1998-1999

Chiquita
Guatemala

3 of 3

GBS

Nimy-68

246016
TUT

144079/CARGO

245726 278765 CARGO

Mead
COMPOSITION

MIDWAY • 14-22 OCT. 98
• 24-27 MARCH 99
• 22-25 Sept 99

GEORGE BALAZS (808) 395-6409

100 sheets • 200 pages • 100 hojas
9¾ x 7½ in/24.7 x 19.0 cm
wide ruled/réglage large/rayado ancho

GEORGE BALAZS
395-6409

(808) 973-2940

14-22 OCTOBER 98
24-27 MARCH 99
22-25 SEPTEMBER 99

BALAZS
992-A Awaawaanoa Place
Honolulu, Hawaii 96825

0 43100 09918 5
B-101

TRIP III

22 Sept. 99 Wednesday Boeing 737
Acoa 1165 N. Miles
Depart 4PM FL. 501 Honolulu to Midway
GATE 54 2 hours 48 min.

① Kattie Herrington, ② Marc Rice,
③ Denise Parker & ④ Me

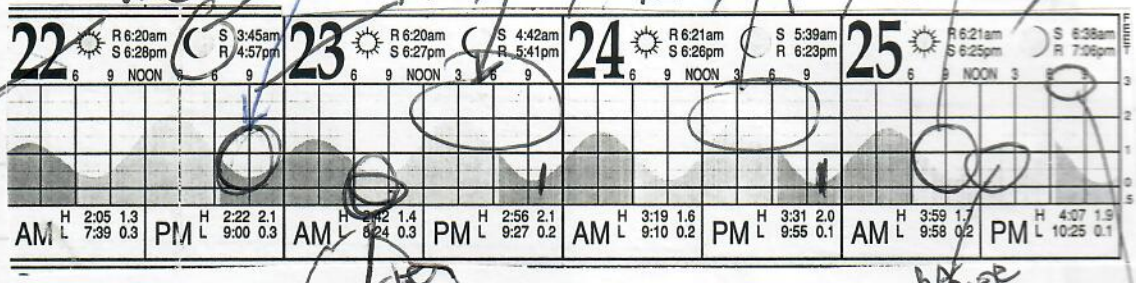
Arrive ~ 6PM Midway time - Video by Marc of Midway

OBjectives: ① Deploy time Depth recorders (TDRs) for HABITAT USE
② Deploy SONIC TAGS - FOR HABITAT USE (to locate resting s... IN INNER HARBOR
③ Recoveries for growth rates; 1970s TAGS
④ Screen for Tumors
⑤ Change Seawater Temperature data loggers
⑥ Map Halophila field
⑦ Train NANCY to Hydrophone Receiver

SUNRISE 615 am?

Met by Carolyn & Nancy Hoffman
TO Branch Fwb rooms 321 & 322
Denise & Kattie to Charlie
~ 8pm to Cargo Pier - Road shift toward Fuel Pier. Two adults 1970s seen under net debris at start of Cargo Pier. Male swam off slowly. Another another female appeared. More video of circling - to side, ready

Sept. 99



9/22/99 Wednesday

upside down. Looking for food on bottom -? trying to stir up food? No fright response to lights - slow and easy turns but splash at surface.

3 adult oshoe basking by the Boat Ramp. I approached & they left it moved started towards the water. But 2 hours later it was back.

3 TOTAL

Nancy says turtles are there at 630 am each day, gone at 7 am.

Drove to inner harbor & small new wooden stairs and floating raft platform. Saw an adult female on ~~the~~ inner harbor side. Slow swimming.

Returned in 10 PM, saw Moto #22 by not debris wad of Cargo Pier.

T page 140

138

CAPTURE DATE, LOCATION AND METHOD:

Sept. 20, 1999, Sand Island, Turtle Beach, MIDWAT ATOLL

PERSON RECORDING DATA: Yuko Sterrer

OLD TAGS:

NEW TAGS: ~~RFF~~ LFF

413B612D7A

~~LFL~~ RFL

4149257D6B

TUMOR SCORE: Ø

OTHER NEW TAGS:

STRAIGHT CARAPACE-LENGTH: 76.0 WIDTH: 59.2

NOTCH LENGTH: 76.0 DB: L.O. VB: L.O.

CURVED CARAPACE LENGTH: 82.5 WIDTH: 76.5

HEAD WIDTH: 10.8

SEX: MALE, FEMALE OR UNDETERMINED: U

PPS: YES OR NO OR NE

TAIL LENGTH: T 22.5 C 7.5

RIGHT FRONT FLIPPER WIDTH: 11.8

SAMPLES COLLECTED:

PLASTRON LENGTH:

WEIGHT:

DESCRIPTIVE REMARKS:

Has ~~one~~ Both eye, scar on 8th lateral scut on Rt. Side

Motolool #24 2nd Lateral Right + Left

#24

from page 137

Midway

By kk Rand

9/23/99 Up 500AM 530AM to Basking Beach
Thursday Marc & I boxed the only Turtle basking - Adult male, no previous marks of IDs. Shoaled Sand around box, took shots eating breakfast, then attached Sonic & TDR. See page ___.

After release, we drove around entire island with scoop nets. one turtle subadult seen along inner harbor sea wall. none else where including SE Seawall, "Garbage Show" Bulky by dump Rusty Bucket.

Ate lunch at cafeteria.

Launched Nettie NOAA 16' whaler - Scuba
Tug Pier - retrieved Data logger # roped to piling 25'
obvious leakage had occured. Saw
Scuba #1 #11 under pier. Caught 2 others.
30 min. 25 ft And saw another didn't catch = 4 TOTAL
Motored to Halophila are off of kk Rand / basking beach.
Scuba #2 60 min 30 ft. Collected Halophila for dino flagellates.
Abundant and relatively dense Halophila
10 - 30' deep. ~~Ate~~ Areas of sand

SCUBA

Chinese: 125. Gym - Courtyard. Black Carp. | G5 Gulfstream JET

Japanese Italian Hungarians

9/23 with lines/marks - placed where turtles feed? Large turtles seen surfacing. 3-4 large seen w/ arc with definity to right side of compass (headed) - I swam with her for awhile, circled, didn't flee. Proceeded to dive Cargo Pier from end inward. Saw adult female no marks - too large to catch. Caught small unmarked Just before end of dive caught maturing male, close to shore, under debris. Into boat, then took all 5 turtles back out at bathouse, worked up all turtles - Marc and Katie did most of attachment of TDR and sonic. All released at boat ramp, slid on slippery algae - video.

Cheked beach after dinner at French Restaurant - no basher.

9-24-99 Friday "Cargo" net moss under Cargo Pier removed by Norman (volunteer FWS). where turtle were aggregating

142 Need- call ANJA +Send email to Mick Gunter

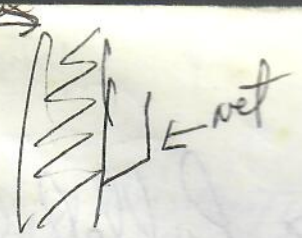
Need copies of # sightings - Nancy Galley posting

9/24/99 6:30am M2RC & Denise Drive around
Friday Results as follows:
Cargo Pier - none seen
Halophila beds - a few heads
Inner Harbor seawall goiz out
#11 + 8 others. 6 goby out, 2 going in
RAIN! SE seawall, Inner Harbor - none seen
Blowing!
MARC 11AM
Denise A.M. Cargo Pier - 1 capture at very end, 36' deep
KATIE resting in a tire. See data page ____
Mototools #14, 17 & 22 seen on dive.
Worked it up in Skaplare Hangar - released Boat ramp.
Removed logger on Cargo Pier.

SON357 #25 248pm head from Cargo pier, determined to be under Fuel Pier - "500" mark - photos
Saw large ♀ surface by Fuel Pier.
Saw 2 large at end of fuel pier - one has healing large scar on top of carapace.

Launched whaler - took 2 x 50' x 8' net tied together to inner harbor - laid ____ on shallow area. Waited for turtles to come
seined

seen on TV | "Space Imaging" "Space Vest" | 12076 Grant | IKONOS satellite

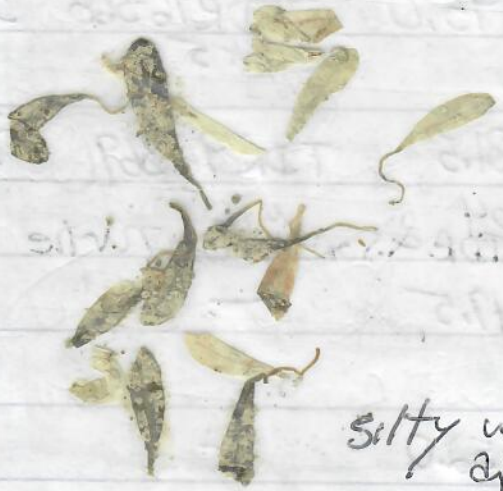


9/24/99 in from Cargo Pier - Halaphila side.
Friday Saw 5 adults (at least 4 ♀'s) swimming by end of seawall, but, swim towards Kihei Harbor, SE side, rather than along inside of seawall where our net was laid. After sunset ~630 pm we took up the net. NO captures
No turtles came along seawall. 17' new NOAA whaler tied to new floating dock by new Harbor Seawall, left overnight. Checked at ~11PM all fine.

9-25-99 Rain - wind during the night. Up ~530 am.
Sat. Checked basking beach - nothing. Waves, wind-driven swell - Roughest conditions I've ever seen by piers. Not possible to scuba. Checked new Harbor Seawall - Waves - Spray going over wall. Boat had ~1/8 full of water. Ate Breakfast - joined by ANJA from Sydney, Australia works ($2.20 hour) for Phoenix Corps. 715 am to Harbor. Bailed boat and set net ENTRANCE No turtles seen But at 830 am large female swimming along wall slowly swam into net, as if it wasn't there. We retrieved it with whaler!

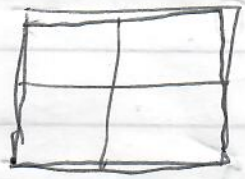
9/25/99 Pulled up net w/ turtle.
Sat. Proceeded to Scuba under
Tug Pier - GB, KH & M.R.
Strong wind, intermittent squalls.
Caught one - easy to catch
didn't struggle much just before reaching
the surface. only other turtle
seen = large male - 2 swam
after him but kept distance. Couldn't
touch, but it circled me. kept
coming back to pier. Scuba
to fishing boat pier. No turtles.
Hauled boat out. Ate lunch. To
Seaplane Hangar where we proceeded
to attach MK7 and Son to
Netted female. And Son 2 to Tug
pier for land-SCUBA capture. Chinese
detainees that were out walking
came and watched us. Photos
taken.
Released both ~ 330 pm. VideoMARC

9/25/99 Sat. Aloha Depart 7PM (Midway TIME (= 8 pm Honolulu time))
ARRIVE ~ 1115 pm



Halophila sampled off Turtle Beach, east of green buoy east of Cargo Pier. This sample used for dinoflagellate analysis

silty with deteriorating appearance



Quadrant to estimate % cover

146 Midway III

Summary of Turtles Captured 22-25 Sept. 99

N=8

	SCL Moto Dcl	CCL	TDR	SONIC	
9/23/99	88.7 (25)	95.0	TDR96-368 MK5	SON 357	MALE BASKING
9/23/99 Recapture from 10/93	75.3 (26)	81.5	TDR96-369	SON 447	MALE Cargo Pier
*	Recovered 6/15/04 TDR & SON		MK5 BASK	Turtle Beach	
9/23/99	44.5 (27)	47.5	—	—	Cargo Pier
9/23/99	48.3 (28)	52.0	—	—	Tug Pier
9/23/99	38.0 (29)	41.0	—	—	Tug Pier
9/24/99	51.3 (30)	54.5	—	—	Cargo Pier
9/25/99	88.8 (31)	96.0	TDR99-421 MK7	SON 469	Female net seawall inner HARBOR
9/25/99	58.0 (32)	62.5	—	SON456	TUG Pier

SCL Range 38.0 – 88.8 cm

See data page 54

9/23/99 - Cargo Pier

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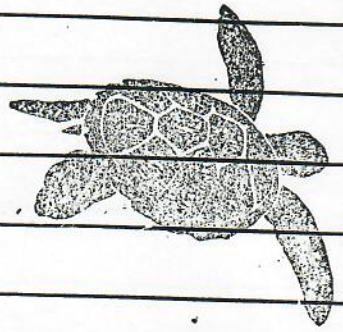
Note Chelonia on Right marginals

Straight carapace length

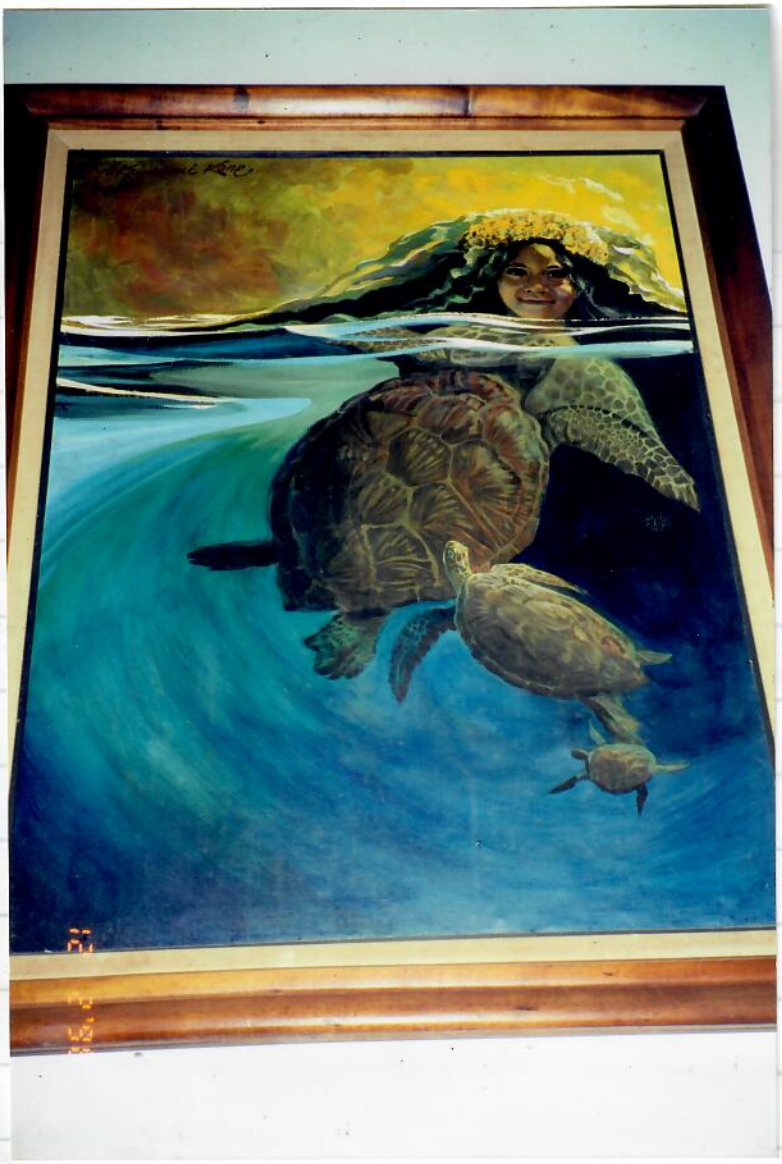
Straight carapace length (cm)	mL Liquamycin
35-39.9	0.5
40-44.9	1.0
45-49.9	1.7
50-54.9	2.3
55-59.9	3.0
60-64.9	3.6
65-69.9	4.3
70-74.9	4.9
75-79.9	5.6



NMFS, HONOLULU LAB

Curved carapace length

Curved carapace length (cm)	mL Liquamycin
40-44.9	0.7
45-49.9	1.3
50-54.9	1.9
55-59.9	2.5
60-64.9	3.1
65-69.9	3.7
70-74.9	4.3
75-79.9	4.9
80-84.9	5.5



150

Midway Atoll NWR - Turtle Tagging Records

Date	Left	Right	Sex	Location	Activity	OCL Carapace
5/12/97	N26	N18	Female	Turtle Beach	Basking	91.5 cm
5/19/97	N21	N20	Female	"	"	95.0 cm
12/5/98	–	N22	Female	"	"	90.0 cm
	(* Note: This turtle had extensive papilloma in arm pits, on neck and at rear portion of each eye. Turtle was also more lethargic than most turtles when handled for tagging. This turtle has been resighted in the same area on several occasions through 1/19/99)					
12/10/98	N24	N25	Male	"	"	87.0 cm
1/14/99	N28	N27	Female	"	"	98.0 cm
1/14/99	N29	N30	Female	"	"	82.0 cm
1/14/99	N31	N32	Female	"	"	97.0 cm

see page 151 Book II

Midway Inventory of un-used Bands as of 1 Sept. 1999.

Metal Bands Numbers	Condition	
N-9	non-useable	examples of how they should be fully locked
N-19	non-useable	
N-23	useable	
N-33 ↓	↓	
N-50	useable	

PIT Tags

29 available tags

GREEN SEA TURTLE SIGHTINGS, MIDWAY ATOLL

Turtle #	Date	Location	Activity	Comments
2				
3	24-Apr	29	2	swimming under pier;
4	29-Apr	21	2	
5	4-Apr	26	2	
	14-Apr	26	2	
	15-Apr	26	2	
	27-Apr	26	2	
	29-Apr	22	2	
6	29-Apr	22	2	
7	2-Apr	29	2	
	14-Apr	26	2	
	20-Apr	29	2	
	27-Apr	26	2	
8	2-Apr	29	2	
	4-Apr	29	2	
	5-Apr	29	2	
	8-Apr	29	2	
	18-Apr	26	2	
	22-Apr	29	2	
	29-Apr	29	2	
9	9-Apr	29	2	
	22-Apr	29	2	
	29-Apr	29	2	
10				
11	21-Apr	26	2	
12				
13	4-Apr	29	2	
	7-Apr	29	2	
	8-Apr	29	2	
	1-Apr	25	2	
	14-Apr	29	2	
	15-Apr	29	2	
	22-Apr	29	2	
	27-Apr	29	2	
14	7-Apr	29	2	
	9-Apr	29	2	
	11-Apr	29	2	
	14-Apr	29	2	
	15-Apr	29	2	
	19-Apr	29	2	
	21-Apr	29	2	
	22-Apr	29	2	
	27-Apr	29	2	
	29-Apr	29	2	
15				
16	21-Apr	26	2	
	~~28 APR~~	~~27~~	~~2~~	
17	11-Apr	29	2	
	14-Apr	29	2	
	18-Apr	26	2	
	22-Apr	29	2	
18				
19				
20				
21	30-APR	29	2	tagged 29-APR Sect. 26
22				

--see attached map for Location (Sand Island sector #'s) and Activity codes
--observations collected by USFWS, OSE and HWF employees

Oct. 21, 1998

Joshua Johansen

ONSET BRAND STOWAWAY DATA LOGGER IN MY BC POCKET

Eastern edge at 5 ft

midwyghb.dtf

10/17/98	12:55:13.0	PM	26.82
10/17/98	12:57:13.0	PM	26.64
10/17/98	12:59:13.0	PM	26.64
10/17/98	01:01:13.0	PM	26.47
10/17/98	01:03:13.0	PM	26.64
10/17/98	01:05:13.0	PM	26.82
10/17/98	01:07:13.0	PM	26.64
10/17/98	01:09:13.0	PM	26.64
10/17/98	01:11:13.0	PM	26.82
10/17/98	01:13:13.0	PM	26.82

Reef edge / CASINO

INNER HARBOR 29 feet

10/19/98	02:33:13.0	PM	26.82
10/19/98	02:35:13.0	PM	26.64
10/19/98	02:37:13.0	PM	26.47
10/19/98	02:39:13.0	PM	26.47
10/19/98	02:41:13.0	PM	26.47
10/19/98	02:43:13.0	PM	26.64
10/19/98	02:45:13.0	PM	26.64
10/19/98	02:47:13.0	PM	26.47
10/19/98	02:49:13.0	PM	26.47
10/19/98	02:51:13.0	PM	26.47
10/19/98	02:53:13.0	PM	26.47

TUG PIER

CARGO PIER at 31 feet

10/19/98	03:55:13.0	PM	26.82
10/19/98	03:57:13.0	PM	26.82
10/19/98	03:59:13.0	PM	26.82
10/19/98	04:01:13.0	PM	26.82
10/19/98	04:03:13.0	PM	26.64
10/19/98	04:05:13.0	PM	26.82
10/19/98	04:07:13.0	PM	26.64
10/19/98	04:09:13.0	PM	26.82
10/19/98	04:11:13.0	PM	26.82
10/19/98	04:13:13.0	PM	26.82
10/19/98	04:15:13.0	PM	26.82

CARGO PIER

INNER HARBOR at 25 feet

10/20/98	11:33:13.0	AM	25.77
10/20/98	11:35:13.0	AM	26.29
10/20/98	11:37:13.0	AM	26.47
10/20/98	11:39:13.0	AM	26.47
10/20/98	11:41:13.0	AM	26.47
10/20/98	11:43:13.0	AM	26.47
10/20/98	11:45:13.0	AM	26.47
10/20/98	11:47:13.0	AM	26.47
10/20/98	11:49:13.0	AM	26.47
10/20/98	11:51:13.0	AM	26.64

TUG

CARGO PIER

10/20/98	12:17:13.0	PM	26.64
10/20/98	12:19:13.0	PM	26.64
10/20/98	12:21:13.0	PM	26.64
10/20/98	12:23:13.0	PM	26.64
10/20/98	12:25:13.0	PM	26.64
10/20/98	12:27:13.0	PM	26.64
10/20/98	12:29:13.0	PM	26.64

