces an equation that spot count data is plugged into. The output of the equation is the estimated total count. The benefit of using this method is that spot count data collected in previous years could be used to estimate total visitor use for those years. However, in order to calculate the regression equations, *both* a total count and a spot count needed to be collected on randomly-chosen days in 2003. One weekend day and one weekday were chosen randomly for each week during the summer of 2003 as "full count/spot count" days. Because of the time that was needed to assess existing data and identify this protocol, full count days were not implemented until mid July 2003. This data collection process was repeated during the summer of 2004 in order to obtain data from Memorial Day through Labor Day.

In addition to the selection of sampling days, differences in visitor use throughout the ELODWA made it necessary to break down data collection by use "zones." Most use zones typically have one major access point such as a dune walkover or beach access from neighboring private properties, and one observation point at which data have been consistently collected since 2000. Additional zones not used in the 2003 data collection process were identified as important to include in 2004 data collection efforts.

In 2003, the exact observation point within most zones was identified using a GPS unit and, in most cases, marked with orange spray paint (where appropriate). Spray paint was also used to mark the ends of the area to be viewed from each observation point (i.e., 250 feet on both sides of the observation point). Spray paint was *not* used in those areas where it would be seen as an aesthetic intrusion to visitors (e.g., on the walkovers), but was utilized along string fencing and snow fencing where it was unobtrusive. The ends of some zones were permanently marked in 2004; others will need to be marked in 2005.

The breakdown of zones and their corresponding observation points by management area is as follows:

- Sandy Pond Natural Area. Three zones as follows (see Figure 3):
  - SP1: southern end of area on Lake Ontario (observation point near dead tree and marked by GPS only).
  - SP2: middle of area including Sandy Pond side of spit (observation point at lakeside end of dune walkover).
  - SP3: northern end of spit including bird sanctuary and Sandy Pond side of spit (observation point at lakeside end of dune walkthrough).

- Deer Creek Wildlife Management Area. Two zones as follows (see Figure 4):
  - DC1: southern end of area near Deer Creek outlet (observation point at outlet).
  - DC2: northern end of area (observation point at lakeside end of walkover).

- Black Pond Wildlife Management Area. One zone only (see Figure 5):
  - BP1: Northern end of Black Pond WMA to the southern end of Eldorado near the Black Pond outlet (observation point at lakeside end of walkover in Black Pond WMA).

- Lakeview Wildlife Management Area. Three zones as follows (see Figure 6):
  - LV1: south end of Lakeview near outlet of South Colwell Pond. (Because of staffing and access limitations, data were not collected at LV1 from 2000 to 2003. It is recommended that the observation point be located on the northern side of the outlet.)
  - LV2: South and north sides of the Sandy Creek outlet. (This zone was identified as zone 2a from 2000 to 2003.) The observation point for zone 2 is located on the south side of the outlet. Visitor counts for the visible portion of the north side of the outlet are included in this zone.
  - LV3: Northern border of Lakeview south. (Because of staffing limitations, data were not collected at LV3 from 2000 to 2003. Data collection in this zone began in 2004.)

In addition to data collection in each zone, total visitor counts were collected at the entrance booths at Southwick Beach and Sandy Island Beach State Parks for 2000 to 2004.

In 2003 and 2004, spot count data were collected by Dune Stewards five days per week (i.e., those days on which they were scheduled to work), including those days during which full count data were collected. The stewards were instructed to count all visitors seen within 250 feet on each side of each observation point for a 5-minute length of time. Spot counts were collected between 11:00 am and noon, and between 3:00 and 4:00 pm each day. Prior to 2003, spot counts were collected either in the morning *or* in the afternoon, depending on the area. Beginning in July 2003, morning *and* afternoon spot counts were collected in order to determine if the best predictor of the total number of visitors is a single spot count or the double spot count.

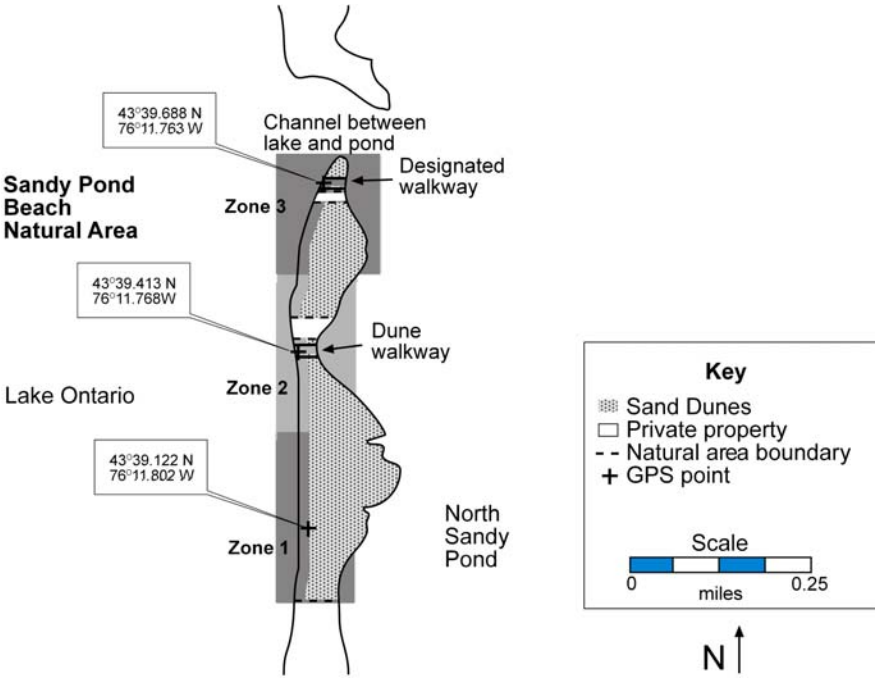

Figure 3. A map of the zones within the Sandy Pond Beach Natural Area.

