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A Survey of Organized Turtle Watch Participants on Sea Turtle Nesting Beaches in Florida

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ABSTRACT. – **Loggerhead turtles are an important natural resource in Florida. Numerous organizations, operating under guidelines and permits issued by the Florida Department of Environmental Protection (FDEP), conduct organized turtle watches to provide the public with the opportunity to observe a nesting loggerhead turtle. To develop recommendations designed to enhance ecotourism activities on sea turtle nesting beaches, we distributed questionnaires to 1319 participants of organized turtle watches in Florida during the 1994 sea turtle nesting season; we received 488 completed responses. The program is viewed very positively and almost all respondents would recommend it. Demand for participation has always exceeded availability, and this lack of tourist accessibility is currently the program's greatest drawback. Our primary recommendation is that the current program should be expanded. Approximately one third of respondents indicated that they had previously been unable to participate because of limited availability. We recommend that turtle eggs not be handled by participants and that participants view a video depicting the nesting process prior to actually observing a turtle on the beach. These recommendations and current FDEP guidelines, although designed specifically for Florida beaches, may be applicable to sea turtle watch programs elsewhere. When conducted under proper conditions, ecotourism on sea turtle nesting beaches will benefit both visitors and sea turtle conservation efforts. However, the activities of visitors must be regulated so that the turtle population is not jeopardized.**

KEY WORDS. – **Reptilia; Testudines; Cheloniidae; *Caretta caretta*; sea turtle; conservation; management; ecotourism; organized turtle watch; participant survey; USA**

Three species of sea turtle (loggerhead, *Caretta caretta*; green, *Chelonia mydas*; and leatherback, *Dermochelys coriacea*) regularly lay eggs in Florida, but numbers of loggerhead nests far exceed those of the other two species. In recent years loggerhead turtles have deposited approximately 65,000 egg clutches during the May through August nesting season (Meylan et al., 1995).

Adult female loggerheads are easily viewed when they come ashore to nest. They exhibit stereotypic nesting behavior (Hailman and Elowson, 1992) and take about 1.5 hrs to complete the nesting process (Johnson et al., in press). Various public and private organizations in Florida conduct supervised turtle watches each summer to allow the public an opportunity to observe a nesting loggerhead. Over 10,000 people annually participate in the state's turtle watch program (Florida Department of Environmental Protection [FDEP], unpublished data). Organizations conduct turtle watches under permits issued by FDEP and follow regulations established by this agency. These regulations define and delimit such parameters as the number of registered participants in the group, position of the group around the turtle, timing of approach to the turtle, use of lights and flash photography, as well as handling of eggs by participants (Table 1).

We conducted research in 1993 and 1994 to determine what influence organized turtle watch groups have on nesting behavior and hatchling production of loggerhead turtles (Johnson et al., 1994, in press). During the 1994 season we distributed questionnaires to participants in Florida's organized turtle watch program. The questionnaire was developed with advice from a technical advisory team, which is comprised of representatives from state and federal management agencies and organizations that conduct turtle watches, as well as sea turtle biologists. The purpose of the questionnaire was to collect data that would allow us to make recommendations to enhance the experience of participants without compromising success of sea turtle nests. In this paper we present questionnaire results and recommendations for guidelines governing Florida's sea turtle watch program. Although designed for activities allowed during organized turtle watches on Florida beaches, these recommendations may be applicable to sea turtle watch programs in other parts of the world.

METHODS

Supervised Turtle Watches. — Prior to observing a turtle, participants meet shortly after dusk at a central location, such as a state park visitor's center or at a public beach access. An interpretive program, usually consisting of a lecture and slide show, is then presented by the turtle watch leader. The presentation covers sea turtle biology and conservation, laws protecting sea turtles and their nests, and procedures to be followed during the turtle watch. While the interpretive program is underway, or immediately thereafter,

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Table 1. Partial list of FDEP guidelines regulating organized turtle watches in Florida.