CARGO

CARGO PIER LAST SCUBA NIGHT at MAX 23 feet

midwyghb.dtf

Time			Temper
10/20/98	10:47:13.0	PM	24.73
10/20/98	10:49:13.0	PM	26.12
10/20/98	10:51:13.0	PM	26.47
10/20/98	10:53:13.0	PM	26.47
10/20/98	10:55:13.0	PM	26.47
10/20/98	10:57:13.0	PM	26.64
10/20/98	10:59:13.0	PM	26.47
10/20/98	11:01:13.0	PM	26.47
10/20/98	11:03:13.0	PM	26.64
10/20/98	11:05:13.0	PM	26.64
10/20/98	11:07:13.0	PM	26.64
10/20/98	11:09:13.0	PM	26.64
10/20/98	11:11:13.0	PM	26.64
10/20/98	11:13:13.0	PM	26.47
10/20/98	11:15:13.0	PM	26.47
10/20/98	11:17:13.0	PM	26.47
10/20/98	11:19:13.0	PM	26.47
10/20/98	11:21:13.0	PM	26.47
10/20/98	11:23:13.0	PM	26.47
10/20/98	11:25:13.0	PM	26.47
10/20/98	11:27:13.0	PM	26.47
10/20/98	11:29:13.0	PM	26.47

CARGO LAST SCUBA

ALL TIMES ARE MIDWAY TIME (= 1 hour earlier than Honolulu)

8153

Depth Ft. / Minutes

Wed to Wed

SCUBA

DIVE NO. Dive Profiles - For Midway (10/14 to 10/21)

9 23/39 - Night Cargo Pier - Video 10/20/98

8 38/36 - } Cargo & Fuel Pier - 10/20/98
32/12 - }

7 25/6 - Tugboat Pier. 10/20

6 31/15 - Cargo Pier - 10/19 - 1 Adult male (2:50 - 3:10 pm)

5 29/15 - Tug Pier - 10/19

4 37/37 } Cargo Pier Day dives 10/18/98 - ~~9~~ 9-10 animals 8 CAPTURES
20/9 }

3 32/27 - Cargo Pier 10/17 - ~~2~~ 2 animals

2 33/57 - Inner Harbor dive - 10/16

1 24/43 - Night dive under Cargo Pier 10/15

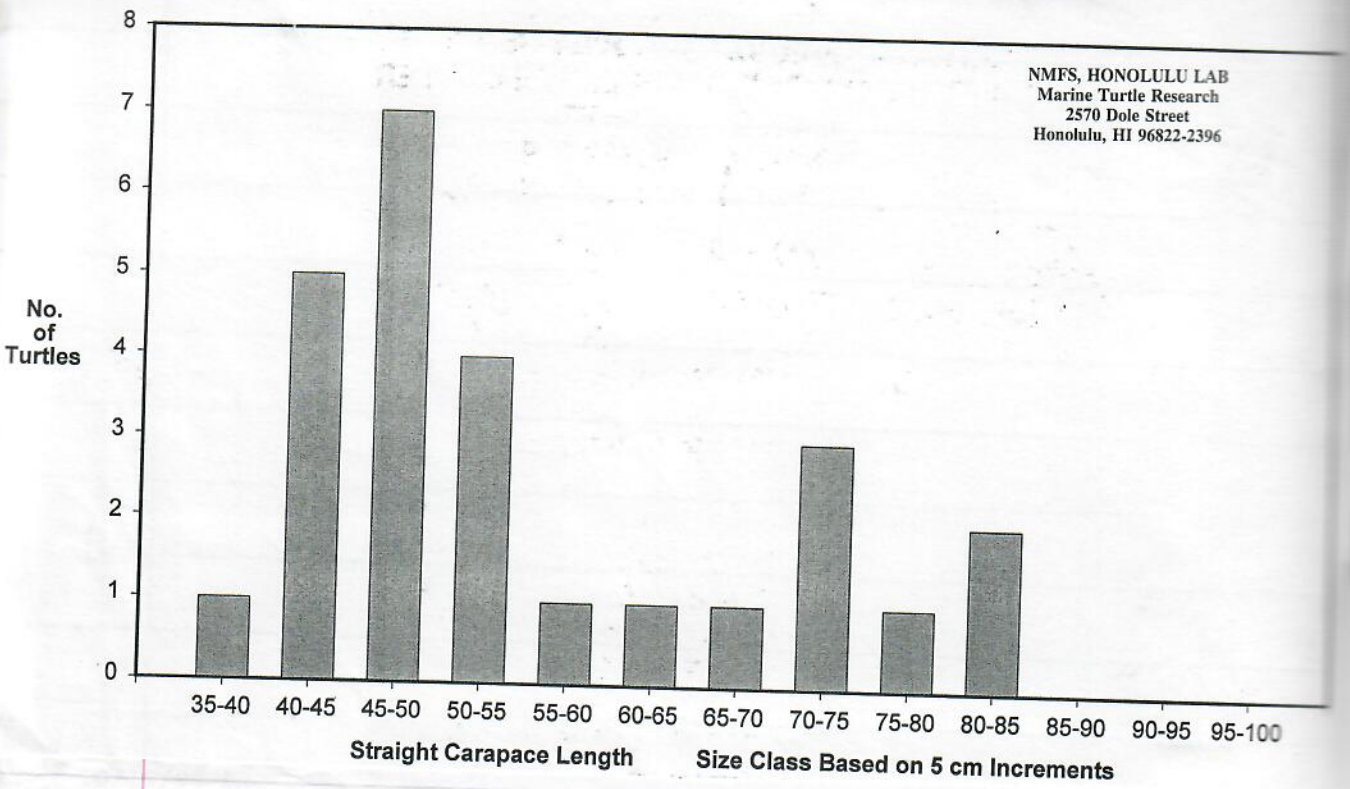
~~10/14/98~~

George - here is what I have pieced together from my dive computer. I am sure there are some inaccuracies.

Best,
Mare

Thought you might like to read the Morelli article -

Distribution of Size Classes for 26 Green Turtles Captured at Midway Atoll, 15 - 21 October, 19



Reservation 213723

Start Travel Date: 10/14/98
End Travel Date: 10/21/98
Date Booked: 10/8/98

Marc Rice
65-1692 Kohala Mountain Road
Kamuela HI 96743-
US

Home Number: (808) 885-4965
Work Number:
Fax Number:
☐ Golf Cart ☐ Bicycle

Citizenship: US
Social Security: 567-62-8818
Passport:
Visa:
Date of Birth: 3/16/45
Place of Birth:
Traveling With:
Email:
☑ Rental Phone

Emergency Contact Name / Phone: Pat Rice (808) 885-7321
Health Problems:
Special Needs:
Notes:
Male/Female: M
Weight:

Booking Notes: Govt. Employee

GEORGE H. BALAZS
HONOLULU LABORATORY
NATIONAL MARINE FISHERIES SERVICE
SOUTHWEST FISHERIES SCIENCE CENTER
2570 DOLE STREET
HONOLULU, HI 96822-2396
PH: (808) 983-5733/FAX: (808) 983-2902

Fedexed 10-27-98
TRACKING #807359166906

LIST OF (26) RBC
FROM MIDWAY MARINE TURTLES
SENT TO DR. PETER DUTTON
VIA FEDEX 10-27-98

FOR DNA ANALYSIS

1F690F3039
1F694D3E6D ← TEARED HIND FLIPPERS
1F70031D51
1F71572871
1F72532C70
1F6D1C4117
1F6D5B6039
1F6D676D20
200C784D0F
2007094907
41037A7E7D
4104134754
4104180D30
411C4C130B
411C670A23
411C726819
411C73127B
411F027D57
411F237B7A
411F4D576F
413B610D79
413B706D7B
414A486806
414B31336D
414B3F7B6E
414B53240F

See hind flipper tracings Page 163, 166

156 Painted #10

10-17-98 SCL=70.6 cm CCL=74.5 cm

78 lbs

SCL=65.3 cm CCL=70.5 cm
86 lbs.

PAINTED #14 CARGO PIER hand Scuba 10-18-98

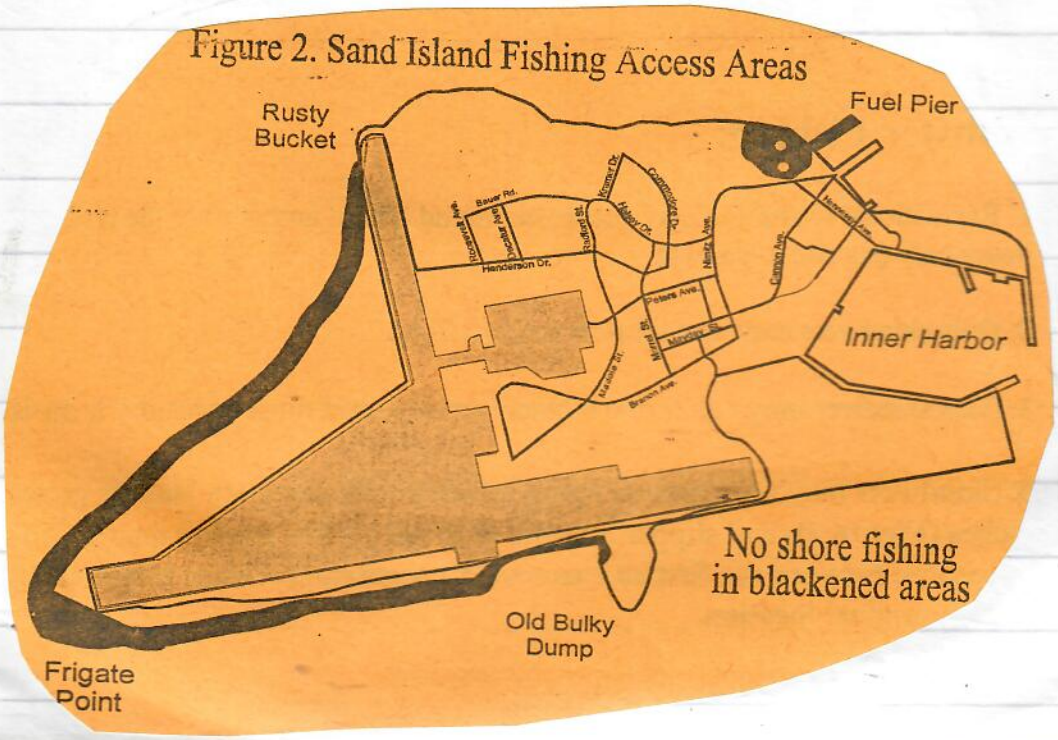
Web Sites:

http://www.midwaysf com: Midway Sport Fishing
http://www.navy.mil/homepages/navfac-es/brac/midway.htm: The Navy Clean up
http://www.sunsite.unc.edu/hyperwar/USMC/IJSMC-M-Midway.html: Marines at Midway
http://www.mtdaily.com/midway: Midway Island - A Nostalgic Look by a former Navy resident, Linda C. Campbell
http:Hwww.peoples.net/-cthawk/midway/midway.html: Battle of Midway by Chris Hawkinson
http://www.crossnet.com/midway: Battle of Midway by John Crossen
http://www.midwayphoenix.com: Midway Phoenix Corporation

Important Telephone Numbers: MOST LIKELY NOT CORRECT

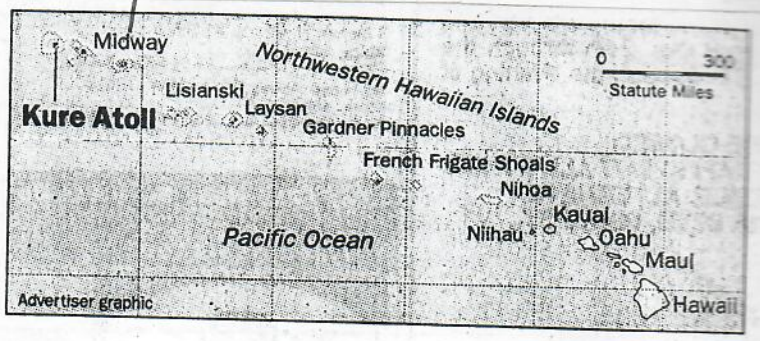
Midway Phoenix Corp.	888-MIDWAY1 (643-9291) (Tel) 770-386-6053 (Fax)
Phoenix Air Office (Honolulu)	808-833-4406 (Tel) 808-833-4310 (Fax)
Fish and Wildlife Service (at Midway)	808-599-5888 at second dial tone 808-421-3363 (Tel.) Please use Midway Phoenix Fax
Midway Phoenix Corporation (at Midway)	808-599-5400 (Tel.) 808-599-2922 (Fax)
Oceanic Society Expeditions	800-326-7491 or 415-441-1106 (Tel)
Midway Sport Fishing, Inc.	888-BIG-ULUA or 808-599-3881 (Tel)
Midway Sport Divers	888-244-8582 or 808-599-3881

Figure 2. Sand Island Fishing Access Areas



158

Oil spilled from wreck may imperil atoll wildlife



By Jan TenBruggencate
Advertiser Science Writer

A Honolulu-based fishing boat wrecked Friday on Kure Atoll is spilling oil and fishing gear onto the state-owned wildlife refuge.

The captain reported the vessel had 11,000 gallons of diesel oil aboard when it ran aground on Kure's northern reef. Kure is the most distant of the Northwestern Hawaiian Islands.

Salvage crews removed more than 7,000 gallons of seawater-contaminated diesel oil yesterday, and one estimate was that 3,000 to 5,000 gallons were still aboard as surf broke over the boat.

A slick spotted from an aircraft was believed to be hydraulic fluid, not diesel oil,

See Spill, Page A10

Spill: Oil, fishing gear may threaten atoll wildlife

FROM PAGE ONE

a state wildlife official said. And oil was not the only potential wildlife hazard aboard.

"We have reports there are 1,000 lobster traps, plastic bait cones and 11½ miles of long line washing out of that boat, and we're concerned about the entanglement risk," said Michael Buck, head of the state Division of Forestry and Wildlife.

The 80-foot Paradise Queen No. 2 ran aground Friday on Kure. Its six-member crew managed to swim and wade to Green Island, which once housed a Coast Guard station but has been uninhabited for several years. They were picked up later.

Capt. Frank Whipple, head of the Coast Guard Marine Safety Office in Honolulu, said the logistics of the spill site make response difficult. Kure's old Coast Guard airstrip is no longer usable. The atoll lies 60 miles northwest of Midway, which in turn is 1,300 miles from Honolulu.

The owners of the Paradise Queen No. 2 have accepted responsibility for the grounding, and their insurance carriers have dispatched the oil-spill response vessel American Islander from Honolulu. It is expected to arrive Saturday. Meanwhile, a crew flown to Midway has used portable equipment aboard a Midway-based tugboat to pump oil from the fishing boat.

Buck said he received a report that one fuel tank ruptured "and that fuel (diesel oil) is sloshing around in there."

There have been no reports of seabirds, sea turtles or seals entangled in the traps and fishing line. Kure is a prime refuge for those species. Whipple said the diesel oil may be more of a hazard to fish and other subsurface life than the denser product known as fuel oil, such as that which spilled in August from Tesoro Hawaii's Barbers Point tanker mooring.

The Tesoro spill was dense, black and floated on the surface, where seabirds, turtles and monk seals could become coated with it. Diesel, by contrast, more readily mixes with water and "affects wildlife in a different way," Whipple said.

10-23-98 THA B2

Diesel fuel removed from Kure Atoll

159

By Jan TenBruggencate
Advertiser Kauai Bureau

All diesel fuel has been removed from an 80-foot fishing boat that wrecked on Kure Atoll a week ago, and crews are planning the recovery of fishing gear that has been washing ashore on the remote island.

There were no indications yesterday of impacts to wildlife.

The Paradise Queen II hit Kure's north reef last Friday, with six men aboard. They made it ashore safely and were rescued by a fishing boat from Midway. Kure and Midway are the northwesternmost of the Hawaiian Islands, lying 1,300 miles from Honolulu.

Early reports indicated there were 11,000 gallons of diesel fuel aboard the boat. Response teams from Pacific Environmental Co. siphoned 7,000 gallons off the boat Wednesday, and reported there was no more fuel aboard. It was not clear yesterday whether that meant the early estimate was high, or whether the remaining fuel had spilled into the waters of the Kure reef.

Other oils are still aboard the vessel, and response crews are working to prevent further leaking. Pacific Environmental's ship, the American Islander, is scheduled to arrive at Kure shortly with additional equipment.

The Coast Guard Marine Safety Office reported yesterday that all compartments of the Paradise Queen II were flooded. The ship was still on the reef, being battered by waves from 6 to 8 feet in height.

Crews still hope to recover fishing gear from the vessel. The latest figures are that the Paradise Queen II carried 22,000 plastic bait containers, 1,040 lobster traps and 6,000 feet of line.

10-27-98 THA B2

Fishing boat stuck on atoll

Weather stalls wreck's removal

Advertiser Staff

A wrecked fishing boat continues to roll in the surf on Kure Atoll's outer reef as recovery teams await calmer weather.

"The vessel was declared a total loss," said Commander Jay Hess of the Coast Guard's Marine Safety Office in Honolulu yesterday.

The Honolulu-based Paradise Queen II ran onto the reef 1,300 miles northwest of Oahu Oct. 16. Its six crew members made it to an island inside Kure Atoll and were rescued. A response crew pumped 7,000 of fuel off the boat last week after an oil slick was seen floating from the vessel. Hess said the slick was headed away from the reef.

Kure is an unstaffed state wildlife refuge. The state Division of Forestry and Wildlife has ordered the Paradise Queen II's owners and insurers to remove the vessel from the island. State Forester Michael Buck said he believes the owners intend to haul it off Kure and sink it in deep water.

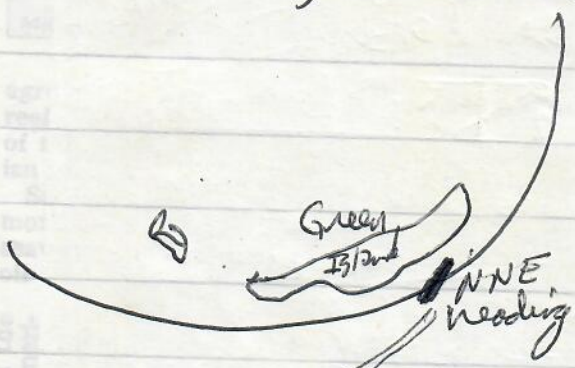
Hess said rough weather has prevented crews from getting aboard to determine whether there is more fuel or oil. Much of its fishing gear, including long sections of line, 22,000 plastic bait containers and more than 1,000 lobster traps, were still on board or washing on the reef, he said.

Buck said state wildlife officers have seen no wildlife hurt or entangled in the gear, but Hess said officials are concerned that the steel ship is damaging the reef as it rolls.

MIDWAY AIR TEMPERATURES

Average Temp	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
High	73	73	74	76	79	85	88	88	87	86	78	75
Low	63	60	62	65	68	74	75	76	75	73	68	66
Average Rainfall	4"	4"	2"	2"	2"	1.5"	2.5"	3"	3"	3"	4"	4"

"TREASURE QUEEN" Lobster Boat on Kure reef night of 10/14/98
160 Skip Naffel
SUNDAY Meeting
10-18-98 8AM
MIDWAY ISLAND TUG
22,000 Storage
~~Blocked ground~~
3-4kt from Lisianski, westward bound
~~Fast Sea~~



① Fuel-Diesel
② Lub oil 200-250gal ③ hydraulic oil 200 gal.
Nothing fueling on the beach.
1040 lobster traps total.
330 off into water.
"Reasonably dangerous operation".
1 trauma nurse, 2 regular nurses
1 Full Board certified emergency room Doctor

2200lbs bait. 1600 lobsters
Returned 10/20/98 Tuesday Returned.
6000 gal diesel removed

161

Start Travel Date	10/14/98	End Travel Date	10/21/98	Date Booked	10/8/98		
Monica K	Goo	Citizenship	US	Emergency Conta			
P.O. Box 1850		Social Security	575-27-8722	Michael Goo			
		Passport		(8080 239-8627			
Honokaa	HI	96727-	Visa		Health Problems		
US		Date of Birth	8/11/82		Special Needs		
Home Number	Work Number	Place of Birth					
(808) 775-8168		Traveling With			Notes		

Start Travel Date	10/14/98	End Travel Date	10/21/98	Date Booked	10/9/98		
Kenneth A	Shimo	Citizenship	US	Emergency Contac			
65-192 Kohala Mtn. Road		Social Security	569-99-2414	Mike Gautreaux			
		Passport					
Kamuela	HI	96743-	Visa		Health Problems		
US		Date of Birth	9/4/81		Special Needs		
Home Number	Work Number	Place of Birth					
(808) 881-4239		Traveling With			Notes		

Start Travel Date	10/14/98	End Travel Date	10/21/98	Date Booked	10/8/98		
Katherine A	Harrington	Citizenship	US	Emergency Conta			
323 Covington Road		Social Security		Roy Harrington			
		Passport		(650) 948-3093			
Los Altos	CA	94024-	Visa		Health Problems		
US		Date of Birth	9/30/83		Special Needs		
Home Number	Work Number	Place of Birth					
(650) 948-3093		Traveling With			Notes		

Start Travel Date	10/14/98	End Travel Date	10/21/98	Date Booked	10/8/98		
Candace M	Sullivan	Citizenship	US	Emergency Contact Nam			
02 Puako Beach Road		Social Security	590-25-6604	Win Sullivan/Viv Varney			
		Passport		(808) 882-1055			
Kamuela	HI	96743-	Visa		Health Problems		
US		Date of Birth	6/19/82		Special Needs		
Home Number	Work Number						
(808) 882-1055					Notes		

Wrecked boat remains at atoll

11-6-98 THA B1

By Jan TenBruggencate
Advertiser Science Writer

Cleanup crews are nearly finished removing debris from a wrecked fishing boat from Kure Atoll, but the removal of the wreck itself remains a problem.

