



## Ecology and Conservation of Green Turtles in the Nearshore Waters of Waikiki Beach

by Russell K. Miya<sup>1</sup> and George H. Balazs<sup>1</sup>

The Hawaiian green turtle, *Chelonia mydas*, has been listed and protected under the U.S. Endangered Species Act since 1978. Equivalent legal protection is also afforded by the State of Hawai'i. Selected nearshore foraging and resting habitats in the main Hawaiian Islands have been a focus of research on this species. On O'ahu, sites such as Kane'ohe Bay, Kawela Bay, Maunalua Bay, and West Beach are among the important areas used by green turtles for such purposes (Balazs et al. 1987, Balazs and Pooley 1991). Additionally, in recent years, an area has been identified off Waikiki Beach where prominent sightings of turtles occur on a daily basis. The area fronts the Sheraton Waikiki Hotel (21°16'48"N, 157°49'59"W) and is unique because of the number of tourists swimming, snorkeling, and even sunbathing on air mattresses while the turtles swim and feed around them. In the past, Waikiki has not been a haven for sea turtles, although occasionally they were reported there. It would appear that only in the past 3-5 years has the number of turtles off Waikiki increased and their presence become more visible.

An effort was made in the present study to better define the ecology and conservation status of the aggregation of turtles fronting the hotel. Research was undertaken to gather basic information on several important aspects, including the environmental characteristics of the habitats used by the turtles for feeding and underwater resting, the approximate number of turtles present and their size classes, the daily feeding patterns and food sources, and any adverse impacts to the turtles, both from humans as well as from natural factors such as disease and shark predation.

A recovery plan to promote the biological recovery and long-term conservation of green turtles in the Hawaiian Islands has been prepared (NMFS 1992). The work that was undertaken off Waikiki is consistent with several recommendations for field research

contained in the recovery plan.

### Methods

Between October 1990 and August 1991, 20 underwater surveys were conducted to determine the environmental characteristics of the study area, including foraging sites and resting habitats. This was accomplished by snorkeling in and around the general area where the turtles were seen. Visual surveys were conducted from the shoreline to observe (1) turtles foraging and (2) the characteristics of the nearshore and intertidal habitats. In addition, the study site was observed from the upper floors (usually a room on the 12th floor) of the hotel, providing an ideal vantage point for sighting and censusing turtles.

Capture methods consisted of (1) entrapment in large mesh nets previously used to safely sample turtles at other sites in Hawai'i and (2) capture by hand while skin diving. Once a turtle was captured it was tagged for long-term identification. Two different tags were used—a highly visible blue plastic tag and a tag made of the highly corrosion resistant alloy, Inconel. Two or three tags were applied to each turtle, depending on the size of the animal. Tagging sites consisted of the trailing edges of the front and rear flippers. Besides tagging, painted letters were applied to each turtle's carapace to facilitate short-term recognition from a distance.

Body measurements and weight were recorded for each turtle. Measurements included straight-line and curved carapace length, straight-line and curved carapace width, and straight-line plastron length. Other measurements included head width, right front flipper width, and tail length.

Food sources were determined by sampling the turtle's mouth shortly after capture, or by gently inserting a plastic tube lubricated with vegetable oil into the esophagus to the upper portion of the fore-stomach (crop). Seawater was then infused at a low pressure

to flush food particles for collection and identification (Balazs 1980; in press).

### Results

#### Environmental setting

Waikiki Beach is located on the south shore of the Island of O'ahu and extends from the Ala Wai Yacht Harbor to Diamond Head, a distance of about 3 km. It is, undoubtedly, the most visited beach in all the Hawaiian Islands and ranks among the best recognized tourist destinations worldwide. The number of beachgoers on any given day can reach into the thousands. One of two main areas, where tagging occurred, fronts the Sheraton Waikiki Hotel. This site is divided by an old seawall that extends seaward for about 30 m and curves toward Diamond Head, parallel to shore, for 20 m. This seawall was used in our capture efforts as a barrier to trap turtles by rapidly swimming out a net to form an enclosure while a turtle was seen feeding. Both sides of the seawall close to shore are shallow with a depth of 1-2 m. The majority of the bottom here consists of sand with some hard calcareous substrate. Patches of vertical reef start approximately where the seawall starts to curve.

A second site discovered during the course of the study that became a focus for tagging is located at 21°16'35"N, 157°49'35"W in water 3 m deep about 300 m off the Kapahulu seawall. The Kapahulu seawall is located 600 m east of the Sheraton Waikiki. This site, designated in our work as "Grace's Ledge," was ideal for hand capturing turtles frequently found resting in the recess of this limestone structure. Three other smaller recesses a short distance away were found to be used occasionally by turtles for resting.

On five occasions, surveys were made along the intertidal shoreline of Waikiki to look for fecal pellets. No pellets were encountered. This was considered an important find-

Table 1.—Body measurements and weights of 15 green turtles captured off Waikiki Beach.

