

G.H. BALAZS

ROSE ATOLL

EXPEDITION I: 5-15 NOVEMBER 1980
II: 1 - OCTOBER 1982

BALAZS

1980 - 84

2 of 2

12 OCT 82
TUES.

Found the home of LMS Minister
("Faifeau") in Olosega village -

NAME: TIMA TIMA, F.T.

OLOSEGA - MANUA

AM. SAMOA

~ 3pm INTERVIEW - AND Fed large meal

In the early 1950's he spent
8 years in the Ellice Islands -
Then 5+ in Fiji; Been in Olosega
for 16 years

Stated populations - Olosega - 200 people
Ofu - 300
Sili - 30

He talked alot about his experience
with turtles in the Ellice Islands;
He visited all atolls, but seems
to have spent the most time on VAITUPU
ATOLL. Indicated that in Ellice they
believe that putting the ^{hawkbill} carapace in
the ground for a time causes the plates
to get thicker.

If you grab the end of the flipper of
a large turtle and turn it forward,
the turtle will be in your control
while swimming. He knows people
"swimming" or "steering" two turtles at a
time to the shore in this manner -
He also told story of a man who got

his arm tangled in a rope while tying a turtle offshore - turtle pulled him down away - but men in boat had hold of the other end of the rope and were able to pull man & turtle up. Man had blood from ears, but was otherwise fine.

On Olosega, the turtle belongs to the taker. However, when caught they bring them to Timā because he knows how to properly clean and cook them. He learned this in the Ellice Islands. After cooking, he gives pieces to the villagers if they ask. (Minister seems to have replaced Matai in this instance).

He has been brought large greens with eggs - also "smaller turtles with scales" - hawksbills. Our lady host (at Olosega home) previous mentioned that he had been given a turtle about 2 months ago.

During our dinner at Timā's I noted that the elder daughter present (Cook) was sitting behind partition in kitchen - out of sight but within hearing range.

Timā said there are no special turtle fishermen in Olosega. Because of a battle between the islands some years ago, beaches on Ofu belong

12 OCT 82

to people on Olosega. Some mention about a spear being thrown into the ground to define the boundary line of land ownership between the two islands. Nesting beaches mentioned in this context were

MAFALA & SUNILAO

Tina said that big clams (Tridacna) are plentiful in deep water - dive down a low tide to get them. Top shells too. He doesn't know of any preserved decorative turtle shells in the village - these get burned in the cooking process. Question asked to Tina if he knows of any families in the village that claim to "own" Rose Island. - answer no.

Drove to Sili Village - noted damage to church and other buildings resulting from Torgan-hurricane storm waves. Was told that white sand previously existed along this shoreline - but now just rocks. Met a Hawaiian man who had not been back for 12 years. Lives in Hawaii for Milo's ceremony. His wife is Milo's sister. President of Sili we talked to stated that "people here don't eat turtles".

12 OCT 82
TUESDAY Saw a large rusted mooring buoy with lots of chain that had washed up on the shore.

Host Mrs. Fai'ai told us of the ceremony to confer high talking chief title. Mito will drink from the awa (?) sugar and pour it on his head. Ministers will say ^{IMPORTANT PART} prayers. Ceremony will last for 2 days, with family members ^{coming} from all over. They will bring gifts of fine mats and money (~\$1000 gift each). On the first day, only immediate family members and "guards" (young tattooed men - "upā coming) will be present. No picture or TV, like is often allowed for these ceremonies on Tutuila. On the second day the event is opened up to the entire village when the chief "gives" to the village. The Samoan name for this ceremony is SAOFA'I. Host stated that no turtles would be given, or served, at the ceremony: "These people don't care about turtles" no value placed on them.

Notes station wagon with lettering -
"First Samoan Full Gospel Pentecostal Church of Ofu Manvā tele"

Frequently saw a rail-like bird running

12 OCT 82

TUES.

across the road.

Ate dinner at host's house.

William went off to visit the 7th Day
adventist minister assigned here.I wrote some notes and went to
sleep in the guest house.

13 OCT 82

WEDNESDAY

Up ~ 6:30 am. At about
8:00 am we went to

Fuliese's (7th DA) for breakfast.
Many-course breakfast prepared by
the wife - I took several
flash photos. He was assigned to
Olosega from Western Samoa. He
has gone pole fishing on Namua
in Alepata.

Interview with FEAGIAI -
electrician with power company.
He has not fished the Tamū Tamū
Caurei method since about 1968,
when he was young. Could get
4-5 turtles a day. He remembered
the poisoning at Aunuu.

Put Tamū leaves outside ofu harbor -
40-50 at a time. Day and night.
Leaves drift back and forth. - Sometimes
right into harbor. No special season-
"catchability" is determined by
tides. Both greens & frigatebill
are taken - but mostly hawks.

13 OCT 82 Turtle were taken to a black guy
 WED (Papolo) (from Fiji?) for butchering.
 He knew how to do it right. Would
 cut the neck and pull the intestines
 out. If they break, turtles was
 discarded.

Both species have been seen nesting.
 One beach site is MAFAA -
 a rough walk to get there.
 when diving, he now catches
 turtles sometimes. Gives them
 to the Faifeau (in Ofu??). Hawksbills
most common. He caught a small
 hawksbill (recently?) and his brother
 took it to Tutuila.

- END OF INTERVIEW -

~ 12 noon At the airport, I was told by
Tapaptui's son (visiting w/wife from Tutuila)
 that they went for a picnic on
 * Samo'i beach yesterday and
 found evidence of a turtle nesting
 (tracks and dig). He dug for
 the eggs to eat them, but couldn't be
 found. Samo'i beach is reportedly
 about 30 minute walk from Ofu
 harbor.

old man also
 said that a
 male and
 "seal" had
 washed up
 here in the
 past.

Reportedly there is not much himu on
 Ofu-Olosega. Three kinds eaten by residents
 are Limu FuaFua (green), Limu MEA (red),

and LIMU VAI ("Pink").

13 OCT 82 Dick Wass, Ben Sablan, Alison Kay,
WED. Roy Tsuda and other members of
the Marine Sanctuary group arrived
at Ofu ~ 1 pm on a chartered
plane. Insect site adjacent to the
airport.

William and I departed for TAV
~ 2:15 pm - had a short narrow
runway at 2:25 pm. Aerial photos
taken enroute. Plane is DeHavilland
Twin Otter. Saw a knocked off
coconut tree where fully loaded plane
crashed on land, no deaths. Noted
all cement "hurricane" houses in village
Small (being used as "secret" homes -
cost \$3,000 (to build)). Airport runway
situated above the village - SPIA holds
the lease. SPIA Agent, "Mata Nua",
drove us to the "Tan Motel", then
to her father's home to get about
use of car, or ride to Fitiuta
Village. (High Chief) TO'ATOLU NUA
has store in front. Reportedly Paul
of Sausaimoana sold him 500 lbs
of fish for \$400. Nua had a big market
at his market and sold all the fish.
Nua knows of 3 beaches on Tan
where turtles lay eggs. No shells

13 Oct 82
WED.

known to him in the village. When a turtle is caught, it is not absolutely necessary to give it to the Matai, but it is shameful if one doesn't. Both species present. If it is a small turtle, the Matai eats it himself. If the turtle is large, he saves it with the village. Same with eggs.

Concerning Rose Island, he made 3 trips - first in 1940's, last in 1964. Stayed on the island 3 days. Planted coconuts and breadfruit. The Governor picked up people to take to Rose - while there they harvested birds, fish, and clams. No known family owns Rose. At a dinner while we interviewed Nua. I learned that he is the grandfather of William (Bill) Nua who I went to high school with in 29 palms. Bill's sister returned to live in Tau for one year.

At ~ 5pm William and I walked to Faleasao Village - took photos of Tau village, and also sailing through the pass with Ofu-Olosega in the background. Saw 2 long "whale boats" on the beach at Faleasao - deteriorating and apparently haven't been used.

13 Oct 82

Wednesday

for a long time. Boats should be visible in photos ^{NO}. At Faleasao, I also saw the elementary school (where children also come to from Tau) and heard the power plant. Met 2 German fellows who were visiting for 2 weeks, one had been out fishing. One on shore indicated that he hadn't seen any signs of turtles. Samoan fishermen from Alea indicated that an "intermediate" size turtle had been seen at the nearby point. At 6pm the gong rang for the second time and we had to sit down for evening prayer time. I could see (inside) three of the nearby homes, and none seemed to be paying. One house had the TV going. We got a ride in a Toyota pickup back to the hotel. At Faleasao I saw several new expensive cars. Met hotel owner NIU MATA; asked him if he had handicraft, or turtle shells, that he sends to Pago (as someone previously suggested to me). He indicated that this was not true.

13 Oct

13 OCT 82 Niunata gave me the names of
the following fishermen in Tau
Village - ()
VEA (who is an old man)
MIKA ULUGALU *subsequently interviewed*

The "young's" family house is 3 poles
past the church - a 2 story
building. He also mentioned that
"Return to Paradise" may be the
title of an old film made in
part at Rose.

In the evening we walked to the home
of Steve Nabej and Michelle Ohira.
Steve has been an Industrial Arts,
and then Math, teacher on Tau
for 1 1/2 years. High school is
located above the village - along
the road leading to Fitiuta.
Steve hasn't heard of or seen any
turtles during his time in Tau. Has
not seen any turtle shells.
He is building a trimaran, which
sits in the yard. Steve
suggested that there may have been
no need for early Tau people to go
to Rose, because there is plenty
of food here on the island and in adjacent
water (but considers "specialty" items).

13 OCT 82

WEDNESDAY

TOMATOES
CABBAGE
BANANAS
TARO

People on Tau work had on their plantations. He also mentioned, and William Pedro confirmed, that the planting of coconut trees is used to (work-off (and declare?) property ownership. Possibly this is a basis for Rose Island claim? (but by who, -- as yet I haven't found anyone, or village, that "claims" it). Talked about Sausamiroara selling fish to Nua -- injured (left hand) crewman may not have gone to the dispensary. No Palolo this month. Report of large dope growing on Tutuila by a certain family.

Side note - Cement marker on Rose seems to indicate exactly who "owns" Rose - the Gov. of Am. Samoa. But what about water of lagoon?

TAU "Village" actually consists of two villages (border is at the church) - AMOULI and ADFULI

Returned to Hotel and ate some Coconut Crab and other food

14 Oct 82
Thursday

send poster & booklet

prepared by Niunata. Other 4 people from Pago with CETA program were also eating. Saw a rat run through the dining room. Species unknown. Pillows (hard mattress) in bed was stuffed with "cotton" from tall tree that grows in these islands.

14 OCT 82

Thursday

UP ~ 6 am. Morning plane came about 6:30 am. Mata came for us in the pickup truck at ~ 7:15 am. Departed for Fitiuta village. Informed that letters "T's" & "K's" are pronounced differently in Fitiuta.

Visited the Faifeau's house in Fitiuta - TIMOTEO TAULOLO.

He has only been here since 1980. He gave us ~~us~~ a historical overview of his life as a minister but little about turtles. He gave us tara and a \$10 tin of beef as a present when we left.

SUAFOA is a good fisherman, but he left for Pago this morning. Note that Fitiuta is situated slightly inland - you can't see the

send
poster
&
booklet

14 OCT 82 ocean from the main road. Mata
 THORSONY mentioned that she has not seen
 any jewelry made of tortoiseshell.

11 canoes (no outboard motors) were
 seen on the beach just before
 Fitinta Village. This is a very
 large number for a village, according
 to William.

Looked for Paopao, but couldn't
 find him at his home or
 plantation. Therefore we
 stopped at the MA LAIMUA (last name) fales of
 the "Tautai" of
 Fitinta village. His wife is
FAAFEU, a 73 year old lady. She
 offered most of the information - in
 contrast to her husband who didn't
 talk much. She said that in
 the olden days, when she was a
 little girl, "TAUHAAGA" ^{paddle} (big boats) were used
 to go to Rose to get slams, birds
 turtles. These boats were made
 of Pua and upu wood. They
 looked just like the present-day
 canoes, only much larger. As
 large as the whale boats at Faleasan.
 These canoes just rolled away

NO
 SAILS
 &

when they fell into disuse. Fitiuta was
 the only village that had these - not Tau.
 Doesn't know of anyone that owns Rose-
 village or family. Question I asked
 through William - if there are plenty of
 resources here, why go on a dangerous
 long trip to Rose? Answer - In the olden
 days the people were very smart - watched the
weather and went when it was good
 (i.e. not dangerous). She never heard of a boat or
 people being lost. How did they first find Rose?
 Her thought - accidentally. Went fishing further out
 and eventually saw it - (or the birds)
 noted chicks that kept pecking at food as their lunch
 dishes. Man said that nesting occurs on
two beaches - both species but mostly
hawksbills. FAGA is the beach
 before Fitiuta, SAU is after Fitiuta.
Eggs are also taken (and boiled) but
 seldom now. If you catch a turtle,
 you can keep it yourself - don't
 have to give it to the Matai. Turtles
 have never known to be poisonous here.
 Lots of people know how to prepare them.
 They are now caught every so
 often while diving - smaller
 sizes and cooked. In the olden
 day the shells were used for hooks -
 but no longer. No jewelry made.
 Young girls name is FaFENU TANCAI

Thursday
14 OCT 82

she is the daughter of TUPI TO MACAEMUA
FITIUTA, MANUA 96799

Photos taken.

We then found PAO PAO ^{y. ESCROMA} - MATABAS cousin.
INTERVIEW - He said that eggs are laid by both species on Tau sand beaches in November & December. He used skippick hooks made from tortoiseshell. Showed us long bamboo pole with 2 lines and hooks. If he gets a turtle, he calls the chiefs and they have a meal. Prime capture method - get them on the beach.

? TUMA TUMA CAUMEI is the name of a turtle catching method. Pao Pao showed me the dried scutes of a large hawksbill - gave me one scute. Wanted to know how much they sell for. Said he didn't save or use marginals or Plastron scutes. He also showed me a 22" carapace of a green turtle - set up in the rafters - 1/2 falling apart. Returned to the airport ^{Couch by Runway} for departure met (64 years old)

MIKA ULUGALU ^{INTERVIEW}
He made trips to Rose starting in 1942. Went on the Naniatela. Planted breadfruit, bananas and coconuts. After the war, went with Director George of movie "Return to Paradise". He took films of them catching birds and turtles. When

M. MOAD returned to TAU in 1972 for
dedication of the power plant, import opened 1972

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they came, there were only 2 coconuts and many Pisonia.
"Big" turtles were seen laying - "many" turtles.
Didn't see, and doesn't know about coral slab
mound. Black rocks were taken to
Rose for umu cooking. Concerning [PAU]?
YOUNG, Mika (Mugali's father) was a
sailor on Pāu Young's schooner. Pāu was
a pure Palagi - but it is not known where he
came from. Pāu married a Samoan
woman from Tau named AMEPERIA.
Their son was TAFA (SR.), who
had a son TAFA (JR.) still alive -
lives in 2 story house, but travels a lot to
Pago. Mika never saw the schooner,
but his dad told him about it. Also,
about many old things. His father died
~1975(?) Pāu took this schooner
to Rose on several occasions. Tafa
Young says that they "discovered" Rose.
There is a way in Tau
in his 80 years - same generation
as his fathers. Mika says that
turtles were very tame in those days at
Rose - would see turtles swimming right close
to shore. Would see 3-5 turtles nesting per
night (i.e. no order of magnitude decrease).
In Tau in the older days, it was required to
give big turtles to the village Matai - but small
ones could be kept for themselves. A
respectful name of the turtle given to the
KING (TUI MANUA) was MELOMELO MANUA.

14 OCT 82

Thursday

A general name given to all turtles. Stated that they seldom find hawksbills - mostly greens. A special part given to the TUI MANUA is called "SAGA" - is the dorsal neck and meat from behind the head of the turtle. Concerning TUI MANUA, a title that has now been abolished - The titles used to be selected between two royal families PAPA and ANOALO, from TAVI. However, Tofa Senior was "elected" ^{for the title} by a group of chiefs - royal families objected.

Also, a TPAFETO who came from Fitiuta claimed he also had a claim to the title ^(AND ROYAL BLOOD). This was all taken to court in Pago, with the outcome that the title was abolished.

