



# ANGELA KAY KEPLER, Ph. D.

ENVIRONMENTAL CONSULTANT

Ornithology • Botany • Mammalogy



Mr. Kelvin Taketa  
The Nature Conservancy - Hawaii  
1116 Smith Street #201  
HONOLULU, Hawaii 96817

6 March , 1991

Dear Kelvin,

I recently visited Washington D.C. to hunt up some obscure, unpublished papers in Ray Fosberg's office that have been difficult to find elsewhere. One was the 1974 Line Islands Expedition Report, (excerpts enclosed), which contains statements and recommendations from Kiribati government officials and Dr. H. Grossman (ornithologist) which may be useful. Briefly:

All the Southern Line Islands were tentively declared as reserves for both birds and marine resources by the Minister of Natural Resources (p. 7). However, the Wildlife Conservation Ordinance of 1975 (Garnett 1983, Part 3, p. 126) only recognizes Vostok as a bird sanctuary.

## FLINT

Director of Agriculture suggests that the island be sold "outright for as large a sum as can be obtained from whoever and for whatever purpose it is required. Flint can never be regarded as a Colony asset from any point of view."

The Minister of Natural Resources stated that "permanent settlement must be out of the question"(p.7). Was upset about turtle killing by the previous lessee, Omer Darr.

Declaring Flint a turtle sanctuary was recommended by Dr. Grossman (p.84).

Declaring Flint a bird sanctuary was recommended also by Dr. Grossman. The Minister of Natural Resources replied, "This we can do but we will never be able to enforce the terms of the declaration fully", (p. 7).

## VOSTOK

Was considered "economically unimportant" and recommended as a bird sanctuary by the Director of Agriculture (p. 48) and Dr. Grossman (p. 89), and in 1975 was declared thus (see above)

Minister of Natural Resources stated that "Vostock is a nice little island ... its isolation makes it unsuitable for settlement at the moment " (p. 6).

## CAROLINE

Dr. Grossman recommended that it become a bird sanctuary (p. 7). Reply from Minister of Natural Resources as for Flint (above), i.e. that it can be done, enforcement is difficult, but "for the time being declare all islands (in the Southern Lines) reserved area for both birds and marine resources" (p. 7).

Minister for Natural Resources: "permanent settlement must be out of the question, at least, for the time being" (p. 7).

The director of Agriculture stated that "The temptation to suggest that G.E.I.C. (Gilbertese) people should be given the opportunity to settle on Caroline should be firmly resisted" (p. 51).

However, the Minister for Natural Resources suggested that Caroline be "an ideal place for 'milking' the tourists". His suggestion of an airstrip and accommodation led to the current situation with Felix Urima (which, as you know, has led to further destruction of resources). The Minister felt that if the venture was carefully realised and managed it would "leave the natural beauties of the island almost unspoiled" (p. 7). Thus he wanted to make a tourist destination out of Caroline, simultaneously declaring it a bird sanctuary, yet realizing that its isolated and uninhabited situation made monitoring of poaching activities impossible.

## MALDEN

The Director of Agriculture suggested that "the best possible use for Malden Island would probably be as a bird sanctuary" (p. 44). It was considered economically useless, and unsuitable for settlement, "bleak and depressing" (pp. 5, 44), yet with a rich complement of breeding seabirds. "All nest on the island in peace and quietude until disturbed and slaughtered by the company of the visiting ship (i.e. the expedition's Teraaka)". Starbuck was also considered "useless".

Seabird and coconut crab slaughtering was not confined to Malden. The report notes the "most disgraceful and unnecessary slaughter of birds" on Malden and Vostok (p. 41) by the Gilbertese members of the expedition. This point was taken up by Dr. Ray Fosberg (Atoll Research Bulletin No. 219, 1977) as it also involved a fire on Vostok which burned for 3 + months. (Observations of the 1990 ICBP expedition, coupled with aerial photos from the 1986 Royal New Zealand Air Force indicated that this fire completely cleared 1.5 ha of virgin te buka (Pisonia grandis) forest, and disturbed a further unknown amount of forest. Coconut crabs, abundant in 1974, were quite rare in 1990, probably resulting from this fire and pillaging: Dr. Grossman wrote that "crew members hunted after nearly every live animal .. (enumerates several species of seabirds) as well as great numbers of coconut crabs of all stages".

What do you think about the suggestion that Malden (Nth. Line Is.) become a bird sanctuary too? The Gilbertese officials also considered Starbuck of no economical worth. The U.S. Fish & Wildlife Refuge could do a terrific job of eliminating the cats on the latter, thus providing an enormous area of potential habitat for breeding seabirds. Both islands are close to Jarvis too, a USFWS Refuge.

Aloha,  
Kay



Vermilion Lakes, Canadian Rockies.



Cam and Kay Kepler  
400 Snapfinger Drive  
Athens, GA 30605

Apr. 2  
1991

Dear Harry (& Honor),  
Thank you so much for your  
recent letter & enclosures.

The Young paper is excellent -  
I actually tracked it down from  
your microfilm information, &  
used it heavily in the Caroline  
monograph. Amazing that most of  
the windward is. were felled for  
coconuts & now have 21 meter  
forests on them! Hurray for poor  
planting techniques & coconut crabs  
who love coconut shoots! Will send you a copy as soon as it's  
out. Terribly sorry about your eyes! Why does it have to happen  
to someone like you? Anyway, keep up the good work and we're  
glad they're getting better. Sent your I-Kiribati list to Martin Garnett,  
The ex-Governor of Sth. Line Is.

I'll look for Kardogoa - looks like a neat book. The ex-Governor of Sth. Line Is.  
Hawaii is discussing preservation of  
with Pres. Tabai now I've asked U.S.  
fish & wildlife service to think about  
Malden Is. as a preserve  
(cont. on yellow paper)

MR. & MRS. H. MAUDE  
42/11 NAMATTJIRA DR.  
WESTON, A.C.T. 2611

AUSTRALIA

The Sierra Club MOUNTAIN LIGHT Postcard Collection.

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Keep healthy & we hope you can  
continue to be productive. Ray  
Fosberg says hello. His librarian,  
Mary M<sup>c</sup> Cutcheon, admires you greatly  
(she's an anthropologist who worked in  
Micronesia) & asked me for your  
address.

Aloha & Tiako

Ray

P.S. Thank you for your offer to help  
finance the preservation of the Line Islands. I'll  
give your name (& talk about you) to the  
Nature Conservancy. If you wish to contact  
them directly, their address is on the  
enclosed letter.

(Glad you liked the  
Orona pictures. If we ever get there  
again we'll send you more!)  
we're working on getting permission

(2)

too, & am also pushing for a joint US/USSR expedition to visit Malden so we have some good scientific data for preserve establishment.

I just decided not to send you a postcard as it occurred to me that you may not have seen the enclosed 1974 expedition report.

You probably don't have time to read it, so

I've included a letter to The Nature

Conservancy with relevant points. The

disgusting slaughter of seabirds by Gilbertese officials on Malden (& Vostok) echoes your comment about a schooner sent from

Tahiti to Malden to strip it (I was not aware of this).

We're off to Leningrad to give papers on Caroline at a World Ocean Conference, & then to Alaska to work on a rare shorebird which migrates to Pacific atolls in the fall.

→

42/11 Namatjira Drive,  
Weston, A.C.T.2611,  
Australia,  
14 March, 1991.

Dear Kay,

Sorry not to have thanked you before for the nostalgic photos, your two Reports and your letter but, as I hope that you guessed, it was due to my eyes and the consequent chaos that they caused to my correspondence.

People wrote from all over the place and I could not do much about it until recently. But the Blind Society turned up trumps in the end, and fixed me up with so much gadgetry that I had to cry mercy.

And then an enthusiastic specialist bombarded me with laser beams; and went off to a Melbourne Conference with a sheaf of photos of my eyes to discuss with the experts. They evidently caused interest for they advised another fusillade on slightly different lines.

Meanwhile I kept on praying for just enough sight to enable me to finish my work for the Gilbertese. And about three months later I was idly turning over the pages of a typescript of oral traditions before putting them in the Reader, and thinking of something quite different, when suddenly I found to my astonishment that I was reading it without magnification.

Things have been getting better ever since, so I have been able to finish The Story of Karongoa, which has now been typeset (by another laser process, I'm told) and we have corrected the proofs and arranged for 1,000 copies to be run off by the ANU Printery. We have also designed the cover jacket, which the Graphic Arts Section are now completing.

I enclose a list from which you will see that we have only the last two items left; if I finish these I shall be able to depart in peace. We are the lucky ones for our work helps others, whether they be birds or plants or humans; or the whole ecosystem. Its those that have only themselves to fuss about that one must feel sorry for.

Your Reports were splendid; especially the one on Caroline: detailed, objective and down to earth. But it makes me sad whenever I think of Felix Urima, who reminds me of Saddam Hussein: a destroyer by nature and all for his own personal gain.

If you start an organisation for the protection of any of the Central Pacific Atolls let me know so that I can send along a subscription. Honor's first cousin Betty Butler in Cairns has given a million dollars to make Raine Island, on the very northern tip of the Barrier Reef, a sanctuary for wildlife. Pity we didn't know in advance or we might have been able to persuade her

to give the money to save Caroline Island. Like us both she comes from Jersey in the Channel Islands - one of the Meaker family - but lived in South Africa until forced to leave for anti-apartheid activities. We sponsored 20 of them to migrate to Australia and all have done well here.

I enclose copies of some items which have turned up in odd places. The trouble is that I never got down to cross-indexing manuscript material and the main entry may be quite deceptive. I used to rely on a good memory for items and their location, but it went soon after I passed the 80 mark.

*local/* Jeremia Tabai is a wonderful President for Kiribati but he is handicapped by having an increasingly public service, and very few Gilbertese are as yet capable of taking the responsibility for deciding anything. To say yes or no to any matter raised is contrary to custom, as everything should be decided by debate between all parties concerned. Even when answering a question the tendency is to give an answer which is likely to please the questioner: not to do so would be impolite.

But Jeremia has been President for the maximum term permitted by law and of the three or four candidates for election we are hoping that Roniti Teiwaki will have the numbers. He is currently managing the USP Kiribati Centre and the Atoll Research Unit, and also working on his doctoral thesis for the University of Wales. You may have read his book on the Management of Marine Resources in Kiribati (Suva, University of the South Pacific, 1988

Anyway, Roniti should be much more receptive to environmental matters, and more accessible to university colleagues like yourself. So let us hope.

Many thanks for your husband's photos of Orona; and for the beautiful view of Vostok from the air. What a magnificent maneaba for the small population of Orona - no wonder that they had to be forced to leave by the European Resident Commissioner, largely for political reasons though a drought gave the excuse - still I had worse droughts in the Central Gilberts and merely distributed rice until it was over. In a really bad drought, like we had on Nonouti, the fish have to leave the lagoon and the ocean reefs owing to lack of food. This never happened at Orona.

I was delighted to hear that you and Martin Garrett liked Of Islands and Men. It was strictly meant for aficionados of the islands and from what I hear they are the people who read it. It sold 4,000 copies, which is really very good for an island book usually we think in terms of 1,000 to 1,500.



I am so glad that I eventually managed to get in touch with you. For years I had been telling people about the call of the lonely Central Pacific Atolls and that I felt that only Arundel and myself really understood and loved them; and how I hated to die feeling that they were destined to be looted by vandals and generally messed up by the crews of passing yachts. It seemed to me that they should be national or international heritages but that no person, organization or government cared enough to give them the help that endangered wild places so essentially need if they are to survive. I think of Malden Island, stripped of everything portable by a schooner sent specially from Tahiti for the purpose.

I used to dream often of the days when I tramped over the islands, intoxicated with the beauty and loneliness of it all, and I felt nearer then to the spiritual experiences of mystics than I have ever felt elsewhere.

But now I can die happy, knowing that what I felt has been, and is being, experienced by a new generation who love the atolls as much as I did but are better equipped to understand their problems and dangers, and better able to fight for the rights of everything, animate and inanimate, which has made them their home.

I hope that you had a good trip to what they now call the Pitcairn Islands. When we lived for eight months on Pitcairn I tried to organize a trip in the island boats to Oeno and Henderson but something always intervened. As for Ducie, it must be (with Vostok) the very epitome of loneliness: I only knew one man, David Young on Pitcairn, who had ever been there

Yours ever,

*Sam*

Notes on items enclosed

1. This is Item 5 in my original list (referred to at (1) on p.2 of my letter of 2 March).
2. This is Item 8 in the original list (referred to at (2) on p.2 of my letter).

Arundel had a particular affection for Sydney Island, as indeed I had myself, and built his island headquarters home there, where his daughter Sydney Arundel (later Sydney Aris and our great friend until she died) was born. Sydney's son John died last year, and his son is married to Aung San Mee (or some such name) the opposition leader in Burma and so is under permanent house arrest with her.

3. This is Item 124 in the original list (referred to at (8) on p.2 of my letter).
4. This comprises 15 pp of miscellaneous material relating to the Protection of Wild Birds, abstracted from my file on that subject.

When I was in charge of the Phoenix Islands Settlement Scheme I had McKean, Phoenix and Birnie Islands declared Wild Bird Sanctuaries under King's Regulation No. VI of 1914 (by Proclamation printed in the Western Pacific High Commission Gazette) but I cannot find a copy among my records here. Possibly there are sets of the Gazette in the Library of Congress.

Presumably the Proclamation of 1921 and my later one now apply to the Republic of Kiribati, including Caroline, Vostok and Flint, i.e. unless the Regulation VI has been specifically annulled or superseded by some subsequent enactment. This can be checked by consulting the bound volumes of Kiribati legislation, which is well indexed.

5. A page from the first Annual Report on the Raine Island Sanctuary. The Meaker referred to never married and part of his vast fortune passed to his niece Betty Butler, now living in Cairns. Meaker lived in Jersey (to escape income tax) and left several millions to Jersey charities.

.....

42/11 Namatjira Drive,  
Weston, A.C.T. 2611,  
Australia,  
29 January, 1992.

Dear Kay,

I havn't written to you for ages to thank you for several cards (what a superb picture of the cleft rock and the cloud) and for the Kiribati Government Line Islands Report, 1874. I was glad to have it as it was missing from my collection; though it may be in Barrie Macdonald's which he has added to mine at the Barr Smith Library in Adelaide: he starts about 1947, when I more or less stop.

The combined collection is by far the best in the world, and one should always build on to strength, so I have added Holland's lot and Reid Cowell's. We had thought of putting everything into the Kiribati Archives, but alas it is far from secure and the Archivist is too lacking in status to prevent items from disappearing.

Our own views on the absolute inviolability of archival material is by no means common even in developed countries and has barely percolated as yet to the Pacific Islands States. So I give them copes of whatever they want and lodge the originals in an absolutely safe repository.

I did not think much of some of the views expressed in the Report, but then I suppose most Gilbertese would regard the Phoenix and Line Islands (except for the Northern Line) as being rather a useless liability. The Cook Islands Government was preparing to negotiate for Caroline, Flint, Vostok. Malden and Starbuck, when Davis was their enlightened President, but their new Government is not interested, or so Ron Crocombe told me recently.

Honor and I have been flat out dealing with the correspondence occasioned by Gillespie's two expeditions to Nikumaroro to find the relics of Amelia Earhart. Goerner and Amelia's sister, and Carol Osborne, the Aviation Historian, are all sure that she fell into the ocean not far from Howland, and there are two other theories current. As I was the first person to explore Nikumaroro after

the event (3 months later) the protagonists look to me for support.

You must have a wonderful time shooting off to England, Europe, Russia, Oceania, Alaska and most everywhere else in the world. Still you have to be young to really enjoy travelling, especially by air, and after about 70 one gets strangely disinclined from moving at all.

Right now we are both saddened at losing our old friend and collaborator Reid Cowell, who collapsed three nights ago and was dead a couple of hours later. But we have to be glad for his sake for he was riddled with cancer, without a stomach and one lung and on three hourly morphine.

Reid had just finished the translation work of our book for 1992 on the settlement of Nui atoll in Tuvalu by I-Kiribati from Abaiang, Nonouti, Tabiteuea and Beru, and was actually working to within a few hours of departing. It is an amazing story and as I work at the details of who was on each canoe, their relationships and the names of their children and whether adopted or not, its hard to realise that it all happened in Elizabeth's time, when Drake and Raleigh were annoying the Spaniards and Shakespeare was writing his plays; and long before anyone in the Gilberts had ever seen or heard of a European. As in the great migration from Samoa about 1350 they would as likely as not appoint a woman as tia borau (captain and navigator): not today they wouldn't, for they've been civilized.

I'm trying to start cataloguing my bits and pieces before sending them off to the archives and have finished one drawer of one filing cabinet. Nine out of ten items are of course on the Gilberts or Ellice but I enclose a few pages on your section of paradise, as from your last epistle you seem to find some useful. You are of course welcome to any you want, as is old man Fosberg, who I remember well: his first publication was on Vostok.

Yours ever,

Harry G. Wade

42/11 Namatjira Drive,  
Weston, A.C.T.2611,  
Australia,  
26 August, 1990.

Dear Kay,

Thanks for your letter of August 14, just received, and I am glad that you have survived intact except for a few bruises: I spent just on two years of my life on small schooners in the Central Pacific, and on the traders one had to share one's bunk with a multitude of cockroaches.

While you were away our son Alaric's sister-in-law lost her husband, son and yacht en route from Queensland to Fiji, despite weeks of searching for them by plane and surface craft.

Many thanks also for your Reports on Caroline Island and the Expedition generally. They look very interesting but I must perforce write this without reading them for judging from your letter you cannot <sup>have had</sup> mine of March 2 with its enclosures. So I must make copies of everything again and post them to you forthwith as you say that you are in a hurry for some of the material.

There seems to be a strange fatality about our correspondence for I never got your first letter and now you have not received my last. I sent it by airmail to await your return and the girl in the post office stuck the stamps on herself, me being visually impaired, and she remarked that her life ambition was to go to Athens, Georgia, which struck me as odd at the time, though no doubt the place has become well-known since you made it your home town.

My enclosed letter, with the rest of the photocopies will give you all the information I know about the items you mention.

I have since discovered Item 46 (Sir Albert's Notes on the Phoenix), in fact I have found three items on the same subject written or dictated by Sir Albert between 1937 and 1940 so I am sending all. But his best account of the Phoenix is in his book Adventuring in Coral Seas (Sydney, Angus and Robertson, 1936).

I also enclose the historical notes you ask for on Flint

and Vostok, as I have them for all the Central Pacific Equatorial Islands and Atolls. And a list of E.H. Bryan Jr's Folder 4<sup>in</sup> the Bishop Museum, which could be useful I think, and another list of ~~birds~~ <sup>plants</sup> collected in the Phoenix by Arundel.

If you could have reached the President, Ieremia, you might have got your permission to go to the Phoenix; but it is a very difficult feat as we know since his Principal Private Secretary is specially trained to prevent anyone speaking to him - but Kiste in Honolulu knows the trick and might have helped you. I find that most everyone else is scared to take any responsibility.

Must stop now; I was delighted to hear that the Gilbertese had not done as much damage on Vostok as I had feared. No need to send me a copy of you Report in the Atoll Research Bulletin as I have a complete set and still receive it regularly.

Honor has kindly done the photocopying, as I am laid low with the aftermath of flu,

Yours ever,

Harry N. Arundel

August 14, 1990

Dr. Harry Maude  
42/11 Namatjira Drive  
Weston, A.C.T. 2611  
Australia

Dear Harry,

Greetings again! I hope that you are well and adjusting to the many changes which must be occurring in Australia.

I have thought of you often this year, even though we have not met. I was 4 months in the Pacific but very unfortunately we never reached the Phoenix Islands. We landed on Caroline, Vostok and Flint, tried unsuccessfully to get on Starbuck and Malden, then arrived at Christmas to find out that permission for our expedition had been granted by the wrong bureaucrat: the Dept. of Natural Resources instead of the Cabinet... We spent over \$600 on phone calls to Tarawa - including speaking several times to the Secretary of the Cabinet - but eventually had to leave after three weeks and head for Moorea. After seven months, the officials in Tarawa had not "had time" to consider our request. They liked the idea of the expedition, appreciated that we were spending our own money to advise Kiribati on wildlife issues. In short, they agreed with everything we were doing and promised to grant us permission eventually..... I'm sure you understand.

Our engine gave us trouble on the way back, so we ended up at Bellingshausen (Motu One) for a quick look at the parakeets there, then revisited Caroline (as guests of the sole inhabitants, the Falconers) as part of a circuitous route back to Tahiti (see map)!

We found both marae on Caroline - enclosed is a xeroxed photo of the one on Nike. The stones were exactly as in Arundel's map! The other one, on Long Is., was partly washed away, but recognizable after having seen the more northerly one. Perhaps no-one has seen them since Arundel's time!

As you'll see from the enclosed report, Flint was more exciting biologically than we had supposed. The coconut crabs were absolutely incredible! They are probably more abundant there than anywhere else in the world (at least one million on 324 ha, approx 1/sq. meter). Plus they are unbelievably large: 25% of the males we measured were larger than any previously recorded crab anywhere in the world. The old copra urn and cistern were in good shape, and we camped in the old settlement. The weather was partly cloudy, and even rainy at times.

Vostok was also wonderful - just as we had expected except that the 1977 fire from the Gilbertese expedition had not done as much damage as we feared. Waves were pretty big there; our inflatable capsized 4 times before we made it out to our tiny boat beyond the reef edge. It took 6½ hours to travel about 100 meters! Plenty of sharks and pretty scary conditions as we struggled in the raging white waters. Two of us almost drowned.

Anyway, we're alive and well, though, as you are well aware, a 10 m boat with 6 people and head winds for weeks at a time is pretty hard on one's body at times...

Thank you again for the reprints that you sent us, especially the

unpublished ones on Caroline. Enclosed is my own contribution to the "grey" literature of that island. Our big monograph is finished and will be out in Atoll Research Bulletin (Smithsonian Institute) at some point in the future.

Right now up working up Vostok and Flint and preparing for another expedition to the Line & Phoenix Is., and note that you have some refs that I am having trouble finding. Would it be possible for you to send me a few more refs? (numbers are from your bibliography on the Line & Phoenix Islands) Those marked with an \* I would appreciate as quickly as possible, as I am writing up the islands right now:

- ✓ #5. Arundel (ca. 1875), on guano islands in the Sth. Pacific.
- ✓ #6 Arundel (ca. 1883) Notes on Sydney Is.
- ✓ #21 Brown (1919) Malden Is.
- ✓ #28 Campbell (1889) Malden
- ✓ #46 Ellis (1937) Notes on the Phoenix Group
- ✓ #67 Hague (no date) Equatorial islands (we have his guano article)
- ✓ \* #80 McClean et al (ca 1909) Solar Eclipse Expedition to Flint
- ✓ \* #124 Young (ca 1922) Notes on Flint, Caroline & Vostok
- \* Do you have chapters on Flint and Vostok similar to the printed (but not published) one on Caroline that says Part L (ca 1942)? If so they would be immensely valuable, as I really like to cover the history as well as the biology as thoroughly as possible.

Thankyou once again for your kindness. I look forward to hearing from you soon. I'll send you a Caroline monograph as soon as it is published, but as the ms is nearly two inches thick we cannot send it now. Sorry I don't have a photo of Mauta, Ona or Arariki Villages to send you.

Best wishes,

Kay





## ANGELA KAY KEPLER, Ph. D.

ENVIRONMENTAL CONSULTANT

Ornithology • Botany • Mammalogy



Dr. Harry Maude  
42/11 Namatjira Drive  
Weston, A.C.T. 2611  
Australia

10, then 15 Jan, 1990

Dear Harry,

Happy New Year and bless you for spending so much time on our account when you don't even know anything about us!

Firstly, thank you so much for all the information you sent us on Caroline - we love "grey literature" - it often has lots of neat tidbits of information that cannot be gleaned from the "real" literature. As you can see from the enclosed xerox of our original correspondence, your intuition was correct in sending us your 1953 paper and personal notes on Caroline. The bibliographies are great - it's also nice to see the original NZ Herald version of Arundel's 1890 paper, which was the only overlap with our own refs. Much of your information is now incorporated into our monograph, which is just about finished (at least the topography, climate, plants, vegetation analysis, and description of the motus sections). It will be first published in Russian - they took us there! then after our expedition, by the Smithsonian Institution. I'll make sure that you get a copy - in english!

Your notes answer an important question in our minds - why you did not put Gilbertese on Caroline! We thought it was probably due to the scarcity of ground water, but apparantly it was because of a mixture of superabundant rats and coconut crabs, as well as the palm diseases, plus presumably remoteness and difficulty of access. Nearly 5000 rats on South Is. in 1920 - we believe it! We camped both on South and Long, and have never seen as many rats in our lives. The present "resident" trapped 1,200 on the small islet just north of South Island (Motu Ana-Ana) on the leeward side last year. Your little trusty terrier has apparantly bitten the dust. It'll be interesting to see if they're gone from Flint too.

Since our original letter - and the reason for my postcard that fortunately got through to you - is that I am leaving in two weeks to be the scientific leader of an incredible expedition, visiting 17 of the Line and Phoenix Is.!!! (incl. Jarvis). We will be gone 4½-5 months, studying the birds, plants and general ecology of basically all islands except Palmyra, Howland and Baker. There'll be 6 of us in a 33' ketch. Hopefully my husband can come on the last month. (If you never hear from me again you, who know these islands, can guess what happened! I am taking along a "survival kit", including the makings of a makeshift plastic "solar still"- even the best skippers can get caught in a storm). We leave from, and return to, Moorea. The only other contacts with "civilization" will be Christmas, Washington and Fanning - and maybe Canton barely fits this category too. Katino Teeb'aki, the present Wildlife Warden on Xmas, will be accompanying us for the nth. Line/Phoenix leg -

we've worked with him several times before. Gentle, right in his element in these islands, and not the slightest bit interested in Western paraphernalia. You know.

We'll be checking out historical remains too. I consider it a real privelege to be following in the footsteps of the "early" Pacific pioneers : yourself, Ed Bryan, Ray Fosberg, Harold St. John.

There is no way I could have explained all this in the post card - I would not expect you to xerox all your files on the Line & Phoenix Is. for us!! Ray Fosberg and Roger Clapp at the Smithsonian have offered use of their files to us, but as they came up with nothing on Arundel except a ref to the 1890 paper, that is why I was writing to you for the "grey literature". Incidentally, Ray sends his greetings. I sent him a copy of your bibliography - he has one of the finest sets of refs to the Pacific anywhere, and did not have some of the obscure refs that you've dug up.

I am assuming that nothing ever came of the Arundel biography book that you mentioned in Of Islands and Men - David Stoddart (who is now at U. Cal. Berkeley, California) thought someone was doing a Ph.D. on it.

Enclosed is a newspaper article you may not have seen - you'll get a few laughs out of it, esp. knowing a few of the people involved.

You have been so kind to us already. However, as you mentioned that you would send us any titles from your bibliography that we wanted, it is hard not to take you up. If you can spare the time, we would love to have copies of the following, which look pretty obscure:

#5 and #6 (Arundel); #21 (Brown); #28 Campbell; #46 (Ellis); #67 (Hague); #80 (McClellan); and especially #124 (Young). In return we could send you, in addition to the Caroline monograph, anything we write about the aforementioned islands and some color photos of some places that might be memorable to you. Just let us know - maybe present photos of Mauta, Ona, or Arariki villages?

Since our original letter we have obtained the publications requested - one sent by you, the others we managed to get by a very roundabout route through Washington D.C. when it seemed that we were not able to locate you.

Thank you once again. I hope we can meet someday - most of my relatives are still in Sydney and Melbourne. May you live to be at least as old as the late Alexander Wetmore and Harold St. John!

Aroha and Mauri

  
Kay Kepler

42/11 Namatjira Drive,  
Weston, A.C.T.2611,  
Australia,  
22 December, 1989.

My dear Kay,

What a surprise getting a postcard from you, sent on by the post office at Forrest. Bless them, for they do not usually forward mail from old addresses after two years have elapsed.

I gather that you are in search of material on the Line and Phoenix Groups but you are not very specific as to requirements. I imagine that this is because you speak of having sent me a letter on the 18th October last which was no doubt more detailed.

I certainly did not receive this letter or any other from you at any time. This is not surprising because I see that your car is addressed to 77 Arthur Circle, which we sold early in 1985.

I don't know who lives there now but am told that he is connected with liquor, gambling and brothels. Anyway he is very seldom at home, or indeed in Canberra, and the whole place looks deserted. He does not readdress letters though the Post Office does occasionally (but yours is the first I think this year).

About your query the trouble is that I have literally hundreds of documents concerning the Line and Phoenix Groups, mostly manuscripts or photocopies, and to send them to you would take weeks of work.

If you want to make any detailed research the only way is to come here, like two others who are working on these islands at the moment: one on shipping and plantation material and the other on Anglo-American rivalry.

The only island you specifically mention is Caroline and the only subject Birds so I have concentrated on these two items so that I can get something off to you before the post office shuts tonight for Christmas and the New Year.

On Caroline I am enclosing:

- (1) a general outline of information on the atoll which I apparently wrote for some purpose in the late 30s; and
- (2) an historical survey written in the early 40s and apparently printed somewhere but not published.

On the general theme of the Central Pacific atolls I send

- (3) A report on the British Central Pacific Islands which I prepared for the Seventh Pacific Science Congress;
- (4) The only item which Arundel ever published (you mention that you would like anything by him); and
- (5) a bibliography of Phoenix and Line Islands published material so that you can ask me for anything you particularly need.

Then on the birds a couple of samples:

- (6) an article on Phoenix birds; and
- (7) another on a rare duck from Sydney Island (*Dafila modesta*).

Items which you may care to get for reference on board:

- (1) Bryan, E.H. jr, American Polynesia and the Hawaiian Chain. Honolulu, Tongg Publishing Company, 1942.
- (2) Bryan, E.H. Jr, Panala'au Memoirs. Honolulu, Pacific Scientific Information Center, Bernice P. Bishop Museum, 1974. (Particularly for the five American owned islands).
- (3) Mayr, Ernst, Birds of the Southwest Pacific. New York, The Macmillan Company, 1945.

There are several good books on the birds of the region, articles such as Peter Child, Birds of the Gilbert and Ellice Islands Colony, Atoll Research Bulletin No.74, and on individual islands; but for the wealth of information ~~xxxxxxxxxx~~ resulting from the Whitney South Sea Bird Expedition, 1924, and the Whippoorwill and Kaimiloa Expeditions since you will need to get in touch with the Bishop Museum I had McKean, Birnie and Phoenix Islands gazetted as bird sanctuaries years ago.

There is no Arundel material in the Sydney Museum. I have the diaries placed in the Rare Book Collection of the National Library here in Canberra, but you would be fortunate indeed to find anything in them of any value to you, as they are mostly about shipping, labour guano shipments and prices - and the sermon he gave last Sunday to the labour. I have recently finished an article on Arundel and Raine Island and know to my cost. But there is a microfilm of the 47 (?) diaries which you can buy from the Pacific Manuscripts Bureau, Research School of Pacific Studies, Australian National University, G.P.O. Box 4, Canberra, A.C.T.2601.

Caroline is my favourite island in the Pacific and I nearly bought it for £600 in 1941 but couldn't raise the money. Give my love to the little fox terrier that used to dart out of the bushes and bark, and then run away: but I suppose he must be dead now. Also to the rabbits on Phoenix Island, relics of an 1870 wreck; they run fast but have no staying power. The Gilbertese called them 'pussies' and took several home, but the local cats and dogs killed them all off.

Wishing you a pleasant cruise on your 53 footer, and all good fortune during 1990,

Sincerely,

Harry Z. Aude.





Cam and Kay Kepler  
400 Snapfinger Drive  
Athens, GA 30605 U.S.A.

Life Portraits



AIR MAIL



PRINTED IN U.S.A. PENROD/HAWATHA Co., Berrien Center, Michigan 49022 Phone 616-461-6993

Dear Dr. Maude,  
Sorry to bug you again - we know you must be busy. We are preparing for a fabulous trip (which you will appreciate) & would really love to read your papers (requested in 16 Oct. letter) before going. Also am on a tight deadline for Caroline Atoll monograph (end of Jan.) I will be spending Feb - mid-June on a 35-ft ketch, visiting all line & Phoenix Is. (well - almost - 17 of them, incl. Jarvis)!! very exciting. It's an expedition sponsored by ICBP (Int'l Council for Bird Preservation). You are one of the few people in history who has had the opportunity also to visit such places, hopefully it will result in their protection. Caroline is now slated for tourist development! I found out some of Arundel's diaries are in The Sydney Museum, but that's a long way off! Anything you could send us of yours

LT 42

Maryann

DR. H. MAUDE,  
77 ~~Arthur Circle,~~  
~~Forest, A.C.T. 2503,~~  
AUSTRALIA  
Nannyan  
Weston  
2611



Common Loon with Chick

or Arundel's relatives to the P. Is. would be greatly appreciated!  
Thank you! Merry Xmas. I have close relatives in Sydney, Melbourne so may meet you one day. Thanks.

16 Oct. 1989

Dr. Harry Maude  
77 Arthur Circle  
Forest, A.C.T. 2603  
Australia

Dear Dr. Maude,

Please allow us to introduce ourselves. We are field biologists, presently living in Georgia (U.S.A.) but with hearts in the Pacific, where we lived and worked for 14 years. I am also an Aussie!

Firstly, we would like to congratulate you on your excellent research on Pacific history. We have particularly found Of Islands and Men interesting, with an accuracy that is valuable to our own interests. After scanning microcards of those old accounts of Quiros, Broughton, etc. we appreciate even more what you went through to sort all those early accounts out! Incidentally, my husband was very interested in your photos of Orona, as he lived in one of the I-Kiribati huts there for a few days in the 60s, as a member of the Smithsonian's Pacific Ocean Biological Seabird Program (we have dreams of living there sometime, studying the natural history in detail, and assisting in its conservation).