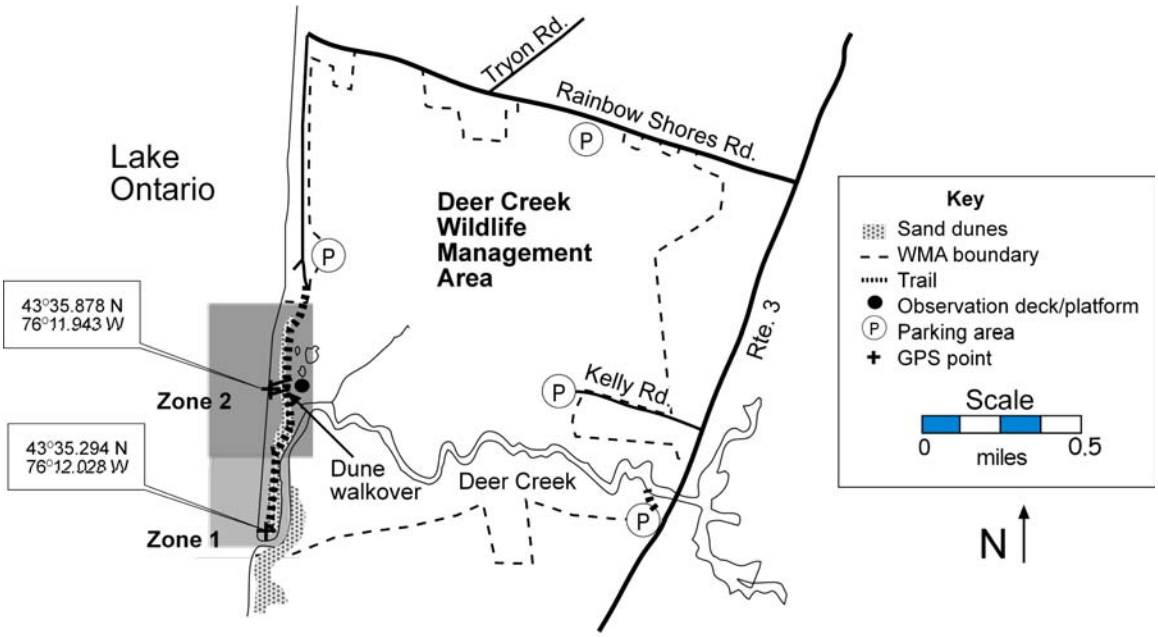

Figure 4. A map of the zones within the Deer Creek Wildlife Management Area.

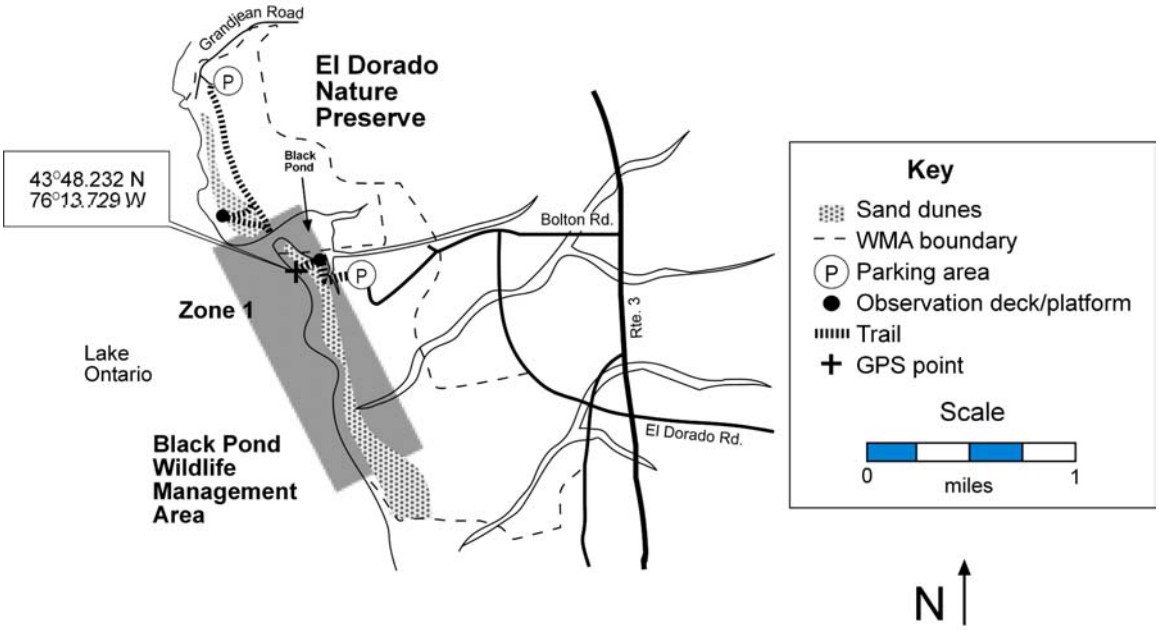

Figure 5. A map of the zones within the Black Pond Wildlife Management Area.