"Apparently most of the (insurance) money has been expended," said Bill Devick, acting head of the state Division of Aquatic Resources.

The 102-foot steel hull of the Paradise Queen II went aground at Kure, 1,300 miles northwest of Oahu, on Oct 16. The crew was rescued safely and most of the fuel aboard was pumped off, but the hull is still rolling in the surf, grinding on the coral reef.

"It is listing heavily and continues to open up at the seams. The starboard side is taking a beating," said Capt. Frank Whipple, head of the Coast Guard's Honolulu Marine Safety Office.

Devick said the state is discussing with the Navy and the Coast Guard the option of one of them hauling the fishing boat off the Kure reef. It would be sunk in deep water, officials said earlier.

Kure is a roughly circular collection of reefs with a shallow center area and several sandbars. The largest sandy islet, Green Island, was once the site of a Coast Guard station for long-range aids to navigation. Kure is now a state wildlife reserve.

250 - 310 PM
Data logger Dive
Cargo Pier Dive
10/19/98 Monday IN my SCUBA VEST

10/19/98
Monday

*
Three ONSET STOWAWAY DATA LOGGERS Deployed AT MIDWAY

(1) #1187 PVC logger
1-hour sampling interval
300 days DURATION
133pm - 153pm
Deployed on INNER HARBOR TUG Pier
Tied with cord TO Girder 20' east
Looking face side
Retrieved 9-23- NOT Replaced
MAIN POSTS
Behind (LANDWARD) of these PILINGS IS AN ARM SIZE RUSTED ROD at an angle. PVC white is tied to this Rod.

MIDWAY

(2)
10/21/98 1PM Cargo Pier - left side - lamp post 15' depth
logger PVC #4074 GPS 28° 13.064 N
Suspended by cord, 177° 22.121 W
3/26/99 Removal, (NOT BLINKING) Replaced with - #224565 Retrieved 9-24-

(3) TUG PIER 4 PM PVC logger #1054 Suspended
10/21/98 by cord end right corner 15' depth.
GPS 28° 12.803' N
177° 21.783' W
3/27/99 Removal - blinking - replaced with # 224566 Removed 9-25-99 Replaced with #266016
OUT Returned 1/00

See p. 14 ~~Female~~ Female 10

SKHM Meas 10-27-98

220.07401
219.26213
220.03905

#10

10-17-98

RHF

See photo page 156

SCL-70.6
CCL-74.5
98 lbs

see p. 166

#10

HND Flipper seems small for turtles size.
See photos.
Brown carapace w/ black flecks.

Closest one found from Hawaii

SCL = 70.8 cm
CCL = 75.0 cm
Wt. = 81.8 #

RHF = ~ 298.30172
LHF = ~ 301.26101

MIDWAY
164 Needs Xerox

- ✓ New Sighting forms to distribute
- — Moto tool baskets / juveniles also (This should have been done this trip)
- * — * NO SCUBA CARGO
- No fish discards in Inner Harbor
- — ✓ Notification of dataloggers deployed
- — Sea watch INNER Harbor
- — New SNORKEL & MASK
- — Thank Lisa King x3339
- — ✓ EMAIL LEON/walt, re KEN T BACHMAN
- ✓ — ? Phone-IN 13 tank rental / MIDWAY SPORT DIVING INC to Ken T BACHMAN SHAWN #3, #5 each
- ✓ — EMAIL Barry & Linda Means; Kurt Haney
- — ✓ Trace Sigma Scan flippers + AUSTRALIA TRACINGS
- x3375 Slides to Ken Neithammer (overheads)
- — String of set distance from each for photo of each turtle.
- — Go to Midway for IN-Service, Lectures Accomp
- — Develop annual Midway Sampling w/ HPA STAGGERED MONTHS
- — Midway Mailing address = USFWS MIDWAY PHOENIX Corp. P.O. BOX 29460 HONOLULU, HI 96820-1860
- — BAN SCUBA under Piers except for Research
- SLIDES — (1) Midway FROM SPACE; (2) MAP of Chain HILITE MIDWAY
- (3) Turtle ? EATING jelly? or ?

- Discard of Fish Remains IN INNER HARBOR — Should be banned —

Date: Thu, 8 Oct 1998 15:28:42 -1000
From: Marc Rice <mrice@hpa.edu>
To: "George H. Balazs" <gbalazs@honlab.nmfs.hawaii.edu>
Subject: Midway Roster

George,

After all the dust had settled and the students sorted themselves out, I have 5 who are going to join us. I am listing their names below:

Katie Harrington- New student from California who participated in the Mauna Lani trip. She is scuba certified and an experienced diver... new to turtle capturing, however.

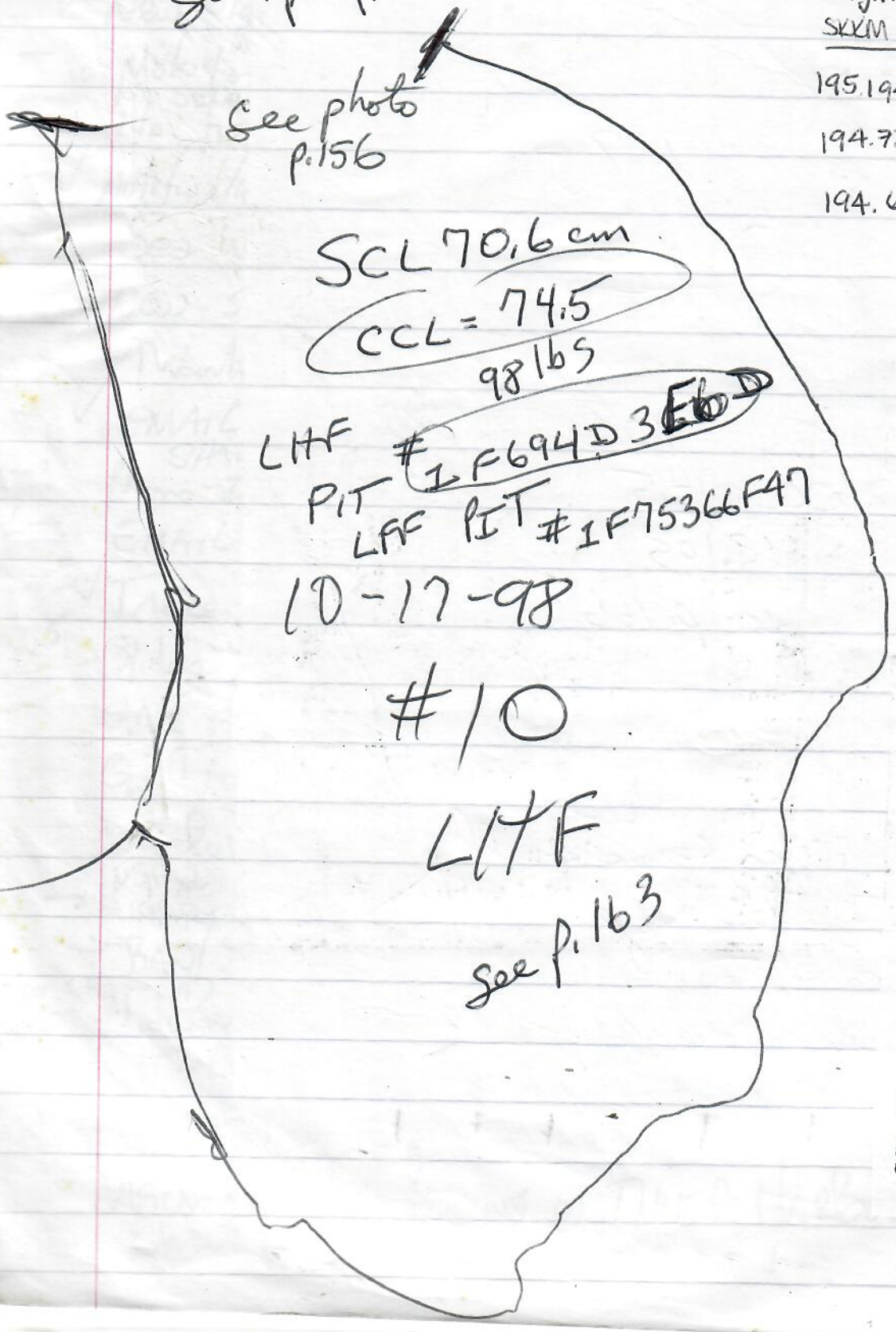
Kalia Goo- long time turtle tatoo specialist and was also present on the Mauna Lani trip. Will be newly certified scuba and will have to make the first couple of dives with me. She is leaning toward a verterinary career and expressed interest in marine mammals- we will have to correct that misdirected affection.

Candace Sullivan- has been on several tagging trips. Is only a snorkeler but should be a help. She is a good worker and does as she is instructed.

Josh Johansen- excellent diver- scuba certified. Will do anything to be in or about the water. He will be a good worker also.

Kenny Shimo- stepson of Mike Gautreaux. I don't know too much about him, but my colleagues say he is a pleasant kid and that he will be an asset. We will see. Anyhow, he will only be there until Sunday night.

That rounds out the student contingent. Thanks very much for allowing us to join you- I hope they will be an asset and improve the level of success of the trip...



See p. 14
paired 10
p. 156

See photo
p. 156

SCL 70.6 cm

CCL = 74.5

98165

LHF PIT # 1F694D3E6D

LHF PIT #1F75366F47

10-17-98

#10

LHF

See p. 163

SigmaScan A
SKKM Meas ID-27

195.19426

194.73481

194.69194

SigmaSca

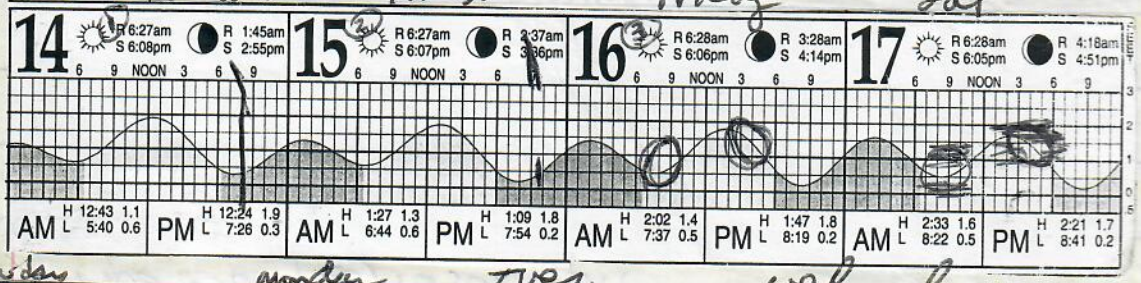
SCL=69.2, CCL=74.5, RHF=~250.59799, LHF=~245.94989
SCL=65.5, CCL=70.0, RHF=~258.76611, LHF=~252.00214
SCL=68.4, CCL=74.0, RHF=~322.39221, LHF=~317.29003
SCL=66.6, CCL=71.5, RHF=~269.44641, LHF=~276.67433

Midway Islands (28°13′N, 177°21′W). Midway is an atoll 11 km in diameter with 2 sand islands (Sand and Eastern) and a well defined fringing reef. Foraging areas exist throughout the lagoon and adjacent to the islands. A U.S. Naval Station is located at this site.

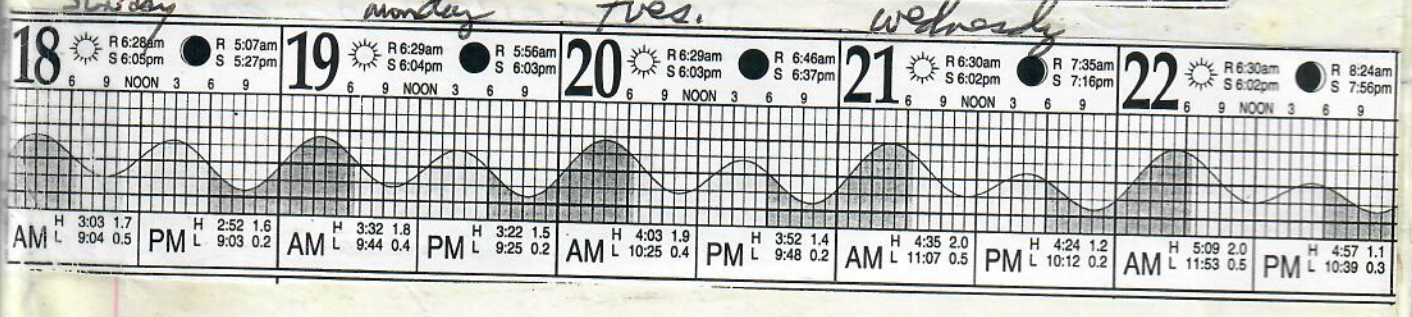
Kure Atoll (28°25′N, 178°10′W). Kure is an atoll 9.5 km in diameter with 2 sand islands (Green and Sand) and a well-defined fringing reef. Foraging areas exist throughout the lagoon but are mostly adjacent to Green Island. Kure is the world's northernmost atoll and, since 1960, the site of a small U.S. Coast Guard Loran Station.

Location and tag number	*Straight carapace length, cm*	*Interval in months*	*Growth rate cm per month*	*Mean growth rate cm per month*
Midway Islands (28°13′N, 177°21′W)	—	—	—	.09
2454	40.0	7.5	.08	—
404	40.6	21	.03	—
873	41.9	37	.04	—
1538	45.7	11.5	.11	—
472	48.9	6	.21	—
1539	50.4	14	.12	—
1539	52.1	8	.04	—
407	55.1	28	.11	
Kure Atoll (28°25′N, 178°10′W)	—	—	—	.08
2991	46.0	24	.04	—
2469	59.4	13	.12	—

Oct. 98 wed. Thurs. Friday Sat



Sunday monday Tues. Wednesday



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Candace Sullivan - 1573a Mckinly rd
Napa CA 94558
- P.O. Box 428
Kamuela Hi 96743

Katie Harrington - 323 Covington Rd.
Los Altos, CA. 94024
65-1692 Kohala Mtn. Rd.
Kamuela HI 96743

Joshua Johansen
65-1692 Kohala Mtn. Rd
Kamuela HI 96743
jjohansen@hpa.edu

Kalia "KalelehoKuikekaiokalia" Goo
MONICA
P.O. Box 1850
Honokaa HI 96727

Date: Thu, 22 Oct 1998 15:59:35 -1000
From: Marc Rice <mrice@hpa.edu>
To: "George H. Balazs" <gbalazs@honlab.nmfs.hawaii.edu>
Subject: Re: tagging turtles-midway (fwd)

George,

We got back to campus around 1100 hrs. and I have just finished my classes and am about ready to go home to unpack.

I wanted to express my sincere gratitude to you for allowing me and my students to join you on the trip. From my perspective, things went quite well and I think the students learned a great deal (probably learned some things I should rather not know about!- but that is life also). I hope that the help rendered was worth the hastles of dealing with teenagers- I know it can be trying at times. Your patience and good cheer, as always, keep us on task in a constructive and useful way. Most of the students will not know what a unique and wonderful experience they were afforded, but someday they will look back on the Midway trip with wonder and appreciation. I know that I do and always will.

Thanks again for being such a wonderful friend and compatriot...

Aloha,
Marc

TO Wildlife Computers 6/24/04

6/18/04

To: George Balazs
From: John Klavitter
Re: Turtle Transmitter

Note.
"K 7/28/97" written on the back

George,

Enclosed is the turtle transmitter that was recovered from Midway on 6/15/04.

Aloha,
John

- Recovered from Adult, male Green Sea turtle.
- ~~Location~~ Sand Island, Midway Atoll NWR, Turtle Beach (~250m East of Cargo Pier on NE side of Island).
- Date: 6/15/04
- Time: 1645-1710
- Captured by: Tim Bodeen, FWS
  - Assisted by: John Klavitter, Leona Laniawe, Stephine Bodeen, Burt (NMFS) ?,
- Turtle released uninjured.
- No flipper tags present on turtle, although looks like tags tore out (skin healed).

Midway firm ends airport services

Federal agency blamed, hopes to reverse decision

Jan 29, 2002 B1

By Jan TenBruggencate
Advertiser Staff Writer

Midway Phoenix officials cite serious differences in policy and management issues with the U.S. Fish and Wildlife Service in their decision to withdraw from providing airport management and ecotourist services at the Midway Atoll National Wildlife Refuge.

They have canceled their contract with Aloha Airlines to provide weekly service to Midway, are no longer taking reservations and are preparing to shut down the airport, power plants and other facilities by the end of February.

Midway Phoenix officials said no tourists are stranded on the island. The Fish and Wildlife Service has two staffers and several volunteers, and is considering chartering a flight to get the volunteers out.

The surprise decision was made Saturday by company president Mark Thompson and announced to Midway workers Sunday and yesterday after more than five years of managing the remote atoll, 1,200 miles northeast of the main Hawaiian islands. The company's 150 on-island employees will lose their jobs, and a number of suppliers, tour booking firms and others associated with the companies already are preparing for cutbacks.

Other victims: The Fish and Wildlife Service no longer will be able to catch the convenient scheduled flights to get personnel, volunteers and equipment to the island. The Coast Guard no longer will have a mid-ocean refueling stop for law enforcement and rescue operations. Overseas commercial air carriers will not have an emergency mid-Pacific landing spot, required by law for certain aircraft.

Neither the Fish and Wildlife Service nor Midway Phoenix has made an official public announcement of the withdrawal, but people close to the operation say the decision was made over the weekend.

"We don't have anything in writing yet, but we understand they have verbally told one of the people in the (Sec-

See MIDWAY, B5

Midway: Company cites dispute

FROM PAGE B1

retary of the Interior's) office," said Barbara Maxfield of the Fish and Wildlife Service Honolulu office.

Midway Phoenix Executive Vice President Bob Tracey said the main reason the company is stepping out is the difficulty of working with Fish and Wildlife Service management.

"We don't feel that Fish and Wildlife has exercised the flexibility to make this work," Tracey said.

Asked for examples, he said the agency restricted access to many of the beaches, often with little notice. It refused to allow the company to provide guests with kayaks, which Tracey said are permitted at other wildlife refuges and would not have threatened wildlife at Midway. The agency killed ironwood trees and left the unsightly wooded areas standing. Such actions left guests with little to do and made the island unnecessarily unsightly, he said.

"It made it unattainable to make money out there. We were really disappointed in their performance," Tracey said. "It's hard for us to take a $15 million beating, rapidly approaching $20 million."

The Fish and Wildlife Service doesn't feel the differences have been that serious, said Rob Shallenberger, deputy project leader for the Hawaiian and Pacific Islands National Wildlife Refuge Complex.

Shallenberger said the beaches designated off-limits to humans have been off-limits since the beginning. He said a kayak operation is allowed, but with conditions including that the trips be supervised.

"We approved it with conditions, and they didn't like the conditions."

Shallenberger said the agency killed off the ironwood trees on Eastern Island, but not elsewhere.

He said the Fish and Wildlife Service still has not received an official letter of notification that Midway Phoenix is leaving, and hopes the move can be averted.

Tracey said it might be able to keep a contractor on the atoll if there were some type of government stipend.

Aloha Airlines, which has run weekly flights from Honolulu to Midway since April 29, 1998, received notice yesterday morning that Midway Phoenix was stopping the flights.

Midway Phoenix has ordered its staffers to begin shutting down all equipment. Aloha has been asked to run a flight to take Midway Phoenix employees off the island on March 2.

Rick Gaffney, owner of Destination Pacific, which books fishing and diving tours at Midway, said Midway Phoenix has stopped taking bookings. "We were going to begin birdwatching tours this year. Midway is our primary destination, so the impact on us will be substantial," he said.

Midway is one of the Northwest Hawaiian Islands, near the end of the Hawaiian Archipelago. Only Kure Atoll, a state wildlife refuge, is farther from the main islands.

Midway Phoenix was the successful bidder for a contract to run the atoll after the Navy turned it over to the Fish and Wildlife Service. The agency was charged with managing the giant bird, sea turtle and Hawaiian monk seal nesting beaches there, but without the money needed to manage such a distant facility.

It arranged for the contractor to keep the old military airfield open, keep power and communications running, and convert old barracks into visitor lodging. But the island — although it has been an excellent fishing, diving and birdwatching site and visited by World War II history buffs — has not generated the volume of visitor traffic that the Fish and Wildlife Service and Midway Phoenix had anticipated.

GREEN TURTLE FORAGING AND RESTING HABITATS AT MIDWAY ATOLL: SIGNIFICANT FINDINGS OVER 25 YEARS, 1975-2000

George H. Balazs[1], Marc R. Rice[2], Nancy Hoffman[3], Shawn K. K. Murakawa[4], Denise M. Parker[5], and Robert J. Shallenberger[3]

[1] National Marine Fisheries Service, Southwest Fisheries Science Center, Honolulu Laboratory, 2570 Dole Street, Honolulu, HI 96822-2396 USA

[2] Hawaii Preparatory Academy, 65-1692 Kohala Mountain Road, Kamuela, HI 96743 USA

[3] Midway Atoll National Wildlife Refuge, P.O. Box 29460, Honolulu, HI 96820 USA

[4] Joint Institute for Marine and Atmospheric Research, 2570 Dole Street, Honolulu, HI 96822-2396 USA

[5] Joint Institute for Marine and Atmospheric Research, 8604 La Jolla Shores Drive, La Jolla, CA 92037 USA

A PINNACLE IN PELAGIC SEAS - In 1975 a unique research partnership was formed with the Koral Kings Dive Club at the Midway Naval Air Station. The goal of this union was to learn more about the sea turtles commonly seen at this tiny remote Pacific atoll (28°N, 177°W) at the northwestern end of the Hawaiian Archipelago (Apple and Swedberg, 1979; Rauzon, 2001). No nesting or terrestrial basking occurred at Midway in the 1970's, and all turtles encountered were green turtles (*Chelonia mydas*), nearly all of which were juveniles (Balazs, 1982a). During periodic visits by Balazs, Koral Kings' members were shown how to safely hand-capture turtles to measure, flipper tag and release them during recreational snorkeling and scuba diving. Important turtle resting habitats were found within the sheltered man-made Inner Harbor and underneath the large Cargo and Fuel Piers at Sand Island (Fig. 1 & 2). At nearby Eastern Island turtles frequented the shallow southern reef flat, but elsewhere within the atoll sightings were not common.