For 24 years, on and off, we have had opportunities to visit the Line and Phoenix Islands, and were recently privileged to spend eight days camping on Caroline Atoll. Our field work was focussed on vegetation and seabirds. A knowledge of history, however, is not only fascinating, but important to an understanding of biological processes. In this regard, we have two requests:

1. In your 1968 book you mention the preparation of a biography of John Arundel at the Australian National University, I believe. We have searched at great length through nation-wide computers to find such a title, in vain. Ray Fosberg, with whom we have worked in Hawaii, had recollections of its preparation, but that's all. He kindly gave us your address. We agreed that if anyone could lay hands on it, you could.

We are particularly interested in knowing which islets Arundel dug for guano; whether he cut down Pisonia or Cordia forests and exported the logs, as he did on Flint; whether coconut crabs were on the atoll when he lived there; if he made notes on the 1878 hurricane, etc. He was a keen observer, as indicated in his 1890 lecture in San Francisco, and will undoubtedly have other observations on Caroline extracted from his diaries (are they available too?)

Caroline, one of the last almost-pristine atolls in the

Pacific, is in immediate danger of begin developed by a French businessman. Our monograph will be the definitive paper involved in any conservation issues, so it is important for us to evaluate exactly how virgin the atoll is. It holds seabird populations and oceanic forests of international importance.

Do you know if it is possible to obtain negatives or prints of Arundel's photographs, mentioned in the Solar Eclipse Party's report of 1884?

2. Please could you also send us xeroxes of your following reports?

1937. Colonization of the Phoenix Is. by the surplus population of the Gilbert and Ellice Is. Suva.

1953. The British central Pacific islands: a report on land classification and utilization. Proc. 7th Pac. Sci. Congr. 60: 89-97 We are assuming that this contains notes on water tables, etc. taken during your visit to Caroline.

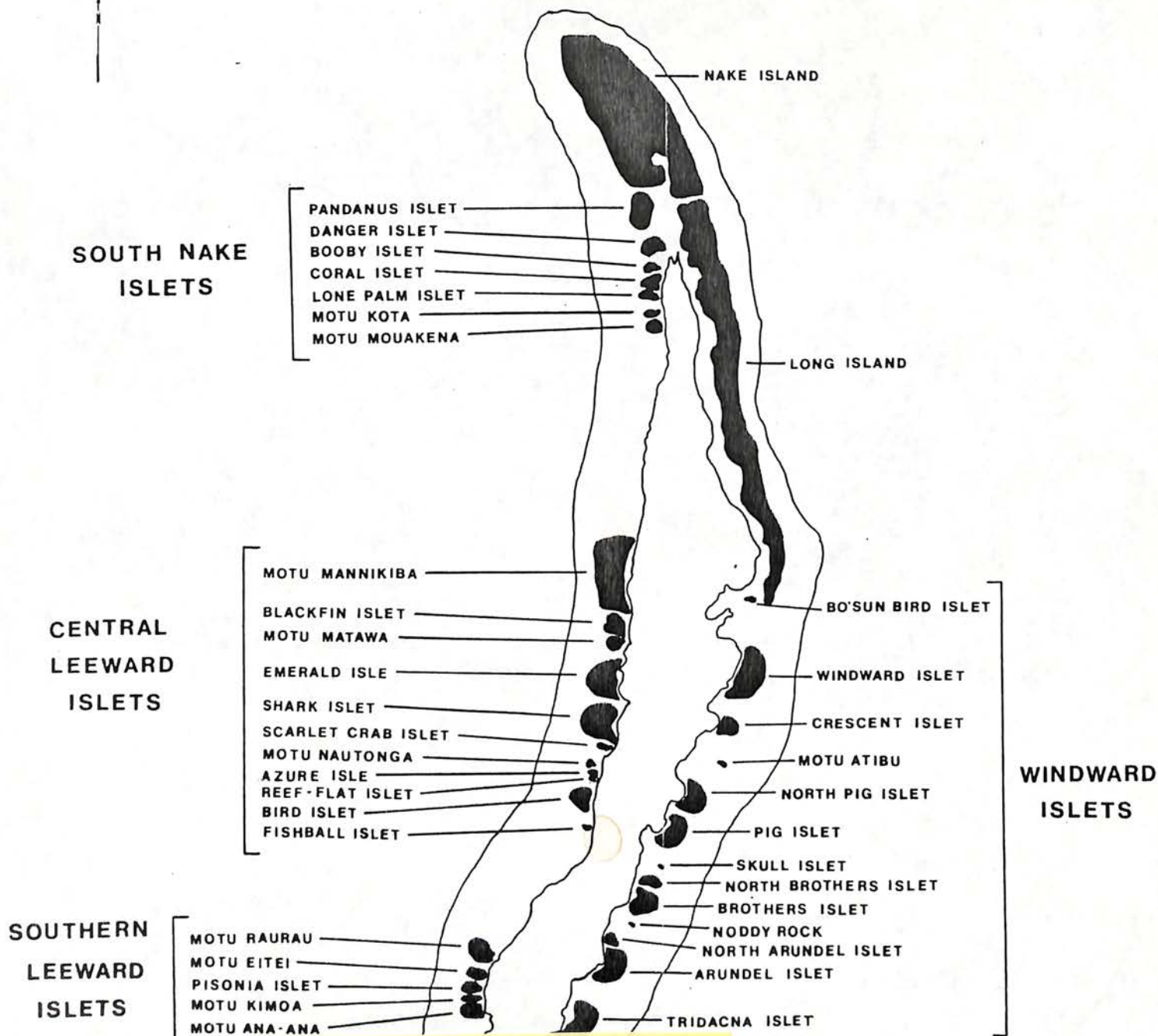
Simply - you are one of the few professional people who has ever visited Caroline, and we appreciate any relevant information that you could send us. Our monograph will be about 250 pages, covering history, geography, structure and topography, botany, ornithology, individual island accounts, and conservation. We are mapping the entire atoll and each islet according to 1985 aerial photos by the NZRAF (Arundel was a surprisingly good surveyor!). We would be happy to incur postage costs for Arundel's published book or a copy of the unpublished ms, if this is relevant. If valuable diaries, photos, etc. need to go through official channels, you could send them to : Mrs. Linda Garrett, Librarian, U.S. Fish and Wildlife Service, Patuxent Research Center, Laurel, Maryland, U.S.A. 20708, or to my husband's USFWS address on the enclosed card.

We realize that you are busy (retired also?), and appreciate your attention to this matter. We are actively working on the ms at this time, as we have a December deadline for its completion.

Ray Fosberg sends his greetings to you. We are sorry we have not crossed paths yet - the Pacific is a big ocean.

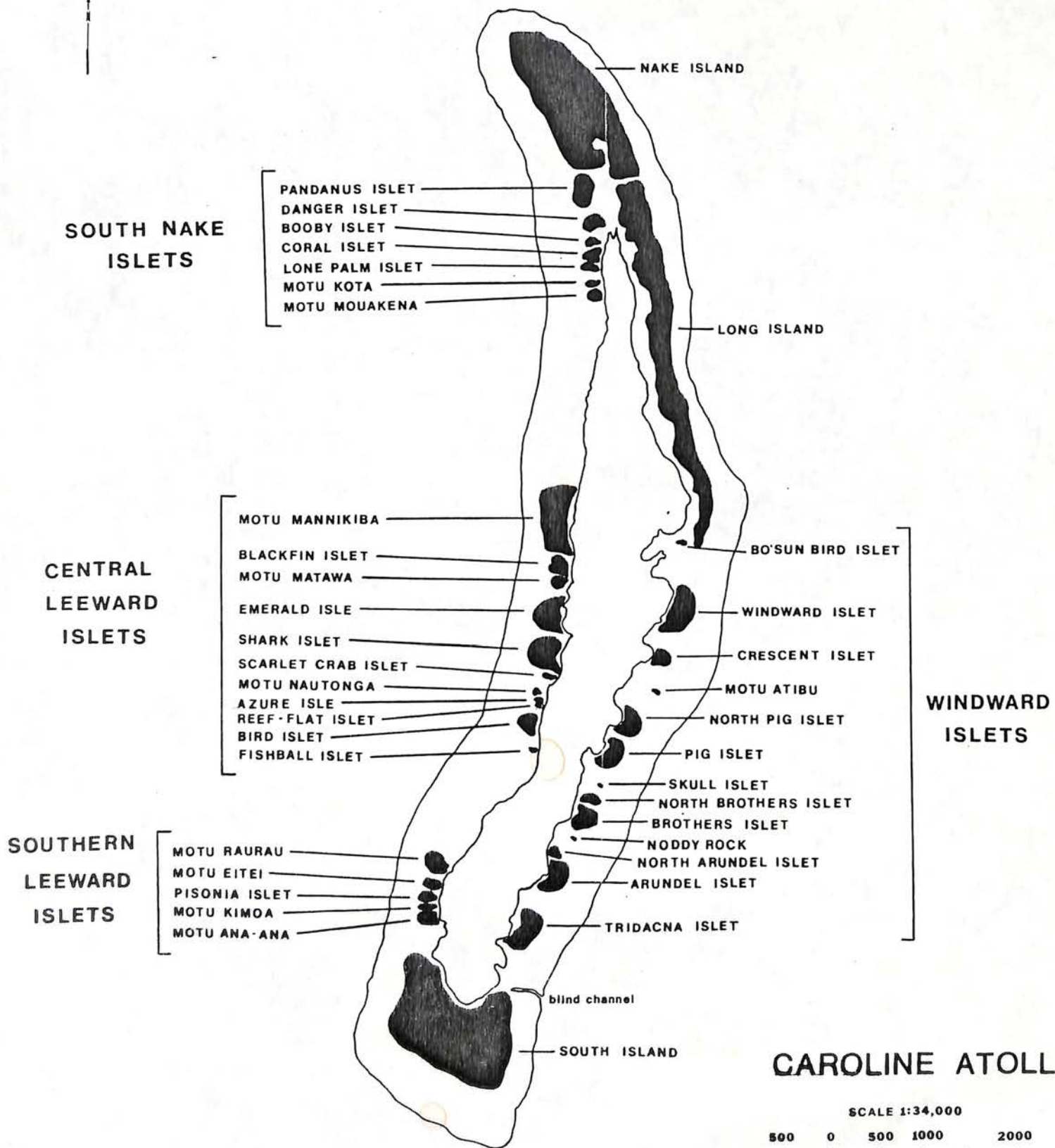
Aloha nui loa



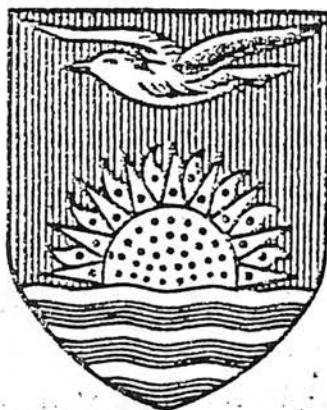


Harry - This is a bit stained but is my only present copy. I constructed it from aerial photos taken in 1985 by the RNZAF. We had the privilege of naming 32 islets - hope you like the names. As you are aware, Arundel's map was pretty good, Bryan's & the Solar Eclipse Expedition scientists poor, but it takes aerial photos to really get the right shapes. Your count was the closest of anyone's (36) - actually 39, nearly 40.

Regards, Kay



# GILBERT & ELLICE ISLANDS



## Line Islands Expedition

AUGUST-OCTOBER 1974

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2. Report by the Secretary for Natural Resources
3. Report by the Director of Agriculture
4. Report of the Fisheries Officer, Line Islands
5. Preliminary Report (Ornithology) by Dr. Grossmann
6. Sailing Directions, Line Islands, by Capt. E.V Ward M.B.E

Scientific Expedition of the

Line Islands

(By Minister of Natural Resources)

It was unfortunate that at short notice the zoologists, botanists and biologists (including Dr. Helfrich) were not able to join the team. Only two scientists joined from abroad, Dr H. Grossman from Hamburg doing research work into diseases carried by sea birds and Mr W. Cooke, a graduate student from the University of Hawaii dealing with corals. Birds and corals may be of some long term benefit to us, but I cannot see any immediate commercial interest that would result from these researches. Our own men consisted of the Chief Agricultural Officer, Fisheries Development Officer Line Islands and Master R.C.S. "Teraaka". Team members reports are included with this report. The Secretary Natural Resources, Mr. R.E.N. Smith, took over as Leader of the expedition in Apia, Western Samoa.

Washington and Fanning

The party spent a day on each island on the first call. The two islands were examined and the following data collected:

	<u>Washington</u>	<u>Fanning</u>
<u>Population Total</u>	430	386
<u>Labour</u>	77	72
<u>Average Total</u>	3494	8528
<u>Coconut Areas</u>	2103	3122
<u>Copra Production</u>	I000 tons average p.a. since 1937	550 tons average p.a.
<u>Rainfall</u>	120" average	77" average
<u>Airstrip</u>	reefmud	nil
<u>Shipping</u>	2 Bank Line p.a. 3 G. & E ships p.a.	2 Bank Line p.a. 3 G&E ships p.a.

Washington has a high level of copra production (0.5 tons/acre) because of high rainfall and peat soil. The palm regenerate continuously, so that there is a continuous involuntary "replanting" programme.

On Fanning Island palms were mostly planted between 1890 and 1923 (a total of 2397 acres), the other 725 acres having been planted in the 1950's. Thus most of the palms on Fanning are very old indeed and they are the cause of the low overall copra yield. In the past Fanning used to average I000 tons of copra every year - but this has now declined with the increasing age of the palms. The Manager has proposed a replanting scheme to Burns Philp Ltd.

There was no information collected about the plantations' assets and liabilities and their profitability or otherwise. The accounts of both plantations are kept in the Sydney office. One could imagine, however, that substantial profits are reaped during good years with peak prices and that adequate financial provisions are made for the bad years. The Fanning Island Plantation Balance Sheet for the year ended 30th June, 1969, (five years ago) revealed that the company made a profit of \$105,531, after payment of dividends of \$40,000 to shareholders.

brine shrimp, big sports fishing, tourism, rock lobsters, lagoon fish, deep sea and pelagic stocks enterprises. Plans for the first 4 projects including the survey of the infrastructure and the necessary communication net work are being carried out by the Development Authority. The rest of the projects listed are being handled by the Fisheries Survey Unit under my Ministry. The Unit has collected considerable data on the tuna resource and the consultants from London thought the information would attract foreign investment. We have since approached a number of foreign fishing companies but have had a negative reply, even from those who are already operating in the Pacific area. A tuna enterprise would be a major contributor to the Christmas Island package, but we are stuck with this project to the disappointment of everyone, not least the Fisheries staff both on Christmas Island and Betio. I have arranged to call a meeting of all parties concerned to discuss not only fisheries (how to exploit the tuna resource primarily) but also the overall Christmas Island development strategy. The longer we wait the better it would be for foreign fishing vessels which are operating in the area.

### Southern Line

Five islands in the Southern Line have recently become part of the territory of the Gilbert and Ellice Islands, and for the first time they were officially visited during this trip.

Scientific and other data are provided in the team members' reports. I shall dwell here on general observations only.

### Malden & Starbuck

These two islands are coral reef islands. They are fairly big by coral island standard, but the vegetation consist only of dying grass and beach shrub. The absence of trees is enough evidence of the islands being very dry and are subject to long periods of drought, perhaps more severe than conditions in the Southern Gilberts.

Colonies of birds of various species live and nest on the islands. For detailed information see Dr. Grossman's report. Pelagic fish are in abundance as well as shallow reef stocks. Clam shells and "Tenmatanen/Alili" are found in limited numbers. Lobster resource particularly at Starbuck, according to Capt. Watt, equals that of Christmas (see Capt. W. Report). Both islands are unsuitable for settlement.

### Vostock

Vostock, a coral reef island is about half the size of Niulakita. The island is thickly wooded with tall "puka" trees and salt bush. Birds of all kinds nest on the trees and on the ground around the ocean side (see Dr. Grossman's report). Fish, both pelagic and shallow reef stocks, are in abundance. Crayfish - not much (see the Watt report).

Vostock is a nice little island which could support an extended family, but the absence of any edible crop on the island and its isolation makes it unsuitable for settlement at the moment.

### Caroline

The island is a typical atoll of rare beauty. The lagoon is surrounded by islets and reef passages. On two of the larger islets grow coconut palms of varying ages (see Mr. Vicker's report on vegetation and soil). Coconut crabs are found everywhere.

Fish in the lagoon are not only numerous but tame. Clam shells of varying sizes live on coral heads in the lagoon in fantastic numbers. Turtles breed here as well. (see Watt's report on marine resources).

Colonies of birds concentrate on two islets. (see Dr. Grossmann's report).

Judging from the vegetation I don't think Caroline gets very much rain water. Underground water was not tested but I think it should prove favourable.

With all the surrounding islets planted with coconut trees, Caroline could absorb the present population of Aranuka and still maintain a higher standard of living purely on a subsistence level. Permanent settlement is not recommended for reasons given below.

### Urgent

Vostock, Caroline and Flint, the best of the Southern Line, were leased to an American, Omer Darr, from the Western Pacific High Commission for 25 years beginning in November, 1964 to 1989. Since then the islands have been given to us and are now an integral part of the Gilbert and Ellice Islands. The half-yearly rent is £stg 87.50. The lessee employs Tahitians to cut copra on Caroline and Flint from time to time. The Tahitians take advantage of their presence to kill turtles that come up to breed on the beach for meat and the shells, they collect shells that are found on the coral reefs and have general access to all island resources. This situation should not be allowed to continue, and in view of what we propose to do with these islands, I recommend that the lease be terminated as quickly as we can. Under the terms of the lease termination can take effect after notice of 6 months has been given. The rental we get for the lease is peanuts compared with the unmanageable exploitation done to (particularly) marine resources and returns on copra and other commodity sales to foreigners.

I have discussed this with the Minister of State, who has agreed to take immediate action.

Flint

Flint is the last island to the south. It is a reef island of coral formation about the size of Niutao but longish. Coconut trees grow from point to point. Flint seemed to be the wettest of the lot. The vegetation is greener than elsewhere.

See team members' report on agriculture, fisheries, birds and hydrography.

General Comments

→ Caroline and Flint are the only two islands which can take up a number of settlers. They are however, so far away from subheadquarters at Christmas let alone from Tarawa that permanent settlement must be out of the question, at least, for the time being.

→ Dr. Grossmann would like to see all the islands in the South to be declared birds sanctuaries. This we can do but we will never be able to enforce the terms of the declaration fully. Foreign fishing vessels which ply in the waters round the islands often make calls for many reasons. Some of them kill birds for food.

Recommendations

1. The lease of Caroline, Vostock and Flint by Mr. Darr must be terminated having given six months notice (the Minister of State has agreed to this).
2. Development in the South cannot be considered until enterprises proposed for Christmas Island have been firmly established.
3. For the time being declare all islands reserved area for both birds and marine resources.
4. Future application for lease of any island or islands must be carefully considered to ensure that returns from such a lease, if granted, would not be a small fee as in the case of the present lease.
5. Caroline atoll with all its natural attractions would be an ideal place for "milking" the tourists. It is not far from the tourist route through Papeete. In this respect Caroline would need an airstrip and accommodation to suit the environment. If such venture is realised and careful management is applied, we would keep whatever benefit that may accrue from such undertaking and still leave the natural beauties of island almost unspoiled.

LINE ISLANDS EXPEDITION 1974

Report by R.E.N. Smith  
Secretary for Natural Resources

October 1974



PREAMBLE

LINE ISLANDS EXPEDITION 1974

The expedition consisted of:-

Hon. Isakala Paeniu, Minister of Natural Resources	Tarawa-Line-Apia
R.E.N. Smith, Secretary for Natural Resources	Apia-Line-Phoenix- Tarawa
Mr. N.H. Vickers, Director of Agriculture - whole voyage	
Dr. H. Grossman, Ornithologist and Parasitologist - whole voyage	
Mrs. Grossman, Assitant to Parasitologist	" "
Mr. W. Cooke, Soft Corals	Line-Apia
Skipper J. Watt M.B.E., Fisheries	Line-Apia
Maroko, Fisheries Assistant	Line-Phoenix-Tarawa

in addition Capt. E.V. Ward M.B.E. of the "Teraaka" carried out navigational investigations.

The Itinerary was as follows:-

22 August	Depart Tarawa
27 - 29 August	Washington
29 August	Fanning
30 -31 August	Christmas
2-3 September	Halden
4-5 September	Starbuck
7-8 September	Vostock
9-10 September	Caroline
11-12 September	Flint
17-21 September	Apia, Western Samoa
26-29 September	Christmas
30 September - 2 October	Fanning
2-4 October	Washington
5-10 October	Christmas
13 October	Phoenix
14 October	Sydney (Manra)
15-16 October	Hull (Orona)
16-17 October	Gardner (Nikumaroro)
21 October	Arr. Tarawa

CHRISTMAS ISLAND

General

1.1 The first, and most lasting impression of Christmas Island is of a most culpable and deplorable neglect and indifference on the part of Government to a ten-million pound windfall. Of the Forces vast complex of installations hardly a building outside London remains intact. Port Camp and the J.O.C. are ravaged ghost towns, and the Main Camp is all but destroyed: great pyramids of ruined furniture and rusted beds mar the landscape and roofless skeletons of buildings are everywhere. Much of the devastation has been carried out by Government itself, and the local population and overseas of visiting Colony ships have joined in the carnage with enthusiasm. Any development of Christmas will now entail the shipment to the island of building materials and equipment at vast expense - when recently they were there in profusion.

1.2 There are 70 miles of excellent sealed roads, but even these are falling into disrepair, since the equipment to maintain them has been taken to Tarawa. The main airfield is deteriorating, and the buildings there becoming delapidated. The three storey Control Tower (the tallest government building in the Colony) was stripped by the P.W.D. and is decaying rapidly - yet it quite possibly will be needed within a few months.

1.3 The island is allegedly a bird sanctuary: this is a hollow myth: I have seen great heaps of slaughtered red-tailed tropic birds and others - killed wantonly for sport, and occasionally for food. Every year hundreds of thousands of birds eggs are stolen - even, in the past, by those whose duty it is to prevent this.

1.4 But with all this, it is also clear that the future of the island can be bright. The brine shrimp are flourishing, game fishing is promising, the plantations are coming into a considerable production and good basic facilities exist.

1.5 The island and indeed the rest of the Line Islands are badly served by Colony shipping and insufficiently visited by senior government officers: it is far too easy to say that one cannot possibly be away from Tarawa for three weeks - the pressures against touring are far stronger than those for it.

12.6 The Unit also has a good freezer of approximately 270 cubic feet (a Smithfrige) without a unit: this should be obtained at once (Millers of Suva have such a unit) and the freezer put into commission. A blast freezer is required to complete the installations.

12.7 I found the scattered buildings of the Unit unsatisfactory, and have arranged with the C.I.P. for the Unit to give up its vehicle shed and receive in exchange the vehicle shed and an old Nissen hut adjoining the Unit's main shed, so that all its activities will be in one neat series of buildings and therefore susceptible of better control. Mr. Watt has built a large lobster "keeper" tank (about 60' x 10') and is resuscitating a pump to keep the water fresh.

12.8 The Auditor reports that financial control within the Unit is poor: this is not surprising, when the officer in charge is a practical deepsea fisherman, with no knowledge of accounting, and all his staff are local fishermen. There is no clerk and no typewriter. If my recommendation that an Executive Officer is posted to the District staff is accepted, then it would be sensible and reasonable for him to undertake vote book, stores and other financial assistance to the Fisheries Officer.

12.9 The University of Hawaii had a research vessel the "Townsend Cromwell" at Christmas in 1973, under the leadership of Dr. Jones, Mr. Watt tells me that copies of the research report were promised both to him and to Fisheries and the Ministry, but no copies have yet been received.

#### WILD BIRDS

13.1 The situation over wild birds is perhaps the most depressing aspect of Christmas Island. The rare and beautiful red-tailed tropic birds, of which nest on the ground and can be picked up by hand, have been plundered and murdered in their thousands, some for food and some for mere pleasure in killing. Their population has been reduced in less than a year from 8000 to about 2000. Great heaps of dead birds were seen by myself and others. Frigate birds rest on low bushes, and can be approached closely: this results in louts taking pleasure in breaking their wings and enjoying the sight of their crippled state. In the nesting season car loads of tern eggs are stolen by the labour force and population of the island.

AND SOME PHOENIX ISLANDS. 1974.

by

M. E. H. VICKERS, DIRECTOR OF AGRICULTURE, G.E.I.C.

During the period 22nd August to 21st October 1974 the Director of Agriculture in T.S. "Teraaka" visited all the Line Islands and four of the Phoenix Islands according to the itinerary given below.

21st August		Departed Betio for Washington Island.
28th	"	a.m. Arrived Washington Island. Departed p.m. for Fanning.
29th	"	a.m. Arrived Fanning Island. Departed p.m. for Christmas.
30th	"	a.m. Arrived Christmas Island.
31st	"	At Christmas Island. Departed p.m. for Malden.
2nd September	a.m.	Arrived Malden.
3rd	"	Departed Malden Island p.m. for Starbuck.
4th	"	a.m. Arrived Starbuck Island.
5th	"	Departed Starbuck p.m. for Vostok.
7th	"	a.m. Arrived Vostok Island.
8th	"	Departed Vostok p.m. for Caroline.
9th	"	a.m. Arrived Caroline Island.
10th	"	Departed Caroline p.m. for Flint.
11th	"	a.m. Arrived Flint Island.
12th	"	Departed Flint p.m. for Apia (W. Samoa).
17th	"	a.m. Arrived Apia, Western Samoa.
21st	"	Departed Apia p.m.
26th	"	p.m. Arrived Christmas Island.
29th	"	Departed Christmas Island p.m. for Fanning.
30th	"	a.m. Arrived Fanning Island.
1st October		Departed Fanning p.m. for Washington
2nd	"	a.m. Arrived Washington.
3rd	"	Departed Washington p.m. for Fanning.
4th	"	a.m. Arrived Fanning. Departed p.m.
5th	"	a.m. Arrived Christmas Island.
10th	"	Departed Christmas p.m. for Phoenix Is.
13th	"	p.m. Arrived Phoenix Island. Departed p.m. for Sydney Island.
14th	"	a.m. Arrived Sydney Island.

16th October	a.m.	Departed Hull.	p.m.	Arrived Gardner Is.
17th	"	p.m.	Departed Gardner Island.	
21st	"	a.m.	Arrived Betio, Tarawa.	

The tour, over a period of two months, covered about 3,000 miles of the Pacific Ocean. Every landfall was made at exactly the time (and date) specified by Captain E.V. Ward, M.B.E. who, due to lack of qualified watchkeeping officers, navigated the ship entirely unaided throughout the voyage. To Captain Ward the highest possible praise is due for this feat of seamanship which must have imposed a heavy strain. His innumerable discourses on local navigation and lore, his flashing wit and every ready helpfulness made the voyage the success it was.

The Chief Engineer, Mr. Jack Muller kept "Toraaka" operational for the whole voyage; breakdowns were few and rapidly repaired, but some required a display of considerable ingenuity. The numerous outboard engines used to ferry expedition parties to and from their objectives were magnificently maintained. Not <sup>one</sup> single serious incident of outboard engine failure occurred and there were several occasions where a faulty engine could have endangered life. Jack Muller and his staff deserve the highest praise.

The new Chief Officer, Mr. M. Hall-Thompson who was in charge of cadet training was the gentleman physically responsible for discovering suitable landing points for members of the expedition. Great credit is due to him and to the various small boat coxswains for the fact that not one boat was overturned or damaged in the several possibly dangerous landings that were undertaken.

It was understood that the prime purpose of the expedition was to be a scientific study of the Line Islands. It was therefore a great pity that so few scientists were in fact present. A great deal more factual knowledge might have been gained if bodies such as the British Museum, the Smithsonian, and Universities had been approached at least twelve months before the ship was due to sail. The voyage was discussed in early 1973 but, as far as is known, none of these institutions was given notice of the proposed itinerary until 1974, which provided insufficient time for first rate men to make themselves available. It is strongly recommended that any future expedition of this nature should include a botanist and an entomologist of repute.

We had the backing of these institutions & were well prepared to make excellent studies in 1990 or there were not granted permission

Since this voyage was intended primarily as a scientific one some thoroughly unscientific activities which occurred must, with great regret, be recorded. That they will be recorded elsewhere is certain, so that it is considered only right that they should be mentioned here in the hope that they can be avoided in the future. A most disgraceful and unnecessary slaughter of birds (tropic birds and boobies) took place on both HALDEN and VOSTOK - in the latter case specimens actually being studied by the guest ornithologists were killed within their vision. These birds, due to their lack of contact with predatory humans, are unafraid and remain on the ground when approached. The peat soil on VOSTOK was set alight by fires used to cook the slaughtered birds. The fire was eventually put out after 2½ hours work with a bucket gang. It is hoped that the fire remained doused. If it caught light again after "Teraaka" sailed that evening there is a good chance that all vegetation on the island will have been destroyed.

The report which follows takes the reader down through the five least visited Southern Line Islands then to the better known Northern Line Islands and Phoenix Islands where descriptions are not necessary and comment is made mainly from an agricultural viewpoint.

In some of the reports on the Southern Line Islands reference is made to objects or facilities not found on this expedition. These remarks refer as a rule to historical notes made by visiting ships of the Royal New Zealand Navy in 1930, 1940 and 1950 and by Mr. H. E. Maude and others during and immediately after the second World War.

MALDEN ISLAND

(Lat. 4° 03' S. Long. 155° 01' W)

GENERAL DESCRIPTION:

Malden island is a flat, triangular island about 5 miles long at greatest length and possibly 4 miles in greatest breadth and covers a reputed 20,000 acres. "Teraaka" reached the island at 0645 on Monday 2nd September 1974. There is no anchorage. The landing is about 300 yds. north of South West point via a 9 feet wide surge channel in the narrow reef. There is now no sign of any blasted channel, if there ever was one, or of any former pier. The beach at the landing point is steep-to and heavy surf over the reef makes for a hazardous disembarkation, the boats crew having to turn the boat round very smartly upon touching the beach. Stretching North and South from the landing point are the remains of C & G.I. sheds used during the 1962 bomb tests, all except one of these is in poor repairs. The tank on the water tower (which is a major landmark) has been dismantled and removed leaving a rickety platform 30 ft. high. The old phosphate company buildings, to the South of the military camp, are in ruins - no reefs exist and many of the coral slab walls have disintegrated. There is no sign whatsoever of any boats or other company gear except an auxiliary ship's wheel (large) and a few wire ropes and heavy chains, all in poor condition. There is no sign of any flagstaff and it is difficult to identify the cistern noted in 1938.

The small gauge tram track is still to be seen and a few bogeys of guano trucks are lying near the track in places - the railway lines themselves are too rusty to be of any use now.

On the western side of the military camp are stocks of fuel consisting of at least 250 drums (44 gall.) of U.S. Navy Dieseline dated February 1962 - there are a few drums of petrol. All these drums are in perfect condition and untapped.

The island, which is about 30 ft. a.s.l. at the edge, appears to slope very slightly towards the central area marked as 'lagoon' on the chart. In fact, the 'lagoon' is at the extreme eastern end of the charted area the remainder being a salt pan, with free sodium chloride in small patches on the surface. The totally enclosed 'lagoon' is about 15 ft. a.s.l. one foot deep in water of exceedingly high salinity. Several depressions on the island which are presumably old phosphate diggings were shallowly filled with highly saline water as were the excavations used to form tram track embankments. There is thus no fresh water lens on Malden.

The only fresh water was found on the eastern side in a cave (old phosphate working?) into which a sloping track had been cut, presumably to haul away the phosphate originally contained in the cave. In this area one cat was seen - another cat was seen near the water tower. Near the North East point are more ruins, presumably used by the guano company and to the West of these ruins are four small groves of stunted Pisonia grandis trees 12-15ft. high and 2ft. in diameter. Most of the Eastern side of the island is taken up by old phosphate diggings. There is no sign at all of any coconut palms.

Travelling South East from South West point is a graveyard containing many Polynesian type graves and those of 8 Europeans. The marble headstones on 3 of the European graves are still in nint condition.

There is an overgrown airstrip running on a North/South bearing about 200yds. east of the main camp buildings on the mud or similar (not concrete) and is about 800-900yds. long. The Northern end of the strip is marked by a pole about 20ft. high and the line of the strip is indicated by 3 poles (others have fallen down) and fuel drums, one or two of which are painted red and white. The strip is sparsely covered with low clumps of Leoturus grass and Portulaca sp. succulents.

#### VEGETATION:

The circumference of the island has a fairly sparse cover of Sida fallax (2ft. high), Lecturus revens, Tribulus cistoides and another unidentified grass. Passing from this area towards the centre there is a wide zone consisting entirely of two species of Portulaca (yellow and white flowered) and more central still and about 150yds. before reaching the 'lagoon' is an area of pure Portulaca lutea. The 'lagoon' salt flats are bare of vegetation. The 4 clumps containing 6,3,3 and 9 stunted Pisonia trees near the North East point have already been noted. Rainfall is obviously very poor and probably very erratic.

#### SOIL:

The soil is entirely coral 'gravel' around the margin of the island with more finely divided coral sand toward the centre, interspersed with exposed coral rock where phosphate has been removed. The 'lagoon' is a brown coral sand with occasional small area of pure sodium chloride of maximum thickness of one inch.

#### BIRDS:

There are large numbers of sea birds including brown boobies, blue-faced (masked) boobies, red-tailed tropic birds and fairy terns. All nest on the island in peace and quietude until disturbed and slaughtered by the company of a visiting ship - which fortunately is a rare occurrence.



- 6 -

ANIMALS:

Cats, mice, polynesian rats (R. exulans).

DEVELOPMENT POSSIBILITIES:

As further phosphate working appears to be out of the question and as there is virtually no freely available fresh water the best possible use for Malden Island would probably be as a bird sanctuary. There is good fishing off the North West and South West Points - yellowfin tuna and kingfish being the main attractions. Due to the most inhospitable landing and narrow reef with no sand beaches any form of tourist venture is out of the question - even if the water problem could be overcome. This is a most bleak and depressing island.