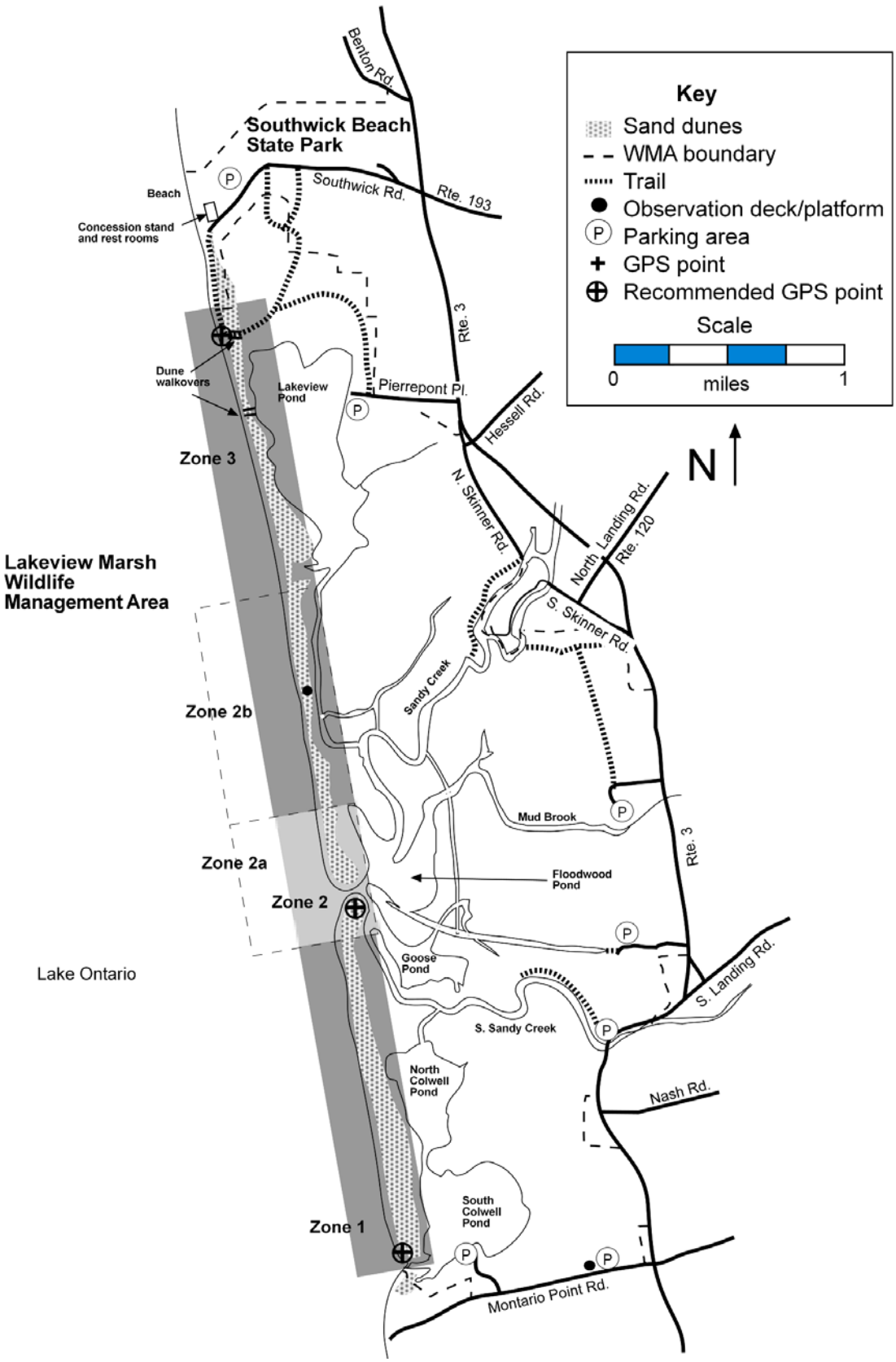

Figure 6. A map of the zones within the Lakeview Wildlife Management Area.

Full count data were collected by Dune Stewards on randomly-selected weekend and weekday days in 2003 and 2004 between the hours of 11:00 am and 4:30 pm. Stewards counted all visitors who entered each public area, taking careful notes of visitors' appearances in order to prevent double counts. Spot counts were conducted on full count days as well. In addition, in 2003, full count data were collected in Lakeview's zone 3 on two randomly chosen days (one weekend day and one weekday) in order to obtain a rough estimate of the percentage of visitors accessing Lakeview from Southwick Beach.

As spot and full counts were tabulated, other data were collected as well. These data were identical to data collected in previous years and included:
1. cloud cover (overcast/rainy; partially cloudy; clear sky);
2. day of the week (i.e., weekday, weekend);
3. surf conditions (rough; moderate (choppy); calm);
4. air temperature (>80 degrees; 70-80; <70);
5. number of violations; and
6. visitor activities (collected during spot counts only).

2003 and 2004 data from spot and full counts were tabulated in EXCEL and later converted to SPSS. Maximum daily temperature and daily precipitation data for the Oswego weather station were obtained from the National Oceanic and Atmospheric Administration for each day between the Friday of Memorial Day weekend and Labor Day, and were added to the SPSS spreadsheets. The numerical day of the year was included as well.

A regression analysis was used to identify the relationship between the weather and spot count data, and the total count data. This type of analysis produces an equation that can be used to calculate total counts in the future, simply by plugging in the weather and spot count data. "Total count" was identified as the dependent variable in the regression analysis, while spot count, day of the week, cloud cover, surf conditions, temperature, and precipitation were used as independent variables. Independent variables not found to be statistically significant ($p \leq 0.05$) were removed from the equations.

In order to estimate total counts for those days on which total count data were not collected, spot count data were plugged into the regression equations. Averages of these estimated total counts were then calculated separately for weekend days and weekdays. These averages were used as the estimated total counts on those days on which the Dune Stewards did not work (i.e., their days off).

Daily visitor use estimates were summed to obtain an estimate of total summertime and daytime visitor use. Regression equations calculated for 2003 were then used to estimate total daily visitor use in each zone within each public area for past years (i.e., 2000 to 2002). Equations calculated for 2004 were used to estimate total visitor use in 2004. Daily visitor use estimates were summed for these years to obtain an estimate of total summertime/daytime visitor use. Graphs were created to highlight trends in estimated visitor use. Correlations between daily visitor use data and number of observed violations in each zone were calculated.

RESULTS AND DISCUSSION

Regression Equations

The regression equations initially tested included all independent variables shown below. The initial regression formula used for each zone was:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5$$

Where:
Y = Total number of visitors counted during full count
X_1 = Number of visitors counted during spot count
X_2 = Cloud cover (rainy/overcast = 1; partly cloudy = 2; full sun = 3)
X_3 = Day of the week (weekday = 1; weekend = 2)
X_4 = Surf conditions (strong = 1; moderate = 2; calm = 3)
X_5 = Maximum daily air temperature (^oF)
a = Intercept on the Y axis
b_1 to b_5 = Parameter estimates for each variable

The initial equations for 2003 were run using four different forms of the spot count data: one utilizing AM spot count data (i.e., data collected between 11 AM and noon), one PM spot count data (i.e., data collected between 3 and 4 pm), one the average of the two spot counts, and one the total of the two spot counts. The spot count data found to be most significant in determining the total count was the average spot count. Because of this, it is highly recommended that all data collection in the ELODWA in the future include both AM and PM spot counts so that an average spot count can be calculated. The average spot counts were used in the 2004 regression equations. Other variables were found to significantly influence total count as well (e.g., DAYWEEK, SUN, DAYYEAR).