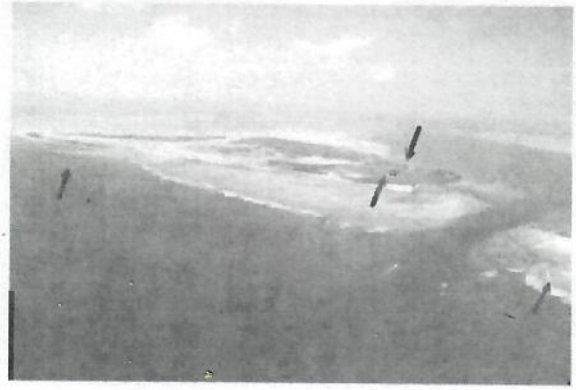
By 1979, as reported that year at the World Conference on Sea Turtle Conservation (Balazs, 1982b), eight juvenile turtles tagged and recaptured at Midway after 0.5-3.0 years were found to exhibit the astonishingly slow growth rate of 1.1 cm/year in straight carapace length (SCL). The high level of predation on juvenile turtles by tiger sharks at Midway caused one to wonder if year-class survival was sufficient, given such slow growth, for any turtles to reach adulthood. By the early 1980's the Navy's personnel and presence had diminished significantly at the historic World War II battle site of Midway. Clean-up activities were initiated to mitigate decades of military use. In 1988, National Wildlife Refuge status was achieved with the Navy's transfer of the atoll to the U.S. Fish and Wildlife Service. In collaboration with Midway Phoenix Corporation, limited ecotourism presently allows public viewing of the atoll's magnificent nesting seabird colonies and other special resources .

During the 1990's new partnerships were formed to resume sea turtle research at Midway, as shown by the authorship affiliations of this paper. Important and exciting discoveries have resulted from this renewed effort founded upon the pioneering work of the 1970's. The conservation status of the turtles at Midway has markedly improved, as demonstrated by the current size-class composition of 40% subadults/adults, in contrast to only 3% in the 1970's (Fig. 3). Resident adult females have been recorded migrating to, and returning from, the Hawaiian green turtle nesting colony at French

Frigate Shoals (see Balazs, 1980; Bowen et al., 1992). The slow growth rates of juveniles at Midway have now been confirmed by additional data that include a 22-year Inconel flipper tag recovery (0.5 cm/year SCL, Fig. 4). However, in contrast, a large subadult recently recovered after a 21-month interval displayed a growth spurt of 5.3 cm SCL (2.8 cm/year). Also of considerable significance is the finding that the Inner Harbor, piers, iron seawalls and related artificial elements at Midway continue to be preferred foraging and resting habitats for turtles (see Rice and Balazs, 2000). Other significant findings of recent work at Midway are briefly presented as follows:

– Basking ashore by juvenile, subadult and adult turtles is now a common occurrence.
– Juvenile turtles regularly feed on algae such as Spyridia filamentosa and Centroceras clavulatum growing on the iron seawalls. The turtles also feed on wind-driven pelagic invertebrates that accumulate along the seawalls, including gooseneck barnacles attached to synthetic floating debris.
– A small seagrass foraging pasture of *Halophila* hawaiiana occurs inside the atoll adjacent to the Cargo Pier and principal basking beach. Foraging on Codium cuneatum by subadults and adults takes place outside the atoll along the southern side.
– A time-depth recorder and sonic tag placed on an adult male revealed long periods of resting at depths of 20-25 ft., probably under the Fuel and Cargo Piers. Average dives lasted 67 min (range 17-120 min) representing 82% of each day. Seawater temperature during 1998-99 ranged from 19-27°C.
– Fibropapilloma tumors have been observed on several turtles during the 1990's, but none were seen during the 1970's.
– Turtles routinely travel between the Inner Harbor and foraging, basking and underwater resting habitats less than a mile away on the north side of Sand Island (Fig. 1). The turtles swim close to the seawalls and shoreline during this short transit, making them highly visible to tourists and readily available for observational research.

Figure 1. Sand Island showing, from left to right, the locations of: deep-water foraging zone of Codium cuniatum used mainly by adult/subadult turtles; Inner Harbor with seawall foraging and underwater resting habitats; Cargo and Fuel Pier underwater resting habitats, adjacent *Halophila* foraging area and "Turtle Beach" used for basking; and the southern reef flat of Eastern Island.



Acknowledgements:

We express our sincere appreciation to the numerous individuals and organizations that have contributed to this work since 1975. Special thanks are given to Linda and Gary Means, Jim Bradley, Curt Haney, Mac MacFarland, Anja Schiller, Noriel Tabo, Ron Anglin, Ken Niethammer, Bruce Casler, Suzanne Canja, Cynthia Vanderlip, Wayne Sentman, Dennis Russell, Peter Dutton, Thierry Work, Skip Naftel, Roy Harrington, Arjun Clary, George Watson, and Hawaii Preparatory Academy students John Alexander, Dylan Boyle, Kelly Davis, Kalia Goo, Katie Harrington, Joshua Johansen, Jill Quaintance, Kenneth Shimo, and Candace Sullivan.

Figure 2. North side of Sand Island showing Midway's lagoon and, from left to right: the Fuel and Cargo Piers where turtles sleep underwater; the *Halophila* hawaiiana seagrass pasture; the concrete seawall where drifting pelagic invertebrates collect and are eaten by turtles; and "Turtle Beach" where basking takes place.

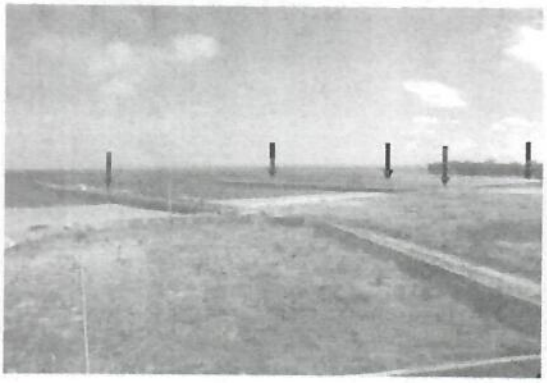


Figure 3. Comparison of size-class composition of green turtles at Midway, 1970's and 1990's.

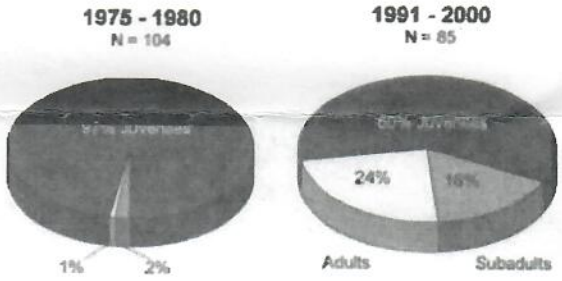
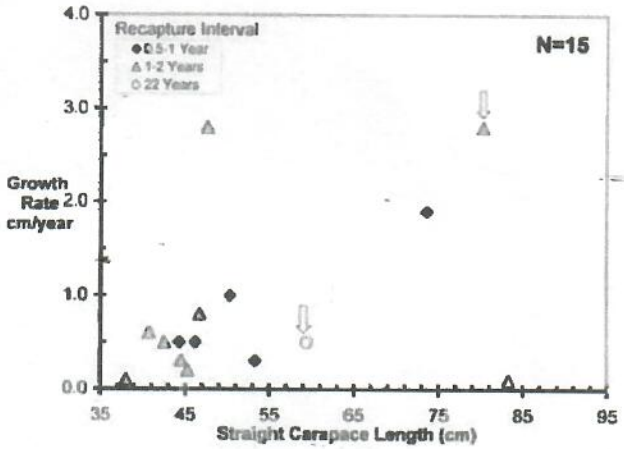


Figure 4. Growth rates of green turtles at Midway determined during the 1990's. Arrows point to the 22-year tag recovery and the large subadult with the growth spurt of 2.8 cm/year.



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NOAA Technical Memorandum NMFS-SEFSC-528

PROCEEDINGS OF THE TWENTY-FIRST ANNUAL SYMPOSIUM ON SEA TURTLE BIOLOGY AND CONSERVATION

Coming of Age

24 to 28 February 2001
Philadelphia, Pennsylvania, USA

Compiled by:
Michael S. Coyne & Randall D. Clark

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, FL 33149 USA

April 2005

Basking in the sun makes our green sea turtles unique

SUSAN
Scott
Ocean Watch

Physicist Stephen Hawking begins his 1988 book "A Brief History of Time" with a cosmic joke: At a public lecture, a scientist explains the earth's orbit around the sun, and the sun's around the galaxy.

"That's wrong," a woman in the audience says, "The earth is a flat plate resting on a turtle's back."

"What's the turtle standing on?" the scientist asks.

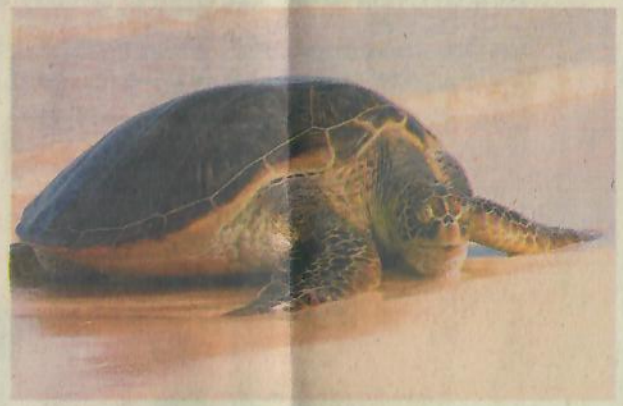
She replies, "It's turtles all the way down."

At Midway Atoll, about 1,000 miles northwest of Honolulu, that phrase often popped into my mind when I visited what is now called Turtle Beach. There, rows of green sea turtles bask in the sun from one end of the roped-off beach to the other.

These are big, fat turtles. Most had rolls of fat around their flippers and necks (turtlenecks!), and some bodies looked so rounded it seemed they might rock on a hard surface.

One day at Turtle Beach I watched one of those portly turtles (pictured) surf to the shoreline and haul its bulky body up the sand with flippers better suited to swimming. Shove by shove, with rests between, the turtle finally got above the break and then promptly fell asleep, safe from sharks and warm from the sun.

Green sea turtles are found in tropical and subtropical waters around the world, but only Hawaii's greens routinely bask on beaches. Other populations of green turtles, as well as other turtle species, lay eggs on beaches but don't sunbathe on dry land.



COURTESY SUSAN SCOTT

A green sea turtle hauls itself up the shoreline at Turtle Beach on Midway Atoll.

Ours sure do. The highest number of turtles I counted on Turtle Beach at one time was 28, a sight to behold but no record. In late 2009, turtle biologist George Balazs photographed 35 baskers on Turtle Beach, and last week a Midway biologist counted 38. When I told an albatross worker these numbers, she said that one sunny day last year she counted, "practically stacked up," 55 turtles.

This is remarkable on several levels. In the not so distant past, there was no such thing as Turtle Beach. Greens have always grazed in Midway waters, but only in the past decade or so has basking "caught on" there.

Researchers don't know all the reasons our greens rest ashore when others don't. It's clear, though, that Hawaii's turtles need places to nap undisturbed.

Besides their beach counts increasing, Midway's turtles are also growing up. In the late 1990s only about 24 percent of the baskers were adults, the others being the equivalent of teenagers, called subadults. Volunteer turtle researchers saw in 2010 that about 67 percent were adults of breeding age.

In checking the sleeping turtles for tags, the 2010 turtle team found one adult female tagged at Midway in 1977. Because she was probably about 20 years old at the time, she's at least 54 now. And still going strong. She nested at French Frigate Shoals in 2009.

Hawaii's green sea turtles are still a threatened species and have not yet recovered their numbers, but they're getting there. The tumor disease that once plagued our turtles seems to have run its course, and the state and federal laws protecting them are working. The sight of turtles in Hawaii's waters and on beaches is now common from Kure Atoll (land's end of the Northwest Hawaiian Islands and 57 miles northwest of Midway) to the Big Island.

For Hawaii the woman in Stephen Hawking's story was right. It's turtles all the way down.

Susan Scott can be reached at www.susanscott.net.

MANAGING PRESERVATION

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A new plan details agency responsibilities for the Northwest Hawaiian Islands

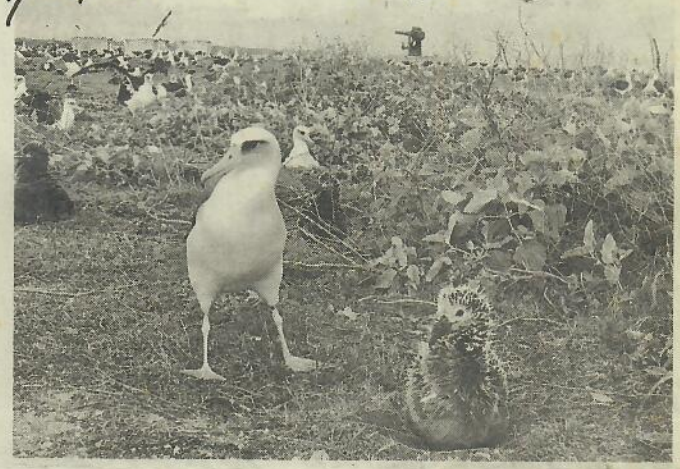
By Audrey McAvoy
Associated Press

LOUIS AGARD, 84, started fishing in the Northwestern Hawaiian Islands shortly after World War II. But in just 10 years, he began to notice stocks were rapidly declining, spurring him to push for the government to protect the vast island chain's resources.

Agard's voice quivered with emotion yesterday after the state and federal governments unveiled a plan for managing the 1,400 mile-long marine conservation area President Bush created for the islands in 2006.

"It almost makes me cry," said Agard. "I always say, 'What my eyes have seen you will not see again,' because we are so prone to getting into everything and taking it."

But now, Agard said there's hope the monument's protections will enable future generations to glimpse some of what he witnessed.



STAR-BULLETIN / 2007

This Laysan albatross and chick are on Eastern Island, part of Midway Atoll in the Papahanaumokuakea Marine National Monument. A World War II-era gun is in the distance.

"The designation of the monument was a spectacular commitment to conservation of the area. But to really bring that designation into reality requires a management plan."
Lynn Scarlett
U.S. Interior Department deputy secretary

The designation of the monument was a spectacular commitment to conservation of the area. But to really bring that designation into reality requires a management plan," said Lynn Scarlett, U.S. Interior Department deputy secretary. This "gives us 15 years of guidance in how to engage in restoration, engage in protection."

Many of the actions are already being pursued by state and federal agencies. The plan, however, lays the foundation for the different entities to break through the bureaucratic barriers dividing them.

"It shows the Hawaiian spirit of ohana of working together as a family even though many of us may have had little different ideas about how to do this," said NOAA Director Conrad Lautenbacher. "But we've come together to create a management plan we can all live with and work with."

Gov. Linda Lingle told officials gathered at Washington Place for a ceremony that she often recalls her two visits to the Northwestern Hawaiian Islands. Especially when she's stressed.

"You might imagine when I'm down at the Legislature I think of it a lot," Lingle joked.

"We can follow this all the way, and the people that will be next can enjoy what we saw," Agard said.

Three government entities are to jointly manage the Papahanaumokuakea Marine National Monument: the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service, and the state of Hawaii.

Yesterday, they released a 1,200-page management plan outlining ways they will combat problems like marine debris and invasive species that threaten wildlife habitats.

Officials are asking the public to review the document and submit their comments either by post, e-mail, or in person at meetings scheduled throughout the state in June.

The plan calls for boosting numbers of the Laysan duck, an endangered species, in part by creating and protecting more habitats for the birds. All 800 of the ducks currently in existence live on Midway and Laysan islands.

Another proposed action is to remove marine debris to protect the Hawaiian monk seal, another endangered species.

PUBLIC COMMENT SOLICITED ON PLAN

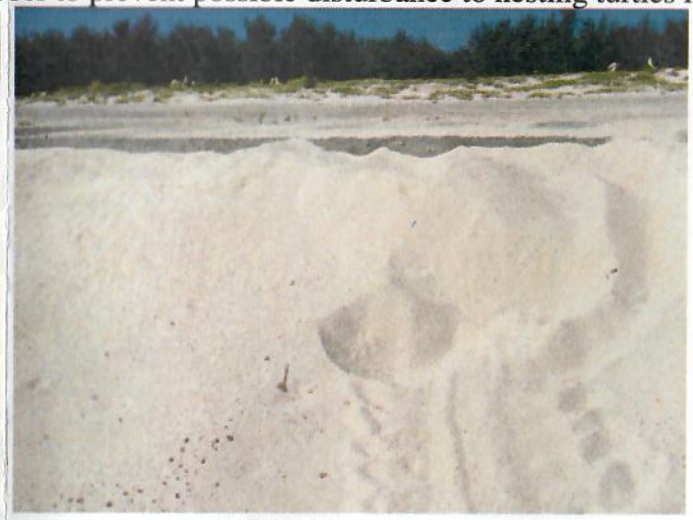
Public meetings on a 1,200-page management plan for the Papahanaumokuakea Marine National Monument:

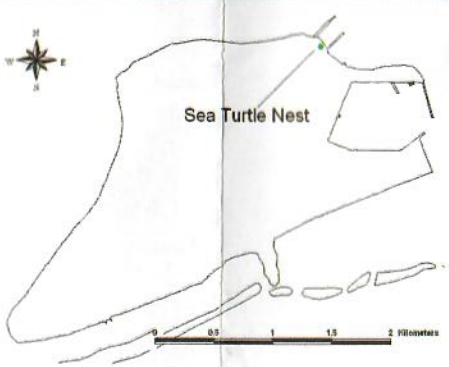
>> Oahu: Waianae Parks and Recreation Complex, June 9
>> Maui: Kahului, Maui Arts and Cultural Center, June 12
>> Lanai: Lanai High and Elementary School, June 13
>> Molokai: Kaunakakai, Kulana Oiwi Halau, June 16
>> Oahu: Heeia Visitors Hall, June 19
>> Big Island: Kona, King Kamehameha Hotel, June 17
>> Big Island: Hilo, Mokupapapa Discovery Center, June 18
>> Kauai: Lihue, Hilton Kauai Beach Resort, June 23
>> Oahu: Honolulu, Japanese Cultural Center, June 24

Green Sea Turtle Nest on Sand Island, Midway Atoll NWR, May 18, 2008

(J. Klavitter, U.S. Fish and Wildlife Service, Midway Atoll NWR, 5/18/2008)

- In the afternoon of May 18, 2008, John Klavitter (U.S. Fish and Wildlife Service) observed multiple sets of Green Sea Turtle tracks (94 cm wide, have the appearance of "ATV tracks") and a possible nest on the Cargo Beach on Sand Island at Midway Atoll NWR (01R 463731 3121353). This is the first known nest at Midway Atoll this year and only the third nest ever recorded on the refuge. One nest was found on Sand Island in 2007 and one nest on Spit on in 2006. Both previous nests successfully hatched.
- Niethammer et al. (1997) gives a mean incubation time for Green Sea Turtles in Hawaii as 66 days (range 53-97). So, the current nest may hatch sometime between July 10 and August 23.
- Signs have been posted around the nest to prevent Midway's residents or visitors from accidentally stepping on the nest.
- The tracks show that the turtle actually went above the sea wall and across the gravel road and into the Fuel Farm Field before returning to the beach to nest. Residents and visitors should be careful when driving and walking in this area after dark, because Green Sea Turtles will nest multiple times in a season. It is likely that this female and others will be in this area this summer.
- Campfires at the Cargo Pier area should be off limits from May to October to prevent possible disturbance to nesting turtles in this area.





Many fear a remote paradise soon may be inaccessible

The U.S. Fish and Wildlife Service cleared ironwood trees at Midway Atoll, which angered those who see it as a move to denude the site. The agency says it wants to improve ground nesting habitat and restore native vegetation.

Service cuts at Midway Atoll raise protests

By Jan TenBruggencate
ADVERTISER SCIENCE WRITER

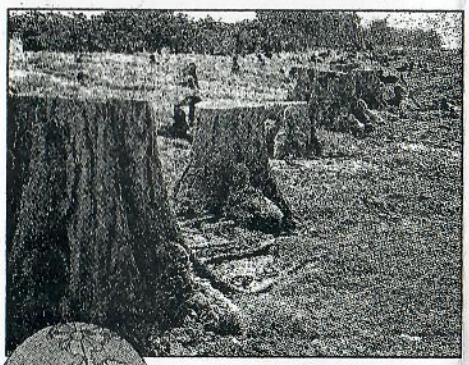
Midway Phoenix Corp.'s announcement that it will stop providing airport, utility and tourism services on Midway Atoll has raised a firestorm of criticism — most of it aimed not at Midway Phoenix but at the U.S. Fish and Wildlife Service.