VOSTOK ISLAND

(Lat. 10° 05'S, Long. 152° 23'W).

GENERAL DESCRIPTION:

Vostok Island lies about 305 miles S.S.E. of Malden. It is a very small coral island about 1400 yds. long, triangular in shape and covered in a dense forest of Pisonia grandis trees some of which reach a height of 30 feet. The island covers a reputed 164 acres.

'Teraaka' reached the island at 0800 on 7th September 1974 - There is no anchorage.

The landing is made through a narrow cut in the reef about 150 yds. north of the West Point. There is the recent wreck of a wooden fishing vessel on the tip of the West Point. The coral beach at the landing is steep - to at an angle of about 35°.

The eastern part of the island consists of a broad flat ledge of black coral fragments, possibly 100 yds. wide on which there is a large nesting colony of brown boobies. The central and northern part of the island is Pisonia forest over a deep brown/black peat soil. There are no buildings of any sort. The beach crest is strewn with wreckage and Japanese (Taiwanese?) fishing floats.

VEGETATION:

Dense Pisonia forest as noted. On the coral flats there are patches of Boerhaavia repens and one low-growing unidentified succulent - the tiny white petalled tubular flower does not resemble Portulaca in any way. These are the only vascular plants on the island.

SOIL:

Coral sands on the periphery. Under the Pisonia is deep peat (moist at 12" depth) extending to a depth of at least 3 feet. THIS PEAT IS HIGHLY FLAMMABLE.

BIRDS:

Brown boobies nesting with eggs and young, Blue-faced (masked) boobies nesting in trees, frigate - birds nesting in trees, blue-grey terns, noddy terns, fairy terns. This place is a miniature aviary of sea-birds.

WATER:

No fresh water evident although rainfall is probably abundant if the Pisonia growth is any measure. The peat is of very fine texture and highly absorbent and it is doubtful if a satisfactory well could be dug to tap the absorbed moisture.

ANIMALS:

Mice and the ubiquitous Polynesian rat (R. exulans) only.

FISH:

Yellowfin tuna, kingfish and caranx sp. were caught and are of large size. Very few lobsters. Coconut crabs in profusion.

DEVELOPMENT POSSIBILITIES:

Virtually nil. This is a most beautiful little place from the point of view of forest and sea-bird colonies. Any human occupation would sooner or later set light to the peat (it took "Teraka's" company less than 12 hours to achieve this) and if the peat is burnt out the Pisonia forest would go for ever.

There is no fresh water. The island could be declared a bird sanctuary. Notices to interested bodies should stress that camping be confined to the eastern coral flats. This is the weather side of the island and this fact might help to deter a lengthy stay by humans.

*done*

CAROLINE ISLAND

(Lat. 10°00'S, Long. 150°14'W).

GENERAL DESCRIPTION:

Caroline Island is a small, narrow atoll with 24 islets. The total length is about 5½ miles and may be 1 mile in greatest width at the southern end. The land area is reputedly 560 acres.

'Teraka' arrived off Caroline at 0800 on 9th September 1974. Landing was made on South Island over a wide reef at a point marked by the shank of an anchor. There is no anchorage.

Only two islets have any number of coconut palms on them - the most northerly islet known as Nake Island and the most southerly islet known as South Island. South Island may have as much as 100 acres of palms which are a wild forest of mature palms, immature palms and heaps of uncut nuts and uncleared fronds. It is not possible to estimate the acreage of palms accurately as patches have died out here and there in the centre of the island. Overgrown ruins of a former settlement were found near the northern point of South Island but no well was found although there is a fresh water lens at a depth of about five feet in the central part of the island.

The northern islet (Nake Is.) is easily reached over the 100 yd. wide flat reef. Here there was evidence of the lessee's activities in the form of a temporary copra store containing about three tons of very poor grade copra in bags and a temporary shelter on the southern shore of the island. At first sight there appear to be a substantial number of palms on this islet, but this is an illusion - the periphery is covered by palm forest but the interior of the southern part of the island consists of an almost pure stand of Pandanus. The northern half of Nake Is. comprises a high beach crest with a black coral fragment platform inland clothed sparsely by Messerschmidia bushes and the central part is forested with Pisonia trees, less dense and smaller than those on Vostok (perhaps 60 feet high) with the characteristic deep layer of peat below. The northern section of Nake Is. is a black broken coral platform with dense Messerschmidia bushes, almost impenetrable without bush knives.

A few of the other islets have small clumps of from 3 to 15 palms on them. All palms areas display symptoms of periodic drought, bottling of the trunk and skirts of dead fronds. Some palms have 'skirts' as heavy as those on Christmas Island. Nuts are small and average about 23 per palm, with only 3 or 4 nuts per inflorescence. The yield of copra must be very low. No copra appeared to have been cut on South Island for at least five years.

#### VEGETATION:

Normal species for an atoll, but Scaevola totally absent. Present and obvious are Messerschmidia, Cocos, Pandanus sp. (with small fruit bunches), Vigna luteola in clearings on S. Island, Pisonia on Wake Island, Boerhavia, some Lepturus. A full report on the flora is in Atoll Research Bulletin, No.145 of 1971.

*never  
previously  
reported*

#### SOILS:

Coral sand beach, black coral rag behind the beach crest. In the centre of South Island a deep, brown humic sand in small pockets interspersed with coral rag. Deep brown/black finely divided peat under Pisonia on Wake Island.

#### BIRDS:

Brown boobies nesting, frigate birds, sooty terns, fairy terns.

#### WATER:

No fresh water wells found. The lens on S. Island is about 5' down at one point.

#### ANIMALS:

Polynesian rat.

#### FISH etc:

Only 20 lobsters caught in one whole nights fishing. Black tip shark (v. numerous) are a menace to the reef walker here - some up to 4 ft. in length. Numerous large coconut crabs - which are probably the source of supply for Wostok. Many turtle tracks seen.

#### DEVELOPMENT POSSIBILITIES:

This is a beautiful miniature atoll - fish abound in the lagoon and there is a fresh water lens - of depth or yield unknown. Caroline might possibly be leased to a tourist venture of some sort, or to private persons. Situated about 500 miles from Papeete this would not be out of the question for those with money sufficient to build a hideaway home. The temptation to suggest that G.E.I.C.

people should be given the opportunity to settle on Caroline should  
be firmly resisted. It is too far away from the Gilberts - it is too  
far away from any administration there may be on Christmas Island.  
Rainfall is uncertain and there are obviously extended drought periods.  
Theoretically this little atoll could be vastly improve from the  
purely agricultural stand point, but in the opinion of the author it  
is quite beyond any consideration in practise - at least as far as  
the G.E.I.C. Government is concerned.

*i.e. no use.  
maybe sell, as  
suggested for Flint?*

FLINT ISLAND

(Lat.  $11^{\circ}25'S$ , Long.  $151^{\circ}43'W$ ).

GENERAL DESCRIPTION:

Flint is another small reef island reputedly covering 600 acres and is about  $2\frac{1}{2}$  miles long and  $\frac{1}{2}$  mile wide at the widest point. This is about  $\frac{1}{3}$  down the length of the island from the northern most point (in fact, from the boat landing eastwards). The island tapers at both ends and its axis is about  $330^{\circ}(T)$  to  $150^{\circ}(T)$ . There is no anchorage.

A long submerged reef extends from the northern tip of Flint so that the island is usually approached at its southern point. The boat passage is about  $\frac{2}{3}$  of the distance along the western coast when approached in this manner. The passage is marked by a 30 ft. high concrete beacon on shore. The boat landing has been blasted or cut from the solid reef and is about 30 yds. long by 20 ft. wide and ends in a low coral wall about 1 ft. high. The surge at the seaward end of this channel is sufficient to send a small boat shooting towards its end at an alarming rate - the bowman and an accomplice are required to leap into the water at the last second to prevent the boat ranning the wall at the far end.

This island, with Caroline, is currently leased to Capt. Omar Dart for copra production. As it happened, five of his Tahitian employees were encamped near the landing beacon, their accomodation being a capacious tent and a tin shack, which contained about 25 tons of copra and 2 large greenback turtle shells. The copra was of poor quality and mouldy as no attempt was made to dry it in the sun - the coconut meat is cut out and immediately sacked with the inevitable result.

Island from the boat passage is an overgrown forest of coconuts; a recent effort has been made to improve this situation by cutting down useless palms and excessive young palms in an area of 2 or 3 acres adjacent to the camp. The rest of the plantation is 'wild', with heaps of old uncut nuts covered by layers of fallen fronds which makes walking and inspection most difficult.

A short distance south-east of the boat landing is the remains of the tram track which in turn leads to the ruins of the old phosphate settlement buildings and a small wooden chapel (which is still in fairly good repair, complete with pews, altar and alter cloth). There are two large concrete cisterns in this area formerly

used to store rainwater from roof catchment. The covers of the cisterns have long since disappeared but they could be put into reasonable order fairly easily. It is estimated that the largest of these tanks could store about 10,000 gallons of water and the smaller about 5,000 gallons.

From the appearance of the palms and other vegetation it is plain that Flint receives more rainfall than Caroline; however, all the usual mineral deficiencies of a coral island are manifest. The palms, having been left in a wild state and all except the originals being selfsown, bear only a meagre crop of nuts - no palm was observed to have more than 27 nuts and the nuts were small.

#### VEGETATION:

Cocoa, Messerschmidia, Pisonia (stunted to 40 ft.), Cordia subcordata, are the main and obvious flora.

#### SOILS:

Coral sand and gravel on the shore above the reef. Inland a humic brown deep sand. One small area of peat swamp was found accidentally, so that there may be more.

#### WATER:

There is evidence of a lens but the well to the south of the island remained undiscovered. Rainfall is obviously adequate so that roof catchment to the cisterns would probably be the most practical method of gaining fresh water.

#### BIRDS:

The usual range of boobies, terns, frigates, curlews and turnstones, but none nesting.

#### ANIMALS:

Large population of Polynesian rats.

#### FISH:

Large kingfish and tuns. Inside the reef the lobster population was disappointing. Much evidence of turtle egg-laying. Many coconut-crabs.

#### DEVELOPMENT POSSIBILITIES:

With the expenditure of effort and a little money the coconut forest could be vastly improved. Palm numbers could be reduced by about 60% to achieve a manageable stand of palms of all ages. There are several hundred times more coconuts lying on the ground than



have ever been cut for copra and the present system, if it can be called such, will never clear them up. In a time of high copra prices a team of 15 or 20 men based on the island for six months could effect a vast improvement; doubtless the lessee would benefit financially if carriage of copra 400 miles to the middleman in Papeete is not too heavy a factor in the cost of operation.

Flint, being a reef island with no lagoon, is not as attractive as Caroline but geographically may have the edge as it is 100 miles nearer Papeete. Any tourist development would require that the island be cleared of its present tangled vegetative state. Even if this were accomplished it is doubtful if any but the most devoted "get away from iters" would be interested; there is no beach for swimming - a pool or pools could be blasted out of the surrounding reef and, like Caroline, some method would have to be found of excluding the numbers of black-tip sharks which live between reef and shore. Bird life is not especially abundant and although a sanctuary could be declared it is doubtful if as much interest would be shown as in, say, Malden or Vostok.

It may be worthwhile to suggest that a much higher rent be paid by the lessee, thus forcing him to improve the estate and cut more copra - or if he refuses, to sell the island outright for as large a sum as can be obtained from whoever and for whatever purpose it is required. Flint can never be regarded as a Colony asset from any point of view.

PRELIMINARY REPORT

Minister of Natural Resources  
Hon. Isakala Paeniu  
Bairiki, Tarawa.

by Henning & Herma Grossmann

Ornithologist

We participated in the Line Island Expedition from 23rd August to 21st October and carried out researches on different topics.

The prior knowledge of the land vertebrate biota of several central and southern line islands is very scant because they are uninhabited, more or less isolated in the central Pacific and had been of little economic importance until now and were therefore seldom visited. Previous information on the biota is therefore limited largely to a few (semi-popular) accounts and notes on the birds are very scattered and hard to find except recent reports of the P.O.B.S.P. personell. Because of the brevity of earlier visits and our limited time being ashore a detailed census work was precluded but we tried to estimate the total bird population of the recently visited islands. In the following species accounts the numbers in parenthesis following the species name are an estimate of the flying birds (including breeding adults and juveniles). Following this figure is another which gives the counted or estimated number of nests. We are presenting these estimates so far as it has been possible because we agree with Clapp (P.O.B.S.P.) that such estimates, although partly subjective, show relative abundance of the various species better than words such as 'common' or 'numerous'.

I. ANNOTATED CHECK LIST OF BIRDS OBSERVED ON:-

The Northern line Islands:

Washington - was only visited from 0900 on 28th August to 1700 so that we got only a very superficial impression of this island.

(a) Seabirds

Red-tailed Tropic Bird  
(Phaethon Rubricauda)

Only 4 birds were seen flying over the lake. Seldomly uncommon, but presumably breeds in small numbers.

Red-footed Booby  
(Sula sula)

Numerous birds were observed on the atoll and offshore. We found several nesting rookeries on the south east corner. Numerous birds with nestlings of different stages were found in *Pisonia* about 80 feet above ground. This species seemed to be the most abundant bird on Washington.

Brown Booby  
(Sula Leucogaster)

Observed flying about 20 miles due west of Washington and observed in the tall *Pisonia*. Certainly breeds but the latter needs confirmation.

Great Frigate-Bird  
(Fregata Minor)

Observed adults and juveniles flying over the lake, resting in *Buka* trees and offshore. Breeding is certain but we didn't find any rookeries.

During our brief visits we found out something about the status of sea turtles there. We found, as had been feared by Marine Turtle Specialists that on the Line Islands as well the turtles were reduced to very low numbers. Turtle nesting is now a very rare occurrence. Quite a number of people who we contacted informed us that the turtle population is fairly large, although no information was available on the current status of turtle stocks in the line Islands. Turtles were killed, not only on Flint which is not permanently inhabited, but also on the northern line Islands nearly every turtle coming up to lay is killed by the local people as fast as they come ashore. Turtle meat has long been a delicacy among Gilbertese and Ellice Islanders. Because of over-killing them in nearly the whole of the central Pacific, it is only in outlying areas that they really survive. Thus, little nesting now takes place, and the remnants of the breeding population are still being killed and their eggs taken. Undoubtedly this situation has existed for hundreds of years on the Gilbert and Ellice Islands, but the increase in population, combined with greater boating nobility has allowed a higher predation on nesting grounds that were previously visited only rarely.

What should be done?

We think that two things should be done at the same time. Firstly important turtle nesting areas (e.g. Flint Island) should be declared strict turtle sanctuaries at all times of the year, or the present legislation should be modified in this line. Protective legislation under the fisheries act would be excellent. But even this alone would not be sufficient, at the same time the local population must be persuaded by education that a total exploitation by overkilling cannot be rational. The loss of turtles would be much more important than the loss of a food resource. Sea turtles are just as integral part of the reef ecology and environment, as algae and corals. Like every animal they have a special function in the Marine ecology. I hope that a teaching in this way will increase awareness of, and interest in, the fauna. Steps should be taken to conserve them first before it is too late. It is a pity that there has been no Marine Turtle Specialist participating in this "expedition" assessing the populations. We are sure that a request from the Government of G.E.I. C. to the Australian or U.S. Government for a Marine Turtle Specialist, to advise them on resource management and help you to combine protective activities with a controlled exploitation, such as turtle farming, would result in help being provided. It would be worthwhile as well, to contact the Regional Ecological Adviser,

Mr Arthur L. Dahl,  
S.P. Commission,  
B.P. D-5 Noumea Cedex,  
New Caledonia.

Dr. Henning Grossmann,  
2 Hanburg 67,  
Mellenbergweg 3,  
West Germany.

II NON-AVIAN TERRESTRIAL VERTEBRATE FAUNA

(a) Lizards: were seen on all visited Line Islands except on Starbuck. Some specimens of different islands were collected but not yet identified. We saw the Black Skink (*Emoia nigra*), Polynesian Geckos, Blue tailed skinks and the Azure tailed skink.

(b) Rats: Mainly Polynesian Rats (*Ratus exulans*) were seen on all visited line islands, except on Malden. These rats were most abundant throughout the forests on Vostok, Flint and Motu Upua (Christmas Island).

(c) Green turtle: Green turtle (*Chelonia mydas*) were never seen swimming offshore and only on a few islands we saw signs of their activity. Only on Starbuck, Christmas Island, Flint, Caroline and Sydney, we found a few recent tracks. Fresh nests were only found on Flint and Sydney. Only on Flint seemed to be a good nesting place on the south and south west beach. We found only one large female in the nesting area, but the remains of five recently killed ones. Piles of blanched turtle bones indicated an earlier exploitation.

III TERRESTRIAL CRABS

Three types of crabs were found in the Line Islands. The omnivorous hermit crabs (*Coenobita* sp.) were abundant on all islands and are the main part of the terrestrial fauna, together with birds. The coconut crab (*Birgus latro*) was only found in great numbers on Vostok, Caroline and Flint. The so-called land crab (*Cardiosoma* sp.) were found nearly on all islands, but were most numerous on the larger ones, like on Christmas Island, Fanning and Gardner.

IV ECTOPARASITE FAUNA

Mainly avian ectoparasites were collected from 15 bird species and some from the Polynesian rats. Identifying them would take a long time and I have to contact quite a lot of specialists. Ectoparasites from vertebrates were collected to point out certain host-ectoparasites specificities and to get information on the parasites and their distribution on the Line Islands.

V KERATINOPHILIC FUNGI

Soil samples of different areas of the visited Line Islands were collected to search for Keratinophilic fungi which could effect the human skin and could cause dermatomycosis. Later on I have to cultivate them in a special fungi culture medium and after isolation, to identify them in a Mycological Department. Such activities take quite a long time before getting any available results.

## CONCLUSIONS AND SUGGESTIONS

Christmas Island supports breeding populations of 18 species of seabirds, and a number of ornithologists visited the island because of its great importance to science. Therefore the whole island was already proclaimed a bird sanctuary on 20th December 1960, and remains so today. Before that time the largest islets (Cook Island, Motu Tabu and Motu Upua) have been already declared bird sanctuaries and could be visited only with permission. But what is the situation today? Under the present legislation it is still illegal to kill a bird or to possess any part of them at any time. But at present there is a terrible destruction of some seabirds, sometimes for food and sometimes for fun only. We saw especially on Christmas Island, nearly on every Isle, islet, peninsular, or on the mainland areas, which were supporting seabirds, piles of their remains (skulls, wings, feet) of recently killed birds. Some of them had only broken skulls or wings, and were thrown away. We counted, for example, on Motu Upua (60), Cook Island (30), Motu Tabu (12) and on the mainland (The Bridges 40), (Bus Point, 32), Manulu Lagoon, 68 recently killed Red-tailed Tropicbird. That means following our accounts and earlier reports that on Christmas Island nearly half the population of the present breeding birds were killed in a short period and especially on the "sanctuary islets", only one more landing for catching Tropicbirds could extinguish the whole present breeding population for this year. Breeding birds are very tame and could be approached without difficulty. If they were killed, nestlings have to die and the incubated eggs were left as well. Red-footed Boobies, Blue-faced Boobies and Christmas Shearwater (Motu Upua) were killed on Christmas Island as well. Killed Frigates with broken wings can be found all over the mainland.

How is the situation on the southern and central line Islands? Though the islands are not permanently inhabited, and therefore we saw no destruction of birds before the "Line Island Expedition" arrived. But at the same time when we did the bird census work quite a lot of birds were killed. For example on Malden nearly all breeding Tropic birds were taken in a short time and Red-footed Boobies killed as well. On Vostok crew members hunted after nearly every live animal. Blue-faced Boobies, Red-footed Boobies and even the rare Brown Boobies, Noddies and Frigates were taken as well as great numbers of coconut crabs of all stages. All juveniles of the Brown Booby, and over 20 of the breeding masked Boobies were taken.

What should be done? Birds are taken for food now, and have been for a long time in the G.E.I.C. and especially the Red-tailed Tropic bird which has been a delicacy. But because of the total exploitation of quite a lot of ground breeders in G.E.I.C. (for example Tropicbirds, Boobies, Frigate birds) you cannot find at present any rookeries of these birds and they have no chance of recovery because of such heavy predating. The land animal fauna has been always very poor on these atolls because of the isolation and the inconvenient conditions, but it is becoming poorer now because one element, the birds, are so heavily predated that certain species can no longer be observed on many of the Gilbert and Ellice Islands. They were over-killed before long term studies could be done to give us a detailed picture of the life cycle, migration and breeding habits. Even in Australia birds, such as the Muttonbird (Shearwater) are commercially taken for food and have been for a long time. But the Animal and Birds Protection Board supervises the industry and tries to prevent an overkill so that an adequate breeding population is maintained for the future. This is possible because they have a

picture of the life cycle of this bird, based on long-term studies so that they can calculate the optimum number of chicks to take in each seasons' harvest. The loss of seabirds, like the turtles would be more serious than just the loss of a food resource. The birds are not only scientific objects, they are more, because they also have a roll in atoll marine ecology. If tourism, as in Fiji, becomes an important source of income, this requires substantial bird populations. Seabirds are just as integral a part of the mystique of coral islands as palm trees and non-polluted clear water. If you build a hotel on Christmas Island for game fishing as is being discussed, the tourists will not be attracted by the incomplete atoll scenery without birds. Wise conservation action is therefore needed now to ensure the future. What could happen is demonstrated on Tarawa, Sydney and Gardner where the seabirds have not been able to recover at all.

Steps should be taken to conserve the birds first before it is too late. We think it is advisable that Government takes steps towards legislation affecting wildlife. So far I haven't met a Gilbert or Ellice Islander who has any idea of conservation or resource management and the best hope of persuading them that rational, as opposed to total exploitation, is in their own interests by education in the schools. From my own point of view only those conservations actions which are based on a change of awareness by education towards an understanding of their own n-tive animals will be rich in meaning. What happened to Christmas Island is quite a good example. It has already been declared a bird sanctuary in 1960 during the occupation time of the services. But there has been no education towards an understanding of protective legislation. Even permission to visit the islands has sunk into oblivion and I suppose none felt responsible to introduce the newcomers to the local protection rules.

Suggestions: (Bird Protection)

To enforce the conservative legislation on Christmas Island more effectively it is necessary to employ a Conservation Officer, with police power, with one or two helpers. Furthermore it would very profitable to have an ornithologist permanently on the island to carry out some long-term population studies. Cook Island, Motu Upua, and Motu Tabu should only be visited with a special permit. The uninhabited, isolated, economically unimportant Vostok Island should be declared as a nature reserve as soon as possible because of the great seabird population there. At some stage in the past Phoenix Island, Birnie and McKean Islands, were declared as bird sanctuaries, but I feel that to ensure their further freedom from habitation, dogs, cats and rats, that further legislation should be made to keep these islands as nature reserves.

*This was done  
He recommended  
all the 5th  
Islands as bird  
sanctuaries  
(p. 6)?*

Suggestions: (Turtle Protection)

On Flint there seemed to be the only good green turtle nesting place in the visited islands. Six large females had been caught in one week by four Tahitian copra cutters. I suppose not only to supplement their diet but also to sell the shells on Tahiti which is quite lucrative today.

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42/11 Namatjira Drive,  
Weston, A.C.T.2611,  
Australia,  
2 March, 1990.

Dear Kay,

I should have replied to your letter earlier but just before it arrived my eyes gave out and I can now neither read nor write - a bit awkward for a documentary researcher. We await the provider of gadgetry from the Royal Blind Society who will, hopefully, fix me up with some method by which I can finish what is left on my plate: two books are now published, two at the publishers but I would like to finish the last two before shutting up shop.

As you say I didn't know you, but I thought I did, mistaking you for the wife of a natural scientist working on the Great Barrier Reef who came to see me at Arthur Circle. and I jumped to the wrong conclusion.

To return to our moutons, your earlier letter makes all sorts of enquiries about Arundel dug, whether he encountered coconut crabs, and the like. So I am sending copies of pages from the Pacific Manuscript Bureau's latest list giving the Arundel Diaries and Papers so that you can order what you want direct.

I lunched the PMB years ago to copy every worthwhile island MS as a co-operative project of the ANU and six metropolitan libraries in Australasia. But the U.S. refused to join in as it was not an American enterprise, so they suffer by having to write to us for information which they should possess.

Re the items requested in your letter of 13.1.90 I should have added the proviso 'providing I have the items and can find them', for the bibliography which I sent is not a list of items which I necessarily have but was prepared during the last war covering items available in Fiji.

Most of them would be in the Alport Barker Library which I later managed to acquire for Fiji, and you should be able to obtain copies



by writing to the Librarian, Suva, Fiji. A few, however, were in the High Commission Archives: my own library was not then in Fiji but in 27 packing cases stored in N.Z.

- ✓ (1) Item 5 I have not sighted since coming to Australia: it was *sent* very unimportant and inconsequential.
- (2) Item 6 I sighted recently but it is not in its proper file. If I can find it I will send a copy. It was entirely on moorings for ships.
- (3) Item 21 Brown. I doubt if I have ever seen it. Better write to the Christchurch Library for a copy.
- (4) Item 28 - a copy is enclosed.
- (5) I saw Item 46 not long ago somewhere. If it can be found I'll copy a copy and send it.
- (6) Item 67 Hague - I am sending it herewith.
- (7) Item 80 McClean - this is a quite well-known monograph and and there must be many copies in America. I have never had it.
- ✓ (8) Evidently I had J.L. Young's Notes but did not take them from Fiji. However, the PMB copied all he had in his Sydney home *16 or 124* before he died and the originals are probably on PMB 23 so I *sent* enclose the listing of PMB 21-23 in case you want to order one or all. He was a very interesting man.

Caroline is important historically because it was the first coral island in the Pacific to be exploited commercially, so I send a copy of Lucett's account of the establishment there started in 1846. This is from: Lucett, Edward, Rovings in the Pacific ....., 1851, vol.2 pp.233-4. But for an important sequel involving Joseph Thomas Browne see my book Slavers in Paradise, published by the Stanford University Press, Stanford, California, in 1981, pp.37 and 201. It is easily obtainable, being an American book and in print.

Congratulations on finishing your monograph to time - if you can send me a copy of the English edition I shall be more than repaid for any help I may have been.

The reason why I did not put Caroline on my original list of islands to be colonized was because I did not want to bite off more than I could chew; I had not been there to make a personal assessment of its potential and it would be an expensive business to maintain communications with it from the Gilberts.

But during the war I visited the Line Islands (including Palmyra and Johnston) and the Cook Group, and recommended Washington, Fanning, Christmas, Caroline Flint and Nassau for settlement.

Caroline, Caroline was estimated to contain 13,000 coconut trees and a potential estimated at 30,000, and was recommended as being able to support an immediate 400 Gilbertese and an ultimate 1,000. Flint was the better bet, as you would expect, and little Vostok, though I loved it, was a non-starter.

I was furious when the Gilbertese sent an exploring expedition to Vostok and lit fires to cook the boobies and other birds - and burnt down the whole island. A passing ship said that the pall of smoke could be seen from well out of sight of land. I think that it was an ecological disaster of the first magnitude, as Vostok was almost the last untouched island in the Pacific (though Arundel's men landed and stayed for several days, planting a few coconuts for castaways. See the note in the Atoll Research Bulletin.

Anyway, after the war the British Government was no longer interested in colonization, having turned towards the EEC and away from Empire, and wanting to get rid of all its Pacific possessions. And the independent Republic of Kiribati has wisely concentrated settlement effort on the much better islands of Fanning, Christmas and Washington, the others being uneconomic propositions, however idyllic.

Re the Arundel Biography, Sydney Aris (his daughter) gave me his Diaries, etc., with a view to my writing this but after going through the source material I realized that I could not do it. So after discussions with her son John Aris, after her death, I put them in the National Library here where they are well kept. If you want it, I have Aimee Bright's Biography in two vols. This was not

approved by Mrs Aris, for good reasons and never published. Now John is dead too.

I doubt anyone being able to make a doctoral thesis out of the Diaries, and if anyone tried he or she would presumably have got in touch with me for the additional which I have.

Thanks for your monograph on the Proteas of Hawaii. It is a lovely book and will make a grand addition to my library in Aselaide. Also for that article on the expedition to Nikumaroro to find America Earhart's bones: it perpetually mazes me that unlimited funds can be found for ridiculous goose-chases but not for serious research.

Honor says that she would very much like to have photos of the Orona villages called after us: it would make a lovely addition to her family album as I never took any photos except during the first week or so before any houses were built. It seems appropriate that we should be immortalised by three heaps of ruins!

Goodness knows when you will get this letter - perhaps sent on to Moorea or perhaps when you get back to safety of your own home after the hazards of the Central Pacific. I nearly got wrecked at Nikumaroro once, as the engine stalled at dead centre just as we were coming up to the reef to anchor.

Best wishes for a happy voyage,

Sincerely,

PACIFIC MANUSCRIPTS BUREAU

SHORT TITLES AND INDEX

TO MICROFILMS

PMB 1-1000

(MANUSCRIPTS SERIES)

The microfilms listed in these pages  
are available from:

Pacific Manuscripts Bureau  
Research School of Pacific Studies  
The Australian National University  
G. P. O. Box 4,  
CANBERRA. A.C.T. 2601.

It is difficult for men and *anti* to come face to face, for there is a veil between them which is called the *kibenanimata*.<sup>28</sup> It is said that perhaps a man who tries to pierce the veil may occasionally succeed, or else that probably he is discovered by chance by some *anti* and is thereupon reputed to be able to see all of them. Not all *anti* can be seen, even by those skilled in magic who have acquired clear sight, for most of them remain invisible, such as those concerned with fishing, canoes, and all types of magic rituals.

### **Abemama and War**

It was the decree from Beru that there should be two lodges of Auatabu and Teabike formed to assist in training for war and with the ritual for preparing young men to become warriors.<sup>29</sup> And so it came about on all islands except those where war was not waged; they became famous institutions on islands where warfare was endemic. Tarawa was the most warlike island, followed by Abemama.

### **By Choice or by Fame?**

One could not choose a lodge: it was a matter of chance, for different lodges prevailed in different places.<sup>30</sup> Teabike was dominant on Tarawa, Abaiang, and Maiana. This was a cause of endless friction and enmity between Abemama and Tarawa and, when Auatabu was supreme on Abemama and Teabike on Tarawa, in the days of Tèn Namoriki—the son of Tèn Tètabo—the Abemamans often invaded Tarawa.

In Teng Karotu's time there were a number of Tarawans and Maiana people living on Abemama who plotted constantly but unsuccessfully to overthrow Auatabu. The war of Kunroro, or Kenna, was fought by Tè Itinaibo in alliance with the Tarawa and Maiana people living on Abemama.

### **The Fall of the Lodge of Teabike on Abemama**

Auatabu was powerful on Abemama and at this time it overthrew Teabike to establish a supremacy which lasted to the present time. On Kuria too Teabike was defeated after several battles.

The ancestors of the royal family and the nobility of Abemama were all adherents of Auatabu. Peace and friendship between Abemama and Tarawa were consolidated only recently [just before British rule was established], during the reigns of Tèm Binoka on Abemama and Tèm Matang on Tarawa.

### **Kenna, or Tè Kunroro**

Teng Karotu went west to Aranuka in pursuit of Tèn Tèbiria, who had taken offence and left. A bloody war began which, starting at Kenna, was waged from the northern villages of Abemama to south of Tokamauea. The people of Tokamauea gave battle south of their village so that its soil would not be stained by blood. The action took place at Teitai, where signs of it can still be seen in the pits of Kaokateun and Mabutonga.

Teabike won this battle, which was the first major action of the war, while Teng Karotu was still on Aranuka.

the soul has come home.

A celebrated woman who is a companion to Naka also lives there. She is a ruler too, and her name is Nei Karamakuna. She examines each spirit that enters for the tattoos which are her sustenance and is well fed by the spirits of those who have been tattooed in life. But she pecks the pupils of the spirits of those who have not been tattooed, though the stories say that the spirits were not really hurt by it.

Bouro and Neineaba lie to the north of Little Makin. Marira is also close by. They are the abodes of Gilbertese souls.

### Death in Battle or of Criminals

When a death has been caused by violence or in battle, the corpse is quickly buried, burnt by fire or thrown away for fish or animals to eat. We do not know what happens to the souls.

### Mone Temamatannana

It has always been said that Mone was created by Nareau at the same time as earth and sky. Bakoa is recognized as the ruler of Mone and Nei Wiriki and Nei Tinanimone are his wives. There is also mention of Enganaba, but he is inferior to Bakoa. There are many more inhabitants of Mone belonging to families of *anti* quite different from the families on earth.

### Supposed Differences between the Antimaomata and the Spirits

There is not a great deal of difference between the *antimaomata*<sup>26</sup> and the *anti*, though people differ on this point. It is commonly held that the *anti* cannot be seen by human beings, or reveal themselves only occasionally, because they are separated from mankind. They have been important throughout the Gilbert Islands from time immemorial.

### The Anti Most Often Visible

The *anti* which were most often visible were the *anti* which were famous from the earliest times: Taburimai, Auriaria, Riki, Nei Tewenei, and Nei Tituabine; others included Nei Rei, Nei Tereitaburi, Nei Tenaotara, Teweia, and Kaobunang.<sup>27</sup> These *anti* were well known in the early days before the beginning of the historic war [of Kaitu and Uakeia], after which every *utu* had its own *anti*. It was the *moti* 'decree' from Beru, and it was spread through the Gilberts after the war; for that decision from Beru was observed, as were their laws on all matters.

### The Antimaomata

The belief in *antimaomata* arose later, for they were normally invisible and would only show themselves occasionally to a few people. The *antimaomata* were Terakunene, Nei Karua, Ten Tekai, and perhaps a few more, but the belief was unreliable, and its truth was not proven.