Primary tag No.	Date and site	Carapace length (cm)		Plastron length (cm)	Weight (kg)
		Straight	Curved		
N840	4-26-91 (S)	37.6	39.5	31.2	7.7
N844	4-26-91 (S)	42.0	45.0	33.5	10.9
N535	11-15-90 (G)	42.5	45.5	34.5	12.3
N842	4-26-91 (S)	42.9	46.0	33.8	10.9
N776	3-28-91 (G)	43.2	46.5	33.7	12.7
N573	12-20-90 (N)	43.7	47.0	34.7	13.6
N741	3-15-91 (S)	44.7	47.0	35.3	15.0
N778	3-29-91 (G)	48.9	53.0	40.2	16.4
N570	12-14-90 (G)	49.5	53.0	40.7	20.5
N691	3-1-91 (S)	49.9	53.3	39.7	21.4
N781	3-29-91 (G)	60.1	63.5	47.1	28.6
Y47	12-14-90 (G)	61.2	65.0	49.9	35.5
N793	4-5-91 (S)	61.3	65.2	49.5	32.7
N744	3-15-91 (S)	69.3	74.0	56.1	51.4
N796	4-5-91 (S)	80.7	86.2	64.4	81.8

Table 2.—Identification of dietary components flushed from four green turtles captured off Waikiki Beach.

Primary tag No./ study site/date	Straight carapace length (cm)	Sample contents	%
			Composition
N691-Sheraton Waikiki 3-1-91	49.9	<i>Spyridia filamentosa</i>	30
		<i>Gelidium pusillum</i>	30
		<i>Laurencia nidifica</i>	20
		<i>Dictyota friabilis</i>	10
		<i>Ulva fasciata</i>	10
		<i>Lyngbya</i> sp.	Trace
		<i>Ceramium</i> sp.	Trace
		Amphipods (commensural)	Trace
N741-Sheraton Waikiki 3-15-91	47.7	<i>Pterocladia capillacea</i>	80
		<i>Hypnea musciformis</i>	15
		<i>Acanthophora spicifera</i>	5
		<i>Ectocarpus indicus</i>	Trace
		<i>Sargassum</i> sp.	Trace
N844-Sheraton Waikiki 4-26-91	42.0	<i>Hypnea musciformis</i>	45
		<i>Sargassum</i> sp.	30
		<i>Ulva reticulata</i>	15
		Paper	10
		<i>Ectocarpus indicus</i>	Trace
N776-Grace's Ledge 3-28-91	43.2	<i>Ulva fasciata</i>	100
		Terrestrial plant material	Trace
		Amphipods (commensural)	Trace
		Unidentified spine	Trace

ing because of the large number of beach users and the potential for negative public reaction if large numbers washed ashore (Balazs et al. 1990).

#### Ecological aspects of turtles captured

Netting efforts conducted on six occasions in front of the Sheraton Waikiki Hotel resulted in eight turtles being captured (Table 1). Six of the turtles were caught on the Sheraton (west) side of the seawall, and two were caught on the Diamond Head (east) side bordering the Royal Hawaiian Hotel. All netting attempts were conducted in the late afternoon because the number of turtles observed from the hotel room was consistently greater at that time of day. Six turtles were hand captured at Grace's Ledge (one turtle was caught twice), and one was caught in front of the Waikiki Natatorium. All turtles were captured during the day as nighttime efforts were not attempted. The straight carapace lengths of the 15 turtles captured ranged from 37.6-80.7 cm. Their weights ranged from 8-82 kg (Table 1). The largest turtle, the only adult captured, was determined to be a maturing male on the basis of its long, thick tail.

Stomach samples collected from four of the turtles resulted in the identification of several species of benthic algae (Table 2). Two of the three turtles captured in front of the Sheraton Waikiki contained *Hypnea musciformis*, a red alga introduced to the Hawaiian Islands from Florida in 1974 (Abbott 1987, Russell and Balazs, in prep.). One of the turtles at Grace's Ledge sampled for stomach contents was found to have been feeding exclusively on the green alga, *Ulva fasciata*. *Ulva fasciata* and *U. reticulata* were both highly visible species at the Sheraton Waikiki study site. Various other algae and related samples shown in Table 3 were identified from the external surfaces of the turtles.

Over the 10 months of this study, three turtles were found dead along Waikiki Beach. Two of these turtles died from obvious boat propeller slashes. The third turtle (tag N535), which was the first turtle tagged at Grace's Ledge, died from entanglement and forced submergence in a fisherman's gillnet. Identification of the stomach contents of the three turtles revealed that considerable foraging had taken place on *H. musciformis*, *Ulva* spp., *Codium* spp., and *Pterocladia capillacea* (Table 4).

Eight of the 15 turtles captured showed some evidence of external injury or abnormality, although in most instances they were minor. One turtle (tag N535) had obvious

healed puncture marks from a threeprong (Hawaiian sling) spear on its head.

One of the turtles captured at Grace's Ledge (tag Y47) had been originally tagged in December 1989 after being found entangled in a fisherman's gillnet set in shallow water off the Kapahulu seawall. A Waikiki life-guard rescued the turtle and turned it in to the Waikiki Aquarium. A few days later the turtle was tagged and transported for release by one of us (GHB) to Kawaiiki Beach Park, about 8 km east of Waikiki on O'ahu's south shore. During the one year period following its release the turtle grew 3.6 cm in straight carapace length. This same turtle was recaptured a second time (again at Grace's Ledge) after 4 more months in the wild. The growth during this period was 1.2 cm in straight carapace length. These rates are relatively rapid compared to turtles residing at other sites thus far studied in the Hawaiian Islands (Balazs 1982).