Tofa Sr. was the son of a rich man, so that is likely why he was elected. The Royal families objected because Tofa Sr. was 1/2 Palagi. Case decided by military or Palagi judges. END OF INTERVIEW

Take off from Tau at 12:45 pm. Quick landing at Ofu to let off and pick up passengers. Photo taken of SPFA Stewardess ELDA. From Pago airport rode to the hotel with Jack Pedro, ⁶³⁹⁻¹¹⁷⁹ 1/2 brother of Williams. Jack's mother a "Jennings". He was born on Swains in 1940 - lived there till he was 7.

15 Oct 82
Friday

Recalls that turtles were now apt to nest during lightning. A channel existed to the lagoon, but got filled in a storm. From my hotel room I telephoned Joseph Theroux at 639-9596 - works for DOE with Rick Davis. He has heard of turtle petroglyph on boulder. Will try to find and write (send photo) to me. A way on Savaii told him that an "old" name for Rose is MULIAVA (Pear) (break in reef). Book AMERIKA SAMOA also mention this. by Capt. J.A.C. Gray way

15 Oct 82
Friday

Saw Papa at Library - no luck in finding info on Annu. Same with "Judy" at LBJ Medical Records, 633-1222. Talked to head of hospital - Dr. Turner. He arrived in late 1967, so poisoning must have been before that time. Suggested a Dr. Salago in Public Health. All medical records were destroyed (intentionally?) when the hospital moved in Jan 1968. Turner will check for me. Checked some stores for hawkbill jewelry then went to OMR for debriefing meeting with Henry, William, Richard and Jerry. I noted list of names as follows:

- Chief ENGINEER - Palela Pule
 - 1st MATE - IAKOPO
 - DECKHANDS - PAULO MATA, ILI
- (cont)

15 OCT 82
FRIDAY

Filifo ; Iona (John? from Swains).
 Captain ; Paul Pedro.
 Pago to SI'UFAALELE POINT, TAU - 72 miles
 " " TO ROSE - 81 miles

William took me to the water from "THE SWEET SHOP" where I photographed a BW of "Swains, Is. Schooner 1952".
 William's father went to Rose on it once. Took black rocks for UMV. Remembers singing songs while they pulled feathers from birds. Brought a small turtle back where it was kept for a while at home.

On the way to the airport, we stopped at William's brother's home - Frank Pedro - saw and photographed green turtle shell obtained at Swains. Curved length - 43 1/2". Colored was darker than those seen at Rose. Departed Pago on SPIA at ~ 3:30 pm. Ben Sablan on flight - also Ben Henderson. Arrived in Honolulu about 10 pm.

Backnote - A knowledgeable fisherman on Tau given as TOA MALUIA

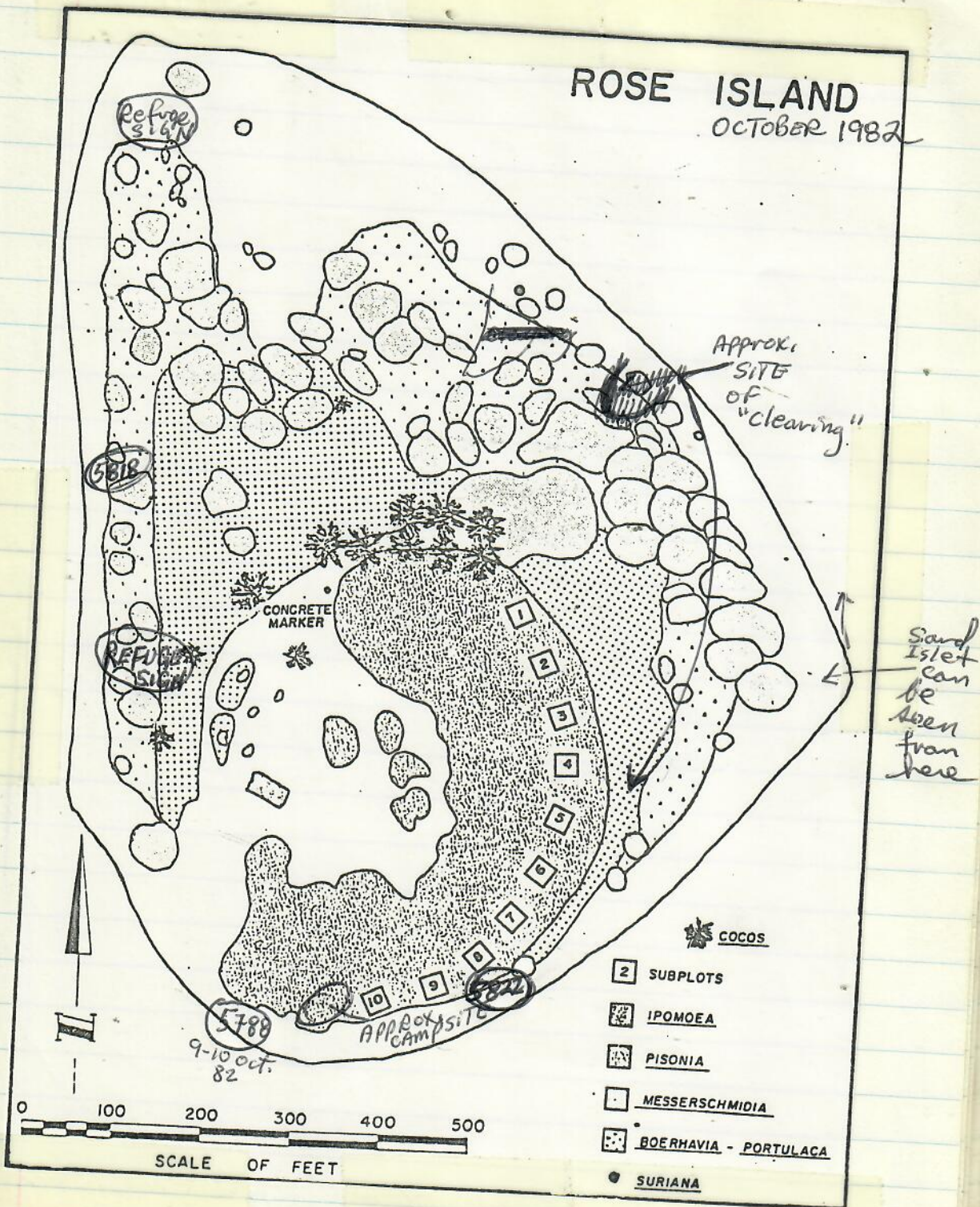
NEED LIST FROM OCTOBER 1982 TR.

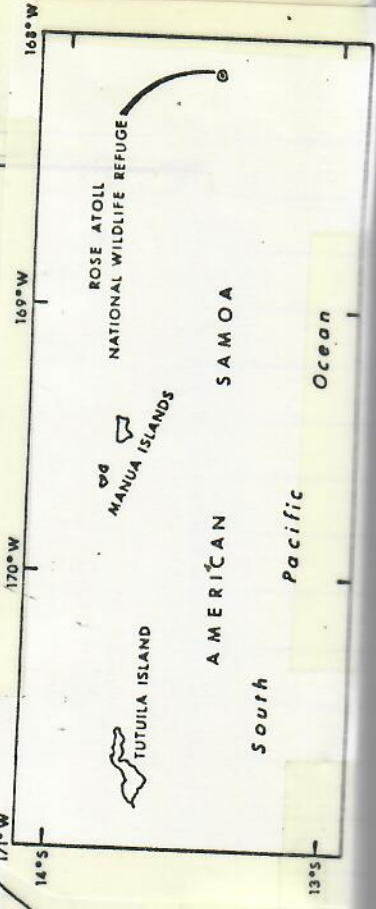
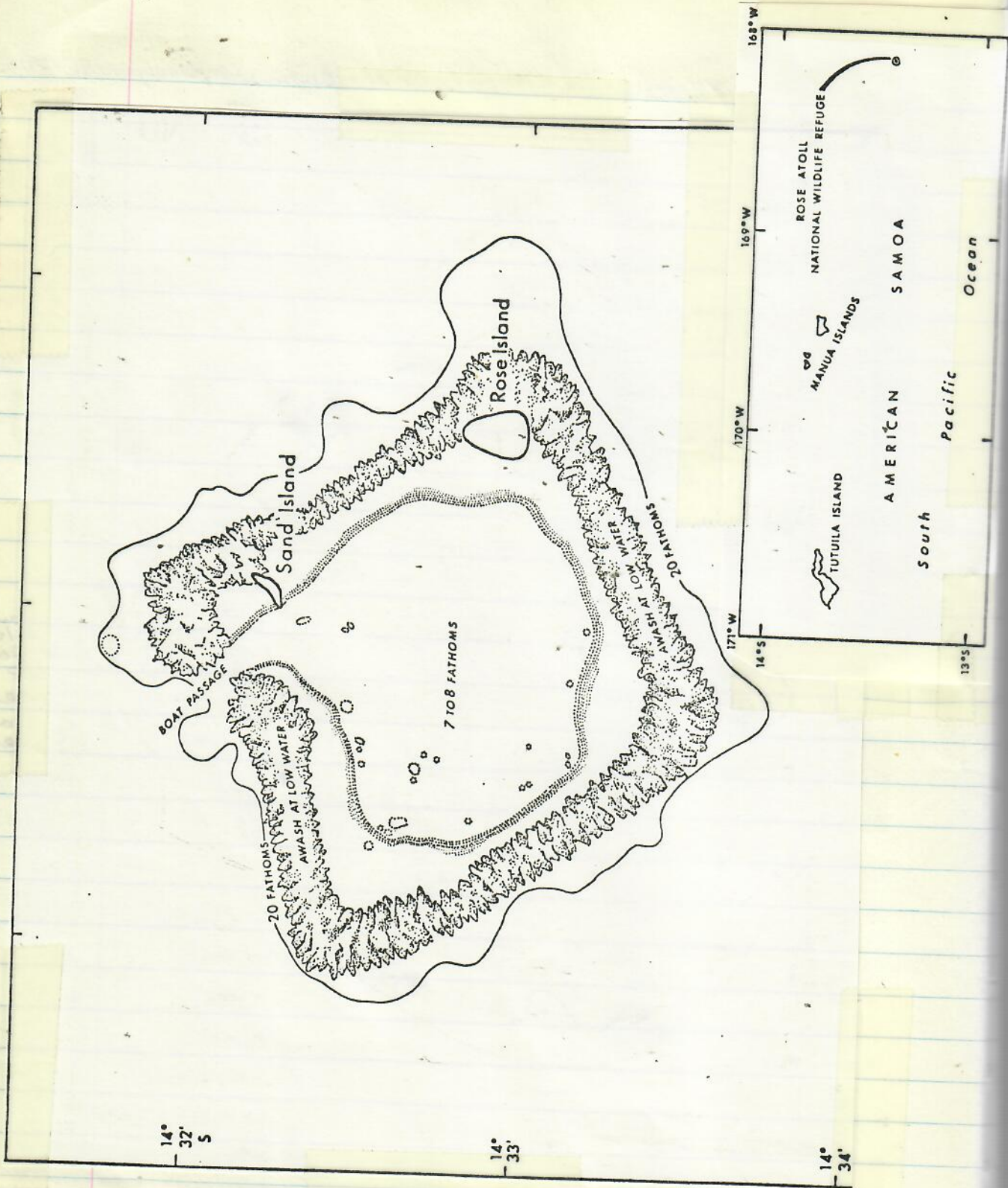
1. Call Tony Brown in Honolulu
2. Go on SSM WITH PAUL TO SWAINS
3. SEND PHOTOS TO VARIOUS INFORMANTS
4. ^{SUGGEST A} TIDE CALENDAR FOR SAMOA (O.M.P.)
5. PHOTO BUSINESS FOR AM. SAMOA
6. MATERIAL TO RICK DAVIS
7. BP MUSEUM PUBLICATIONS ON SAMOA, MANUA, ^{ETHNOLOGY OF} MANUA
8. MUSEUM/HISTORICAL SOC. - PAGO
9. FWS should be doing nesting survey in AM. SAMOA - GET MONEY FROM THEM
10. WWF money FOR AM. SAMOA?
11. Carnegie publication (as per Rose/Alison Kay)
12. Read Margaret Mead book.
13. Make up modified turtle ID chart using only 3-4 species -- cut and paste.
14. Topographic map of Manua
15. Book titled "AMERIKA SAMOA" by Capt. J.A.C. Gray (mentions old name of Rose) "MULIAYA"
16. Aerial photos from Jerry Ludwig ^{DUP. SLIDES} (same ones used in field study)
17. Self-address label to William to get medical kit back
18. Rick - MAKE FEELINGS ^{SUPPORTING} (REASONS) KNOWN; LET ME know IF HE PAYS FOR A ROSE CHARTER.
19. ^{sent} Promised to send gift to LMS Minister Olosega (TIMA)
20. Xerox map of Ofu/Olosega
21. Call Bill Hugh.
22. Take portable Scuba compressor to Manua
23. Get Samoa folklores from HIMB files

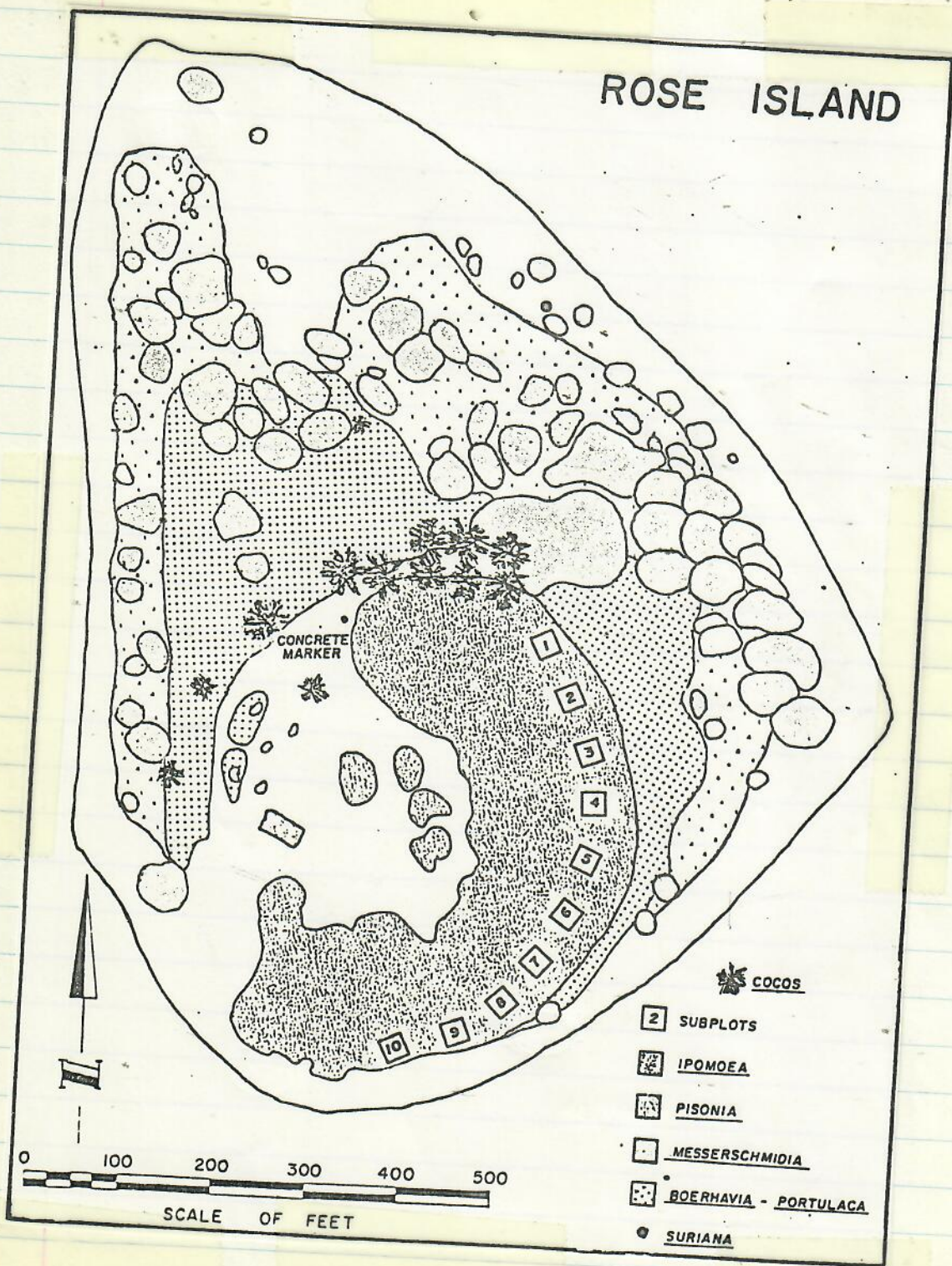
24. "Return to Paradise" - Gary Cooper? - filmed in part at Rose?
25. tags to Sablan & OMR ^{5/1} 19/8
26. Check with USCG about Channel 16 & vessel ^{11:30 pm}
 (There ^{10/20} radio may have been out. ⁶⁸²⁻²⁶⁶⁰ Gt. Com. Bernstein
 only one boat seen on that day - 2 longlines going into Page)
 operations for flight schedule - 682-2623
27. Check Samoan News at Hamilton
28. Check Rose soil sample brought to me by R. Coleman
29. Survey Palaoa & "backside" of TUTUILA
30. Evaluate need for altering turtle
 regs for Samoa.