- Turtle watches may only be conducted with loggerhead turtles.
- Interpretive programs which incorporate accurate, updated information on sea turtle conservation and biology are mandatory.
- Group size shall not exceed 25 participants per guide with the total group size not to exceed 50 individuals.
- Use of flashlights by participants is not permitted. The use of low intensity flashlights is limited to the walk leader and permitted scouts only. After approaching the turtle, one light may be used by the group leader or a scout to illuminate the nest cavity so that participants can observe egg deposition. The light may not be turned on the turtle until after covering is underway.
- Turtle watch leaders and scouts are encouraged to invite persons who are out on their own looking for turtles to join the group.
- The leader or scout must exercise great caution when exposing the nest so as not to disturb the turtle. At no time should sand be allowed to fall into the nest chamber.
- Participants must be instructed to stay with the group and remain quiet at all times. During the entire watch, the group must remain together. The group may not approach the turtle until egg deposition is well underway. Participants, scouts, and the leader must approach from the rear and remain behind the nesting turtle during egg deposition. At the principal permit holder's discretion, a single egg may be removed from the nest by the guide and passed around for the participants to touch. The egg must be returned to the nest before egg deposition is completed.
- Contact (light touching) with the nesting female is permitted only after all eggs have been deposited. Contact must not impede nest covering or the turtle's return to the ocean.
- The use of flash photography and lights for filming is not permitted.
- No more than four turtle watches per seven day week may be conducted in the selected beach area.

trained personnel (scouts) search the adjacent beach for a turtle that has recently emerged from the sea to nest. During the search for the turtle, the group waits at the beach access point.

Once a turtle is encountered, the scouts and the group leader escort participants to the site of the nesting turtle. While traveling to the turtle, the group remains together and walks along the water's edge. The leader walks slightly ahead of the group to ensure that other turtles that may be emerging in the vicinity are not frightened by the group. If an emerging turtle is sighted, the group is instructed to squat down and remain still until the female is either well up the beach or returns to the surf. After the turtle that is to be observed by the group begins oviposition, the leader or a scout carefully excavates sand from behind the turtle to reveal the nest chamber and the egg laying process. When oviposition is well underway the participants move to within a few meters of the turtle but stay behind the turtle during the entire nesting process (Fig. 1). After the turtle finishes nesting and returns to the sea, the group is escorted back to the initial beach access location. Under current regulations, only one loggerhead per night (and no individuals of any other species) may be watched by the group. FDEP regulations prohibit groups from conducting organized turtle watches for profit. However, some organizations request a nominal donation from participants, and some turtle watches are held in state parks which have entrance fees.

Figure 1. Turtle watch group observing a nesting loggerhead in Florida.

Participant Questionnaires. — Questionnaires (Table 2) were distributed during the 1994 sea turtle nesting season by six organizations conducting turtle watches at locations along the east coast of Florida: Merritt Island National Wildlife Refuge (north Brevard County), Sea Turtle Preservation Society (central Brevard County), Sebastian Inlet State Recreation Area (Indian River County), Florida Power and Light Company (St. Lucie County), John D. MacArthur Beach State Park (Palm Beach County), and John U. Lloyd Beach State Recreation Area (Broward County). At the end of the turtle watch, surveys were given to all registered participants over the age of 15 years. At all sites except central Brevard County, questionnaires were enclosed in postage-paid, addressed envelopes, and participants were asked to return them by mail. At the location in central Brevard County, completed questionnaires were collected immediately following turtle watches. All organizations operated under permits issued by FDEP and adhered to guidelines regulating organized turtle watches.

For the final survey question (Table 2), a relative value of importance was calculated for each of the eight possible "enhancements." For each questionnaire a value of 3.0 was given for the enhancement that the participant ranked as most important, a value of 2.0 for the second most important item, and a value of 1.0 for the third. For comparison among enhancement ranks, the total value of each item was summed and percentage of the overall total was calculated. Distributions of first choice enhancement options for the four age groups were compared using a k-sample chi-square test.

RESULTS

Of 1148 distributed surveys to be returned by mail, we received 437 (38%); 171 questionnaires were administered and collected on site in central Brevard County. Of the 608 questionnaires received, 488 were completed according to instructions, and results were compiled from only these responses.

Participants initially became aware of Florida's organized turtle watch program through a variety of sources. The news media, primarily newspaper articles, were the source for 37%; friends or relatives for 42%; clubs, environmental organizations, schools, and employers for 16%; hotels, billboards, or magazine ads for 3%; and others for 2%.