Submergence intervals (breath-hold times) were recorded on two turtles that were meticulously observed from a room at the Sheraton Waikiki Hotel. Both turtles were foraging during this period. Their average submergence times were relatively short (1 min 46 sec, and 2 min 11 sec). Submergence times ranged from 35 sec to 3 min 30 sec (n = 32).

#### Foraging habitat appraisal

Surveys conducted from shore and underwater demonstrated an abundance of various algae in the nearshore waters fronting the hotel. Algae that were highly abundant included *U. reticulata* and *U. fasciata*. An assortment of detached algae was also seen along the sand bottom adjacent to the seawall. Loose algae collected were identified as *Codium* spp., *Sargassum* spp., and *H. musciformis*.

The number and frequency of turtles sighted from shore were always greater during late afternoon to early evening than in the morning and early afternoon. Also, the number of turtles sighted was greater during these times when high tides occurred.

Underwater surveys taken at Grace's Ledge indicated that there were no foraging habitats in the immediate vicinity.

#### Resting habitat appraisal

Hawaiian green turtles spend most of their time foraging, resting on the bottom, and swimming to the surface to breathe. The turtles' resting periods are often spent at the bottom in or near caves, reef outcroppings,

Table 3.—Identification of samples scraped from the external surfaces of three green turtles off Waikiki Beach.

Primary tag No./ study site	Straight carapace length (cm)	Sample contents	% Composition
N741-Sheraton Waikiki 3-15-91	44.7	<i>Sphacelaria furcigera</i>	90
		<i>Achrochaetium</i> sp.	10
		<i>Chaetomorpha gracilis</i>	Trace
		<i>Lyngbya</i> sp.	Trace
		Round worm	
N744-Sheraton Waikiki 3-15-91	69.3	5 <i>Ozobranchius branchiatus</i> on front flipper	
Y47-Grace's Ledge 12-14-90	62.4	1 <i>O. branchiatus</i> in mouth	

ledges, or crevices. Two important resting locations were discovered in this study—Grace's Ledge and a site known as Canyons. Canyons is located about 400 m off Fort DeRussy in Waikiki, in water 10 m deep at 21°16'38"N, 157°50'32"W. This site was brought to our attention by personnel of the vessel Explorer operated by Atlantis Reef Divers. The Explorer visits this site daily to conduct scuba diving with tourists and other

clients. In addition to resting motionless on the bottom, turtles have been seen at this location being "cleaned" by surgeon fish and wrasses. Additional studies are needed for a better understanding of the significance of this behavior and what factors contribute to the establishment of discrete cleaning stations.

John Wilson, a video specialist and professional diver on the Explorer, reported the

Table 4.—Identification of dietary components from three green turtles found dead on Waikiki Beach.

Primary tag No./ cause/date	Straight carapace length (cm)	Sample contents	% Composition
Propeller slashes 10-9-90	53.0	<i>Ulva reticulata</i>	90
		<i>Acanthophora spicifera</i>	5
		<i>Amansia glomerata</i>	Trace
		<i>Champia parvula</i>	Trace
		<i>Gelidiella acerosa</i>	Trace
		<i>Gracilaria coronopifolia</i>	Trace
		<i>Lyngbya majuscula</i>	Trace
Z227 Gillnet mortality 12-17-90	42.5	<i>Hypnea musciformia</i>	30
		<i>Pterocladia capillacea</i>	30
		<i>Ulva reticulata</i>	25
		<i>Codium edule</i>	15
		<i>Acanthophora spicifera</i>	Trace
Propeller slashes 4-3-91	50.0	<i>Ulva fasciata</i>	50
		<i>Pterocladia capillacea</i>	40
		<i>Amansia glomerata</i>	10
		<i>Bryopsis pennata</i>	Trace
		<i>Polysiphonia howei</i>	Trace
		Cellophane Fishing line	Trace Trace

underwater sighting of three tagged turtles at Canyons. Two of these turtles (tags N842 and N844) had been netted in front of the Sheraton Waikiki, and the other (tag N570) had been hand-captured at Grace's Ledge.

#### Adverse impacts to the population

Several potential and actual impacts to the turtles off Waikiki were identified in this study, in addition to the ones previously mentioned relating to boat collisions and gillnets. Plastics and other synthetic debris were commonly seen along the beach and in the nearshore waters. Buoyant litter of this nature can be ingested by or can entangle sea turtles and have harmful effects (Balazs 1985). One of the turtles (tag N844) sampled off the Sheraton Waikiki was found to have eaten paper (Table 2).

Disease and predation by sharks were not identified in this study as major factors. On one occasion, a turtle was observed with a section of its carapace missing, but healed. This may have resulted from impact by a boat, or from shark attack.

During the course of the study only one turtle was sighted with fibropapillomas (tumors). This turtle was seen at Canyons and documented on videotape by John Wilson as being in poor condition because of emaciation and numerous large tumors. The turtle was subsequently found dead—washed ashore at Magic Island near Ala Moana Beach Park, immediately west of Waikiki Beach. The prevalence of tumors on green turtles is substantially greater at several other locations on O'ahu and elsewhere throughout the Hawaiian Islands. For example, in Kane'oh'e Bay an estimated 50% of the turtles are afflicted with this disease (Balazs and Pooley 1991).