### The Barrier (or Veil)

FILMS PMB 1-1000 - SHORT TITLES

<u>No. of film</u>	<u>Title</u>
PMB 1	WITTS, Maurice M. (copra planter) - Diary for 1905, kept at Hog Harbour, New Hebrides
PMB 2	MEKEO DISTRICT, PAPUA - Genealogies, 1904-c.1960
PMB 3	MOULTON, J. Egan - Notes on Tongan history and Tongan legends
PMB 4	ROMAN CATHOLIC MISSION - NORTH SOLOMON ISLANDS - Miscellaneous Papers, 1900-1940
PMB 5	GARSIA, Rupert C. (Administrator of Nauru from 1933 to 1938) - Papers, 1920-1938
PMB 6	FASTRE, <u>Father</u> P. - Notes sur les Moeurs et Coutumes des Fuguges (a Papuan tribe)
PMB 7 (2 reels)	GRABOWSKY, Ian - A history in diary form of civil aviation in New Guinea, 1913-35
PMB 8	WITTS, Maurice M. (copra planter) - Diary for 1911, kept at Hog Harbour, New Hebrides
✓PMB 9	MOORS, Harry J. - 'Tapu: A Tale of Adventure in the South Seas' (A novel)
✓PMB 10	MOORS, Harry J. - 'The Tokanoa: A Plain Tale of Some Strange Adventures in the Gilberts' (a novel)
PMB 11	PINNEY, <u>Captain</u> C.R. (Administrator of Norfolk Island from 1932 to 1937) - Papers, 1932-1944
PMB 12	TREGURTHA, <u>Captain</u> Edward Primrose (South Seas whaler) - Autobiography
PMB 13	MURRAY, <u>Sir</u> Hubert - Letters from Papua to his family, 1930-1940
✓PMB 14	MOOUGA, H.I.N. - Flint Island diary, 1889-1891
PMB 15	HAMILTON, <u>Captain</u> William - Papers concerning New Guinea, the New Hebrides and the Solomons, 1882-1905
PMB 16	NAURU - German Administration - Official Records, 1887-1916
PMB 17 (2 reels)	DESNOES, <u>Father</u> Gustave - Mekeo Dictionary
PMB 18	MASON, <u>Lieut</u> Theodorus B.M. - Private Journal of a cruise, Philadelphia to Hawaii 1872-75
PMB 19	RICKARD, <u>Mrs</u> R.H. and others - Papers relating to the New Guinea Islands, 1882-1939
✓PMB 20	CHAVE, Richard Branscombe - Adventures of a Guano Digger in the Eastern Pacific, 1871
PMB 21	YOUNG, James Lyle - Private journal, 1875-77
PMB 22	YOUNG, James Lyle - Private journal, 1880-81



<u>No. of film</u>	<u>Title</u>
PMB 23	YOUNG, James Lyle - Miscellaneous papers, 1878-1929
PMB 24	WILLIAMS, John Chauner (British Consul in Samoa) and his wife Amy - Journal-letters, 1855-56; 1864, 1873-74
PMB 25	WALLESA, <u>Monsignor</u> Salvador Pedro - Memorandum on the Mariana and Caroline Islands, c.1922 (in Spanish)
PMB 26	FISON, <u>Rev.</u> Lorimer - Miscellaneous Papers on Fiji, 1865-68
PMB 27	DORRANCE, John C. - John Brown Williams and the American claims in Fiji (a study)
PMB 28	COLLOCOTT, <u>Rev. Dr</u> E.E.V. - Correspondence, 1921-59
PMB 29	HARVEY, <u>Dr</u> William Henry - Letters from Tonga and Fiji, 1855
PMB 30	NEW HEBRIDES - Newspaper cuttings relating to the Labour trade with Queensland, 1890-95, collected by the Rev. Dr J.G. Paton
PMB 31	NEW HEBRIDES PRESBYTERIAN MISSION - Minutes of Synod, 1857-1938
PMB 32	PATON, <u>Rev.</u> Frederick J. - New Hebrides Journals, 1893-1908
PMB 33	PATON, <u>Mrs</u> Helen I.M.R. - New Hebrides Journals, 1903-05
PMB 34	SARKA, Charles - Tahiti Nui, narrative of an artist in the South Seas, 1903
PMB 35	WILLIAMS, John and BOURNE, Robert - Journal of a missionary voyage, 1823, and other papers
PMB 36	THOMAS, Gordon - 'Rabaul, 1942-45' (an account of four years as a war prisoner of the Japanese)
PMB 37	WILLIAMS, John Chauner - Journal, 1868-72
PMB 38	GREEN, James L. - Papers, 1874-1908
PMB 39	DRIVER, <u>Captain</u> William - Logbook, 1831-32, and Memoirs
PMB 40	GILL, <u>Archdeacon</u> Stephen Romney - Letters, 1897-1928
PMB 41	BALDWIN, <u>Father</u> B. - Biga Boyowa - A notional study of the Trobriand Islands language
PMB 42	TANGOA TRAINING INSTITUTION, Tangoa, New Hebrides - Records, 1894-1967
PMB 43	MELANESIAN MISSION, NEW HEBRIDES - Records, 1857-1968
PMB 44	GALLYON, R.N. - Vocabulary of the Kwara'ae language
PMB 45	NEW HEBRIDES - LAND (papers relating to land at Duindui, Aoba)

<u>No. of film</u>	<u>Title</u>
PMB 476	GLEESON, L.T. - 'The Economy of Norfolk Island and the Financing of the Administration'
PMB 477	GEDDIE, <u>Rev. Dr.</u> John - Miscellaneous Papers, 1844-47
PMB 478	EASTMAN, <u>Rev.</u> G.H. - Rarotongan-English Dictionary
PMB 479 (2 reels)	WESTERN SAMOA - English Translations of papers on German Administration, 1900-1914
PMB 480	ARUNDEL, John T. - Diaries, 1870-1872
PMB 481	ARUNDEL, John T. - Diaries, 1873-1880
PMB 482	ARUNDEL, John T. - Diaries, 1881-1887
PMB 483 (2 reels)	ARUNDEL, John T. - Diaries, 1888-1892
PMB 484	ARUNDEL, John T. - Diaries, 1893-1894
PMB 485	ARUNDEL, John T. - Diaries, 1895-1896
PMB 486 (2 reels)	ARUNDEL, John T. - Diaries, 1897-1898
PMB 487	ARUNDEL, John T. - Diaries, 1899-1900
PMB 488	ARUNDEL, John T. - Diaries, 1901-1902
PMB 489	ARUNDEL, John T. - Diaries, 1903-1904
PMB 490 (3 reels)	ARUNDEL, John T. - Diaries, 1905-1910
PMB 491	ARUNDEL, John T. - Diaries, 1911-1913
PMB 492	ARUNDEL, John T. - Diaries, 1914-1919
PMB 493	ARUNDEL, John T. - Correspondence, chiefly with Lord Stanmore, 1897-1912
✓ PMB 494	ARUNDEL, John T. - Summary of activities, 1865-1892
PMB 495	ARUNDEL, John T. - Miscellaneous Correspondence, 1902-1909
PMB 496	FARQUHAR, W.G. - Diaries, 1870-71, 1871-72
PMB 497	ELLIS, Albert F. - Miscellaneous Papers and Correspondence, 1900-1951
PMB 498	ARUNDEL, John T. - Miscellaneous Papers on Phosphate Industry



ANGELA KAY KEPLER, Ph. D.

ENVIRONMENTAL CONSULTANT

Ornithology • Botany • Mammalogy



4 Sept. 1980

Dear Harry,

I'm just off to England/Scotland for 3 weeks, but your package — the 2nd one, never did see the first one! — arrived today. Wonderful! Thank you so much.

Somebody included the Phoenix Group paper which looks like your original — is enclosed.

Seems like I'll be in Honolulu next July & will hunt through the late Ed Bryan's files.

Everything you sent is great. Your "chapters" on Flint & Vostok are just what I need right now to write up papers on those islands.

→

When I get back I'll hunt out  
a few ~~pr~~ slides of Orona villege -  
The one Cam (my husband) stayed in  
in 1964. Right now I don't  
have the map so I forget which  
villege it was. I'll send you a  
few prints for your scrapbook.

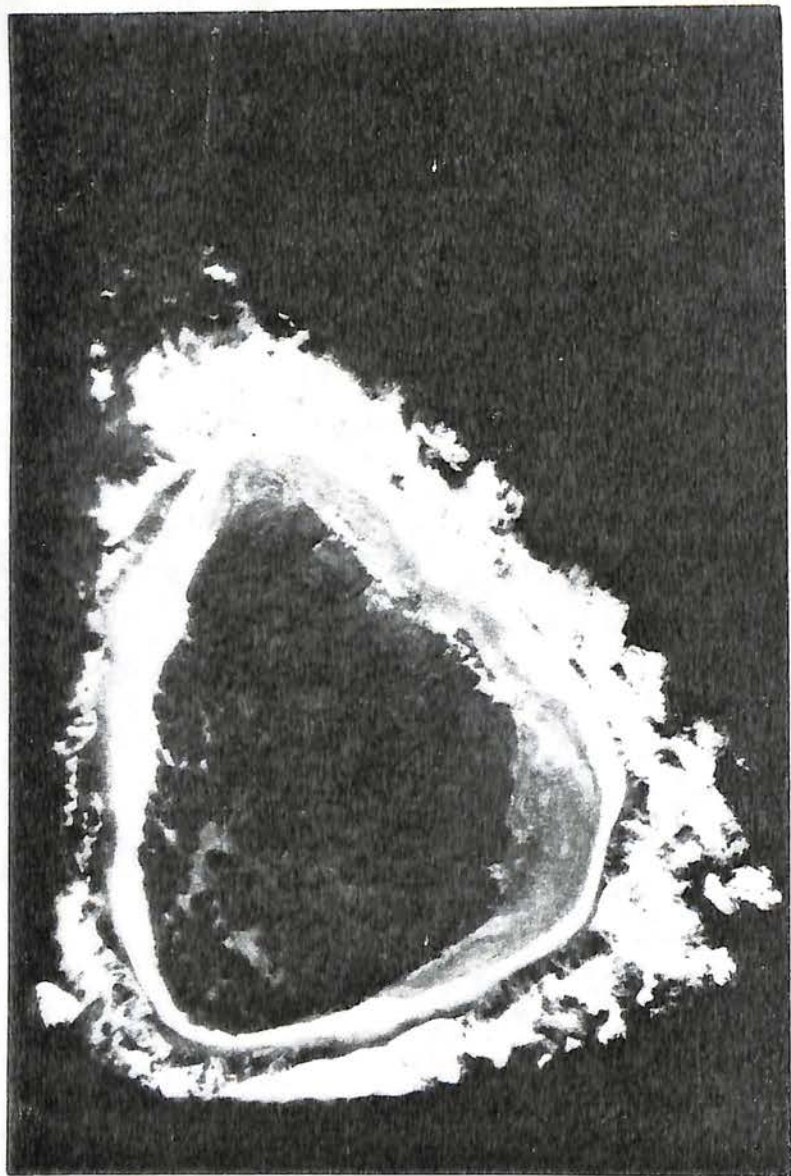
We do plan to return to  
the Phoenix Is. in a year or two,  
& will take more pictures then.

Once again - bless you for your  
kidneys, & do get your eyes better.  
What a horrible thing to happen  
to a bookworm. I do hope your  
operation is successful.

1 Scuse  
mish

Aloha nui loa

Kay Kepler



aerial photo  
of Vostok. Can  
see fire damage.

K

REPORT: ICBP 1990 LINE & PHOENIX ISLANDS EXPEDITION

FEB.20 - MAY 31, 1990

<u>Personnel</u>	Joint Co-ordinators	Dr. Martin C. Garnett (U.K.) Dr. A. Kay Kepler (N.Z./ U.S.A.)
	Captain/Seabird Biologist	Mr. Graham Wragg (N.Z.)
	Ecologists	Mr. John Phillips (U.K.) Mr. Mark Linsley (U.K.) Mrs. Annabel Garnett (U.K.)
	Seaman	Mr. Alve Hendricson (Sweden)

Note: Mr. Katino Teeb'aki, Wildlife Officer, Wildlife Unit, Christmas Is.(Kiribati), was not able to accompany us due to unavoidable changes of plan associated with the Gilbertese government (see below).

Vessel Research Vessel Te Manu, a 10 m cutter from Auckland (N.Z.)

Objectives The ultimate aim of the ICBP 1990 Line and Phoenix Islands Expedition was to conduct detailed surveys of the birds, plants, and other biota (turtles, coconut crabs, terrestrial and marine mammals, insects). This information, supplemented by color photographs, maps, and data from previous surveys, is now being used in efforts focussing on the future establishment and management of inviolable, international preserves.

We planned to visit 19 of the 20 Line & Phoenix Islands (Fig. 1), which stretch eastwards from Howland (lat. 01°00'N, long. 177°00'W) to Washington Is. (04°43'N, 160°25'W), and south to Caroline (10°00'S, 150°13'W) and Flint (11°26'S, 151°48'W). Politically, 16 of these islands are affiliated with the Republic of Kiribati (formerly Gilbert and Ellice Is.) and 4 to the United States. Fifteen are uninhabited (3 are U.S.

National Wildlife Refuges), and 4 are inhabited.

Background These islands, all low coral atolls or filled-in atolls, are some of the least visited and remotest crumbs of land dotting the world's oceans. Of immense conservation value, they are some of the last havens for large colonies of breeding seabirds. Up to 18 species of seabirds, numbering millions of breeding pairs, utilize their shores, and up to a dozen species of migrant shorebirds winter on them. They feature the world's largest (or close to largest) colonies of Great and Lesser Frigatebirds (Fregata minor and F. ariel), Red-footed and Masked Boobies (Sula sula and S. dactylatra), Sooty Terns (Sterna fuscata), and Fairy (White) Terns (Gygis alba).

Botanically, the Line & Phoenix Islands offer examples of relatively untouched atoll plant communities and groves of tree species that have dwindled remarkably elsewhere. For example, pisonia (Pisonia grandis) forests (to 30 m high), occurring on several islands, are the largest, most magnificent, and some of the last basically unmodified groves in the Pacific. Similarly, the formerly common hardwood, kou (Cordia subcordata), once used in native cultures for carving quality bowls, is hard to find anywhere except on Caroline.

Other notable biological attributes, common to many of the islands, are discussed in the attached fact sheet on Caroline: the outstanding coral reef ecosystems (including abundant giant clams, Tridacna maxima), turtle nest sites, archaeology, lack of anthropogenic pollutants, record densities and sizes of coconut crabs, and the kaleidoscopic beauty of its lagoon. One of their most important features is lack of disturbance: since most of the Line & Phoenix Is. have been minimally altered by man, they provide examples of atoll ecosystems "before" modification. They also harbor potential value as outdoor ecological laboratories for both pure and applied science. For example, Caroline would be

6 Nov., 1990

Dear Harry,

Thankyou very much indeed for your most recent letter and enclosures - most useful. I have written to the PRB and followed up on other refs as you suggested. Glad you xeroxed off your May letter, as I never received the first one ...

I was most disturbed to hear of your failing sight. That's terrible! I do hope that by now things are a little better, as you are so productive. Sounds as though Honor is a wonderful help, but one's own eyes are so precious.

Conservation is slow for Caroline, Vostok and Flint. The Sec. to the Cabinet and Ministry on Christmas don't answer letters or acknowledge information that they requested; The Nature Conservancy (U.S.A.) is offering to help but don't have any time to even offer the Kiribati Govt. money for a lease, which would prevent this French businessman (Urima) from further raping the islands; and the biologist ICBP (U.K.) want to send to Tarawa in the interests of conservation, wants to build big which would be a disaster for the forests and wildlife. Meanwhile, French customs officials are preventing Urima from leaving Tahiti. If only Kiribati would respond! But, I know, their priorities and pace of life are totally different from ours. I will send Kiste's name to the Nature Conservancy. It's unbelievable that you nearly bought Caroline for ~~£~~ 600 in 1941. Wish you had. I'd buy it if the price was within our bank account. Anyway, I still keep trying. Have a contact with the World Bank that may pan out.

Enclosed are prints of all the pix we have of Arariki. Cam, my husband, stayed in the single fale (or whatever the Gilbertese call them) for about 3 nights in 1964, as biologist with the Pacific Ocean Biological Survey Program (Smithsonian). The boys loved the maneaba, which was cool during the day (they banded seabirds all night), and ate several papayas & coconuts. If you want a dupe slide or further prints of any of these, please ask - we'd be happy to send them. Sorry the maneaba one was at the end of a film. We are very sorry about Alaric's sisterin-law's family - were they ever found?

I have been invited to be the biologist on a trip to Howland and Baker next Feb/March - to check out the birds on the Wildlife Refuge for the U.S. Fish & Wildlife Service. The trip is organized primarily by HAM radio enthusiasts, who like to call from different "countries". May proceed from there to Henderson, Pitcarirn, Ducie and Oeno for a 3-mth stint after that ... don't want to get too excited yet though. I see you unravelled the story about de Quiros' discovery of Henderson.

Once again, our very best to you & your family. Sorry I did not reply earlier, but I went to England to see ICBP about conservation matters relating to Caroline/Vostok/Flint, etc. Please send me the titles of your newest books when they come out. Incidentally, Martin Garnett (who was the biologist on Xmas from 1978-81, & who wrote the wildlife management plan for Kiribati in 1983) asked me to convey his best wishes to you. You've never met him, but he admires you greatly and says his most favorite book about the Pacific is (the same as mine) "Of Islands and Men". Keep up the good work.

E a tau, tiabo

Kay (& Cam)



excellent for biomedical research on ciguatoxic (fish) poisoning, an increasing problem on inhabited Pacific islands. Here, the red snapper (Lutjanus vaigiensis) and three-spotted crab (Carpilius maculatus), normally poisonous, are safe to eat.

**Background on Personnel** The researchers' combined experience spans the Pacific and Indian Oceans, Caribbean, South China Sea, Indonesia, Africa, Asia, North and South America, New Zealand, Australia, and Europe. Dr. & Mrs. Garnett, and Dr. K. Kepler (with her husband, Dr. Cameron Kepler, U.S. Fish & Wildlife Service Endangered Species biologist), have an ongoing commitment to wildlife conservation in the Line & Phoenix Islands. Martin Garnett lived 3 years on Christmas Is., initiating and training the Wildlife Unit there, advising the central Kiribati government (Tarawa) on key preserve areas and wildlife management, and wrote a long monograph on the Line & Phoenix Is. (Garnett 1983). The Keplers' involvement began in 1961, when Cameron first visited seven of them as a member of the Smithsonian Institution's 10-year Pacific Biological Survey Program (POBSP), later visiting Jarvis, Christmas (5 times) and Caroline. The Keplers, involved in setting up wildlife refuges and natural reserves in the Caribbean and Hawaii, where they lived for 14 years, have just completed a monograph on Caroline (Kepler et al, in press) after a 1988 visit there on a joint US/USSR Oceanographic Expedition.

We were very fortunate to have Captain Wragg as our skipper. A conservationist and seabird biologist (currently pursuing a Ph.D. at Oxford University, U.K.), he assisted in data acquisition both on land and at sea. Widely travelled, he has participated in, and led, several scientific expeditions, including 12 months of archaeological research in Africa with the British Museum. He is presently involved in an

4

extended expedition to Pitcairn and Henderson Is. His personality was delightful, he made every effort to accommodate us, his well-researched equipment was the best available, and his fees were unbeatable.

### Accomplishments

Itinerary: The six of us on the Tahiti-Christmas leg arrived in Moorea at different times: February 5 (KK), 10 (AS,JP), 15 (ML), 17 (GW), 19 (AH). We welcomed MG aboard at Christmas Is. on April 4, and bid farewell to JP and AH on April 11. We lived on Te Manu the entire time except for 5-25 February, when we stayed at the University of California (Berkeley) Richard Gump Marine Laboratory, Paopao, Moorea.

Between departing from Moorea on March 2 and returning there May 31, 1990, we travelled, mostly under sail, 4100 nautical miles (4600 miles) within the Line and Society Islands (Fig. 1). Our passage spanned latitudes 18°S to 02°N and longitudes 155°W to 149°W. From Moorea we sailed east to Tahiti then north to Caroline, Flint, Vostok. It was on these three islands that we did most of our terrestrial work. We continued northward to Starbuck and Malden, where sea and wind conditions prevented us from landing. Further north and west brought us to Christmas Is., where we were informed that although the Government of Kiribati was in full approval of our expedition, permission had been granted by the Minister for Natural Resources without approval of the Cabinet. Because of this bureaucratic nuance, plus miscommunication between Tarawa and Christmas, we were obliged to return to Tahiti immediately. For three weeks we tried desperately to secure provisional permission (with ICBP's help), to no avail except that the Secretary of the Cabinet, the highest political officer in Kiribati, assured us that in 6 to 8 weeks they would consider our situation and eventually grant us

permission to continue! It was with great regret that we sailed homeward. En route we again attempted to land on Starbuck (in vain), spent two hours on Bellingshausen (Motu One), and revisited Caroline.

Survey Results: We visited 7 islands, landing on five: Caroline, Flint, Vostok, Christmas, and Bellingshausen. Three were uninhabited, two nearly so. Please see pp 3-13 of the updated ICBP Project Proposal (enclosed) for a complete description of our planned research. We used tested survey techniques in conjunction with 1985 aerial photographs taken by the RNZAF (Royal New Zealand Air Force). Enclosed are samples of our predesigned, fill-in-the-blank field forms which were prepared for cross-island transects, perimeter surveys and seabird colony counts on each of the 19 islands we planned to visit. The transects involved detailed coverage (birds, plants, mammals, coconut crabs, lizards, etc.) of at least 5% of each island's area.

A brief summary of our findings, primarily on Caroline, Flint and Vostok, and organized according to the updated expedition proposal, follows:

**A. SEABIRDS - On Islands**

- We gathered data on the current status, distribution, phenology (breeding cycle), and population sizes of all resident and non-resident seabird species present during our visits. Results included: a) full nest counts of discrete colonies (e.g. Masked Boobies, Lesser Frigatebirds) and b) estimated population sizes of species whose nests were dispersed within the various plant communities (Red-footed Boobies, Great Frigatebirds, White Terns). Only one or two sets of previous seabird population estimates were available - from decades ago except

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for Caroline (1988). Highlights on Caroline included more than twice as many Red-tailed Tropicbird nests than were previously known; predation on Sooty Terns by large terrestrial coconut crabs (Birgus latro); and two new island records, White-tailed Tropicbird (Phaethon lepturus) and a possible Hudsonian Godwit (Limosa haemastica). This last shorebird is an extremely rare migrant to the tropical Pacific, and a new record for the Line & Phoenix Islands.

- At Christmas Is. we found a bird ring (band) on a long-dead Masked Booby. The Smithsonian Institution (Washington D.C.), who requested us to look for rings, have banded millions of seabirds in the Pacific, and use such returns in research on longevity and distribution.

- ML and AG recorded several hours of seabird vocalizations, requested by the French Colonial Research Service, Papeete. The species, mostly from Christmas Island, included Audubon's Shearwater (Puffinus l'herminieri), Wedge-tailed Shearwater (P. pacificus), Christmas Shearwater (P. nativitatus), Phoenix Petrel (Pterodroma alba), Polynesian (White-throated) Storm Petrel (Nesofregetta fuliginosa), Black Noddy (Anous tenuirostris), Brown Noddy (A. stolidus), and Sooty Tern (Sterna fuscata).

- We collected some avian skeletal remains, requests from the New Zealand National Museum (Wellington, N.Z.), Smithsonian Institute, and British Museum (London, U.K.): Phoenix Petrel, Wedge-tailed Shearwater, Great Frigatebird, Red-footed Booby, and Red-tailed Tropicbird. All were victims of poaching or the recent cyclone, "Peni", which coursed through the South Pacific just prior to our trip. (N.B. we collected specimens only when we assumed we were permitted to do so, stopping when permission

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was retracted.)

- On Caroline, Flint and Vostok the effects of feral mammals, rodents, and land crabs on seabird breeding activities were slight, see p. 14. Of unique interest were the predatory interactions of Sooty Terns and coconut crabs on Brothers Islet, Caroline Atoll. Here, in mature Pisonia grandis forest, where the rotting boles of old trees provided shelter for coconut crabs, rotting tern carcasses disclosed telltale evidence of recent crab feasts. We have the first detailed record, and first photographs, of coconut crab-bird predation.

- Mapping of the seabird distribution relative to vegetation type is presently underway. Although maps were almost complete for Caroline, this expedition added details that improved our overall comprehension of the atoll's ecology. Flint and Vostok have never been mapped in detail.

#### B. SEABIRDS - At Sea

- We conducted continuous dawn-to-dusk, at-sea observations of seabirds (12-13.5 hours daily for 8 weeks). At two-hourly intervals we recorded data on weather, cloud, swell, compass direction and boat speed. Of a possible 35 species known to inhabit this section of the Pacific, we observed 25 (Table 1), including rarities such as the Black-winged Petrel (Pterodroma nigripennis), Gould's Petrel (Pt. leucoptera), Stejneger's Petrel (Pt. longirostris), White-necked Petrel (Pt. externa) and Juan Fernandez Petrel (Pt. cervicalis). As Te Manu's course passed through oceanic swaths little known by ornithologists, our multiple sightings of several species represented considerable extensions of

their ranges. These first-ever sightings extended the known ranges of birds in every compass direction. For example, that of Stejneger's Petrel was a west and northward extension, while the White-necked and Juan Fernandez Petrels were to the south and east. cursory examination of our data indicates that we have new information, not only of the geographic locations of migration routes and at-sea distribution, but can also add refinements on flight directions and specific dates. For example, we saw no Stejneger's Petrels on our northward track during March-April but encountered many flying north as we proceeded south in May. As these petrels breed on islands off Chile, we were observing postbreeding dispersal through a previously unknown area, with birds heading towards their "wintering" grounds off Japan.

### C. LAND BIRDS AND WATERBIRDS

- We searched for possible Acrocephalus warblers on Flint, Vostok and Caroline, in vain.
- Although we were unable to study the Scarlet-breasted Lorikeet (Vini kuhlii) in the wild (Washington, Fanning Islands), we located three captives on Christmas. Information on ecology, care and diets of Vini spp. was a special request from the San Diego Zoo (California, U.S.A.), whose endangered species program is currently focussing on the captive propagation and establishment of native reserves of these Pacific island endemics, and also from the Dept. of the Environment, Tahiti. We obtained preliminary information on the distribution and abundance of the rare Tahitian Lorikeet (Vini peruviana) at Bellingshausen Island, a remote, little visited atoll at the far western extremity of the Society Islands. A long report on both Vini spp was sent to the San Diego Zoo and Dr. Philippe Siu, Minister of the Environment, French

Polynesia.

- We observed the New Zealand migrant, Long-tailed Cuckoo (Eudynamis taitensis) on Caroline in February and May. The Falconers had further sightings. The first record of this species from Caroline, and the Line Islands, was in September 1988 (Kepler, et al, in press).

D. SHOREBIRDS

We updated species lists and ecological annotations on each island. Table 1 lists all species seen. Population estimates, based on perimeter surveys, will soon be calculated. We saw no color-banded Bristle-thighed Curlews, but noted some bill lengths, a request from the U.S. Fish & Wildlife Service, Alaska.

E. PLANTS

- we obtained total (or near-total) plant lists for Caroline, Vostok and Flint. All islands had received ample rainfall during the past 8 months, thus vegetation was lush and any species present would not only be alive but relatively easy to identify.

Caroline: Its list of established species now totals 24, 83% of which are endemic (an extremely high figure), to which we added three: Hibiscus tiliaceus, Thespesia populnea, and Species "A". The latter, a tall shrub (similar to Clerodendron inerme), is unidentifiable as it was sterile. All are theoretically indigenous, although the first 2 may also have been introduced last century.

To the known list of extinct/temporary species, we added an indigenous species not seen since 1884 (Sida fallax), a potential weed (Kyllinga brevifolia) and more garden plants (Hibiscus

schizopetale, peppermint, okra, Gardenia taitensis, etc.). The first two are weeds, limited to a tiny clearing around a new cistern; we hope they do not become established, as the atoll presently harbors only one weed (Phyllanthus amarus) represented by 2-3 dozen individuals. This weed, a legacy of the 19th century, was absent in 1988, having been resurrected since a small patch of land was cleared around the cistern in 1989. AKK's correspondence with the Falconers enabled them to find a rare indigenous plant (Tribulus cistoides) that we had not located in 1988. They also showed us some of the above first records for the atoll.

**Flint:** We found 28 species, including 6 new island records: Terminalia catappa, Tacca leontopetaloides, Leucaena leucocephala, Portulaca oleracea, Paspalum vaginatum, and Boerhavia tetrandra. We hope to have collected all species present, as Flint's outdated total is 38, a figure which includes several possible extinctions from the 19th century settlement. Flint boasts many sizable indigenous trees in its peripheral buffer zone: Pisonia grandis, Cordia subcordata and Calophyllum inophyllum. We measured the circumferences and heights of a number of these.

**Vostok:** This tiny 24-ha, filled-in atoll has been oft touted as the island with the fewest number of species in the world. It still is, but now has three instead of two! We found a new island record, Boerhavia tetrandra within the peripheral herb mats and burned clearings within the forested interior.

- We are currently preparing first-ever vegetation maps for Flint and Vostok, which detail the distribution of each major species as well as the overall distribution of each plant community. Minor vegetative details added from this trip were also helpful to the Kepler's monograph on Caroline.



- Another major aspect of the botanical work was our plant collection of 161 specimens, requested by the Bishop Museum (Honolulu, Hawaii), Smithsonian Institution, University of Georgia (Athens, Georgia), and ORSTOM (Papeete, Tahiti). Bishop Museum personnel are currently checking identifications, preparing, mounting, and mailing the duplicate specimens. ORSTOM kindly provided us with botanical preservative (FAA), cut newspapers, and heavy-duty plastic sacs.

- The buka tree (Pisonia grandis). Formerly widespread, this grand tree is now rare in the Pacific; its largest and finest groves are in the Line Islands. Research conducted on this expedition will allow us to evaluate the size and extent of Pisonia groves of Flint and Vostok. It was formerly assumed that Flint had no groves of any worth; similarly with Caroline (prior to 1988). It is possible that Caroline's 67 ha of forests cover more area than those on any other Pacific island (Kepler et al, in press). We were disappointed that we could not examine the magnificent groves on Fanning and Washington, reputed to possess exceptional diameters and rise to 35+m tall (Garnett, pers comm).

We measured heights, cbh (circumference at breast height), base circumference, and number of accessory trunks of 74 Pisonia trees on 3 islands. Maximum measurements were:

<u>Is.</u>	<u>No. trees</u>	<u>hgt.(m)</u>	<u>cbh(cm)</u>	<u>base (cm)</u>	<u>no. trunks</u>
Caroline	31	21	500	660	15
Flint	13	30	200	430	2
Vostok	30	20	323	not meas.	4

- Kou (Cordia subcordata) was less common, but we measured 8 trees, mostly on Caroline. Maximum measurements were: height 25 m, cbh 175cm, base 170 cm.

- We photographed and noted the condition of the abandoned plantations of Caroline and Flint, looking especially for persistent exotic plants leftover from the 19th century settlement days.

- We searched for, and collected, plant species which had been specifically requested by Dr. Ray Fosberg, Smithsonian Institute, viz. Boerhavia (see p. 10) and Lepturus.

## F. REPTILES

### Turtles

Caroline: Found 3 old nests, far northern tip of Nake Is. and 2 live green turtles (Chelonia mydas), obtained a report of a possible Pacific Hawksbill Sea Turtle (Eretmochelys imbricata), and photographed shells of two illegally killed green turtles. We also discussed wildlife laws with the Tahitian fishermen employed by Felix Urima (pending leasee for the atoll), who had killed and trapped an unknown number of green turtles.

Flint: A complete perimeter survey revealed about 20 turtle tracks (mostly old), many nest holes, and one Chelonia skeleton.

Vostok: Several complete perimeter surveys disclosed no turtle sign.

### Skinks, Geckos

- Incidental notes on 3 islands on at least 4 species: azure-tailed skink (Emoia cyanura), snake-eyed skink (Cryptoblepharus boutoni), ?black skink (? Emoia nigra), and mourning gecko (Lepidodactylus lugubris). Identification was only by sight.

Caroline: No additions to the known small reptiles

Flint: No lizards previously recorded. We observed only one species, the azure-tailed skink, in prodigious numbers. With practically every

step, several skinks scurried away. Our density estimate of 1/sq. m. is not unreasonable. The total area of Flint is 324 ha, of which 238 ha (75%) are covered with either native or Cocos forest, both of which provide prime habitat for the skinks: our population estimate is approximately 2 million. Such an outstanding density, perhaps unequalled anywhere, surely reflects the absence of large rats and other introduced mammals. In damp areas their density increased by at least a factor of two.

Vostok: Azure-tailed skinks abundant

## G. INSECTS

- We collected hundreds of specimens of insects, spiders, and scorpions on Caroline, Flint, Vostok, and Christmas (including 3 lagoon islets). A collection list, with data and ecological notes, was personally delivered to Dr. Scott Miller (Bishop Museum, Honolulu), who had requested them and provided us with vials and alcohol. cursory sorting indicates that about 20 species are of particular interest.
- The collection included scale insects (Coccidae) and Neuropteran larvae (Chrysopa sp) from Pisonia trees on Caroline as a special request. These insect pests, present on all the southern Line Is. visited, appeared to be endangering the health of the most mature trees.

## H. MAMMALS (Terrestrial and Marine)

Rats: Polynesian rats (Rattus exulans) were abundant on Caroline, Flint and Vostok, especially in the Cocos and Pisonia forests. We found no evidence of them disturbing breeding seabirds, except perhaps limiting the distribution of Red-tailed Tropicbirds on Caroline (see Kepler et

al, Pt. II).

**Cats and Dogs:** We found no trace of the terriers imported to control rats on Flint and Caroline in the early 1900s, and which were last seen on Caroline in the 1930s. On the latter island, the Falconers own a dog and cat which, together with four people, contribute to the essential lack of breeding seabirds on Motu Ana-Ana. The dog visits all 5 of the Southern Leeward Islets and accompanies the family in their sailing-canoe excursions throughout the atoll. It has killed at least one Great Frigatebird. Mr. Urima's fisherman took a large dog everywhere with them during their 6-week stay there.