- SUMMARY OF TURTLE OBSERVATIONS DURING EARLIER
VISITS TO ROSE ATOLL -

(See typed pages)







NORTH

PACIFIC OCEAN
SAMOA ISLAND
ROSE ISLAND

UNITED STATES POSSESSSIONS
Mercator Projection
Scale 1:80,000 at Lat. 14°
SOUNDINGS IN FATHOMS

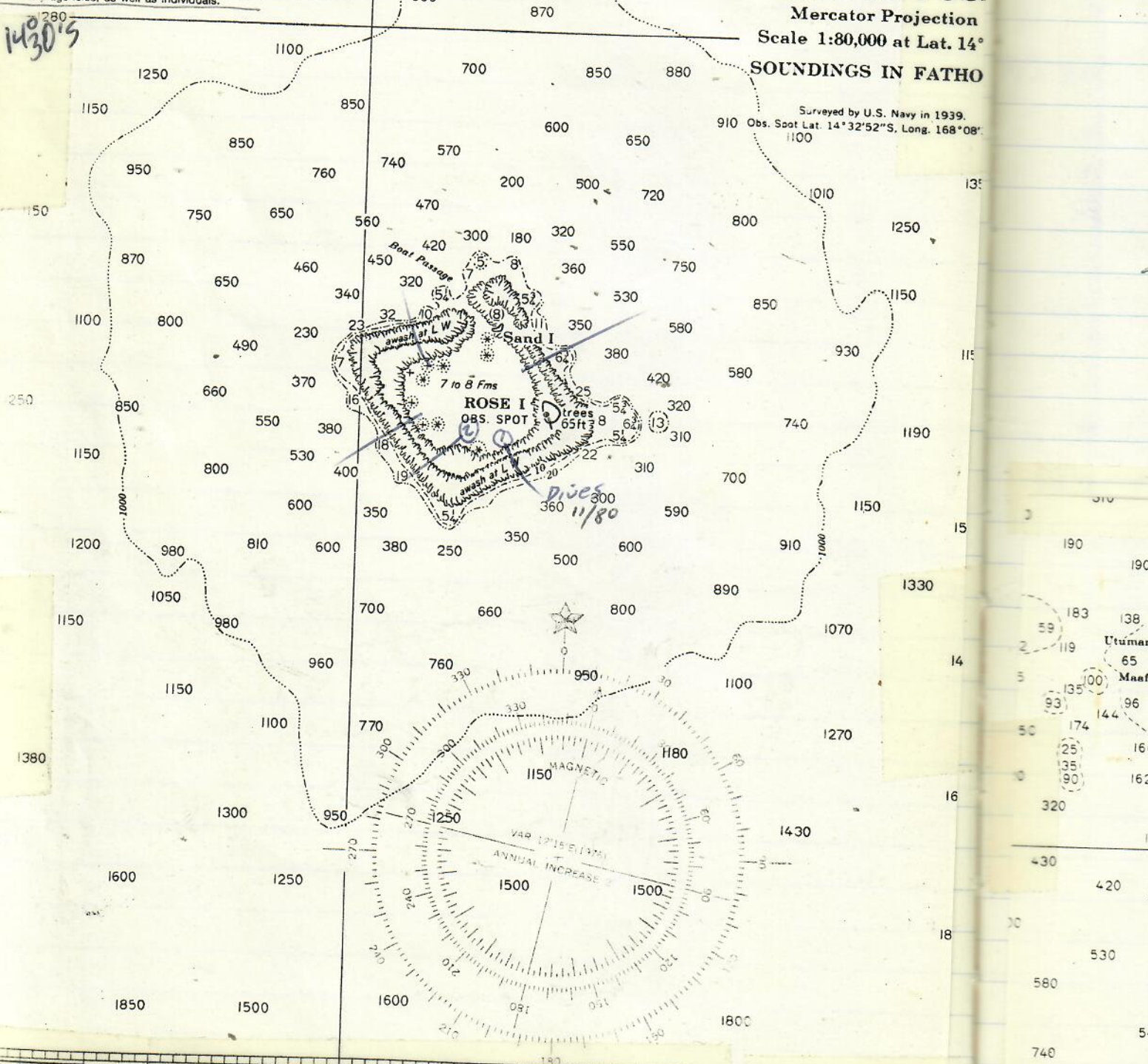
Surveyed by U.S. Navy in 1939.
Obs. Spot Lat. 14°32'52"S, Long. 168°08'

NATIONAL WILDLIFE REFUGE

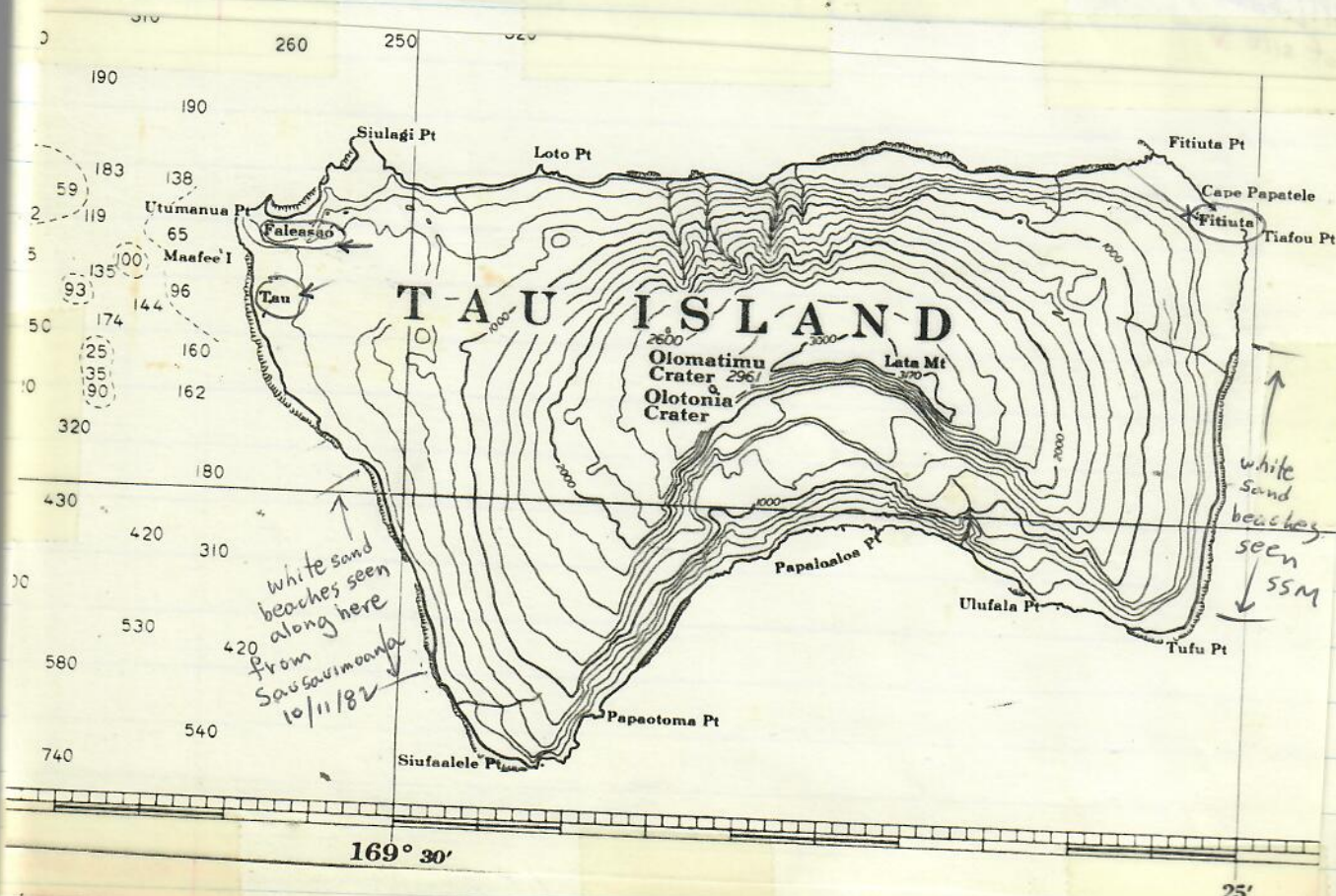
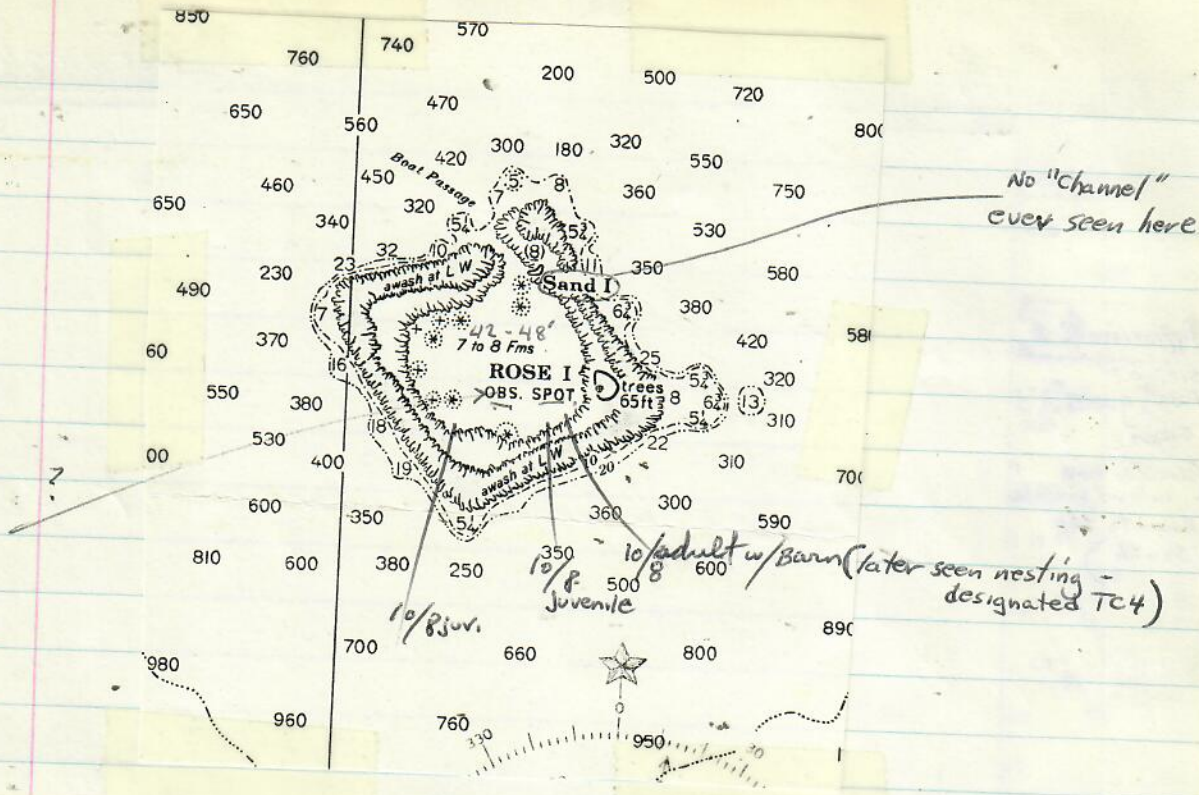
and National Wildlife Refuge, located within the American group is part of the National Wildlife Refuge System, and the jurisdiction of the U.S. Fish and Wildlife Service, Department of the Interior.

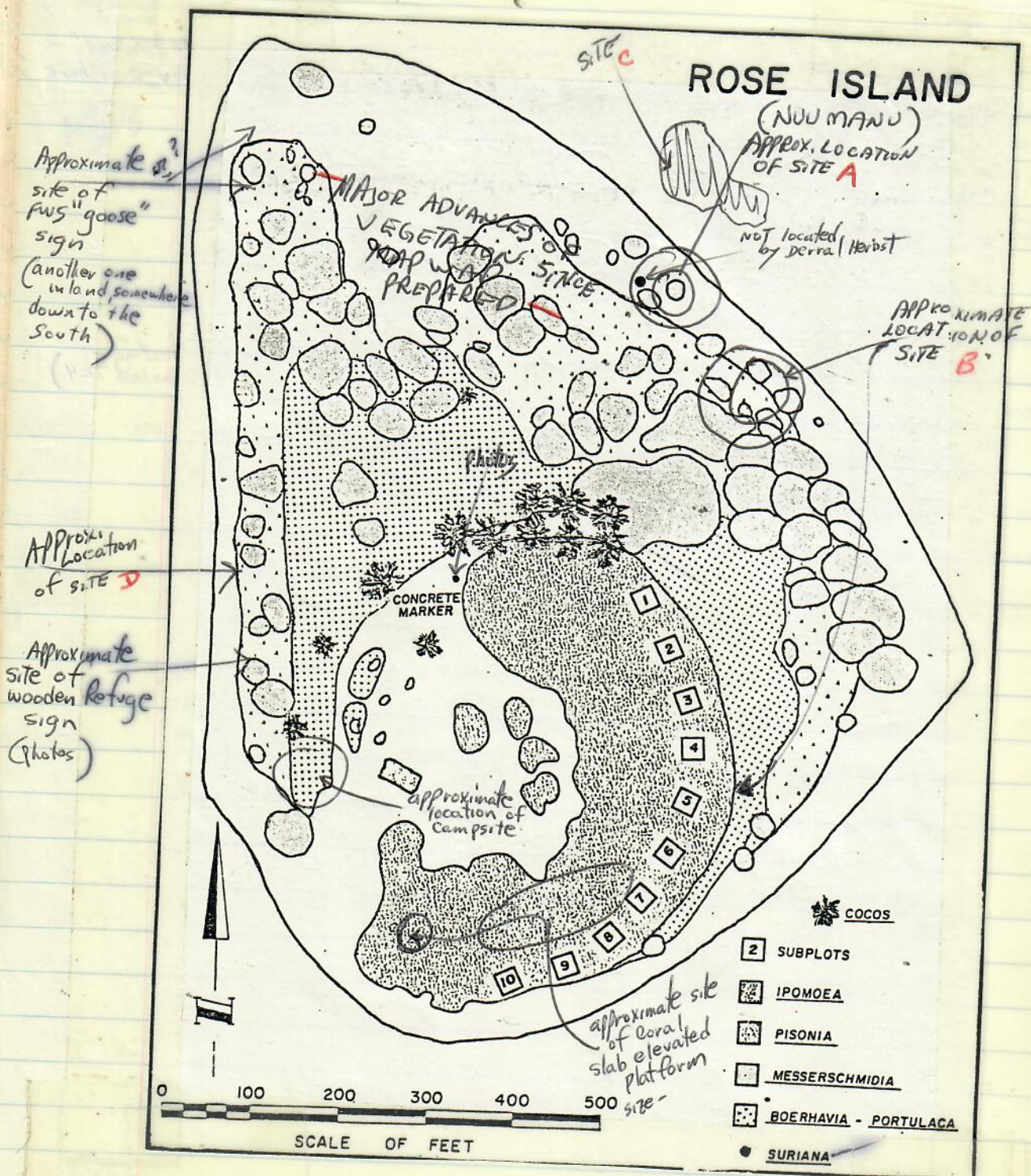
to the refuge is prohibited except by permit issued by the Manager, U.S. Fish and Wildlife Service, 337 Uluni Street, Danu, Hawaii 96734. The restrictions apply to all civilian agencies, as well as individuals.