Most respondents (99%) were from the US, two individuals were from France, and three from the United Kingdom. Of the US respondents, 429 (89%) were residents of Florida, and 11% were from 26 other states.

Table 2. Organized turtle watch participant questionnaire.

How did you find out about the public turtle watch program? (circle one)
A) Newspaper article B) Through your hotel C) Magazine ad
D) From a friend E) Other (please specify)_____
Where do you live? Country _____ State _____ County _____
Please indicate which of the following best describes your situation. (circle letter)
- Came to area for one night to watch sea turtles ..... A
- Had not initially planned to watch sea turtles during visit to area .. B
- Had planned to watch sea turtles during visit to area C
- Resident of the area ..... D

Your age? (circle one) . . . . . .16 - 30 31 - 45 46 - 60 over 60
Is this the first time you have seen a sea turtle nest? (circle one)
YES NO
Have you previously been unable to participate in a public turtle watch because all openings were already filled? (circle one)
YES NO
If the opportunity to participate in this public turtle watch had not been available would you have gone out on your own (or with friends or family) to observe a nesting turtle? (circle one)
YES NO
Would you recommend this program to a friend? (circle one)
YES NO
Which of the following do you feel would enhance your turtle watching experience the most? (indicate your first 3 choices, 1-2-3, 1 being most important)
___ • Taking flash photographs
___ • Touching the turtle
___ • Getting closer to the turtle
___ • Receiving educational literature
___ • Watching two turtles the same night
___ • Handling an egg
___ • Having fewer people in the turtle watch group
___ • Watching a video of the nesting process prior to going on the beach
Please use the back of this form for any additional comments on how you feel this program could be improved to enhance the experience of the observer.

Of the Florida residents, 67% were from the county in which the turtle watch was held. Twenty percent of all respondents came to the area for one night to observe a nesting sea turtle. Most of these tourists were apparently from central Florida (Orange, Seminole, and Volusia counties). An additional 15% of all respondents had planned to watch sea turtle nesting during their stay in the area, and 3% had not originally planned to attend an organized turtle watch during their visit to the coast.

Age classes of respondents were the following: 14% from 16–30 years, 40% from 31–45, 26% from 46–60, and 20% over 60 years. Most people (75%) indicated that this was the first time that they had watched a sea turtle nest. Demand for participation in organized turtle watches in Florida is great. Thirty percent of respondents had been previously unable to participate in a turtle watch because all openings had already been filled.

During interpretive programs watch leaders presented information to discourage people from trying to observe a nesting turtle on their own. Despite this information, 32% of respondents indicated that they would have ventured onto the beach unsupervised in an attempt to find a turtle if they had not been able to participate in the program.

Respondents viewed Florida's turtle watch program highly favorably. Almost all (484 out of 488) indicated that they would recommend the program to a friend.

Of the potential enhancements (Table 2, last question), having fewer people present in the group and viewing a video of the nesting process prior to going on the beach were the two highest ranked options (Table 3). Getting closer to the turtle, taking flash photographs, and handling an egg were the three lowest ranked options (Table 3). Whether or not respondents had handled an egg during their turtle watch did not significantly influence their rank of this option ($\chi^2 = 0.108$, $P > 0.05$). Additionally, respondents commented that flash photography and egg handling should not be allowed because they felt that these activities might be harmful to the turtle or the nest. Age had a significant effect on enhancement option preferences. The distributions of the first choice enhancement options are significantly different among age classes (Fig. 2; $\chi^2 = 48.7$, df = 21, $P < 0.001$).

DISCUSSION AND RECOMMENDATIONS

We have developed recommendations for Florida's turtle watch program based on responses to the questionnaire, results of a study on effects of organized turtle watches on loggerhead nesting behavior and hatchling production (Johnson et al., 1994, in press), and observations from 94 organized turtle watches which one of us (SAJ) attended during the 1993 and 1994 nesting seasons. Table 4 summarizes our recommendations, each of which is discussed in detail below. These recommendations are designed to enhance the experience of turtle watch participants without sacrificing sea turtle hatchling production.