The presence of a female cat is also disturbing. The number of yachts visiting Caroline has increased tremendously during the past 6 months, and will continue (yachts sometimes have pet cats on board). The ecological disasters resulting from cat and dog predation on seabird islands are sad chapters in the history of the Pacific. We discussed this subject with the Falconers. Future management of Caroline will probably involve removal/banning of all pets.

On Christmas Is., a cat eradication program, instigated by Martin Garnett and presently directed by Katino Teeb'aki, has been operating for nearly 10 years. The Wildlife Unit currently have a bounty program in operation (cat tails), which supplements regular cat-shooting. During our stay there, Garnett further advised Teeb'aki on this subject.

**Pigs and Goats:** We saw no evidence of feral ungulates on Caroline, Flint or Vostok. However, the Falconers had been hoping to import dairy goats to Caroline, an idea which met with our strong disapproval.

**Humans:** Caroline: The increased visitation of yachts; current plans for exploitation, development and tourism; and the destructive and illegal activities of Urima's fishermen are discussed in the accompanying

fact sheet. In a nutshell, despite the fact that Urima's lease is not yet fully approved, his men are taking commercial catches of fish, green turtles (theoretically protected on Caroline), seabirds and their eggs, crayfish and coconut crabs. They also burned 7000 sq m of land on South Island and erected a "tin" shack (see photo).

**Vostok and Flint:** We saw no evidence of recent human visitation. However, on Vostok we evaluated the effects of a 4+ month fire, a legacy of the 1977 "scientific" expedition sponsored by the Kiribati government. Dr. Ray Fosberg, an authority on Pacific botany who had visited Vostok in 1934, was particularly concerned about this fire and its effect on the dwindling Pisonia forests of the Pacific. Supplementing field work with a dot matrix over an enlarged aerial photo, we estimated that the fire cleared approximately 1.5 ha. A further unknown amount of land was affected, but because of the natural openness of pisonia forests, the abundance of black algal slime on the trunks, and the natural tendency for the tree's branches to drop off and disintegrate, it was difficult to evaluate the extent of damage to the intact forests. We also suspect that this fire, smoldering in Vostok's damp peaty soil, was responsible for the dearth of coconut crabs on Vostok. Lacking the speed to walk away from the searing heat, and lacking burrows in which to shelter from each other, many must have died or been killed in cannibalistic fights.

On Christmas Is. we were disturbed by the blatant human predation on two islets designated as wildlife refuges (Motu Tabu and Motu Upua). Species included Phoenix Petrels, Wedge-tailed Shearwaters, Red-tailed Tropicbirds, Great Frigatebirds and Red-footed Boobies. On Motu Upua, an islet to which one can wade at low tide, we found mounds of seabird skulls and wings. Naturally, few of the larger species were nesting. We reported this to the Wildlife Unit.

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Marine Mammal Skeleta: We collected ribs and vertebrae of a spinner dolphin at Motu Upua, Christmas Island. The bones, sun-bleached and in excellent condition, have been sent to the National Museum (Wellington, New Zealand). Larger cetacean remains on Vostok and Caroline were measured and photographed.

Marine Mammals : At-sea Observations: During our dawn-to-dusk

"sea-watches" we observed 7 species of cetaceans:

Sperm whale, Physeter macrocephalus

Pilot whale (probably short-finned), Globicephala macrorhynchus

Pacific bottlenose dolphin, Tursiops gilli

Spinner dolphin, Stenella longirostris

Risso's dolphin, Grampus griseus

Common dolphin, Delphinus delphis

False killer whale, Pseudorca crassidens

At each sighting our captain slowed down or stopped Te Manu so that we could observe the cetaceans with minimum disturbance. Data included numbers, behavior, sea temperature, geographic position, time of day, and age structure of the pods. Information on spinner dolphins, was a special request from Michael Poole, Ph.D student at the University of Southern California (Berkeley), whose research base is Moorea, French Polynesia. Michael gave us detailed field forms for cetaceans, which we filled out at each sighting. Marine mammal data will be presented to the Cetacean Group, Mammal Society, U.K.

## I. PHYSIOGRAPHY

- Descriptions of soils and substrates of Vostok and Flint will be written up in scientific papers.

## J. ARCHAEOLOGY and PALAEOLOGY

Caroline: We located both Tuamotan marae (ancient religious sites), one of our primary objectives for this island. We took detailed measurements and photographs of the main, intact marae on Nike Island, which has probably not been seen since the 1870s. The other site was partly washed away by storms, but still recognizable. It was located approximately 100 m north of the southern tip of Long Is. Duplicate color slides, data, and relevant literature have been sent to Prof. Jeff Irwin, Polynesian anthropologist, University of Auckland, New Zealand, who requested this information.

Flint: We took photographs and vegetation notes of the old copra-cutting settlement (abandoned in 1929), which still had cisterns, shacks, and a copra-drying urn. We also explored the entire length of the railroad and guano pits (now swamps) in the interior.

Starbuck: On two trips and two nights here we took photographs of the settlement ruins (north-east point).

Christmas: We collected over a hundred sub-fossil shells from two sites in the interior lagoons. These specimens, together with ecological notes and photographs, were sent to Dr. Gustav Pauley, specialist in molluscs at the Smithsonian Institute.

## COCONUT CRABS

Caroline: We were dismayed to find a dwindling coconut crab population. this enormous crab, up to one meter across (including legs), largest of the world's terrestrial invertebrates, is currently under

consideration for endangered status. Mr. Urima's fishermen have killed an unknown number of coconut crabs, and are not about to stop. As well as eating them they brought a container of formalin to preserve some to sell as curios in Tahiti (see photo). As coconut crabs are a greatly esteemed delicacy throughout their range (Indo-Pacific), and can be kept alive for weeks on a boat, it is only natural that Urima has plans for harvesting them on a larger scale. He may be doing it already. Our rough estimate of Caroline's coconut crab population (Kepler et al, in press) is approximately 2200 individuals. This is only based on daytime transect data, not marking/recapturing at night.



**Flint:** The sole known information on coconut crabs was that they were "abundant" (Garnett 1983); we found them in prodigious numbers. Our population estimate is remarkable and needs some explaining. Using the accepted techniques for estimating coconut crab populations, viz. mark/recapture techniques, Lincoln Index, and the proven fact that only one-third of the crab population is active, we estimate 1,900,000 crabs on Flint. This is roughly one crab per sq. meter. Even considering that the crabs might have been attracted to our study plot, we halved the population estimate and still came up with an overall density of 1 crab per 2 sq meters, or approximately one million crabs. (In actual fact, our plot was in a peripheral forest, part-Cocos and part-native, and our subjective impression was that the crabs were more abundant in the pure Cocos forest, which covers 77% of the island.) The highest density ever recorded is 1 crab per 14 sq m on Ngerkersiul, Palau. We do not have data for crabs on Aldabra (Indian Ocean), which reportedly has "millions" (Dr. Stoddart, pers comm).

We also obtained record data on crab sizes: More than one quarter of our males were larger than the largest coconut crabs ever recorded. In addition, the average size of our females was the exact size of the largest female that Dr. E. Helfman (specialist in coconut crabs) has ever seen.

Measurements of the thorax (carapace) width of 49 randomly chosen crabs follow:

**Males:**  $\bar{x}$  = 149 mm, range 65 - 213 mm. The largest crab ever recorded (from North Keeling Is., Indian Ocean) was 178 mm wide; we had 8 larger than this, averaging 195 mm. Maximum size was a whopping 213 mm ( $8\frac{1}{2}$ ").

**Females:**  $\bar{x}$  = 109 mm, range 63 - 150 mm

The largest female crab reported by Helfman was 109 mm; 50% of our females were larger than this, averaging 139 mm. Maximum female size

was 157 mm

Our coconut crab data, currently being analysed, was requested by the two world authorities on this species: Dr. E. Reese (University of Hawaii, Honolulu, HI) and Dr. E. Helfman, University of Georgia, Athens, GA).

In summary, Flint Is. is an outstanding haven for coconut crabs, perhaps supporting the highest density in the world. This astronomical number of crabs, including a sizable proportion of crabs of world record size - are indeed world treasures. There is no doubt that Mr. Urima (who, as far as we know, is not aware of them yet), will extirpate them for a handsome profit only to himself, perhaps even without the knowledge of the Kiribati Government. It is only a days' trip from Caroline in his fishing boat.

Vostok: Coconut crabs were uncommon; in two days were saw only nine.

## L. MISCELLANEOUS

### Updating of Nautical Information

Following our practical experience and knowledge of the poorly-known southern Line Islands, AKK, GW, and Ron Falconer are collaborating on updating the Pacific Islands' Pilot (British Admiralty and U.S. Hydrographic Office). In addition to information on anchorages, "landings", and climatic conditions during our stay, we have very accurate data on geographic co-ordinates of the islands we visited. Te Manu carried a compact, state-of-the-art navigation aid ("Magellan" GPS NAV 1000), which communicated daily with overhead satellites to compute our exact position. We found, for example, that Caroline was situated one mile east of its charted position; its corrected latitude is  $10^{\circ} 13' S$ .

## "Mailboxes"

As planned in Garnett's initial expedition proposal, we left small plastic containers - with notebook, pencil, brief notes on special island features, and a request to write to the Garnett's c/- ICBP - on Flint and Vostok. The Wildlife Unit at Christmas Island had also built large wooden, engraved signs for erection on the northern Line & Phoenix Is.; these will have to wait until the next expedition.

## Learning Experiences

During our three months in an extremely remote portion of the tropical Pacific, visiting islands notoriously difficult to land on, we learned many refinements in safety procedures, equipment back-up, first aid, sailing techniques, judgement of environmental conditions, and government protocol. We established or strengthened important personal contacts - crucial in developing nations such as Kiribati - which we trust will assist in future dealings relating to conservation. Overall, we are all better prepared for a future, similar expedition. We thank ICBP for their dedication to our efforts, and hope that we can further co-operate to preserve the beauty and valuable ecosystems of these lonely tropical outposts.

## M. CONSERVATION

The ultimate goal of the ICBP Line & Phoenix Islands Expedition was to obtain scientific information to be used as ammunition in the establishment of international preserves.

In this respect we were very successful. The bulk of the information known about the 3 southern Line Islands was gathered in the 1960s and 1970s by the Pacific Ocean Biological Survey Program (POBSP), in 1988 on the US/USSR expedition to Caroline, and on the

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present expedition. Christmas Is. is better known, with conservation information primarily from Garnett in the early 1980s. We can now confidently say that Caroline, Vostok, Flint, and the three major motus of Christmas Island (Tabu, Upua and Cook) eminently qualify for status as international preserves. These islands, and their motus (islets) harbor atoll ecosystems of both national and international importance: breeding seabirds, plant species and forests, coconut crabs, virgin coral reefs, and (for some) remarkable lack of disturbance. All except Vostok are currently threatened by the greedy (= "traditional", but times have changed) activities of man.

A further aspect of the expedition's success revolved around conservation discussions (in person or by phone) with the Kiribati Government: the Ministry of the Line and Phoenix Islands, Christmas Island, and the highest political officer in the nation, Secretary for the Cabinet. We were also able to observe and photograph the exploitative activities of the Tahitian fishermen working for Felix Urima, pending leasee of the atoll. Living with the Falconers on Caroline revealed that they possess a high conservation ethic, an intense love for the atoll, and strong desire to be its wardens/managers. Since our initial correspondence with them 1½ years ago they have learned much about its wildlife, and as a result, have become quite attuned to its rhythms.

Since returning to our respective countries, we have been actively involved in analysing data, sending information, photographs, and conservation recommendations to the central government (Tarawa) and Ministry (Christmas). Our hopes are that an international conservation agency acquire Caroline, Flint and Vostok by outright purchase or by negotiating a long-term lease. The important point is that a proposal involving wildlife protection and management should be more financially lucrative than a developmental one. Since the previous leasee's annual

dues were about 350 for all three islands, this does not promise to be an undue strain on an international agency's resources!

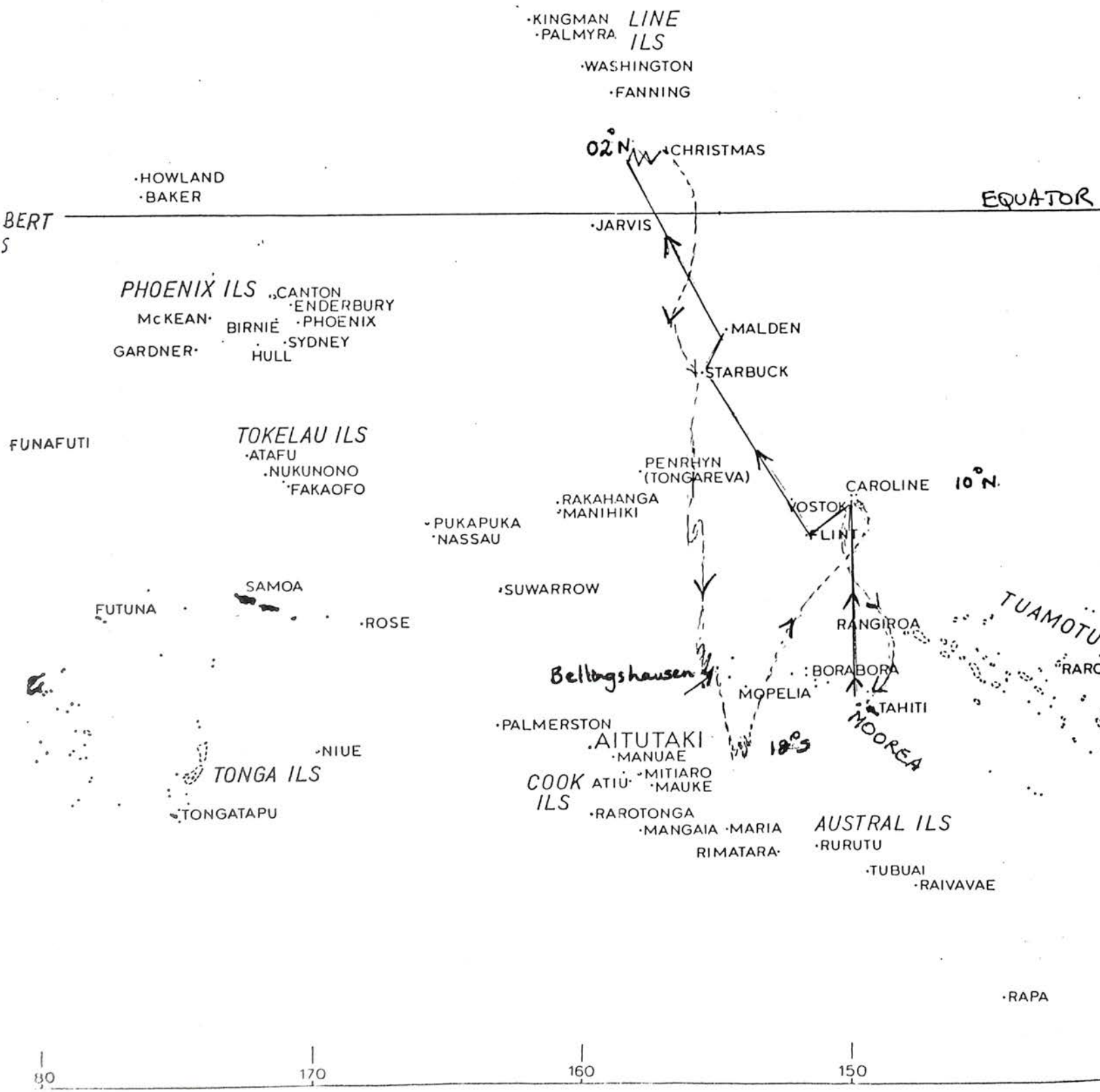
A brief summary of our recommendations, detailed in the accompanying fact sheet on Caroline, are:

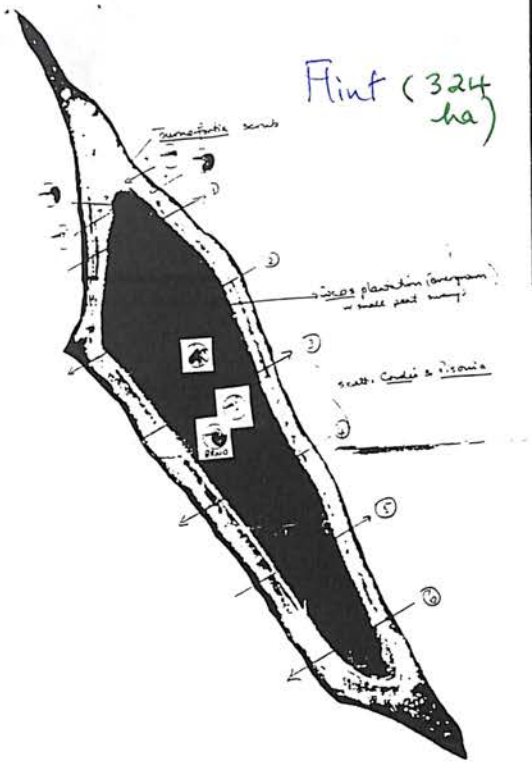
1. Immediate action be taken by the Kiribati Government concerning wildlife management
2. Before Urima's lease to exploit and develop Caroline is fully granted, we wish an alternative proposal involving wildlife preservation and management to be considered
3. That officials seek advice from the Wildlife Unit (Christmas), and from an international group of biologists whose sole purpose for existence is to advise Kiribati on matters pertaining to wildlife (Scientific Advisory Panel for Nature Conservation in the Line & Phoenix Groups - of which Drs. M. Garnett and C. Kepler are key members).
4. That one or more specialists on wildlife of the Line Islands (preferably with a representative from an international conservation agency) accompany government officials on their pending visit to Caroline with Mr. Urima (this visit is necessary before the final contract is finalized).
5. Until measures are taken to adequately protect wildlife and plant communities from further exploitation, we recommend that Caroline's residents, Ron and Anne Falconer, represent the government in monitoring Urima's activities

We also wish to add 6. That the government of Kiribati forbid Mr Urima from further visitation of Caroline, and ban entry to Vostok and Flint.

Note: References in this report are identical to those in the Caroline fact sheet

# LINE & PHOENIX ISLANDS EXPEDITION





Flint (324 ha)

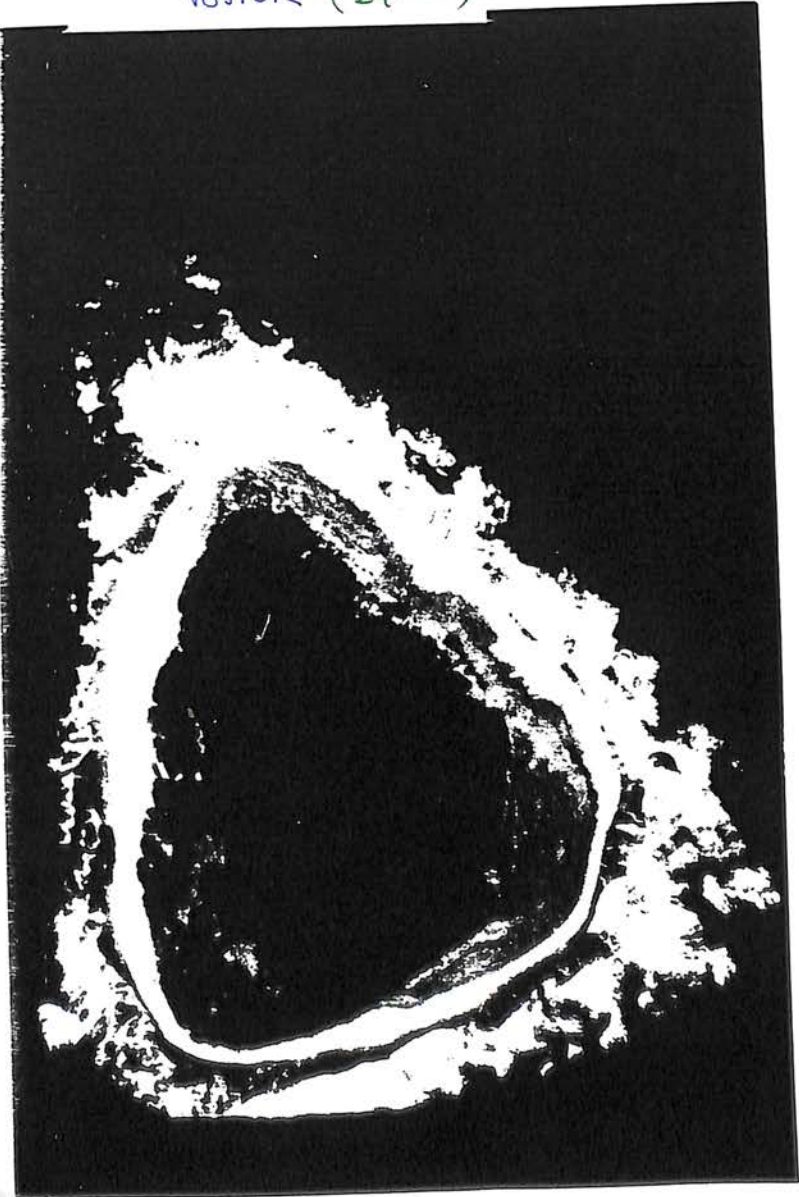
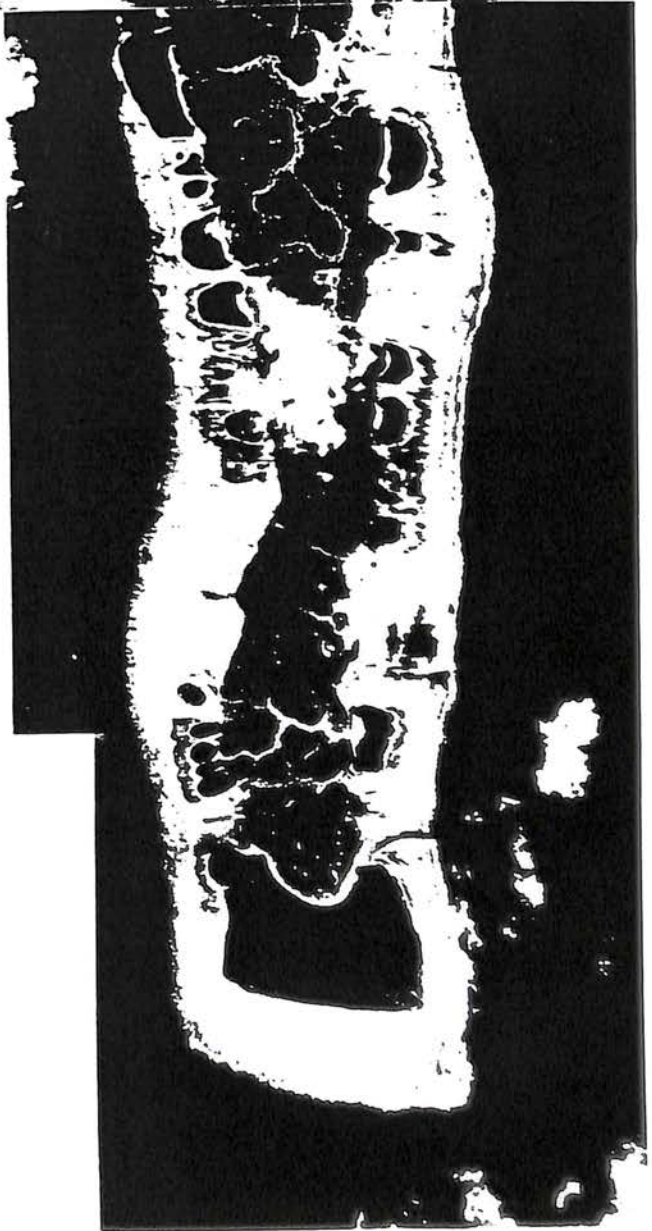


Caroline (399 ha)



1036/92-h

Vostok (24 ha)



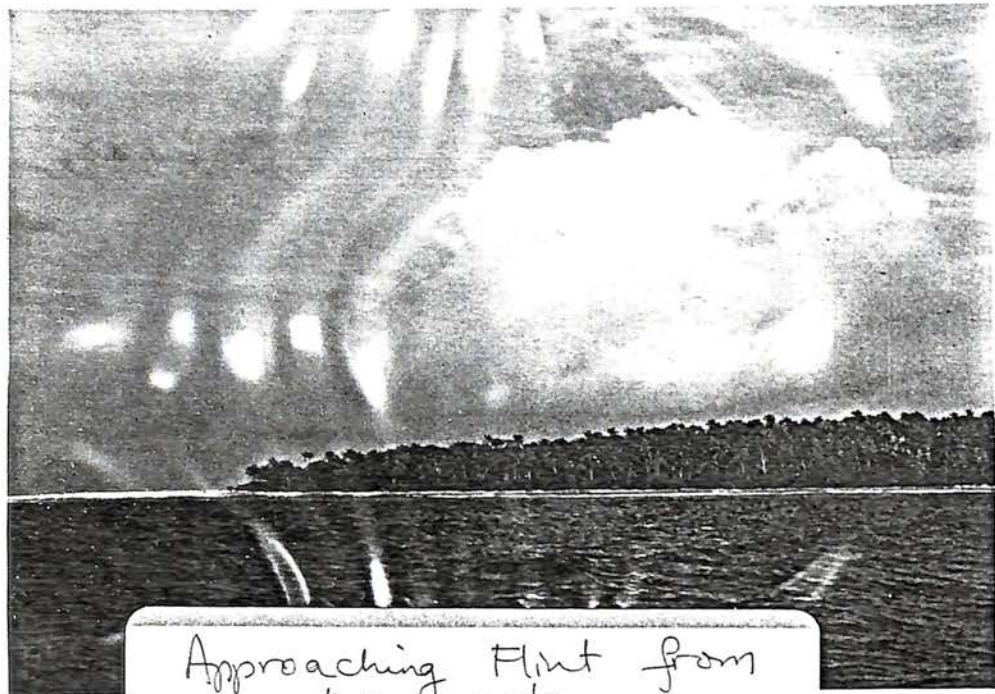


Native buffer zone:  
Pisonia and Tournefortia

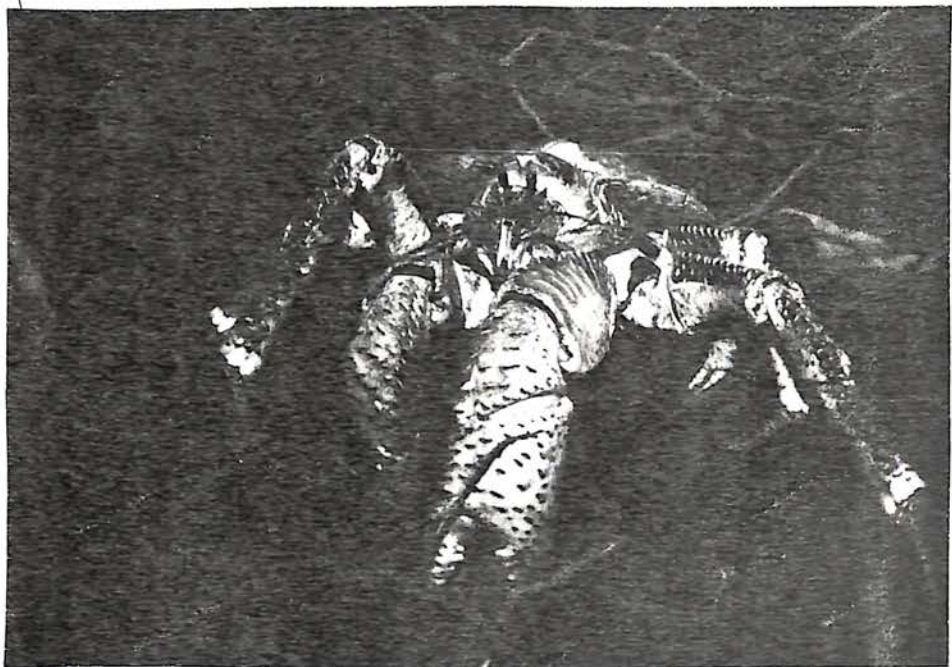
FLINT IS.  
(324 ha)



Largest central pond  
with Cocos and Paspalum (grass)

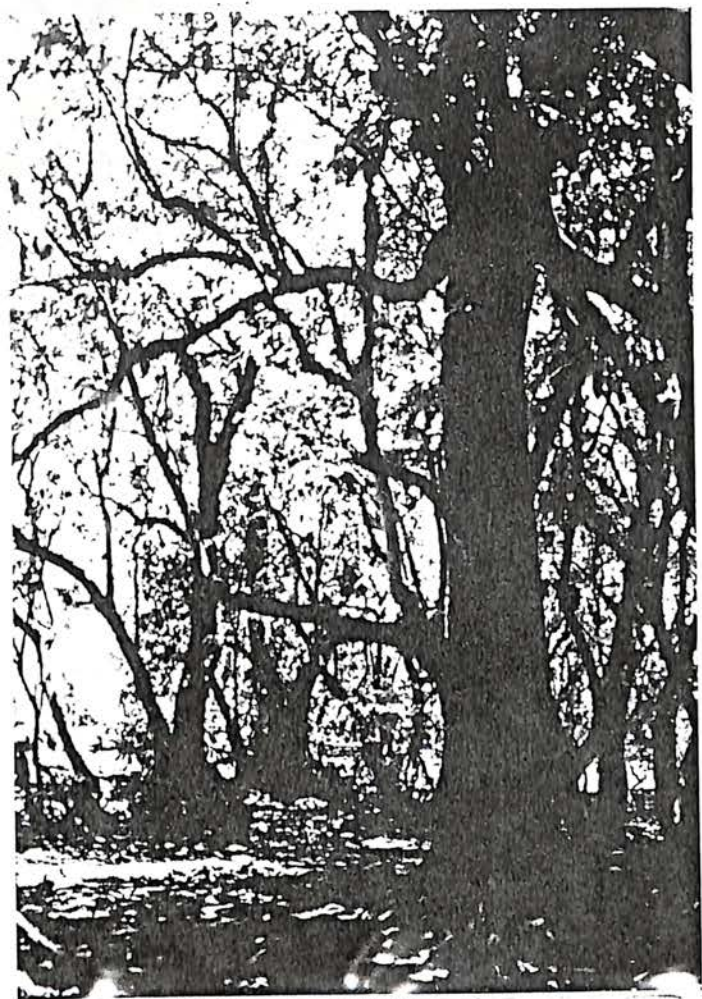


Approaching Flint from  
the West



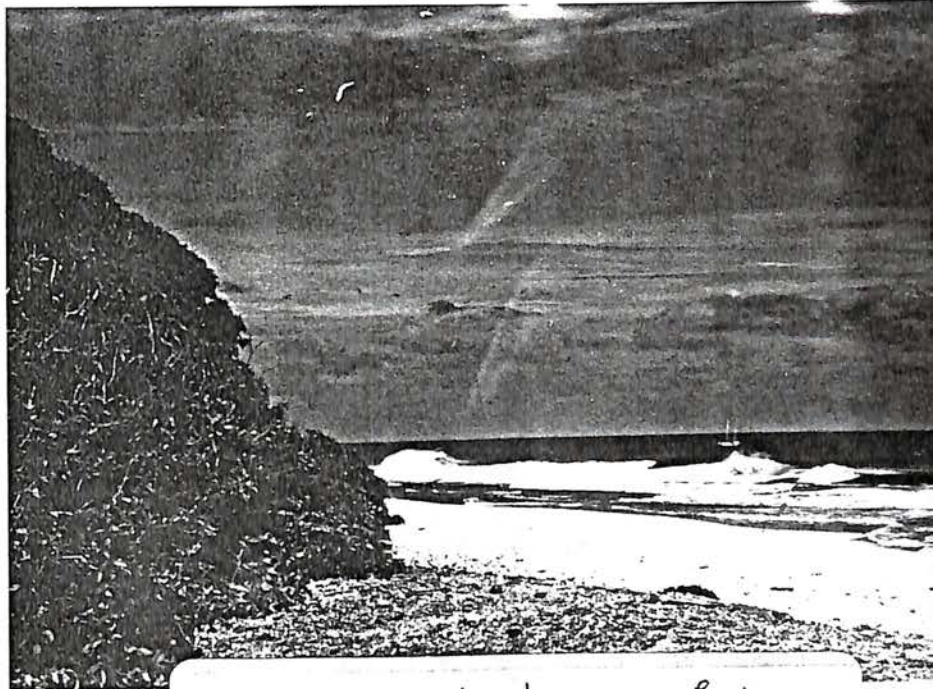
25% of Flint's coconut crabs measured were larger  
than the largest known coconut crabs in the world



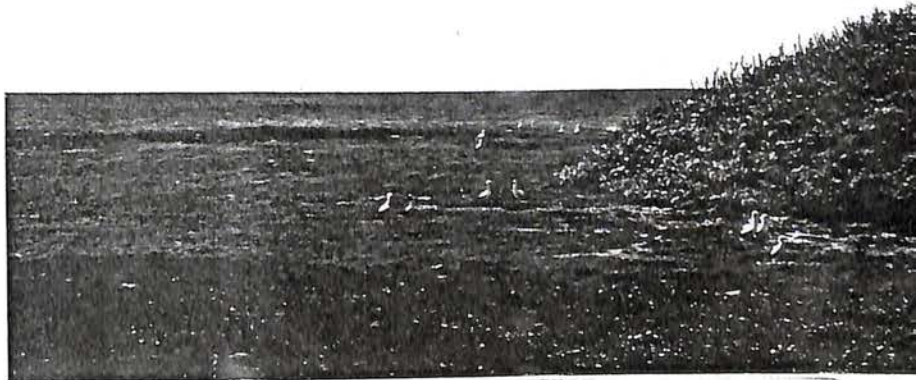


Pisonia grandis (Te Buka)  
Forest

VOSTOK IS. (24-ha)