280
1430'S

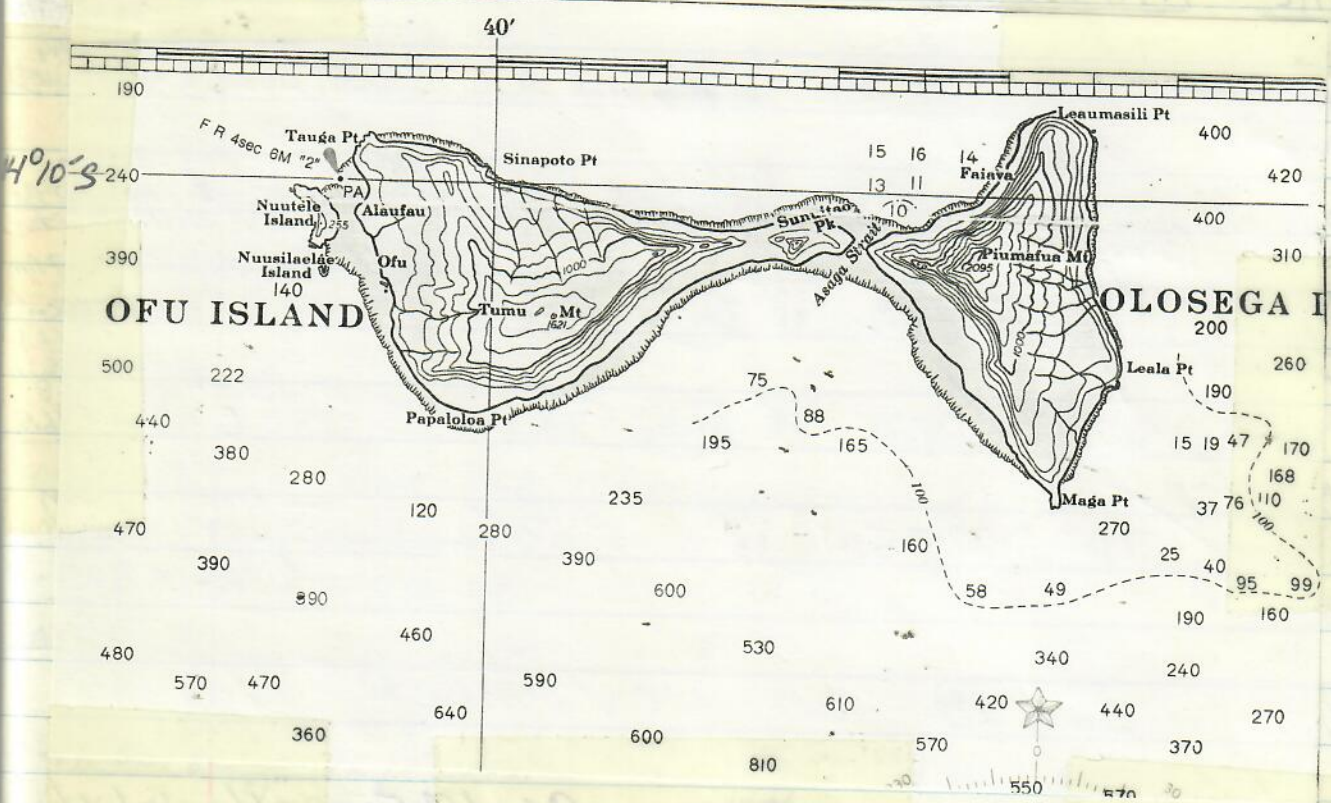


168°10' West SOUTH





Pisonia greatly increased since this map was drawn from a 1975-76 aerial photo by B. Amersen.



4°10'S

OFU ISLAND

OLOSEGA I



ROSE ATOLL TURTLE TAGGING

boxed
TDRS 9/193

DATE	TAG NUMBERS	PAGE	SITE	CIRCUMSTANCES
10 NOV 80 MONDAY	3502LFL, 3503RFL	Page 21	SITE "A"	8:55 AM TAGGED AFTER EGG CHAMBER ABANDONED
10 NOV 80 MONDAY	3504LFL, 3505RFL	Page 22 (Photos)	SITE "B"	Laid eggs 9:30 PM + 11 PM cover - v. 4/37 Letter from ALAN/ETA NIUMATASERE 8/4/86
MORNING OF 12 NOV 80 Wednesday	3506LFL, 3508RFL	Page 31 (Photos)	SITE "C"	ON exposed reef flat - 7 AM ecl - 125cm (49.2)
12 NOV 80 Wednesday	3509LFL, 3510RFL	Page 32 (Photos)	Between SITES A & B	11:45 PM 41 x 38 C 104cm x 96.5cm
12 NOV 80 - 13 NOV	3511LFL, 3512RFL, 3514RFL	Page 33 (Scale)	SITE "D" (N of Wooden Refuge sign)	11 PM - 2 AM 40.9" x 38 1/2" 104cm x 97.8

DATE	DAY
5-6 Oct 80	TUESDAY
6-7 Oct 80	WEDNESDAY
7-8 Oct 80	THURSDAY
8-9 Oct 80	FRIDAY
9-10 Oct 80	SAT-SUN
10-11 Oct 80	SUN - MON
11-12 Oct 80	MON - TUES
12-13 Oct 80	TUES - WED
13-14 Oct 80	WED - THU

LUDWIG 18 - 20 NOVEMBER 1981
(From trip report) - need to see photos

18 NOV 81 5801, 5802 CL-43.5cm "Hawksbill"
Caught by Dick Wass in water 2m deep -
(slack water by channel entrance)

19 NOV 81 11 PM 5804, 5805 CL-106cm Adult Green - up to nest
Reported by Bonnie Porwich 5804 only - nesting on Rose other flippers disputed
Saw slide in Ludwig's office 9/82

5806 missing - bad → RETAINED - will be used at a later date.

19 NOV 81 11:45 PM 5807, 5808 CL-94cm Green up to nest

20 NOV 81 2 AM 5809, 5810 CL-106cm Green up to nest

13-14 Oct 80	WED - THU
14-15 Oct 80	THUR - FRI
15-16 Oct 80	FRI - SAT
16-17 Oct 80	SAT - SUN
17-18 Oct 80	SUN - MON
18-19 Oct 80	MON - TUES
19-20 Oct 80	TUES - WED
20-21 Oct 80	WED - THU
21-22 Oct 80	THUR - FRI
22-23 Oct 80	FRI - SAT
23-24 Oct 80	SAT - SUN
24-25 Oct 80	SUN - MON
25-26 Oct 80	MON - TUES
26-27 Oct 80	TUES - WED
27-28 Oct 80	WED - THU
28-29 Oct 80	THUR - FRI
29-30 Oct 80	FRI - SAT
30 Oct 80	SAT

GHB on Rose - EXPEDITION II:

109

5-11 OCTOBER 1982

DATE	TAG NOS.	SIZE	CIRCUMSTANCES
5-6 Oct 82 - TUESDAY - Wed.	ONE PAIR TRACKS - NORTH END;		NO NESTING TURTLES SEEN
6-7 Oct 82 - WEDNESDAY - Thurs.	NO NESTERS		
7-8 Oct 82 Thurs. - FRIDAY	5818, 19, 20, 21	S-105.1 x 79.8	TC1
8-9 Oct 82 Friday - Sat.	5822, 23, 24, 25	S-96.2	Scale TC2 COUNTS
9-10 Oct 82 - SAT - SUN	5788, 89, 90 Near camp	S ^{straight} -95.6 x 76.1	TC3

10-11 OCT 82 - 1) TC3 nested - west side C^{curved}-100.2 x 93.5
SUN. - MON. 2) 5791, 92, 93 C^{curved}-108 cm N. POINT

~~FOLLOWING MONITORED BY LUDWIG & DAVIS
AFTER I LEFT FOR MANUA~~

11-12 OCT 82
MON. - TUES. TWO SETS OF FRESH TRACKS SEEN
DURING MORNING SURVEY

12-13 OCT 82 ✓ Two turtles seen; + one set tracks TURTLE NOT SEEN (1-TC4 seen at 8:28pm "109cm"; NWSide) TOTAL MAX. = 3
TUES - WED. 5794 Right Flipper 98cm curved length
RFL

13-14 OCT 82 (5795) Retained - will be used at a later date.
WED. - THURS. (5796) "Came off" Length Carapace C = 99cm
= 7:47pm

RetAG 5797 Left Flipper

RetAG 5798 Right Flipper

8:10 - 9:42pm 5799 Left Flipper

NO MARKS OR BARRUELOS

NE side of island
near Messerschmidia
7:47pm - low tide
(NOTE - High tide was about 4:30pm
Watched digging of egg chamber -
Laying of eggs - covering; 94cm
carapace length

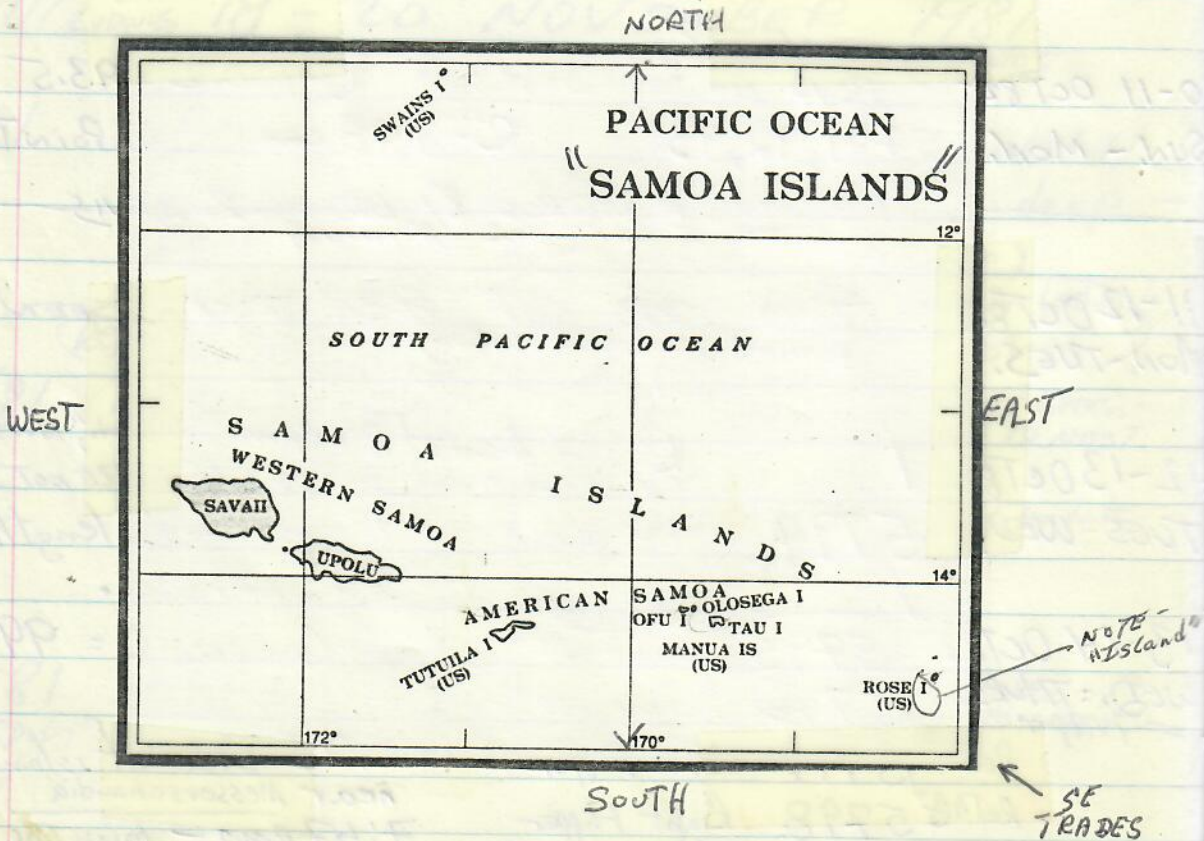
10/13 - CUDWIG & JAVIS saw 6 in lagoon - 2 adults by island
 3 elsewhere
 1 juvenile

NOTE - "ROSE" ISLAND

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TABLE 2.—TIDAL DIFFERENCES AND OTHER CONSTANTS

No.	PLACE	POSITION		DIFFERENCES				RANGES		Mean Tide Level
		Lat.	Long.	Time		Height		Mean	Spring	
				High water	Low water	High water	Low water			
				h. m.	h. m.	feet	feet			
SOUTH PACIFIC GROUPS—Continued Samoa Islands Time meridian, 165°W.										
2838	Asau Harbor, Savaii Island-----	13 30	172 38	-0 03	-0 32	+0.2	-0.3	3.1	3.9	1.6
2839	APIA (Observatory), Upolu Island-----	13 48	171 46	Daily predictions				2.6	3.2	1.6
2841	Pago Pago Harbor, Tutulla Island-----	14 17	170 41	+0 21	-0 09	-0.4	-0.3	2.5	3.1	1.2
2843	Tau Island, Manua Islands-----	14 13	169 32	-0 04	-0 34	+0.8	-0.3	3.7	4.6	1.8



NOTE: Hatchings from Rose would drift with currents in the direction of rest of Samoan Archipelago.

APIA Time ?

APIA, SAMOA ISLANDS, 1980
TIMES AND HEIGHTS OF HIGH AND LOW WATERS

NOVEMBER

DAY	TIME			HEIGHT			DAY	TIME			HEIGHT		
	h.m.	ft.	m.	h.m.	ft.	m.		h.m.	ft.	m.	h.m.	ft.	m.
1	0233	2.9	0.9	16	0123	3.1	0.9	SU	0804	0.4	0.1		
SA	0905	0.5	0.2	SU	1402	3.1	0.9						
	1506	2.8	0.9		2029	0.4	0.1						
	2124	0.6	0.2										
2	0318	2.9	0.9	17	0223	3.2	1.0						
SU	0947	0.5	0.2	M	0857	0.2	0.1						
	1545	2.9	0.9		1457	3.3	1.0						
	2206	0.6	0.2		2124	0.2	0.1						
3	0356	2.9	0.9	18	0318	3.4	1.0						
M	1024	0.4	0.1	TU	0946	0.0	0.0						
	1619	3.0	0.9		1548	3.6	1.1						
	2246	0.5	0.2		2217	0.0	0.0						
4	0433	3.0	0.9	19	0414	3.5	1.1						
TU	1059	0.4	0.1	W	1035	-0.1	0.0						
	1651	3.1	0.9		1638	3.7	1.1						
	2321	0.5	0.2		2309	-0.2	-0.1						
5	0505	3.0	0.9	20	0504	3.5	1.1						
W	1131	0.5	0.2	TH	1124	-0.1	0.0						
	1724	3.2	1.0		1728	3.8	1.2						
	2355	0.5	0.2										
6	0540	3.0	0.9	21	0000	-0.2	-0.1						
TH	1202	0.5	0.2	F	0555	3.5	1.1						
	1756	3.2	1.0		1214	-0.1	0.0						
					1818	3.9	1.2						
7	0029	0.5	0.2	22	0051	-0.2	-0.1						
F	0615	2.9	0.9	SA	0647	3.4	1.0						
	1231	0.5	0.2		1302	0.0	0.0						
	1831	3.2	1.0		1907	3.8	1.2						
8	0104	0.5	0.2	23	0144	-0.2	-0.1						
SA	0652	2.9	0.9	SU	0739	3.3	1.0						
	1306	0.6	0.2		1353	0.1	0.0						
	1908	3.2	1.0		1957	3.6	1.1						
9	0143	0.5	0.2	24	0238	0.0	0.0						
SU	0731	2.8	0.9	M	0832	3.1	0.9						
	1339	0.7	0.2		1448	0.3	0.1						
	1947	3.2	1.0		2051	3.4	1.0						
10	0225	0.6	0.2	25	0335	0.2	0.1						
M	0815	2.7	0.8	TU	0930	2.9	0.9						
	1417	0.8	0.2		1549	0.5	0.2						
	2030	3.1	0.9		2147	3.2	1.0						
11	0307	0.7	0.2	26	0435	0.3	0.1						
TU	0903	2.6	0.8	W	1029	2.7	0.8						
	1506	0.9	0.3		1653	0.7	0.2						
	2120	3.0	0.9		2247	3.0	0.9						
12	0402	0.7	0.2	27	0538	0.5	0.2						
W	0957	2.6	0.8	TH	1134	2.6	0.8						
	1602	0.9	0.3		1758	0.8	0.2						
	2215	3.0	0.9		2349	2.8	0.9						
13	0502	0.7	0.2	28	0639	0.6	0.2						
TH	1057	2.6	0.8	F	1240	2.6	0.8						
	1711	0.9	0.3		1903	0.8	0.2						
	2315	2.9	0.9										
14	0604	0.7	0.2	29	0049	2.7	0.8						
F	1202	2.7	0.8	SA	0735	0.6	0.2						
	1822	0.9	0.3		1338	2.6	0.8						
					2002	0.8	0.2						
15	0020	3.0	0.9	30	0148	2.7	0.8						
SA	0707	0.5	0.2	SU	0227	0.6	0.2						
	1303	2.8	0.9		1427	2.7	0.8						
	1927	0.7	0.2		2053	0.8	0.2						