The final regression equations calculated for 2003 and 2004 are below (Tables 1 and 2). It is recommended that the equations for 2004 be used during the next two years for estimating total visitor counts, and that new equations be calculated in 2007. The equations using the AM or PM spot counts were used to calculate estimates for 2000 to 2002 since only one spot count was collected daily in these years. (Note: The areas using an AM spot count in the past have a regression based on the AM spot counts in 2003, while those areas using a PM spot count in previous years have regression equations that use the 2003 PM spot count data.)

The variables in each of the regression equations in Tables 1 and 2 are as follows:

- TOTCOUNT = total count of visitors in sample point zone on a specific day
- AVGSPOT = average of morning and afternoon spot counts for a specific day
- DAYWEEK = Day of the week (weekend = 2; weekday = 1)
- DAYYEAR = Numerical day of the year (i.e., 1 to 365)
- PMSPOT = afternoon spot count used
- AMSPOT = morning spot count used
- SUN = Sky conditions (1 = rain/overcast; 2 = partly cloudy; 3 = full sun)
- TEMPMAX = Daily maximum air temperature from Oswego weather station

Table 1. Equations used to calculate visitor estimates for 2000 to 2003.

Area	Zone	Regression equation	R^2	Significance of F
Sandy Pond Beach	SP1	TOTCOUNT = -11.775 + 3.954 (AMSPOT) + 22.630 (DAYWEEK)	0.841	0.025
	SP2	TOTCOUNT = -84.174 + 0.989 (AMSPOT) + 165.070 (DAYWEEK)	0.914	0.007
	SP3	TOTCOUNT = -37.5 + 3.315 (AMSPOT) + 63.815 (DAYWEEK)	0.883	0.040
Deer Creek	DC1	TOTCOUNT = 2.346 + 1.244 (PMSPOT) + 12.481 (DAYWEEK)	0.868	0.002
	DC2	TOTCOUNT = 0.869 + 1.326 (PMSPOT) + 6.150 (DAYWEEK)	0.904	0.001
Black Pond	BP1	TOTCOUNT = -101.121 + 2.098 (AMSPOT) + 60.717 (SUN)	0.755	0.030
Lakeview	LV1	Data not collected for this zone prior to 2004.		
	LV2a	Regression equation not significant.		
	LV2b	TOTCOUNT = -7.256 + 1.147 (AMSPOT) + 15.323 (DAYWEEK)	0.812	0.007
	LV3	Data not collected for this zone prior to 2004.		

Table 2. Equations from summer, 2004, to be used for future visitor estimates.

Area	Zone	Regression equation	R^2	Significance of F
Sandy Pond Beach	SP1	TOTCOUNT = -115.234 + 2.495 (AVGSPOT) + 0.691 (DAYYEAR)	0.879	0.0001
	SP2	TOTCOUNT = 31.649+ 2.732 (AVGSPOT)	0.928	0.0001
	SP3	TOTCOUNT = -39.836 + 1.999 (AVGSPOT) + 56.947 (DAYWEEK)	0.894	0.0001
Deer Creek	DC1	TOTCOUNT = 7.323 + 4.115 (AVGSPOT)	0.930	0.0001
	DC2	TOTCOUNT = -80.795 + 2.348 (AVGSPOT) + 1.312 (TEMPMAX)	0.659	0.0001
Black Pond	BP1	TOTCOUNT = -154.33 + 3.732 (AVGSPOT) + 2.807 (TEMPMAX)	0.878	0.0001
Lakeview	LV1	TOTCOUNT = -17.496 + 5.245 (AVGSPOT) + 24.301 (DAYWEEK)	0.865	0.0001
	LV2 & 3[a]	TOTCOUNT = -21.06 + 1.465 (AVGSPOT) + 48.304 (DAYWEEK)	0.595	0.0001

[a] Full count data for zones 2 and 3 in Lakeview WMA were accidentally combined during data collection in 2004. Equations for these zones should be recalculated in 2005.

While the regression equations for most areas are significant for 2003, problems occurred in data collection and analysis of this year that made the collection of full count data in the summer of 2004 necessary. Concerns over 2003 data include:

- Data were collected only from mid July through the end of August in 2003 because of the time needed to assess visitor access to the ELODWA and data from previous years, and to identify a suitable data collection protocol.

- For Lakeview, spot count data were not collected on the full count days in 2003. Because of this, observational data collected between 11 am and noon on full count days was used in place of AM spot count data; adequate data could not be identified to replace the missing PM spot count data. A significant regression formula using the AM counts was calculated for zone 2b in Lakeview; a significant formula could not be calculated for zone 2a. Because of this, spot count data for zone 2a were used to represent total daily use on spot count-only days, likely yielding a very conservative estimate of use in this zone.

- Data were not collected for zones 1 and 3 in Lakeview in 2003 because of staff and access limitations. The total estimated use of Lakeview in 2003 is likely to be much lower than that actually occurring in the area because of these problems. Results for Lakeview for 2000 to 2003 should be used only as an indication of trends in use, not as accurate estimates of use.

While the above concerns were corrected in 2004, one additional problem developed. Specifically, the total count data for Lakeview zones 2 and 3 were mistakenly combined by a Dune Steward. It is recommended that full counts be conducted in 2005 for Lakeview in order to obtain separate data for each zone. The Lakeview zone 3 estimate should be removed from the total ELODWA visitor use estimate because of an overlap in use between Southwick Beach State Park and Lakeview zone 3.