Our recommendations may also be pertinent to other sea turtle ecotourism programs around the world. Because of numerous factors, guidelines regulating turtle watch programs on nesting beaches vary greatly. The work of Campbell (1994), Jacobson and Lopez (1994), and Johnson et al. (1994, in press) represent the first studies to evaluate the influence of visitor activities on sea turtle nesting behavior and hatchling production. Results from these studies and our turtle watch participant survey provide much needed information that may lead to improved guidelines for visitor activities on beaches elsewhere in the world. While some of our recommendations are specific to Florida, others are applicable to most sea turtle nesting beaches where turtle watches are held. On most nesting beaches, for example, FDEP guidelines and our recommendations regarding flash photography, egg handling, and possibly group size, would likely enhance the experience of the tourist while minimizing deleterious effects to the turtle and nest.

Turtle Watch Group Size. — Determination of the ideal number of participants that should be allowed on a turtle watch involves compromise. The primary concern is that group size should not be so large as to cause unnecessary disturbance to the turtle. We found no significant correlation between number of people present (range = 16 to 65) and duration of oviposition, covering, or camouflaging phases for loggerhead turtles in Florida (Johnson et al., in press). However, presence of a turtle watch group is known to influence duration of loggerhead camouflaging behavior although not hatchling production (Johnson et al., in press).

We received questionnaires from attendees in turtle watch groups of varying sizes (mean group size = 31.0, SD = 12.8). The most highly ranked enhancement option was reduction in number of participants (Table 3). However,

Table 3. Importance values of organized turtle watch participant enhancement options.

Option	No. ranked first	No. ranked second	No. ranked third	Sum of ranks*
Fewer people	118	59	50	522
Watch video	110	79	46	507
Watch two turtles	69	54	50	365
Touch turtle	64	48	56	344
Receive literature	34	51	55	259
Handle egg	31	58	47	256
Flash photography	39	34	31	216
Closer to turtle	32	19	45	179

*See Methods for an explanation of this category.

limiting organized turtle watch group size to fewer than currently allowed is not practical. Demand for participation in the program always greatly exceeds availability. Decreasing the number of registered participants allowed would only aggravate this situation. On the other hand, an increase in the number of registrants beyond 50 might result in a significant increase in disturbance to turtles while diminishing the positive experience of the participant.

Turtle watch leaders should direct participants to exchange positions around the turtle periodically so that all group members are able to see the nesting process. This might address the respondents' desire to have fewer people in the turtle watch group without further limiting access. However, we strongly endorse the FDEP guideline that turtle watch leaders invite unaccompanied persons encountered on the beach to join the turtle watch group. This is an excellent opportunity to involve unsupervised individuals in an organized turtle watch.

Expansion of Florida's Turtle Watch Program. — To allow more people to view a nesting loggerhead, we recommend that Florida's turtle watch program be expanded. This could be accomplished by increasing the number of permitted organizations that conduct turtle watches in the state and by allowing organizations currently involved with the program to increase the number of watches they conduct each nesting season.

Some of the organizations now participating in the program, such as various wildlife refuges and state parks and recreation areas, do not normally conduct as many turtle watches per week as allowed under the present FDEP guidelines. Some also restrict their watch schedule to the peak time of loggerhead nesting season. Because lack of funding for personnel to lead watches may limit schedules, implementing volunteer programs might enable some organizations to increase the number of watches they conduct each summer.

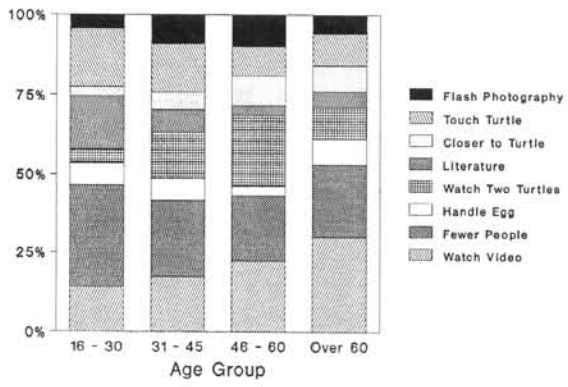

Figure 2. Distribution of first choice enhancement options among the four age groups. Distributions are significantly different among the four groups.

Presently, FDEP regulations limit the number of turtle watches conducted in a selected beach area to four turtle watches per week (Table 1). Raising this limit would allow all organizations to conduct more watches each summer. However, the influence of such an increase on sea turtle nesting success is unknown and needs to be studied.