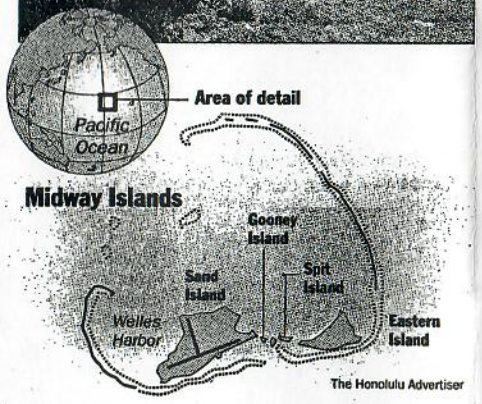
Many appear to fear that the company's departure will mean the end of public access to Midway. The Fish and Wildlife Service, however, insists that it is committed to continued public use of the site.

The agency will find another operator or multiple operators to run facilities if Midway Phoenix leaves, but the company has not said it is pulling out, said Rob Shallenberger, deputy project leader for the Hawaiian and Pacific Islands National Wildlife Refuge Complex.

Midway Phoenix executive vice president Bob Tracey said the company has stopped flights to the atoll, is no longer accepting reservations for visitors and "we're demobilizing our operation as we speak."

See MIDWAY, A7





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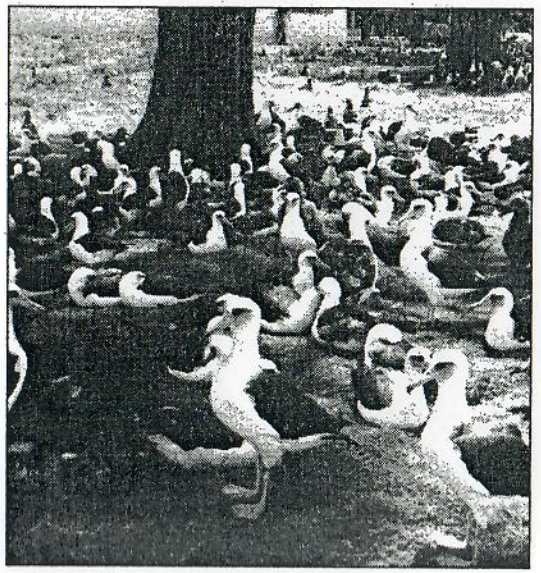


Midway Atoll has long been a nesting spot for albatrosses and other seabirds. Many would rest in shade of the ironwoods.

Midway: Agency accused of trying to limit access

FROM PAGE ONE

He said the company hasn't had time to send a formal letter of withdrawal.

However, Tracey also said the company would like to stay but under different circumstances — perhaps with a government stipend to help cover its losses, or in partnership with a different government agency than the Fish and Wildlife Service.

He said the company concluded that it cannot recoup its investment in running Midway under the restrictions that the Fish and Wildlife Service places on it. The service is so committed to its views of conservation that it does not concede the needs of a commercial operator, he said.

Among the complaints: Fish and Wildlife Service officials have chopped down scenic trees, limited visitors' access to many areas and ordered Midway Phoenix to deny landing rights at times to planes seeking to refuel, from which the company makes a profit.

"Unfortunately, we're dealing with the wrong agency," he said.

Ultimately, another Department of Interior agency, such as the National Park Service, would have been a better partner, Tracey said, since it has more experience dealing with private business entities.

Midway, an atoll near the end of the Northwestern Hawaiian Islands, lies 1,200 miles northwest of Honolulu. It has a firm place in military history — the battle that turned the tide of World War II in the Pacific occurred around it. It continued as a Navy base through the mid-1990s, and tens of thousands of military personnel and contractors have stayed there. Many developed a deep love for the place, and have returned as visitors during the past five years.

It also has a long history as a wildlife refuge. The other Northwestern Hawaiian Islands were designated a seabird refuge in 1903 by President Theodore Roosevelt, but Roosevelt turned over Midway to the Navy. Despite a century of human activity, it remained dense with nesting seabirds, and was regularly visited by seals and turtles. When the Navy had no more use for it, the Fish and Wildlife Service took over.

In an unusual step, the service invited a contractor to manage the old military base, run its airport and establish an ecotourist and history tour center, partly as a way to defray its expenses in managing such a remote site.

Midway Phoenix has been the contractor for more than five years. It said it has sunk nearly $20 million into the island and now does not believe it can make a profit there, given the service's aggressive conservation stances.

The service makes no apologies for its efforts at preservation, which it sees as its mission.

A point of contention is trees. Tracey concedes that early photographs of the island show no trees at all, and that imported trees were planted by the Navy for both shade and to retain eroding sand.

Most people who have visited the island during the past half century have known a Midway thick with trees, and many are appalled by the Fish and Wildlife Service's removal of all the trees from Eastern Island, one of the two largest islands within Midway Atoll, and the removal of a small portion of the trees on Sand Island, where human activity is centered.

"This (Eastern) was the island from which the bombers and fighter planes flew from in World War II," said Michael Denison, who worked on Midway as a contractor in 1940 and 1941. "It is one of the very few places belonging to the United States that a battle was waged from during that war. Now it is naked."

Bob Wilson, a Midway Phoenix employee and the harbormaster at Midway, said: "There is a map showing the areas of priority for tree removal on Sand Island (the only inhabited island in the atoll), with the stated intention to have all trees removed in 15 years."

Shallenberger said his staff has removed about 10 percent of the ironwood trees on Sand Island, and plans to cut down the trees from another one or two coastal acres, to provide additional habitat for black-footed albatross, a species whose numbers are declining. He said the service does not intend to remove all the trees, and said some species on Sand Island, notably terns, have begun using ironwood trees for nesting habitat.

But the service is also actively planting. The trees being removed are mostly introduced ironwoods. The service wants Midway revegetated with native species, most of which are much lower-growing than ironwoods. "Naked" Eastern Island is in the intermediate stage between ironwood removal and a new growth of native coastal plants, said the Fish and Wildlife Services public information officer Barbara Maxfield.

Wilson said he believes Fish and Wildlife Service officials ultimately want all humans off the Northwestern Hawaiians Islands so the agency's personnel can have the islands to themselves.

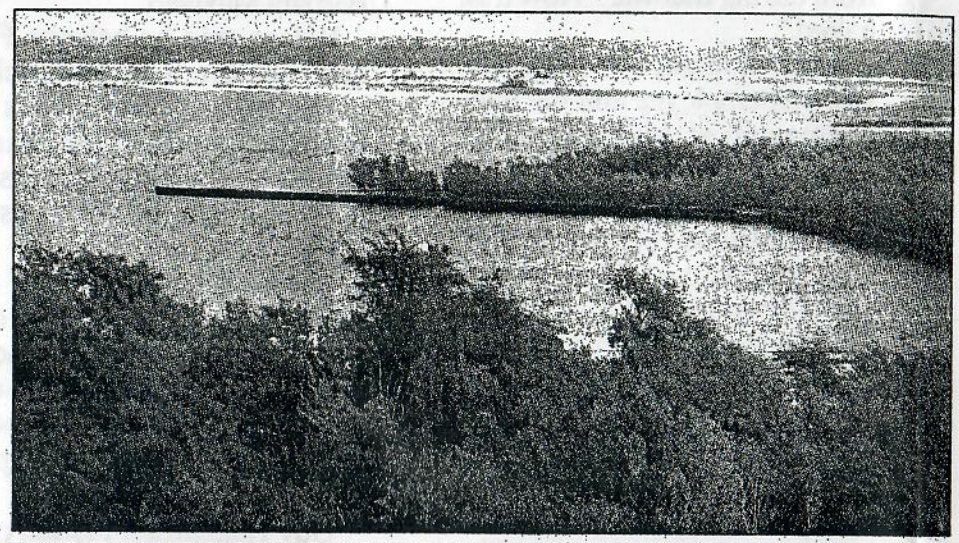
"These 'island paradises' are entirely supported by tax dollars, but the various agencies are quite reluctant to have any 'outsiders' see how they spend the monies supplied by taxpayers," Wilson said.

Guy Haggard, a Florida resident who once lived on Midway, agrees: "My opinion is that the real aim of FWS is eliminate any evidence of man on Midway."

Maxfield said that perception is incorrect.

"We saw it as a unique opportunity to experience a remote island wildlife spectacle and a historical treasure," she said. "We were convinced it could be done, and I don't think we've changed our minds on that."

Many fear a remote paradise soon may be inaccessible



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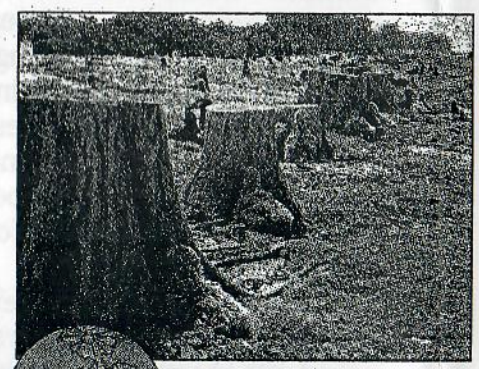

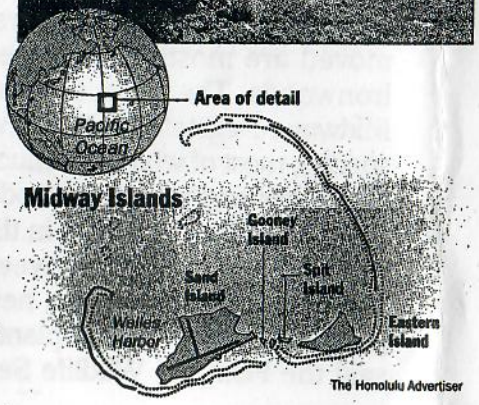

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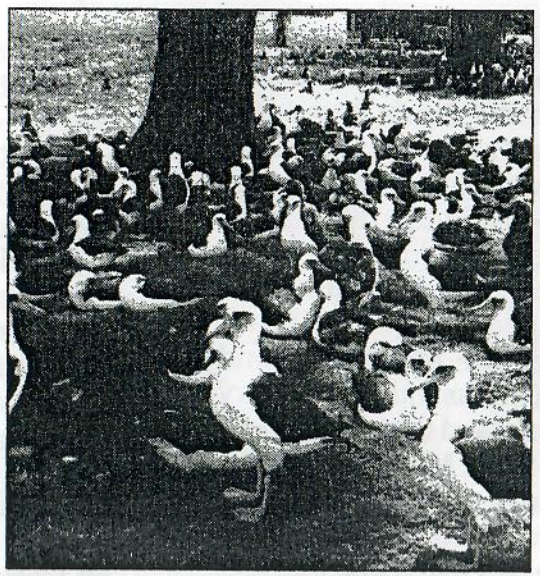

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Ultimately, another Department of Interior agency, such as the National Park Service, would have been a better partner, Tracey said, since it has more experience dealing with private business entities.

Midway, an atoll near the end of the Northwestern Hawaiian Islands, lies 1,200 miles northwest of Honolulu. It has a firm place in military history — the battle that turned the tide of World War II in the Pacific occurred around it. It continued as a Navy base through the mid-1990s, and tens of thousands of military personnel and contractors have stayed there. Many developed a deep love for the place, and have returned as visitors during the past five years.

It also has a long history as a wildlife refuge. The other Northwestern Hawaiian Islands were designated a seabird refuge in 1903 by President Theodore Roosevelt, but Roosevelt turned over Midway to the Navy. Despite a century of human activity, it remained dense with nesting seabirds, and was regularly visited by seals and turtles. When the Navy had no more use for it, the Fish and Wildlife Service took over.

In an unusual step, the service invited a contractor to manage the old military base, run its airport and establish an ecotourist and history tour center, partly as a way to defray its expenses in managing such a remote site.

Midway Phoenix has been the contractor for more than five years. It said it has sunk nearly $20 million into the island and now does not believe it can make a profit there, given the service's aggressive conservation stances.

The service makes no apologies for its efforts at preservation, which it sees as its mission.

A point of contention is trees. Tracey concedes that early photographs of the island show no trees at all, and that imported trees were planted by the Navy for both shade and to retain eroding sand.

Most people who have visited the island during the past half century have known a Midway thick with trees, and many are appalled by the Fish and Wildlife Service's removal of all the trees from Eastern Island, one of the two largest islands within Midway Atoll, and the removal of a small portion of the trees on Sand Island, where human activity is centered.

"This (Eastern) was the island from which the bombers and fighter planes flew from in World War II," said Michael Denison, who worked on Midway as a contractor in 1940 and 1941. "It is one of the very few places belonging to the United States that a battle was waged from during that war. Now it is naked."

Bob Wilson, a Midway Phoenix employee and the harbormaster at Midway, said: "There is a map showing the areas of priority for tree removal on Sand Island (the only inhabited island in the atoll), with the stated intention to have all trees removed in 15 years."

Shallenberger said his staff has removed about 10 percent of the ironwood trees on Sand Island, and plans to cut down the trees from another one or two coastal acres, to provide additional habitat for black-footed albatross, a species whose numbers are declining. He said the service does not intend to remove all the trees, and said some species on Sand Island, notably terns, have begun using ironwood trees for nesting habitat.

But the service is also actively planting. The trees being removed are mostly introduced ironwoods. The service wants Midway revegetated with native species, most of which are much lower-growing than ironwoods. "Naked" Eastern Island is in the intermediate stage between ironwood removal and a new growth of native coastal plants, said the Fish and Wildlife Services public information officer Barbara Maxfield.

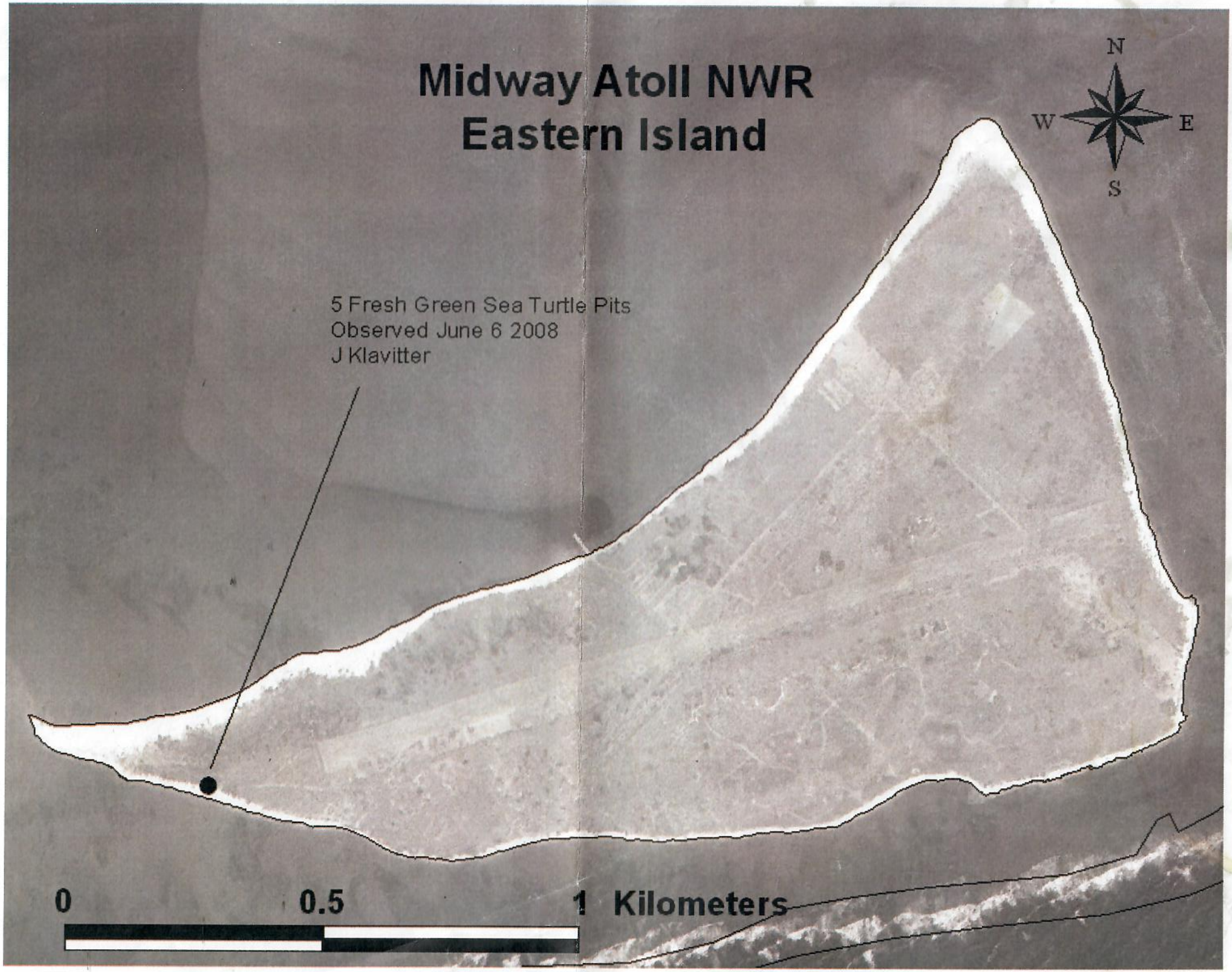
Wilson said he believes Fish and Wildlife Service officials ultimately want all humans off the Northwestern Hawaiians Islands so the agency's personnel can have the islands to themselves.

"These 'island paradises' are entirely supported by tax dollars, but the various agencies are quite reluctant to have any 'outsiders' see how they spend the monies supplied by taxpayers," Wilson said.

Guy Haggard, a Florida resident who once lived on Midway, agrees: "My opinion is that the real aim of FWS is eliminate any evidence of man on Midway."

Maxfield said that perception is incorrect.

"We saw it as a unique opportunity to experience a remote island wildlife spectacle and a historical treasure," she said. "We were convinced it could be done, and I don't think we've changed our minds on that."


Midway Atoll NWR
Eastern Island
N
W
E
S
5 Fresh Green Sea Turtle Pits
Observed June 6 2008
J Klavitter
0
0.5
1 Kilometers

Date: Wed, 30 Jan 2002 09:13:50
From: wayne sentman <mangoman37@hotmail.com>
To: gbalazs@honlab.nmfs.hawaii.edu
Subject: Re: your mail

George,

Thanks for the reply. Saw a few more turtles today, #13, and #14 both near the Cargo Pier in their usual location. Also as previously mentioned we are seeing regular basking on Turtle Beach of 4+ turtles, including males. Yesterday Cynthia and I saw a male with tumors around the eyes. We got some digital video and some photos just in case. Also saw #37 there as well. We are keeping are eye out for the transmitter male but so far no luck.

Midway Atoll Booth

Midway Atoll Marine Turtle Survey
April 16-29, 2010

Marc R. Rice
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Hawaii Preparatory Academy
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Kamuela, Hawaii 96743
November, 2010

Introduction

Midway Atoll (28^0 N, 177^0 W) measures approximately 9 km in diameter with 234,876 hectares of submerged reef and has three coral islands (Eastern Island, Sand Island and Spit Island) totaling approximately 626 hectares. Work done by Balazs (Balazs, et al, 2005) between 1975 and 2001 showed that there was a significant population of green turtles (*Chelonia mydas*) living at Midway Atoll. The main population was congregated around Sand Island with the inner harbor and the cargo and fuel piers acting as sleeping locations for juvenile, sub-adult and adult turtles. In the 1970's and 1980's, most of the population was composed of juvenile turtles with a slow growth rate. By the late 1990's, the population had matured such that 40% of the animals were sub-adults or adults. (Balazs, et al, 2005). There were several cases of fibropapillomatosis observed in the 1990's, whereas no cases had been observed in the 1970's.

In April of 2010, I went to Midway Atoll with the Oceanic Society Expedition to conduct a survey of the green turtles that bask on "Turtle Beach," Sand Island and to observe related behaviors within the waters adjacent to Sand Island and Eastern Island.

Methods

From April 17 to April 25, the basking beach (28.216^0 N, 177.366^0 W) on Sand Island was visited frequently (usually every hour on the hour) during the daylight hours and occasionally during the early night hours. All observations were conducted by me and a 3 person team from the Oceanic Society expedition group. Photographs of the beach were taken and telephoto shots of the turtle heads (mostly the right side because of the orientation of the turtles) were taken for future individual identification using head scale patterns. Observation of the turtles was limited to the northwest end of the beach because of concern about disturbing turtles, birds and monk seals. When possible, isolated individual basking turtles were unobtrusively approached from behind and scanned for PIT (passive integrated transponder) tags, and a straight carapace length (SCL) measurement was taken.

In between visits to the basking beach, we visited other sites on Sand Island where turtles had been seen in the past. The Inner Harbor and the cargo and fuel piers were the primary sites visited, but the entire island was visited at least once

except for an area called "rusty bucket" (28.215^0 N, 177.387^0 W) that was closed because of a monk seal (*Monachus schauinslandi*) birth. Observations of turtles and their behaviors were noted and collated relative to time and location.

Only one trip was made outside of Sand and Eastern Islands, but our earlier work in 1998-2004 (Balazs, et al, 2004) failed to find any significant numbers of turtles along the inner reef of the atoll and there were no reports to suggest that this had changed since then. It should be noted that Suzanne Canja, Cynthia Vanderlip Bruce Casler and Wayne Sentman have documented regular basking on the emergent reef during kayak patrols in the past (Wayne Sentman, pers. com.)

Notes on observing basking turtles at Turtle Beach:

Standing just back from the edge of the northwest end of the beach to observe basking turtles did not elicit any response from them. Turtles could be photographed and observed using binoculars from that vantage point as long as they were not in the process of coming out within about 10 meters of the ramp. The impact of human presence was significantly reduced by keeping a low profile (kneeling or laying down).