TIDE TABLE FOR THE MONTH OF: OCTOBER 1982

SUN.	MON.	TUES.	WED.	THURS.	FRI.	SATUR.
31 0559 3.0 1146 -0.2 1820 3.2					1 0547 2.9 1142 -0.1 1807 2.8 2356 -0.1	2 0624 3.0 1217 -0.2 1846 2.9
3 0035 -0.1 0706 2.9 1254 -0.1 1926 3.0	4 0117 -0.1 0750 2.9 1333 -0.1 2011 3.0	5 0205 -0.1 0838 2.7 1420 0.1 2101 2.9	6 0301 0.0 0931 2.5 1514 0.2 2157 2.8	7 0407 0.2 1034 2.4 1623 0.4 2301 2.7	8 0523 0.2 1146 2.3 1738 0.4	9 0014 2.7 0639 0.2 1301 2.3 1854 0.4
10 0127 2.7 0747 0.1 1412 2.4 2003 0.2	11 0233 2.8 0846 -0.1 1513 2.6 2104 0.1	12 0334 3.0 0939 -0.2 1606 2.8 2154 -0.1	13 0424 3.1 1024 -0.3 1653 2.9 2242 -0.2	14 0512 3.1 1108 -0.3 1734 3.0 2328 -0.2	15 0554 3.0 1149 -0.3 1816 3.0	16 0011 -0.2 0634 2.9 1228 -0.1 1855 3.0
17 0053 -0.1 0716 2.8 1307 0.0 1934 2.9	18 0136 0.0 0757 2.6 1346 0.2 2014 2.8	19 0223 0.2 0838 2.4 1429 0.4 2056 2.6	20 0311 0.4 0925 2.2 1514 0.6 2144 2.5	21 0407 0.5 1016 2.0 1609 0.8 2234 2.3	22 0510 0.6 1116 1.9 1713 0.9 2335 2.2	23 0615 0.6 1224 1.9 1821 0.9
24 0037 2.2 0713 0.6 1327 2.0 1921 0.8	25 0136 2.3 0803 0.5 1421 2.1 2014 0.7	26 0228 2.4 0844 0.4 1504 2.3 2056 0.5	27 0313 2.5 0920 0.2 1542 2.5 2136 0.3	28 0355 2.7 0957 0.1 1622 2.7 2213 0.1	29 0436 2.8 1032 0.0 1659 2.9 2252 0.0	30 0518 2.9 1107 0.9 1739 3.1 2334 -0.4

PHOTO LOG

SAMOA - ROSE ATOLL I 5-15 NOV 80

ROLL 1

ASA 64

EL

"/8/80 ~ #1-8 Two 16 year-old Samoan girls at Aoa Beach, Tutuilla; "/9 Sunday - Leitani at dock; "/10 Rose Is. & pass from Leitani; Rose Is. from zodiac 55 & WA; Pink coralline algae - fringing reef + ^{North end} - close ups.

ROLL 2

ASA 64

EL

"/10 Monday night - flash 5.6 red mode of 3504, 3505 (white laying eggs & ~ 1/2 hours at final stage of cover-up).
 "/11 Tuesday - Sand Is. area photos at ~ 9 AM; Refuge "goose" sign; ^{note chicks} habitat area where 3504-05 nested (note Frigates in top of Pisonia trees); Many photos taken on reef flat at low tide - 55mm and WA; ^{PINK REEF} flash at night of brown crab - species unknown.

ROLL 3

ASA 64 EL

"/12 Wednesday - Turtle 3506 & 3508 on reef rubble; Pisonia trees with WA; ^{self photo} Cement markers; Bomb found by Rob; Self-photos taking bath in pool way out on reef flat; (3509, 10 - right flipper partially missing, healed; (Flash photos of Gropus (?)); "/13 Crew in zodiac approaching Rose (24mm WA);

ROLL 4

ASA 64 EL

"/13 Photos of group by wooden sign (self-timer); Uropi in tree; 2:30 AM William (WA) diving zodiac; Sand Island WA; Leitani WA at crew/wally; ^{self photo} Flash photos of "Tongan" green shell at Burn Philp. "/16 - close-ups of pink coralline in backyard at home; "/23 - CHRISTIAN

PHOTO LOG
Rose ATOLL II 1-15 OCT 82

ROLL 1 Previous photos of Kahuku nesting beach; graft
EKTACHROME 64 Turtles scheduled for release; Christmas in tub 9/30;
10/3 ^{AUNUU} Sand beach & coast of south shore;
10/4 Sausauiroana at dock; views of Pago harbor;
AUNUU ~~at~~

ROLL 2 10/4 AUNUU 10/5 Rose; hooked Brown Boobie; uprooted
KR 64 Messerschmidia trees at NE end; 10/6 RAT w/FLASH; BASE
of PISONIA with 110mm; slab mound structure 110 & WA; PISONIA
tree WA; red-tailed TROPIC-Flash; slow speed of PISONIA forest;
People around campsite; 10/7 ^{Thursday} Close-ups of Homotrema
on coralline alga pieces; Topped Messerschmidia.

ROLL 3 10/7 ^{Thursday} Topped Messerschmidia; BIK Tipped sharks with 110mm; People
KR 64 in BW; Rose & ^{Sand} Islets & red Reef from Sausauiroana; Sausauiroana
at anchor; William Washing fishes; 10/7 ^{MIDNIGHT} Many flash
photos 3.5-5.6 Red of ^{coconut CAB in shell} Messerschmidia; TC 2 5822, 23, 24, 25 under
Messerschmidia.

ROLL 4
UW ASA200 10/8 FRIDAY NOON - coral heads and clams 250 at F11-16.
NIKONOS III C-130 over island; 10/10 Snorkel at "Pinnacles" - divers.

ROLL 5 10/8 Friday ^{Flash} - Rick with band on suckers of crown of thorns -
Samoan "cure" for thorn wound; 10/9 Saturday Close up
of green "lichens" on Pisonia 10/10 Rick at Sand
Islet; Paul & Rick on the boat; 10/10 TC 3 covering;
TC "4" 5791-93 returning to the water;

PHOTO LOG

Roll 5 (CONTINUED) Tau from SSM; also ofu-obosega; ^{Tues.} 10/12 4 elder men interviewed at ofu near L.M.S. church; TAEATUI WITH SKIPJACK loves

Roll 6 10/12 TUESDAY - Scenes around ofu-obosega 10/13 Wed FLASH
ASA 64 breakfast table at SDA minister's house; ^{"FULI ESE"} Aerials of ofu-obosega; plane on runway at Tau; Tau village; ^{also aerial} Faleasao village; Aiea coming in pass with ofu-obosega in the background; 10/14 Thursday

Roll 7 10/15 FRIDAY - Girl in "Women's Handicraft Market"; ^{William Padro} 43 1/2" curved length green turtle shell taken while nesting at Swains; 20 EXPOSURE Photos of BW photo of Swain's Is. Schooner 1952 hanging on the wall at "The Sweet Shop" near OMR.

No.

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

All Logged
9/17/93

117

No.	Date	Tag Nos.*	Carapace length, cm		Researcher
			curved	straight	
1	11-3-71	1080, 1080	-	-	EK
2	11-3-71	1081, 1081	-	-	EK
3	11-10-80	3502, 3503	-	-	GB
4	11-10-80	3504, 3505	111	-	GB
5	11-12-80	3506, 3508	-	-	GB
6	11-12-80	3509, 3510	104	-	GB
7	11-12-80	3511, 3512 3514	104	-	GB
8	11-18-81	5804, 5805	106	-	GL
9	11-19-81	5807-5808	94	-	GL
10	11-20-81	5809-5810	106	-	GL
11	10-7-82	5818, 5819 5820, 5821	-	105.1	GB
12	10-7-82	5822, 5823 5824, 5825	-	96.2	GB
13	10-9-82	5788, 5789 5790	100.2	95.6	GB
14	10-10-82	5791, 5792 5793	108	-	GB
15	10-12-82	5794	98	-	GL
16	10-13-82	5797, 5798	99	-	GL
17	10-13-82	5799	94	-	GL

*All tags applied by GB and GL are inscribed with the return address: "WRIT UNIVERSITY, HAWAII, 96744". Tags applied by EK read: "BUREAU WILDLIFE, KAI HAWAII".

**GB - George Balazs; GL - Gerald Ludwig; EK - Eugene Kridler.

Birds Seen October 1982

1. Lots of Brown Boobies, young, no full adult plumage
2. Flocks of sooty terns overhead at night
3. Some Frigates overhead - 10/7 ^{large swirling} - flock over lagoon
4. Red-footed boobies (mostly young)
5. Fairy Terns
6. Red-TAILED TROPIC Birds
7. Bristle-Thighed Curlews
8. few noddies

FISH IN LAGOON

1. Wrasses
2. TANGS
3. Damsel Fish
4. Big Triggerfish
5. A few Rabbit fish
6. Black-tipped sharks
7. Small black groupers
8. ^{blue} Parrot fish

TAKEN - 6990 (25)
 1976 + knife & regular pliers & instructions -
 1980

TABS TAKEN - 6900 (25)
6976 + knife & regular pliers & instructions -
Requested turning over to tag.

TABS Returned = 6886 - 6900 (15)
11/84

GREEN SEA TURTLE OBSERVATIONS -- ROSE ATOLL NWR

1984 - Dick WASS

At approximately 0530 each morning we circled the island on the beach to count fresh turtle tracks indicative of nesting attempts during the night. ^{For some mornings} the counts are probably lower than the actual number of attempts as it is likely that some tracks were obliterated by incoming tides. This is certainly true for the morning of the 23rd when the high tide occurred simultaneously with the survey erasing all tracks.

Counts for the other mornings were as follows:

October 22 - 4

October 24 - 7

October 25 - 11

October 26 - 11

The period of our survey coincided with the new moon and very high tides. These are probably optimal conditions for nesting and likely account for the relatively large amount of nesting activity observed.

Nest pits were counted on both Rose and Sand Islands. Only those pits that appeared to be relatively fresh (less than 3 months old) were counted and if one turtle had obviously made several pits, all were counted as one. A total of 73 pits were counted on Sand Island and 100 pits on Rose Island (84 pits on the ocean side and 16 pits on the lagoon side).

Five turtles were double tagged during our stay. ^{on the evening of Feb 23rd} one was tagged after knocking down a tent erected on the beach. An attempt had been made to turn it away from the tent ^{by tagging on its flippers} and ^{Three days later} it was headed back into the water. It is of interest ^{at this time} that this same turtle was observed laying eggs and nesting successfully 3 days later. A second ^{one} was also tagged in the evening when it was returning to the water after an unsuccessful attempt at nesting. The other three were tagged just after daybreak as they were returning to the water. Tagging data are as follows:

11/80
 "BACK COVER"
 "DELAMINATED"
 FROM LAYING
 ON TENT FLOOR
 at ROSE ISLAND
 moisture

Date	Time of Day	Right Tag No.	Left Tag No.	Carapace Length (curved-line method)
10-23-84	1930	6877	6876	102.5 mm
10-24-84	2100	6879	6878	106 mm
10-26-84	0600	6880	6881	110 mm
10-26-84	0615	6882	6883	102 mm
10-26-84	0630	6884	6885	92 mm

LFL

RFL

- ✓ 1.
- ✓ 2.
- ✓ 3.
- ✓ 4.
- ✓ 5.

CONVERSION TABLE WITH U.S. EQUIVALENTS

ENT

METRIC UNIT (1) U.S. EQUIVALENT

VOLUME

cubic centimeter (cm ³)	0.061 cubic inches
cubic decimeter (dm ³)	0.0353 cubic feet
cubic meter (m ³)	1.31 cubic yards
cubic decameter (Dm ³)	13.10 cubic yards

CAPACITY, CUBIC

milliliter (ml)	0.06 cubic inches
centiliter (cl)	0.6 cubic inches
deciliter (dl)	6.1 cubic inches
liter (l)	61.02 cubic inches
decaliter (Dl)	0.35 cubic feet
hectoliter (hl)	3.53 cubic feet
kiloliter	1.31 cubic yards

CAPACITY, DRY

deciliter (dl)	0.18 pints
liter (l)	0.908 quarts
decaliter (Dl)	1.14 pecks
hectoliter (h)	2.84 bushels

CAPACITY, LIQUID

milliliter	0.27 fluidrams
centiliter	0.338 fluidounces
deciliter	0.21 pints
liter	1.057 quarts
decaliter	2.64 gallons

1954

ATOLL RESEARCH BULLETIN

No. 29

A Summary of Information on Rose Atoll

by

M.-H. Sachet

LIBRARY OF
GEORGE H. DALRYMPLE

Issued by

THE PACIFIC SCIENCE BOARD

National Academy of Sciences—National Research Council

Washington, D. C.

A summary of information on Rose Atoll

by
Marie-Hélène Sacht

Rose Atoll, the easternmost of the Samoa Islands, is one of the smallest atolls known and is of special interest, because it has hardly been influenced by man. Its situation not too far from the settled islands of the group, the fact that it is generally easy to enter the lagoon and land on the islets, and various other circumstances have made it one of the better known uninhabited atolls. The literature concerning it has been brought together by Setchell (1924) and by Bryan (1942). This paper is not intended to replace these contributions but to summarize all available information on land aspects of the atoll. It necessarily repeats much information contained in these earlier compilations but may thus be helpful to those students of atolls to whom these are not easily available. In addition to published accounts, it includes notes based on letters of Mr. E. H. Bryan, Jr. and on conversations with Dr. L. P. Schultz and data obtained from their photographs and unpublished records. Their valuable help is gratefully acknowledged.

Geography

Rose Atoll is located between $14^{\circ}31'$ and $14^{\circ}34'$ S and between $168^{\circ}08'$ and $168^{\circ}10'$ W. It is a very small atoll, roughly square in outline and about $1\frac{3}{4}$ miles from north to south and 2 miles from east to west. Just west of the north point, or corner of the square, is the only channel into the lagoon. The channel is 100-150 feet wide and of variously reported depth: 6 fathoms or more (Rantzau in Graeffe, 1873), 30 or 40 feet (Anon., 1953) with records of 6 to 9 feet, or 6 feet or more that are probably erroneous or refer to the part of the channel that is choked with coral: Bryan (1942) reported the channel partly blocked with coral heads on the west side. The lagoon is about 2000 yards across its greatest width, and its depth is variously estimated as 6 to 12 fathoms (Wilkes, 1845), not more than 8 fathoms (Mayor, 1924) or up to 50 feet (Bryan, 1942). The floor of the lagoon is sandy, and generally free of living corals (Couthouy, 1942, p. 138). But some corals do grow in it. Wilkes described one such formation: "like a submerged tree, thirty feet in diameter over its top [it] was found in the center of the lagoon rising to the level of low water and having all around it a depth of six fathoms." This may be part of the two coral patches mentioned by Rantzau (Graeffe, 1873) as occurring in the southwest corner of the lagoon and indicated on his and later maps.

The reef is remarkably uniform in width, about 500 yards everywhere, with a very flat surface, most of which is under water even at low tide, though some areas emerge as smooth platforms about a foot above low tide. There is very little loose material on the reef. It supports only two islets. Sand Islet, to the north, near the entrance to the lagoon, is a bank of sand and broken reef material, devoid of vegetation and about 5 feet above sea level. Although the charts are not entirely reliable, there is some indication that the islet has been

(see discussion of Rantzau's chart, (pp. 4-5)).