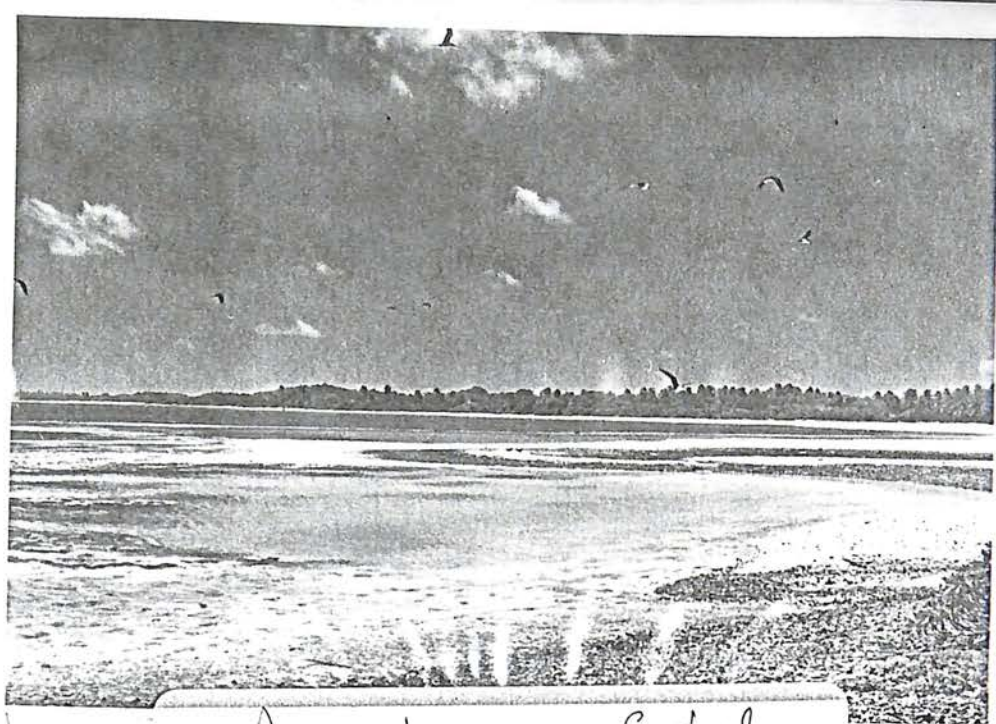
East Coast by reef  
"entrance" with 10m Te Manu



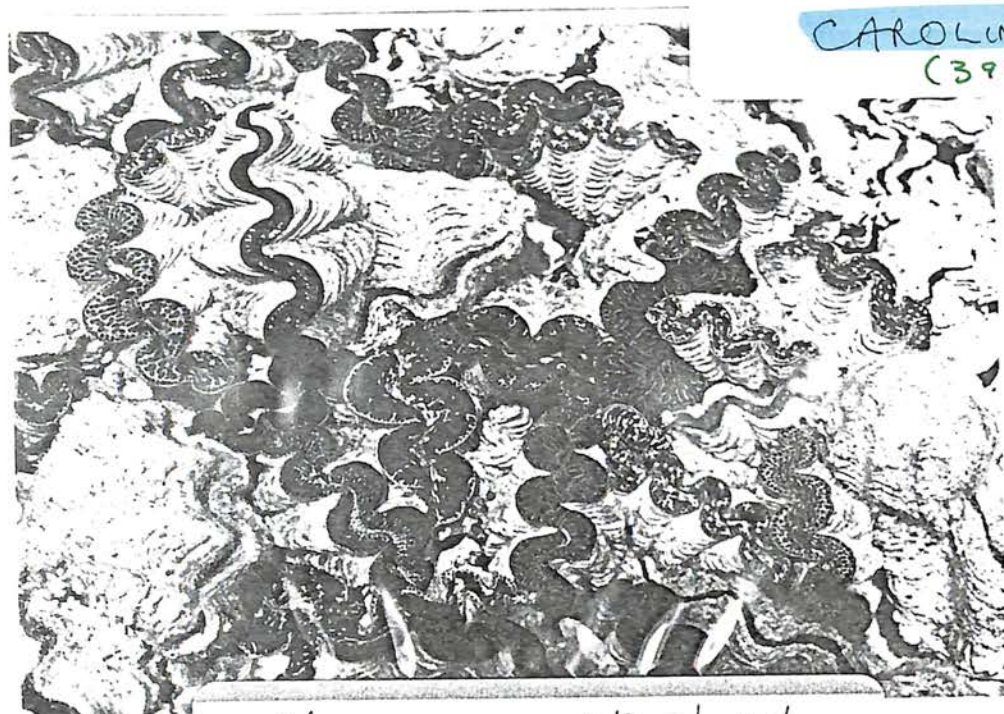
Masked Booby Colony,  
nth. end, Vostok.



stunning Acropora reef with  
high densities, giant clams, (Tridacna  
maxima)

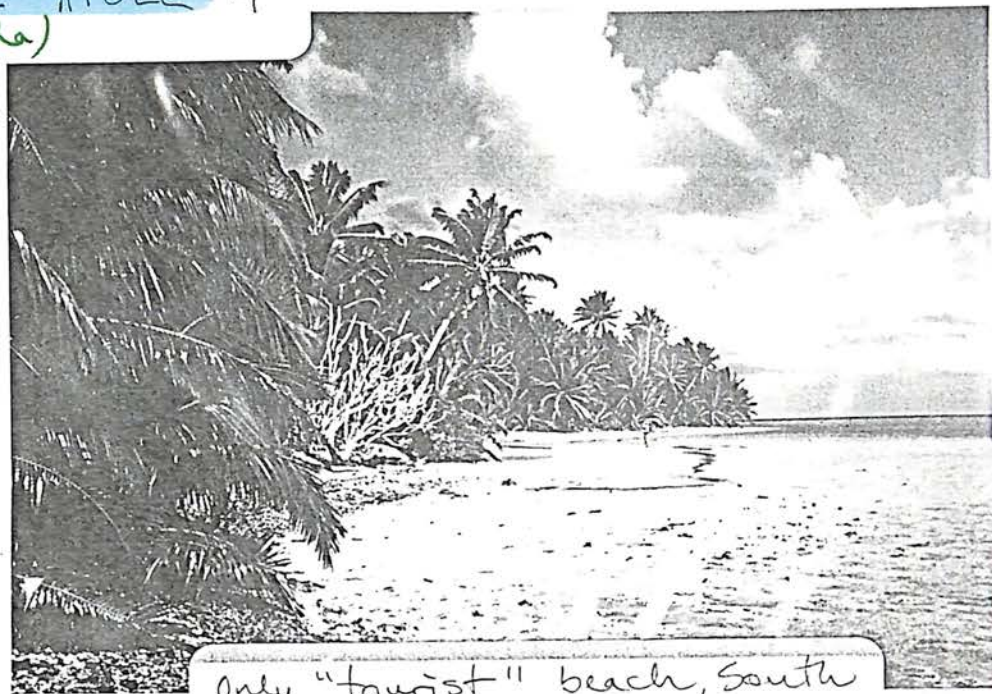


Azure Lagoon, Central  
Leeward Islets



Close-up, multicolored  
mantles of giant clams

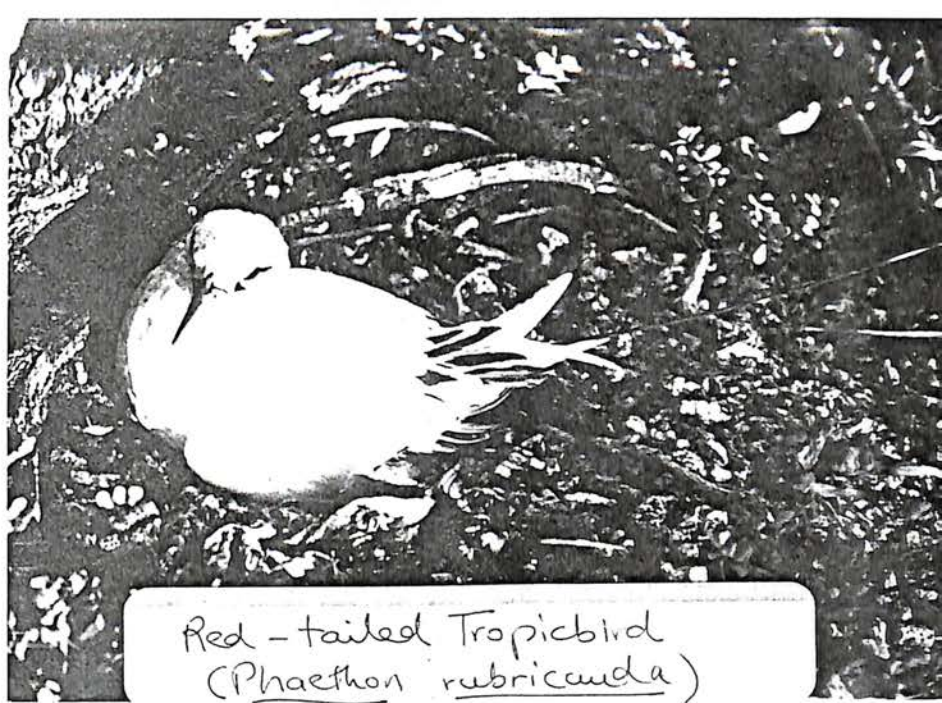
CAROLINE ATOLL -1-  
(399 ha)



only "tourist" beach, South  
Island



WHITE (FAIRY) TERN  
(Gygis alba)



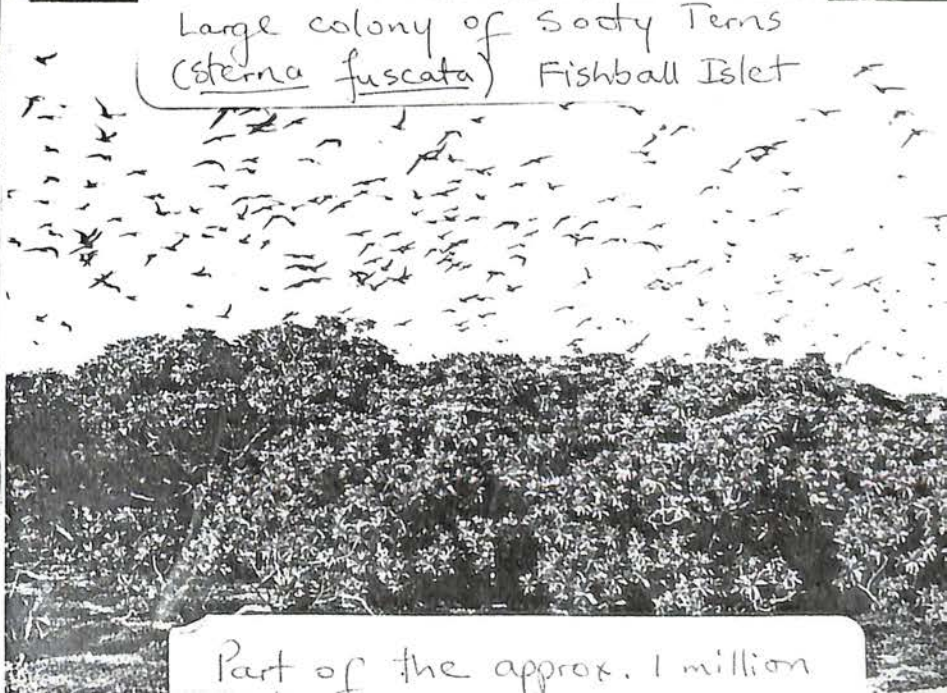
Red-tailed Tropicbird  
(Phaethon rubricauda)



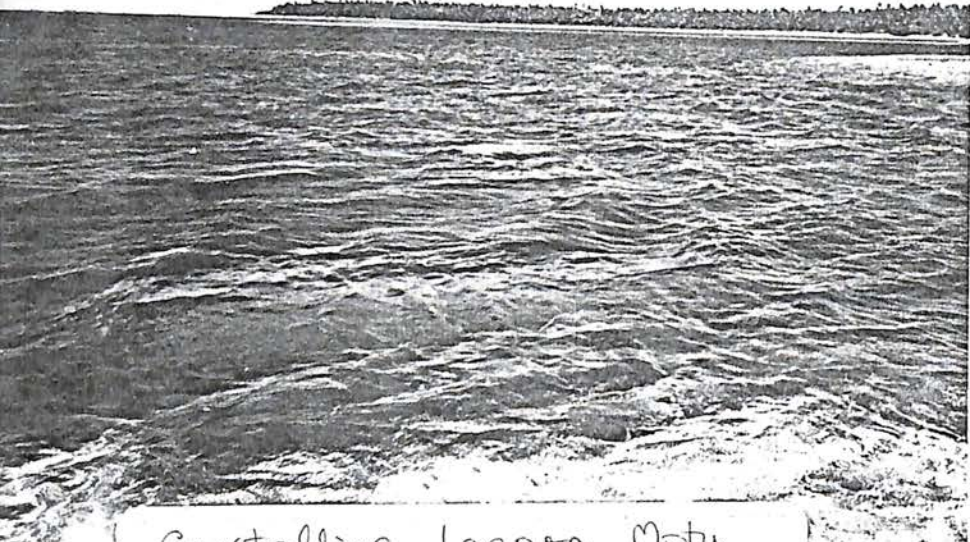
Large colony of Sooty Terns  
(Sterna fuscata) Fishball Islet



Masked Booby



Part of the approx. 1 million



Crystalline Lagoon, Motu  
Ana-Ana towards South Is,



Lagoon bay, Brothers  
Islet



Cordia subcordata, 12.6  
ft., Pig Islet. Rare hardwood



← Morae, Naka Is,

↑  
Close-w. Sooty Tern

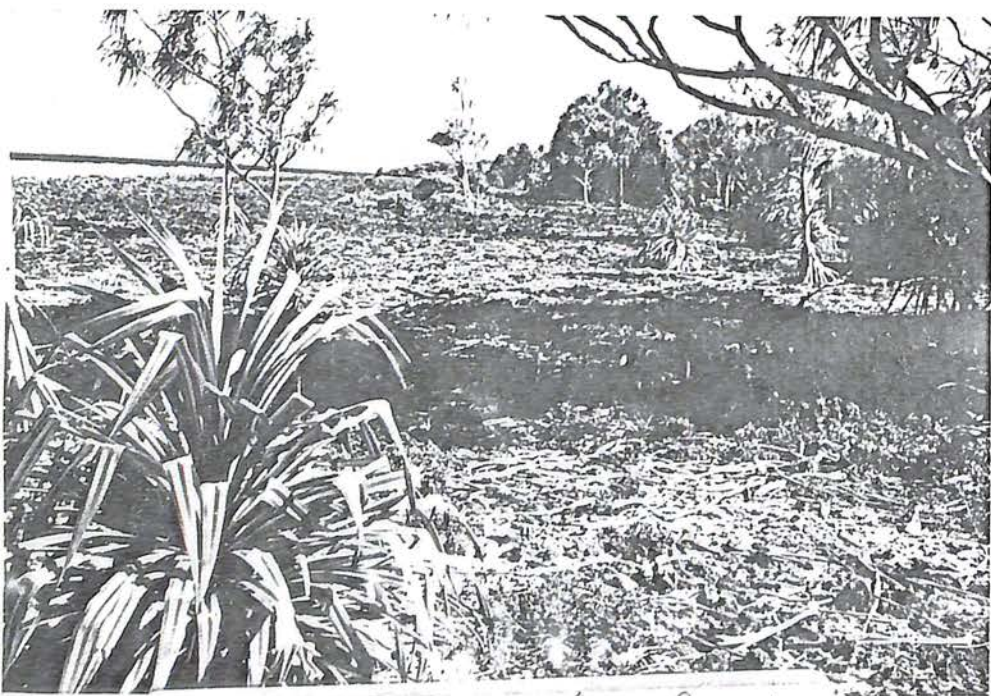
MADE IN U.S.A.  
People involved in trying to protect Caroline, Vostok, Flint



Kay Kepler cuts Martin Garnett's hair



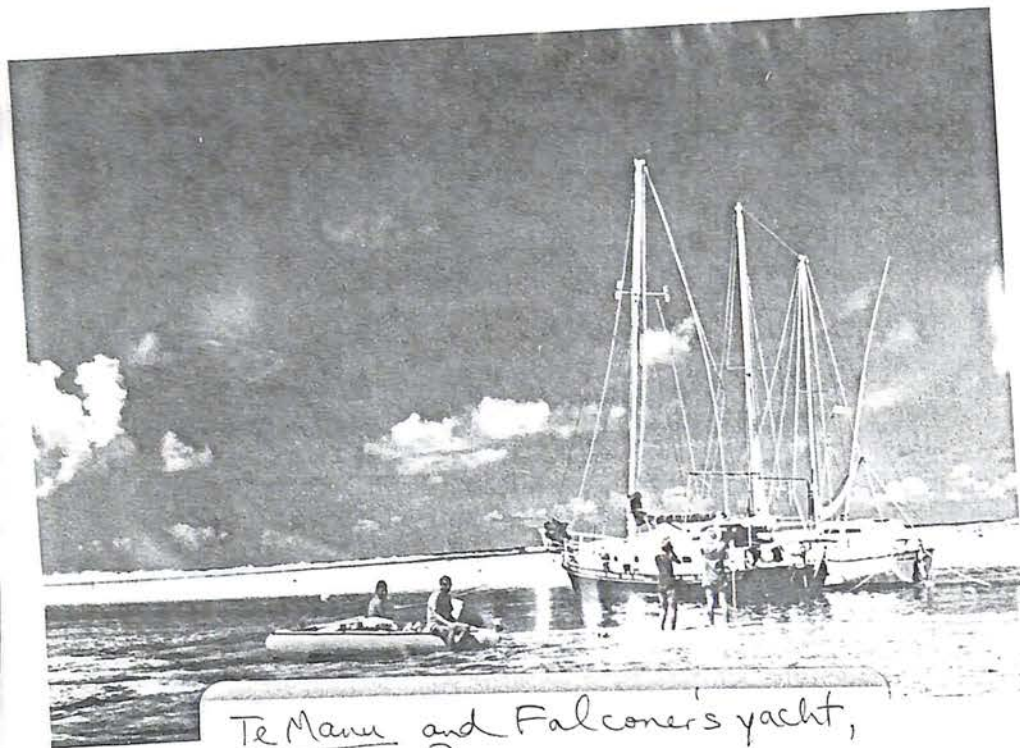
Cam Kepler admires a young Great Frigatebird (from 1988 expedition)



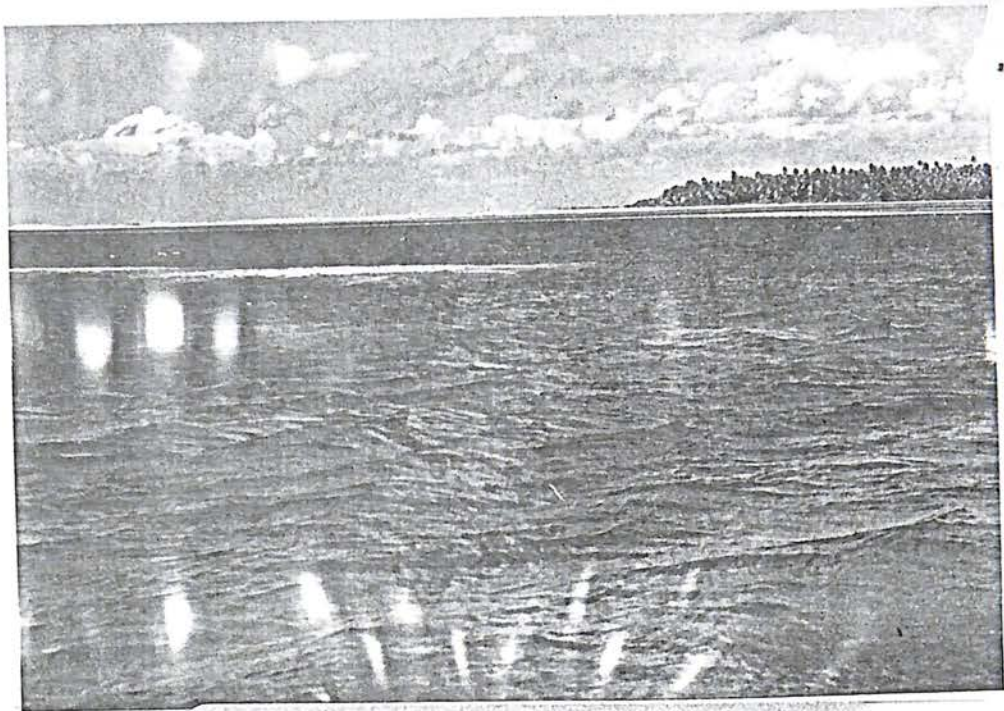
Robinson's forest



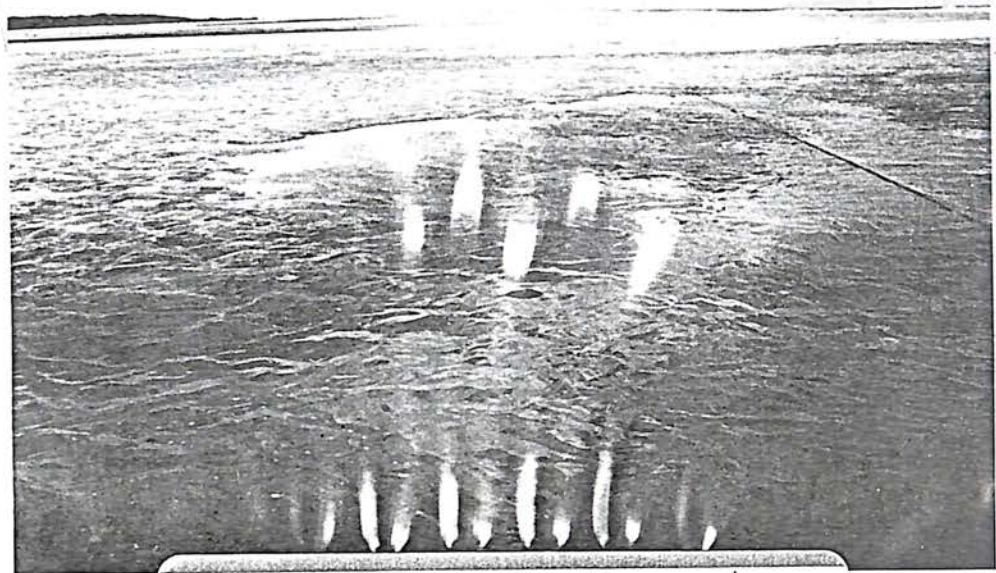
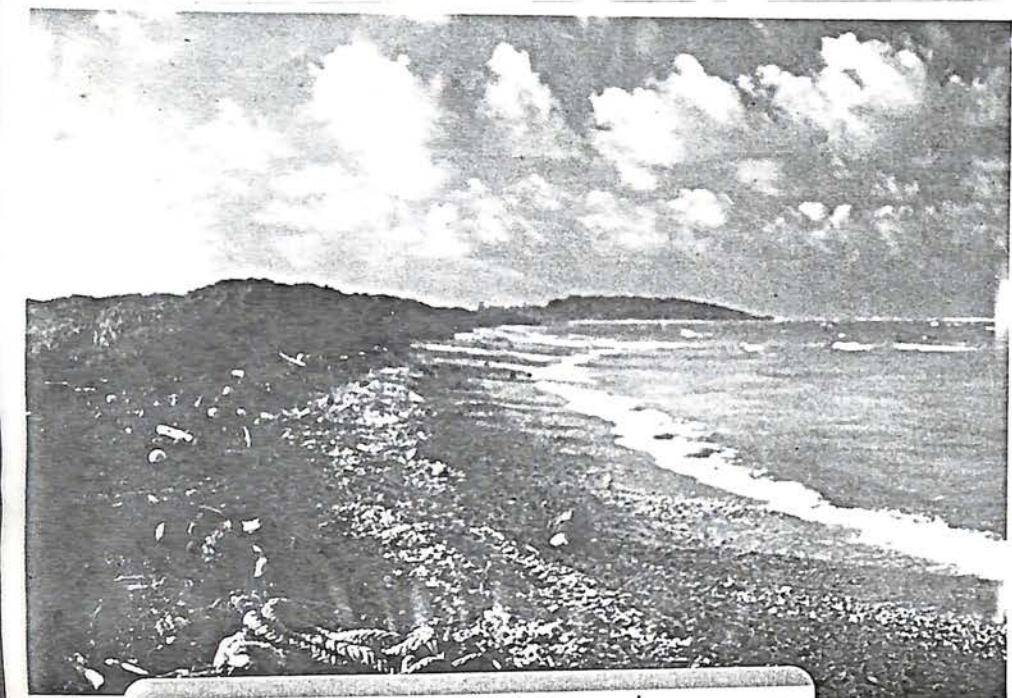
Anne Ron Anais and Alexandre Falconer - sole inhabitants of Caroline



Te Manu and Falconer's yacht,  
Blind Passage



Lower lagoon  
(South Is. in distance)



Blue green clarity and

ICBP

## CAROLINE ATOLL

NAME: Caroline Atoll or Caroline Island

DISTRICT: Southern Line Islands

COUNTRY: Kiribati

REGION: South-central Pacific Ocean

LOCATION: 10°00'S and 150°14'W

MAXIMUM/MINIMUM ELEVATION: 0 to 5 m

SHAPE: A true atoll consisting of a crescentic coral ring of 39 islets centered on a continuous reef enclosing a relatively shallow lagoon

SIZE: 9.7 km long, 2.3 km wide at its widest point

AREA: 399 ha

OWNER: Government of Kiribati, with pending 50-year lease (renewable every five years) to Mr Felix Urima, French Polynesia

PROTECTION STATUS: None

PRINCIPAL PROTECTION MEASURES TAKEN: Since November 1988 two international conservation agencies have been contacted: The Nature Conservancy (U.S.A.) and International Council for Bird Preservation (U.K.). From February to June, 1990, this latter organization (ICBP) part-sponsored the ICBP 1990 Line Islands Expedition, which included ecological surveys of Caroline, Flint and Vostok, as well as discussions with the Ministry of the Line & Phoenix Islands at Christmas Is.

LIST OF HABITATS: Natural herb mats, beach scrub with Suriana, Pandanus forest, Tournefortia scrub and forest, Cordia forest, Pisonia forest, and overgrown coconut woodlands. Atoll is dominated by fairly lush woodlands up to 21 m tall, covering 86% of the land area.

PLANT SPECIES: 25 (excluding extinct and temporary garden species), 80% of which are indigenous (native). Coconuts present, but only dominate one islet; 23 islets harbor wholly indigenous vegetation.

ANIMAL SPECIES: Ten species of seabirds breed: Red-tailed Tropicbird (Te Taake), Brown Booby (Te Kibui), Masked Booby (Te Mouakena), Red-footed Booby (Te Kota), Great and Lesser Frigatebirds (Te Eitei), Black Noddy (Te Mangkiri), Brown Noddy (Te Kunei), White/Fairy Tern (Te Matawa), Sooty Tern (Te Tarariki). Blue-gray Noddy (Te Kunei), and Reef Heron (Te Kaai) probably also breed.

Wintering grounds for at least five species of migratory shorebirds (including Bristle-thighed Curlews) and the

2

Long-tailed Cuckoo (Te Kabunei), a migrant from New Zealand.

Polynesian rats are common to abundant. Green turtles occur in relatively small numbers and probably breed. Three species of skinks and geckos.

Large terrestrial coconut crabs and at least three other species of land crabs are important elements of the fauna.

HUMAN ACTIVITIES: Inhabited by small numbers of Tuamotans in pre-historical times. Never supported a long-term population. During periods of guano export 1873-1895 and copra production 1886-1936 maximum population known was 31 people. From 1936-1987 occasional copra parties from Tahiti.

Very little known by the outside world until 1988. From 1988 to present, inhabited by a single European family. Number of visiting boats increasing.

CURRENT EXPLOITATION: In March 1990 Urima, though his lease is not yet fully approved, nor does it include exploitation of the lagoon and seaward reefs, began commercial fishing along Caroline's outer reefs and within the lagoon (2 tons of fish on his first trip). His Polynesian workers have also killed dozens of coconut crabs (for eating and preservation in formalin for curios), and unknown quantities of green turtles, seabirds, seabird eggs, giant clams, lobsters and marine crabs. Urima's plans for the exploitation of Caroline include exporting timber, running a small hotel and casino, pearl culture, turtle farming, constructing an airstrip and blasting a channel through the leeward reef. In April 1990 he also permitted a large cruise ship, the World Discoverer, to take tourists to Caroline without consulting the Kiribati Government.

CONSERVATION IMPORTANCE: Caroline, with the majority of its islets still in pristine condition, is one of the most beautiful, least spoiled atolls in the Pacific. The Line and Phoenix Is., of which Caroline is a part, harbor some of the largest colonies of tropical seabirds in the world, and many of the last breeding refuges in the Pacific. It is important that Caroline, whose exploitation is just beginning, should be protected immediately.

Caroline Atoll's most outstanding attributes, annotated in the appendix to this report, are:

1. Seabird populations of national and international importance
2. Plant ecosystems (including Pisonia, Cordia, and Tournefortia forests) of national and international importance
3. Its geology, and marine and terrestrial ecosystems are prime outdoor ecological laboratories for research on ground water, fish poisoning and numerous facets of ecology
4. Coconut crab populations of Pacific-wide importance



5. The stunning beauty of its multicolored lagoon-reef system and its lushly wooded islets (see photos)
6. Outstanding coral reefs thickly studded with giant clams
7. Breeding site for green turtles
8. Ancient Tuamotan marae

EFFECTS OF DEVELOPMENT AND EXPLOITATION: Man's presence anywhere - especially on pristine or near-pristine islands - brings rapid, generally irreversible, changes. There are few, if any, islands remaining in the Pacific which can claim the impressive array of conservation features exhibited by Caroline, thus it is imperative that such a relatively untouched island should remain undeveloped.

Currently Caroline is uninhabited, except for one family of volunteer caretakers who live a spartan yet ecologically sound lifestyle. There are no roads, stores, vehicles, stores, jetties, services (water, sewage, food), and no communication except a private HAM and marine SSB radio. There is no passage into the lagoon or safe sea anchorage.

There are many factors to consider before allowing even a small amount of development on Caroline:

1. It is not an island for tourists. It has high populations of rats and mosquitoes. It is several days' boat trip from medical aid (Tahiti, 830 km distant) and there is no airstrip. The lagoon has many sharks, dangerous to swimmers.
2. It is hot and humid, with no beaches suitable for sunbathing. Sand comes and goes with storms, leaving coastlines thickly littered with coarse coral rubble.
3. Solid waste and sewage disposal pollute lagoons, killing corals, destroying the immaculate clarity of the waters, and ushering in fish poisoning (ciguatera).
4. People introduce weeds and garden plants, which interfere, often drastically, with natural ecosystems. This has happened on every inhabited island in the world, resulting in diminishing numbers and extinctions of plants, seabirds, insects and others forms of wildlife.
- (3) 5. Caroline has no water supply except rain. Efforts to dig for drinkable ground water have been unsuccessful.
6. There is no commercial timber. Urima's plans include timber export, yet he has not yet visited Caroline, and knows nothing of its conservation attributes or international worth. He is ignorant of its types of trees and hence their unsuitability for commercial harvest. For example, wood from the tallest trees, pisonia or Te Buka (Pisonia grandis), is soft and spongy, disdained by Polynesians even for firewood!
7. There is no passage into the lagoon. Blasting a channel

through Caroline's reef would:

- a) be a difficult and prohibitively expensive task. It will destroy the wilderness nature of Caroline by creating enormous piles of rubble and debris and opening the way for increasing numbers of people, pollution, and wildlife destruction
- b) be useless because the lagoon is shallow and criss-crossed with a maze of reefs over most of its lower end and middle half (see aerial photos). These are Caroline's most stunning reefs; anchors, sewage, detergents and other pollutants will soon kill them.
- c) be impractical, as no boats, keeled or not, are suitable to Caroline's lagoon. Even inflatables cannot venture up-lagoon without the passengers "walking" the boat across shallow sections.
- d) alter the flow dynamics of the lagoon, especially during outgoing tides, when the trapped water level is higher than the surrounding sea. A deep-water passage would expose the lagoon reefs and clam beds to the air as much as 1.5 feet (0.5 m), causing deterioration. Simultaneously the lagoon level would fall, making it even less appropriate for boats.
- e) introduce fish poisoning, a direct and predictable result of reef disturbance and pollution.

8. People disturb and destroy wildlife. Traditionally, islanders eat marine life, clear land, eat coconut crabs, etc. but in an overpopulated world with fast disappearing resources, traditions must change.

9. Overfishing occurs. Caroline's fish are typically more abundant and larger than those of inhabited atolls. However, commercial fishing rapidly reduces both numbers and size of fish.

6. There is no excess of tourists or shortage of beautiful islands nearby. No part of the Society Islands, including Tahiti (having the closest international airport), has a booming tourist industry. French Polynesia includes dozens of gorgeous high islands and atolls which can adequately, and more cheaply, serve as tourist destinations. Getting to, and staying in, the Society Islands is very expensive already. Bringing tourists from a French dependency to Kiribati also creates immigration problems (now it is all done illegally!) High islands such as Moorea are far superior to Caroline from a scenic point of view. There is no purpose in spoiling another atoll, especially when the Kiribati Government is not contributing workers or receiving any of the profits!

#### RECOMMENDATIONS

1. Immediate action be taken by the Kiribati Government on matters concerning Caroline.

During the last two years Caroline has become more visited than ever before, mostly without the knowledge, or consent, of the Kiribati Government. Caroline could easily become the "new Suvarov" or "new Palmyra", atolls which became

so popular that the former is now a Cook Islands' National Park, and owners of the latter (a private, U.S.-owned island south of Hawaii) are actively seeking protection status for it. Illegal activities, wanton destruction of wildlife, littering, lagoon pollution, and even a scandalous murder on Palmyra, prompted these changes. Neither is as pristine as Caroline.