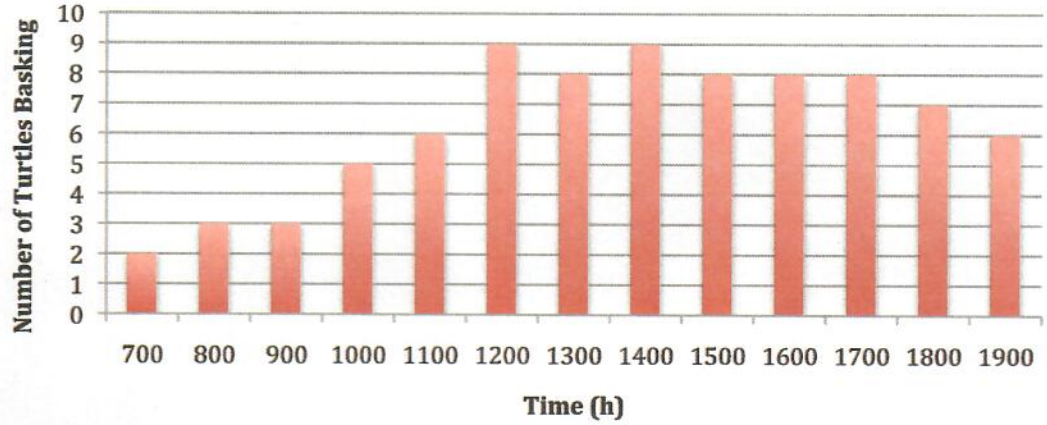
Once basking turtles were up as high on the beach as they were going to go, they settled into a quiescent state within approximately 15 minutes. In this state, they were not as alert and one could carefully, crouching as low as possible, walk up behind them and scan for a flipper tag and take an SCL measurement. It is only possible to do this if the turtles on the beach are all facing one direction, are in deep "sleep" and/or are alone on the beach.

A monk seal gave birth on Turtle Beach on April 25, 2010 in nearly the same location where one had given birth the previous year when there was no observation effort. This repeated use of a preferred pupping beach certainly indicates that our presence during the beach surveys was not disruptive to one of the most sensitive creatures on the island.

Findings

The basking data for emergence times, numbers on the beach, identification of individuals, etc. gave a snapshot of the behavior during the 9 days of observation. Prior to 0700 h, there were usually very few turtles on the beach (Figure 1). The number of turtles basking increased through the morning reaching a peak between 1200 and 1400 h. The counts tapered off toward the evening hours. By 2100 h, there were very few turtles on the beach. On one occasion we were able to confirm that one turtle (PIT tag # 4A7E3F173E, Table 1) had remained out all night and into the next morning. The sex ratio of basking turtles was 31% males, 36% female and 33% sub-adults and unknown. The combined total percent adults (male and female) in the basking population is 67%.

Figure 1. Mean number of turtles basking on Turtle Beach (4/18 to 4/26/10) during each one hour interval between 0700 and 1900 h.



The number of basking turtles was influenced by tidal fluctuation, and whenever the tide was rising and near its high point many of the basking turtles would be washed over by the incoming waves and return to the water. Although it did not rain during this trip, observations made during our work from 1998 to 2001 found that basking turtles will return to the water if there is significant rainfall.

The largest number of basking turtles counted at any one time from 4/17 to 4/27/2010 was 17. Past counts have been higher. Wayne Sentman reported 20 basking turtles on May 9, 2010 with most coming out after 1100 AM when the sun came out following an entire morning of rain and 100% cloud cover (Wayne Sentman, pers. comm.). A picture taken on October 24, 2009 by George Balazs shows 35 turtles basking on Turtle Beach (Figure 2).

Opportunities to read tags on quiescent basking turtles were intermittent. The number of turtles on the beach had to be small, they needed to be facing in a direction that would prevent them from observing the approaching investigator and they needed to be quiescent with their eyes closed. This situation occurred 25 times during the 9 day observation period. Table 1 outlines the results of the 25 readings. The 8 re-sightings were very significant and are presented in Table 1 of the Appendix.

Table 1. The list of tag reading attempts made on green turtles basking at Turtle Beach, Midway Atoll between 4/17/2010 and 4/26/2010.

Number of turtles scanned for PIT tags	23
Number of turtles with PIT tags:	8
Number of turtles without tags	15
Number of turtles with metal tags	1*

* Adult male observed with metal tag in right front flipper, but it was impossible to get close enough to read the tag and it was not counted in the total.

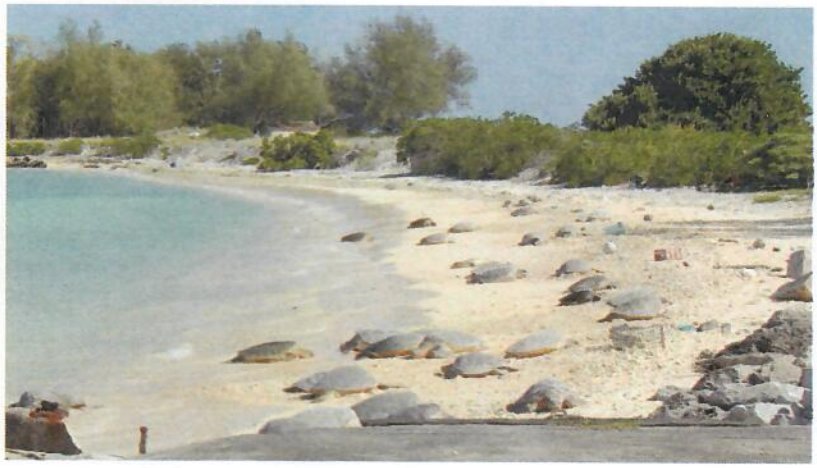


Figure 2. Digital image of 35 basking turtles on Turtle Beach, Sand Island, Midway Atoll taken by George Balazs on 10/24/2009 at approximately 1530 h.

Island Locations

Cargo Pier Area (28.72⁰ N, 177.37⁰ W):

We observed the cargo pier area every day from 4/17 to 4/27/10 and noted turtle movement and behavior. The region around the cargo pier and Turtle Beach is very important for green turtles. There are turtles in the area almost continuously during the day. We observed turtles exhibiting mating behavior, transiting the area, coming in to bask on Turtle Beach and the adjacent launching ramp and foraging approximately 100 meters offshore in deeper water (~10 meters deep). As was the case 10 years ago, this area of the lagoon has the greatest concentration of juvenile, sub-adult and adult green turtles on the atoll.

We snorkeled the cargo pier three times (4/21/10, 4/25/10 and 4/26/10) during mid-afternoon. Each time there were approximately 6 juvenile green turtles present, sometimes resting on the submerged pier structure, but more often slowly swimming about under the pier (Figure 3). It is likely that on each of our snorkel surveys we saw some of the same animals repeatedly. No juvenile turtles were ever seen basking on Turtle Beach so we never observed juvenile green turtles except under the pier or in the inner harbor. Larger (sub-adult and adult) green turtles could occasionally be observed moving through under the cargo pier and, almost certainly, larger turtles use the cargo and fuel pier as resting sites at night (Rice & Balazs, 2000). On 4/25/10, we observed one set of turtle tracks on the sand immediately to the west of the cargo pier, indicating a basker that we did not see.

Figure 3. Juvenile green turtle (*C. mydas*) under the cargo pier with pilings in the background. (Photo by Wayne Sentman)

Bulky Dump (28.201^0 N, 177.374^0 W)

No turtles were observed or reported after 4 visits (4/18, 4/20, 4/25 and 4/26/2010) to the Bulky Dump area. All observations were made during the late morning and early afternoon.

Rusty Bucket - Off limits because of monk seal pup.

Southwest Corner of Channel Entrance (28.208^0 N, 177.360^0 W)

No turtles observed or reported after 3 visits (4/19, 4/22, 4/25/2010) of approximately 30 minutes each.

West and South Beaches

These beaches are off-limits, but while viewing from approved points we were unable to observe any green turtles.

North Beach (28.218^0 N, 117.378^0 W)

We observed one basking female on North Beach (28.217^0 N, 177.376^0 W) at 1700 h on 4/22/10. We haven't observed basking turtles on North Beach before although one additional basking green turtle was reported during the week of April

28 to May 4, 2010 (Wayne Sentman, per. com.). Limited observations of the waters off the beach failed to reveal any green turtles.

North Harbor Breakwall (28.2140 N, 177.3600 W)

The inner harbor at Midway Atoll is a resting area for green turtles and sub-adults, and adults can be observed moving in and out of the harbor along the northern harbor wall. Most of them turned left at the end of the break-wall and followed the wall over toward the cargo pier area and Turtle Beach. A few were observed swimming straight into the deep water off of the harbor entrance. One female came back into the harbor by the north point and then crossed the harbor entrance to the south side of the harbor. The south side of the harbor is a known resting area also.

South Harbor Breakwall (28.209^0 N, 177.360^0 W)

We made 5 trips to the south harbor wall to look for green turtles (4/19, 4/21, 4/22, 4/23, 4/25/2010). During our previous work (1998-2001), we had captured a few juvenile turtles feeding on algae growing on the harbor wall. During this trip we only observed two juveniles feeding along the wall after 10 spot surveys made during the daytime (usually mid-morning and/or mid-afternoon). Grazing the wall does still occur, but turtles were definitely not lined up along the wall feeding.

We did find a sleeping "cave" at the northeastern terminus of the south breakwall. The large flat platform is hollow underneath, and a sand bottom area is accessible to turtles there. When we first observed it, there was one large female and one sub-adult resting in the cave. John Klavitter (FWS) mentioned that they have previously observed several turtles in the cave at one time. On two other occasions we checked the "cave" and found one sub-adult on each occasion (Figure 4). We don't know if it was the same turtle.

4a 4b

Figure 4. Photograph 4a shows a sub-adult turtle resting unharmed inside of an electrical outlet box that has fallen into the area under the pier surface. (photograph by Wayne Sentman). Photograph 4b is of a sub-adult resting on the sand "beach." (photograph by Marc Rice)

Eastern Island

We visited Eastern Island from 0830 until 1130 h on 4/21/10. No turtles were observed basking although basking in very small numbers regularly occurs on the beach near the pier (27.210^0 N, 177.335^0 W) (Wayne Sentman, per. com.). We crossed the island to the east side and spent about 20 minutes looking for turtles without success. Upon return to the west side of the island,one turtle was observed about 30 meters off of the pier at approximately 1115 h.

Reef Hotel (28.278^0 N, 177.367^0 W)

April 23, 2010, Fish and Wildlife personnel took us to the area known as Reef Hotel. The water was very calm, and visibility was excellent. The trip out of the harbor to the reef hotel took about 20 minutes each way. During the ride out and back we did not observe any turtles. We snorkeled the reef for about one hour at the Reef Hotel (1330 to 1430 h) and covered approximately 100 m along the inside of the outer reef platform but did not see any turtles. Small turtles are occasionally seen in that area (Wayne Sentman, per. com.), and we captured and tagged a couple of juveniles there during our earlier work (1998-2001).

Spit Island (28.206⁰ N, 177.349⁰ W)

On May 3, 2010 Wayne Sentman accompanied FWS personnel to Spit Island where the perimeter of the island was walked looking for invasive plant species and marine debris. No turtles were observed basking on the beaches. In the past a few turtles have been seen basking on Spit Island and swimming in the shallows off shore. (Wayne Sentman, per. com.)

Discussion

The tag recoveries made during this trip were significant. The procedure for reading the tags was excellent because it was a passive operation and did not involve any impact on the turtles. Of the 8 tag recoveries, the most interesting was turtle number 4A7E3F173E (Table 1, Appendix). This animal was first captured on June 6, 1977 by a member of the Koral Kings Dive Club. At that time it was already 90.1 cm SCL and probably a mature female. Assuming that it was 20+ years old at that time, it would now be somewhere in the vicinity of 55 years of age. She was recorded nesting at French Frigate Shoals in 2009. It was not possible to get an accurate SCL measurement, but a fairly accurate estimate was made and, based on that estimate and her size in 1977, she had a growth rate of ~0.3 cm/year.

Four other recoveries were of animals tagged during our work at Midway Atoll from 1998 to 2001 (Balazs, et al, 2004). Three recoveries were turtles that were originally tagged at French Frigate Shoals during the nesting season. Growth rates for mature animals is very low and, as expected, the data on growth rates of mature animals recaptured during this trip ranged from 0 to 0.58 cm/yr. The growth rate of two recaptures that were originally tagged as sub-adults was 2.29 and 2.62 cm/year (mean = 2.45 cm/year).

The percentage of adult turtles in the Turtle Beach basking population was 67%. While it cannot be assumed that the basking turtles are representative of the population as a whole, it is interesting to consider the possibility that the number of adult turtles in the population may have increased from approximately 24% in the late 1990s (Balazs, et al, 2004) to 67% in 2010.

Based on overall observations and the relative number of tagged and untagged turtles found on Turtle Beach, I speculate that Midway has a population of between 200-600 turtles. It is evident that basking behavior has "caught on" at turtle beach, and the basking rate is definitely higher than it was a decade earlier. Unless there are new areas where turtles are gathering or there are feeding areas that we don't know about, the numbers of turtles is probably similar to what it was in 2001. The size-class distribution has apparently shifted over the intervening 10 years as the juvenile and sub-adults of the 1970s and 1980s have matured. The turtles that come out to bask appear to be very well fed with an obvious rotund appearance and rolls of fat showing in the area of the hind flippers.

The juveniles we observed under the cargo pier also appeared to be 'nicely rounded' and healthy. They were wary but not overly concerned about our presence.

There were no fibropapilloma tumors observed on any of the basking turtles or on the small turtles we observed while snorkeling. This was particularly good news because of the presence of tumored animals discovered during our work from

1998 - 2001 (Balazs, et al, 2004). It appears that the disease may have run a course similar to that in the population in Pala'au, Molokai, Hawaii where the disease has gone from a high of nearly 60% incidence rate in 1996 to approximately 11% in 2010 (Chaloupka et al, 2009).

Turtles were regularly observed on Turtle Beach basking in or near marine debris that they could potentially become entangled in. It might be prudent to organize some marine debris collection effort at the beach during times of low basking numbers (during rain storms, early morning or late evening).

Thoughts about the future:

1. New tagging and recapture work would be useful to:
    a. gain further insight into the size of the population
    b. gather growth data on immature turtles
    c. assess the health of the population through weight measurement and or body mass calculations
    d. determine food preferences
    e. determine if the "old haunts" are still being used or if there are new areas where turtles are aggregating
    f. continue to obtain data from previously tagged individuals is very enlightening and useful to:
        1. get an idea of how many of the adult females are using FFS as their nesting site.
        2. clarify the length of the internesting period of females at Midway Atoll
        3. get an understanding of the growth rates of various size classes
    g. assess the occurrence of fibropapillomatosis
        1. incidence of the disease appears to have declined since 2001
    h. assess recent nesting activity observed for the first time at Midway Atoll.
        1. An increased monitoring effort may allow FWS to assess the significance of these events

2. Placing a PTZ (pan, tilt, zoom) camera out at the launch ramp to observe would be very useful
    a. scheduled photographs of the beach would allow analysis of basking behavior
    b. the ability to PTZ from "headquarters" would allow staff to observe what was happening out at the cargo pier
    c. individual head shots could be taken with the camera to begin to develop a catalog of habitual baskers
    d. developing a catalog of habitual baskers would help to ascertain how many individuals we are dealing with

3. The PTZ camera and direct observations might allow the cooperative project between HPA/NOAA/OS/FWS to continue.

4. If the cost of transportation to and from Midway ever gets to be reasonable, it would be productive to plan an HPA/NOAA trip using student assistants as we did in 1998-2001. It may also be possible to obtain support for such a project that would ameliorate the overall cost so that participant cost was reasonable.
    1. this would fit into the FWS stated goal of "providing visitors opportunities to learn about the animals, the history and the environment." "Hands-on learning opportunities may also be available through participatory research projects, including seabird and spinner dolphin monitoring.... projects." No reason the same can't be provided for turtles!

Acknowledgements:

This project could not have been completed without the help of many people and organizations. Special thanks to Dan Aeberli and Doris Aeberli for their dedication and hard work in monitoring Turtle Beach, taking pictures and recording data, Oceanic Society for sponsoring the trip and promoting interest in Midway Atoll sea turtles, to Oceanic Society biologist Wayne Sentman for his expertise, experience and support, to John Klavitter and the Fish and Wildlife Service personnel for their outstanding help and support and to George Balazs (NOAA Pacific Islands Fisheries Science Center) for reviewing this manuscript and making significant contributions to its content. He was originally scheduled to participate in this survey, but was unable to because of circumstances beyond his control.

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Appendix

Table 1. Eight tag recoveries made at Turtle Beach, Midway Atoll. Tags were read by unobtrusively sneaking up behind basking turtles and reading the PIT tag and taking a straight carapace length measurement (SCL).

Tags	Date Read	Location	SCL (CM)	Date First Capture	Location	SCL (CM)	Growth cm/year	Remarks
4A7E3F173E, 413611786C	4/18/10	Midway, Turtle Beach	~100	6/3/77	Inner Harbor, Midway	90.1	~.3	Tagged by G. Balazs & Koral Kings diver Chris Baireuther in Inner Harbor. Clean, gold/brown shell. Large barnacles in skin, no copulation scars seen. Last nested East Island, FFS 2009.
41363F315B, 413E2D6650	4/18/10	Midway, Turtle Beach	88.7	13-Nov-01	INNER HARBOR, MIDWAY	83.1	.58	Captured using scoop net from breakwater by HPA/NOAA team
50191B4D63, 500E1B000C	4/19/10	Midway, Turtle Beach	80.4	11/13/01	Basking, East Island	58.4	2.29	Captured by hand by HPA/NOAA team
4135704F6D, 4136356E27	4/19/10	Midway, Turtle Beach	92.2	6/14/94	East Island FFS	90	.14	East Island, FFS, nesting.
470B4D5E22, 470D087522	4/19/10	Midway, Turtle Beach	89.2	6/20/08	East Island FFS	89.2	0.0	Originally tagged on 6-20-08 nesting at East Island, FFS (SCL=89.2cm)
4144330940	4/21/10	Midway, Turtle Beach	84.9	10/19/98	Sand Island, cargo pier	83.5	.11	Posterior shell damaged and healed. Short measurement reflects this injury. Likely shark scratch in carapace. Long thick tail. Tail 30cm beyond carapace. 5 laterals on right. Released in inner harbor
4135747E3F 4136012807	4/23/10	Midway, Turtle Beach	89.4	11/15/00	Tug Pier	61.9	2.62	PPS. Mototool #52. Axial: 24cm, Lateral: 23.6cm. 3.6cc IM Liquamycin. Eye and ventral photos taken. VB-1 (2.8cm).
413B1B0E44	4/23/10	Midway, Turtle Beach	91.7	5/16/99	East Island	91.1	.05	Originally tagged while nesting at Tern Island, FFS on 5-16-99 (SCL=91.1cm)

ATOLL RESEARCH BULLETIN

No. 109

A preliminary list of the algal flora of the Midway Islands

by

Richard G. Buggeln

Issued by

THE PACIFIC SCIENCE BOARD

National Academy of Sciences-National Research Council

Washington, D.C.

July 15, 1965

A preliminary list of the algal flora of the Midway Islands

by

Richard G. Buggeln[1/]

Algal collections which have been reported from the Hawaiian Islands are largely based on materials collected from the more accessible and most heavily populated islands of Oahu, Maui, Molokai, Hawaii, and Kauai. However, collections have also been recorded from two of the lesser islands in the northwestern part of the Hawaiian chain: Laysan Island (Lemmermann, 1905) and Pearl and Hermes Reef (Howe, 1934). To the author's knowledge there have been no published reports of algae collected from the Midway Islands--two islands situated on one of the last atolls toward the northwestern end of the Hawaiian archipelago.

On a trip to the Midway Islands, January 12 through 16, 1962, Dr. Charles H. Lamoureux of the Botany Department, University of Hawaii, collected algae which had drifted onto several of the beaches of both islands after a storm. These algae are listed below.

The Midway Islands (177°25' W. Longitude and 28° 15' N. Latitude) are on an atoll located 1300 statute miles northwest of Honolulu, Hawaii. The diameter of this circular coral atoll is about 5 miles. Wide reefs jut out of the water on the northeast side. The two islands, Sand and Eastern, are situated in the lagoon inside but near the southern rim. Around the inside of the rim of the atoll is a wide margin of shallow water which drops off toward the center of the atoll into the depths of the lagoon.

Sand Island, the larger of the two islands, is one and a half miles in length along the north-south axis and a mile wide along the east-west axis. The island has a maximum elevation of 43 feet. Eastern Island, located about a mile and a half across the shallows to the east of Sand Island is relatively flat and triangular in shape. The longest of the three sides of the island is oriented in an east-west direction and is about one and a half miles long.

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The collection numbers cited are those of the catalogued serial listings of the specimens in the herbarium of Dr. Maxwell S. Doty, Botany Department, University of Hawaii. The material from Sand Island has the following numbers: 18725 to 18731, and 18739 to 18754; those specimens from Eastern Island have the numbers: 18704 to 18719, 18732 to 18738, and 18754 to 18762.

Acknowledgments

The author wishes to thank both Dr. Maxwell S. Doty and Dr. Albert J. Bernatowicz for their critical reading of this manuscript and for allowing the author to use their libraries during the preparation of this floral list.

CYANOPHYTA

Lyngbya majuscula Gomont, 1892: 151, pl. 3, figs. 3 & 4.

Collection numbers 18756, 18715, 18742B, and 18754F.
Masses of long intertwining filaments, 65 microns in diameter were frequently entangled with larger algae.

CHLOROPHYTA

Ulva sp.