Other potential adverse impacts from humans were discovered at Grace's Ledge during November 1990. An illegal mooring buoy was found attached to the ledge by a chain and rope, immediately over the turtle resting site. Three possible consequences could have resulted from this mooring had it not been reported to authorities and subsequently removed. First, the mooring line could have entangled a turtle, causing it to drown. Secondly, power boats using the mooring increased the likelihood of collision with a turtle. And lastly, the buoy served to "mark" the ledge thereby attracting visitors to it and increasing the level of disturbance.

#### Conclusions

During this 10-month study 15 turtles were captured, tagged, and released off

Waikiki Beach. Only one species, the green turtle, was encountered. Green turtles feed in shallow waters within 100 m of shore, and were commonly seen engaged in this activity in front of the Sheraton Waikiki. Food sources utilized off Waikiki Beach consisted primarily of the benthic algae *U. fasciata*, *U. reticulata*, *H. musciformis*, *P. capillacea*, *Spyridia filamentosa*, and *Gelidium pusillum*. Sizes of the turtles tagged ranged from 37.6 cm (8 kg) to 80.7 cm (82 kg). Resting habitats for turtles were identified at Grace's Ledge off the Kapahulu seawall and at Canyons off Fort DeRussy. None of the turtles tagged and released had signs of disease, although one turtle was seen with fibropapillomas, and subsequent to this study a few others with the disease have been reported in the area. The findings from this study lead to the tentative conclusion that the green turtle population off Waikiki Beach is relatively large (perhaps > 100 individuals), and in a generally healthy condition. However, adverse impacts especially from gillnet fishing and boat traffic are causes for concern that should be addressed. Efforts need to be made to enhance the protection of these turtles and the habitats upon which they depend. The educational and ecotourism aspects of viewing turtles in a benign fashion, from both above and below the water, should be promoted wherever possible.

#### Acknowledgments

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Many people contributed to the successful accomplishment of this work. Steve Russell and Sherwood Maynard of the Marine Option Program gave valuable advice and facilitated the necessary financial assistance. Students of the Marine Science Program of Hawai'i Loa College regularly contributed their time and talent during netting activities, along with Michele Finn, Teresa Parsons, and Karl Bromwell. Corey Hanner and Glynnis Nakai also volunteered their assistance. The support and help of Christina Lamb and William Gilmartin are also appreciated.

Valerie Boyar-Nato originally called our attention to the presence of turtles in front of the Sheraton Waikiki. Grace Yavelow made us aware of turtles resting under a ledge off

the Kapahulu seawall which we named on her behalf. The use of facilities at the Sheraton Waikiki was generously supplied by B. J. Hughes of the hotel's public relations department. Terry O'Halloran of Atlantis Reef Divers hosted us on the commercial dive vessel Explorer. John Wilson, Steve Ball, Tom Fake, and the Hawaiian Moving Company expertly photodocumented the turtles off Waikiki and our research activities and kindly made copies of their work available to us. Dennis J. Russell of Seattle Pacific University professionally identified the algae reported herein. Bob Morris, D.V.M., provided valuable veterinary services and advice. We gratefully acknowledge all of the above individuals and organizations.

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## Learn to Care for Oiled Birds

by Suzanne Palmer

With the recent oil spills in Spain and Scotland, one has to wonder, "Is Hawai'i next?" A grim thought, yet an accident of catastrophic proportions could become a reality due to our major dependence on imported oil.

Imagine a drop of oil the size of a dime. Although a seemingly miniscule amount, it can cause hypothermia and loss of buoyancy by matting a bird's naturally waterproof feathers.

If just one drop of oil can create this problem, imagine what could arise out of a major spill where birds are completely drenched in sludge.

With Hawai'i the state with the most endangered species, the National Audubon Society (in cooperation with several federal and environmental agencies) has taken the lead in organizing oiled wildlife rescue and rehabilitation classes statewide.

Volunteer classes will be taught by bird expert Jay Holcomb of the International Bird Rescue and Rehabilitation Center of Berkeley, California. Classes, which last for four hours, will be held on O'ahu on Saturday 13, Sunday 14, and Wednesday, 17 February; on Kaua'i Monday, 15 February; on Hawai'i Thursday, 18 and Friday, 19 February; and on Maui, Saturday, 20 February. Call Suzanne Palmer, 522-5566, for information and to register.

## Can You Give Some Time to Help Your Audubon Society?

by Lynne Matusow

A volunteer organization is only as good as the efforts put forth by its members. Without the assistance of members like you, the Hawaii Audubon Society will be hard pressed to continue and expand its services. At press time we were seeking to fill the following positions:

**Program Committee Chair.** This committee is responsible for running the general membership meetings six times a year. The committee finds guest speakers, prepares press releases concerning the meeting, conducts the meeting, and serves refreshments. Most of the work can be done from your home or office. If you can spare four hours a month to coordinate these activities, call Lynne Matusow, 532-4260 (H) or Phil Bruner, 293-3820 (W).

**Phone Tree Coordinator.** You will be responsible for maintaining the list of persons participating in the telephone tree and giving information to phone tree participants when calls need to be made. We need a self starter who is a good communicator and who can devote four to eight hours a month for a minimum of a year. This work can be done from home. Some knowledge of environmental issues and legislators is a plus. To volunteer call David Hill, 943-2784 (H).