Sand Islet is quite possibly variable in area, especially as no plants are present that are capable of colonizing and fixing its soil. In 1933 its dimensions were estimated as 200 yards in length and 50 yards in width (Bryan, 1942). It lies on the lagoon side and has a wide expanse of reef on its seaward side. *330m* *229m*

At the eastern corner of the square is Rose Island, which is larger than Sand Islet. Mayor, in 1920, gave the length as 240 yards along a north to northeast direction and the width as 200 yards. Bryan, in 1938, estimated the island 350 yards long and 250 yards wide. Schultz (1943, p. 3) says that in 1939 it seemed to be building up on the northwest and being eroded on the south end. This agrees with some notes by Mayor and Bryan. Rose Islet has a greater elevation than Sand Islet, reaching 11 feet above high tide a little inland of the southeast corner (Mayor, 1924, p. 74). It is higher in the south than at the northern end and, like Sand Islet, it is located on the lagoon half of the reef.

History

Rose Atoll was discovered on October 21, 1819, from the ships l'Uranie and la Physicienne, and was named Rose Island by the commander of the expedition, Louis de Freycinet "for a person extremely dear to me." The ships did not enter the lagoon or come very close to the island. However, Freycinet described the island as observed from the sea, and Duperrey drew a chart that is included in the atlas of the expedition reports. In his volume on navigation and hydrography (1826, p. 85), Freycinet gave information on the weather, on the animals observed off the atoll, on the longitude, and on the latitude estimated at noon. He described his discovery (1826, p. 250) marveling at the fact that the atoll had not been observed and charted earlier. He mentioned only Rose Islet, but he said of it:

"Its height generally mediocre, is greater in the SW; the land gradually slopes down toward the NE where it merges with the sand of the shore.

"Although very small, this island is well wooded, which gives it a very pleasant look of freshness. Various sea birds seem to be the only inhabitants of this lonely place; we particularly noticed frigate birds, boobies, tropic-birds, noddies, and terns [apparently two small species]. Among the trees, there are no coconut trees nor any other kind of palms.

"The whole island, as we have said, is surrounded by a bank just below water level, grossly triangular, of mixed sand and madrepores; it is bristling with small black rocks, not very much raised above its surface, and all of about the same height. One of the angles of the bank is to the SW, another to the E, and the third to the N; its dimensions are 3 miles [nautical] from N to S, and a little less from E to W. The sea breaks much all around, and the surge can be felt from one or two cable lengths at sea: we followed its eastern part at a distance of one

and a half mile [s], without seeing bottom under us.

"When one stands to the N of Rose Island, it shows a semi-circular shape; seen from the E it looks like a 'coin de mire' [is wedge-shaped] with its higher part looking to the south. To the NE, and very close [to the islet?] a little black rock, a regular cone, rises above all the rocky heads just mentioned."

This literal translation shows that Freycinet observed the islet and reef exactly, which makes it all the more difficult to understand some aspects of Duperrey's chart, namely, the two areas that Setchell interpreted as two additional sandy islets. Although Freycinet did not mention any sandy "islet", his drawing of the landfall, presumably made from about east to southeast, showed on either side of the wooded islet some little black rocks and a broad mound. These may be sand banks and correspond to the patches of the chart. Freycinet's description of the islet is detailed enough for us to believe that the trees may have formed two groves, a large one to the southwest and a tiny one to the northeast, which apparently does not exist any more. ~~The~~ northeast grove either joined the other one or was destroyed by a change in the shape of the islet. Freycinet described Rose again later in his historical account of the voyage.

The Russian expedition of the *Predpriatie* (*Enterprise*), commanded by O. de Kotzebue, passed a little coral island on April 2, 1824, and named it Kordinkoff (Kotzebue, 1830, p. 256), later to realize that it was the same as Rose. Kotzebue's sketch of the atoll is not much better than Duperrey's, although it shows a closed lagoon.

On September 23, 1838, Dumont d'Urville, on another French expedition, passed Rose Island following the reef at a distance of less than a [nautical] mile and gave a brief description of it (1842, pp. 91-92):

"Rose Island is but a pile of sand about 200 m. in diameter, covered with a grove of verdure very fresh looking and pleasant.

"Passing about 600 m. to the north of the reef edge, we saw in the reef a break about 100 m. wide, leading into the lagoon where the water seems rather deep, and which ought to be able to offer shelter to ships as small as ours."

The French expeditions were scientific in purpose, and their instructions placed much emphasis on obtaining physical, nautical, and meteorological information. The discovery and surveying of new lands was recommended also, but these lands were especially worth investigating if they could bring new people and their customs, new plants, new animals, to the notice of Science. The fact that low islands present danger and difficulty in landing, especially with a sailing vessel, as well as their recognized paucity in scientific novelties, resulted in a general avoidance of atolls by most early expeditions, including the French.

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The U. S. Exploring Expedition was different in scope and aims, and without neglecting scientific discovery, visited many of these atolls, reputedly all alike, for the purpose of charting them. It was much larger than any of the previous expeditions both in ships and in naval and scientific personnel. In spite of its vessels and the unending arguing, prosecuting and fantastic mishandling of the results which followed it, the expedition was generally remarkably successful, and, although some of the information has never been published, it brought back vast amounts of data, charts, scientific collections, and drawings. It was the first "Atoll Program", and after surveying many of the Tuamotus, one of the ships, the Vincennes arrived at Rose Atoll, on October 7, 1839. A part of the day was spent in observations, and Wilkes (1845, p. 64) in the narrative of the voyage gave an account of them, but the best description published, and the only one of an eye-witness, is that of Pickering (1876, pp. 235-236):

"14. ROSE CORAL-ISLAND. As the Vincennes drew near, the supposed rock proved to be a dense clump of trees upon a small coral-island; 'in S. Lat. 14°18' and W. long. 168°05', and about eighty miles' from the nearest rocky island of the Samoan Group. Rose coral-island, though hardly 'two miles' in diameter, was found to contain a lagoon; having a large outlet deep enough to admit a ship, and 'six fathoms' inside, except at the centre of the lagoon, where a column of coral-rock rises to within 'three feet' of the surface. The tide rising 'about five feet', most of the island is submerged at highwater; but the outline continues distinguishable by the line of surf, with here and there a projecting massive coral-block; at all times, we found much water beating over from the windward, and running in streams into the lagoon, and afterwards in a strong current through the outlet.

.....

"Two banks on the rim were never overflowed by the tide; one of them devoid of vegetable growth; the other, containing the above-mentioned dense grove of trees, found to be three or four acres in extent."

Dana (1849, p. 78, 308) also discussed Rose Atoll, but unfortunately he did not see it, as he was traveling in another of the ships. Couthouy, however, was still on the Vincennes (he was going to abandon the Expedition shortly, in Samoa), and presumably landed on Rose. Parts of his account (1842) seem different from what was reported by Wilkes, Pickering, and Dana, and his account has been termed "somewhat fanciful" (Setchell, 1924): but he did give some information on the entrance and lagoon. He noted (p. 99) that the entrance is to leeward, as is often the case on atolls, and water pours out of it at ebb tide "so as to resemble a mill race."

The next recorded visit was that of Captain Rantzau (Graeffe, 1873, p. 32), who visited the atoll at various times while a German firm was trying to establish a fishing station there. He transmitted some valuable information to Graeffe and drew a sketch of the atoll, on which Sand Islet

is represented as large and extending far into the lagoon and Rose Islet as covering the whole width of the reef and supporting a house and trees. During these times coconut trees were planted and reported to do well and to bear fruit. The island was settled for a while by an Englishman and a few natives. Later one native alone remained with his family, and then the island was finally restored to its loneliness. Rantzau's sketch, together with excerpts from Graeffe's text, was reproduced in the first volume of the Hydrographische Mittheilungen (later Annalen der Hydrographie...) p. 64, 1873. His outline of the reef may have been based on some earlier chart, but his sketch was apparently used at later dates by the Hydrographic Offices of England and the United States.

In 1899, after much tension and political difficulty, Eastern Samoa became an American territory. The first governor, B. F. Tilley, visited Rose Atoll on July 10, 1900, hoisted the American flag "with appropriate ceremonies," and planted coconuts. In January 1920, Governor W. J. Terhune visited the Manu'a district, and on January 12 landed on Rose Atoll, erected a sign to warn trespassers, and planted a variety of fruit trees, including coconuts. His stop at Rose was reported in the monthly government newspaper O Le Fa'atonu, in the issue for February 1920 (Dumstrey, 1920). In June 1920, he returned there and was accompanied by the marine biologist A. G. Mayor who was working in Samoa. The July issue of O Le Fa'atonu gave a short but informative account of the visit and mentioned the value of the information collected by the distinguished scientist. More coconuts were planted, including two on Sand Islet. The invitation extended by Governor Terhune to A. G. Mayor resulted in valuable observations that are the most important body of information on Rose Atoll and are described in other parts of this paper.

There were yearly governor's visits to the atoll after this and more plantings of coconuts. In 1922, Governor Pollock found that Governor Terhune's coconuts had disappeared, so he planted some more. He also collected soil samples for Lipman.

Wray Harris now conchologist at the B. P. Bishop Museum, made at least two visits to Rose in 1937 and 1938 and collected mollusks and a few plants.

In 1938 the U. S. Coast Guard cutter Taney visited the Equatorial Islands and landed a party of scientists on Rose Atoll on August 4, for an hour. E. H. Bryan wrote accounts of his observations (1939 and 1942, pp. 91-93), and much of our knowledge of Rose Atoll is derived from them. W. Donagho (1953, p. 68), assistant to G. C. Munro, wrote some notes on the birds observed.

In 1939 the U. S. S. Bushnell made a survey of islands in the central Pacific, and Dr. L. P. Schultz, of the U. S. National Museum, spent 11 days collecting fish around Rose Atoll and in the lagoon (June 11-21).

On February 14, 1941, Rose Atoll was made a Naval Defense Sea Area by an Executive Order of President F. D. Roosevelt.

This order was rescinded by Executive Order 10,341 signed by President Truman on April 8, 1952. Earlier (July 1, 1951) the Samoan

Islands had come under the jurisdiction of the Office of Territories in the Department of the Interior. In February 1953 a fishing survey was conducted near Rose Atoll, and some information on the island was published in the Weekly News Bulletin on February 21, 1953. Excerpts from this bulletin were received through the kindness of Mr. Emil Sady, chief of the Pacific Division, Office of Territories. This is the latest information available on Rose, and it brings up to date our knowledge of this little atoll.

Meteorology

There are no meteorological records whatsoever from Rose Atoll. Even the visitors whose accounts are used here gave almost no information on the weather at the time of their stays, except for the weather at sea described by Freycinet. The only source of data that gives an idea of meteorologic conditions in the region is the Weather summary for Naval Air Pilot, H. O. 272 of the U. S. Hydrographic Office, which is used throughout this section, without further acknowledgment. It offers information that can be used in getting an idea of weather and climate at Rose Island and is compiled from ships' observations, mapped and tabulated for 5-degree ocean areas, together with general trends as expressed by isobar or isotherm charts. The island nearest to Rose Atoll from which are available data that cannot be collected by ships' observations (such as temperature variation and total rainfall) is Tutuila. But this is a high island, and its weather station at Pago Pago is dominated by a mountain called the "Rainmaker", because it precipitates moisture from every cloud passing over it. The atoll nearest to Rose with some weather data is Puka-Puka (Danger Island). It is in the same 5-degree square as Rose but in the northeast corner ($10^{\circ}53'S$, $165^{\circ}54'W$.) The records available since 1929 are summarized in a note by the New Zealand Meteorological Office (Seelye, 1943) and in the Great Britain Pacific Islands Pilot (v. 3, 1946). Both of these publications also offer some information on weather and climate at Aitutaki, the other weather station nearest to Rose Atoll, although much to the southeast. This is a high island (460 feet) on an atoll-like reef. The observations are made on the west side of the main island ($18^{\circ}52'30''W$.) at an altitude of 10 feet. Rather than use data from the high Samoan Islands or Niue, those from Puka-Puka and Aitutaki are occasionally mentioned, because they can at least give an idea of the order of magnitude of conditions on Rose Atoll.

Atmospheric pressure: The 1008-millibar isobar for January passes just north of Rose Atoll and just south of Puka-Puka; the 1012-millibar isobar for July passes near the location of Rose, whereas the 1010-millibar isobar for July passes close to Puka-Puka. (Great Britain Pacific Islands Pilot, v. 2, pp. 18-19). These figures probably express the range of variation at Rose Atoll, except, of course, for depressions accompanying possible hurricanes.

Tropical cyclones and hurricanes: No cyclones and hurricanes are reported from Rose Atoll, but among the Samoa Islands, years may pass without a destructive storm, though two or three cyclones have been known to occur in a single year, with January and March as months of highest frequency. The most famous hurricane in Samoan history is that of March 13 to 23, 1899, which, occurring at a moment of great international tension, kept everyone so busy that political issues became

secondary and were solved more amicably than they might otherwise have been. The track of this hurricane (Chart 23, H.O. 272) does not pass near Rose Atoll, nor do any other tracks of the few cyclones plotted on this chart. East of Rose Atoll, hurricanes have been known to occur and cause much damage, at Puka-Puka, Nassau, and especially at Suwarov, but they are rare.

Prevailing winds at sea: Rose Island lies in the region where the northeasterly trade winds penetrate the south latitudes: In the 5-degree square just north and west of that of Rose (5° to 10° S., 170° to 175° W.), surrounding the Union group, 29 percent of the annual winds are from the northeast, 32 percent from the east, and only 13 percent from the southeast. At about the 10° S. the southeast trade winds definitely become more frequent; and in 10° to 15° S, 165° to 170° W. (Rose Atoll square) southeast winds are recorded as 25 percent of the annual winds, north-east trades as 17 percent, and east winds, the most frequent, as 34 percent (see table p. 9).

Ocean gales, squalls and thunderstorms: Rose Atoll lies in an area where both gales and squalls are rather common, being reported in 14 percent of the ships' weather observations. Thunderstorms are reported in 4 percent of the ships' observations. All the figures for gales, squalls, and thunderstorms are much less for the 5-degree square of Rose Atoll than for the next one west, where the high Samoan Islands are situated.

Sea temperature: Rose Atoll lies in a region between the two 82° F isotherms for sea temperature (north and south of the Equator) for February (southern summer), and the 80° F isotherm for sea temperature (Southern Hemisphere) for August passes just north of Rose (Great Britain Pacific Islands Pilot, v. 2, pp. 18-19). These figures probably express the range of yearly variation of sea temperature at Rose. At Puka-Puka the variation is reported as from 81° to 83° F (Seeley, 1943).

Air temperature: There are no figures at all for air temperature at Rose Island or the ocean around it. At Puka-Puka the mean for the year is 82.2° F, with very slight variation from month to month (83.1° for May, warmest month; 81.8° F for January, coolest month). The averages of the annual extremes are 93° F and 71° F, and the absolute extremes are 97° F and 70° F. At Aitutaki the Southern Hemisphere seasons are well marked; the warmest months are January and February (81.0° F mean temperature), and the coolest is August (75.4° F). The yearly mean is 78.2° F. At Rose Island the southern seasons are probably slightly felt, whereas Puka-Puka still has Northern Hemisphere seasons. Rose probably has a rather even yearly temperature, of about 81° F, the extremes not reaching much above 90° F or below 70° F.

Clouds and visibility: Table p.8 is made from Charts 13 to 17 of H.O. 272, for the 5-degree square of Rose Atoll. The total of ships' weather observations for this square is 760 for the period 1879-1933.

Feb. 78	May 49	July 74	Oct. 63	Dec. 63
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Figures express percent of observations recording lower type clouds.*

3.4	5.1	4.4	9.5	5.4
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Percent of observations with exceptional visibility.

1.7	1.3	1.5	0.0	1.8
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Percent of observations with haze.

0.0	0.0	0.0	0.0	0.0
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Percent of observations with fog.

* Lower type clouds are apparently the trade wind cumulus and various rain clouds.

Relative humidity: At Puka-Puka the mean relative humidity for the year is 79 percent, with a variation of 2 percent above and below for the individual months (morning observations); the mean dew point ranges from 74° F in July to 78° F in April, the average being 76.3° F (Seelye). It may be assumed that figures for Rose Atoll would be similar.

Rainfall: The evenness of rainfall is an important factor on atolls, in making the amount of precipitation effective. The rain water percolates immediately through the extremely porous material forming the islands, so that the amount of rain that corresponds to extremely arid conditions on an atoll may mean much moister ones on large islands or continents. On Puka-Puka the rainfall is usually heavy, the average for 1930-1942 being 117.57 inches a year, the totals ranging from 85.46 (in 1938) to 155.13 (in 1931). There is a marked rainy season from November to March. The average number of rainy days (with 0.10 inch or more rain) is 170 days per year. This is rather low. At Aitutaki the yearly average is 77.57 inches in 92 days, and there is a wet season from December to March (Seelye, 1943). Rose Atoll probably has a similar rainfall, although the number of rainy days may be greater.