Collection number 18719.
The specimens, too young for specific identification, were ovoid in shape, 1 to 2 cm in breadth.

Boodlea vanbosseae Reinbold in Weber van Bosse, 1913: 70, 12; Dawson, 1956: 29, fig. 6.

Collection number 18761.
This was a thickly woven mass of filaments composed of cells 150 to 175 microns wide and 2 to 4 times as long. A main axis or axes could not be distinguished by the size of the filaments: They all had a uniform diameter. Frequently, the apical cell of the filament had developed into a long multicellular rhizoid of slender diameter and anastomosed with another filament through the production of a tenacular cell. The material agrees with that figured in Weber van Bosse (1913).

Boodlea sp.

Collection number 18755.
The material was matted more or less loosely and entangled with and connected with pieces of coral and Halimeda. Branching occurred at random with laterals cut off by a crosswall but not necessarily near the transverse wall of the parent cell. Frequently a lateral of indeterminate length was long and attenuated and had produced a terminal tenacular cell which adhered to another filament. The diameter of the major axis near the basal holdfast was 200 microns and that of the secondary axes above was 150 microns.

Microdictyon setchellianum Howe, 1934; Egerod, 1952: 366, pl. 33, fig. 6c-g.

Collection number 18719B.
This loose to compact clump, 1 cm across, was growing intertwined with Jania capillacea (18719J). The diameter of the cells was 450 microns with no prominent central axis.

Struvea anastomosans (Harvey) Picc. & Grun. ex Piccone, 1884a; Egerod, 1952: 359, pl. 31, fig. 4a-h.

Collection number 18709.
This specimen was growing on a small basalt stone.

Udotea javensis (Montagne) A. & E. S. Gepp, 1904; Taylor, 1950: 73.

Collection number 18706B.
This small specimen was 3.5 mm high from rhizoid to apex with a stipe of 110 microns and with filaments of 55 microns diameter composing the monostromatic blade. The blade had a width of 1 mm; the individual filaments of the blade were constricted at irregular intervals above the dichotomies. The specimen was referred to this species because U. javensis has been commonly reported from Hawaiian waters. It is possible, however, that the alga might be a juvenile stage of a larger species of Udotea.

Codium arabicum Kuetzing, 1856; Egerod, 1952: 382, pl. 34, b. figs. 11-13.

Collection numbers 18741A and 18712B.
The thalli, 4 cm across, were flattened and closely appressed to the surface of coral fragments.

Codium edule Silva in Egerod, 1952: 392, pl. 35, b, fig. 18.

Collection numbers 18740B, 18759B, 18741B, 18712B, 18725C, and 18733. The specimens all displayed the characteristic anastomosing between the dichotomous branches. The longest of the specimens was 10 cm. The branches were frequently anastomosed with the segments of Halimeda incrassata.

Codium reediae Silva in Egerod, 1952: 389, pl. 36, fig. 17.

Collection numbers 18740A, 18733A, 18725A, 18712A, and 18759A. The collection included specimens of 15, 20, and 25 cm in length. The branching was freely dichotomous with no anastomosing between branches.

Halimeda discoidea Decaisne, 1842; Hillis, 1959: 352, pl. 2, fig. 5; pl. 5, fig. 11; pl. 6, fig. 11.

Collection number 18705.
A single sterile specimen about 8 cm high was identified. The size of the segments was quite variable in both width and length and they were lightly calcified with an average thickness of 1 to 1.4 mm. The largest segment was 2 x 1.25 cm. Two to 5 segments arose from the spical end of each lower segment. In surface view, the utricles were 5 to 7 sides and asymmetrically compact with no interutricular spaces. The outer surfaces appeared smooth with a diameter of 70 to 100 microns.

Halimeda incrassata (Ellis) Lamouroux, 1816; Hillis, 1959: 365, pl. 4, fig. 1-2; pl. 5, fig. 6, fig. 21-24.

Collection numbers 18707, 18747, 18738, and 18758.
The collections included fragments of larger thalli and one entire alga 6 cm in height. The segments were heavily calcified and of uniform size and shape, 4 to 7 mm in width and 4 mm high. In surface view, the utricles were round to slightly oval and measured 10 to 18 microns in diameter. The utricles were not appressed to each other and interutricular spaces were present. The branching was di- and trichotomous and in one plane.

PHAEOPHYTA

Ectocarpus indicus Sonder in Zollinger, 1854; Børgesen, 1941: 16, figs. 6-7.

Collection number 18762.

The fragmentary material was sterile but the method of branching was indicative of the species. The laterals arose from a central uniseriate filament with an acute adaxial angle between the lateral and central axis. The cells in the filaments were quite variable in length.

Sphacelaria sp.

Collection numbers 18746, 18754D, and 18703D.

All of the material, 8 mm high, was too young for certain specific identification. The propagules were knob-like and measured 100 microns long by 70 microns wide at the expanded apex, but it appeared that the divisions at the widened portion were not yet completed. At this stage of growth, the propagules could develop into either those of S. tribuloides or S. novae-hollandiae. Unilocular sporangia with a diameter of 40 microns were borne on short pedicels. The segments of cells composing the vegetative axes had a length and breadth of more or less equal dimensions.

Dictyota crenulata J. Agardh, 1847; Børgesen, 1914: 56, figs. 36-37.

Collection number 18734.

The fragmentary material had the distinct small crenulations along the margins which suggested that the 2 cm pieces could be placed in this taxon.

Dictyota divaricata Lamouroux, 1809; Taylor, 1928: 120.

Collection number 18754.

This single specimen measured 6 cm in length, 3 mm broad at the torn-off base, and 10 microns wide at the attenuated tips. The material was fertile and bore mature spherical oogonia 6 to 8 microns in diameter. These were not grouped into sori, although frequently in triads, but were generally evenly distributed toward the tip of the thallus. The reproductory structures were considered to be oogonial rather than sporangial because of the absence of the classical 'tetrasporic' divisions which are characteristic of the sporangia in this genus.

Zonaria sp.

Collection numbers 18729, 18745, and 18716.
The material was young. In cross-section the medulla consisted of one layer of large square cells. The cortex, both above and below, was also mostly monostromatic with evidence of ensuing periclinal divisions. On the ventral surface rhizoids were present.

RHODOPHYTA

Falkenbergia hillebrandii (Bornet) Falkenberg, 1901; Bøergesen, 1910: 199, fig. 17; Feldmann & Feldmann, 1942: 89.

Collection number 18751.
This sterile material was epiphytic on segments of Halimeda incrassata. Fragments of this species were also commonly found with other small epiphytes.

Asparagopsis taxiformis (Delile) Coll. & Herv., 1917; Bøergesen, 1915-1920: 352, figs. 347-351.

Collection numbers 18742 and 18714.
The specimens were 7 to 8 cm high with rhizoidal, creeping bases attached to segments of Halimeda incrassata. Club-shaped spermatangial stichidia, 700 microns long, were borne on lateral branchlets. These had a basal diameter of 74 microns and 225 microns at the apex.

Galaxaura cylindrica (Ell. & Sol1.) Kjellmann, 1900: 64, pl. 8, figs. 34-42.

Collection numbers 18750 and 18736.
Two sterile specimens of 7 and 9 cm height were identified by Mr. Gavino Trono, Jr., Botany Department, University of Hawaii.

Hydrolithon reinboldii (W. v-B. & Foslie) Foslie, 1909; Weber van Bosse & Foslie, 1904: 49, fig. 21, pl. 10, fig. 1-6.

Collection numbers 18748 and 18749.
This coralline crust was growing on coral fragments. The hypothallial cells were 15 microns long and the perithallus was constructed of irregularly shaped cells. The specimens corresponded well with the description and figures in Weber van Bosse & Foslie (1904).

Jania capillacea Harvey, 1853; Dawson, 1953: 116.

Collection numbers 18712, 18719J, and 18735.
The small alga of 3 mm height was found frequently entangled with larger algae including Microdictyon setchellianum. The diameter of the dichotomously branching axes was 100 to 110 microns. The material was sterile.

Hypnea spinella (J. Ag.) Kuetzing. 1849; Bøergesen, 1920: 384, fig. 369.

Collection numbers 18710 and 18757.
Several small clumps 2 to 4 cm in diameter and 1 cm high were identified. These clumps of intricately woven, terete axes with short spiny lateral branches frequently anastomosed with each other and with segments of Halimeda incrassata. The material was sterile.

Spyridia filamentosa (Wulf.) Harv. in Hooker, 1833; Taylor, 1928: 197, pl. 28, figs. 14-18.

Collection numbers 18760, 18737, 18728, and 18706.
The specimens varied in height from 2 to 8 cm and fragments were commonly extracted from other algae. Tetrahedral tetraspores were cut off by nodal corticating cells of the uniseriate laterals. The tetraspores, occurring 3 to 5 on a branchlet, tended to be borne on the adaxial surface although they were often produced laterally.

Centroceras clavulatum (Ag.) Montagne in Durieu, 1846; Taylor, 1950: 139.

Collection number 18763.
This material was epiphytic on segments of Halimeda incrassata and also commonly found on other algae.

Dasya pedicellata (C. Agardh) C. Agardh, 1824; Taylor, 1937: 326; Dawson, 1954: 451, fig. 56j.

Collection number 18743.
A single tetrasporic specimen 3.5 cm high, attached to a piece of coral, was identified as D. pedicellata by comparison with Dawson's collection (1954) of a short mature specimen of similar description which he placed in this taxon. The main axes were nude below but densely covered with branching monosiphonous laterals above. The lateral filaments had a diameter of 25 to 35 microns at the base and 5 to 7 microns at the tip. The juvenile stichidia were 230 to 250 microns in length, 80 to 90 microns wide, and lanceolate in shape. The tetraspores, the largest with a diameter of 25 to 30 microns, were not yet fully divided. With the exception of the small stature, this specimen agrees with the description given by Taylor (1937).

Taenioma perpusillum J. Agardh, 1863; Okamura, 1930: Icones 6, pl. 264, figs. 17-19.

Collection numbers 18726, 18753, and 18750B.

This alga was commonly mixed with the other small epiphytic algae and was easily recognized by its dorsi-ventral habit, terminal trichoblasts at the ends of the erect axes, and the single-celled rhizoid arising from a ventral pericentral cell with no crosswall separation. The diameter of the prostrate filament was 140 microns and the rhizoids, 45 microns. The material was sterile.

Herposiphonia tenella (C. Ag.) Ambronn, 1880: Bøergesen, 1918: 286, figs. 287-289.

Collection numbers 18730, 18707, and 18754A.

The creeping, prostrate portion of this small epiphyte gave rise to erect branches 1 mm in height at random intervals along the dorsal surface of the prostrate filaments; rhizoids were cut off from the apical end of the ventral pericentral cells of nearly every segment. The diameter of the prostrate portion was 125 microns and the erect, 60 to 85 microns. The alga was a common epiphyte among the collections of larger algae. No fertile material was found.

Polysiphonia sp.

Collection numbers 18713, 18750, and 18704.

These specimens were commonly found on coral fragments, segments of Halimeda, and mixed with other small algal epiphytes. Both the branching, prostrate system and the non-branching, erect filaments had 12 to 15 pericentral cells. The erect axes, born dorsally on the prostrate axes, were separated from each other by one or more segments with no apparent regularity. The pericentral cells were 50 microns long and 135 microns in diameter. Unicellular rhizoids were cut off by a crosswall and arose from the middle of the ventral pericentral cells of the prostrate axes. The tips of the rhizoids were either slightly branched or discoid. No fertile material was found.

Polysiphonia sp.

Collection number 18704A.

The erect axis, 6 mm high, was composed of segments of 4 pericentral cells; each pericentral cell measured 140 microns square. There were no prostrate portions, and the erect filament arose from a basal clump of rhizoids. Above one pericentral cell in each segment was a scar cell. These latter cells were arranged in a spiraling sequence on the thallus. This specimen agreed with one of Dr. G. J. Hollenberg's tentative species, in manuscript.

Polysiphonia sp.

Collection numbers 18727 and 18704.

An erect axis 7 mm long, with 4 pericentral cells was borne from a tuft of rhizoids at the base. The pericentral cells were 140 microns long and 70 microns wide. Prostrate portions were not apparent. Trichoblasts were present only at the tips of the branches with a scar cell present above one pericentral cell in every segment and ultimately arranged in spiral sequence on the thallus. There was little branching except for several major dichotomies. The material agreed with one of Dr. G. J. Hollenberg's tentative species, in manuscript.

Laurencia obtusa (Huds.) Lamouroux var. densa Yamada, 1931: 226, pl. 17, fig. c; Dawson, 1954: 458, fig. 61 H.

Collection numbers 18708 and 18732.

Densely entangled mats, 3 to 4 cm high were identified. All axes were approximately 1 mm in diameter and they were frequently anastomosed with Halimeda. The primary branches as well as the secondary laterals were given off in spiral succession, the latter were slightly tapered at the base and were up to 5 mm long. The cortical cells were approximately 30 to 40 microns wide and 50 to 60 microns long. The outer periclinal wall of the cortical cells was about 10 microns thick. Lenticular thickenings were common in the medullary cells. The material was sterile.

Laurencia parvipapillata Tseng. 1943b; Dawson, 1854: 458, fig. 61g.

Collection number 18754L.

This small alga, 1.75 cm long corresponded well with Dawson's figure (1954).

Chondria repens Børgesen, 1924; Tanaka, 1963: 66, fig. 4a-d.

Collection numbers 18754C and 18749A.

This material was common on small pieces of coral and was frequently anastomosed with fragments of Spyridia and Laurencia. This small alga had both a prostrate portion and an erect system, the latter having a height of 4 to 5 mm. The terete vegetative thallus had a nearly uniform diameter of 210 to 250 microns. Tetrahedral tetraspores 70 to 130 microns in diameter were scattered at the ends of erect, determinate branches. The tetrasporangial branches were broadly clavate when young and became less expanded when older. These mature branches had a diameter of 720 to 740 microns at the apex and 250 microns at the axil. Erect vegetative branches produced secondary laterals sparingly. In cross-section, the cortical cells were more or less the same size as the medullary cells, about 100 microns in diameter. The specimens agreed well with Tanaka's description (1963).

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Role of Human Disturbance in Response Behavior of Laysan Albatrosses (*Diomedea immutabilis*)

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Laysan albatrosses (*Diomedea immutabilis*) nest on Midway Atoll, which was historically devoid of mammalian predators. They therefore exhibit few antipredator behaviors. The importance of the degree of prior exposure to human disturbance as an influence on response behavior was examined using an approaching person as the stimulus. Both the prior disturbance and the type of approach (direct or tangential), as well as their interaction, influenced how soon and how strongly the albatrosses responded. Albatrosses that had experienced very little prior human exposure responded sooner and more severely than did those that were frequently exposed to humans. These experiments suggest that albatrosses can habituate to the presence of humans, and that human exposure should be limited to confined areas, rather than distributing human activities throughout the colony. Maintaining some areas for ecotourism (accepting the consequences of disturbance), and restricting access to other areas, appears to be a sound management strategy. The impact of disturbance on survival remains to be studied.

Habituation *Human disturbance* *Albatross* *Approach distance*

Avoiding and fleeing from predators, and performing defensive behaviors aimed at repelling intruders, is one of the most important tasks faced by any animal. Seabirds nesting on many remote oceanic islands, however, were not exposed historically to mammalian predators nor to many avian predators (Lack, 1968; Nettleship, Burger, & Gochfeld, 1994). Consequently, many oceanic seabirds are remarkably unequipped to deal with mammalian predators, and frequently suffer dire consequences when predators, including humans, arrive on nesting islands (Burger & Gochfeld, 1994). This has been particularly true for small mammals such as rats (*Rattus* spp.) and feral cats (*Felis cattus*) (Atkinson, 1985; Fitzgerald & Veitch, 1985; Moors & Atkinson, 1994). In some cases, seabirds have suffered complete reproductive failures, and have eventually abandoned islands after the introduction of predators (Nettleship et al., 1994; Seto & Conant 1996).

Island-nesting seabirds have also suffered directly from the activities of humans, including plume hunting (Rice & Kenyon, 1962), hunting for food or other products (Blanchard, 1994; Feare, 1984), and interactions with fisheries (Duffy & Schneider, 1994). In recent years seabirds on remote nesting islands also have been exposed to increased human disturbance through traditional tourism as well as ecotourism (Cepeda & Cruz, 1994; Kenchington, 1989; Reville & Stokes, 1994). Tourism for recreation (such as swimming, fishing, diving) or other purposes can have a direct effect bird behavior and reproduction, as well as an indirect impact on the

environment by promoting development of habitats into tourist facilities (Butler, 1991).

There is a growing interest in ecotourism as a means of raising awareness and money to conserve wildlife. However, there is an implicit assumption that increased ecotourism will not unduly impact nesting seabirds (Burger & Gochfeld, 1993; Cepeda & Cruz, 1994). In most cases, however, direct effects on behavior or reproductive success of the seabirds have not been examined. Although there is an extensive literature on the effects of human disturbance on coastal nesting birds (see Burger & Gochfeld, 1994), little has been done with nesting seabirds on remote islands. Jungius and Hirsch (1979) and Burger and Gochfeld (1993) examined the effect of passing tourists on boobies (*Sula* spp.) and other seabirds nesting on the Galapagos, but these studies were in areas of relatively heavy human use by ecotourists.

In this article we examine the behavior of Laysan albatrosses (*Diomedea immutabilis*) on Midway Atoll in the central Pacific Ocean as a function of variation in prior exposure to humans. Humans arrived on Midway in the late 1800s and exploited seabirds extensively, until the United States government took control of the island. A communication station was built in the early 1900s. Since the 1930s Midway was occupied by the U.S. Navy, and until recently Midway has been off limits except to the military. Indeed, many parts of the island were restricted even to military personnel.

Our visit to Midway in May, 1997 came at a transition point when the Navy was completing its cleanup and closure of the military base, prior to transferring full authority (July of 1997) to the U.S. Fish & Wildlife Service. The Fish & Wildlife Service planned to support its activities in part with ecotourism. Since Midway is a National Wildlife Refuge, refuge personnel can control access to different parts of the atoll. During the last year of military occupation, Midway was in transition, and had very limited ecotourism, with only 30 ecotourists allowed on the island at any one time. Access to the seabird nesting areas was limited. The U.S. Fish & Wildlife Service intends to increase the number of ecotourists up to a limit of about 150, making it essential to understand the effects of human intrusion on the behavior and reproductive success of the birds.

In May 1997 we were able to examine albatross behavior as a function of prior human exposure before the advent of expanded tourism. We test the null hypothesis that Laysan albatrosses show no differences in response behavior as a function of degree of prior human exposure.

Methods

The Laysan albatross breeds in the central Pacific and on islands off Japan (American Ornithologists' Union, 1983; Whittow, 1993). Over 70% (more than 400,000 pairs) of the world population of Laysan albatrosses nest on Midway (U.S. Fish & Wildlife Service, 1996), where they breed in mixed-species colonies with black-footed albatrosses (*Diomedea nigripes*).

Midway Atoll was used by the Navy during the Second World War, and one of the decisive battles of the war was fought near the island, during which about 60,000 pairs of albatrosses perished. Midway Atoll comprises two main islands: Sand and Eastern. Eastern Island contains the original runway that was used during the Second World War, but human habitation was always on Sand Island, which now has a central Mall containing restaurants, small stores, and offices that is surrounded by housing and other facilities. A long runway along one side of Sand Island is now used for air traffic. Planes now land and take off at night to avoid collisions with the albatrosses.

We made our observations in May 1997, just before the anticipated increase in the number of tourists. In May the albatross chicks were half grown. They were nearly adult sized, but were just beginning to molt from downy into juvenile plumage. We examined the behavior of Laysan albatrosses (both adults and young) in four areas that differed in prior human intrusion exposure rates: undisturbed; low disturbance; medium disturbance; and high disturbance. The undisturbed areas had not been visited previously or had been entered only by researchers once a week for less than 30 min. Low disturbance areas were located on Eastern Island and had intrusion once a week by up to 20 people for 1 h or less. Medium disturbance areas, located at the end of the active runway on Sand Island, had irregular human intrusion nearly daily of up to 20 people for varying periods. The high disturbance area had hourly human intrusion by many people for varying periods. The high disturbance area was located in the Mall and dorm areas where there was frequent pedestrian

and bicycle traffic. We approached birds in any given area only once, and used each study area only once, to avoid resampling the same bird.

We approached birds that were facing us, either directly or tangentially (on a path that would pass 1 m from them). Before each observation we recorded: approach type (direct or tangential), location, time of day, age (chick or adult), and initial behavior of the albatross. One of us then walked slowly toward the bird, while the other noted the distance at which the albatross first changed its behavior, and all subsequent changes of its behaviors until we reached it. We then measured the distance at which its first change in behavior occurred, and the distance when its most severe behavior occurred. Behaviors were categorized as sleep, preen, alert or look, sit, sit on heels, stand, rock backward, retreat backward, lunge (sometimes stepping forward), snap bill, and strike. We later converted the most severe behavior exhibited into a severity score, where 0 = no change in behavior, 1 = preen, 2 = look or turn toward us, 3 = sit on tarsus, 4 = stand up, 5 = rock backward, 6 = retreat backwards, 7 = lunge, 8 = snap bill, and 9 = strike with bill. This scoring, although not perfect, allowed us to compare areas statistically. For the multivariate analysis (MANOVA), categories 6–9 were lumped because they intergraded.

MANOVA procedures were used to determine if disturbance type, bird age, approach type (direct or tangential), or time of day contributed to differences in behavioral responses (SAS, 1985). The procedure also allows for interaction variables (treatment × age). We used the Duncan Multiple Range option to compare disturbance levels. We also used the nonparametric Kruskal-Wallis ANOVA to examine differences between disturbance groups (Siegel, 1956).