**Phone Tree Callers.** We are growing a phone tree—a chain of people who can make calls to decision-makers on environmental issues. This allows the environmental community to respond very quickly with public pressure on important issues. To join our phone tree, call David Hill at 943-2784 (H).

**Testimony Presenters.** Here we need self-starters who can tactfully and effectively present testimony at the legislature, county councils, and hearings of governmental boards and agencies, usually on weekdays during daytime hours. If you can't write the testimony, we will have someone else do it. A knowledge of Hawai'i, including issues, politicians, and who the players are is a big plus. A minimum of four hours a month is required. To volunteer call David Hill, 943-2784 (H).

**Recordkeeper.** This position, which requires you to spend one morning or afternoon a week at the office, entails integrating our membership records with our fundraising records and locating telephone numbers for all new members. The work is done manu-

ally. To volunteer call Lynne Matusow, 531-4260 (H).

**Volunteer Coordinator.** This hardworking, gregarious individual will match volunteers with available jobs, see that volunteers are trained, and maintain contact with volunteers to see if they are happy or have suggestions for improving things, and plan volunteer recognition events. This job will take two hours or more weekly. To volunteer call Lynne Matusow, 531-4260 (H).

**Office Staff.** We would like to have our office open five days a week. People are needed for morning or afternoon shifts Monday, Tuesday, Thursday, and Friday. Among the duties are answering the telephone, distributing the mail, referring problems to the appropriate officer or committee chair, filing, and responding to routine correspondence. To volunteer call Lynne Matusow, 531-4260 (H).

**Writers and Editors for 'Elepaio.** If you can write stories, edit copy, and come up with story ideas call Lynne Matusow, 531-4260 (H).

The above is only a partial list. If you have a particular skill or interest, call Lynne Matusow, 531-4260 (H). Who knows, maybe we have the right opening but haven't publicized it yet. All of the above are volunteer positions. Hawaii Audubon does not have paid staff.

## Research Grants

The Hawaii Audubon Society makes grants for research in Hawaiian or Pacific natural history. Awards generally do not exceed \$500 and are oriented toward small-scale projects within Hawai'i. Special consideration will be given to those applicants studying dryland forests and aeolian systems on Hawai'i.

The deadlines for receipt of grant applications are 1 April and 1 October. For an application form send a self-addressed stamped envelope to Grants, Hawaii Audubon Society, 212 Merchant Street, Suite 320, Honolulu, HI 96813. For more information, call Phil Bruner, (808) 293-3820 (W).

# Volunteer Corner: the Making of Paradise Pursuits

by Doug Lamerson

The shift in momentum is subtle, almost imperceptible; a point here, a point there, a couple back-to-back. Gradually the spectators take notice. The once confident leaders begin to appear tentative, vulnerable. A foregone conclusion is reconsidered. The improbable becomes imaginable. A comeback is underway.

Waipahu High School, having dug a very deep hole in the early going is trying to climb out with a desperate last ditch rally to stave off elimination at the hands of Kalani. Have they waited too long? Is it too late? Can they do it?

The tension and rivalry belie the setting. For this is not some sun-beaten quarter mile oval or pulsating OIA gridiron on a Friday night. Rather, this is the serene campus of the Hawai'i School for Girls where chirping birds and an impressive view from the slopes of Diamond Head are observable through an open second story window on a tranquil Saturday morning. And the competition here is academic, not athletic. This is Paradise Pursuits, the environmental quiz game cosponsored by Hawaii and National Audubon Societies, where the players are more likely informed about endangered species than end runs, and the issue for Waipahu is dwindling questions, not seconds on a scoreboard clock.

Jan Nakamura's post-mortem is matter-of-fact, incisive. "We didn't study the fish enough. That really killed us." Then, slightly sheepishly, "I was responsible for the fish." Captain of the three member Waipahu Team, Ms. Nakamura is disappointed that they won't be advancing beyond this preliminary round toward the finals and a 26 January appearance on KHON TV-2. Yet, the 15-year-old sophomore is upbeat about the experience and the opportunity to make students more aware of environmental issues.

For her, Paradise Pursuits complements perfectly an emerging personal concern for the natural world. She is both fascinated and saddened by the plight of Hawai'i's native plants and animals. She speaks softly but earnestly of the need to raise public consciousness and develop protection strategies to save what remains of Hawai'i's natural endowment. Nakamura's conviction and enthusiasm bring a proud smile to the face of her science teacher and team advisor, Liza Shigeteta. And it's the kind of response Kersten



Left to right: Kersten Johnson, Alyssa Miller, Susan Scott, and Emily Gardner.

Johnson was thinking about when she began noodling around with the notion that ultimately became Paradise Pursuits.

One weekend a couple of years ago, Johnson and friend, Will Freeman, were wondering what to do. "We didn't want to go to one more movie or rent yet another video," she recalls, "and I started leafing through a magazine and saw an ad for an environmental board game. We both thought that was kind of an interesting idea."

Johnson had good reason to be interested in interesting ideas of that sort. As then-chair of the HAS Education Committee she had already been thinking about groups that were not benefitting from environmental education programs and strategies to reach them. Hawai'i's high school students provided a ready focus. "The 'Ohi'a Project (administered by Bishop Museum and Moanalua Gardens Foundation) targeted kids K-6 and intermediate school age, but there was really nothing for the high schools," says Johnson.