TRENDS IN VISITOR USE OF ELODWA

Visitor use in ELODWA

Trends in visitor use are shown in Figures 7 to 13.

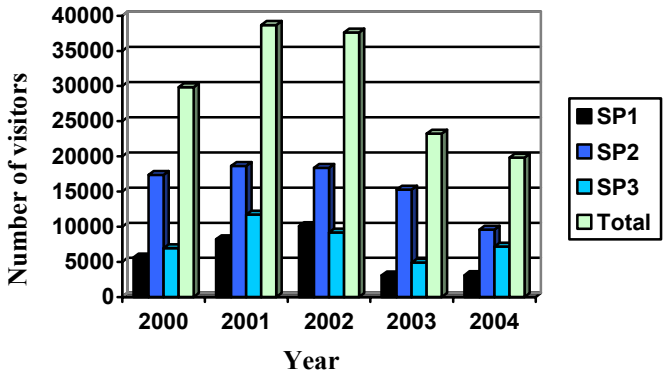

Figure 7. Estimated visitor use in the Sandy Pond Beach Natural Area, 2000-2004. Estimates are provided for each zone as well as the total area (summers only).

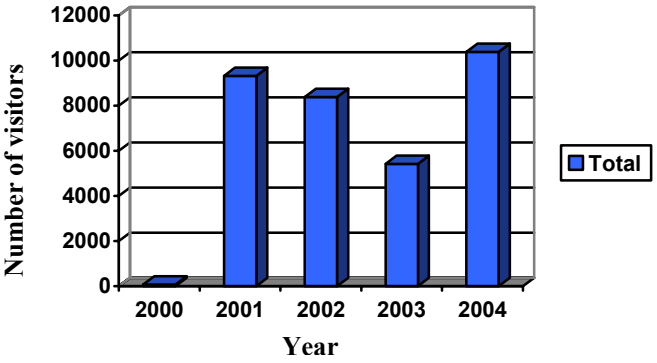

Figure 8. Estimated visitor use in the Black Pond Wildlife Management Area, 2000-2004 (summers only).

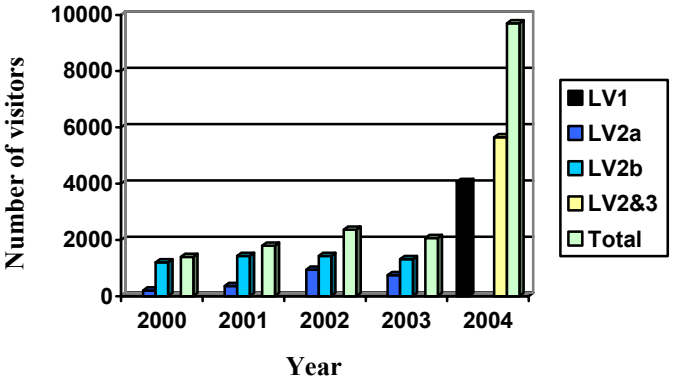

Figure 9. Estimated visitor use trends in the Lakeview Wildlife Management Area (zones 2a and 2b only), 2000-2004 (summers only).

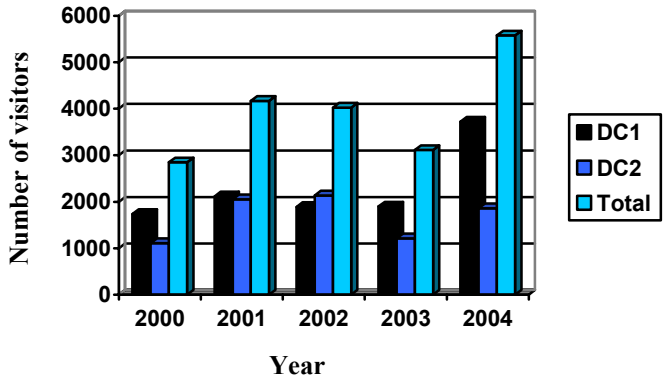

Figure 10. Estimated visitor use in the Deer Creek Wildlife Management Area, 2000-2004 (summers only).

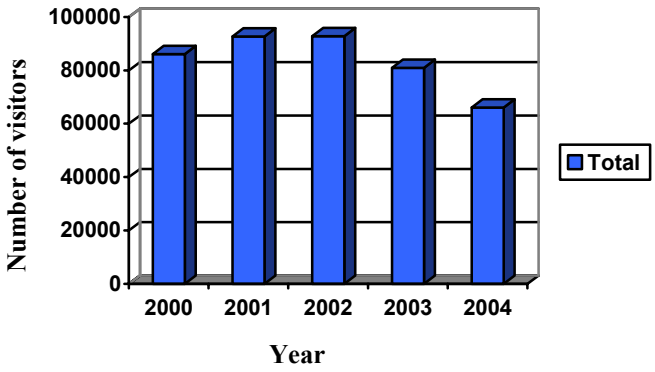

Figure 11. Estimated visitor use in Southwick Beach State Park, 2000-2004 (summers only).

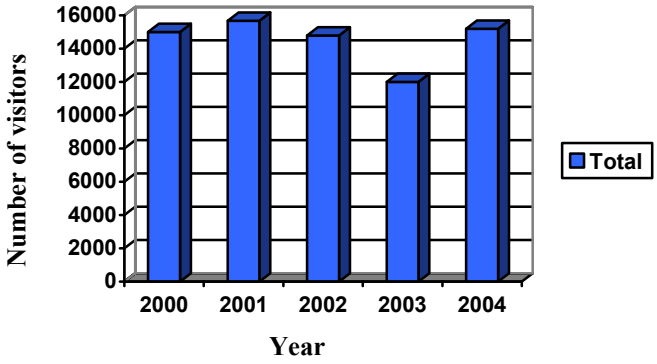

Figure 12. Estimated visitor use at Sandy Island Beach, 2000-2004 (summers only).