It is urgently requested that the Kiribati government understand the aesthetic and conservation values of Caroline and act quickly to ensure its protection before it is too late.

2. Before Urima's lease to exploit and develop Caroline is granted, an alternative proposal involving preservation of its wildlife, should be considered.

This idea was suggested by the Ministry for the Line & Phoenix Is. and is excellent. We heartily endorse it, and will co-operate to bring this about. Reports will continue to be sent, and liason with the Wildlife Unit and conservation agencies will increase. The same applies to Flint and Vostok Islands.

3. Because the Kiribati Government has sensibly established policies for protecting wildlife, it is recommended that officials seek advice both from the Wildlife Unit on Christmas Island, and from the group of international biologists whose sole purpose for existence is to advise Kiribati on matters pertaining to Wildlife (Scientific Advisory Panel for Nature Conservation in the Line and Phoenix Groups\*).

One of the panel members and his wife (Drs. Cameron and Kay Kepler), as well as Katino Teeb'aki (Wildlife warden, Christmas Is.) visited Caroline with the Russian Expedition in 1988, becoming the first biologists to thoroughly survey the entire atoll. A short report and draft of a long one have been sent to Christmas Is. Teeb'aki's report (attached) highly recommends that Caroline be afforded full protection, possibly as an International Biosphere Preserve.

Another panel member, Dr. M. Garnett, lived three years on Christmas Is., instigated the Wildlife Unit, and supplied detailed reports on wildlife management of the Line & Phoenix Is. to the Kiribati Government. He was the force behind the 1990 ICBP Expedition to the Line & Phoenix Is., and co-leader with Dr. Kay Kepler (above). The 1990 expedition visited Caroline, Flint, Vostok and Christmas Islands. Dr. Garnett and the Keplers are also exploring the possibilities of a World Heritage Site and or Nature Conservancy (U.S.) Preserve.

4. As part of the conservation proposal, it is recommended that one or more authorities on the wildlife of Caroline accompany government officials on their pending visit to the island with Urima.

If two lease proposals are to be considered, then each should be fairly represented before Caroline's future is determined. Urima's lease is for 50 years. Both the financial

and conservation benefits to the Kiribati Government resulting from such a long-term commitment need careful consideration.

Caroline is very remote. It takes much time, effort and expense to visit it, therefore any opportunity should maximize the number of people who may be influential in shaping its future.

The Keplers, world authorities on Caroline and experienced environmental consultants, are offering their free services to the Kiribati Government for consultation (see attached letter). If possible, one or more representatives from international conservation agencies should also be included.

5. Until measures are taken to adequately protect wildlife and plant communities from further exploitation, it is recommended that the Kiribati Government appoint Caroline's residents, Ron and Anne Falconer, to be their representatives in monitoring the activities of Urima

The Investment Proposal by Urima to develop Caroline and Flint Islands (MTIL Memo No. 85/89, attached), states that he wishes to lease "an area to be identified by him on either or both of the islands". However, despite the fact that his lease has not yet been fully approved, his men are taking fish, turtles, seabirds and their eggs, crayfish, and terrestrial coconut crabs. Unless a manager is on the island to monitor his activities, what will stop him from disturbing and killing wildlife from the lagoon and islets that he is officially not leasing? The fact that his workers are killing turtles illegally indicates that they disregard wildlife laws.

As mentioned earlier, Caroline is very isolated and the close monitoring of Urima's projects, as requested in Memo 85/89, is impossible unless the Falconers, voluntary wardens of Caroline, be designated as the Government's appointee. (Please note that the Falconers, for conservation reasons, have killed no turtles or seabirds, hardly any coconut crabs, and take no more fish than they can eat daily).

5. If a proposal for Caroline's conservation, rather than for its exploitation, is accepted, the next step would be for the Kiribati government to work directly with the conservation agency on financial and legal matters.

The island's previous lease-holder, Mr. Omer Darr, paid relatively small annual dues to cover three islands: Caroline, Vostok and Flint. If Urima's dues, covering only Caroline and Flint, are comparable, there is no doubt that a conservation agency will be happy to discuss a more profitable financial contract with the Kiribati Government, in the interests of protecting wildlife.

It is possible that a small amount of wildlife oriented tourism might be possible on Caroline, for example, day-visits from cruise ships. This has already happened once; in April 1990 the World Discoverer visited Caroline without the knowledge of the Kiribati Government. This ship plans to

return to Caroline.

Wildlife oriented tourism forms part of the Management Plan for Nature Conservation in the Line & Phoenix Islands (Garnett 1983b). It is already operating on Christmas Island, and has been recently proposed for Kanton. The governments of countries such as Kenya, Costa Rica, Seychelles Is. are discovering financial benefits to "ecotourism".

## CONSERVATION ATTRIBUTES OF CAROLINE ATOLL

## 1. Seabird populations of national and international importance

Kiribati, though a small island nation, probably supports more seabirds per land area than any other country in the world. Its rich seabird reserves, notably those of the Line and Phoenix Islands, are crucial for tropical seabirds throughout the Pacific. These uninhabited islands provide safe breeding locations for many millions of birds. Caroline's breeding seabirds constitute important elements in the overall wildlife reserves of Kiribati. Up till 1988 the quality and quantity of Caroline's plants and animals were not realized.

Caroline harbors ten species of breeding tropical seabirds and two other possible breeding species. Highlights include:

- a) Several colonies of Te Tarariki or Sooty Terns (Sterna fuscata), totalling approximately one million birds
- b) The fifth largest colony of Te Kota or Red-footed Boobies (Sula sula) in the world (7,000 birds)
- c) One of the largest Te Matawa or Fairy/White Terns (Gygis alba) colonies in the world, and the largest colony in Kiribati (8,000 birds).
- d) The largest population of Te Mangkiri or Black Noddy (Anous tenuirostris) in the Line Islands: 17,000 birds. These are primarily associated with Caroline's outstanding Pisonia forests (see below).
- e) Substantial numbers of Te Eitei or Great Frigatebird (Fregata minor) : 6,100 birds.
- f) Sizable population of Te Kunei or Brown Noddy (Anous stolidus): 3,000 birds.
- g) An important breeding site for Te Taake or Red-tailed Tropicbird (Phaethon rubricauda), a ground nesting seabird which suffers particularly heavy predation on inhabited islands. Its principal predators are people, cats and dogs, none of which are present on Caroline (the Falconers, Caroline's sole family, do not kill seabirds).

## 2. Plant Ecosystems of national and international importance

Caroline's lush, pristine and near-pristine woodlands cover 70% of the atoll's land area, and include tree species which, though formerly widespread in the Pacific, are now quite rare.

In addition, Caroline's flora is 80% native (indigenous). In other words, eight out of ten of its plant species occur naturally. This is an extremely high percentage, shared with only a handful of other islands in the Pacific (primarily those in Kiribati).

Caroline only harbors three species of weeds (exotic introductions: Malvastrum coromandelianum, Phyllanthus amarus, Cyperus brevifolius). To date, all occur in a tiny area around 3 square meters on South Island. Once again, this is remarkably low number of introductions for any island in the world\*\*.

\*\* This figure does not include a few Polynesian introductions: coconut, breadfruit (one tree), Polynesian arrowroot, and pandanus (probably also native). The small number of garden plants are not included, as none have escaped into the wild.

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a) Te Buka or Pisonia (Pisonia grandis) Forest (62 ha)

Reaching to 21 m tall, this majestic forest occurs on 29 of the 39 islets (74%). Although not as large as the prime forests on Washington and Fanning, (Nth. Line Is.), which enjoy a heavier rainfall, those on Caroline nonetheless constitute some of the finest representatives of this forest community in the entire Pacific. Although precise information on the dimensions of Te Buke forests elsewhere does not exist, the groves on Caroline may well cover a larger area than on any other Pacific island.

b) Te Kanawa or kou (Cordia subcordata) Forest (26 ha)

Today a rare forest hardwood on Pacific islands, Cordia groves on Caroline reach 15 m tall, having trunk circumferences (breat height) up to 156 cm. These groves, though patchy, and often occurring in mixed woodlands, are widespread on Caroline. Research and information from the foremost Pacific botanist, Dr. Ray Fosberg, indicates that the Te Kanawa groves on Caroline cover a greater than on any other Pacific island.

This is the only hardwood on Caroline. Because of its scattered distribution, it would be very difficult to harvest. Almost all the trees were taken last century from the largest, and most accessible island, South Is. Because of the rarity of this species, Urima should not be given permission to cut even one tree of Te Kanawa.

c) Te Ren or tree heliotrope (Tournefortia argentea) scrub and forest (146 ha)

Abundant on Caroline on every islet except tiny dots of pure coral rubble, Te Ren forms 40% of the atoll's woodlands. Caroline's scrub and forests of this species are some of the most extensive in the Pacific; on most other islands Te Ren forms only a fringe around the coast, but on Caroline it extends well inland.

3. Caroline is ideal for scientific research involving atoll vegetation, geological processes, marine biology, and the ecological relationships of plants and animals on islets of different sizes. It also provides a rare example of an "outdoor ecological laboratory", ideal for to human-oriented studies such as underground freshwater supplies and biomedical research such as fish poisoning.

Near-pristine Caroline contains 39 islets ranging from tiny (0.02 ha) to relatively large (107.50 ha), as well as three incipient islets. Though seemingly of academic interest, research on plants, birds, geology, soils and marine animals is of great practical importance. Valuable clues as to the nature of underground water supplies from an untouched island such as Caroline may lead to a better understanding of the regulation of water supplies on inhabited islands.

Similarly, marine biological and biomedical research could unearth further clues as to the causes and treatment of fish and crab poisoning, tropical infections, etc. Such topics become increasingly important as more and more islands are subjected to marine disturbance and pollution. For example, the abundant red snapper (Lutjanus vaigiensis) and red spotted crab (Carpilius

maculatus), both of which are notorious for their potent poisons (at times leading to death), are safe to eat at Caroline.

Caroline would be, in all types of research, a "control" area lacking many of the problems and pollution that beset other islands today. Research projects, carried out by a small number of biologists based on a ship, would result in minimal disturbance to the atoll.

#### **4. Coconut Crabs are present in fair numbers (1100-1500)**

Coconut crabs (Birgus latro), the largest terrestrial invertebrate in the world, are now rare or absent on inhabited islands. Their abundant, delicious meat and oily abdomens are deemed great culinary delicacies on islands throughout the Indian and Pacific Oceans. These huge crabs, with leg-spans over approaching one meter when fully mature, are the first animals to be extirpated when people begin to inhabit islands.

They are common on Caroline, occurring primarily in the coconut woodlands, but also within natural woodlands such as pisonia (Te Buka) forest.

#### **5. Caroline's lagoon has exceptional aesthetic beauty; its lagoon waters are stunning in their crystalline clarity and exquisite colors**

Beauty is a relative and abstract concept. Enclosed are some photographs, which may convey, in a small way, the remarkable beauty of Caroline's lagoon. Few people have visited Caroline, therefore opinions are few. However, eight of the nine biologists who have visited Caroline on scientific expeditions during the last two years have travelled extensively in the Pacific and Indian Oceans, the Caribbean Sea and Southeast Asia. In addition, the Keplers lived for 14 years in Hawaii and Dr. Garnett, three years on Christmas Island. None of us have seen colors and clarity which are as immaculate as those at Caroline. For this attribute alone Caroline should be preserved, as a reminder of the beauty and harmony of pristine lagoons and coral reef ecosystems.

#### **6. Giant clams are superabundant**

A maze of patch reefs and coral "mushrooms" crisscross the lagoon, supporting abundant vertebrates and invertebrates. Of particular interest is the superabundance of giant clams (Tridacna maxima), whose multicolored, iridescent "lips" (mantles) dot the reefs with vibrant color. These are tightly packed along and within the coral up to the second highest density ever recorded: 40 clams per square meter.

#### **7. Green Turtles occur in small numbers within the lagoon and Caroline's surrounding seas.**

Te On or green turtle (Chelonia mydas) is a fully protected animal on Caroline (Wildlife Ordinance No. 2 of 1975, Schedule 2). It is not common, as Caroline does not have large areas of sand. It apparently breeds, or at least attempts to breed, as the 1990 Line and Phoenix Islands Expedition found several old nesting holes.

#### **8. An ancient Tuamotan marae still exists.**

Basically undisturbed since the 1870s, this relic of prehistoric



11  
occupation is worthy of protection, and is the only Tuamotan marae  
(ancient religious site) in the Line and Phoenix Islands.

\* Address of the Scientific Advisory Panel for Nature Conservation  
in the Line and Phoenix Islands:

c/- Dr. M. Garnett, Maes Llech, Rhydymain, Dolgellau, Gwynedd, North  
Wales, United Kingdom or

Dr. C.B. Kepler, U.S. Fish and Wildlife Service, School of Forest  
Resources, University of Georgia, Athens, Georgia, U.S.A. 30602

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- Kepler, A.K. and C.B. Kepler. In prep. Ecological Studies of Caroline Atoll, Republic of Kiribati, East-central Pacific Ocean. Part I. History, Physiography, Botany, Coconut Crabs and Islet Descriptions. 178 pp, 57 figs, 12 tables, 81 plates.
- Kepler, C.B., A.K. Kepler, and D.H. Ellis. In prep. Ecological Studies of Caroline Atoll, Republic of Kiribati, East-central Pacific Ocean. Part II. Seabirds, Other Terrestrial Vertebrates, and Conservation. 100 pp, 12 figs, 4 tables, 2 plates.

Bearded Lizard (*Grammatophora barbata*), and the White-streaked Earless Lizard (*Tympanocryptis lineatus*); also four Lizards (in spirits) from Mt. Stanley, North-Eastern Victoria. By Mr. G. A. Keartland.—Eggs of 17 species of Water Birds, including the Painted Snipe. By Mr. P. A. Forbes-Leith.—Case of Little Falcons from Java; ethnological photographs from India. By Mr. G. Lyell, jun.—Specimens of Larva, Pupa, and Imago of Butterfly (*Pyrameis itea*); specimens of *Danais petilia* and *Heteronympha merope*, showing locality differences. By Baron F. von Mueller, K.C.M.G.—Three plants new for Victoria, viz., *Caladenia cairnslana*, *Aster picridifolius*, and *Calocephalus drummondii*. By Dr. Ralph.—Specimens under microscope in illustration of paper. By Mr. J. Searle.—Insects collected at Tooradin excursion.

After the usual *conversazione* the meeting terminated.

### NOTES FROM MALDEN ISLAND.

By A. J. CAMPBELL.

(Read before the Field Naturalists' Club of Victoria, 9th September, 1889.)

As Malden Island has a bearing with regard to the geographical distribution of many Australian sea-birds, and as several of our members have received skins and eggs from that remote quarter, the following notes may be of interest, if not of value. The notes are most kindly supplied especially for this club by Messrs. J. T. Julian and Fred. J. Fox.

Malden Island is an integral part of the British Dominions, situated in the mid Pacific in 4° 4' south latitude and 154° 58' west longitude, or about 4,000 miles from Melbourne. The island is of coral formation, only about six miles in diameter, and enclosing completely a small muddy tidal lagoon.

The rough coral pavements are covered with a rich deposit of phosphoric guano, the accumulations of bird ordure of untold ages. The deposits are of great commercial value, and have been worked successfully for years by Messrs. Grice, Sumner and Co. of this city.

The island is gradually rising. This has been particularly noticeable of late years by marked observations in the alteration of the flooring levels of the dwellings. South of Malden there exists a volcanic axis, which may account for this land movement. It has been estimated that since the island was first discovered in 1825 by Lord Byron, of H.M. frigate *Blonde*, and named in honour of his first lieutenant, it has risen about three or four feet. However, the island is generally low; the highest part does not

exceed 30 feet above sea level, and from a vessel's deck can only be seen about 8 miles distant.

Although so near the line the temperature in the house rarely exceeds a steady heat of 86°. The vegetation chiefly consists of sun-trees, with large smooth foliage, bearing yellow flowers, and a species of succulent pig-face weed.

Remains of ancient aboriginal graves are upon the island, and human bones and a native well were unearthed underneath very old and deep layers of guano.

The guano station is worked by eight Europeans and about 150 Polynesians, which constituted the entire population of the island. The Polynesians are recruited from Savage Island, named by Captain Cook on account of the ferocious tribes of cannibals encountered there. Under the efforts of the London Missionary Society, the whole island is now Christianized.

The natives, chiefly those from Aitutaki, are expert swimmers. They have been known to descend into 8 or 9 fathoms of water to release a fouled anchor, and at the guano station they placed three sheets of copper upon a ship's bottom by driving a couple of nails each dive. They frequently dive into spongy coral groves to place a running noose about a basking shark 8 or 10 feet long. Should the monster not be in a suitable position, the native administers a gentle nudge in the ribs, as much as to say, "Move over there, old fellow." After adjustment the line is drawn taut, and the shark is rapidly hauled up to the surface by a canoe's crew, where it is killed for food. Mr. Julian has been an eyewitness of this unique method of fishing. I think it is also mentioned in one of the missionaries' works, by the Rev. Wyatt Gill. The only shark the natives really fear is a species possessing yellow fins. Another illustration proves that these like the natives are almost semi-aquatic beings. During one of those terrible hurricanes so frequent among the Pacific Islands, a schooner was seen to founder in the boiling surf, with all hands lost, apparently, beyond any doubt. Hours afterwards a woman swam ashore, and when found on the strand was adjusting her toilet and shaking the gritty coral sand out of her raven locks as if nothing extraordinary had happened. And 24 hours after the wreck a man was observed swimming about, and only succumbed when he was dashed to pieces upon the merciless rocks.

The birds that frequent Malden Island are:—

Sandpiper or Plover (*Totanus incanus*), which always appears around the lagoon. Mr. Henry Seebohm, to whom I submitted the skin for identification, informs me that the bird "breeds in Alaska, but can only be a winter visitor to Malden. This you can prove by the date. It is in newly moulted breeding dress. If it is going to Alaska to breed the date ought to be March, April,

or May. If it is going to breed in the Southern Hemisphere, the date is probably about September."

Curlew (*Numenius*) appears throughout the year. \*Sooty Tern (*Sterna fuliginosa*). These birds are called "Wide-awakes" from the peculiar cry they utter. They breed in a company of many hundreds, laying one egg upon the bare ground, generally in November, but sometimes in April and May. \*Panayan Tern (*Sterna anaetheta*) is similar in appearance, and habit to the Sooty Tern, but smaller. \*Noddy Terns (*Anous stolidus*) resort in numbers to the small islands in the lagoon to breed. No nests are made, their single eggs being simply deposited a few yards apart. They commence to lay in November, but sometimes a few birds are earlier.

Blue Tern (*Anous corulatus*), found on islands in the lagoon. At early morning they fly in companies of about 50 or 60 towards the outer beach, returning at evening. They are by no means timid birds. In October they also lay a single egg under some shelving piece of coral. Hitherto I think the egg has not been described. Its ground colour is of a soft, warmish white, moderately distributed with spots of pinkish red and light dull purple, the latter colour appearing as if beneath the surface of the shell. Dimensions, 3.7 x 2.8 cm. Another specimen has less and finer markings, but with the addition of one or two large bold blotches of dark brown. Dimensions, 3.85 x 2.8 cm.

Lanulated Tern (*Sterna lunata*) is an occasional visitor, possessing a very restricted range in that region of the Pacific. Small White Terns (*Cygis microrhynchus*) continually frequent the island.

\*Masked Gannet (*Sula cyanops*). One or two eggs are laid in November, but sometimes in March, upon the ground at the east side of the lagoon. Nests made of herbage. Young in down white. Both male and female assist at incubation, and fear to leave their tasks when Frigate Birds are hovering about. \*Brown Gannets (*Sula leucogastra*) deposit in company two or three eggs in herbage-constructed nests upon the small islands in the lagoon during the months of November and December.

\*Red-legged Gannet (*Sula piscator*) is the rarest of the "Boobies." It occasionally breeds upon the island. One egg is laid. Young have been noticed in December. \*Small Frigate Bird (*Atagen minor*) always inhabits Malden Island, but is found in greater numbers during the laying season—March and April—when they arrive in thousands and take up their quarters upon the lagoon islands. One egg is laid. The young in the down

are dirty white. During breeding season the male is very conspicuous by his bright red gular pouch, which he distends upon the throat. Of course it is well-known that these birds live by plundering other birds, principally the Gannets, or "Boobies," of the fish they catch. But it has not been recorded of this Frigate Bird, or any other bird I am aware of, that when disturbed certain individuals will jst their egg in their claws and ascend into the air. On one occasion an incredulous visitor was scrutinizing from below a bird that had risen, when by fright or accident it released its hold of the egg, which fell and smashed upon the spectator, who was then and there convinced of this peculiar trait in the bird's character, and was only too thankful the egg was not addled. \*Frigate Bird (*Atagen aquila*). Years ago this larger species used to frequent the island, but has now disappeared.

\*Red-tailed Tropic Bird (*Phaeton rubricauda*) is an occasional visitor, and once a pair of eggs were taken from under the coral shelves.

I think we have exhausted our brief "Notes from Malden Island" if we mention a species of small duck, resembling Australian Teal in plumage, that periodically—November and December—touch there in small numbers. They arrive very bare and poor and evidently much exhausted after a long flight. After a short sojourn of four or six weeks, when they have regained a better condition, they decamp. Where they came from and whence they go are mysteries yet to be solved.

## DESCRIPTION OF AN ORCHID, NEW FOR VICTORIA.

By BARON FERD. VON MUELLER, K.C.M.G., M. & Ph.D.,  
F.R.S. &c.

### PRASOPHYLLUM FRENCHII.

Tuber almost spherical; leaf from the upper part of the stem thinly cylindrical, attenuated upwards and slightly channelled, almost equalling in height the inflorescence or variously of less length, occasionally the new leaf already developed from the base of the stem at the time of flowering and then compressed; pedicels very short; bracts semi-ovate or deltoid-orbicular, thus about as broad as long, reaching but slightly beyond the base of the calyx; upper (through resupination lower) calyx-lobe rhomboid; or lanceolar-ovate, lower (through resupination upper) two disconnected, all dark-purplish, but at and towards the margin greenish; paired petals elliptic-lanceolar, somewhat or hardly

\* Australian birds.

*July 4th.* — Late in the afternoon sighted Caroline Island, formerly uninhabited; but we carried several native families there with pigs, fowls, turkeys, &c., to form an establishment for rearing stock. The settlement we have established is on the south by west side of the island, and as it was too dark when we reached it to pay a visit of inspection, we lay to till morning.

*July 5th.* — Caroline Island is a lagoon island, but its links of land are better connected, and possess a richer soil, than most of the islands of the Paumotu group. The south side of the island is densely wooded, and possesses a glorious grove of cocoa-nut trees — our inducement for forming the establishment. A smaller and an only other grove exists on the south-south-west side; the other variety of trees are those common to the Paumutus, but I did not notice the pandanus. Compared with the lagoon islands of the Paumutus, the lagoon is small to the extent of the island, which, according to our estimation, is from thirteen to fifteen miles in circumference. Its centre we made to be in latitude  $9^{\circ} 56'$  S., longitude,  $150^{\circ} 14'$  W. Our stock at this time amounts to between 100 and 200 fine hogs, fowls, &c., in quantity; our stock-men and women looked thriving and healthy, and had made three additions to their number; the young ones fat and squalling. It has been our invariable plan to spread as many fruit and vegetable seeds as we could amongst the islands, and now, at Caroline Island, they have more pumpkins, melons, ninitas, &c. than they can consume. Settled with our stock-men to date, and with twelve recruits

for the oil establishment, bore away for Fanning's Island.

*July 10th.*—Made Christmas Island. This island has been the scene of some recent wrecks: the Mozart Bremen whaler, with 4000 barrels of oil and a considerable quantity of bone, homeward bound from the Sandwich Islands, ran ashore and became a complete wreck in the end of December last. The crew were taken off by another vessel that happened to be in company, an American whaler. Her captain, with the genuine shrewdness of a Yankee, not being sure of his ground, dropped astern, leaving the other one to feel the way for him. Scarcely had the wrecked crew effected their escape, when the Maria Helena merchantman, under the Chili flag, laden with a valuable cargo, ran ashore, and was literally crushed to atoms. The passengers and crew were saved, but one of the latter was subsequently drowned in the surf. The Maria Helena was formerly the Averick whaler (see entry March 19th, 1845); and after Captain H—— had succeeded in putting her in thorough repair, he obtained a British sailing letter of protection for her, and under the name of Recovery, because we had regained her from the deep, we sent her to Valparaiso for sale, and I was now doomed to be "in at the death," last scene of all,—and a melancholy one it was. The Mozart was wrecked on the east by north point of the island, and the Maria Helena in a bight about five miles further to the westward and northward. The island is egregiously in error on the charts, which occasioned the wrecks; and it is



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## OUR EQUATORIAL ISLANDS

WITH AN ACCOUNT OF SOME PERSONAL EXPERIENCES

BY JAMES D. HAGUE  
WITH PICTURES BY C. L. BULL, I. W. TABER AND M. L. STOWELL



IT has not come to be generally known that about forty-five years ago the United States acquired formal and actual possession of certain islands in the mid-Pacific, lying within and along the equatorial belt, and reaching westward nearly to the Eastern Hemisphere.

In 1856 it had already come to pass that certain voyagers in those regions, mostly American whalemens cruising along the line, had occasionally visited several small, low, and desolate coral reefs and islands, on some of which they had found valuable deposits of phosphates, or so-called phosphatic guano; and in August of that year Congress passed an act authorizing American citizens, under prescribed conditions, to claim, acquire, and

enter into possession of such islands in the name of the United States. Under the operation of this act a number of islands were so claimed and entered upon by American citizens, who there and then acquired lawful possession, and for many years thereafter enjoyed exclusive rights of ownership and exploitation under the authority and jurisdiction of the United States government and the protection of the American flag.

Two of these islands, Jarvis and Baker's (New Nantucket), about that time became unquestionably American possessions, not only under the congressional act, but also by the official act of the commander of the United States ship *St. Mary's*, Captain Davis, U. S. N., who, under instructions from his government, in 1858, visited both and took formal possession of the islands in the name of the United States, and deposited in the earth a declaration to that effect, executed on parchment and well protected," all of which

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he duly reported to the Secretary of the Navy (Executive Document No. 11, Senate, Thirty-fifth Congress, First Session, 1858).

The flag of the United States was therefore floating over American insular possessions in the Pacific as long ago as 1858 and as far west as 176° 32' from Greenwich, at Baker's Island, thirteen miles north of the equator, and only about three hundred miles from the anti-prime meridian dividing the two hemispheres.

If these facts are new or in any way surprising to some good American citizens who, in these latter days, have become urgent advocates of the policy of territorial extension in the Pacific, and who, perhaps, especially maintain that the flag, once raised, must never be hauled down, it may be still more surprising to such readers to learn that, somehow, in the course of human events, after many years of possession and active operation by American citizens, and notwithstanding the provision of the original congressional act that no guano should be taken from such islands except for the benefit of American citizens and for the purpose of being used within the United States, all these islands have been delivered or abandoned to other claimants and, by hook or crook, have passed into British possession, under the British flag.

This is true not only of islands which were once acquired and held under the act of 1856

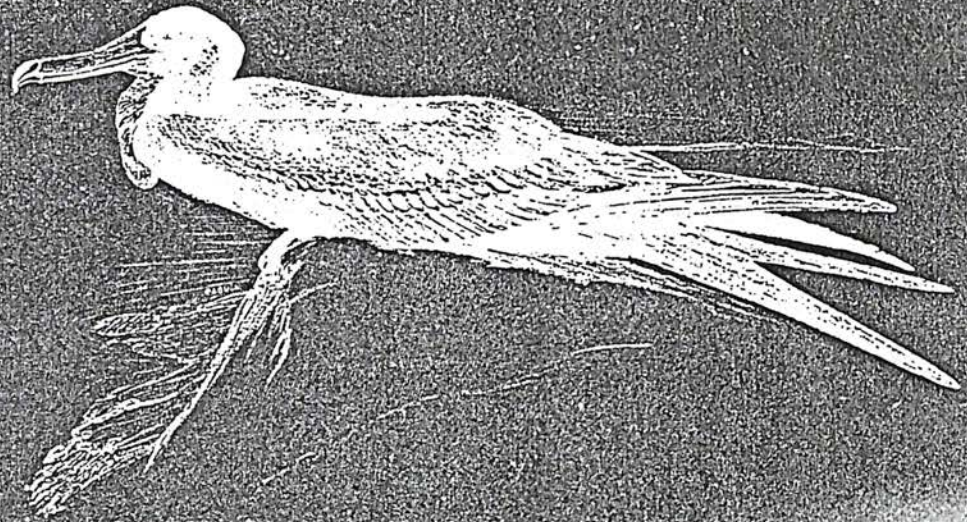
alone, but also of Jarvis and Baker's, for which special claims were made in 1858 by the United States government through its agent Captain Davis, in the *St. Mary's*: both of these islands have since passed, either by sale or license or abandonment of the American claimants and occupants, into the possession of an English trading firm, and thus to an English corporation formed for the purpose of taking over the business of said firm about January 1, 1897. That the deposits were not then entirely exhausted is at least indicated by the prospectus of the English company, which states that the islands referred to then contained about one hundred and twenty thousand tons of guano.

It was some years before the date just named that one or more of her British Majesty's ships appeared in the mid-Pacific, cruising with a sharp lookout for any unoccupied islands that could be had for the picking up; and in 1889, more than thirty years after the visit of the *St. Mary's*, when Captain Davis took possession of Jarvis Island in the name of the United States, H. M. S. *Cormorant* (funny name!) came sailing over the equatorial ocean, seeking what she might devour in that line, and finding Jarvis presumably with nobody at home to set the Stars and Stripes, naturally gobbled up the little island and sailed away, not only without provoking any protests, but, apparently, with such acquiescent assent on the part of



DESIGNED BY CHARLES E. DULL. HALF-TONE PLATE ENGRAVED BY G. C. COLLINS.

GANNET, OR BOOBY, AFTER FLYING-FISH.



DRAWN BY CHARLES L. BULL. HALF-TONE PLATE ENGRAVED BY R. G. COLLINS.  
MAN-O-WAR HAWK.

the United States that a naval chart of the Pacific, published in 1896 by the Hydrographic Office of the United States Navy Department for the purpose of showing the insular possessions of various nations, expressly indicates Jarvis as a British island. Christmas, Fanning, and Palmyra islands, lying several degrees farther north and, generally, between Jarvis and Hawaii, were taken up by the *Cormorant* about the same time. Since then almost every island in that part of the Pacific has been claimed as a British possession; and on the naval chart just referred to the only islands in that region which are not distinctly indicated as British are Baker's and its single near neighbor, Howland's; and both of these are now actually occupied by the above-mentioned English company, which is, or recently was, actively engaged in the shipment of guano therefrom, under lease or license of the Colonial Office of the British government and under the protection of the British flag.

These scattered islands, unrelated to other groups, are generally known as the "Line Islands." What importance they may still have for their guano deposits is perhaps questionable; but their possible value as cable stations has recently come into view and may some day demand serious consideration. This possibility seems now all the more important since the United States government, in 1899, seeking to acquire an eligible cable station, made an offer of one million dollars, which the German government declined, for Ualan, or Kusaie, sometimes known as Strong's Island, situated

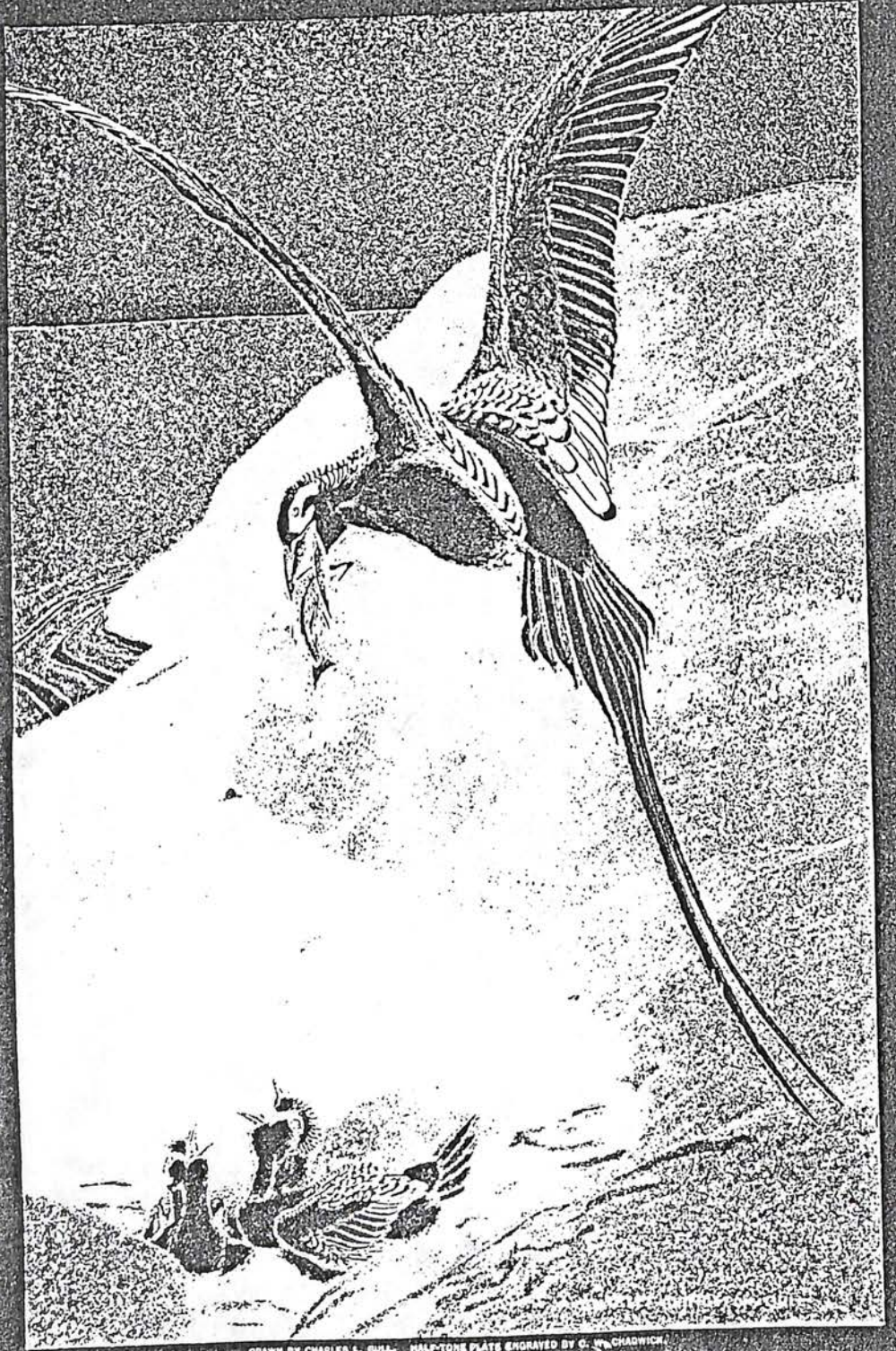
fifteen hundred miles or more west and northerly from Baker's. Fanning's Island, an inhabited coral lagoon, a few degrees north of Jarvis, was some time since made a permanent cable station for a British five-thousand-mile cable now in process of construction between Vancouver and Australia. As will be seen by the accompanying chart, Jarvis and Baker's are both conveniently situated on lines connecting the Pacific coast of the United States with Australia or New Zealand, touching Hawaii and Samoa; and the claim of ownership by the United States, based on the act of possession taken by Captain Davis, may sooner or later give rise to an international question.