The idea of a board game to promote awareness of Hawai'i's unique natural domain seemed to embody the critical element for pedagogical success in the adolescent milieu: fun. But, Johnson believed the format would also appeal to a broader population of adults as well. Eventually, she teamed up with Sheila Laffey who was developing the Alien Species Alert Program (ASAP) for National Audubon

Society and the Paradise Pursuits concept evolved into its present quiz game format. However, Johnson still thinks the board game is a viable strategy capable of engaging an even larger audience. But that's a project that will have to get in line behind other competing concerns.

A consultant in community environmental education and co-coordinator of the East-West Center's Participatory Development Group, Johnson manages a full schedule of research and applied activities that transcend strictly environmental issues. After completing a policy oriented master's curriculum in energy and resources at UC Berkeley, she found herself focusing increasingly on the micro issues of individual and small group dynamics in the social change process and her life's question—how to encourage people to live in a responsible manner. The pursuit of an answer is as likely to take her to rural communities back east as to the Big Island for workshops on leadership development skills.

Still, she managed to fit in a term on the HAS Board and finds time to rehabilitate young birds—"mostly introduced who aren't too smart"—that have tumbled from their nests, a practice she began when growing up in Minnesota.

She acknowledges that volunteerism can be difficult to sustain amid a full agenda of

professional and personal business. Her own involvement in Paradise Pursuits has ebbed and flowed over time as the press of other commitments has dictated. "In an ideal society," she says, "we would be able to pay people for many of the volunteer activities we value so highly." Realizing, however, that the millennium was not yet at hand she turned to other committed but uncompensated helpers when it came time to get Paradise Pursuits off the ground.

That's where geography graduate student Alyssa Miller entered the picture. A self-described strong believer in individual action with a B.S. in natural resources planning and a lifelong interest in environmental education, she was easily persuaded of the value of the project by her friend Johnson. The most immediate challenge was to create an inventory of questions that would constitute the basis of the competition. They figured they needed about 1,000 to avoid repetition through the qualifying and final rounds. Furthermore all the questions had to be verified against authoritative references. That herculean task was the major contribution of Dan Moriarty, another early collaborator and, a huge relief, according to Miller and Johnson. Still after two months of brain racking with the help of others the count stood at 250 or so and it was clear more help was needed.

A modest appropriation from both HAS and NAS brought marine biologist Emily Gardner on board to help make up the shortfall. As the question pool rose to an acceptable level, the volunteers continued to feel their way along, in the words of Alyssa Miller, ironing out wrinkles, nailing down details. Finally, the first Paradise Pursuits competition was staged last Spring with 10 O'ahu schools participating. That number rose to 16 including six Neighbor Islands schools when the second competition got under way this Fall.

As the players nervously strain forward to the edge of their chairs in anticipation of moderator Randy Scoville's next question the intensity of concentration becomes obvious. Points won and lost create rollercoaster-like emotional responses that hint at the preparation invested. In conversation with students and teachers it's clear that Paradise Pursuits has succeeded as entertaining, engaging education.

It's been instructive for the volunteers too. Kersten Johnson quickly dismissed an initial apprehension that some of the questions might be too tough. Student comprehension exceeded her expectations, and she was particularly impressed with team spirit. Alyssa

Miller was also surprised at the depth of student knowledge, and she found their enthusiasm contagious and a cause for optimism. She calls Paradise Pursuits "a powerful tool" for educating adults as well because, "the kids take the experience home with them and share it with their parents."

As for Emily Gardner, the Earth Trust research associate and Chaminade biology instructor found the experience so much fun she stayed on as a volunteer and was appointed education committee chair in January. This Fall environmental writer Susan Scott was hired by NAS to expand the question base further. The author of three environmental books and the *Star-Bulletin* "Ocean Watch" column, Scott has been "a great addition to the team," according to Gardner, bringing a solid research background and different perspective to the on-going refinement process.

The four women agree the hundreds of hours invested in Paradise Pursuits has been time well spent. The project has been typical in many ways of their other volunteer activities, an enriching and challenging experience that has strengthened their sense of personal commitment and growth. And, says Miller, it's the kind of worthwhile community education project HAS should do more of if more members could make the time to be involved.

The noon break is over now. Johnson, Miller, Gardner, and Scott prepare to resume their duties as judges and scorekeepers for the afternoon competition. Meanwhile, in an exchange that perhaps best illustrates the dynamics that make Paradise Pursuits a success, Jan Nakamura and teammates Mark Paguyo and Marlow Beleno have seamlessly segued from critical post-game analysis to a lively discussion of which pizzeria will offer the best return on their lunch money. As they depart, the Waipahu team confirms that this has been a fun learning experience they hope to repeat. "But," assures Nakamura evenly, "next time we'll know those fish."

*The Paradise Pursuits final rounds, moderated by Leslie Wilcox, air on KHON TV-2 on Tuesday, 26 January, at 7:00 p.m. The broadcast will be repeated on Sunday, 7 February, at 4:00 p.m.—Ed.*

## Moving?

Please allow four weeks for processing address changes. Because our records are kept in order by zip code, we need both old and new addresses.