For all sites where questionnaires were distributed for this study, respondents commented on the difficulty of making reservations for a turtle watch. For example, in 1993 staff of the Merritt Island National Wildlife Refuge scheduled 25 watches. Prior to the nesting season they placed a small ad in a local paper stating that reservations would be taken during one day only. Within a 6-hour period, all 1000 slots were filled, and an estimated 2500 people were denied access to the refuge's public turtle watches that year (K. Whaley, *pers. comm.*). In both 1993 and 1994, all organized turtle watches conducted by the Sea Turtle Preservation Society were filled weeks in advance of the scheduled watch date.

Disturbance to nesting females has been identified as the most serious threat resulting from the presence of humans on sea turtle nesting beaches (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1991). Human disturbance of female loggerheads attempting to lay eggs has been shown to cause turtles to shift nesting beach locations, delay oviposition, and choose poor nest sites (T. Murphy, *pers. comm.*). Presence of tourists on sea turtle nesting beaches has also been implicated as the cause of observed changes in nesting patterns both within and between nesting seasons (Arianoutsou, 1988; Fangman and Rittmaster, 1994; Jacobson and Lopez, 1994). Much of this disturbance, at least in Florida, is caused by unsupervised individuals — those people, not involved in organized turtle watch groups, who wander the beach at night during sea turtle nesting season. Many unsupervised individuals are unaware of, or unable to reserve a space in, organized turtle watches. One third of turtle watch participants who returned our questionnaires indicated that had the opportunity to participate in this program not been available, they would have gone out on their own in an attempt to observe a nesting turtle.

During our study we counted as many as 80 unsupervised persons per night roaming a 3 km stretch of beach. We observed many sea turtles return to the sea without nesting because of disturbance by well-meaning individuals trying to view a nesting turtle. The magnitude of this issue was reinforced by members of the technical advisory team, who unanimously expressed concern about the severity of disturbance to nesting turtles from unsupervised individuals.

While increasing the availability of permitted turtle watches would not reduce the absolute number of people on

Table 4. Recommendations for enhancing guidelines regulating organized turtle watches in Florida.

1. As currently stipulated in FDEP guidelines, turtle watch group size should remain limited to 25 persons per guide with total group size not to exceed 50 registered participants.
2. Florida's turtle watch program should be expanded to include more permitted organizations and to increase the number of watches conducted by organizations currently involved with the program.
3. Current FDEP guidelines should remain the same with regard to timing of group approach and positioning around the turtle.
4. Current FDEP guidelines regarding excavation of sand to expose the nest chamber should remain the same.
5. Participants should not be allowed to handle an egg, nor should an egg be removed for viewing purposes.
6. As currently stipulated in FDEP guidelines, the use of flash photography and lights for filming purposes should not be allowed.
7. When facilities permit, a video depicting all phases of nesting behavior should be shown to participants prior to going on the beach.

the beach, it would reduce the level of disturbance to sea turtles by incorporating unsupervised individuals into organized turtle watches. This would concentrate people into groups, and the activities of the groups would be regulated to minimize disturbance. A similar idea has been successfully employed in Costa Rica to mitigate negative impacts of tourists on nesting green turtles (Jacobson and Robles, 1992).

Most participants were from Florida, and most lived in the county in which the turtle watch was conducted. Increasing availability of the turtle watch program would enable out-of-state tourists, who initially become aware of the program during their visit to the coast, to have greater access. Out-of-state tourists represent a large group of potential sea turtle conservation advocates. In lieu of an immediate increase in overall participation, we recommend that organizations conducting turtle watches make some provision to ensure greater access for out-of-state residents.

Group Approach and Positioning Around Turtle. — Current guidelines regarding timing of group approach and positioning of the group around the turtle (Table 1) should remain the same. Loggerhead turtles tend to be more susceptible to disturbance early in the nesting sequence (Caldwell et al., 1959; Margaritoulis, 1985). However, once oviposition begins, the turtle becomes less sensitive to disturbance, probably because of hormonal changes (Guillette et al., 1990), and the group may approach and remain a few meters behind the turtle without causing her to abort the laying process. At this distance most participants are able to adequately view the nesting turtle, and oviposition may be easily observed. Respondents to the questionnaire did not feel it was important for them to be allowed to move closer to the turtle (Table 3).