Our overall protocol for conducting behavioral experiments with birds was approved by the Rutgers University Animal Review Committee, and our project was approved by the U.S. Fish & Wildlife Service, Midway Atoll office. We adhered to the *Guidelines for the Use of Animals in Research.*

Results

Undisturbed Laysan albatrosses stand in an alert posture, looking about, or may be preening or sleeping (Fig. 1). As the experimenter approached, albatross chicks usually turned toward the experimenter, looked about, or shifted slightly (to heel or stand). However, as the experimenter continued approaching, more chicks became alert, looked around, retreated backward, or lunged forward, sometimes snapping the bill or striking (Fig. 1).

Behavior during the tests varied significantly for chicks as a function of disturbance category, approach type (except for distance to bill snap), and disturbance × approach type (except for severity

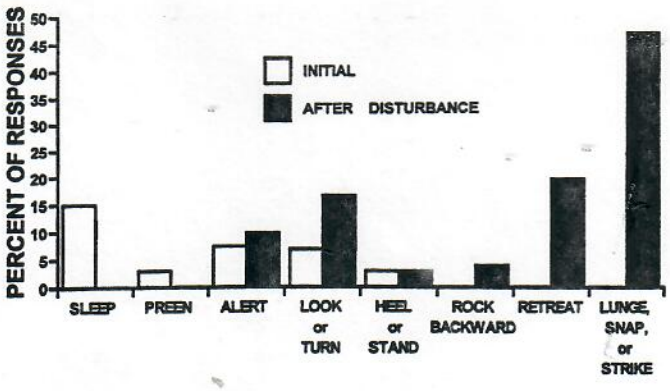

Figure 1. Behavior of Laysan albatross chicks when at rest (initial, open bars), and after disturbance (solid bars) when approached by a person. Look or turn is accomplished without moving the feet or body. Heel or stand involves raising the body onto the folded tarsi or fully standing on feet. Rock backward involves tilting the body backwards, away from the approaching person, without moving feet. Lunge refers to moving toward the approaching human, including a step. Snap and strike refer to bill movements.

Table 1. Models Explaining Variations in Behavior of Laysan Albatrosses on Midway Atoll When Approached by the Experimenter (all Disturbance Types and Approach Types Combined)

	Initial Response Distance	Severe Response Distance	Severity Score	Bill Snap Distance
Model for chicks				
F (p)	46 (***)	94 (***)	59 (***)	4.13 (***)
r^2	0.35	0.52	0.31	0.10
df[a]	6, 526	6,529	4, 530	6, 228
Factors entering model (F, p)				
Disturbance type	48 (***)	82 (***)	45 (***)	2.59 (*)
Approach type	2.9 (0.08)	4.7 (*)	38 (***)	
Interaction	19 (***)	83 (***)		4.62 (*)
Model for adults				
F (p)	2.95 (*)	9.0 (***)	10.7 (***)	NS
r^2	0.09	0.25	0.24	
df	3, 84	3, 84	2, 86	

For adults, only disturbance category was used in the models.
[a]Differences in df reflect missing values.
*$p < 0.05$, ***$p < 0.001$.

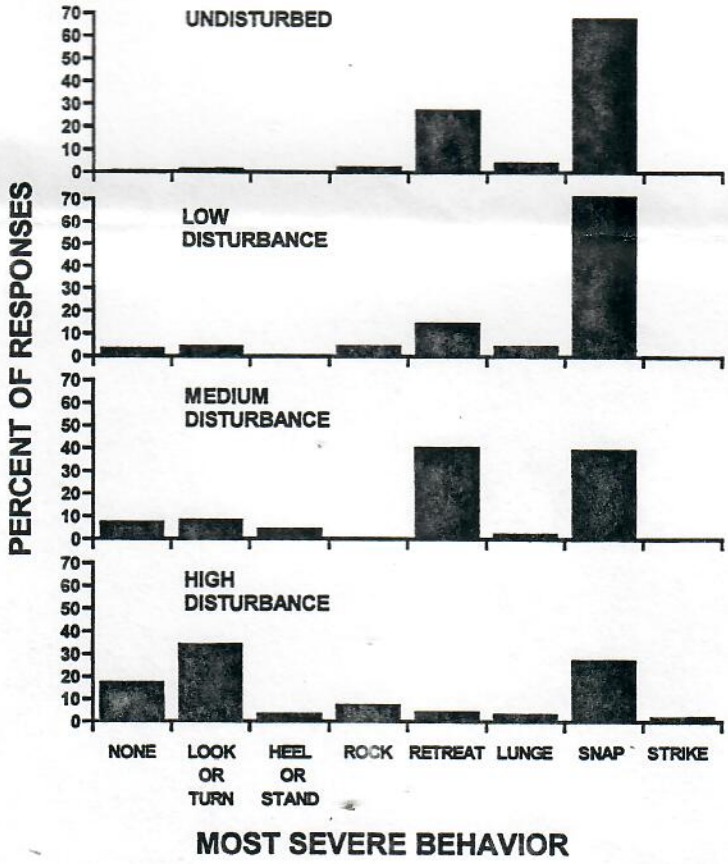

Figure 2. The most intense behavioral responses given by Laysan albatross chicks when approached by a human as a result of prior exposure to humans. The behaviors are described in the text and in Figure 1 legend.

Table 2. Response Behavior of Laysan Albatross Chicks and Adults on Midway Island as a Function of Prior Human Exposure (all Approach Types Combined)

Disturbance	Initial Response Distance (m)	Response Distance for Most Severe Behavior (m)	Severity Score	Bill Snap Distance (m)
Chicks				
Undisturbed ($N = 135$)	2.8 ± 0.18*	1.9 ± 0.06*	7.3 ± 0.09*	1.1 ± 0.11*
Low ($N = 28$)	1.6 ± 0.20†	1.3 ± 0.21†	7.1 ± 0.37*	0.8 ± 0.18*†
Medium ($N = 151$)	1.6 ± 0.08‡	1.3 ± 0.08†	5.9 ± 0.19†	0.7 ± 0.07*†
High ($N = 236$)	0.7 ± 0.05§	0.05 ± 0.4‡	4.1 ± 0.2‡	0.6 ± 0.07†
Kruskal-Wallis χ^2 (p)	252 (0.0001)	193 (0.0001)	104 (0.0001)	5.5 (NS)
Adults				
Low ($N = 33$)	1.8 ± 0.19*	1.4 ± 0.22*	7.1 ± 0.15*	1.0 ± 0.16*
High ($N = 56$)	1.1 ± 0.16†	0.5 ± 0.07†	4.9 ± 0.35†	1.3 ± 0.30*

Different symbols in each column indicate significant differences among means for each variable (Duncan test).

score) (Table 1, Fig. 2). Disturbance type contributed the most to explaining the variation observed in chicks for initial response distance, most severe response distance, and severity score (Table 1). For adults, only disturbance type contributed significantly to explaining variations in behavior.

The mean distance between the experimenter and an albatross when it first changed behavior was greatest in the undisturbed area, and was least in the highly disturbed area (Table 2). The same distance relationships held for the most severe behavior; previously undisturbed albatrosses reacted sooner. Moreover, the number of retreats and snaps, and the severity score decreased, with increasing human intrusion (Fig. 2, Table 2). Nearly 70% of the albatrosses in undisturbed areas snapped or struck at the experimenter, while only 26% of the albatrosses in the highly disturbed area snapped at the experimenter.

Because approach type was significant for distance to change behavior, we examined approach type in the two disturbance types (medium and high disturbance) with the largest sample sizes of both direct and tangential approaches (Table 3). Albatrosses responded significantly sooner when we approached directly rather than tangentially (on a trajectory that would pass 1 m from them). However, the bill-snapping response was given sooner (i.e., at a greater distance) by birds approached tangentially than by those approached directly. However, there was not a significant difference in the severity score by approach type.

Discussion

Perception is critical to antipredator behavior because an animal must perceive the presence of a predator (including a human predator), judge the predator's intention, and assess its own vulnerability (Webb, 1986). Laysan albatrosses are not equipped to deal with predators, and on nearby Kure Atoll, Kepler (1967) found that albatrosses sometimes remained incubating while rats ate their flesh until they died. Humans have been important predators of Laysan albatrosses because they harvested albatrosses for food and feathers, and birds were

Table 3. Effect of Approach Type on Responses of Albatross Chicks in the Medium and High Disturbance Aneas Combined

Behavior	Direct Approach ($n = 190$)	Tangential Approach ($n = 197$)	Kruskel-Wallis χ^2 (p)
Initial response distance (m)	1.2 ± 0.08	0.89 ± 0.05	6.9 (0.01)
Severe response distance (m)	0.96 ± 0.08	0.71 ± 0.04	1.0 (0.31)
Severity score	5.2 ± 0.19	4.4 ± 0.23	2.0 (0.16)
Distance to snap (m)	0.45 ± 0.09	0.83 ± 0.06	13.6 (0.001)

killed intentionally because of their interference with air traffic (Fisher, 1966; Rice & Kenyon, 1962; Whittow, 1993).

Detection and identification are important aspects of antipredator behavior, enabling an animal to rapidly assess whether the approaching intruder is potentially dangerous, and whether and how soon to retreat. Although adult albatrosses can fly away, the young are unable to do so, and have only three options: sit still, attack, or retreat. In our study, young albatrosses in undisturbed areas attacked 70% of the time, and retreated only 27% of the time. In contrast, in the highly disturbed areas, young albatrosses showed very little response 59% of the time, retreated 10% of the time, and attacked the rest. Even those that did not appear to respond may have been stressed, however, as Jungius and Hirsch (1979) showed with seabirds on the Galapagos; heartbeat rate at least doubled in seabirds that otherwise appeared unaffected.

In terms of potential predation or harm caused by people, the albatrosses in undisturbed areas clearly defended themselves, while those in disturbed areas were habituated and were more likely to show no overt response. This result is similar to our previous experiments with herring gulls (*Larus argentatus*) (Burger & Gochfeld, 1981, 1983). However, the gulls showed higher aggression rates in areas with frequent exposure to humans, rather than being less aggressive as were the albatrosses in this study.

The results of these experiments clearly indicate that the albatrosses in highly disturbed areas habituated to the presence of people. They waited longer to respond, they responded with less severe behaviors, and they normally did not attack the experimenters. The albatrosses in the highly disturbed plot did not waste time and energy in defending themselves against humans, and their response was no doubt modified by previous experience with humans who came very close to them, without harming them.

Although our results appear to indicate habituation, it is necessary to consider whether the behavioral differences were due directly to learning by the individual or were a product of selection for tolerance over generations. The latter is unlikely to be a contributor, because until the last two decades the military removed albatrosses that were nesting near buildings, and, because albatrosses do not breed until after age 8, there would be at most only two generations during which nesting near buildings has been allowed. This is inadequate time for selection to act; however, we believe that albatrosses, like many other species, have been selected for the capacity to habituate to disturbance that is nonthreatening.

On Midway, anthropogenic disturbances can be divided into humans, vehicles, and aircraft. Lack of avoidance to the latter two threats has a cost, however, as we saw several albatrosses killed by approaching vehicles. Thus, it would seem prudent to err on the side of caution, and to move out of the way of approaching vehicles, and perhaps of humans whose movements are often associated with vehicles. For all disturbance groups, however, even when we came directly upon them, only 21% or less actually retreated. Another potential cost of excessive response to approaching humans would be if young albatross retreated into the territory of a nearby albatross, incurring the wrath of either the young or adults.

The behavior of the other researchers in their study plots (very slow movement, lack of eye contact) resulted in the birds responding to our experimental protocol as if they were undisturbed. By contrast, we moved more purposefully toward the birds, and in the case of direct approach, made eye contact as we approached. Elsewhere we have shown that eye contact enhances the retreating responses of black iguana (*Ctenosaura similis*) (Burger & Gochfeld, 1990; Burger, Gochfeld, & Murray, 1991) and gulls (Burger & Gochfeld, 1981). Similarly, in this experiment, the albatrosses in the medium and high disturbance areas (where we conducted both types of approaches) responded sooner when we made a direct approach.

The potential for species differences in behavior exists between Laysan and black-footed albatrosses. Black-footed albatrosses did not nest in the highly disturbed sites. When we were working in the low and undisturbed sites we noted that adult Laysans that were approached moved about a meter away from their nest and chick. After we left, they returned within a few minutes to their chick. However, black-footed albatrosses that were approached always moved several meters away, and many flew away. Some black-footeds returned to their chicks relatively quickly, but some did not. This could cause harm because if the parent had not fed its chick, the chick might be deprived of that feeding. This provides another reason to minimize human intrusion into undisturbed areas with nesting black-footed al-

batrosses. We did not follow the chicks through the last stage of development or fledging, so cannot comment on overall survival as a function of human disturbance.

The ability of albatrosses that live in highly disturbed areas to habituate to the presence of people, and to essentially give no response about 60% of the time, means that they can devote less time to unnecessary defensive or escape behavior. It also means that they are vulnerable to accidents because they do not get out of the way of approaching vehicles, including bicycles. Although we conducted our tests with a person, the albatrosses did not seem to respond more strongly to either a person on a bicycle, or one walking ahead of a truck (truck drivers or their helpers frequently had to get out of vehicles to manually remove an albatross chick from the road).

The relatively more intensive response of albatrosses in undisturbed areas suggests that these areas should remain so. From a management perspective, it is better to have some areas with frequent disturbance, leaving other areas relatively undisturbed (except for limited research or monitoring visits) than to rotate visits to all areas. Occasional disturbance may have worse impacts than frequent disturbances. This may be particularly true where the albatrosses must learn the relative dangers of a solitary person, a person riding a bicycle, and one with a vehicle. The responses of the albatrosses provide a method for evaluating the degree of disturbance that is being caused by any type of human activity, whether it be tourists, researchers, or others. Only by understanding the relationships between ecotourism, environmental conservation, and behavioral responses will we be able to manage seabirds and their habitats (Budowski, 1976; Burger, Gochfeld, & Niles, 1995). Thus, these experiments demonstrate a relationship of the effect of prior human intrusion on Laysan albatross behavior, offer a method to evaluate the relative effect of human intrusion, and provide some guidelines for managing human intrusion in a nesting colony of Laysan albatrosses.

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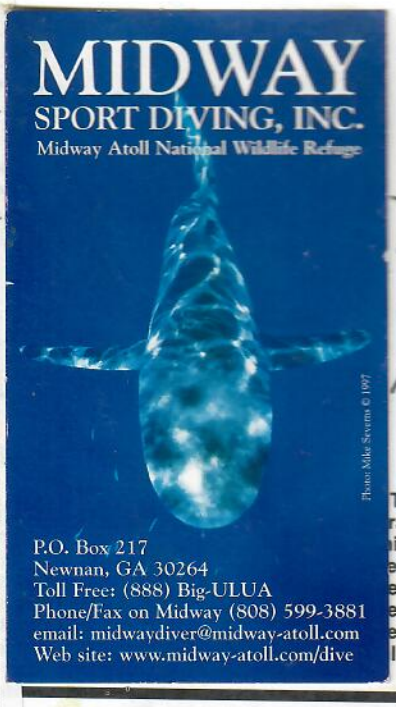
First Name	Last Name	Cell #
Abner	Begino	32
Adolfo	Lucero	404
Alain & Laure	Sacasas	41
Alex	Olitres	79
Alfredo	Chavez	446
Andro	Amoy	453
Andy	Daak	18
Antonio	R	449
Arcadio	Sison	448
Arnel	Tanada	12
Arnold	Domine	408
Arom	Suksangiam	84
Bernardo	Soriano	436
Bill	Johnston	69
Bob	Dieli	23
Bob	Wilson	35
Captain	MSF	441
Captain	MSF	442
Carlito	Banquirigo	38
Carolin	Rogers	63
Carolin & Bruce	Rogers	63
Cesario	Lubay	431
Charlie Graham	Unny	36
Chris	Sheeder	442
Clyde	Courson	87
Cynthia	Vanderlip	54
Dan	Cardinal	437
Danny	Babasa	89
Danny	Cabatac	88
Danny	Cardinal	437
David	Stewart	25
David /Terry	Stewart	25/55
Delfin	Gacutan	432
Derick	Felicilda	37
Dits	Tumbocon	80
Doc		11
Donato	Cajudo	94
Donato	Mondejar	443
Duty Operator		911
Duty Operator		555
Edgar	Salting	450
Eugene	Arcega	42
Felipe	Ison	447
Fidelito	Araya	13
Florencio	Del Mundo	434
Freddie	Banan	439
FWS		68
Heidi	Auman	16
Herbert	Gunasekera	62
Ismael	Guzman	83
Jaime	Esparagoza	400
James	Aliberti	19
Jesus	Borja	437
Jesusimo (Toto)	But	430
Jimmy	Esparagoza	400
John & Binka	Bone	440
Joyce	Goetz	85
Juan	In-Onn	402
K.G.S.	Perera	22
Kalamulla	Lenin	31
Kalamulla	Lenin	92
Kasem	Kamjorn	49
Ken	Neithammer	75
Kent	Bachman	39
Kiringodagamag	Perera	22
Kokkawita	Bedin	78
Lenny	Goetz	53
Lenny / Joyce	Goetz	53/85
Leszek	Karczmarski	34
Lisa	King	93
Lorenzo	A	435
Lorenzo	Araya	13
Loy	Deleon	456
Magsilang	Manolo	445
Manimel	Shemaratne	67
Mariano	Silvela	454
Masaki	Tabada	26
Michael	Cacawa	433
Mike	Daak	15
Mike	Gautreaux	29
Mike	Pandolfe	48
Mike / Martha	Daak	15
Mike / Phyllis	Gautreaux	29
Nancy	Hoffman	73
Narciso	Baylosis	405
Nemesio	Estares	455
Noriel	Tabo	77
Norman	Mistica	37
OSE	Rep	52
Randy	Tumbocon	452
Rell	Ramos	50
Rene	Marco	91
Reynaldo	Divina	59
Rico	Angeles	72
Rob	Shallenberger	65
Rob / Annarie	Shallenberger	65
Robert	Ferrancullo	457
Roger	Harshbarger	24
Roger / Tanya	Harshbarger	24
Ruben	Babasa	10
Sak	Phosri	56
Samarn	Kutprom	56
Sarawut	Kamjorn	81
Suzane	Canja	423
T. Shantha	Kumar	61
Terry	Colling	401
Terry	Stewart	55
Thotabaddedura	Silva	43
Tonya	Harshbarger	17



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MAR RULES

327 - KATHE Guest services = 28 NANCY 68 SILVA - 43

5. **PRONOUN-** substitutes for a noun
6. **PREPOSITION-** connects a noun to another part of the sentence
7. **CONJUNCTION-** connects words or ideas
8. **INTERJECTION-** an exclamation

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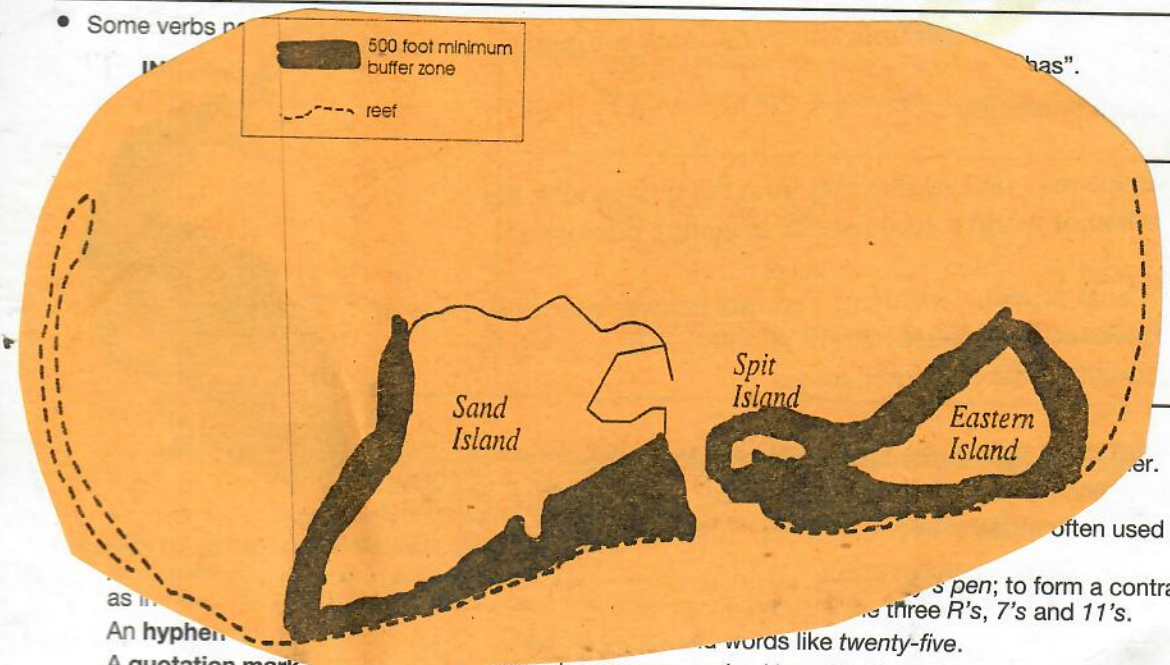

…er.

…often used

…s pen; to form a contraction
…e three R's, 7's and 11's.
An **hyphen** … words like *twenty-five*.
A **quotation mark** … the exact words someone spoke. Use with titles of songs, short stories, chapter titles, short plays, television programs, magazine articles and poems.
Underlining is used with the titles of books, movies, newspapers, magazines, long plays and poems.


Aloha
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BALAZS/GEROG
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CLAIM
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