## Mahalo Donors!

The Hawaii Audubon Society thanks the following members and friends for their generous contributions. This list reflects donations received through 31 December, 1992.

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## Two Get Grants

In December the Hawaii Audubon Society awarded two research grants. Nanette Seto received \$602 to study the effects of rat predation on Bonin Petrel (*Pterodroma hypoleuca*) reproductive success at Midway Atoll. Lisa Privitera, who is studying alternative mating tactics in coral reef fish, received a \$533 grant.

## Scholarships Available

The Hawaii Audubon Society will be awarding two undergraduate tuition scholarships of \$1,340 to Hawai'i residents attending the University of Hawai'i for the 1993-94 school year. This scholarship, named the Rose Schuster Taylor Scholarship, is made available by the Yao Shen Trust, in honor of Rose Schuster Taylor. Terms of the trust require that recipients be Hawai'i residents, attending the University of Hawai'i, whose area of study is related to Hawaiian natural history, especially if it may lead to the better protection of native wildlife in Hawai'i. HAS will also be awarding the Clara Grenville Hatch undergraduate scholarship. This \$1,000 stipend for the 1993-94 school year is for a student at any college or university in the state whose area of study is related to Hawaiian natural history.

Applicants should submit the following information: name, address, telephone number, class year, and explain how their academic major relates to Hawaiian natural history. They should also discuss how they plan to apply their academic degree to further study or work experience in Hawaiian natural history, how their course of study will enable them to contribute to the better protection of native Hawaiian wildlife, and if they have made contributions to the study of Hawaiian natural history, especially to anything that might contribute to the protection of native wildlife.

Applicants should attach a transcript of their college or high school records and three letters of recommendation.

Applications should be sent to Phil Bruner, Chair, Scholarships and Grants Committee, Box 1775, BYU-H, La'ie, HI 96762, telephone 293-3820 (W). The application deadline is 1 May.

## Notice to Authors

*'Elepaio* invites submission of original scientific articles of between 1,500 and 3,000 words on the natural history of Hawai'i and the Pacific. Such articles are subject to peer review.

Scientific articles should be typewritten and double-spaced. Four copies must be submitted. In addition, authors are asked to submit the article on a computer diskette, with a clear indication of the word processing program used. Because we have a Macintosh computer, we prefer you use that Macintosh compatible software, although we can convert DOS.

We do all layouts directly on the computer. For that reason, authors are asked to adhere to the following guidelines: only one space after periods; no indentations, except for paragraphs and tables; no underlines, if on a diskette underlines should be shown as italics; no bold face type; use upper and lower case, nothing is to be in all capital letters; Hawaiian glottals should be used; capitalization for all bird species should follow American Ornithologists' Union nomenclature; dates should be shown as date, month, year; and the address of all authors should be included.

Photographs/illustrations may be either color or black-and-white prints, 3.5 by 5 inches or larger. They should be clearly labelled as to subject and photographer/artist. Cropping lines (if needed) should be indicated. The originals of figures, maps, graphs, etc. should be clean and clear, with lettering large enough to remain legible after reduction to fit journal format. Submit two good-quality xerographic copies along with each original illustration.

Manuscripts should be sent to *'Elepaio*, Hawaii Audubon Society, 212 Merchant Street, Suite 320, Honolulu, HI 96813.

## Birding on O'ahu

A two-page guide listing areas on O'ahu where interesting birds may be found and where access is not a problem is now available. Written by Peter Donaldson, it offers important information for birders unfamiliar with Hawai'i. The guide is not designed to give detailed directions or information on bird identification. For a free copy, send a self-addressed stamped envelope to O'ahu Birding Guide, Hawaii Audubon Society, 212 Merchant Street, Suite 320, Honolulu, HI 96813.

## Election Results

by Lynne Matusow

Reginald E. David has been re-elected Hawaii Audubon Society President. Also elected were Linda M. Paul as second vice president and David Hill, E. J. "Jay" Lembeck, Lance Tanino, and Marjorie Ziegler as directors. At the January board meeting, Betsy H. Gagne was appointed recording secretary and Emily Gardner was appointed a director of the Society. Their terms expire in December, 1994.

The terms of First Vice President Casey Jarman, Corresponding Secretary Carl Christensen, Treasurer Lynne Matusow, and directors Kevin Shaney and Joyce Stanney expire in December, 1993.

## Just Because It Says Audubon Doesn't Mean It's Us

Recently ads have appeared stating the Plantation at Kapalua's three golf courses in the West Maui mountains are registered with the Audubon Cooperative Sanctuary Program. This is not a program of either the Hawaii Audubon Society or the National Audubon Society.

## Available: *Condor*, *American Birds*, *Wilson Bulletin*

The Society has the following publications excess to its needs and is making them available to institutions, libraries, and its members.

*American Birds*: V. 28—Nos. 1, 3, 4, 5, 6; V. 29—Nos. 1, 3, 4, 5, 6; V. 30—Nos. 1, 3.

*The Condor*: V. 3—No. 2; V. 7—Nos. 1, 2, 3, 4, 5; V. 49—Nos. 1, 2, 3, 4, 5, 6; V. 50—Nos. 1, 2, 3, 4, 5, 6; V. 51—Nos. 1, 3, 4, 6; V. 52—Nos. 4, 5; V. 72—No. 3; V. 73—No. 4; V. 75—Nos. 2, 3; V. 76—Nos. 1, 2, 3, 4; V. 77—Nos. 1, 2, 3, 4; V. 78—No. 1.