Jarvis Island, nearly due south from Hawaii, lies hundreds of miles from any high land and many miles from any land whatever. In latitude it is twenty-two miles south of the equator and in longitude  $159^{\circ} 58'$  west from Greenwich. It is a small speck of coral reef in mid-ocean, between one and two miles long from east to west, and less than a mile wide from north to south, with an area of perhaps a thousand acres. On the flat surface of the coral-built platform-reef, just level with the sea at low tide, the waves, breaking on its outer edge, have swept together a mass of coral debris and sand, piling up a snow-white beach between twenty and thirty feet high, which is an encircling rim of a saucer-shaped surface, the central part of which is eight or ten feet lower than the crest. The island, once a lagoon, is now filled with coral debris. The evaporation of sea-water in the central



DRAWN BY CHARLES L. PULL. HALY-TONE PLATE ENGRAVED BY A. W. EVANS.

FRIGATE-BIRD, OR MAN-O'-WAR HAWK.



DRAWN BY CHARLES L. GULL. HALF-TONE PLATE ENGRAVED BY G. W. CHADWICK.

TROPIC-BIRD, OR BO'S'N, AND ITS YOUNG.

basin left there, long ago, a bed of gypsum (sulphate of lime), on which the guano was subsequently deposited, with resulting phosphates.

The interior surface of Jarvis is almost as completely white as the beach and the surrounding ring of surf, shaded only slightly here and there by a thin and scanty growth

any of the lookouts aloft, when one of these suddenly sang out, not "Land ho!" but that he could see a flag on the water, then a house, then a man riding on a mule, and, finally, the island under the mule! The rider thus distinguished was the late Dr. Judd of Honolulu, celebrated in the history of Hawaiian affairs, who was just then visiting the island



DRAWN BY LAWRENCE S. BULL. HALF-TONE PLATE ENGRAVED BY G. M. LEWIS.

FRIGATE-BIRD AFTER THE CATCH OF A GANNET, OR BOOBY.

of dark-green vegetation, a sort of creeping purslane and a little, long, coarse brownish grass. Seen from a ship several miles away, in a dazzling sunlight, the white island can hardly be distinguished from the sea breaking in shining surf upon the encircling reef or rippling with whitecaps in the distant view. It was a tradition of early days that a vessel once approached the island, known to be very near, but not yet made out by

as agent for the American Guano Company of New York, the newly established occupant in actual possession.

Baker's Island is about one thousand miles west of Jarvis, resembling it in general character, but smaller, containing only about four hundred acres, and being darker in color and somewhat more thickly covered with purslane and grass. It also is very remote from any high land, and has only one

near neighbor, Howland's Island, about fifty miles away to the northwest.

As sources of phosphatic guano Jarvis and Baker's were unquestionably the most important of all the Pacific equatorial islands which were acquired by American citizens under the congressional act of 1856. The above-named company of New York capitalists engaged actively in the enterprise of equipping these two islands with all required facilities for the exploitation of the deposits and the loading of vessels. Supplies, materials, and laborers were sent there from Honolulu. Vessels were chartered at San Francisco to load at the islands and to sail for Hampton Roads. A ship was despatched from New York to Jarvis and Baker's, loaded with materials for the construction of houses and working plant on the islands, and with cables, chains, anchors, buoys, and other needed outfit for deep-water moorings.

It was to examine these phosphatic deposits and to search for others like them that the writer visited and explored a large number of coral islands lying along the Pacific equatorial belt in 1859-61.

The most serious difficulties of the new enterprise were met in the mooring of vessels and the transport of guano from shore to ship. There was no safe anchorage. The shores of coral reefs and islands in the Pacific are generally very bold, descending at a precipitous angle from the surface to submarine depths, which, in this part of the ocean, average probably more than fifteen thousand feet. At Jarvis and Baker's and similarly situated islands the water deepens boldly from the outer edge of the reef, and at hardly a ship's length from the shore a hundred-fathom line could not reach bottom. Ships were usually moored off the western shore of the island, where they were made fast to mooring-buoys, which were held in place by heavy anchors and connected chain cables, two anchors for each mooring, one on the outer edge of the reef and one offshore in deep water. Thus moored, there was hardly room for a ship to swing between the buoy and the reef, a safe enough position with wind and current both steadily offshore, but very dangerous under other conditions. The prevailing winds were easterly trades, which, with the equatorial current running almost always strongly to the westward, usually kept the ships tailing offshore.

This strong westerly current was thus an important factor in the safety of vessels

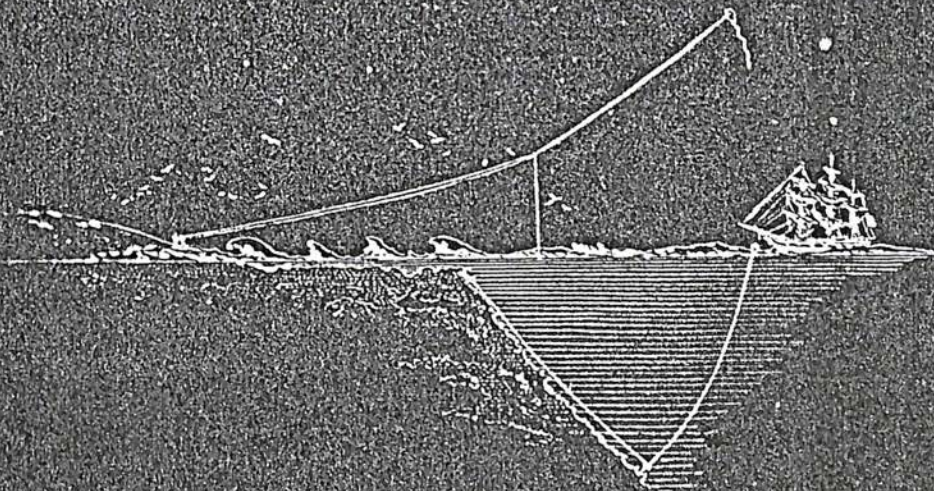
lying at the islands; but it sometimes slacked, and sometimes turned eastward, probably because the belt of current and counter-current, somewhat like a double-track roadway, shifted now and then north or south. The westerly current also greatly increased the difficulty of bringing ships safely to the moorings. The experiences of shipmasters engaged in that service in those days were often trying and occasionally disastrous. The captain of a ship found himself confronted with the difficult task of bringing his vessel to the mooring under sail, and virtually in the open sea, with just way enough to reach and get hold of the cable, already made fast by one end to the mooring-buoy and coiled in a boat, ready to be put aboard ship at the moment of her coming within reaching distance. Too much way meant forging ahead to fatal disaster on the reef, a ship's length beyond the buoy. Too little way meant failure to make fast, with all the unhappy consequences of drifting swiftly to leeward in the strong westerly current, and beating to windward, sometimes many days, before returning for another attempt. In some instances this was many times repeated, and one ship was unlucky enough to lose more than a month's time in trying to get fast to the island. Sometimes it came to pass that a ship-captain, having in mind an overmastering fear of missing his mooring and thus falling helplessly to leeward, gave his vessel too much way, and went straight to wreck and ruin on the reef before him. Such was the fate which the good ship *Silver Star* met at Jarvis Island, November 10, 1860, in which unhappy event the writer participated as passenger.

Once securely moored under the lee of the western shore, a ship might lie for days and weeks as quietly as in a well-protected harbor and almost as free from any considerable danger. The vessels usually lay within a cable's length of the platform-reef, on the outer edge of which the sea broke in a gentle surf, which offered no hindrance to the passage to and fro of the whale-boats carrying the guano in canvas bags from shore to ship. These conditions prevailed generally during summer months. At other seasons, especially between October and March, there would come occasional periods of very high surf, several days in duration, when all traffic between the shore and the ships became impossible. Then the sea, rolling in from the vast expanse of ocean, moving in long, swelling billows with smooth,

almost unruffled surface until broken on the outer shore, gathered itself in overwhelming masses, like uplifted walls of water, often higher than the highest point of the island, and fell precipitously upon the reef with a body and violence which seemed to threaten with destruction everything before it. On these occasions the spectacle was superb. The outer waves, advancing and culminating as they broke, fell, with a mighty roar, as massive water falls from the brink of a cataract with inconceivable force, and from crests which sometimes must have been

kas, amphibious fellows, very skilful in their work, apt in choosing the favorable moment for passing the breakers, and, in an unlucky capsize, as much at home in the water as fishes. Sometimes, when high surf made the reef quite impassable for boats, it was an easy task and good sport for one of these Kanakas to swim from the shore to a ship at the mooring and return, carrying messages in a bottle tied about him.

It was during one of these high surf periods, when the sea was breaking on the reef with such extreme violence that neither



METHOD OF MOORING SHIPS—LETTERS BY KITE LINE.

more than thirty feet high. I have seen from the shore a whale-boat, twenty-eight feet long, caught unhappily in the surf, lifted up endwise like a chip, its whole length projected vertically, for an instant, against the face of the advancing, still higher, wall of white foaming water. Wave after wave of this sort would come pouring in, following each other in quick succession, sweeping across the platform-reef with beautifully combing, curling, wind-blown crests, washing the beach to its summit and then swiftly receding, moving with noisy attrition a shifting mass of pebbles, sand, and fragments of coral.

The business of loading ships was, of course, much interrupted by these periods of surf. No wharf or pier built on the platform-reef could be made to withstand such destructive force. All the traffic of the islands between ship and shore was carried on in whale-boats manned by Hawaiian Kana-

boat nor swimmer could live in it, that the writer devised and successfully employed a method of communication between shore and ship by means of a large kite, which was made of a light wooden frame covered with thin cotton sheeting, and provided with a strong kite line. When the kite was well up in the air, trailing out seaward across the reef, and had mounted high enough to sustain a little extra weight, a small ring was securely fastened to the kite line. Through this ring a lighter cord was passed, and a bottle, containing a letter for the ship, was tied to the outer end. The kite was then allowed to rise, taking out both lines and carrying aloft the bottle, swinging high in air. When the bottle was evidently out beyond the surf, the kite line was made fast on shore, and the lighter line, passing through the ring, was paid out, allowing the bottle to descend to the water. The ship-captain, seeing what was intended, sent a



boat to fetch the letter; a reply was presently placed within the bottle, which was then pulled up to the ring on the kite line, and soon brought ashore by hauling in the kite.

Jarvis and Baker's were known and located on the charts long before they were supposed to contain anything valuable. They were rarely visited or seen except by whalers, who, cruising along the equator, might find occasion to land in search of eggs or to call at the solitary post-office, which, at Baker's, during many years prior to permanent occupation, consisted of a covered box fastened to a post set upright in the sand, where passing whalers might both find letters for themselves and leave letters for others, it being a custom for all whale-ships bound homeward or to the Arctic to take along all letters going their way. Occasionally such an island has become the burial-place of some poor mariner whom death has overtaken in its neighborhood, and whose body, instead of being committed to the deep, has been left to repose in a sandy grave upon this remote speck of terrestrial isolation, high up on the far crest of the beach, beyond the sweep, but always within the sound, of the breakers on the reef.

Such were two unfortunate whalers, my contemporary voyagers, whose bodies lie buried on one of the Caroline Islands, and whose epitaph, printed some time since in the New York "Tribune," reads as follows:

Sacred to Wilm. Collis  
Boat Steerer of the SHIP  
SaiNT george of New BED  
ford who By the Will of  
Almity god  
was sivriliery injured by a  
BULL WHALE  
off this Iland on  
18 March 1860.  
also to  
Pedro Sabbanas of Guam  
4th MaTE drowned on  
the SAME Date his  
Back broken by WHALE  
above  
MeNTioned

It was doubtless due to observations made by visitors on such errands that the guano deposits on these islands first attracted the attention which led to the discovery of their value. The material of the deposits, both in appearance and composition, was generally quite unlike guano of the Peruvian islands, much of it, especially of Jarvis, being as

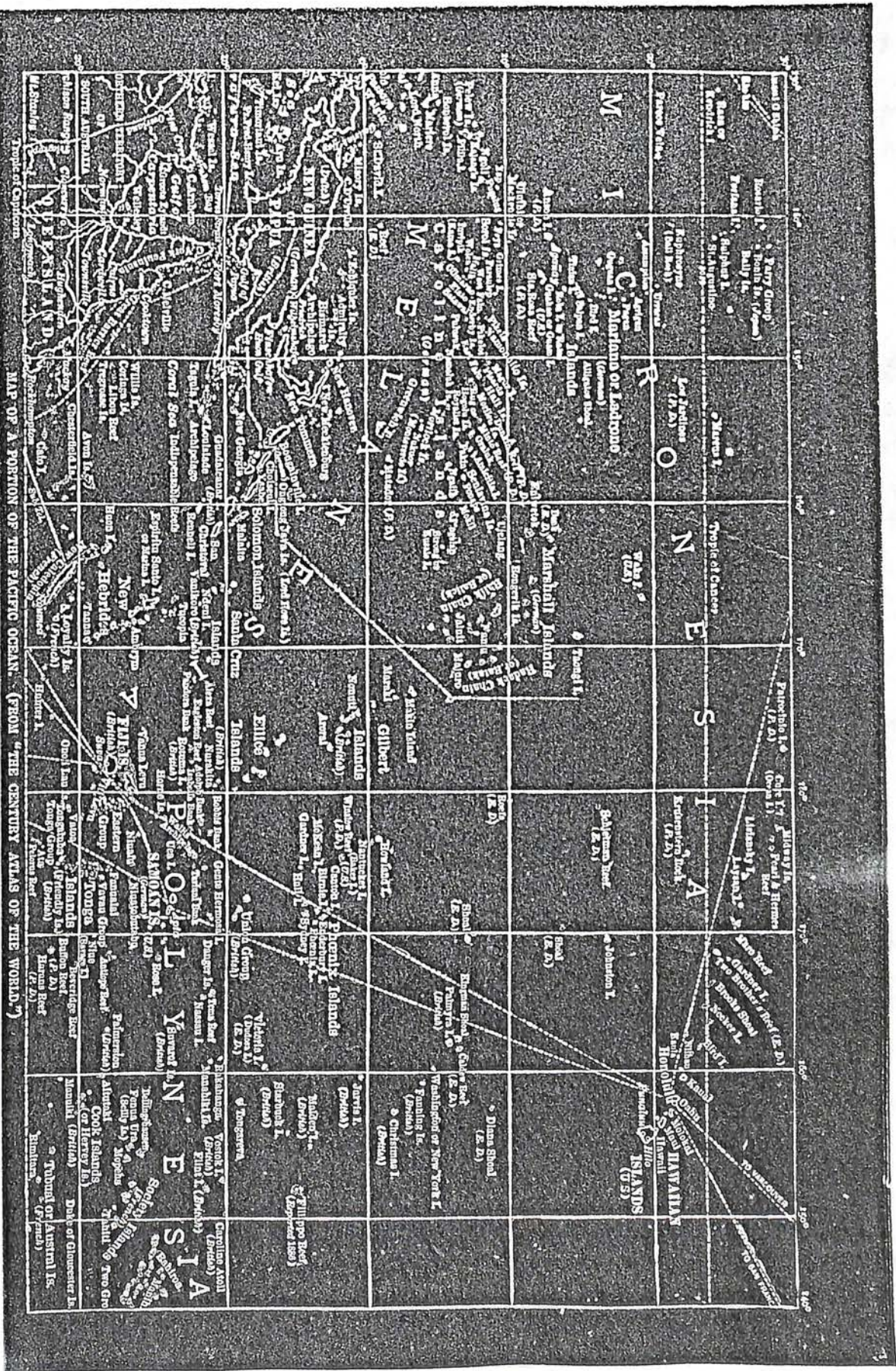
white as snow, as hard as rock, and almost wholly without ammonia. It was, in fact, bird-guano from which almost everything soluble had been leached by water, leaving a highly concentrated calcareous phosphate, then worth, in the United States, about thirty dollars a ton.

These deposits varied in thickness from a few inches to a few feet. The islands had been for ages the breeding-places of millions of birds of many kinds, large and small, subsisting mainly on the fish of the sea and partly on the products of the reef. The birds rest mostly on the bare surface of the island, flocking together in solid masses of thousands, each different kind grouping apart and not mingling with other sorts. Where vegetation affords the material, some kinds build roosts of twigs and stems two or three feet high. Many burrow, and nest in holes beneath the sandy surface.

In the course of ages these countless millions of birds produced a vast deposit of material containing the concentrated phosphates most desirable as food for plants and for the enrichment of the earth's soil; and it is interesting to note how, by processes partly natural and partly artificial, these mineral phosphates of the Pacific Ocean, in their various states of being, illustrate what may be called the transmigration of atoms.

From a state of solution in sea-water these atoms of calcareous phosphate, derived originally from primitive rocks, were converted into various forms of fish food, both animal and plant, and, thus assimilated, were subsequently transformed into the bones and bodies of the fish, which, in turn, as food for birds, came, by and by, to form part of the phosphatic deposits on these islands, whence they have been conveyed in ships to the opposite side of the planet for the fertilization of the fields of America and Europe, there to be again transformed into food, both plant and animal, for millions of people in both hemispheres, to become bone of our bone and, through human embodiment, to be made partakers in all that mortal man is heir to. Some such atoms may rest in Westminster Abbey or in the tomb of royalty; and countless thousands may thus await the final mystery, at the last trump, when this mortal must put on immortality.

Among the birds of these islands an ornithologist might perhaps find many varieties, all of which are known to ordinary observers by a few common names. The most numerous kinds found there by the early occupants



were the gannets or boobies, the frigate-birds or man-o'-war hawks, the tropic-birds or "bo's'ns," the gulls, tern, mutton-birds, noddies, petrels or Mother Carey's chickens, and, during their breeding-seasons, some game-birds, notably curlew, snipe, and plover.

The gannets are comparatively large birds and great diving fishers, pouncing from high in the air upon fish deep in the water. They go out from the island for a day's fishing early in the morning, and return at evening, heavily laden with fish, many of them large, which they disgorge for home consumption, usually after first satisfying the demands of the tax-gatherers to whom they are compelled to pay tribute. These are the man-o'-war hawks, the tyrants and pirates of the feathered community, depending largely on the toiling fishers for their food. They patrol the coast, a little way offshore, usually about sunset, like a line of guards or revenue officers, and waylay the returning fishing-birds, preventing their landing until they have surrendered a portion of their day's catch.

The man-o'-war hawk is also a somewhat large bird and an expert fisher, but he does most of his fishing in the air. When the booby-bird comes home from abroad he finds the man-o'-war hawk "layin' for him"; and however persistently he may seek to escape by dashing flight, with much screeching and screaming, he finds that before he can safely set foot on the land he must disgorge a fish or two, which the swift pursuer adroitly catches in the air. It seemed, however, to be generally understood, as a *modus vivendi*, between the fisher and the pirate-birds that their contentions were only on the wing and that, once on land, they should dwell peacefully in their separate camping-grounds.

The boobies are awkward and unwieldy on land, and may be easily captured. They rarely seek to escape when a man approaches, but, accustomed to meet the demands of their familiar enemy, the man-o'-war hawk, by disgorging a fish in the air, they frequently resort to the same process and lay at the feet of the intruding stranger what stock of fish they have available. The man-o'-war hawks turned this practice to their own advantage by following after any man who might appear among the nesting birds, circling in the air just overhead, ready to pick up the fish which the frightened boobies might give up as a peace-offering. The man-o'-war hawks were generally eager for anything, and would hover closely, ready to

take from the hand of a man whatever he might toss in the air. On one occasion one of these birds swiftly snatched a note-book, which lay for a moment on the ground, and sailed away, dropping it, however, on finding it to be neither fish nor rat. All the game-birds, the curlew, snipe, and plover, were as shy and hard to get at as they are in populated countries. The gulls and the smaller tern, when disturbed by man, would rise from the ground in innumerable flocks, flying, curving, and circling in the sunlight and casting a perceptible shadow, like a cloud, on the land beneath.

There was one beautiful little white bird, rarely to be seen except on the weather shore of the island, hovering there over the reef and the foaming breakers, flying slowly with a gently wafting movement, circling overhead almost within reach, and peering inquisitively into one's eyes, as if seeking some spiritual intercourse. Almost every visitor who saw these birds was impressed by their remarkable beauty and curious behavior.

Even sailors who came ashore for a Sunday's liberty, sometimes rough fellows whose path across the island could too often be traced by the dead bodies of the booby-birds wantonly slain, were strangely affected.

"What kind of a bird is that little white one over there to windward?" one of these men asked, returning from his tramp.

"Don't know any special name for it. Why?"

"Danged if I don't believe it's a spirit of some kind," he replied.

It was interesting to read, some time after, in Darwin's "Journal of Researches" during the voyage of the *Beagle*, the following note, referring to the birds on Keeling Island:

The gannets, sitting on their rude nests, gaze at one with a stupid yet angry air. The noddies, as their name expresses, are silly little creatures. But there is one charming bird; it is a small snow-white tern, which smoothly hovers at the distance of a few feet above one's head, its large black eye scanning, with quiet curiosity, your expression. Little imagination is required to fancy that so light and delicate a body must be tenanted by some wandering fairy spirit.

The tropic-bird, or "bo's'n," is about as large as a gannet and, although generally white, has two very long, delicate, and usually bright red tail-feathers, which sailors call the "marlinespike," whence comes the name after the boatswain. It is a pluckier bird than the gannet, more self-

respecting and self-contained. When approached by man, it neither waddles away in a flurry nor disgorges a peace-offering of fish, but defends its eggs or young against intruders.

Some interesting experiments were made with these birds as messengers, especially between Baker's and Howland's islands, about fifty miles apart. On several occasions a bird was taken from her eggs at Howland's Island and placed on board a vessel going to sea or to Baker's, whence she returned to her nest directly after being liberated, bearing a message, written on a bit of canvas, tied to her foot. Thus the schooner *Ortolan* sailed from Howland's one morning at eight o'clock, carrying a bo's'n which was set free the following day and was found on her nest next morning at daylight with message reporting the latitude and longitude of the vessel, sixty-eight miles away, at the time of the bird's departure.

This may recall to readers of "Foul Play" an interesting incident of that well-known story by Charles Reade and Dion Boucicault, in which the hero and heroine, being castaways together on an otherwise uninhabited island in the Pacific, are led to study the problem "how to diffuse intelligence from a fixed island over a hundred leagues of ocean."

The idea of tying messages to the feet of birds and so communicating with ships sailing in that part of the world was derived by the authors of the story from the actual experiences of an Australian ship-captain on whose vessel a bird once alighted, bearing a message from stranded castaways seeking rescue; but the plan of weighting the bird's foot, not heavily enough to prevent flight, but sufficiently to induce the bird to alight on a vessel if occasion should offer, was an invention which the author puts into his hero's mind by causing him to observe a duck seeking rest on a boat after flying with obvious difficulty, due to an unnatural impediment attached to one foot, which proved to be a crab that had fastened itself there some time before.

By a curious coincidence, this ideal conception of the self-attachment of the over-weighting crab was actually realized at Jarvis Island in the case of a gannet which was seen by the writer to move with difficulty, by reason of a heavy lump attached to one foot, which, on examination, plainly told its own story. The bird, at some time long before, had evidently been on the reef at low

tide, where a bivalve as large as a full-sized clam had closed upon its foot, never to open again. The bird had flown away, and in time the mollusk inside the shell had died without relaxing the grip. Gradually the interior had been compactly filled with fine sand, which, with alternate wetting and drying, had become a solid petrification. The under side of the shell was worn away by long contact with other surfaces; but the upper side still showed the scallops and flutings of the original form. It evidently caused the bird much distress, which was mercifully ended there and then, and the foot, with its extraordinary attachment, found a place, long ago, in the museum of the Sheffield Scientific School at Yale.

There are but few, if any, islands in the Pacific where rats may not be found, and they are sometimes present in large numbers. In many cases they are the survivors of shipwreck. On Howland's Island especially they had increased and multiplied almost beyond belief. They must have been on the island for years, as there seemed to be no remaining sign of any shipwreck that might have brought them. They were very small, and had probably degenerated under changed conditions of food. They lived on eggs and the bodies of birds too small to defend themselves. A struggle for existence seemed to be in progress between the rats and the smaller kinds of birds, on the eggs of which the little rats depended chiefly for their support, and these birds appeared to be at the verge of extermination. The larger birds were in no danger of this sort, as they could not only easily defend their eggs, but some were eager hunters for the rats, which they greedily sought as food. The man-o'-war hawks especially were as ravenous for rats as for fish, and it seemed marvelous that the rats could ever come to be so numerous in the presence of such an enemy. The rats probably managed to survive and increase by keeping out of sight during the day, hiding themselves away in holes or beneath the stones or slabs of beach-rock, beyond the reach of watchful hawks. Under cover of night they emerged from their hiding-places and swarmed over the surface of the island, seeking their food among the smaller birds. They had no fear of man, entering and overrunning his premises with great freedom, seeking food and fresh water. A little bait, attracting the rats together, made it easy to kill a score or more at a single fire of a shot-gun. One day a gang of less than thirty Kanaka laborers went out in the

morning to hunt rats, and returned before noon with a catch of more than thirty-three hundred.

It became an amusing diversion to overturn the large flat stones beneath which the rats were hiding in solid masses, and watch them as they scampered in all directions, pursued and quickly snatched up by the man-o'-war hawks. These crafty birds were apt to learn that the appearance of a man walking on the island, especially with a dog, meant rats for them, and any one thus going forth was usually followed by a hovering flock, ready and impatient for the sport they had learned to expect. A rat brought to hand by the dog was quickly tossed in air, where the birds were ready to snatch it, sometimes with a contest on the wing for disputed possession. One form of this sport, a sort of aerial polo, which seemed to be as good fun for the birds as for the observers, consisted in tossing two rats into the air at the same moment, not singly and apart, but tied together with about six feet of strong twine.

Instantly the birds made a dash for the rats, and the successful winner of the first prize went sailing off with one rat in his bill and the other swinging in the air beneath until snatched by the second winner, when, after a quick, sharp struggle and a taut strain on the cord, the bird with the weaker hold was compelled to let go, which again opened the game to all pursuers. This then went on as a continuous performance, with somewhat Jonah-like but rapidly repeated disappearances and reappearances of the little rats, swallowed and reluctantly disgorged by the birds in quick succession, until the flock, thoroughly exhausted by their impetuous flight and extraordinary exercise, alighted on the ground for a short truce, when the two temporary stake-holders would be found sitting face to face, keenly eying each other from opposite ends of the string still connecting them, each anxiously on the sharp lookout for sudden jerks and unpleasant surprises, while all the other pursuers gathered around in a ring, waiting for the two prize-birds to fly. The general aspect of all participants seemed to verify the familiar adage that the pleasure is not in the game, but in the chase.

Sports and amusing or interesting diversions, although somewhat rare at these islands, were not wholly lacking. The game-birds afforded some shooting, while the reef and the sea were more or less attractive for a fisherman. Students of natural history

found many engaging pursuits. At low tide the reef is almost bare. Along the outer edge it is frequently gullied with short and narrow inlets from the sea, forming pools with white sandy bottoms, into the depths of which one may look down, through quiet and beautiful green sunlit water, and see, as in a great natural aquarium, innumerable kinds of marine life—growing corals, fishes of vivid colors flashing in the sunlight, mollusks, sea-urchins, and sea-shells in countless varieties of form, size, and color. In such a pool a lady, wife of the resident manager, nearly lost her life while seeking shells on the reef at low tide, when, having stepped into the water and stooped deep down to reach a shell, her arm was suddenly seized by a monstrous squid or cuttlefish, which held her there with such irresistible force that she would have been quickly overcome and drowned if help had not been close at hand.

Sharks, large and small, abound in the neighboring waters, and sometimes, when the sea is smooth, come within the outer edge of the reef. Flying-fish are always in sight. Pursued by their enemies in the water, they take to air, where the fishing-birds await them. The flying-fish are excellent food. It was easy to catch them, during the night, by hanging a lantern in a boat moored offshore. The fish, attracted by the light, fell into the boat, from which they could not escape.

At high tide the reef was often beautiful, covered then by about five or six feet of water. The Kanakas are fond of frolicking in the water, and find as much fun playing with their surf-boards on the reef as New England boys do in coasting. It was very amusing to watch a company of natives in the surf, perhaps fifty or a hundred of them, strung out in a line along the outer edge of the reef, just where the water begins to break, each with a light board six or eight feet long, all ready and waiting for the breaker as it gathered and rose to a combing crest, each launching his board just in front of the advancing wave, climbing on to it, standing up, balancing himself adroitly, keeping the board "end on" as it shot in with the foaming breaker, all shouting and singing as they came darting toward the shore, or making fun of companions who lost their balance and tumbled into the sea again, and then up quickly and out, ready for another shoot.

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Sometimes the surf offered other diverting scenes, more amusing to the observers on

the beach than to the active participants on the reef. Occasionally a boat-load of sailors, coming ashore for half a day's liberty, might be seen risking the passage of high surf on the reef in an ordinary boat, steered with rudder and tiller-ropes, capsized by the first breaker, tossed about in the water, the sport of the waves and the amusement of the Kanakas, and lucky to reach the beach alive, and, if remaining in their boat at all, crawling out of it at last through a hole in its bottom.

Nor were unpleasant experiences of this sort strictly limited to strangers and green-horns, as the resident nautical expert or pilot-captain at Baker's Island had good reason to know.

The captain was going off one day to board a ship, the *Flying Dragon*, then lying at the mooring, intending to take with him as a present to the ship's captain and company a very large basket of fresh eggs which he had caused to be gathered that morning among the nesting-places of the tern. These eggs, though small, were very good to eat, and the captain in his generous way provided enough to fill a laundry hamper of the largest size, one in which *Falstaff* might easily have been concealed. It must have contained thousands of eggs. As the captain of the ship was accompanied by his wife, an accomplished and agreeable young lady from Boston, the shore-captain had arrayed himself in his best linen and spotless white duck suit, with the purpose of paying a visit of ceremony in the cabin. The hamper filled with eggs, uncovered at the top, was placed in the bow of the whale-boat, while the portly captain stood proudly in front of it, like a commanding figurehead. Thinking the moment favorable, he gave the order to shove off, but, unhappily, before the boat could reach smooth water, a heavy sea fell upon the reef in an unusually vicious breaker, lifting the bow of the boat suddenly upward, taking the captain off his feet, and tumbling him backward into the hamper, where, in the confusion which followed while the boat was tossing in the breakers, he was left to struggle helplessly in a mass of crushed eggs, from which he was quite unable to extricate himself. When, after some assistance, he finally scrambled out of the hamper, there was not an egg in it left unbroken. The ludicrous effect of this albuminous spectacle in white and yellow, varied in tone by adhering masses of brown-speckled egg-shell, may be left to the imagination of the reader.

When these equatorial islands first became

American possessions, the birds were their chief occupants. Other inhabitants were few, both in kind and number, although ants and flies appeared in swarms when people came to dwell there. Sheep and rabbits were introduced about that time, as a contingent food resource, and they thrived fairly well on the scanty vegetation without fresh water.

These islands are in an almost rainless region, and, having no source of fresh water in the ground, are, for that reason, naturally uninhabitable for mankind. Living there required hardly less provision of water and food-supplies than is needed for shipboard. The native food resources of the islands were amply abundant in fish, birds, and eggs; but the rainfall was found to be too uncertain and unreliable for the needed water-supply.

Distilling apparatus was sometimes provided, so that potable water could be produced from the sea in the event of short supply from ships; but, lacking this in one or more instances, a precautionary measure consisted in laying out on the ground in long rows and wide areas, like strawberry patches, a great number of shells, halves of large bivalves, each of which, during a shower, caught a little water, which was then gathered in buckets and poured into a cask. Heavy showers fell occasionally, usually in the night; but in the daytime it often happened that a rain-squall, approaching the island from the windward, would part in two, apparently divided by the upward column of heated air rising from the land, and so pass by, partly to the north and partly to the south, leaving the central portion of the island dry.

The climate was very equable and the weather almost always perfect. The temperature varied slightly between extremes ranging from 75° to 85° Fahrenheit. The prevailing winds were easterly trades, varying in their direction with the changing seasons, coming from the northeast during the northern winter, when the sun's declination is south, and from the southeast during the northern summer, when the sun's declination is north.

The apparent flow and set of the sea showed similar variations, running from northeast to southwest during the months of northern winter, bringing more frequent periods of rough water and higher surf; and from southeast to northwest during the months of northern summer, with smoother seas and fewer surf-days.

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