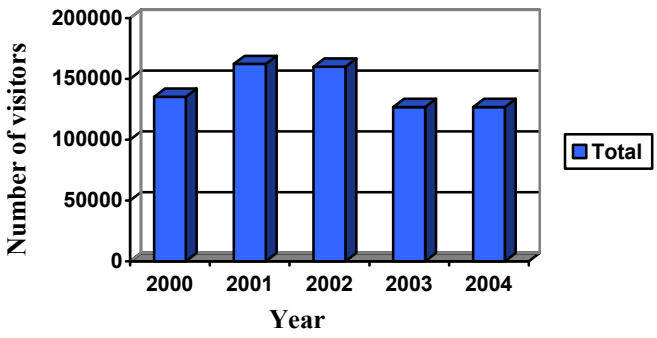

Figure 13. Total estimated visitor use in the ELODWA, 2000-2004 (summers only).

Overall, use of public areas in the ELODWA showed a decline in 2003 over previous years (Figure 13 and Table 3). The cold, wet beginning of the 2003 summer season is likely partially responsible for this decline. Comparisons between the 2000-2003 time period and 2004 for the ELODWA area are difficult to make because of the addition of two data collection zones (i.e., zones 1 and 3) in the Lakeview WMA in 2004.

Areas receiving the highest use between 2000 and 2004 were Southwick Beach, Sandy Pond Beach Natural Area, and Sandy Island Beach. Visitor use at Black Pond showed a large increase between 2000 and 2001 because of the addition of a boardwalk access trail to the area in 2001. The estimates for Lakeview for 2000 through 2003 are likely much lower than the levels of actual use that occurred during these years because of the lack of data for zones 1 and 3 (data for these zones were collected in 2004).

In 2003, a full count of visitors in zone 3 of Lakeview (i.e., the north end of the management area) on two randomly chosen days was conducted in order to identify how visitors are accessing the zone 3 area. On these two days, an average of 13.21% of Southwick visitors walked to Lakeview from Southwick. Because of this overlap in users between Southwick Beach and Lakeview, it is highly recommended that, in 2005, zone 3 estimates be removed from total visitor estimates for ELODWA. It was not possible to remove the zone 3 estimate from the total ELODWA estimate in 2004 since the zone 2 data were not collected separately from zone 3 data during this year.

Table 3. Total visitor use estimates for management areas in the ELODWA.

Year	Black Pond	Lakeview[a]	Lakeview[b]	Southwick	Sandy Pond	Sandy Island	Deer Creek	Total ELODWA[c]
2000	64	1,393	NA	86,084	29,864	14,994	2,849	135,248
2001	9,325	1,790	NA	92,723	38,557	15,664	4,168	162,227
2002	8,378	2,363	NA	92,830	37,616	14,785	4,024	159,996
2003	5,415	2,061	NA	80,896	23,247	12,001	3,110	126,730
2004	10,385	NA	9,703	66,095	19,825	15,185	5,576	126,769

[a]Estimates are for Lakeview zones 2a and 2b only from 2000 through 2003.
[b]Estimate is for Lakeview zones 1, 2, and 3 in 2004.
[c]The 2004 total for ELODWA includes data for Lakeview zone 3. It is recommended that zone 3 be removed from total ELODWA use estimates in the future due to overlap between zone 3 users and Southwick Beach users.

Violations in ELODWA

The total number of violations observed by Dune Stewards for each day were tallied throughout the summers of 2000 through 2004. Correlations between these numbers and total estimated visitor use per day were calculated, but were not statistically significant. In other words, a high number of violations were not necessarily experienced on days of high visitor use or in locations having high visitor use. However, when violations are examined for each individual public area, higher numbers of violations are shown in some areas than in others. For example, violations at Lakeview and Black Pond/Eldorado are higher on average per day than at Deer Creek and Sandy Pond Beach (Figure 14). Violations are likely occurring when Dune Stewards are not on duty (e.g., night time) and in areas that Dune Stewards can not easily monitor. Black Pond's moderately high number of violations per day appears to be decreasing somewhat, a trend that is likely to continue over the next several years as visitors become accustomed to having a Dune Steward present on this site (easy visitor access to this site was first opened in 2001). Lakeview, however, appears to have a relatively high average number of daily violations each year, indicating that additional dune steward efforts may be needed. In addition, careful monitoring of violations in Sandy Pond and Deer Creek will be needed over the next several years in order to prevent further increases in the average number of violations (as observed in 2004).

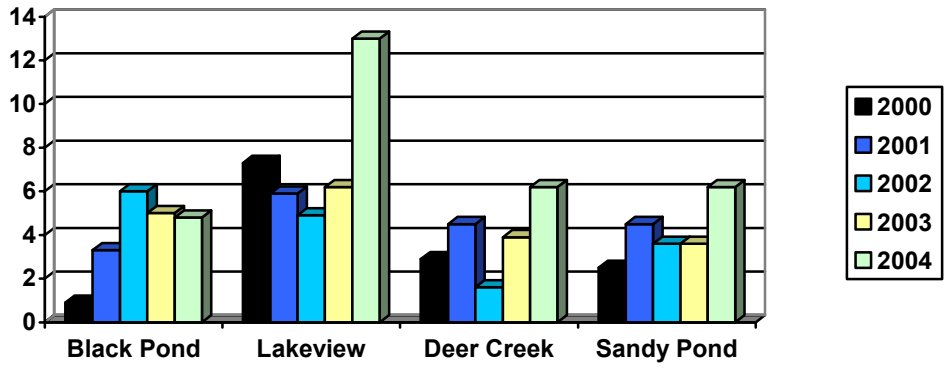

Figure 14. The average daily number of violations observed for Black Pond/Eldorado, Lakeview, Deer Creek, and Sandy Pond Beach for 2000 to 2004.

RECOMMENDATIONS FOR A DATA COLLECTION PROTOCOL

The results of this study indicate that adequate estimates of total visitor activity can be obtained through the indirect count (i.e., regression equation) method. However, limited data collection in 2003 (i.e., full count data were collected from mid July to Labor Day only) made the collection of full count data in 2004 necessary in order to obtain the most accurate visitor use estimates.