*The Wilson Bulletin*: V. 83—No. 3; V. 84—Nos. 1, 2; V. 85—Nos. 2, 3, 4; V. 86—Nos. 1, 2, 3, 4; V. 87—Nos. 1, 2, 4; V. 88—No. 1.

Requests may be made no later than 12 March. There will be no charge for numbers picked up at the Hawaii Audubon Office. If mailing is required, the applicable postage will be charged. There is only one copy of each number.



# Hawaii Audubon Society

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# T-shirts for Sale

The Hawaii Audubon Society has a stock of T-shirts designed to spread the Audubon message. Not only are they attractive personal apparel, but they make excellent presents as well.

T-shirts bearing the Society's 'Elepaio logo are available in ash (gray) with a black design. We also have a few in aqua, navy, white, and beige. In addition, the "hot" Kolea (Pacific Golden Plover) T-shirts are also available. This T-shirt is white with a three-color design of the Kolea and native hibiscus. Proceeds from the Kolea T-shirt go to help HAS fund research on shorebirds in Hawai'i and elsewhere in the Pacific region.

T-shirts are \$12 each, plus \$2.00 per shirt for postage. They are available in medium, large, and extra large adult sizes only. When ordering T-shirts, be sure to list size and first, second, and third choice of color. To order T-shirts send your check, payable to the Hawaii Audubon Society, to Yvonne Izu, 2069 California Avenue, #20B, Wahiawa, HI 96786. Don't forget to add \$2.00 per shirt for postage. Insufficient postage will delay your order until the proper amount is remitted. T-shirts are not available at the HAS office.

# HAS Dues for 1993

All amounts are in U.S. dollars.  
Includes delivery of 'Elepaio.

## Life Membership \$300.00

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# BOOK REVIEW

by Bruce D. Eilerts

## *Waterfowl: An Identification Guide to the Ducks, Geese and Swans of the World*

Steve Madge and Hilary Burn, foreword by Roger Tory Peterson, 298 pages, including 47 color plates, 153 range maps, and line drawings. Paperback edition 1991, \$24.95, Houghton Mifflin Company, 215 Park Avenue South, New York, NY 10003.

One of the few complete field guides to the waterfowl of our planet, *Waterfowl: An Identification Guide to the Ducks, Geese and Swans of the World*, is a must for serious or novice birders and naturalists alike. Anyone who frequents the world's wetlands, continental coastlines, and oceanic islands will find this book extremely useful and informative. The guide is a complete reference which covers every known waterfowl species in the world. A cloth and paperback version of the book is now available. The cloth version is 6"x9-1/2" and makes a hardy and attractive reference to one's natural history library. The paperback version is more compact, lightweight, and flexible, allowing for more convenient use while traveling or working in the field.

The guide's color plates are beautifully illustrated and well organized. Some species are depicted more accurately than others, but all illustrations are more than adequate for use in waterfowl identification. The difficulty involved with identifying winter and female plumages in waterfowl is addressed successfully in the book's text and illustrations. Distribution maps are placed immediately opposite the color plates, making waterfowl identification and range information readily available for quick reference. Brief life histories precede species descriptions as the reader peruses the various families of waterfowl, arranged in proper taxonomic sequence.

Since waterfowl are encountered almost everywhere one ventures in the world, this field guide is the perfect travelling companion for a birder, naturalist, or traveler. It is an excellent reference and is highly recommended.

# Calendar of Events

## First Monday of Every Month

Monthly meeting of the Conservation Committee, 6:30 p.m., at the Coffeeline, 1820 University Avenue (in the YWCA). To join or for more information call David Hill, 943-2784 (H).

## January 26, Tuesday

Semi-finals and finals of Paradise Pursuits Quiz Show for high school students, KHON TV-2, 7:00 p.m. See related story on page 14.

## February 7, Sunday

Rebroadcast of Paradise Pursuits Quiz Show, 4:00 p.m. See 26 January for details.

## February 8, Monday

Board meeting, 7:00 p. m., HAS office. Call Reggie David on Hawai'i, 329-9141 (W), for details.

## Week of 13 February

Oiled bird rescue and rehabilitation classes on O'ahu, Maui, Kaua'i, and Hawai'i. See story on page 13.

## February 21, Sunday

Field trip, James Campbell National Wildlife Refuge. Bruce Eilerts will lead this 2-mile walk (3-4 hours) which features endangered Hawaiian waterbirds, migratory shorebirds and waterfowl, and vagrant species and seabirds. Walking shoes, sunscreen, binoculars or spotting scope, and water are recommended. Meet at 7:30 a.m. at the State Library on Punchbowl Street or at 9:00 a.m. at the Kahuku Sugar Mill Texaco station. For more information call Bruce Eilerts, 487-1806 (H). Suggested donation: \$2.00.

## February 22, Monday

General membership meeting, Paki Conference Room, Bishop Museum, 7:30 p.m. Members of the Honu Project will present "Fall of the Ancients," a video funded in part by HAS which documents the problems facing Hawai'i's green sea turtles Refreshments will be served.

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