High seas: It may be of interest to mention that on Puka-Puka in February 1935 a hurricane that affected Rarotonga brought rather high seas (Seelye, 1943). The seas rose on the 8th, and canoes left under trees 200 yards from the usual low-tide mark were nearly washed away. Conditions were worse on the 9th and 10th, but the sea went down rapidly the following day. This phenomenon might have affected Rose Atoll also.

Geology*

The reef of Rose Atoll is almost entirely made up of Lithothamnion rock as are the boulders scattered on it. The surface of the atoll rim, where awash at low tide, is covered by vigorous growths of Porolithon that form connected pink patches or -- west of the lagoon entrance -- ridges 6 inches high and 6 inches to several feet wide. The ridges,

* The geology and soils sections were prepared with much assistance from F. R. Fosberg and utilize unpublished data from his investigations in the northern Marshalls in 1952.

Ocean area S10 165. Position: Latitude 10° - 15°S, Longitude 165° - 170°W.
Greenwich noon observations. Years covered 1883-1933.

Month	Number of observations surveyed	Mean velocity (knots)	Wind													Percentages of observations from													Percentages of observations recording -												
			N	NE	E	SE	S	SW	W	NW	Calh	Haze	Mist	Fog	Drizzle	Rain	Light squalls	Showers	Thunderstorms	Heavy squalls	Gales (force 8 or over)	Exceptional visibility	Mean cloud amount (0-10)																		
January	45	11.1	8	27	16	21	6	5	7	5	5	0	0	2	0	15	20	9	2	0	8	4	4.6																		
February	59	8.9	11	30	19	5	2	11	4	17	1	2	0	0	2	8	10	5	0	0	3	4.6																			
March	57	8.4	14	19	29	19	5	0	5	7	2	2	0	0	0	18	16	7	4	0	2	5.5																			
April	66	5.7	5	19	31	15	7	2	0	6	15	2	0	0	0	5	2	3	0	0	3	3.8																			
May	78	9.7	5	19	44	27	1	1	0	0	3	1	0	0	0	8	12	6	3	0	0	4.2																			
June	76	11.1	5	8	54	25	2	1	1	3	3	1	0	0	0	4	12	10	3	1	3	3.6																			
July	68	11.6	5	8	50	29	6	0	0	1	1	1	0	0	0	9	12	12	1	1	0	4.8																			
August	64	11.1	0	10	40	43	3	2	0	2	0	2	0	2	2	5	11	11	0	0	0	5.5																			
September	66	12.0	3	20	34	41	2	0	0	0	0	0	0	0	0	0	15	11	3	2	2	4.7																			
October	63	8.0	7	13	36	29	2	2	4	4	3	0	0	0	0	2	9	14	3	3	0	4.2																			
November	62	8.0	10	10	35	22	5	7	4	7	0	3	0	0	0	5	11	8	5	0	0	4.9																			
December	56	6.8	21	17	20	21	0	7	0	10	4	2	0	0	0	6	4	5	11	0	0	4.8																			
Mean		9.4	8	17	34	25	3	3	2	5	3	1	*	*	*	7	11	9	4	1	1	5.4																			
Total	760																																								

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* Less than 0.5 percent.

From H.O. 272, p. 62. Compiled by the U.S. Weather Bureau

which are separated by channels, are occupied by other algae. The slopes of the reef are not different in their algal constituents from the flat top, except for the presence of some stunted Acropora and Pocillopora (corals) "at the extreme edges of the atoll rim fronting the lagoon or the sea." The algal ridge at the edge of the reef is very weakly developed, as also are surge channels (Schultz, conversation 1953). Freycinet mentioned small black rocks, all of about the same height, and the U. S. Exploring Expedition found them to be limestone boulders. Mayor gave them much attention and wrote (1924, p. 75):

"Hundreds of large blocks of limestone lie scattered over the flat, wave-washed rim of Rose Atoll. These loose boulders are quite uniformly about 5.5 feet high, and only when tilted are they any higher. In addition to these boulders there are a few others which are mushroom-shaped and still remain attached to the floor of the atoll-rim, of which indeed they form an integral part. One of the most remarkable of these mushroom-rocks lies to the eastward of Rose Islet, and is supported upon so slender a pedicel that it would seem as if the next storm must cause it to topple over. In many places over the flat, wave-washed floor of the atoll-rim one finds remnants of pedicels which once supported 'mushrooms'. In addition, some of the boulders have become secondarily cemented to the floor of the flat by the growth of Lithothamnium around their bases. The largest boulder we observed lay loosely upon the reef-flat east of Rose Islet and was somewhat tilted by being jammed against another rock. It was 12 feet 5 inches long, 8 feet wide, and 7 feet 6 inches high, and as its specific gravity was 2.3 it apparently weighs 46 tons."

He concluded that the boulders showed that sea level must have been at one time 6 or 8 feet higher than now and that the scattered detached boulders were mushrooms that had been completely undercut. He reported that the boulders were made up of the same algae and had generally the same chemical composition as the solid reef platform, with the same high percentage of magnesium attributable to Porolithon.

Among these boulders, the Exploring Expedition found some scattered blocks of volcanic stone. They are mentioned by Wilkes, Dana, and Couthouy and also by Pickering, who says (1876, p. 235):

"For the first time on a coral-island, the mineral kingdom was represented; several blocks of vesicular lava being met with by our party; in all instances resting upon the coral-shelf, not imbedded. Two or three of these blocks were seen by myself, the largest weighing perhaps twenty pounds. From the mineral composition, they had evidently been derived from some volcanic island; and there seemed no means of transportation, unless entangled in driftwood. This actually takes place at the Tarawan coral-islands; where Mr. Hale found a native name for 'basaltic stones in the roots of trees drifted to those shores'."

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Mayor failed to find these rocks among the coral blocks and supposed that the members of the Exploring Expedition had mistaken blackened limestone for basalt. The matter rested until 1939, when Schultz again found them. He only mentions (1940, p. 48) collecting lava but (conversation, 1953) observed many volcanic blocks, a dozen or more up to the size of a man's head, scattered on the reef. His specimens were brought back to the U. S. National Museum and were found to be compact olivine basalt. They are being studied further by Gilbert Corwin, who says the rocks are olivine basalts, such as are typical of Pacific islands. Schultz supposed that they might have been thrown up from the sides of the island with the niggerheads. *

For an idea of the geology of the two bits of land on this reef, we must rely almost entirely on Mayor's account.

Sand Islet is "a mere accumulation of fragments of Lithothamnium shells, and broken coral only about 5 feet above high tide level." The loose and unstable nature of such debris lying on a flat reef surface makes entirely probable the changes in size and shape of the islet indicated in the different accounts and maps. There is no suggestion anywhere that any of this material is consolidated or cemented to the reef.

Rose Islet, on the other hand, seems to be mainly a mass of such debris that has been consolidated into a "coquina" or reef-conglomerate such as is a common feature of other atolls. Probably the word "coquina" is improperly used here, as the material is not primarily composed of shells. Mayor's description of this follows (1924, p. 74):

"The tree-covered rocky center of the islet is composed of a coquina consisting chiefly of wave-worn fragments of lithothamnium and also rare and occasional fragments of broken coral, such as Favites, Porites, Symphallia, Pocillopora, and still more rarely Acropora. Embedded in it are many wave-worn half-valves of Tridacna and gasteropod shells, and spines of Echini such as Cidaris were found, as was also the much corroded ulna and part of the skull of a small cetacean about the size of a blackfish, the latter being embedded in the coquina about 8 feet above high-tide level. A large amount of organic matter, dark brown in color and derived from the decomposed roots of the Pisonia trees, permeates this coquina to a depth of several feet. All of the fossils found embedded in the coquina are forms now living on the reef-flat, which have simply been tossed on shore by the waves."

The height of this conglomerate above the reef surface is rather remarkable for such a small islet. Mayor says, "On the southeast side of Rose Islet the sand-beach is reduced to from 1 to 5 feet in width at low tide, and cliffs of coquina from 5 to 8 feet high front the sea A few feet inland this rocky ledge rises to a height of about 11 feet above high-tide level."

Schultz (1943, p.3) says that on this southeast side the island apparently is being eroded away. Here, again, on the southeast shore, is some beach-rock, said by Mayor to be more recent than the "rocky matrix of the islet." Schultz (1943, p. 3) adds, "To the east of the island for a few hundred feet are loose slabs of coral-shell conglomerate rock left on the reef, which may have at one time formed part of the island." These must be slabs of beach-rock as shown by photographs.

On the northwest side the islet is reported by Schultz to be building up by accumulation of coral debris (incorrectly called breccia by Mayor). Here the beach is much wider. On the surface of the conglomerate where it is covered by the Pisonia grove there seems to be little accumulation of loose material (Schultz simply says that the conglomerate is "overlaid by coral-shell gravel!"). No boulder ridges, dunes, or "ramparts" have been described.

Soils

The surface of Sand Islet and the bare north part of Rose Islet are apparently of unaltered or scarcely altered limestone debris, largely of algal origin. This debris is similar to what is found on bare or newly formed parts of most atolls, except that the proportion of algal material is unusually high here.

The soil within the Pisonia grove is very different and is the subject of an extensive study by Lipman and Shelley (1924). A good description of the profile does not exist, but from Mayor's casual remarks and Lipman and Shelley's descriptions of the materials they analyzed, a profile can be roughly reconstructed as follows:

Top layer -- (Mayor) "a rich chocolate-colored humus which is of considerable depth near the southern end of the grove."

Intermediate layer -- (Lipman and Shelley) "a loose porous mass, very light in weight," (Mayor) "dark brown in color to a depth of several feet."

Bedrock -- (Lipman and Shelley) "a compact, fine-textured, almost pure calcium carbonate which shows no vital structure. It is pure white, fairly soft ..." (but see Mayor's description of the coquina, which is the same material, p. 11).

Lipman and Shelley regard the intermediate layer as being an intermediate product in the decomposition of the bedrock, to form, with the addition of much humus, the surface layer of "fine-textured, mellow, organic soil." They had only a small bit of soil adhering to a partly decomposed rock, this rock, and some of the bedrock to examine and work with. Their interpretation of their analytical results is completely dependent upon this conception of the origin of the profile, and if more recent studies in other atolls (Fosberg, in press; Hatheway, 1953) are reliable, their interpretation is erroneous, the situations seeming more

or less comparable. Stone (1951, p. 10) regards Lipman and Shelley's conclusions as entirely vitiated by the presence of basalt fragments on the reef.

Lipman and Shelley's analyses are as follows (p. 208):

	Rose Islet soil	Intermediate product	Lithothamnium rock	Water soluble constituents	
				Rose Islet soil	Intermediate product
	p.ct.	p.ct.	p.ct.	p.p.m.	p.p.m.
H ₂ O at 100°C	5.12	2.49	0.40	Total	
Loss on ignition	22.84	31.09	46.22	soluble salts	
Si O ₂	.18	.20	.16	Na ₂ CO ₃	26,000
Al ₂ O ₃	16.72	9.20	.46	Na ₂ SO ₄	11,600
Fe ₂ O ₃	.40	.48	NaCl	1,837
P ₂ O ₅	20.94	14.60	.57		4,414
CaO	29.26	35.78	44.01		14,391
MgO	1.75	3.34	7.46		
SO ₃	1.14	.87	.61		
Na ₂	1.38	1.39	.35		
K ₂ O	.23	.23	.15		
TOTAL	99.97	99.66	100.40		

The striking facts about these analyses are the increasingly high percentages of Al, P, S, Na, and K (from bedrock to soil), compared with decreasing percentages of Ca and Mg and very little change in Si, also the greater moisture-holding capacity of the organic soil and the "intermediate product."

Lipman and Shelley's explanation of the high aluminum content and low silica content is ingenious. They explain, "The aluminum silicate in the original rock undergoes decomposition through reaction with ammonia, formed from the decomposition of the soil organic matter or of the bird droppings on the islet. Such a reaction would be followed by the leaching out of the ammonium silicate formed and, while allowing of the accumulation of alumina in the soil, would prevent accumulation of silica there." This would necessitate a reduction of 36 times in the weight of soil decomposed to yield this amount of alumina.

The two authors interpret the increased of sodium, potassium and sulfur as results of the great adsorptive capacity of the soil, differential leaching, and increment from spray.

The astonishingly high phosphate content of the soil and the rather high content of the "intermediate product," they regard as resulting from

simple accumulation of the phosphate of the original rock; without even taking into account the bird droppings usually considered the source of such phosphates. The correspondence of the figures with those for aluminum would suggest this conclusion, but then the problem would arise of what had actually become of the phosphorus in the droppings of the large bird population that is found on the island.

The picture, in light of investigations, incomplete as yet, in the Marshalls, supported by a survey of the literature, appears to be actually quite different. Generally, under Pisonia forest, a layer of pure humus, corresponding to Mayor's description and acid in reaction (pH 4.5 to 6), accumulates. Usually these forests are inhabited by large numbers of birds, as on Rose Islet. Their droppings (normally pH 6) are acidified by the humus as they are washed down through the humus layer, and the finely divided calcium phosphate is dissolved. When it reaches the sand and rock beneath, it becomes alkaline and therefore insoluble, precipitating out and cementing the loose calcareous material together. The acid solution tends to dissolve out the calcium carbonate and permits it to be replaced by calcium phosphates. Thus a cemented layer or hardpan is formed immediately beneath the humus layer.

This process is not at all similar to the one suggested by Lipman and Shelley. It would not account for the enormous concentration of aluminum, nor the relatively low loss on ignition. It is clear, from the two authors' description of their soil sample "containing many undecomposed particles of the original lithothammium rock," and the fact that their sample was material adhering to the surface of the partially decomposed rock, that they did not have a typical sample of the pure humus as described by Mayor. The ignition loss would likely have been much higher if the sample had been representative. The high aluminum content may well have been the result of contamination by decomposed pumice pebbles, common enough on atolls, or even from the basalt. How the silicon was lost if so, is not clear, except that it tends to leach out under tropical conditions.

There is a record of subsequent samples being collected for Lipman by Governor Pollock, but though they were studied for soil micro-organisms, no more chemical analyses were reported. Further studies to ascertain whether this high Al content is a general feature or only a localized one would be desirable.

One other fact revealed by Lipman's investigations is the unusually high concentration of water soluble salts in the soil (see table of analyses, p. 13). The authors mention, "If our analyses are to be considered as even approximately correct, the Pisonia tree is to be regarded as one of the most salt-tolerant plants of which we have record at present." They point out that the toxic effects of the salts may be somewhat mitigated by the high content of organic matter present but consider that the tolerance is still remarkable. This concentration may well be of significance in connection with the extremely small land flora of the atoll and possibly with the lack of success of the coconuts planted there repeatedly.

In a bacteriological study of the soil samples collected by Governor Pollock, Lipman and Taylor (1924) found that the numbers of organisms were enormously higher in the humus-rich soil in the Pisonia

forest, much lower in the soil where Boerhavia and Portulaca were growing, and extremely low where there was no vegetation. This is exactly what would have been expected and does not require further comment.

The authors found, also, that both nitrite and nitrate producing bacteria are present in all the soils, and that their nitrifying activity is more or less proportional to the amount of organic matter in the soils. What was probably Azotobacter was found, but it was concluded that such organisms "do not find conditions propitious for their rapid development in competition with other forms which occur there."

Land Flora

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The land flora of Rose Atoll was first described by Pickering (1876, p. 236):

"The whole flora of the island consisted of but two species of plants: one of them, as will be perceived, additional:

Portulaca (No. 1). Normal; multicaul and prostrate, having the habit of P. oleracea, but much larger flowers; petals five, yellow. Growing in a scattered manner on top of the beach, and in all instances outside the grove.

(Calpidia ovatifolia?); bis (No. 1 Paumotu coral-islands). Constituting the grove; some of the trees being fifty feet high, with the trunk four feet or more in diameter. Additional anomalies of growth were here observed: as two proximate upright branches anastomosing ladder-like at intervals; and several instances of upward-tending branches, as in the trees seen in the distance on Serle and other coral-islands. The timber proved on examination to be brittle and to all appearance worthless."