In addition, some changes in data collection are recommended as follows:

- The addition of zones 1 and 3 in Lakeview is highly recommended to improve estimates for this area. However, access patterns for zone 3 observed in 2003 indicate that nearly all visitors using this area enter from Southwick Beach State Park. It is important that researchers calculating future estimates for the entire ELODWA area remove zone 3 estimates in order to prevent double-counts of visitors using both zone 3 and Southwick Beach State Park.

- Full count data collection is needed for Lakeview WMA in 2005, due to the accidental merging of data for zones 2 and 3 by a Dune Steward in 2004.

- An additional dune steward is recommended for Lakeview in order to collect zone 1 and 2 data (i.e., the southern portion of Lakeview) and reduce the daily average number of violations. The large size of Lakeview WMA makes data collection and visitor education efforts difficult. One steward would be responsible for education efforts in the southern portion of Lakeview (i.e., from Montario Point north to the Sandy Creek outlet) and the other for efforts in the northern portion (i.e., zone 3). Collection of data for visitor use at the Sandy Creek Outlet will continue to be done from the southern side of the outlet (see zone 2 in Figure 6).

Randomly-selected full count dates for 2004 and 2005, and revised data collection sheets are included in the appendices. Full counts of visitor use and recalculation of regression equations are recommended every three years after 2004 to maintain accuracy in total visitor count estimates and account for any changes in management of each area.

CONCLUSION

Data collection for the ELODWA indicates several interesting visitor use patterns. For example, trends indicate lower levels of use in the past two years in most management areas. Lower levels of use are likely to result in lower levels of visitor-caused impacts on the dunes. Second, there appears to be no correlation between the number of visitor violations and the number of visitors. Most violations are likely occurring in the evenings when Dune Stewards are not on duty and in locations where constant supervision is difficult (e.g., interior sections of Lakeview). Third, areas having high visitation (e.g., Sandy Pond) are *not* more likely to have more violations than areas with low visitation. Violations appear to be more dependent on the ability of the Dune Steward program to provide education and supervision efforts across each area. Large areas such as Lakeview are difficult to adequately monitor and manage because of their size, and are thus likely to have a greater number of violations. Expanding the dune steward program to include an additional steward at Lakeview would likely reduce some of the daytime violations. Continual monitoring and education of visitors is needed throughout the ELODWA in order to ensure the continued protection of this fragile ecosystem and enjoyment of visitors.

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APPENDICES

Appendix A. Recommended full count days and years

Full count days in 2004	Full count days for Lakeview in 2005
Saturday, May 29	Saturday, May 28
Memorial Day, Monday, May 31	Memorial Day, Monday, May 30
Saturday, June 5	Saturday, June 4
Thursday, June 10	Thursday, June 9
Sunday, June 13	Sunday, June 12
Friday, June 18	Friday, June 17
Saturday, June 19	Saturday, June 18
Wednesday, June 23	Wednesday, June 22
Sunday, June 27	Sunday, June 26
Thursday, July 1	Thursday, June 30
Saturday, July 3	Saturday, July 2
Friday, July 9	Friday, July 8
Sunday, July 11	Sunday, July 10
Wednesday, July 14	Wednesday, July 13
Saturday, July 17	Saturday, July 16
Thursday, July 22	Thursday, July 21
Sunday, July 25	Sunday, July 24
Friday, July 30	Friday, July 29
Saturday, July 31	Saturday, July 30
Wednesday, August 4	Wednesday, August 3
Sunday, August 8	Sunday, August 7
Thursday, August 12	Thursday, August 11
Saturday, August 14	Saturday, August 13
Friday, August 20	Friday, August 19
Sunday, August 22	Sunday, August 21
Saturday, September 4	Saturday, September 3

Years for future full counts:
Full counts should be collected every three years in order to update the regression equations. Recommended years are as follows:
2007
2010
2013
2016
2019
Etc…

Appendix B. Monitoring protocol instructions for Dune Stewards

1. Spot count only days.
Use the "spot count tally sheet" to collect data for the shoreline/dune area in each zone twice a day, on all days that you are working (including full count days (see below)).

- The AM spot count is collected between 11:00 AM and Noon.
- The PM spot count is collected between 3:00 and 4:00 PM

Stand at the designated GPS/observation point. Count all visitors, for each activity specified on the tally sheet, within a 250-foot radius of the observation point (this includes people in the water). Write in the number of visitors participating in each activity on the tally sheet.

Circle the following variables on the spot count data sheet for noon.

- Day of the week (weekday = 1; weekend = 2)
- Cloud cover (rainy/overcast = 1; partly cloudy = 2; full sun = 3)
- Surf conditions (rough = 1; moderate (choppy) = 2; calm = 3)

Repeat the count for all observation points in your area.

2. Full count and spot count days.
Use the "full count tally sheet" to count the total number of visitors for the shoreline/dune area in each zone throughout the day. Full count data are collected as follows:
1. At 11:00 AM, start at the observation point for your first zone. Conduct the spot count using the "spot count tally sheet."
2. Move from one end of the zone to the other, counting visitors as you go. Take notes on what visitors are wearing, the color of their towel, the color of their beach chair, etc...and/or map the location of visitors so that you do not double-count visitors throughout the day. Write the number of visitors counted on the "full count tally sheet."
3. Move to the observation point for your next zone. Conduct the spot count.
4. Move from one end of the zone to the other, counting visitors as you go.
5. Repeat steps 3 and 4 for any additional zones.
6. After all AM spot counts have been completed, take a lunch break. Start counting again at 1:00 PM.
7. At 1 PM, move back to the zone that you started with at 11 AM. Add to your data collection sheet any visitors that may have appeared in that zone since the first count in the morning. Be careful not to double-count visitors that you counted in the morning. Repeat for all zones until 3 PM.
8. At 3 PM, move to the observation point in your first zone and conduct a spot count. Walk through the entire zone and add any new visitors to your full count data sheet. Repeat for all zones.
8. Continue with the full counts until 4:30 PM.