Excavation of Nest Chamber. — As now stipulated in FDEP guidelines, turtle watch leaders may expose the nest chamber prior to the arrival of the group so that participants may observe the egg laying process. This should be done without touching the turtle or allowing sand to fall into the chamber. Excavation of the egg chamber does not adversely affect success of nests (Johnson et al., in press). No significant difference in hatchling production was found between nests deposited by loggerheads observed by organized turtle watch groups in which nests were excavated during the turtle watch to reveal the egg chamber, as compared to nests deposited by loggerheads not observed by turtle watch groups.

Handling of Eggs. — Under the present guidelines a single egg may be removed from the nest for participants to handle (Table 1). Survey respondents ranked handling an egg low on the possible list of enhancements (Table 3) and expressed concern about possible detrimental effects. Given the potential for egg handling to have a negative impact on hatchling production, we recommend that an egg not be removed from the nest. Passing an egg among participants may inoculate the egg, and thus the entire nest, with microbes other than those found naturally in the nest. Microbial infestation has been implicated as a cause for low hatching success in sea turtle nests (Cornelius, 1986; Wyneken et al., 1988). Eggs handled by turtle watch participants may also become contaminated with insect repellents and cosmetics. Nevertheless, no difference in hatchling production was found between nests in which a single egg was passed among participants in turtle watches and nests where no egg was handled (Johnson et al., in press).

Use of Flash Photography. — Current FDEP regulations forbid the use of lights for filming and taking of flash photographs by participants; this should remain unchanged. Respondents did not feel that flash photography was important for enhancing their turtle watching experience (Table 3). They expressed concern that such an activity might frighten the nesting turtle. Other turtles attempting to nest in the area of the turtle watch might also be affected by the flashes of light. In addition to influencing the turtle, taking of flash photographs by some participants would likely offend others in the group and detract from the overall ambience. Flash photography has been previously demonstrated to influence nesting behavior in green turtles (Campbell, 1994). To satisfy the desire of some tourists to have photographs of the turtle, slides and photos of nesting sea turtles should be made available for purchase. Monies from sales could be used to help expand the turtle watch program or be directed toward other sea turtle conservation efforts in Florida.

Viewing a Video of a Nesting Turtle. — Respondents indicated that viewing a video of the nesting process prior to going on the beach would enhance their turtle watching experience (Table 3). When possible, a video depicting all phases of the nesting process should be shown to participants. This would make them aware of what to expect during the actual event and ensure a consistent presentation of accurate information regarding sea turtle biology and conservation as well as laws protecting sea turtles in Florida. Although the chances of observing a nesting loggerhead are quite good at many Florida beaches, a video would guarantee that participants were able to view the nesting process even when a turtle was not found.

CONCLUSION

When ecotourism on sea turtle nesting beaches is conducted properly, both people and turtles benefit. The participant is provided with an opportunity to experience an unforgettable natural event. Ecotourism benefits sea turtles by providing an economic incentive to protect nesting habitat and populations and by educating people about threats to the survival of sea turtle species. Ecotourism activities at some nesting beaches provide sustainable income for local residents (Zubieta et al., 1990; Jacobson and Robles, 1992). In many countries, including Greece, Turkey, South Africa, Mexico, Costa Rica, Malaysia, India, Australia, and the USA, sea turtle nesting beaches already host active ecotourism programs. Conservationists have expressed concern that activities of tourists at nesting beaches be conducted in a manner not detrimental to sea turtle reproductive success (Arianoutsou, 1988; Agardy, 1992; Jacobson and Robles, 1992; Johnson et al., 1994, in press; Whitmore, 1994).

Public support for conservation efforts is essential for the long term success of sea turtle conservation programs (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1991). Florida's organized turtle watch program, and similar programs around the world, are a means for garnering this support through education. However, studies like those of Campbell (1994), Jacobson and Lopez (1994), and Johnson et al. (1994, in press) should be conducted to evaluate guidelines regulating sea turtle ecotourism programs before it is assumed that tourists are not jeopardizing the resource that they have come to experience. Research focusing on possible impacts of sea turtle ecotourism activities on other animal and plant species present on the same beaches where such activities are conducted are also recommended.

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