Pickering's observation of the two plants had been reported earlier by Dana (1849, p. 309). The plants were discussed and identified as Pisonia grandis R. Br. and Portulaca lutea Sol. by Setchell (1924) who was studying Mayor's specimens. Mayor gave the second enumeration of the flora, and found one more plant, Boerhavia tetrandra Forst., growing on the rough limestone surface of the north part of the islet, with Portulaca.

In 1938, Bryan recorded no native plants other than those three, which is a remarkable fact. It would be interesting to know when Boerhavia took hold. It would probably not have been missed by Pickering, who was familiar with it and had found it on several of the Tuamotus. No account mentions plants other than the grove of trees, between the time of the U. S. Exploring Expedition's visit and Mayor's visit.

In the U. S. National Herbarium there are no specimens from Rose Atoll collected by Pickering. He may not have made any collections. There are several sheets of Pisonia grandis from later collections, however:

Bryan 1382, Aug. 4, 1938; Wray Harris 287, April 1938; Schultz 26 and 27, June 11, 1939. There is also a sheet of Portulaca lutea, Schultz 25.

In the B. P. Bishop Museum (information kindly supplied by E. H. Bryan, Jr., curator) there are sheets of the three phanerogams: Pisonia grandis: Setchell 50 (collected by A. G. Mayor, June 6, 1920); Wray Harris 274 and 287, April 21, 1938; Bryan 1382, Aug. 4, 1938. Boerhavia tetrandra: Setchell 51 (collected by A. G. Mayor, June 6, 1920); Wray Harris 303, April 21, 1938, and 304, November 30, 1937; Bryan 1384, Aug. 4, 1938. Portulaca lutea: Setchell 52 (collected by A. G. Mayor), June 6, 1920); Wray Harris 301 A, Nov. 30, 1937; Bryan 1383, Aug. 4, 1938.

The latest addition to the flora, due to human interference, is that of the coconut palm. The story of the Rose Atoll coconut palms is quite intriguing; the palms flourished at the time of Rantzau's visits, but had disappeared by 1900. Of those planted by Rantzau, one remained in 1920, sterile, probably as suggested by Dumstrey, because it was choked by the Pisonia trees. The nuts planted by Terhune in January 1920 were growing in June, but had all disappeared by 1922, when Pollock planted some new ones. Bryan in 1938 found about 20 palms, 8 large and a dozen small. Schultz (unpublished notes) observed seven large trees and two small ones, besides several recent plantings now 1 to 3 feet high. The tall palms were bearing nuts, and photos show that some of the fallen nuts may have been sprouting. By 1953 the total number was reduced to 12 and these were bearing heavily, and it is hoped that no more were planted, and that Rose Atoll will have a chance to increase its flora by natural means only. Why the palms have failed to survive and multiply, when some did grow into adult trees from planted nuts, is hard to explain. Perhaps the coconut palms were destroyed by a typhoon between 1873 and 1900, whereas the Pisonia grove was seemingly unaffected; this is possible since Pisonia trees are practically indestructible, new trunks springing up from fallen ones (see below, Vegetation). Most of the plantings of nuts probably failed very early. Another possible explanation has been suggested on page 14; it is possible that the high concentration of water-soluble salts in the soil prevents coconut seedlings from developing. The rainfall of Rose Atoll, if estimated at 77 to 110 inches a year, is not very heavy; and it may be irregular. In any case, the minute islet may not be sufficient in area to permit the formation of a fresh-water lens, and the palms may suffer from physiologic drought. There may be also too great an amount of sea spray for coconut seedlings to do well. In this connection, it may be remarked that the three native plants are very hardy ones, often found alone or with a few other such halophytic species, on the most destitute atolls. Schultz (unpublished notes) also records plantings of bananas, papayas, and a few other plants, and indeed a very small banana plant is discernible on one of his photographs. But it is not known whether these plants have persisted.

There is only one record of a macroscopic land cryptogam, a lichen, which Bryan collected on the trunks of the Pisonia trees, and which has not been identified as yet (Bryan 1385, in Bishop Museum). In the study of the soil flora, Lipman and Taylor isolated 19 bacterial colonies of which they gave descriptions (pp. 213-214). Most of them were actinomycetes, one or two could clearly be recognized as other than actinomycetes, and one was a mold. The presence in the soil of nitrifying bacteria and Azotobacter has been mentioned in the section on soils.

Vegetation

According to all available reports, Sand Islet is completely destitute of vegetation. Governor Terhune planted two coconuts on it, but they did not grow.

The fresh green grove of trees is the most conspicuous feature of the vegetation of Rose Islet, giving it from afar the appearance of a low rounded hill, for which it has often been mistaken. Freycinet seemed to indicate the presence of two separate groves (see History); Wilkes wrote, "The islet is entirely covered by the clump of trees." Pickering said of Portulaca plants that they grew on the top of the beach, which might indicate that indeed the grove covered most of the island surface. Later, Mayor estimated that the trees occupied one half of the land area, and in 1953 this was reported as only one third. It is difficult to decide whether the grove has decreased or the island grown larger. The latter is possible, especially since its estimated dimensions are reported larger in 1938 than 1920, and it seemed in 1939 to be increasing on the northwest side (see Geography). It is more unlikely that the Pisonia grove should become much smaller, unless parts were removed by a hurricane.

The forest is made up entirely of large trees of Pisonia grandis with no undergrowth at all. Pickering, Mayor, and others emphasize the fact that the other plants do not grow at all under the trees. This is, furthermore, quite normal in luxuriant Pisonia groves on atolls. When Mayor visited Rose, one coconut tree, probably planted by Governor Tilley, grew among the Pisonia. Rantzau's sketch map of the island showed mixed coconuts and other trees, but this may not have been meant to express the exact condition, as the Pisonia would probably shade out the growing coconut seedlings. Pure Pisonia forest occurs on various atolls in the Pacific, for instance on some islets of the northern Marshalls, and especially on Vostok Island, which must be very like Rose. The trees have many twisted stems with creamy white bark and large light-green leaves. Pisonias can attain enormous sizes, and those on Rose Atoll were fifty feet in 1839, 80 in 1920 and estimated at 85 feet in 1953. The largest are on the southern part of the islet, and, in 1920, one had a girth of 25'7" at 3 feet (Mayor, p.73). Pisonia can form sprouts from practically any part of the tree, roots, branches, stubs, and fallen trunks, forming luxuriant tangles of stems and branches. This forest on Rose Islet must be a magnificent sight. Two good photos of it by Mayor accompany Setchell's paper, and Bryan published two of his own that show well the rounded contour of the grove.

Along the northeast edge of this grove are the coconut palms. They have been discussed in the description of the flora.

The whole north part of the islet is free of trees, and the surface of broken reef material supports Boerhavia and Portulaca. One of Mayor's photos (in Setchell, 1924) shows well this tangle of low plants. The Boerhavia plants have a thick woody root crown, with creeping stems up to 3 feet long. The Portulaca form little bushy succulent herbs up to 2 feet high, with erect, much branched stems, fleshy but firm. Besides the north part of the island, these two plants seem to be scattered on

the strand along the Pisonia grove, at least on the lagoon side (Mayor, p. 74).

Except for the lichen collected by Bryan, no mention is made on macroscopic cryptogams in any of the available accounts. Possibly other cryptogams occur on Rose, and a search might discover them. The black limestone boulders strewn over the reef doubtless owe their color to microscopic blue-green algae.

Fauna

There have been a few collections of land animals on Rose Atoll, by Mayor, by members of the 1938 and 1939 surveys (see History), and by others. The specimens have been added to museum collections but have not been mentioned in the literature.

Birds are the most conspicuous animals on the atoll. Freycinet (see History) mentioned frigate birds, boobies, noddies, tropic birds, and terns. At sea (p. 85) he also observed curlews on the day of the discovery of the atoll. Wilkes observed at least four kinds:

"Birds were seen flying over the island, and on landing we found them in great numbers and very tame. The frigate-birds, and boobies (*Sula*), whose nest had before been observed on low bushes, were here found on the tops of trees fifty feet high. The noddies laid their eggs on the parts of the island destitute of vegetation. Tern were in great numbers; their breeding-place was in a thicket on the weather side of the island, or that which was exposed to the wind and sea, and was remarkable from the regularity with which the eggs were placed, about three feet apart, without any nest, and, with but few exceptions, out of many thousands, each egg lay separately. The colour of the eggs is a dirty white, mottled with brown. The noise made by these birds when disturbed was almost deafening; but on making a loud sound, such as the firing of a gun, their cries would cease for a moment or two, producing a singular stillness."

Graeffe only said that a great many birds, especially species of Sterna or sea-swallows, nested in the trees.

Mayor wrote:

"Several hundred boobies (*Sula*), most of which had half-grown young, were nesting on the coral breccia of Rose Islet ..., while others had constructed nests of sticks high among the branches of the Pisonia trees. A few boatswain-birds with eggs were also nesting in the trees, and several nearly grown young sooty terns visited the island at night. Frigate-birds were hovering over the island, but none were nesting. Wilkes states that the noddies and sooty terns were nesting on

Rose Islet on October 7, 1839, and these species were still nesting when Governor Terhune visited the island on January 10, 1920."

In 1938 (Donaggho, 1953, p. 68) frigate birds were flying above, brown boobies were nesting, and red-footed boobies were sitting in the trees, as did the fairy terns. Munro (1949, p. 50) said that there were numbers of these lovely white birds, and he hoped that they did not too often get gummed with the sticky fruit of Pisonia. Bryan (1942, p. 92) also reported some wandering tattlers; and reef herons, one blue, one white.

Schultz in 1939 (1940, p. 48) observed that in the Pisonia trees were nesting boobies and frigate birds and "underneath, on the ground sooty terns were nesting." This had been mentioned by Donaggho and seems rather unusual. In his unpublished notes Schultz also recorded yellow-billed [blue-faced] boobies, nesting on the ground with their white and downy young, and brown boobies. He vividly described the enormous numbers of birds, their incessant clatter, the terrific stench of guano, which falls "like rain all day and night" from the trees. His collections of bird skins are preserved in the U. S. National Museum:

USNM 358134	<u>Sula leucogaster plotus</u> (Forst.)	brown booby
USNM 358138	<u>Demiegretta sacra</u> (Gmel.)	reef heron
USNM 358149	<u>Anous stolidus pileatus</u> (Scoop.)	common noddy
USNM 358155	<u>Heteroscelus incanus</u> (Gmel.)	wandering tattler

Summary of other birds recorded:

<u>Sula sula rubripes</u> Gould	red-footed booby
<u>Sula dactylatra personata</u> Gould (Schultz photo)	blue-faced booby
<u>Fregatta minor</u> (Gmel.) (?) (probably this, but could be <u>F. ariel</u>)	frigate bird
<u>Phaeton lepturus</u> (Daudin) (probably this, as Mayor says it nests in trees)	white-tailed tropic bird
<u>Sterna fuscata</u> L.	sooty tern
<u>Gygis alba</u> (Sparrm.)	fairy tern
<u>Numenius tahitiensis</u> (Gmel.) (Freycinet, probably this species)	curlew

The 1953 survey only mentions the presence of birds. It is rather interesting to observe the fact that the same species have visited Rose Atoll for more than 100 years and were found in the same situations.

Wilkes and Graeffe do not mention any land animals other than the birds. Mayor on the other hand found a small brown-gray rat, very tame and very abundant, which is probably the Polynesian rat, Rattus exulans (Peale). Besides, he observed a small brown short-tailed lizard that was identified by Thomas Barbour as Lepidodactylus lugubris (Dum. and Bibron). Bryan also noted rats and lizards, but the 1953 survey does not mention the latter.

The only other vertebrates occasionally visiting the land at Rose Atoll are the turtles. Wilkes saw several small ones, "feeding upon a species of fucus that grows upon the reefs." Girard (1858, pp. 459-461) described Chelonia tenuis giving the locality as Honden / Pukapuka, Tuamotus, Tahiti, Eimeo and Rosa Island. He quoted the "Notebook" of the Expedition which said that the turtle captured at Rose "had the alimentary canal crowded with sea-weeds (the Caulerpa seen at Raraka)." Girard's name, Chelonia tenuis was recognized as a synonym of Chelonia mydas L. by Boulenger (1889, p. 182). Rantzau (Graeffe, 1873) gave the best account of turtles:

"On the sand island, in the months of August and September, a great number of sea turtles came to lay their eggs. Most of them were the common sea-turtle (Chelonia mydas L.). More seldom came the caret (Chelonia imbricata L.). When the time came for the young to hatch, the surrounding sea was full of sharks who avidly snapped up the little turtles as fast as they arrived in deeper water."

The 1953 survey reported evidences of the presence of turtles, but gave no details. It is often recognized that turtles visit some uninhabited islands repeatedly, and natives of certain groups protect these "turtle-islands": thus the Marshallese know that turtles come to Jemo and Bikar, and certain islets of the larger atolls, and had very strict rules concerning them (Tobin, 1952, pp. 23-27). It is to be hoped that Rose Atoll will remain a bird and turtle island.

Very few land invertebrates are recorded from Rose Atoll. Mayor observed a sphinx-moth larva of the genus Celerio (Oken) feeding upon the Portulaca. He also observed a few gnats and flies, but supposed that they might have been introduced by the ship. Most of the reports of Governors' visits, in O Le Fa'atou, point out the absence of flies and mosquitoes. There are no mentions of insects in the published accounts of the 1938 and 1939 visits. However, Bryan (unpublished field notes) collected small moths, crickets, numerous flies on the Pisonia foliage and adjacent Boerhavia, and ants. The ants were especially noticed by Schultz, who said that they were small, red, nonbiting, but quite a plague because of their enormous numbers. He also noted a small beetle and collected various other insects. Neither of these collections has been identified. On the specimen of Portulaca lutea seen in the U. S. National Herbarium, a scale insect was found. Dr. Harold Morrison, of the U. S. Department of Agriculture identified it as a species of Coccus, very close to or possibly identical with Coccus hesperidum L. The specimen was too poor to permit a more positive determination.

Strangely enough, the only group of Rose Atoll land animals on which some systematic work has been published is that of mites. Ewing (1924) found two species in the fur of some rats sent him from the Bishop Museum in 1920. It is supposed that these were the rats that Mayor mentioned presenting to the Museum. The mites identified were: Laelaps echidnidus Berlese on Rattus sp., Laelaps hawaiiensis n. sp. described from Hawaii (on R. hawaiiensis) but recorded also from Rose on Rattus sp.

Of other invertebrates, Bryan simply reports "the usual hermit-crabs." Schultz collected an earthworm, a very interesting fact, but the specimen has not been identified.

The land fauna of Rose Atoll is undoubtedly larger than is indicated by these sketchy records, and it would be interesting to have a complete investigation of it and to correlate it with the flora, the paucity of which certainly must influence the number of animal species, especially small invertebrates, that can take hold on the atoll. Some larger invertebrates, such as Birgus latro, may be absent because of lack of food.

Conclusion

In many ways, Rose is an unusual atoll. Its pink Lithothamnion reef, and the basalt on it, its interesting soils, its enormous trees, and its curiously small flora and fauna are some of its striking features. More is known about Rose Atoll than about most uninhabited islands, but this knowledge is just sufficient to show that a detailed survey of the little atoll may be extremely interesting and may help us to understand certain features and ecological aspects of larger and more disturbed atolls.

A comparison with Vostok Island, which is very like Rose Islet, with a dense Pisonia forest and some Boerhavia, might be of use to explain some of their common characters. Vostok, unlike Rose Atoll, is very difficult to land on, and therefore no attempt at coconut plantings has been made (Fosberg 1937).

Few undisturbed atolls remain in the Pacific, and the pressure of increasing populations makes the utilization of unoccupied atolls likely. To maintain an example of a natural atoll, it may be suggested that Rose Atoll, so remote, so tiny, so devoid of economic possibilities, except for the fish found in the surrounding water, be protected in its present state. Some measures should be taken to prevent the introduction of coconuts and other fruits, and of animals transported by ships, especially large rats, and to instruct fishing parties in the purpose of conservation. The recent colonization of the almost unstudied Phoenix Islands by Gilbertese with resulting destruction of natural conditions makes urgent the preservation of one of the few undisturbed atolls. Phoenix, McKean, and Birnie Islands had previously been officially declared sanctuaries for birds but have been turned over to these colonists for plantations (Maude, 1952, p. 87). Experience in the Marshalls shows that sea birds, in numbers, do not persist in proximity to human settlements. Conceivably, Rose may soon be the only refuge left for breeding of the sea bird and turtle faunas of the Central Pacific.

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