3. Violations
Use the "Violations Tally Sheet" to collect data on the number of violations of each type that you observe for the entire day (i.e., 11 AM through 4:30 PM).

Appendices C, D, and E. Visitor Count and Violations Tally Sheets

Full Count Tally Sheet

Site:	**Collect weather data at noon. Circle one for each of the following:**			
Observation Point:	**Surf:**	3=calm	2=moderate	1=rough
Observer:	**Sun:**	3=full sun	2=partly cloudy	1=cloudy/rainy
Date:				

Time Period:	**Count of New Visitors**	**Use this area for notes/diagrams as necessary to track visitors.**
11:00-11:30		
11:30-12:00		
12:00-12:30		
12:30-1:00		
1:00-1:30		
1:30-2:00		
2:30-3:00		
3:00-3:30		
3:30-4:00		
4:00-4:30		

Spot Count Tally Sheet

Site:

Name of observer:

Date:

Collect weather data at noon. Circle one answer for each of the following:

Sun: Cloudy/Rainy (1); Partly cloudy (2); Full sun (3)

Surf: Rough (1); Choppy (2); Calm (3)

Day of week: Weekday (1); Weekend (2); Holiday (2)

	AM SPOT COUNT (11 AM - 12 PM)			**PM SPOT COUNT (3 PM - 4 PM)**		
Activity	**Obs. Point 1**	**Obs. Point 2**	**Obs. Point 3**	**Obs. Point 1**	**Obs. Point 2**	**Obs. Point 3**
Time:	Time:	Time:	Time:	Time:	Time:	Time:
# of People						
On Beach						
In Dunes						
Swimming						
Riding Bike						
Riding Horse						
Birdwatching						
# of Dogs						
On Leash						
Off Leash						
# of Vehicles						
Boats						
Cars						
Personal watercraft						
4-wheelers						

Comments

Violations Tally Sheet

Site: _____

Zone/Observation Point: _____

Date:

	# People in dunes	# People in bird areas	# Personal watercraft	# Boats in bird areas	# People removing driftwood	# of structures	# of dogs off leash	# evidence of fires	# of camp sites	# of four-wheelers	# of cars	# vandalism evidence	# of nudes	# of bikes or horses (specify)
Total														
													Grand Total	

Site: _____

Zone/Observation Point: _____

Date:

	# People in dunes	# People in bird areas	# Personal watercraft	# Boats in bird areas	# People removing driftwood	# of structures	# of dogs off leash	# evidence of fires	# of camp sites	# of four-wheelers	# of cars	# vandalism evidence	# of nudes	# of bikes or horses (specify)
Total														
													Grand Total	

Appendix G. Key to Data Entry

Notes:

- Use one computer file per management area.
- Use one spread sheet in each file for each observation point/zone.

Name of Variable:

Management areas:

EL	Eldorado Nature Preserve
BP	Black Pond WMA
SW	Southwick Beach State Park
LV	Lakeview Marsh WMA
DC	Deer Creek WMA
SP	Sandy Pond Beach Natural Area
SI	Sandy Island Beach

Data entry:

dayyear	Numerical day of the year (e.g., January 1 is "1" and December 31 is "365").
source	Source of estimate of total count (1 = full count; 2 = spot count/regression equation; 3 = average of spot count estimates).
year	Calendar year during which data were collected.
dayweek	Day of the week (1 = weekday; 2 = weekend or holiday).
point	Observation point for the use zone.

Spot counts of people:

ambeach/pmbeach	Number of beach users counted during the AM or PM spot counts.
amdunes/pmdunes	Number of visitors in the dunes during the AM or PM spot counts.
amswim/pmswim	Number of visitors swimming during the AM or PM spot counts.
ambike/pmbike	Number of visitors biking during the AM or PM spot counts.
amhorse/pmhorse	Number of visitors horseback riding during the AM or PM spot counts.
ambird/pmbird	Number of visitors birdwatching during the AM or PM spot counts.
amspot/pmspot	*Total* number of visitors counted during AM or PM spot count (NOTE: this column self-calculates when data is entered for other spot count observations).

Spot counts of dogs:

amdogon/pmdogon	Number of dogs *on* their leashes during the AM or PM spot counts.
amdogoff/pmdogoff	Number of dogs *off* their leashes during the AM or PM spot counts.
amdogs/pmdogs	*Total* number of dogs observed during the AM or PM spot counts (NOTE: this column self-calculates when data is entered for other spot count observations).

Spot counts of vehicles:

amboats/pmboats	Number of boats landed in the management area or observed/anchored near shore during the AM or PM spot counts.
amcars/pmcars	Number of cars observed on the beach during the AM or PM spot counts.
ampwater/pmpwater	Number of personal watercraft (e.g., jet skis) landed in the management area or observed near shore during the AM or PM spot counts.
am4wheel/pm4wheel	Number of four-wheelers or dirt bikes observed on the beach during the AM or PM spot counts.
amvehicl/pmvehicl	*Total* number of vehicles observed on the beach during the AM or PM spot counts (NOTE: this column self-calculates when data is entered for other spot count observations).

Weather data:

sun	Level of sunshine (1= cloudy/rainy; 2 = partly cloudy; 3 = full sun).
surf	Roughness of water (1 = rough; 2 = choppy; 3 = calm).
tempmax1	Maximum daily temperature as reported by the Oswego, NY weather station.
precip1	Total daily precipitation as reported by the Oswego, NY weather station.

Other data:

fulcount	Enter the total number of visitors counted on full count days ONLY (i.e., *source* = 1). Leave this column blank for all other days.
totcount	Do not enter any data into this column. The total count of visitors in the zone will be calculated as follows: • If *source* = 1, than *totcount* = *fulcount*; • If *source* = 2, than *totcount* = regression equation output; • If *source* = 3, than *totcount* = average of regression equation outputs (calculated separately for *dayweek* = 1 and *dayweek* = 2).
violatn	Total daily number of violations observed in zone.