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REJ:jt

12th July 1982

Mr. G. Balazs,
NMFS,
P.O. Box 3830,
HONOLULU, HAWAII 96812,
U.S.A.

Dear George,

Many thanks for your Tokelau MS. I enjoyed reading it. It is well written, full of interesting information and conveys a genuine sympathy for the people you worked with. You needn't reword the part about re-nesting on page 23 on my account. I made a mistake and you caught it. It seems like a fair comment.

What needs to be done to the MS for publication depends on where you publish it. It could go into Atoll Research Bulletin with only a little condensing. It could go into Pacific Science with moderate condensing. For most other journals you would probably have to cut fairly substantially. Whereas none of it is superfluous, the section that could survive the heaviest pruning is the introduction.

I like your recommendations - the best thought-out programme for Pacific islanders I've seen. I would hope you could publish some place that would allow the inclusion of these recommendations because they form a useful template for others framing conservation programmes in other island areas.

I'm going to try to find in my files the names and addresses of two New Zealand anthropologists that have been working in the Tokelaus for years and have gathered a great deal of (unpublished) information on fishing. I met them in Apia on their way to Tokelau for about the tenth time. You imply in your MS that the project is to be a continuing one. If so it might be useful to compare notes with these people. (Later - their names are Tony Hooper and Susan Huntsman, but I don't know what university they are affiliated with in New Zealand).

With regard to your comment that nesting is uncommon on lagoon beaches, I have a recollection of reading this comment in connection with other atolls too. If it is a general phenomenon, perhaps this should be mentioned with the appropriate citations. I imagine you know more about this than anyone else.

On page 26 - "delectable" portions? Seems a peculiar choice of phrase, not only value-laden but implying that all of the turtle is delectable. Including the shell?

P. 28, keratinous^{ok} (spelling).

On rereading the paper it strikes me that a lot of the flavor of Tokelauan behavior and customs will have to be excised to make the paper acceptable to most journals, and this would be a pity. That's why I would favor Atoll Research Bulletin, unless you are under pressure to get something out quickly.

On or around page 34 you might insert a suggestion to the effect that the following recommendations might be considered by others for adoption in other Pacific island areas.

On page 36 I think you should expand in a sentence or two on the implications for harvesting of the long time it takes turtles to reach maturity, perhaps citing your paper, Limpus's and the third person's (I'm working at home and don't have my references) providing data on how much longer it takes than was previously thought to reach maturity.

On the bottom of page 36 you mention turtles ought to be viewed like kanava trees - but don't tell us how they are viewed.

I spent a very educational afternoon and evening in Queensland last week with Col Limpus and two of his dedicated assistants. He's a fascinating fellow.

My research trip up north to follow up on the sand moisture salinity work provided a big surprise, and I won't be sending you a manuscript for a while after all.

You'll recall that I found significantly lower sand moisture salinities in 15 nesting beaches than in 16 non-nesting beaches. I had virtually taken it for granted that I would find a relationship between sand moisture salinity at nesting depth and the salinity of the underlying groundwater. To my great surprise I found 1: no relationship between the two and 2. groundwater salinities every where were much higher than overlying sand moisture salinities.

Since there had been less than 1 cm of rain total in the four months preceding my sand moisture salinity measurements one cannot attribute the low salinities here to rain. It has been demonstrated that moisture moves up from the water table to keep the insides of coastal sand dunes moist. The mechanism has not been established. Capillary forces are not strong enough to do it. A process of "internal dew formation" has been proposed, whereby water vapor moving up from the water table cools and condenses between sand grains. This could explain the low salinities of sand moisture overlying salty groundwater.

Even if this is so, it doesn't explain why non-nesting beaches should contain significantly higher sand moisture salinities than nesting beaches. Could this be influenced by the degree of exposure of the beach to salt spray? That's the only explanation I can think of at the moment. When I go up in January I'll check this out, and also take samples of surface (dry) sand directly above the spots where I take samples at nesting depth to see if there is any relation.

Another problem with my observations - in the non-nesting beaches the sand-moisture salinities were far below salinities at which hatchling mortality occurs.

But despite all these perplexing questions the fact remains that turtle nesting beaches in the area are distinguished by sand-moisture salinities that are lower than those in non-nesting beaches and the data is highly statistically significant ($p < .002$). It seems to me there's got to be something I can learn from this, but I'm not sure what now.

N In January I'll extend my observations to some loggerhead-green nesting beaches in the nearby Muiron Islands and see if they still hold.

I would be delighted if you would take some sand samples on your travels too. I should warn you however that I misled you in an earlier letter concerning how easy it is to measure salinities. Once you have mixed enough distilled water with the sand so as to be able to draw off enough for a salinity determination, you have knocked the salinity down so low that you can't read it with a refractometer. You have to titrate it with AgNO_3 . So, if you take sand samples you have several alternatives.

1. Get someone in the lab at NMFS to process the samples (method enclosed) if such an analytical services lab is available there to you.
2. Get the Coconut Island analytical services group to run them for you at a price. (I think I can afford to pay for it - if you decide to go this route let me know what the costs are).
3. You can mail the samples to me and I'll get them run here.

In order for the data to be useful, control samples from non-nesting beaches of similar general appearance are needed, along with samples taken from nesting beaches. In either type of beach the samples should be taken after digging to the depth at which turtles nest and at likely nesting sites - i.e. in the case of North West Cape the turtles almost always nest right beside dune vegetation in sand with plenty of rootlets. It would also be desirable to have surface sand samples for comparison. The results will be less ambiguous if you can sample during the nesting season and at times when it hasn't rained for a while.

→ I find about 25- grams of sand in an airtight vial is about right. That means a vial of about 2 cm diameter and 4 cm long.

→ If you only sample a few beaches, get ten or 15 samples from each. If you can do a dozen of each of nesting and non-nesting beaches then three or four samples (both at nesting level and at the surface) from each would be enough to demonstrate salinity differences if they exist. This may be considerably more arduous than you realized when you volunteered. Don't feel apologetic if you decide that too much work is involved and prefer to drop it.

Windward → Are nesting beaches in areas where you have worked liable to be less exposed to salt spray than similar beaches that are not used for nesting? (I assume that lagoon beaches aren't used much by turtles because of the long distances hatchlings would have to swim to get to the relative safety of deep water. Turtles that lay on such beaches would presumably be selected against by higher hatchling mortality).

more

One of my tangential hypotheses has been that groundwater carrying essence-of-turtle-eggshell into water near the beach might provide the olfactory cue that enables turtles to identify nesting beaches. (In such an instance the salinity of the groundwater would be irrelevant). I understand from Col. Limpus that this notion is not original with me, and the Pritchard has put it forward. Can you give me any reference to this?

Cheers,



R.E. Johannes
PRINCIPAL RESEARCH SCIENTIST